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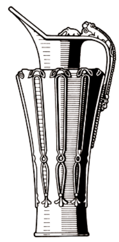

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Editorial

Mit der 104. Ausgabe der Archaeologia Austriaca ist es uns gelungen, ein besonders umfangreiches und thematisch vielfältiges Heft zu gestalten. Elf Artikel und fünf Rezensionen konnten in die vorliegende Ausgabe aufgenommen werden. Die vorgestellten neuen Forschungen aus verschiedenen Regionen Europas beinhalten neue bioarchäologische Forschungen ebenso wie geoarchäologische, archäometallurgische, montanarchäologische, sedimentologische und landschaftsarchäologische Analysen zu konkreten kulturhistorischen Fragestellungen. Die archäologischen Beiträge widmen sich Kulturkontakten und Einflüssen, Technologien und Symbolik anhand verschiedener Methoden. Das chronologische Spektrum reicht dieses Mal von der frühen Bronzezeit bis in die Frühe Neuzeit.

Eröffnet wird der Band durch die interdisziplinären Untersuchungen an frühbronzezeitlichen menschlichen Skelettresten aus Schleinbach in Niederösterreich. Im Zusammenspiel von osteologischer Analyse, mitochondrialer DNA-Analyse, Zahnzement- und $\delta^{13}C/\delta^{15}N$-Isotopenanalysen, ^{14}C-Daten und archäologischer Interpretation zeichnen die Autor*innen Doris Pany-Kucera, Michaela Spannagl-Steiner, Lukas Waltenberger, Walther Parson, Christina Strobl, Barbara Rendl, Lukas Janker, Fabian Kanz und Katharina Rebay-Salisbury ein komplexes Bild sozialer Differenzierung im frühbronzezeitlichen Schleinbach, wo Konflikte und Misshandlungen im Sozialgefüge eine entscheidende Rolle spielten. Ein Online-Katalog liefert die systematische Beschreibung aller untersuchten Individuen.

Im zweiten Beitrag gehen Anika Retzmann, Anna-Maria Kriechbaum, Monika Griebl, Karin Wiltschke-Schrotta, Maria Teschler-Nicola, Johanna Irrgeher und Thomas Prohaska der Frage nach, ob die ungewöhnlichen Bestattungen aus Siedlungsgruben in Stillfried/March mit einer möglichen nicht-lokalen Herkunft der Individuen korrespondieren. Die Autor*innen präsentieren die im Zahnschmelz bestimmten Sr-Isotopenverhältnisse von elf Individuen und schlussfolgern, dass die Bestattungspraktiken nicht mit der Herkunft zusammenhängen, da die menschlichen Überreste sowohl von ansässigen als auch von nicht-lokalen Individuen stammen.

Hochaktuell ist der Artikel zur Datierung der Himmelsscheibe von Nebra in die frühe Bronzezeit. Das interdisziplinäre Autor*innenteam (Ernst Pernicka, Jörg Adam, Gregor Borg, Gerhard Brügmann, Jan-Heinrich Bunnefeld, Wolfgang Kainz, Mechthild Klamm, Thomas Koiki, Harald Meller, Ralf Schwarz, Thomas Stöllner, Christian-Heinrich Wunderlich, Alfred Reichenberger) zieht nicht nur ein ausführliches Resümee zu den langjährigen interdisziplinären Analysen, sondern präsentiert auch einen systematischen Überblick inklusive neuer Daten zu Ursprung und Zusammensetzung des berühmten Nebra-Fundes. Neben den archäologischen Untersuchungen stützen sich die Autor*innen auf die Ergebnisse von rekonstruierten Deponierungsprozessen, Sedimentanhaftungen, die chemischen Konzentrationen von Gold und Kupfer im geologischen Untergrund des Fundortes, astronomische Referenzen, typologische Analogieschlüsse sowie polizeiliche Ermittlungen und abgeschlossene Gerichtsverfahren. Der kürzlich geäußerten Skepsis an der Datierung dieses einzigartigen Depotfundes in die frühe Bronzezeit ist damit eine deutliche wissenschaftliche Antwort entgegengesetzt.

Der prähistorische Kupferbergbau im schweizerischen Hochgebirge steht im Fokus der Forschungen von Leandra Reitmaier-Naef, Peter Thomas, Julia Bucher, Monika Oberhänsli, Caroline O. Grutsch, Klaus-Peter Martinek, Mathias Seifert, Philippe Rentzel, Rouven Turck, Thomas Reitmaier und Philippe Della Casa. In der bislang kaum erforschten Montanregion Oberhalbstein (Graubünden) konnten zwei Abbauareale näher untersucht und spätbronze- und eisenzeitliche Aktivitäten sowie bergbauspezifische Holzobjekte und Steingeräte dokumentiert werden. Die Daten der dendrochronologischen Analysen werden als Online-Appendix publiziert.

„Sonnenbarken" und „Mondscheiben" im bronzezeitlichen Istrien? lautet der Titel von Anja Hellmuth Krambergers Beitrag über das keramische Formenspektrum Istriens. Anhand der Ornamentik auf zwei außergewöhnlichen Schalen aus Monkodonja erörtert sie Verbindungen zum mittleren Donaugebiet und dem Karpatenbecken und nimmt dabei auch auf die zuvor behandelte Scheibe von Nebra Bezug. Nicht nur technisches Wissen, sondern

möglicherweise auch astrologische Kenntnisse und Vorstellungen wurden transferiert. Hinweise darauf könnten in der Ornamentik der besprochenen Schalen zu finden sein, deren Bedeutung sehr wahrscheinlich über eine reine Zier hinausging und womöglich als Sinnträger fungierte.

Annalisa Rumolo beschäftigt sich mit der Keramik und den Geweihartefakten aus Treazzano di Monsampolo (Italien), einer bronzezeitlichen Siedlung, in der ein Fragment mykenischer Feinkeramik – das erste ägäische Artefakt der Region – entdeckt worden war. Der Großteil der Keramik entspricht der subapenninischen Fazies und weist nur wenige Einflüsse aus dem Gebiet der Terramare-Kultur auf; allerdings sind Kontakte dorthin unter den Geweihartefakten der Siedlung zu finden.

Umfassende Kalkulationen zu Fassungsvermögen mittelhelladischer und frühmykenischer Kelche hat Laetitia Phialon angestellt, um ein besseres Verständnis von Trinkpraktiken und Konsumgewohnheiten zu erlangen. Insgesamt wurden die Fassungsvermögen von mehr als hundert Kelchen und über 400 weiteren Gefäßen berechnet. Die Autorin kommt zu dem Fazit, dass die größten Kelche bei Festen oder zeremoniellem Trinken von mehreren Personen geteilt und weitergereicht wurden. Die Daten der Berechnungen stehen in einem Online-Appendix zur Verfügung.

Paul Gleirscher stellt den Fund eines späthallstattzeitlichen Knotenarmreifs mit gegenständiger Kopfzier aus Möllbrücke in Kärnten vor und diskutiert motivgeschichtliche Einflüsse. Für Armreifen mit Kopf- bzw. Gesichtsappliken („Masken“) gibt es frühkeltische, aber auch etruskische Vergleichsfunde, die im Beitrag vorgestellt werden. Bei der Deutung der Köpfe geht der Autor zudem der Frage nach, inwieweit an apotropäische Vorstellungen oder auch an die symbolische Darstellung von im Kampf getöteten Kriegerköpfen (*têtes coupées*) zu denken ist.

Nives Doneus, Igor Miholjek, Kristina Džin, Michael Doneus, Pavle Dugonjić und Hannes Schiel präsentieren die Ergebnisse der archäologischen Prospektion des römischen Fundkomplexes von Vižula (Kroatien). Das großflächige Gebiet wurde mittels Bodenradar, Luftbild und Airborne Laser Scanning / Airborne Laser Bathymetrie untersucht. Ihre Forschungen deuten nicht nur darauf hin, dass statt einer einzigen luxuriösen Residenz gleich zwei *villae maritimae* und zwei *villae rusticae* auf Vižula existierten, sie zeigen auch, dass eine kombinierte Interpretation von integrierter Prospektion und Ausgrabungen Resultate ermöglicht, die über die Möglichkeiten der einzelnen Methoden hinausgehen.

Mithilfe der statistischen Methode der Hauptkomponentenanalyse identifiziert Mária Műllerová häufige Korrelationen zwischen Artefakten aus frühmittelalterlichen Eisenhortfunden. 74 Hortfunde aus der Slowakei bestehend aus landwirtschaftlichen und handwerklichen Werkzeugen, Kriegerausrüstungen, Sicheln und Axenbarren wurden für die Untersuchung herangezogen. Die Hauptkomponentenanalyse ermöglicht es, die Variabilität, Häufigkeit und Kombinationen der Eisengegenstände sichtbar zu machen.

In die Frühe Neuzeit führt uns Martin Neumann mit seiner landschaftsarchäologischen Untersuchung zur Standortwahl des Kalvarienberges im Vorfeld der Burg Červený Kameň (Slowakei). Der Autor präsentiert die Ergebnisse seiner Sichtbarkeitsanalyse verschiedener Standorte und hinterfragt Einflüsse und Motive des Bauherrn, die zur Wahl jenes Standorts geführt haben, an dem das Bildhauerwerk mit der Kreuzigung Christi dann tatsächlich errichtet wurde. Zusätzlich zieht er schriftliche und kartografische Quellen heran, um den gesellschaftlichen Kontext zu belegen, der den Bauherrn beeinflusst hat.

Fünf Buchbesprechungen, die von Eva Lenneis, Jörg Weilhartner, Felix Höflmayer, Ernst Cerny und Karl Reinhard Krierer verfasst wurden, beschließen das Heft.

Die Auszeichnung zum besten Beitrag in der ArchA 103/2019 durch die Wahl der Beiratsmitglieder (Best Paper Award) ergeht an Hans Reschreiter und Kerstin Kowarik für *Bronze Age Mining in Hallstatt. A New Picture of Everyday Life in the Salt Mines and Beyond*. Im Namen des Herausgeber*innengremiums und des gesamten Teams gratulieren wir herzlich und dürfen den Autor*innen als Preis ein Bücherpaket des Instituts für Orientalische und Europäische Archäologie überreichen.

Nach drei erfolgreichen Jahren war es wieder soweit, unseren wissenschaftlichen Beirat neu zu organisieren. Wir bedanken uns herzlich bei Biba Teržan und Jiří Svoboda, die uns freundlicherweise zwei Funktionsperioden lang fachlich unterstützt haben. Als neue Beiratsmitglieder konnten Philip R. Nigst und Viktória Kiss gewonnen werden, die wir herzlich begrüßen. Unser neues Advisory Board setzt sich nun aus folgenden Mitgliedern zusammen: Alexandra Busch (Abteilung für Römische Archäologie am Römisch-Germanischen Zentralmuseum in Mainz), Svend Hansen (Eurasien-Abteilung, Deutsches Archäologisches Institut, Berlin), Viktória Kiss (Institut für Archäologie, Ungarische Akademie der Wissenschaften, Budapest), Philip R. Nigst (Abteilung für Archäologie, Universität Cambridge), Peter Pavúk (Institut für Klassische Archäologie, Karls-Universität Prag), Ernst Pernicka (Curt-Engelhorn-Zentrum Archäometrie gGmbH Mannheim und Universität Heidelberg), Katarina Katja Predovnik (Institut für Archäologie, Universität Ljubljana), Eva Rosenstock (Einstein Center Chronoi, Berlin), Stefanie Samida (Historisches Seminar, Universität Heidelberg) und Maria Teschler-Nicola (Anthropologische Abteilung, Naturhistorisches Museum, Wien).

Veränderungen gibt es auch in unserem Editorial Board: Michaela Lochner und Timothy Taylor scheiden aus dem Gremium der Herausgeber*innen aus. Wir bedanken uns herzlich bei beiden für ihr Engagement. Michaela Lochner ist mit der ArchA seit vielen Jahren verbunden, zeichnete zehn Jahre als Gesamtredakteurin verantwortlich und war seit der Neupräsentation der ArchA im Jahr 2013 im Herausgebergremium vertreten. Timothy Taylor hat seit 2013 neue Anregungen und seine Erfahrung als Journal-Herausgeber ins Board eingebracht. Wir verabschieden die beiden und wünschen alles Gute für die Zukunft!

Die ArchA ist in allen relevanten Rankingsystemen inkludiert, im Web of Science – Emerging Sources Citation Index (ESCI) gelistet und somit auch für Leser*innen und Autor*innen international attraktiv, wie die steigenden laufenden Einreichungen belegen. Wieder konnte sich die ArchA im Scopus-Ranking verbessern und in der Kategorie Archaeology (Arts and Humanities) von Platz 63 (2018) auf Platz 48 (2019) von derzeit 278 gelisteten Zeitschriften aufsteigen. Sie ist somit unter den Top 50 angelangt, wofür wir unserer Leser*innen- und Autor*innenschaft herzlich danken!

Besonders bedanken möchten wir uns bei Ulrike Schuh, die die Redaktion in allen Belangen unterstützt und ihr als Leiterin des OREA Publication Lab jederzeit tatkräftig zur Seite steht. Für das gewohnt professionelle Layout geht unser Dank an María Antonia Negrete Martínez. Für die schnelle Korrektur der englischen Beiträge und Abstracts danken wir Nicola Wood. Die Buchbesprechungen wurden von Michaela Zavadil und Mario Gavranović koordiniert. Katharina Rebay-Salisbury scheidet auf eigenen Wunsch als Rezensionsbetreuerin aus; wir danken ihr herzlich für ihre Arbeit in den letzten fünf Jahren. Assistierende Tätigkeiten haben dankenswerterweise Bibiana Dernec und Natalie Savic übernommen.

Die aktuelle Ausgabe der ArchA steht wieder nicht nur online, sondern auch komplett Open Access zur Verfügung. Um einen Artikel einzureichen, kontaktieren Sie bitte archa@oeaw.ac.at. Wir freuen uns auf Ihre Beiträge und wünschen Ihnen eine anregende Lektüre!

Sophie Zimmermann (*Redaktion und Koordination*)
Barbara Horejs (*Editor-in-chief*)

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Artikel / Articles

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Social Relations, Deprivation and Violence at Schleinbach, Lower Austria. Insights from an Interdisciplinary Analysis of the Early Bronze Age Human Remains

Doris Pany-Kucera
Michaela Spannagl-Steiner
Lukas Waltenberger
Walther Parson
Christina Strobl
Barbara Rendl
Lukas Janker
Fabian Kanz
Katharina Rebay-Salisbury

Abstract
The interdisciplinary analysis of the skeletal remains of 63 individuals from settlement features and graves from Schleinbach in Lower Austria brought new insights into Early Bronze Age social relations, health aspects, signs of stress and trauma patterns. The individuals were buried in two groups of formal graves as well as in former storage pits. Mitochondrial DNA analysis identified genetic relationships between two individuals placed close together in a double grave, and between individuals from a multiple burial. The sex of four children buried in contexts suggestive of violence was revealed by proteomic sex identification. The high incidence of peri-mortem fractures in individuals from formal graves and pit burials suggests conflict within the community and neighbouring groups that were competing for scarce resources. The osteological analysis focused on skeletal and dental markers of deprivation, traumas, degenerative conditions and pelvic changes possibly linked to reproduction. In addition, we present data from ^{14}C dating, tooth cementum annulation and $\delta^{13}C/\delta^{15}N$ isotope analyses for selected individuals. The detailed examination of the archaeological context in conjunction with assessing and interpreting non-specific stress indicators and traumas revealed a rich and complex picture of social differentiation at Early Bronze Age Schleinbach, in which conflict, abuse and marginalization played a decisive role.

Keywords
Early Bronze Age, Austria, Schleinbach, social relations, stress, deprivation, trauma, violence, conflict.

Zusammenfassung – *Soziale Beziehungen, Entbehrung und Gewalt in Schleinbach, Niederösterreich. Ergebnisse einer interdisziplinären Analyse der frühbronzezeitlichen menschlichen Skelettreste*

Die interdisziplinäre Analyse der Skelettreste von 63 Individuen aus den Gräbern und der Siedlung von Schleinbach in Niederösterreich brachte neue Erkenntnisse zu sozialen Beziehungen, allgemeinen Belastungszeichen und traumatischen Veränderungen in der frühen Bronzezeit. Die Individuen wurden in zwei Gruppen formeller Gräber sowie in ehemaligen Speichergruben beigesetzt. Die mitochondriale DNA-Analyse identifizierte genetische Beziehungen zwischen zwei Personen, die in einem Doppelgrab eng beieinanderliegend bestattet wurden, sowie zwischen Personen aus einer Mehrfachbestattung. Das Geschlecht von vier Kindern, die im Kontext mit Gewaltevidenz begraben waren, wurde durch proteomische Geschlechtsidentifikation bestimmt. Das gehäufte Vorkommen perimortaler Frakturen bei Individuen aus formellen Gräbern und Grubenbestattungen deutet auf Konflikte innerhalb der Gemeinschaft und zwischen benachbarten Gruppen hin, die im Wettbewerb um knappe Ressourcen standen. Die osteologische Analyse konzentrierte sich auf Entbehrungszeichen am Skelett und an den Zähnen, Traumata und degenerative Veränderungen sowie Beckenveränderungen, die möglicherweise mit speziellen Belastungen durch Schwangerschaften und Geburten in Verbindung stehen. Darüber hinaus präsentieren wir Daten der ^{14}C-Datierung, Zahnzementanalyse und $\delta^{13}C/\delta^{15}N$-Isotopenanalysen für ausgewählte Personen. Die detaillierte Untersuchung des archäologischen Kontextes in Verbindung mit der Bewertung und Interpretation von Stress- und Belastungszeichen und Traumata ergab ein reiches und komplexes Bild sozialer Differenzierung im frühbronzezeitlichen Schleinbach, in dem Konflikte, Misshandlungen und Marginalisierung eine entscheidende Rolle spielten.

Schlüsselbegriffe
Frühbronzezeit, Österreich, Schleinbach, soziale Beziehungen, Entbehrung, Trauma, Gewalt, Konflikt.

1. Introduction: Archaeological and Historical Background of the Materials

Few skeletal collections have such a colourful excavation, storage and assessment history as the remains of over 60 individuals from 36 graves and nine pits at the Early Bronze Age site of Schleinbach.[1] The burial of an adult male with three children and the double burial of two individuals that were placed together in the grave made the site particularly well known beyond the borders of Austria. So far, however, a detailed, modern assessment of the entire skeletal material from this site has been lacking. We were able to integrate Schleinbach as a case study in the larger framework of the ERC-funded project 'The value of mothers to society', which aims to clarify the relationship between motherhood and women's social status. This approach, outlined in detail for the site of Unterhautzenthal,[2] necessitates an interdisciplinary examination of the excavation context and a morphological assessment of the skeletal remains. A focus on changes in the pelvis and degenerative or pathological conditions in the surrounding bone elements aims to reveal the physical burden of pregnancies and childbirth events. Moreover, we investigate signs of deprivation and indicators of violence from traumatic lesions in this group and discuss their social framework. We conducted ^{14}C dating, tooth cementum annulation and $\delta^{13}C/\delta^{15}N$ isotope analyses to acquire additional insights into details of the lives of selected individuals. The genetic relationship between the individuals from double burial 30/31 and burial pit 60 were tested by mtDNA analysis and the sex of the children from burial pit 60 as well as 1981/Grube 3 was revealed by proteomic analysis.

1.1. Site, Excavation and Research History

Schleinbach is located north of the Danube in Lower Austria, 10 km northeast of the city of Vienna. The 63 individuals under study are part of a cemetery and settlement complex of the Únětice Culture. The first finds were discovered in 1911 on the grounds of a brick factory, but systematic excavations by Karl Kriegler did not begin until 1926. The recovery strategy largely depended on clay extraction, with a considerable number of graves and settlement features destroyed without documentation. The Bronze Age settlement covered about 1.5 ha and might have been situated next to a prehistoric lake.[3] Two distinct groups of Early Bronze Age burials are known: Group 1 in the western site area, and Group 2 in the east. Excavations of the 17 graves of Group 1 started in 1926. Double burial 30/31 came to light in 1927, and the quadruple burial of an adult male and three children in Pit 60 was excavated in 1931. The 14 graves of Group 2 were amongst the last contexts Kriegler excavated in 1940/41.[4]

Kriegler recognized the importance of the finds, and – exceptional for the time – arranged the *en bloc* preservation of burial 29, double burial 30/31, and quadruple burial 60. It was an enormous undertaking to fix the skeletons in situ in the surrounding soil, mount them onto wooden boards, stabilize them with plaster and transport the blocks to the Lower Austrian Museum (at that time located at Herrengasse 9, 1010 Vienna) and the Anthropological Institute of the University of Vienna (Van Swietengasse 1, 1090 Vienna). In the museum, burials 30/31 and 60 were presented to the public in a similar way as they were found in the field. They survived World War II in a room with broken windows on the second floor of the museum in Herrengasse. In 1950 and 1951, some cleaning and conservation work was carried out, including the installation of a new glass cover, before the burials were put on display in the newly designed prehistoric exhibition. The prehistoric finds moved to the new museum of prehistory in Asparn/Zaya in 1967 and remained on display until the redesign of the exhibition in 2013. They provisionally found a home in the storage facilities of the old tobacco factory in Hainburg, broken into pieces, before they were transported to the Natural History Museum in Vienna in 2017 in order to unite the skeletal remains from Schleinbach in the Department of Anthropology.[5]

1 The full catalogue of Bronze Age human remains from Schleinbach is available as an online Appendix: doi: 10.1553/archaeologia104s13-A.
2 Rebay-Salisbury et al. 2018.
3 Weninger 1954a. – Rettenbacher 2004, 7.
4 Rettenbacher 2004, 8.
5 Rebay-Salisbury 2018b.

Fig. 1. Early Bronze Age cylindrical pit (Grube 3) with the remains of a 5–6-year-old child excavated in 1981 (Photos: H. Schwammenhöfer).

The focus on preservation and display of the most interesting contexts rendered the osteological analysis of the skeletal remains of secondary importance. Josef Weninger assessed the bones of the quadruple burial 60 after they had been mounted and remarked that the methodology had to be restricted to a morphological assessment and the measurement of the accessible bones.[6] His published report included some very sophisticated observations regarding taphonomic formation processes within the burial pit, and a slightly shortened version was reprinted thirteen years later with less emphasis on racial aspects.[7] In the same journal issue, Margarete Weninger published osteological observations on twelve individuals from Graves 9–18, 29 and Pit 56.[8]

As the clay extraction at Schleinbach continued, Hermann Schwammenhöfer resumed rescue excavations from 1981 to 1986, primarily documenting Late Neolithic and Early Bronze Age settlement finds.[9] Human remains were found in some of the Early Bronze Age features. The partial and disarticulated skeleton of a 5–6-year-old child (1981/Grube 3) with multiple impression fractures of the skull was found in a trapezoidal pit with a bottom diameter of c. 2.6 m. The pit was preserved to a depth of c. 1.25 m and filled with dark, humus soil (Fig. 1). Finds in the fill include sherds, animal bones and a cylindrical clay weight.[10]

Another grave of a child (Grave 1981) was discovered and excavated by the Museum Stockerau. The body had been placed in a flexed position and was buried with a ceramic vessel.[11] The facial portion of the skull of an adult (1983/Grube 61) was recovered from a pit in 1983. Although within the area of a Neolithic house, the shape and contents of the pit, including ceramic sherds and animal bones, suggest an Early Bronze Age date. The trapezoidal pit was preserved to a depth of 1.30 m and its bottom diameter was 2.4 m.[12] The cranium and mandible of a 16–18-year-old (1983/Grube 71) was found in the dark, humus-rich fill of a circular pit of 1.9 m diameter at the top and bottom and 0.75 m depth, alongside several large sherds of a storage vessel, animal bones, daub and a chert tool.[13]

The contexts of Schleinbach found their way into many synthetic works on Austrian prehistory and the Bronze Age,[14] but it was not until 2004 that the archaeological material of the Early Bronze Age settlement and cemetery was finally published, thanks to the efforts of Mirjam Rettenbacher.[15] Rettenbacher only had access to J. and M. Weninger's initial anthropological assessment,[16] which was biased by the excavator's intuitive judgement and partly incorrect. Maria Teschler-Nicola included the skeletal material held in the Natural History Museum at the time (Graves 9–18, Pit 56 and Grave 1981) in her habilitation thesis and came to different conclusions regarding the age and sex assessment.[17] In this introduction and the archaeological analysis, we use the results of our re-examination of human remains detailed below.

6 Weninger 1941, 7.
7 Weninger 1954a.
8 Weninger 1954b.
9 Schwammenhöfer 1982. – Schwammenhöfer 1986a. – Schwammenhöfer 1986b. – Schwammenhöfer 1987a. – Schwammenhöfer 1987b.
10 Schwammenhöfer 1982, 380.
11 Schwammenhöfer 1982, 390. – Teschler-Nicola 1992, 46.
12 Schwammenhöfer 1984, 244.
13 Schwammenhöfer 1984, 245.
14 Pittioni 1954, Fig. 211. – Lauermann 1992. – Neugebauer 1994. – Probst 1996. – Lauermann 2003, 507–510. – Probst 2011.
15 Rettenbacher 2004.
16 Weninger 1954a. – Weninger 1954b.
17 Teschler-Nicola 1992, 46–47.

Today, the entire skeletal assemblage from Schleinbach, some of which has been collected for this study from the storage facilities in Hainburg, Korneuburg Museum, the Department of Anthropology of the University of Vienna and private collectors, is curated in the Department of Anthropology of the Natural History Museum in Vienna. We included all available remains from securely dated Early Bronze Age contexts in this study.

1.2. Individuals and Cemetery Structure

In total, skeletal remains of 62[18] individuals from Schleinbach were available for osteological analysis, although some were represented only by isolated bones. The collection includes 14 adult and mature females over 20 (22.6 %), 15 adult and mature males (24.2 %) and six adult and mature individuals that could not be sexed (9.7 %). The 27 subadults under 20 years (43.5 %) comprise one foetus/neonate of 7–8 lunar months gestational age, 12 children under 7, five children between 7 and 14, and nine adolescents between 14 and 20, four of which were classified as females (Fig. 2). The low number of foetal/neonatal remains is probably a result of the antiquarian excavation techniques.

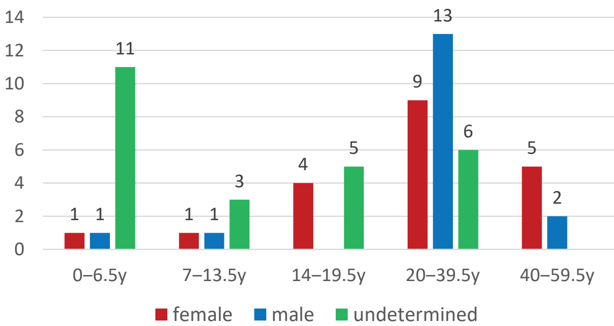

Fig. 2. Age and sex of the Early Bronze Age individuals buried at Schleinbach (n = 63, including 55).

Fig. 3. Burial in Pit 55 (Photo: K. Kriegler 1929, © Landessammlungen Niederösterreich, Bereich Ur- und Frühgeschichte, No. 17860).

The human remains were found in two distinct grave groups as well as buried or deposited in former storage pits and other features within the settlement.

Group 1 is composed of 18 individuals[19] buried in 16 graves loosely arranged in two (perhaps three) rows along a northwest-southeast axis (9AB, 10–18, 23, 27–31, 59). Eleven adults, seven females and four males, as well as seven subadults are part of this group. Cranial fragments and an upper incisor from a 1.5-year-old were found with the 45–55-year-old female in Grave 9, perhaps the remains of a co-buried young child. The individuals 30 and 31, males aged 27–30 and 30–35, were buried in close bodily contact in one grave pit. Individuals 15 and 18 were buried a little further apart from each other, but perhaps also in a common grave structure.

Pit 60 with the quadruple burial of an adult male with three children is located about 20 m west of Group 1. The child's Grave 22 was discovered nearby. Pit 32, about halfway between this feature and Group 1, contained a cranium and a femur from two females of different ages. Pit 63, about 20 m northeast of Group 1, also held cranial remains. Burials 55 (Fig. 3) and 56 (Fig. 4), about 25 m east of Group 1, appear to have been deposited in former storage pits. Kriegler's interpretations as 'pit, in which a creature died' and 'stoning

18 No human remains are preserved from the disturbed Grave 113 or Pit 55. A photograph of the skeleton in Pit 55, however, clearly shows the incomplete epiphyseal closure of the distal ends of the femora. We therefore infer that an adolescent individual of 14–18 years was buried here.

19 Human remains of four individuals (1927/1–4) were not marked on the plan, but were recovered in the same year as individuals from Group 1; a geographical proximity is therefore likely.

Fig. 4. Burial in Pit 56 (Photo: K. Kriegler 1929, © Landessammlungen Niederösterreich, Bereich Ur- und Frühgeschichte, No. 17871).

of an old woman'[20] testify to the vivid imagination of the excavator.

Group 2 is located about 180 m southeast of the settlement and encompasses 14 graves (101–109, 111–115) and one pit (110), from which the skeletal remains of 23 individuals were recovered. The burials in this group were often found disturbed and the skeletons were disarticulated.

The group comprises two females and eight males over 20 as well as 13 individuals under 20, two of which were likely female (106/1, 112). The humerus of a foetus/neonate aged 7–8 lunar months (104/2) was found together with the remains of a 30–35-year-old female (104/1) and represents the youngest individual in the whole sample.

Graves 89 (with two crania), 90 and 91 were not found on the site map. The child's grave of 1981 had only postcranial remains preserved. Skeletal remains recovered from 1981 to 1983 could not be precisely located in relation to the other graves (Fig. 5).

20 Rettenbacher 2004, 83.

1.3. Bronze Age Setting and Radiocarbon Chronology

The small-scale communities that lived in eastern Austria north of the Danube during the Early Bronze Age[21] belong to the Únětice cultural complex, distributed from Thuringia and Saxony via Bohemia and Moravia to Silesia, Slovakia and Lower Austria. Material remains from settlements, clusters of a few houses, testify to a farming lifestyle of growing crops and keeping animals. Few bronze objects were in circulation, but they appear to play a significant role in the economy and the development of social stratification. Both men and women were buried in a flexed position, placed on the right side of the body with the head in the south, in contrast to communities south of the Danube, in which gendered placement of bodies was the norm.[22] Bodies were buried in formal, single graves near the settlements, but also buried or disposed of in decommissioned storage pits.[23] This post-mortem social differentiation is significant. Individuals buried in close contact, often referencing each other in the body positions, suggest social and family relationships.[24]

Samples from eight individuals from different contexts and groups were taken for AMS radiocarbon dating, which was performed at Beta Analytic on bone collagen extracted with alkali. Individuals were chosen to represent a wide range of contexts and for their association with datable material culture. Conventional Radiocarbon Ages (BP) were corrected for natural and laboratory-induced total isotopic fractionation effects and calibrated with BetaCal 3.21 using the INTCAL 2013 atmospheric reservoir database.[25] Probable calendar dates fall between 2084–1627 calBC, a timespan of over 450 years (Tab. 1, Fig. 6). The shortest possible use of the cemetery is roughly 100 years (c. 1950–1850 BC), which seems most likely, given that graves plotting far from each other in radiocarbon years are actually located in close proximity to one another.

Comparing the radiocarbon dates to the typo-chronological framework,[26] Grave 9 dates late in the Únětice development, based on the decorated disk-headed pin and the shape of the ceramic cup. Grave 12 also includes a cup considered late in the typological development. The multiple burial 60 is dated to the developed phase of the Únětice Culture primarily because of the pottery placed on top of the burial; no other radiocarbon-dated contexts contained material culture for comparison.

21 C. 2150–1700 BC, cf. Stockhammer et al. 2015.

22 E.g. at Franzhausen, Pottenbrunn and Gemeinlebarn: Bertemes 1989. – Neugebauer 1991. – Neugebauer, Neugebauer 1997. – Blesl 2006.

23 Neugebauer 1994. – Lauermann 2003.

24 Rebay-Salisbury 2018a.

25 Reimer et al. 2013.

26 Rettenbacher 2004, 55–56.

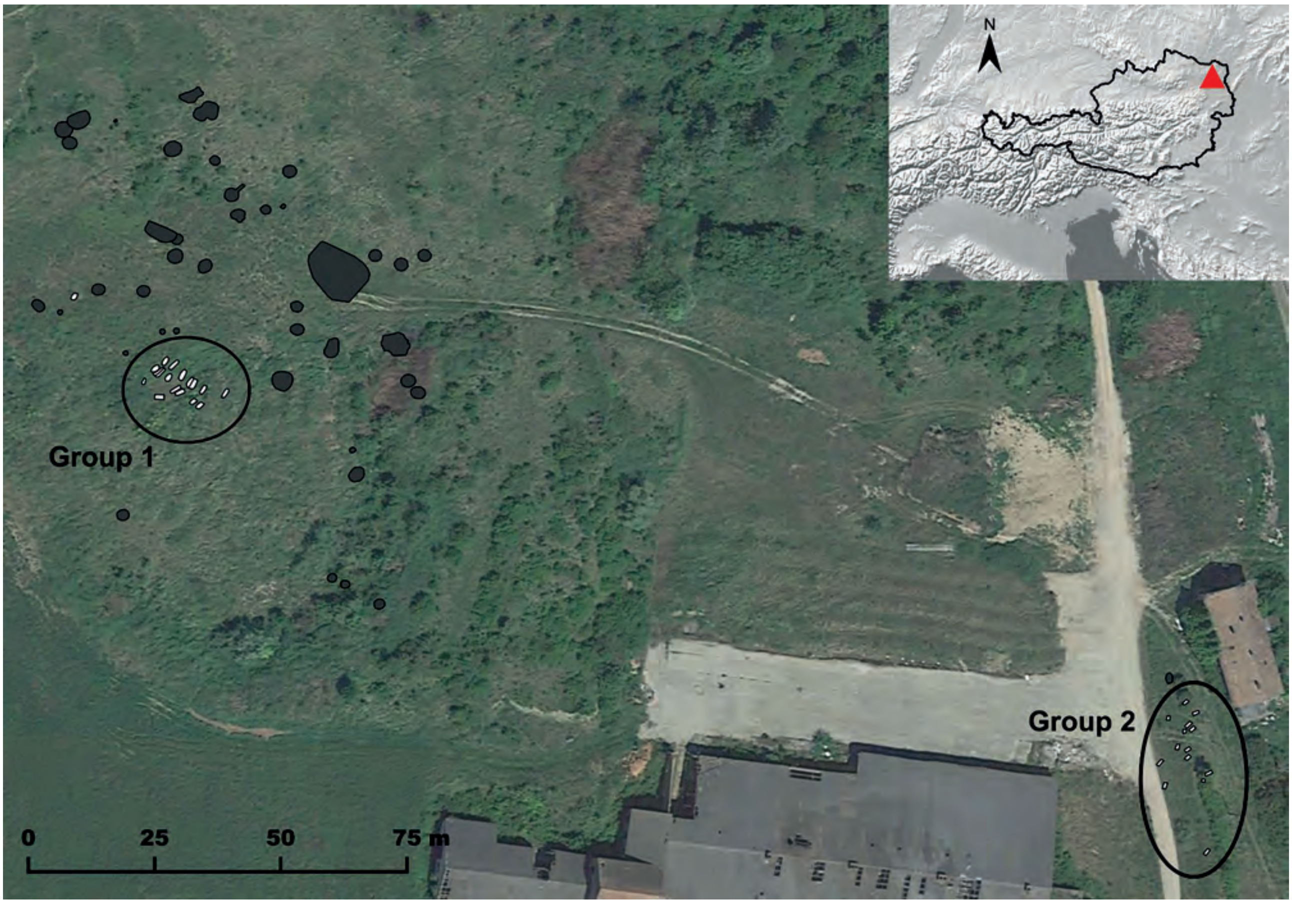

Fig. 5. Schleinbach site map. – Bronze Age pits and graves, including grave groups 1 and 2 (Base map: Google Maps, © 2015 Google; satellite image provided by QuickMapsServices, © 2019 DigitalGlobe; figure: R. B. Salisbury).

Beta no.	Individual	Sex	Age	Conventional age	Calendar calibration (probability)
490671	9A (Group 1)	female	45–55 years	3410 ± 30 BP	1773–1627 calBC (93.1 %) 1865–1849 calBC (2.3 %)
490672	12 (Group 1)	–	5–6 years	3480 ± 30 BP	1888–1737 calBC (90.9 %) 1715–1697 calBC (4.5 %)
490673	22	–	3.5–4.5 years	3610 ± 30 BP	2036–1889 calBC (94.9 %)
494944	30 (Group 1)	male	27–30 years	3640 ± 30 BP	2056–1921 calBC (79.6 %) 2133–2084 calBC (15.8 %)
490674	60C (multiple burial)	–	3–4 years	3500 ± 30 BP	1906– 1743 calBC (95.4 %)
494945	1927/1	female	18–21 years	3550 ± 30 BP	1976–1861 calBC (67.7 %) 1853–1772 calBC (26.9 %)

Tab. 1. Radiocarbon dates of six individuals from Schleinbach (submitted samples of individuals 104/1 and 109 were too contaminated to produce reliable results).

1.4. Burial Practices

Bodies buried in simple grave pits are usually found placed on their right side, with arms bent in front of the body and legs loosely to extremely flexed (n = 18). The three individuals found on their left side were buried in pits (56, 60A, 60B). The supine position, which was used for individuals 60 and 60B in a pit and the individuals in double burial 30/31, is unusual.

The shape and measurements of the grave pits were only recorded in a few cases, but data on the depth of graves is available for 29 graves. The shallowest grave was found at 0.15 m depth, the deepest at 1.6 m, and on average graves were 0.86 m deep. Women were buried in graves with an average depth of 0.83 m, whereas men averaged 0.99 m; individuals under 20 years were buried in graves of 0.83 m depth, and those over 20 years at 0.92 m depth. Age and

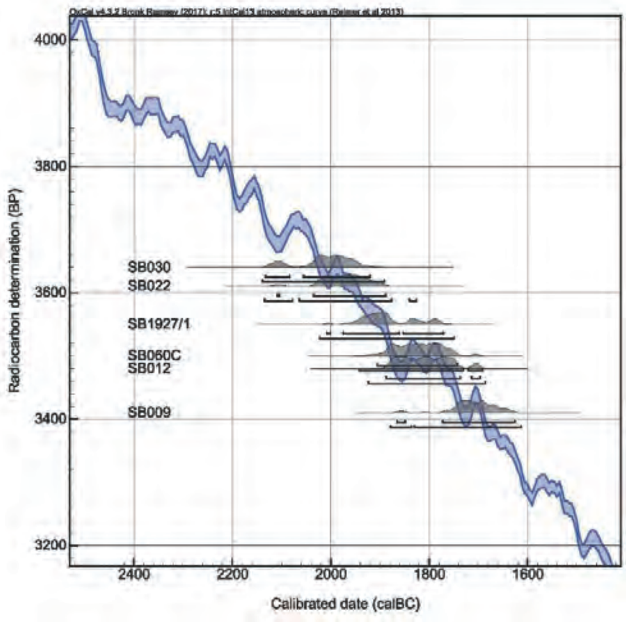

Fig. 6. Curve plot from OxCal 4.3 (https://c14.arch.ox.ac.uk/oxcal/OxCal.html).

gender differences such as these have been observed in other cemeteries such as Unterhautzenthal.[27]

A sketch of the cemetery plan[28] suggests all individuals from Group 1 and Child 22 were placed in a southwest-northeast orientation; the placement of the bodies in Group 2 and within the settlement is less clear. Pit burial 55, the grave of a 14–18-year-old, followed the regular conventions (right body side, southwest-northeast orientations).

The double burial of the two male individuals 30 and 31 (Fig. 7), who died at the ages of 27–30 and 30–35 years, most likely as a result of skull fractures, were placed very close together in a single grave pit. The bones of the feet overlapped (30 over 31) and the pelvic bones almost touch, giving rise to the suspicion that they were bound or wrapped together after death.[29] The kneecaps in anatomical position suggest minimal movement and covering with soil after deposition. The individual on the right, older and more robust, had his left humerus parallel to the body, the elbow was bent at about a right angle so that the lower arm came to rest across the body. The right upper arm, however, slightly overlay the individual on the left (31 over 30) and was bent so that the right hand came to rest on his own neck; the skull may have turned towards the right as part of post-depositional

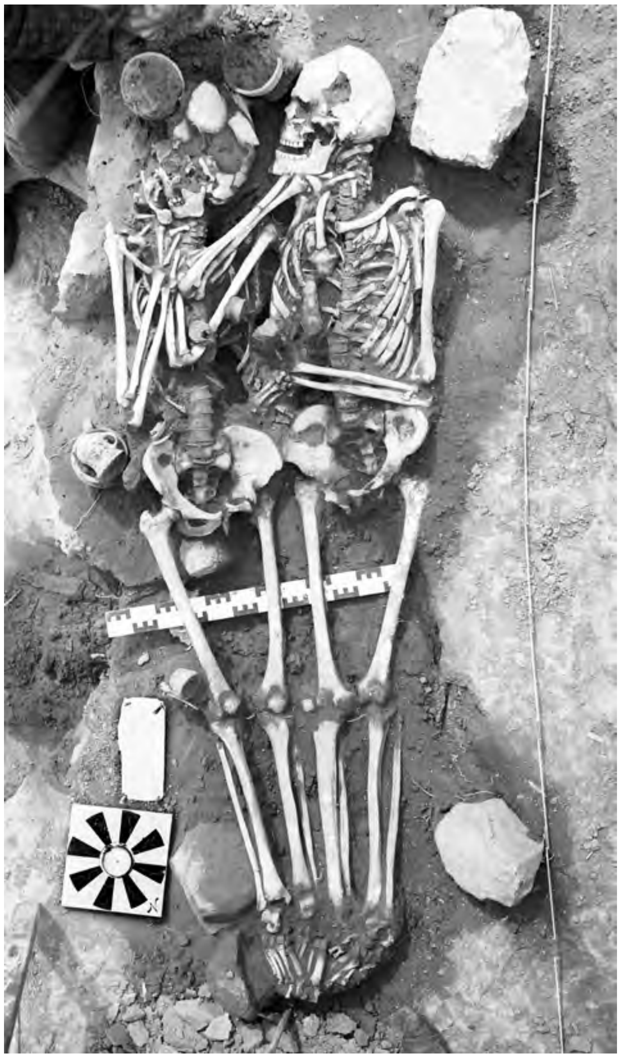

Fig. 7. The male individuals 30 (27–30 years) and 31 (30–35 years) buried together (Photo: K. Kriegler, © Landessammlungen Niederösterreich, Bereich Ur- und Frühgeschichte, No. 17885).

processes. The left, younger and more gracile male, who was originally thought to be a female, had both arms folded on the chest. Again, the hands came to rest near the neck. The skull was found fractured, but the position of the cervical vertebrae suggests that the head had been turned towards the right upon deposition.

Pit 60, a circular structure of 1.4 m depth, contained the quadruple burial of an adult man (60) and three children (Fig. 8). Individual 60A, an 8–9-year-old child of about 120–124 cm in height, was found on the left body side, oriented north-northeast/south-southwest, with flexed arms in front of the upper body, and flexed legs, the left one bent more towards the upper body than the right one. Individual 60B, approximately 12 years old based on the dental status, but probably only 115–119 cm tall, was found with the upper

27 Rebay-Salisbury et al. 2018.

28 Weninger 1954a, 2.

29 Weninger 1954b, 58.

Fig. 8. Burial of an adult male (30–35 years) with three children, 3–4, 8–9 and c. 12 years at death (Photo: K. Kriegler, © Landessammlungen Niederösterreich, Bereich Ur- und Frühgeschichte, No. 17883).

body in an extended position, oriented northeast-southwest, with flexed legs tilted to the left. The right arm is bent at 90° and placed over the body; the left lower arm and lower leg were truncated during excavation. The 30–35-year-old adult male 60 was placed directly on top of both children. There was no soil separating the skeletons, suggesting a single depositional event – a multiple rather than collective grave. He lay in an extended position, with a northwest-southeast orientation, and with legs slightly opened at about 35°. The left lower leg is damaged and the feet are missing. The spine of child 60A came to lie just under the spine of the adult and provided a barrier, which caused a specific break at the thoracolumbar junction. His humeri were found parallel to the upper body, elbows were bent and the hands were found next to the shoulders. This unusual body position has led to his nickname 'the priest' (given by Kriegler). We found the cervical vertebrae in a straight position when we lifted the skull. Since they had not rotated to turn the head while it was still articulated, we can infer that the skull fell towards the right side after the soft tissues had decomposed. Originally, the head was facing straight when it was buried. Individual 60C, a 3–4-year-old child of 75–79 cm height with an unhealed peri-mortem impression fracture of the left parietal bone was the only one placed according to the burial customs of the community, on the right side with flexed legs, in a southeast-northwest orientation. The stratigraphic position over the legs of child 60A suggests it was placed in the pit after this child, but it is unclear if it was deposited before or after the adult, as they do not seem to overlap directly.[30]

It had been noted during the excavation that the rib cages of the adult and children A and B were extraordinarily well, three-dimensionally preserved. The excavator Kriegler interpreted this fact as an indication of artificial body preservation such as mummification. J. Weninger, however, drew a more likely conclusion, namely that after the decomposition of soft tissue, the rib cage must have been filled by 'fortunate soil filling'.[31] He also noted that the children's skulls were turned backwards in relation to the body axes, which some observers interpreted as a sign of a violent death. Weninger suggested that this effect might be explained by water entering the grave, causing the light skulls to float.[32]

In light of the principles of archaeothanatology,[33] we can suggest that the bodies were placed in a pit – presumably an old storage pit – and initially composed in a void. The pit may have been covered, since no traces of rodent gnawing were discovered. The open legs of the adult and older children suggest that the lower bodies had not been bound or restrained by textiles such as shrouds; they were either naked or covered by loose clothing. No bronze dress elements nor traces thereof as stains on the bones were found; only a few animal bones and the fragment of a ceramic vessel were recovered at the level of the bodies. During the decomposition process, gravity caused the skulls to fall backwards and/or rotate. Some bones, such as the right radius of individual 60B, might have moved due to bioturbation. After the decomposition of soft tissue, the void was filled by fine sediment – loess –, which was probably washed into the pit with precipitation. Two complete Early Bronze Age jugs were found on top of the burials, separated by about a metre of fill.[34]

1.5. Material Culture

Many artefacts originally found with the bodies from Schleinbach and mentioned in Kriegler's protocols have subsequently been lost. Rettenbacher described and analysed all available finds in detail;[35] some observations on age and gender associations therefore suffice here.

Bronze dress pins – *Scheibenkopfnadeln*, a *Rollenkopfnadel* and pin fragments – were found in six graves, those of a 3–4-year-old (105) and a 10–12-year-old child (10), a 14–15-year-old (17), and three graves of mature women

30 Weninger 1941, Pl. 2, Fig. 2.
31 Weninger 1954a, 4.
32 Weninger 1954a, 26.
33 Duday 2006. – Duday 2009.
34 Cf. Rebay-Salisbury 2018b.
35 Rettenbacher 2004.

(9, 11, 107). A bronze sewing needle was found with a 13–15-year-old (13).

An *Ösenhalsreif* neck ring was found with individual 101/1, a 14–16-year-old, and mentioned in connection with the 14–15-year-old possible female in Grave 17. *Spiralröllchen* necklace components are primarily found in the graves of women of different ages (3–4-year-old in Grave 105, 14–16-year-old in Grave 101, 15–21-year-old in Grave 112, 30–35-year-old in Grave 104, 45–55-year-olds in Graves 9 and 11).

The c. 4-year-old child in Grave 22 had an arm ring on the right wrist. A pair of cast arm rings were part of the grave good assemblage of the 12–14-year-old in Grave 10. A child's arm ring was further mentioned in context with the mature female in Grave 11, labelled as not part of the grave set.

Noppenringe are amongst the most common pieces of jewellery. Sets were found in three graves of subadults (10–12-year-old in Grave 10, 13–15-year-old in Grave 13, 14–15-year-old female? in Grave 17) and three adult/mature women (30–35, Grave 104; 45–55, Graves 9 and 11). A single *Noppenring* was associated with the 25–35-year-old adult male in Grave 103.

Bone pins and awls are relatively common finds. They were found with a 10–12-year-old in Grave 10, the adult males in double burial 30/31 and a 21–25-year-old male in Grave 15, as well as three females (30–35-year-old in Grave 18, 21–25-year-old in Grave 16, 30–35-year-old in Grave 104).

Mollusc jewellery was found in the form of *Dentalium* pendants in Grave 112 (15–21-year-old, perhaps female) and in the form of shells in Grave 10 (10–12-year-old). A bone disc with a central hole was discovered in Grave 17, near the skull of a 14–15-year-old, possibly female individual. The bone ring discovered in Grave 109 most likely belonged to the 30–40-year-old male, and not to the 2–3-year-old child represented by a cranium in the same grave.

Chipped stone artefacts were also common and were found with ten individuals – both males and females – from the age of 12. Noteworthy is the flint saw, discovered in Grave 9, the burial of a 45–55-year-old female and a 1.5-year-old child.

Pottery was found with 28 of the 64 individuals and was most often deposited as the typical Early Bronze Age set of cup, bowl and jug. Positions near the head, in front of the body or towards the feet have been recorded. Large vessel fragments were part of the fill of pits. Seven graves contained animal bones, likely primarily from sheep/goat and cattle. Their specific placement within the graves suggests they were part of a meat provision.[36]

36 Rettenbacher 2004, 54–55.

1.6. Grave Disturbance and Reconstructed Grave Goods

The secondary reopening of graves, the manipulation of the skeletal remains and object removal was common in the Moravian-Austrian area of the Únětice Culture[37] and in Lower Austria south of the Danube.[38] At Schleinbach, there are significant differences within the cemetery as to the extent of grave robbing.

Group 1 in the northwestern area includes 18 buried individuals, some of which remained undisturbed (10, 13, 29, 30, 31), some were slightly disturbed (14–17) with some body parts, such as the legs, remaining in situ, and one was contracted to a bone pack (9A). The child in Grave 22 buried between Group 1 and Pit 60 was left in peace. The individuals of Pit 60 likewise do not seem to have been moved by human manipulation after decomposition and before they were discovered. The two pit burials, 55 and 56, held bodies in full articulation. Graves 89, 90 and 91 were disturbed (89B perhaps acquired the second skull of a female 89A in the process), but the body placement and orientation remained evident.

In Group 2, only 2 of the 23 individuals (104/1, 105) appear undisturbed; many individuals were found completely disarticulated, such as Graves 107–109, 111 and 112. The majority are hard to assess, as no photographs are available. Grave 115 contained an articulated postcranial skeleton of a 30–39-year-old male, but the skull is missing.

We recorded the anatomical location of green stains on the bones of the skeletons that likely stem from copper salts from bronze grave goods, compared them to the objects found in the graves, and reconstructed missing grave goods for the social status analysis.[39]

Of the 14 individuals associated with bronzes, 12 showed green stains on the bones that could be explained by the still present grave goods (9A, 10, 11, 13, 14, 17, 22, 101/1, 104/1, 105, 107, 112). The individuals from Graves 103 and 106 were likely not in contact with the bronze fragments recorded in their graves. Grave 14, that of a 15–18-year-old with stains on the left zygomatic process, the left clavicle, the left scapula and both radii and ulnae, is likely to have had more jewellery than the recorded '3 mm bronze wire in pin diameter'.[40]

Green staining of the bones was observed in nine individuals (Tab. 2) whose graves did not contain any bronzes upon excavation. Particularly intriguing is the individual in Grave 12, a 5–6-year-old child, which appeared undisturbed.

37 Stuchlík 1990, 165.
38 Sprenger 1999.
39 Cf. Sprenger 1999.
40 Rettenbacher 2004, 75.

Individual	Sex	Age	Location of green stains
12	–	5–6	left side of the viscerocranium (glabella, nasal bone, maxilla, zygomatic bone) and right ramus mandibulae; right clavicle, right scapula and proximal portion of right humerus; right first rib; phalanges of the right hand
16	female?	21–25	left temporal bone
18	female?	30–35	left temporal bone, one cervical vertebra, ribs (?)
89A	female	30–45	right parietal, temporal and occipital bone; skull base, right maxilla, right zygomatic bone; all present cervical vertebrae
89B	male	25–30	right parietal, temporal and occipital bone; both zygomatic processes, right side of the mandible, 5–7th cervical vertebrae and first thoracic vertebra; right clavicle and scapula; some metacarpals and phalanges of the right hand
90	female	27–35	thoracic vertebrae, carpals and metacarpals of the right hand
103/3	–	14–20	distal femur shaft
106/2	–	20–40	lumbar vertebrae, phalanges of the right hand
110	female?	20–40	ribs, cervical vertebrae fragments

Tab. 2. Sex, age and location of green stains for individuals from Schleinbach not associated with bronze grave goods.

The discolorations of the bones suggest that jewellery must have been present in the head, neck, chest and finger regions.

Stains to the temporal regions of the skull suggest *Noppenringe* hair ornaments (12, 16, 18, 89A, 89A, 89B). The extra female skull discovered in Grave 89 probably came from a rich woman's grave, equipped with hair and neck jewellery. The male in the same grave was most likely originally laid into the grave with a *Noppenring* and at least a dress pin, perhaps also a neck ring. Stains on the cervical vertebrae, such as in the individual from Pit 110, suggest neck jewellery; green discolouration of finger bones points to finger rings or bracelets (12, 89B, 90, 106/2). Other stains in a-typical body regions may be traced to unrecovered bronze fragments dislocated in the grave reopening process.

1.7. Social Status

A social status assessment of individuals from Schleinbach is hindered by the site's very incomplete excavation, documentation and artefact recovery. In addition, the level of (contemporary?) grave reopening and artefact removal was high. It is therefore not possible to follow the more detailed social index methodology used at Unterhautzenthal[41] or Franzhausen I.[42] Despite the limitations of the data, a coarse classification into 'rich', 'average' and 'poor' graves enables a comparison of the social treatment of the dead with pathological conditions noted in their skeletal remains. We base the classification on the following criteria:

- rich: two or more types of material culture, evidence for a set of bronze dress elements and jewellery (including inferred by green discolorations on bones)
- average: pottery vessels, but no evidence of bronze assemblages (beyond single rings or fragments, no significant green stains)
- poor: no evidence of bronze goods, no green stains, no pottery vessels (but some pottery fragments in the fill).

Almost all of the 13 'rich' individuals are part of Group 1 (9–14, 17, 18). Only two of Group 2 (101/1, 112), as well as 89B and 90, fall in this category. Importantly, all 'rich' individuals are buried in graves. The 5–6-year-old from Grave 12 is the youngest afforded an individual grave of this category; two older children (10–12 years from Grave 10 and 13–15 years from Grave 13), four adolescents (14, 17, 101/1 and 112), three adults between 20 and 40 years (18, 89B, 90) and two mature individuals between 45 and 55 years (9A, 11) are further in the group of 'rich' burials. Group 1 includes seven (probably) female individuals, but only one male (89B).

Of the 19 individuals rated 'average', seven were buried in Group 1 (15, 16, 23, 27, 29–31), nine in Group 2 (102, 103/1, 104/1, 105, 106/1, 106/2, 107, 113, 114) and three (22, 89A, 1981) off the cemetery groups. All were again found in graves. Group 1 includes five children (c. 1, 3–4, 3.5–4.5, 6–7, 7.5–9 years old), but only one adolescent (the female 16–20-year-old from Grave 106). Eleven adults aged between 20 and 40 and one mature woman aged 40–60 were rated as buried with an average grave good assemblage. Six (probably) female and six (probably) male individuals make for an even gender balance.

The group of the 32 'poor' individuals comprises only two from Group 1 (28, 59), 12 from Group 2 (101/2, 101/3, 103/2, 103/3, 103B, 104/2, 104/3, 108, 109/1, 109/2, 111, 115) and Grave 91. It is noteworthy that most complete burials in storage pits (55, 56, 60, 60A, 60B, 60C, 110) and human remains found in storage pits (32/1, 32/2, 63, 1927/1–4,

41 Rebay-Salisbury et al. 2018.

42 Sprenger 1999.

1981/Grube 3, 1983/Grube 61, 1983/Grube 71) do not include grave goods clearly associated with the individuals. The group of 'poor' burials includes one foetus/neonate, six young (0.3–6 years) and three older (7–13 years) children, four adolescents (14–20-years old), 11 adults aged between 20 and 40 and seven adults over 40 years, amongst which five were identified as female and nine as male.

The 40–55-year-old female from Pit 56, originally described as the 'stoning of an old woman' by Kriegler[43] was indeed found lined and partly covered with stones (Fig. 4). The list of her pathological conditions is impressive and includes multiple healed and partly healed fractures, degenerative changes, sinusitis, periostitis, and poor dental health. This individual embodies ambiguity in the way she was treated: as one of the oldest individuals in the community, she must have received care and help from other members of the community[44] during the healing of her sacrum and forearm fractures. However, the combination of the absence of grave goods, burial in a storage pit, and multiple fractures indicative of hard life experiences, accidents and/or interpersonal violence may indicate a rather low status within the community.

	Rich		Average		Poor	
Female	7	39 %	6	33 %	5	28 %
Male	1	6 %	6	38 %	9	56 %
Undetermined	5	17 %	7	23 %	18	60 %
0–6 years	2	15 %	4	31 %	7	54 %
7–13 years	2	33 %	1	17 %	3	50 %
14–20 years	4	44 %	1	11 %	4	44 %
20–40 years	3	12 %	12	46 %	11	42 %
40–60 years	2	20 %	1	10 %	7	70 %
All	13	20 %	19	30 %	32	50 %

Tab. 3. Gender- and age-related trends of status distribution at Schleinbach (n = 64).

Table 3 summarizes gender- and age-related trends. Overall, 13 (20 %) of all individuals are classified as 'rich', 19 (30 %) as 'average' and 32 (50 %) as 'poor'. That women appear richer in the burial record than men is primarily due to their gender-typical dress and jewellery. It is nevertheless noteworthy that a majority of women are afforded a 'rich' grave, and very few are in the group of 'poor' individuals, whereas with men it is the opposite.

The age structure of the distribution suggests an increase in a person's value from childhood through adolescence. 14–20-year-olds have the highest likelihood of having a well-equipped grave, especially if they are female. The trend tapers off in adulthood, when individuals are most likely to have an average burial. In old age, few individuals receive 'rich' or 'average' burials, more than two-thirds are buried in the 'poor' category.

2. Methods

2.1. Osteology

The methods used to assess age and sex, health aspects and trauma by the morphology of the human remains follow standard protocols and are outlined in detail in the context of our Early Bronze Age case study Unterhautzenthal.[45] For estimating body stature and height, the maximum length of the femora[46] was used to calculate the body height of individuals from Schleinbach.[47] Only 13 individuals had complete femora preserved (9A, 11, 14, 15, 29, 30, 31, 60, 90, 104/1, 108, 106/1, 109/1). The stature of four additional adult/mature individuals and 12 subadults was reconstructed using other long bone measurements.[48] When possible with respect to group size, the best preserved individuals were tested for significant differences with SPSS version 23. Calculations were performed between adult individuals buried in graves, and those buried in storage or settlement

43 Rettenbacher 2004, 27.

44 Tilley 2017.

45 Rebay-Salisbury et al. 2018, with further references. Methods of ageing adults are based on dental abrasion, changes at the pubic symphysis, fusion of endo- and ectocranial sutures, changes in the sternal joint surface of the clavicle and epiphyseal fusion. Bone length measurements, tooth eruption patterns and epiphyseal fusion are taken into account for children. Methods of sexing include a macroscopic assessment of the following features: Cranium: glabellar region, superciliary arch, frontal and parietal eminence, frontal inclination, mastoid process, zygomatic process, relief of nuchal plane, external occipital protuberance, zygomatic process, zygomatic bone, supraorbital margin, shape of orbits; Mandible: total aspect, mental eminence, mandibular angle, inferior margin; Pelvis: preauricular sulcus, greater sciatic notch, subpubic angle, arc composé, complete pelvis, obturator foramen, body of ischium, iliac crest, iliac fossa, greater pelvis, acetabular fossa/femoral head; Long bones: robusticity of humerus and femur. Characteristic features were graded between +2 (definitely male) and –2 (definitely female) and weighted according to their relevance. Pelvic features were given more weight than cranial features. Adapted i.a. from Acsádi, Nemeskéri 1970. – Bass 1971. – Fazekas, Kósa 1978. – Lovejoy et al. 1985. – Szilvassy 1988. – Buikstra, Ubelaker 1994. – Brůžek 2002. – Lewis 2007. – White, Black, Folkens 2012. – Cunningham, Scheuer, Black 2016.

46 FE 1: Martin, Saller 1957.

47 Ruff et al. 2012.

48 Breitinger 1937. – Bach 1965.

pits ('others', total N = 20; 9 females, 11 males; graves: males 15, 108, 109/1, females 9A, 11, 14, 29, 104/1, 106/1, 107; others: males 30, 31, 60, 89B, 115, 1927/2; females 32/2, 56, 90, 1927/1).

Traumatic lesions on the skeletons from Schleinbach were systematically recorded.[49] With the aim of revealing interpersonal violence in this group, we differentiated ante-, peri- and post-mortem lesions. By definition, peri-mortem fractures occur around the time of death, and it cannot be determined whether the individual was alive or dead at that point. No signs of healing are present and specific breakage patterns point to the presence of collagen and elastin in the bones.[50]

The recording of health aspects focused on skeletal and dental markers of deprivation. These include non-specific indicators of stress (porotic hyperostosis, cribra orbitalia, enamel hypoplasia, periostitis, sinusitis, pleurisy, endocranial changes) and signs of metabolic diseases (osteoporosis/demineralization, vitamin C and D deficiency). Dental and periodontal disease (caries, tooth loss) can give general information on the health status and living conditions of a population, enamel hypoplasias further on weaning practices. As a second line of evidence for breastfeeding and weaning, we submitted seven samples from the ribs of individuals of different ages to Beta Analytic for isotope-ratio mass spectrometry (IRMS) measurement of %C ($\delta^{13}C$), %N ($\delta^{15}N$) and C:N ratio.

Degenerative joint changes to the femoral head or the lumbar vertebrae were noted due to their potential influence on the morphology of pelvic features. We recorded ten pelvic features in the bones of the pelvic girdle which may be of interest in relation to pregnancies and childbirth events, in order to understand motherhood and its physical and social consequences for women. These include the shape and stage of the preauricular sulcus, the margo auricularis groove at the sacrum, lesions on the dorsal pubic surface (dorsal pitting), lesions and exostoses on the ventral pubic surface, the shape and exact location of the extended pubic tubercle,[51] sacral preauricular extensions and notches, corresponding facets to the iliac bones, and, complementary to this, exostoses at the margin of the iliac facies auricularis, which can also be age-related.[52] We also assessed adjacent skeletal elements, particularly details on the lumbar spine.

For each person, we represent the aggregation of pelvic changes as a single value, the 'Pelvic Pattern Index' (PPI).[53] The Pelvic Pattern Index can be calculated to compare pelvic patterns within a skeletal series, to other skeletal samples and to the archaeological record to estimate impact levels in terms of load on the pelvis. Elevated values may indicate strain experienced through pregnancies and birthing events, but may also stem from other biomechanical stressors.

2.2. Tooth Cementum Annulation Analysis

Tooth cementum annulation analysis was conducted on seven individuals from Schleinbach to confirm and refine the morphological age assessment (9, 30, 31, 56, 60, 1983/Grube 61 and 1983/Grube 71). Three thin sections of one dental root per individual were prepared at the Centre for Forensic Medicine of the Medical University of Vienna.

Tooth cementum, a connective tissue that surrounds the dental roots, deposits in incremental growth lines visible under the microscope in histological thin sections; each pair of a light and a dark band corresponds to a full seasonal cycle. Counting the number of cementum annulations and adding the number of paired lines to the estimated year of eruption of the analysed tooth[54] reveals the histological age of the individual.[55] In addition to the age at death, tooth cementum annulation analysis may also give insights about the season of death[56] and life events such as pregnancies, skeletal traumas and certain diseases.[57]

In archaeological samples, fungal growth and erosion may affect the preservation of the dental cementum. As an alternative to counting all lines across the whole of the cementum section, we counted the average distance between lines in a well-preserved area and extrapolated the results across the entire section. The number of incremental lines is the total width of the cementum divided by the width between two incremental lines.[58] For example, a lower left second premolar of the 30–35-year-old male individual from a multiple burial in Pit 60 (sample 5628) is overlaid with fungus so it is difficult to see most of the lines. The total width of the cementum is 116.11 µm and the mean distance between two lines 4.43 µm, resulting in 26.2 extrapolated lines across the cementum, which equals an age of 37.7 ± 5 years.

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49 Following the descriptive protocols outlined by Lovell 1997.

50 Cattaneo, Cappella 2017.

51 The features and their recording systems are described in detail in Rebay-Salisbury et al. 2018, 93.

52 Pany-Kucera, Spannagl-Steiner, Rebay-Salisbury 2018a. – Pany-Kucera et al. 2019.

53 We refined the approach used at Unterhautzenthal (Rebay-Salisbury et al. 2018, 98, Parity Index) to include a mathematical formalization: Pany-Kucera, Spannagl-Steiner, Rebay-Salisbury 2018b.

54 AlQahtani, Hector, Liversidge 2010.

55 Wittwer-Backofen, Gampe, Vaupel 2004. – Bertrand et al. 2016. – Blondiaux et al. 2016. – Naji et al. 2016.

56 Meckel 2016. – Ralston 2016. – Wedel, Wescott 2016.

57 Kagerer, Grupe 2001. – Künzie, Wittwer-Backofen 2008.

58 Gupta et al. 2014.

2.3. Mitochondrial DNA Analysis

In order to test the biological relatedness of the individuals buried together in the double burial 30/31 and the multiple burial 60, six samples of teeth were sent for mtDNA analysis to Christina Strobl and Walther Parson from the Institute of Legal Medicine, Medical University of Innsbruck.

The six teeth were analysed according to the protocol published in Parson et al. 2018.[59] In brief, the surfaces of the teeth were mechanically cleaned using a dremel tool and chemically cleaned using a 5 % bleach solution. The teeth were carefully drilled with a dental drill at low speed to prevent overheating, the roots were subjected to milling in a Retsch grinding mill MM400 (Retsch GmbH, Haan, Germany). The resulting powder was lysed and DNA was extracted following the protocol described in Odile M. Loreille et al. 2007.[60] Estimation of mtDNA copy number was performed using a tetraplex real-time PCR quantitation system.[61] Specimens that resulted in the highest mtDNA yields (drill or mill) were directly subjected to sequence library preparation using the IonXpress Fragment Library Kit (TFS) according to the manufacturer's protocol and as described in Mayra Eduardoff et al. 2017.[62] The libraries were sequenced on the Ion S5 (TFS) with automated template preparation using the IonChef pipeline (TFS) according to the manufacturer's protocol. Raw data analysis was performed using the IonTorrent Server analysis pipeline. MtDNA sequence variants were manually reported relative to the rCRS revised Cambridge Reference Sequence,[63] based on phylogenetic alignment considerations.[64] Polynucleotide stretches were not analysed. Haplogroups were determined based on Phylotree,[65] using the haplogrouping function in EMPOP.[66]

2.4. Proteomic Sex Identification

The identification of sexually dimorphic amelogenin protein fragments in dental tooth enamel by nanoflow liquid chromatography-tandem mass spectrometry (nano-LC-MS/MS)[67] has emerged as a new, minimally destructive method to assess the sex of children, even if nuclear DNA is not preserved. We applied this method to four juvenile individuals from Schleinbach and sampled the left deciduous mandibular canine (FDI 73) of the 5–6-year-old child from Feature 1981/Grube 3,[68] the left mandibular second molar (FDI 75) of the 8–9-year-old individual A from Pit 60, the right mandibular second molar (FDI 85) of the c. 12-year-old individual B from Pit 60, and the right maxillary second molar (FDI 55) of the 3–4-year-old individual C from Pit 60.

Samples were prepared at the Medical University of Vienna[69] and analysis took place at the Department of Analytical Chemistry of the University of Vienna. We chose a c. 2.5 × 2.5 mm well-accessible area on each tooth surface.

A small fraction of the tooth enamel was abraded using fine grit sandpaper. The tooth was subsequently washed with 4 % (v/v) hydrogen peroxide (8070.1; Carl Roth) and rinsed with MS grade water (83645.320; VWR). The abraded part of the tooth's surface was immersed in 120 µL 5 % (v/v) hydrochloric acid (1.00317.100; Merck) and etched for two minutes. After the first etch solution was discarded, a second etch was performed similarly to the first one, which was further processed. C18 ZipTips (87782; Pierce® C18 Tips, Thermo Scientific) were used for the peptide clean-up procedure. The C18 ZipTip conditioning was performed by pipetting 10 µL 100 % acetonitrile (83639.320; VWR) three times, followed by 10 µL 0.1 % (v/v) formic acid (84865.180; VWR) three times. Each draw was discarded. The etch solution containing enamel peptides was transferred onto the pre-conditioned C18 ZipTip by transferring the solution into a clean tube, totalling 20 pipette strokes. The resin was washed by pipetting 10 µL 0.1 % formic acid six times; each draw was discarded. Elution of peptides was performed by pipetting 10 µL of elution buffer (60 % ACN, 0.1 % FA) into a clean tube twice. The sample was dried in a vacuum concentrator and reconstituted in 2 µL 30 % formic acid solution containing four synthetic standard peptides (10 fM each) for internal quality control, 10 µL Eluent A (98 % MS grade water, 2 % ACN, 0.1 % FA) were added.

Analysis was performed employing a Dionex Ultimate 3000 RSL Cnano system coupled to a Q Exactive orbitrap mass spectrometer equipped with a nanospray ion source.[70] The measurement protocol for LC and MS conditions was an adapted version of a recently published method.[71]

Data analysis was performed, employing an adapted approach from Nicolas Andre Stewart et al. 2017, focusing

59 Parson et al. 2018.
60 Loreille et al. 2007.
61 Xavier et al. 2019.
62 Eduardoff et al. 2017.
63 Andrews et al. 1999.
64 According to Bandelt, Parson 2008. – Parson et al. 2014.
65 Build 17 www.phylotree.org (last access 21.9.2020): van Oven, Kayser 2009.
66 https://empop.online (last access 21.9.2020): Parson, Dur 2007.
67 Stewart et al. 2016. – Stewart et al. 2017. – Parker et al. 2019. – Cappellini et al. 2019.
68 Rebay-Salisbury et al. 2020.
69 Following a slightly modified version of the protocol described by Stewart et al. 2017.
70 For more details, see Janker et al. 2019.
71 Stewart et al. 2017.

Individual	Femur 1: maximum length (cm)	Body height females (Ruff et al. 2012)	Body height males (Ruff et al. 2012)	Minimum body height (Sjøvold 1990)	Maximum body height (Sjøvold 1990)	Body height females (Sjøvold 1990)	Body height males (Sjøvold 1990)
9A	44.3	162.7 ± 2.92		161.4	170.4	165.9 ± 4.49	
11	41.8	156.0 ± 2.92		154.6	163.6	159.1 ± 4.49	
14	39.9	150.9 ± 2.92		149.5	158.5	154.0 ± 4.49	
15	43.5		161.2 ± 3.21	159.3	168.2		163.7 ± 4.49
29	43.5	160.6 ± 2.92		159.3	168.2	163.7 ± 4.49	
30	44		162.5 ± 3.21	160.6	169.6		165.1 ± 4.49
31	47.4		171.8 ± 3.21	169.8	178.8		174.3 ± 4.49
60	46.1		168.2 ± 3.21	166.3	175.3		170.8 ± 4.49
90	40.9	153.6 ± 2.92		152.2	161.2	156.7 ± 4.49	
104/1	40.4	152.2 ± 2.92		150.9	159.8	155.3 ± 4.49	
108	44.5		163.9 ± 3.21	162.0	170.9		166.5 ± 4.49
106/1	40.8	153.3±2.92		151.9	160.9	156.4 ± 4.49	
109/1	43.4		160.9 ± 3.21	159.0	168.0		163.5 ± 4.49
Mean		155.8 ± 2.92	164.8 ± 3.21			157.6 ± 4.49	163.5 ± 4.49

Tab. 4. Femoral measurements and estimated body height at Schleinbach.

on unique peptide signals of distinct amelogenin isoforms present in the sample via extraction of precursor signals and calculation of isotopic distribution products by employing the software package Skyline,[72] as well as sequence annotation through fragmentation experiments.

3. Results

3.1. Age and Sex

The results of our age and sex assessments led to the revision of previously published biological profile data for the following individuals: the individual from Grave 9A, a 45–55-year-old female according to our assessment, was first published as male,[73] which was repeated in Rettenbacher 2004[74] despite a contradictory assessment as adult female in Teschler-Nicola 1992.[75] The individual from Grave 16, a 21–25-year-old woman according to our assessment, was likewise first classified as a 25–35-year-old male[76] and later as a juvenile to adult female.[77] The individual from Grave 18, probably a 30–35-year-old female according to our analysis, was classified as a 20–25-year-old male[78] and adult male[79] in previous works. M. Weninger already doubted the *ad hoc* interpretation of the double burial 30/31 as that of a man and woman who had to follow the man into the grave in 1954, but this attractive interpretation persisted even in recent publications.[80] The individuals in question are both male and were 27–30 and 30–35 years old at death.

3.2. Body Stature

Females in the community of Schleinbach were on average c. 156 cm tall, males c. 165 cm (Tab. 4), which compares well to individuals from Unterhautzenthal.[81] There is no correlation between social status and body height.

The c. 12-year-old child 60B from the multiple burial in Pit 60 has a noticeable discrepancy between the age derived from the dentition (M2 nearly in masticatory plane, but persisting deciduous teeth) and the measurements of the diaphyseal length of the bones (femur 287 mm). The body height was reconstructed at 115–119 cm, which corresponds to an age of 8–9 years. For comparison, child 60A, with a dental age of 8–9, has a femoral length of 292 mm

72 MacLean et al. 2010.
73 Weninger 1954b, 32.
74 Rettenbacher 2004, 25.
75 Teschler-Nicola 1992, 46–47.
76 Weninger 1954b, 35.
77 Teschler-Nicola 1992, 46–47.
78 Weninger 1954b, 35.
79 Teschler-Nicola 1992, 46–47.
80 See Rebay-Salisbury 2018 for a detailed discussion.
81 156 cm for women, 166 cm for men: Rebay-Salisbury et al. 2018, 85.

and a reconstructed body height of 120–124 cm. Long bone growth retardation may occur because of severe infections in the first three years of life, malnutrition, genetic and hormonal influences as well as diseases.[82]

3.3. Traumas

Cranial injuries were found in 7 of 37 (18.9 %) individuals from Schleinbach (Tab. 5, Fig. 9). The adult male from Pit 60 is the only one with a healed cranial lesion; no signs of healing were found in either adult male from the double burial 30/31, the adult male from Grave 102, the young female 1927/1 and the children from Pit 1981/Grube 3 and Pit 60 (individual 60C). Four of these individuals additionally suffered multiple postcranial fractures. Males were distinctly more frequently affected from neurocranial trauma in this group than females (males 44.4 % compared to females 9.1 %), and most of the lesions were found unhealed. Moreover, 2 of 16 assessable children showed lethal cranial fractures (12.5 %), and neurocranial trauma was found with a higher frequency in individuals not buried in graves.

	Degree of expression	Neuro-cranium	Postcranium upper limb	Postcranium lower limb
Males	0	5/14	4/14	3/14
	1	5/9	8/10	8/11
	2	1/9	1/10	1/11
	3	3/9	1/10	1/11
Females	0	6/17	6/17	4/17
	1	10/11	8/13	11/13
	2	0	2/13	1/13
	3	1/11	1/13	1/13
Undet.	0	3/19	6/18	2/14
	1	14/16	12/12	11/12
	2	1/16	0	1/12
	3	1/16	0	0

Tab. 5. Frequencies of traumatic lesions at Schleinbach. – Degrees of expression: 0 = not assessable, 1 = normal, 2 = one lesion, 3 = two or more lesions present.

Healed postcranial upper limb fractures were documented in 5 of 19 (26.3 %) adults. The females from Grave 9 and Grave 107 show healed possible parry fractures of the ulnae, and the female from Grave 56 had several healed sacrum fractures and both distal forearms were fractured. Bilateral, largely healed fractures of the spina scapulae were found in male 1927/2. Postcranial lower limb lesions, healed and unhealed, were found in 5 of 21 adults (20 %; 30, 31, 56, 104/1 and 108, only haematoma), the 8–9-year-old male child from 60A, and the 7–9-year-old child from Grave 111.

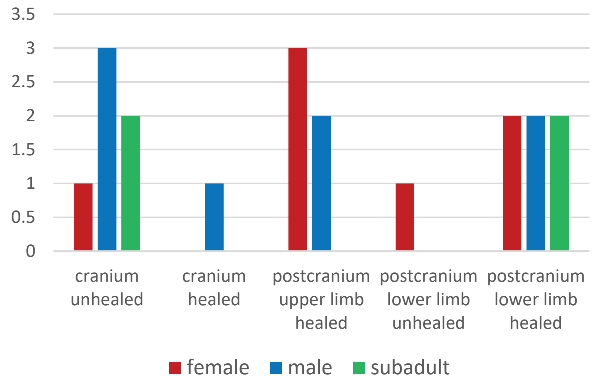


Fig. 9. Healed and unhealed, cranial and postcranial fractures in males, females and children from Schleinbach (n = 63).

Trauma patterns in single individuals demonstrate the extent of violence prevalent in the Early Bronze Age. The well-healed fracture with callus formation found in the distal part of the left ulna of the 45–55-year-old female from Grave 9 most likely represents a parry fracture.

The 40–55-year-old female from Pit 56 reveals well-healed fractures in the distal part of both radii, and superficial bony changes in the right ulna, but no fracture was visible in the radiograph (damage to the distal left). The sacrum of this female, consisting of six vertebrae, exhibited multiple fractures (Fig. 10) including a well-healed, incision-shaped fracture of the right ala ossis sacri, with a fracture line from the middle of the ala to the auricular facet. This fracture also affects the upper quarter of the sacral auricular facet, presenting as a sharp bend in the upper part of the surface, as well as the auricular surface of the ilium. The joint surface in the upper part is completely remodelled with a lateral rim formation. The right ala is narrower than the left one (right: 26.9 mm, left: 33.4 mm from the lateral margin of the basis ossis sacri to the lateral margin of the ala). Another well-healed fracture leads horizontally through the right lateral part of the third sacral segment, with a small vertical fracture line from the second to the third anterior sacral foramen. The third fracture, probably continuing from the second one, presents as a horizontal area of about 10 mm in width, c. 5 mm below the second transverse line. The distinct kyphosis in this area points to a burst fracture. In this area, new

82 Lovejoy, Russell, Harrison 1990.

Fig. 10. Fractures in the sacrum of the 40–55-year-old female from Pit 56 (Photo: W. Reichmann, © NHM Vienna).

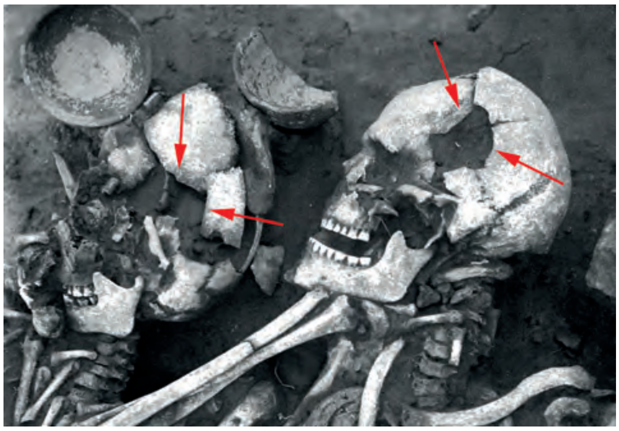


Fig. 11. Individuals 30 and 31 with almost identical peri-mortem injuries to the left parietal bones (Photo: K. Kriegler, © Landessammlungen Niederösterreich, Bereich Ur- und Frühgeschichte, No. 17884).

bone apposition represents inflammatory changes from the healing process. The fourth healed fracture continues in the left lateral part of the sacrum to the lateral margin. Moreover, a crack was observed in the middle of the crista sacralis mediana, and she suffered from a healed fracture in the left fourth metacarpal, and from partial fractures of some ribs.

The third lumbar vertebra was probably affected by a compression fracture, as the right upper plate in particular is flattened on the ventral side. The asymmetry in the sacroiliac joint may be a result of the fracture pattern in this female individual. Most likely, the exostoses on the tubera of the os ischium were caused by altered muscle strains in this region. This rare pelvic trauma pattern is most likely the result of a fall from a height;[83] the bilateral healed fractures of the lower arm bones support this assessment. Whereas the majority of the sacral fractures are well healed, woven bone at the transverse fracture site at the level of S2–S3 indicates active healing. Either this fracture occurred later than the others did, or the fracture never healed, leading to a chronic inflammation.

The two males from the double burial 30/31 (Fig. 7), aged 27–30 and 30–35 years, were found with unhealed peri-mortem neurocranial injuries in the same location in the left temporal region. The fractures are very similar, large burst fractures with radial fracture lines (Ø c. 60 mm, Fig. 11). The lesion in the cranium of individual 30 is round to oval, with sharp margins and chipping to the internal lamina. It is accompanied by an unhealed fracture in the left anterior part of the mandible, extending from the mentum to the premolars, and chipping of the tooth crowns. He furthermore shows a lumbosacral transitional vertebra on the left side,[84] a 'false joint' between the enlarged lateral part of L5 and the ala ossis sacri. An anterior pelvic ring fracture is probably due to lateral compression caused by side-impact accidents and falls.[85] The fracture of the left superior pubic ramus shows clear signs of healing, whereas the inferior pubic ramus is eroded and therefore difficult to evaluate.

Individual 31's cranial lesion in the left parietal bone near the coronal suture is also accompanied by characteristic fracture lines. Chipping is visible in the internal layer of the cranium, and the temporal bone and zygomatic process show related sharp-edged fracture lines. A healed compression fracture to the left side of the fifth lumbar vertebra and signs of an inferior subluxation of the shoulder in the left glenoid cavity were found in the same individual. The lower border of the left glenoid cavity of the scapula developed a new, smooth joint surface (20 × 15 mm). Interestingly, this traumatic event did not result in alterations in the humeral head itself.

Two of the individuals from the multiple burial of a male with three children in Pit 60 show cranial lesions. A circular, well-healed depression fracture was found in the left lateral part of the frontal bone of the 30–35-year-old male 60 (Ø 15 mm, c. 10 mm deep, Fig. 12).

83 Bydon et al. 2014. – Rodrigues-Pinto et al. 2017.

84 Bertolotti's syndrome: Jancuska, Spivak, Bendo 2015.

85 Type 1, Young and Burgess classification: Khurana et al. 2014.

Fig. 12. Cranial lesion on the left side of the frontal bone of the 30–35-year-old male 60 (Photo: W. Reichmann, © NHM Vienna).

The 3–4-year-old child 60C exhibits a star-shaped, peri-mortem burst fracture of the left parietal bone, with five radial fracture lines emerging from the points. The internal lamina is chipped (45 × 25 mm, Fig. 13).

Fig. 13. The 3–4-year-old child 60C with burst fracture in the left parietal (Photo: W. Reichmann, © NHM Vienna).

The remains of the adult individual 1983/Grube 61, found in a pit, consist of the viscerocranium without mandible and a small part of the frontal bone. The nasal bone and the superior orbital margin show a peri- or post-mortem horizontal fracture line, the maxillary tooth crowns are completely chipped off and only the roots of the teeth remained in the alveolar bone. The frontal bone reveals a peri- or post-mortem horizontal linear fracture including chipping of the inner table, with continuation into the temporal bone. Although it cannot be ascertained whether the injuries occurred pre- or post-mortally, the skull appears abraded and eroded. This may point to the curation and circulation of this person's facial remains for a longer period (Fig. 14).

Fig. 14. Cranial remains of the adult individual 1983/Grube 61 (Photo: W. Reichmann, © NHM Vienna).

Fig. 15. Peri-mortem sharp force polytrauma to the cranium of the 25–30-year-old male from Grave 102 (Photo: W. Reichmann, © NHM Vienna).

A peri-mortem sharp force polytrauma of extraordinary extent was found in the cranium of the 25–30-year-old male from Grave 102 (Fig. 15). A horizontal crack extends in an arch from the bregma (mid-point of the coronal suture) to the lambda (mid-point of the lambdoidal suture). This fatal sharp force injury might have been caused by a blow to the left side of the cranium. A bevelled edge was noticed in the left parietal bone near the coronal suture, perhaps from a second sharp cut. A triangular piece of the left orbital margin of the frontal bone was broken off. Several other cranial fragments of the parietal and occipital bones show signs of fracture.

Severe osteophyte growth, especially on the left side of the base plate of the fifth lumbar vertebra of the 30–35-year-old female from Grave 104/1, started to bridge to the first segment of the sacrum. The origin of the lesion is unclear. It may be traumatically induced and is accompanied by possible inflammatory signs. The left calcaneus reveals a small, cone-like exostosis at the fronto-lateral margin of the bone, which may also stem from a trauma.

Healed postcranial traumatic lesions were found in the 40–60-year-old female from Grave 107, one on the distal shaft of the left ulna, most likely a parry fracture, and one on the mid-shaft of the left clavicle, which healed in malposition at a slight angle.

The superior part of the left femur shaft of the 7–9-year-old child buried in Grave 111 appears thickened and slightly bent in the antero-posterior direction. This change in the normal morphology of the femur points to a greenstick fracture in the early life of this child. The 8–9-year-old boy 60A exhibits a healed avulsion fracture of the lateral tubercle of the right talus.

The 30–40-year-old male from Grave 115 suffered from a severe fracture at the distal end of the left radius, probably involving the carpal bones. The epiphysis of the radius is thickened and shows signs of osteoarthritis. During the fracture event, the os lunatum was shattered and later merged with the joint surface at the facies articularis carpea, the joint surface facing the carpal bones. The preserved part of the circumferentia articularis at the caput ulnae corresponding to the radius shows only slight remodelling. Since the lesion healed and a pseudo joint developed, the hand appears to have been used after the incident, despite the pain (Fig. 16).

Two peri-mortem, slightly overlapping round to oval sharp force traumas were found in the right parietal and frontal bones of the 18–21-year-old female 1927/1 (Fig. 17). The smaller injury (c. 18 × 27 mm) affects the right parietal and frontal bone equally, and partly overlaps with the larger one (c. 25 × 33 mm) located around the bregma; it affects a small portion of the frontal and right parietal bone as well as the left parietal bone, which is only partly preserved. An unhealed, peri-mortem sharp cut in the left tibia (12 mm length) was found in the same individual.

A rare bilateral scapular fracture affected the 40–50-year-old male 1927/2 (Fig. 18). The right scapula exhibits a well-healed fracture with callus formation in the medial part of the spina scapulae. The left scapula shows a healing fracture with porotic new bone formation in the medio-lateral part of the spina scapulae; perhaps a repeated injury. These rare fractures result from direct trauma, and lesions of the scapular body and vertical scapular spine fractures were ascribed to beatings.[86] Only the spinae of the scapulae are affected by a transversal healed fracture in this case, which may be a result of repeatedly carrying heavy loads on the back.

The remains of a 5–6-year-old child with multiple cranial fractures were found in Pit 1981/Grube 3 (Fig. 19). The cranium shows four peri-mortem blunt force traumas: an oval-shaped impression fracture with partial penetration of the inner and outer table is located on the left side of the frontal and parietal bone in the area of the coronal suture (60 × 35 mm). The lesion represents an incomplete impression fracture; the dorsal part is still attached. This lesion could represent the location of the first blow. Two smaller, round to oval-shaped comminuted lesions with linear and radial fracture lines were detected in the right parietal bone, one in the area of the parietal tubercle and the other next to the sagittal suture in the area of S2 (Ø 25 mm each). The fourth lesion is a large, circular impression fracture with complete penetration of the skull in the right parietal and occipital bones in the area of lambdoid suture (Ø 45 mm).

3.4. Health Aspects

Non-specific indicators of stress and infections

The causes of unspecific indicators of stress and infection are multifactorial, but deprivation and stress are frequently involved.[87] At Schleinbach, 3 of 15 (20 %) assessable adults were affected by cribra orbitalia (Pit 61: 20–40 years, undetermined sex, bilateral clustered porosities, Stage 3; 15: 21–25-year-old male with a cluster of fine foramina in the left orbit, Stage 2; 56: 40–55-year-old female, small area with porosity on the right orbital roof). 3 out of 11 children (27.3 %) with preserved orbital roofs showed severe orbital cribra (13: 14-year-old with right orbit Stage 3, left orbit Stage 2; 60C: 3–4-year-old with fine foramina covering the roof of both orbita, Stage 2; 91: 3–5-year-old with fine porotic cribra orbitalia in the left orbital roof, Stage 2).

Porotic hyperostosis was found in the form of pitting in the parietal and occipital bones of the lamina externa of the cranium in 4 of 15 assessable adults (26.7 %, features 32/2, 56, 63, 101/2). Only 1 of 17 children (5.9 %), the

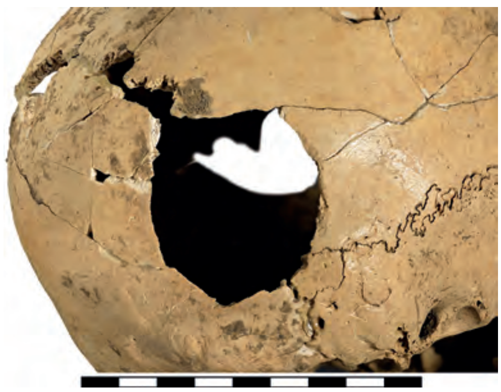
86 Resnick 1995, 2719. – Blondiaux et al. 2012. – Mays 2015.

87 See Rebay-Salisbury et al. 2018 for a summarized overview.

Fig. 16. Fracture and remodelling of the left wrist of the 30–40-year-old male from Grave 115 (Photo: W. Reichmann, © NHM Vienna).

Fig. 17. Sharp force traumas to the right parietal and frontal bones of the 18–21-year-old female 1927/1 (Photo: W. Reichmann, © NHM Vienna).

Fig. 18. Bilateral scapular fracture in the 40–50-year-old male 1927/2 (Photo: W. Reichmann, © NHM Vienna).



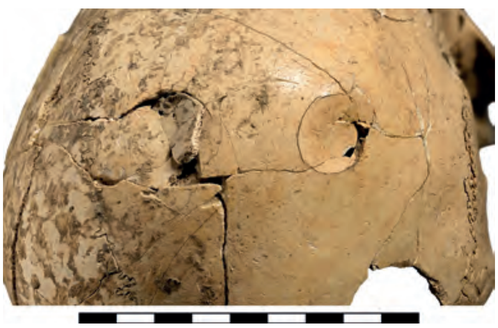


Fig. 19. Multiple head injuries to the cranium of the 5–6-year-old child 1981/Grube 3 (Photo: W. Reichmann, © NHM Vienna).

Beta no.	Individual	Sex	Age	Sampled material	IRMS δ^{13}C	IRMS δ^{15}N	C:N ratio	Wt %C (concentration of C)	Wt %N (concentration of N)
490671	9A	female	45–55 years	rib	–19.1	11.34	3.2	41.97	15.08
490672	12	–	5–6 years	rib	–19.3	11.37	3.3	40.12	14.29
490673	22	–	3.5–4.5 years	rib	–18.7	11.82	3.3	41.61	14.88
494944	30	male	27–30 years	rib	–19.2	11.39	3.3	39.98	14.05
490674	60C	–	3–4 years	rib	–19.6	12.92	3.3	41.21	14.65
490662	105		3–4 years	rib	–19.49	11.56	3.2	42.93	15.43
494945	1927/1	female	18–21 years	rib	–19.1	11.89	3.3	33.74	11.95
All	Average				–19.22	11.76	3.3		

Tab. 6. Carbon and nitrogen isotope values from Schleinbach individuals.

8–9-year-old 60A from the multiple burial in Pit 60, revealed porotic hyperostosis in the form of fine porosities in the parietal bones.

Four adolescent individuals (of 14 subadults, 28.6 %) and none of the 13 assessable adults revealed linear enamel hypoplasias in their incisors and canines. In all four individuals, the hypoplasias correspond to a similar formation age: between 2.5 and 3.5 years in individual 13, between 2.5 and 3.4 years in individual 14, between 2.9 and 3.5 years in individual 17, and between 2.5 and 3.4 years in individual 1983/Grube 71. Linear enamel hypoplasias indicate physiological stress in early childhood, caused by disease or nutritional stress, which is often experienced during weaning. The findings may suggest that children were weaned after the second year of life at Schleinbach.

The results from the mass spectrometry isotope analyses of weaning practices are very similar to the ones obtained from Unterhautzenthal,[88] with average values of –19.22 for δ^{13}C and 11.76 for δ^{15}N suggesting a terrestrial diet based on C3 resources. The 3–4-year-old child 60C from the multiple burial in Pit 60 has elevated δ^{15}N values, which perhaps points to a longer period of breastfeeding, but may be rooted in other causes such as illness and starvation.[89] The similarly aged individual 105 shows no such nursing signal (Tab. 6).

3 out of 14 adult individuals (21.4 %), all of female sex, have signs of sinusitis in the maxillary sinuses. The 45–55-year-old female from Grave 11 shows remodelled new bone formation in the right maxillary sinus, caused by acute or chronic respiratory infections. The 40–55-year-old female from Pit 56 reveals spiculae and netlike new bone deposits in the right maxillary sinus, pointing to a healed sinusitis. The changes are perhaps related to the periapical abscess in the upper first molar. The 30–45-year-old female 89A was affected by dentogenous sinusitis, with remodelled inflammatory reactions in the right maxillary sinus possibly caused by an apical lesion of the first molar.

Signs of pleurisy were found in 3 of 17 adults (17.6 %) and 5 of 16 subadults (31.3 %). The adults were all late adult males: acute and healed new bone formation at the upper dorsal rib ends was found from the first rib onwards in 108. The spine of this individual further showed multifocal lytic lesions of the cervical vertebrae 2, 3, 5–7 (4 is missing) and the thoracic vertebrae 1–6. These changes may be attributed to brucellosis, mycosis or cancer. Partially remodelled new bone formation on the pleural side of some left dorsal ribs was observed in 109/1. The third affected individual, 115, shows bilaterally remodelled periosteal new bone formation in four dorsal rib fragments. Changes on the pleural side of some ribs were found in five subadults, often in the dorsal part (13, 17, 105, 106/1, 111). The observed fine porous new bone apposition indicates active pleurisy; only the young female 106/1 shows partial healing of the lesions (Fig. 20).

Fig. 20. Pleurisy visible in the dorsal ribs of the 16–20-year-old female from Grave 106/1 (Photo: W. Reichmann, © NHM Vienna).

88 Rebay-Salisbury et al. 2018, 106–107.

89 Reynard, Tuross 2015. – Beaumont et al. 2018.

	Degree of expression	Porotic hyperostosis	Cribra orbitalia	Periosteal reactions	Neurocranial trauma	Intravital tooth loss
Graves	0	14/34	20/30	5/34	11/32	12/33
	1	19/20	8/10	22/29	18/21	18/21
	2	1/20	1/10	4/29	1/21	2/21
	3	0	1/10	3/29	2/21	1/21
Settlement features	0	7/18	3/16	9/17	3/16	5/16
	1	7/11	9/13	5/8	10/13	8/11
	2	4/11	3/13	3/8	2/13	0
	3	0	1/13	0	1/13	3/11

Tab. 7. Differences in frequencies of non-specific signs of stress, neurocranial trauma and intravital tooth loss between individuals buried in graves and settlement features. – Degrees of expression: 0 = not assessable, 1 = no pathological change, 2 = slight pathological change, 3 = severe pathological change; for neurocranial trauma and intravital tooth loss 3 = two or more lesions.

Traces of perisinusitis, indicated by secondary new bone formations at the venous blood vessels inside the cranium have been noticed in two individuals, 1 of 15 adults (6.7 %, 18: 30–35-year-old female) and 1 of 13 children (7.7 %, 105: 3–4-year-old). The female individual showed remodelled changes at the confluens sinuum. The netlike new bone formations in the confluens sinuum and the transverse sinuses of the 3–5-year-old child 105 point to a healing process.

Periostitis, an inflammation of the periosteum, is mainly caused by bacterial infections, but vitamin C deficiency, local trauma or autoimmune diseases are possible causes, too. At Schleinbach, periostitis was found in 6 of 20 adults (30 %, 32/2, 56, 59, 60, 108, 115) and 4 of 18 children (22.2 %, 13, 14, 105, 106/1). New bone formations indicative of active periostitis were found in the proximo-dorsal shaft of the right ulna of the 13–15-year-old from Grave 13, perhaps caused by a local trauma. The 3–4-year-old child 105 shows widespread new bone formation in the shaft of the left femur and the left tibia, which may have been part of a systemic disease such as scurvy. The severe porosity and thickening of the femora and tibiae in the late adult male 115 may be associated with other diseases such as osteomyelitis or osteitis related to the severe wrist fracture. A secondary infection might have spread via the bloodstream. In general, males and females were equally affected by periosteal reactions in this group.

Striations in the bones as possible signs of healed periostitis were detected in the 15–18-year-old individual from Grave 14 (femora and tibiae), the 35–45-year-old female from Pit 32 (right femur shaft), the 40–55-year-old female from Pit 56 (femora, tibiae, signs of remodelled haematoma in the left femur), the 35–45-year-old male from Grave 59, the 30–35-year-old male from multiple burial 60 (femora and tibiae) and the 16–20-year-old female 106/1 (medial shaft of both tibiae). The 40–50-year-old male 1927/2 shows striations in the femora and the right tibia in addition to the acute pathological condition of the left tibia. The reactive new bone formation in the left fibula could indicate an additional soft tissue injury.

Group differences between the 'grave' and the 'others' group were revealed in crosstabs results. An approximate significance for the presence of porotic hyperostosis in the others group as a non-specific sign of stress was found in Kendall's tau-c test for the left side ($p = .046$) and close to significant results for the right side ($p = .051$). The others group also surpassed the grave-buried individuals in the other non-specific signs of stress, however, not with significant results. Moreover, neurocranial trauma and intravital tooth loss were found with a higher frequency in individuals buried outside formal graves (Tab. 7, Fig. 21).

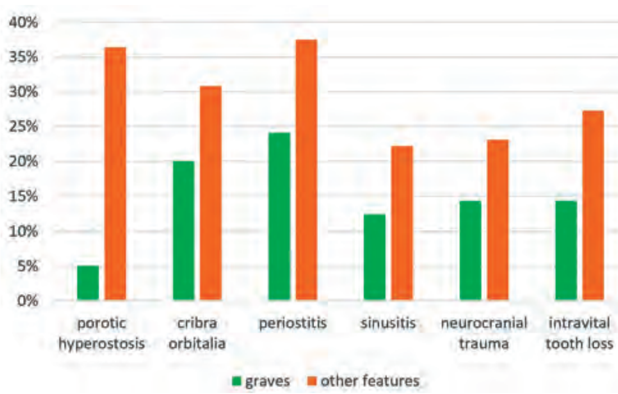


Fig. 21. Percentage of individuals buried in graves and other features affected by non-specific stress signs, neurocranial trauma and intravital tooth loss.

Metabolic diseases

Signs of metabolic diseases were found only rarely at Schleinbach. One of the affected individuals is the 15–18-year-old probably female adolescent from Grave 14. She shows very well remodelled striations on the surface of the femora and tibiae; together with bilateral indentations and flattening in the distal medial part of the femora as well as distinctly bowed tibial shafts, these indicate the disease pattern of rickets. Pronounced attachments of the soleus and the tibialis anterior muscle may add to the picture of altered muscular requirements (Fig. 22).

The 3–4-year-old child from Grave 105 and the 16–20-year-old female from Grave 106/1 were possibly affected by scurvy. The child 105 reveals severe periostitis through extensive new bone apposition in the lateral shaft of the left femur and the medial part of the left tibia. The reactive new bone apposition in the dorso-distal part of both femora (*facies poplitea*) and the striations in the medial shaft of both tibiae of 106/1 also match the disease pattern of scurvy. The signs of pleurisy in these subadults add to the diagnosis.

The remodelled intensified pitting and new bone formation to the facial bones of the 5–6-year-old child 1981/Grube 3 affected the maxilla, zygomatic bone, squamous part of the temporal bone and the auditory meatus, possibly indicating (healed?) scurvy. In addition to the metabolic diseases, porotic thickening of the external auditory meatus and osteomyelitic changes in the maxillary bones of this individual might indicate an uncontrolled infection of the middle ear.

In contrast to Unterhautzenthal, there were no noticeable signs of osteoporosis/osteopenia in any of the individuals buried at Schleinbach, except for the female in Pit 56.

Fig. 22. Femora and tibiae indicating rickets in the 15–18-year-old probably female adolescent from Grave 14 (Photo: W. Reichmann, © NHM Vienna).

Dental and periodontal disease

Caries, tooth loss and other conspicuous changes in dentition were recorded. Of 21 assessable adult individuals, 2 females and 1 male were affected by carious lesions (14.3 %), 104/1 with a single lesion, and 11 and 89B with more than one. Interestingly, none of the 15 subadults showed signs of caries. Intravital tooth loss in the adults was present in 6 of 14 (42.9 %) assessable individuals: 11, 29, 56, 89A, 89B and 107. Except for 89B, all of the individuals affected by intravital tooth loss are female, three of them (all of them over the age of 30 years) suffered from multiple tooth loss, and intravital tooth loss was found more frequently in individuals buried outside formal graves (Tab. 7). Calculus or its traces were found in the adult individuals 11, 31 and 56 as well as in the children 10 and 60A. A severe alveolar atrophy in child 60A was probably caused by the formation of the calculus at a young age.

The 45–55-year-old female from Grave 11 has noticeable changes in her dentition. The three carious lesions in the upper right second molar, the lower left second molar and premolar are all located at the necks of the teeth. Thick dental calculus deposits formed especially in the lower jaw – the outer surfaces of the second premolar and the first molar are completely covered. She was further affected by tooth loss and parodontosis as well as an asymmetrical abrasion of the teeth in the upper jaw.

Several periapical abscesses, tooth loss and very strong wear down to the dentine, especially in the maxillary teeth, were found in the dentition of the 40–55-year-old female from Pit 56. Most of the changes, including pronounced

Fig. 23. Dental status of maxilla and mandible of the 40–55-year-old female from Pit 56 (Photo: W. Reichmann, © NHM Vienna).

stomatitis with spiculae and small ridges on the palate probably stand in a causal relationship with the severe wear of the teeth. The new bone deposits in the right maxillary sinus are probably connected to a periapical abscess at the upper first molar (Fig. 23).

The 30–35-year-old male from the multiple burial in Pit 60 reveals a strong, uniform dental abrasion, especially in the upper jaw. He further suffered from apical abscesses in both upper first molars. The advanced alveolar atrophy may have been caused by extensive calculus formation. The oblique wear on the lingual side of the upper left maxillary premolars and molars as well as the dental chipping, especially in the frontal teeth, point to use of the teeth as a tool (Fig. 24).

Fig. 24. Tooth wear to the maxilla in the 30–35-year-old male from the multiple burial in Pit 60 (Photo: W. Reichmann, © NHM Vienna).

The 30–45-year-old female from Pit 89 shows similar changes in her dentition to the female from Pit 56: severe, uniform dental wear in the upper jaw. Furthermore, apical lesions were found at the roots of the upper right and left first molars; signs of severe stomatitis with ridge-like exostoses were found in the palatine. The alveoli of both upper third molars are in the same stage of healing after recent tooth loss. Distinct degenerative changes were found in the left mandibular fossa. Taken together, these changes point to a lack of oral hygiene and perhaps frequent use of the teeth as a tool. The 25–30-year-old male from Pit 89 shows signs of stomatitis, carious lesions in the lower second molar and intravital tooth loss. The 40–50-year-old male 1927/2 reveals severe oblique dental wear, especially in the upper jaw, and some teeth with intravital chipping. The 30–35-year-old female from Grave 104 has a small caries lesion at the interface of the canine and the first premolar in the right upper jaw. Alveolar atrophy and alveolar pitting were further found in her dentition. Only the mandible is preserved of the dentition of the 40–60-year-old female from Grave 107; it shows multiple intravital tooth loss in the molars and a general alveolar atrophy.

Degenerative joint disease

Degenerative changes were noted in 14 individuals from Schleinbach, including two children. The 45–55-year-old female from Grave 11 shows a severe form of osteoarthrosis and osteoarthritis in the femora and tibiae of both knee joints. Distinct changes in the form of rim-like new bone formation at the margins and a loss of smoothness on the surface affected the distal femoral joints and the proximal tibial joints. A periarticular cyst was detected on the lateral part of the right tibia. None of the other large joints of this female show osteoarthritic changes. The cause of these changes might be both her severe case of gonarthrosis (*genu valgum*, 'knock knees') and the plane of the proximal tibial joint surfaces tilting downwards towards the dorsal side (Fig. 25). Risk factors for knee osteoarthritis include ageing, being female, excess weight and obesity, knee injuries, repetitive joint movements, reduced bone density, muscle weakness and joint laxity. Clinical radiography studies indicate that a high number of pregnancies, i.e. more than five or six, increases the risk for knee osteoarthritis.[90]

Degenerative changes in the form of new bone formation at the joint margins of both knees were also found in the 30–35-year-old male 31 from double burial 30/31. His tuberositas tibiae reveals distinct exostoses, and both femora show strong muscular changes at the linea aspera (similar to the adult male 60). The anterior-posterior diameter of the femora surpasses the sagittal one, indicating high mobility.[91]

The 40–55-year-old female from Pit 56 shows degenerative changes in several joints: the mandibular joints, the distal phalanges and the third to sixth cervical vertebrae. She further exhibits signs of deforming spondylosis in the second to fifth lumbar vertebrae. Taken together, the changes could point to the presence of chronic polyarthritis.

The acetabulum and the femoral head of the right hip joint of the 35–45-year-old male from Grave 59 is affected by severe coxarthrosis. The acetabulum is enlarged with new bone formation at the margin. The femoral head has developed a flattened, mushroom-like shape (Fig. 26), which may be caused by trauma.

The 30–35-year-old male from multiple burial 60 shows slight degenerative changes in the lumbar vertebrae, strong muscle attachments at the linea aspera of the femora and ridge-like exostoses in the superior part of the dorsal shaft of the tibiae (M. gastrocnemius and M. soleus). He, too, was of very robust stature.

Distinct degenerative changes to the left mandibular joint with enlarged facets were noted in the 30–45-year-old female from Pit 89.

The 27–35-year-old female from Grave 90 shows changes in both humeri from a pronounced attachment of the M. teres minor on the lateral side of the humeral heads and the M. brachialis in the upper part of the frontal humeri. These muscles are involved in external rotation and forearm flexion.

Slight degenerative changes in the form of osteophyte growth were found in the proximal part of the caput tali

Fig. 25. Gonarthrosis in the 45–55-year-old female from Grave 11 (Photo: W. Reichmann, © NHM Vienna).

Fig. 26. Coxarthrosis in the 35–45-year-old male individual from Grave 59 (Photo: W. Reichmann, © NHM Vienna).

90 Heidari 2011.

91 Ruff et al. 2006.

(*facies articularis navicularis*) in the 16–20-year-old female from Grave 106.

The 7–9-year-old child 1981 is another young individual with exostoses; changes were found in the lateral aspect of the dens axis.

The 40–60-year-old female from Grave 107 has degenerative changes in the second cervical vertebra, especially in the dens axis. Distinct degenerative changes (Stage 3) were found in the left femoral head, which appears very large. Distinct muscle attachments were found in the upper and lower limbs.

The individuals from the graves 109/1, 114 and 115 reveal slight degenerative changes in the large joints. Degenerative changes in the distal joint of the first phalanx of the right hand and osteophyte formation on the ventral side of the lumbar vertebrae 1–4 were recorded in the 40–50-year-old male 1927/2.

Fig. 27. Extended pubic tubercle and dorsal pitting of extraordinary size. – Left side: Deep long groove, 26.4 mm length, 6.2 mm width, 4.2 mm depth. – Right side: Deep oval pit, 13.4 mm diameter, 5.9 mm depth (Photo: W. Reichmann, © NHM Vienna).

3.5. Pelvic Features and Pelvic Pattern

Pelvic features were recordable for 21 individuals from Schleinbach, including nine adult/mature males (15, 30, 31, 60, 89B, 108, 109/1, 115, 1927/2), ten adult/mature females (9A, 11, 14, 29, 56, 90, 104/1, 106/1, 107, 1927/1) and two female adolescents (14: 15–18 years, 106/1: 16–20 years).

The region of the preauricular sulcus was preserved in 19 individuals: nine males and ten females (Tab. 8). Eight males showed the typically male, smooth shape, Stage 1, in this region.[92] This shape and stage was not found in any of the females. A weakly developed sulcus (Stage 2) was found in two females (14, 107) and one male (89B). More strongly expressed preauricular sulci (moderate/strong expression, Stages 3/4) were exclusively found in females; Stage 3 in individuals 9A (45–55 years) and the adolescents 106/1 (16–20 years) and 1927/1 (18–21 years). Five females presented a large, well defined sulcus of Stage 4, three of them on both sides (29: 30–35 years, 56: 40–55 years, 90: 27–35 years), and two of them on one side (11: 45–55 years, 104/1: 30–35 years).

The Schleinbach sample revealed a similar relation between the presence of a deep preauricular sulcus and short body height as at Unterhautzenthal.[93] Half of the eight females with deep sulci (Stage 3 or 4) are shorter than or equal to the mean body height of 156 cm (11, 90, 104/1, 106/1).

The margin of the auricular facet at the ilium was observable in 19 individuals: 11 females and eight males. Exostoses were found in six females (9A, 11, 32/2, 56, 90, 104/1) and three males (60, 108, 1927/2). The region of the extended pubic tubercle was available for assessment in six individuals: five females and three males. Two of the females revealed a distinct development of the tubercle (11: 45–55 years, 90: 27–35 years). A large, clearly defined extended tubercle (> 3 mm, Stage 3, Fig. 27) and a sharp-edged pecten ossis pubis on the right side were present in the female from Grave 11, and a small extended tubercle (Stage 2) in the female from Grave 90. None of the males had an extension at the pubic tubercle location.

The dorsal symphyseal and adjacent area was observable in nine individuals: six females and three males. Four females (11, 29, 56, 90) had lesions on the dorsal pubic surface. The female from Grave 11 revealed an exceptionally large, oval-shaped dorsal pit in the centre of the right side of the dorsal pubic surface, extending into the upper part, although less deep (Stage 3, > 2 mm, Fig. 27). The Stage 3 lesion on the left side of the dorsal pubic surface, in contrast, resembles a groove, is elongated and extends parallel to the symphysis. It covers nearly the whole surface from the upper to the lower third of the dorsal symphysis. Her severe bilateral gonarthrosis might be a cause of this severely pronounced form of dorsal pitting. None of the males had any changes to the dorsal pubic surfaces.

Exostoses on the ventral pubic surface were found in 3 of 6 females (29, 90, 56) and 1 of 3 males (60) for which the region could be examined. Lesions on the ventral pubic symphysis were present in 4 of 6 females (11, 29, 90, 56) and 1 in 3 males (30, an individual with a left-sided lumbosacral transitional vertebra).

In the detailed and systematic skeletal analysis of pelvic parts in the framework of the project, we noticed specific

92 Brůžek 2002. – Steckel et al. 2006.

93 Rebay-Salisbury et al. 2018, 96 and Fig. 15.

		Pelvic Pattern Index	0.56	0.61	0.05	0.00	0.44	0.10	0.00	0.50	0.67	0.22	0.06	0.55	0.33	0.43	0.33	0.00	0.00	0.25	0.11
	10	Number of calculated weightings	3	9	7	5	9	10	5	2	8	9	6	10	6	5	3	2	2	10	9
	10	Number of assessable pelvic features (10)	3	9	7	5	9	10	5	2	8	9	6	10	6	5	3	2	2	10	9
		Corr. changes at apex of iliac auricular facet left	1	1	1	0	1	1	1	0	1	1	1	1	1	1	0	0	0	1	1
		Corr. changes at apex of iliac auricular facet right	0	0	1	1	1	1	1	1	2	1	1	1	1	2	1	0	0	2	1
2	1	Corr. changes at apex of iliac auricular facet	1	1	1	1	1	1	1	1	2	1	1	1	1	2	1	0	1	2	1
		Sacral preauricular notch left	0	0	0	0	1	1	1	0	1	1	0	1	1	1	0	0	0	0	1
		Sacral preauricular notch right	0	1	0	1	1	1	1	0	2	1	1	2	0	2	0	0	0	1	1
3	1	Sacral preauricular notch	0	1	0	1	1	1	1	0	2	1	1	2	1	2	0	0	0	1	1
		Sacral preauricular extension left	0	0	0	0	2	1	1	0	1	1	0	1	1	1	0	0	0	0	1
		Sacral preauricular extension right	0	2	0	1	2	1	1	0	1	1	1	1	0	1	0	0	0	2	1
3	1	Sacral preauricular extension	0	2	0	1	2	1	1	0	1	1	1	1	1	1	0	0	0	2	1
		Os sacrum margo auricularis groove left	0	0	0	0	0	1	0	0	1	0	1	1	1	1	0	0	0	1	0
		Os sacrum margo auricularis groove right	0	0	0	0	0	1	0	0	2	0	1	1	0	1	0	0	0	2	0
4	1	Os sacrum margo auricularis groove	0	0	0	0	0	1	0	0	2	0	1	1	1	0	0	0	0	2	0
		Ventral pubic surface, lesion left	0	2	1	0	2	2	0	0	0	1	0	2	0	0	0	0	0	1	0
		Ventral pubic surface, lesion right	0	2	1	0	2	2	0	0	2	1	0	2	0	0	0	0	0	0	1
2	1	Ventral pubic surface, lesions	0	2	1	0	2	2	0	0	0	1	0	2	0	0	0	0	0	1	1
		Ventral pubic surface, exostoses left	0	1	1	0	2	1	0	0	0	1	0	2	0	0	0	0	0	1	0
		Ventral pubic surface, exostoses right	0	1	1	0	2	1	0	0	2	2	0	2	0	0	0	0	0	0	1
2	1	Ventral pubic surface, exostoses	0	1	1	0	2	1	0	0	2	2	0	2	0	0	0	0	0	1	1
		Dorsal pubic surface left	0	3	1	0	1	1	0	0	0	0	0	2	0	0	0	0	0	1	0
		Dorsal pubic surface right	0	3	1	0	2	1	0	0	2	1	0	1	0	0	0	0	0	0	1
3	1	Dorsal pubic surface	0	3	1	0	2	1	0	0	2	1	0	2	0	0	0	0	0	1	1
		Extended tuberculum pubicum left	0	2	1	0	1	1	0	0	0	1	0	2	0	0	0	0	0	1	0
		Extended tuberculum pubicum right	0	3	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
3	1	Extended tuberculum pubicum	0	3	1	0	1	1	0	0	0	1	0	2	0	0	0	0	0	1	1
		Exostoses facies auricularis left	2	2	0	0	1	1	1	0	2	0	1	2	2	1	0	1	0	1	0
		Exostoses facies auricularis right	2	0	1	1	1	1	1	2	2	2	1	2	0	1	2	1	0	1	2
2	1	Exostoses facies auricularis	2	2	1	1	1	1	1	2	2	2	1	2	2	1	2	1	0	1	2
		Preauricular sulcus left	2	4	1	0	4	1	1	0	4	0	1	4	4	3	0	1	1	2	0
		Preauricular sulcus right	3	0	2	1	4	1	1	0	4	1	2	4	0	3	1	1	1	3	1
4	1	Preauricular sulcus	3	4	2	1	4	1	1	0	4	1	2	4	4	3	1	1	1	3	1
		Femoral length (mm)	443	418	399	435	435	440	474	0	0	461	0	409	0	408	0	434	0	0	437
		Body height femur (cm, Ruff et al. 2012)	163	156	150	161	161	163	0	0	161	168	0	154	152	153	169	161	175	0	0
		Sex	female	female	female	male	female	male	male	female	female	male	male	female	female	female	male	male	male	female	male
		Age	45–55	45–55	15–18	21–25	30–35	27–30	30–35	35–40	40–55	27–35	25–30	27–35	30–35	16–20	30–40	30–40	30–40	18–21	40–50
Maximum degree of expression	Weighting of pelvic features	Individual	9A	11	14	15	29	30	31	32/2	56	60	89B	90	104/1	106/1	108	109/1	115	1927/1	1927/2

Tab. 8. Age, sex, body height, and pelvic features for 19 assessable individuals from Schleinbach.

Fig. 28. Preauricular extension to the right sacrum of the 18–21-year-old woman 1927/1. – a. Right lateral view. – b. Frontal view (Photo: W. Reichmann, © NHM Vienna).

changes at the ventrosuperior margin (ventral apex) of the ala ossis sacri, adjacent to the auricular facet at the sacrum. The first morphological modification termed sacral preauricular extension is a ventrally pointing flat osseous structure, and it frequently has a corresponding facet at the ilium. The sacral preauricular extension is delineated from the auricular surface by a subtle line, can vary in size and usually occurs on one or on both sides of this predilection site at the ventral apex of the sacrum. The changes are very likely caused by increased pressure at this location, ligament laxity and positional changes during pregnancies and birthing events. The second structure is termed the sacral preauricular notch, which describes a loss of convexity at this location. It may be accompanied by a recess at the ilium and stand in a causal relationship with giving birth at a young age.[94] The relevant region at the sacrum, the ventral apex of the ala ossis sacri, was present in seven females and six males from Schleinbach. A sacral preauricular extension was found in three females: the 45–55-year-old from Grave 11 and the 18–21-year-old from 1927/1 (Fig. 28) have a small sacral preauricular extension on the one present side, the 30–35-year-old from Grave 29 on both sides. No male individual had similar changes in this region.[95]

A sacral preauricular notch was noticed in 3 out of 8 females at Schleinbach (56: 45–55 years, 90: 27–35 years, 106/1: 16–20 years) and in none of the 6 observable males from Schleinbach. The sacral preauricular notch at the right sacrum of the 45–55-year-old female in Grave 90 is particularly large (Fig. 29). The sacral preauricular notch of the female from Grave 56 may relate to the partially healed fractures in the sacrum. A facet at the ilium, corresponding to the extensions and notches, was recorded in 3 of 10 observable females (56, 106/1 and 1927/1) and none of the 8 observable males.

The region of the margo auricularis groove at the sacrum adjacent to the preauricular sulcus was preserved in five females and two males; a groove at the lateral margin of the os sacrum was present in two females. In both cases, changes affected only the right sides, whilst the other sides were normal (56, 1927/1).

An interesting observation is that some females combine several distinctly expressed features in the pelvis and sacrum bones. If some of the features are particularly pronounced, we suggest the term 'Pelvic Pattern'. At Schleinbach, we observed such patterns in the females 9A, 11, 29, 56, 90, 104/1, 106/1 and 1927/1 (Tab. 8).

The 45–55-year-old female from Grave 9 (9A) shows a moderately developed preauricular sulcus (Stage 3 on the right side, left side is eroded) and some exostoses located at the upper margin of the facies auricularis. She was found with some cranial fragments and an upper first incisor of a c. 1.5-year-old child (9B).

The 45–55-year-old female from Grave 11 has a combination of a deep preauricular sulcus (Stage 4 on the left side), developed exostoses at the margin of the auricular facet of the ilium, an extended pubic tubercle (Stage 3 on the right side), severe dorsal pubic pitting (Stage 3), and a sacral

94 Pany-Kucera et al. 2019.

95 At the contemporaneous Early Bronze Age site Unterhautzenthal, a bilateral sacral preauricular extension was found in 2 of 11 observable females (93: large extension, 88: small extension).

Fig. 29. Sacral preauricular notch in the right sacrum of the 45–55-year-old female in Grave 90. – a. Right lateral view. – b. Frontal view (Photo: W. Reichmann, © NHM Vienna).

preauricular extension at the right ventral apex of the ala ossis sacri. Severe gonarthrosis was noticed in both her knee joints, with severe exostotic new bone formation around the joint surfaces of the distal femora and proximal tibiae (see Fig. 25).

The 30–35-year-old female from Grave 29 combines deep, delimited preauricular sulci (Stage 4, true preauricular groove), a bilateral sacral preauricular extension without clearly corresponding facets at the ilium, dorsal pubic pitting (Stage 2) to the right pubic bone, and distinct lesions and exostoses on the ventral side. Irregular exostotic structures are further visible at the location of the extended pubic tubercle, but a real extension did not form. A bilateral accessory sacroiliac articulation formed at the upper dorsal end of the facies auricularis. This modification is an elongated facet, somewhat elevated and delimited from the joint surface, pointing in the dorsal direction (right side: 16.5 mm, left side: 13.6 mm). This facet corresponds to a structure at the ilium, which is visible on the right side, but eroded on the left (Fig. 30). It may have formed in response to supporting increased weight.

Fig. 30. Accessory sacroiliac articulation in the 30–35-year-old female from Grave 29 (Photo: W. Reichmann, © NHM Vienna).

The 40–55-year-old female from Pit 56 has a strongly developed preauricular sulcus (Stage 4), exostoses at the margin of the facies auricularis of the ilium, dorsal pubic pitting on the right side, ventral exostoses and lesions at the pubis, a margo auricularis groove (Stage 2) and a sacral preauricular notch on the right side. She has multiple sacrum fractures in different stages of healing. The upper part of the right auricular facet is completely remodelled. A small exostosis formed at the right ilium in the frontal part of the ala ossis ilii, which originates from the iliac side and extends over the sacroiliac joint. Degenerative changes in the lumbar vertebrae, in the form of a deforming spondylosis (L2–L5) and a probable compression trauma in L3, are probably related to her multiple sacrum fractures. Additionally, we noticed bilateral accessory sacroiliac articulations, which are ascribed to the frequent carrying of loads on the back, particularly babies, as deduced from this custom in an East African group.[96] Ridges and exostoses on the dorsal side of her iliac bones stem from a more robust attachment of the gluteal muscles in line with the pelvic modifications.

The Pelvic Pattern of the 27–35-year-old female from Pit 90 includes a preauricular sulcus Stage 4, dorsal pitting on the left side (Stage 2), an extended pubic tubercle on the left side (Stage 2), distinct exostoses on the ventral pubic surface, and a sacral preauricular notch at the ventral apex of the left ala ossis sacri. Four exostoses of slightly different sizes and the form of spiculae were found adjacent to the left dorsal end of the iliac auricular facet; currently, these cannot be conclusively interpreted. Distinct osteophyte growth and extensive inflammatory changes were recorded at the lumbosacral junction (L5/S1), which may indicate that she suffered from a lumbar disc herniation. In addition, her right femur is shorter than the left by 12 mm. The attachment site of the oblique muscles at the iliac crest shows a distinctly developed ridge on the right side; this muscle is involved in the tension of the abdominal musculature.

The 30–35-year-old female found in Grave 104/1 reveals a combination of a bilateral, deep preauricular sulcus Stage 4 and exostoses along the margin of the iliac auricular facet (forming a sharp-edged ridge at the ventral apex and lower part of the margin on both sides). Moderate osteophyte growth was noticed at the front of the lumbosacral junction (only L5 preserved, most other pelvic features were not observable). The humerus of a 7–8-month-old foetus/neonate was found with the bones of this female.

The Pelvic Pattern of the 16–20-year-old adolescent female from Grave 106/1 consists of a preauricular sulcus Stage 3 on the right and Stage 2 on the left side, as well as a sacral preauricular notch at the ventral apex of the right ala ossis sacri. A corresponding facet in the shape of a depression is visible adjacent to the ventral apex of the auricular facet at the right iliac bone. The two modifications form a recess at the terminal line, best visible when the bones are held together (Fig. 31). We further noticed spina bifida occulta at the lower dorsal end of the sacrum (S4/S5).

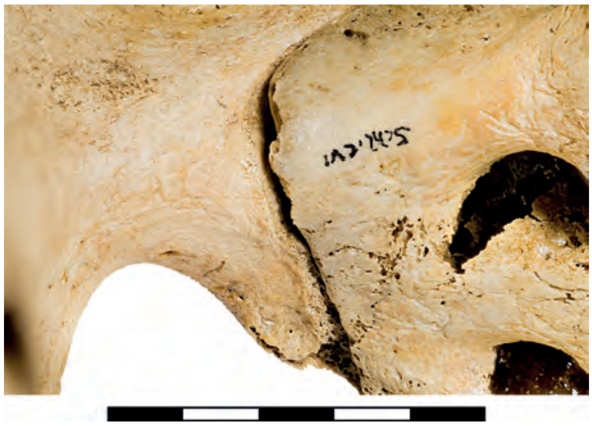


Fig. 31. Recess at the level of the terminal line between sacrum and ilium in the 16–20-year-old female from Grave 106/1 (Photo: W. Reichmann, © NHM Vienna).

The 18–21-year-old female 1927/1 shows a combination of a preauricular sulcus Stage 3 on the right/Stage 2 on the left side with a unilateral sacral preauricular extension on the right (with inflammatory signs) as well as a margo auricularis groove on the right side (see Fig. 10). The skeleton of this female was found with other human remains, including the right femur of a 4–6-month-old child (1927/4).

It is interesting to note that two different expressions of the recently described morphological changes at the sacrum occur in young females such as the latter two. This might point to a young age of first motherhood.[97] Two females of middle age (90: 27–35 years; 104/1: 30–35 years) with pelvic patterns show degenerative changes combined with inflammatory signs in the lumbar vertebrae. Clinical studies on females treated for lower back pain in pregnancy indicate that increased pelvic relaxation causes irritations in the lumbosacral region.[98] A pattern with distinctly expressed pelvic features was not found in any of the nine observable male individuals from Schleinbach.

In order to compare the severity of pelvic changes to the archaeological contexts, we assigned a Pelvic Pattern Index (PPI) to the ten females and nine males with at least two assessable features (Tab. 8). Since little is known about the relevance of the features, they are not weighted; only the number of accessible features and the degree of expression is taken into account. High Pelvic Pattern Index numbers correspond to an accumulation of significant changes in the pelves. The women with the highest values were buried in Grave 11 (45–55 years, PPI 0.61, nine recordable features, 'rich' grave), Grave 29 (30–35, PPI 0.44, nine recordable

96 Trotter 1964.

97 Pany-Kucera et al. 2019.

98 Hagen 1974.

Histo ID	Individual	Morphological		FDI	Full eruption age	TCA counts in 3 areas			Width of cementum/ width between lines	
		Sex	Age			Mean	SD	Age	Mean	Age
5627	9A	female	45–55	41	7.5	20.0	4.1	27.5 ± 5	20.1	27.6 ± 5
5629	30	male	27–30	21	7.5	30.5	0.5	38.0 ± 5	31.9	39.4 ± 5
5630	31	male	30–35	25	12.5	21.3	2.1	33.8 ± 5	22.5	35 ± 5
Schl G 56	56	female	40–55	44	11.5	15.67	0.47	27.2 ± 5	35.75	47.2 ± 5
5628	60	male	30–35	35	12.5	–	–		26.2	38.7 ± 5
5654	1983/61	undet.	20–40	24	11.5	16.3	1.2	27.8 ± 5	13.4	24.9 ± 5
5655	1983/71	undet.	16–18	21	7.5	6.7	1.7	14.2 ± 5	9.2	16.7 ± 5

Tab. 9. Results of the tooth cementum annulation analysis of seven individuals from Schleinbach. – The table includes morphological sex and age estimation, the type of tooth (FDI World Dental Federation) and the average age of its alveolar eruption. The means and standard deviations of the TCA counts were calculated from three independent counts of subsequent cross-sections of the middle third of the dental roots. The alternative method divides the width of the cementum by the mean distance between lines. Age at death is calculated by adding the means of counts or measurements to the tooth eruption age; an error range of ± 5 years is assumed.

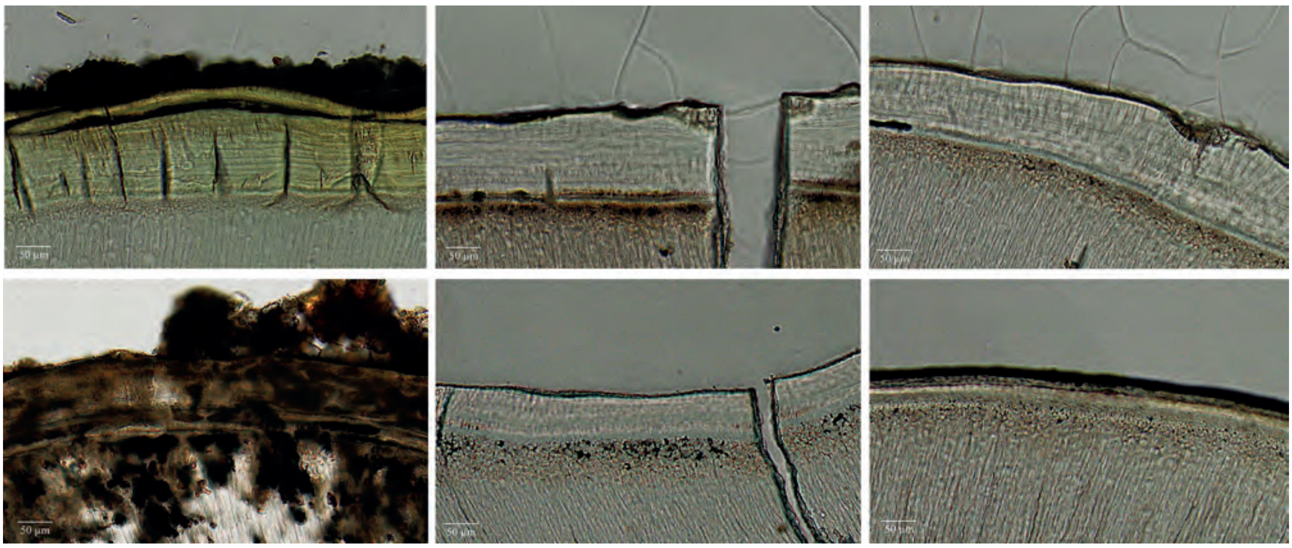


Fig. 32. Thin sections of dental roots of six individuals from Schleinbach: 9, 30, 31, 60, 1983/Grube 61 and 1983/Grube 71 (Photos: B. Rendl, © Medical University of Vienna).

features, 'average' grave), Pit 56 (40–55, PPI 0.67, nine observable features, 'poor' pit burial) and Grave 90 (27–35, PPI 0.55, ten recordable features, 'rich' grave). We found a weak positive correlation between the Pelvic Pattern Index and the social status of the individuals (r = 0.15, if poor = 0, average = 50, rich = 100), between the Pelvic Pattern Index and age (r = 0.25) and the Pelvic Pattern Index and body height (r = 0.18).

3.6. Tooth Cementum Annulation Analysis

We arrived at very similar results with both methods of analysing tooth cementum annulations – counting and interpolating (Tab. 9, Fig. 32). The difference in age estimation via counting all tooth cementum lines and the extrapolation method is less than three years in five individuals. Only the 40–55-year-old female from Pit 56 was estimated at 26.2 ± 5 years with counting and 46.2 ± 5 years applying the interpolation method, which matches the morphological age estimation.

The results of the tooth cementum annulation analysis (TCA) of two individuals did not match the morphological age estimation. The 45–55-year-old female from Grave 9 appeared younger (TCA age 21.5–31.6 years), whereas the 27–30-year-old male 30 from the double burial 30/31 appeared older (TCA age 32–43.4 years) than first estimated. The age ranges of the remaining individuals overlap. At present, we cannot conclusively explain the differences, but would like to highlight the potential of exploring the differences to understand how people age.

3.7. Kinship Analysis in Multiple Burials via Mitochondrial DNA

The two male individuals buried close together in Grave 30/31 share the same haplotype belonging to haplogroup H+152; this provides evidence that they may have been (closely) related via the maternal line, e.g. they could have been brothers or cousins.

Of the four individuals buried in Pit 60, the 8–9-year-old child 60A and the 3–4-year-old child 60C share the same haplotype (haplogroup U2e3a). Again, this points to a (close) maternal relationship between these two individuals, whereas the other individuals in the pit are not maternally related to anyone else in this sample and belong to haplogroups H2a1 and J1c2 (Tab. 10).

In terms of population genetics, haplogroup H is the most common mtDNA clade in Europe (present in about 40 % of today's Europeans); H2 is a common west Eurasian lineage with concentrations in eastern Europe and the Caucasus, central and western Asia. The subclade H2a1 has recently been found in 3 of 80 genetically typed individuals from the Lech River Valley in Bavaria,[99] and is present once in samples from Bronze Age Hungary.[100]

Haplogroup U2 is not as common as H in Europe today and shows higher abundance in the Caucasus. Archaeologically, U2 is considered steppe ancestry, appearing more frequently in samples after the Neolithic. Haplogroup J is a common component of the west Eurasian gene pool today, probably of Near Eastern origin.[101] J1c is associated with the spread of Neolithic farmers from Anatolia via the Balkans.[102] J1c2 has been found at the LBK site Karsdorf,[103] and in an Early Bronze Age sample from the Bavarian Lech Valley.[104] J1c2 has further recently been found in five Late Bronze Age/Iron Age samples from the northern Iberian Peninsula,[105] and is part of Richard III's genome.[106]

99 Knipper et al. 2017.
100 Allentoft et al. 2015, suppl. tab. 14.
101 Chyleński et al. 2017.
102 Mathieson et al. 2015.
103 Brandt et al. 2013.
104 Knipper et al. 2017.
105 Núñez et al. 2016.
106 King et al. 2014.

3.8. Proteomic Sex Identification in Selected Juvenile Individuals

The sex of the three children buried together with the 30–35-year-old male in Pit 60 was determined as male for the 8–9-year-old child 60A, and female for the 12-year-old child 60B as well as the 3–4-year-old child 60C.[107] The 5–6-year-old victim of violence from Feature 1981/Grube 3 was male.[108]

4. Discussion and Conclusion

The detailed osteological examination of the skeletal material comprising 62 individuals, of which 27 were subadults, in combination with supplementary ^{14}C, TCA, mtDNA, peptide and isotope analysis allows new insights into the social fabric of the Early Bronze Age community of Schleinbach.

The clear social differentiation between persons buried in 'regular' graves and those deposited in former storage pits, albeit not unusual in the cultural context,[109] remains perplexing. Social differentiation may entail not only the acquisition of land and material wealth – although this is the easiest to see and quantify for archaeologists – but also the domination of people and the exploitation of their labour, including the bearing of children.

Formal burial in one of the two grave groups includes the placement of bodies in a flexed or extended position, a uniform orientation, and the inclusion of grave goods, even if graves were often later reopened and metal grave goods were removed. The deposition of bodies and body parts in former storage pits is less formal: the bodies appear placed without care or empathy and are often found in secondary, disarticulated positions and without grave goods. Bio-archaeological indicators of mistreatment and marginalization[110] of individuals are plentiful at Schleinbach.

Most striking at this site is the high prevalence of traces of violence. Small-scale communities such as Schleinbach in the Early Bronze Age may be less peaceful than often imagined; life in the settlement may include frequent ambushes and raids, the taking of captives, and the domination of some people by others.[111] The trauma patterns observed in each of those individuals testify to accidents and interpersonal violence.

The unhealed cranial fractures point to a high level of interpersonal violence. At least six individuals (16.2 %) – three men, two children and one woman – died from fatal injuries

107 Weninger 1954a, 16–17 had suggested the male sex for the two older children (60A, 60B).
108 Rebay-Salisbury et al. 2020.
109 E.g. Lauermann 1992. – Müller-Scheessel et al. 2013.
110 Martin 2008. – Martin, Harrod, Fields 2010.
111 Cameron 2016.

Grave	30	31	60	60A	60B	60C
Description	Male	Male	Male	Infant	Infant	Infant
Age	27–30	30–35	30–35	8–9	11.5–12.5	3–4
FDI	36	47	17	36	47	55
Mill/drill	Mill	Mill	Mill	Drill	Drill	Drill
mtGE (67 bp)	147.7	305.1	98.4	56.1	18.0	28.1
Haplogroup	**H+152**	**H+152**	**H2a1**	**U2e3 (U2e3a)**	**J1c2**	**U2e3 (U2e3a)**
Mitotype	152C	152C	263G	73G	73G	73G
	263G	263G	315.1C	152C	185A	152C
	315.1C	315.1C	750G	217C	188G	217C
	750G	750G	8860G	263G	228A	263G
	(4769G)	4769G	16354T	315.1C	263G	315.1C
	8860G	8860G		394T	295T	394T
	15326G	15326G		508G	315.1C	508G
	16519C	16519C		524.1A	462T	524.1A
				524.2C	489C	524.2C
				750G	750G	750G
				1811G	14766T	5390G
				3170A	14798C	5426C
				4769G	16069T	(10876G)
				5390G	16126C	(11467G)
				5426C	16519C	(12372A)
				8860G		13734C
				10876G		15907G
				11719A		16051G
				12308G		16129C
				12372A		(16182M)
				13020C		16183C
				13734C		16189C
				14180C		16260T
				14766T		16356C
				15326G		16362C
				15721C		16519C
				15907G		
				16051G		
				16129C		
				(16182M)		
				16183C		
				16189C		
				16260T		
				16356C		
				16362C		
				16519C		

Tab. 10. Summary of DNA analyses of six individuals from Schleinbach. Sex, age (years), tooth (FDI), haplogroup and mitotype relative to the rCRS.

to the head, which were inflicted with both sharp and blunt weapons. Four of them had injuries to the left parietal bone, with lesions at the top and front of the head suggesting that the victims were probably facing their aggressors.[112] Moreover, the left side of the head is a typical location for attacks by a right-hander.[113] Males were affected by neurocranial trauma about four times more frequently than females. In the Bronze Age group of Unterhautzenthal, for comparison, 6.9 % of the individuals showed neurocranial fractures, two males and two females, and all lesions – most of them located in the left parietal bones – were healed.[114]

An exceptionally high number of unusual, rare and complicated postcranial fractures characterizes the Schleinbach individuals, for instance the bilateral fracture of the spina scapulae in the male from Feature 1927/2, the severe wrist fracture in the male of Feature 115, and the multiple skull fractures of the boy in Feature 1981/Grube 3. Women were not excluded from violence, as demonstrated by the 18–21-year-old female 1927/1 with two peri-mortem sharp force traumas to the skull and a sharp cut to the left tibia, and indicated by probable parry fractures found in two female individuals. Complex trauma patterns, as documented in the 40–55-year-old female from Pit 56, suggest that the Bronze Age community was able to provide a level of care that ensured survival; and yet, her burial in a pit without grave goods raises questions regarding full social membership.

The two adult male individuals 30/31 buried in close physical contact in one grave were closely related via the maternal line and died of almost identical neurocranial injuries in the same location of their skulls. Whether they were warriors, victims of an attack on the community or executed, they received a formal burial at Schleinbach. The four individuals buried together in the former storage pit 60, in contrast, seem haphazardly disposed. Two of the individuals from this pit show peri-mortem cranial injuries, and it seems likely that the others died in the same violent event, even if it did not manifest directly on their bones. The proteomic analysis revealed that the adult male was buried with children of both sexes; the 3–4-year-old girl and the 8–9-year-old boy were closely related via the maternal line, whereas the 12-year-old girl and the adult male have distinct matrilines. The age difference between the adult male and the three children makes it possible that he was the father of all of the children, which he would have had with two different female partners. If the younger children had the same mother, the sibling age gap is about five years. The possible weaning age after 2–3 years inferred through linear enamel hypoplasias and $\delta^{15}N$ isotope data suggests a minimum of 3–4 years between siblings.

A bottleneck in Y-chromosome lineages after Neolithisation around 5000 to 3000 BC, in which only one male reproduced for every 17 females,[115] is currently explained by the formation of patrilineal kin groups. A high level of intergroup competition among these groups reduced the male genetic diversity.[116] Some men were able to accumulate wealth and power, which translated into reproductive success. High status men might have been able to entertain polygynous relationships and thus monopolize women, leaving low status men fewer chances to reproduce. Competition between males further led to the violent elimination of Y-chromosome linages from the gene pool. The lethal lesions in the males from double burial 30/31, Feature 102, and Pit 60 may be archaeological evidence of male lineage editing.

The children from Pit 60 may have been casualties of a group conflict, but violence seems directly targeted at the 5–6-year-old boy from Feature 1981/Grube 3, who was killed by at least four significant blows to the head. Multiple and bilateral cranial fractures in children are found more frequently in victims of systematic abuse.[117] The child's poor health status, including traces of scurvy and ear infections, as well as the deposition in a pit underline this assessment.

Burials of young women, adolescents from about 15 years of age, appear to have been carried out with the most care, perhaps a comment on their reproductive potential. The occurrence of a pelvic pattern including a sacral preauricular notch in the adolescent female of 106/1 (16–20 years), possibly linked to first giving birth at a young age, and a sacral preauricular extension in 1927/1 (18–21 years) suggest they may have first become mothers in their teenage years.[118] Sacral preauricular extensions and notches affected 60 % of the females from Schleinbach. The interpretation of pelvic features in relation to pregnancy and parturition is still contested due to uncertainties in the process of their formation and subject to further research on modern, documented skeletal collections. Regardless of their causes, the Pelvic Pattern Index can be a first step toward quantifying pelvic changes for comparison within and between skeletal series, and to the archaeological record. High reference and relevance values may indicate strain experienced through

112 Fibiger 2013, 138.
113 Kremer, Sauvageau 2009. – Martin, Harrod, Pérez 2012.
114 Rebay-Salisbury et al. 2018.
115 Karmin et al. 2015.
116 Zeng, Aw, Feldman 2018.
117 Lewis 2013.
118 Pany-Kucera et al. 2019.

pregnancies and parturitions, but also represent increased activity and stress levels in females as well as hormonal differences compared to males.

Genetic testing has confirmed that individuals that are buried together are frequently closely related. This may also apply to women buried with the remains of (small) children. The 30–35-year old female from Grave 104 was found with the humerus of a foetus/neonate in the 7–8th lunar month, which might indicate she was pregnant. Nothing in the way she was buried suggests any comment on her circumstances; she was placed in a flexed position on her right side. Two bronze hair rings, *Spiralröllchen* and a few pieces of pottery can be considered typical Bronze Age jewellery and grave goods. Grave 9, equipped with a comparatively rich set of grave goods including pottery, a stone tool and a jewellery set with hair rings and an elaborate dress pin, held the remains of a 45–50-year-old woman and a c. 1.5-year-old child.

As expected in a death sample,[119] the health status of the individuals from Schleinbach was rather poor, and we found differences between males and females and between individuals buried in graves and pits. Three times more females suffered from caries lesions than men, 5 of 6 individuals affected from intravital tooth loss were female, and sinusitis was found more frequently in females. The disease pattern of rickets (14) and scurvy (105, 106/1, 1981/Grube 3) was found in a few young individuals from Schleinbach. More than 36 % of individuals buried in pits were affected by porotic hyperostosis – an unspecific indicator of stress and deprivation – but only 5 % of individuals buried in graves. The incidence of cribra orbitalia, sinusitis and periostitis is higher in individuals buried in pits. They also suffered more frequently from neurocranial trauma and intravital tooth loss. Such individuals seem to have suffered from deprivation, although some individuals with traumatic lesions and impaired health were also found in formal graves. Individuals whose health is most severely affected, such as the 5–6-year-old boy from Pit 1981/Grube 3 or the 40–55-year-old woman from Pit 56, tend to be disposed of rather than formally buried. The bio-archaeological evidence from Schleinbach points to a high level of social stress and deprivation for at least part of the group.

The curation and handling of body parts, for example of the damaged and severely worn facial skull portion of an adult eventually deposited in Pit 1983/Grube 61, as well as other Early Bronze Age ways of engaging with the dead – the reopening of graves, the disarticulation of bodies and the removal of bones and grave goods – remain difficult to rationalize and explain.

119 Wood et al. 1992.

Acknowledgements

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Appendix 1

The catalogue of human remains from Schleinbach can be found at: doi: 10.1553/archaeologia104s13-A.

Author Contributions

Doris Pany-Kucera: skeletal analysis, osteological methodology, writing
Michaela Spannagl-Steiner: skeletal analysis, sampling, catalogue
Lukas Waltenberger: excavation of blocks, catalogue, skeletal schemes
Walther Parson, Christina Strobl: DNA analysis
Barbara Rendl: tooth cementum annulation analysis
Lukas Janker: proteomic sex identification
Fabian Kanz: tooth cementum annulation analysis, proteomic sex identification
Katharina Rebay-Salisbury: concept, archaeological analysis, methodology, funding acquisition, interpretation, writing

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Appendix 1.
Catalogue of Human Remains from Schleinbach

Social Relations, Deprivation and Violence at Schleinbach, Lower Austria. Insights from an Interdisciplinary Analysis of the Early Bronze Age Human Remains

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The following catalogue contains a systematic description of over 60 Bronze Age individuals from settlement features and graves from Schleinbach in Lower Austria. The schemes indicate preserved skeletal elements in red, green stains in green.

Image credits: Skeletal representation scheme after M. Schultz, Zentrum Anatomie Göttingen 1994, adapted for the Natural History Museum Vienna by W. Reichmann.

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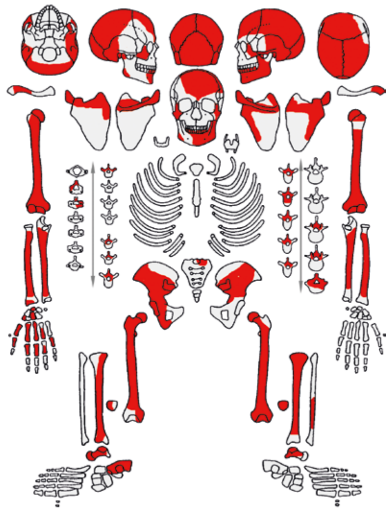
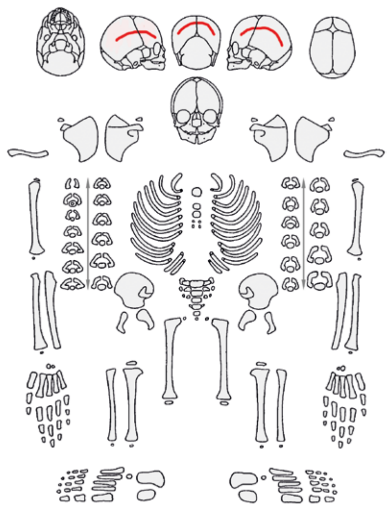
Schleinbach, Feature 9A (Group 1), NHM AA Inv. no. 27619



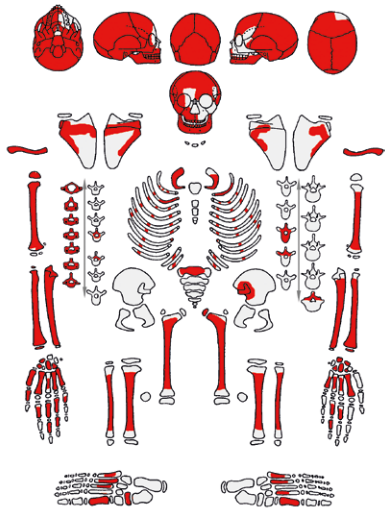
Sex: **female**, female expression of sexually dimorphic traits in the cranium and pelvis
Age: **45–55 years**, dental wear (> III, oblique dental wear in two maxillary molars, but no intravital tooth loss, mandibular teeth uniformly worn), coronal and sagittal sutures completely fused, lambda suture partially closed (> 50 years)
TCA age (counts): **25.5/25.6 ± 5 years**
Body height: **163 cm**
Bone surface preservation: moderately eroded
Green stains: mastoid process, cranial base of occipital bone, right zygomatic process, right mandible and teeth, 2 cervical vertebrae, both clavicles, right proximal humerus, right distal radius, carpals, metacarpals and phalanges of the right hand
Pelvic features: right preauricular sulcus is moderately developed (shape r/l: f-f-f/f-f-, stage r/l: 3/2); some exostoses are located in the anterior/superior part of the iliac auricular facet (stage r/l: 2/2)
Stress/bone reactions: none detected (bad preservation of long bone surfaces)
Trauma: possible parry fracture in the distal portion of the left ulna, no displacement, but callus formation
Degenerative changes: changes on the first phalanx of the right hand
Other: granular foveolae on the lamina interna of the frontal and parietal bones
Anatomical variation: –
Comments: long bone measurements: left femur = 443 mm, ^{14}C and C/N isotope samples taken from ribs, TCA samples from FDI 22 and FDI 41
Comments: male sex according to Weninger 1954, female sex according to Teschler-Nicola 1992

Schleinbach, Feature 9B (Group 1), NHM AA Inv. no. 27620



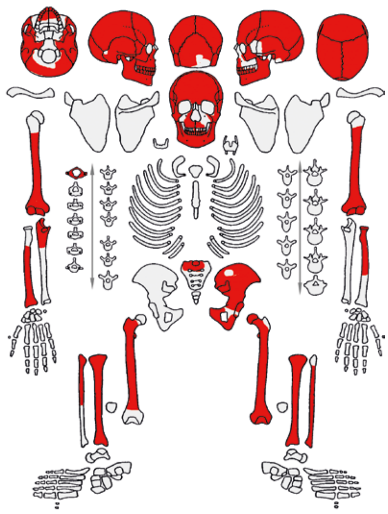
Sex: **undetermined**
Age: **1.5 years**, size of cranial fragments and dental development of maxillary incisor 1
Body height: –
Bone surface preservation: moderately eroded (cranial fragments and maxillary incisor 1)
Green stains: none detected
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comments: skeletal remains found with a female individual from Feature 9A

Schleinbach, Feature 10 (Group 1), NHM AA Inv. no. 27621



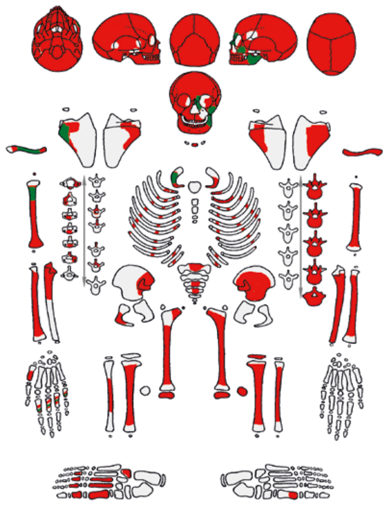
Sex: **undetermined**
Age: **c. 10–12 years**, status of dentition and epiphyseal fusion
Body height: **c. 125 cm**
Bone surface preservation: slightly eroded
Green stains: the right parietal bone is partially stained, both temporal bones, right occipital bone, (C1–7) both clavicles, right scapula, right humerus, both radii and ulnae, numerous ribs, carpals, metacarpals and phalanges of the hands, left knee
Pelvic features: –
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes: none detected
Other: persisting right deciduous 2nd molar (MM2) in the upper and lower jaw; substantial calculus build-up especially in the lower jaw
Anatomical variation: –
Comments: measurement of the diaphyseal length: left femur = 309 mm, additional skeletal fragments of an adult individual and some animal bones

Schleinbach, Feature 11 (Group 1), NHM AA Inv. no. 27622



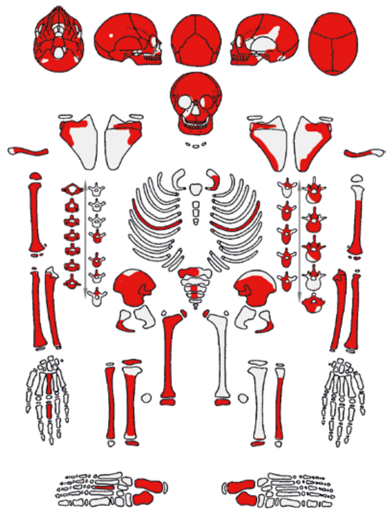
Sex: **female**, female expression of sexually dimorphic traits in the cranium and pelvis
Age: **45–55 years**, dental wear (> III), cranial suture fused
Body height: **156 cm**
Bone surface preservation: slightly eroded
Green stains: temporal bones, mastoid process, occipital bone, left zygomatic bone, left mandible, 1st and 2nd cervical vertebra, a fragment of left scapula, left humerus, right radius distal
Pelvic features: left preauricular sulcus is wide and y-shaped (shape r/l: -/f-f-f, stage r/l: 0/4); bilaterally developed clearly defined pubic tubercle (stage r/l: 3/2) and a sharp-edged pecten ossis pubis; large and deep lesions present (> 2 mm) in the middle and lower third of dorsal pubic surface (stage r/l: 3/3); slight ventral pubic lesions (stage r/l: 2/2); sharp-edged attachment of medial gluteal muscles; slightly developed sacral preauricular extension on the right side (stage r/l: 2/0)
Stress/bone reactions: healed sinusitis maxillaris in the form of remodelled new bone apposition in the left maxillary sinus
Trauma: none detected
Degenerative changes: signs of osteoarthrosis/osteoarthritis in both knee joints, with large exostotic bone growth especially at the joint margins, in the femora for the most part medially located (only a fragmentary preservation of the right side), in the tibiae mainly in the anterior and medial part of the proximal joint, cystic lesion on the lateral side of the right tibia
Other: granular foveolae on the internal layer alongside the sagittal suture; a circular focal lytic lesion on the occipital bone (protuberance region, c. 13 × 13 × 10 mm, *contra* Weninger 1954b, 55, who interpreted this lesion as a trepanation)
Several carious lesions at the dental cervices; strongly developed calculus especially in the lower jaw; asymmetrical abrasion of the teeth in the upper jaw
Anatomical variation: –
Comments: long bone measurements: left femur = 418 mm

Schleinbach, Feature 12 (Group 1), NHM AA Inv. no. 27623



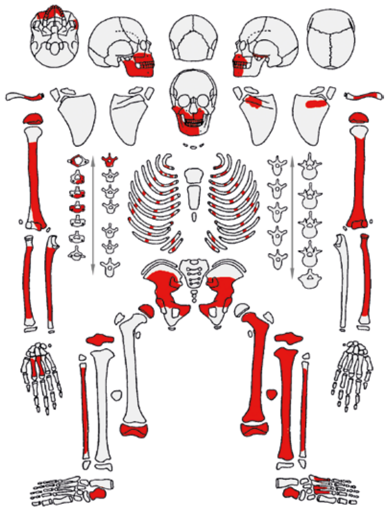
Sex: **undetermined**
Age: **5–6 years**, dental development
Body height: –
Bone surface preservation: slightly eroded
Green stains: left side of the viscerocranium and right mandible, right clavicle, right scapula and proximal portion of right humerus, right 1st rib, phalanges of the right hand
Pelvic features: small groove bilaterally visible in the preauricular region
Stress/bone reactions, trauma, degenerative changes: –
Anatomical variation: none detected
Other: intravital chipping of the right 1st maxillary deciduous incisor
Comments: no measurements of diaphyseal length possible; cranium exhibits numerous post-mortem fracture lines
Comment 2: ^{14}C+ C/N sample: rib

Schleinbach, Feature 13 (Group 1), NHM AA Inv. no. 27624



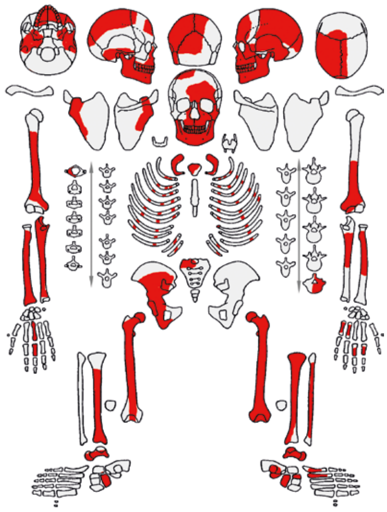
Sex: **undetermined**
Age: **13–15 years**, dental development (M2 in masticatory plane, > 14 years), but diaphysis length points to a 10–12-year-old individual
Body height: **120–124 cm**
Bone surface preservation: moderately eroded
Green stains: right side of the temporal bone, cranial base, zygomatic process, mandible and teeth, clavicle, scapula and proximal humerus; 1st ribs; all cervical vertebrae and two thoracic vertebrae
Pelvic features: –
Stress/bone reactions: bilateral cribra orbitalia visible as foramina in the orbital roofs; local periosteal reaction/new bone apposition (c. 10 × 20 mm) in the dorsoproximal shaft of the right ulna; pleuritis visible as a porous new bone layer on the pleural side of three ribs
Trauma: none detected
Degenerative changes: none detected
Other: LEH (enamel hypoplasia): severity stage 2, 2 fine hypoplastic lines in maxillary first and 1 in second incisors; further, 2 hypoplastic lines in mandibular second incisor and 1 in the right canine, corresponding to a formation age of 2.5 and 3.5 years
Anatomical variation: upper 2nd molar exhibits an accessory protuberance; foramina caeca on all lower molars
Comments: measurements of diaphyseal lengths: right humerus = 210 mm, left femur = 300 mm; discrepancy in age estimation between dentition and bone growth

Schleinbach, Feature 14 (Group 1), NHM AA Inv. no. 27625



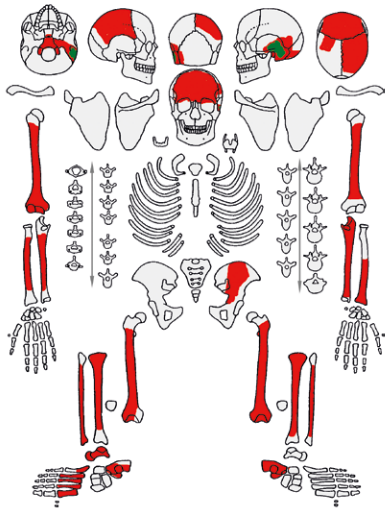
Sex: **female?**, female expression of sexually dimorphic traits in the cranium and pelvis
Age: **15–18 years**, dentition status (M3 not erupted); epiphyseal fusion in the distal humerus, proximal radius, ulna, and y-shaped epiphysis in the acetabulum
Body height: **151 cm**
Bone surface preservation: strongly eroded
Green stains: left side of zygomatic process, clavicle, scapula, radii and ulnae
Pelvic features: preauricular sulcus shape r/l: f-i-f/i-i-f, stage r/l: 2/1; pectineal line is well defined
Stress/bone reactions: remodelled periosteal reactions (striations) in the shaft of the femora and tibiae; possible case of rickets – bending in the anterodistal part of both femora and both tibiae exhibit a lateral flexion in the upper part with strong muscle attachments
Trauma: none detected
Degenerative changes: none detected
Other: LEH (enamel hypoplasia): severity stage 3, 1 hypoplastic line in mandibular left second incisor; further, 2 hypoplastic lines in mandibular left canine, corresponding to a formation age of 2.5 and 3.4 years
Anatomical variation: none detected
Comments: long bone measurements: right tibia = 340 mm, right femur = 399 mm; the surface of some bones are covered with sintering, male sex according to Weninger 1954, female sex according to Teschler-Nicola 1992

Schleinbach, Feature 15 (Group 1), NHM AA Inv. no. 27626

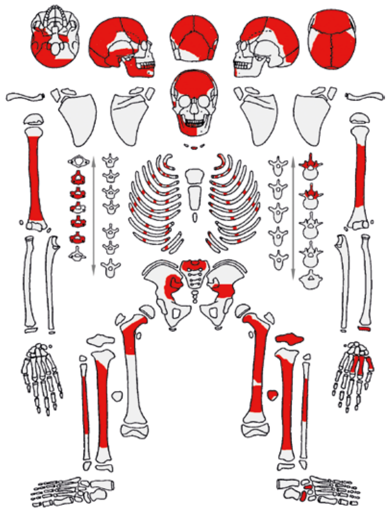


Sex: **male**, male expression of sexually dimorphic traits in the cranium, mandible, and pelvis
Age: **21–25 years**, no cranial suture closure, dental wear (Ic)
Body height: **c. 161 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: preauricular sulcus shape r/l: mm-/---, stage r/l: 1/0
Stress/bone reactions: cribra orbitalia represented as a cluster of fine foramina in the left orbital roof
Trauma, degenerative changes, other, anatomical variation: none detected
Comments: long bone measurements: right femur = 435 mm, buried close to individual in Feature 18 (double burial?)

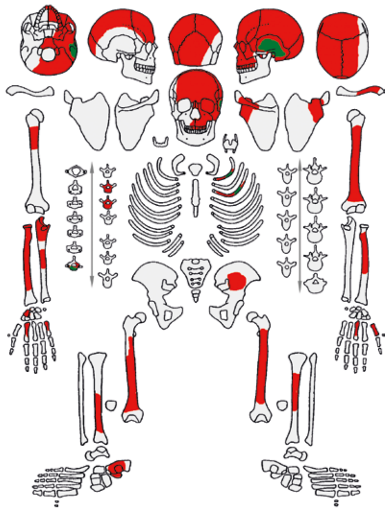
Schleinbach, Feature 16 (Group 1), NHM AA Inv. no. 27627



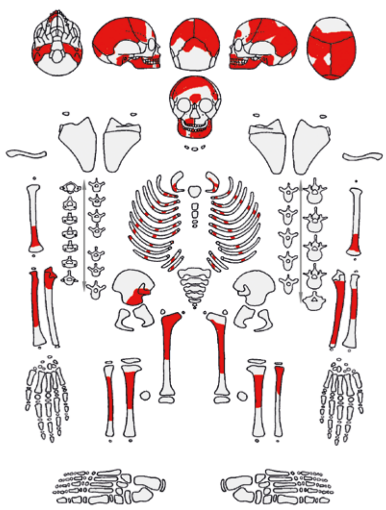
Sex: **female?**, female expression of some of the sexually dimorphic traits in the cranium. Indifferent expression of pelvic features. Robustness of the long bones
Age: **21–25 years**, no cranial suture fusion, epiphyseal fusion finished; M3 not fully developed
Body height: **164–165 cm**
Bone surface preservation: strongly eroded
Green stains: left temporal bone
Pelvic features, stress/bone reactions, trauma and degenerative changes: none detected, severely eroded
Other: only isolated teeth, one upper I1, two lower PM1 and two M3 (root not completely developed)
Anatomical variation: none detected
Comments: long bone measurements: left ulna = 263 mm, left tibia = 394 mm; cranial internal layer and some postcranial skeletal elements are covered with sinter – no evaluation possible; 25–30-year-old male according to Weninger 1954, juvenile adult female according to Teschler-Nicola 1992



Schleinbach, Feature 17 (Group 1), NHM AA Inv. no. 27628
Sex: **female?**, female expression of sexually dimorphic traits in the cranium and pelvis; gracile stature
Age: **14–15 years**, dentition and mineralization (M2 in masticatory plane, M3 still in the jawbone); epiphyseal fusion not finished (distal humerus, distal metacarpals, sacrum S1)
Body height: –
Bone surface preservation: moderately eroded
Green stains: internal layer of parietal bones, and on the right side of the temporal bone, maxillary molars, mandible, cervical vertebrae, humerus, carpals and metacarpals of the right hand
Pelvic features: –
Stress/bone reactions: pleuritis visible as a fine porous new bone layer on the dorsal part of the inner surface of two ribs
Trauma: none
Degenerative changes: none detected
Other: LEH (enamel hypoplasia): severity stage 3, 1 hypoplastic line in mandibular right second incisor and further, with severity stage 2, 2 hypoplastic lines in mandibular canines, corresponding to a formation age of 2.9 and 3.5 years; bilateral localized new bone apposition, possible haematoma, in the dorsal mid-shaft of the tibiae
Anatomical variation: none detected
Comments: no long bone measurements possible; additional skeletal remains of an adult individual and some animal bones

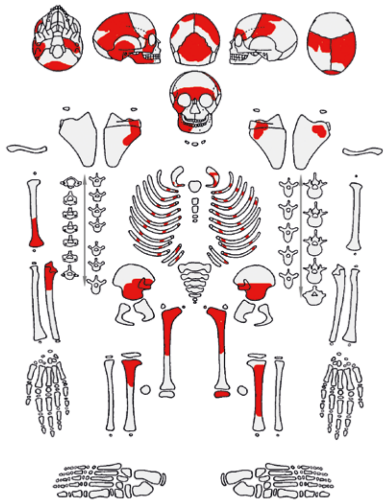


Schleinbach, Feature 18 (Group 1), NHM AA Inv. no. 27629
Sex: **female?**, female expression of sexually dimorphic traits in the cranium but skeletal robusticity (+1)
Age: **30–35 years**, cranial suture fusion (S3 fused), dental wear (IIc)
Body height: –
Bone surface preservation: moderately eroded
Green stains: left temporal bone, one cervical vertebra, some rib fragments
Pelvic features: –
Stress/bone reactions: perisinusitis manifested as remodelled new bone apposition in the confluens sinuum of the occipital bone
Trauma: none detected
Degenerative changes: none detected
Other: internal layer of the left parietal bone reveals deep vessel impressions
Anatomical variation: none detected
Comments: no long bone measurements possible; 40–45-year-old female according to Weninger 1954, male adult according to Teschler-Nicola 1992

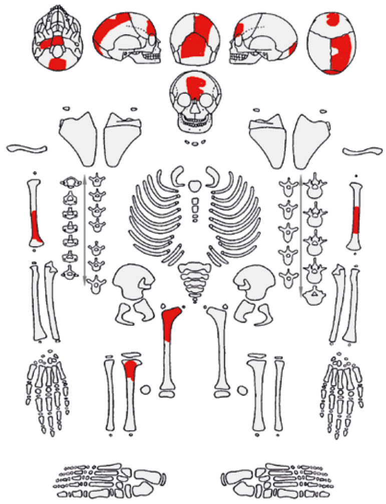


Schleinbach, Feature 22 (pit), NHM AA Inv. no. 27630
Sex: **undetermined**
Age: **3.5–4.5 years**, status of dentition and mineralization (c. 4 years)
Body height: –
Bone surface preservation: strongly eroded
Green stains: proximal portion of right ulna and radius, and distal portion of left ulna and radius
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comment: no measurements possible; ^{14}C and C/N isotope samples taken from ribs

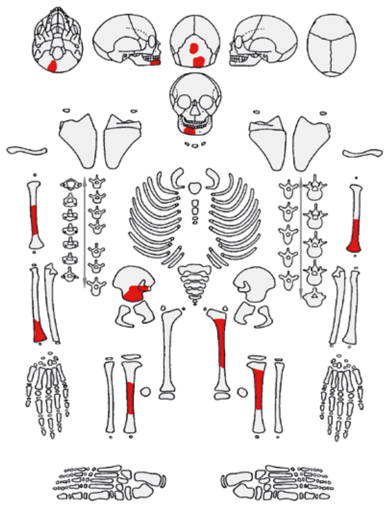
Schleinbach, Feature 23 (?) (Group 1), NHM AA Inv. no. 27631
Sex: **undetermined**
Age: **6–7 years**, dentition and mineralization (6–7 years), diaphyseal length
Body height: **c. 105 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions, trauma, degenerative changes, other, anatomical variation: none detected
Comments: diaphyseal measurement of the right femur = 225/– mm; fracture lines on some cranial fragments and long bone elements



Schleinbach, Feature 27 (Group 1), NHM AA Inv. no. 27632
Sex: **undetermined**
Age: **0.75–1.25 years**, diaphyseal length
Body height: **70–74 cm**
Bone surface preservation: strongly eroded
Green stains: left petrosal bone
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comments: diaphyseal measurement of femur = 120/– mm; nearly all cranial fragments show post-mortal fracture lines

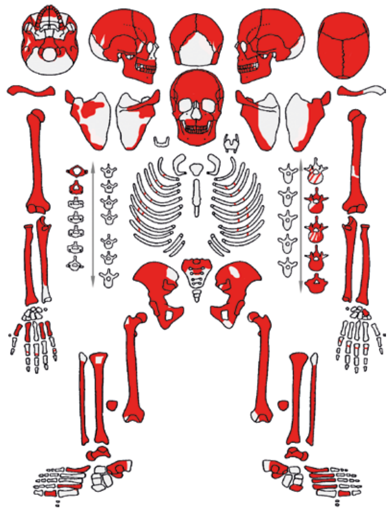


Schleinbach, Feature 28 (Group 1), NHM AA Inv. no. 27633
Sex: **undetermined**
Age: **1.5–2.5 years**, primary dentition and mineralization
Body height: –
Bone surface preservation: strongly eroded
Green stains: none detected
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comments: no diaphyseal measurements possible; navicular bone of an additional adult individual, fragments of animal bones and shells



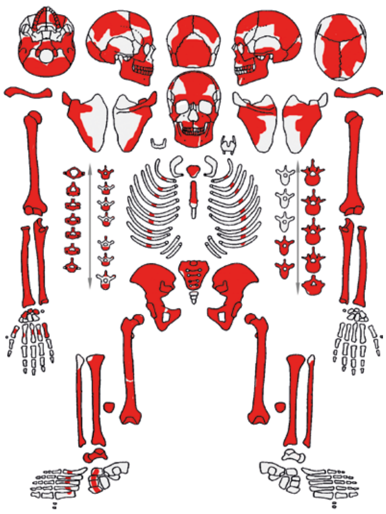
Schleinbach, Feature 29 (Group 1), NHM AA Inv. no. 27634

Sex: **female**, female expression of sexually dimorphic traits in the cranium and pelvis, but not in the mandible
Age: **30–35 years**, cranial fusion (S3/4, C3 fused), dental wear (IIb–IIIa), clavicle (> stage 3), facies symphysialis (stage VI)
Body height: **c. 161 cm**
Bone surface preservation: moderate, nearly complete skeleton (surface partly covered with sintering)
Green stains: none detected
Pelvic features: right preauricular sulcus consists of one deep groove, the left one consists of two deep grooves with a closed border (shape r/l: f-f-f/ f-f-f, stage r/l: 4/4); bilaterally developed sacral preauricular extensions (right side: h = 12 mm, w = 4 mm; left side: h = 12 mm, w = 5 mm), no related changes in the iliac bones; bilateral modification at upper dorsal end of sacral auricular facet, an elevated and delimited elongation, corresponding with ilium on the left side, right iliac side eroded; bilaterally developed irregular exostotic structures in the area of the pubic tubercle – but no distinct extended pubic tubercle; possible dorsal pubic pitting in the right pubic bone (stage r/l: 2/1 – partially sintered); ventral pubic surface shows rim-like exostotic structures running parallel to the symphysis and irregular lesions, especially in the upper third (stage r/l: 2/2)
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes: caput mandibulae appears flattened bilaterally; big irregular fovea on right femoral head
Other: –
Anatomical variation: bilaterally occurring foramen olecranon
Comments: long bone measurements: right femur = 435 mm, body height = c. 161 cm (Ruff et al. 2012)

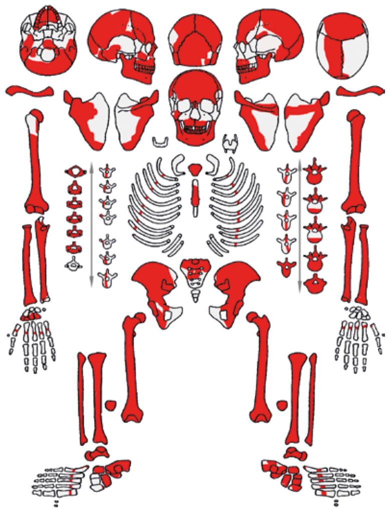


Schleinbach, Feature 30 (Group 1, double burial), NHM AA Inv. no. 27635

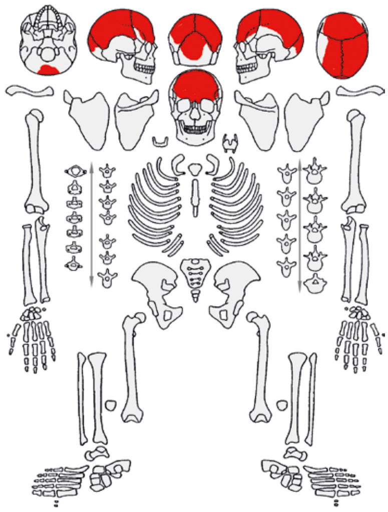
Sex: **male**, male expression of sexually dimorphic traits in the cranium and pelvis, but long bone gracility
Age: **27–30 years**, dental wear (IIb), clavicle (> stage III), symphyseal facet (stage V)
TCA age: **37/38.4 ± 5 years**
Body height: **163 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: preauricular sulcus (shape r/l: m-m-m/m-m-m, stage r/l: 1/1); slight lesions on ventral pubic surface (stage r/l: 2/2)
Stress/bone reactions: none detected
Trauma: cranial polytrauma, peri-mortem fractures: 1. blunt force trauma, of burst fracture type, round to oval shape (size not measurable, fragmented) with sharp margins, chipping at internal lamina, and radial fracture lines in the left parietal bone, continuing through suprameatal spine and external acoustic meatus (similar to the cranium of grave 31); 2. viscero-cranial fracture of the left anterior part of the mandible extending from the mentum to the premolars, including chipping of the crowns down to the root of the left maxillary and mandibular canine and premolars; fracture of the left superior and inferior pubic ramus of unclear status (lateral compression type 1, anterior pelvic ring fracture)
Degenerative changes: none detected
Other: lumbosacral transitional vertebra L5/S1 (false-joint formation at the left transverse process of the fifth lumbar vertebra with the left lateral part of the sacrum)
Anatomical variation: facies poirier to the right femoral head
Comments: long bone measurements: left femur = 440 mm; aDNA sample taken from FDI 34, ^{14}C and C/N isotope sample taken from femur, TCA sample taken from FDI 21; buried in double grave with the individual from Feature 31



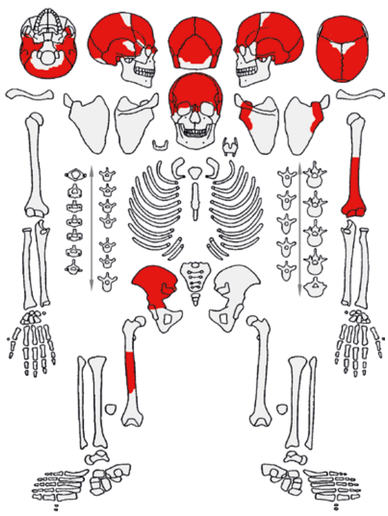
Schleinbach, Feature 31 (Group 1, double burial), NHM AA Inv. no. 27636
Sex: **male**, male expression of sexually dimorphic traits in the cranium and pelvis
Age: **30–35 years**, dental wear (IIb), clavicle (> stage III), cranial suture fusion (S3)
TCA age: **32.8/34 ± 5 years**
Body height: **172 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: small, well-defined groove below the inferior margin of the right auricular facet (10 × 4 mm) preauricular sulcus (shape r/l: m-m-m/m-m-m, stage r/l: 1/1)
Stress/bone reactions: none detected
Trauma: peri-mortem cranial fractures, 1. burst fracture of half-rounded shape (60 × 60 mm) with characteristic fracture lines in the left parietal bone (near coronal suture) and chipping of the internal layer of the cranium; 2. sharp-edged fracture lines on temporal bone and zygomatic process; 3. intravital compression fracture on the left side of the fifth lumbar vertebra; 4. intravital traumatic inferior subluxation of the shoulder joint, including the development of a new, smooth joint surface (size 20 × 15 mm) at the lower border of the left glenoid cavity of the scapula, but no alteration is visible in the humeral head
Degenerative changes: degenerative new bone formation at the joint margin of both knees; distinct exostoses on the tuberositas tibiae; both femora show strong expression of the adductor muscle attachment (similar to the adult male of grave 60)
Other: strong calculus formation on the teeth
Anatomical variation: bilaterally developed facies poirier to the femoral head/neck
Comments: long bone measurements: right femur = 474 mm; DNA sample taken from FDI 45, TCA sample taken from FDI 25; buried in double grave with individual from Feature 30



Schleinbach, Feature 32/1 (pit), NHM AA Inv. no. 27637
Sex: **female?**, mainly female expression of the sexually dimorphic traits of the skull
Age: **25–29 years**, dental wear (Ic, isolated teeth), no cranial suture closure (< 30 years)
Body height: –
Bone surface preservation: strongly eroded (surface of lamina interna partially covered with sinter)
Green stains: none detected
Pelvic features: –
Stress/bone reactions: none detected
Trauma, degenerative changes, other, anatomical variation: –
Comment: no measurement of long bones possible

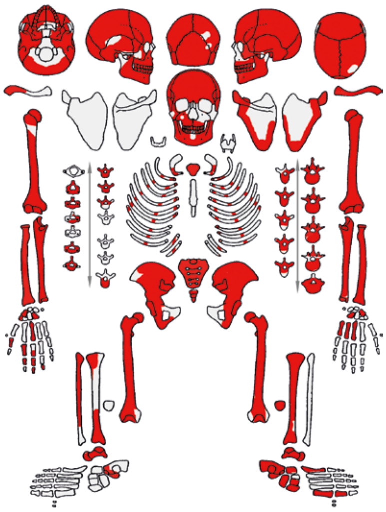


Schleinbach, Feature 32/2 (pit), NHM AA Inv. no. 27638
Sex: **female?**, female expression of sexually dimorphic traits in cranium, iliac bone, and long bones
Age: **35–45 years**, cranial suture fusion (coronal part still open, sagittal 2/3 and lambdoid sutures partially fused)
Body height: –
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: sharp margin with slight new bone formation on the superior part of the right auricular facet
Stress/bone reactions: porotic hyperostosis visible as slight pitting in the external layer of the skull
Trauma, degenerative changes, other, anatomical variation: none detected
Comments: no long bone measurements possible; occipital bone of an additional individual with remodelled new bone formations in the sinus sagittalis area



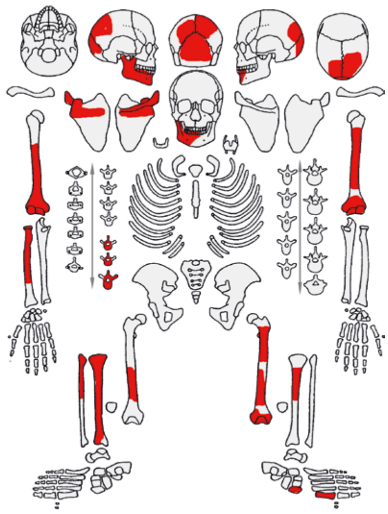
Schleinbach, Feature 55 (pit), NHM AA Inv. no. 27639
Sex: **undetermined**
Age: **14–18 years**
Comment: The skeletal remains were not available for evaluation. Karl Kriegler's *ad hoc* assessment: probably female, young (Rettenbacher 2004, 83). The incomplete epiphyseal closure of the distal ends of the femora visible in the photograph (reprinted in Rettenbacher 2004, 154 and Pl. 50/2) suggest an age of 14–18 years

Schleinbach, Feature 56 (pit), NHM AA Inv. no. 27640



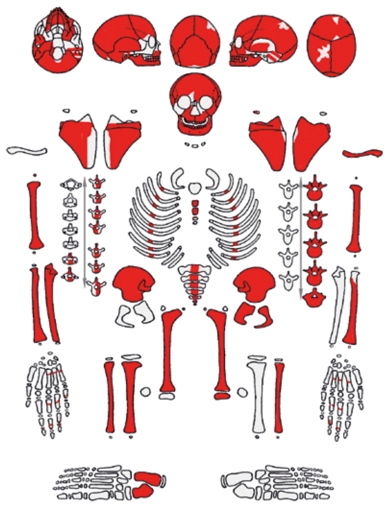
Sex: **female?**, indifferent expression of sexually dimorphic traits in the cranium and mandible but pelvic features are distinctly female
Age: **40–55 years**, fusion of cranial suture (S3, S4 fused), dental wear (IIIc/IV, intravital tooth loss and periapical inflammation), pubic symphysis (stage X)
TCA age: **26.2/46.2 ± 5 years**
Body height: **(160–162 cm)**
Bone surface preservation: weakly eroded
Green stains: none detected
Pelvic features: clearly defined true preauricular sulcus with a structured surface (shape r/l: f-f-f/f-f-f, stage r/l: 4/4); moderately developed exostoses at auricular facets (stage r/l: 2/2); commencing ossific bridging ventro-superiorly at right sacroiliac joint (potentially influenced by multiple fracture of the sacrum); moderate lesions and exostoses (stage r/l: 2/0) on the right ventral and dorsal pubic surfaces; slight margo auricularis groove (stage r/l: 2/1) on the right side of the sacrum; further, a sacral preauricular notch is visible on the right side (stage r/l: 2/1); remarkable attachments of gluteal muscles at the iliac bone
Stress/bone reactions: porotic hyperostosis (slight porosity at lamina externa of the parietal and occipital bones); cribra orbitalia (fine porosity on the right orbital roof); (healed) sinusitis maxillaris apparent as spicules and net-like new bone deposits in the right maxillary sinus; stomatitis (changes due to osteomyelitis?); hyperostotic new bone formation (hyperostosis frontalis and foveolae granulares) on the lamina interna of the frontal bone, generalized periostitis on the long bone surface and a local remodelled new bone apposition (haematoma) on the distal lateral part of the left femur (20 × 10 mm)
Trauma: polytrauma on the postcranial skeletal remains: healed fractures with callus formation visible on the distal shaft elements of both radii, slight bony surface changes but no fracture line on the right ulna (distal end damaged on the left side). Sacral bone with four different kinds of fractures: 1. sagittal fracture line (incision) from healed fracture on the right ala ossis sacri (ala is narrower on this side); 2. healed fracture leading horizontally from the right lateral margin to the upper border of the third sacral foramen; 3. transversal fracture line with new bone apposition (in healing status) at level of S3 between sacral foramina; 4. continuing healed fracture in left distolateral part of the sacrum, crack at the level of third sacral foramen on the dorsal side; thickening (callus?) of the sternoclavicular part of the left clavicle and of the acromioclavicular part of the right clavicle, healed fracture of left fourth metacarpal, further, healed partial fractures of some ribs on the left dorsal arch
Degenerative changes: bilateral degeneration of the mandibular joint; distinct entheseal features on the clavicles, ribs, humeri, scapulae, radii, ulnae and phalanges; (fracture-related) arthrosis especially in the wrists; exostoses on the ischium at the location of the deep transverse perineal muscle; chronic polyarthritis at articular facets and spondylitis of cervical vertebrae 3–6, further deforming spondylosis at the lumbar vertebra bodies 2–5
Other: external layer of the right parietal bone exhibits two noteworthy, local, round, sharp-edged porous lesions which are probably of post-mortem origin; abnormal wear patterns were observed in all existing upper teeth (worn down to the dentine); numerous periapical lesions in the maxilla and mandible; severe dental calculus formation in the lower jaw; bilateral calcaneus secundarius; suspicious perforation in the dorsal-plantar direction of pinhead size in healed status of one distal phalanx (traumatic origin, feature of gout, oedema?); signs of demineralization of the bones
Anatomical variation: spondylolysis at lumbar vertebra 5 (as a result of a stress fracture in growth)
Comments: long bone measurements: left humerus = 299 mm, left radius = 223 mm; mature female according to Weninger 1954, male adult according to Teschler-Nicola 1992

Schleinbach, Feature 59 (Group 1), NHM AA Inv. no. 27641



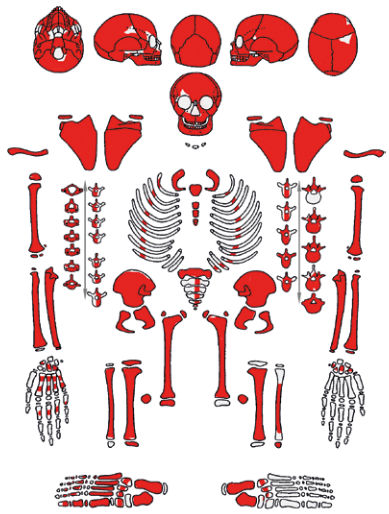
Sex: **male**, male expression of sexually dimorphic traits in the cranium (fragments) and mandible
Age: **35–45 years**, dental wear (IIIc), cranial fusion of the cranial remains that are present (except of L and S4)
Body height: –
Bone surface preservation: strongly eroded
Green stains: none detected
Pelvic features: no evaluation possible
Stress/bone reactions: periosteal reactions/striations on the surface of both tibiae
Trauma: the coxarthrosis described below may be of traumatic origin
Degenerative changes: coxarthrosis – right iliac joint reveals a severe enlargement of the fossa acetabulum with distinct marginal new bone apposition and a flattened, mushroom-shaped right femoral head with exostotic new bone formation
Other: none detected
Anatomical variation: none detected
Comments: no long bone measurements possible
Comment 2: left femur of an additional individual present (7–14 years)

Schleinbach, Feature 60 (multiple burial), NHM AA Inv. no. 27642



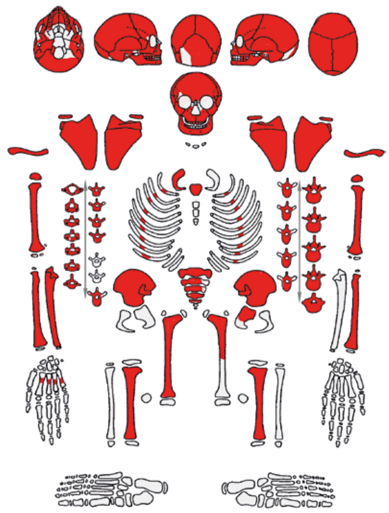
Sex: **male**, male expression of sexually dimorphic traits in the cranium and pelvis as well as the robustness of postcranial elements
Age: **30–35 years**, dental wear (IIc + strong uniform abrasion), ectocranial fusion (S3), sacrum (S1 fused) and symphyseal facet (stage V/VI)
TCA age: **37.7 ± 5 years**
Body height: **168 cm**
Bone surface preservation: slightly eroded
Green stains: none detected
Pelvic features: some exostoses on the right facies auricularis (stage r/l: 2/0); right ventral pubic surface with marginal ridge (stage r/l: 2/1); very robust pubic bones; strong muscle attachments at pubic bones and iliac crest; ridge-like exostoses at the anterior/superior border of iliac and sacral auricular facets, preauricular sulcus (shape r/l: m-m-m/---, stage r/l: 1/0)
Stress/bone reactions: remodelled periosteal reactions (striations) on the surface of lower long bones
Trauma: healed circular depression fracture in the lateral part of the left frontal bone (15 × 15 × 10 mm)
Degenerative changes: collapsed region in the frontal part of the upper end plate of the second lumbar vertebra, possibly from disc prolapse; very strong muscle attachments with ridge like exostoses on the dorsal shaft of the tibiae (hamstrings; M. soleus – plantarflexion)
Other: stomatitis on the palatine; uniform dental wear, dental chipping especially in the upper jaw, apical lesions on the upper first molars
Anatomical variation: facies poirier to the femoral head/neck; unilateral (left side) foramen parietale; lambdoid ossicles (left side); sacralization (six sacral vertebrae)
Comments: long bone measurements: right femur = 461 mm, aDNA sample from FDI 15, TCA samples from FDI 35; remains of another middle-aged male and a 10–11-year-old child were found “near 60”, but are not part of this context and are not dated

Schleinbach, Feature 60A (multiple burial), NHM AA Inv. no. 27643



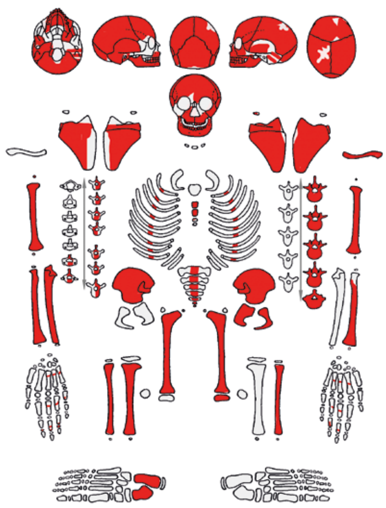
Sex: **male** (proteomic sex identification)
Age: **8–9 years**, dentition and mineralization, diaphyseal length
Body height: **120–124 cm**
Bone surface preservation: weakly eroded
Green stains: none detected
Pelvic features: ridges and exostoses on the lateral margin and inferior auricular facets (similar to 60)
Stress/bone reactions: fine porotic hyperostosis on the outer layer of parietal bones; stomatitis
Trauma: right talus exhibits a healed avulsion fracture of the lateral tubercle (processus posterior tali); external layer of the right parietal bone suspiciously spalled, alteration of unclear peri-/post-mortem origin
Degenerative changes: –
Other: alveolar atrophy possibly caused by strong calculus
Anatomical variation: lambdoid ossicle (left side); foramen olecrani
Comments: measurements of diaphyseal length: left ulna = 184 mm, left femur = 292 mm, right tibia = 233 mm; aDNA sample taken from FDI 34

Schleinbach, Feature 60B (multiple burial), NHM AA Inv. no. 27644



Sex: **female** (proteomic sex identification)
Age: **c. 12 years**, age discrepancy between dentition (M2 nearly in masticatory plane, but persisting deciduous teeth) and measurements of diaphyseal length (indicate an age at death of 8–9 years), postcranial elements are slightly more robust than those of the child 60A
Body height: **115–119 cm**
Bone surface preservation: weakly eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions, trauma, degenerative changes, other: none detected
Anatomical variation: sagittal and lambdoid ossicle; bilateral trochanter tertius on femora
Comments: measurements of diaphyseal length: right tibia = 230 mm, right femur = 287 mm, left humerus = 194 mm, left radius = 144 mm; aDNA sample taken from FDI 45

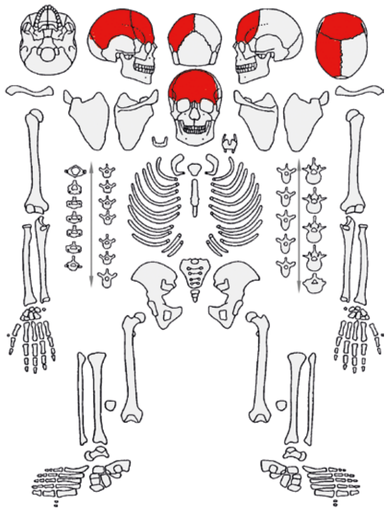
Schleinbach, Feature 60C (multiple burial), NHM AA Inv. no. 27645



Sex: **female** (proteomic sex identification)
Age: **3–4 years**, dentition and mineralization, measurements of diaphyseal length
Body height: **75–79 cm**
Bone surface preservation: weakly eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions: bilateral cribra orbitalia (fine foramina covering the orbital roof)
Trauma: peri-/post-mortem burst fracture (nearly stellar shaped, elongated anterior-posterior in direction, 45 × 25 mm) of the left parietal bone with five radial fracture lines and chipping on the internal lamina
Degenerative changes: none detected
Other: none detected
Anatomical variation: metopic suture
Comments: measurements of diaphyseal length: femur = 145 mm, tibia = 111 mm, fibula = 107 mm; ^{14}C and C/N isotope samples taken from ribs, aDNA sample taken from FDI 55

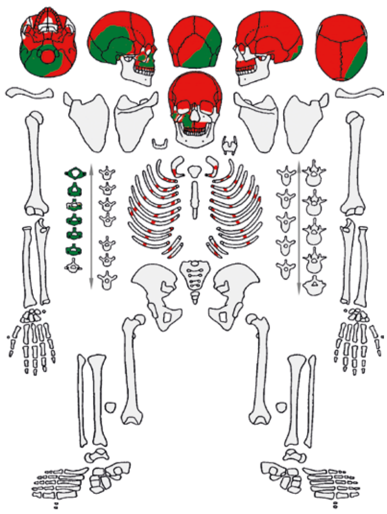
Schleinbach, Feature 63, NHM AA Inv. no. 27646

Sex: **male**, male expression of sexually dimorphic traits in the preserved frontal and parietal bone
Age: **20–30 years**, no fusion of cranial suture
Body height: –
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions: fine porotic hyperostosis in the parietal bones
Trauma: none detected
Degenerative changes: –
Other: –
Anatomical variation: none detected
Comment: no long bone measurements possible, no postcranial remains present



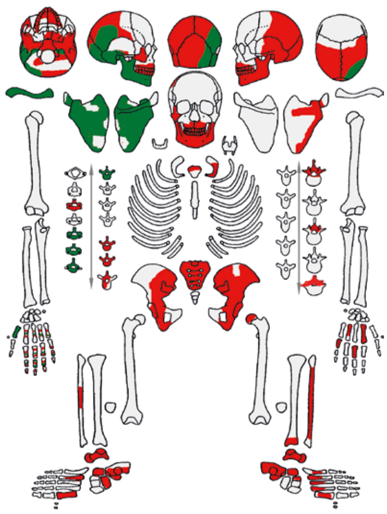
Schleinbach, Feature 89A, NHM AA Inv. no. 27647

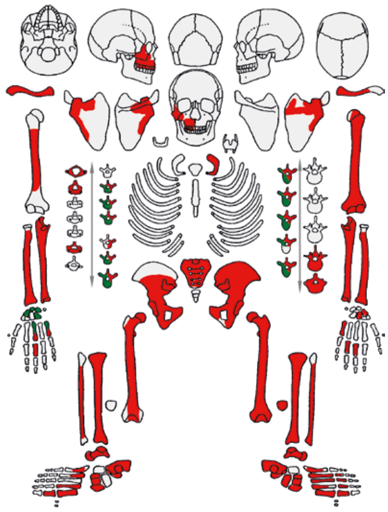
Sex: **female**, mostly female expression of sexually dimorphic traits in the cranium
Age: **30–45 years**, severe dental wear, fusion of cranial sutures (S3, C2/C3 fused)
Body height: –
Bone surface preservation: cranium moderately eroded; no postcranial remains (except of some cervical vertebra and rib fragments)
Green stains: right side of temporal, parietal and occipital bone, maxilla and zygomatic bone; further, skull base and all present cervical vertebrae
Pelvic features: –
Stress/bone reactions: internal layer of frontal and parietal bones reveals foveolae granulares (pits on the inner surface of the skull caused by arachnoid granulations), and a cystic lesion on the left parietal; active sinusitis maxillaris on the right side with inflammatory reactions (fine remodelled new bone formation); severe stomatitis (distinct ridge-like exostoses in the palatine)
Trauma: none detected
Degenerative changes: strong changes of the left mandibular joint with enlarged facets
Other: both alveoli of maxillary M3 in healing status; general severe dental wear in the upper jaw, apical lesions on both first molars; alveolar atrophy and alveolar pitting
Anatomical variation: metopic suture; some lambdoid ossicles
Comments: no long bone measurements possible (no postcranial remains present except for the cervical vertebrae); buried with individual 89B, settlement burial



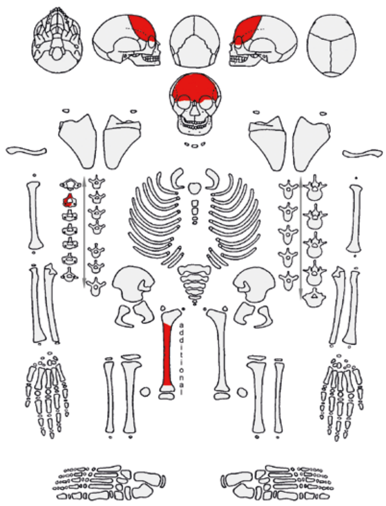
Schleinbach, Feature 89B, NHM AA Inv. no. 27648

Sex: **male**, male expression of sexually dimorphic traits in the cranium, mandible and pelvis
Age: **25–30 years**, fusion of cranial suture (S3 fused), dental wear (IIb), clavicle (stage III) and sacral vertebrae (S1/S2 fusing)
Body height: –
Bone surface preservation: moderately eroded
Green stains: right parietal, temporal and occipital bones, both zygomatic processes, right side of the mandible, cervical vertebrae vC5/6/7, thoracic vertebra vTh1, right clavicle and scapula, some metacarpals and phalanges of the right hand
Pelvic features: right preauricular sulcus is smooth and wide (maybe in context with the spondylolysis of fifth lumbar vertebra); preauricular sulcus (shape r/l: i-m-m/m-m-m, stage r/l: 2/1)
Stress/bone reactions: stomatitis visible as fine porosity in the palatine
Trauma: none detected
Degenerative changes: none detected
Other: deep fovea granulares (pits) in the inner layer of parietal bones running parallel to the sagittal suture; caries lesions in the mandibular M2; spondylolysis (isolated arch) of the vL5
Anatomical variation: very long transversal process in the second lumbar vertebra
Comment: no long bone measurements possible; buried with individual 89A, settlement burial



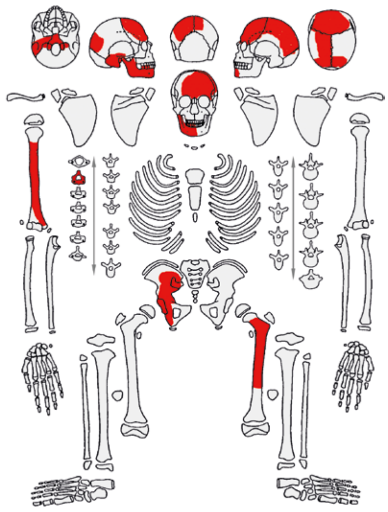


Schleinbach, Feature 90, NHM AA Inv. no. 27649
Sex: **female**, female expression of sexually dimorphic traits in the pelvis
Age: **27–35 years**, dental wear (IIb), pubic symphysis (V–VI), clavicle (> III), sacral vertebra (S1 fused)
Body height: **154 cm**
Bone surface preservation: moderately to strongly eroded
Green stains: thoracic vertebrae, carpal and metacarpal bones of the right hand
Pelvic features: preauricular sulcus is very large, wide and deep (shape r/l: f-f-f/f-f-f, stage r/l: 4/4); marked ridges at the attachment area of M. obliquus externus and internus; ridge-like structures in the anterior and superior part of the sacroiliac joint (stage r/l: 2/2); some exostoses visible on the surface of the sacral auricular facet and area of sacroiliac ligaments; sacral preauricular notch (bone loss) (5 × 10 mm) visible at the right ventrosuperior margin of the ala ossis sacri (stage r/l: 2/1); left pectineal line of pubis shows a small extended tuberculum pubis (pyramidal exostosis, stage r/l: 0/2); left dorsal pubic surface reveals pubic pitting (small chain like imprints, stage r/l: 1/2); strongly developed exostoses (stage r/l: 2/2) and lesions (stage r/l: 2/2) on the ventral pubic surfaces
Stress/bone reactions: lumbar vertebrae vL5 and vS1 exhibit osteophytes and inflammatory reactions on the ventral side of the body (possible lumbar disc herniation)
Trauma: see above
Degenerative changes: strong attachments of the M. teres minor and M. brachialis (flexion) at both humeri; sternal part of the left clavicle seems enlarged due to strong entheseal attachment
Other: there are two alveolar sockets at the position of the right first incisor (either persisting deciduous first incisor or the permanent incisor had two roots)
Anatomical variation: ossific bridging at the right side of the scapula over the scapular notch; foramen olecrani on the left distal humerus
Comments: long bone measurements reveal length differences (right/left side): femur = 397/409 mm; tibia = 347/350 mm

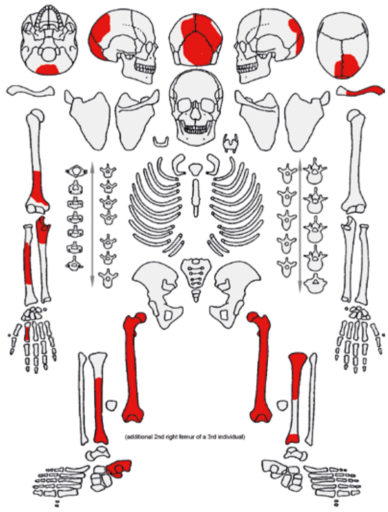


Schleinbach, Feature 91, NHM AA Inv. no. 27650
Sex: **undetermined**
Age: **3–5 years** (size comparison of frontal bone with a child from Gars/Thunau NHM Inv. no. 25062)
Body height: –
Bone surface preservation: moderately eroded (only frontal bone preserved)
Green stains: none detected
Pelvic features: –
Stress/bone reactions: cribra orbitalia (left orbital roof covered by fine porosity)
Trauma: none detected
Degenerative changes: –
Other: none detected
Anatomical variation: none detected
Comments: no postcranial remains, femur fragments (left side) and vC2 of an additional adult individual

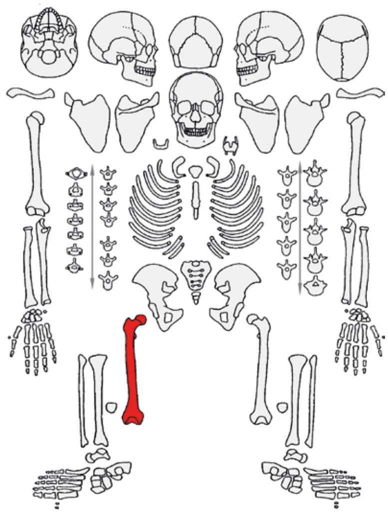
Schleinbach, Feature 101/1 (Group 2), NHM AA Inv. no. 27651
Sex: **undetermined**
Age: **14–16 years**, no cranial suture fusion, dental development (lower second molar not fully developed) and status of epiphyseal fusion (open: cranial base, proximal right humerus, proximal left femur and tuber ischiadicum)
Body height: –
Bone surface preservation: moderately eroded
Green stains: occipital bone, skull base, mandible (right side) and second cervical vertebra
Pelvic features: preauricular sulcus region (shape r/l: i-i-f/---, stage r/l: 1/0)
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes, other, anatomical variation: –
Comments: no measurements possible
Comment 2: commingled skeletal remains 101/1, 101/2 and 101/3

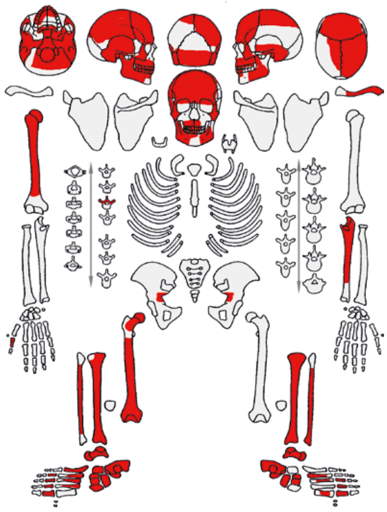


Schleinbach, Feature 101/2 (Group 2), NHM AA Inv. no. 27652
Sex: **undetermined (female?)**, postcranial remains are very gracile, no other sexing characteristics available
Age: **20–60 years**, cranial fusion of lambda suture nearly finished
Body height: –
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions: fine porosity in the external layer of parietal bone (porotic hyperostosis); new bone apposition in the sagittal sinus (perisinusitis)
Trauma: none detected
Degenerative changes: none detected
Other: –
Anatomical variation: lambdoid suture very irregular
Comments: no measurements possible, commingled skeletal remains 101/1, 101/2 and 101/3

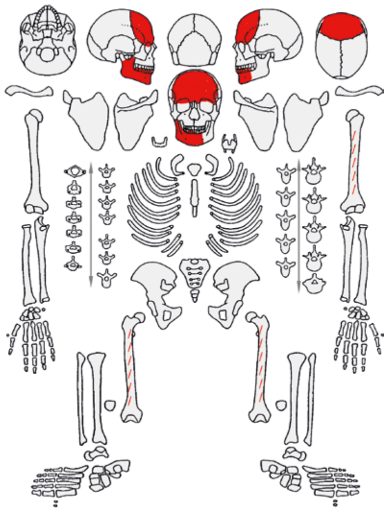


Schleinbach, Feature 101/3 (Group 2), NHM AA Inv. no. 27653
Sex: **undetermined (male?)**, only very robust right femur present
Age: **20–60 years**
Body height: –
Bone surface preservation: moderately eroded
Green stains: –
Pelvic features: –
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes: none detected
Other: –
Anatomical variation: –
Comments: no measurements possible, commingled skeletal remains 101/1, 101/2 and 101/3

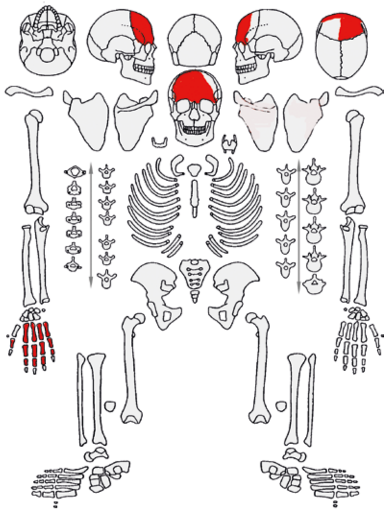




Schleinbach, Feature 102 (Group 2), NHM AA Inv. no. 27655
Sex: **male**, male expression of sexually dimorphic traits in the cranium and mandible
Age: **25–30 years**, dental wear (IIa) and cranial suture fusion (< 30)
Body height: **174 cm** (Breitinger 1937)
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions: none detected
Trauma: probably peri-mortem sharp force polytrauma to the cranium: right parietal bone reveals a horizontally trending crack, originating from the bregma and laterally arch-shaped (antero-posterior direction, 100 × 130 mm) directing to the lambda (mid-point of lambdoidal suture); left parietal bone, near the coronal suture, shows a bevelled edge margin; left orbital margin of the frontal bone reveals a triangularly shaped spalling; fracture patterns are present in several other cranial fragments from the parietal/occipital bones
Degenerative changes: none detected
Other: internal layer of frontal and temporal bone exhibits several cone-shaped hyperostoses
Anatomical variation: none detected
Comments: long bone measurements: left tibia = 393 mm

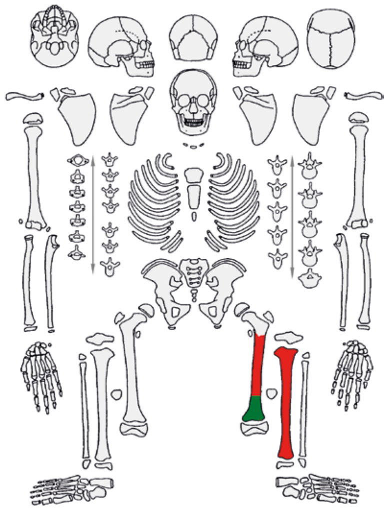


Schleinbach, Feature 103/1 (Group 2), NHM AA Inv. no. 27656
Sex: **male**, male expression of observable sexually dimorphic traits in the cranium and mandible
Age: **25–35 years**, no cranial fusion of the present coronal suture, dental wear (IIb)
Body height: –
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: –
Stress/bone reactions, trauma, degenerative changes, other, anatomical variation: none detected
Comments: no long bone measurements possible; total grave content 103: cranial remains (ossa frontalia) of 2 adult male individuals (103/1, 103/2), additional fragmented postcranial elements of 2 or 3 individuals (femora and humerus of a male individual (possibly 103/1), left femur and left tibia of a 14–20-year-old (103/3) and left iliac bone of a female (103/4), left scapula, proximal humerus and phalanges of the right hand of an adult (103B)

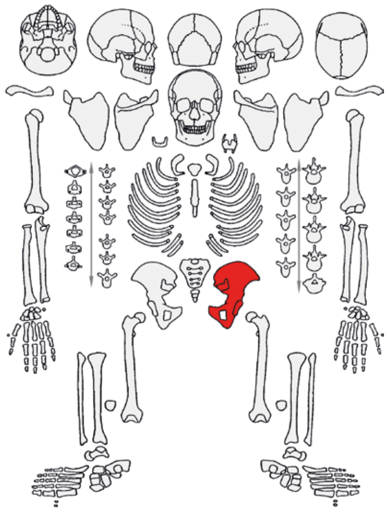


Schleinbach, Feature 103/2 (Group 2), NHM AA Inv. no. 27657
Sex: **male**, male expression of sexually dimorphic traits in the cranium
Age: **20–40 years**, no cranial fusion of the present coronal suture
Body height: –
Bone surface preservation: strongly eroded
Green stains: none detected
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comments: no long bone measurements possible

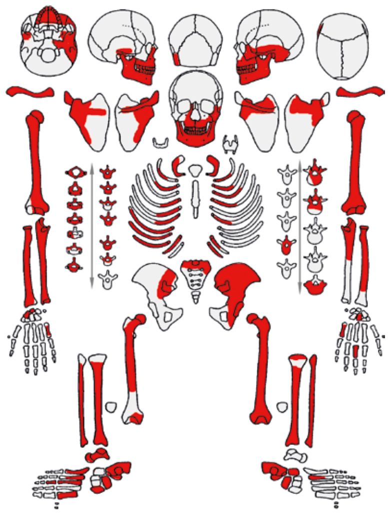
Schleinbach, Feature 103/3 (Group 2), NHM AA Inv. no. 27658
Sex: **undetermined**
Age: **14–20 years**, epiphyseal fusion not finished in the proximal tibia and distal femur
Body height: –
Bone surface preservation: strongly eroded
Green stains: distal shaft of the left femur
Pelvic features: –
Stress/bone reactions, trauma, degenerative changes, other, anatomical variation: none detected
Comments: no measurements possible



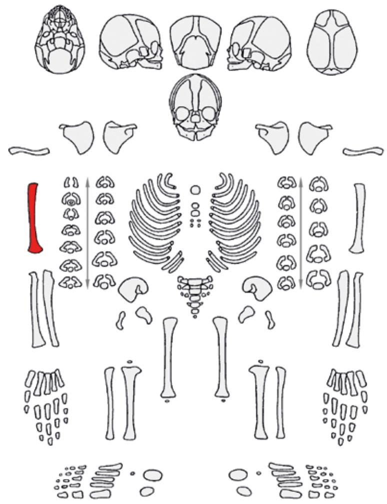
Schleinbach, Feature 103/4 (Group 2), NHM AA Inv. no. 27679
Sex: **female**, pelvic characteristics are clearly female, os ilium preauricular sulcus –1, incisura ischiadica –2, arc compose –2
Age: **20–40 years** (no degenerative changes at acetabulum)
Body height: –
Bone surface preservation: strongly eroded
Green stains: –
Pelvic features: preauricular sulcus (shape i-i-i, stage 2)
Stress/bone reactions, trauma, degenerative changes, other, anatomical variation: none detected
Comments: partial left os ilium, no measurements possible



Schleinbach, Feature 103B (Group 2), NHM AA Inv. no. 27654
Sex: **undetermined**
Age: **20–40 years**, epiphyseal fusion finished, no degenerative changes
Comments: in situ documented left scapula, proximal humerus and phalanges of the right hand



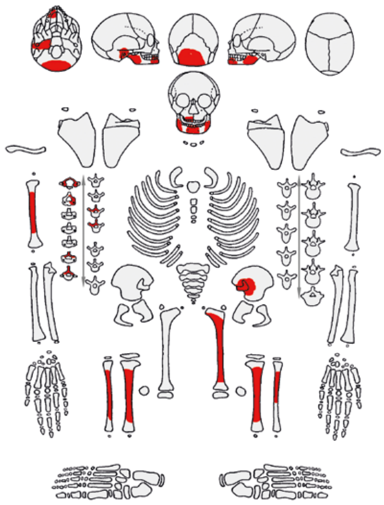
Schleinbach, Feature 104/1 (Group 2), NHM AA Inv. no. 27659
Sex: **female**, female expression of sexually dimorphic traits in the cranium, mandible and pelvis
Age: **30–35 years**, dental wear (IIb), clavicle (> 30)
Body height: **152 cm**
Bone surface preservation: moderately eroded
Green stains: temporal bones, right side of maxilla (plus teeth) and mandible, all cervical vertebrae, acromial parts of clavicles and scapulae, left caput humeri, several ribs of the left side
Pelvic features: left preauricular sulcus is a deep depression with closed circumference (shape r/l: ---/f-f-f-, stage r/l: 0/4); furthermore, a sharp margin is developed at the upper medial part of the left sacroiliac joint (stage r/l: 0/2)
Stress/bone reactions: none detected
Trauma: development of distinct osteophytes located at the base plate of the fifth lumbar vertebra (vL5) and cover plate of the first sacral vertebra (S1, possibly caused by a compression trauma and/or by a spondylolysis of vL5)
Degenerative changes: left calcaneus reveals distinct osteophytes at the cuboid articular facet
Other: small caries lesion at the interface of the maxillary right canine (C) and the first premolar (PM1), calcaneus secundarius on the anterior articular facet of the right calcaneus
Anatomical variation: none detected
Comments: long bone measurements: right humerus = 282 mm, left ulna = 245 mm, right femur = 404 mm, right fibula = 324 mm; ^{14}C and C/N isotope samples taken from ribs; bones of additional individuals: humerus of a foetus (104/2, see below), left pelvis of a 35–45-year-old male (104/3, facet stage of the symphysis 7/8)



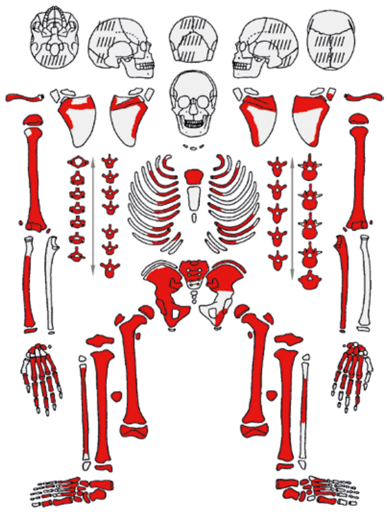
Schleinbach, Feature 104/2, NHM AA Inv. no. 27660
Sex: **undetermined**
Age: **7–8 lunar months**, foetus, diaphyseal length of the right humerus (c. 43 mm)
Body height: –
Bone surface preservation: slightly eroded (only humerus preserved)
Green stains, pelvic features, stress/bone reactions, trauma, degenerative changes, anatomical variation: –
Comment: found with 104/1

Schleinbach, Feature 104/3 (Group 2), NHM AA Inv. no. 27661
Sex: **male**, male expression of sexually dimorphic traits in the pelvis
Age: **35–45 years**, facet stage of the symphysis 7/8
Comments: left pelvis of a 35–45-year-old male found with 104/1

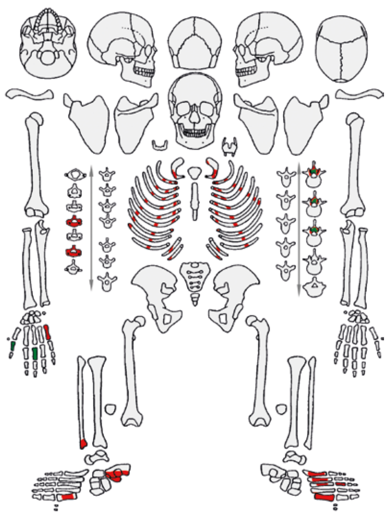
Schleinbach, Feature 105 (Group 2), NHM AA Inv. no. 27662
Sex: **undetermined**
Age: **3–4 years**, status of dentition
Body height: –
Bone surface preservation: moderately eroded
Green stains: mandible fragment, cervical and thoracic vertebra, several ribs
Pelvic features: –
Stress/bone reactions: perisinusitis (internal layer of occipital bone with net-like new bone deposition at the confluens sinuum and sinus transversus); possible scurvy: distinct periostitis characterized by widespread new bone apposition on the lateral shaft of the left femur and the medial part of the left tibia; pleuritis (some ribs show fine porotic new bone formation on the internal dorsal part)
Trauma, degenerative changes, other, anatomical variation: none detected
Comments: no measurements of diaphyseal length possible, C/N isotope sample taken from rib



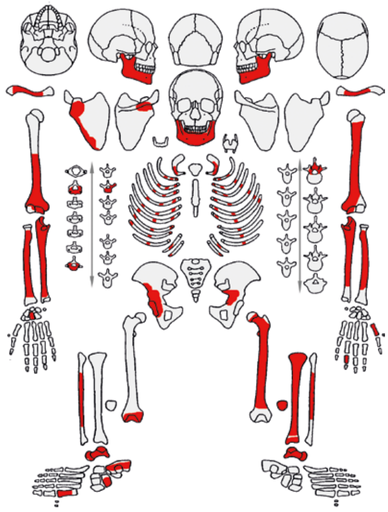
Schleinbach, Feature 106/1 (Group 2), NHM AA Inv. no. 27663
Sex: **female**, female expression of sexually dimorphic traits in the cranium and pelvis
Age: **16–20 years**, open sagittal/occipital sutures, cranial base (sphenobasilar joint), pars basilaris and lateralis of occipital bone, clavicle, tuber of the ischium and S1 (sacrum) suggest the individual is 14–18 years old; the remaining epiphyseal fusion is completed, which points to a higher age (20–22 years)
Body height: **153 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: well-defined preauricular sulcus with closed circumference (shape r/l: f-f--/f-f-f, stage r/l: 3/3); sacral preauricular notch at ventrosuperior margin of right ala ossis sacri, probably corresponding recess (small depression) on right side of iliac auricular facet (stage r/l: 2/1); spina bifida occulta visible as incomplete closure of sacral vertebral arches four and five
Stress/bone reactions: bilaterally developed localized new bone deposition on the dorsal distal part (facies poplitea) of the femora; healed periostitis in the form of bony striations present in the medial shaft of both tibiae; partly remodelled fine porotic new bone apposition on the pleural side of some left ribs indicative for pleuritis (in healing status)
Trauma: none detected
Degenerative changes: slight hyperostotic bone growth in the proximal part of the caput tali
Other: bilaterally developed distinct attachment of the deltoid and brachial muscles to the humeri
Anatomical variation: bilateral foramen olecranon; ossicle at bregma
Comments: long bone measurements: right humerus = 285 mm, right ulna = 242 mm, left femur = 408 mm, left tibia = 342 mm



Schleinbach, Feature 106/2 (Group 2), NHM AA Inv. no. 27664
Sex: **undetermined**, no sexually dimorphic characters present
Age: **20–40 years**
Body height: –
Bone surface preservation: strongly eroded
Green stains: lumbar vertebrae and several phalanges of the hand
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comments: no long bone measurements possible

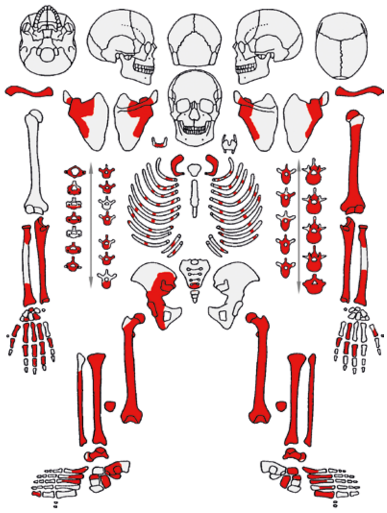


Schleinbach, Feature 107 (Group 2), NHM AA Inv. no. 27665



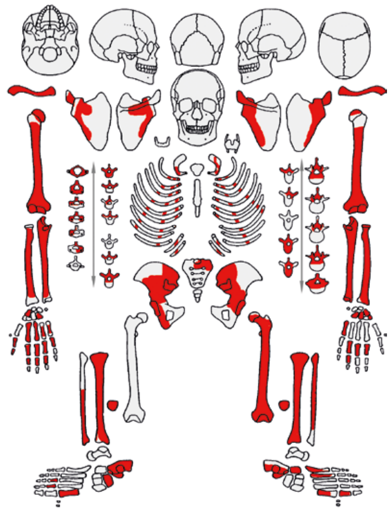
Sex: **female**, female expression of the sexually dimorphic traits of the mandible and in the preserved fragments of the right iliac bone
Age: **40–60 years**, intravital tooth loss in the mandible; postcranial degenerative changes indicate an elderly individual
Body height: –
Bone surface preservation: moderately eroded
Green stains: right ramus mandibulae, third cervical vertebra, first thoracic vertebra, first lumbar vertebra, right clavicle, right scapula, several ribs
Pelvic features: fragments of preauricular region have female characteristics (sulcus preauricularis shape r/l: f---/---, stage r/l: 2/0)
Stress/bone reactions: none detected
Trauma: polytrauma at postcranium, 1. well-healed fracture (with callus) of the left distal ulnar shaft; 2. mid-shaft of left clavicle exhibits a healed fracture in an angular position; 3. distinct and widespread new bone deposition on the ventral and dorsal aspect of right scapula fragment; 4. ossified haematoma on the mediodistal shaft of the right fibula
Degenerative changes: distinct changes in the second cervical vertebra (vC2 – dens axis) and femoral head (stage 2/3)
Other: intravital tooth loss in the mandible along with alveolar atrophy; strong attachments at the left humerus (M. pectoralis major) and at the left femur muscles for hip flexion (external obturator, gluteal, iliac and pectineal muscles, adductor muscles)
Anatomical variation: bony bridge over supra-scapular incisura (suprascapular foramen)
Comment: no long bone measurements possible

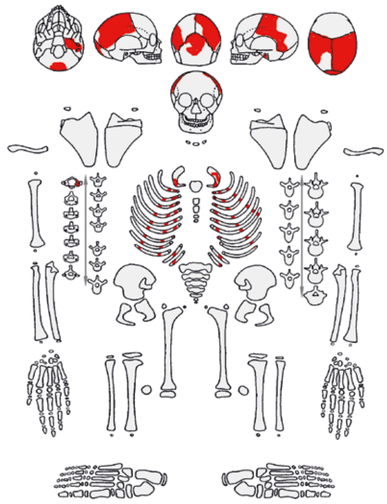
Schleinbach, Feature 108 (Group 2), NHM AA Inv. no. 27666



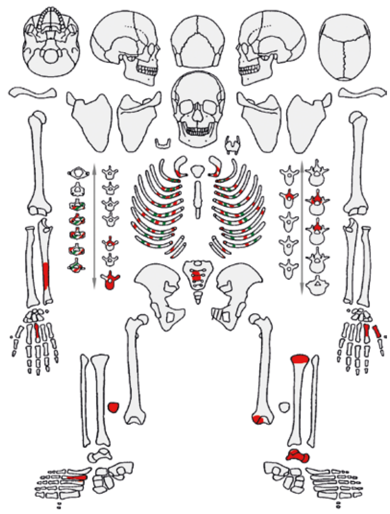
Sex: **male**, male expression of sexually dimorphic traits of the pelvis and distinctly male robustness of long bones
Age: **30–40 years**, epiphyseal fusion finished, clavicle (> stage III), slight degenerative changes
Body height: **169 cm** (Breitinger 1937)
Bone surface preservation: moderately eroded (only postcranial remains)
Green stains: none detected
Pelvic features: preauricular sulcus (shape r/l: m-m-/---, stage r/l: 1/0); smooth exostoses at the antero-superior margin of the right iliac auricular facet (stage r/l: 2/0)
Stress/bone reactions: acute and healed new bone formation at the rib-vertebral joints from pleuritis (starting from the first rib, in healing status)
Trauma: remodelled local haematoma (c. 10 × 10 mm) on the right tibia
Degenerative changes: none detected
Other: multifocal lytic lesions of spine: 2^{nd}–7^{th} cervical vertebrae and 1^{st}–6^{th} thoracic vertebrae; medial mid-shaft of the right tibia exhibits a slight thickening with striations (haematoma)
Anatomical variation: none detected
Comment: long bone measurements: right femur = 445 mm, right tibia = 377 mm

Schleinbach, Feature 109/1 (Group 2), NHM AA Inv. no. 27667
Sex: **male**, male expression of sexually dimorphic traits in the pelvis, but robustness (–1) of long bones
Age: **30–40 years**, clavicle (> stage III), slight degenerative alterations
Body height: **161 cm**
Bone surface preservation: moderately eroded (postcranial remains only)
Green stains: none detected
Pelvic features: ridge-like muscle attachment of the gluteal muscles bilaterally developed at iliac bones; preauricular sulcus of male characteristic (shape r/l: m-m-m/m-m-m, stage r/l: 1/1)
Stress/bone reactions: pleuritis (partially remodelled new bone deposition on the pleural side of some left ribs, in healing condition)
Trauma: none detected
Degenerative changes: slight changes at major joints
Other: remodelled localized haematoma on the dorsal tubercle of the right radius (c. 1 × 1 cm) and the distal lateral portion of the left tibia (c. 2 × 2 cm)
Anatomical variation: none detected
Comments: long bone measurements: left radius = 251 mm, left ulna = 273 mm, left femur = 434 mm; cranial remains of child 109/2 found south of 109/1



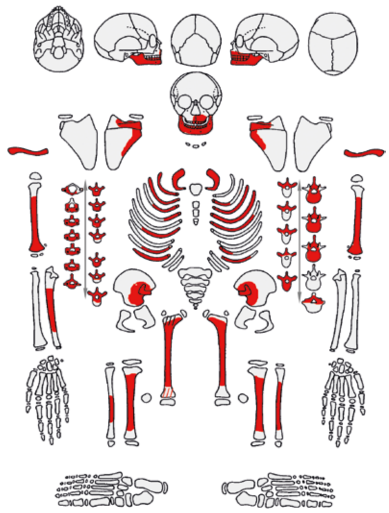


Schleinbach, Feature 109/2, NHM AA Inv. no. 27668
Sex: **undetermined**
Age: **2–3 years** (by comparison of cervical vertebra C1, petrous parts and parietal bones with Schleinbach, Feature 105)
Body height: –
Bone surface preservation: strongly eroded (cranial and three rib fragments)
Green stains: none detected
Pelvic features, stress/bone reactions, trauma, degenerative changes, other, anatomical variation: –
Comments: no measurements possible, ^{14}C and C/N isotope samples taken from rib

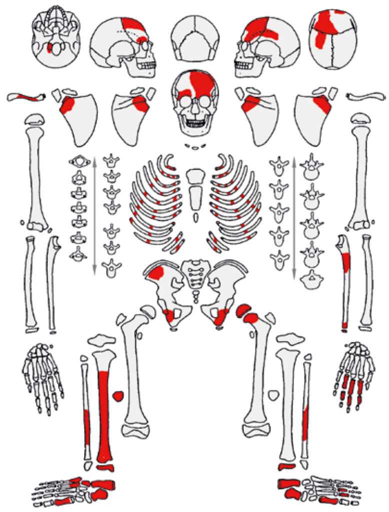


Schleinbach, Feature 110 (pit), NHM AA Inv. no. 27669
Sex: **female?**, shape of ischiopubic ramus (fragment), gracility of bone fragments
Age: **20–40 years**, epiphyseal fusion finished, no degenerative changes visible at joint facet of proximal tibia, talus, phalanges and vertebral joints
Body height: –
Bone surface preservation: moderately eroded (fragmentary postcranial remains)
Green stains: fragments of vertebral arches and ribs
Pelvic features: –
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes: –
Other: spondylolysis (vertebral arch and body not fused), visible in two isolated vertebral arches (probably from lumbar vertebrae three and four)
Anatomical variation: none detected
Comments: no long bone measurements possible

Schleinbach, Feature 111 (Group 2), NHM AA Inv. no. 27670
Sex: **undetermined**
Age: **7–9 years**, status of dentition and diaphyseal length (right femur)
Body height: **100–105 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: none detected
Stress/bone reactions: probably acute pleuritis visible as fine porotic new bone deposition bilaterally and dorsally on the internal side of some ribs
Trauma: possible (greenstick) fracture in the mediosuperior shaft of the left femur, a thickening is visible
Degenerative changes: –
Other: mandible exhibits distinct features
Anatomical variation: none detected
Comments: measurement of the right femur: diaphyseal length = 230 mm, additional right maxilla of an early adult individual (dental wear Ib = c. 20 years, no pathological conditions)

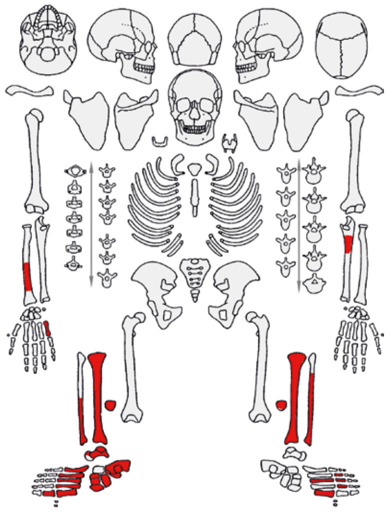


Schleinbach, Feature 112 (Group 2), NHM AA Inv. no. 27671
Sex: **female?**, only two observable sexually dimorphic traits in the frontal bone (–1) available, gracility of long bone fragments
Age: **15–21 years**, no fusion of cranial suture and iliac crest, but finished epiphyseal fusion in scapula, phalanges (hand and foot), distal tibia
Body height: –
Bone surface preservation: moderately eroded
Green stains: left scapula and ribs
Pelvic features: –
Stress/bone reactions, trauma, degenerative changes, other, anatomical variation: none detected
Comments: no long bone measurements possible; additional animal bones

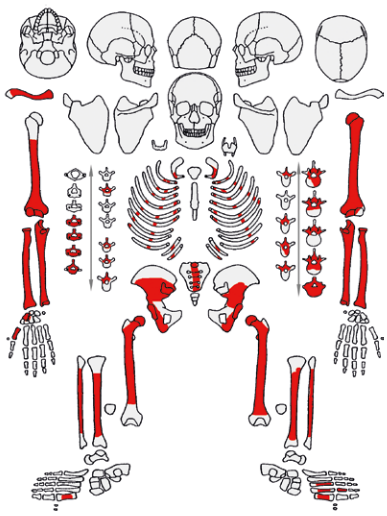


Schleinbach, Feature 113
Sex: –
Age: –
Comment: no human remains preserved. Bone of a destroyed grave found together with a handled cup at a depth of 30 cm (Rettenbacher 2004, 101)

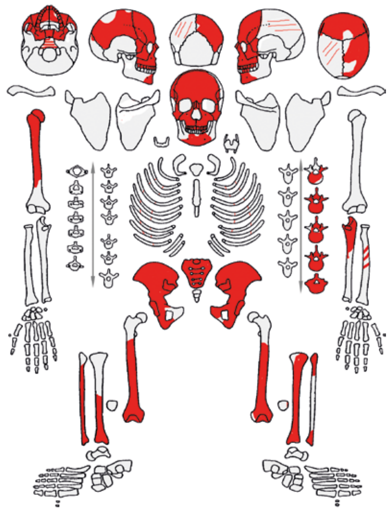
Schleinbach, Feature 114, NHM AA Inv. no. 27672
Sex: **male?**, high robustness of lower limbs and strong muscle attachments
Age: **20–40 years**, epiphyseal fusion finished, slight degenerative changes
Body height: **170 cm**
Bone surface preservation: moderately eroded (lower limb only)
Green stains: none detected
Pelvic features: –
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes: slight changes
Other: none detected
Anatomical variation: none detected
Comments: long bone measurements: right tibia = 383 mm; additional vertebral body and metacarpal of a child



Schleinbach, Feature 115, NHM AA Inv. no. 27673
Sex: **male**, male expression of sexually dimorphic traits of the pelvis and the robustness of long bones
Age: **30–40 years**, epiphyseal fusion finished, clavicle (> stage III), slight degenerative changes
Body height: –
Bone surface preservation: moderately eroded (postcranial skeletal remains only)
Green stains: none detected, but the surface of the left humerus, ulna and radius is largely covered with greyish discolouration
Pelvic features: preauricular sulcus (shape r/l: m-m-/m-m-, stage r/l: 1/1)
Stress/bone reactions: bilateral remodelled new bone apposition in the dorsal part of four ribs (pleuritic); cortical bone of both femora and tibiae exhibit thickening and strong porosity, this condition could be related to osteitis or osteomyelitis (potentially a secondary infection, spreading from the primary infection – fracture in the distal part of the left radius – via the bloodstream)
Trauma: severe fracture of the left wrist: left radius end shows thickening and osteoarthritic changes, fractured os lunatum merged with radius, healed in malposition
Degenerative changes: slight changes in major joints
Other: none detected
Anatomical variation: bilateral foramen olecrani
Comments: long bone measurements: left humerus 347 mm, right radius = 264 mm, right ulna = 288 mm

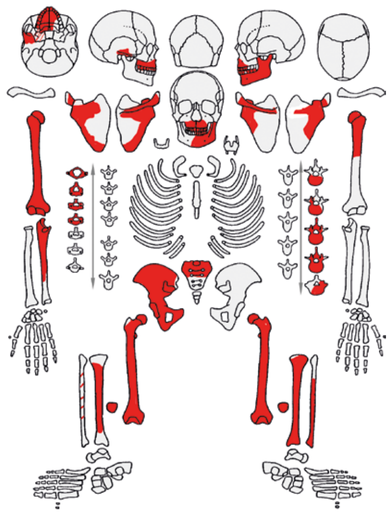


Schleinbach, Feature 1927/1, NHM AA Inv. no. 27675



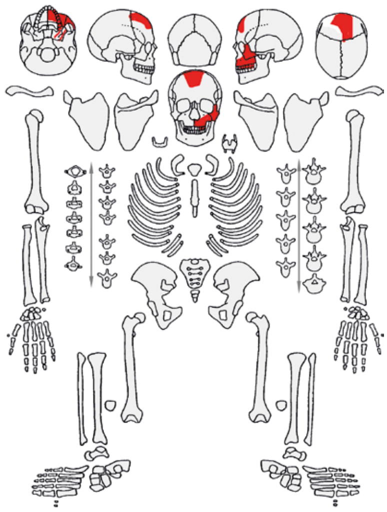
Sex: **female**, female expression of sexually dimorphic traits in the cranium, mandible and pelvis, and gracility of long bones
Age: **18–21 years**, cranial sutures open, dental wear (Ia) and epiphyseal fusion finished, symphysis (stage I/II)
Body height: –
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features: 2 depression pits on the preauricular sulcus of the right side; the left side exhibits a small but long sulcus with small tubercle (shape r/l: f-f-f/f-f-m, stage r/l: 3/2); spina ischiadica of the right side is particularly pronounced; right sacral side has a well-defined impression at the margo auricularis (stage r/l: 2/1); right pars lateralis of the sacrum has a small but well defined sacral preauricular extension (12.5 × 5 mm, stage r/l: 2/0), with a corresponding facet at the iliac auricular facet; right iliac auricular facet reveals fine porosity from an inflammation (stage r/l: 2/0)
Stress/bone reactions: none detected
Trauma: peri-/post-mortem sharp cut (c. 12 mm long) visible at the proximal condyles of the left tibia, furthermore, the right frontal and parietal bone exhibit two peri-/post-mortem oval sharp blows (c. 18 × 27 mm, c. 25 × 33 mm)
Degenerative changes: none detected
Other: none detected
Anatomical variation: –
Comments: no long bone measurements possible; ^{14}C and C/N samples taken from femur; feature contains commingled skeletal remains of four individuals

Schleinbach, Feature 1927/2, NHM AA Inv. no. 27676



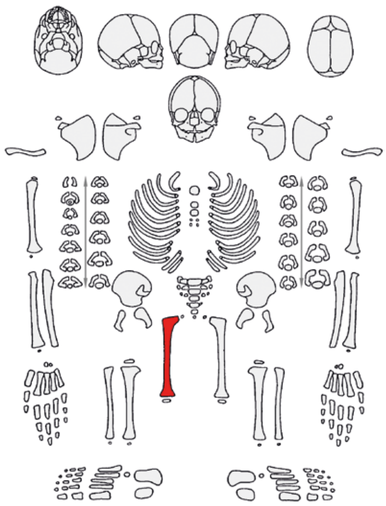
Sex: **male**, male expression of sexually dimorphic traits in the mandible and pelvis, and robustness of the long bones
Age: **40–50 years**, severe oblique dental wear (IIIc/IVa), epiphyseal fusion finished, symphysis (stage VIII/IX)
Body height: –
Bone surface preservation: slightly eroded
Green stains: none detected
Pelvic features: preauricular sulcus (shape r/l: m-m-m/---, stage r/l: 1/0); bilateral new bone exostosis formation at the anterior and superior margin of iliac auricular facets (stage r/l: 2/0) and marked muscle attachments of M. gluteus maximus/medius
Stress/bone reactions: an average to severe degree of bilateral periosteal reactions in femora and tibiae; reactive new bone formation on the distal anterior surface of the left fibula (possible soft tissue injury?)
Trauma: bilateral fracture of spina scapulae: well healed (callus) in the medial portion of the spina for the right scapula; signs of healing with porotic new bone formation in the lateral to medial portions of the spina for the left scapula
Degenerative changes: osteophyte formation in 1st to 4th lumbar vertebrae especially localized at the ventral margin of vertebral body; an incision-shaped, longitudinal, anterior-posterior directing change visible in the ventral part of the upper endplate of the 1st sacral vertebra
Other: severe oblique dental wear especially in the upper jaw; some teeth present intravital chipping
Anatomical variation: slight marginal lipping at femur head, bilateral facies poirier to femoral head/neck
Comments: long bone measurements: right humerus = 314 mm, right femur = 437 mm

Schleinbach, Feature 1927/3, NHM AA Inv. no. 27677



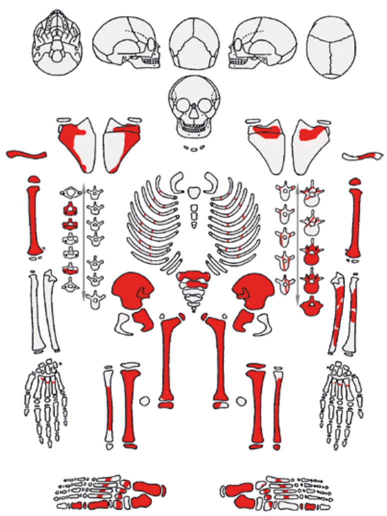
Sex: **undetermined**, no sexing characteristics visible in the available frontal bone and maxilla (fragments)
Age: **27–35 years**, no cranial suture fusion of C1, dental wear in left upper jaw (IIb)
Body height: –
Bone surface preservation: moderately eroded
Green stains: none detected
Pelvic features, stress/bone reactions, degenerative changes, other: –
Trauma: post-mortal fracture lines in the frontal bone fragments
Anatomical variation: none detected
Comments: no long bone measurements possible

Schleinbach, Feature 1927/4, NHM AA Inv. no. 27678



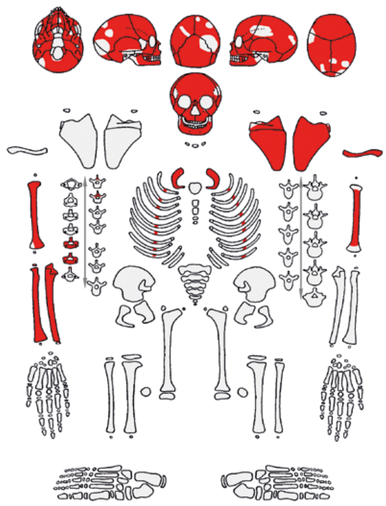
Sex: **undetermined**
Age: **4–6 months**, diaphyseal length of the right femur = 102 mm
Body height: **60–64 cm**
Bone surface preservation: moderately eroded
Green stains: none detected
Stress/bone reactions: none detected
Trauma: none detected
Pelvic features, degenerative changes, other, anatomical variation: –
Comments: measurement of the right femur: diaphyseal length = 102 mm

Schleinbach, Feature 1981, NHM AA Inv. no. 27674



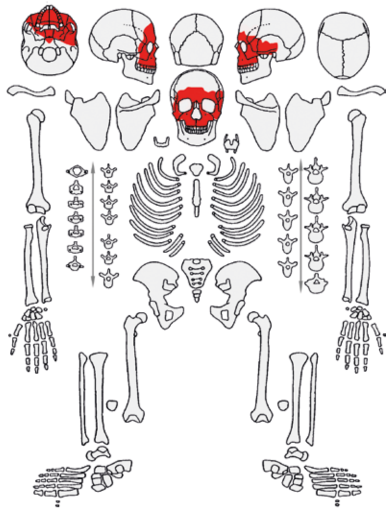
Sex: **undetermined**
Age: **7.5–9 years**, epiphyseal fusion (vertebrae), measurements of diaphyseal length
Body height: **120–124 cm**
Bone surface preservation: slightly eroded (postcranial remains only)
Green stains: none detected
Pelvic features, stress/bone reactions, trauma: –
Degenerative changes: dens axis (2nd cervical vertebra) shows a slight exostosis in the lateral aspect; large porous area at the attachment of M. teres major of both humeri (internal rotation, adduction – possibly due to changes in the workload)
Other, anatomical variation: –
Comments: measurement of diaphyseal length: left humerus = 208 mm, left femur = 302 mm, left tibia = 241 mm; skeletal remains brought to the NHM by Ernst Lauermann in 1987

Schleinbach 1981/Grube 3 (pit), NHM AA Inv. no. 27617



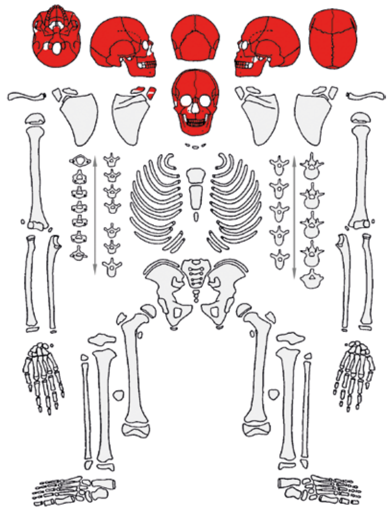
Sex: **male** (proteomic sex identification)
Age: **5–6 years**, status of dentition (full primary dentition), measurements of diaphyseal length
Body height: **100–105 cm**
Bone surface preservation: slightly eroded (skull and upper extremities)
Green stains: none detected
Pelvic features: –
Stress/bone reactions: intensified pitting and new-bone formation at maxilla, zygomatic bone, squamous part of temporal bone and auditory meatus; plus porotic thickening of external auditory meatus, possibly indicating an 'otitis media'(?) and possibly related changes (osteomyelitis?) of maxillary bones
Trauma: four peri-mortem cranial blunt force traumas: 1. antero-posteriorly-oriented, oval impression fracture with partial penetration of inner and outer table located on the left side of the frontal (one third)/parietal (two thirds) bone in the area of the coronal suture (60 × 35 mm); 2. two smaller, round to oval comminuted lesions with linear and radial fracture lines in the right parietal bone, one in the area of the parietal tubercle and the other next to the sagittal suture (25 × 25 mm); 3. large, circular depression fracture with complete penetration of the skull bone in the right parietal/occipital bone in the area of lambdoid suture (Ø 4.5 cm)
Degenerative changes: none detected
Other: signs of rodent gnawing at the margins of the depression fracture in the right parietal bone, right orbital rim, crista frontalis on the inside (!) of the frontal bone, and foramen magnum
Anatomical variation: persisting foramen Huschke (located in the anteroinferior aspect of the external auditory canal)
Comment: from Stadtmuseum Korneuburg, Inv. Nr. 01068, now NHM Vienna

Schleinbach 1983/Grube 61 (pit), NHM AA Inv. no. 27618



Sex: **undetermined**, only six cranial sex characteristics present, indifferent expression
Age: **20–40 years**, full secondary dentition, no apical lesion, no intravital tooth loss, pars basilaris fused
TCA age: **26.8/23.9 ± 5 years**
Body height: –
Bone surface preservation: moderately eroded (frontal/temporal bone and viscerocranium only)
Green stains: none detected
Pelvic features: –
Stress/bone reactions: orbital roofs exhibit cribra orbitalia with larger porosities and tendency to cluster; stomatitis at the palatine
Trauma: neurocranium: frontal bone reveals a peri-/post-mortem horizontal linear fracture with chipping of the inner table, with continuation into the temporal bone; viscerocranium: nasal bone and superior orbital margin show a peri-/post-mortem horizontal fracture line
Degenerative changes: –
Other: peri/post-mortem total chipping of the tooth crowns, only roots of the teeth remain in the alveolar bone
Anatomical variation: –
Comment: from Stadtmuseum Korneuburg, now NHM Vienna

Schleinbach 1983/Grube 71 (pit), NHM AA Inv. no. 27616



Sex: **undetermined**
Age: **16–18 years**, pars basilaris (open), status of dentition (third molars not erupted), dental wear (IIa/b)
TCA age: **13.2/15.7 ± 5 years**
Body height: –
Bone surface preservation: slightly eroded, skull only
Green stains: none detected
Pelvic features: –
Stress/bone reactions: none detected
Trauma: none detected
Degenerative changes: –
Other: a local lytic lesion (Ø c. 0.7 mm) on the external surface of the pars basilaris occipitalis between the M. longus capitis (deep cervical flexor muscles); LEH (enamel hypoplasia): severity stage 2; 2–3 fine hypoplastic lines in the maxillary canines, corresponding to a formation age of 2.5 and 3.4 years; further, possible overbite in frontal teeth region (oblique dental wear especially of the 1st incisors)
Anatomical variation: metopic suture
Comments: from Stadtmuseum Korneuburg, now NHM Vienna

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Sr Isotope Analysis of Human Remains from Settlement Pits at Stillfried/March. Reappraising Diagenetic Changes

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Karin Wiltschke-Schrotta
Maria Teschler-Nicola
Johanna Irrgeher
Thomas Prohaska

Abstract

Objectives: Since the late 1970s, when the first human skeletal remains from a pit (V1141) located within the Late Bronze Age hillfort at Stillfried an der March, Austria, were discovered, their deviation from the predominant burial rite of cremation became the subject-matter of a variety of archaeological and bioanthropological studies. Through continuous archaeological excavations, further settlement pits with unusual human inhumation burials or depositions of isolated skeletal remains became apparent and posed the question of their possible non-local origin. The human samples in this study come from the Pits V841 and V1133, furthermore we re-investigate two individuals from V1141. The aim is to get a better understanding of Stillfried's population structure and to enrich the debate about the mortuary practices of the Urnfield culture.

Material and Methods: Here we present and discuss the radiogenic Sr isotope ratios determined in the enamel of eleven individuals from three settlement pits: eight individuals from Pit V841 and one individual, represented by a skull without mandible (calvarium) of a 12–13-year-old child from Pit V1133; two individuals were taken from Pit V1141 and re-investigated for comparative reasons. We compared all data to signals of the local environment derived from modern environmental samples and to the autochthonous signal of the Late Bronze Age derived from archaeological faunal remains (incl. mussels) and archaeological plants. Further, we investigated and discussed the potential of a mathematical approach to access biogenic Sr isotopic information from diagenetically altered dentine.

Results: It has been shown that both supposedly autochthonous and allochthonous (non-local) individuals are buried within the settlement pits of Stillfried, which shows that burial practices do not relate to the individual's origins. In particular, the $n(^{87}\mathrm{Sr})/n(^{86}\mathrm{Sr})$ isotopic values of six individuals match the supposedly autochthonous Sr signature, while the other five individuals represent allochthonous individuals. Three of the latter showed $n(^{87}\mathrm{Sr})/n(^{86}\mathrm{Sr})$ values that were higher and two that were lower compared to the autochthonous Sr range, thereby indicating at least two different homelands. Despite the small sample size which constrains the validity of the data, the diversity of the inhabitants' provenance reflects a high mobility. This may support the interpretation of Stillfried as a 'central site' – a finding which is also important in the wider context of the European Late Bronze Age.

Keywords

Deviant burials, hillfort site, human skeletal remains, Late Bronze Age, Urnfield Culture, Stillfried/Lower Austria, Strontium isotopes, diagenetic alterations.

Zusammenfassung – *Sr-Isotopenanalyse menschlicher Skelettreste aus Siedlungsgruben in Stillfried/March. Überprüfung der diagenetischen Veränderungen*

Ziel: Seit den späten 1970er Jahren, als die ersten menschlichen Skelettreste aus einer Siedlungsgrube (V1141) der spätbronzezeitlichen Wallanlage von Stillfried an der March geborgen wurden, stand deren Abweichung von der üblichen Leichenverbrennung im Brennpunkt archäologischer und bioanthropologischer Forschung. Durch fortdauernde archäologische Ausgrabungen wurden weitere Siedlungsgruben mit ungewöhnlichen Bestattungen menschlicher Körper oder Niederlegungen einzelner Skelettreste freigelegt, die die Frage nach ihrer möglichen nicht-lokalen Herkunft aufwarfen. Die menschlichen Proben dieser Studie kommen aus den Gruben V841 und V1133, darüber hinaus untersuchten wir erneut zwei Individuen

*Equal contribution

aus V1141. Ziel ist es, ein besseres Verständnis von Stillfrieds Bevölkerungsstruktur zu erhalten und die Debatte über die Bestattungspraktiken der Urnenfelderkultur zu bereichern.

Material und Methode: Hier präsentieren und diskutieren wir die im Zahnschmelz bestimmten Sr-Isotopenverhältnisse von elf Individuen aus drei Siedlungsgruben: acht Individuen aus Grube V841 und ein 12–13-jähriges Kind aus Grube V1133, von dem nur der Schädel ohne Unterkiefer (Calvarium) erhalten ist. Zwei weitere, aus Siedlungsgrube V1141 geborgene Individuen mit bereits bekannten Sr-Isotopensignaturen wurden für Vergleichszwecke ebenfalls einbezogen. Wir verglichen alle Daten mit Sr-Werten, die wir aus der lokalen Umgebung und aus urnenfelderzeitlichen Faunen- und Pflanzenresten (einschließlich Muscheln) gewonnen haben. Darüber hinaus untersuchen und diskutieren wir das Potential eines mathematischen Ansatzes für die Ermittlung biogener Sr-Isotopen-Informationen aus diagenetisch verändertem Dentin.

Ergebnisse: Die menschlichen Überreste in den Siedlungsgruben von Stillfried stammen sowohl von ansässigen Personen als auch von Individuen anderer Herkunft, was zeigt, dass die Bestattungspraktiken nicht mit der Herkunft des Individuums zusammenhängen. Konkret entsprechen die Sr-Isotopenwerte von sechs Individuen der autochthonen Sr-Signatur, während die Werte der restlichen fünf Individuen auf eine Herkunft außerhalb von Stillfried verweisen, also allochthone Individuen darstellen. Drei der allochthonen Individuen zeigen höhere Sr-Isotopensignaturen im Vergleich zur autochthonen Sr-Signatur, die restlichen zwei allochthonen Individuen niedrigere Sr-Isotopensignaturen. Dies weist auf mindestens zwei unterschiedliche Herkunftsgebiete hin, was für die Interpretation der Siedlungsbestattungen in der Wallanlage von Stillfried von Bedeutung ist, da die daraus abzuleitende hohe Mobilität auch den Charakter der Siedlung als „Zentralort" unterstreicht. Auch im Kontext der überregionalen populationsdynamischen Entwicklungsprozesse in der europäischen Spätbronzezeit ist dieses Resultat von großer Relevanz. Die Ergebnisse dieser Studie basieren auf einer ausgewählten, kleinen Stichprobe. Ihre Aussagekraft in Bezug auf Fragen zur Bevölkerungsstruktur des spätbronzezeitlichen Stillfried ist dementsprechend begrenzt.

Schlüsselbegriffe
Sonderbestattungen, Wallanlage, menschliche Skelettreste, späte Bronzezeit, Urnenfelderkultur, Stillfried/Niederösterreich, Strontiumisotopie, diagenetische Veränderungen.

1. Introduction

1.1. Archaeological Background

The Late Bronze Age hillfort of Stillfried an der March, known since the 19th century, was systematically explored between 1969 and 1989 as part of extensive field excavations under the direction of Fritz Felgenhauer.[1] A multitude of structures, e.g., a fortification system and about 100 voluminous settlement pits, were uncovered and point to a 'central site', which developed on an important trade route. Striking features of the Stillfried site are the deviant human burials with unburned human skeletons and animal depositions in about twenty of these abandoned storage pits.

These findings have been the subject of several interdisciplinary research projects focusing on the historical development of this particular 'living space' and its inhabitants. Experts revealed, among other things, individual data (age at death, sex, pathological alterations, cause of death); they dealt with questions concerning residence, provenance and familial relationship and reflected on possible reasons for the deviant treatment of the deceased in conjunction with social status, group relation or non-local origin. To date, many, but far from all questions have been deciphered.[2]

According to Irmtraud Hellerschmid,[3] the scenarios reflected in the archaeological records, particularly in the backfills of the storage pits, indicate not only production-related activities, but ritual practices as well. The explanation of these ritual practices varies; some associate these findings with a different provenance, for example, some with homicide or human sacrifice, and others with a possible social diversity of the residents.

Although the provenance of the individuals receiving a deviant burial is a core element in the debate on such an entity, up to now we only possess knowledge about the origins of seven individuals from Pit V1141 obtained through the Sr isotope analysis of tooth enamel.[4] Hence, the present study aims to continue and expand the isotope investigation by including further individuals from the site buried in a deviant manner to acquire a deeper insight into the population formation of the Late Bronze Age society at Stillfried. For the given study, we included individuals from three settlement pits:[5] Pits V841 and V1141 with multiple inhumations and Pit V1133, where one isolated human skull without its mandible (calvarium) was recovered. The skeleton of an elderly woman from pit house V601 was not available for examination. The settlement pits from which the investigated individuals originated were located in the highest area of the hilltop site ('Hügelfeld' and 'Kirchhügel') close to the rampart (Fig. 1). Based on the averages of ^{14}C data[6] and

1 Felgenhauer 1996.

2 Breitinger 1980. – Eibner 1980. – Eibner 1988. – Szilvássy, Kritscher, Hauser 1988. – Hellerschmid 2015. – Teschler-Nicola, Irrgeher, Prohaska 2016. – Parson et al. 2018. – Hellerschmid, Griebl in prep. – Wiltschke-Schrotta, Marschler in prep.

3 Hellerschmid 2015, 206, 219, 222, 227–228.

4 Teschler-Nicola, Irrgeher, Prohaska 2016.

5 Griebl, Hellerschmid 2013.

6 ^{14}C data: 1/**V1141**: Man SK 1 (sign. 09023): VERA-2918: 2745 ± 35 [980–810 BC (95.4 %)]; 2/**V1141**: Child SK 7 (sign. 09029): VERA-2919: 3000 ± 35 [1380–1120 BC (95.4 %)]; 3/**V1141**: Human bone no. 9208 (sign. 09030, layer above the burial): Poz-78217: 2770 ± 30 BP [997–839 BC (95.4 %)]; 1/**V841**: Man SK 1 (sign. 09041): Poz-59980: 2735 ± 30 BP [970–814 BC (95.4 %)]; 2/**V841**: Child SK 12 (sign. 09053): Poz-59981: 2770 ± 30 [998–838 BC (95.4 %)]. – Hellerschmid 2006, 293. – Griebl, Biederer in prep., Chapter 1.4.2 and Figs. 30–32.

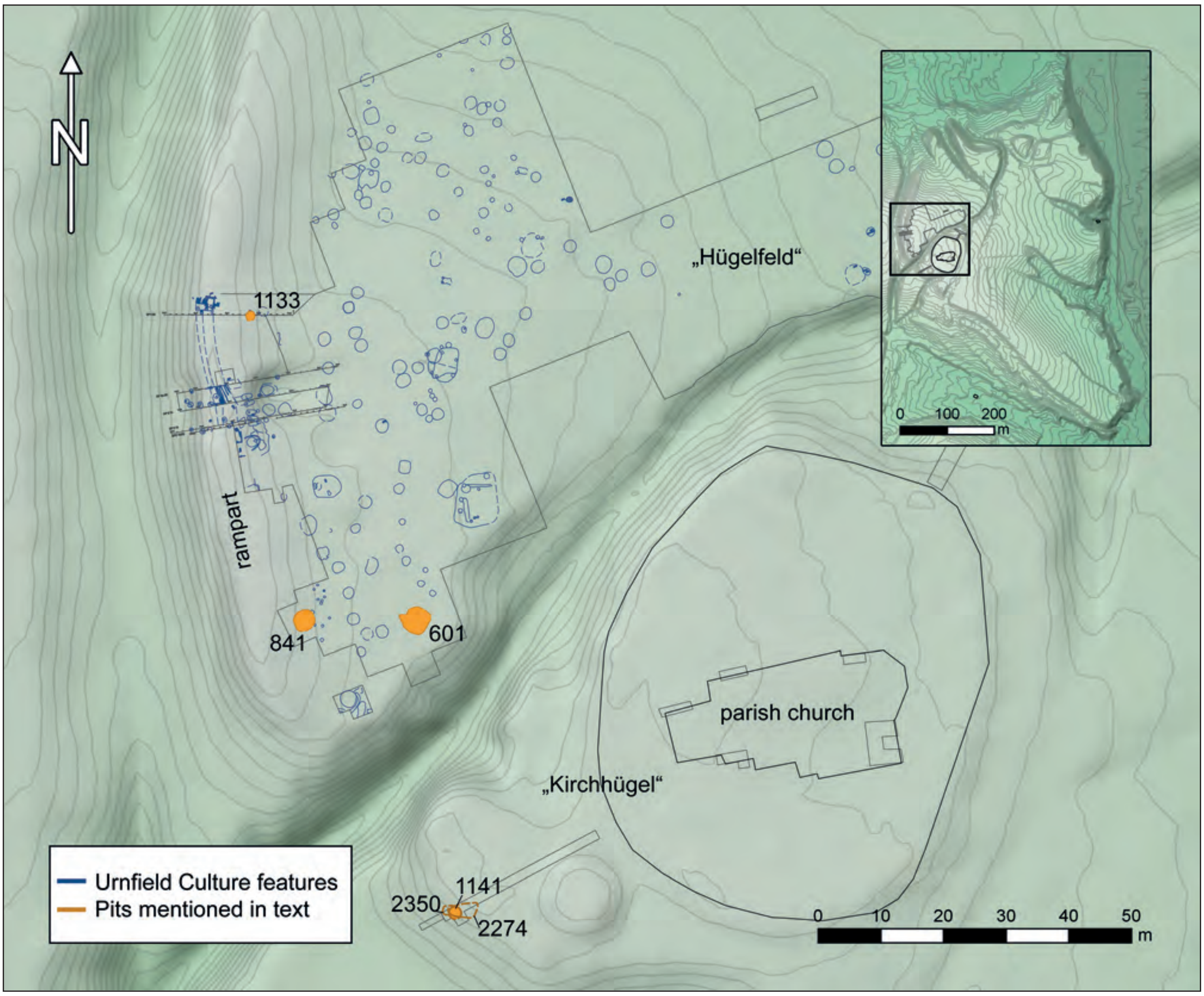

Fig. 1. Map of the hillfort site at Stillfried/March with the Late Urnfield Culture findings, most of them are conical pits. The findings with human remains which are mentioned in the text (V601, V841, V1133, V1141) are coloured (processed by ARDIG, I. Hellerschmid, I. Petschko and S. Tikatsch).

the archaeological classification,[7] the Pits V841 and V1141 were dated to the same period, around 900 BC. This is the transition from Reinecke Ha B2[8] to Ha B3[9]. It correlates well with the transition of the Stillfried-settlement phase II[10] (with the first rampart construction V1267) to the Stillfried-settlement phase III/1[11] (this is the beginning of the second and final rampart construction V1154). While the multiple inhumations are chronologically consistent with the cremation burials at the cemetery in the valley nearby,[12] the two ^{14}C dates[13] of the child (V1133) are slightly older, corresponding to Reinecke Ha B2 and Stillfried-settlement phase II. The third ^{14}C date determined for an animal bone[14] from V1133 and the archaeological dating of V1133 fit with the results of the ^{14}C dating of Pits V841 and V1141. This

7 Hellerschmid 2006. – Griebl, Biederer in prep.
8 960–900 BC after Sperber 2017, 171 and Fig. 72C.
9 Sperber 2017 separates this phase into Ha B3a (900–850/840 BC) and Ha B3b (850/840–800/780 BC): Sperber 2017, 171 and Fig. 72C.
10 Ha B2 (after Sperber 2017, 960–900 BC), Hellerschmid 2006, 22–23. – Hellerschmid, Griebl in prep.
11 Ha B3a (after Sperber 2017, 900–850/840 BC), Hellerschmid 2006, 22–23. – Hellerschmid, Griebl in prep.

12 Strohschneider 1976. – Kaus 1984.
13 Poz-59987: 2810 ± 30 BP [1050–860 BC (95.4 %)]; VERA-2917: 2810 ± 35 BP [1050–830 BC (95.4 %)].
14 Poz-59943: 2770 ± 30 BP [998–838 BC (95.4 %)]. – Griebl, Biederer in prep.

means that the child died years before its calvarium became embedded in the pit.

Based on the fact that cremation of the deceased was the norm in the Late Bronze Age, we suspect that these individuals buried in a deviant manner might represent migrants, i.e., non-locals. Therefore, the present study aims to identify the provenance of further individuals from Pits V841 and V1133 (and to re-investigate two samples from V1141 for comparative reasons) to verify the hypothesis that burial practices relate to the individual's origins. The results are of paramount importance for decoding the internal population structure of this 'central site', which was possibly associated with its economic rise. We also intend to discuss and compare the findings with other studies of Late Bronze Age societies that seem to indicate social inequality and substantial mobility documented by a significant number of incorporated immigrants.[15]

1.2. Deviant Burials in Settlements – General Remarks, Archaeological and Bioanthropological State of the Art

As mentioned above, a particular feature of the Stillfried settlement is the finding of unburned human remains and animal depositions in abandoned storage pits – a phenomenon that originates in the Knovíz culture of north and northwest Bohemia (Bz D–Ha B) and its adjacent regions (Germany, Moravia).[16] Stillfried's Late Bronze Age inhabitants obviously adopted this practice from these areas (especially Moravia and Bohemia).[17] Corresponding hillfort sites with deviant burials in settlement pits are, for example, known from Brno-Obřany[18] in Moravia and Gór-Kapolnadomb[19] in western Hungary.

Characteristic for this practice are complete skeletons, displaced or partial human skeletons and single elements in conical storage pits. The bodily remains are placed on the base of these abandoned storage pits and rapidly covered by soil. The positions of the bodies are diverse, loose bent legs often prevailing.[20] Some corpses may have been thrown into the cavities (e.g., such examples are also known from Stillfried Pit V1141) or seem to be bound by using cloths or ropes.[21] Multiple burials outweigh individual burials. It has been shown that the number of incomplete skeletal remains increases with the number of individuals in a pit. Thus, it has been suggested that in such cases the decomposition process had happened elsewhere. This relates to children and adults of both sexes, whereby children and adolescents (3–18 years) predominate.[22] Evidence of deadly violence exists, but for most individuals the cause of death is unknown. Aspects under discussion are the manner of death (diseases etc.), social status, origins or crisis situations and mass mortality.[23] The human remains investigated here and in the previous study[24] were recovered from the two pits with multiple burials – containing a total number of seven individuals in V1141 and of 23 individuals in V841 – and a pit with a single skull V1133 (see detailed description below). Out of these 31 individuals, seven were previously studied by Maria Teschler-Nicola et al.[25] and eleven individuals were selected for this study, which included overall eleven subadults, two adult males and three adult females (Tab. 1). Jewellery or traditional clothing accessories in conjunction with human remains are rare, whereas fragments of craft items, e.g., tools for textile and metalworking, grinding stones and ceramic vessels are typically found associated with them.

1.2.1. Stillfried Settlement Pit V1141

As mentioned above, Pit V1141[26] is located on the 'Kirchhügel', which is the name given to a conical-shaped elevation, where archaeologists assume the former residence of the Late Bronze Age leadership to have been (Fig. 1).[27] The corpses of seven individuals were placed there, presumably within a short timeframe: a male, two females and four children (SK 1–7)[28] (Figs. 2–3). Their sequential deposition was thoroughly documented: to the south, on an ash layer at the very bottom (sign. 9020), the corpses of an approx. 45-year-old female SK 5 (sign. 9027) and two children were deposited. Both children, the 7–8-year-old SK 4 (sign. 9026) and the 5–6-year-old SK 6 (sign. 9028) were identified as males based on their morphometric features. They were

15 Cavazzuti et al. 2019.

16 E.g. Müller-Scheessel 2013. – Especially within the Late Knovíz Culture (Ha A, Ha A–B1): Wiesner 2009, 150–161 and list 24; 902–907. – Stapel 1999, 393–409 (catalogue): 58 out of a total number of 228 documented Late Bronze Age settlement burials from 112 archaeological sites (= skeletal remains of 332 individuals) were associated with the Knovíz Culture, including two findings in central Germany: Stapel 1999, 393, sites nos. 120 and 121 (catalogue). – Central German Lusatian Culture: Balfanz, Jarecki 2004.

17 Stapel 1999, 218–219. – Griebl in prep.

18 Adámek 1961, 213–214.

19 Ilon 1992. – Ilon 2001, 245–246. – Zoffmann 2001.

20 Stapel 1999, 410, footnote 1809. – Wiesner 2009, 150–151.

21 Stapel 1999, 207.

22 Stapel 1999, 215 and Tab. 14. – Wiesner 2009, 902–907 and list 24. – Griebl, Biederer in prep.

23 Aspöck 2013, 31 with further literature.

24 Teschler-Nicola, Irrgeher, Prohaska 2016.

25 Teschler-Nicola, Irrgeher, Prohaska 2016.

26 Diameter at the bottom 2 m; reconstr. depth 1.8–2 m, reconstr. volume 3.6 m^3.

27 In historical times the parish church was built exactly on this highest point of the landscape, see Figure 1.

28 Eibner 1980. – Hellerschmid 2015.

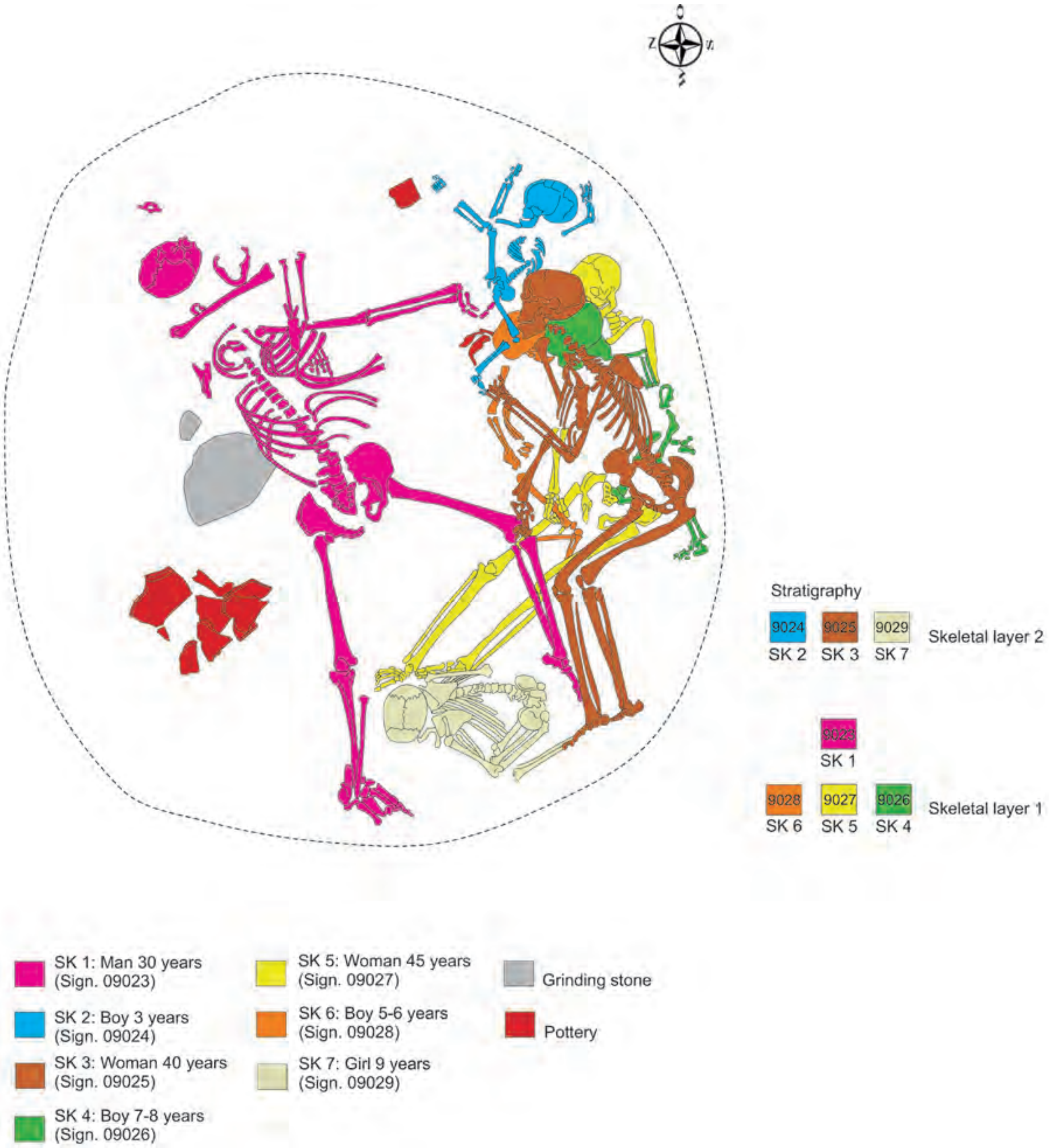

Fig. 2. Stillfried/March, Pit V1141. – Schematic representation of the seven skeletons deposited close to the bottom of the pit (after Szilvássy, Kritscher, Hauser 1988, Pl. 15, Fig. 47, processed by I. Hellerschmid and M. Griebl).

'set' on the female's lap (Fig. 4). Next, the adult, an approx. 30-year-old male SK 1 (sign. 9023) was placed in the centre of the pit (Figs. 3, 5). The setting was subsequently covered with loess (sign. 9021). The approx. 40-year-old female SK 3 (sign. 9025) was deposited in a right-sided flexed position in the next layer and the child SK 2, a 3-year-old boy (sign. 9024), was found close to her head. The position of the child's remains imply that its corpse was thrown down into the cavity. The 9-year-old subadult SK 7 (sign. 9029), a girl, lay crouched between the feet of SK 1; her head was placed on an unusually large and barely burned loom weight. The pit was filled with loess (layer 9030) and ash (layer 9031) (Fig. 6). Emil Breitinger[29] examined these skeletal remains intensively; his report focused on age at death estimation and sex diagnosis, identification and documentation of pathological alterations, genetically determined traits ('genetic markers') as well as peristatic-functional features. It is an excellent example of bioanthropological research of the

29 Breitinger 1980.

Fig. 3. Stillfried/March, Pit V1141. – Photo taken during the excavation (Documentation of the excavation of Stillfried, Niederösterreichische Landessammlung für Ur- und Frühgeschichte, photo no. ST 28389).

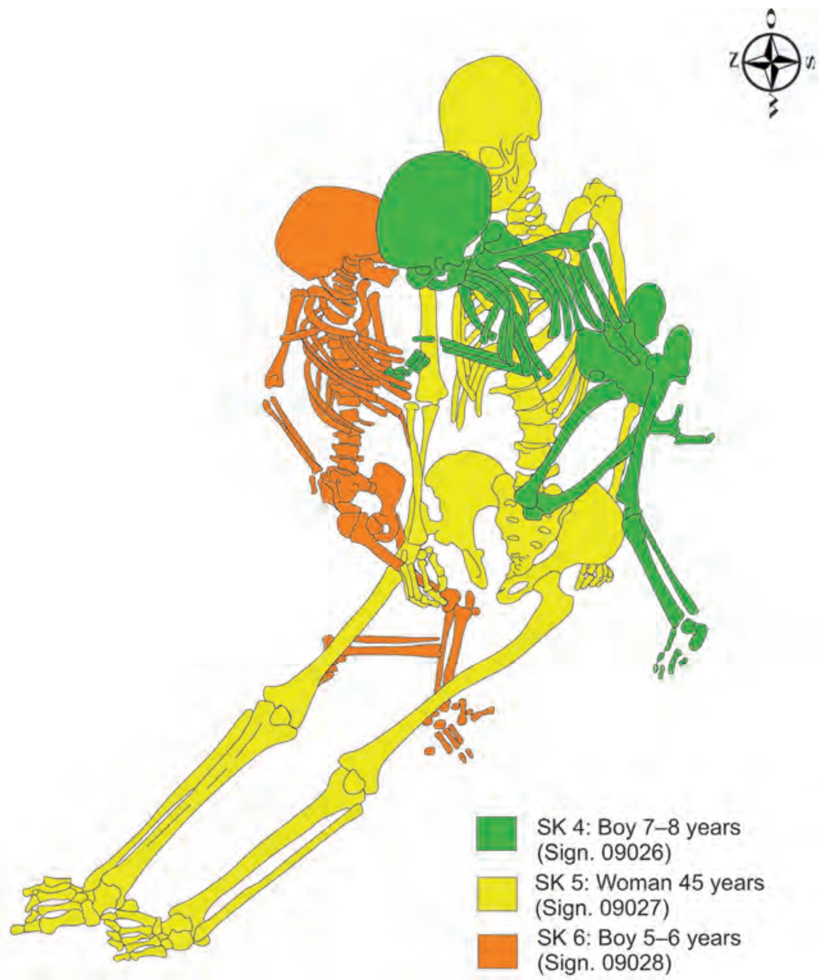

Fig. 4. Stillfried/March, Pit V1141. – Schematic representation of the three skeletons from the lower position in the pit, SK 4, 5 and 6 (after Szilvássy, Kritscher, Hauser 1988, Pl. 16, Fig. 48, processed by I. Hellerschmid and M. Griebl).

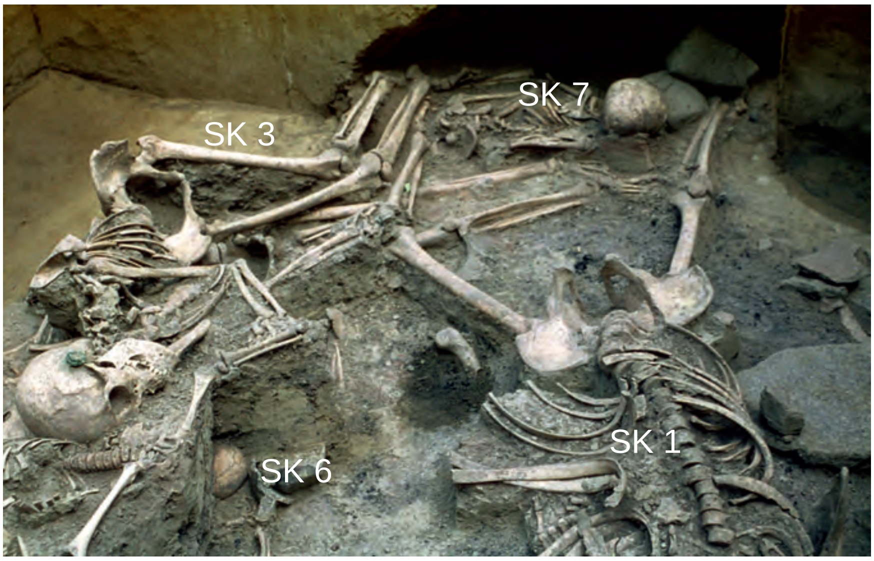

Fig. 5. Stillfried/March, Pit V1141. – Detail of the southwestern part of the deposition: in the middle one can see the left leg of the man SK 1, which is touching the right lower leg of the woman SK 3 and overlays the legs of woman SK 5. The right hand of SK 3 lies above the man's knee but without any physical contact. Between the man's feet one can see SK 7. Under SK 3 the skull of child SK 6 comes to light under the loess layer sign. 9021, which is very thick in this area (Documentation of the excavation of Stillfried, Niederösterreichische Landessammlung für Ur- und Frühgeschichte, photo no. ST001473).

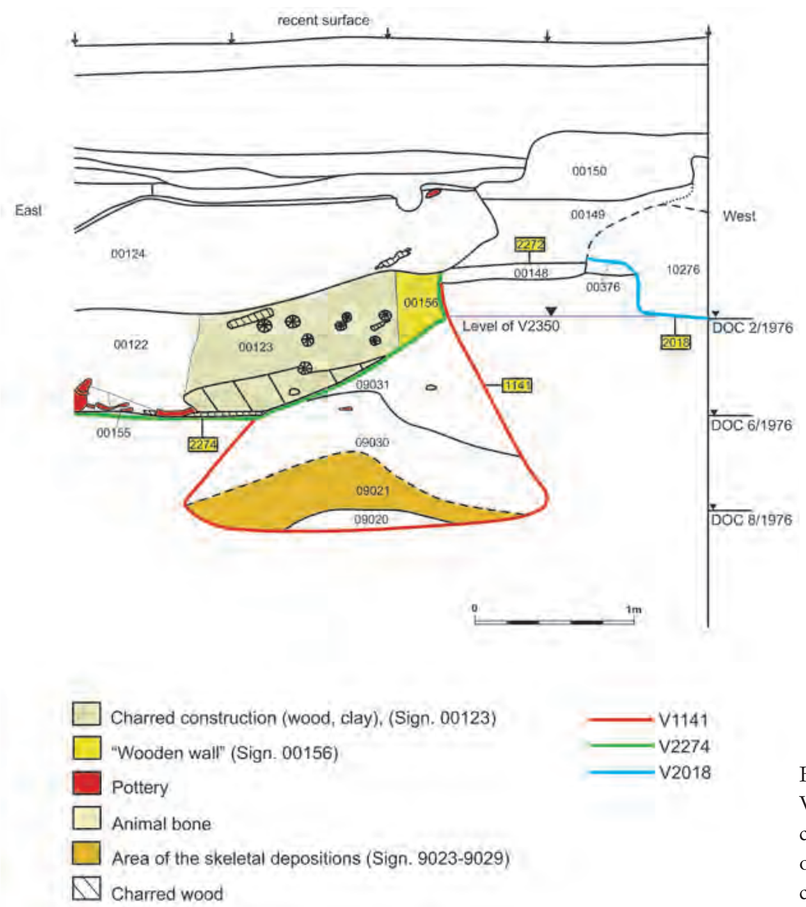

Fig. 6. Stillfried/March, Pit V1141. – South profile of V1141 and the (wooden) construction V2274, which cuts into V1141 in the upper area. The level of the flat object V2350 with a human skull is also shown (processed by I. Hellerschmid, S. Tikatsch and M. Griebl).

1980s. Nevertheless, it is possible that he has overlooked some symptoms of malnutrition (e.g., inflammatory changes at the alveolar rims caused by vitamin C deficiency) that are evident in the associated tables. Thus, we assume that a systematic palaeopathological re-investigation of the seven individuals recovered from Pit V1141 could presumably enhance our understanding and interpretation of non-normative burials and their complex, interrelated causes at Stillfried.

The remains of the seven individuals were investigated for the first time for $n(^{87}Sr)/n(^{86}Sr)$ isotopic composition in enamel and dentine by Teschler-Nicola et al. along with some environmental samples from Stillfried/March.[30] The isotope ratios varied considerably. The ratios determined for SK 5 (the 45-year-old female), SK 1 (the 30-year-old male) and the two children SK 6 (the 5–6-year-old boy) and SK 7 (the 9-year-old female) are above the range that characterizes the local Stillfried environment. Hence, we have a well-founded argument that these four individuals most likely spent their early childhood outside Stillfried (Tab. 1).[31] In contrast, the $n(^{87}Sr)/n(^{86}Sr)$ ratios of the enamel of the three individuals SK 2 (the 3-year-old boy), SK 3 (the approx. 40-year-old female) and SK 4 (the 7–8-year-old boy) match the local signal from Stillfried/March (Tab. 1), according to which these individuals presumably grew up in or in the immediate vicinity of the central settlement of Stillfried.

Further research questions concerned the reconstruction of a genealogical pedigree of the seven individuals buried in Pit V1141. Morphological similarity/dissimilarity resulted in two models.[32] In 2018, mitochondrial (mt)DNA was applied to resolve the matrilineal relationship – with a surprising result: a maternal relationship was detected only in one case (SK 5, the approx. 45-year-old woman and SK 6, the 5–6-year-old boy).[33]

1.2.2. Stillfried Settlement Pit V1133

Out of the pear-shaped Pit V1133 located at the inner rim of the rampart a child's calvarium was recovered (Fig. 7). It exhibits several perimortally caused ovoid/circular buttonhole fractures, some associated with burst fractures, resulting from a violent attack.[34] Moreover, the child's remains show some serious inflammations.[35] Among other remarkable findings from this pit, a pure barley glume ash[36] and the carcass of a maltreated young female dog are worth mentioning.[37]

Fig. 7. Stillfried/March, Pit V1133. – The stroke-pierced calvarium of a 12 to 13-year-old – obviously female – individual (Documentation of the excavation of Stillfried, Niederösterreichische Landessammlung für Ur- und Frühgeschichte, photo no. 120308_29727).

1.2.3. Stillfried Settlement Pit V841

In the deep Pit V841[38] the remains of 23 individuals were deposited within at least four subsequent deposition processes (Figs. 8–9).[39] Each of these four corpse layers was covered with soil.

The lowest skeletal layer of V841 (skeletal layer 1) consisted of the complete skeletons of a woman

30 Teschler-Nicola, Irrgeher, Prohaska 2016, 165 and Fig. 5.

31 All four values are higher than the signal of the environment at Stillfried, with the values for the two children (SK 6, SK 7) being higher than the values for the adults (SK 1, SK 5). – Teschler-Nicola, Irrgeher, Prohaska 2016, 165 and Fig. 5.

32 With mismatched results, Breitinger 1980, 88 and Fig. 4. – Szilvássy, Kritscher, Hauser 1988, 70.

33 Parson et al. 2018, Fig. 2.

34 Seven artificial holes in the right half of the skull. – Breitinger 1976, 95–98. – Eibner 1976. – Griebl, Hellerschmid 2013, 331–332. – Wiltschke-Schrotta, Marschler in prep. (catalogue).

35 Evidence of an inflammatory haemorrhagic process located in the skull's endocranial layer, which indicates a disease, e.g. meningitis or meningoencephalitis, additional evidence of enamel hypoplasia, which is to be interpreted as the result of malnutrition or a serious infectious disease in early childhood: Wiltschke-Schrotta, Marschler, in prep. (catalogue).

36 Sauter, Wurst, Hoke 1976.

37 Eibner 1976.

38 Depth 3 m, max. diameter at the bottom 3.50 m, volume 19 m^3.

39 Wiltschke-Schrotta 2006. – Griebl, Hellerschmid 2013, 334–340. – Griebl in prep. – Hellerschmid, Griebl in prep.

Fig. 8. Stillfried/March, Pit V841. – Photo taken during the excavation. Clearly recognizable and remarkable is the great depth of the pit. The reconstructed pit depth is 3.70 m, the reconstructed diameter at the bottom 3.80 m (Documentation of the excavation of Stillfried, Niederösterreichische Landessammlung für Ur- und Frühgeschichte, photo no. 3597).

(SK 13/sign. 9054) and two children (SK 11/sign. 9052, 12/sign. 9053). The corpses were placed along the pit wall, facing each other. Skeletal layer 2 contained the remains of five individuals, including three children (SK 9/sign. 9050, 10/sign. 9051, 15/sign. 9056), a teenager (SK 8/sign. 9049) and a female (SK 14/sign. 9055), whose body positions vary widely. The skulls of all individuals pointed south or southeast. The body positions ranged from almost stretched (SK 8, 10) to flexed (SK 9) and even extremely contracted legs, which suggests fetters (SK 14). From child SK 15 only the upper part of the body was preserved, and child SK 10 (characterized by a striking small skull) had been covered with ceramic shards. Skeleton layer 3 included two almost complete human bodies (SK 4/sign. 9044, 7/sign. 9048) and the remains of four individuals (SK 3/sign. 9043, 5/1/sign. 9045, 5/2/sign. 9046 and 6/sign. 9047) in various degrees of decomposition and completeness. Most of the skeletons from this layer show bite marks, which suggests a different place of decomposition where carnivores could approach the corpses.[40] The twisted body posture and position of the extremities of SK 7 (female, 15–19 years) most likely indicate fetters on the arms and legs. Then a hot layer of ash (layer 363) followed, in which two individuals were possibly plunged: a mature male who still had his accessory bag on his belt (SK 1/sign. 9041) and a child (SK 2/sign. 9042). Their bones were affected by the heat. Finally, the badly burned but already calcified pieces of bones from at least seven individuals (SK 16–22) were found in this ash layer.

Filling took place quickly because there are no traces of sedimentation. Therefore, the pit must have been covered in between; probably with a wooden lid (Fig. 10). A cavity remained after the last filling until the covering collapsed. This leads to the conclusion that all manipulations of the human bodies took place outside the deep pit. Even animals were only able to reach the corpses outside the pit (to a very limited extent).

It has been ascertained that the individuals from Pit V841 (and V1133) were more frequently affected by inflammations located at the skull's endocranial layer and other skeletal elements than the individuals recovered from

40 SK 4, 5/1, 5/2, 6, 7: Wiltschke-Schrotta, Marschler in prep. (table).

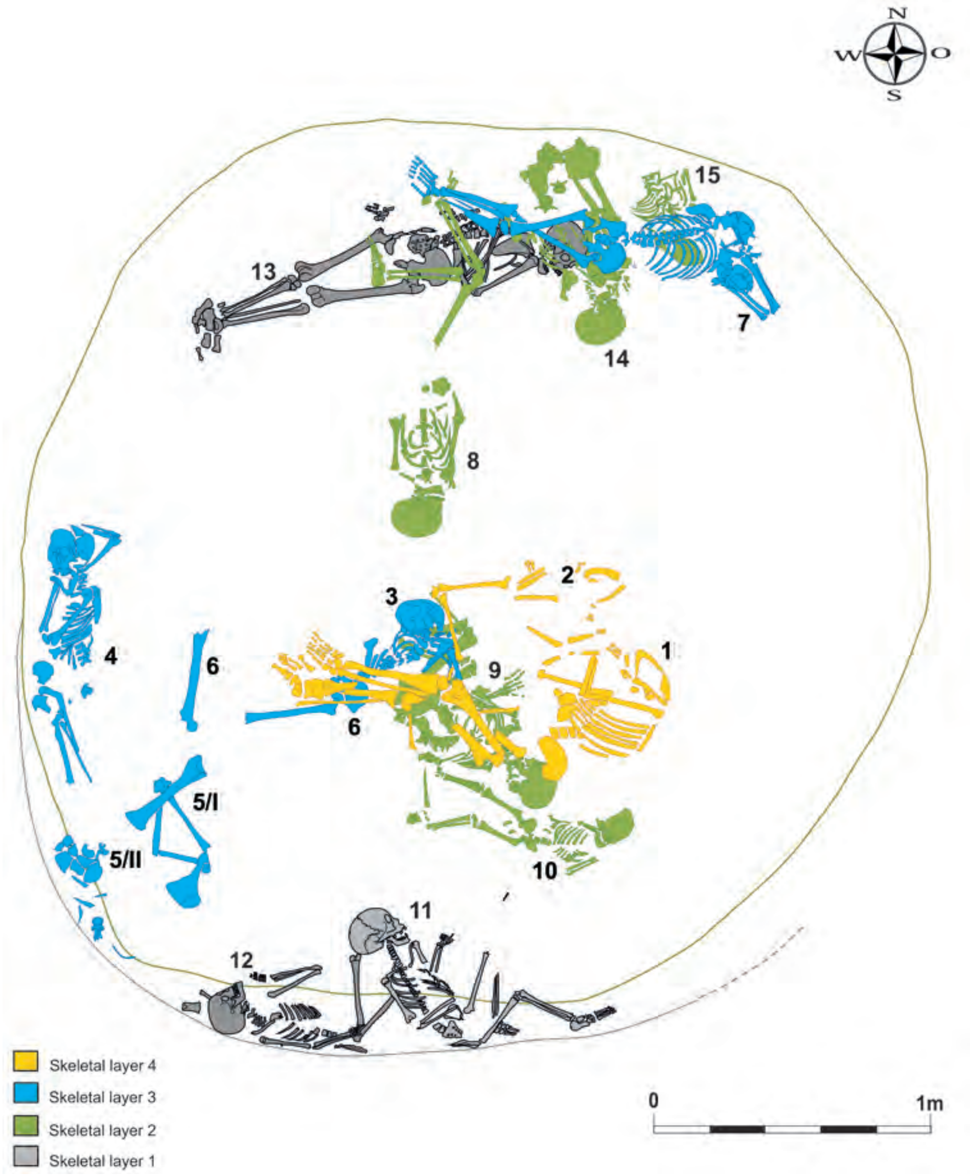

Fig. 9. Stillfried/March, Pit V841. – Schematic presentation of the four skeletal layers of Pit V841 with a total of sixteen unburned human skeletons or skeletal parts (SK 1–4, 5-1, 5-2, 6–15). Also, badly burned but already calcined pieces of bones from at least seven individuals (SK 16–22) were found within skeletal layer 4, but are not shown here (processed by I. Hellerschmid and S. Tikatsch).

Pit V1141.[41] Some features are already healed. Tooth decay is barely detectable in the individuals from Pit V841,[42] whereas enamel hypoplasia gives some indications for a deficiency disease.[43] By contrast, as mentioned above, the skeletons from Pit V1141 seem to be less affected by pathological traces:[44] only carious lesions were observed.[45] Nevertheless,

41 Wiltschke-Schrotta, Marschler in prep. (text and catalogue): *Cribra orbitalia*: V841: SK 2, 8, 13?, 14, 15; V1141: SK 6 (slight expression), SK 7; perhaps SK 2 (Breitinger 1980, 73); meningitis/meningoencephalitis: V841: SK 2(?), 3, 4(?), 5-2, 8, 10, 11(?), 12(?), 15 and the skull from Pit V1133; sinusitis: V841: SK 7; V1133; perisinusitis: V841: SK 15; striae: V841: SK 1, 2, 5, 6, 8, 9, 11–14, 16, 17, 21.

42 Only SK 14 (V841): Wiltschke-Schrotta, Marschler in prep. (catalogue).

43 Enamel hypoplasia: V841: SK 1, 2, 7 (slight expression), 8, 9, 11 and 12 (slight expression), 14; V1133.

44 37 examples of evidence of inflammation in 16 individuals from V841, whereas only two cases in V1141 are documented: Wiltschke-Schrotta, Marschler in prep. (catalogue).

45 Due to caries, the first molar (right, upper jaw) of the elderly woman SK 5 is destroyed completely: Wiltschke-Schrotta, Marschler in prep. (text and catalogue).

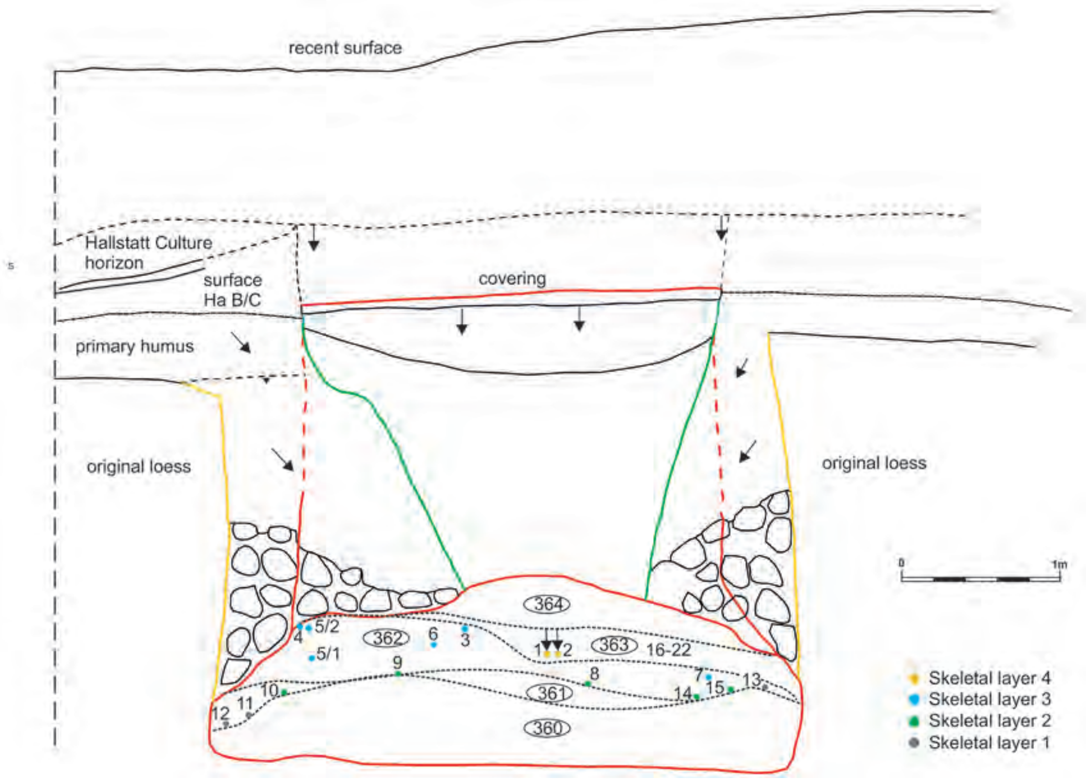

Fig. 10. Stillfried/March, Pit V841. – The schematic overall profile shows the different filling layers in the lower area of the pit with sixteen unburned human skeletons or skeletal parts (SK 1–4, 5-1, 5-2, 6–15) and the approximate location of the burned remains of at least seven individuals (SK 16–22). – Red: Original pit edge. – Green: Secondary filling funnel of the cavity. – Yellow: Secondary break edge (processed by I. Hellerschmid and M. Griebl).

it must be mentioned here that Breitinger's recording system is not consistent with the one used in the recent study, a fact that limits the possible level of reliability, at least with regard to symptoms of malnutrition.

1.3. Sr Isotope Ratio Analysis and Diagenetic Changes

1.3.1. State of the Art

Sr isotope ratio analysis of human skeletal remains has been used widely to answer questions of provenance and migration.[46] The main interest lies in the radiogenic $n(^{87}Sr)/n(^{86}Sr)$ ratio (commonly also noted as $^{87}Sr/^{86}Sr$ ratio),[47] which varies according to the radioactive decay of ^{87}Rb to ^{87}Sr (half-life ~48.8×10^9 years) and is therefore a function of the geological age and the original Rb/Sr ratio of the bedrock material.[48] Sr is mobilized from geological material by weathering and transferred into soil, water and further incorporated into plants. Finally, the radiogenic Sr signature is taken up without substantial fractionation[49] by animals and humans through the food chain and stored in Ca-rich matrices (such as bones and teeth[50]) due to the chemical similarity of Sr and Ca. The incorporated Sr isotopic signature reflects the ratio of a geographic location inhabited during a specific period of an individual's life, depending on the type of tissue, its specific turnover and diet.[51] Human enamel is of primary interest in migration studies. Enamel stores Sr only during tooth-formation (varying between teeth[52]) and therefore preserves information about the place of residence of an individual during their childhood[53] ('archive of the

46 As comprehensively described in recent reviews: Bentley 2006. – Slovak, Paytan 2012. – Szostek, Mądrzyk, Cienkosz-Stepańczak 2015. – Sehrawat, Kaur 2017.

47 The isotopic composition is reported in this manuscript as isotope-amount ratios ($n(^{87}Sr)/n(^{86}Sr)$), which is the correct notation according to IUPAC guidelines: Coplen 2011. In the following text, the $n(^{87}Sr)/n(^{86}Sr)$ ratios are also referred to as Sr isotope ratios.

48 Capo, Stewart, Chadwick 1998.

49 Capo, Stewart, Chadwick 1998. – Blum et al. 2000.

50 Price, Grupe, Schroter 1998. – Bentley 2006.

51 Capo, Stewart, Chadwick 1998. – Bentley 2006.

52 Hillson 1996 – AlQahtani, Hector, Liversidge 2010.

53 For example, the incremental growth of human first premolar (Hillson P3 after Hillson 1996) enamel (used in this study) starts and continues until completion between 2.5 and 6.5 years of age: AlQahtani, Hector, Liversidge 2010.

childhood'[54]). The comparison of the Sr isotopic signature in enamel with the autochthonous Sr isotopic composition of the habitat of interest (the place where an individual was buried) can give an indication of an individual's possible autochthonous (local) or allochthonous (non-local) origins and, thus, enable us to reconstruct a possible change of residence.[55] The general approach is based on the comparison of the Sr isotope signature to an isoscape[56] (= composition derived from **iso**tope and land**scape**) providing the spatial distribution of the local environmental Sr isotopic composition of bioavailable Sr. A more refined procedure considers dietary sources of Sr provided by food and beverages[57] in addition to the chemical fingerprint of the habitat.

Human dentine, on the other hand, is a living tissue[58] and re-equilibrates in accordance with an individual's metabolism due to its intimate intergrowth with capillary veins.[59] The majority of the compartment forms the primary dentine, which is secreted before apical closure of the tooth root.[60] In addition, a thin layer of secondary dentine forms after the complete formation of the tooth around the pulp chamber.[61] Tertiary dentine forms as a response to damage to the tooth (e.g., caries or severe abrasion).[62] Although primary dentine, once formed during adolescence and early adulthood, does not remodel and undergo significant metabolic or structural changes, its odontoblasts lining the pulp chamber retain the ability to produce new dentine throughout life.[63] In this respect, similarly to human enamel, it is expected that human primary dentine preserves Sr isotopic information about the place of residence of an individual during certain time spans of their adolescence/early adulthood, which varies between teeth.[64] When compared to the Sr isotopic signatures of its enamel and the habitat under investigation, the primary dentine might give additional information about the timing of a change in the Sr source and thus a possible change of residence.

54 Grupe 1998.

55 Lee-Thorp, Sponheimer 2003. – Slovak, Paytan 2012. – Lewis, Coath, Pike 2014. – Szostek, Mądrzyk, Cienkosz-Stepańczak 2015.

56 Evans et al. 2010. – Bataille, Bowen 2012. – Maurer et al. 2012. – Zitek et al. 2015. – Kootker et al. 2016.

57 Evans et al. 2010. – Bataille, Bowen 2012. – Maurer et al. 2012. – Zitek et al. 2015. – Kootker et al. 2016.

58 Fortes et al. 2015.

59 Fergusson, Purchase 1987. – Chiaradia, Gallay, Todt 2003.

60 Arana-Chavez, Massa 2004.

61 Shepherd et al. 2012.

62 Beaumont et al. 2015.

63 Nanci 2013.

64 Hillson 1996. – AlQahtani, Hector, Liversidge 2010.

1.3.2. Diagenetic Alterations of Sr – the Potential of (Primary) Dentine for the Evaluation of Biogenic Sr Isotopic Signature

The post-depositional overprint of the Sr isotopic signatures incorporated in ancient skeletal remains by cumulative physical, chemical and biological alteration in the form of inorganic modifications and structural alterations – referred to as diagenesis – is a challenge in the application of Sr isotope ratio analysis and the interpretation of its results.[65] Buried bodily remains may absorb (diagenetic) Sr from repository material (soil, groundwater) and accumulate it, primarily in bones and teeth, by processes of recrystallization of the hydroxyapatite lattice, adsorption onto the apatite crystal surface or crystallization of secondary minerals (e.g., brushite ($CaHPO_4{\cdot}2H_2O$) or carbonate ($CaCO_3$)) in micro-cracks, pores and vacancies.[66] This effect changes the Sr fingerprint incorporated in vivo (often referred to as biogenic Sr).

Hence, one must consider diagenetic phenomena in elemental or isotopic analyses of ancient skeletal remains and/or teeth. In population studies, the correlation of the Sr mass fraction $w(\mathrm{Sr})$ and the $n(^{87}\mathrm{Sr})/n(^{86}\mathrm{Sr})$ isotope amount ratios in bone/teeth in combination with the chemical information of the burial environment has been applied as a useful tool to assess a potential diagenetic impact.[67] Further indicators for post mortem alterations are elevated $w(\mathrm{Ca})/w(\mathrm{P})$ mass fraction ratios above the theoretical value of biogenic hydroxyapatite of (2.16).[68] Elevated levels of transition elements like Al, Si and Ba (in vivo <10 µg g^{-1} to 100 µg g^{-1}), elevated contents of V, Fe and Mn, and/or the presence of elevated mass fractions of (ultra-)trace elements (mainly REE, Y, Hf, Th, U, which show an in vivo content <1 µg g^{-1})[69] may also be a sign of contamination. The degree of damage depends on the depositional conditions (soil, water, acidity, microorganisms, etc.) and is therefore matrix-dependent and site-specific.[70]

The idea that enamel does not undergo significant diagenetic alteration due to its extremely compact structure with very small pores and minor amount of organic content (~2 %) and that it, thus, represents a reliable matrix for mobility and migration studies is more or less generally

65 Wilson, Pollard 2002.

66 Nelson et al. 1986. – Kohn, Schoeninger, Barker 1999. – Nielsen-Marsh, Hedges 2000. – Prohaska et al. 2002. – Hoppe, Koch, Furutani 2003.

67 Hoppe, Koch, Furutani 2003. – Copeland et al. 2010.

68 Sillen 1986.

69 Kohn, Schoeninger, Barker 1999. – Trueman et al. 2008. – Koenig, Rogers, Trueman 2009. – Kohn, Moses 2013. – Benson et al. 2013. – Willmes et al. 2016. – Kamenov et al. 2018.

70 Sponheimer, Lee-Thorp 2006. – Dudás et al. 2016.

accepted.[71] Nonetheless, enamel is not immune to diagenetic alterations.[72] Signals of diagenetic modification can be identified by comparing the Sr mass fraction content in enamel and published values and modern biogenic Sr content mass fraction ranges: it is indicated by elevated (>250 µg g^{-1}) or depleted (<100 µg g^{-1}) Sr mass fractions.[73] Dentine and bone as 'living tissue',[74] on the other hand, are characterized by higher porosity, smaller crystallites and a higher organic content (~30 %). Therefore, these compartments are more prone to diagenetic changes.[75] This effect is well known and used to provide an indication of the $n(^{87}Sr)/n(^{86}Sr)$ ratio of the burial environment, which has been used in a number of studies to estimate the bioavailable $n(^{87}Sr)/n(^{86}Sr)$ ratio at a particular location.[76] However, the use of bone and dentine in migration studies of past populations is under discussion. Most studies categorically exclude these tissues from the interpretations, if diagenetic alterations have been identified. Only a limited number of publications deal with this issue of biogenic Sr isotope preservation in human/animal bone and (primary) dentine and diagenetic proportions of Sr.[77] To estimate the biogenic Sr isotopic signature in diagenetically altered (primary) dentine, one can use chemical/mechanical (e.g., sequential leaching[78]) and mathematical approaches (based on the diagenetic Sr proportion and the Sr isotopic signature of the repository material).[79] The present study deals with this particular methodological subject by proposing an improved mathematical correction.

2. Samples and Methods

2.1. Samples

The samples for the $n(^{87}Sr)/n(^{86}Sr)$ ratio analysis were provided by the Austrian Academy of Sciences and the Natural History Museum Vienna. Eleven individuals from the Late Urnfield Culture deposited in three different pits (V841, V1133 and V1141) were selected: 8 of the 23 individuals from the large Pit V841 were sampled, whereby each of the four skeletal layers was considered. Furthermore, and as mentioned above, we included the isolated calvarium of the child from Pit V1133. Lastly, we selected and re-investigated two of the seven individuals deposited in Pit V1141 to ensure comparability to the study of Teschler-Nicola et al.[80] By preference, the first premolars were taken;[81] in one case a second premolar[82] and in another case a deciduous canine[83] were analysed instead (Tab. 1).

Animal teeth, mussel shells, plant (straw, wood), recent water and recent soil samples from the Late Urnfield Culture were used to determine and verify the local and autochthonous $n(^{87}Sr)/n(^{86}Sr)$ ratio range. The local environmental range was determined by recent soil and water (in duplicates) samples that were taken in a diameter of about five kilometres around the site, based on the assumed maximum area that could be reached on foot (Tab. 3).[84] The autochthonous $n(^{87}Sr)/n(^{86}Sr)$ ratio of the hillfort site at Stillfried/March was identified by the faunal remains of species, e.g., the wild boar and domesticated animals such as dogs, prehistoric plant remains and prehistoric mussel shells (Tab. 2).

2.2. Methods

2.2.1. Technical Procedures

Sample preparation, analysis and evaluation took place at the VIRIS Laboratory (University of Natural Resources and Life Sciences, Vienna). The procedure of sample cleaning followed standard protocols.[85]

The human teeth were cut vertically in half from the crown to the root using a low speed saw (IsoMet, Buehler, Lake Bluff, IL, USA) with a diamond blade for sampling circumpulpal primary dentine. The surface and the pulp cavity of teeth and mussel shells were pre-cleaned using an electric drill (Dremel Moto-Tool, Wisconsin, USA) combined with 100 µm diamond drilling heads.[86] Approximately 10–20 mg of enamel and dentine from animal and human individuals

71 Kyle 1986. – Bentley 2006. – Montgomery 2010. – Slovak, Paytan 2012. – Szostek, Mądrzyk, Cienkosz-Stepańczak 2015.

72 Kohn, Schoeninger, Barker 1999. – Lee-Thorp, Sponheimer 2003. – Dauphin, Williams 2004. – Sponheimer, Lee-Thorp 2006. – Dudás et al. 2016.

73 Dudás et al. 2016.

74 Fortes et al. 2015.

75 Driessens, Verbeeck 1990.

76 Grupe et al. 1997. – Budd et al. 2000. – Price, Burton, Bentley 2002. – Schweissing, Grupe 2003. – Price et al. 2004. – Bentley, Knipper 2005. – Irrgeher et al. 2012. – Knipper et al. 2012. – Maurer et al. 2012.

77 Budd et al. 2000. – Lee-Thorp, Sponheimer 2003. – Copeland et al. 2010.

78 Sillen 1986.

79 Budd et al. 2000. – Copeland et al. 2010. – Kreutz 2011. – Retzmann et al. 2019.

80 Teschler-Nicola, Irrgeher, Prohaska 2016.

81 The incremental growth of human first premolar (Hillson P3) enamel starts and continues until completion between 2.5 and 6.5 years of age: AlQahtani, Hector, Liversidge 2010.

82 The incremental growth of human second premolar (Hillson P4) enamel starts and continues until completion between 3.5 and 7.5 years of age: AlQahtani, Hector, Liversidge 2010.

83 The incremental growth of human deciduous canine enamel starts *in-utero* and continues until completion at 7.5 months of age: AlQahtani, Hector, Liversidge 2010.

84 Kohler-Schneider 2001.

85 Irrgeher et al. 2012.

86 It is assumed that the thin layer of secondary dentine is completely removed by this pre-cleaning.

as well as the mussel shells were sampled using an electric drill (Dremel). The sampled powders were mixed with 2 ml double sub-boiled concentrated nitric acid (w = 65 %, further purified from nitric acid p.a., Merck, Darmstadt, Germany) and 1 ml (w = 30 %) hydrogen peroxide (Merck). The samples were digested on a hot plate at 150° C for 2.5 hours. Afterwards nitric (c = 8 mol L^{-1}) acid, which was prepared from double sub-boiled concentrated nitric acid (w = 65 %), was added until a total weight of approximately 10 g was achieved. The mobile Sr fraction of soil was extracted using ammonium nitrate following the protocol DIN ISO 19730 (1997) to retrieve the bioavailable Sr fractions.[87] The water samples were filtered and acidified to w = 2 %. Digestion of the archaeological wood and straw samples was accomplished by microwave assisted digestion using double sub-boiled concentrated nitric acid (w = 65 %) and hydrogen peroxide (w = 30 %).

Prior to Sr isotopic analysis, Sr was separated from interfering matrix elements (mainly Ca, Rb and P). The digested teeth, mussels and prehistoric wood and straw samples were manually separated following the standard protocol.[88] The extracted soil and acidified water samples were automatically separated (Sr-matrix separation) using a prepFAST-MC (ESI, Omaha, US) according to a standard protocol.[89] By using an ICP-MS (NexION 350D, PerkinElmer, Waltham, MA, US), we performed a multi-elemental analysis and screenings following a standard protocol.[90]

A multi collector ICP-MS (Nu Instruments Ltd., Wrexham, UK) was used for the assessment of the $n(^{87}Sr)/n(^{86}Sr)$ ratios. Separated samples were diluted with nitric acid (w = 2 %) to achieve a mass fraction of β = 50 ng g^{-1}. A solution of NIST SRM 987 (NIST Gaithersburg, USA) was used as an isotopic reference for standard-sample bracketing (SSB). Diluted samples and NIST SRM 987 solution were doped with Zr (Merck-Millipore) to allow for internal inter-elemental instrumental isotopic fractionation correction.[91] Mass fractions of samples and SSB standards were matched within 10 %. A detailed description of the instrument configuration, data collection, blank correction and measurement strategy can be found elsewhere.[92] The results were evaluated, and the measurement uncertainty was calculated using a Microsoft Excel spreadsheet.[93]

87 Swoboda et al. 2008.
88 Swoboda et al. 2008. – Irrgeher et al. 2013.
89 Retzmann et al. 2017.
90 Retzmann et al. 2017.
91 Yang et al. 2008. – Kramchaninov, Chernyshev, Shatagin 2012. – Irrgeher et al. 2013. – Irrgeher et al. 2015. – Horsky, Irrgeher, Prohaska 2016. – Retzmann et al. 2017.
92 Retzmann et al. 2017.
93 Horsky, Irrgeher, Prohaska 2016.

2.2.2. Data Reduction

The local environmental Sr isotope ratio range of Stillfried/March was defined by the upper limit of the water $n(^{87}Sr)/n(^{86}Sr)$ ratio range and the lower limit of the soil $n(^{87}Sr)/n(^{86}Sr)$ ratio range. The Sr isotope range in water was determined by twice the standard deviation of all five recent water samples. The Sr isotope range in soil was calculated as twice the standard deviation of all seventeen recent soil samples.

An autochthonous $n(^{87}Sr)/n(^{86}Sr)$ ratio range was estimated by plus/minus twice the standard deviation of the mean $n(^{87}Sr)/n(^{86}Sr)$ ratio of all prehistoric animal enamel samples as a proxy for the Sr diet, of prehistoric plant samples as a proxy for Sr in vegetation, and of prehistoric mussel samples as a proxy for Sr in drinking water. The $n(^{87}Sr)/n(^{86}Sr)$ ratio of the burial environment of Pit V841 was calculated as an average from soil (sign. 13307) and mudbrick (sign. 13289) samples taken from the pit.

The provenance of each analysed individual from Stillfried was classified by the comparison of enamel $n(^{87}Sr)/n(^{86}Sr)$ values to the corresponding local environmental Sr range and the autochthonous Sr range.

The $n(^{87}Sr)/n(^{86}Sr)$ isotope ratio data of the soil and water samples were assigned to the geographic coordinates of their sampling spot and imported into the geographical mapping software ArcGIS® 10.2 (ESRI, Redlands, CA, USA). By using geological and soil maps (eBOD, Bundesministerium für Nachhaltigkeit und Tourismus) of Stillfried/March, a multi-layered isoscape was established. Existing geomorphological data were incorporated into the model to enable a more comprehensive interpretation (Figs. 11–12).

The biogenic Sr isotopic composition of the primary dentine for the five individuals that were identified as allochthonous individuals (see results) was estimated considering possible diagenetic alterations. The mathematical correction assumed that the primary source of diagenetic Sr is the burial environment. Consequently, the overall Sr isotopic ratio of the primary dentine shifts towards the diagenetic Sr value at a rate proportional to the amount of diagenetic Sr.[94] The biogenic Sr isotopic signatures in human primary dentine was therefore estimated as summarized in equation 1:[95]

$$n(^{87}Sr)/n(^{86}Sr)_{bio} = \frac{n(^{87}Sr)/n(^{86}Sr)_{dentine} - n(^{87}Sr)/n(^{86}Sr)_{rep} \cdot p\%_{dia}}{1 - p\%_{dia}}$$

94 Montgomery, Evans, Cooper 2007. – Copeland et al. 2010.
95 Copeland et al. 2010. – Kreutz 2011.

where $n(^{87}Sr)/n(^{86}Sr)_{bio}$ and $n(^{87}Sr)/n(^{86}Sr)_{dentine}$ are the estimated biogenic and measured (diagenetic) Sr ratios in human primary dentine, $n(^{87}Sr)/n(^{86}Sr)_{rep}$ is the measured Sr ratio of the repository material and the diagenetic proportion $p\%_{dia}$. The latter is estimated from the measured Sr mass fractions β measured in enamel and primary dentine considering the normal modern enrichment factor f_{enrich} for Sr in human (primary) dentine, according to equation 2:

$$p\%_{dia} = \frac{\beta(Sr)_{dentine} - \beta(Sr)_{enamel} \cdot f_{enrich}}{\beta(Sr)_{dentine}}$$

where an average enrichment factor of f_{enrich} = 1.2 was applied. The average enrichment factor was calculated from the average Sr mass fractions for modern human enamel and dentine, given in Waleska Castro et al.[96] Individual enrichment factors for the study ranged from 1.1 up to 1.7. Similar factors can be calculated for modern herbivores, omnivores and carnivores with data given in Matthew J. Kohn and Randolph J. Moses,[97] and correspond to our own measurements of modern teeth (unpublished results). The uncertainty contribution of the enrichment factor (U_{rel} = 20 %) has a minor effect on the estimated biogenic Sr signature in human primary dentine. Generally, the major contributors for the uncertainty budget of the estimated biogenic Sr signature in human primary dentine are the uncertainties of the $n(^{87}Sr)/n(^{86}Sr)$ ratio measured in diagenetic altered primary dentine and the $n(^{87}Sr)/n(^{86}Sr)$ ratio measured of the repository material (sum > 65 %). It must be mentioned that the combined uncertainty (u_c, k = 1) increased significantly for diagenetic proportions > 50 %. Thus, we must consider the estimated primary dentine data with care.

3. Results

The $n(^{87}Sr)/n(^{86}Sr)$ ratios of the analysed samples are given in Tables 1–3. The Sr isotope ratios of water and soil samples within a radius of five kilometres around the hillfort site at Stillfried range between 0.70864 and 0.71077 (Tab. 3). The geological map and the soil map (Figs. 11–12) indicated that the sampling spots closer to the hillfort site tend towards higher $n(^{87}Sr)/n(^{86}Sr)$ ratios. The local environmental $n(^{87}Sr)/n(^{86}Sr)$ ratio (including recent soil and water samples) of Stillfried/March range from 0.70852 to 0.71113 and represent the local environmental bioavailable Sr range.

96 Castro et al. 2010.

97 Kohn, Moses 2013.

3.1. The Local and Autochthonous $n(^{87}Sr)/n(^{86}Sr)$ Signal

The $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and dentine of the prehistoric faunal remains overlapped within their uncertainties. All enamel and dentine values approached the upper half of the local environmental Sr range (Fig. 13). Due to the consistency in Sr isotopic signatures and the fact that primary residential wild animals like boar and beaver, as well as domesticated animals like dogs and pigs were included, all enamel samples were used to identify an autochthonous signal.

The $n(^{87}Sr)/n(^{86}Sr)$ ratios of the mussel samples approached the upper half of the local environmental Sr range and overlapped with the local water Sr range (0.70919–0.71113) within their uncertainties (Fig. 13). This fact underlined the similarity of $n(^{87}Sr)/n(^{86}Sr)$ ratios of modern and historic water samples.[98] Therefore, the data obtained from mussel samples were included into the calculation of a representative autochthonous signal, as a reference for potential drinking water sources.[99]

The $n(^{87}Sr)/n(^{86}Sr)$ ratios of straw and wood overlapped within their uncertainties. Both samples approached the upper limit of the local environmental Sr range and were included to provide a representative autochthonous signal (Fig. 13), since they are a reference for potential vegetation sources.

The resulting autochthonous $n(^{87}Sr)/n(^{86}Sr)$ ratio ranged from 0.70987 to 0.71130 and represents the potential $n(^{87}Sr)/n(^{86}Sr)$ signature, which was most likely bioavailable for human individuals.

The $n(^{87}Sr)/n(^{86}Sr)$ ratio of the leachable Sr of the two soil samples taken from Pit V841, overlapped within uncertainties and lay in the upper half of the local environmental and autochthonous Sr ranges (Fig. 13). Hence, these soil samples and herewith the burial environment was determined as 0.71046 ± 0.00019, supporting the estimated autochthonous Sr range.

3.2. Diagenetic Effects

The Sr content in enamel of the investigated individuals ranged from 71 µg g^{-1} ± 11 µg g^{-1} to 199 µg g^{-1} ± 30 µg g^{-1} (Tab. 1). This is in accordance with normal modern Sr mass fractions of human enamel that are known to be geographically variable and lifestyle-dependent, and typically range between 50 µg g^{-1} and 300 µg g^{-1}.[100] The Sr mass fraction of enamel of the eleven human individuals from the hillfort site at Stillfried/March can be considered as biogenic.

98 In agreement with observations by Maurer et al. 2012.

99 The edible mussels were not approximated by the Sr signature of the shell.

100 Montgomery, Evans, Cooper 2007. – Castro et al. 2010. – Dudás et al. 2016.

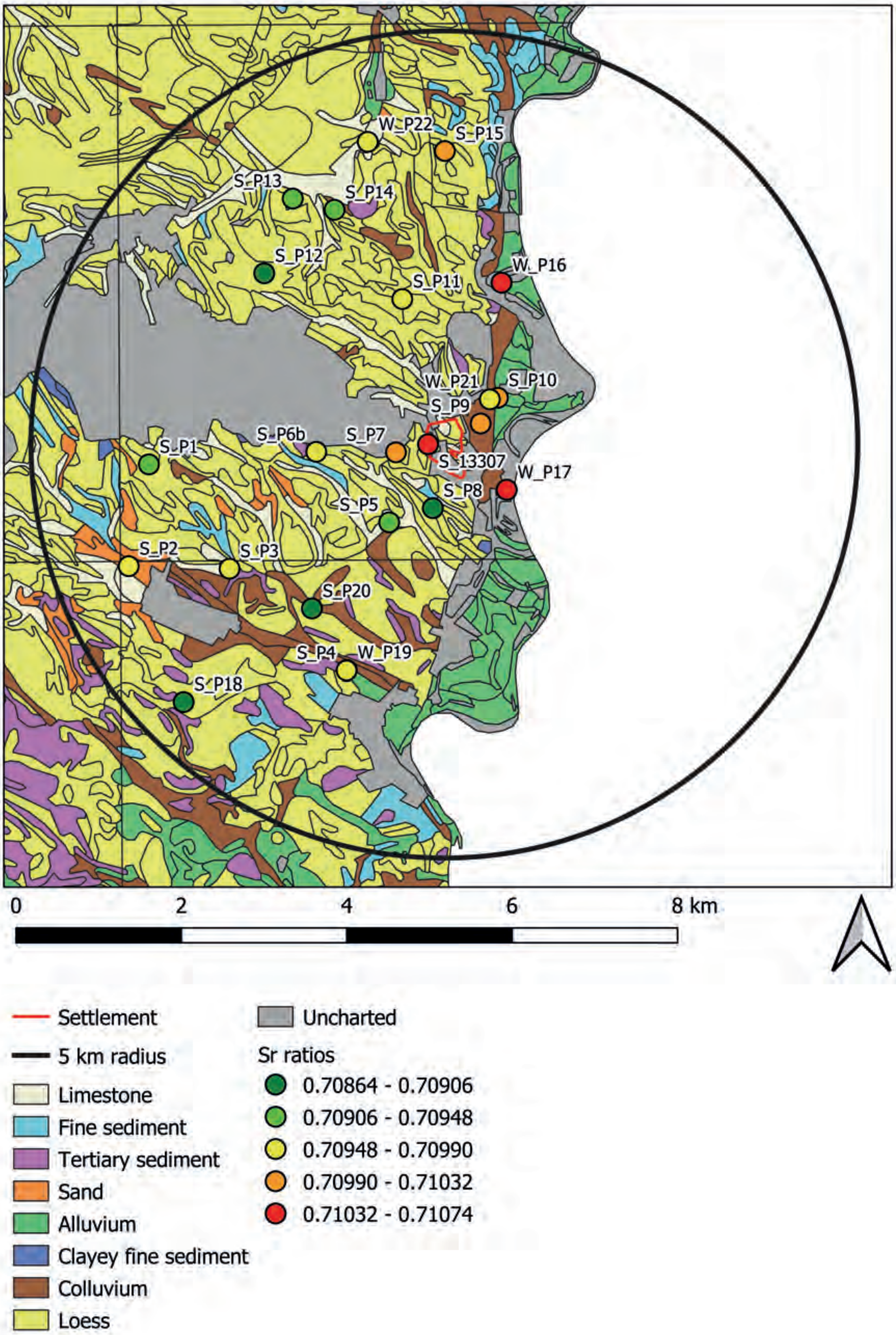

Fig. 11. Geological map of Stillfried/March showing the $n(^{87}Sr)/n(^{86}Sr)$ ratios of the soil and water samples in a five-kilometre radius around the settlement (Map: Digitale Bodenkarte von Österreich, 1km-Raster, Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BFW), map processing by F. Köstelbauer).

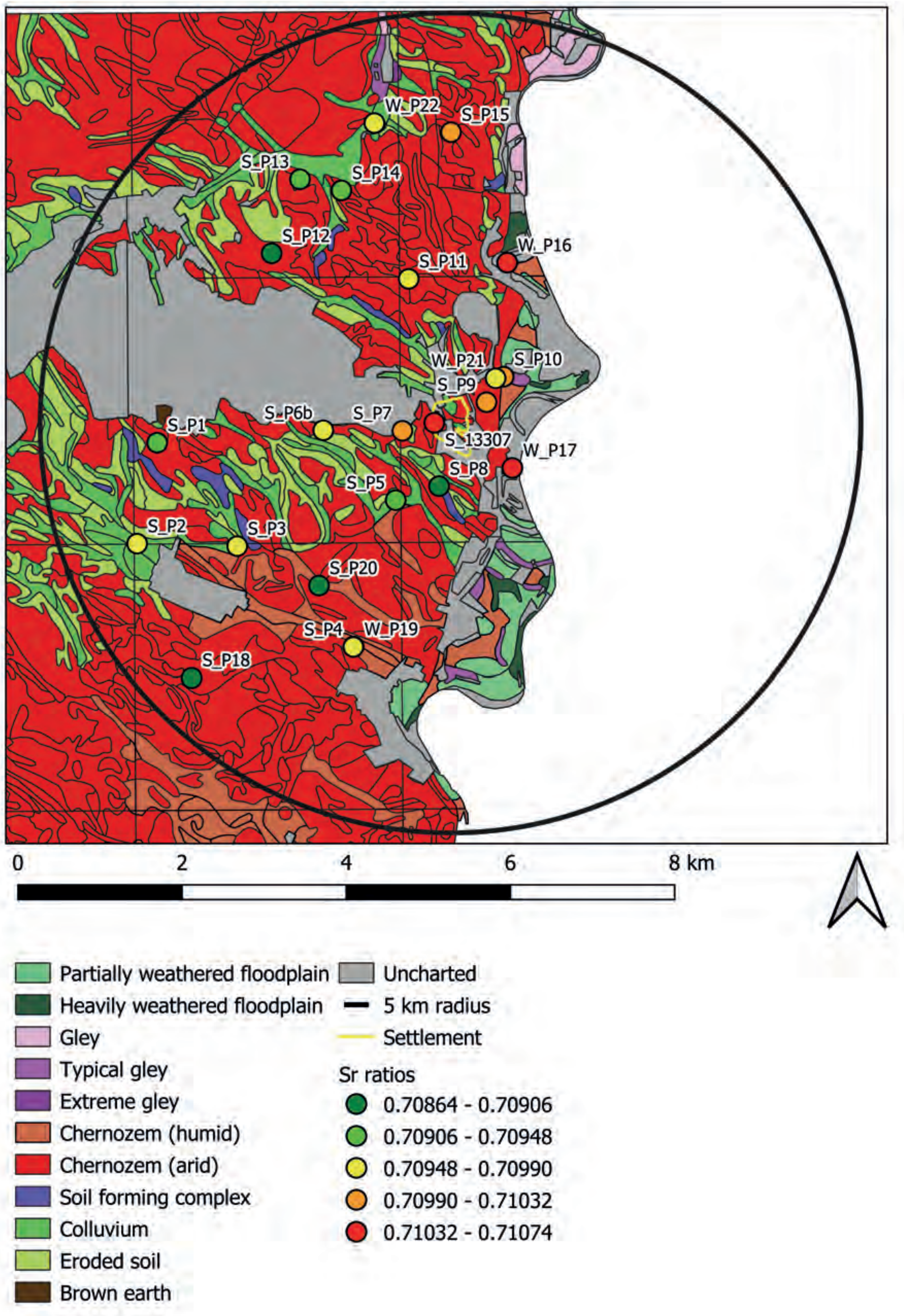

Fig. 12. Soil map of Stillfried/March showing the $n(^{87}Sr)/n(^{86}Sr)$ ratios of the soil and water samples in a five-kilometre radius around the settlement (Map: Digitale Bodenkarte von Österreich, 1km-Raster, Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BFW), map processing by F. Köstelbauer).

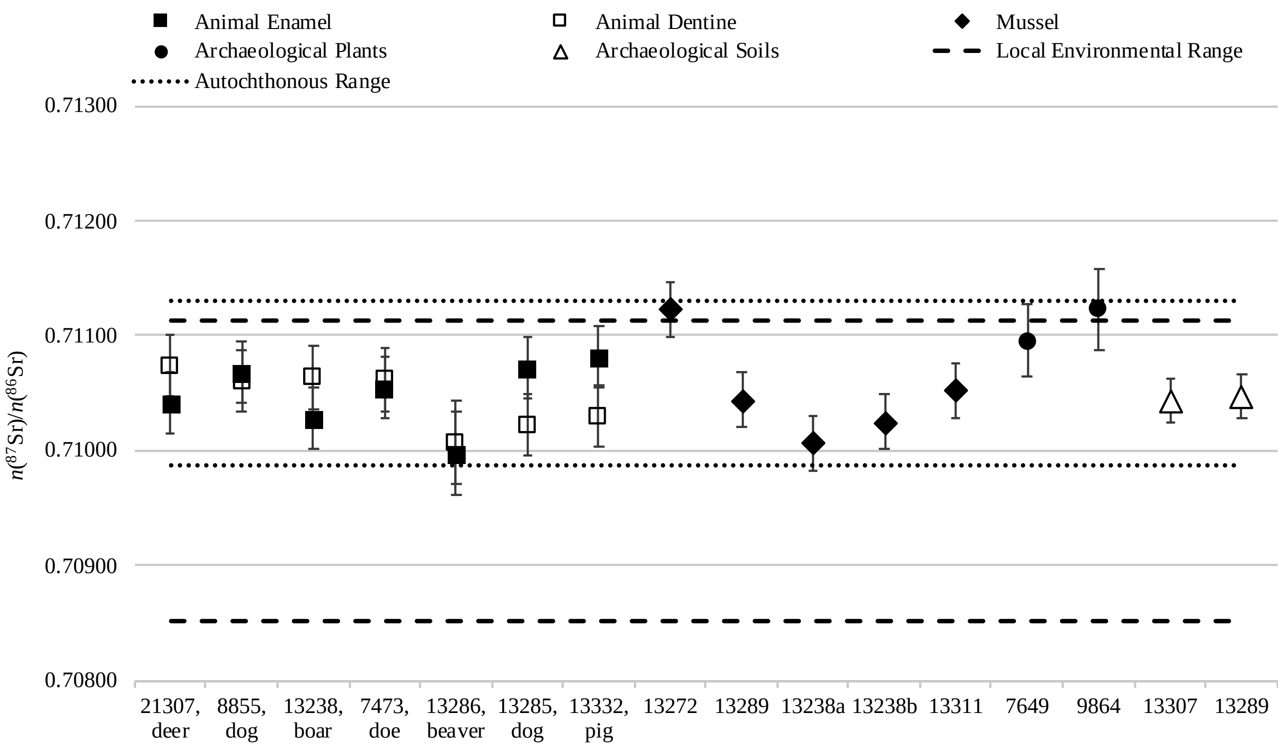

Fig. 13. The $n(^{87}Sr)/n(^{86}Sr)$ ratios of archaeological animals (enamel, dentine), mussels, plants (straw, wood) and soils (taken from Pit V841), and the calculated autochthonous range, compared to the calculated local environmental range. Error bars correspond to expanded uncertainty U (k = 2).

The elevated elemental contents (mainly Ba, V, Sr)[101] of human primary dentine from all investigated individuals indicated diagenetic alterations. Interestingly, these changes are less pronounced in the present study that used premolar pulp dentine (Tab. 1) than in a previous study[102] that used molar root dentine.

Sr mass fractions of enamel and dentine are comparable due to in vivo assimilation,[103] and, therefore, a significantly higher Sr content in the primary dentine is likely due to post mortem Sr addition by diagenetic processes.[104] The estimated diagenetic proportion of Sr in primary dentine samples ranged from 11 % to 94 % (Tab. 1). The diagenetic proportion of Sr in primary dentine of deciduous teeth, such as in SK 10 (sign. 9051/V841) and SK 4 (sign. 9026/V1141), tended to be higher. This might be related to the differing chemical composition and significant lower Sr contents of deciduous teeth.[105] Since the primary dentine samples were found to be highly affected by diagenetic alterations, biogenic $n(^{87}Sr)/n(^{86}Sr)$ ratios of primary dentine of the (supposedly) allochthonous individuals were calculated (Tab. 1).

3.3. Sr Isotope Signals in Human Remains

3.3.1. Stillfried Settlement Pit V1141

The measured $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel of SK 1 (sign. 9023) did not lie within the local environmental and autochthonous Sr ranges and classified SK 1 as a possible allochthonous individual. The measured Sr isotopic signal of primary dentine did not overlap within uncertainties with the enamel signal and overlapped within uncertainties with the upper end of the autochthonous Sr ranges (Fig. 14).

The measured $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and primary dentine of SK 4 (sign. 9026) on the other hand, were indistinguishable from both the local environment and autochthonous Sr ranges and overlapped within their uncertainties. Hence, SK 4 was classified as a supposedly autochthonous individual.

101 Kohn, Schoeninger, Barker 1999. – Trueman et al. 2008. – Koenig, Rogers, Trueman 2009. – Kohn, Moses 2013. – Benson et al. 2013. – Willmes et al. 2016. – Kamenov et al. 2018.

102 Teschler-Nicola, Irrgeher, Prohaska 2016.

103 Budd et al. 2000. – Dudás et al. 2016.

104 Chiaradia, Gallay, Todt 2003.

105 Williams et al. 2002.

ID	Sign.	Pit	Sex and age	Tooth (FDI)	Enamel/ dentine	Formation period (AlQahtani, Hector, Liversidge 2010)	$n(^{87})Sr/n(^{86}Sr)$	Sr mass fraction (µg g^{-1})	Diagenetic indicator	Diagenetic proportion (%)	Biogenic $n(^{87})Sr/n(^{86}Sr)$	Classification	Reference
SK 2	9042	V0841	Infans II, 8–9 years	14	Enamel	2.5–6.5 years	0.70853 ± 0.00019	199 ± 30				Allochthonous	This study
					Primary dentine	≤ 14.5 years	0.71032 ± 0.00019	379 ± 57	V > 1 µg g^{-1}, Sr > 250 µg g^{-1}	36 % ± 5 %	0.71024 ± 0.00024		
SK 3	9043	V0841	♂ (?), Adult, 25–35 years	15	Enamel		0.71055 ± 0.00019	99 ± 15				Supposedly autochthonous	This study
					Primary dentine		0.71050 ± 0.00019	491 ± 74	V > 1 µg g^{-1}, Sr > 250 µg g^{-1}	75 % ± 11 %			
SK 4	9044	V0841	Juvenis, 13–15 years	24	Enamel	2.5–6.5 years	0.71264 ± 0.00019	78 ± 12				Allochthonous	This study
					Primary dentine	≤ 14.5 years	0.71081 ± 0.00019	370 ± 55	Sr > 250 µg g^{-1}	74 % ± 11 %	0.71185 ± 0.00077		
SK 5/ II	9046	V0841	Infans II, 10–12 years	14	Enamel		0.71064 ± 0.00019	132 ± 20				Supposedly autochthonous	This study
					Primary dentine		0.71046 ± 0.00019	559 ± 84	V > 1 µg g-1, Sr > 250 µg g^{-1}	71 % ± 11 %			
SK 8	9049	V0841	♂ (?), Juvenis, 15–18 years	14	Enamel	2.5–6.5 years	0.71183 ± 0.00019	136 ± 20				Allochthonous	This study
					Primary dentine	≤ 14.5 years	0.71055 ± 0.00019	316 ± 47	Sr > 250 µg g^{-1}	47 % ± 7 %	0.71063 ± 0.00029		
SK 10	9051	V0841	Infans I, 3–4 years	64	Enamel	30 weeks *in utero* – 4.5 months	0.70960 ± 0.00019	71 ± 11				Allochthonous	This study
					Primary dentine	≤ 3.5 years	0.71045 ± 0.00019	481 ± 72	V > 1 µg g^{-1}, Sr > 250 µg g^{-1}	82 % ± 12 %	0.71043 ± 0.00098		
SK 11	9052	V0841	Infans II, 8–10 years	14	Enamel		0.71024 ± 0.00019	127 ± 19				Supposedly autochthonous	This study
					Primary dentine		0.71049 ± 0.00019	470 ± 70	Sr > 250 µg g^{-1}	67 % ± 10 %			

Tab. 1. The (biogenic) $n(^{87}Sr)/n(^{86}Sr)$ ratios, Sr mass fractions and diagenetic Sr proportion of enamel and (primary) dentine of all investigated human individuals including previous data for 'the seven from the pit' (Teschler-Nicola, Irrgeher, Prohaska 2016). Error bars correspond to expanded uncertainty for enamel Sr ratios and Sr mass fractions U (k = 2), and combined uncertainty for biogenic primary dentine Sr ratios u_c (k = 1). Estimation of sex and age at death of the individuals were collected from published data elsewhere (Breitinger 1980. – Szilvássy, Kritscher, Hauser 1988. – Teschler-Nicola, Irrgeher, Prohaska 2016. – Wiltschke-Schrotta, Marschler in prep.).

ID	Sign.	Pit	Sex and age	Tooth (FDI)	Enamel/ dentine	Formation period (AlQahtani, Hector, Liversidge 2010)	$n(^{87}Sr)/n(^{86}Sr)$	Sr mass fraction (µg g^{-1})	Diagenetic indicator	Diagenetic proportion (%)	Biogenic $n(^{87}Sr)/n(^{86}Sr)$	Classification	Reference
SK 13	9054	V0841	♀ (?), 40–60 years	14	Enamel		0.70995 ± 0.00019	120 ± 18				Supposedly autochthonous	This study
					Primary dentine		0.71040 ± 0.00019	411 ± 62	Sr > 250 µg g^{-1}	64 % ± 10 %			
Burial environment Pit V0841 (sign. 13307 and sign. 13289)							0.71046 ± 0.00019						This study
SK 1	9023	V1141	♂, Adult, 30 years	14	Enamel	2.5–6.5 years	0.71204 ± 0.00019	185 ± 28				Allochthonous	This study
					Primary dentine	≤ 14.5 years	0.71144 ± 0.00019	260 ± 39	V > 1 µg g-1, Sr > 250 µg g-1	13 % ± 2 %	0.71161 ± 0.00031		
SK 1	9023	V1141	♂, Adult, 30 years	36	Enamel	4.5 month – 3.5 years	0.71216 ± 0.00018	92 ± 14					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine	≤ 9.5 years	0.71070 ± 0.00018	627 ± 94	Ba > 100 µg g-1, V > 10 µg g-1, Sr > 250 µg g-1	82 % ± 12 %	0.71181 ± 0.00106		
SK 2	9024	V1141	♂, 3 years	74	Enamel		0.71062 ± 0.00018	105 ± 16					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine		0.71044 ± 0.00018	665 ± 100					
SK 3	9025	V1141	♀, 40 years	36	Enamel		0.70937 ± 0.00018	85 ± 13					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine		0.71048 ± 0.00018	444 ± 67					
SK 4	9026	V1141	♂, 8 years	73	Enamel		0.71027 ± 0.00019	143 ± 21				Supposedly autochthonous	This study
					Primary dentine		0.71057 ± 0.00019	621 ± 93	V > 10 µg g-1, Sr > 250 µg g-1	72 % ± 11 %			

Tab. 1. Continued.

ID	Sign.	Pit	Sex and age	Tooth (FDI)	Enamel/ dentine	Formation period (AlQahtani, Hector, Liversidge 2010)	$n(^{87}Sr)/n(^{86}Sr)$	Sr mass fraction ($\mu g\ g^{-1}$)	Diagenetic indicator	Diagenetic proportion (%)	Biogenic $n(^{87}Sr)/n(^{86}Sr)$	Classification	Reference
SK 4	9026	V1141	♂, 8 years	37	Enamel		0.70990 ± 0.00018	113 ± 17					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine		0.71018 ± 0.00018	490 ± 74	Ba > 100 µg g-1, V > 10 µg g-1, Sr > 250 µg g-1				
SK 5	9027	V1141	♀, 45 years	47	Enamel		0.71253 ± 0.00018	179 ± 27					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine		0.71090 ± 0.00018	511 ± 77					
SK 6	9028	V1141	♂, 5–6 years	75	Enamel		0.71416 ± 0.00018	92 ± 14					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine		0.71049 ± 0.00018	653 ± 98					
SK 7	9029	V1141	♀, 9 years	36	Enamel		0.71386 ± 0.00018	65 ± 10					Teschler-Nicola, Irrgeher, Prohaska 2016
					Dentine		0.71085 ± 0.00018	579 ± 87					
	1377	V1133	♀, 12 years	14	Enamel		0.71007 ± 0.00019	113 ± 17				Supposedly autochthonous	This study
					Primary dentine		0.71067 ± 0.00019	283 ± 42	Sr > 250 µg g-1	51 % ± 8 %			

Tab. 1. Continued.

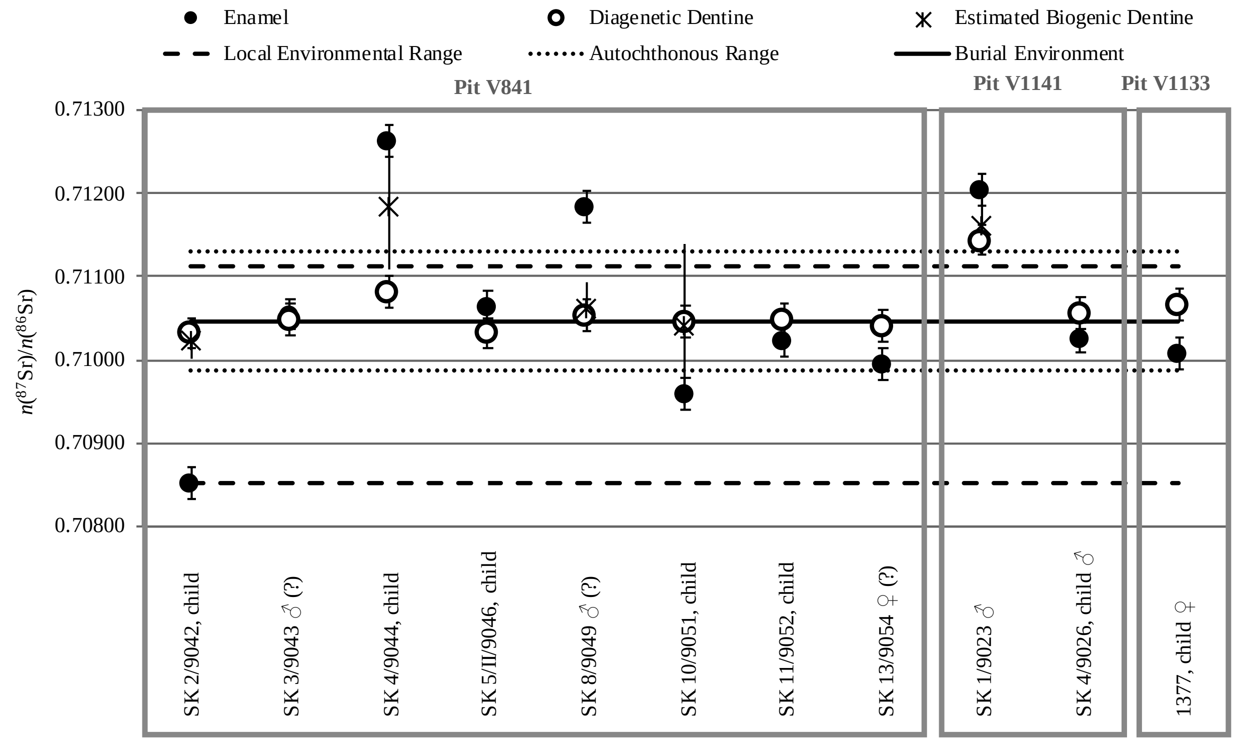

Fig. 14. The $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and primary dentine (diagenetic and partly biogenic) from all investigated human individuals, ordered by pits and compared to the local environmental and autochthonous Sr ranges. Error bars correspond to expanded uncertainty for enamel Sr ratios U (k = 2) and combined uncertainty for biogenic primary dentine Sr ratios u_c (k = 1).

3.3.2. Stillfried Settlement Pit V1133

The child from Pit V1133 shows $n(^{87}Sr)/n(^{86}Sr)$ ratios that were indistinguishable from the local environmental and autochthonous Sr ranges. However, one can see a significant difference between the enamel and primary dentine. The enamel signature is placed at the lower end of the autochthonous Sr range whereas the primary dentine signature was located at the upper end of the local environmental and autochthonous Sr ranges and was closer to the soil samples taken from the pit (Fig 14). Nonetheless, the child was classified as a supposedly autochthonous individual.

3.3.3. Stillfried Settlement Pit V841

The measured $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and primary dentine of both analysed individuals (SK 11/sign. 9052, SK 13/sign. 9054) from skeletal layer 1, were indistinguishable from both the local environmental and autochthonous Sr ranges and, therefore, classified as supposedly autochthonous individuals (Fig. 14).

The measured $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and primary dentine of both individuals (SK 8/sign. 9049, SK 10/sign. 9051) of skeletal layer 2 did not overlap within their uncertainties. The enamel signal of SK 8 lay clearly outside the local environmental and autochthonous Sr ranges, which allowed classification as an allochthonous individual. The measured $n(^{87}Sr)/n(^{86}Sr)$ ratios of deciduous enamel (formation starts *in-utero*[106]) of the 3–4-year-old child SK 10 lay within the local environmental range, but outside of the autochthonous range. At this point, its classification based on the enamel signature was not definitively clarified. The Sr isotopic value of the enamel displayed a significantly lower value compared to primary dentine.

The $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and primary dentine of individuals selected from layer 3, SK 3 (sign. 9043) and SK 5/2 (sign. 9046), were indistinguishable from both local environmental and autochthonous Sr ranges (Fig. 14). Therefore, these individuals were classified as supposedly autochthonous individuals.

SK 4 (sign. 9044) from layer 3 and SK 2 (sign. 9042) from layer 4 showed different enamel $n(^{87}Sr)/n(^{86}Sr)$ ratios. The signal of enamel of SK 2 lay at the very lower end of the local environmental Sr range, whereas the measured primary

106 AlQahtani, Hector, Liversidge 2010.

ID	Pit	Type	Tooth	Enamel/Dentine	$n(^{87}Sr)/n(^{86}Sr)$
7473	1140	Doe	Isolated incisivus	Enamel	0.71054 ± 0.00027
				Dentine	0.71062 ± 0.00027
8855	V601	Dog	Upper M2	Enamel	0.71068 ± 0.00027
				Dentine	0.71061 ± 0.00027
21307	V2784–V3784	Deer	Upper premolar	Enamel	0.71041 ± 0.00027
				Dentine	0.71074 ± 0.00027
13285	V841	Dog	Caninus (?)	Enamel	0.71072 ± 0.00027
				Dentine	0.71023 ± 0.00027
13238	V841	Boar	Caninus (?)	Enamel	0.71028 ± 0.00027
				Dentine	0.71064 ± 0.00027
13286	V841	Beaver		Enamel	0.70998 ± 0.00027
				Dentine	0.71008 ± 0.00027
13332	V841	Pig		Enamel	0.71082 ± 0.00027
				Dentine	0.71031 ± 0.00027
13311	V841	Mussel			0.71053 ± 0.00024
13272	V841	Mussel			0.71123 ± 0.00024
13238a	V841	Mussel			0.71007 ± 0.00024
13238b	V841	Mussel			0.71025 ± 0.00024
13289	V841	Mussel			0.71044 ± 0.00024
7649	V1154	Charred straw			0.71116 ± 0.00030
9864	V1154	Wooden balk			0.71110 ± 0.00035
13307	V841	Charcoal and soil			0.71044 ± 0.00017
13289	V841	Mudbrick			0.71048 ± 0.00017

Tab. 2. The $n(^{87}Sr)/n(^{86}Sr)$ ratios of all investigated animal individuals (enamel and dentine), mussels and archaeological environmental samples. Error bars correspond to expanded uncertainty U (k = 2).

dentine Sr signal lay within the local environmental and autochthonous Sr ranges. At this point, its classification based on the enamel signature was not definitively clarified. The Sr signal of enamel of SK 4 lay higher than the local environmental and autochthonous Sr ranges. Hence, the 13–15-year-old individual SK 4 was classified as an allochthonous individual.

4. Discussion

However, one needs to stress that the number of human individuals selected and handed over for Sr isotope ratio analysis in the course of the present study is extremely small. Based on this fact, we had to abstain from statistical analysis that could verify possible age- and gender-based migration patterns in Stillfried's Late Bronze Age population or chronological relations.

4.1. Definition of Autochthony

Even though Sr isotopes applied in migration studies is a method of exclusion and identifies only allochthony, it is likely for an individual to be autochthonous (also called 'local'), when found with a $n(^{87}Sr)/n(^{86}Sr)$ signature indistinguishable from the local environmental and autochthonous Sr range.

In general, the identification of allochthonous or supposedly autochthonous individuals is based on the determination of the autochthonous (commonly called bioavailable) $n(^{87}Sr)/n(^{86}Sr)$ signature of the habitat under investigation. The autochthonous $n(^{87}Sr)/n(^{86}Sr)$ signature in the food chain cannot be derived directly from the known isotopic composition of the underlying bedrock geology,[107] as significant heterogeneity in Sr signatures of the different compartments in a given habitat can occur.[108]

107 Price, Burton, Bentley 2002.
108 Price, Burton, Bentley 2002.

ID	Type	lat. (°N)	lon. (°E)	Sampling spot	$n(^{87}Sr)/n(^{86}Sr)$
ST_S_P1	Soil	48.41224	16.79142	Uncultivated field	0.70929 ± 0.00034
ST_S_P2	Soil	48.40117	16.78802	Uncultivated field	0.70949 ± 0.00029
ST_S_P3	Soil	48.40083	16.80449	–	0.70955 ± 0.00029
ST_S_P4	Soil	48.38968	16.8235	Uncultivated field	0.70955 ± 0.00029
ST_S_P5	Soil	48.40577	16.83062	Uncultivated field	0.70948 ± 0.00029
ST_S_P6b	Soil	48.41349	16.81878	Vineyard	0.70980 ± 0.00029
ST_S_P7	Soil	48.41338	16.8318	Nearby vineyard	0.71004 ± 0.00029
ST_S_P8	Soil	48.40728	16.83777	Uncultivated field	0.70890 ± 0.00029
ST_S_P9	Soil	48.41646	16.84567	Ploughed field	0.70994 ± 0.00017
ST_S_P10	Soil	48.41925	16.84852	Nearby groves	0.71024 ± 0.00017
ST_S_P11	Soil	48.43006	16.833002	Hedge bank	0.70965 ± 0.00017
ST_S_P12	Soil	48.43296	16.81046	Hedge bank	0.70864 ± 0.00017
ST_S_P13	Soil	48.44107	16.8152	Hedge bank	0.70915 ± 0.00017
ST_S_P14	Soil	48.43982	16.82202	Hedge bank	0.70940 ± 0.00017
ST_S_P15	Soil	48.44614	16.84012	Ploughed field	0.71002 ± 0.00017
ST_S_ P18	Soil	48.38642	16.79686	Uncultivated field	0.70905 ± 0.00018
ST_S_P20	Soil	48.39645	16.81791	–	0.70866 ± 0.00017
ST_W_P16	Water	48.43177	16.84924	Backwater of March by Hufeisenteich	0.71050 ± 0.00017
ST_W_P17	Water	48.40923	16.84986	March	0.71077 ± 0.00017
ST_W_P19	Water	48.38973	16.82354	Moat by P4	0.71008 ± 0.00017
ST_W_P21	Water	48.41908	16.8472	Small stream by P10	0.70954 ± 0.00017
ST_W_P22	Water	48.44719	16.82752	Krüttelbach	0.70990 ± 0.00017

Tab. 3. The $n(^{87}Sr)/n(^{86}Sr)$ ratios of all investigated recent environmental samples (soils and water), taken in a radius of five kilometres around Stillfried/March. Error bars correspond to expanded uncertainty U (k = 2).

Hence, in the present study, a local environmental Sr range has been established based on the Sr isotope ratio ranges derived from soil and water samples taking account of the following considerations: i) secondary anthropogenic impact such as from fertilizer might hamper the determination of representative Sr isotopic compositions;[109] ii) a local Sr isotopic signature derived from soil extracts does not always match with $n(^{87}Sr)/n(^{86}Sr)$ signatures measured in vertebrate and human body tissue, since their Sr originates from different sources with different, diet-dependent amounts.[110] Nevertheless, Sr signatures of plants are more likely to be representative for the local biosphere Sr values compared to the extractable Sr fraction of soils.[111] Due to the limited number of recent and prehistoric vegetation remains in the present study, we used the extractable Sr from recent soils and water to determine the local environmental Sr range of the hillfort site at Stillfried/March. The local environmental Sr range is seen as an indicator for an autochthonous Sr signal and a reasonable proxy for capturing the variability of Sr isotopic signals in the local environment of Stillfried/March.

Further, in the present study, an autochthonous Sr range has been established to estimate the Sr fraction, which is taken up via the food chain. In this, a simplified approach from the concept of mixing models[112] has been applied. It combined different sources representing bioavailable Sr (Sr that can potentially be taken up by living organisms) in nutrition supplies (food/water) of the habitat under investigation, taking account of the following considerations: in general, the preservation of archaeological foodstuff (e.g., vegetation remains) and beverages supplies are crucial, and in most archaeological contexts are only preserved to

109 Maurer et al. 2012.

110 Lengfelder et al. 2019.

111 Maurer et al. 2012. – Ryan et al. 2018.

112 Lengfelder et al. 2019.

a limited extent. In the case of the hillfort site at Stillfried/March, nutrition supplies were not available for the Sr isotopic analysis. In the absence of such objects, the autochthonous $n(^{87}Sr)/n(^{86}Sr)$ signature can be estimated making use of presumably local (archaeological) faunal remains,[113] assuming that they have mainly incorporated the local bioavailable Sr,[114] or making use of dentine Sr values from a residential human population.[115] In the previous study by Teschler-Nicola et al., the autochthonous $n(^{87}Sr)/n(^{86}Sr)$ range was defined as the mean human dentine $n(^{87}Sr)/n(^{86}Sr)$ plus or minus four times the standard deviation.[116] The autochthonous Sr range thus determined exceeds the autochthonous Sr range of the hillfort site at Stillfried/March in the present study. A previous study has observed that modern animals (especially domesticated animals) may have Sr sources different to local sources, and archaeological animal dentine is more generally subject to the vagaries of contamination or diagenesis.[117] Hence, only enamel from residual animals which fed locally in the same area as the humans[118] have been considered to generate a representative autochthonous Sr signal for the hillfort site at Stillfried/March.[119] In this, the $n(^{87}Sr)/n(^{86}Sr)$ signature of the recommended residential large vertebrates and omnivores[120] and domesticated animals (dogs and pigs) is in agreement with prehistoric plants (Fig. 13) used as a proxy for the Sr source in vegetation like vegetables. The fractional contribution of animal products itself is negligible.[121] The overlap of the modern local water range and prehistoric mussel samples has been taken as a representative source of Sr for drinking water. Based on that, the autochthonous $n(^{87}Sr)/n(^{86}Sr)$ range presented is seen as a more defined range in comparison to Teschler-Nicola et al.[122]

4.2. Sr Isotope Signals in Human Remains

4.2.1. Stillfried Settlement Pit V1141

The $n(^{87}Sr)/n(^{86}Sr)$ ratios of individuals from Pit V1141 have previously been analysed.[123] Comparing the results of Teschler-Nicola et al.[124] with the present study, the enamel data are in good agreement. Slightly differing $n(^{87}Sr)/n(^{86}Sr)$ ratios are observed for the measured dentine values.

The determined Sr signatures of the enamel of SK 1 (sign. 9023) from both studies overlap within uncertainties (Tab. 1). Regardless of the fact that the two studies used different teeth reflecting different stages in an individual's life,[125] neither the enamel of the first molar (M1) nor that of the first premolar (PM1) of SK 1 lies within the local environmental and autochthonous Sr ranges. This means that the classification of SK 1 as an allochthonous individual is supported by both datasets. On the other hand, the isotope signals in (primary) dentine diverge in their values. The signatures of the (primary) dentine of SK 1 from the two studies do not overlap within their uncertainties. While the ratio of M1 lies within the local environmental and autochthonous Sr ranges, the ratio of PM1 does not. In the case of M1, the sampled mixture of root and pulp dentine of the previous study[126] contains 82 % ± 12 % diagenetic Sr, which points towards an overlap with the local environmental and autochthonous Sr ranges, since root dentine is more likely to be exposed to diagenesis. In the case of PM1, where circumpulpal primary dentine has been sampled in the present study, a portion of 13 % ± 2 % diagenetic Sr has been calculated. In agreement with previous studies,[127] it is expected that circumpulpal primary dentine is less affected by diagenesis.

The measured $n(^{87}Sr)/n(^{86}Sr)$ ratios of enamel and primary dentine of SK 4 (sign. 9026) determined by Teschler-Nicola et al.[128] and this study overlap within their uncertainties (Tab. 1). This finding supports the classification of individual SK 4 as an supposedly autochthonous individual.

Within the present study, only two out of the seven individuals from Pit V1141 were re-investigated based on the more sophisticated approach, which took the effect of diagenetic changes in dentine into account. These results, speaking generally and with a degree of caution, do not contradict the results obtained by a former pilot study of $n(^{87}Sr)/n(^{86}Sr)$ ratios, which included all seven skeletons deposited in this pit. Some scholars suggest that the remains

113 E.g. Grupe et al. 1997. – Price, Burton, Bentley 2002. – Bentley, Knipper 2005. – Maurer et al. 2012.
114 Lengfelder et al. 2019.
115 E.g. Budd et al. 2000. – Schweissing, Grupe 2003. – Price et al. 2004. – Irrgeher et al. 2012. – Knipper et al. 2012. – Teschler-Nicola, Irrgeher, Prohaska 2016.
116 Teschler-Nicola, Irrgeher, Prohaska 2016.
117 Copeland et al. 2010.
118 Blum et al. 2000. – Price, Burton, Bentley 2002. – Maurer et al. 2012.
119 Trade, exchange of animals or animal products as well as unknown nutrition habits and preferences might hamper the determination of an autochthonous signal.
120 Price, Burton, Bentley 2002. – Bentley 2006. – Lengfelder et al. 2019.
121 Knipper et al. 2012. – Lengfelder et al. 2019.
122 Teschler-Nicola, Irrgeher, Prohaska 2016.
123 Teschler-Nicola, Irrgeher, Prohaska 2016.
124 Teschler-Nicola, Irrgeher, Prohaska 2016.
125 Hillson 1996. – AlQahtani, Hector, Liversidge 2010.
126 Teschler-Nicola, Irrgeher, Prohaska 2016.
127 Bell, Boyde, Jones 1991.
128 Teschler-Nicola, Irrgeher, Prohaska 2016.

probably stem from members of a 'big family',[129] representing an 'exceptional social position', a 'dynasty', etc.[130] Nevertheless, the variability of the $n(^{87}Sr)/n(^{86}Sr)$ signals obtained by the pilot study was unexpected – four individuals showed signatures above the signal of the location (SK 1,[131] SK 5, SK 6 and SK 7),[132] two are within the range (SK 2 and SK 4), and one showed a lower value (SK 3). A detail, probably of interest for further studies, is the fact, that two of the (purported local) infants (SK 2 and SK 4) shared some similarity with the (purported local) female SK 3, whereas the other two infants (SK 6 and SK 7) shared some similarity in their $n(^{87}Sr)/n(^{86}Sr)$ signals with the female SK 5. The ratios of the latter are above the local geological fingerprint signals of the Stillfried site, implying non-local origins or a change of residence.

Another question concerned the relationship between the depositional strata and the provenance of the individuals buried in a non-standard manner in Pit V1141. Based on the precise descriptions and documentary evidence of the findings, two skeletal layers are obvious. Layer 1, the deepest layer of the skeletal remains included four individuals (SK 1, SK 4, SK 5 and SK 6). Three of them, the male (SK 1), the older female (SK 5), and the 6-year-old child (SK 6) are non-locals (allochthonous; their values lie above the geological fingerprint of the Stillfried area; probably matching the area of the Bohemian Massif[133]). The $n(^{87}Sr)/n(^{86}Sr)$ signals of SK 1 and SK 4 were confirmed by the present study. Layer 2 is an assemblage of the remains of three individuals (SK 2, SK 3, and SK 7); here, only the $n(^{87}Sr)/n(^{86}Sr)$ isotope signal of individual SK 2 is in accordance with the local signal; SK 3's signal is below and SK 7's above the local Sr isotope range. This heterogeneity, which appears not only in the individuals buried in a deviant manner in both layers of Pit V1141, is a structural condition that obviously characterizes Pit V841 in an analogous manner as well.

We will leave open the question of whether, and if so why, the finding positions of the human remains (e.g., the dominant position of SK 1 in the centre of the pit in an extended supine position, while the other six individuals share the southern pit edge), which were documented in detail and often (controversially discussed), relate to their provenance. Nonetheless, there is one peculiar feature that may attract interest. Figure 2 shows that the corpses were deposited differently; some seem to be laid down carefully (e.g., the 45-year-old female SK 5 and the 6-year-old boy SK 6), whereas one was – with high probability – rashly thrown into the cavity (the 3-year-old boy SK 2). Their $n(^{87}Sr)/n(^{86}Sr)$ isotope values show that there is no association between a particular 'ritual' and the provenance of the individuals: SK 5 and SK 6, for example, were deposited carefully and in close physical contact; both are identified as non-locals. On the other hand, the two individuals SK 1 and SK 2, characterized by their accidental position caused by a rash throwing down of the corpses, are of non-local (SK 1) and local origin (SK 2).[134]

To verify these few 'similarities' of provenance by using the geological fingerprinting and to verify the conflicting genealogical pedigree reconstructions of the seven individuals deposited in Pit V1141 of Stillfried/March, that were carried out earlier,[135] we used the mitochondrial (mt) DNA analysis[136] as a further approach to highlight the matrilineal relationship. As stated by Walther Parson et al., the (mt)DNA test did "not corroborate any of the [pedigree] models" suggested.[137] Conspicuously, two individuals, SK 5, the 45-year-old female, and SK 6, the 6-year-old boy, not only showed the same Haplogroup (H5) and the same mitotypes. They were also buried in close physical relation and show $n(^{87}Sr)/n(^{86}Sr)$ isotope values above the local range of Stillfried, implying similar provenance. This seems to confirm the hypothesis of a "female protecting her son (or a close maternal relative)".[138] All the other individuals yielded different mitotypes implying that they were maternally unrelated. However, all these approaches are limited, as they cannot decode the social-emotional ties that linked this group of people when they met the same fate.

4.2.2. Stillfried Settlement Pit V1133

The difference in the Sr fingerprint of enamel and primary dentine of the child whose calvarium was found in Pit V1133 could be the result of either diagenetic alteration, a change in nutrition or in food supply, or a change of residence from an area with a similar $n(^{87}Sr)/n(^{86}Sr)$ ratio.

129 Breitinger 1980. – Szilvássy, Kritscher, Hauser 1988, 70.
130 Eibner 1980, 132–135. – Eibner 1988, 84–86.
131 Signatures see Tab. 1.
132 The bioavailable Sr signature of the Stillfried location was identified by using recent soil samples.
133 The Austrian part of the Bohemian Massif shares the Moldanubian unit and the Moravian unit, which consists predominantly of granite, granulite, granitoids and gneiss: Friedl et al. 2004. – The $n(^{87}Sr)/n(^{86}Sr)$ ratios within this unit display values up to 0.770: Janoušek, Rogers, Bowes 1995. – Vrána, Janoušek 1999. – Janoušek et al. 2004.
134 Teschler-Nicola, Irrgeher, Prohaska 2016, Fig. 5.
135 Breitinger 1980. – Szilvássy, Kritscher, Hauser 1988.
136 Parson et al. 2018.
137 Parson et al. 2018, 150.
138 Parson et al. 2018, 150.

4.2.3. Stillfried Settlement Pit V841

SK 4 (sign. 9044) and SK 8 (sign. 9049) display similar allochthonous enamel $n(^{87}Sr)/n(^{86}Sr)$ ratios (Tab. 1) and could therefore originate from the same or a geologically similar region, probably from the area of the Bohemian Massif (similar to SK 1 from Pit V1141).

The enamel $n(^{87}Sr)/n(^{86}Sr)$ ratios of SK 10 (sign. 9051) and in particular SK 2 (sign. 9042) are different from the ratios of the other autochthonous and allochthonous individuals even though they are still within the local environmental Sr range but below the autochthonous range. This could be the result of a different source of food compared to the other individuals during childhood. Alternatively, the individual lived in another area with a similar $n(^{87}Sr)/n(^{86}Sr)$ signature to the local environmental range of Stillfried/March. Based on the autochthonous Sr range, determined in particular from residual and domesticated animals, potential drinking water sources and archaeological plants, which represents most closely the autochthonous human $n(^{87}Sr)/n(^{86}Sr)$ ratio of the hillfort site at Stillfried/March, the latter seems to be more likely. This would also classify SK 10 and SK 2 as allochthonous individuals of the hillfort site at Stillfried/March, who were nevertheless born and raised nearby.

The variation in the enamel and primary dentine $n(^{87}Sr)/n(^{86}Sr)$ ratio of SK 13 could be the result of either diagenetic alterations, a change in nutrition or a change in the source of food, as in the case of the child from Pit V1133.

4.2.4. Archaeological and Bioanthropological Interpretation of the Skeletal Depositions

All three findings (V841, V1133, V1141) were excavated on the highest and most heavily fortified area of the site, situated strikingly close to the prehistoric rampart. The human depositions were therefore most likely located in a public and/or well-controlled area. Secret criminal actions are therefore more likely to be excluded. In addition, V1141 was found in the range of the presumed former residence of the leadership (the so-called 'Kirchhügel').

Furthermore, the individuals from V1141 are of greater body height than the average[139] – a phenomenon sufficiently documented by many recent population studies and correlated with socio-economic circumstances and higher social affiliation – and presumably less often affected by inflammations than the individuals from Pits V841 and V1133.[140] These findings imply that the individuals from Pit V1141 may belong to a higher social class; but such a conclusion is weak and currently highly speculative due to the very small sample size and the inconsistent recording systems used for the documentation of the stress markers. Further, it should be mentioned that the results of the Sr isotopic analysis of this study (V841, V1133) and the previous study (V1141)[141] are not able to support such an assumption as the deposited individuals of both groups comprise an identical frequency of supposedly autochthonous (~50 %) and allochthonous individuals (~50 %).

The stratigraphy of the depositions in V841 proves diverse activities in view of settlement burials. Some patterns are observable within the individual skeletal layers: complete corpses were put down in layer 1; in layers 2 and 3 complete and incomplete bodies were deposited. With caution, due to the small number of samples, the Sr isotopic data might indicate that layer 1 of V841 is dominated by autochthonous individuals, while layers 2–4 contain at least one allochthonous individual. In order to explore differences between the various layers of V841, future studies must include the total number of human remains recovered. Four of the five skeletons of skeletal layer 3 show the bite marks of carnivores. These multi-phased events recognizable for V841 seem to run parallel to those of V1141 and reflect a different treatment of the deceased. Furthermore, the incomplete human skeletons and single human bones recovered at the Stillfried site – including single calvaria – indicate that decay of the corpses started in another location. These various ways of dealing with dead bodies are well known in Late Bronze Age central Europe (see section 1.2).

Pit V1133, for example, contained a child's calvarium, which exhibits several (deadly) fractures as a result of blunt force trauma.[142] Referring to the interpretation of similar finds from the comparable fortified site of the Late Urnfield Culture settlement 'Wasserburg Buchau' (Baden Württemberg, Germany),[143] it is possible that the Stillfried child was killed in a similar ritual act during the first phase of the rampart. At the 'Wasserburg Buchau' site the skulls or parts of skulls of five children with traces of injuries were recorded. The skulls were found in close proximity to the annular wooden fortification and interpreted as sacrifices.[144] Two individuals, identified as a boy (no. S4) and as a girl (no. IP6), died at an age of 7–8 years. These children were

139 Breitinger 1980, 61–62.

140 See sections 1.2.2 and 1.2.3.

141 Teschler-Nicola, Irrgeher, Prohaska 2016.

142 Eibner 1976. – Griebl, Hellerschmid 2013, 331–332. – Typically fractures in the area of the foramen magnum indicate that the blows hit the head while the child was in an upright position: Teschler-Nicola, Irrgeher, Prohaska 2016, 162 and footnote 2. – Hellerschmid, Griebl in prep.

143 Baumeister, Menninger, Trautmann 2009. – Trautmann, Wahl 2009. – Trautmann, Trautmann, Baumeister 2012.

144 Trautmann, Trautmann, Baumeister 2012, 33–34.

most likely related to each other and the profiles of the Sr isotopes suggest a local origin for both individuals.[145] Interestingly, local origin has also been proven for the child from Stillfried V1133.

4.2.5. Stillfried in the Context of Human Migration Studies from the Bronze Age in Europe

Previous studies of the Early Bronze Age in central and western Europe reported no or low portions of non-local individuals of up to some 20 % at the individual sites based on Sr isotopic analysis.[146] In their study, Corina Knipper et al.[147] tested the archaeological hypotheses whether the deviant burials (incl. settlement pits) of the Early Bronze Age (Únětice Culture) represented socially distinct or non-local individuals. They found no indications for higher proportions of non-local individuals among inhumations in rectangular or settlement pits.

By contrast, Sr isotope studies of Late Bronze Age (Urnfield culture, Hallstatt A1 period) skeletal populations revealed a slightly higher proportion of non-locals of almost one-third of the adults from inhumations at e.g., Neckarsulm[148] in southwestern Germany; moreover, it became apparent that local residents dominated the single graves (approx. 50 %), while only 25 % of non-locals had been buried in single graves. Interesting results were yielded by the study carried out by Claudio Cavazzuti et al.[149] on the skeletal remains of a Late Bronze Age population from Frattesina, in northern Italy, a site that was also identified as a 'central site' or 'port of trade'. The authors identified 'flows of people' there, an outcome that seems to be – carefully interpreted due to the small sample size – consistent with the results we obtained for the Stillfried settlement.

Overall, two out of the five analysed adults (incl. previous study[150]) from two settlement pits in Stillfried were classified as allochthonous individuals based on Sr isotopic information. Even though the proportion of allochthonous adult individuals may be skewed by the small sample sizes and sample selection, it shows a similar trend as the previous study from south-western Germany, where almost one-third of the adults individuals from inhumations were classified as non-local individuals.[151]

Six out of the eleven analysed subadult individuals (incl. previous study[152]) from the settlement pits in Stillfried were classified as allochthonous individuals based on Sr isotopic information. Two of these allochthonous subadults might still have been born and raised nearby (see section 4.2.3). Nonetheless, this is a fairly high proportion for subadults, who can be expected to be less mobile than adults in settled societies.[153] Therefore, these results are unexpected, and may imply either a rising/growing population or a common historical phenomenon of young foreign workers. To prove such an assumption it would be helpful to include the whole sample of subadults, focusing on the younger children (Infans I) for comparative reasons.

Overall, there is no clear indication that the inhumations in settlement pits represent a distinct group of the Late Bronze Age society at the Stillfried settlement, which is distinguished by a higher or lower percentage of allochthonous individuals. Again, in order to clarify the picture, future studies must include the total number of human remains recovered from the settlement pits as well as a representative sample of cremated remains from the Stillfried site.

4.3. Sr in Primary Dentine – Diagenetic Challenge and Potential

Apart from the identification of allochthony and supposed autochthony based on Sr isotopic signatures in human enamel, a mathematical approach has been tested in order to correct the Sr isotope ratios in human primary dentine for diagenetic alteration considering a diagenetic Sr proportion and the Sr isotopic composition of the repository material (see section 2.2.2). When using Sr mass fractions of human enamel to calculate the diagenetic proportion of primary dentine, one might argue that with residual changes the Sr mass fraction might change too. But in the approach presented here, the calculated uncertainty for Sr isotopic ratios of the biogenic human primary dentine covers small changes in the estimated biogenic Sr signatures in the Sr mass fraction of the enamel.

In the case of the five allochthonous individuals[154] from the hillfort site at Stillfried, the mathematical approach has revealed estimated biogenic $n(^{87}\mathrm{Sr})/n(^{86}\mathrm{Sr})$ ratios for the primary dentine that are significantly different from their enamel Sr signature. Except for individual SK 4 (sign. 9044) from Pit V841, the estimated biogenic $n(^{87}\mathrm{Sr})/n(^{86}\mathrm{Sr})$ ratios for the primary dentine overlap within uncertainties with

145 Stephan 2009. – Trautmann, Trautmann, Baumeister 2012, 26–27.
146 Evans, Chenery, Fitzpatrick 2006. – Kreutz 2011. – Oelze, Nehlich, Richards 2012. – Knipper et al. 2016.
147 Knipper et al. 2016.
148 Wahl, Price 2013.
149 Cavazzuti et al. 2019.
150 Teschler-Nicola, Irrgeher, Prohaska 2016.
151 Wahl, Price 2013.
152 Teschler-Nicola, Irrgeher, Prohaska 2016.
153 Knipper et al. 2016.
154 V841: SK 2/sign. 9042, SK 4/sign. 9044, SK 8/sign. 9049, SK 10/sign. 9051; V1141: SK 1/sign. 9023.

the measured (diagenetic) Sr value of the primary dentine (Fig. 14). It is noticeable that individuals SK 4 (sign. 9044) from Pit V841 and SK 1 (sign. 9023) from Pit V1141 reveal higher estimated biogenic Sr isotope ratios in the primary dentine compared to the rest of the investigated population, which do not overlap with the local environmental and autochthonous Sr range. Further, when comparing the estimated biogenic $n(^{87}\mathrm{Sr})/n(^{86}\mathrm{Sr})$ ratios of primary dentine of SK 1 in the study by Teschler-Nicola et al.[155] and this study (M1: 0.71181 ± 0.00106, PM1: 0.71161 ± 0.00031, Tab. 1), the values overlap within uncertainties, indicating no differences between the two studies.

The life span of an individual potentially preserved in its dentine, e.g., as an elemental finger print or (biogenic) Sr isotopic signature, is subject to discussion. The formation period of human dentine differs significantly from that of human enamel, for example, the incremental growth of human first premolar enamel starts formation at 2.5 years of age and continues until completion at 6.5 years of age, whereas human first premolar primary dentine continues formation at least until the apical closure of the tooth root[156] at 14.5 years of age.[157] In his textbook on oral histology Antonio Nanci has stated that once formed during adolescence and early adulthood, human primary dentine does not remodel and undergo significant metabolic or structural changes. On the downside, the odontoblasts lining the pulp chamber of human primary dentine retain the ability to produce new dentine throughout life,[158] and human secondary and tertiary dentine forms throughout our lifetime.[159] This leaves unsolved and challenging questions about structural changes in dentine during an individual's life. Further, a limited number of studies indicate potential regeneration and remodelling of dentine layers, providing information about the elemental and isotopic composition related to more recent exposure/uptake.[160]

5. Conclusion

This contribution provides new data about the possible origins of individuals from deviant burials in settlement pits of the Late Bronze Age site Stillfried/March, Lower Austria. For that purpose we calculated a local environmental Sr range from recent environmental samples, which was further narrowed down to an autochthonous Sr range using prehistoric faunal (incl. mussels) and plant remains. By means of the latter approach, we derived an isotopic signature of bioavailable Sr from dietary sources that were taken by the Late Bronze Age residents of Stillfried. Based on a careful consideration of a representative autochthonous Sr range, we identified five individuals from Pits V841 and V1141 as allochthonous individuals, while the remaining six individuals most likely represented autochthonous individuals. The sample investigated included adults (male and females) and subadults. Neither a chronological nor a layer coherency concerning the isotope signatures of the deposited individuals could be observed. This 'similar treatment' of the deceased along with an atypical burial practice corroborates the assumption that this pattern of high mobility matches the structure of the local/autochthonous population and probably reflects – based on the diversity of the individuals origin – even the structure of a 'central site' with a wide catchment area. Given the rarity of provenance studies in respect of this period which are probably biased by the specific cultural tradition of cremation burial, the outcome of this study is also of paramount relevance in the wider context of the European Late Bronze Age.

155 Teschler-Nicola, Irrgeher, Prohaska 2016.
156 Arana-Chavez, Massa 2004.
157 AlQahtani, Hector, Liversidge 2010.
158 Nanci 2013.
159 Shepherd et al. 2012. – Beaumont et al. 2015.
160 Castro et al. 2010. – Fortes et al. 2015.

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Why the Nebra Sky Disc Dates to the Early Bronze Age. An Overview of the Interdisciplinary Results

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Abstract
It is not unusual that archaeological finds come under renewed scrutiny. This is actually an important part in the progress of scientific research. All the more so when important and ground-breaking discoveries are involved, like the Nebra Sky Disc, which is listed among the UNESCO "Memory of the World". However, in most cases a new assessment is based on new data or insights. None of this is presented in a recently published article by Gebhard and Krause (2020). Instead, their argument is based on early published and unpublished material, which is used and cited selectively and ignores a substantial number of subsequent publications. Since the Nebra Sky Disc is a unique find that was not recovered during a controlled excavation, it can neither be dated by traditional typological methods nor *prima facie* by its appearance. Moreover, there is no scientific method yet available to date copper alloys exactly, so that the date suggested in the original publication was established by reconstructing the find context and by analysing the accompanying finds that are typologically and radiocarbon dated to around 1600 BC. The find location on the Mittelberg was excavated in great detail and a number of scientific analyses confirmed the testimony of the looters in a court trial that the Sky Disc had been buried there together with the accompanying finds. These analyses also disproved an earlier claim that the Sky Disc was a modern fake. This allegation is not repeated by Gebhard and Krause (2020) but they do use similar arguments for their claim that the Sky Disc was not found together with the hoard and may not even have been on the Mittelberg near Nebra. By contrast, they assert that the Sky Disc should be typologically dated to the Iron Age. It can be shown that their arguments are based on a distortion of the evidence derived both in the court trial and by scientific analyses. They combine their proposal with a superficial typological discussion of the image displayed on the Sky Disc. As this overview demonstrates, through interdisciplinary studies it is possible to determine the origin and composition of the Nebra hoard with the greatest possible certainty. This determination was based on results from sediment attachments, the chemical concentrations of gold and copper in the geological subsoil of the findspot, astronomical references, as well as an analysis of the traces left by the looters, police investigations, and a comprehensive confession by the offenders, which has confirmed the independently obtained archaeological and scientific observations.

Keywords
Nebra Sky Disc, find context, Early Bronze Age, authenticity, archaeology, archaeometry, soil pedology/geology.

Zusammenfassung – *Warum die Himmelsscheibe von Nebra in die Frühbronzezeit datiert. Überblick über die interdisziplinären Ergebnisse*
Es ist nicht ungewöhnlich, dass archäologische Funde einer erneuten Prüfung unterzogen werden; dies ist eigentlich ein wichtiger Teil im Fortschritt der wissenschaftlichen Forschung. Umso mehr gilt das,

wenn es sich um wichtige und bahnbrechende Entdeckungen handelt, wie die Himmelsscheibe von Nebra, die in das UNESCO-Weltdokumentenerbe („Memory of the World") aufgenommen wurde. In den meisten Fällen beruht eine neue Beurteilung jedoch auf neuen Daten oder Erkenntnissen. Nichts davon findet sich in einem kürzlich veröffentlichten Artikel von Gebhard und Krause (2020). Stattdessen stützt sich ihre Argumentation auf früh veröffentlichtes und unveröffentlichtes Material, das selektiv verwendet und zitiert wird und eine beträchtliche Anzahl von Folgepublikationen ignoriert. Da es sich bei der Himmelsscheibe von Nebra um einen einzigartigen Fund handelt, der nicht bei einer kontrollierten Ausgrabung geborgen wurde, kann sie weder mit traditionellen typologischen Methoden noch *prima facie* nach ihrem Aussehen datiert werden. Zudem gibt es noch keine wissenschaftliche Methode zur exakten Datierung von Kupferlegierungen, so dass die in der Originalpublikation vorgeschlagene Datierung durch die Rekonstruktion des Fundkontextes und durch die Analyse der Beifunde, die typologisch und radiokohlenstoffdatiert um 1600 v. Chr. liegen, ermittelt wurde. Der Fundort auf dem Mittelberg wurde sehr detailliert ausgegraben und eine Reihe von wissenschaftlichen Analysen bestätigten die Aussage der Raubgräber in einem Gerichtsverfahren, dass die Himmelsscheibe dort zusammen mit den Begleitfunden vergraben lag. Diese Analysen widerlegten auch eine frühere Behauptung, dass die Himmelsscheibe eine moderne Fälschung sei. Diese Behauptung wird von Gebhard und Krause (2020) zwar nicht wiederholt, aber sie verwenden ähnliche Argumente für ihre Behauptung, dass die Himmelsscheibe nicht zusammen mit dem Hort und vielleicht nicht einmal auf dem Mittelberg bei Nebra gefunden wurde. Stattdessen behaupten sie, dass die Himmelsscheibe typologisch in die Eisenzeit datiert werden sollte. Es lässt sich zeigen, dass ihre Argumente auf einer Verzerrung der sowohl im Gerichtsverfahren als auch durch wissenschaftliche Analysen gewonnenen Beweise beruhen. Sie verbinden ihren Vorschlag mit einer oberflächlichen typologischen Diskussion des auf der Himmelsscheibe dargestellten Bildes. Wie dieser Überblick zeigt, ist es durch interdisziplinäre Studien möglich, Herkunft und Zusammensetzung des Nebra-Horts mit größtmöglicher Sicherheit zu bestimmen. Diese Bestimmung basiert auf den Ergebnissen von Sedimentanhaftungen, den chemischen Konzentrationen von Gold und Kupfer im geologischen Untergrund der Fundstelle, astronomischen Referenzen sowie einer Analyse der von den Raubgräbern hinterlassenen Spuren, polizeilichen Ermittlungen und einem umfassenden Geständnis der Täter, das die unabhängig gewonnenen archäologischen und wissenschaftlichen Beobachtungen bestätigt hat.

Schlüsselbegriffe
Himmelsscheibe von Nebra, Fundkontext, Frühbronzezeit, Authentizität, Archäologie, Archäometrie, Bodenkunde/Geologie.

1. Introduction

The Nebra Sky Disc is one of the most important archaeological finds of the past century. It is widely accepted that it displays the world's earliest known concrete representation of astronomical phenomena. Its cultural significance is also reflected by its inclusion into the UNESCO "Memory of the World" register in June 2013. However, since the Sky Disc, together with a number of accompanying metal objects known as the Nebra hoard, was not recovered in a controlled archaeological excavation, doubts have occasionally been raised concerning the authenticity of the Sky Disc and if it was actually found together with the metal objects that undisputedly can be dated to the developed central European Early Bronze Age around 1600 BC.[1] These doubts were thoroughly rebutted in a judicial trial against the looters and the antiquities dealers at the Regional Court in Halle in 2005 and, after completion of the appeals procedure, in a scientific article.[2] Since then a number of further investigations have widened and consolidated the culture-historical setting of the Nebra Sky Disc.[3] Most of the results of these investigations are widely scattered in different specialist journals, conference proceedings, and books, because the ramified research comprised many different disciplines. It is not possible and was never our intention to define an endpoint of the research on the Sky Disc, but a volume including a summary of the insights gained over the last fifteen years is in preparation.

This overview was triggered by a recently published claim that it is more likely that the Sky Disc was not part of the Nebra hoard and, based on stylistic arguments, should be dated to the Iron Age.[4] It is also mentioned there that the new assessment was made "on the basis of sources that are more difficult to access" and that the "underlying sources were published only insufficiently or not at all". As it turns out, these sources are partly out of date and represent the state of the art at the beginning of the investigations of the Nebra hoard. Nevertheless, Gebhard and Krause present an interpretation of the find context and the associated

1 This began with a letter from Peter Schauer to the '*Frankfurter Allgemeine Zeitung*' on 30.11.2004, followed by Schauer 2005a, using almost identical arguments against the Mittelberg site as now. – Compare Gebhard, Krause 2020.

2 Judgement of the Regional Court Halle 2005: LG Halle 2005. – Pernicka et al. 2008.

3 Two conference volumes, nine dissertations and dozens of articles on the Sky Disc and its cultural environment have emerged from the DFG research group FOR550 alone: Meller, Bertemes 2019, 15–19 with a bibliography of the articles published since 2004 within the respective project groups of the FOR550. – See also Bertemes 2019, 21–32.

4 Gebhard, Krause 2020. – Almost identical arguments were published by the same authors in a book on alleged Middle Bronze Age gold and amber finds from Bernstorf, Freising district, Bavaria (Gebhard, Krause 2016), which strangely enough gives the Nebra Sky Disc a conspicuously wide scope. These arguments do not seem to have been given much consideration among relevant specialists. The Bernstorf finds have meanwhile been exposed as forgeries, see Pernicka 2014b and the following consistently negatively assessed reviews of Gebhard, Krause 2016: Ernée 2017. – Harding, Hughes-Brock 2017. – Jung 2017. – Pernicka, Wunderlich 2017. – Reichenberger 2017. – Weiss 2017.

Fig. 1. The Nebra hoard with the Sky Disc, two swords, two axes, one chisel and two arm spirals after restoration (Photo: J. Lipták, Munich).

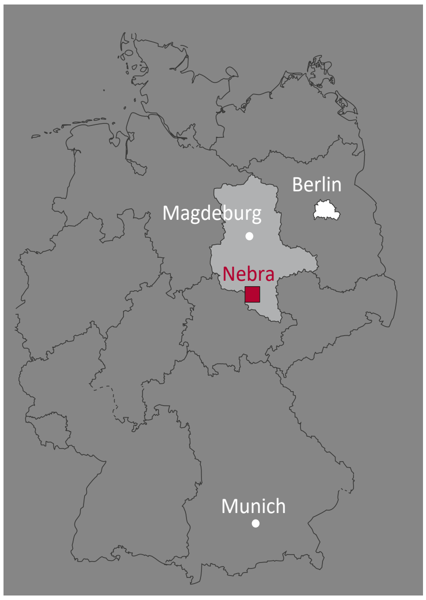

Fig. 2. Map with the Nebra site (B. Janzen, LDA).

scientific analyses which is essentially a rehash of the arguments put forward by Peter Schauer,[5] with the important difference that the Sky Disc is no longer seen as a modern forgery but as an archaeological object from a different site that may be dated to the Iron Age. Three major arguments are used for this interpretation, namely the divergent reports of the two looters who uncovered the hoard, minor differences in samples of adhering soil on three objects of the hoard including the disc, and differences in the chemical and lead isotope compositions of the objects in the hoard.

In the following, these arguments are dealt with in the same order. They resemble, as mentioned, the same arguments put forward to support an earlier allegation that the Sky Disc was a modern forgery, which were effectively refuted in a comprehensive article in the '*Archäologisches Korrespondenzblatt*'.[6] Inevitably, these results must in parts be taken up again, but new images and new arguments in the light of more than a decade of research are presented.

5 Schauer 2005a. – Schauer 2005b.

6 Pernicka et al. 2008. – Compare with the judgement of the Regional Court Halle 2005 (LG Halle 2005) and Riederer 2016, 307: "I am convinced about the authenticity of the disc and the origin of the disc in the Bronze Age because the scientific arguments presented (the type of metal, the type of patina, the technological characteristics, the results of the isotope and lead-210 analyses) have a conclusive force that cannot be refuted" (published in German, translated by the authors).

2. The Find Context of the Nebra Hoard

On 4 July 1999, two looters discovered an Early Bronze Age hoard on the Mittelberg hill near Nebra, Burgenlandkreis (Saxony-Anhalt), which consisted of two swords, two axes, one chisel, and two arm spirals as well as a bronze disc which was almost completely covered with adhering soil (Figs. 1–2, 12, 15). After the initial and improper cleaning of this disc, an image consisting of gold inlays was revealed. A few days later, the looters sold the entire find to the first dealer. Almost three years later, the Sky Disc and other objects from the hoard were recovered in a Swiss hotel and seized by the authorities. Subsequent police investigations were able to track down the missing pieces as well as localising the findspot.

The discovery of the Nebra hoard with the Sky Disc, its illegal excavation and later recovery by the authorities[7] has been described in detail several times and need not be repeated here.[8] The looters were convicted in a first court trial and gave testimony in a second trial before the Regional Court in Halle against the two antiquities dealers who last had the hoard in their possession. In the course of the interrogations, one of the looters, Mario Renner, cast doubt on

7 The disc was seized by the Basel police on 23 February 2002, i.e. some two and a half years and not four years after its discovery as suggested by Gebhard, Krause 2020, [1].

8 LG Halle 2005, esp. 6–18. – Meller 2010a, 24–31. – Schöne 2015, esp. 12–99. – Meller, Michel 2018, 24–51.

the narrative of his accomplice Henry Westphal in a book which was written by two ghostwriters.[9] He described both the place of discovery and the composition of the hoard as being made up of different finds. However, in court Renner himself described this book as a merely fictitious report in which the find situation is not authentically reported.

The facts of the case were extensively and thoroughly assessed by the 10th Criminal Chamber of the Halle Regional Court, chaired by the presiding judge, Judge Gester, who concluded: "After a comprehensive review of all the evidence, there was no doubt about the find location of the Nebra Sky Disc." In particular, the court paid close attention to the credibility of the witnesses Westphal and Renner and came to the conclusion: "…Based on the impression gained of Westphal during the hearing of 03.06.2005, which lasted several hours, the chamber had no doubt that Westphal faithfully reported the location of the hoard of Nebra." The "dubious insinuations about a possibly completely different find situation" by Renner were, however, judged by the court to be untrustworthy.[10]

It is difficult to understand why Gebhard and Krause rely on such grey literature as the booklet published by Renner as a key witness to support their own interpretation of the find context. Contrary to the conclusions reached by the court trial, they claim that the witness Westphal was influenced by "suggestive questions by archaeologists involved".[11] Based on this assumption, for which no new evidence is presented, the authors cast doubt on the credibility of this testimony. Instead, they claim that the "original traces of diggings and damage to the disk during its retrieval"[12] are contradictory. Firstly, they maintain that the shallow depth and the alleged partial storage in humus in which the disc was found should have caused differences in the corrosion of the Sky Disc. The information provided by the looters in this regard must, therefore, be incorrect.[13] The differences in the corrosion can, however, be explained by the vertical position in the ground (see section 3). Secondly, they claim that the damage to the Sky Disc was not caused by its improper recovery by the looters, but in two separate events at widely different times.[14] From this it was concluded that the Sky Disc was either initially buried somewhere else or possibly added to the Nebra hoard later.[15] This would imply that the looters found the disc as well as a set of unique Early Bronze Age swords and the other findings at different locations within a short period of time.

9 Renner [2005].

10 LG Halle 2005, 21–23 (translated by the authors).

11 Gebhard, Krause 2020, [4].

12 Gebhard, Krause 2020, [2].

13 Gebhard, Krause 2020, [4].

14 Gebhard, Krause 2020, [3–4].

15 Gebhard, Krause 2020, [17].

2.1. The Archaeological Excavation

The archaeological investigation of the looter's excavation pit took place under the local supervision of Thomas Koiki (State Office for Heritage Management and Archaeology Saxony-Anhalt in Halle, in the following: LDA) between 19 August 2002 and 25 November 2002.[16] The pit-like feature which was the remnant of the looter's activity was localised according to information provided by the looters themselves and (independently of them) by one of the dealers. It was still recognisable as a shallow depression and located directly next to a charcoal kiln at the incipient northwestern slope area about 50 m from the centre of an Iron Age enclosure on the top of the Mittelberg. The localisation of the findspot required little effort because of the charcoal kiln, a hunter's stand, and a tree mark made by the looters.

Although a final publication of the excavation report is still in preparation, a plan and two sections with accompanying information and photos have already been published several times (Fig. 3).[17] This published information should actually be sufficient for any archaeologist to understand the context of the find. The major difference in the interpretation of the find context is the thickness of the humus layer. Gebhard and Krause estimate it, based on Josef Riederer's suggestion, to have been 15 cm (Fig. 4).[18] However, the looters always spoke of a 3–5 cm-thick humus layer,[19] consistent with the situation found at the Sky Disc's findspot (Fig. 5). A thicker topsoil deposit can indeed be found a few metres away from the findspot. However, this is the result of a medieval to early modern charcoal kiln located here (Fig. 6).[20]

After the removal of the forest soil, which varied in thickness between approx. 6 and 8 cm in the immediate undisturbed surroundings, a brown to dark grey-brown, almost circular discolouration (4b) with a diameter of 90–100 cm emerged in the first subsoil level (Bv horizon) (see Fig. 3). Within this feature there was a darker, round to oval core area (4a) filled with decaying foliage, small twig fragments

16 The excavation has been published in Pernicka et al. 2008, 332–334. – Meller 2010a, 35–45. – Meller 2013, 496–499.

17 Pernicka et al. 2008, 332–334, 333 and Figs. 1–2. – Meller 2010a, 35–44, 36–37 and Figs. 4, 6. – Meller 2010b, 78–83. – Meller 2013, 496–499, 498 and Figs. 5–6.

18 Gebhard, Krause 2020, [4]. – Already stated in Gebhard, Krause 2016, 30–31. – Riederer 2016, 309.

19 This is correctly cited in Gebhard, Krause 2016, 27 and Gebhard, Krause 2020, [4] with footn. 8 referring to "Trial minutes RA Thommen" (correct: Thom-Eben).

20 Mentioned, for instance, by Pernicka et al. 2008, 332. – Meller 2010a, 43, 37 and Fig. 6a.

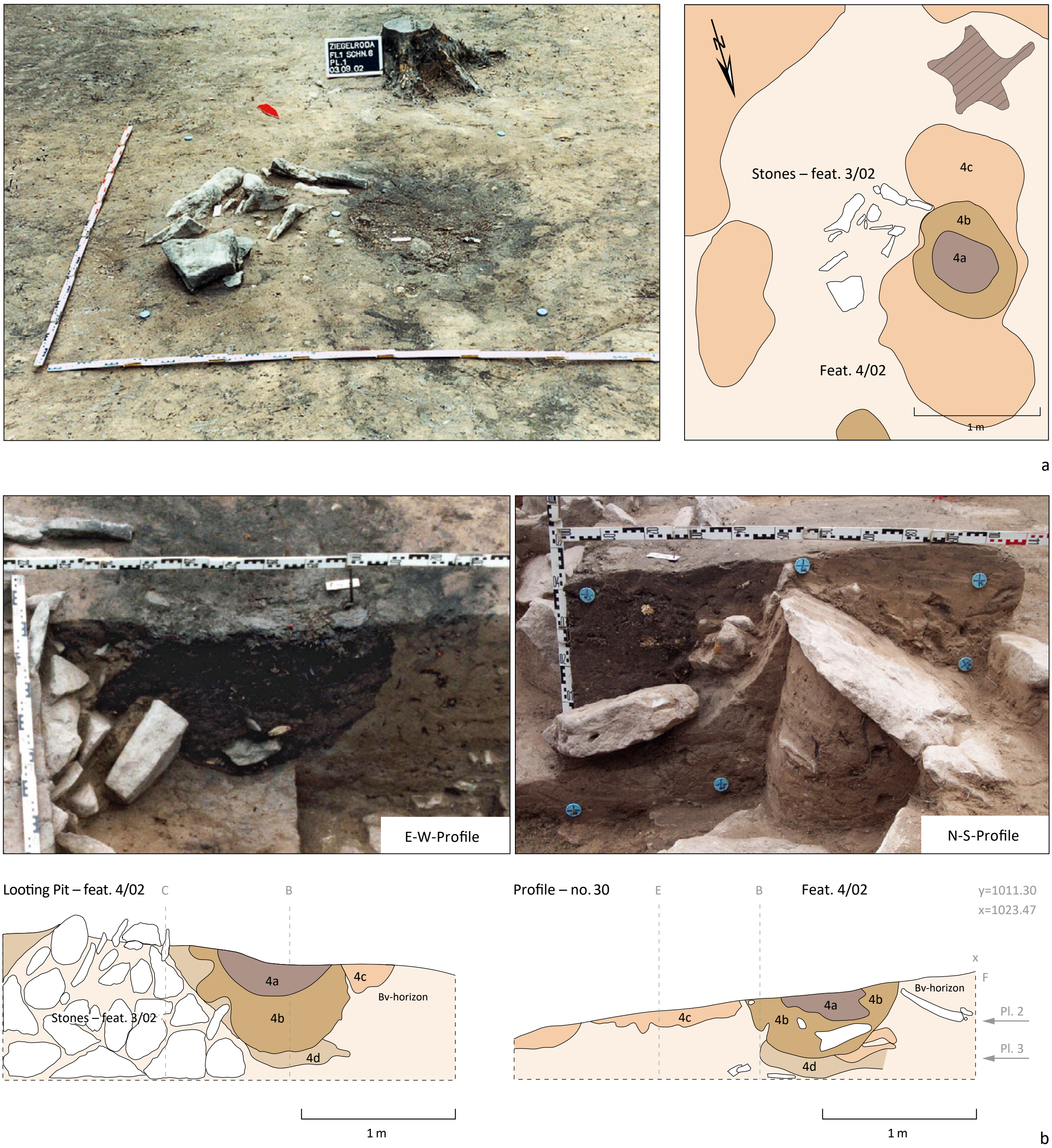

Fig. 3. Archaeological documentation of the looter's pit feature 4/02 on the Mittelberg near Nebra 2002. – a. Planum in a photo (left) and drawing (right). – b. East-west section (left) and north-south section (right) in photo and drawing. The pit-like feature consists of three layers (4a–c). The core (4a) consisted of fresh leaves, wood, and humus remains. The surrounding pit filling (4b) contained less recent organic components. In contrast to the adjacent material of the humification horizon, the area around the pit (4c) had a brown colour. Below the pit, high copper and gold concentrations could be measured in an undisturbed, banded clay layer (4d) (see Fig. 8). The stone packing east of the pit could be identified as a natural geological phenomenon (Meller 2013, 498 and Figs. 5–6).

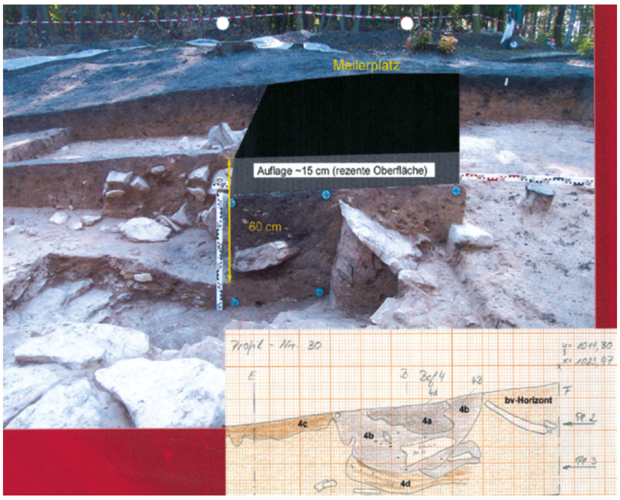

Fig. 4. On the excavation photo, which was made available to the court by the LDA, Gebhard and Krause reconstructed the topsoil structure above the looters' pit with a thickness of 15 cm (Gebhard, Krause 2020, [3] and Fig. 2c). However, the thin humus layer had already been removed when this photograph was taken. Even here it becomes visible that the schematic drawing (grey) lies entirely within the browning horizon of the section behind it. However, the thickness is augmented by the remains of a charcoal pile, which is why the black layer is actually thicker here (Gebhard, Krause 2020, [3] and Fig. 2c).

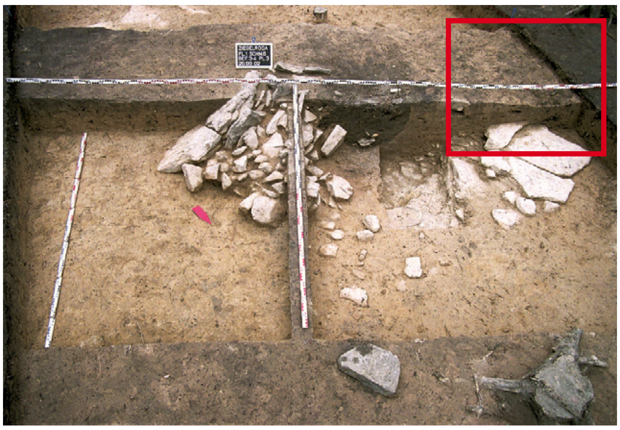

Fig. 5. The photograph shows the looters' pit with the adjacent stone packing from a different perspective. On the right edge of the photo we see the northwestern section (see plan Fig. 6), which is located opposite the charcoal pile on the southeastern section (see Fig. 4). After removal of the foliage, the humus layer (Ah horizon) measured only about 5 cm (red box) (Meller 2010a, 36 and Fig. 4, adapted by B. Janzen, LDA).

and humic sand. This core feature had dimensions of about 45 × 56 cm. In the area surrounding the actual pit, the otherwise light-brownish yellowish material of the humification subsoil horizon was discoloured to a brownish shade (4c). This irregular, shapeless feature had vague boundaries and measured about 2.50 × 0.80 m from south to north. Because it was only a few centimetres deep it was interpreted as being the result of the looter's diggings.

Immediately to the east of the findspot, stones were discovered which appeared to be tightly packed. At first this was treated as an anthropogenic feature but this interpretation had to be corrected in the course of the excavation work.[21] Later it was found that this was a natural geological feature, among other things because of its contact with the bedrock and numerous frost cracks on the stone slabs.[22]

The soil (4b) on the edge of the fill of the looter's pit was altogether less humic than the core area (4a), reaching about 30 cm deep, and also contained less foliage and fewer twigs. Moreover, the proportion of loamy sand was higher. As a result, the soil had a lighter hue and was partly mottled. Occasionally, charcoal particles were found which probably derived from the adjacent charcoal pile. The remains of leaves and twigs prove that the backfilling of the pit could not have taken place a very long time ago. The greatest depth of the feature is 60 cm below the top edge of the humus. The pit's edge is very irregular, its contour is partly bulged, partly rounded, then again polygonal with short straight sections.

During the excavation of the backfilled material from the southeastern part of the pit, the very irregular pit wall, which was interspersed with small pieces of sandstone, was carefully exposed. Some vertical, narrow, 3–8 cm-long longitudinal grooves were interpreted as possible traces of hammer blows. According to the investigations by the public prosecutor the hoard find was uncovered with a modified fire brigade pickaxe. The two most distinct impact marks were cast in plaster and thus preserved.

Directly below the looter's pit a brown to reddish-brown, weakly banded, maximally 10 cm-thick, irregular discolouration (4d) was found. The consistency of the sandy material corresponded to that of the C-subsoil horizon. The banding was probably caused by the relocation of clayey or humic material from the original prehistoric feature, which had been completely destroyed during the looter's 'excavation'. Through this the former context could be reconstructed at least indirectly.

Two soil sections were investigated, each at a distance of 15 m from the findspot of the Sky Disc (soil profile KA 142a

21 Still wrongly reported in Meller 2002, 18, but corrected in Meller 2013, 498.

22 Kainz, Klamm in prep.

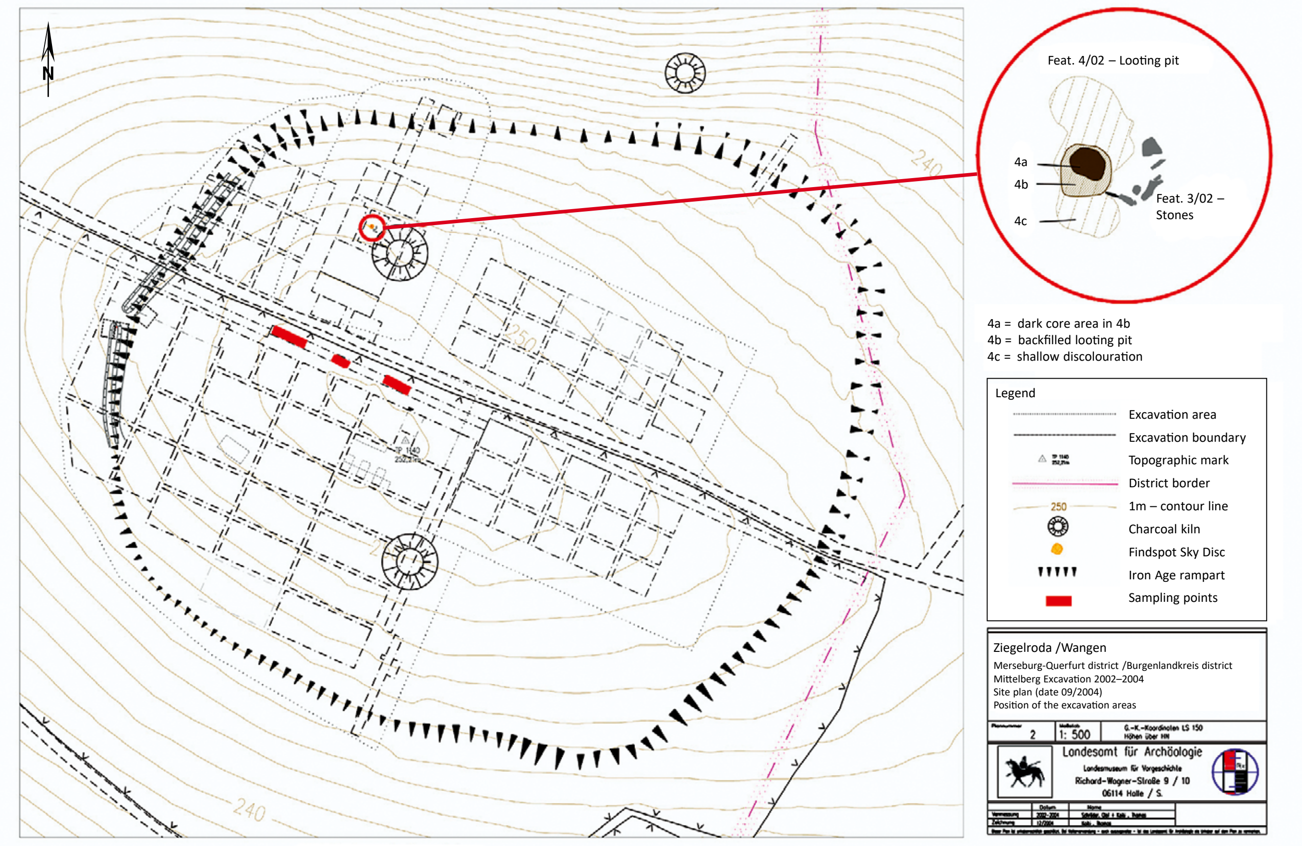

Fig. 6. The location of the looting pit within the Iron Age rampart on the Mittelberg (feature 4/02, red circle). Southeast of the feature, the remains of a medieval or early modern charcoal pile were documented. The sampling sites of reference samples for the determination of the background concentrations of copper and gold in the local sediment are marked as red rectangles south of the looting pit (Meller 2010a, 37 and Fig. 6a).

and 142b).[23] The soils are characterised by brunification and clay leaching (brown albeluvisols) and developed in layers of moderately silty to moderately loamy sand above sandstone. The clay-enriched horizons consist of sandy loam. The thickness of the layers above the bedrock varies between 45 and 65 cm. The fact that these layers are so thin is explained by early Holocene soil erosion, which is evidenced by the presence of relocated soil material in the adjacent dry valleys. However, soil erosion and soil relocation (section KA 142a) also took place after albeluvisol formation and brunification, which is the reason for the near-surface location of the Sky Disc. If the Sky Disc had been re-embedded in the course of this soil relocation, it would have been found lying horizontally.[24]

The observed thickness of the humic topsoil was 5 cm in the neighbouring anthropogenically unaffected soil section, corresponding to the find circumstances. Certainly, the pit, in which the disc was once buried, was refilled with the excavated soil, which consisted mainly of light-coloured subsoil. Except for a small fraction of humus that was added during the refilling process, the material originally surrounding the disc consisted of the light-coloured subsoil, which, according to the photos taken shortly after the discovery, adhered firmly to the disc.[25] It can also be assumed that the Sky Disc originally lay in the area of the clay leaching, the result of which was documented under the pit (feature 4d).[26] Hence, the Sky Disc was buried in a pre-existing brown albeluvisol. No traces of bleaching or leaching were observed within the topsoils and brown soil horizons. Thus, younger humic or clayey coatings could not form on the Sky Disc.

23 Kainz, Klamm in prep.

24 Its vertical position when found, but also the fact that it lay in an artificial pit, contradicts the purported secondary position postulated by Gebhard, Krause 2020.

25 See Meller 2010a, 32 and Figs. 1a, 1c.

26 Koiki 2006, 8 and Fig. 13/4d.

Subsequently, due to the slight slope and former erosive types of land use (grazing, trampling etc.), a moderate and small-area differentiated soil erosion took place. Also, the Iron Age rampart on the Mittelberg was flattened due to erosive processes.[27] It can therefore be assumed that the disc was initially buried deeper in the ground than it appeared at the time of discovery, and would therefore certainly not have come into contact with the thin 'forest humus' that was newly formed on the surface of the terrain after embedding and after later soil erosion.

In summary, the testimony of the looters, the surface quality of the Sky Disc at the time of discovery according to the photos, and the soil conditions on the Mittelberg are entirely consistent.

Fig. 7. With this fire brigade pickaxe the two looters excavated the hoard with the Sky Disc. Traces of the pickaxe could be documented at the limits of the looting pit in the course of the excavation (Large photo: J. Lipták, Munich; cf. Meller 2010b, 79).

2.2. The Authenticity of the Find Context

Finally, there can be no doubt about the exact identification of the site for a number of other reasons. The LDA's investigations also independently confirm the aforementioned statements of the looters made before the public prosecutor's office and before the court in a further series of essential points:

• A shattered mineral-water bottle of the type '*Deutscher Brunnen*' was found in the looter's pit. This bottle type had been in use since the end of the 1960s in West Germany, but its presence would be very unusual in the former GDR.[28] The appearance of such a bottle on the Mittelberg can thus hardly be expected to date before 1989. The wear and tear on the shoulder of these returnable bottles provides an indication of the length of time it was in circulation, namely about a year, as criminological investigations have shown. It was therefore most likely deposited not before 1990, but later. The looters confirmed in court – without knowing that a water bottle had been found during the re-excavation by the LDA Halle – that they had smashed such a bottle and thrown the fragments into the pit.

• Imprints of the tool used by the looters were identified in the section of the pit.[29] The tool in question was a fire brigade pickaxe (Fig. 7),[30] which was presented to the court in Halle and also confirmed by the testimony of the looters, who admitted that they had used it to excavate the hoard, and in doing so damaged the Sky Disc.

• The analysis of the soil from the looter's pit showed a significant enrichment with copper and gold (Fig. 8).[31] The most revealing aspect is the fact that the highest concentration of copper (138 µg/g) and a high concentration of gold (19 ng/g) was found in the undisturbed soil below the pit (feature 4d). This can only be explained by the partial dissolution of copper and gold during corrosion, which was subsequently absorbed in the undisturbed subsoil below. This eliminates the possibility that the pit's fill was contaminated with gold by the looters during their activity. Furthermore, this finding shows that a considerable amount of copper and gold had been buried in the pit for a long period of time. Of course, this time span cannot be quantified, but it is consistent with the fact that a large surface area of copper and gold is present in the Nebra hoard, particularly on the Sky Disc. Only a few finds are known from central Germany for the entire Bronze Age in which gold and bronze objects are combined. Moreover, the gold finds in such cases are often only small *Noppenringe* (lock rings), the surface of which is too small to leave significant traces in the ground.[32]

3. Original Position, Corrosion and Damage to the Sky Disc

The exact position of the Sky Disc within the Nebra hoard can no longer be determined. However, there are two clues: on the one hand, the statements by the looter Westphal (see

27 Meller 2010b, 82–83.
28 Pernicka et al. 2008, 334. – Meller 2010a, 38. – Meller 2010b, 78–79.
29 Cf. Pernicka et al. 2008, 333 and Fig. 2 (with the pertinent section photo).
30 Meller 2010a, 36 and Fig. 5b; 38. – Meller 2010b, 79.
31 Pernicka et al. 2008, 342, 345 and Figs. 14–15; 346 and Fig. 16. – Gebhard, Krause 2016, 36–37 wrongly claim, however, that this is not transparent from the publication.
32 Meller 2014, 623–628.

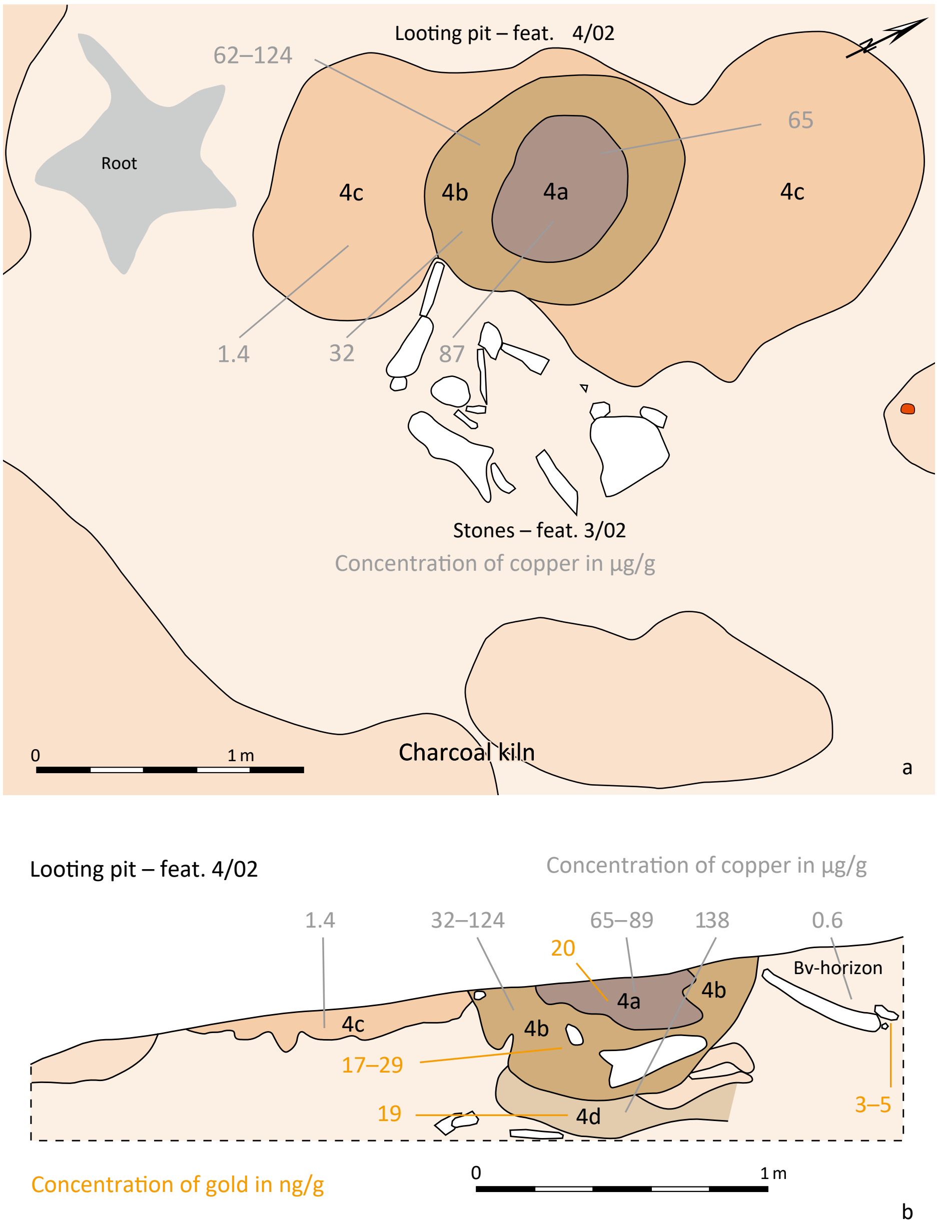

Fig. 8. Plan (a) and section (b) of the looters' pit (feature 4/02) on the Mittelberg (see Fig. 3) with indications of the measured copper and gold concentrations in the sediment (orange numbers in ng/g and grey numbers in µg/g; see Pernicka et al. 2008, 345 and Fig. 14). – The background values for copper are less than 11 µg/g and those for gold are less than 10 ng/g. All samples from the pit (layers 4a and 4b) show enhanced copper concentrations by two orders of magnitude and simultaneously elevated gold concentrations. These indicate that copper and gold must have been deposited here for a long time. The highest copper concentration comes from the undisturbed layer 4d below the find and suggests a leaching of the metals which has accumulated here in the clay-rich sediment (Pernicka et al. 2008, 345 and Fig. 14).

above); on the other hand, the corrosion of and damage to the object itself. On 26 August 2003 Westphal and Renner, in the presence of their respective lawyers, gave a statement that they discovered the disc 3–5 cm below the surface. Both declared that the area with the missing horizon arc had been lying uppermost. On 11 May 2005 Westphal prepared a sketch of the find situation (Fig. 9) in the presence of his lawyer and the second looter Renner, according to which the disc stood vertically in the ground, the boat at the lower edge, and the Pleiades at the top.[33] On 29 May 2005 Westphal reconstructed the find situation on the Mittelberg with

33 Meller 2013, 495–496.

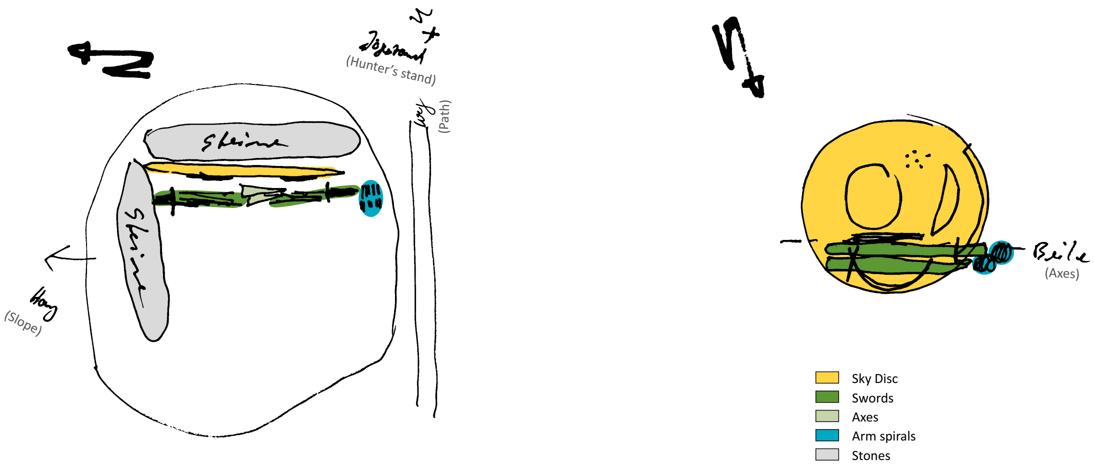

Fig. 9. Already in 2005 the looter, H. Westphal, drew these sketches of the find situation of the Sky Disc hoard. To aid understanding the artefacts have been coloured and transcriptions of the handwriting provided. According to this, the disc stood upright with the ship at the bottom (Meller 2010a, 35 and Fig. 2).

copies[34] again deviating slightly in relation to the position of the disc, turned clockwise (Fig. 10). These differences manifest the looter's doubts about the exact orientation angle of the disc, but not about its vertical position.

A second line of argument is based on clearly visible damage, as is also argued by Gebhard and Krause.[35] However, the authors postulate that the damage to the Sky Disc was caused by two different events that occurred at different times. While they attribute the scratches on the left side of the obverse of the Sky Disc to the looting, they speculate that the impacts and deflections on the edge of the Sky Disc are due to an earlier event. The authors claim that the Sky Disc was mechanically damaged once before, at an unspecified time between its deposition and the looting in 1999. Thus, the disc would have been removed from its original burial context and, in an unspecified process, was incorporated into a new context with the accompanying finds.[36]

The authors argue with images taken after the recovery,[37] in which they claim to have recognised that the damage on the edge was still covered by adhering soil. Gebhard and Krause also suggest that the original position of the Sky Disc during burial can be reconstructed from the type of corrosion, namely that "...in humus and partly in completely different soil, […] corresponding differences in the patina should be apparent. […] the evenly thick encrustation of the disk indicates its original location in a uniform soil layer".[38] However, the corrosion on the Sky Disc is not "evenly" thick, as pitting corrosion has been observed only on one half of the disc (Fig. 11). The corrosion of metals is a complex electrochemical process affected by many, partly self-reinforcing parameters.[39] While under redox reactions in moist soil environments, anodic and cathodic reaction zones spontaneously form on the surface of a metal object (contact corrosion), the anodic zones, where, for example, pitting corrosion occurs, are predominantly formed on the side with less oxygen.[40] Consequently, as the pitting corrosion observed in the radiography of the Nebra Sky Disc formed in the area where the half moon is located (see Fig. 11), it is likely that this was the lower, oxygen-poor part in a vertical placement of the disc in the soil over a long period of time.

The notches on the disc's edge, and the scratches and tracks on its obverse side only appear in the zone above the half moon, indicating that this half was excavated first while the rest of the disc was still standing vertically in the soil. This position would also explain the abrasion clearly observable on the edge next to the missing horizon

34 Meller 2013, 495–496 and Fig. 22.
35 Gebhard, Krause 2020, [2–4].
36 Gebhard, Krause 2020, [17].
37 Gebhard, Krause 2020, [2] and Fig. 1c; [16] and Fig. 9.
38 Gebhard, Krause 2020, [4].
39 Without claiming to be comprehensive, the following factors shall be mentioned here: the way the metal was worked and used (keyword: 'stress corrosion'), conductive connection with more noble or less noble metals (keyword: 'sacrificial anode', 'contact corrosion'), local changes in soil chemistry, alloy composition, chemical and mechanical surface treatment (patination, polishing), and many more.
40 Evans 1926.

Fig. 10. – a. The looter Henry Westphal re-enacted the find situation on the Mittelberg with replicas in 2005. – b. He arranged the Sky Disc essentially in the same way as he did in the sketch (see Fig. 9). It is turned slightly clockwise (© LDA Halle, photos: J. Lipták, Munich).

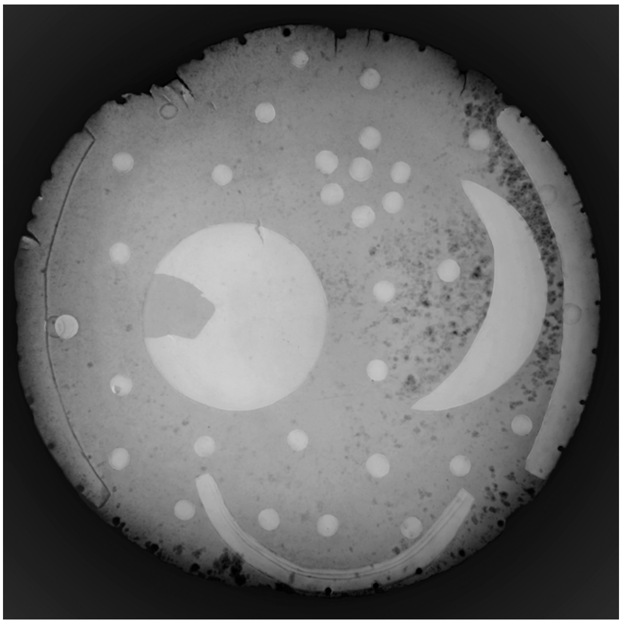

Fig. 11. Radiography of the Nebra Sky Disc. The dark spots, visibly concentrated on the right side, are caused by pitting due to heavy corrosion. The disc is therefore not, as Gebhard and Krause claim, "evenly" corroded (analogue image on X-ray film, mounted from two images, LDA, H. Breuer, 2003; detail already in Meller 2010a, 46 and Fig. 14b and Meller 2011, 167).

arc (Fig. 12). The detailed study of the differential corrosion, surface abrasion, and damage by the looters forms part of the publication of the Nebra hoard which is in preparation. In any case, the exact rotation angle of the disc does not abnegate its vertical position in the soil nor its dating. In summary, there remains some uncertainty on the exact rotation position of the disc in the ground.

With regard to the direction of the impact of the pickaxe used by the looters,[41] Gebhard and Krause erroneously assume that all blows came from above or from the edge of the disc towards the centre, which is not the case. Rather, the blows came from at least two directions, as shown in Figure 12.

Two types of damage can be recognised: First, the peen of the pickaxe strikes the edge and the obverse of the disc, coming from the upper right, and the peen cuts the metal with notches being formed. As a result of the violent blows, sections of the rim are bent backwards in two places. The vertical orientation described by the looter is consistent with this type of damage. The impacts and scratches have left visible marks in the adhering soil which prove that the damage to the rim is also modern (Fig. 12, blue arrows). Figure 13 shows that the notches, such as those found on the upper edge of the disc, are freshly incised, with the incisions appearing almost like bare metal. If they were of older origin, they should have corroded in the ground.

Due to the impacts, the rim of the disc was bent backwards. During this process, adhering soil also flaked off locally on the obverse, which is visible even in the blurred pictures that Gebhard and Krause have published. However, since the bending of the bronze results in an increase in surface area on the convex side, the soil does not necessarily have to flake off from the entire deformed surface (Fig. 14).

The soil adhering to the concave side of the damaged rim, on the other hand, had to flake off, as shown in Figure 15. The illustration dates from spring 2002, when the find was still at the State Office of Criminal Investigation in Magdeburg and no restoration had taken place.

41 Gebhard, Krause 2020, [2] and Fig. 1b.

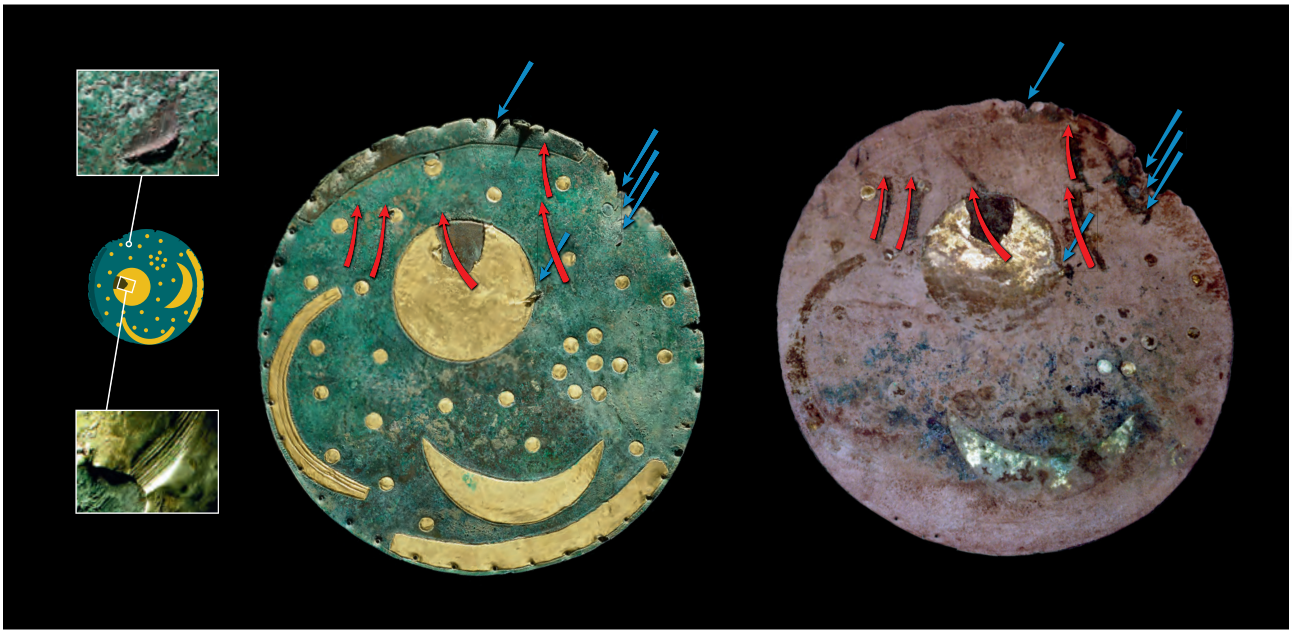

Fig. 12. The traces of the damage on the restored Sky Disc (left side) and the unrestored Sky Disc (right side; from a time when it was still on the illegal antiquities market, showing the same damage [Meller 2010a, 44 and Fig. 12, cropped]) with the respective directional indications and the corresponding characteristic traces. Two types of damage can be recognised: 1. The peen of the pickaxe strikes the edge and the disc's surface, coming from the upper right, and the peen cuts the metal with notches being formed. As a result of the violent blows, sections of the rim are bent backwards in two places (blue arrows). 2. The peen hits the disc surface almost perpendicularly to the former blow. The peen then scrapes across the surface, creating wide profiled tracks and part of the gold sheet is torn off and pleated (red arrows). The pulling direction is from bottom to top. This also damaged the star situated next to the sun (Illustration: C.-H. Wunderlich, adapted by B. Janzen, LDA).

Fig. 13. Recent impact mark on the upper edge of the disc. The green patina that had formed during burial in the soil was broken, exposing the metallic bronze core (Photo: LDA, adapted by B. Janzen, LDA).

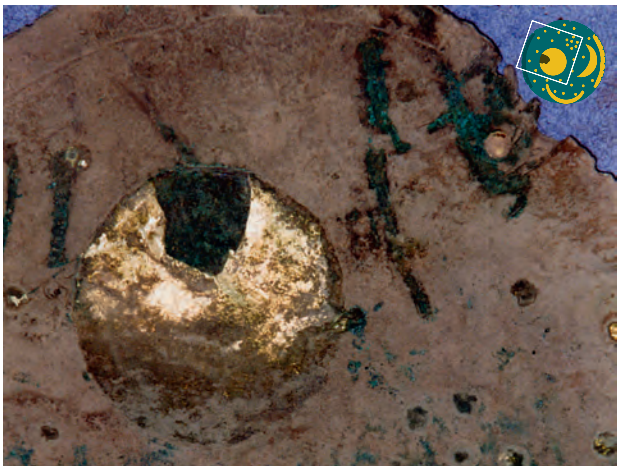

Fig. 14. Image taken by the first dealer. It can clearly be seen that parts of the soil adhesions (e.g. on the right above the star) have flaked off in the area of the damaged edge. These therefore are fresh traces which occurred during the looting (detail from Meller 2010a, 44 and Fig. 12).

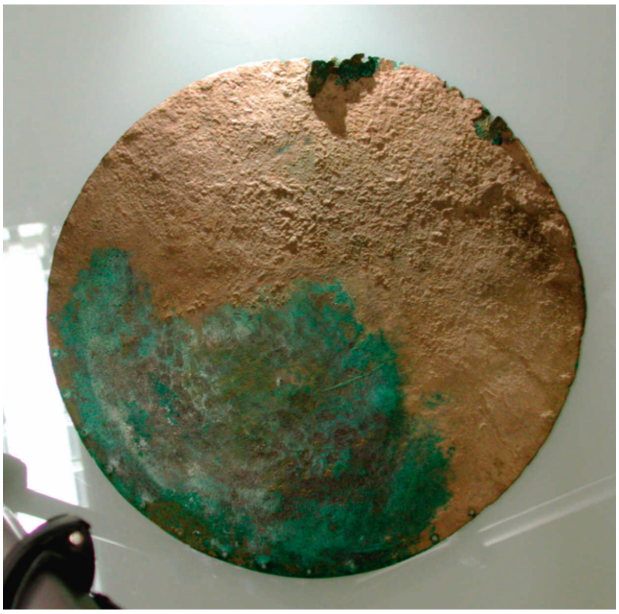

Fig. 15. The reverse of the Sky Disc, image from March 2002 at the State Office of Criminal Investigation in Magdeburg. It is clearly visible that the adhering soil has flaked off at two locations on the upper rim of the disc as a result of impacts with the pickaxe and the resulting bending of the metal. It is obvious that these marks are not ancient. As a result, the assertion by Gebhard and Krause that these traces derive from an earlier relocation of the object can be discarded (Photo: LKA Magdeburg).

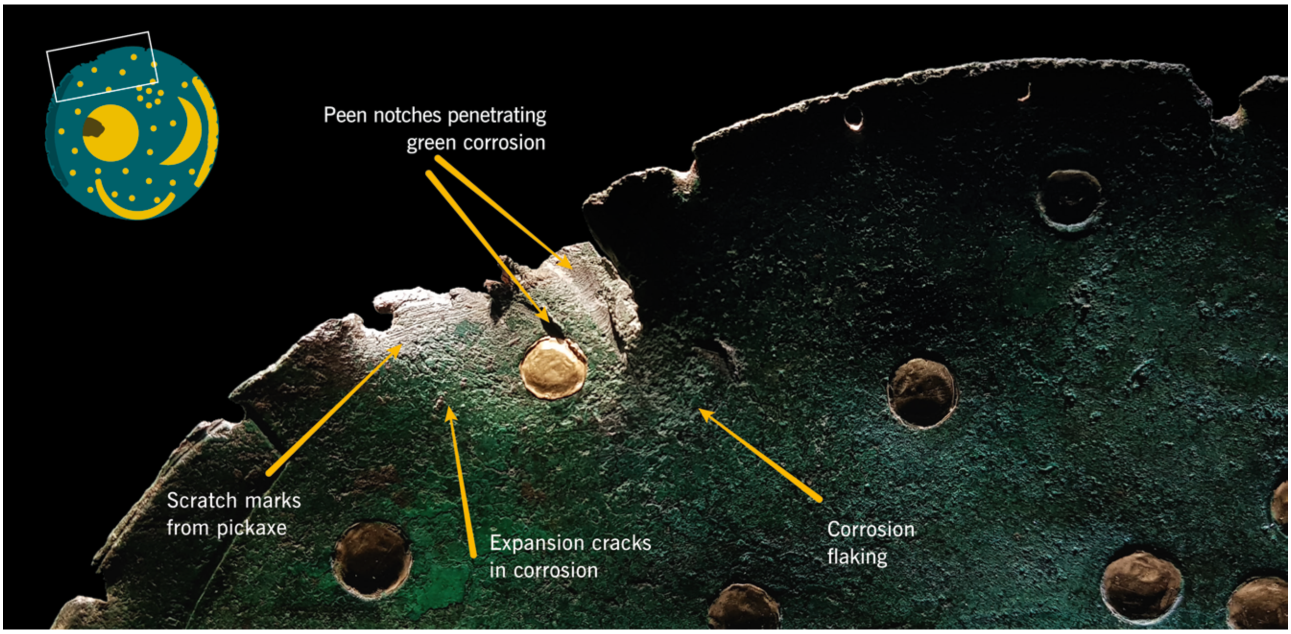

Fig. 16. Upper part of the rim of the Sky Disc, deformed by axe blows with cracks in the corrosion layer and local flaking. The notches of the impacts are also clearly visible. This damage was clearly caused during or shortly after the unearthing and cannot be of older origin (Photo: C.-H. Wunderlich, LDA, adapted by B. Janzen, LDA).

Evidence of bending can also be found in the malachite corrosion. On the obverse, the corrosion layer shows a fine fracture pattern in the form of parallel cracks. This is caused by the surface enlargement on the convex obverse of the warped metal (Fig. 16).

On the reverse the corrosion was compressed, resulting in lighter, thin flakes that are characterised by a lighter appearance (Fig. 17, corresponding to the zones where the soil is flaking in Fig. 15).

Such fine traces, if they had occurred earlier in the ground, would have been overprinted by subsequent corrosion. The theory of Gebhard and Krause that the bending and damage on the rim occurred before the Sky Disc was discovered can therefore be disregarded.

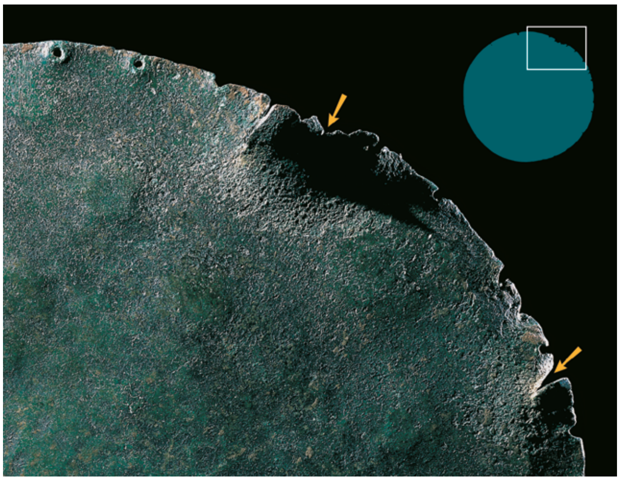

Fig. 17. Reverse of the Sky Disc. Flaking of adhering soil and worn, bright corrosion due to compression of the surface as a result of the axe blows. These traces were clearly induced during or after the looting. These areas also correspond to the areas where adhering soil was removed (see Fig. 15) (Photo: J. Lipták, Munich, adapted by B. Janzen, LDA).

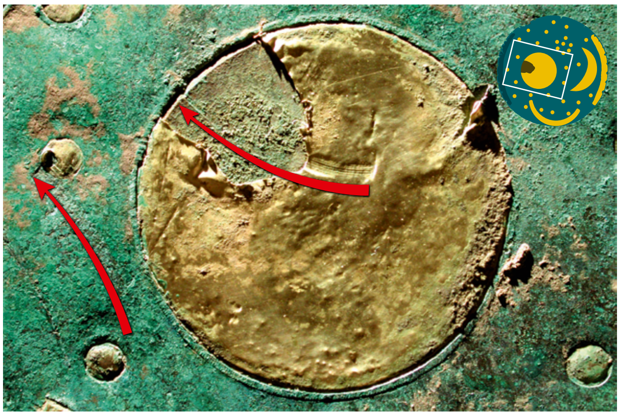

Fig. 18. Photo taken on 27 February 2002 at the State Office of Criminal Investigation in Magdeburg. The arrows mark the course of the scraping movement after the impact of the peen. In the process the firmly adhering soil residue was stripped down to the green corrosion layer. Upper arrow: after the impact (of which the notch above the arrow is the beginning) the peen moved across the gold sheet, leaving the profiled mark. A piece of the gold sheet was torn off, the peen continues to move across the corroded bronze underneath and comes to rest at the groove at the edge of the sun. Lower arrow: The peen passes over the patinated bronze disc, moves across the star, where it leaves a profiled mark, similar to that on the gold disc. Part of the golden star is torn off and pleated at the edge, where the peen comes to a halt (Illustration: C.-H. Wunderlich, LDA, adapted by B. Janzen, LDA).

Second, the peen strikes the disc surface almost vertically and then scrapes upwards across the surface, creating wide profiled tracks, and part of the gold sheet is torn off and pleated. The damage to the star situated next to the sun is caused in a similar way (Fig. 18). During the scraping movements with the peen of the pickaxe, the firmly adhering soil residues were stripped right down to the green corrosion layer (Fig. 12, red arrows). Again, the damage fits with the looter's descriptions.

In sum, a certain variance in the orientation of the disc in the ground is conceivable. This possibility was never denied. On the contrary, from the marks alone, variants of the rotation angle come into consideration. It is essential, however, that at the time of damage the disc must have been standing vertically, a fact that Gebhard and Krause do not dispute. The decisive factor is that the damage was demonstrably caused recently by hitting and pulling with a pickaxe-like tool, in agreement with the judicial reconstruction of the looting process.

4. Do the Objects of the Nebra Hoard Belong Together?

Besides the reconstruction of the burial conditions, another topic of the critical discussion by Gebhard and Krause is the question of whether all recovered finds belong and were buried together. This is indeed a crucial question because the only way to archaeologically date the Sky Disc more closely is by the accompanying finds. Two lines of investigation were followed from the beginning of the study of the Nebra hoard, namely the comparison of the adhering soil on the objects with the soil at the findspot and the chemical compositions of all artefacts (see below). Both approaches have now been questioned by the two authors, again based on outdated material, misleading interpretations, and selective citation of published evidence.

4.1. Soil Samples

When analysing sediment samples, natural variations are an inherent analytical feature and must be taken into account. The primary sedimentary bedrock succession on the hilltop at the Mittelberg (i.e. the Middle Bunter Sandstone Formation[42]) as well as the overlying autochthonous regolith with traces of aeolian loess, and the overlying soil are no exception to this fundamental rule. The bedrock consists of fluviatile sandstone and mudstone with very minor carbonate content, deposited in rivers and creeks, and contains siliciclastic detrital material with both vertically and laterally variable compositions on a m-, dm-, and cm-scale. The natural succession has been disturbed three times, i.e. during the deposition of the Nebra hoard, during the unearthing

42 Klatt, Stelter 2019.

by the looters, and finally by the archaeological excavation. None of these three disturbances has homogenised the excavated and infilled material and thus minor variations in the mineralogical parageneses and particle size distributions are common and to be expected. It is important to check if samples from a geological location, and from artefact samples to be compared with the former, consist of sediment-petrologically and mineralogically consistent, logical, and plausible parageneses. Only significant deviations from a specific paragenesis would then allow doubts as to the similarity of such samples and could indicate an origin from a spatially and geologically completely different location.

An initial forensic investigation of the adhering soil on the Sky Disc was ordered by the public prosecutor's office in Halle (Saale) in June 2003. A soil sample from the suspected find location of the Sky Disc and a sample from the adhering soil on the disc (see Fig. 12, right side, and Fig. 15) were sent to the Brandenburg State Office of Criminal Investigation. The public prosecutor's office pursued the aim of finding evidence that the Sky Disc was originally buried on the Mittelberg near Nebra, or, if not, of finding evidence of another possible location.

Subsequently and not in immediate conjunction with the initial proceedings, the LDA handed over two further soil samples, which were taken from one of the two swords and one of the two axes (Fig. 19). In addition, six samples from other locations with a similar geological setting were analysed for comparison (Tab. 1) to test how site-specific the similarities between the adhering sediment and the sediment from the Mittelberg were. These samples were obtained from previous forensic investigations in connection with other crimes and thus fulfil the criterion of random sampling of alternative locations.

The methodology used in the investigations and the results have been published in detail.[43] The most important conclusions are summarised in Table 2. The physical, chemical, and mineralogical investigations revealed almost complete qualitative and extensive quantitative matches between the soil samples VM 1 (soil sample from a depth of approx. 30–40 cm from the presumed location of the Sky Disc), and Sp 1 (adhesions taken from the Sky Disc), and Sp 2 (adhesions taken from Sword II). The additional

Fig. 19. The other bronze objects of the Nebra hoard were also covered with sediment, as this photo, taken shortly after the recovery, shows. Smaller pieces of adhering sediment have fallen off and collected on the greenish fabric on which the objects were presented. Like the Sky Disc, Sword II also produced extensive agreement with the Mittelberg soil sample, see Adam 2019 (Meller 2010a, 33 and Fig. 1c).

comparison with data from soils which originate from areas that are geologically similar to the find location of VM 1 did not reveal any indications of any possible origin of Sp 1 and Sp 2 other than the Mittelberg near Nebra. All in all, the origin of both the adhering soil on the Sky Disc (Sp 1) and that on the sword (Sp 2) being their presumed location (sampling point of VM 1) is considered as highly probable. However, a statement of certainty is difficult with only one soil sample. For this a detailed investigation of the soil conditions on the Mittelberg near Nebra using a much larger number of reference samples would be required.[44]

A somewhat different statement can be made concerning the soil residues on the axe (Sp 3). A large part of the determined properties and characteristics also indicate an origin

43 Adam 2019. – At this point it should be emphasised that the method of forensic soil analysis developed by Adam manages with surprisingly small sample quantities, has long been recognised in criminology and has been applied in a large number of criminal cases: Adam 1984. For example, a forensic soil analysis provided a key indication in a murder trial that ended with a life sentence: Hellmann et al. 2012, 157. – On methodology, see also Murray, Tedrow 1992. – Demmelmeyer, Adam 1995 (with numerous further references).

44 This was not part of the mandate for the judicial investigations.

Sample designation	Description
VM 1	Air-dried soil sample, taken from approx. 30–40 cm depth at the presumed location of the Sky Disc on the Mittelberg, Nebra district, packed in a plastic box, labelled "Mittelberg 4c – 30–40 cm u. HOK". The net weight was 70 g.
Sp 1	Dry, sandy residues, isolated from the Sky Disc with a net weight of 0.113 g, packed in a small plastic vial.
Sp 2	Dry soil isolated from a bronze sword, packed in a small plastic box, labelled "Sword II from tip". The net weight was 0.217 g.
Sp 3	Dry soil isolated from a bronze axe, packed in a small plastic box, labelled "Axe HK 2002:1649 C, adhering dirt in the area of the cutting edge". The net weight was 0.049 g.
VM S-29	Forested area between Jena and Eisenberg, c. 1 km south of Hainspitz (Thuringia), bedrock Middle Bunter Sandstone Formation.
VM S-45	Suhl (Thuringia), c. 1 km south of the railway station, bedrock Lower Bunter Sandstone Formation.
VM S-47/1	C. 5 km northeast of Hettstedt (Saxony-Anhalt) in the area of the Wipper River, bedrock Lower and Middle Bunter Sandstone Formation.
VM S-47/2	Collected at a distance of c. 10 m from VM S-47/1.
VM S-58A	Northern bank of lake Süßer See at the inlet of the Böse Sieben River east of Eisleben (Saxony-Anhalt), bedrock Lower Bunter Sandstone Formation with loess.
VM S-58B	Collected at a distance of c. 100 m from VM S-58A.

Tab. 1. Samples examined by J. Adam for the court report.

Feature	Number of features	Number of matches		
Sample designation	VM 1	Sp l	Sp 2	Sp 3
Sample description	find location of the Sky Disc	Sky Disc	Sword II	axe
1. General characteristics	5	5	4	5
2. Chemical composition	7	4	4	4
3. Grain size	1	1	0	0
4. Sand fraction	31	30	29	24
5. Silt fraction	81	79	76	68
Total	125	119	113	101
Agreement in percent	100	95	90	81

Tab. 2. Characteristics and agreement of the investigated sediment samples from the site and objects found.

from the Mittelberg,[45] but in comparison to VM 1, Sp 1, and Sp 2 some deviations, like the finer grain size, absence of phyllite, lower proportions of phytholites, increased contents of garnet and anatase can be determined, which may only partly be explained by the small quantity of the test material (0.049 g). The agreement would be even greater if the presence of malachite in the samples from the artefacts were ignored, because this difference is readily explained by the inclusion of corrosion material.

This means that no differences were observed between the sediments on the Sky Disc and the sword – the key evidence for the unity of the hoard – even if the sediments on the axe slightly deviated. Overall, it was established that all three sediment samples (VM 1, Sp 1, and Sp 2) were consistent with a provenance from the Mittelberg. The same possibly applies to Sp 3.

Gebhard's and Krause's assertions that "Neither the analyses of the remaining soil adhesions nor the geochemical analyses of the metals (copper, gold) support a possible coherence of the finds",[46] and elsewhere, "What is indeed remarkable thereby is that the assessment by J. Adam, which is also central to the argumentation, already determined that

45 Adam 2019, esp. 91.

46 Gebhard, Krause 2020, [17].

in one case an object was not affiliated with the finds",[47] are therefore untenable. Rather, the opposite is true.

It may be noted that the 10th Criminal Chamber of the Regional Court of Halle did not consider "the results of the soil experts Dr. Adam and Prof. Dr. Riederer […] for the determination of the verdict, because they neither absolutely confirm the location claimed by the finders nor make it appear doubtful".[48] Nevertheless, this cannot be seen as evidence to the contrary.

The clay fractions (< 2 µm) of sediment adherences from the surfaces of all artefacts from the Nebra Sky Disc hoard and the clay fraction of one comparative sample of the sediment from Mittelberg, near Nebra, were additionally characterised mineralogically by X-ray diffraction (XRD) analyses. In total, more than twenty samples were investigated by XRD analyses. These include four samples, analysed for an expert report to the court by Borg in 2005.[49] Following the critical comments by Gebhard and Krause,[50] these early XRD analyses were complemented in 2017,[51] when the clay fraction of sediment attachments of all artefacts of the Nebra hoard find were additionally analysed by XRD. It should go without saying, but needs to be clarified here, that XRD analyses are not suitable for determining 'soil types' and were never intended as such, as implied by Gebhard and Krause.[52]

The XRD analysis of the clay fraction offers an additional method for determining or estimating the plausibility of the provenance of sediment samples. The method also allows one to check for minerals in the sediment adherences of the artefacts that would conflict with a presumed provenance, i.e. if certain minerals would fit only a specific and especially geologically and mineralogically different bedrock.

The mineral parageneses of the clay fraction of the clastic sediment adherences of the artefacts and of the sediment sample from Mittelberg are largely identical or are logically related to each other in a geological or weathering context. The identified minerals, such as quartz, different feldspars, mica, illite, kaolinite as well as some traces of ankerite and metal hydroxides all represent typical primary minerals or weathering products of felsic siliciclastic bedrocks and possibly some relicts of aeolian loess, as can be expected on top of the Mittelberg. It is important to note that these determined mineral parageneses are typical for the underlying sandstone-mudstone bedrocks and – on their own – do not allow a precise determination of a certain provenance. However, the determined mineral parageneses from the artefacts generally match the mineral paragenesis from the top of the Mittelberg. Furthermore, there are no paragenetic or mineralogical indications that the sediment adherences from the artefacts would originate from another location, situated on a significantly different type of weathered bedrock, such as crystalline, metamorphic, volcanic, or carbonate rocks.

47 Gebhard, Krause 2020, [5], similar also [17].
48 LG Halle 2005, 33.
49 Borg 2005.
50 Gebhard, Krause 2016, 32–37.
51 Borg, Pöllmann, Stöber in prep.
52 Gebhard, Krause 2016, 32–37. – Riederer 2016, 312–317.

4.2. Metal Samples

From the beginning it was decided to address the question of the affiliation of the objects of the Nebra hoard not only by studying the adhering soil but also by determining their chemical compositions. This was accomplished early on, and the results were included in an unpublished diploma thesis at the Freiberg University of Mining and Technology,[53] temporarily available on the Internet, which is cited by Gebhard and Krause. Accordingly, all metal artefacts of the Nebra hoard, including the Sky Disc, had a similar chemical composition. They all consist of tin bronze with only copper and tin as major components and similar trace element patterns. This information was already submitted during the court trial and was published in the form of diagrams of the concentrations of silver, gold, nickel, arsenic, and antimony.[54] It was concluded that the copper of all parts of the hoard originates from the same deposit, but the artefacts are not so similar that they could all have been produced in a single casting process. The trace element pattern is also consistent with Early Bronze Age rib ingots,[55] and this type of copper was found in a large number of objects that are mainly distributed on the northern foothills of the eastern Alps but extending as far as the Carpathian Basin and southern Scandinavia.[56] For decades it has also been related to the long-known Bronze Age copper mine of Mitterberg in Salzburg, Austria.[57] Subsequently it was shown that the trace element pattern of the Nebra hoard does indeed match the copper ores from Mitterberg very well[58] and this is here demonstrated again in Figure 20. In addition, Manuela Frotzscher was able to show in an extensive study of European copper ores that other deposits could be excluded as suppliers for the copper of the Nebra Sky Disc.[59]

53 Nickel 2003.
54 Pernicka et al. 2008, 336 and Fig. 4. – Pernicka 2010, 724 and Fig. 4.
55 Pernicka 2010, 726.
56 Pernicka 2010, 725 and Fig. 5.
57 Pittioni 1957.
58 Pernicka, Lutz, Stöllner 2016.
59 Frotzscher 2009. – Frotzscher 2012.

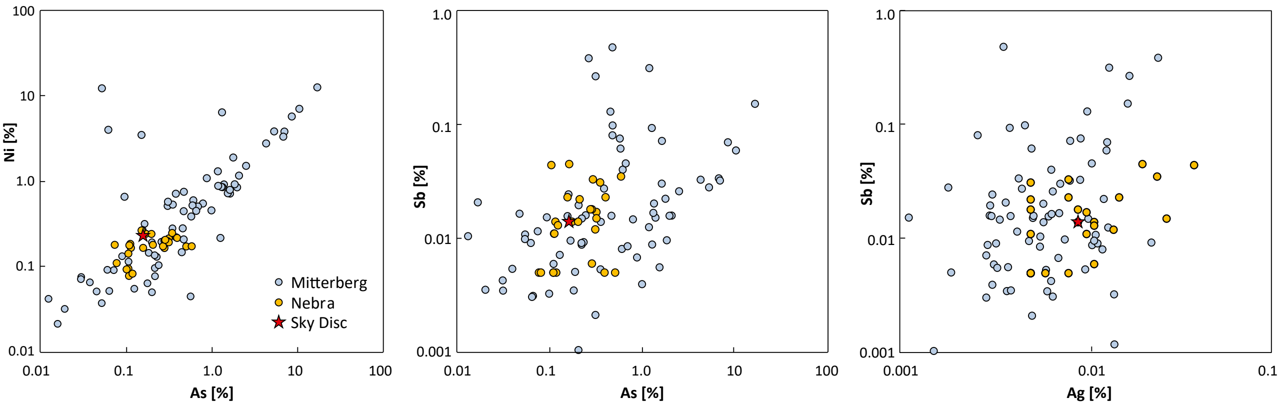

Fig. 20. Trace element concentrations of the objects of the Nebra hoard compared with copper ore samples from the Mitterberg that contain more than 10 % copper. For comparison the concentrations in the ore samples were normalised against copper (E. Pernicka, CEZA Mannheim).

It seems characteristic for the argumentation of Gebhard and Krause that these findings are not mentioned at all. Instead only a very minor difference between the Sky Disc and the other objects of the hoard concerning the zinc concentration is discussed.[60] It is manipulative to compare only the reported zinc concentration in the Sky Disc of between 0.1 and 0.2 % that was obtained by energy-dispersive X-ray fluorescence analysis with the low zinc concentrations in the other objects of the hoard obtained by the much more sensitive neutron activation analysis. Using the latter method 0.077 % zinc was also detected in the Sky Disc, which is ignored by Gebhard and Krause. This is still higher than the average 0.0035 % in the accompanying finds, but insignificant. First of all, there is a variation of trace element concentrations in all ore deposits on the micro and macro scale. Secondly, the zinc concentration is a poor indicator of the ore source, since zinc is largely lost during the production of copper metal and indicates the smelting conditions rather than the ore source. Thirdly, an identical composition of all objects cannot be expected because each object was cast in its own right. Actually, this was a strong argument against a forgery that may have used a larger metal stock to produce all of the objects. And finally, the image on the Sky Disc has been altered at least four times so that it may reasonably be assumed that it was produced earlier than the accompanying finds. It is not unusual to find objects of different ages in archaeological contexts. In this case one cannot expect that the Sky Disc was produced from the same ore charge or the same part of the mine as the other objects in the hoard.

The major emphasis of the criticism concerning the composition of the metal objects was on the isotope analyses.[61] The use of lead isotope ratios for the determination of the provenance of metals was introduced some fifty years ago,[62] first for lead and silver and later also for copper-based objects.[63] The advantage of the lead isotope ratios for the provenance of copper is the fact that the ore and the final object have the same isotopic composition as long as no other lead containing material was added to the copper. This can safely be assumed when the lead concentration is below c. 2 %, which is the case for the Nebra hoard. However, lead isotope ratios are not unique for each deposit and it is possible that an overlap can occur between the characteristics of different deposits. In that case it is advisable to use both sets of parameters, namely trace element patterns and lead isotope ratios.[64]

This combined approach was also used for the Nebra hoard and it turned out that the lead isotope ratios exhibit a very large spread. At first sight this would have contradicted the conclusion drawn from the chemical composition. However, it was already known that copper deposits with low lead concentrations commonly tend to contain highly variable lead isotope ratios due to the presence of uranium. This is explained in more detail elsewhere,[65] but it was already known that Mitterberg is one of those copper deposits that are chemically rather homogenous but quite variable in their lead isotope ratios. This characteristic confirms the conclusion that all objects of the Nebra hoard consist of copper from the same mining region but were not cast from one large batch of homogeneous copper or bronze.

60 Gebhard, Krause 2020, [5].

61 Gebhard, Krause 2020, [5–8].

62 Grögler et al. 1966. – Brill, Wampler 1967.

63 Gale, Stos-Gale 1982.

64 Pernicka 2014a.

65 Pernicka et al. 1993. – Pernicka 2014a.

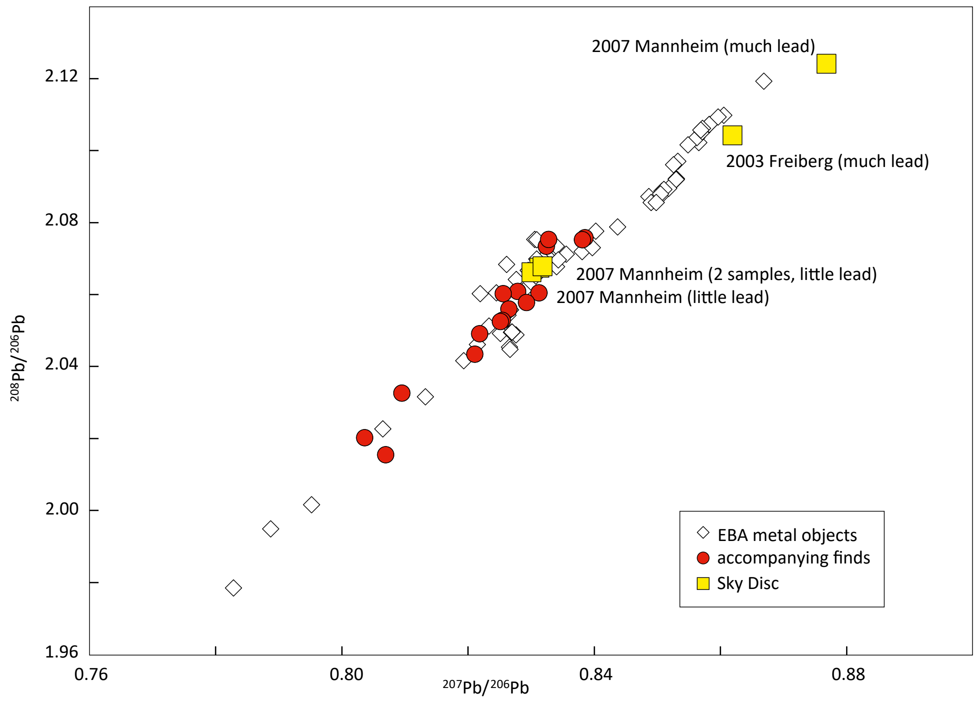

Fig. 21. Lead isotope ratios of the Nebra hoard (measurements 2003 and 2007) and Early Bronze Age metal objects from the region around Nebra (unpublished). The lead concentrations were not determined during the measurements of the lead isotope ratios but a relative estimate was accomplished by the count rates for lead (M. Brauns, CEZA Mannheim).

The lead isotope ratios of the Nebra hoard were first measured at the newly founded Institute of Archaeometallurgy at the Freiberg University of Mining and Technology, Saxony, and were included in a diploma thesis.[66] The discussion of the lead isotope ratios followed a similar line as described above, namely that the large spread of values may be due to uranium- and/or thorium-bearing copper ores. It was thus concluded that "The isotopic inhomogeneity of the Nebra artefacts does not speak against a uniform metal origin. Therefore only the uniformity of the chalcophile trace element analysis and not isotopic inhomogeneity is of importance".[67]

A number of remaining samples were re-analysed in 2007 by Michael Brauns in the Curt-Engelhorn-Zentrum Archäometrie in Mannheim under much better laboratory conditions[68] and it turned out that the sample of the Sky Disc analysed in Freiberg was contaminated with lead and that the original value could not be reproduced (Fig. 21).[69] Fortunately, a second sample from the interior of the Sky Disc and another one from the rim contained much less lead and yielded reproducible results so that it can safely be assumed that those were not contaminated. The mean value of these two measurements was taken as the true lead isotope ratio of the Sky Disc and published in 2008 and 2010.[70] These represent the final values of all objects in the Nebra hoard.

Three more objects in the Nebra hoard yielded enough remaining sample material to check if further contamination had occurred (Tab. 3). Since most values agree within errors, it can be assumed that all values for the accompanying objects are correct. Even with the wrong value for the Sky Disc included in the diploma thesis, it is not possible to state that the Sky Disc has an "exceptional position",[71] if one considers other Early Bronze Age objects from the same region

66 Nickel 2003.
67 Nickel 2003, 79 (translated by the authors).
68 For the laboratory procedure to measure the lead isotope ratios in Freiberg, see Niederschlag et al. 2003 and in Mannheim, see Nørgaard, Pernicka, Vandkilde 2019.

69 The origin of this contamination cannot be traced, but laboratory contamination during sample preparation can be ruled out, because the remaining sample material was also contaminated. Accordingly, the contamination may have been introduced by the drill bit or the sample vial.
70 Pernicka et al. 2008, 335–337. – Pernicka 2010, 730 and Tab. 6.
71 Gebhard, Krause 2020, [7].

Lab no.	Museum ID	Object	Analysis	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{206}Pb/^{204}Pb$
FG-020687	HK 2002:1649 e	sword hilt	Mannheim 2007	2.0602	0.82557	19.029
FG-020687	HK 2002:1649 e	sword hilt	Freiberg 2003	2.0609	0.82595	19.043
FG-020680	HK 2002:1649 b	chisel	Mannheim 2007	2.0155	0.80692	19.477
FG-020680	HK 2002:1649 b	chisel	Freiberg 2003	2.0171	0.80770	19.503
FG-020701	HK 2002:1649 h	sword hilt, tang	Mannheim 2007	2.0491	0.82181	19.112
FG-020701	HK 2002:1649 h	sword hilt, tang	Freiberg 2003	2.0485	0.82191	19.126
FG-020984	HK 2002:1649 a	Sky Disc, drill hole 2	Freiberg 2003	2.1043	0.86185	18.105
Avg HS2-1	HK 2002:1649 a	Sky Disc, drill hole 2	Mannheim 2007	2.1242	0.87675	17.737
HS 1	HK 2002:1649 a	Sky Disc, drill hole 1	Mannheim 2007	2.0662	0.83002	18.920
HS A	HK 2002:1649 a	Sky Disc, drill hole 1	Mannheim 2007	2.0675	0.83126	18.888
Himmelss.	HK 2002:1649 a	Sky Disc, rim	Mannheim 2007	2.0679	0.83175	18.879

Tab. 3. Lead isotope ratios of samples analysed in Freiberg and Mannheim.

and the fact that the Mitterberg copper deposit has highly variable lead isotope ratios.

The application of cluster analysis for this small data set is neither necessary nor methodologically correct. The methods applied (average linkage, centroid method, Ward's method) cannot identify very elongated groups because they search for multivariate globular groups, implicitly assuming a normal distribution of the values in each variable. However, lead isotope ratios are usually not normally distributed.[72] Incidentally, cluster analysis is only an aid to identify structure in multivariate data that should not be correlated. However, lead isotope ratios are usually highly correlated for geochemical reasons, and anyone can see that the incorrect value of the Sky Disc has a larger distance to the data points in the centre of the diagram, but not larger than the three samples in the lower left part of the diagram (see Fig. 21). This part of the argument is therefore obsolete.

Gebhard and Krause, however, present a diagram of lead and tin isotope ratios of objects from the Nebra hoard and other Early Bronze Age objects that was recently published in an extended abstract of a conference.[73] Surprisingly, it was observed that the two isotope ratios are highly correlated, which can only be explained by the remelting and mixing of bronze objects. The major goal of that study was to investigate the origin of the earliest known swords in Europe of the so-called Apa type, named after the eponymous hoard of swords in northwestern Romania. These swords are the model for the hilts of the two swords from Nebra.[74] A few other objects from the Nebra hoard also follow this trend, so that these may also consist of mixed bronze. However, this need not necessarily be the case for all objects, especially if they might not be contemporary with the swords, like the Sky Disc, which is generally assumed to be older than the swords.

According to Gebhard and Krause this diagram confirms that the Nebra ensemble does not belong together.[75] This interpretation is based on two data points, which lie off the general trend in this diagram. The original conference article, however, referred mainly to the somewhat unexpected phenomenon of bronze recycling. This could point to the sphere of action of a single workshop or a group of associated workshops that used specific bronze or ore sources and finished the objects for a limited period of time locally, for example in the Carpathian Basin. Thus, the isotopic composition of the swords from Denmark provides an argument for considering them as imported pieces from the south. Furthermore, these data show the close relationship of the sword from Valsømagle with the swords of Apa type, which formerly was only suspected based on stylistic and technical criteria as well as a similar chemical composition.[76] Accordingly, outliers of this trend do not necessarily imply that they do not belong to a single archaeological context.

What is more irritating is the fact that Gebhard and Krause modified the original figure without mentioning this modification in their figure caption. For example, they labelled the outlier data points with the numbers 1 and 2 and related these to the Sky Disc (1) and a chisel (2) to illustrate

72 Baxter 1999.

73 Brügmann et al. 2018. – Gebhard, Krause 2020, [8] and Fig. 4.

74 Meller 2013, 503–515.

75 Gebhard, Krause 2020, [8].

76 Cf. Bunnefeld 2016, 61–63.

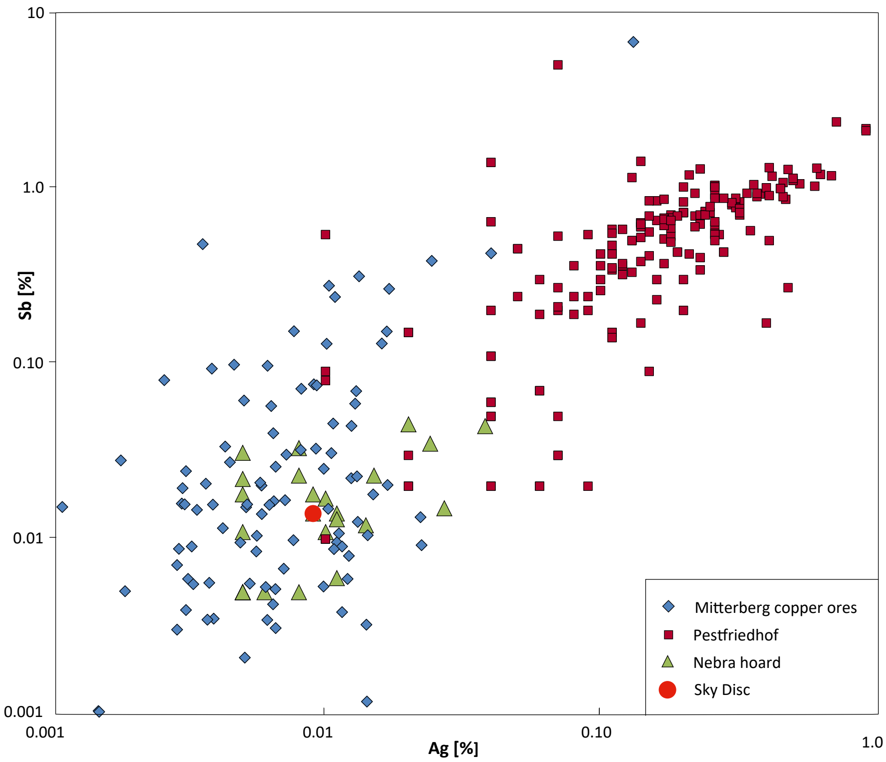

Fig. 22. Silver and antimony concentrations of copper-based metal objects from the Iron Age cemetery Bischofshofen-Pestfriedhof compared with copper ores from the Mitterberg mining region and the Nebra hoard. Copper ores were normalised against copper in order to be comparable with the artefacts. – Data for Mitterberg from Pernicka, Lutz, Stöllner 2016, data for Pestfriedhof from Northover 2009 and data for the Nebra hoard from Pernicka 2010 (E. Pernicka, CEZA Mannheim).

their interpretation. The assignment of sample 2 to the chisel, however, is wrong and it is unclear on what information the authors based this assignment: the raw data have not yet been published, neither in the conference volume nor in any other publication. Gebhard and Krause also did not contact the authors of the original figure to ask for further information or assistance, otherwise they would have realised that the chisel was not analysed for tin isotopes at that time; thus it is not part of the data set shown in this figure. The data point is actually related to a rivet. This kind of modification of original published data is in conflict with ethical principles common across all scientific disciplines.

4.3. Provenance of the Metals of the Nebra Hoard

Although the provenance of the metals of the Nebra hoard is not discussed in detail by Gebhard and Krause, they nevertheless claim that the provenance of the copper from the Mitterberg area, which they do not dispute, would also be consistent with their proposed dating of the Sky Disc to the Iron Age.[77] In support of this statement they cite an article by Joachim Lutz[78] that deals with the analyses of three Bronze Age helmets, which could be related to the Mitterberg mine. The only chronological statement in this article simply expresses the general knowledge that large-scale mining occurred at Mitterberg mainly in the Middle and Late Bronze Age. On the other hand, a comprehensive summary of the mining activity at Mitterberg confirmed by radiocarbon dating that mining flourished between the 16th and 13th centuries BC and that minor mining activities, especially at the main lode, may have phased out by the 9th century BC. This is corroborated by almost 200 metal objects from the Iron Age cemetery Pestfriedhof in the Salzach Valley just below the Mitterberg.[79] These metal objects consist of a completely different type of copper than the one that was produced in the Bronze Age in the Mitterberg mine (Fig. 22), namely

77 Gebhard, Krause 2020, [5], [11].

78 Gebhard, Krause 2020, n. 25. – Cf. Lutz 2011.

79 Northover 2009.

so-called fahlore copper that is characterised by high antimony and silver contents. It is much more likely that the copper used for the metal objects from the cemetery originates from the Inn Valley near Brixlegg, where, indeed, Late Bronze Age and Early Iron Age copper production is well attested,[80] ending around 700 BC, as evidenced by the absence of any later mining archaeological findings.

Although the composition of metal artefacts cannot be used for precise dating, there are nevertheless certain recognisable trends, like the tendency from the Late Bronze Age to the Iron Age of increasingly adding lead to bronze. This is also exemplified in the cemetery of Bischofshofen-Pestfriedhof that was in use from the Late Bronze Age to the Late Iron Age with most graves dating to the Hallstatt C period (c. 780 to 600 BC).[81] Bronze was not yet heavily alloyed with lead but a substantial number of objects contain one or two percent lead, which is significantly more than what the regional copper ores in the Mitterberg region and the Inn Valley contain. Still later, in the Late Iron Age, lead becomes a major component in copper-based alloys.[82]

However, an iron pick from the Pestfriedhof archaeological site, corresponding with the type of Iron Age picks from the Salzach Valley (Dürrnberg type), points to more recent activities, although the metal analyses for the cemetery do not match the regional deposits (see above). It may be dated to the Hallstatt period, because it precedes the typologically early forms at the Dürrnberg and overlaps with the finds from the Pestfriedhof cemetery,[83] but there is no evidence of large-scale production as in previous periods, judging from the lack of Iron Age smelting sites. These would undoubtedly have to be expected when smelting the sulphidic ores such as those occurring in the eastern Alps.

The assignment of archaeological metal objects to a deposit is most convincing when archaeological evidence of mining is also available to support or invalidate the supposed origin, especially if it can be shown that the exploitation is contemporaneous with the analysed objects. This is all the more true as the production figures provide an estimate of the chance that the metal is represented in the archaeological finds. It is estimated that altogether close to 23,000 tonnes of copper were produced in the Mitterberg region in the Bronze Age, the bulk of it between around 1700 and 1200 BC.[84] Recent investigations show that 'Mitterberg copper' was widely distributed between the Carpathian Basin and eastern central Europe, even as far as southern Scandinavia.[85] Thus, it was the most important type of copper, especially in the period between the 16th and 13th century BC.[86]

The determination of the peak operating period is confirmed by 141 items of ^{14}C data (mostly determined by the AMS method in several laboratories; state of the art 2020), and dendrochronological data are available from mines and surface operations (Fig. 23).[87] According to this, the main operating period of the Mitterberg area lies in the period between the 18th and the 9th century BC, with an emphasis on the 15th to 13th centuries BC. The conclusion is that most of the black copper went to the markets during this time.

Close examination of the geochemical data suggests yet another result for the Sky Disc of Nebra. It corresponds isotopically to the geologically older ore veins around the Salzach Valley, most likely the Buchberg lode east of the Salzach River, not the main lode. In contrast, the metals investigated from the Apa hoard are related to the geochemical pattern of the main lode at Mitterberg.[88] This has a certain logic, because the areas close to the Salzach River (like Buchberg, Brander lode region) might have been used earlier (from the 19th/18th century BC) than the area around the main lode on the Mitterberg itself at higher altitude (from the 17th century BC onwards).[89]

The assignment of the Sky Disc to the Mitterberg area is therefore secured by mining archaeological and archaeometallurgical or geochemical methods. The main phases of mining do not provide any indication of a younger, i.e. Iron Age dating, but corroborate the evidence for a Bronze Age

80 Goldenberg 2013. – Goldenberg, Staudt, Grutsch 2019.

81 Lippert, Stadler 2009.

82 Danielisová, Strnad, Mihaljevič 2018.

83 The investigation of the pick has shown beyond any doubt that the tip of the pick, unlike the ones used in salt mining, consists of a martensitic steel structure and is therefore specifically related to the lodes of the Mitterberg: Stöllner, Schwab 2009. – The pick therefore indicates Early Iron Age mining activities near the Salzach Valley, most likely at the Eastern Haidberg part of the main lode. But this would not match the geochemical data of the Sky Disc.

84 Zschocke, Preuschen 1932. – Stöllner, Hanning, Hornschuch 2011. – T. Stöllner in: Pernicka, Lutz, Stöllner 2016.

85 Pernicka, Lutz, Stöllner 2016. – Pernicka et al. 2016. – Nørgaard, Pernicka, Vandkilde 2019.

86 The eastern Alpine region was re-investigated and characterised with improved analytical detection limits within the research focus HiMAT (The History of Mining in the Tyrol and Adjacent Areas) i.e. Lutz et al. 2010. – Gebhard and Krause do not mention the more precise results that allow the differentiation of the mined lodes from the Mitterberg district and from Kitzbühel based on lead isotope ratios and trace element patterns.

87 Stöllner 2009. – T. Stöllner in: Pernicka, Lutz, Stöllner 2016. – Pichler et al. 2018.

88 See also Pernicka, Lutz, Stöllner 2016. – Pernicka et al. 2016.

89 The dating of the earliest stages of mining near the Salzach Valley is based on AMS-^{14}C-dating and also on archaeological contexts (settlements, mining contexts) starting at Bz A2: Kienlin, Stöllner 2009. – Eibner 2016, 444–446 and Fig. 5.

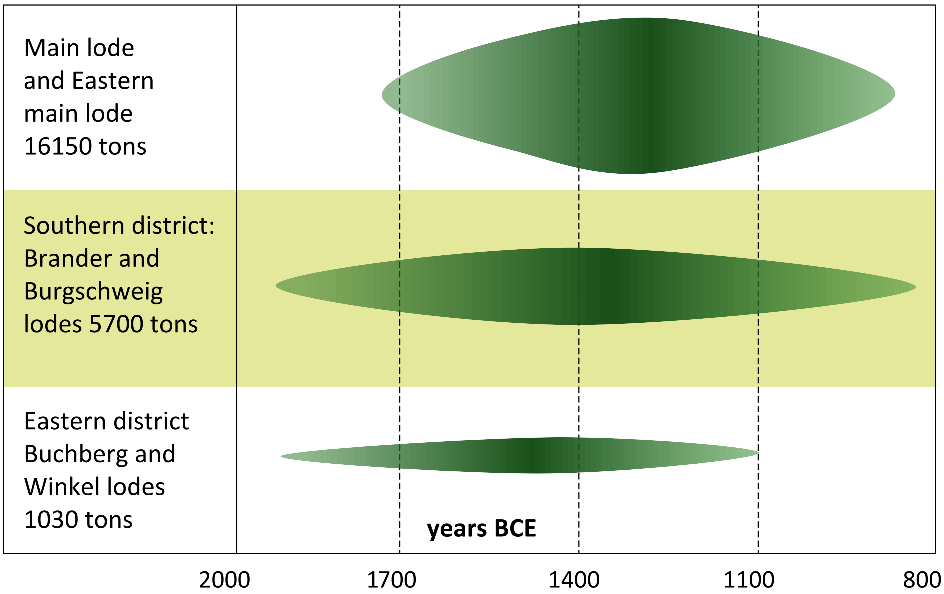

Fig. 23. Copper production in the three major ore districts in the Mitterberg region. The production was estimated from the mined averages based on the initial figures from Zschocke, Preuschen 1932 and the parameters discussed by Stöllner, Hanning, Hornschuch 2011. The losses of about 1.5 % on beneficiation and 13 % on smelting are based on analyses and empirical data.

date, most likely between the 18th and 11th centuries BC, when the Mitterberg mine was in its main operational period. Thus, the copper of the Sky Disc can be considered as one of the very few examples for which a copper type not only ensures the authenticity but also the dating of an object.

A diachronic comparison for the gold composition comes to a similar result. Looking at Hartmann's compositional gold groups,[90] one finds that his group A3 with relatively high silver concentrations and low copper contents is typical for the Early Bronze Age, whereas in the Late Bronze Age, and especially the Iron Age, copper concentrations tend to increase substantially and the silver contents tend to decrease. There is less comparative data available for the Iron Age compared to the earlier periods, but according to present knowledge, the composition of the gold of the Nebra hoard differs from that of Iron Age gold.[91]

Regarding the provenance studies of the gold of the Nebra Sky Disc, Gebhard and Krause[92] selectively refer to and quote only initial working hypotheses[93] and premature proposals from a PhD thesis,[94] but critically discard the matching with natural gold from Cornwall identified later on.[95] Gebhard and Krause somehow disregard the publications that comprehensively explain the rationale of the origin of the Nebra gold from the Carnon River in Cornwall, and which include detailed discussions of the metallogenic reasons for the exclusion of alternative sources.[96] It is important to note that an antler pick, excavated from an alluvial placer mine along the Carnon River has been radiocarbon dated to 1620–1497 calBC, thus documenting placer mining in Cornwall during the late Early Bronze Age.[97]

5. Archaeological and Astronomical Interpretations

It is not unusual that hoard finds were deposited in isolation at topographically unique locations. Accordingly, it would not even be an argument against the find location of the Nebra hoard on the Mittelberg that seemingly "no indications of any activity on or use of the mountain during the 2nd millennium BC were detected".[98] In fact, this statement ignores the fact that structures and finds from several periods from

90 Hartmann 1982.
91 Hartmann 1970.
92 Gebhard, Krause 2016. – Riederer 2016. – Gebhard, Krause 2020.
93 Pernicka et al. 2004. – Borg 2010.
94 Schmiderer 2009.
95 Ehser, Borg, Pernicka 2011.
96 Borg, Pernicka 2017. – Borg 2019. – Borg et al. 2019.
97 Timberlake, Hartgroves 2018.
98 Gebhard, Krause 2020, [2].

the Neolithic and Bronze Age to the Iron Age were identified on the Mittelberg in the immediate surroundings of the findspot of the Sky Disc. The remains of a Late Bronze Age hoard were found only about 200 m north of the Iron Age oval rampart (feature 30/2003), and information on this is provided by Meller on the immediately following pages of his article cited by Gebhard and Krause.[99] Furthermore, a Middle Bronze Age ornamental disc (find 15/03) from just outside the oval enclosure is known,[100] as well as an Early Bronze Age and an Iron Age radiocarbon date from the eastern transecting rampart.[101] All this reinforces the significance of the summit area of a hill above the river Unstrut with a wide view over the lowlands to the west and northwest. It was suggested by Wolfhard Schlosser that the importance of the site over such a long time period may be sought in its topographical situation as an outpost for astronomical observations.[102] Although no proof for the Mittelberg being the find site, the visual relations given by the prominent dates of the solar year (sunset on 1 May behind the Kyffhäuser Mountain and on 21 June behind the Brocken massif) may be related to the Sky Disc, which we interpret as a memogram for certain calendar dates. As such, the horizon arcs on the disc relate to the summer solstice on 21 June and may indicate an astronomical relation to the find site and its surroundings.

Considering the composition of the hoard, it is remarkable that it is not only chemically but also from a typochronological point of view quite homogenous. This does not necessarily mean that it was produced in one workshop at the same time, because the hoard comprises diverse objects. It is, nevertheless, remarkable that all objects represent the same chronological phase Bz A2c of the central European Early Bronze Age. This is true for i) the swords, which represent proto-types of the classical Sögel swords of the early Middle Bronze Age (Bz B1a);[103] ii) the arm spirals, which can be assigned to period Bz A2c by the hoard find from Luzice in Bohemia;[104] iii) the chisel, which can also be dated to the period Bz A2c by the hoard find from Kläden due to its peculiar shape.[105] It has to be considered that for the phase Bz A2c only a few hoard and grave finds are available from central Germany at all, in order to allow for a compilation of a time-specific set. In addition, this would only be possible with extraordinary typochronological knowledge, which the treasure hunters and antiquities dealers hardly had at their disposal. In this respect, the hoard find has to be considered as most likely belonging together, simply from a purely archaeological and typological perspective.

In addition, the chemical analyses show that the disc and the accompanying finds were made of a type of copper which was dominant and widely distributed in the developed Early to Late Bronze Age. A certain 'lifetime' (period of use) of the disc is attested by the stratigraphic superimposition of the additions (horizon arcs, curved element, edge perforations).[106] How long the successive iconographies remained in use before they were abandoned and supplemented or replaced by new features cannot, of course, be determined. However, it is legitimate to suggest a scenario[107] and include additional corroborating information, such as the chronology of the exploitation of the mines at Mitterberg for the determination of the earliest possible time for the production of the Sky Disc.

As to the interpretation of the pictorial representation on the Sky Disc, there seems to be a general agreement that it reflects celestial bodies, namely the sun (or the full moon), the crescent moon, and stars. Since the stars are only visible during the night, the conclusion is that the Sky Disc is a representation of the night sky.[108] It is also widely accepted that the cluster of seven stars can be interpreted as the Pleiades, which is the basis for the interpretation of the Sky Disc as a memogram and leap rule gauge for the lunar and solar years.[109] Gebhard and Krause do not mention these seven stars but, citing Emília Pásztor and Carl Roslund,[110] state that "the 'stars' shown on the disc [...] do not represent a concrete image of the sky".[111] But in the same article it is also stated that "...one cluster of seven spots lying between the 'sun' and the 'moon' has naturally been associated with the Pleiades",[112] a statement ignored by Gebhard and Krause. The Pleiades as a star cluster are clearly separated from the otherwise evenly distributed stars.[113]

99 Meller 2010a, particularly 42–44, 41 and Fig. 10 (finds); 39 and Fig. 8a (plan with all Bronze Age finds). – Older Neolithic finds from the Mittelberg have also been illustrated: Meller 2010b, 68.
100 Meller 2010a, 44 and Fig. 8.
101 Meller 2010a, 44, footn. 25. – Meller 2010b, 82 raises the possibility of an Early Bronze Age dating of the eastern transecting rampart.
102 E.g. Schlosser 2002. – Schlosser 2003. – Schlosser 2004. – Schlosser 2010.
103 Schwarz 2016, 483–484. – Schwarz 2020, 50.
104 Schwarz 2016, 483.
105 Schwarz 2016, 484.

106 Meller 2010a, 44–48.
107 Meller 2010a, 48 and Fig. 16.
108 Schlosser 2010.
109 R. Hansen 2007. – R. Hansen 2010.
110 Pásztor, Roslund 2007.
111 Gebhard, Krause 2020, [13]. – Cf. Schlosser 2002. – Schlosser 2003.
112 Pásztor, Roslund 2007, 269.
113 Schlosser 2002. – Schlosser 2003. – Schlosser 2004. – Schlosser 2010, 921–922.

It rankles that Gebhard and Krause do not discuss the Pleiades at all because they are present on the sword blade of Allach, according to Peter Kurzmann's statement.[114] But, this constellation is not depicted on the gold bowl of Zürich-Altstetten (= Ha C2–D2),[115] which is dated by Gebhard and Krause to the late Urnfield period[116] and thus too early. As is usual in regions of the early situla style, the iconography includes an animal frieze with deer and other animals. Above this, bosses (suns) and horizontal lunar crescents are depicted in alternating sequence, below a row of horizontal C-shaped arcs. Except for the suns, the animal figures are recessed from the finely bossed background. Only the points of the deer antlers are additionally incised with a graver. It remains open whether the decoration resembling crescent moons is really intended as such, since the crescent moon never appears horizontally but always, though slightly tilted, upright in the night sky. If the many small bosses really represent stars, as Gebhard and Krause assume, then the animals would most likely represent signs of the zodiac. The Pleiades apparently have no meaning in the Altstetten sky and are therefore missing.

In the La Tène period, only six stars of the Pleiades were visible, as the Greek astronomer Aratos of Soloi (c. 310–245 BC) testifies in his *Phainómena* (celestial phenomena): "Close to his (i.e. the constellation Perseus') left knee, all the Pleiades travel in a swarm. The place, which is not very large, holds them all, and they are only faintly visible. Seven pathways are called those among the people, although only six of them can be seen with eyes. After all, the star was not lost without news from the house of Zeus, after we heard about its creation, rather it is spoken of in exactly the same way."[117]

On the 'rainbow' stater Celtic coins of the type 'Vogelkopfstater' from the 2nd century BC,[118] six points are depicted which are vaulted by an arch with small spherical ends. The latter is usually referred to as a torque. However, a neck ring is to be depicted as a circular shape and not as a wide open arc. If this argumentation is correct, the coins would actually show representations of the Pleiades, but would be set in a completely different mythological background. The arch on the coins could then be interpreted not as a torque but as the firmament. Gebhard and Krause suggest that these arcs are not torques, but they lose sight of the essential, the Nebra Sky Disc, whereby the intention of their explanations remains unclear.

The search for analogies becomes far-fetched with the reference to the Holstein belts, a costume element of the Jastorf Culture that developed in the Ha D2 stage, whose distribution is limited to northern Germany and never reached central Germany. The components identified by Gebhard and Krause are "serpents, arches with spherical ends, arcs with different numbers of dots below, encircled knobs with a corona (sun symbols), as well as half-arches with external dashes",[119] which are not found at all on the Sky Disc in the manner presented. The reference to Paul Gleirscher's interpretation,[120] who purported to be able to identify the arc as a harvest sickle, does not lead any further either, since the arc with feather-like incisions all around definitely is not a sickle.

The two authors Gebhard and Krause also remarked on "the noticeably simple craftsmanship of the 'Himmelsscheibe'".[121] This does not match the high level of Celtic art, which is why it is considered a product of the region north of the low mountain range. There, on the edge of the Keltiké, it is held that people were not able to produce objects of high craftsmanship. In fact, the craftsmanship of the Sky Disc is indeed somewhat primitive. The Celts would have probably outlined every single star, the sun or the full moon, and the crescent moon with a compass, and also placed the stars in a firmament constructed with the compass. No construction lines can be identified on the Sky Disc.[122] Also, the gold sheets were clamped at their edges into grooves cut with a chisel. In comparison, even the inlay of the Nebra swords testify to greater craftsmanship and knowledge.[123] Finally, the reference to Siberian shaman drums with a decoration similar to the Sky Disc[124] counteracts Gebhard and Krause's dating to the Iron Age.

As a unique find, the Nebra Sky Disc is and remains an absolutely singular specimen. It goes without saying that it

114 Kurzmann 2016. – The reference made in connection with this sword by Gebhard, Krause 2020, [17] with n. 67 and 73 on David 2010, esp. 481–482, that the Sky Disc is an outlier in Bronze Age symbols claims David as a key witness for a possible La Tène period dating of the Sky Disc. But David only discusses this possibility in order not to pursue it in the end and is anyway convinced of the Bronze Age dating of the Nebra Sky Disc.

115 Straub 1980, 228, cat. no. 10.14. – For comparison, see Prüssing 1991, Taf. 118–119.

116 Gebhard, Krause 2020, [13]. – See also the discussion in Nagy 1992, 113, who favours a late Urnfield period date.

117 Arat. 254–261. – English translation after Erren 1971.

118 See, e.g., the coin hoards from Gaggers and Irsching: Overbeck 1981, 58–59 and Figs. 9–10.

119 Gebhard, Krause 2020, [14].

120 Gleirscher 2007.

121 Gebhard, Krause 2020, [14].

122 Breuer 2010 was able to plausibly demonstrate that the disc is constructed from seven circles or circle segments, which are based on a small common multiple of 26.5 mm. This concept cannot be compared with the complex Celtic toreutics.

123 Cf. Berger 2012, 34 and Pls. 2–4.

124 Gebhard, Krause 2020, [13].

therefore is not easy to fit into the motif stock of its time. Nevertheless, it is important to note that the ship in particular, which was added in phase III of the Sky Disc,[125] is an element that does not appear in the Iron Age but is a central motif of the Bronze Age.[126]

Table 4 summarises the most important arguments and shows the most important published works.[127]

6. The Judicial Assessment of the Case

A few brief remarks shall be devoted to the judicial assessment of the case. As already mentioned several times, it is strange that Gebhard and Krause quote from the trial against robbers and dealers from the documents of the since-deceased expert Josef Riederer[128] as well as from those of the criminal defence lawyer Elke Thom-Eben,[129] who in turn had provided Riederer with her documents. However, the official documents that have come to light and the detailed explanations and justifications of the Regional Court of Halle are not taken into account in the explanations of the authors Gebhard and Krause. This necessarily causes irritation, especially since the Regional Court of Halle, after an intensive examination of the defence's arguments, did not follow them in its judgment, which, on appeal by the defendants, was unconditionally confirmed by the Naumburg Higher Regional Court.

In archaeological circles it is often objected that a court cannot pass judgement on an archaeological find. This is right and wrong at the same time. Only in very few exceptional cases will the court – judge and jurors – be composed in such a way that it can judge a case on the basis of its own specific knowledge – for example, if one of the jurors happens to be a 'professional'. However, this applies to any criminal trial. Even in a murder case, the judge himself does not autopsy the victim or analyse fingerprints and DNA samples. Nevertheless, the (often sworn) experts who carry out this work are required to present their methods, especially the limits of their methods, and the results of their investigations and their probability and significance to the court in an objective and truthful manner so that the court can form its own opinion on the expert's reports.

In the court trial against the antiquities dealers concerning the Nebra Sky Disc, the question of the authenticity of the find, including its origin and composition, was of fundamental importance. After extensive compilation and assessment of all pieces of evidence, the court answered this question "affirmatively with a probability close to certainty". In the light of this endeavour, the verdict of the Regional Court of Halle cannot be denied validity, even in a scientific discourse.

7. Conclusions

In a recently published article, Rupert Gebhard and Rüdiger Krause tried to prove that the Nebra Sky Disc should not be dated to the Early Bronze Age, as the consensus of specialists assumes, but rather to the Iron Age. The *conditio sine qua non* of their thesis is the assumption that the connection between the Sky Disc and the other finds of the ensemble, whose Bronze Age date the authors do not call into question, is uncertain. Thus a closed find cannot be assumed. The Sky Disc must therefore be treated as a single find and can only be dated with the help of stylistic and cultural-historical considerations.

As arguments they cite, in particular, that the location of the disc close to the surface speaks against its being found in situ, and thus its connection with the other finds is called into question. This is supported, they believe, by the nature of the traces of damage on the Sky Disc, by geochemical and forensic examinations of the soil adhesions, and by deviating descriptions of the finding by the looters. Therefore, it is even conceivable that the Sky Disc may have been found in a different location from the Mittelberg near Nebra. Incidentally, all of these arguments and assertions are, for the most part, repetitions of an earlier publication[130] which does not seem to have been given much consideration among relevant specialists.

The two authors are extremely selective in their argumentation, sometimes make false claims, and ignore a large part of the extensive research results of the last 20 years on the Nebra Sky Disc and its context. All of their arguments and allegations can be readily refuted.

1. The excavations at the site named by the looters have confirmed their statements in detail, right up to the discovery of an item that was left behind during their diggings at the site (see section 2). In particular, the fact that the Sky Disc was found near the surface does not in any way speak against the location, especially since considerable erosion can be assumed on the Mittelberg. The argument that the hoard with the Sky Disc could not have come from the Mittelberg, since it otherwise only produced Iron Age finds, is, in fact, incomprehensible. The latter assertion is incorrect, but above all, the former is not mandatory.

125 On the phases of the Sky Disc: Meller 2010a, 44–48, 59–70.
126 Cf. Meller 2002. – Maraszek 2010. – In general Kaul 1998.
127 See also footn. 3.
128 Gebhard, Krause 2020, [18], n. 10; [19], n. 16.
129 In Gebhard, Krause 2020, [18], n. 8, the name is incorrectly given as "RA [=Rechtsanwältin] Thommen".
130 Gebhard, Krause 2016, 25–43.

Topical issues	Key publications
Unity of the find verified by:	
Criminal investigations, independent confessions, judicial assessment	LG Halle 2005.
Sediments adhering to the Sky Disc (Sp 1, certain), Sword II (Sp 2, certain) and axe HK 2002:1649 c (Sp 3, possible)	Pernicka et al. 2008, 343. – Adam 2019.
Metal analyses (trace elements, lead isotope ratios)	Pernicka et al. 2008, 335–337. – Pernicka 2010 (original data).
Associated finds date to a narrow time frame (Bz A2c) and follow a characteristic pattern	S. Hansen 2010. – Meller 2010a, 48–57. – Meller 2013, 500–503. – Schwarz 2016, 483–485.
Authenticity of the Mittelberg near Nebra as the place of discovery verified by:	
Criminal investigations, independent confessions, judicial assessment	LG Halle 2005.
Confirmation of the looters' statements through subsequent excavations by the LDA (including locating and identifying the looting pit, finding the water bottle, traces from the fire brigade pickaxe, increased concentrations of gold and copper within and below the looting pit)	Pernicka et al. 2008, 332–334, 342. – Meller 2010a, 35–45. – Meller 2013, 496–499.
Soil sample from the Mittelberg (VM 1) matches with sediments adhering to the Sky Disc (Sp 1, certain), Sword II (Sp 2, certain) and axe HK 2002:1649 c (Sp 3, possible)	Pernicka et al. 2008, 343. – Adam 2019.
Cultural-historical evidence (astronomical references)	Schlosser 2002. – Schlosser 2004. – Schlosser 2010.
Dating to the end of the Early Bronze Age verified by:	
Dating by means of associated finds (stylistic, and radiocarbon date from one of the swords); the multiphase character of the Sky Disc suggests an earlier date of manufacture than the associated finds	Meller 2002. – Meller 2010a. – Meller 2013. – Schwarz 2016, 483–485.
Use of copper from the Mitterberg mining district	Pernicka et al. 2008, 335–337. – Frotzscher 2009. – Pernicka 2010, 725–732. – Frotzscher 2012. – Pernicka, Lutz, Stöllner 2016.
Main phase of use of Mitterberg copper in the Bronze Age (usage probably ends in the 9th century BC)	Pernicka, Lutz, Stöllner 2016.
Correlation of tin and lead isotope ratios of the Nebra hoard and other Early Bronze Age objects	Brügmann et al. 2018.
Cultural-historical evidence (representation of a ship on the Sky Disc as a central motif of the Bronze Age, relatively primitive technical production and motifs of the Sky Disc speak against Celtic craftsmanship)	Meller 2002. – David 2010, 481–482. – Maraszek 2010.
Origin of the gold on the Sky Disc and the swords from the Carnon River in Cornwall; gold from this source was already extracted in the Early Bronze Age	Ehser, Borg, Pernicka 2011. – Borg, Pernicka 2017. – Timberlake, Hartgroves 2018. – Borg 2019. – Borg et al. 2019.
Further investigations:	
Damage to the Sky Disc	Pernicka, Wunderlich 2002, 30. – Pernicka et al. 2008, 339–342.
Corrosion on the Sky Disc	Pernicka, Wunderlich 2002, 24. – Pernicka et al. 2008, 337–339.
Further Neolithic, Middle and Late Bronze Age finds from the Mittelberg	Meller 2010a, 41 and Fig. 10; 43–44. – Meller 2010b, 66–70 (selection).
Pedological investigations on the Mittelberg and its surroundings	Klatt, Stelter 2019.

Tab. 4. A large number of investigations prove the unity of the hoard, the authenticity of the location, and the dating of the Sky Disc to the end of the Early Bronze Age. The table shows the investigations carried out as well as the most important published works. Highlighted in blue are references which were only selectively or falsely considered by Gebhard, Krause 2020, in red, publications that were not considered.

2. The investigation of the damage to the Sky Disc shows beyond doubt that this did not occur on different occasions that were far apart in time, but most likely during the process of its improper recovery by the looters (see section 3). The assertion that the soil samples from the site and the sediments adhering to the found objects would show that the accompanying finds and the Sky Disc did not come from the same site is wrong. On the contrary, the samples from the looter's pit and the soil adhering to the Sky Disc and one of the splendid swords revealed the greatest possible accordance (see section 4). Just as false is the claim that one of the bronze axes did not belong to the hoard according to the forensic expert. In this case, the samples were not sufficient to make a definite statement, but based on the forensic investigations, the affiliation is at least possible. The affiliation of the sword and the Sky Disc alone is sufficient for an archaeological-temporal classification.

3. The assertion that the geochemical analyses do not support the integrity of the hoard is also incorrect. Analyses show that for the Nebra bronze finds copper from the Mitterberg district in the Salzburg Alps had been employed which was no longer being used during the Iron Age. Moreover, when compared to each other, Iron Age and Bronze Age copper alloys show completely different composition patterns, both in terms of their main components as well as the trace elements and lead isotope ratios (see section 4).

Since the basis for a re-dating to the Iron Age thus no longer applies – and it can hardly be assumed that the swords, which were almost as good as new, were deposited more than a thousand years after their manufacture – also the further arguments put forward by Gebhard and Krause are largely obsolete. Especially as the Celtic comparative examples they cite belong formally, stylistically, and cultural-historically to a completely different context (see section 5).

Due to the fact that the Nebra hoard was not recovered in a scientifically controlled excavation and without any photographic documentation, it is only natural that doubts arise. This led to unprecedented scrutiny of the evidence available not only in the court trial but also in a number of scientific investigations on the Nebra Sky Disc and its surroundings, in order to put the findings to the test again, and, if necessary, to modify, revise or confirm earlier conclusions. Without sceptical remarks, some lines of investigation might not have been followed at all. The investigations will continue. For the near future, a compilation of all relevant, often scattered publications – including the research results not yet published – is planned, as well as a catalogue-like presentation of the Nebra finds. This will not only shed further light on this important find but will also provide new impulses to Bronze Age research as a whole. In particular, the research around the Nebra hoard find can be considered as an outstanding example of the fruitful cooperation of numerous disciplines from the natural sciences and the humanities.

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Mining at the Fringes. High-Altitude Prehistoric Copper Mining in the Oberhalbstein Valley (Grisons, Switzerland)

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Abstract

The mining region of Oberhalbstein, to date sparsely studied, has been the subject of archaeological research since 2013. Two mining areas which lie well above the forest line were studied in the summer of 2017. The Avagna-Ochsenalp site includes multi-phased heap features, of which the earliest phase has been dendrochronologically dated to the 11th century BC. In Cotschens, mining traces in an area of approximately 0.1 km² from an unknown time period have been observed. Here, the flooded mine 1 was studied in more detail. After the cavity had been drained, 66 wood objects were revealed, including mining tools from the 1st century BC. ^{14}C dating further confirms Late Bronze Age and Early to Late Iron Age activity. Stone tools from the adjacent heap also confirm prehistoric on-site ore processing, a unique find so far in the Oberhalbstein region.

Keywords

Mining archaeology, copper production, Central Alps, Late Bronze Age, Hallstatt period, La Tène period.

Zusammenfassung – *Bergbau in Randzonen. Prähistorischer Kupferbergbau im Hochgebirge des Oberhalbsteins (Graubünden, Schweiz)*

Die bislang kaum erforschte Montanregion Oberhalbstein ist seit 2013 Gegenstand archäologischer Untersuchungen. Im Sommer 2017 wurden zwei deutlich über der Waldgrenze gelegene Abbauareale erforscht. Die Fundstelle Avagna-Ochsenalp umfasst ein mehrphasiges Haldengelände, dessen älteste Phase mittels Dendrochronologie ins 11. Jh. v. Chr. datiert wurde. In Cotschens sind auf einer Fläche von ca. 0,1 km² zahlreiche Abbauspuren unbekannter Zeitstellung zu beobachten. Genauer untersucht wurde die abgesoffene Grube 1. Nach dem Abpumpen der feuergesetzten Hohlräume kamen 66 Holzobjekte zum Vorschein – darunter bergbauspezifische Geräte aus dem 1. Jh. v. Chr. ^{14}C-Datierungen belegen hier darüber hinaus spätbronzezeitliche sowie früh- und späteisenzeitliche Aktivitäten. Im angrenzenden Haldengelände wurden außerdem Steingeräte dokumentiert, die eine prähistorische Erzaufbereitung vor Ort bezeugen – ein bisher einzigartiger Befund im Oberhalbstein.

Schlüsselbegriffe

Montanarchäologie, Kupferproduktion, Zentralalpen, Spätbronzezeit, Hallstattzeit, Latènezeit.

1. Introduction

The Oberhalbstein is situated in the Central Alpine region of the canton of Grisons (GR) in southeast Switzerland. It is the only region of the country in which evidence of prehistoric copper mining has been found so far. The valley is divided into a lower northern and an upper southern step (Fig. 1).

Evidence of several settlements[1] on the lower valley step confirms that this area was inhabited from the 2nd millennium BC onwards, by a society based largely on agriculture

1 Cunter-Caschligns, Salouf-Motta Vallac, Savognin-Padnal, Savognin-Rudnal.

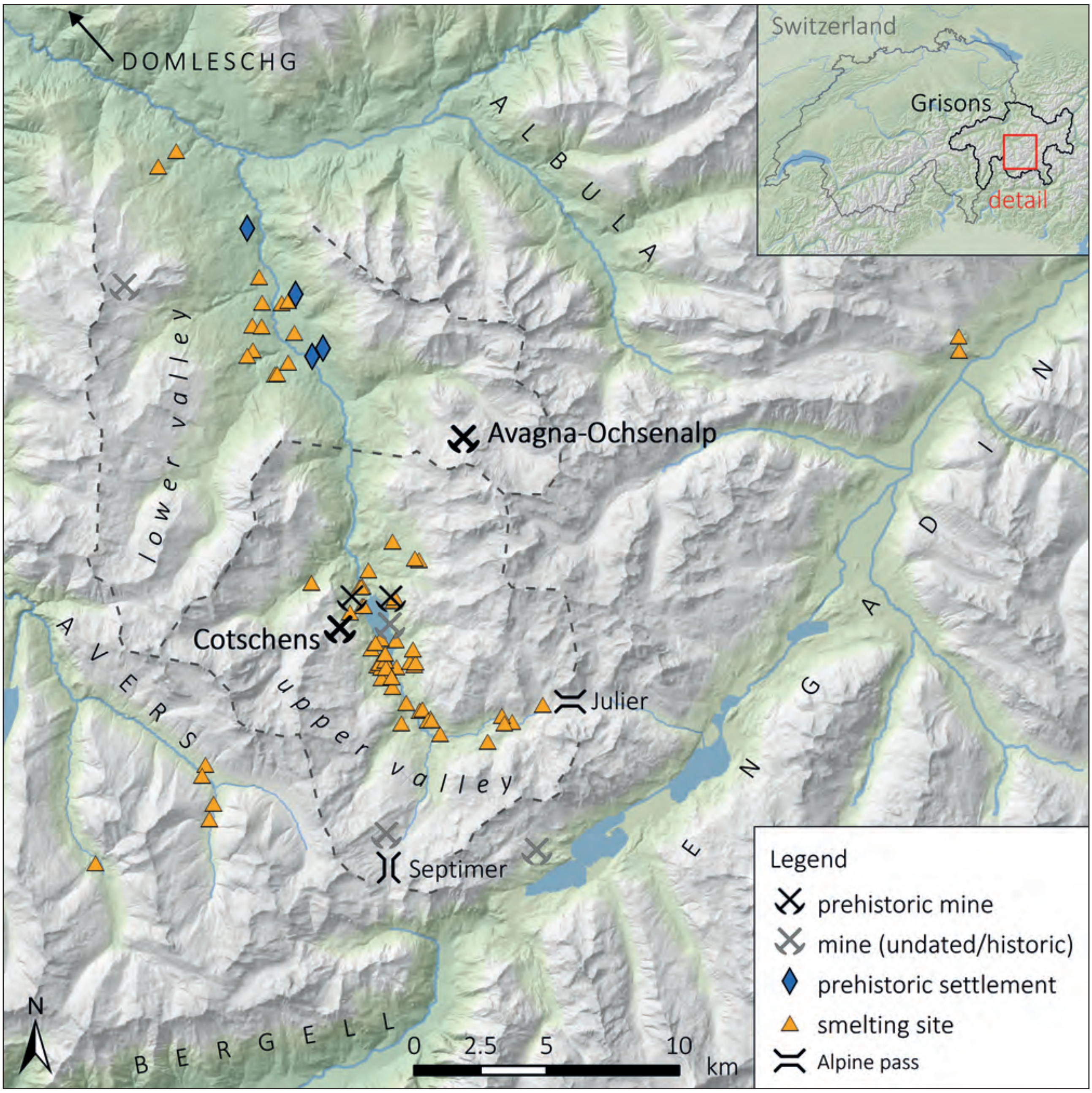

Fig. 1. Overview of the Alpine region of Oberhalbstein, showing the sites described in the text (Map: L. Reitmaier-Naef, UZH; geodata: Federal Office of Topography and Canton of Grisons).

and livestock farming. The Oberhalbstein has played an important role as an Alpine transit route at the latest since the Middle Bronze Age, connecting Domleschg and the Albula Valley in the north to Engadin and the Bergell Valley in the south, by way of the Julier and Septimer passes.[2]

Early evidence of local copper production – smelting sites and single finds of smelting slag in settlement contexts – dates to the Late Bronze Age.[3] However, mining activity in the region seems to have reached its peak in the Early Iron Age, when dozens of smelting sites and several mines were established on the upper valley step.[4] Written sources for historical ore mining in the Oberhalbstein begin in the Late

2 Rageth 1986.

3 Wyss 1993. – Schaer 2003. – Fasnacht 2004. – Wyss 2004.

4 Turck, Della Casa, Naef 2014. – Reitmaier-Naef, Turck, Della Casa 2015. – Della Casa, Naef, Turck 2016.

Middle Ages but only sporadically document the following centuries, leaving the scope of the mining activity unknown. All of Grisons was finally seized by a full-blown mining boom during the industrialization of the early 19th century. However, in view of the unprofitable nature of most of the mines, this came to an end towards the middle of the 19th century, and apart from manganese mines during the world wars, there has been no mining activity in the Oberhalbstein region since.[5]

Prehistoric mining activity was focused around iron-rich sulfidic copper ore, which crops out in several areas of the valley. These mineralizations are found only in the upper Pennine *Platta* nappe, which is comprised primarily of ophiolites. The mineralizations are mainly contained in serpentinite sequences, more rarely in metabasalt.[6]

Evidence of prehistoric metal production in the Oberhalbstein region has been known since the beginning of the 20th century. In recent years, it has been the subject of systematic investigation by the University of Zurich's Department of Prehistory, as part of the international research project 'Prehistoric copper production in the Eastern and Central Alps'. The field work completed between 2013 and 2018 included extensive surveys as well as excavations in the areas of known smelting sites around Lake Marmorera, on the upper valley step.[7]

While there had previously been no direct archaeological evidence of prehistoric mining activity in the investigated area, today at least four mines[8] and several as yet unstudied or inaccessible potential sites are known. Two of the most striking mining sites, situated well above the forest line, are Avagna-Ochsenalp (Tinizong GR) and Cotschens (Marmorera GR) (Fig. 1). Both sites were first studied more closely in August 2017 by an international team. In advance of the field work, high-resolution orthophoto and terrain models (SfM) of both mining sites were taken with the aid of a drone. These served as a basis for further work and surveys. Subsequently, the two sites were subjected to a mining archaeological survey in order to describe, map and photograph the numerous structures and features in detail and to sample the localized mineralizations for geochemical and mineralogical investigations. Small trenches were opened at archaeologically promising spots within the heaps of both sites. The main focus, however, was on the initial investigation of mine 1 in Cotschens, whose underground part is normally partially flooded. After the cavity had been drained, a substantial part of the mine was accessible for archaeological investigations for the first time. In addition to a detailed documentation of the mine, a complex profile of the underground area could be uncovered, documented and sampled. The results of these studies are presented below.

2. Avagna-Ochsenalp

2.1. Mining Site

The area known as *Ochsenalp* is situated between the main valley and the Val d'Err, which lies to the east and parallel to the main valley (Fig. 2). Here, the mining site Avagna (l'Avagna, Romansh: (ore) vein) is one of the few known copper mineralizations on the lower valley step. This site has long been considered the potential source of raw materials for the many known prehistoric smelting sites in the lower part of the valley.[9]

Written sources attest to the relatively intensive historical usage of the Avagna site compared to other mining sites in the valley. The earliest written evidence for historical mining in the Oberhalbstein region is an agreement between members of the local ministerial family 'von Marmels' on the usage of the ore veins in the Val d'Err, which dates to the year 1338 AD.[10] The locality is named '*Jsenberg*[11] … *Emede*', indicating that the extracted ore was not only used for copper at this point, but also for iron production. Despite the mineral royalties staying in the hands of the von Marmels for a further two hundred years, no further documentation for the duration and the extent of mining activity in Avagna-Ochsenalp is known.[12] Several mines on the lower valley step are mentioned in the 1606 records of a mining judge named Gadmer,[13] although the location of these mines is unknown today. It is unclear whether Avagna-Ochsenalp was not in use at this point, or if there are other reasons for it not being included in these records. It is certain, however, that the mineralization on the Ochsenalp was periodically exploited in the first third of the 19th century. Beside iron and/or copper, vitriol was also extracted from the sulphidic ores of the Ochsenalp at this time. The ruins of the Cruschetta vitriol factory, situated at the end of the Val d'Err (Fig. 2), as well as the partially preserved road for ore transportation between Avagna and Cruschetta, attest to this.[14] Mining activity in Avagna came to an end in the 1830s at the latest. This is indicated by both the lack of written mining records

5 Brun 1987.

6 Dietrich 1972. – Peters, Dietrich 2008.

7 Della Casa, Naef, Turck 2016. – Turck 2019.

8 Besides the two sites presented here: Gruba II (Marmorera GR), see Turck et al. 2018. – Vals (Marmorera GR), see Reitmaier-Naef, Turck, Della Casa 2015.

9 Rageth 1986. – Wyss 1993.

10 Hitz 2012.

11 *Jsenberg* or *Eisenberg* means iron mountain in German.

12 Brun 1987.

13 Brügger 1866.

14 Brun 1987.

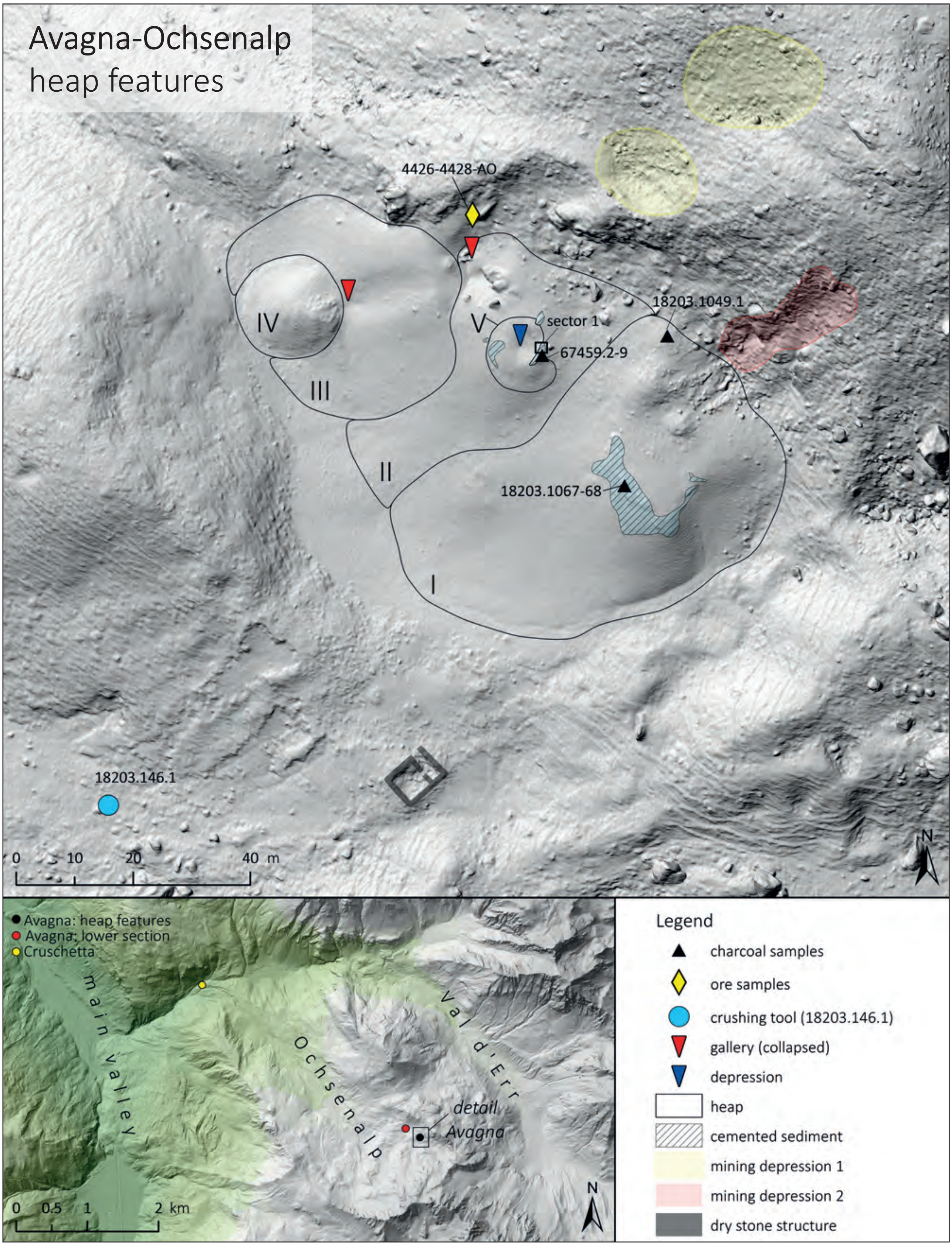

Fig. 2. Avagna-Ochsenalp, map of the described structures, finds and samples (Map: L. Reitmaier-Naef, UZH; terrain model: A. Zwicky and Ch. Walser, ADG; geodata: Federal Office of Topography and Canton of Grisons).

Fig. 3. Avagna-Ochsenalp, panorama of the upper section of the site with heap features (Photo: P. Thomas, DBM).

and the description of abandoned, inaccessible mines in slightly younger geological literature.[15]

2.2. Description of the Mining Structures

The site is situated in the upper part of the Ochsenalp area, which opens to the northwest, and can be divided into an upper and a lower section. These sections are separated by a distance of around 100 m (Figs. 2–3).

The upper section is situated at approximately 2480 masl[16]. Characterized by a large heap which stands out from afar due to its striking red colouring, it lies halfway up the northeastern flank of the valley. A clearly defined step in the terrain to the southwest and northwest separates it from the slope below. The maximum extent of the area parallel to the slope is approximately 100 m from northwest to southeast, and approximately 70 m from northeast to southwest. The heap is not uniform, its shape and coloration show that it in fact consists of several features which follow each other both chronologically and spatially (Fig. 3).

One of the oldest features is a heap (I) which occupies the southeast of the site over an area of 40 × 65 m. Its upper section is a flattened plateau which holds debris from the slope above. Several isolated piles of rocks and mining waste are grouped around it. A similar plateau lies around 15 m northwest of the first heap. It can be assumed that this is a second, comparable heap (II). This heap has been disturbed by stratigraphically younger features, making its original extent difficult to determine. The older features are characterized by an intensive red colouring and a predominance of fine-grained mining waste.

A stratigraphically younger heap (III) adjoins the two older heaps at the northwestern end of the site. It is roughly circular and has a diameter of 40 m. The top of heap III is also flattened, and a disturbance of the older, covered heap (II) runs from this plateau towards the northeast. Parts of the older heap were apparently removed, exposing sections of the bedrock. The mining waste in heap III is significantly yellower, the characteristic red only occurring on its southeastern side. In addition, an elongated depression runs across the surface of the heap, beginning at the upper edge and continuing down the slope in a west-southwest direction.

Another, younger heap (IV) lies below the linear depression and covers the lower part of heap III. This heap is also circular, with a diameter of 17 m and a mostly yellow colouring, with grey in the northwest area. The mining waste on its surface is finely grained, interspersed with larger stone blocks which show evidence of drill holes from blasting work (Fig. 4).

The fifth feature (V) lies to the south of the disturbance in heap II, slightly beneath its peak. It is crescent shaped, with a width of 14 m, and borders a depression with a diameter of 4 m. Feature V is stratigraphically younger than feature II. Due to the lack of overlap with the other features, its temporal relation to them cannot be determined.

Beginning above the heaps, two features follow the slope upwards to the north. The northwestern feature (mining depression 1) is comprised of several depressions which can be followed over a length of approximately 50 m.

15 E.g. Theobald 1862.
16 Metres above sea level.

Fig. 4. Avagna-Ochsenalp, large stone blocks on heap IV with drill holes from blasting work (Photo: P. Thomas, DBM).

The southeastern feature (mining depression 2) is a distinct trench of around 25 m in length.

A final feature in this area of the site is the dry-stone walls of a building, which lie approximately 20 m to the south of the heaps (Fig. 2). The 10 × 6 m structure built of rough stone blocks contains a visible partition wall, which indicates the division of the interior into at least two rooms.

A hand-held crushing tool, a so-called pestle (Fig. 19, 18203.146.1), was found on the slope below the building structure. This is the only artefact found in this area of the site. The raw material is an augite-biotite-diorite, a plutonic rock possibly originating from the bedrock of the *Err* nappe, which lies above the site. The artefact was artificially worked into a rounded, flattened shape. It has a relatively regular diameter of 10 cm and weighs just under 600 g. Traces of use are visible on the worn edges of the tool.

The lower section of the site lies at approximately 2410 masl, northwest and down-slope, at the foot of the terrain step which borders the heap features in the upper area of the site. Several building structures and small heaps are found in this area, which extends over 125 m from east to west and reaches 50 m at its widest point. The former are two round buildings which are sunk into the ground, and the foundations of a smaller, rectangular building. One of the round structures shows evidence of burning on the inner walls. The heaps have a distinctive red colouring, and one contains a noticeable amount of stones with secondary copper mineralization. The heaps and a possible gallery situated near the rectangular building suggest that this group of finds may be connected to mining activity. However, in what period these structures were in use remains undetermined at this point.

2.3. Description of the Findings

Almost the entire area surrounding the heaps of the upper section, especially the steep slopes, is covered with fine, loose rubble. The red colour of the largest heaps (I and II) is most intense on the surface and changes to a yellow-grey or ochre-yellow shade in the layers beneath.

The mining waste appears as compact, layered, breccia-like cemented sediment in the upper areas of heaps I and II, especially at the edges of the plateaus (Fig. 5). Regularly occurring charcoal fragments und negative imprints of wood splints are found in these areas. Some of the wood imprints from the edge of heap I have square or rectangular cross sections of 3–8 mm and are occasionally found in pairs (Fig. 6).

An area of mining waste in the northwest of the heap features was excavated in a sector of 1.5 × 2 m, the stratigraphy was documented and sampled (Figs. 2, 5, sector 1). These layers belong stratigraphically to the older heap II and not to the younger, crescent-shaped heap V. The trench revealed a sequence of layers of differing thickness, which also differ significantly in their composition. The layers run horizontally or at a slight downhill slant. The uppermost 20–30 cm are the most compactly cemented, and mainly consist of rubble (1–10 cm) that shows varying degrees of weathering. The polished section of a micromorphological block sample (67459.4.1) of this area reveals a stratified sequence with layers a few centimetres thick. Beneath this cemented upper part lies a noticeably looser, subhorizontally bedded deposit of 10–20 cm thickness. It contains isolated charcoal fragments (5–50 mm), and partially burned, fine-grained reddish sediment. Below this follows a more compact layer which contains rock fragments up to 20 cm in diameter.

The polished section of a micromorphological sample from the uppermost layer of the edge of heap I shows a similar composition and an even more pronounced stratification (Fig. 7, 18203.115.1). These deposits, consisting mainly of weathered greenish to brownish serpentinite fragments (ultramafic bedrock) are strongly cemented by iron hydroxides. The angular rock fragments (0.1–2 cm) generally occur as elongated flakes and contain occasional ore inclusions (chalcopyrite or pyrite). The uppermost layer is dominated by big, well-preserved and subangular charcoal fragments (1–20 mm). Interestingly, in the central area of the sample, there are indications of a trampled surface on top of layer 4,

Fig. 5. Avagna-Ochsenalp, area of oldest heap features with solidified ridges, view to southeast. – In foreground: documented sector 1 with heaps II and V (Photo: P. Thomas, DBM).

Fig. 6. Avagna-Ochsenalp, negative imprint of two wood shavings (picture centre; width: 4 mm) – presumably lighting tapers – from the upper cemented area of heap I (Photo: P. Thomas, DBM).

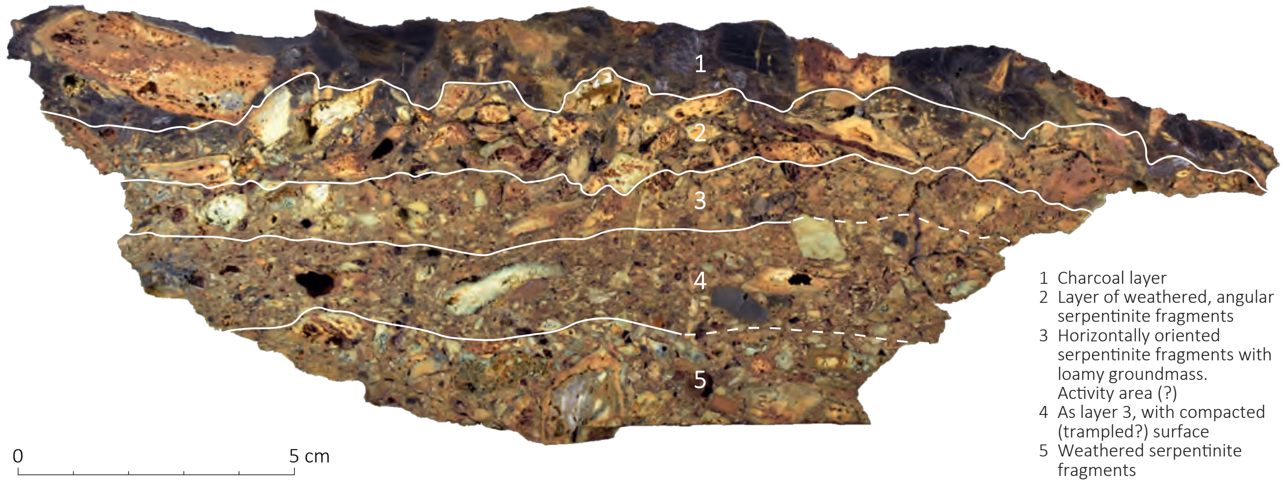

Fig. 7. Avagna-Ochsenalp, polished section of a micromorphological sample from the cemented area of heap I, showing delineated layer boundaries (Photo and illustration: J. Bucher, UZH).

in the form of compacted sediment and horizontally oriented components.[17] Layer 3 shows similar features and probably represents an activity area.

2.4. Dating

Previous research had yielded a Late Bronze Age ^{14}C date for Avagna-Ochsenalp[18] from a charcoal fragment found in what is apparently a piece of smelting slag. However, an appraisal of the original sample material showed that it was not slag, but a piece of the aforementioned cemented mining waste, presumably from an area west of and below the building structure. Three new ^{14}C samples of cemented sediment from heap I (18203.1067–68, 18203.1049.1) also date to the Late Bronze Age (Fig. 8). However, due to the lack of waney edges and sapwood, it is not possible to estimate how accurately these samples date the mining activities. In view of the narrow growth of the tree rings, a single year as well as even entire centuries could be missing.

Newer samples of the mining waste from heap II taken for the present study proved more suitable for dendrochronological dating. A mean curve was constructed of a total of 25 charcoal fragments (Fig. 8, 67459.2–9), the end year being 1043 BC. Short sequences were only taken into

17 Rentzel et al. 2017.

18 Wyss 1993, 202: B-4188: 2990 ± 90 BP; 1433–976 calBC (2σ) [new calibrated].

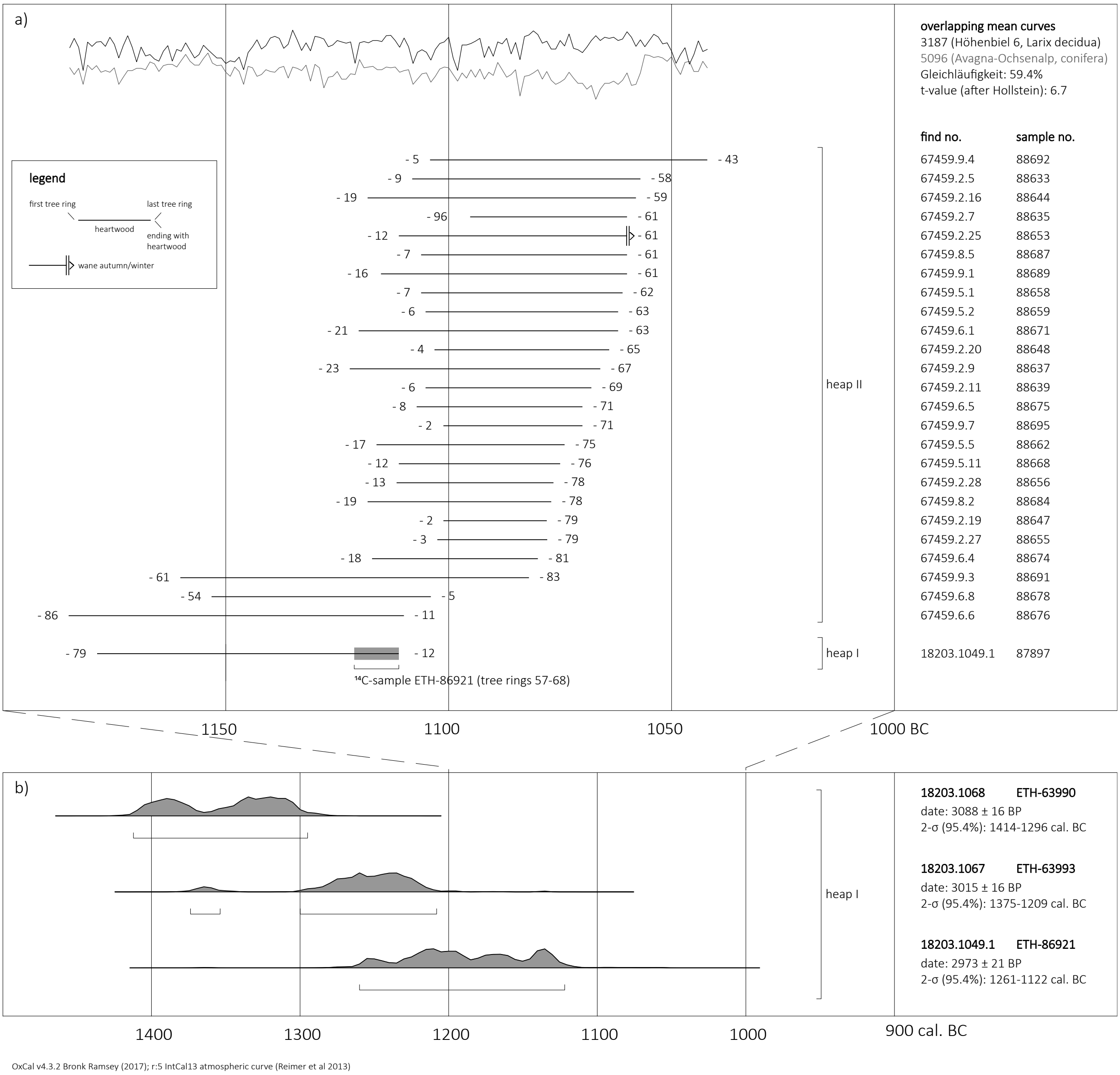

Fig. 8. Avagna-Ochsenalp, absolute dates. – a. Cross-correlation and dendrochronological dating of mean curve 5096 and bar chart of all 25 series from heaps I and II. – b. ^{14}C dates of charcoal fragments from heaps I and II (Illustration: L. Reitmaier-Naef, UZH).

account if other samples from the same layer had more than 50 tree rings. Waney edges are generally difficult to detect in charcoal fragments; experience has shown that within dated sample groups there are sometimes waney edges that are older than the youngest end year, indicating the sporadic use of old wood.[19] Here, bast remains confirm the only definite waney edges, which dates to the year 1061 BC (Fig. 9). However, definitive activity in Avagna can be dated at the earliest to 1043 BC, based on the later end year dates.

The dendrochronological date of a charcoal fragment (18203.1049.1) from heap I was gained with the help of a ^{14}C dating to the end year 1112 BC (without a waney edge) (Fig. 8). This series correlates with the samples from heap II. Due to the fact that most of the waney edges are missing, it is chronologically possible, but not absolutely certain, that the heaps are contemporaneous.

19 Oberhänsli et al. 2019.

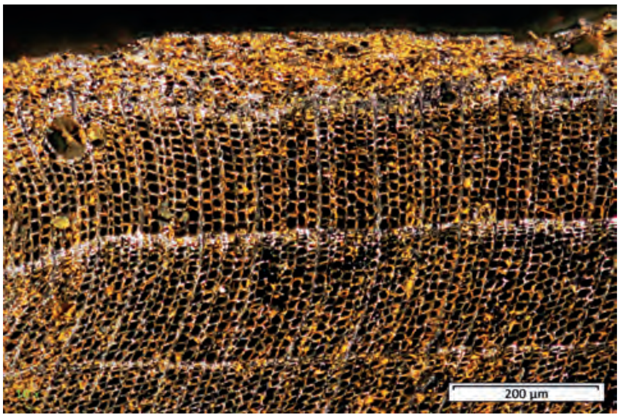

Fig. 9. Avagna-Ochsenalp, sample 67459.2.25 (reflected light): waney edge confirmed by bast remains, dated to 1061 BC (Photo: W. H. Schoch, Laboratory for Ancient Wood Research, Langnau am Albis).

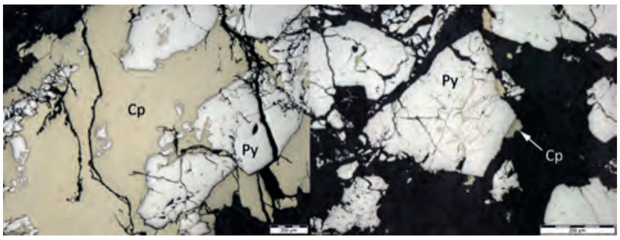

Fig. 10. Avagna-Ochsenalp, cross sections (reflected light). – Ore Sample 4428-AO (left): pyrite (Py), largely replaced by chalcopyrite (Cp). – Ore Sample 4426-AO (right): pyrite with small amounts of chalcopyrite spreading along the fractured edges (Photos: L. Reitmaier-Naef, UZH).

2.5. Mineralization

The mineralized outcrop in Avagna is one of the most copper rich mineralizations in the Oberhalbstein region. Because the bedrock of the site is almost completely covered by the heap features, the mineralization is only visible in the terrain to the north of the mining area. It lies roughly horizontally in a heterogenous fault zone in the upper *Platta* nappe. Two distinct areas can be differentiated within the ore mineralization. The footwall comprises mainly pyrite (FeS_2) in a chloritic-calcitic matrix, while the hanging wall contains a larger concentration of chalcopyrite ($CuFeS_2$) in a mylonitic matrix of chlorite, muscovite and quartz.[20] Compared with other locations in the Oberhalbstein, the mineralization in Avagna-Ochsenalp is mineralogically relatively simple. The lack of ore minerals such as pyrrhotite (FeS) or magnetite (Fe_3O_4), which appear regularly in typical serpentinite mineralizations in the Oberhalbstein, is particularly noticeable.

Three ore samples were taken from the northern border of the heap features of Avagna-Ochsenalp, where remains of the mineralization can be found in situ. They represent the two distinct areas of the mineralization (Fig. 10):

1. The samples 4426-AO and 4428-AO both primarily contain pyrite, which is reflected in high FeO and S and low Cu levels in the overall chemistry. In polished sections chalcopyrite has been accordingly observed only in minor amounts, replacing pyrite along fractured edges.

2. In contrast, ore microscopy showed no pyrite in sample 4427-AO. The sample contains only chalcopyrite, as indicated by the corresponding Cu and S levels of the analysis. The gangue material of this mineralization is quartz.

While both mineralizations may have been of interest for the vitriol mines of the modern period, it can be assumed that only copper ore was mined and processed in the prehistoric period. However, it is unclear if or how well both types could be separated during the mining process. The copper produced from this ore cannot be definitively characterized with a single general chemical analysis, but it would be generally low in trace elements and – in contrast to copper from the upper valley step (see section 3.7) – it would not contain high Ni levels (Tabs. 1a–1b).

2.6. Interpretation

Written sources attest to mining activity in Avagna-Ochsenalp from the Middle Ages at the latest. Existing radiocarbon data from earlier studies suggested older, prehistoric phases of use, which led to the mining archaeological survey in 2017.

The most prominent features are the multi-phased heaps of the upper section. The evaluation of a detailed digital terrain model allowed at least five separate heaps to be identified, which can be assigned to at least two different operating phases. The two oldest, largest heaps date to the Late Bronze Age. The tops of these heaps have been flattened to plateaus. The sediment on the plateaus is compact and finely layered, which allows an interpretation as a trampling surface. Presumably, these are the peaks that lay directly in front of and functioned as access areas to the mines that are found in the adjoining mining depressions.

The Bronze Age heaps make up the bulk of the features, while the heaps from later activities are less extensive. They lie at the northwestern edge of the terrain and, due to their location and size, can be interpreted as the results of later prospections and clearing-up efforts. The older heaps were partially disturbed or repositioned during these activities. Only the youngest phase can be dated with certainty; due to the use of gunpowder, this phase can be placed in the

20 Dietrich 1972.

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MgO	MnO	CaO	Na_2O	K_2O	P_2O_5	S	Cu	ZnO	Sum
4426-AO	16,0	0,29	11,16	43,6	2,53	0,05	0,01	0,04	0,97	0,01	22,78	0,72	0,02	98
4427-AO	57,1	0,20	5,27	14,1	2,27	0,08	0,89	0,03	0,12	1,08	3,32	3,26	0,01	88
4428-AO	9,5	0,10	8,11	43,8	3,26	0,04	0,01	<0,025	0,01	0,01	26,82	0,97	0,01	93

a

Sample	Cr	Co	Ni	Pb	U	As	Sb	Ag	Se	Te	Bi	Sn
4426-AO	5	400	<5	1,3	2,2	70	11,1	<0,3	15	2,3	0,2	5,7
4427-AO	7	15	<5	70	2,0	100	<0,5	3,8	55	3,8	0,4	5,0
4428-AO	7	1500	<5	5	2,4	15	1,4	1,0	20	1,9	0,2	1,4

b

Tab. 1. Avagna-Ochsenalp, general chemical analysis (ICP-MS) of ore samples. – a. Major and secondary components in wt.-%, total in %. The total iron content was calculated as FeO. – b. Trace elements in ppm. – All samples were measured in the DBM laboratory.

modern period. The older heaps were possibly forepoled during the prospection and clearing up efforts, in order to evaluate the deposit in the bedrock behind them. The collapse of the forepoling after the mine was abandoned resulted in the long depression found on the surface of heap III.

Further structures in the immediate vicinity of the heap features, as well as those in the working area situated at a lower level, cannot be dated with certainty. Only a pestle found below the heaps may be connected to prehistoric copper ore beneficiation.

3. Cotschens

3.1. Mining Site

The second surveyed area lies on the upper valley step of the Oberhalbstein, west of Lake Marmorera, at the western end of the largest and most important mineralization zone of the region. The mineralization extends roughly along the present-day dam wall to the Gruba mining area on the eastern side of the valley and crops out at various points. It is not surprising, then, that the former plain of Marmorera contains the highest number of verifiable prehistoric smelting sites. Beside the prehistoric mines Vals (Marmorera GR) and Gruba II (Marmorera GR), which have been the subjects of earlier studies,[21] the previously unstudied mining area *Cotschens* seemed a likely source of materials for prehistoric copper production,[22] particularly in light of the lack of written and archaeological evidence of medieval or modern mining activity.

The area, which lies at 2130–2300 masl, extends over an Alpine pasture and slopes to the east, with a total extent of over 0.1 km². From east to west, the following areas along the ascending slope can be distinguished (Fig. 11):

Val Starschagns

There are several working traces in the area of the upper escarpment of Val Starschagns. A small mine is situated directly below the escarpment. It comprises two parallel, slightly sloped adits of around 10–15 m in length. The working face of the northern structure is flooded, and a heap of fine material anterior to this suggests underground processing activity. To the south of the mine, a depression filled with coarse rubble suggests a further underground part, which is now almost completely collapsed.

Slightly to the northwest of this area, directly above the escarpment of Val Starschagns, a flat mining depression of 30 m in length runs from east-southeast to west-northwest, accompanied almost continuously along the east-northeast by a heap. Further mining activity, presumably younger, is evident at both ends and seems to align with the course of the mining depression.

To the south of this, a 12 m-long trench which strikes southeast to northwest runs towards the mining depression at an acute angle. Small drifts that follow the line of strike of the mining depression can be found at the northwestern end. Downslope, this depression is almost entirely surrounded by a contiguous heap.

Area S

An ore outcrop lies around 150 m to the southwest, further up the slope. It is primarily marked by a heap of roughly 35 m in diameter. Both the bedrock and the heap material show the rust-red colouring that is characteristic for Cotschens. Detailed archaeological examinations are still pending, but various features in the terrain, such as a ramp-like structure south of the heap, could indicate more extensive mining activity.

21 Reitmaier-Naef, Turck, Della Casa 2015. – Turck et al. 2018.
22 E.g. Schaer 2003.

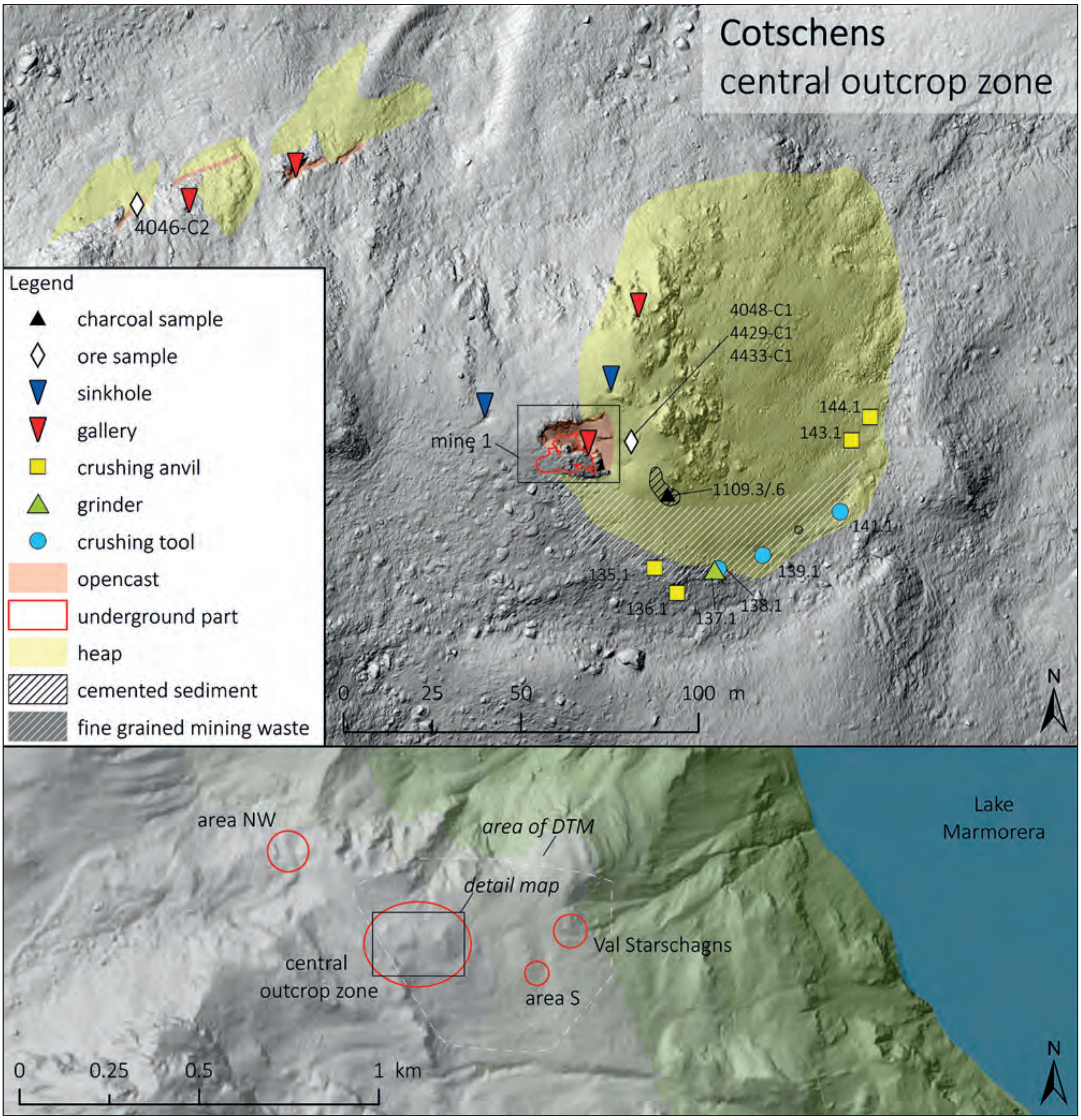

Fig. 11. Cotschens, maps of the mines, heaps, finds (18203.[…]), charcoal samples (18203.[…]) and ore samples (Map: L. Reitmaier-Naef, UZH; terrain model: A. Zwicky and Ch. Walser, ADG; geodata: Federal Office of Topography and Canton of Grisons).

Central Outcrop Zone

The largest area of activity lies at a central position in the terrain and is visible from afar due to its extensive, strikingly red mining waste heaps. This colour is eponymous for the entire mining area of Cotschens (cotschen, Romansh: red). The area is divided into an eastern and a western part, the eastern part being more productive in terms of mining archaeology. Here, the outcrop zone extends over an area of 70 × 65 m. A heap measuring 120 × 60 m lies in front of this to the east. Mine 1, which was archaeologically surveyed in the summer of 2017, is situated in this area. At least two collapsed portals, a sinkhole directly northeast of mine 1 and a similar depression 16 m to the west of the mine all indicate further underground mining activity. Cemented sediment, which contains numerous fragments of wood and charcoal, is found around the heap, especially southeast of mine 1. The upper and middle part of the southern side of the heap contains comparatively fine material. Based on the stone tools found here, this area could be interpreted as a processing site, which is a unique find so far in the Oberhalbstein region (Fig. 11).

In the western part of the area, the outcrop stretches over 120 × 60 m. Heaps are found mainly to the northeast and to a lesser extent to the northwest. Traces of mining are found here mainly as mining depressions and trenches that follow diabase dykes which strike from northeast to southwest (Fig. 12), as well as isolated collapsed portals which seem to follow the direction of the dykes. Finally, at the northwestern edge of the outcrop, there are several small test trenches.

Fig. 12. Cotschens, view of an undated mining trench in the north-western area of the central outcrop zone, which follows a diabase dike (pale stone, center of image). View to southwest (Photo: P. Thomas, DBM).

Area NW

A smaller, previously completely unknown mining area lies roughly 250 m northwest of the central outcrop zone. It comprises several features: an elongated trench runs west-southwest to east-northeast over approximately 30 m, an approximately 65 × 20 m heap of noticeably fine-grained material adjoins the trench to the north, and a small but pronounced southwest-northeast striking trench, which consists of three mining depressions of up to 10 m in size is situated in the eastern part of the area.

3.2. Description of Mine 1

The mine is situated at the southern edge of the eastern part of the central outcrop zone. It consists of two main parts: an elongated opencast and an underground part which adjoins to the south.

The opencast strikes in an east-west direction for around 20 m (Fig. 13). Its widest point of 12 m lies at the eastern, down-slope end. As it extends up the slope, it narrows to around 6 m and ends in a working face that is around 3 m high. The northern side wall also has a height of around 3 m and inclines noticeably to the south, especially in the back, western end of the opencast. At the eastern end, the wall is set more to the north over a length of 5 m, and slightly undercut. The southern side wall is slightly higher than its northern counterpart. However, because the infill of the opencast slopes to the south, the southern side wall rises significantly higher and reaches a height of up to 5 m. It is almost vertical and in places also slightly undercut.

Due to the fissured rock, the surfaces of the side walls are very irregular, making traces of mining work difficult to detect. Rounded forms have only been preserved in a few places in the harder areas of the rock, especially on the south wall and on the western working face.

The opencast mine is partially filled with rubble, which covers the entire floor of the mine. The sediment generally inclines to the east and south. In the eastern area, several boulders protrude from the sediment; some are collapsed blocks, while others seem to be part of the bedrock. This also seems to be the case for a low step that runs through the middle of the mine, following the line of strike. A massive rock spur to the southwest of this forms a northeast-southwest wall, which only shows traces of deep incisions at its southwestern end and is thus separated from the southern wall of the mine. On its southeastern side, a rounded mining feature undercuts the spur in a western direction. However, the full extent of this feature cannot be determined due to the infill.

In the area surrounded by the described structures, the surface of the infill is markedly lower than in the rest of the opencast, the difference in height reaching up to 3 m in some areas. The entrance to the underground part of the mine is situated here, lying at the foot of the south wall and opening to the southwest.

The entrance to the underground part from the opencast is around 9 m wide. Most of this, however, is filled with rubble which has entered the mine from the opencast. Access to the mine is only possible from the east, where the infill is lower.

The underground part of the mine inclines by 20° to the west-southwest and has a length of 17 m. The total height is around 8 m, and the maximum width reaches 12 m in the line of strike (Fig. 14). The mine comprises several domed working sections which intersect and are arranged in a linear fashion along the incline. At least three such structures can be differentiated. Their roofs are domed, but the walls are partially segmented into smaller structures with further domes and recesses, most prominently in the central area of the south wall of the mine. Two structures which seem to differ from this principle extend the mine to the north. A small drift is situated at the mine's lowest point and extends from the north wall for around 1.5 m to the north. While the cross section is rounded, the ground plan is clearly rectangular. A larger drift in the upper section of the mine shows similar characteristics. This drift extends over 4 m to the northwest. It is considerably larger, with a width of around 4 m and a height of over 4 m. Straight walls and an irregular profile suggest that a different mining technique was used here.

Large parts of the floor of the mine are covered with rubble, making it difficult to completely determine its southern extent. Only the lowest stope and the two drifts which extend to the north are free of sediment (Fig. 15). Beginning at the opencast mine, the infill slopes steeply to the southwest, south and southeast. Rough rubble is concentrated at the foot of the incline, while the material in the upper part of the mine is finer. Two large rocks found here in the infill are presumably collapsed blocks from the roof of the mine.

3.3. Description of the Findings in Mine 1

In order to study the infill in the opencast, a test trench measuring 80 × 80 cm was opened directly at the base of the southern wall (Fig. 13, sector 1). From just a few centimetres below the surface, the bedrock below is relatively flat, sloping only slightly to the east, indicating that the infill may not be very thick in the southwest part of the opencast. It consists of heterogeneously distributed, partly sub-horizontally stratified serpentinite rubble (mainly 0.5–10 cm). The components are strongly weathered and cemented to a hard, breccia-like deposit. At a depth of around 30 cm, especially in the area of the walls, the material is so solidified that it is almost impossible to remove it manually.

The underground part of mine 1 is currently flooded; water fills the entire lower area of the stope. The flooding contributed to the good preservation of the wooden objects. After the stope had been drained, a layer of mud a few centimetres thick remained. Most of the wooden artefacts were found in this layer. Many of them were probably moved by the water and date from different periods of use. A trough, of which more than half was preserved (Figs. 16, 18, 67457.22.1) was found on the floor of the small drift in the northern wall.

In a small, raised recess in the southern wall of the lower stope, sediment was preserved between the mud layer and the bedrock. This was excavated manually and documented (Fig. 14, sector 2). The up to 5 cm-thick sediment consisted of partially oxidized, fine angular rock fragments. This layer also contained several charcoal fragments and further wooden artefacts, including a spatula (Fig. 18, 67457.38.1) in situ.

The largest outcrop is situated in the upper area of the mine, between the portal and the northern wall (Fig. 14, sector 3). From here, the infill inclines sharply from the roof to the southwest into the mine. The loose rubble on the surface, presumably originating from the opencast, was removed from an area of approximately 3.5 × 3.5 m (sloping over a height of almost 4 m). Several layers of older filling, levels with evidence of burning and stone structures were revealed beneath. The layers, partially cemented due to secondary oxidization, had been almost vertically truncated even before they were covered by the loose material. They were generally left as found, which is why the documented profile is stepped.

These layers are aligned horizontally south-north and cover the floor in the northern part of the mine (Fig. 17). Three to four thick layers of rough infill, separated by thin sediment layers containing fine charcoal, make up the lower half. Two of these thin charcoal layers are visibly reddened by exposure to heat in their lower area. Two charred animal bones were found in the uppermost layer of the two. The roughly layered infill consists of sharp-edged serpentinite rubble of varying sizes (0.5–30 cm) and proportions. The coarse-grained, porous infill generally seems to be more cemented than the finer material. The deposit has a reddish-brown to violet-black colour and shows a glossy surface in the cemented areas. Polished sections show that the dark-green serpentinite and especially the ore-bearing veins are heavily weathered, leading to a porous structure or a peripheral weathering zone. At least one fragment is completely coloured red, presumably due to exposure to

Fig. 13. Cotschens, mine 1, opencast with underground cavity. – Top: ground plan. – Bottom: vertical projection (Plan: P. Thomas and G. Steffens, DBM).

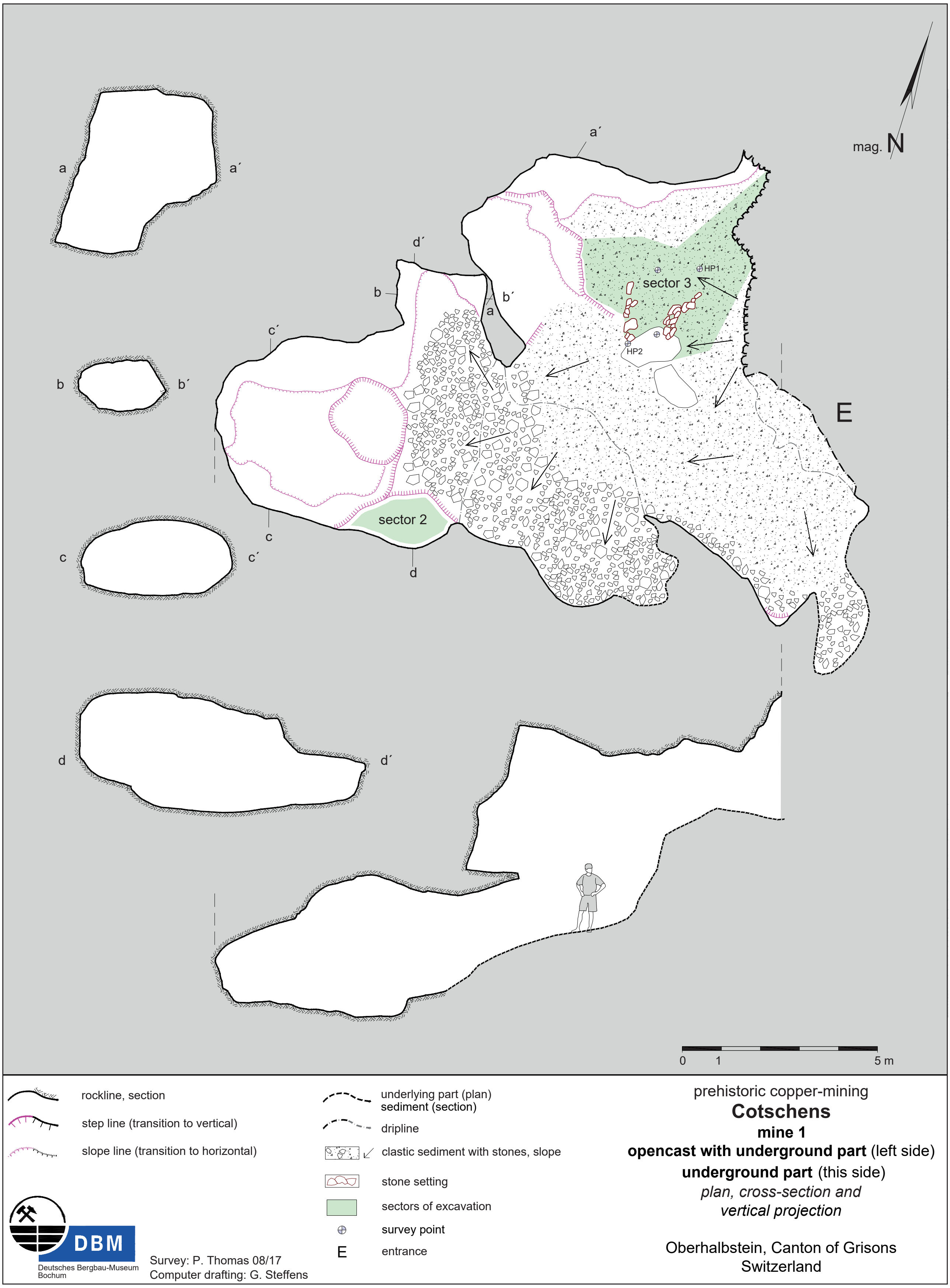

Fig. 14. Cotschens, mine 1, underground part with cross sections and vertical projection (Plan: P. Thomas and G. Steffens, DBM).

Fig. 15. Cotschens, mine 1, lowest stope area with wood finds and small northern drift, view to the west (Photo: P. Thomas, DBM).

Fig. 16. Cotschens, mine 1, one of the La Tène period troughs (67457.22.1) in its original position on the floor of the small drift in the northern side wall of the lowest stope area (Photo: P. Thomas, DBM).

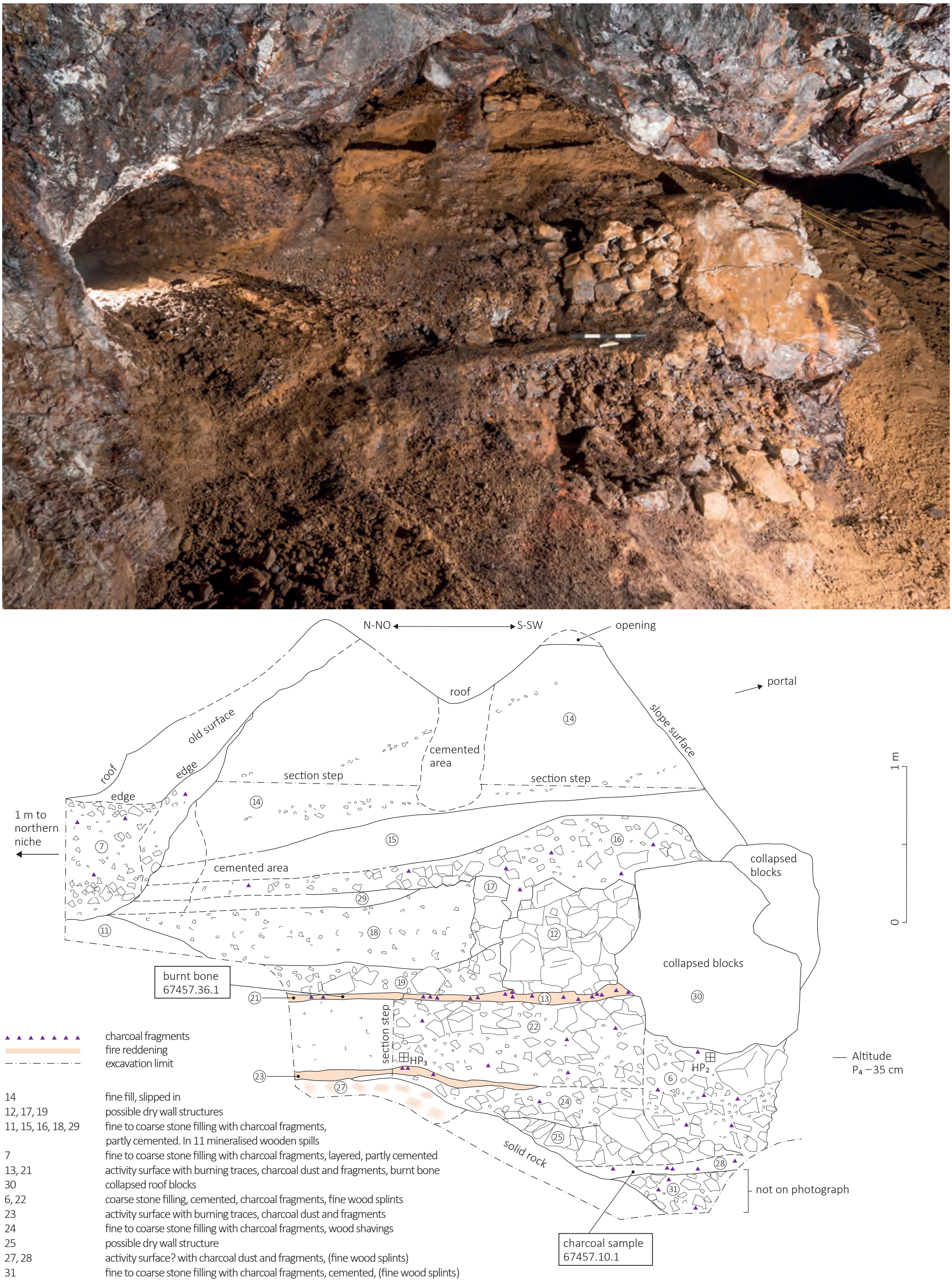

Fig. 17. Cotschens, mine 1, sector 3, east section (Photo: P. Thomas, DBM; drawing: J. Bucher, UZH and M. Huwiler, ADG).

intense heat. The locally abundant charcoal fragments, as well as the smaller wood shavings, are mostly either partially or completely impregnated by iron precipitations.

The two large boulders, which presumably stem from the roof of the mine, lie on top of the three lowest infill layers. The uppermost burned layer abuts these blocks, indicating that the collapse took place while the mine was in use.

The stone structures in sector 3 may be walls constructed as the western border of the infill of the east section. The structures cannot be stratigraphically placed with certainty and may belong to a younger phase of mining activity. The infill layers in the western area of the documented profile may have slipped away or been removed in this phase.

3.4. Wood Objects

A total of 66 wood objects were found in mine 1 in Cotschens, 50 of which have been worked. Both the excellent preservation of the objects and the partial traces of washing out are due to the waterlogged preservation conditions.

While the purpose of 14 of the objects is unclear, the remaining 36 artefacts could be assigned to ten object groups (Tab. 2). These include three modern artefacts: a machine-produced, burned matchstick (67457.35.3), which dates to the 19th century at the earliest,[23] a red and white painted snow pole (67457.13.1) and a roof batten (67457.12.1).

The determination of the wood species revealed that – apart from the matchstick, which was made of poplar (*Populus*) – the objects were made of Scots pine or mountain pine (*Pinus sylvestris* or *mugo Turra*), Swiss stone pine (*Pinus cembra*) or spruce (*Picea abies*)/larch (*Larix decidua*). While the larch and spruce are particularly suitable for stable constructions and robust tools, the Swiss stone pine and the mountain pine are softer conifer species that are suitable as firewood. Grouping these 36 artefacts according to function-specific ideal properties, even this small sample size showed a tendency towards an intentional choice of wood, which takes into account the suitability of hard wood for tools or soft wood as firewood.

The most significant finds will be discussed below.

Fragments of two troughs (Fig. 18, 67457.22.1; 67457.28.1) dated to the La Tène period (see section 3.6 and Fig. 20) are among the most spectacular finds. The larger of these fragments can be described in more detail. The preserved segment, made of a half section, has a reconstructed width of 22 cm and a length of 51.8 cm. A segment was removed tangentially from the bottom to form a base. The end faces are inclined slightly outward and short handles have been worked out of their upper edges. A cavity was worked into the upper side which is trapezoidal in both longitudinal and cross section. Traces of manufacturing are only found on the inner end sides and floor. The toolmarks, visible due to the excellent state of preservation of these parts, indicates the use of a single axe.[24] Most of one longitudinal half of the trough is missing from its present form, having broken off along a longitudinal fracture. A similar fracture runs along the intact side wall. The second preserved fragment is the handle of another, presumably slightly smaller trough.

A shovel-like tool (Fig. 18, 67457.9.1) with a maximum width of 8.4 cm and a length of 52.7 cm, which was carved from a log, also dates to the La Tène period. The handle, almost round in cross section and roughly worked at the end, merges smoothly with the narrow blade. The blade constitutes approximately two thirds of the length of the tool and is flattened on the underside and only slightly concave on the upper side. Large-scale charring appears in the area of the hollow. Traces of manufacture are mainly found around the handle. In addition, the underside of the tool shows extensive marking, with 165 vertical tool or chopping marks.

The spatula (Fig. 18, 67457.38.1) dating to the Hallstatt period was carved from a radially split piece of wood and has a flat cross section and longitudinal section. The preserved length of 27.8 cm almost entirely comprises the elongated blade, which transitions smoothly to the stub of the broken handle. The surface is slightly washed out, making it impossible to see potential traces of use on the long and broad sides.

An undated fragment of an object of unknown purpose (Fig. 18, 67457.14.1/15.1/23.1) shows noticeably careful shaping and working around the edge, despite poor surface preservation.

Seven lighting tapers and wedges with charred ends, of different shapes and dimensions and made of both branch and trunk wood, were also found in Cotschens. Only one lighting taper (67457.35.2) – dating from the modern period – is known to be fully preserved. Axe marks that have clearly cut the shaft are visible at the end of the taper. The other lighting tapers show signs of breaking or erosion at the ends. In addition, nine contorted, charred wooden objects were assigned to a group of objects of unknown function. They were presumably used for timbering or as firewood. Three wedges, a fragment of a shaft and four wood shavings were also found. The latter in particular can be seen as waste from the woodworking process.

23 Bujard 1910.

24 Sands 1997.

Categories	Object groups (number of objects)	Larix decidua/ Picea abies	Pinus cembra	Pinus sylvestris/ mugo Turra	Populus
Tools	Shovel-like tool (1)		1		
	Spatula (1)	1			
	Troughs (2)	1	1		
	Shaft (1)	1			
	Wedges (3)	1	1	1	
Manufacturing waste	Wood shavings (4)	4			
Lighting	Lighting tapers (7)	1	1	5	
Building/firewood	Split wood with charred ends (4)	2	1	1	
	Contorted, charred wood artefacts (9)	1	5	3	
Tally stick	Tally stick (1)	1			
Unknown	Unknown (14)	8	3	3	
Modern artefacts	Match stick (1)				1
	Roof batten (1)	1			
	Snow pole (1)	1			
	Total	23	13	13	1

Tab. 2. Cotschens, mine 1, distribution of wood artefacts by object groups.

A fragment of notched wood (Fig. 18, 67457.30.1) showing symbols carved with a knife dates to the early modern period.

The spectrum of prehistoric wood artefacts found in Cotschens corresponds well with mining finds from other periods. Troughs similar in all characteristic details to those found in Cotschens appear in earlier, Bronze Age contexts, and can be traced almost unchanged to the modern period. These vessels are ore or mining troughs, used to transport extracted ore or mining waste.[25] The same applies to the spatula-like tools. While these are also found in settlement contexts,[26] some examples have been found in Alpine mining contexts, where they are associated with the haulage and the beneficiation of ore.[27] Shovels are also a part of the standard repertoire of mining tools for both prehistoric and later mines,[28] although the artefact from Cotschens is distinct due to its clumsy design. It is possible that it was made as an *ad hoc* tool. Similar objects were deposited in large numbers on the Schöllberg-Göge in South Tyrol, presumably as part of a ritual act.[29] The charring on the blade of this fragment, however, corresponds with other Alpine mining finds that show similar patterns of charring. This may indicate the use of these shovels to carry embers.[30] The notched wood can be interpreted as a tally stick. These objects were used in some areas into the 20th century, and recorded house signs, ownership status or the calculations of shepherds, Alpine dairymen and farmers with carvings and decorations that ranged from simple to elaborate.[31]

3.5. Stone Objects

An assemblage of stone artefacts that fit well into the spectrum of prehistoric ore beneficiation tools[32] was found in the area of the heap south of the mine: several hand-held crushing tools or pestles, anvil stones and the fragment of a grinder (Fig. 19).

Two of the pestles are preserved completely (Fig. 19, 13203.138.1/139.1), while the third is fragmented (18203.141.1). Gneiss which probably originates in the Julier crystalline was used to craft two of these tools, while the third is made from local serpentinite. The rough stones were artificially worked into flattened spherical to discoid shapes. Their diameter is between 8 and 11 cm, the weight of the complete pestles between 600 and 700 g. Only half of the fragmented pestle has survived. This fragment alone weighs

25 Thomas 2018.
26 E.g. Perini 1987.
27 Goldenberg et al. 2011. – Stöllner et al. 2012. – Koch Waldner 2017. – Thomas 2018.
28 Thomas 2018.
29 Steiner et al. 2009. – Steiner 2010.
30 See Thomas 2018.
31 Stebler 1907. – Weiss 1941.
32 Stöllner et al. 2012. – Timberlake 2014.

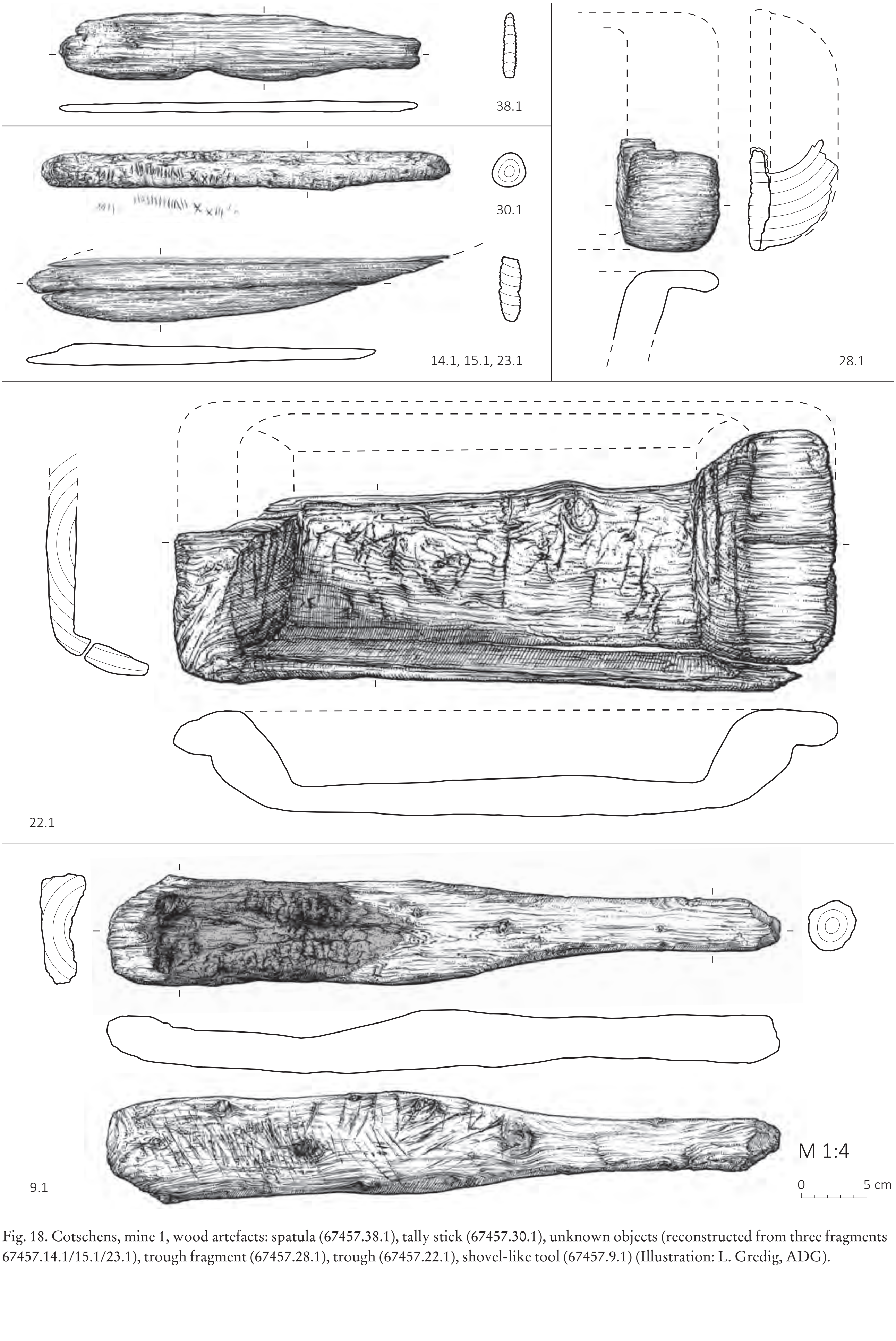

Fig. 18. Cotschens, mine 1, wood artefacts: spatula (67457.38.1), tally stick (67457.30.1), unknown objects (reconstructed from three fragments 67457.14.1/15.1/23.1), trough fragment (67457.28.1), trough (67457.22.1), shovel-like tool (67457.9.1) (Illustration: L. Gredig, ADG).

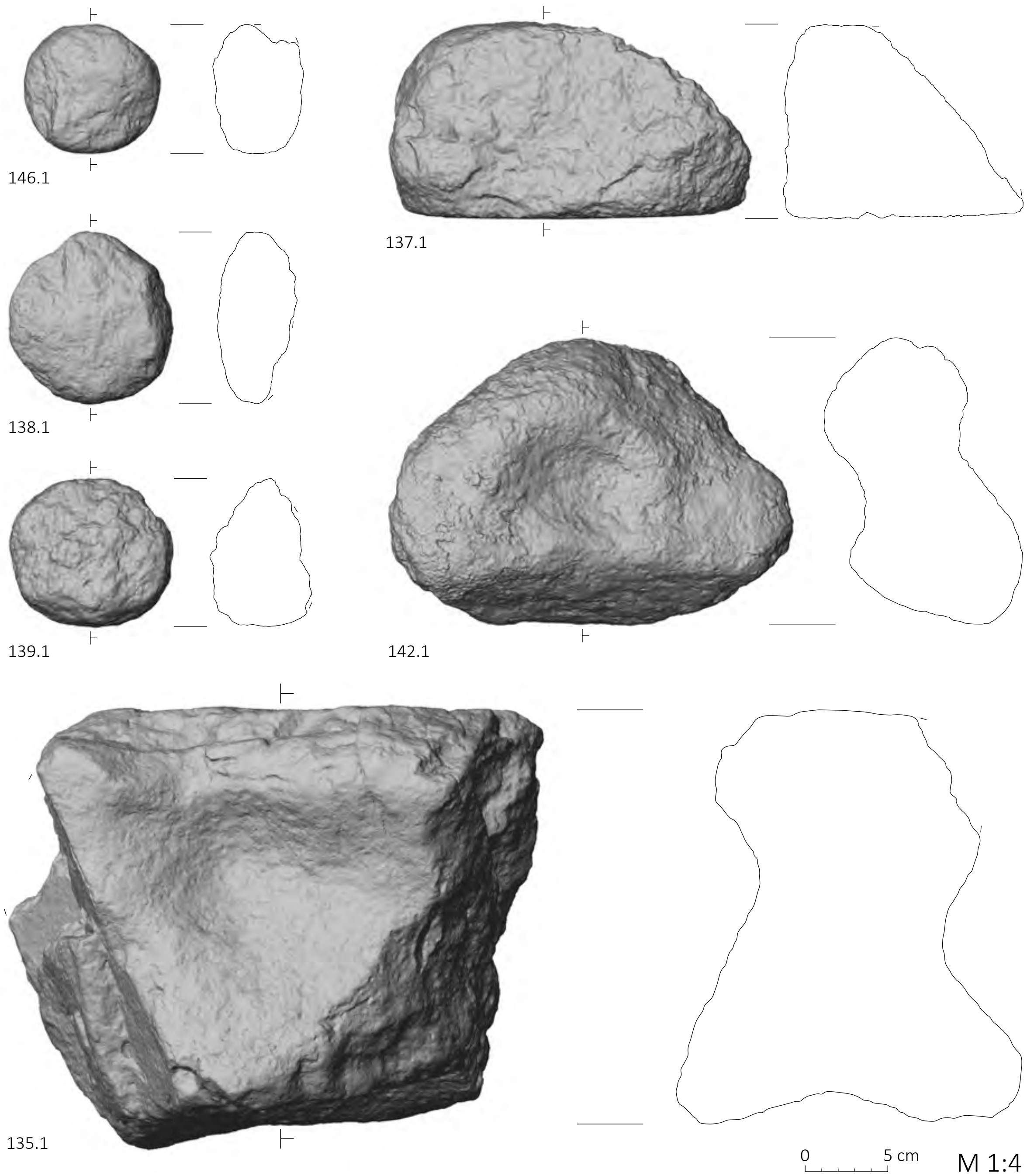

Fig. 19. Stone tools. – Avagna-Ochsenalp: pestle (18203.146.1). – Cotschens: pestles (18203.138.1/139.1), grinder (18203.137.1), anvil stones (18203.135.1/142.1) (3D models: A. Zwicky, ADG; illustration: L. Reitmaier-Naef, UZH).

700 g, which indicates the use of much larger tools. Traces of use can be seen in the form of worn edges and flaking around the longest perimeter.

The anvil stones are heterogenous in appearance, despite the small sample size. Two anvil stones are complete (18203.136.1/Fig. 19, 18203.142.1), three are damaged (Fig. 19, 18203.135.1) or fragmented (18203.143.1/144.1). They vary in size, from 20 to 30 cm in length and a weight of 3 to 7.5 kg, to the largest blocks which are over 40 cm in length and weigh almost 30 kg. The raw material is usually local stone that was roughly hewn into shape. Flaking is rare and only found on the ridges and flat surfaces. Dimples in the surfaces of the stones, sometimes on several surfaces of the same stone, attest to the use of these stone tools. Their size ranges from small, shallow dimples of a few centimetres in diameter to hollows over 20 cm wide and over 4 cm deep. The diameter and depth of the dimples remain in proportion to one another: the wider hollows are also deeper than smaller ones.

The final stone object found in this area is a fragment of a grinder (Fig. 19, 18203.137.1) made from biotite-diorite. Originally roughly loaf-shaped, the artefact has broken off diagonally. It has a length of 22 cm and a weight of approximately 5.5 kg. The underside is noticeably flat and slightly convex, which supports an interpretation as a grinder. The slight roughness of the surface may indicate that the tool was not in use long before it broke.

3.6. Dating

Absolute dates could only be gained with material samples collected from around the central outcrop zone of Cotschens. Since a reliable dendrochronological date was not possible in any case, additional radiometric age determination was carried out (Fig. 20).

The cemented material from the heap southeast of mine 1 yielded a dendrochronological date (b-quality/uncertain dating) with the end year 1131 BC. Because the mean curve extrapolated from the two charcoal fragments (18203.1109.3, 18203.1109.6) is relatively short (56 tree rings), this date was further ensured through wiggle-matching. For this, ^{14}C samples of the youngest and oldest tree rings were analysed. However, the 2σ range (94.4 % confidence) of the youngest tree rings lies between 1362 and 1278 BC – over 150 years earlier than the putative dendrochronological date.[33] The cause of this deviation from the otherwise internally consistent wiggle-matching is as yet unclear and cannot be clarified with the progression of the calibration curve. It cannot be estimated how many tree rings are missing between the end year 1131 BC, which remains the most likely date despite the lack of consistency with the ^{14}C results, and the waney edge.

The wood artefacts found in mine 1 all date to younger periods. The spatula (67457.38.1) dates to the Hallstatt period, although here, too, the distance missing between the sampled tree rings and the waney edge cannot be determined. The samples from the east profile documented in mine 1 also date to the Early Iron Age. The charred rib fragment from an animal the size of an ovicaprid (67457.36.1), found in the uppermost burned layer, and a charcoal fragment (67457.120.1) from the lowest burned layer were also dated. Both dates fall into the Hallstatt plateau and thus date the lower half of the stratigraphy to the early 8th to the mid-6th century BC.

The shovel-like tool (Fig. 18, 67457.9.1), the trough fragment (Fig. 18, 67457.28.1) and the partially preserved trough (Fig. 18, 67457.22.1) all date to the later La Tène period. For the latter, the most likely synchronisation of the tree ring series lies at the end year 67 BC. For the artefacts dating to the La Tène period, only a few tree rings are missing before the waney edge, meaning any significant old wood effect can be ruled out.

Younger ^{14}C dates confirm that there was occasional activity in the mine after this period (Fig. 21). A contorted, charred wood artefact dates to the Roman period (67457.18.1; near waney edge). The tally stick (Fig. 18, 67457.30.1; near waney edge), a lighting taper (67457.35.2; near waney edge) and the fragment of a shaft (67457.25.1; near waney edge) date to the modern period. Other wood artefacts such as a matchstick (67457.35.3), a snow pole (67457.13.1) and a roof batten (67457.12.1) are also clearly modern.

3.7. Mineralization

The mineralizations in Cotschens, like the majority of copper mineralizations in the area, are embedded in a serpentinite sequence of the *Platta* nappe.[34] Several mineralizations can be differentiated in the central outcrop zone of Cotschens, two of which are relevant for the study of prehistoric copper mining (Fig. 22):

1. A first type of mineralization (type 1) occurs in the eastern area of the central outcrop zone (mine 1) and comprises pyrrhotite, chalcopyrite and minor bornite. It is generally associated with ilavite and the host rock is serpentinite, particularly antigorite.

The analysed samples show high concentrations of FeO (>30 wt-%) and SiO_2 (approx. 30 wt-%) and MgO (up to 15 wt-%) and only minor copper (<3 wt-%), which confirms the findings of the optical microscopy. MgO is a characteristic secondary component of serpentinites and indicates – along with the low Cu content – a high amount of host rock in the sample material. Geochemistry also shows higher levels of Ni, Cr (>240 ppm) and Co (30–400 ppm) and very low proportions of Ag, Sb and As which is typical for mineralizations in serpentinites. Copper produced from these ores is characterized by low impurities apart from a certain Ni content and as such is easily discernible from copper produced from fahlores (Tabs. 3a–3b).

The samples were taken from heap material because the in-situ mineralization was not accessible. However, in the eastern area of the central outcrop zone, the heap material

33 For raw data of ^{14}C and dendrochronology, see Fig. 20 and Appendix 1 (supplementary data).

34 Dietrich 1972.

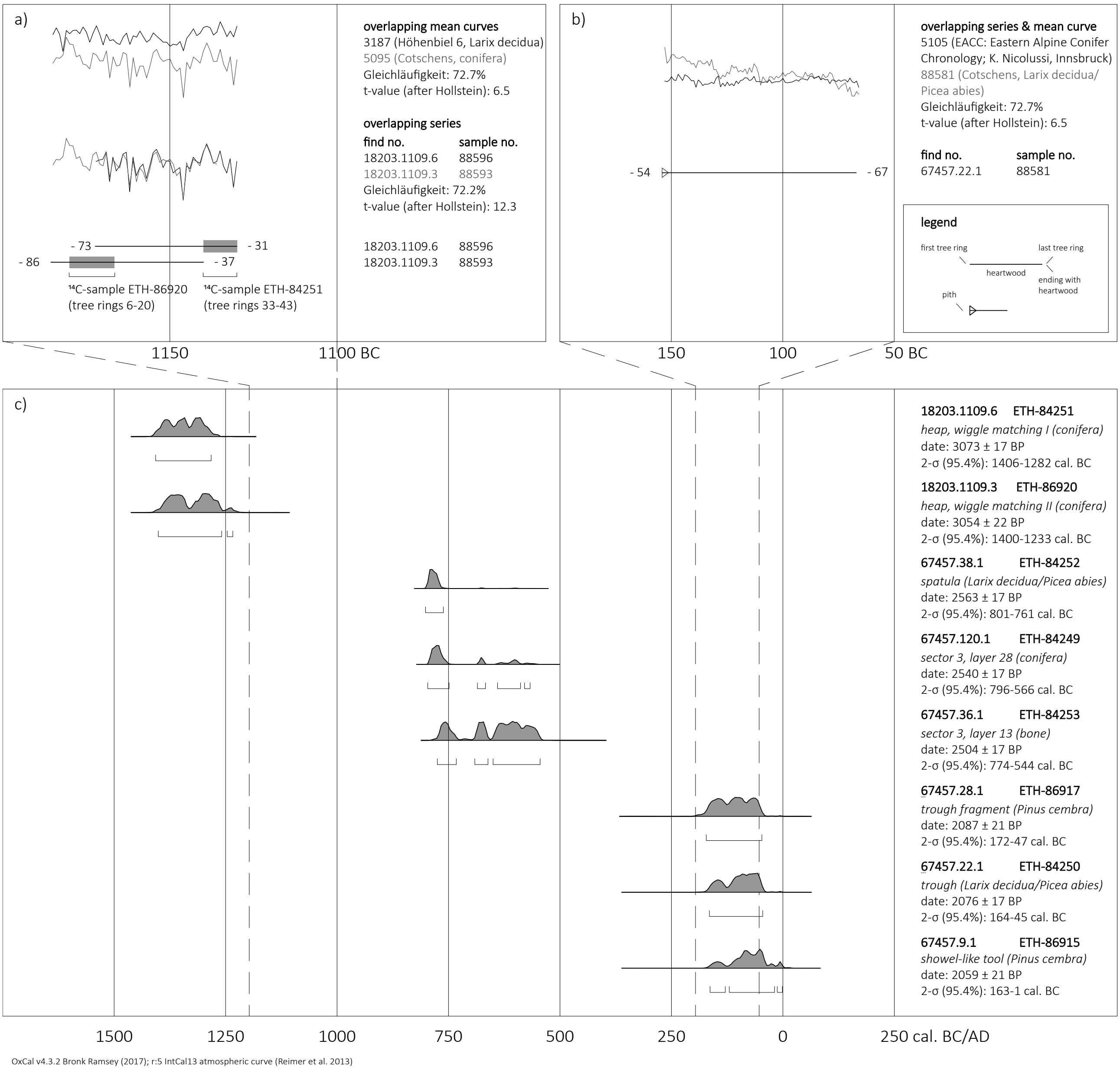

Fig. 20. Cotschens, central outcrop zone and mine 1, absolute dates. – a. Dendrochronological dates from charcoal from the heap. – b. Dendrochronological date of the trough (67457.22.1). – c. [14]C dates from prehistoric wood objects, charcoal fragments and bones from mine 1 and the surrounding heap (Illustration: L. Reitmaier-Naef, UZH).

contains this ore paragenesis quite regularly and it can be assumed that the ore extracted from mine 1 corresponds to this first type of mineralization.

2. A further, copper-rich mineralization is situated at the northwestern edge of the central outcrop zone. An undated opencast of several metres in length exposes the mineralization, which was sampled directly from the ore vein. This mineralization is mainly comprised of the copper-rich minerals bornite and chalcocite, with very small amounts of remaining chalcopyrite. In contrast to the first mineralization type and the majority of local copper ore mineralization, this mineralization is embedded in a pale metabasalt host rock. The mineralization runs northeast-southwest through the almost vertically inclining diabase dyke that traverses the outcrop zone, following the junction of the diabase and the surrounding serpentinite.

In comparison to mineralization type 1, this sample is comprised of SiO_2, CaO and Al_2O_3, with significantly lower

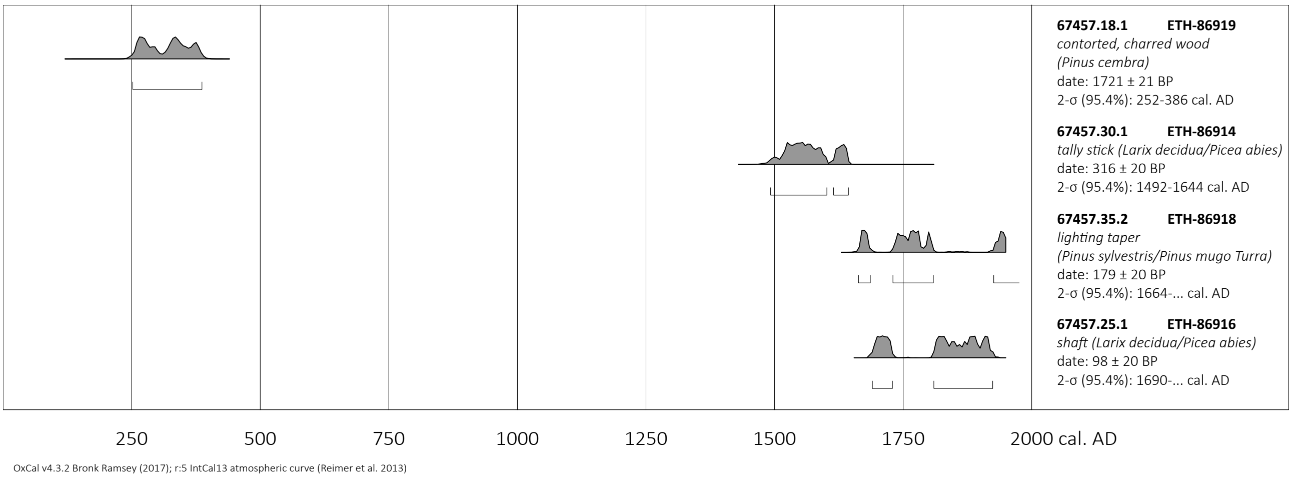

Fig. 21. Cotschens, mine 1, ^{14}C dates for wood objects dating from the Roman to the modern period (Illustration: L. Reitmaier-Naef, UZH).

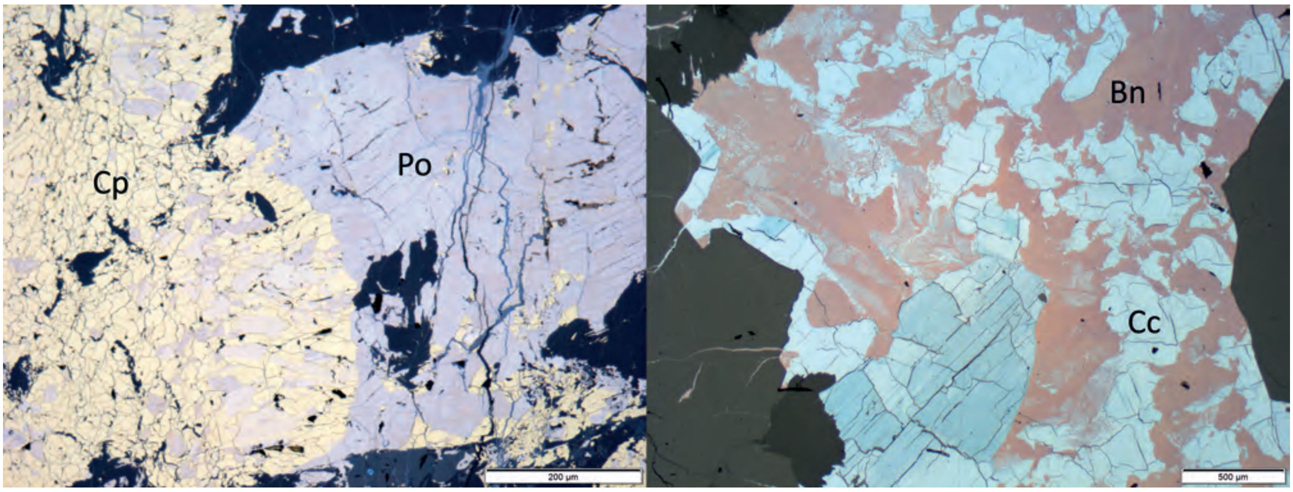

Fig. 22. Cotschens, cross sections (reflected light). – Sample 4948-C1 (left), type 1: chalcopyrite (Cp) and pyrrhotite (Po). – Sample 4046-C2 (right), type 2: copper-rich mineralization with eutectic intergrowth of bornite (Bn) and chalcocite (Cc) (Photos: L. Reitmaier-Naef, UZH).

MgO and FeO levels. Both types also show substantial variation in their trace element content: the analysed sample of type 2 shows only very low amounts of trace elements, of which only Ni, Co, Ag and Se are slightly higher (40–80 ppm).

It is unclear if this raw material was extracted and processed in prehistory. Considering the high copper content of the mineralization, however, it seems entirely conceivable and would have been achievable with the technology available at the time.

3.8. Interpretation Cotschens

To date, the mining area of Cotschens has yielded the most finds from a prehistoric mining context in the Oberhalbstein region. The extensive outcrop zones are strewn with traces of mining activity whose differing characteristics, as well as recognizable superimpositions, show spatial as well as chronological succession. In concrete terms, this can be demonstrated for mine 1, which was the subject of mining archaeological investigations in 2017.

The mine feature is mainly characterized by rounded cavities which may have been created through fire-setting. This interpretation is supported by the charcoal contained in the infill and by burned layers turned red by intense heat. Radiocarbon dates place these layers in the Hallstatt period, making this the earliest and, so far, the most extensive known operational phase of the mine. A spatula, which may have been used for haulage, also dates to this period.

Sample	SiO_2	TiO_2	Al_2O_3	FeO	MgO	MnO	CaO	Na_2O	K_2O	P_2O_5	S	Cu	ZnO	Sum
4433-C1	30,5	0,03	0,65	35,2	11,6	0,24	4,54	<0,025	0,003	0,003	2,57	2,67	0,10	88
4429-C1	31,6	0,05	0,83	32,7	14,0	0,23	3,96	<0,025	0,004	0,005	1,78	2,04	0,02	87
4048-C1	28,0	0,01	1,28	41,3	15,0	0,20	0,83	0,21	0,017	0,005	7,46	0,59	0,04	95
4046-C2	22,5	0,16	11,78	5,3	1,1	0,16	19,00	0,20	0,019	0,005	10,07	29,42	0,08	100

a

Sample	Cr	Co	Ni	Pb	U	As	Sb	Ag	Se	Te	Bi	Sn
4433-C1	1400	70	490	5	0,86	4	1,6	7,8	<10	1,2	0,1	3
4429-C1	1600	30	240	5	0,86	4	3,5	3,8	<10	1,3	0,1	3
4048-C1	2200	400	1200	<3,5	0,02	6	0,6	0,5	<10	<2	0,1	<2
4046-C2	10	40	50	15	0,03	8	0,9	60,0	80	4,1	<0,1	9

b

Tab. 3. Cotschens, general chemical analysis (ICP-MS) of ore samples. – a. Major and secondary components in wt.-%, total in %. The total iron content was calculated as FeO. – b. Trace elements in ppm. – All samples were measured in the DBM laboratory.

Mining tools dating to the 2nd and 1st centuries BC confirm another operational phase in the La Tène period. Both the fragmented troughs and the shovel-like tool date to this phase. The infill in the upper part of the mine may have been removed in this period, in order to clear out the lower-lying parts of the mine. The position of one of the troughs found in the drifts suggests that the two north-facing drifts may have been created during these activities. Unlike in the earlier phase, where fire-setting was likely used, the structure of the drifts suggests the use of metal tools in their driving. The activity carried out in this second operational phase is on a much smaller scale, suggesting prospection work which was not followed by more extensive mining.

Later dates attest to occasional activity in the mine into the modern period, but further mining operations cannot be derived from this. The absence of any iron objects in the mine and on the surrounding heaps, which are reliable indicators of medieval and modern mining activities, also suggests that no more recent mining activities were undertaken.[35]

However, an earlier, Late Bronze Age operational phase is confirmed by dating from the heap close to the mine. While this cannot be definitively connected to mine 1, the inclusion of the charcoal in the heap material clearly indicates mining activity.

The stone tools found on the surface, at the edge of the heaps, can generally be placed in a prehistoric ore extraction context. While anvil stones were used into the modern period,[36] hand-held stone crushing tools were not, nor was the fragment of a grinder.[37] The spectrum of tools for crushing and grinding confirms a beneficiation process with at least two stages performed directly in the mining area[38] – to date, this is a unique find in the Oberhalbstein region.

4. Summary and Outlook

Mining archaeological investigations completed in 2017 provided reliable evidence of prehistoric copper ore mining in the two mining areas of Avagna-Ochsenalp and Cotschens. The features, which primarily date to the Late Bronze Age and the Early Iron Age, fit chronologically into the larger context of the previously known local Alpine archaeological landscape. The well-preserved Alpine mining tools found in the flooded mine 1 in Cotschens provided new evidence of small-scale mining activity during the Late Iron Age. These finds are so far unique to the Alps.[39]

In addition to the historical use of these two mining areas, the identification of processing equipment at both sites is of particular importance, as evidence of this stage of the copper production has so far been completely lacking in archaeological finds from this area. A detailed investigation of suspected processing sites therefore seems especially promising for future research. In connection with further investigations on the well-preserved, finds-rich strata in the heap and mine areas, a characterization of individual mining and processing steps could be achieved, as well as a better general understanding of the mining and exploitation methods used. It may also be possible to construct a detailed

35 E.g. Cech 2007.

36 See Cech 2007.

37 Domergue et al. 1997.

38 Stöllner et al. 2012.

39 See Morin, Tizzoni 2009. – Stöllner 2009.

chronology of individual operating phases using stratified charcoal sample series. An extensive analysis of wood and charcoal material could also supply valuable information regarding how the prehistoric miners used their resources. Mining in extreme altitudes of up to 2500 masl would have entailed significant logistical and technological difficulties, especially considering the smelting sites nearby, which consumed significant amounts of wood. First bone finds from the sediment of the mine additionally indicate the possibility of further finds from otherwise largely unknown aspects of life – for example the material culture or the diet of the miners – as has been achieved in similar fire-set mines in the Lower Inn Valley, which have proved exceptionally rich in finds.[40]

Climatic constraints probably meant that the mining activity in Cotschens and Avagna-Ochsenalp was seasonal and stood in conjunction with other Late Bronze Age and Early Iron Age usage of the Alpine landscape. An intensification in the use of Alpine pastures can be observed in the same period, indicating a possible increase in the territorial occupation of the landscape and its resources.[41]

Questions remain concerning the geographical and cultural provenance of the miners and their knowledge of mining and metallurgy in the different periods of activity, as well as the market for copper from the Oberhalbstein region. The extrapolation of a copper signature for the Oberhalbstein region provides a promising basis for further provenance-analytical investigations, considering that the copper produced here can be relatively well differentiated from that of other Alpine regions due to its trace element pattern and lead isotope ratio.[42]

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Appendix 1

Supplementary raw data of ^{14}C and dendrochronology related to this article can be found at: doi: 10.1553/archaeologia104s123-A.

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Appendix 1.
Supplementary Data

Mining at the Fringes. High-Altitude Prehistoric Copper Mining in the Oberhalbstein Valley (Grisons, Switzerland)

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The following data contain all raw values of dendrochronological analysis carried out from Avagna-Ochsenalp and Cotschens. Dendrochronological values refer to the historical time scale where the year "0" does not exist.

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Tree-ring width values in 1/100 mm
Zurich format

No. 87895.0 undated conifera 98 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MS
18203.1047

1 - 10	22	27	19	25	19	25	22	24	8	16
11 - 20	18	19	26	15	18	8	11	13	14	21
21 - 30	30	30	25	21	30	32	22	36	28	28
31 - 40	30	30	39	36	36	28	37	30	34	38
41 - 50	42	45	38	37	38	36	45	52	39	44
51 - 60	33	38	31	28	31	21	26	26	32	25
61 - 70	22	30	27	28	19	37	32	25	34	29
71 - 80	29	21	23	29	26	23	33	33	33	31
81 - 90	21	38	25	30	27	30	24	29	24	32
91 - 98	25	36	25	25	34	38	42	41		

(edited: 20181208)

No. 87896.0 undated conifera 42 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MS
18203.1048

1 - 10	24	28	34	29	32	31	37	29	30	37
11 - 20	40	37	43	37	30	41	45	39	33	32
21 - 30	50	43	35	35	28	39	31	28	25	32
31 - 40	29	36	30	48	38	35	47	51	26	38
41 - 42	36	39								

(edited: 20181208)

No. 87897.0 Date: -1112 b conifera 68 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MS
18203.1049

1 - 10	19	17	27	28	15	23	19	16	12	16
11 - 20	13	14	11	12	17	21	17	20	28	30
21 - 30	39	36	32	35	50	36	30	28	23	22
31 - 40	31	26	16	30	31	24	22	20	22	27
41 - 50	35	39	29	37	30	31	29	18	42	30
51 - 60	31	48	51	45	38	39	35	35	47	38
61 - 68	35	36	46	48	50	57	63	55		

(edited: 20181208)

No. 88629.0 undated conifera 57 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.1

1 - 10	50	50	44	46	51	40	50	50	52	53
11 - 20	53	44	56	52	46	45	40	47	43	51
21 - 30	29	44	31	30	33	36	26	32	30	42
31 - 40	33	34	29	29	25	20	27	21	21	29
41 - 50	27	31	25	23	25	22	27	24	33	36
51 - 57	40	30	30	37	41	40	55			

(edited: 20181208)

No. 88630.0 undated conifera 36 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.2

1 - 10	41	49	34	57	59	66	31	45	29	36
11 - 20	65	44	42	34	45	59	45	34	41	56
21 - 30	65	40	31	59	52	36	68	63	45	49
31 - 36	32	52	32	30	40	36				

(edited: 20181208)

No. 88631.0 undated conifera 31 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.3

1 - 10	44	27	39	38	44	35	29	40	38	31
11 - 20	26	26	43	37	53	42	32	42	32	39
21 - 30	43	49	30	41	38	53	53	49	75	58
31 - 31	45									

(edited: 20181208)

No. 88632.0 undated conifera 29 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.4

1 - 10	122	107	90	80	59	42	60	46	44	55
11 - 20	56	57	62	58	39	51	56	51	60	68
21 - 29	39	40	48	43	32	40	45	50	66	

(edited: 20181208)

No. 88633.0 Date: -1058 a conifera 52 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.5

1 - 10	36	39	46	35	29	27	34	49	38	24
11 - 20	24	36	29	33	24	30	18	25	26	42
21 - 30	26	20	19	30	9	21	17	21	22	16
31 - 40	18	15	12	19	24	29	22	15	18	13
41 - 50	13	10	11	11	10	13	10	11	7	7
51 - 52	6	11								

(edited: 20181208)

No. 88634.0 undated conifera 46 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.6

1 - 10	42	44	32	50	48	46	36	44	31	56
11 - 20	38	48	40	44	52	35	36	34	35	43
21 - 30	39	45	38	40	39	37	34	39	37	54
31 - 40	46	37	37	37	42	42	48	36	46	39
41 - 46	26	45	30	34	46	38				

(edited: 20181208)

No. 88635.0 Date: -1061 a conifera 36 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.7

1 - 10	79	54	56	45	56	59	77	72	47	65
11 - 20	65	29	54	68	78	73	60	75	52	47
21 - 30	47	57	79	52	52	47	49	52	34	49
31 - 36	59	62	68	76	68	88				

(edited: 20181208)

No. 88636.0 undated conifera 26 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.8

1 - 10	60	38	54	54	78	46	64	67	64	70
11 - 20	87	63	56	50	77	39	57	52	48	64
21 - 26	53	56	47	44	44	38				

(edited: 20181208)

No. 88637.0 Date: -1067 a conifera 57 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.9

1 - 10	35	24	33	34	41	44	33	39	36	37
11 - 20	35	36	35	31	21	26	28	30	20	17
21 - 30	19	26	20	15	15	19	12	16	17	19
31 - 40	16	16	15	23	13	12	9	14	5	16
41 - 50	12	13	17	11	15	13	14	16	10	17
51 - 57	12	12	15	10	10	11	17			

(edited: 20181208)

No. 88638.0 undated conifera 50 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.10

1 - 10	80	60	34	23	36	47	47	35	46	38
11 - 20	45	38	51	56	48	42	42	42	35	40
21 - 30	42	46	39	28	35	31	24	21	23	23
31 - 40	22	25	18	25	19	17	11	11	13	16
41 - 50	13	21	11	21	10	16	18	13	11	9

(edited: 20181208)

No. 88639.0 Date: -1069 a conifera 38 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.11

1 - 10	94	70	69	86	78	72	72	54	60	60
11 - 20	66	46	67	53	61	48	71	61	43	43
21 - 30	62	35	62	51	62	65	51	90	72	53
31 - 38	52	57	66	58	56	55	46	57		

(edited: 20181208)

No. 88640.0 undated conifera 65 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.12

1 - 10	75	70	70	78	72	70	63	63	72	70
11 - 20	58	48	59	62	80	65	70	69	74	81
21 - 30	63	58	58	61	65	70	75	66	62	58
31 - 40	62	54	61	48	40	37	40	34	40	40
41 - 50	29	22	29	26	21	19	22	20	27	25
51 - 60	32	25	30	23	22	25	20	14	21	18
61 - 65	13	20	15	22	25					

(edited: 20181208)

No. 88641.0 undated conifera 41 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.13

1 - 10	51	51	61	58	56	49	51	37	45	43
11 - 20	40	38	46	43	52	54	55	48	52	45
21 - 30	51	46	49	42	58	60	58	53	48	41
31 - 40	44	50	48	55	48	53	47	48	48	59
41 - 41	52									

(edited: 20181208)

No. 88642.0 undated conifera 22 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.14

1 - 10	35	23	38	29	46	33	38	24	20	29
11 - 20	15	21	28	25	27	29	29	29	34	31
21 - 22	43	20								

(edited: 20181208)

No. 88643.0 undated conifera 71 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.15

1 - 10	40	17	29	21	32	23	22	16	15	18
11 - 20	19	22	12	15	20	17	10	18	24	25
21 - 30	21	19	21	12	23	18	17	31	20	11
31 - 40	16	7	16	11	12	16	17	17	10	9
41 - 50	13	10	20	9	10	9	11	8	9	12
51 - 60	12	14	17	17	11	17	15	12	4	8
61 - 70	11	8	7	6	7	9	11	11	7	4
71 - 71	12									

(edited: 20190423)

No. 88644.0 Date: -1059 a conifera 61 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.16

1 - 10	64	71	56	59	76	69	74	72	73	52
11 - 20	32	42	38	32	15	22	28	28	26	19
21 - 30	18	24	18	24	17	21	18	25	24	33
31 - 40	31	26	31	33	12	27	30	30	34	30
41 - 50	25	32	20	24	25	28	22	22	21	20
51 - 60	26	14	21	26	24	29	27	27	30	33
61 - 61	35									

(edited: 20181208)

No. 88645.0 undated conifera 33 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.17

1 - 10	43	48	42	45	20	47	34	23	38	36
11 - 20	29	34	29	24	35	31	25	31	42	38
21 - 30	41	40	48	44	45	35	37	37	33	29
31 - 33	38	23	30							

(edited: 20181208)

No. 88646.0 undated conifera 29 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.18

1 - 10	36	38	43	24	36	34	38	43	38	47
11 - 20	29	36	36	29	34	36	29	34	28	30
21 - 29	34	37	39	40	45	38	40	45	54	

(edited: 20181208)

No. 88647.0 Date: -1079 a conifera 24 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.19

1 - 10	100	100	90	64	75	62	73	68	75	54
11 - 20	73	70	97	84	63	69	68	46	69	63
21 - 24	71	71	62	98						

(edited: 20181208)

No. 88648.0 Date: -1065 a conifera 40 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.20

1 - 10	146	121	109	104	85	68	73	56	58	48
11 - 20	61	41	50	45	66	49	49	41	60	27
21 - 30	57	50	59	63	52	63	57	44	42	49
31 - 40	64	60	53	53	51	61	39	51	52	67

(edited: 20181208)

No. 88649.0 undated conifera 32 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.21

1 - 10	108	117	119	87	97	95	72	58	65	97
11 - 20	37	37	35	55	38	31	38	36	48	38
21 - 30	31	27	38	30	34	37	44	16	33	38
31 - 32	37	32								

(edited: 20181208)

No. 88650.0 undated conifera 36 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.22

1 - 10	85	67	68	84	39	29	36	43	42	36
11 - 20	46	30	36	38	35	28	35	26	23	35
21 - 30	30	21	34	22	30	31	34	36	43	32
31 - 36	25	39	35	34	31	40				

(edited: 20181208)

No. 88651.0 undated conifera 61 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.23

1 - 10	57	53	53	44	51	51	40	39	40	39
11 - 20	46	34	33	29	25	28	27	31	33	31
21 - 30	34	38	41	37	35	37	31	37	29	31
31 - 40	32	25	37	39	39	36	33	34	33	35
41 - 50	32	40	44	49	40	41	45	54	58	52
51 - 60	61	39	41	31	34	25	33	40	40	38
61 - 61	51									

(edited: 20181208)

No. 88652.0 undated conifera 39 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.24

1 - 10	88	104	91	97	99	75	54	25	47	45
11 - 20	45	63	94	46	57	45	59	55	52	43
21 - 30	48	60	54	65	56	65	73	85	62	65
31 - 39	70	40	38	46	44	32	50	42	46	

(edited: 20181208)

No. 88653.0 Date: -1061 a conifera 52 values autumn/winter
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.25; bast remains

1 - 10	28	23	24	19	24	31	26	20	30	35
11 - 20	31	26	28	24	33	24	27	26	38	23
21 - 30	27	25	36	26	27	27	31	21	36	33
31 - 40	28	41	39	36	34	34	34	32	35	31
41 - 50	30	34	32	38	28	31	36	36	38	26
51 - 52	33	37								

(edited: 20181208)

No. 88654.0 undated conifera 70 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.26

1 - 10	142	149	158	146	109	92	116	104	106	109
11 - 20	104	104	99	80	78	86	72	64	65	61
21 - 30	78	66	57	59	53	50	49	44	52	49
31 - 40	52	65	67	39	47	60	79	73	81	59
41 - 50	59	60	61	38	55	46	40	42	47	45
51 - 60	50	42	48	46	59	47	55	46	36	40
61 - 70	35	34	36	29	38	34	32	33	21	32

(edited: 20181208)

No. 88655.0 Date: -1079 a conifera 25 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.27

1 - 10	46	85	102	78	65	72	61	68	60	69
11 - 20	59	62	62	85	79	54	63	53	39	64
21 - 25	65	56	70	64	73					

(edited: 20181208)

No. 88656.0 Date: -1078 a conifera 36 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.28

1 - 10	84	71	71	62	46	60	49	51	25	39
11 - 20	32	37	35	23	24	34	30	37	25	33
21 - 30	39	46	47	58	51	33	45	34	13	32
31 - 36	39	27	35	29	26	33				

(edited: 20181208)

No. 88657.0 undated conifera 28 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.2.29

1 - 10	76	82	62	62	67	61	59	54	59	50
11 - 20	44	53	55	51	45	44	72	67	74	56
21 - 28	43	63	57	73	67	75	52	73		

(edited: 20181208)

No. 88658.0 Date: -1062 a conifera 46 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.1

1 - 10	55	43	58	45	53	50	52	52	42	50
11 - 20	52	64	52	52	40	56	39	67	47	43
21 - 30	54	48	23	41	42	45	48	41	53	37
31 - 40	32	32	41	46	32	30	25	23	19	15
41 - 46	16	22	14	9	11	7				

(edited: 20181208)

No. 88659.0 Date: -1063 a conifera 44 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.2

1 - 10	97	91	59	92	77	76	70	57	74	73
11 - 20	75	67	69	63	70	61	90	63	70	86
21 - 30	65	40	70	79	77	75	61	90	88	68
31 - 40	61	59	69	48	38	31	20	14	11	15
41 - 44	11	6	10	9						

(edited: 20181208)

No. 88660.0 undated conifera 49 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.3

1 - 10	64	55	60	57	48	42	39	47	45	50
11 - 20	35	32	44	34	34	35	32	28	35	28
21 - 30	47	35	27	36	34	26	33	22	30	37
31 - 40	30	32	30	23	23	23	28	24	20	19
41 - 49	19	20	19	20	23	25	25	26	34	

(edited: 20181208)

No. 88661.0 undated conifera 58 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.4

1 - 10	63	65	50	43	47	29	51	57	49	46
11 - 20	31	44	54	35	49	41	39	31	43	33
21 - 30	32	29	32	30	45	34	36	43	38	40
31 - 40	38	38	33	37	46	42	50	38	30	54
41 - 50	30	27	47	38	37	28	27	35	21	36
51 - 58	34	35	30	37	29	40	37	22		

(edited: 20181208)

No. 88662.0 Date: -1075 a conifera 43 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.5

1 - 10	65	64	74	61	59	57	63	59	43	42
11 - 20	48	34	30	28	41	44	54	38	25	35
21 - 30	26	40	29	43	29	37	32	58	52	38
31 - 40	45	69	16	14	23	32	42	30	35	18
41 - 43	21	26	21							

(edited: 20181208)

No. 88663.0 undated conifera 67 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.6

1 - 10	52	47	61	54	43	41	49	34	58	43
11 - 20	45	52	54	43	43	43	50	50	40	37
21 - 30	41	47	40	34	31	29	36	38	27	22
31 - 40	39	33	39	35	39	35	36	34	32	20
41 - 50	29	20	26	19	20	26	22	32	28	39
51 - 60	35	34	36	37	31	30	27	34	29	34
61 - 67	30	28	36	42	36	36	54			

(edited: 20181208)

No. 88664.0 undated conifera 31 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.7

1 - 10	48	51	49	52	42	34	41	35	47	37
11 - 20	33	31	37	36	44	35	47	47	37	50
21 - 30	39	25	32	27	30	34	28	41	30	24
31 - 31	25									

(edited: 20181208)

No. 88665.0 undated conifera 33 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.8

1 - 10	156	150	158	156	130	156	192	142	125	153
11 - 20	143	98	74	146	152	108	113	70	97	106
21 - 30	109	90	111	95	95	70	65	65	94	85
31 - 33	119	47	95							

(edited: 20181208)

No. 88666.0 undated conifera 55 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.9

1 - 10	63	52	70	64	58	59	51	67	72	62
11 - 20	49	59	45	42	47	51	37	37	42	35
21 - 30	38	31	32	33	39	42	39	47	44	34
31 - 40	35	26	34	26	21	30	31	28	29	21
41 - 50	26	26	29	27	34	36	37	33	26	33
51 - 55	33	29	29	28	32					

(edited: 20181208)

No. 88667.0 undated conifera 27 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.10

1 - 10	37	32	34	45	42	43	38	34	38	36
11 - 20	44	43	52	38	46	45	52	48	57	65
21 - 27	38	36	45	47	28	28	52			

(edited: 20181208)

No. 88668.0 Date: -1076 a conifera 37 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.11

1 - 10	20	23	31	23	30	28	24	21	20	25
11 - 20	20	21	15	14	17	17	30	21	33	21
21 - 30	24	24	36	29	24	24	51	17	23	22
31 - 37	22	23	15	11	9	6	9			

(edited: 20181208)

No. 88669.0 undated conifera 35 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.12

1 - 10	34	61	46	47	51	53	57	41	27	28
11 - 20	36	42	48	54	41	41	34	40	47	49
21 - 30	42	46	60	60	63	62	67	77	75	66
31 - 35	67	71	52	47	88					

(edited: 20181208)

No. 88670.0 undated conifera 39 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.5.13

1 - 10	67	67	39	46	46	56	50	25	45	36
11 - 20	40	56	54	59	60	56	50	59	64	62
21 - 30	75	68	84	75	72	73	76	79	73	62
31 - 39	59	65	58	54	52	34	67	64	56	

(edited: 20181208)

No. 88671.0 Date: -1063 a conifera 59 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.1

1 - 10	77	68	58	63	50	54	59	56	70	63
11 - 20	65	45	34	45	41	33	18	22	31	38
21 - 30	24	25	20	29	20	23	20	27	18	31
31 - 40	20	40	29	34	31	32	15	22	29	36
41 - 50	30	26	27	32	19	25	20	25	20	20
51 - 59	22	20	23	15	25	25	31	34	31	

(edited: 20181208)

No. 88672.0 undated conifera 32 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.2

1 - 10	27	28	38	43	45	35	49	43	39	32
11 - 20	35	39	33	35	37	23	47	47	32	36
21 - 30	38	35	29	38	39	32	34	38	41	45
31 - 32	35	48								

(edited: 20181208)

No. 88673.0 undated conifera 31 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.3

1 - 10	91	166	95	104	102	80	67	85	67	54
11 - 20	83	77	78	78	69	58	81	84	84	79
21 - 30	42	32	48	46	60	54	60	59	62	51
31 - 31	63									

(edited: 20181208)

No. 88674.0 Date: -1081 a conifera 38 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.4

1 - 10	68	63	69	67	71	58	56	72	84	45
11 - 20	51	53	52	23	32	55	53	45	37	31
21 - 30	42	46	61	40	52	42	58	44	65	50
31 - 38	35	48	52	19	44	37	44	73		

(edited: 20181208)

No. 88675.0 Date: -1071 a conifera 38 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.5

1 - 10	36	55	43	15	23	47	48	47	27	19
11 - 20	44	35	50	36	56	30	36	44	62	41
21 - 30	37	28	37	16	37	41	45	56	36	45
31 - 38	33	32	37	39	56	42	30	43		

(edited: 20181208)

No. 88676.0 Date: -1111 a conifera 76 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.6

1 - 10	51	42	50	32	55	48	54	45	47	45
11 - 20	51	32	39	47	47	50	50	48	60	57
21 - 30	46	54	56	56	52	46	57	52	51	50
31 - 40	53	66	49	45	53	40	36	45	42	36
41 - 50	49	55	30	34	43	30	29	33	39	34
51 - 60	35	43	41	54	40	52	44	27	42	35
61 - 70	46	38	34	45	48	61	36	48	44	41
71 - 76	41	45	48	46	37	45				

(edited: 20181208)

No. 88677.0 undated conifera 33 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.7

1 - 10	52	93	98	97	81	59	80	86	81	73
11 - 20	101	73	99	88	110	87	109	77	66	39
21 - 30	78	67	79	158	88	77	55	69	82	98
31 - 33	77	61	48							

(edited: 20181208)

No. 88678.0 Date: -1105 a conifera 50 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.6.8

1 - 10	64	57	49	50	34	50	44	30	48	43
11 - 20	39	38	40	45	35	52	48	40	45	50
21 - 30	51	54	37	55	54	32	43	40	46	35
31 - 40	37	47	58	74	62	74	56	53	45	46
41 - 50	48	41	46	52	68	52	35	36	33	38

(edited: 20181208)

No. 88679.0 undated conifera 46 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.7.1

1 - 10	48	37	38	34	31	36	32	29	31	36
11 - 20	21	32	29	14	23	22	22	18	25	27
21 - 30	18	19	24	18	28	25	18	28	15	31
31 - 40	29	31	25	36	31	32	21	30	25	27
41 - 46	22	29	43	53	35	45				

(edited: 20181208)

No. 88680.0 undated conifera 32 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.7.2

1 - 10	69	90	101	87	87	89	106	86	68	81
11 - 20	84	56	61	67	56	48	53	61	60	63
21 - 30	56	43	44	45	55	62	72	44	62	63
31 - 32	98	68								

(edited: 20181208)

No. 88681.0 undated conifera 51 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.7.3

1 - 10	29	31	24	23	16	29	22	18	19	24
11 - 20	26	21	17	23	20	24	16	22	24	25
21 - 30	22	25	28	32	31	26	28	23	27	22
31 - 40	22	16	16	23	20	20	19	17	13	12
41 - 50	19	14	18	13	18	16	15	16	17	19
51 - 51	20									

(edited: 20181208)

No. 88682.0 undated conifera 39 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.7.4

1 - 10	88	67	61	63	71	66	59	68	60	59
11 - 20	53	59	55	55	50	52	56	56	54	47
21 - 30	56	52	59	47	41	51	57	53	55	46
31 - 39	62	57	67	56	73	76	84	65	65	

(edited: 20181208)

No. 88683.0 undated conifera 47 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.8.1

1 - 10	101	80	68	62	69	65	44	43	48	43
11 - 20	38	39	37	48	46	51	45	42	41	47
21 - 30	45	46	37	40	24	36	36	36	33	43
31 - 40	49	54	50	84	97	63	55	73	34	44
41 - 47	35	55	53	63	67	73	70			

(edited: 20181208)

No. 88684.0 Date: -1078 a conifera 42 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.8.2

1 - 10	25	22	28	24	28	26	27	24	26	30
11 - 20	25	29	32	27	23	18	25	28	29	20
21 - 30	21	25	19	37	23	33	24	32	29	42
31 - 40	29	24	28	50	25	19	14	15	14	6
41 - 42	9	5								

(edited: 20181208)

No. 88685.0 undated conifera 43 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.8.3

1 - 10	46	65	38	32	26	33	30	27	30	30
11 - 20	23	30	22	46	29	25	35	32	20	18
21 - 30	27	28	24	20	23	22	18	21	24	26
31 - 40	20	13	16	20	15	16	15	16	18	14
41 - 43	13	11	15							

(edited: 20181208)

No. 88686.0 undated conifera 39 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.8.4

1 - 10	99	79	75	71	70	62	56	62	60	87
11 - 20	84	79	80	73	58	48	32	47	45	52
21 - 30	48	43	38	40	31	45	37	53	47	41
31 - 39	42	37	36	37	35	31	32	30	30	

(edited: 20181208)

No. 88687.0 Date: -1061 a conifera 47 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.8.5

1 - 10	89	79	75	73	107	76	99	85	60	93
11 - 20	87	103	80	105	70	93	77	114	94	73
21 - 30	65	68	43	65	53	66	54	40	45	36
31 - 40	37	35	36	34	38	33	26	32	28	31
41 - 47	36	47	31	50	47	43	45			

(edited: 20181208)

No. 88688.0 undated conifera 31 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.8.6

1 - 10	46	70	65	50	44	44	50	62	56	66
11 - 20	45	59	60	55	47	38	39	57	42	59
21 - 30	57	48	49	45	46	39	44	49	46	46
31 - 31	38									

(edited: 20181208)

No. 88689.0 Date: -1061 a conifera 56 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.1

1 - 10	35	43	44	48	39	33	44	21	35	34
11 - 20	29	27	18	33	37	37	31	28	30	32
21 - 30	22	29	36	30	25	23	32	32	26	26
31 - 40	26	12	26	20	29	33	31	43	27	30
41 - 50	35	31	39	38	30	34	30	25	20	30
51 - 56	42	42	46	32	36	38				

(edited: 20181208)

No. 88690.0 undated conifera 53 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.2

1 - 10	73	78	61	83	93	99	70	76	122	112
11 - 20	93	83	57	55	55	64	59	62	63	52
21 - 30	57	67	70	58	58	63	60	65	45	59
31 - 40	57	49	55	56	46	53	48	38	30	37
41 - 50	36	26	31	37	39	49	53	56	38	50
51 - 53	46	45	32							

(edited: 20181208)

No. 88691.0 Date: -1083 a conifera 79 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.3

1 - 10	79	92	71	60	61	79	88	63	61	65
11 - 20	47	51	62	52	31	62	57	52	54	61
21 - 30	65	72	68	72	40	76	57	49	59	29
31 - 40	61	55	28	34	47	47	38	40	45	40
41 - 50	75	57	59	62	50	52	55	51	39	44
51 - 60	42	47	25	35	37	35	22	25	36	40
61 - 70	40	21	13	28	22	34	27	36	25	29
71 - 79	29	44	34	26	26	42	17	26	39	

(edited: 20181208)

No. 88692.0 Date: -1043 a conifera 63 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.4

1 - 10	37	64	46	63	56	66	67	43	35	54
11 - 20	57	80	78	83	70	79	78	73	78	82
21 - 30	43	75	79	70	75	63	55	76	52	59
31 - 40	60	54	53	54	44	29	40	34	36	37
41 - 50	45	55	60	69	67	55	55	78	73	72
51 - 60	68	70	67	61	70	52	42	59	61	46
61 - 63	46	61	51							

(edited: 20181208)

No. 88693.0 undated conifera 51 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.5

1 - 10	36	41	37	37	31	38	47	36	32	39
11 - 20	38	35	30	31	33	27	26	30	36	38
21 - 30	37	32	36	39	26	32	35	21	21	22
31 - 40	24	25	27	20	31	26	25	25	21	23
41 - 50	22	22	23	22	17	19	24	24	25	28
51 - 51	27									

(edited: 20181208)

No. 88694.0 undated conifera 42 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.6

1 - 10	50	43	45	32	37	40	31	27	31	43
11 - 20	31	37	45	37	30	38	35	27	30	35
21 - 30	27	34	38	31	34	36	26	25	26	25
31 - 40	20	22	17	24	27	22	26	27	23	17
41 - 42	25	22								

(edited: 20181208)

No. 88695.0 Date: -1071 a conifera 32 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.7

1 - 10	36	35	22	21	35	28	42	32	43	26
11 - 20	37	34	56	40	36	31	39	17	38	40
21 - 30	46	45	32	40	27	25	31	34	43	46
31 - 32	31	31								

(edited: 20181208)

No. 88696.0 undated conifera 51 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.8

1 - 10	65	60	56	46	46	42	41	37	46	43
11 - 20	27	31	42	34	33	26	27	23	27	28
21 - 30	28	38	29	32	31	38	26	29	31	27
31 - 40	19	27	22	21	27	25	25	23	21	20
41 - 50	25	20	20	18	25	19	16	19	23	31
51 - 51	25									

(edited: 20181208)

No. 88697.0 undated conifera 23 values
GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
67459.9.9

1 - 10	131	112	102	101	157	138	115	106	68	86
11 - 20	95	92	70	92	95	101	76	84	81	76
21 - 23	96	92	69							

(edited: 20181208)

No. 5096.0 Date: -1043 A conifera 144 values
+MK: GR/TINIZONG-RONA, AVAGNA-OCHSENALP MO
1174-1043 BC

1 - 10	51	42	50	32	55	48	54	45	47	45
	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x
11 - 20	51	32	39	47	47	50	50	48	60	57
	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x
21 - 30	46	54	56	56	52	62	74	61	55	55
	1x	1x	1x	1x	1x	2x	2x	2x	2x	2x
31 - 40	66	77	58	54	55	45	40	52	46	32
	2x	2x	3x	3x	3x	3x	3x	3x	3x	3x
41 - 50	53	51	40	42	48	46	45	51	53	38
	3x	3x	3x	3x	3x	3x	3x	3x	3x	3x
51 - 60	52	50	47	55	35	56	51	29	39	40
	3x	3x	3x	3x	3x	3x	3x	3x	3x	3x
61 - 70	46	37	37	43	42	64	51	52	53	48
	3x	3x	3x	4x	4x	5x	5x	7x	8x	9x
71 - 80	48	52	51	52	45	47	48	32	37	43
	10x	10x	10x	11x	13x	13x	12x	13x	14x	16x
81 - 90	44	34	40	49	52	51	42	35	44	38
	18x	19x	19x	20x	22x	22x	22x	22x	22x	22x
91 - 100	48	39	49	37	45	41	59	48	39	42
	23x	23x	23x	23x	23x	23x	23x	23x	23x	23x
101 - 110	48	23	40	41	44	48	37	46	36	32
	23x	23x	23x	23x	22x	22x	21x	21x	19x	17x
111 - 120	34	37	45	38	33	33	28	31	21	28
	17x	16x	15x	15x	15x	15x	13x	13x	12x	12x
121 - 130	33	33	35	32	36	44	31	32	44	73
	11x	11x	10x	10x	8x	7x	3x	3x	2x	1x
131 - 140	72	68	70	67	61	70	52	42	59	61
	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x
141 - 144	46	46	61	51						
	1x	1x	1x	1x						

(edited: 20181107)

No. 88591.0 undated conifera 67 values
GR/MARMORERA-COTSCHENS MO
18203.1109.1

1 - 10	6	9	11	11	11	8	11	9	9	11
11 - 20	9	11	11	11	11	13	6	6	6	7
21 - 30	15	13	18	10	9	10	10	11	9	13
31 - 40	13	15	9	14	13	15	6	11	9	15
41 - 50	6	13	20	11	11	6	12	11	13	8
51 - 60	6	4	11	4	9	11	6	11	9	6
61 - 67	10	5	4	6	4	6	6			

(edited: 20181208)

No. 88592.0 undated conifera 50 values
GR/MARMORERA-COTSCHENS MO
18203.1109.2

1 - 10	32	29	21	33	27	38	26	33	34	36
11 - 20	22	39	20	31	18	25	29	32	22	20
21 - 30	26	19	19	33	26	25	25	29	25	20
31 - 40	16	15	26	25	29	19	20	18	20	15
41 - 50	22	18	17	8	23	18	19	19	20	25

(edited: 20181208)

No. 88593.0 Date: -1137 b conifera 50 values
GR/MARMORERA-COTSCHENS MO
18203.1109.3

1 - 10	30	37	36	41	81	62	61	38	41	29
11 - 20	28	24	44	48	31	29	48	19	37	30
21 - 30	27	45	36	14	35	16	27	23	16	25
31 - 40	44	48	33	37	34	37	31	20	23	8
41 - 50	33	23	37	34	29	47	67	50	33	31

(edited: 20181208)

No. 88594.0 undated conifera 41 values
GR/MARMORERA-COTSCHENS MO
18203.1109.4

1 - 10	22	27	27	27	13	36	22	8	16	29
11 - 20	25	36	47	35	30	24	38	34	30	11
21 - 30	28	27	30	26	53	51	26	23	19	24
31 - 40	22	25	22	49	49	34	25	24	20	16
41 - 41	22									

(edited: 20181208)

No. 88595.0 undated conifera 44 values
GR/MARMORERA-COTSCHENS MO
18203.1109.5

1 - 10	23	15	19	19	20	19	9	19	16	20
11 - 20	22	22	26	19	23	18	22	14	24	9
21 - 30	13	19	19	23	29	27	22	16	18	23
31 - 40	27	25	25	16	25	19	22	25	19	22
41 - 44	15	22	26	22						

(edited: 20181208)

No. 88596.0 Date: -1131 b conifera 43 values
GR/MARMORERA-COTSCHENS MO
18203.1109.6

1 - 10	34	36	37	49	16	40	24	29	45	48
11 - 20	11	40	20	27	31	18	29	47	54	41
21 - 30	27	35	34	22	25	27	8	29	26	40
31 - 40	34	32	49	64	47	32	34	51	29	22
41 - 43	38	13	34							

(edited: 20181208)

No. 88597.0 undated conifera 46 values
GR/MARMORERA-COTSCHENS MO
18203.1109.7

1 - 10	35	37	47	37	37	45	31	30	32	38
11 - 20	43	27	27	23	9	15	9	8	4	6
21 - 30	6	4	8	9	8	5	9	8	9	11
31 - 40	13	10	14	13	19	13	19	22	22	13
41 - 46	8	9	6	9	11	10				

(edited: 20181208)

No. 88598.0 undated conifera 55 values
GR/MARMORERA-COTSCHENS MO
18203.1109.8

1 - 10	9	13	8	16	9	9	10	8	12	12
11 - 20	11	12	16	23	15	23	18	8	9	9
21 - 30	16	15	13	18	12	12	11	10	14	13
31 - 40	15	21	20	25	23	23	26	27	25	25
41 - 50	35	33	22	18	16	16	19	13	12	11
51 - 55	15	16	20	24	11					

(edited: 20181208)

No. 88581.0 Date: -67 b conifera 88 values Mark
GR/MARMORERA-COTSCHENS MO
67457.22.1

1 - 10	474	194	228	312	319	271	257	260	286	260
11 - 20	216	221	186	194	152	221	224	190	190	219
21 - 30	169	241	136	138	103	81	101	91	120	108
31 - 40	175	150	162	120	131	120	142	107	152	117
41 - 50	188	162	111	57	91	76	68	93	91	78
51 - 60	95	86	97	116	94	109	111	125	115	97
61 - 70	93	90	88	119	95	102	111	87	86	97
71 - 80	80	107	88	93	117	107	75	59	45	54
81 - 88	59	66	40	51	31	31	40	34		

(edited: 20181208)

No. 88582.0 undated conifera 38 values
GR/MARMORERA-COTSCHENS MO
67457.28.1

1 - 10	182	319	267	260	252	238	243	207	225	191
11 - 20	312	265	226	220	134	119	161	158	164	166
21 - 30	162	210	151	181	112	148	140	127	170	140
31 - 38	144	143	114	193	124	117	150	149		

(edited: 20181208)

No. 88583.0 undated conifera 45 values
GR/MARMORERA-COTSCHENS MO
67457.38.1

1 - 10	126	98	126	109	103	143	134	104	115	91
11 - 20	139	127	134	134	109	98	65	114	120	129
21 - 30	123	119	103	117	85	94	82	85	133	121
31 - 40	137	161	142	163	164	160	88	103	109	85
41 - 45	117	109	82	102	98					

(edited: 20181208)

No. 88584.0 undated conifera 38 values
GR/MARMORERA-COTSCHENS MO
67457.46.1

1 - 10	182	319	267	260	252	238	243	207	225	191
11 - 20	312	265	226	220	134	119	161	158	164	166
21 - 30	162	210	151	181	112	148	140	127	170	140
31 - 38	144	143	114	193	124	117	150	149		

(edited: 20181208)

No. 88585.0 undated conifera 25 values
GR/MARMORERA-COTSCHENS MO
67457.100.1

1 - 10	91	100	94	59	120	55	51	84	51	63
11 - 20	72	72	81	59	63	45	61	52	65	66
21 - 25	81	55	72	95	91					

(edited: 20181208)

No. 88586.0 undated conifera 22 values
GR/MARMORERA-COTSCHENS MO
67457.100.2

1 - 10	84	63	81	55	83	87	62	68	52	47
11 - 20	47	41	50	56	45	62	76	66	62	84
21 - 22	101	84								

(edited: 20181208)

No. 88587.0 undated conifera 20 values
GR/MARMORERA-COTSCHENS MO
67457.100.3

1 - 10	58	74	81	72	66	44	54	43	38	48
11 - 20	47	48	55	76	70	62	78	92	87	50

(edited: 20181208)

No. 88588.0 undated conifera 35 values
GR/MARMORERA-COTSCHENS MO
67457.101

1 - 10	55	44	44	40	48	27	28	29	36	23
11 - 20	16	27	33	30	22	21	24	22	22	25
21 - 30	30	24	25	27	38	33	30	27	27	13
31 - 35	29	51	45	59	48					

(edited: 20181208)

No. 88589.0 undated conifera 73 values
GR/MARMORERA-COTSCHENS MO
67457.103

1 - 10	84	86	119	74	91	105	100	111	137	116
11 - 20	91	166	104	89	82	134	71	79	109	79
21 - 30	79	86	85	91	60	108	87	71	27	45
31 - 40	30	23	28	26	25	14	33	34	29	28
41 - 50	37	27	50	39	30	25	42	57	61	57
51 - 60	33	47	60	107	71	73	79	79	57	112
61 - 70	61	36	52	45	22	22	50	65	65	54
71 - 73	57	49	52							

(edited: 20181208)

No. 88590.0 undated conifera 18 values
GR/MARMORERA-COTSCHENS MO
67457.125

1 - 10	63	58	52	63	45	72	64	38	70	56
11 - 18	62	58	62	35	41	51	55	51		

(edited: 20181208)

No. 88845.0 undated conifera 70 values
GR/MARMORERA-COTSCHENS MO
67457.14.1, 67457.15.1, 67457.23.1

1 - 10	79	89	99	137	106	98	80	100	129	119
11 - 20	96	101	49	63	73	62	37	34	30	36
21 - 30	26	36	33	32	43	43	47	46	49	51
31 - 40	48	61	61	56	41	41	51	53	54	74
41 - 50	40	34	40	42	50	45	42	46	39	33
51 - 60	35	38	29	37	40	61	56	61	76	92
61 - 70	77	49	51	52	58	56	57	46	59	38

(edited: 20181208)

No. 5095.0 Date: -1131 B conifera 56 values
+MK: GR/MARMORERA-COTSCHENS MO
1186-1131 BC

1 - 10	30	37	36	41	81	62	61	38	41	29
	1x	1x	1x	1x	1x	1x	1x	1x	1x	1x
11 - 20	28	24	44	41	33	33	48	17	38	27
	1x	1x	1x	2x	2x	2x	2x	2x	2x	2x
21 - 30	28	45	42	12	37	18	27	27	17	27
	2x	2x	2x	2x	2x	2x	2x	2x	2x	2x
31 - 40	45	51	37	32	34	35	26	22	25	8
	2x	2x	2x	2x	2x	2x	2x	2x	2x	2x
41 - 50	31	24	38	34	30	48	65	48	32	32
	2x	2x	2x	2x	2x	2x	2x	2x	2x	2x
51 - 56	51	29	22	38	13	34				
	1x	1x	1x	1x	1x	1x				

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„Sonnenbarken“ und „Mondscheiben“ im bronzezeitlichen Istrien? Zu zwei besonderen Schalen mit verziertem Boden aus der Gradina von Monkodonja nahe Rovinj, Kroatien

Anja Hellmuth Kramberger

Zusammenfassung

Lange Zeit war über das keramische Formenspektrum der entwickelten Frühbronzezeit und der Mittelbronzezeit der kroatischen Halbinsel Istriens nur wenig bekannt. Studien am umfangreichen Keramikmaterial aus der befestigten Bergsiedlung (Gradina) von Monkodonja an der Westküste der Halbinsel, gelegen südlich von Rovinj, haben einerseits Licht auf das variantenreiche Gefäßrepertoire geworfen, andererseits konnten über die Keramik Kontaktzonen zu den benachbarten und weiter entfernten Gebieten herausgestellt werden. Besonders deutlich, und gleichzeitig überraschend, zeichnen sich über die Keramik Verbindungen zum mittleren Donaugebiet und dem Karpatenbecken ab. In diese Richtung weisen auch einige Kleinfunde, wie beispielsweise die Funde bestimmter Nadel- und Beiltypen. Die Gradina Monkodonja und Istrien waren offensichtlich in das zentraleuropäische früh- und mittelbronzezeitliche Kommunikationsnetz eingebunden und es ist wahrscheinlich, dass der Austausch nicht nur Waren und technisches Know-how umfasste, sondern möglicherweise auch andere Kenntnisse und sogar spirituelle Vorstellungen. Hinweise darauf könnten in der Ornamentik auf der Keramik zu finden sein, deren Bedeutung sehr wahrscheinlich über die Funktion einer reinen Zier hinausging und die vielmehr als Sinnträger fungierte. Die Ornamentik auf zwei außergewöhnlichen großen Schalen von Monkodonja lässt dabei an bestimmte astrologische Kenntnisse bzw. Vorstellungen denken und wird im vorliegenden Beitrag gemeinsam mit den Verbindungen zum mittleren Donaugebiet und dem Karpatenbecken erörtert.

Schlüsselbegriffe

Früh- und Mittelbronzezeit, Istrien, Gradinen, Verzierungen auf Keramik, astrologische Kenntnisse, Himmelsscheibe von Nebra.

Abstract – *‘Solar Barks’ and ‘Moon Discs’ in Bronze Age Istria? On Two Special Bowls with Decorated Bottoms from the Gradina of Monkodonja near Rovinj, Croatia*

For a long time, little was known about the ceramic spectrum of the developed Early Bronze Age and the Middle Bronze Age of the Croatian Istrian peninsula. Studies on the extensive ceramic material from the fortified hilltop settlement (gradina) of Monkodonja on the west coast of the peninsula, located south of Rovinj, have, on the one hand, shed light on the varied repertoire of vessels, and on the other hand, they have enabled contact zones to neighbouring and more distant regions to be highlighted. Connections to the central Danube region and the Carpathian basin are particularly clear and surprising at the same time. Some small finds also point in this direction, such as the finds of certain types of pins and hatchets. The Gradina of Monkodonja and Istria were obviously integrated into the central European Early and Middle Bronze Age communication network and it is likely that the exchange included not only goods and technical know-how, but possibly also other knowledge and even spiritual ideas. Evidence of this could be found in the ornamentation on the ceramics, the meaning of which was very likely to go beyond the function of a mere ornament and was, rather, intended to convey a meaning. The ornamentation on two extraordinary large bowls from Monkodonja suggests certain astrological knowledge or ideas and is discussed in this article together with the connections to the central Danube region and the Carpathian basin.

Keywords

Early and Middle Bronze Age, Istria, hillforts, ornaments on ceramics, astrological knowledge, Sky Disc of Nebra.

1. Die Keramik aus der Gradina von Monkodonja und ihre Verbindungen zum mittleren Donaugebiet und dem Karpatenbecken

Die befestigte Bergsiedlung von Monkodonja stellt den derzeit wichtigsten und am besten erforschten Fundplatz für die entwickelte Früh- und Mittelbronzezeit Istriens (Kroatien) dar. Der auf einem Hügel zwischen Rovinj und Bale gelegene Siedlungsplatz wurde erstmalig durch Boris Baćić, seinerzeit Kurator des Archäologischen Museums Istriens in Pula, zu Beginn der 50er Jahre des letzten Jahrhunderts durch kleinere Ausgrabungen untersucht.[1] Im Jahr 1997 wurden die archäologischen Arbeiten in der Siedlung von Monkodonja als DFG-gefördertes kroatisch-deutsch-slowenisches Gemeinschaftsprojekt wieder aufgenommen und bis 2008 unter der Leitung von Kristina Mihovilić, Bernhard Hänsel und Biba Teržan fortgesetzt.[2] Eine Serie von 45 ^{14}C-Daten, die unter der Leitung von Pieter M. Grootes im Kieler Leibnitz-Labor für Altersbestimmung und Isotopenforschung anhand von tierischen und menschlichen Knochenfunden ermittelt wurden, bezeugen, dass die Siedlungsgründung um oder vor 1800 v. Chr., möglicherweise schon um 2000 v. Chr., stattgefunden hat, wenn man die Datierung der menschlichen Knochen aus den zwei Steinkistengräbern am Westtor in Betracht zieht.[3] Erste Bauaktivitäten der Mauer der Hauptbefestigung fanden im 19. Jh. v. Chr. statt, die ältere Phase der Hauptnutzung der Anlage fällt in das 18.–17. Jh. v. Chr., die jüngere in das 16. bis an den Beginn des 15. Jhs. v. Chr. Nach dem chronologischen Schema Reineckes für Zentraleuropa geht es also um einen Zeitraum zwischen dem Ende der Bz A1 bis zum Übergang der Stufen Bz B1 nach Bz B2/C1.

Die intensiven Studien zur Gefäßkeramik mit detaillierten Vergleichen zum keramischen Fundspektrum der benachbarten und weiter entfernten Gebiete haben deutlich gezeigt, dass Istrien während der entwickelten Frühbronzezeit und der Mittelbronzezeit eine wichtige Kontaktzone zwischen dem adriatischen Kulturraum und Zentraleuropa darstellte.[4] Einerseits umfasst das Gefäßspektrum verschiedene Formen, die als charakteristisch für Istrien, den Triester Karst und die Kvarner-Bucht zu bezeichnen sind. Zu nennen sind hier beispielsweise eine spezifische Form der dreieckig geformten Henkel, die an unterschiedlichen Gefäßtypen vorkommen, sog. Dreieckshenkel mit Abschlussplatte,[5] große amphorenförmige Vorratsgefäße mit x-förmigen Henkeln unterhalb des Randes,[6] Dreifüße bzw. Dreifußteller[7] oder sphärische Flaschen mit einer Verzierung aus Buckeln auf der Schulter.[8] Andererseits lassen sich anhand der Keramik, wie erwähnt, zahlreiche Kontakte in die Nachbargebiete oder auch weit entfernte Regionen beobachten. Bemerkenswert ist dabei insbesondere ein Bezug zum mittleren Donauraum und dem Karpatenbecken, wobei sich nicht nur einzelne Stücke vergleichen lassen, sondern ein insgesamt ähnliches Gefäßspektrum mit gemeinsamen Charakteristika vorliegt.[9] Besonders deutlich zeigen sich Beziehungen zwischen Istrien und dem Milieu der Aunjetitz-Kultur, genauer der Aunjetitz-Kultur im nördlichen Niederösterreich. Bekanntermaßen ist die Frühbronzezeit (Bz A1–A2 (a–b) nach der Stufengliederung Reineckes) in Niederösterreich durch das Auftreten verschiedener Gruppen gekennzeichnet, deren Keramik und Bronzen einen Bezug zur böhmischen Aunjetitz-Kultur aufweisen.[10]

Als die wichtigsten Gruppen der Frühbronzezeit in Niederösterreich wurden die Leithaprodersdorf-, die Wieselburger-, die Unterwölblinger-Gruppe, die Mährisch-Niederösterreichische Gruppe der Aunjetitz-Kultur und die Böheimkirchner Gruppe der Věteřov-Kultur beschrieben. Innerhalb des Formenrepertoires der Keramik in Niederösterreich finden sich nun einerseits bestimmte Einzelstücke, die auch in Monkodonja vertreten sind und womöglich als Importe anzusprechen sind, sowie andererseits bestimmte Charakteristika in Form und Machart der Keramik, die sich allgemein parallelisieren lassen. Besonders deutlich werden die Bezüge im allgemeinen Formenspektrum bei der Feinkeramik. Charakteristisches Formengut der Feinkeramik der frühbronzezeitlichen Aunjetitz-Kultur in Niederösterreich[11] sind Krüge und Becher mit kugeligem Körper und abgesetztem Hals, wie sie

1 Funde und Befunde aus den Grabungen von B. Baćić wurden Ende der 90er Jahre von K. Buršić-Matijašić in einer Katalogmonografie vorgelegt: Buršić-Matijašić 1998.

2 Die Ergebnisse wurden in den letzten Jahren durch zahlreiche Publikationen einer breiteren Öffentlichkeit vorgestellt, eine Auswahl verschiedener Aufsätze zu unterschiedlichen Themen stellen die folgenden dar: Teržan, Mihovilić, Hänsel 1999. – Hänsel et al. 2009. – Mihovilić, Hänsel, Teržan 2011. – Zupančič et al. 2012. – Hellmuth 2012. – Hellmuth 2014. – Die monografische Veröffentlichung der Grabungen und der Baubefunde wurde im Jahr 2015 durch die Ausgräber vorgelegt: Hänsel, Mihovilić, Teržan 2015. – Das keramische Fundmaterial wurde 2017 durch die Autorin des vorliegenden Beitrages publiziert: Hellmuth Kramberger 2017. Im Jahr 2020 ist der dritte Band zu den Kleinfunden sowie tierischen und menschlichen Knochenfunden erschienen: Hänsel, Mihovilić, Teržan 2020.

3 Hänsel, Mihovilić, Teržan 2015, 424–452.

4 Hellmuth Kramberger 2017, 337–378. – Die Kontaktzonen finden sich auch bei anderen Artefakten wie z. B. den Bronzen aus Monkodonja reflektiert, siehe dazu die Ausführungen weiter unten.

5 Hellmuth Kramberger 2017, 244–248.

6 Hellmuth Kramberger 2017, 176–179, 202–205, 240–242.

7 Hellmuth Kramberger 2017, 215–220. – Hierbei ist zu bemerken, dass es jedoch um eine Form geht, die aller Wahrscheinlichkeit nach auf ostmediterrane Vorbilder zurückgeht: Hänsel, Teržan 2000, 179. – Mihovilić 2001, 47–48. – Hänsel, Mihovilić, Teržan 2015, 503.

8 Hellmuth Kramberger 2017, 116–124.

9 Hellmuth Kramberger 2017, 367–378, 409.

10 Neugebauer 1987, 19. – Bertemes 1989, 164–167, 167 und Abb. 73. – Neugebauer 1994, 49–71. – Lauermann 2003. – Zur böhmischen Aunjetitz-Kultur bspw.: Moucha 1963. – Bartelheim 1998. – Hinz 2009. – Zur nördlichen Aunjetitz-Kultur bspw.: Zich 1996.

11 Lauermann 2003, 587–591. – Für die Aunjetitz-Kultur in Böhmen siehe die Typengliederung der Krüge und Becher bei Bartelheim 1998, 23–28.

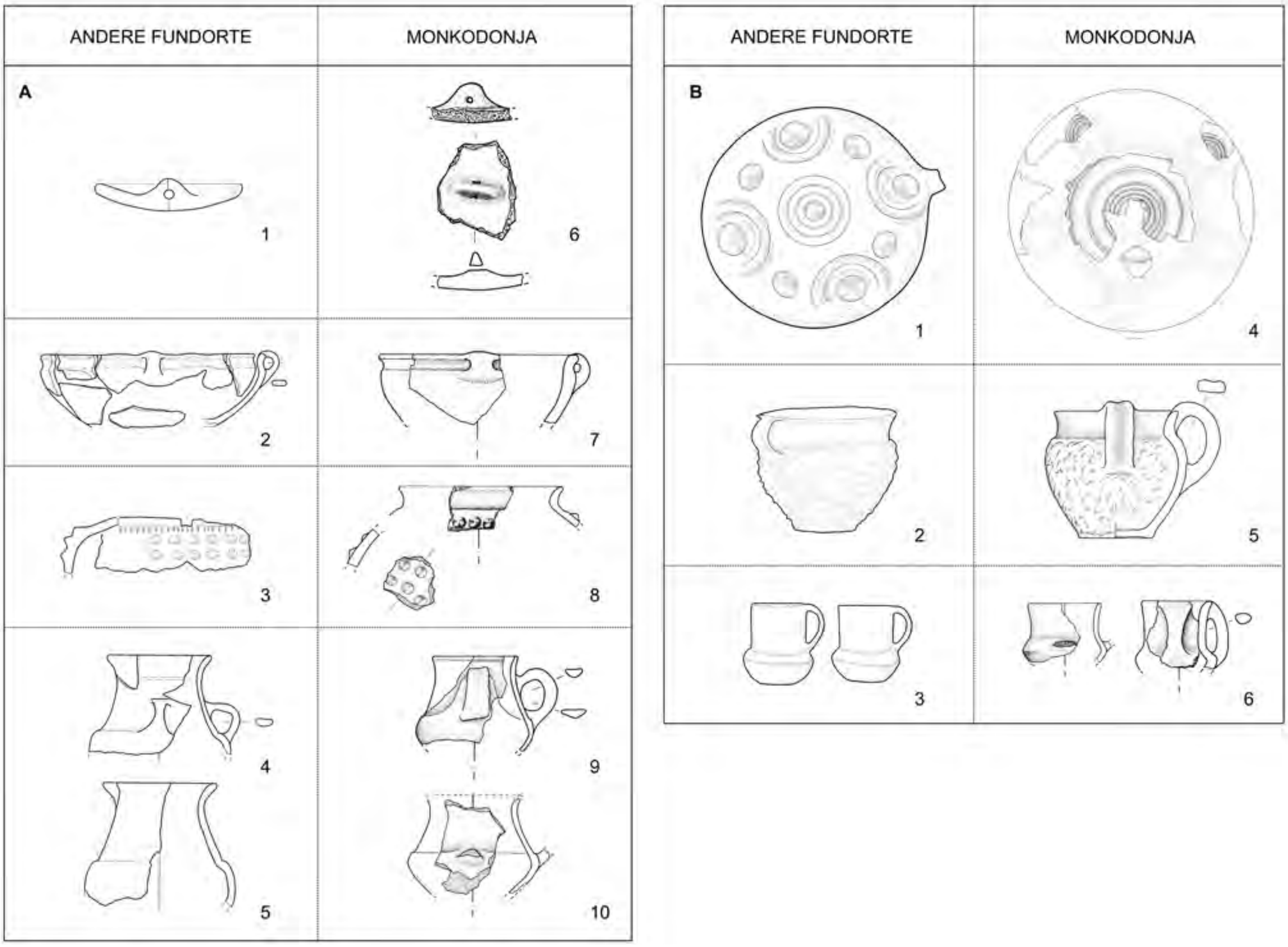

Abb. 1. Vergleiche zwischen keramischen Formen aus Monkodonja und dem Donau-Karpatenbecken (zusammengestellt nach Hellmuth Kramberger 2017, Abb. 273, 275).

beispielsweise aus dem Gräberfeld von Gemeinlebarn bekannt sind (Abb. 1/A4–5).[12] Sie finden sich in zahlreichen Varianten von unterschiedlichen Proportionen in der Relation von Randdurchmesser zum Bauchmaximum, der Länge und Stärke der Auswärtsrichtung des unverdickten, stets abgesetzten Randes sowie mit und ohne Henkel.[13] Derartige Krüge, Becher und kleine Töpfe mit abgesetztem, unverdicktem Hals und kugeligem Gefäßkörper bzw. Unterteil bilden nun auch in Monkodonja das charakteristische Formenspektrum der Feinkeramik bzw. des Trinkservices.[14] Zu denjenigen Stücken aus Monkodonja, die mit sehr großer Wahrscheinlichkeit einen Import darstellen und damit einen deutlichen Bezugspunkt in den niederösterreichischen Raum bilden, gehört ein kleiner scheibenförmigen Deckel mit leicht nach unten gewölbter Unterseite (Abb. 1/A6).[15] Solche Deckel stellen in Böheimkirchen eine ausgesprochen charakteristische Form dar (Abb. 1/A1).[16] Weitere Formen, welche Monkodonja mit Böheimkirchen verbinden, sind die Gefäße mit flächendeckender Verzierung aus kleinen Knöpfen,[17] Dornengefäße bzw. Gefäße mit Zapfen

12 Bertemes 1989, Taf. 25/9 (vgl. Hellmuth Kramberger 2017, z. B. Taf. 51/6); Taf. 12 (vgl. Hellmuth Kramberger 2017, z. B. Taf. 107/3); Taf. 26/9 (vgl. Hellmuth Kramberger 2017, z. B. Taf. 136/7); Taf. 29/Grab 74,4 (vgl. Hellmuth Kramberger 2017, z. B. Taf. 51/6); Taf. 33/Grab 96,3; Taf. 34/Grab 111,6; Taf. 39/Grab 134,2; Taf. 45/6/Grab 159,6; Taf. 59/Grab 227,15 und 237,2; Taf. 62/Grab 251,1 und 257,1. – Andere Fundorte sind beispielsweise Franzhausen (Neugebauer, Neugebauer 1997, Taf. 462/5b. – Neugebauer, Blesl 1998, 414 und Abb. 115/2), Eggenburg (Lauermann 2003, 40 und Abb. 20/2), Großmugl (Lauermann 2003, 92, Nr. 60) oder Großweikersdorf (Lauermann 2003, 106, Nr. 8).

13 Wie auch in Monkodonja handelt es sich um dunkle, gut geglättete oder polierte Keramik, siehe bspw. Zich 2004, 136.

14 Hellmuth Kramberger 2017, Abb. 66/ IVa–c; 274/f, h.

15 Hellmuth Kramberger 2017, Taf. 68/2, Abb. 273/b.

16 Neugebauer 1977, 71 und Abb. 9G/10–11; 154 und Taf. 28/8; 183 und Taf. 64/1; 187 und Taf. 69/2; 201 und Taf. 87/8.

17 Hellmuth Kramberger 2017, Taf. 25/2.5; 31/2; 38/3; 94/6; 139/1; Abb. 231/a–c; 273/e, f1–2. – Vgl. mit Neugebauer 1977, 143 und Taf. 15/1; 155 und Taf. 30/4; 176 und Taf. 55/2; 194 und Taf. 77/11.

an der Innenwand[18] und „baguetteförmige" plastische Leisten.[19] Dabei gehört die Verzierung der Gefäßoberfläche mit kleinen Knöpfen zu den Charakteristika der früh- bis mittelbronzezeitlichen Fundplätze im mittleren Donaugebiet wie der Aunjetitz-Kultur im nördlichen Niederösterreich,[20] der Hatvan-Kultur[21] oder der Věteřov-Kultur[22] (Abb. 1/A3, 8). In Bezug auf das niederösterreichische Material kann auch auf eine Parallele zwischen Funden aus Monkodonja und Gefäßen aus einem frühbronzezeitlichen Fundplatz bei Gollnsdorf/Leobersdorf hingewiesen werden.[23] In Gollnsdorf/Leobersdorf wurden Randfragmente eines oder mehrerer großer Töpfe mit vollplastischem x-förmigem Henkel („Pseudo-x-Henkel") und horizontaler plastischer Leiste gefunden,[24] die sehr deutlich an einen Pithos und einen kleinen Topf mit identischer Randgestaltung aus Monkodonja erinnern.[25] Als „Bindeglieder" zwischen Niederösterreich und dem Istrischen Karstgebiet inklusive Südwestslowenien, welches in den Kulturkreis der Gradinen eingebunden war,[26] können bestimmte keramische Einzelfunde angesprochen werden, die im Gebiet der österreichischen Steiermark gefunden wurden. Besonders deutlich wird dies in Form von Gefäßfragmenten, die frappant an den Typ der amphorenförmigen Töpfe und Pithoi mit x-Henkeln aus Monkodonja erinnern (Abb. 2a). Zu denken wäre hier zunächst an ein Gefäß aus Vorwald bei Wald am Schoberpass.[27] Interessant ist jedoch auch ein Gefäßrand mit Henkel, der jüngst von Georg Tiefengraber veröffentlicht wurde und der aus dem umfangreichen Keramikmaterial vom Wildoner Schlossberg stammt, eine der prominentesten Fundstellen im südlichen Grazer Becken an der Mur, gelegen an einem strategisch bedeutsamen und verkehrsgeografisch wichtigen Schnittpunkt des Südostalpenraumes (Abb. 2b).[28] Formal betrachtet entspricht das besagte Gefäßfragment vom Wildoner Schlossberg den Randformen bzw. Gefäßoberteilen der amphorenförmigen Töpfe und Pithoi Monkodonjas und Istriens bis ins Detail.[29] Von besonderer Bedeutung ist außerdem, dass Tiefengraber bemerkt, dass die Faktur des Stückes deutlich vom übrigen Bestand der Keramik vom Wildoner Schlossberg abweicht.[30] Er interpretiert das Randfragment als „kümmerlichen Rest eines aus dem oberadriatischen Küstengebiet importierten Gefäßes […], wobei dieses selbst wohl eher als Transportmedium bzw. Verpackung fungiert haben wird und nicht die eigentliche Handelsware dargestellt haben dürfte".[31] Um welche Art der Handelsware es sich gehandelt haben dürfte, bleibt letztendlich unbekannt, doch es ist durchaus möglich, dass die amphorenförmigen Töpfe und Pithoi in Istrien zur Aufbewahrung von Wein gedient haben.[32]

Dass Istrien in das früh- und mittelbronzezeitliche Handels- und Kommunikationsnetz mit Zentraleuropa und insbesondere mit dem mittleren Donauraum und dem Karpatenbecken eingebunden war, wird auch durch andere Funde aus der Gradina von Monkodonja deutlich.[33] Zu nennen ist im Zusammenhang mit den Bronzefunden[34] eine Hülsenkopfnadel mit großer rhombischer Kopfplatte und schwach tordiertem Schaft, die im Bereich des Westtores in der Grabungsfläche Sonda V unter der Schuttlage der jüngeren Befestigung gefunden wurde.[35] Die besten Vergleiche für die Nadel aus Monkodonja finden sich laut Hänsel und Teržan im mittleren Donauraum, wo möglicherweise auch ihre Herkunft zu suchen ist.[36] Eine Hülsenkopfnadel mit

18 Hellmuth Kramberger 2017, Taf. 113/6. – Zwei weitere Dornengefäße aus den Altgrabungen auf Monkodonja: Buršić-Matijašić 1998, 61, 63 und Taf. 13/234.236. – Vgl. Neugebauer 1977, 153 und Taf. 26/1; 175 und Taf. 54/9; 181 und Taf. 61/5. – Lochner 2012, 199–200. – Hellmuth 2014.

19 Hellmuth Kramberger 2017, Taf. 76/1. – Vgl. Neugebauer 1977, 143 und Taf. 15/12; 171 und Taf. 49/2; 174 und Taf. 52/7; 53/1; 177 und Taf. 57/2; 186 und Taf. 68/14; 198 und Taf. 83/5; 199 und Taf. 84/11–12; 201 und Taf. 87/6; 196 und Taf. 80/5.

20 Lauermann 2003, 595, 120 und Abb. 53/39; 134 und Abb. 60/20; 397, Nr. 7; 401 und Abb. 184/7.13–14.

21 Kalicz 1968, Taf. 60/6; 61/5. – Vgl. Stuchlík 2003, 448.

22 Stuchlík 2003, 448, 464 und Abb. 7/13–14. – Neugebauer 1977, 64, 65 und Abb. 7D2; 143 und Taf. 15/1; 155 und Taf. 30/4; 176 und Taf. 55/2; 194 und Taf. 77/11.

23 J.-W. Neugebauer ordnete die Funde aus Gollnsdorf/Leobersdorf dem Beginn der Bronzezeit zu (BZ A1a): Neugebauer 1976, 51.

24 Neugebauer 1976, 72 und Abb. 3/2–3.

25 Hellmuth Kramberger 2017, Taf. 41/8; 152/2; Abb. 273/h.

26 Vgl. dazu Hellmuth Kramberger 2017, 353–365.

27 Schamberger 2007, Taf. 6/24. – Vgl. Hellmuth Kramberger 2017, Abb. 171/a.

28 Tiefengraber 2018, 222 und Abb. 261/19; 228–229.

29 Vgl. Hellmuth Kramberger 2017, 178, 203–205. – Es geht um die Variante a2, einen dreieckig verdickten Rand mit Rille auf der Oberseite: Hellmuth Kramberger 2017, 177, 178 und Abb. 146/a2.

30 Tiefengraber 2018, 229.

31 Tiefengraber 2018, 229.

32 Hellmuth 2014, 71. – Ein ähnlicher Gefäßrand liegt auch aus dem bislang unpublizierten multiperiodischen Fundplatz Obrežje an der Save nahe der Grenze zwischen Slowenien und Kroatien, ca. 20 km von Zagreb entfernt, vor. Die Information verdanke ich B. Kramberger.

33 Hänsel, Mihovilić, Teržan 2015, 503. – Hänsel, Mihovilić, Teržan 2020.

34 Die chemischen Analysen an verschiedenen Bronzen aus Monkodonja haben gezeigt, dass für die Metalllegierungen verschiedene Sorten an Rohkupfer verwendet wurden und somit aus unterschiedlichen Erzquellen stammen: Urankar 2020. Eine Bestimmung der Provenienz des Rohkupfers war dabei jedoch nicht möglich.

35 Hänsel 2002. – Hänsel, Mihovilić, Teržan 2015, 449 und Abb. 112. – Hänsel, Teržan 2020, 166 und Abb. 5; 205–208 und Abb. 22–23.

36 Hänsel, Teržan 2020, 207 und Abb. 22.

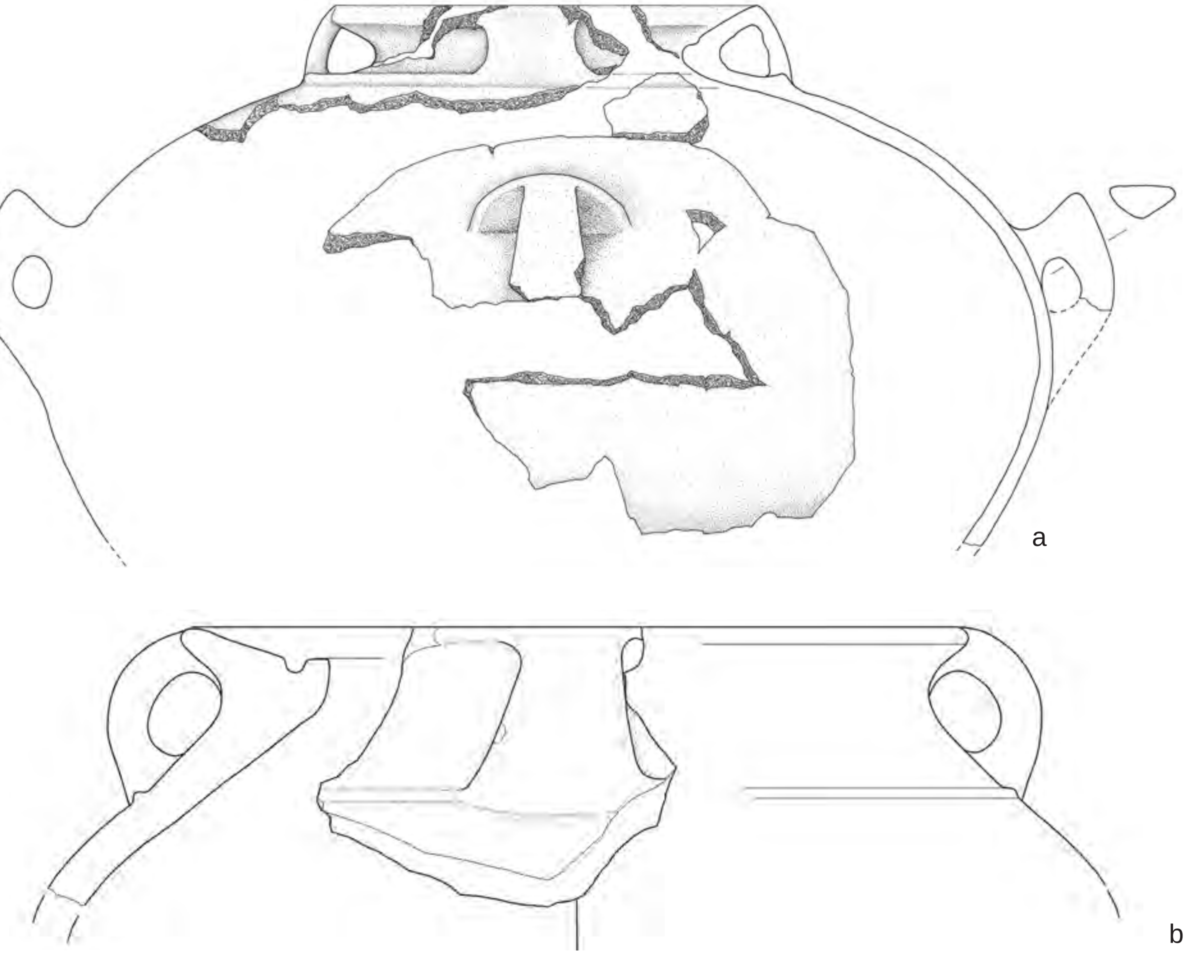

Abb. 2. Amphorenförmige Vorratsgefäße aus Istrien und der Steiermark. – a. Monkodonja (nach Hellmuth Kramberger 2017, Taf. 37/3). – b. Wildon, Schlossberg (nach Tiefengraber 2018, Abb. 261/19).

glattem Schaft kann auch aus dem frühbronzezeitlichen Gräberfeld von Gemeinlebarn in Niederösterreich angeführt werden, und zwar im Grab 93.[37] Dieses Grab ist insofern interessant, da es auch eine Schüssel mit rechteckig nach außen verdicktem Rand und Bandhenkel mit runder Seitenansicht enthielt, die deutlich an ein Gefäß aus Monkodonja erinnert.[38] In das Karpatenbecken weisen auch das Fragment einer Sichelnadel aus Monkodonja[39] und ein Blechtutulus mit breiter Krempe, der mit zwei konzentrischen Kreisen mit Hohlbuckelchen verziert ist.[40] Im ostösterreichischen Raum bis nach Passau, Mähren und die Slowakei finden sich die Parallelen für ein Lappenbeil mit kleinen, mittelständigen Lappen aus Monkodonja, das der Variante Unterradl des Typs Gmunden nahesteht.[41]

Auch das Vorkommen von Brotlaibidolen in Monkodonja ist als weiteres, deutliches Zeichen der Einbindung Monkodonjas bzw. Istriens in den Kommunikationsraum zwischen mittlerem Donaugebiet und Karpatenbecken, dem zirkumalpinen Raum mit Zentrum im Bereich der Polada-Kultur um den Gardasee in Norditalien sowie dem Verbreitungsgebiet der Aunjetitz-Kultur zu benennen.[42] Das Vorkommen dieser „enigmatischen Täfelchen" ist mit einer Reihe früh- und mittelbronzezeitlicher Kulturen bzw. kultureller Gruppen verknüpft, wie neben der

37 Bertemes 1989, Taf. 5/unten Mitte, Taf. 32/Grab 93.
38 Hellmuth Kramberger 2017, 370, 371 und Abb. 272/a, d.
39 Hellmuth Kramberger 2017, 208 und Taf. 6/2.
40 Hellmuth Kramberger 2017, 216 und Taf. 7/13.
41 Hänsel, Teržan 2020, 184 und Taf. 2/1, Abb. 2. – Vgl. Mayer 1977, 128–130 und Taf. 33/482–483 u. a.
42 Mihovilić, Hänsel, Teržan 2011. – Mihovilić, Hänsel, Teržan 2017. – Mihovilić 2020.

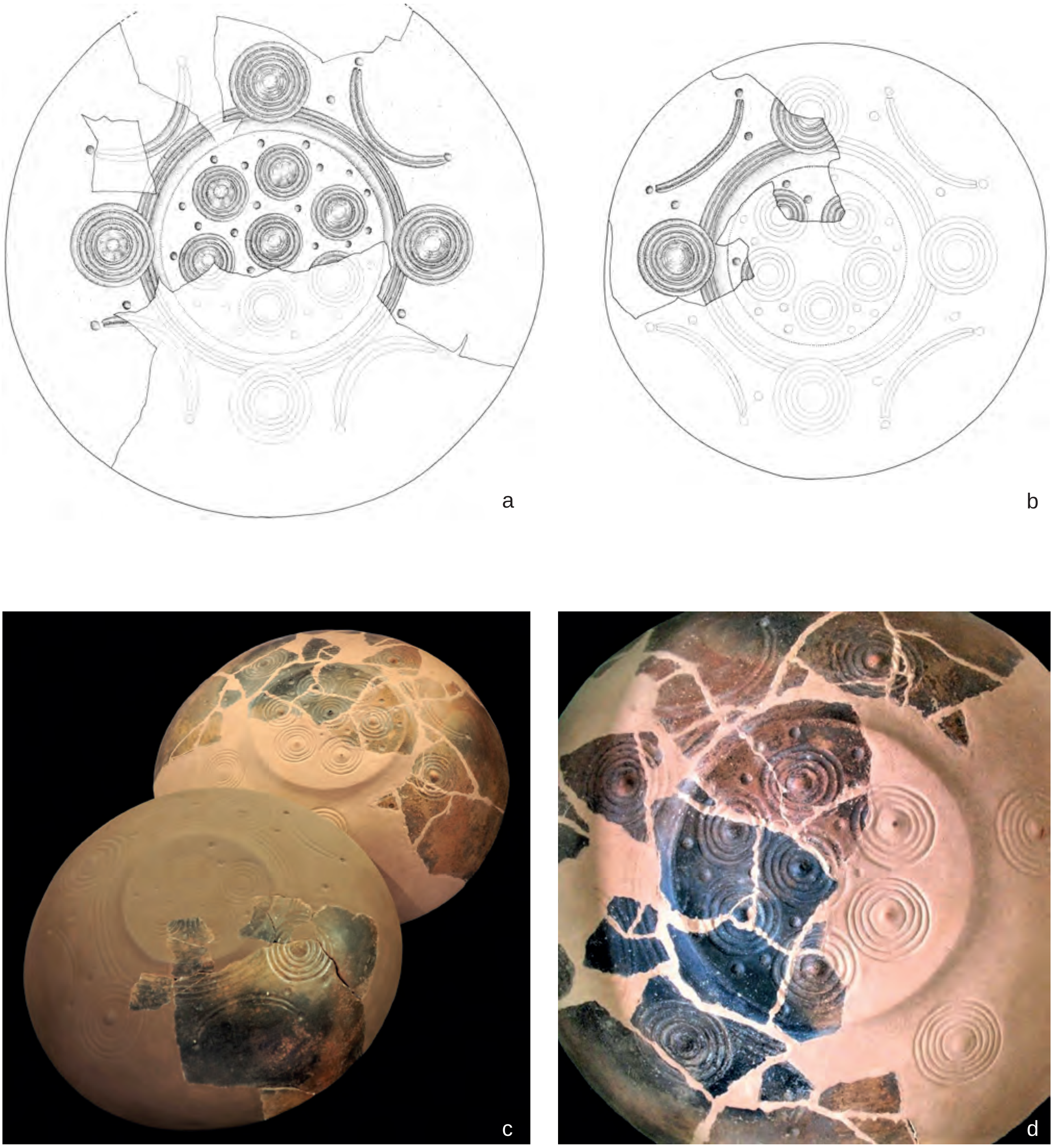

Abb. 3. Große Schalen mit verzierter Unterseite aus Monkodonja, Istrien (a–b. nach Hellmuth Kramberger 2017, Taf. 45–46. – c. Foto: D. Matošević. – d. Foto: K. Mihovilić, © Archäologisches Museum Istriens/AMI Pula).

genannten Polada-Kultur Norditaliens oder der Aunjetitz-Kultur etwa auch die Füzesabony-Kultur Ungarns oder die Böheimkirchner Gruppe Niederösterreichs.[43] Es wird nun demzufolge kein Zufall sein, dass sich in der Keramik Monkodonjas deutliche Einflüsse aus ebendiesen Gebieten fassen lassen, einerseits in Form vergleichbarerer Merkmale im Formenspektrum, andererseits in Form von mutmaßlichen Importen.[44]

Der Austausch innerhalb dieses weitgespannten Kommunikationsnetzes dürfte jedoch nicht nur den Austausch von Waren und handwerklichem Know-how umfasst haben, sondern wahrscheinlich auch von intellektuellem und religiösem Wissen und Vorstellungen. Vor diesem Hintergrund soll im Folgenden auf einige besondere keramische Funde aus Monkodonja eingegangen werden, deren markante Verzierungen möglicherweise auf bestimmte astrologische Kenntnisse und womöglich damit verknüpfte spirituelle Vorstellungen hindeuten könnten.

2. Schalen mit verzierter Bodenunterseite aus Monkodonja

Gegenstand der Betrachtungen bilden zwei fragmentarisch erhaltene, große Schalen von gut 50 cm Randdurchmesser (Abb. 3a–d).[45] Sie tragen auf der Außenseite und der Bodenunterseite eine komplexe Verzierung bestehend aus umlaufenden konzentrischen Kanneluren, eingetieften Punkten, unterschiedlich großen konzentrischen Kreisen mit kleinen Buckeln („Tutuli“[46]) in der Mitte sowie bogenförmigen Objekten.

Bei den besagten Schalen handelt es sich um Funde, die im Grabungsabschnitt der Sonda VI zutage gekommen sind, also jenem Eckbereich südlich von der Torgasse des Westtores der Hauptbefestigung von Monkodonja.[47] Von besonderer Bedeutung ist, dass sich im Eckturm der Toranlage ein Steinkistengrab (Steinkistengrab B) fand,[48] ein weiteres Steinkistengrab (Steinkistengrab A) wurde auch im Bereich der nordwestlichen Flanke des Westtores entdeckt.[49] Beide Steinkisten wurden, so bezeugen es die ^{14}C-Datierungen, die anhand menschlicher Knochen gewonnen wurden, über mehrere Jahrhunderte belegt, von ca. 2000 v. Chr. bis in die zweite Hälfte des 17. Jhs. v. Chr.[50] Die beiden Gräber wurden in den Jahrhunderten nach ihrer Errichtung unterschiedlich behandelt. Nach dem Ende der Belegung wurde das Grab A durch Überbauungen der Sicht entzogen, d. h. es wurde zwar einerseits versteckt, doch gleichzeitig bewahrte man auch das Andenken an die darin Bestatteten durch seinen Erhalt. Im Siedlungsinneren bzw. jenem inneren Bereich, der an den Eckturm der Toranlage mit dem Steinkistengrab B angrenzt, wurden abgesehen von den beiden relevanten Schalen auch größere Mengen an Gefäßkeramik geborgen.[51] Unter diesen fällt insbesondere die Anzahl weiterer Sonderformen der Schalen mit verziertem Boden auf, die nur in diesem Bereich dokumentiert werden konnten.[52] Genannt werden können darunter auch mindestens fünf identische Schalen mit unterschiedlich breiten konzentrischen Kanneluren an der Bodenunterseite, in deren Mitte ein Buckel („Tutulus“) sitzt; eine Punktreihe schließt jeweils die äußerste konzentrische Kannelur ab (Abb. 4).[53]

Die fünf kleinen identischen Schalen weisen eine gut geglättete, ursprünglich womöglich sogar polierte[54] Oberfläche auf und wurden im Oxidationsbrand hergestellt, ihre Oberflächen auf der Innen- und Außenseite sowie im Kern sind von einem kräftigen beigen Farbton mit leicht oranger

43 Z. B. Piccoli, Laffranchini 2011, 21.

44 Eine Gesamtdarstellung: Hellmuth Kramberger 2017, 346–378.

45 Hellmuth Kramberger 2017, Katalogteil, 38 und Taf. 45/2; 46.

46 Im Fall der Keramik aus Monkodonja wurde der Bezeichnung „Tutulus“ den Vorrang gegeben (Hellmuth Kramberger 2017, 267), da die – insbesondere an Flaschen vorkommenden – Ausbuchtungen oft hohl gearbeitet sind und eine spitze kegelförmige Gestalt aufweisen. Möglicherweise imitieren sie Vorbilder aus Metall.

47 Hänsel, Mihovilić, Teržan 2015, 71, 119–121.

48 Hänsel, Mihovilić, Teržan 2015, 211–224.

49 Hänsel, Mihovilić, Teržan 2015, 199–211.

50 Hänsel, Mihovilić, Teržan 2015, 431, 433–434, 439 und Abb. 320; 449, 509.

51 Hellmuth Kramberger 2017, Katalogteil, 35–42 und Taf. 39–56.

52 Unter 7420 im Detail analysierten Gefäßen und Gefäßfragmenten aus Monkodonja konnten 143 Schalen mit verziertem Boden (2 %) identifiziert werden: Hellmuth Kramberger 2017, 309–310 und Abb. 247. Dabei kann jedoch noch einmal hervorgehoben werden, dass sich in jenem, dem Eckbau des Westtores mit dem Steinkistengrab B vorgelagerten Bereich eine auffällige Zahl an Varianten von Schalen mit verziertem Boden fand, die sonst in keinem anderen untersuchten Areal der Siedlung vorkommen, also etwas Besonderes darstellen.

53 Hellmuth Kramberger 2017, 38, 138–139 und Taf. 44–45/1; 153/13. – Abgesehen von den benannten fünf Schalen sowie den beiden Schalen, die Gegenstand des vorliegenden Aufsatzes sind, fanden sich auch weitere Fragmente von Schalen mit verziertem Boden, die jedoch allesamt sehr fragmentarisch erhalten sind.

54 Dies lässt sich jedoch auf Grund des Erhaltungszustandes nicht mehr eindeutig bestimmen, die Oberflächen sind erodiert und zum Teil von Ablagerungen überzogen, was auf der Abb. 4 speziell auf der linken Hälfte der Schale erkennbar ist. Unter den bestimmbaren Stücken nehmen polierte Oberflächen 19 % ein (Hellmuth Kramberger 2017, 41), sie zeichnen sich durch einen metallischen Glanz aus: Hellmuth Kramberger 2017, 44 und Abb. 7. Es ist anzunehmen, dass die Gefäßoberflächen zunächst mit einem harten Gegenstand geglättet wurden (z. T. sind deutliche Glättspuren an der Keramik erkennbar), im Anschluss wurden diese mit Hilfe eines weichen Objekts, z. B. Tuch, poliert, bis ein hochgradiger Glanz erzielt war: vgl. z. B. Schneider 1989, 13.

Abb. 4. Kleine Schale mit verzierter Unterseite aus Monkodonja (Foto: K. Mihovilić, © Archäologisches Museum Istriens/AMI Pula).

Nuance und es ist gut vorstellbar, dass versucht wurde, den Schalen das Aussehen von Metallgefäßen – Bronzegefäßen – zu geben.[55] Auf Grund der Buckel („Tutuli“) auf der Mitte der Bodenunterseite erscheint es wahrscheinlich, dass die Schalen als Deckschalen benutzt wurden.[56] Die Bodenunterseite der Schalen wurde somit zur Schauseite. Etwas Ähnliches ist nun auch für die beiden großen Schalen anzunehmen, die im Zentrum der vorliegenden Betrachtung stehen. Sie zeigen eine gut geglättete Oberfläche auf der Innen- und Außenseite und waren im Oxidationsbrand hergestellt, wobei ihre Farbgebung stark uneinheitlich ist und zwischen verschiedenen Beige-, Braun- und Orangenuancen changiert. Während sich von der einen, etwas kleineren, kalottenförmigen Schale mit steilerem Wandprofil nur ein knappes Viertel erhalten hat (Abb. 3b),[57] sind von der zweiten, geringfügig größeren Schale mit flacherem Wandprofil ca. zwei Drittel vorhanden (Abb. 3a).[58] Beide Stücke waren stark fragmentiert. Die Ornamentik auf beiden Stücken ist nahezu identisch. Auf der Bodenunterseite sitzen kreisförmig angeordnet mehrere konzentrische Kreiskanneluren, in deren Mitte jeweils ein kleiner Buckel sitzt. Während die Anzahl der Kreise für die kleinere Schale auf Grund ihres Erhaltungszustandes nicht mehr eindeutig zu bestimmen ist,[59] sind es bei der großen Schale zweifelsfrei sieben konzentrische Kreise aus jeweils drei Kreiskanneluren – sechs Kreise, die um einen zentralen Kreis herum angeordnet sind. Das Motiv erinnert an die Verzierung auf runden Goldblechen, die im Schachtgrab III im Gräberrund A von Mykene gefunden wurden.[60] Um die sieben konzentrischen Kreise auf dem Boden der Schale aus Monkodonja sind kleine eingedrückte Vertiefungen, Punkte, verteilt.[61] Ihre genaue Anzahl lässt sich nicht bestimmen, insgesamt 17 haben sich erhalten. Auf der Schalenaußenseite finden sich nun weitere Ziermotive, welche die gesamte untere Schalenhälfte einnehmen. Zunächst laufen drei konzentrische Kanneluren kreisförmig um den Boden herum, die von vier großen konzentrischen Kreiskanneluren, gebildet aus je vier Kreisen mit zentralem Buckel, geschnitten werden. Die konzentrischen Kreise mit zentralem Buckel sind antithetisch angeordnet bzw. weisen in jeweils eine Himmelsrichtung. Im Fall der größeren Schale sitzen jeweils unmittelbar auf der äußersten Kannelur, die um den Boden verläuft, sichelmondförmige Bögen, die aus jeweils zwei parallelen breiten Kanneluren gebildet sind. Im Fall der etwas kleineren Schale sind diese Bögen einige Zentimeter von der äußersten Kannelur um den Boden herum abgerückt. An den Enden der sichelmondförmigen Bögen sitzen kleine eingetiefte Punkte, identisch zu jenen auf der Bodenunterseite. Weitere Punkte sind in den „Zwickeln“ zwischen den Bögen und den konzentrischen Kreisen angebracht, wobei sich keine Regelhaftigkeit feststellen lässt. Während bei der kleineren Schale sowohl im linken, als auch im rechten Zwickel Punkte sitzen, finden sie sich auf der größeren Schale einmal einzeln im linken Zwickel, als auch im rechten Zwickel, wobei auf Grund des Erhaltungszustandes nicht mehr

55 Bei der Mehrzahl der im Detail analysierten Gefäße und Gefäßfragmente aus Monkodonja (3997 von 7420) konnte die Oberflächenbehandlung auf der Außenseite auf Grund der Erhaltungsbedingungen nicht mehr bestimmt werden.

56 Vgl. auch Hellmuth Kramberger 2017, 163, 404 und Abb. 281/b.

57 Hellmuth Kramberger 2017, Taf. 45/2.

58 Hellmuth Kramberger 2017, Taf. 46.

59 Von drei Kreisen haben sich Teile erhalten (vgl. Abb. 2b): Hellmuth Kramberger 2017, Taf. 45/2. Da sie in ihrer Rekonstruktion bereits etwas über die Hälfte des Bodendurchmessers einnehmen, ist es unwahrscheinlich, dass die gleiche Anzahl von Kreisen bestand, wie im Falle der größeren Schale. Auch ist fraglich, ob ein zentraler konzentrischer Kreis vorhanden war.

60 Karo 1930–1933, 44 und Taf. 28–29. – Marinatos, Hirmer 1973, Abb. 224/zweite Reihe. – Vgl. Hellmuth Kramberger 2017, 385–386 und Abb. 278–279.

61 Im Zentrum sitzen die Punkte jeweils im „Zwickel“ zwischen dem zentralen Kreis und zwei angrenzenden konzentrischen Kreisen, jeweils drei Punkte sitzen in dem „Zwickel“ zwischen Bodenrand und jeweils zwei Kreisen. Allerdings findet sich im Fall eines konzentrischen Kreises, dem vollständig erhaltenen auf der rechten Seite, noch ein zusätzlicher Punkt dicht gedrängt zwischen dem Bodenrand und dem konzentrischen Kreis.

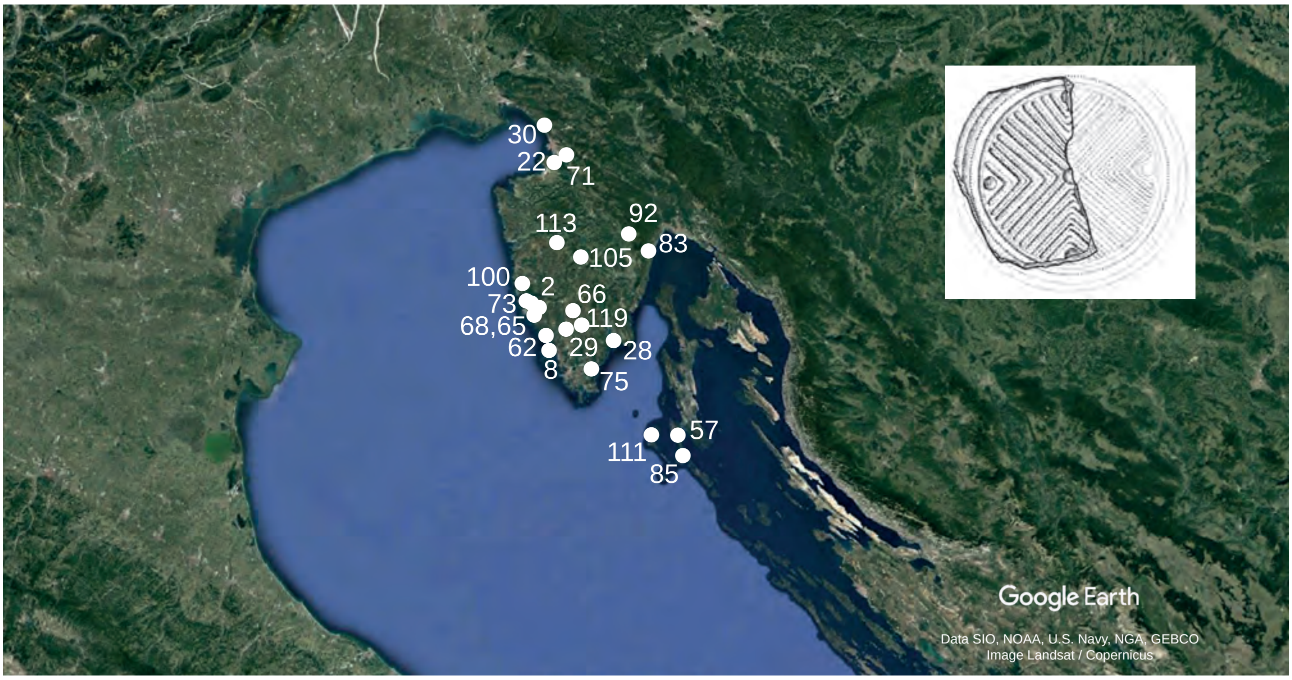

Abb. 5. Verbreitung von Schalen mit verzierter Unterseite in Istrien (nach Hellmuth Kramberger 2017, Abb. 134, ergänzt; Hintergrund: Google Earth). – 2. Bale/Valle (Buršić-Matijašić 2010, Taf. 4/74). – 8. Brijuni-Gradina (Cardarelli 1983, Taf. 24b/14, 16). – 22. Èlleri/Jelarji (Maselli Scotti 1997, Taf. 3/12–13). – 28. Gradac-Turan (Mihovilić 1997, Taf. 1/3; 3/6–7; 4/11). – 29. Gropi-Stari Guran (Mihovilić 2007–2008, Taf. 3/24). – 30. Grotta Caterina (Canarella, Pitti 1978–1981, Abb. 4/3). – 57. Lošinj,Vela spilja, Insel (Mirosavljević 1968, Taf. 24/oben links). – 62. Mandriol (Kaspar, Kaspar 2005, 122, Foto rechts). – 65. Monbrodo (unpubliziert). – 66. Moncas di Valle/Monkas kod Bala di Valle (Cardarelli 1983, Taf. 24a/6). – 68. Monkodonja. – 71. Montedoro/Dolga Krona (Maselli Scotti 1997, Taf. 6/8). – 73. Monvi/Monvè (Bekić 1996, Taf. 7/4). – 75. Nesactium/Nesazio (Mihovilić 2001, Taf. 117/26). – 83. Podosojna peć/Podosojna Höhle (Starac 1991, Taf. 24/5). – 85. Polanža, Lošinj, Insel (Cardarelli 1983, Taf. 26/12). – 92. Pupićina peć/Pupićina Höhle (Forenbaher, Kaiser, Miracle 2003–2004, Abb. 9/5). – 100. Školjić-Funtana (Mihovilić 1995, Taf. 2/1). – 105. Sv. Marija Magdalena (Kaspar, Kaspar 2005, 53, Foto rechts unten). – 111. Unije, Gradina Turan, Insel (Miletić 2002, Taf. 4/9–10). – 113. Vela peć kod Vranje/Vela Höhle bei Vranje (Forenbaher, Rajić Šikanjić, Miracle 2006, Abb. 12/2). – 119. Vrčin/Monte Orcino (Buršić-Matijašić 1997, Taf. 9/129–139; 17/368).

zu bestimmen ist, ob es noch einen zweiten Punkt auf der linken Seite des entsprechenden Bogens gab.[62]

Auf das Vorkommen von Schalenverzierungen an der Bodenunterseite allgemein wurde bereits an anderer Stelle ausführlich eingegangen, sie stellen eines der charakteristischen Elemente der früh- und mittelbronzezeitlichen Keramik in Istrien dar (Abb. 5).[63] Es kann jedoch bemerkt werden, dass zwei Kontaktzonen zu benennen sind, die während des betreffenden Zeitraums ebenfalls Bodenverzierungen an Schalen kannten, wobei es teilweise sogar um identische Ziermotive geht: dies sind einerseits der norditalienische Raum mit dem Veneto und dem südlichen Gardaseegebiet,[64] andererseits das Karpatenbecken mit Bodenverzierungen an Schalen im Mileu der Füzesabony-Gruppe bzw. -Kultur Ungarns[65] sowie in Rumänien.[66]

62 Eine weitere Gruppe an Schalen mit verziertem Boden aus dem Bereich der Sonda VI bilden ebenfalls sehr große Exemplare, deren Ornamentik auf der Bodenunterseite in gewissem Sinne eine Kombination aus derjenigen an den vorab beschriebenen Stücken der identischen fünf kleinen und zwei großen Schalen darstellt (Abb. 1/B4). Der gesamte Boden wird von unterschiedlich breiten konzentrischen Kanneluren mit zentralem Buckel eingenommen, um diesen herum sind fünf konzentrische Kreise, ebenfalls mit zentralem Buckel, angebracht: Hellmuth Kramberger 2017, Taf. 43/4; 47; 48. – Weitere Fragmente von Schalen mit ähnlicher Motivik finden sich auch in Sonda IX (Hellmuth Kramberger 2017, Taf. 12/11), V (Taf. 70/4) und III (Taf. 107/6; 119/8).

63 Hellmuth Kramberger 2017, 161–168, 375–377.

64 Vgl. dazu auch: Urban 1993, 152–169, 160 und Abb. 80/b; 165 und Abb. 86; Teržan, Mihovilić, Hänsel 1999, 187.

65 Bóna 1975, Taf. 174/7.13.17; 175/18; 177/1.5; 178/11.13; 179/19; 180/1.5.10. – Hellmuth Kramberger 2017, 377.

66 Dumitrașcu, Emődi 1981. – Die Bodenverzierungen an Schalen der Wietenbergkultur Rumäniens zeigen hingegen kaum vergleichbare Ziermotive: vgl. Boroffka 1994, 194 und Typentafel 18/21–26; 19–20/1–7.

Genannt seien beispielsweise Schalen mit Bodenverzierung in Form von Buckeln, konzentrischen Kanneluren und Girlanden im Gräberfeld von Megyaszó (Abb. 1/B1).[67] Dabei sei jedoch betont, dass sich für die beiden großen Schalen, die im Zentrum der Betrachtung stehen, keine Parallelen finden. Sie stellen in Monkodonja insgesamt etwas Besonderes dar und haben keine direkten Vergleiche, weder in Istrien, noch in den benachbarten oder weiter entfernten Regionen.

Schalen mit verziertem Boden kommen im gesamten gegrabenen Siedlungsbereich von Monkodonja vor,[68] doch die größte Konzentration sowie die herausragenden bzw. besonderen Stücke finden sich ausschließlich in Sonda VI vor dem Eckbau bzw. Eckturm mit dem Steinkistengrab B. Welche Funktion erfüllten diese speziellen Schalen, waren sie womöglich Bestandteil von Zeremonien, die zu bestimmten Anlässen in der unmittelbaren Umgebung bzw. in der Anwesenheit der Ahnen in den Gräbern abgehalten wurden? Welche Rolle spielte die Ausrichtung des Tores gen Westen, in Richtung des Meeres und des Sonnenuntergangs zur Tagundnachtgleiche?[69] Fragen, die sich heute freilich kaum beantworten lassen. Dennoch finden sich Hinweise darauf, dass es um besondere Objekte ging, deren Verzierung nicht nur eine ansprechende Ornamentierung repräsentierte, sondern einen speziellen Sinnträger darstellte. Bereits in einem anderen Zusammenhang hat sich gezeigt, dass bestimmte Verzierungen auf den Gefäßen in Monkodonja nicht nur schmückenden Charakter hatten, sondern aller Wahrscheinlichkeit nach auch Sinnträger waren. So konnte festgestellt werden, dass manche Töpfe und Pithoi, große Vorratsgefäße, auffällige Verzierungen tragen.[70] Die kombinierten Motive aus bogenförmigen plastischen Leisten oder Einritzungen, kleinen Buckeln, Knöpfen und antithetisch angeordneten Handhaben formen „Gesichter“ und geben so den Gefäßen eine anthropomorphe Gestalt. Man mag sie als die „Hüter“ über den Inhalt der Gefäße interpretieren. Dass es sich nun auch bei den Verzierungen auf den beiden großen Schalen aus Monkodonja nicht um einen bloßen Schmuck, sondern vielmehr um einen Sinnträger bzw. genauer, einen möglichen Bezug zu kosmologischen Vorstellungen handeln könnte, soll im Folgenden mit einem Vergleich diskutiert werden. Konzentrische Kreise, Buckel, eingetiefte Punkte und Bögen bilden, wie vorab beschrieben, die einzelnen Elemente. Erwähnt sei in diesem Zusammenhang, dass Wolfgang David das Vorkommen von Kreis- und Buckelverzierungen (flache Buckel und Spitzbuckel) auf der karpatenländischen Keramik der Stufen Bz A2–C nach mitteleuropäischer Terminologie, dabei speziell im Bereich der Füzesabony-Otomani- und Guylvarsánd-Otomani-Kultur, als Sinnträger angesprochen hat, der mit kosmologischen oder religiösen Vorstellungen in Verbindung zu bringen sei.[71]

3. Astrologische Kenntnisse der Frühbronzezeit und eine mögliche Deutung der Ornamentik auf den beiden besonderen Schalen aus Monkodonja

Zu den bemerkenswertesten Funden der mitteleuropäischen Frühbronzezeit gehört die sog. Himmelsscheibe aus dem Hortfund von Nebra, entdeckt auf dem Mittelberg im Burgenlandkreis Sachsen-Anhalts (Deutschland), die ohne Zweifel mit kosmologischen Vorstellungen in Zusammenhang steht (Abb. 6a–b). Viel wurde sowohl zur Geschichte der spektakulären Auffindung bzw. Sicherstellung des Hortes sowie der einzelnen Bestandteile als auch seiner Interpretation veröffentlicht.[72] Deponiert wurde der Hortfund von Nebra, der dem kulturellen Milieu der mitteldeutschen Aunjetitz-Kultur zugeordnet wird,[73] um 1600–1550 v. Chr., in der ausgehenden Frühbronzezeit (Bz A2c[74] bzw. Bz A3[75] nach der Phasengliederung für Zentraleuropa). Er kam damit zu einer Zeit in den Boden, als auch die befestigte Siedlung von Monkodonja in Istrien bestand. Abgesehen von der Himmelsscheibe[76] umfasste der Hortfund auch zwei bronzene Vollgriffschwerter mit goldener Manschette am

67 Bóna 1975, Taf. 174/7.13.17; 175/18; 177/1.5; 178/11.13; 179/19; 180/1.5.10.13. – David 2010, 476 und Abb. 41/4.6.

68 Hellmuth Kramberger 2017, 309–310 und Abb. 247.

69 Für das Nordtor von Monkodonja ist eine besondere Bedeutung relativ offensichtlich, denn so führt die zickzackförmig gestaltete Torgasse direkt zu einer 51 m tiefen Schachthöhle, deren Umfeld in prähistorischer Zeit überarbeitet und sehr wahrscheinlich kultisch genutzt worden war: Hänsel, Mihovilić, Teržan 2015, 179–192, 381–387.

70 Hellmuth 2012. – Hellmuth 2015.

71 David 2010, 476–479. – Auch in Hinblick auf zeitgleiche Verzierungen auf Bronzen.

72 Aus dem umfangreichen Korpus an Veröffentlichungen sei an dieser Stelle nur eine Auswahl genannt: Meller 2002. – Meller 2004. – Meller 2010. – Meller 2013a. – Meller 2013b. – Meller 2018. – Hansen 2010. – Pernicka et al. 2008. – Schlosser 2010.

73 Z. B. Meller 2002, 17. – Meller 2013a, 493. – Siehe Beitrag von E. Pernicka et al. in diesem Band, S. 89–122 [Anm. d. Red.].

74 Meller 2013a, 500–503, 513, siehe auch Fußnote 26.

75 Meller 2002, 9.

76 Die Himmelsscheibe selbst war zu dem Zeitpunkt, als sie dem Boden übergeben wurde, entsprechend der Forschungsergebnisse bereits 150–200 Jahre alt: Meller 2010, 62. – Meller 2018, 356 und Abb. 6.

a

b

Abb. 6. – a. Der Hortfund von Nebra in rekonstruierter Fundlage (Foto: J. Lipták, © Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt). – b. Die Himmelsscheibe von Nebra (Foto: J. Lipták, © Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt).

Griff,[77] zwei Randleistenbeile,[78] einen Knickrandmeißel[79] sowie zwei mehrfach zerbrochene Armspiralen.[80] Es wird angenommen, dass die Scheibe derart positioniert werden konnte,[81] dass das rechte Ende des linken „Horizontbogens“ auf der Scheibe[82] (vgl. Abb. 6b) den Sonnenuntergang zur Wintersonnenwende anzeigt, während das linke Ende desselben Bogens in Richtung des Sonnenuntergangs zur Sommersonnenwende weist. Letzteres konnte vom Mittelberg aus während der Frühbronzezeit auf Höhe des Brockens im Harzmassiv beobachtet werden.[83] Umgekehrt zeigten die Enden des rechten „Horizontbogens“ auf die Sonnenaufgänge. Offensichtlich war die Nutzung der Scheibe auf die spezifischen Begebenheiten ihres Auffindungsortes zugeschnitten, wobei technische und naturwissenschaftliche Analysen ergeben haben, dass das Bildwerk auf der Scheibe in vier Phasen entstanden sei, also mehrfach modifiziert bzw. angepasst wurde, wobei drei unterschiedliche Goldsorten Verwendung fanden.[84]

Dabei umfasste das Bildwerk in seiner ersten Phase zunächst 32 Sterne, die Mondsichel[85] sowie den Vollmond/die Sonne, welches in der zweiten Phase durch die beiden „Horizontbögen“ erweitert wurde. In der dritten Phase wurde die „Sonnenbarke“ in der Mitte der beiden Bögen hinzugefügt. Die vierte Phase umfasst die Perforierung des Randes der Scheibe, sehr wahrscheinlich, um sie auf einem organischen Untergrund zu fixieren. In einer letzten, fünften Phase wurde der linke „Horizontbogen“ wieder entfernt, was womöglich geschah, um die Scheibe vor ihrer Deponierung unbrauchbar zu machen bzw. zu entwerten. Die Anpassung auf die astronomischen Gegebenheiten am Mittelberg erfolgte demnach mit der zweiten Phase, wobei entsprechend der Goldanalysen nicht nur die Bögen (bzw.

77 Bei den beiden Schwertern handelt es sich aller Wahrscheinlichkeit nach um Kopien donauländischer Vollgriffschwerter, da sie einerseits Klingen besitzen, die jenen des Typs Sögel entsprechen, andererseits Griffe, die denen der Schwerter vom Typ Apa entsprechen: Meller 2010, 48–56. – Meller 2013a, 503–515.

78 Die Randleistenbeile werden dem Typ Bühl zugerechnet, der von K.-F. Rittershofer beschrieben wurde: Meller 2010, 56. – Vgl. Rittershofer 1983, 178–189.

79 Der Meißel entspricht dem Typ 36a nach B. Zich: Meller 2010, 56. – Vgl. Zich 1996, 214–215 und Karte 97.

80 Meller 2013a, 496–498 und Abb. 2/a–b; 3; 5–6. – Niedergelegt war der Hort, den Erkenntnissen der Ausgrabungen im Bereich des „Raublochs“ auf der Kuppe des Mittelberges zufolge, an einer markanten natürlichen Steinschichtung, wobei die Himmelsscheibe senkrecht stehend an einen Stein angelehnt gewesen sein soll, die übrigen Gegenstände unmittelbar vor ihr übereinander aufgeschichtet. Die Schwerter lagen dabei zuunterst übereinander, darüber im Wechsel ein Beil, der Knickrandmeißel und wiederum ein Beil, die Armspiralen befanden sich auf der rechten Seite.

81 Bzw. positioniert werden musste, da die Beobachtungen nur gemacht werden konnten, wenn die Scheibe dem Sternenhimmel gleich über den Kopf gehalten wird: Meller 2018, 357.

82 Von der „Sonnenbarke“ in der Mitte am Rand der Scheibe aus betrachtet der linke Bogen.

83 Schlosser 2004. – Schlosser 2010. – Meller 2018, 357.

84 Meller 2010, 46–48 und Abb. 15–16; 59–70 und Abb. 35.

85 In Frage kommt auch eine Deutung als partielle Sonnen- oder Mondfinsternisse: Schlosser 2004, 46.

der eine erhaltene Bogen) angebracht wurden, sondern auch ein einzelner Stern (Nr. 23).[86] Insgesamt wird vermutet, dass in der Vorstellungswelt der Frühbronzezeit der Himmel als kuppelförmiges Gebilde angesehen wurde und die Himmelsscheibe von Nebra somit „die früheste Abstraktion dieses dreidimensionalen Gedankens in eine zweidimensionale Form" verkörpert.[87] Der gefiederte und als Schiff („Sonnenbarke") interpretierte Bogen zwischen den beiden „Horizontbögen" könnte dabei eine mythologisch-religiöse Komponente verkörpern, deren genaue Deutung sich jedoch unserer Kenntnisse entzieht.[88] Eine besondere Bedeutung kommt aus astronomischer Sicht einer Gruppe aus sieben Sternen zu, die sich rechts oberhalb der Sichel findet (Abb. 6b). Diese Gruppe stellt mit hoher Wahrscheinlichkeit den offenen Sternenhaufen der Plejaden dar, das „Siebengestirn", der sich am Himmel mit bloßem Auge erkennen lässt und der vermutlich das zentrale Objekt auf der Himmelsscheibe bildet.[89] Dem Siebengestirn bzw. auch der Zahl Sieben an sich kam in der mythologischen und religiösen Vorstellungswelt Mesopotamiens eine besondere Bedeutung zu.[90] In der babylonischen Astrologie wurden die böse Sieben mit den Plejaden identifiziert, die auch durch eine siebenköpfige Schlange versinnbildlicht waren, der eine Gruppe der guten Sieben gegenüberstand.[91] Ein zentraler Bestandteil der babylonischen Astrologie war die Beobachtung und Dokumentation des ersten Erscheinens und Verschwindens von Sternen und Planeten in der Morgen- und Abenddämmerung nahe des Horizontes. Eine Sammlung von Keilschrifttexten des 3.–1. Jts. v. Chr., die derartige Informationen enthält, sind die MUL.APIN-Tafeln, in denen die Plejaden als MUL.MUL benannt sind.[92] Auf dem Mittelberg in Sachsen-Anhalt waren die Plejaden in der Frühbronzezeit in der Dämmerungshelligkeit innerhalb von zwei bis drei Tagen unsichtbar und zwar einerseits um den 10. März, andererseits um den 17. Oktober, was man in etwa mit dem Beginn und dem Ende des bäuerlichen Jahres gleichsetzen kann.[93] Wie Wolfhard Schlosser bemerkt,[94] wurden Plejadenbeobachtungen beispielsweise in Litauen noch bis in die jüngste Vergangenheit genutzt, um den rechten Zeitpunkt zum Vorbereiten der Frühjahrssaat zu bestimmen, und eine ähnliche Nutzung erscheint unter Anbetracht der aufgeführten Begebenheiten auch für die Himmelsscheibe von Nebra wahrscheinlich.

Die Ikonografie der Himmelsscheibe von Nebra ist in dieser Art bislang für die entwickelte Frühbronzezeit Mitteleuropas einzigartig. Wenn nun auch in ihren jeweiligen Details unterschiedlich und auf unterschiedlichen Objekten und Materialien angebracht, so lassen sich dennoch gewisse Parallelen zwischen der Ornamentik bzw. einzelnen Elementen auf den beiden zuvor besprochenen Schalen aus Monkodonja und der Himmelsscheibe von Nebra feststellen. Die offensichtlichste Parallele stellen dabei die sichelmondförmigen Bögen dar. Der doppelt geriefte und „gefiederte", d. h. mit feinen senkrechten Linien umsäumte Bogen auf der Himmelsscheibe von Nebra wird in der Regel als Schiff, als „Sonnenbarke" interpretiert.[95] Auf den Schalen aus Monkodonja finden sich jeweils vier (in jeder Himmelsrichtung eine) solche „Barken", die ebenfalls gerieft bzw. in diesem Fall kanneliert, nicht aber gefiedert sind. Die „Sonnenbarke" auf der Himmelsscheibe sei, wie weiter oben bemerkt, erst in der dritten Fertigungsphase hinzugefügt worden.[96] Dennoch ist interessant, dass sie derart eingefügt wurde, dass sich, wenn auch leicht versetzt, jeweils oberhalb der Enden des Bogens ein Stern befindet; ein einzelner Stern findet sich auch in dem Zwickel zwischen dem Scheibenrand und der linken Hälfte des Bogens (Abb. 6b). Punkte (Sterne?) oberhalb der Bogenenden finden sich auch bei den Schalen aus Monkodonja, und in einem Fall wurde ebenfalls ein einzelner Punkt in dem Zwickel zwischen der linken Bogenhälfte und der äußersten Kannelur angebracht, die um den Boden herumläuft. Im Fall der größeren Schale sitzen die Bögen, die „Barken", wie bemerkt, unmittelbar auf dieser äußersten Kannelur auf und es erscheint reizvoll, letztere als Horizont zu interpretieren. Aus diesem Horizont tauchen dann die großen konzentrischen Kreise mit zentralem Buckel („Tutulus") auf bzw. in diesen ab. Sie könnten demnach entweder den Vollmond oder die Sonne darstellen, der bzw. die sich auch als zentraler Bestandteil bei der Nebra-Scheibe findet. Und auch ein weiteres zentrales Motiv der Himmelsscheibe von Nebra findet sich möglicherweise auf der größeren Schale aus Monkodonja – das Siebengestirn, die Plejaden. Repräsentiert könnten diese in Form der sieben konzentrischen Kreise auf der Bodenunterseite sein, die von zahlreichen Punkten, Sternen, umgeben sind.

Eine Frage, die sich bei dem vorliegenden Vergleich stellt, ist freilich, ob eine ähnliche kosmologische Ikonografie und

86 Schlosser 2004, 47 und Abb. 15.
87 Meller 2018, 357.
88 Meller 2002, 10–14. – Vgl. auch Meller 2010, 59. – Eine andere Deutung schlug P. Gleirscher vor, nämlich die der Knopfsichel: Gleirscher 2007, 30.
89 Schlosser 2004, 46–47. – Meller 2010, 59–60.
90 Haas 1986, 133–138.
91 Haas 1986, 137–138.
92 De Jong 2007, 108–109.
93 Schlosser 2004, 46–47.
94 Schlosser 2004. – Schlosser 2010.
95 Meller 2002, 10–14. – Vgl. auch Meller 2010, 59.
96 Meller 2010, 46–48 mit Abb. 16; 65–67.

wahrscheinlich auch damit verknüpfte Vorstellungswelt in den beiden geografisch weit entfernten Regionen bestanden haben könnte, ohne dabei jedoch so weit gehen zu wollen, dem Töpfer in Istrien Kenntnisse von der Himmelsscheibe zu unterstellen. Wie eingangs ausgeführt wurde, zeigen die Funde aus der Gradina Monkodonja deutlich, dass Istrien in das weitreichende früh- und mittelbronzezeitliche Kommunikationsnetz Mitteleuropas eingebunden war und sich insbesondere Verbindungen in das mittlere Donaugebiet mit jenen Gruppen, die einen mehr oder minder starken Bezug zur böhmischen Aunjetitz-Kultur aufweisen, das Karpatenbecken sowie nach Norditalien[97] nachverfolgen lassen. Einen Beleg dafür bilden die Brotlaibidole, bestimmte Bronzen und ferner auch ein zum Teil ähnliches Gefäßspektrum mit gemeinsamen Charakteristika sowie mutmaßliche Importe. Auf der anderen Seite stellt Istrien bzw. der Raum um Monkodonja den nördlichsten Ausläufer des Mittelmeeres dar und dürfte somit die Funktion eines Umschlagplatzes für Waren, Personen und Ideen zwischen dem Süden und Kontinentaleuropa gehabt haben.[98] Vor diesem Hintergrund erscheint es also möglich, dass es sich bei den aufgezeigten Parallelen zwischen den Verzierungen auf den beiden Schalen aus Monkodonja und der Ikonografie der Himmelsscheibe von Nebra nicht um einen bloßen „Zufall“ handelt, sondern sich auch in Istrien ähnliche astrologische Kenntnisse und vielleicht damit verknüpfte spirituelle Vorstellungen fassen lassen.

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97 Siehe auch Hellmuth Kramberger 2017, 346–353.

98 Hänsel, Mihovilić, Teržan 2015, 501. – Zu den Südkontakten Monkodonjas: Hänsel, Mihovilić, Teržan 2015, 175–177, 500–504. – Hellmuth Kramberger 2017, 379–386. – Hänsel, Teržan 2020, 193–195 und Abb. 17. – Ein Handelsgut, das offensichtlich vom nördlichen Mitteleuropa über Istrien weiter nach Süden gehandelt wurde, stellt der Bernstein dar, der zahlreich in den Grabhügeln auf dem Nachbarhügel Mušego gefunden wurde: Hänsel et al. 2011. – Hänsel, Mihovilić, Teržan 2015, 501.

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Treazzano di Monsampolo, a Recent Bronze Age Settlement in the Middle Adriatic Area

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Abstract

Treazzano di Monsampolo is situated in the basin of the Tronto River in the Marche region, central-eastern Italy. In 1979, the site was investigated by the Soprinendenza Archeologica delle Marche through explorative trenches following the fortuitous discovery of a Mycenaean fine ware fragment, which constituted the first Aegean artefact from the region. The excavation, whose documentation has been lost, brought to light evidence of structures related to a settlement. The findings, which mainly include pottery but also animal bones, lithic and bronze fragments as well as evidence of an antler industry, date to a period comprising the end of Middle Bronze Age 3 (MBA 3) and the very beginning of the Final Bronze Age (FBA) (14th–12th century BC). Except for a few decorated fragments belonging to the Apennine facies, most of the pottery from Treazzano di Monsampolo shows Subapennine typical features, sometimes characterized by regional or local elements. Although the pottery does not show marked influences from the Terramare area, some evidence of these contacts can be seen in the antler industry quite well represented at the site.

Keywords

Treazzano di Monsampolo, Marche, Tronto River, Adriatic Sea, Italy, Subapennine facies, Recent Bronze Age, Mycenaean pottery.

Zusammenfassung – *Treazzano di Monsampolo, eine bronzezeitliche Siedlung im mitteladriatischen Raum*

Im Jahr 1979 wurde der Fundort Treazzano di Monsampolo (Region Marken, östliches Zentralitalien) von der Soprintendenza Archeologica delle Marche mit Hilfe von Testschnitten untersucht, nachdem ein Fragment mykenischer Feinkeramik entdeckt worden war, das das erste ägäische Artefakt der Region darstellte. Bei der Ausgrabung, deren Dokumentation unglücklicherweise verloren ist, wurden Spuren von Baubefunden einer Siedlung aus der Bronzezeit freigelegt. Die beweglichen Funde – hauptsächlich Keramik, aber auch Tierknochen, Stein- und Bronzefragmente sowie Geweihartefakte – haben einen Datierungsrahmen, der vom Ende der Mittelbronzezeit (MBZ 3) bis zum Beginn der Endbronzezeit (EBZ) reicht (14.–12. Jh. v. Chr.). Obwohl die Keramik nur wenige Einflüsse aus dem Gebiet der Terramare-Kultur in der Poebene aufweist, sind einige Belege für diese Kontakte unter den Geweihartefakten zu finden, die an diesem Fundort gut belegt sind.

Schlüsselbegriffe

Treazzano di Monsampolo, Marken, Tronto, Adriatisches Meer, Italien, subapenninische Fazies, Bronzezeit, mykenische Keramik.

1. Introduction

The Tronto is a 115 km-long river representing the most important waterway of the Marche region in middle Adriatic Italy. Its basin is characterized by the presence of two geographically distinct landscapes: the upper valley to the west and the middle and lower valley to the east. In the upper valley, the river runs through the Sibillini Mountains to the north and the Monti della Laga to the south. The lower valley presents, on the one hand, flatlands, which become progressively wider as they reach the river mouth, and on the other hand, hills close to the coast.

Because of the favourable geo-morphological conformation of the territory, human presence is continuously attested from the Paleolithic period to Roman times.[1] The findings are quite frequent for the Roman age, while the pre- and protohistoric periods are underrepresented. Nora Lucentini assumed that this diversification might not depend on the greater occupation in historical times, but that it is related to the modern farming techniques introduced in the 1960s, which involved the use of mechanical tools, destroying the weak pre- and protohistoric traces, which were certainly more fragile than Roman ones.[2] The archaeological evidence dating back from the period of the Neolithic to the Middle Bronze Age is rather rare. The Recent Bronze Age (RBA), relative to its chronological duration, is more attested, although very few sites have been excavated or intensively investigated. The map (Fig. 1) shows the main RBA sites

1 Giorgi, Lucentini 2007, 9–17.

2 Lucentini 1995, 17–48.

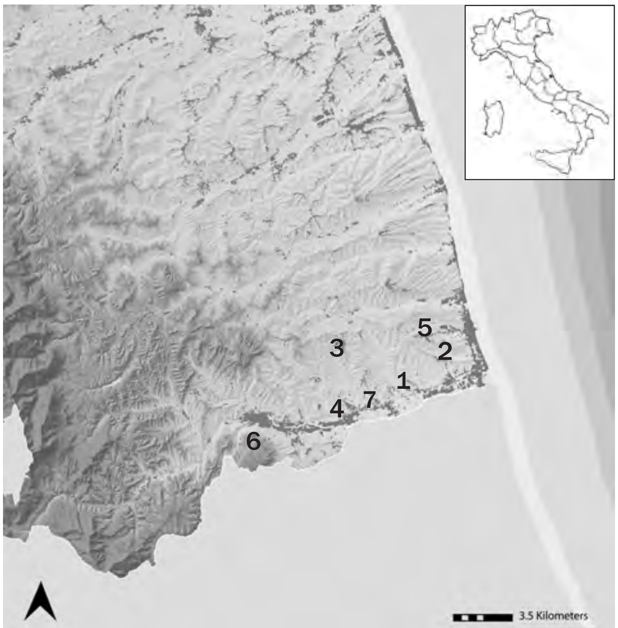


Fig. 1. Distribution map of the RBA sites in the area around the Tronto River. – 1. Treazzano di Monsampolo. – 2. Monteprandone. – 3. Offida. – 4. Castel di Lama. – 5. Laferola di Acquaviva Picena. – 6. Castel Trosino. – 7. Casale Superiore presso Colli del Tronto.

identified in the surroundings of the Tronto River. Almost all of them are settlements occupying hill plateaus with good drainage systems and without natural borders constraining their extension. Moreover, it seems that they were fairly close to each other, the average distance between the sites being about 2.5–3 km.[3]

The RBA settlements in this part of the region seem to flourish alongside the future route of the Via Salaria.[4] Their position might suggest the existence of a regular network of contacts and trades. This network probably involved the northern part of the peninsula (Terramare Culture) and the Aegean world.

2. Discovery and Excavation of the Site

The archaeological site of Treazzano di Monsampolo was identified during the sixties by the members of the local 'Archaeoclub' of Castel di Lama. On the southern slopes of a small hill on the left of a natural spring called Fiobbo, they collected numerous fragments of Bronze Age *impasto* pottery and a small sherd (about 3 cm) of Mycenaean fine ware pottery decorated with floral motifs (Fig. 2). The discovery of this latter had great relevance since it was the first Aegean artefact found in the Marche region.

3 Cocchi Genick 1996, 202.
4 Lucentini 1987, 444.

Fig. 2. Mycenaean pottery fragment from Treazzano di Monsampolo (1:1) (Lollini 1982, Pl. LXXIV).

In 1979, the Soprintendenza Archeologica delle Marche authorized and carried out the excavation of the site.[5] The first archaeological exploration of the area, executed through an elongated trench named A, was restricted to the eastern part of the plain. The archaeological layers were deeply plough-damaged (about 1.10 m in depth). After the removal of the reshuffled soil, the trench was divided into nine sections. All of them were rich in ash and provided a copious amount of impasto ware belonging to the Subapennine facies, bones and a few pieces of bronze. The typology of the pottery shapes – mainly cups, bowls and jugs – left no doubt about the residential function of the site. In the second section three postholes, five huge stones in situ and clear evidence of a beaten earth floor were identified.[6] In the western part, not affected by the ploughing, another trench called B (Fig. 3) was excavated. Trench B contained a large amount of pottery belonging to the same chronological horizon as that collected in trench A.[7]

3. Chronotypological Interpretation of the Pottery

The pottery from Treazzano di Monsampolo appears highly fragmented. Among 21,861 sherds collected, 4999 pieces have been classified as diagnostic. Only 30 % of the fragments measured more than 10 cm (major axis length). The most represented category of vessels is constituted by

5 Unfortunately, none of the reports and documentation drawn up during the digging are available because they were partially lost. The data relative to the excavation mentioned in the paragraph have been reconstructed through photographic dossiers stored in the Soprintendenza delle Marche archives and the short bibliographic information recorded by Fornarini 1979. Neither the size of the trenches nor the extension of the settlement could be estimated.
6 Fornarini 1979, 314–315.
7 The materials collected during the excavation are stored in the Archaeological Museum of Ascoli Piceno. The tags placed on the boxes suggested the presence of other trenches (C, XIX, XXV, XXVII). The extension, the depth and even the position of these trenches are not clear. However, they provide very little archaeological evidence in comparison with trenches A and B.

Fig. 3. Treazzano di Monsampolo, Trench B (Photo: D. Lollini; Soprintendenza Archeologica delle Marche archive). Unfortunately, most of the excavation documentation was lost, only a few photos in low quality have been preserved.

jars (33 %), followed by cups (29 %) and bowls (29 %).[8] The lack of stratigraphic data and detailed documentation about the excavation prevent different occupation phases of the settlement being identified. However, the typological study of the pottery (Tab. 1) has attested a continuous occupation which covers the Recent Bronze Age (therefore both RBA 1 and RBA 2) up to the very beginning of the Final Bronze Age (FBA). Only 30 sherds with incised and impressed Apennine decorations seem to belong to a more ancient chronological horizon (Middle Bronze Age 3 – MBA 3). The widespread Apennine motif is the checkerboard pattern with alternately free and carved squares (Pl. 1/A).[9] This decoration is found at numerous Adriatic sites in central (e.g. Castel Trosino) and southern Italy (e.g. Coppa Nevigata).[10] At Coppa Nevigata, this motif occurs in association with pottery dating back to the first phase of the RBA.[11] The carved lines are another Apennine motif fairly well attested at Treazzano di Monsampolo (Pl. 1/B).[12] Only a few fragments present grooved (Pl. 1/C1–3) or impressed decoration (Pl. 1/D1). Regarding the open shapes, at Treazzano di Monsampolo two main forms have been identified: the bowls and the cups.

3.1. Bowls

The bowls have been organized into ten sub-groups, according to shape and type. Type A1 is constituted by bowls with an enlarged oblique lip and internal edge (Pl. 1/E). This type is usually found in MBA 3 and RBA 1 contexts.[13] Two specimens had a preserved triangular lug on the lip (Pls. 1/E1, 1/E4). Articulated bowls presenting shallow angular-profile basins and oblique rims with an internal edge, as the type A2, are often associated with RBA 2 sites (Pl. 1/F). Sometimes, as in the specimen from Treazzano di Monsampolo, the rim is decorated with vertical grooves on the interior part.[14]

The family of truncated conical bowls is widely represented and differentiated into three groups based on their size and decoration: A3, A6, A7 (Pls. 2/B, 3/A). Type A3 is particularly attested in central Italy during the MBA and RBA; it comprises medium-sized truncated conical bowls decorated with a straight plastic cordon close to the rim (Pl. 2/B1–2).[15] The types A6 and A7 include large bowls characterized by a deep basin. Type A6 has a slightly convex profile with a flat rim and one or two plastic cordons on the body (Pls. 2/B3–5, 3/A1);[16] type A7 is marked by a short rim forming a slight concavity with the considerably convex body below (Pl. 3/A2–3).[17]

The semiglobular bowls with a non-articulated profile (Pl. 2/A) are rather numerous. They have been divided in two sub-groups: the types A4 and A5, characterized by different shapes of the rim. Type A4 with a rounded or semi-rounded rim is a form with long continuity of use (from the MBA to the advanced RBA) and wide distribution (Pl. 2/A1–4). Similar bowls have been found throughout Italy.[18] Type A5 is distinguished by a concave rim (Pl. 2/A5–7). Its distribution mainly concerns the internal and coastal zones of the Adriatic region.[19] One of the specimens from Treazzano di Monsampolo has a vertical handle designed as a head with

8 The statistic is based on all the diagnostic fragments found at the site. Such quantitative data are slightly different taking into consideration only rims (40 % cups, 31 % jars and 20 % bowls).

9 Macchiarola 1987, motif 165A.

10 Cf. Polletti 2000, Figs. 29, 4. – Cazzella, Recchia 2012, Pl. 11/9.

11 The issue regarding the persistence or the absence of Apennine decorations in the RBA contexts is still unsolved, especially for a multilayered site such as Coppa Nevigata.

12 Macchiarola 1987, motif 126.

13 Damiani 1991, Pl. 58/1.

14 Cf. Andreotti, Zanini 1995–1996, Pl. 6/2.

15 Cf. Belardelli 2004, Fig. 2/2. – Gonzalez Muro, Maini, Mazzari 2010, Fig. 28/4.

16 Cf. Moscoloni, Danesi, Galluzzi 2007, Fig. 2/8.

17 Cf. Di Fraia, Grifoni Cremonesi 1996, Fig. 53/2.

18 Cf. Bernabò Brea, Cavalier 1980, Fig. 106/c. – Salzani 1994, Pl. II/4. – Cazzella, Recchia 2012, Pl. 20/6.

19 Cf. De Grossi Mazzorin 1976, Pl. 18/1. – Cazzella et al. 2007, Fig. 5/5. – Damiani 2010, Fig. 6B/2.

eyes made of small lateral horns (Pl. 2/A6). This variety is well known in central and southern Italy and dates to an advanced phase of the RBA.[20]

The family of the bowls found at Treazzano di Monsampolo also includes the types A8 and A9 (Pl. 3/B) marked by a shallow basin. Type A8 presents an everted external rim and convex profile (Pl. 3/B1). This kind of bowl is usually characterized by different stylized handles. The specimen from Treazzano di Monsampolo has a bilateral-head knob on the rim. A similar attribute appears on a sample coming from Grotta S. Angelo sulla Montagna dei Fiori.[21] Type A9 is very common in RBA middle Adriatic archaeological contexts, although comparable bowls with a softly flaring rim and slightly convex profile already appear in middle Tyrrhenian sites during the MBA. The specimen from Treazzano di Monsampolo (Pl. 3/B2) has extremely strong parallels with bowls found in the South Marche region.[22] Type A10 is represented by a shallow basin characterized by an external rim and almost straight profile (Pl. 3/C1). This shape is very common and its diffusion rather wide.

3.2. Cups

Cups are widely attested at Treazzano di Monsampolo. Among the huge family of cups, five main forms have been recognized, each of them containing different variants. The largest type includes carinated cups (Pls. 4, 5/A), which have a rather long continuity of use covering almost all of the protohistoric period. At Treazzano di Monsampolo, type B1 is characterized by a slight concavity between the rim and the body below (Pl. 4). This type is quite common from the MBA to RBA 2.[23] The B1A variety presents a vaguely concave body between the indistinct rim and the rounded carination (Pl. 4/A). The closest parallels for this form come from the Terramare territory in the Po Plain[24] and central Italy.[25] To the B1B variety belongs a series of carinated cups, often characterized by a flaring rim, with a slightly concave body and deep basin (Pl. 4/B). The specimens compare particularly well with some carinated cups found in Coppa Nevigata RBA 2 layers[26] and in the Marche region.[27] Carinated cups with a rather concave profile and short flaring rim have been grouped in the B1C variety (Pl. 4/C) and could be easily assimilated with similar samples coming from RBA 1 sites in north-central Italy.[28] The variety B1D is represented by carinated cups with a concave profile and pronouncedly flaring rim (Pls. 4/D, 5/A). The chronology of this vessel covers all the RBA, even if it is more attested in RBA 1. The geographical diffusion comprises both the middle Adriatic and the middle Tyrrhenian areas.[29] Comparable specimens to those from Treazzano di Monsampolo are found especially in Marche[30] and Lazio.[31]

The B2, B3, B4 and B5 cup types have a convex profile (Pl. 5/B). Type B2 is characterized by a rim softly distinguished by an internal edge and a deep basin (Pl. 5/B1). The shape, common in the MBA, is also used during the first phase of the RBA and could be compared to a similar cup from Torre Mordillo.[32] Type B3 is characterized by an indistinct rounded rim with a barely visible carination (Pl. 5/B2). One cup from Vaccina, different in size, has some resemblance with the specimen from Treazzano di Monsampolo and could be dated to RBA 1.[33] A fairly shallow basin differentiates the types B4 (Pl. 5/B3) and B5 (Pl. 5/B4) from the other cups. Type B4 is represented by a slightly flaring rim marked by an internal edge (Pl. 5/B3) which found a distant parallel in one vessel coming from the RBA settlement of Vejano.[34] From the same site comes a carinated cup which has some affinities with the type B5 of Treazzano di Monsampolo, characterized by a rounded carination and a strongly flaring rim (Pl. 5/B4).[35]

Handles

The cups are usually provided with handles typified by plastic projections. At Treazzano di Monsampolo, the most common plastic handle shows bird-shaped knobs (Pl. 6/A). On the basis of their characteristics, the handles have been allocated to several sub-groups. The shape G1A presents a long, slightly or strongly hooked neck with a beak curved upwards and the forehead marked by a transversal crest (Pl. 6/A1–7). This category of handles is very widespread during RBA 2 in central and northern Italy. The main comparisons with Treazzano di Monsampolo G1A handles come from

20 Cf. Belardelli 2004, Pl. LXII/7.
21 Cf. Di Fraia, Grifoni Cremonesi 1996, Fig. 57/4.
22 Cf. Damiani 2010, Pl. 16/A1.
23 Damiani 2010, 176–208.
24 Cf. Massi Pasi, Stoppioni 1988, Fig. 166/56.
25 Cf. De Grossi Mazzorin 1976, Pl. 16/2. – Di Fraia, Grifoni Cremonesi 1996, Fig. 67/6. – Ialongo 2007, Fig. 84/18.
26 Cf. Puglisi 1982, Pl. VI/1. – Cazzella, Moscoloni 1988, Figs. 6/13; 7/5. – Cazzella, Recchia 2012, Pl. 24/12.
27 Cf. De Grossi Mazzorin 1976, Pl. 17/3. – Damiani 2010, Pl. 16/4.
28 Cf. Vigliardi 1968, Pl. 6/8. – Damiani 2010, Pl. 46/A4.
29 Damiani 2010, 172.
30 Cf. Damiani 2010, Pls. 5/7; 32/2–7.
31 Cf. Peroni 1959, Pl. 24/7.
32 Cf. Trucco, Vagnetti 2001, Fig. 82/4.
33 Cf. Damiani 2010, Pl. 41/4.
34 Cf. Di Gennaro et al. 2000, Fig. 3/2.
35 Cf. Di Gennaro et al. 2000, Fig. 3/3.

Fontanavecchia di Camerano,[36] S. Paolina di Filottrano,[37] Luni sul Mignone,[38] Scarceta[39] and S. Giuliano in Toscanella.[40] Type G1B is a small handle with a horizontal beak, short forehead and thickened neck (Pl. 6/A8). The presence of this type is confined to a not advanced RBA phase; its diffusion is mostly concentrated in central Italy.[41] The specimen from Treazzano di Monsampolo has convincing similarities with an example from Vaccina.[42] An unconventional bird-shaped handle represents the type G1C characterized by a stylized form without anatomic details (Pl. 6/A10). Isabella Damiani defines this type as a variant of the axe-shaped handle; its distribution mainly relates to the Marche region and its chronology covers the whole RBA.[43] Another variety of ornitomorphic handles represented at Treazzano di Monsampolo (G1D) is constituted by bird-shaped handles with the head turned towards the interior of the vessel, a vertical crest or intense convexity on the forehead and eyes made with small lateral horns (Pl. 6/B1–4). This type is more attested in RBA 1, although it is considered a long-duration form, also appearing in RBA 2 contexts.[44] A more stylized bird-shaped knob set on a curvilinear strap handle is considered an advanced version of the type and is diffused in RBA 2. The specimen from Treazzano di Monsampolo (Pl. 6/B5) has marked resemblances with a piece from Casale Nuovo dating to the late RBA.[45] Very interesting is the presence of one exemplar of a bird-shaped knob in a flying position set on a horizontal handle (Pl. 6/A9). This type (G1E) is distinctive of a more recent phase of the RBA; its circulation seems to be limited to the middle and low Adriatic areas. The only exception comes from Lipari, where the type is interpreted in a 'monumental' way.[46]

Less represented at Treazzano di Monsampolo are the horn-shaped knobs (type G2). The still-preserved apexes refer to bovine horns (Pl. 6/C), while in one case a bird-shaped appendix without anatomic details has been documented (Pl. 6/C3).[47] When the connection between the two horns is preserved, it is possible to note a short protuberance interpreted as a muzzle (Pl. 6/C1–2). Among the horn-shaped handles found, one specimen has a decoration composed of grooves on the trunk and the horn connection and impressed hoops (Pl. 6/C1).[48]

Only one equine-shaped handle (type G3) has been discovered at the site (Pl. 7/A1). It is decorated with carved lines and presents small lateral horns.[49] The type is not really widespread in the RBA, although it has an extensive distribution which covers both the Adriatic and the Tyrrhenian side.[50] Bilateral-head knobs set on bowls or cups constitute the type G4 (Pls. 2/A6, 3/B1). They are comparable to specimens found in RBA sites in the middle and south Adriatic areas.[51] The bilateral-head knob is considered a type of long duration as well as the oblique handles with volutes called '*manici con ripresa*' by Damiani.[52] These particular handles (type G5) are very popular during the MBA, while their diffusion is limited to Lipari and central Italy, especially the Marche region, during the whole RBA. At Treazzano di Monsampolo two specimens have been documented (Pl. 7/A2–3), both having an oval hole in the middle and apexes with fairly circular sections. Close parallels have been identified with pieces coming from S. Giovenale[53] and Monteroduni.[54]

Strap (type G6) and tubular (type G7) handles are also represented at Treazzano di Monsampolo (Pl. 7/B). The first ones have a simple form, some of them presenting one or several longitudinal ridges on the external surface (Pl. 7/B1–7). The tubular handles have a smooth surface, sometimes characterized by a central ridge (Pl. 7/B9), corresponding to a shape very widespread in the whole of Italy during the RBA. Some of the tubular handles are decorated with horizontal or vertical grooves (Pl. 7/B8–11). Similar handles have been found in several coeval contexts in central and northern Italy.[55]

3.3. Jars

The excavation also brought to light several jars. Six different jar shapes have been identified at the site. Type C1 is characterized by a cylindrical body and flat rim (Pl. 5/C). The diffusion of these jars covers the entire peninsula from

36 Cf. Damiani 2010, Pl. 97/6.
37 Cf. Rellini 1932, Pl. VIII/5.
38 Cf. Fugazzola Delpino 1976, Fig. 45/5.
39 Cf. Poggiani Keller 1999, Fig. 45/14.
40 Cf. Pettazzoni 1916, Fig. 14/2.
41 Damiani 2010, 275–279.
42 Cf. Pacciarelli 1979, Fig. 4/3.
43 Damiani 2010, 398–400.
44 Damiani 2010, 293–301.
45 Cf. Angle et al. 1993, Fig. 5/5.
46 Cf. De Grossi Mazzorin 1976, Pl. 22/1. – Damiani 2010, 291.
47 Cf. Lollini 1979, Fig. 8/19. – Damiani 2010, Pl. 112/8.
48 Cf. Lucentini 1987, Fig. 7/10. – Damiani, Morico 1996, Pl. 4/C 21.
49 Cf. Bianchi 2004, Fig. 11.
50 Damiani 2010, 369.
51 Cf. Pennacchioni, Persiani 1982, Fig. 1/6. – Di Fraia, Grifoni Cremonesi 1996, Fig. 57/4. – Cazzella, Recchia 2012, Fig. 31/8.
52 Damiani 2010, 402–405.
53 Cf. Gierow 1984, Fig. 10/7.
54 Cf. Cazzella et al. 2007, Fig. 6/15.
55 Bianchi 2004, Fig. 9/14. – Caironi, Guerra, Vaccari 2009, Fig. 9/2. – Cf. Danesi, Galluzzi 2009, Pl. II/6. – Pignocchi, Silvestrini 2015, Fig. 1/7–9.

the MBA to the FBA.[56] Sometimes they are decorated with horizontal cordons and interpreted as bowls.

Different-sized jars with an expanded ovoid body and short flaring rim are grouped in type C2 (Pl. 8/A1–4). They have strong parallels with RBA 1 specimens found at Coppa Nevigata[57] and at Collelongo-Fond'jò.[58] One of these jars shows an Apennine decoration composed by an incised zigzag pattern and dots (Pl. 8/A3). The shape of the vessel, as well as its decoration, has a strict resemblance with a MBA 3 jar from Coccioli.[59]

The type C2 is quite similar to the type C3 (Pl. 8/A5–6), which is distinguished only by the rim characterized by an internal flex. Most of the analogous vessels come from the middle Adriatic area.[60] A unique specimen from Treazzano di Monsampolo is decorated with impressed circlets and horizontal and oblique incised lines (Pl. 8/A6). The motif is considered typical of the FBA and is a fairly good parallel with a sherd brought to light at Madonna degli Angeli.[61]

The jars belonging to the type C4 present an expanded flat rim, which is very flaring and characterized by an internal edge (Pl. 8/B). Since this type is only represented by two small fragments of rim, it is not possible to define exactly the form of the body below, which is probably ovoid. Based solely on the rim shape, the specimens from Treazzano di Monsampolo match with jars which were quite widespread in the whole RBA that are mainly attested in central Italy.[62] Some vessels with a distinct concave neck have also been included in the huge family of the jars (Pl. 8/C). Their frequency is quite high in MBA 3 sites, especially in southern Italy, although their production probably continued during the first phase of the RBA.[63]

Two vessels with beak handles (Pl. 9/B1–2) from Treazzano di Monsampolo have also been classified as jars. This type (C6) is more attested on the central and southern Adriatic coast and relatively uncommon in coeval Tyrrhenian contexts. Renato Peroni dated this type to the whole RBA period, while Damiani assumes that its production was restricted to RBA 1.[64]

56 Cf. Mieli, D'Ercole, Cosentino 2003, Fig. 5. – Damiani 2010, Fig. 47/7. – Cazzella, Recchia 2012, Fig. 26/10.
57 Cf. Cazzella, Moscoloni 1988, Fig. 2/15.
58 Cf. Gatti 2004, Fig. 54/7.
59 Cf. Macchiarola 1987, Fig. 20/1.
60 Cf. Di Fraia, Grifoni Cremonesi 1996, Fig. 57/8. – Lo Porto 1997, Fig. 42.
61 Cf. Leopardi, De Pompeis 1980, Fig. 5/13.
62 Cf. Di Fraia, Grifoni Cremonesi 1996, Fig. 56/11. – Damiani 2010, Pl. 51/2.
63 Cf. Di Fraia, Grifoni Cremonesi 1996, Fig. 56/9.
64 Damiani 2010, 256–259.

3.4. Other Forms

At Treazzano di Monsampolo an open-shape vessel with short beak and articulated rim has also been identified (Pl. 9/B3). The shape (type E1) is not widespread in the Peninsula; the only specimen which has strong similarities with the one from Treazzano di Monsampolo was found at Fossa Nera and is dated to RBA 2.[65]

A small number of large-dimension vessels *(pithoi)* were found at the site during the excavation (Pl. 9/A1–2). They are characterized by a quite flaring rim and a more or less marked internal edge (type D). The type is rather popular in central Italy; the strongest resemblance with Treazzano di Monsampolo *pithoi* has been noted at Vaccina.[66]

Very interesting is the presence of open-shape vessels with an internal ledge (type E2). Usually this kind of jar is typified by a series of bosses or horns on the external surface.[67] At Treazzano di Monsampolo both the vessels identified for this category have a smooth surface decorated with plastic cordons (Pl. 9/C1–2). The internal ledge was most likely used to hold a lid.

Several types of lids have been identified (Pl. 9/D). The lids belonging to the type F1 have a truncated conical shape, rounded lip and horizontal or vertical plastic cordons (Pl. 9/D1–3). This shape is very common, particularly in central Italy, and largely attested during the RBA and FBA.[68] Other lids (type F2) are characterized by a rounded form, with or without a horizontal handle (Pl. 9/D4–6). In this case again, the closest parallels come from central Italy.[69]

Besides the numerous vessels mentioned above, the site has provided a copious amount of plaster, some stoves (Pl. 10/C) and both disc-shaped and biconical spindle whorls (Pl. 10/B). All these materials leave no doubt about the function of the site, which was clearly a settlement.

Among the pottery three small zoomorphic figurines (Pl. 10/A) have been identified, probably representing horses (one head and two quadruped bodies are preserved). The discovery of these figurines is really interesting because of their limited presence in southern and central Italy. Besides the middle Adriatic coast, zoomorphic figures have only been identified at Campomarino,[70] Madonna degli Angeli,[71] Moscosi di Cingoli[72] and Colle dei Cappuccini.[73] By

65 Cf. Andreotti, Zanini 1995–1996, Pl. 7/9.
66 Cf. Damiani 2010, Pl. 52/15.
67 Cf. Damiani 2010, Pl. 11/3.
68 Cf. Fratini 1997, Pl. XV/8. – Ialongo 2007, Fig. 18/1.
69 Cf. Damiani 2010, Fig. 9/1.
70 Di Niro 1991, 47.
71 Leopardi, De Pompeis 1980, 32.
72 Silvestrini, Pignocchi 1997, 160.
73 Lollini 1959, 52.

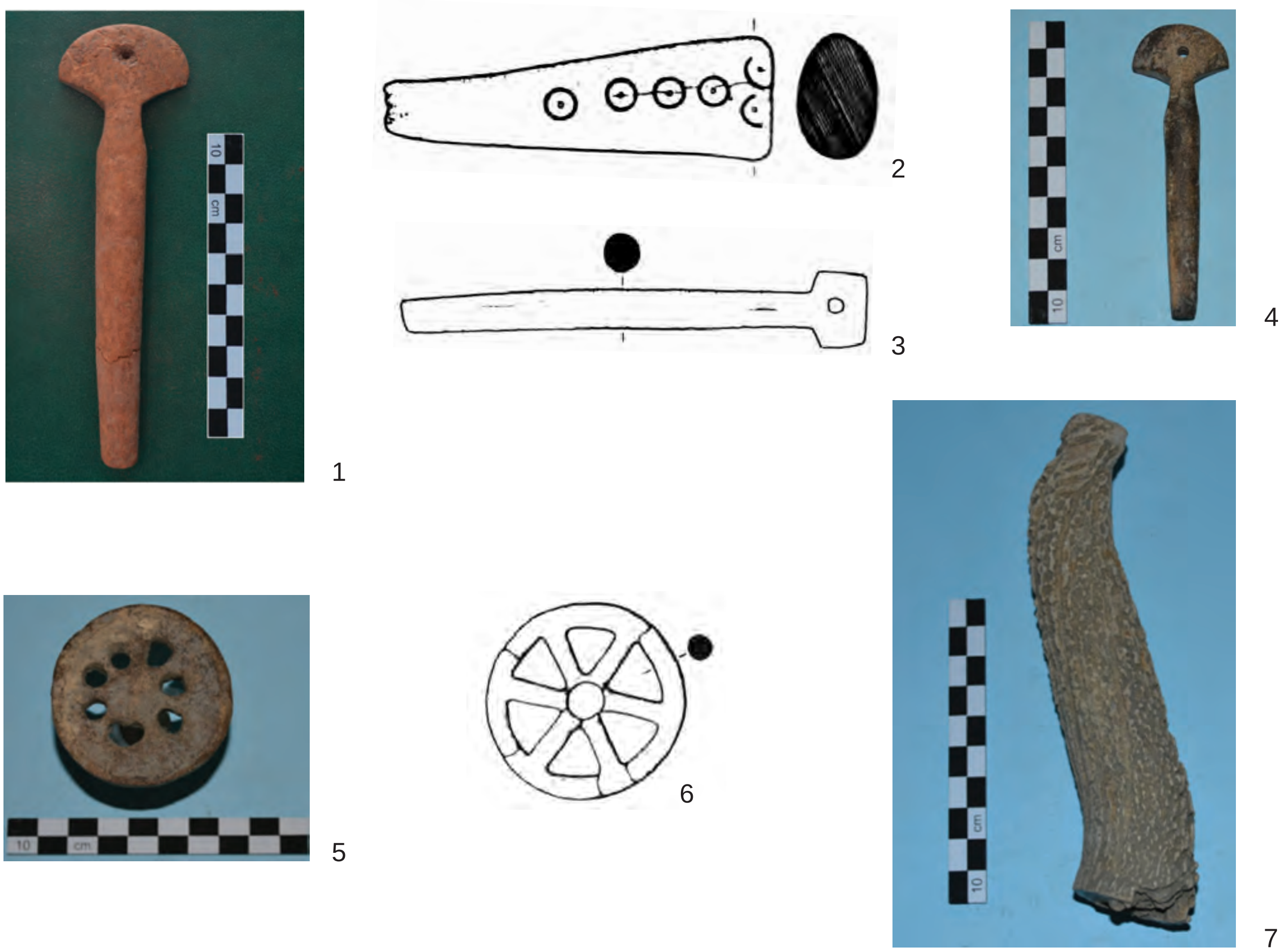


Fig. 4. Bone and antler industry (Photos: A. Rumolo, drawings: Lollini 1982, Pl. LXXIII).

contrast, this form of manufacture is quite widespread in northern Italy during the end of the MBA and the FBA.[74]

4. The Antler Industry

At Treazzano di Monsampolo the antler industry is represented by few artefacts (Fig. 4), which are comparable with specimens coming from both central and northern Italy. The excavation has brought to light several awl handles (Fig. 4/1–4). The specimens found at Treazzano di Monsampolo mainly belong to two types: the one with a straight simple handle (Fig. 4/2) and the one with a flat-shaped head (Figs. 4/1, 4/3–4). Both the types are well-known in the Terramare region and rather widespread along the northern Adriatic coast during the MBA and the RBA.[75] The simple awl handles, usually decorated with incised circles (Fig. 4/2), are more attested in the Emilia Romagna region[76] although some specimens have been found in the Veneto[77] and South Marche[78] areas. The most common awl handle in the area between Terramare and the Marche region is the type with a shaped head. It was probably used for holding fine bits with a circular section and shows a certain variability in the shape of the head. The three awl handles with a shaped head from Treazzano di Monsampolo are extremely well made with a smooth surface, straight body and a circular hole in the middle of the head. While two specimens have globular heads (Figs. 4/1, 4/4), another one (Fig. 4/3) is characterized by a small quadrangular end. All the awl handles from Treazzano di Monsampolo are dated to the RBA based on their similarities with specimens found at Santa Rosa di

74 Bernabò Brea, Cremaschi 1995, 309–323. – Bianchi 2004, 411–485. – Damiani 2010, 11–21.
75 Bianchi 2004, 473.
76 Provenzano 1997, 524–544.
77 Salzani 2014, Pl. 3/6.
78 De Grossi Mazzorin 1976, Pl. 20/4.

Family	Type	Brief description of the main characteristics	Chronology	Plate
Bowls	A1	Enlarged oblique rim with internal edge (sometimes with triangular lugs).	MBA3 – RBA1	1/E
	A2	Oblique rim with internal edge and shallow angular profile of the basin below.	RBA2	1/F
	A3	Truncated conical body decorated with plastic cordons close to the rim.	MBA – RBA	2/B1–2
	A4	Rounded or semi-rounded rim and cap-shaped body.	MBA – RBA	2/A1–4
	A5	Rounded concave rim and cap-shaped body.	RBA2	2/A5–7
	A6	Flat rim and slightly convex profile of the body underneath usually decorated with one or two plastic cordons.	RBA – FBA	2/B3–5 3/A1
	A7	Short rim forming a slight concavity with the considerably convex body below.	RBA – FBA	3/A2–3
	A8	Everted external rim and convex profile of the body below.	RBA	3/B1
	A9	Slightly flaring rim and convex profile of the body below.	MBA – RBA	3/B2
	A10	External rim and almost straight profile.	MBA – RBA	3/C1
Cups	B1	Slight concavity between the rim and the body below. *Varieties*: • **B1A:** indistinct rim and concave body underneath with rounded carination; • **B1B:** flaring rim and slightly concave body underneath characterized by quite deep basin; • **B1C:** very short flaring rim and concave profile of the body underneath characterized by a marked carination; • **B1D:** extensive flaring rim and concave profile of the body underneath.	MBA – RBA	4 5/A
	B2	Rim softly distinguished by an internal edge with deep convex basin below.	MBA – RBA	5/B1
	B3	Indistinct rounded rim with a convex body underneath characterized by a barely visible carination.	RBA1	5/B2
	B4	Slightly flaring rim marked by an internal edge and convex body below.	RBA	5/B3
	B5	Strongly flaring rim and convex body characterized by rounded carination.	RBA	5/B4
Jars	C1	Flat rim and cylindrical body below.	MBA – FBA	5/C
	C2	Short flaring rim and expanded ovoid body below.	MBA – RBA1	8/A1–4
	C3	Rim with internal edge and ovoid body below.	MBA – FBA	8/A5–6
	C4	Expanded flat rim with internal edge and most likely ovoid body.	RBA	8/B
	C5	Flaring rim and distinct concave neck.	MBA3 – RBA	8/C
	C6	Flaring rim with beak-handle and concave body.	RBA	9/B1–2
Pithoi	D	Flaring rim with internal edge and deep basin.	RBA	9/A

Tab. 1. Summary typological table.

Family	Type	Brief description of the main characteristics	Chronology	Plate
Open-shaped vessels	E1	Articulated rounded rim with short beak underneath.	RBA	9/B3
	E2	Expanded rim and straight body underneath. The inner part is characterized by a thick ledge.	RBA	9/C1–2
Lids	F1	Rounded lip and truncated-conical shape. Usually decorated with horizontal or vertical plastic cordons.	RBA – FBA	9/D1–3
	F2	Circular shape with or without horizontal handle.	RBA – FBA	9/D4–6
Handles	G1	Bird shaped knobs. *Varieties*: • **G1A:** head marked by transversal crest, beak curved upwards and long slightly or strongly hooked neck; • **G1B:** short forehead, horizontal beak and thickened neck; • **G1C:** external stylized beak without anatomic details; • **G1D:** head turned towards the interior of the vessel, vertical crest or intense convexity on the forehead and eyes made with small lateral horns; • **G1E:** bird in flying position set on a horizontal handle.	RBA	6/A–B
	G2	Horn-shaped knobs.	MBA – RBA	6/C
	G3	Equine-shaped handle.	RBA	7/A1
	G4	Bilateral-head knobs.	RBA	2/A6 3/B1
	G5	Oblique handles with volutes.	MBA – RBA	7/A2–3
	G6	Strap handles with one or several longitudinal ridges.	MBA – FBA	7/B1–7
	G7	Tubular handles with horizontal or vertical ridges.	RBA	7/B8–11

Tab. 1. Continued.

Poviglio (Emilia Romagna),[79] Cerea-Le Vallette (Veneto)[80] and Moscosi di Cingoli (Marche).[81]

At Treazzano di Monsampolo two antler spoked wheels were also collected (Fig. 4/5–6). One of them has six spokes (Fig. 4/6) and constitutes the most widespread type in the whole of northern and central Italy. This kind of artefact, probably pinheads, is underrepresented in the southern part of the peninsula where the only specimens have been identified at Timmari and Termitito.[82] The other antler wheel from Treazzano di Monsampolo presents a seven-spoke wheel (Fig. 4/5). The uncommon number of the spokes, together with the absence of a central hole and the rough shape of the cylindrical stalk, suggests that it was unfinished (or a production waste). Although the quantity of antler objects is quite low at Treazzano di Monsampolo, the seven-spoke wheel and the identification of a semi-worked horn (Fig. 4/7) seem to show the presence of a local industry.

5. The Mycenaean Fragment

As mentioned above, the excavation of Treazzano di Monsampolo was preceded by archaeological surveys during which copious materials were collected. Among them, a small fragment of Mycenaean fine ware pottery decorated with a floral motif was recognized (Fig. 2). Since it constituted the first Mycenaean ceramic vessel from the Marche region, the Soprintendenza Archeologica delle Marche decided to start the exploration of the site. Unfortunately, the excavation did not bring to light any other Mycenaean evidence. However, in the subsequent years, accurate research in the Marche region has shown that the area had a not

79 Provenzano 1997, 524–544.
80 Salzani 2014, 112–118.
81 Silvestrini, Pignocchi 1997, 155–160.
82 Pasquini 2005, 985–991.

marginal role in the exchange networks connecting Italy to the Aegean. So far, in several sites in the region materials attesting direct or indirect contacts with the Mycenaean culture were found: Montagnolo di Ancona,[83] Jesi,[84] Moscosi di Cingoli[85] and Cisterna di Tolentino.[86] Recent archaeometric analyses conducted on the Mycenaean-type ceramics from these sites have attested that they were locally produced. The Mycenaean fragment from Treazzano di Monsampolo is the only sample that does not belong to the same cluster as the others. Its high chromium content suggests that it was probably imported from the Peloponnese.[87]

Although the sherd was previously published as a fragment of a stirrup jar shoulder,[88] the organization of the decoration, consisting in a floral motif (FM 18,119) delimited by one broad band below and a group consisting of three narrower bands and at least five lines above, suggests that it belongs to a small piriform jar (either FT 45 or FT 48).[89] Indeed, if the sherd belonged to a stirrup jar, there would not be any parallel bands and lines above the flower, but only a single band at the base of the false spout.[90]

However, the combination of motif and piriform jar is unusual. This kind of unvoluted flower is attested on stirrup jars, for instance at the House of the Oil Merchant at Mycenae (LH IIIB1), the Tiryns *Epichosis* (dated to LH IIIB Final/IIIC Early 1)[91] in the Argolid,[92] at Tsoungiza (LH IIIB1) in Corinthia,[93] and, finally, at Pefkes (LH IIIB).[94] The piriform jars FT 45 and FT 48 appear in LH IIIA2/IIIB1 and LH IIIB/IIIC Early 1 respectively.[95]

Since the Mycenaean sherd from Treazzano di Monsampolo was not found during the excavation but is part of a collection due to a previous survey conducted by amateurs, its provenance is often discussed. However, both the shape and decoration of the fragment could be dated to a period between the end of LH IIIA2 and LH IIIB coeval to the RBA, which is the main chronological horizon of the *impasto* pottery found at the site.

6. Conclusions

The study of the archaeological finds at Treazzano di Monsampolo leads us to state the existence of a settlement dated to a period between the end of the MBA and the late phase of the RBA (or probably the very beginning of the FBA). The first occupation of the site could, most likely, be dated to MBA 3, as attested by the presence of a few fragments with Apennine decorations and some vessels which have parallels in shapes diffused at the end of the MBA period. Except for these materials, the pottery found at Treazzano di Monsampolo belongs to the Subapennine facies and clearly shows that the settlement was in use during the whole RBA period. The abandonment of the settlement can be dated to the end of RBA 2 or the beginning of the FBA. A few pieces from Treazzano di Monsampolo are comparable with FBA specimens but they could also belong to the last stage of RBA 2. This abandonment seems to correlate with a more general phenomenon that occurred at the transition between the RBA and FBA. In this period, especially in central Italy, people started to move from open sites to more defendable zones.

Even if the Subapennine facies can still be considered 'the earliest Italian cultural unit' (as Peroni defined it),[96] some typical characteristics of the pottery at Treazzano di Monsampolo have been exclusively recognized in the central and southern Adriatic regions, such as the prevalence of bird-shaped knobs instead of horns and the lack or the scarce number of the straight-cylinder knobs. These latter have long been classified as fossil types of RBA 1. Based on their absence,[97] Treazzano di Monsampolo was dated to RBA 2 by previous studies.[98] However, Treazzano di Monsapolo does not represent an isolated case: the frequency of the straight-cylinder knob is very low in the area between the South Marche and the lower Adriatic area.[99] The similarities which characterize the pottery of the Adriatic

83 Vagnetti et al. 2006, 1168. – Sabbatini, Silvestrini, Milazzo 2009, 245.
84 Vagnetti et al. 2006, 1168.
85 Sabbatini, Silvestrini, Milazzo 2009, 241.
86 Percossi, Pignocchi, Sabbatini 2005, 673.
87 Jones et al. 2014, 209–211.
88 Jones et al. 2014, 209.
89 Furumark 1941, (FT 45 or FT 48) 591–592, (FM 18,119) 293.
90 As the drawing does not provide any diameter, no statements can be made about the neck of the vessel.
91 Voigtlander 2003, 102 and Fig. 31/14, Pl. 73/14. – For the chronology of the *Epichosis* see Kardamaki 2015, 93–94.
92 Mountjoy 1999, 140 and Fig. 33/248.
93 Pit 1, containing domestic refuse with no later contamination or apparent disturbance: Thomas 2005, 453, 473 and Fig. 8/2.
94 Chamber tomb 3, on top of pit II: Vikatou 2001, 104, 105 and Fig. 45 (however with double outline).
95 Piriform jars FT 45 are attested, for instance, at the Petsas House at Mycenae dated to LH IIIA2 (Shelton 2007, 173 and Pl. XLVI) and at Pefkes dated to the LH IIIB (Vikatou 2001, 99, 105 and Fig. 46); piriform jars FT 48 are known from Tiryns, dated to the LH IIIB (Voigtlander 2003, 114 and Pl. 143) and from the House of the Sphinxes at Mycenae dated to LH IIIB1 (French 1967, 154 and Figs. 4–5).
96 Peroni 1989, 352–354.
97 Cattani 2009, 252 reported the presence of two fragments of straight-cylinder knobs from the site, but the author did not find any evidence within the material stored in the Museum of Ascoli Piceno.
98 Lollini 1982. – Lucentini 1995.
99 Cattani 2009.

macro-region suggest possible contacts, probably passing through the Tronto Plain (Tab. 2).

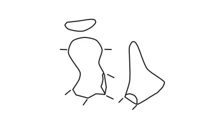
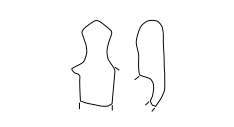
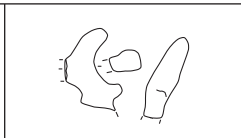
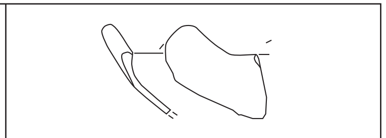
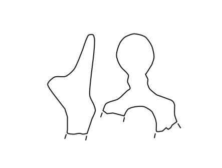
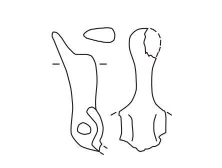
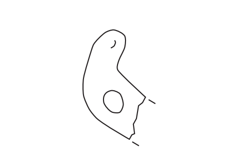
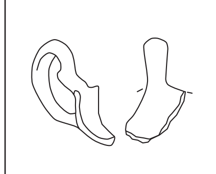
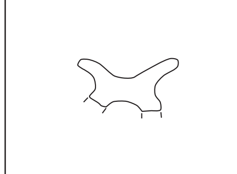
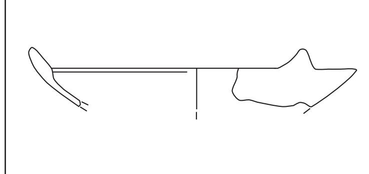
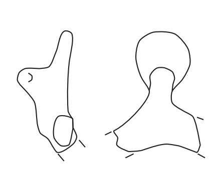
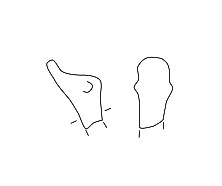
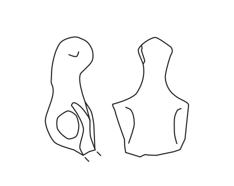
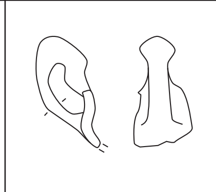
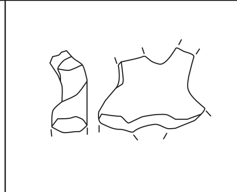
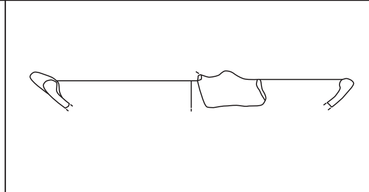
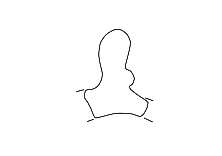
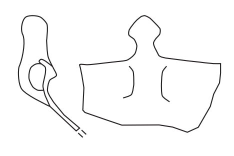
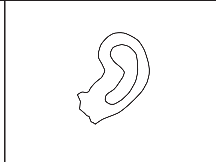
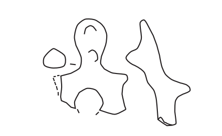
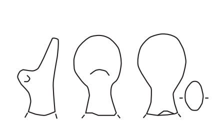
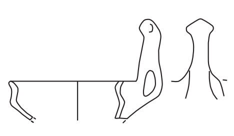
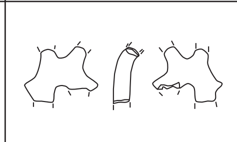
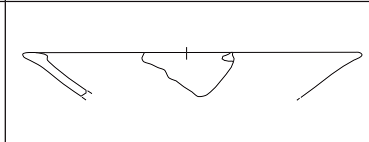
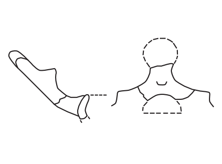
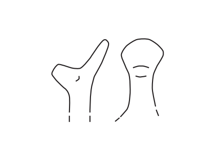
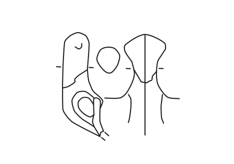
The chronotypological analysis of the archaeological materials presented in this paper also allows us to identify parallels with the Terramare area. Research conducted in the Po Plain and central Adriatic regions has shown a cultural osmosis between the two areas documented, besides the antler industry, by strong parallels in metallurgic and pottery production. Although the majority of the Subapennine settlements where Terramare influences are more evident are located in the northern part of the region (i.e. Moscosi di Cingoli, Cortine di Fabriano, Conelle di Arcevia, and Cisterna di Tolentino), some characteristics of the Terramare traditions have also been identified in the southernmost sites of the Marche region.

First of all, it is possible to identify Terramare influences in antler artefacts found at Treazzano di Monsampolo and Laferola di Acquaviva Picena; secondly, in elements characterizing the pottery collected in some of the settlements of the Tronto Plain – as well as at Treazzano di Monsampolo, at Colli del Tronto and Offida. Among the pottery of Treazzano di Monsampolo, few pieces have decorations with grooves, which are typical elements of the Terramare facies. At the site, this decoration occurs on some handles (mainly with a circular section), on three non-joining wall fragments, on the rim of a shallow bowl and on the beak and the body of a beak-handled jar. The handles with horn-shaped knobs decorated with grooves, largely attested in Terramare area and also widespread in the northern part of Marche region,[100] are represented by only two fragmentary specimens at Treazzano di Monsampolo. In both cases, the knobs are not preserved, but it is possible to note a decoration composed of grooves on the trunk and on the connection of the knobs where one of the specimens presents a small central boss (Pl. 6/C1), which also occurs in other specimens both from Terramare and the northern Adriatic area. Besides the two specimens from Treazzano di Monsampolo, two other similar handles have been recognized in the southern Marche territory, one from Offida and the other one from Colli del Tronto.[101]

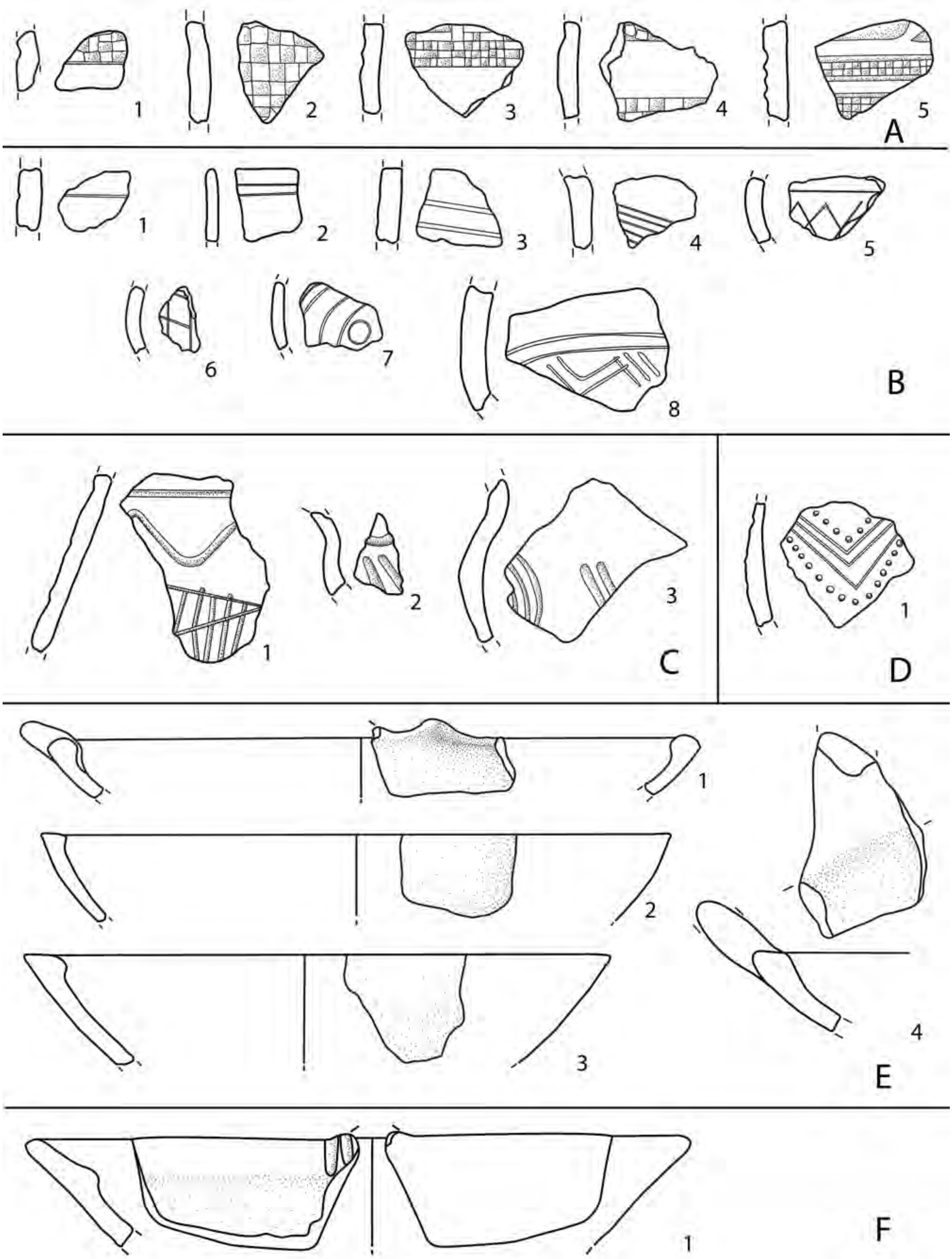
At Treazzano di Monsampolo an interesting wall fragment has also been found (Pl. 1/C1), decorated with transversal, horizontal and wavy grooves, probably related to a biconical jar.[102] Such a sherd has a very close parallel in a specimen coming from Fiobbo (Colli del Tronto, southern Marche) and might be a local re-interpretation of a decorative motif largely attested on jars at Moscosi di Cingoli, where the grooves have a more regular disposition.[103] In turn, such decoration appears in several sites of the Po Plain area[104] and, although it is sporadically present in central and southern Italy,[105] it is considered as belonging to the Terramare tradition. Likewise, the grooves decorating the beak and the body of one of the two beak-handled jars (Pl. 9/B2) found at Treazzano di Monampolo seem to derive from the same tradition. In this case, the decoration clearly has Terramare influences but the shape is characteristic of the Subapennine facies. Indeed the type is mainly attested in central and southern Italy[106] while it is less represented in the northern regions.[107] Another element connecting the pottery of Treazzano di Monsampolo and that coming from the Terramare area is constituted by the small zoomorphic clay figurines. The three figurines of Treazzano di Monsampolo, which probably represent horses, have comparisons with similar objects mainly found in Emilia Romagna and the Po Plain.[108]

To summarize, the co-presence of 'northern' (not numerous) and 'southern' elements characterizing Treazzano di Monsampolo pottery suggests the existence of contacts with both the areas and supports the hypothesis, already assumed by previous studies, of the existence of a link between the two areas passing through the Marche region. The findings of Mycenaean-like pottery at Montagnolo di Ancona, Jesi, Moscosi di Cingoli and Cisterna di Tolentino,[109] together with the discovery of the Mycenaean pottery fragment at Treazzano di Monsampolo, seem to provide evidence of the cultural and economic importance of the region, which was a 'hinge' area connecting the northern part of the Peninsula and the south, directly involved in the Aegean traffic.[110] Unfortunately, the lack of systematic excavations, in particular in the southern area of the region, and the limited data at our disposal do not allow for a thorough investigation into the mediation role played by the region.

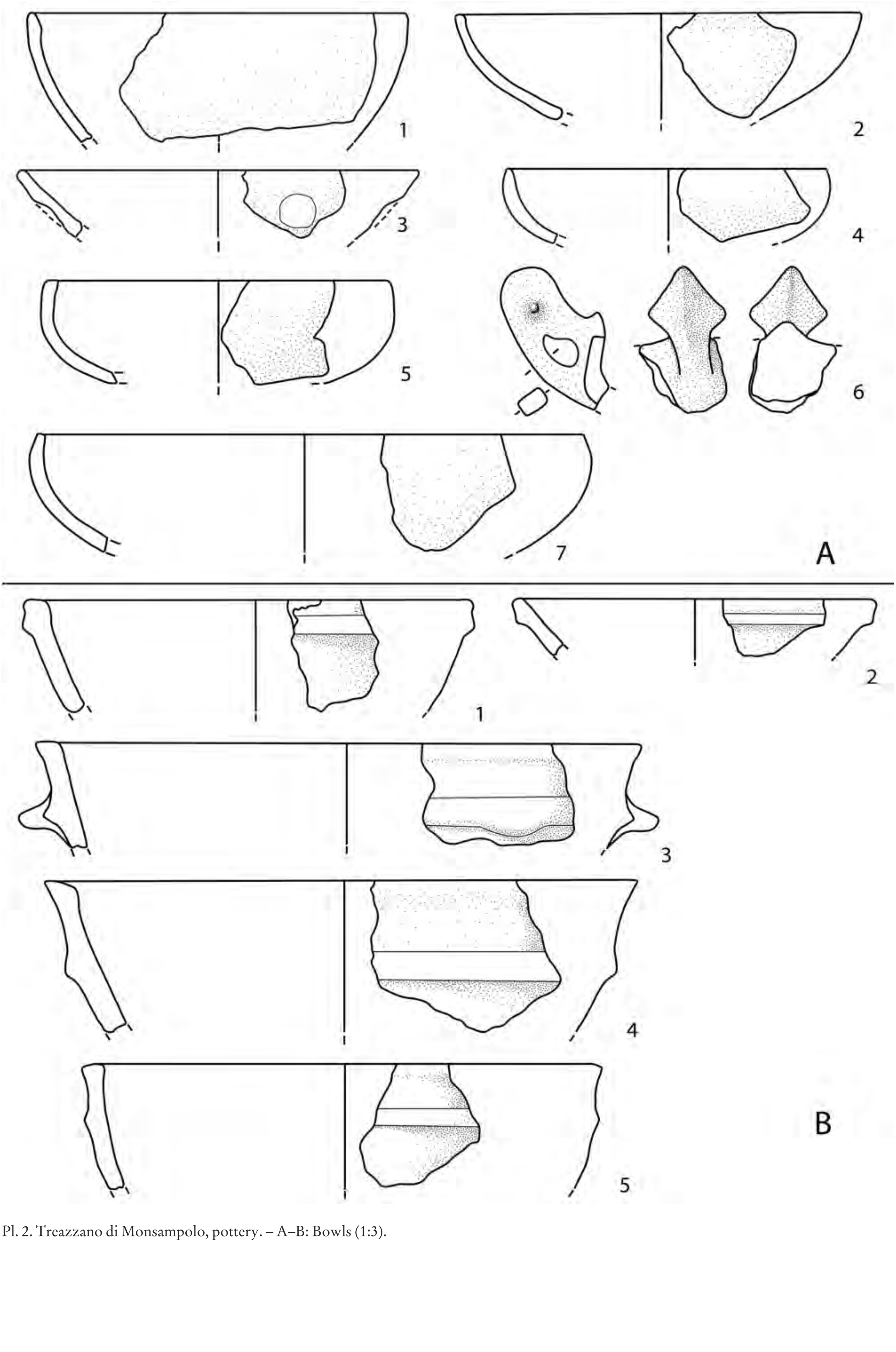
100 Evidence has been found at Moscosi di Cingoli, Cisterna di Tolentino, Frasassi Cave, S. Paolina di Filottrano and Gola del Sentino.
101 Lucentini 1987, 437–494.
102 Damiani 2010, 455.
103 Cf. Sabbatini, Silvestrini 2005, Fig. 3/1–4.
104 Cf. Bianchi 2004, Fig. 10/3. – Cardarelli, Pellacani 2004, Fig. 4/8.
105 For central Italy cf. Mandolesi 1993, Fig. 3/A5. – For southern Italy cf. Arancio et al. 2001, Fig. 46/1.
106 For central Italy cf. Damiani 2010, Pl. 84/5. – Pignocchi, Silvestrini 2015, Fig. 2/7. – For southern Italy cf. Cataldo 1995, Pl. 40/1. – Lo Porto 1997, Fig. 67/1.
107 Caironi, Guerra, Vaccari 2009, 236–237.
108 Bianchi 2004, Fig. 14/1–11. – Damiani 2010, Fig. 4/7.
109 Jones et al. 2014, 209–211.
110 Percossi, Pignocchi, Sabbatini 2005, 672–675.

Cortine di Fabriano						
Offida						
Treazzano di Monsampolo						
Grotta S. Angelo sulla Montagna dei Fiori						
Coppa Nevigata						
Ariano Irpino						

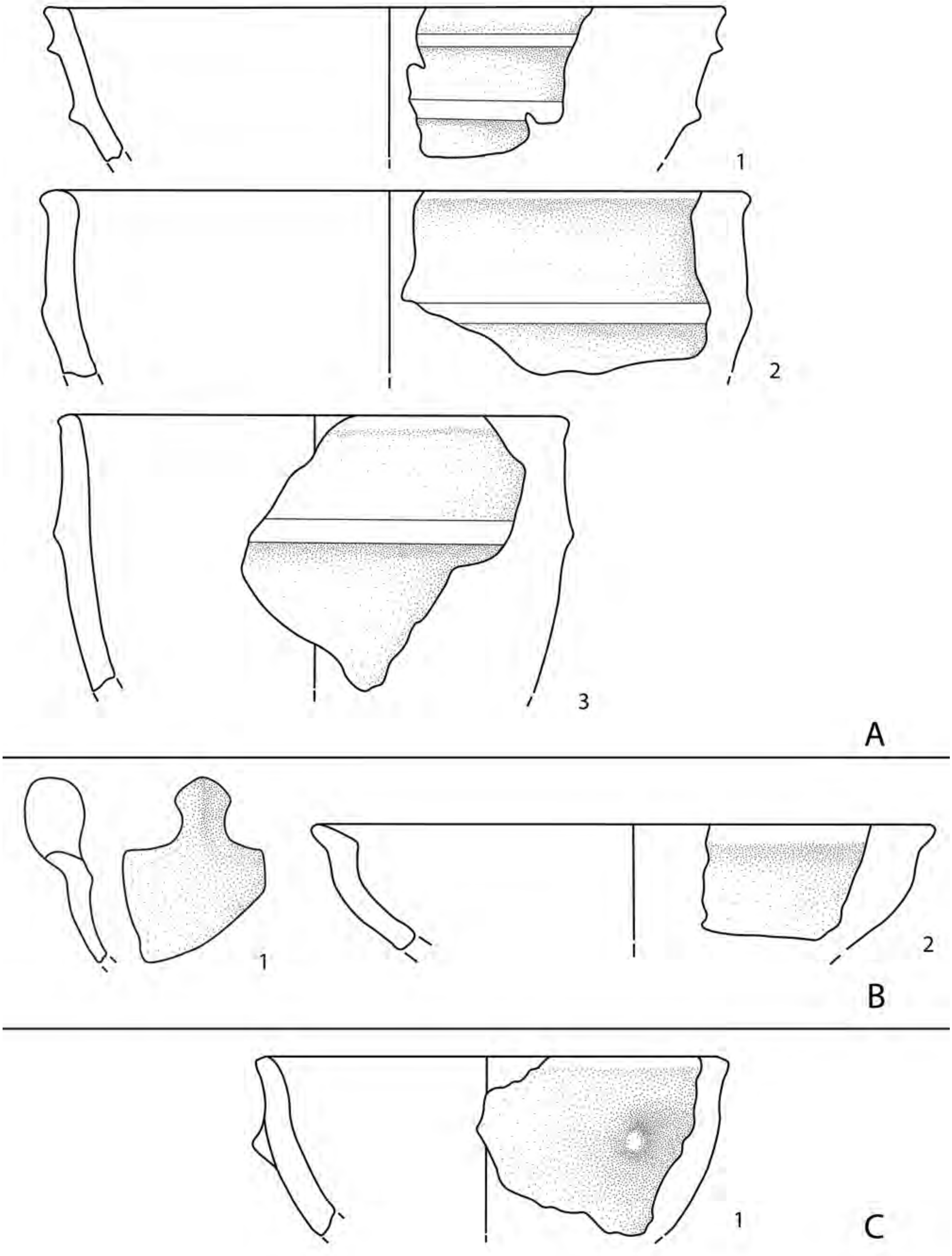
Tab. 2. Characteristic shapes of the middle and lower Adriatic area. The sites are listed following a geographical order, from the north to the south.



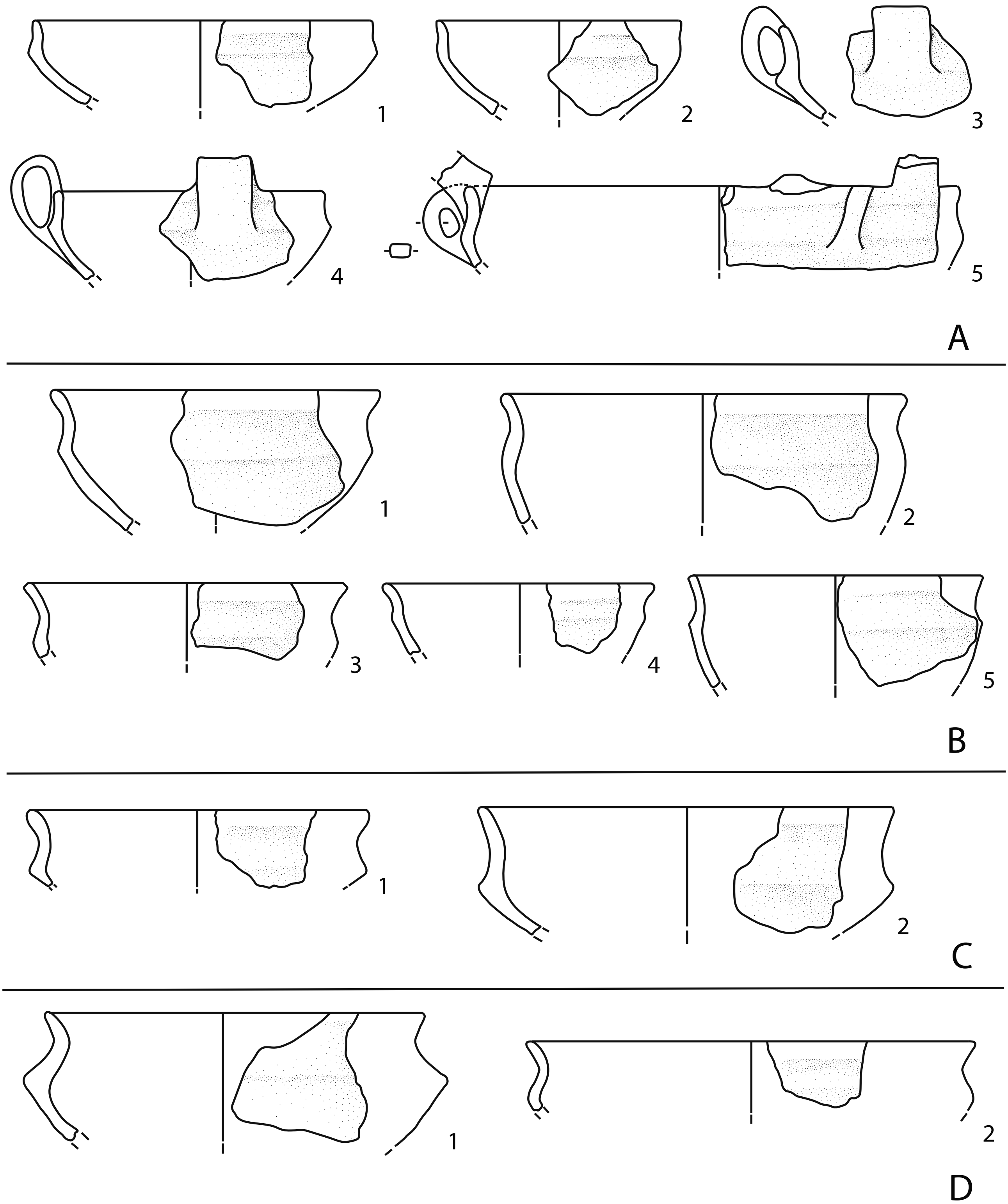
Pl. 1. Treazzano di Monsampolo, pottery. – A–D: Apennine pottery (1:2). – E–F: Bowls (1:2).



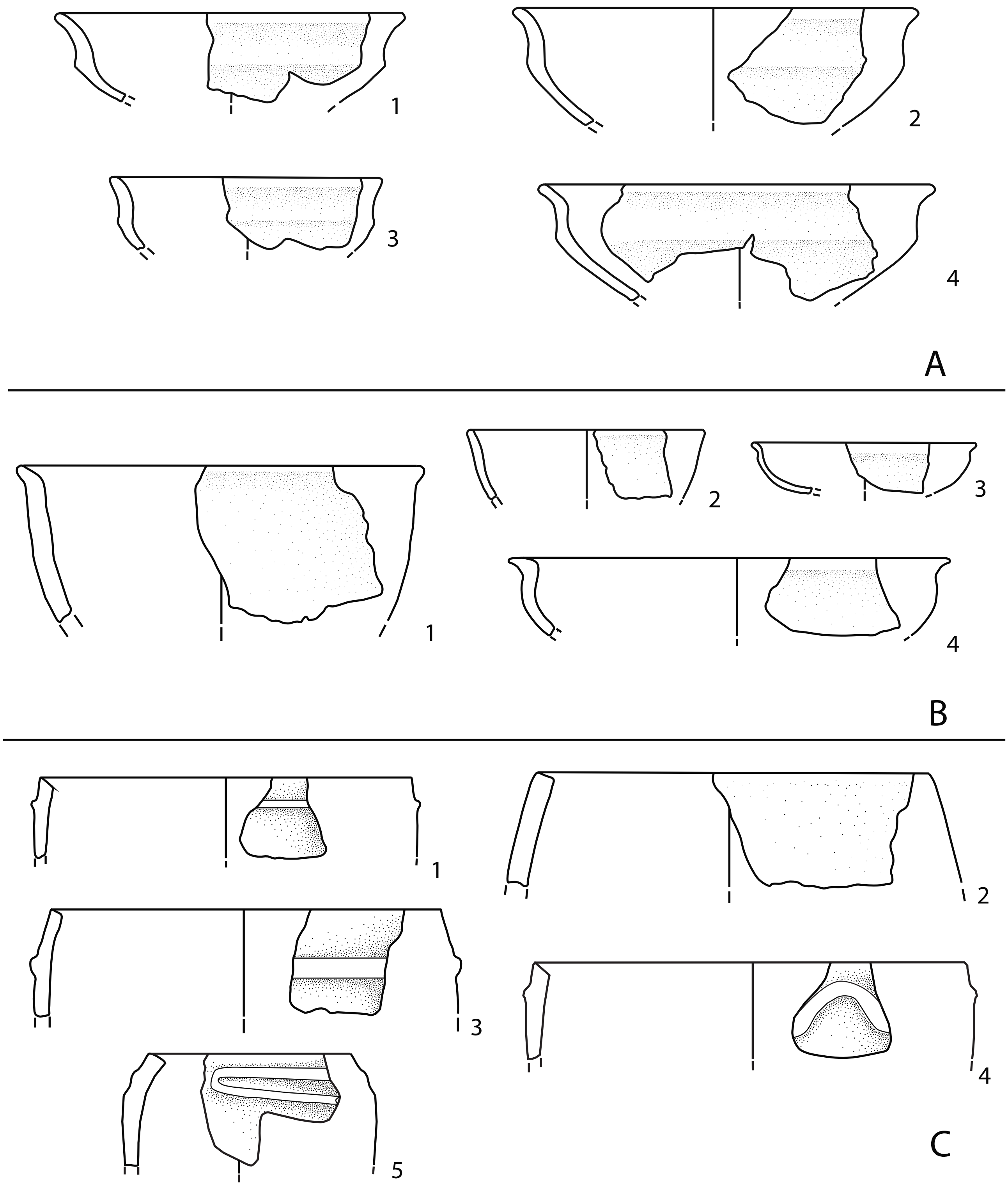
Pl. 2. Treazzano di Monsampolo, pottery. – A–B: Bowls (1:3).



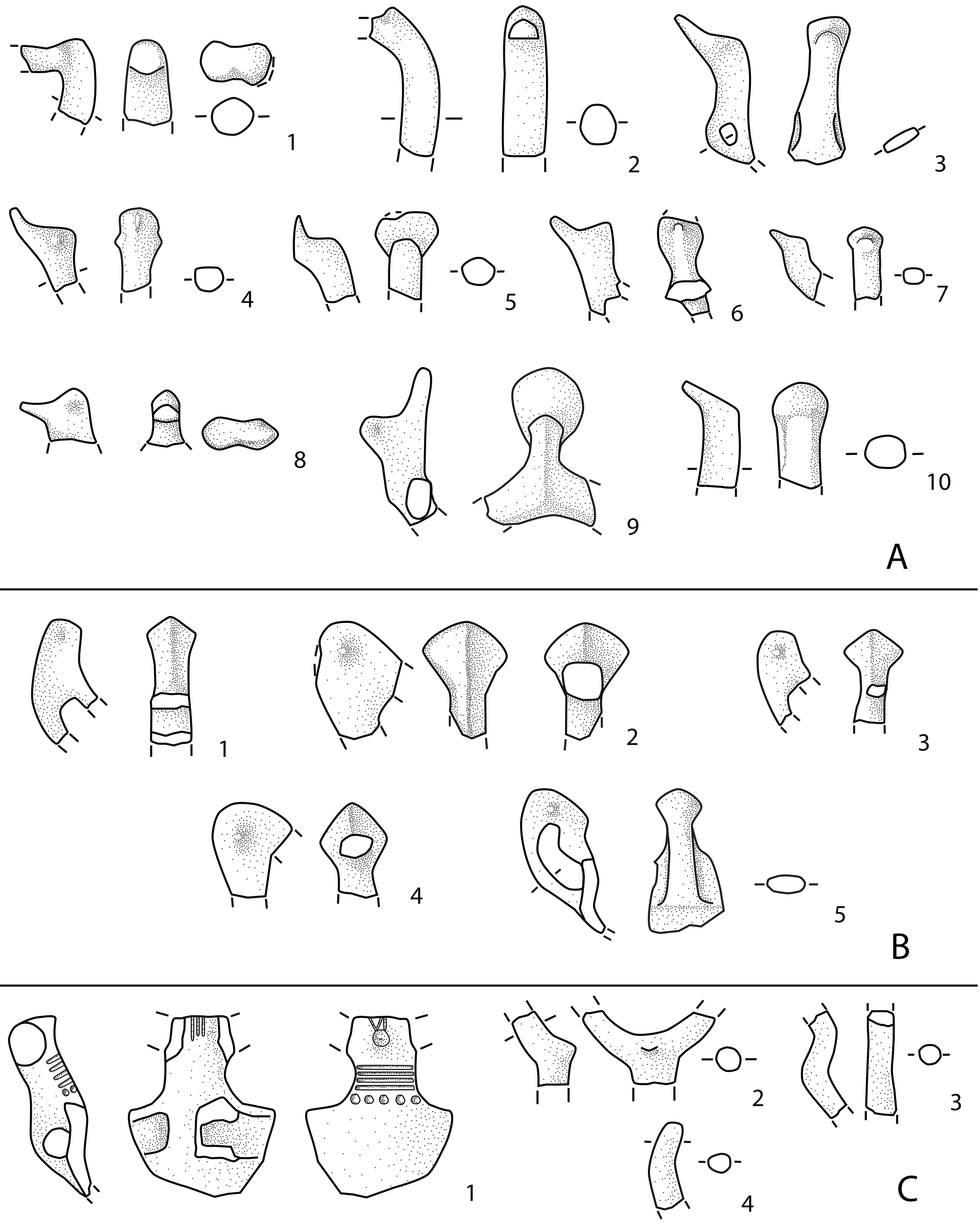
Pl. 3. Treazzano di Monsampolo, pottery. – A: Large Bowls (1:3). – B–C: Medium-sized bowls (1:2).



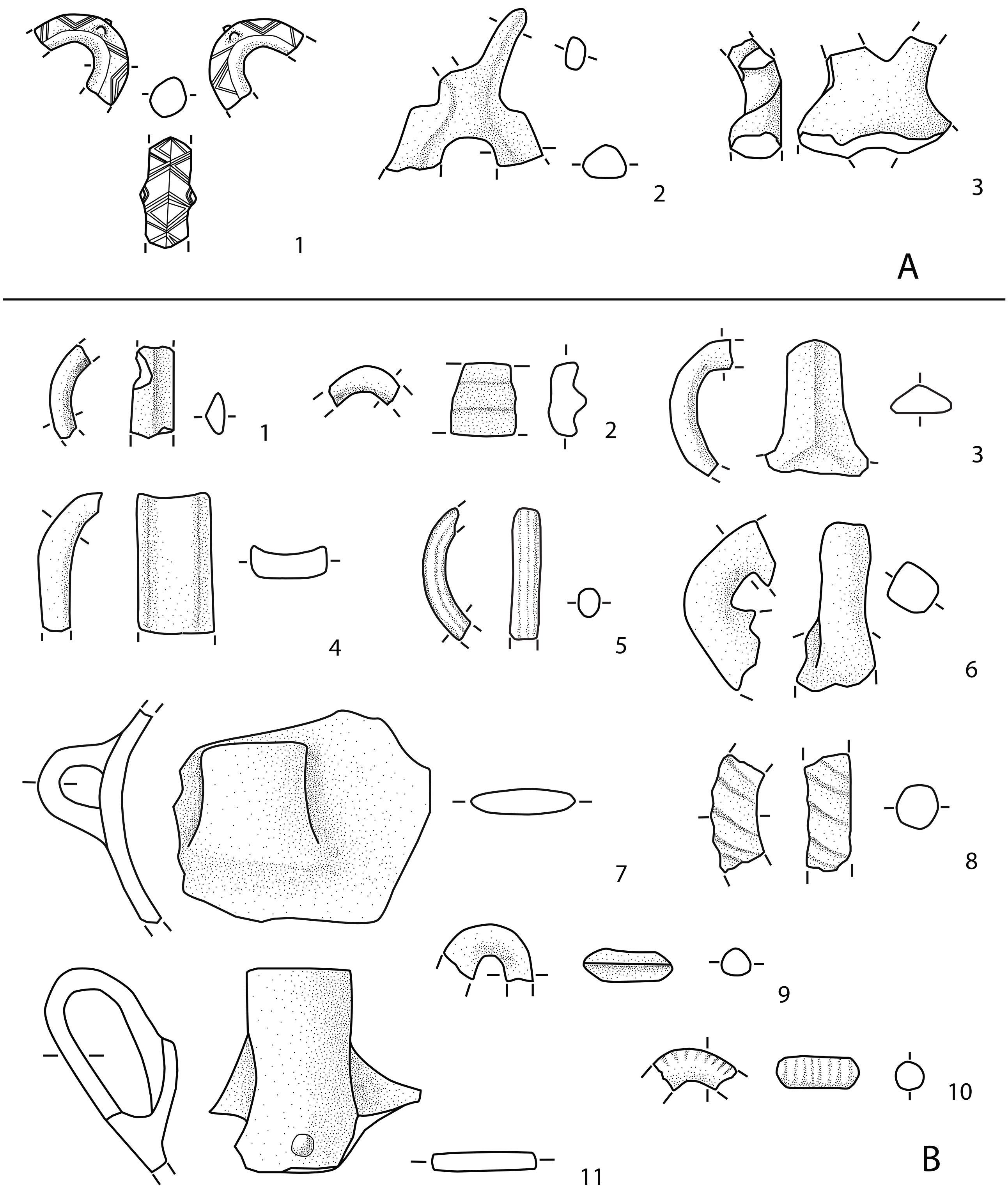
Pl. 4. Treazzano di Monsampolo, pottery. – A–D: Carinated cups (1:3).



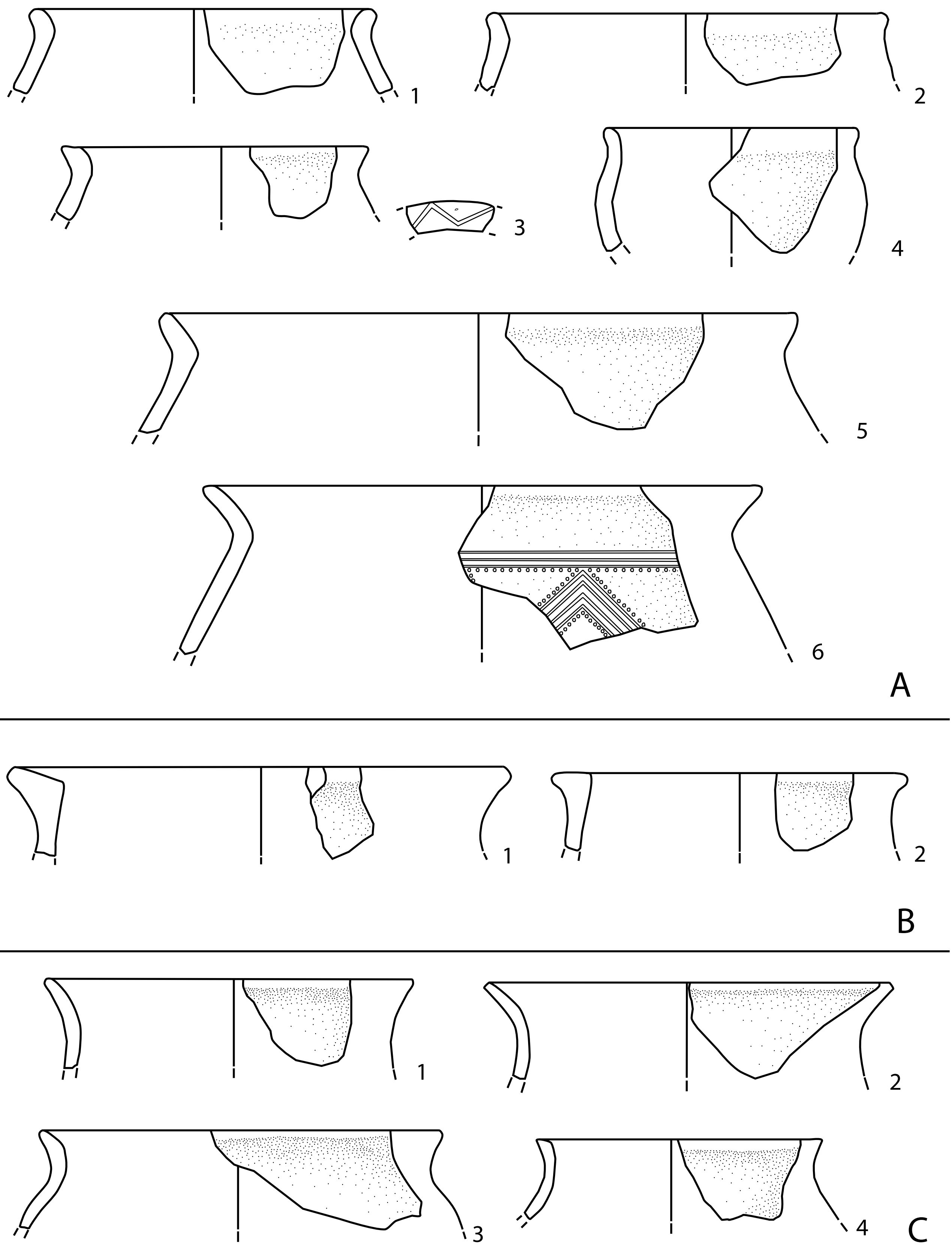
Pl. 5. Treazzano di Monsampolo, pottery. – A: Carinated cups (1:3). – B: Cups with a convex profile (1:3). – C: Cylindrical jars (1:3).



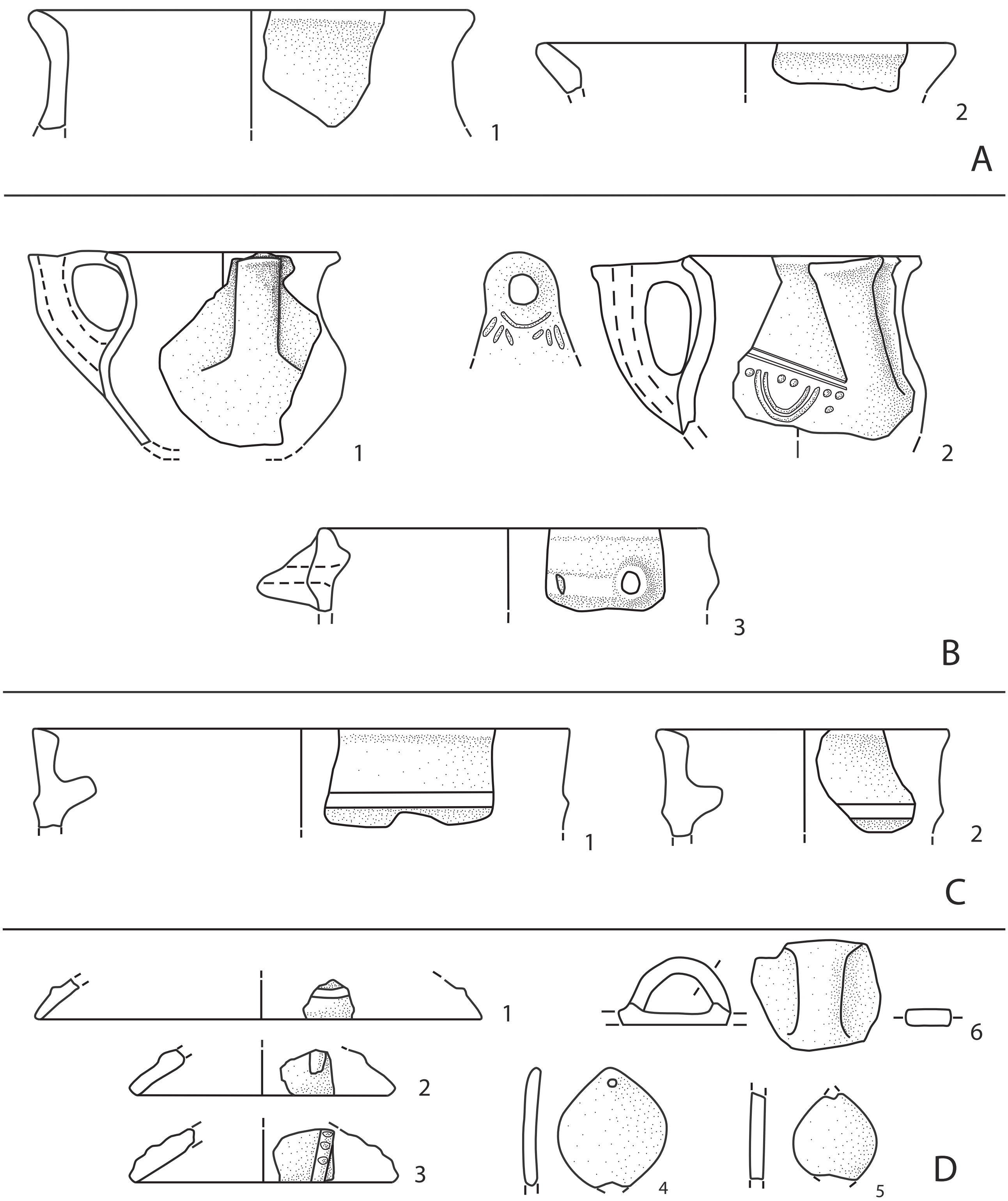
Pl. 6. Treazzano di Monsampolo, pottery. – A: Bird-shaped knobs with beak curved upwards (1:4; nos. 6–8: 1:3). – B: Bird-shaped knobs with beak turned towards the interior of the vessel (1:3). – C: Horn-shaped knobs (1:3).



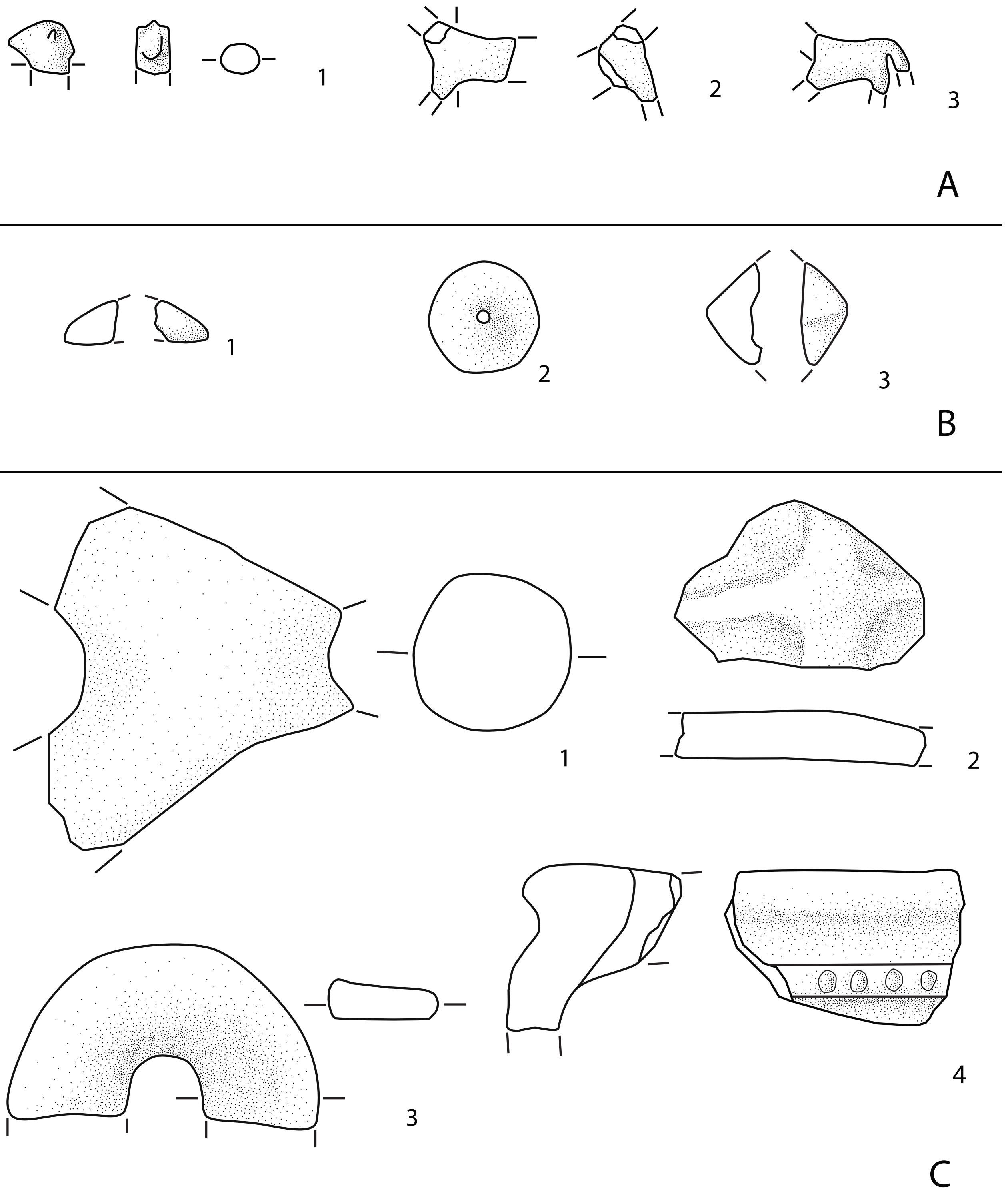
Pl. 7. Treazzano di Monsampolo, pottery. – A: Equine handle and handles with volutes (1:3). – B: Strap and tubular handles (1:3).



Pl. 8. Treazzano di Monsampolo, pottery. – A: Jars with an ovoid body (1:3; nos. 3 and 6: 1:2). – B: Jars with a rim characterized by an internal edge (1:3). – C: Jars with a concave neck (1:4).



Pl. 9. Treazzano di Monsampolo, pottery. – A: Pithoi (1:5). – B: Jars with a beak (1:4; no. 3: 1:2). – C: Open-shape vessels with an internal strip (1:3). – D: Lids (1:4).



Pl. 10. Treazzano di Monsampolo, pottery. – A: Zoomorphic figurines (1:2). – B: Spindles (1:2). – C: Stoves (1:3).

Acknowledgements

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Thoughts on the Capacities of Goblets and Consumption Practices in Middle Helladic and Early Mycenaean Settlements

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Abstract

This article focuses on ceramic goblets found in settlement contexts, using their capacity as a leading criterion for a better understanding of drinking practices and consumption patterns in the MH – LH IIIA1 periods. It compares goblets of various sizes and capacities obtained by calculation methods with other individual open shapes and explores their use within wider ceramic assemblages. In total, the capacities of over one hundred goblets and more than 400 vessels of other shapes have been calculated. I argue that the largest goblets, at least those exceeding three litres in capacity, were certainly shared by several individuals in commensal activities, passing from hand to hand, as was probably the case at small-scale gatherings at Asine in the MH III period. From LH I onwards, this practice may have coexisted with the use of kraters for mixing drinks subsequently distributed in smaller individual drinking vessels, goblets included, among the participants at feasts or ceremonial drinking. The large number of drinking vessels and the wide capacity range of the LH IIB–IIIA1 goblets from the Menelaion of Sparta support this idea. This constitutes a milestone in the development of drinking events, which reached their peak in LH IIIB within the framework of huge feasting ceremonies organized by the Mycenaean palaces.

Keywords

Drinking vessels, ceramic, volume, Greece, Aegean Bronze Age, commensal practice, feasting.

Zusammenfassung – *Überlegungen zu Fassungsvermögen von Kelchen und Trinkpraktiken in mittelhelladischen und frühmykenischen Siedlungen*

Dieser Artikel konzentriert sich auf keramische Kelche, die in Siedlungskontexten gefunden wurden und deren Fassungsvermögen als führendes Kriterium für ein besseres Verständnis von Trinkpraktiken und Konsumgewohnheiten in den Perioden MH – SH IIIA1 verwendet wird. Kelche verschiedener Größen und durch Kalkulationen ermittelte Kapazitäten werden mit anderen individuellen offenen Formen verglichen und deren Verwendung in größeren Keramikensembles untersucht. Insgesamt wurden die Fassungsvermögen von mehr als hundert Kelchen und über 400 weiteren Gefäßen anderer Formen berechnet. Das Fazit lautet, dass die größten Kelche, zumindest die mit einem Fassungsvermögen von mehr als drei Litern, sicherlich von mehreren Personen bei entsprechenden Aktivitäten geteilt wurden, und von Hand zu Hand gingen, wie es wahrscheinlich bei kleineren Versammlungen in Asine in der MH III-Periode der Fall war. Von SH I an kann diese Praxis mit der Verwendung von Kratern zum Mischen von Getränken koexistiert haben, die anschließend in kleinere einzelne Trinkgefäße, einschließlich Kelchen, unter den TeilnehmerInnen an Festen oder zeremoniellem Trinken verteilt wurden. Die große Anzahl von Trinkgefäßen und der große Kapazitätsbereich der SH IIB–IIIA1 Kelche aus dem Menelaion von Sparta unterstützen diese Idee. Dies ist ein Meilenstein in der Entwicklung von Trinkveranstaltungen, die ihren Höhepunkt in SH IIIB im Rahmen riesiger Feiern, die von den mykenischen Palästen organisiert wurden, erreichten.

Schlüsselbegriffe

Trinkgefäße, Keramik, Volumen, Griechenland, Ägäische Bronzezeit, Kommensalität, Feste.

1. Introduction

Research on vessel capacities and ceramic containers in the Aegean Bronze Age has provided valuable insights into Minoan and Mycenaean storage patterns and metric systems.[1] Thanks especially to the measurements carried out on the pottery from the Palace of Nestor at Pylos,[2] absolute values for units of volume involved in Aegean Bronze Age scripts have been calculated.[3] It has also been pointed out that large quantities of drink, wheat, and animals were certainly provisioned for feasting ceremonies, essentially in a religious context, as recorded in Linear B.[4] Large amounts of wine were listed on the tablets and possibly stored in pottery receptacles such as pithoi at the palaces, notably at Pylos.[5] In addition, the numerous drinking vessels and kraters kept in the LH IIIB pantries of the Palace of Nestor, which varied significantly in size and capacity, were certainly used on such special occasions.[6]

It has been stressed that the capacity range of the standard-sized kylikes from the Palace of Nestor and the smallest MH goblets from Asine were mostly similar.[7] However, with the exception of the pottery from MH Asine, there is an apparent lack in research about the capacities of drinking vessels in assemblages ranging in date from the MH to LH I–IIIA1 periods, i.e. a period of more than 600 years (c. 2000 – c. 1370 BC). This article seeks to fill this gap by tracing the development of pottery shapes and drinking practices in the settlements of these periods. It brings with it a number of issues of interest, including the extent of drinking events and the nature of the drinks/foods consumed.

On the assumption that drinking vessels may have been filled with drinks from kraters, it can be suggested that goblets and other drinking vases probably held alcoholic beverages, and most likely wine mixed with water in the Late Bronze Age.[8] A standard set for consumption of wine would include a krater, a dipper and drinking vessels,[9] as well as a jug in the LH period.[10] Nevertheless, one may wonder whether another pottery shape may have been used for mixing beverages, especially in the absence of kraters in ceramic assemblages. A hypothesis that this article aims to explore is that the largest MH – LH IIIA1 goblets, which could have held as much drink as the smallest LH I–IIIA1 kraters, may

1 On oil or liquid contained in stirrup jars from Mycenae: Tournavitou 1995, 81. – Haskell 1984, 101 and n. 28. – On LH IIIB1 individual shapes and function: Tournavitou 1992. – On graffiti, storage and capacities in Knossos: Boskamp 1996, 111–112. – On jars from Pylos and Zygouries: Darcque 2005, 226. – Shelmerdine 1985, 147. – Thomas 1992, 321. – On capacities of jars from Rooms 23 and 24 at Pylos: Darcque 2005, 279–281. – On clay containers from various Minoan sites: Christakis 2008. – For a pithos with a Linear A inscription, see Christakis 2010. – On capacities of clay containers and built silos in Ayia Triada: Privitera 2014. – On capacities of pithoi from Kastanas and Thessaloniki Toumba: Margomenou 2008, esp. 204. – On traces of beeswax identified in pithoi from Thessaloniki Toumba: Margomenou, Roumpou 2011, 131–132. – On capacities of pithoi from Akrotiri (Thera): Nikolakopoulou 2002, 89–92. – For various types of contents as well as traces of beeswax that could prevent the evaporation of alcohol if applied on the internal surface of the vessels, see Nikolakopoulou 2002, 127–129.

2 Blegen, Lang 1964. – On the capacities of 778 vessels of different shapes: Blegen, Rawson 1966, 354–414. – Haskell 1984, 101 and n. 28. – On the distribution and numbers of kylikes at the Palace of Nestor: Bendall 2011, 112–124.

3 Ventris, Chadwick 1973 [1956], 60, 394. – On weight values, degree of standardization in the quantity of a commodity, and units of volume for dry or liquid commodities: Michailidou 2008, 227, 287. – Michailidou 2010, 75–76.

4 585.6 litres of wine provisioned at the initiation of the wanax at Sphagianes, recorded on PY Un 2: Palaima 2004, 242–243. – Weilhartner 2008, 412. – Weilhartner 2017, 224 – On a total of 172.8 litres of wine recorded on PY Un 718, with Poseidon as recipient: Palmer 1994, 103. – Shelmerdine 2008, 401. – Zurbach 2015, 38. – On miniature kylikes related to feasting rituals from Room 7 at Pylos: Stocker, Davis 2004, 189–190. – On drinking vessels and wine used in ritual contexts in Crete: Palmer 1994, 139–142. – On tablets recording paraphernalia used on ceremonial occasions, but not drinking vessels: Palaima 2004, 236. – However, *di-pa* (δέπας 'goblet') and *ka-ra-te-ra* (κρατήρ 'krater') as well as ideograms of cups are attested in Linear B: Ventris, Chadwick 1973 [1956], 326–327, 331. – Bernabé, Luján 2008, 223–226 and Tab. 7/1. – Hruby 2010, 201–204 and Fig. 3. – On a krater listed among the goods on tablet MY Ue 611: Panagiotopoulos 2014, 170–171 and Tab. 5. – On ideograms of vases in Linear A: Perna 2003.

5 About the wine magazine at Pylos, see Palmer 1994, 194: "Even if all the pithoi held wine, their total minimum capacity of 4682.575 l. falls below some of the totals listed in the texts, notably PY Vn 2011, which lists a total of 11,808 l., or the largest single entry in KN Gm 840, 4838.4 l. (line .2)", and Tab. 9/1.

6 Blegen, Rawson 1966, 359–374 and Figs. 353–366 (6060 examples of drinking vessels, with capacities ranging from 0.009 to 7 litres); 399–402 and Figs. 387–388 (30 examples of kraters, with capacities ranging from 4 to 14.6 litres). – To sum up, 30 kraters (median capacity of 7.18 litres) and 52 tripods (average capacity of 0.69 and 0.96 litres) are recorded: Fox 2008, 138 and Pl. XXI; Tab. 2. – On pantries (Rooms 18–22) and metrical data used in the revision of the vessel typology: Hruby 2010, esp. 213 and Fig. 19.

7 Nordquist 2002, 131. – On rim diameters and capacities of kylikes from Pylos: Hruby 2010, 208–211.

8 On beverages, principally wine or beer: Jung 2006, 412 and n. 39. – On alcohol, esp. in Megiddo: Stockhammer 2011a, 288. – On Linear A and Linear B wine ideograms: Palmer 1994, Chap. 2. – On traces of fermented beverages in various ceramic vessels from Aegean Bronze Age sites attested by chemical analyses, even if kraters were not sampled: McGovern et al. 2008. – On mixed fermented beverages in Late Bronze Age conical cups, mugs, an askos, rhyton, and cooking vessels: Tzedakis, Martlew 1999, 166–171. – On drinking vessels from Armenoi: Tzedakis, Martlew 1999, 175–177. – Hamilakis 2008, 13–14.

9 On LH IIIA pottery shapes involved in a ritual of consumption of wine: Wright 2004, 170. – On a variety of functions for the dipper family, with dippers from LH IIIC Lefkandi possibly used as cooking pots: Lis 2013, 8–10 and Fig. 1. – On dippers from Mitrou, as plausible cooking utensils: Lis 2015, 108 and Fig. 9/4.

10 Shelton 2008, 222.

have been used either as mixing vessels or drinking vessels shared by several individuals.

Thus the question arises whether some goblets or stemmed bowls may have functioned as serving vessels.[11] By comparison, the Mycenaean stemmed bowl, a shape that occurred from LH IIIA2 (FS 304)[12] to LH IIIC (Early), was a popular serving vessel in LH IIIA2 Tsoungiza[13] and was probably used for holding both liquids and food.[14] The idea that LH III and MH stemmed bowls may have been used in the same way for similar contents is appealing but remains conjectural, since these vessels belong to two distinct shapes and periods. Future organic residue analysis could shed light on this issue, but the hypothesis that some MH stemmed vessels regarded as goblets in this article held contents other than alcoholic beverages cannot be excluded.[15] This idea may be reinforced by the results of a use-wear approach.[16] The issue then becomes how to assess the diversified use of vessels and how to determine whether, in the case of the goblets, alcohol consumption was prevalent.[17]

In addition to sizes and specific morphological features, I argue that the capacity of ceramic vessels can be used as a leading criterion for understanding how goblets may have functioned with kantharoi, cups and kylikes – i.e., shapes traditionally seen as drinking vessels[18] – and tableware shapes within wider assemblages in settlement contexts. This study will focus on pottery found in houses or large buildings, in some cases associated with a floor, as well as in refuse pits, from eleven sites on the Greek mainland: Asine (Argolid), Tsoungiza (Corinthia), Ayios Stephanos, Menelaion (Laconia), Nichoria (Messenia), Athens-Acropolis South Slope, Eleusis, Kiapha Thiti (Attica), Orchomenos (Boeotia), Krisa (Phocis), Pefkakia (Thessaly). Pottery assemblages from Kolonna on the island of Aegina will also be studied (Fig. 1).

The selection criteria of the deposits examined in this article are the availability of complete or nearly complete profiles allowing us to calculate the capacities of drinking vessels by using their line drawings (Appendix 1), as well as the consistency of the settlement assemblages, involving precise information about the contexts and dates of vessels. Drinking vessels from other MH and LH I–II settlements, like Korakou (Corinthia)[19] and Ayios Vasileios (Laconia),[20] are too fragmentary for estimating capacities. Similarly, many vessel profiles from Kaloyerovrysi (Euboea) have been published, but complete examples are rare.[21] The dimensions of some tableware shapes with complete profiles from Lefkandi (Euboea) are missing.[22] As regards Iklaina, the last volume of the publication series came out in 2018, and includes five LH IIB and IIIA1 drinking vessels with complete profiles.[23] I will only point here to the fact that most of the inventoried pottery finds in this book (MH II/III – LH IIIB/IIIC) are drinking vessels, but further analyses of the ceramic assemblages from this settlement will

11 The idea that the matt-painted goblets from Argos have been used for drinking is questioned by Philippa-Touchais 2002, 21. – See also Dietz 1991, 166.

12 FS = Furumark's Shape, see Furumark 1972 [1941].

13 Dabney, Halstead, Thomas 2004, 208–209 and Fig. 4; 202 and n. 17.

14 On residues of olive oil in a LH IIIB stemmed bowl from Mycenae: Tzedakis, Martlew 1999, 204–205 (No. 208). – On residues of barley, fermented wine, and also olive oil, in a LH IIIB/C deep bowl from Thebes: Tzedakis, Martlew 1999, 185 (No. 174). – On traces of fat in a LH IIIB shallow angular bowl: Tzedakis, Martlew 1999, 133 (No. 116).

15 For lipids of various animal and plant origins revealed by chemical analysis of organic residues from pottery, notably sherds of kantharoi and goblets from MH Argos, see Decavallas 2011, 127, 174, 180, 224–225, 229 and Tabs. VI.i, VII.b, VII.d. – A different type of analysis would however be required in order to detect traces of tartaric acid in these samples (O. Decavallas, personal communication, 2019).

16 E.g., a LH IIIA2 carinated kylix (FS 267) from Tsoungiza with an interior abraded surface possibly used for consumption of food: Lis 2013, 11 and Fig. 12. – A use-wear analysis applied to an unpainted kylix found in a pithos at Iolkos would be helpful for understanding its function (scooping?): Adrymi-Sismani 2014, 212.

17 For a distinction between the use of a vase (Archaic funerary context) and its primary function, see Coulié et al. 2017, 573, 575. – On Roman vessels, see Baddiley 2018, 18: "it is possible that the vessels were made with an end use in mind, but actual vessel use was likely to have been situational [...]".

18 E.g., Scheibler 1998, 854, 858 and Fig. D, 'Trinkgefäße'. – Tournavitou 1992, 195–196, 198; 210: "*Drinking vessels*. Vessels originally intended for the drinking of liquids or semi-liquid substances".

19 Dickinson 1972. – Davis 1979. – By contrast, the post-palatial ceramic assemblages are well preserved (capacities of vases, courtesy of B. Lis), especially two LH IIIC Early formal drinking services (House P, northeast chamber), as discussed by J. Rutter, with examples from Mycenae and Tiryns, in a paper titled 'The Floor Deposits of LH IIIC Early at Korakou: Some Unconventional Approaches to Ceramic Analysis Made Possible by More Fully Preserved Pots' presented at the Conference 'Οξυδερκειν at Korakou: A Centennial Celebration of C. W. Blegen's 1915–1916 Excavations' on September 7, 2015. – For capacities (volumes) of LH IIIC vessels from Tiryns, see Stockhammer 2008.

20 See comment in Kardamaki 2017, 87.

21 Sampson 1993, Figs. 47 (No. 18, pedestalled goblet), 70 (No. 24, matt-painted Vapheio cup, LH I, see also p. 23), 71 (No. 27, matt-painted one-handled cup).

22 Popham, Sackett 1968, Figs. 7–9. – On Lefkandi as a settlement used for MH synchronisms: Maran 1992a, 329–335, 370 and Fig. 25.

23 Cosmopoulos 2018, Figs. 10/P3226, 15/P3743, 21/P2878, P2882, P3763.

certainly stimulate future discussion on MH and early Mycenaean consumption practices.

This study is all the more important as research on Aegean Bronze Age consumption customs also addresses questions on the nature of the societies under study.[24] It involves assessments of the size of the groups and the social actors implied in this consumption,[25] as well as of the impact of social drinking,[26] in a timeframe that is marked by major cultural changes and a strong progression of social complexity from the Shaft Grave period at the MH III – LH I transition to the dawn of the palatial period in LH IIIA1. It also endeavours to explain how drinking consumption patterns developed, from limited household consumption in MH villages[27] to larger commensal consumption in LH II–IIIA1 settlements and mansions. In a world of "increased competition for power and prestige",[28] one may assume that the LH II–IIIA1 pottery assemblages studied in this article will provide evidence of large-scale social occasions.[29] It will also be argued that these events, which took place in regional centres different from the later palaces at Mycenae, Tiryns, Pylos and Thebes, may be regarded as forerunners of the palatial feasting ceremonies that may have included a thousand people in LH IIIB according to textual evidence in Linear B.[30]

2. A Note on Computer Methods and Geometric Vessel Volumes

In this article, computer methods have been applied to calculate the capacities of various vessels using scale drawings: *Pot Utility* (© Jean-Paul Thalmann & Arcane, 2006) and the web-based applet *Calculating vessel capacities* (© Synthèse et Analyse [LISA] and Centre de recherches archéologiques [CReA]).[31] Capacities obtained by using computer programs are geometric volumes of strictly symmetrical objects.[32] In reality, most pottery vessels from the period under study, even wheelmade vases,[33] vary in diameter or height. Exact capacities can be estimated by direct measurement methods, i.e., by filling the vessels with material such as polystyrene beads.[34] However, practical difficulties can be avoided by computer-aided calculation.[35]

In both computer programs, the scale must be checked. In *Calculating vessel capacities*, the exact measurement corresponding to 1 cm on the drawing must be entered (e.g., 1:3 scale), in some cases after using cross-multiplication on the basis of the rim diameter, or exceptionally on that of the height. In *Pot Utility*, the scale is set by clicking on the image in order to obtain a pixel number and by entering the equivalent measurement in cm (Fig. 2).

A volume obtained in *Calculating vessel capacities* can be reproduced, since the internal profile and vertical axis of the vessel are automatically extracted.[36] The central axis line must be strictly vertical, otherwise results will vary slightly. By contrast, in *Pot Utility*, the internal profile of a vase is selected by a series of manual clicks on the image. This may lead to some variations from one test to another. For this reason, I systematically used *Calculating vessel capacities* in my research and checked the results by using *Pot Utility*. All capacities provided in this article correspond to

24 Wright 2004, 133. – Lindblom 2007, 123. – Stockhammer 2011a, 208. – Lis 2017.

25 "Consumption of liquids by single individuals, or alternatively consumption on a massive scale by large numbers of participants […]": Rutter 2012, 73, 85–86 and n. 1. – The issue concerns settlement contexts as well as funerary ones, "family, clan, village, faction, region, political or religious group": Hamilakis 2008, 16.

26 On social contexts in which private consumption by groups or commensal consumption of drink took place at the Late Bronze Age – Early Iron Age transition: Borgna, Levi 2015, 125, 128.

27 On a basic twosome social unit in MH Asine: Nordquist 1987, 53. – This interpretation is discussed below. – See also elite practices in Nordquist 1999. – Nordquist 2002.

28 Lis 2017, 184.

29 Pantou 2014, esp. 388.

30 See Palaima 2004, 229: "[PY] Un 138 gives us a good impression of what a banquet for a thousand or more people would have been like".

31 *Pot Utility*: Thalmann 2007. – *Calculating vessel capacities*: http://capacity.ulb.ac.be/ (last accessed 4.6.2020). – Engels, Bavay, Tsingarida 2009. – Pixel images are imported or sent in these two programs. By contrast, *AutoCAD*, that requires vector files for processing the objects, is by far the most complex program, as pointed out in my poster presented at the 13th European Meeting on Ancient Ceramics, 24–26.11.2015, N.C.S.R. Demokritos, British School at Athens. – I thank Cydrisse Cateloy for providing me with *Pot Utility*, see Cateloy 2016, 46. – On the computer program *Vase* (not tested): Younger 2003.

32 On volume calculation methods based on cones and truncated cones: Darcque 2005, 279. – Engels, Bavay, Tsingarida 2009, 130 (bevel-walled cylinders).

33 E.g., Mountjoy 1981, Fig. 8/59.

34 Engels, Bavay, Tsingarida 2009, 129–130. – Polystyrene beads are lighter than lentils and, thus, the optimal solid material for measuring vessel capacities. However, static electricity can cause them to adhere to the pot walls. The filling of vessels with water requires special preservation conditions of the objects and specific access to them. – Cateloy 2016, 46. – Small differences in capacity may be observed between the filling of vessels and the results of computer methods, see comment on Krisa below.

35 On errors that may occur in illustration preparation and digitization: Senior, Birnie 1995, 327–328.

36 Engels, Bavay, Tsingarida 2009, 131.

Fig. 1. Map of the settlements (numbered as in the Appendix 1).

the maximum internal volumes of the vessels, with water heights reaching the top of the rims, although the realistic use of these vessels implies lower filling heights.[37] In other words, these drinking vessels were probably only filled up to 70–90 %.

3. The MH – LH I Goblets: Morphology and Capacity

3.1. Pottery Classes and Specific Features of Individual Shapes

A large range of fine wares was produced in the MH period,[38] together with a wide range of shapes and variations among the drinking vessels (kantharos, cup, goblet).[39] MH and LH goblets are generally interpreted as footed/stemmed

37 On the difference between the optimum fill (Opt), a more realistic 'optimum' fill level, and the maximum fill (Max): Baddiley 2018, 1.

38 French 1972. – Dickinson 1977, 17–24. – Pavúk, Horejs 2012.

39 On the nomenclature of MH pottery shapes: Nordquist, Zerner 1987.

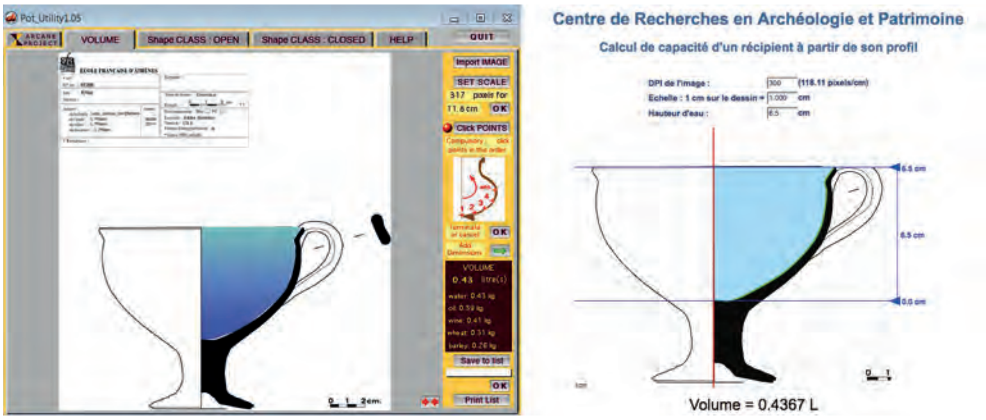

Fig. 2. Internal volumes of vessels obtained in *Pot Utility* and *Calculating vessel capacities* (Krisa, Inv. 6088, see Phialon 2018).

Fig. 3. Examples of MH and LH goblets. – 1. Brown-RM (Sarri 2010, Pl. 15/1), see also GM Lianokladhi goblets. – 2. YM (Nordquist 1987, Fig. 47/1). – 3. MP (Nordquist 1987, Fig. 50/6). – 4. Bichrome matt-ptd (Sarri 2010, Pl. 28/4). – 5. Unptd burnished, FS 263 (Mountjoy 1981, Fig. 8/57). – 6. Unptd polished, FS 270 (Mountjoy 1981, Fig. 10/90). – 7. Myc. decorated, Ephyraean (Mountjoy 1981, Fig. 15/177).

drinking vessels. The diversity of terms used in ceramic studies for describing pottery classes and shapes such as the goblets must be pointed out. The Minyan goblet[40] is also named stemmed bowl[41] or *Fußschale* in German[42] and *coupe à pied* in French.[43] In addition, the morphology and size of the goblets varied significantly in the MH – LH I period (Fig. 3/1–4). Some shapes such as the Lianokladhi goblets were typically produced in unpainted burnished classes. Taking this into account, special attention must be given to the pottery classes, before focusing on the morphological features of the goblets.

MH goblets, wheelmade[44] or handmade[45] ones, belong to various burnished wares, such as Grey Minyan (GM), Brown Minyan (BM), Red Minyan (RM), Yellow Minyan (YM), Dark Burnished (DB) and Burnished Dark Tempered

40 Dickinson 1994, 111 and Fig. 5/6. – Poursat 2008, 139 and Fig. 193. – Touchais 2008a, 190.

41 Nordquist 1987, 48–49.

42 Maran 1992b, 121.

43 Jannoray, van Effenterre 1938, Pl. XLIII. – See also '*coupe*' in Philippa-Touchais 2002, 5–6.

44 E.g., Sarri 2010, Pls. 15–29. – The generic term 'wheelmade' encompasses, however, a variety of different techniques. – On wheel-fashioning and wheel-thrown techniques: Choleva 2012.

45 E.g., Nordquist 1987, Figs. 45, 47, 49–52.

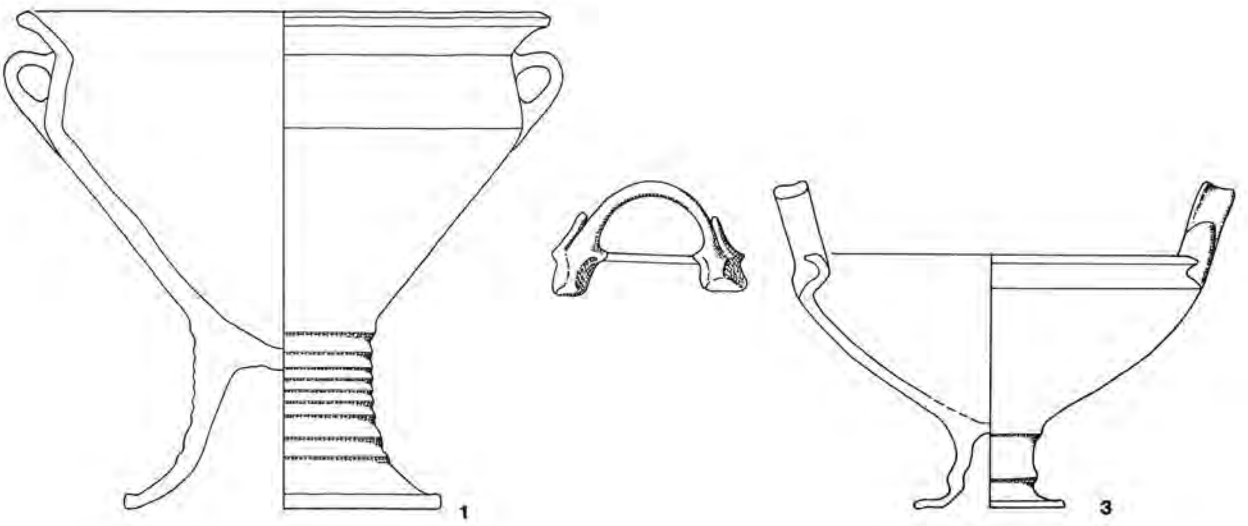

Fig. 4. A Lianokladhi goblet and a Pteleon goblet (Maran 1992a, Pls. 69/1, 148/3).

(DT) fabric. The term 'Minyan' has been inconsistently applied by scholars to describe different ceramic productions in different areas: 'fine' and 'coarse' pottery with a burnished surface; 'true Minyan' and 'imitations'; and 'local' productions.[46] It would be worthwhile to use unambiguous technical terms. For instance, Fine Grey Burnished is a term applied for Grey Minyan pottery at Mitrou.[47] By contrast, there is no exact equivalence between Red Minyan and Red Burnished Ware, between Black Minyan, Argive Minyan (AM) and Black or Dark Burnished Ware, which may refer to different classes and production environments. Therefore, the original terms used in the publications of pottery are maintained in this article (see Appendix 1).

Specific shapes of unpainted (unptd) burnished goblets have been attributed to distinguishable potting traditions: the Lianokladhi goblets to production centres in central Greece, the ribbed/grooved goblets to centres in the northeastern Peloponnese, especially the Argolid, and the plain, low pedestalled goblets to centres in either the northeastern Peloponnese, Aegina, or possibly Keos.[48] The shaft graves of Grave Circle B (GCB) at Mycenae provided 62 goblets attributed by Mylonas to the Minyan type.[49] It appears that more than the half of the GCB goblets that have been drawn,[50] i.e. 12 examples, can be related to shape 61B of Gauß and Lindblom, and thus most likely belong to a potting tradition located in the northeastern Peloponnese,[51] unlike the Pteleon goblet from GCB, which may be assigned to a central Greek production.

As regards morphological features, it is worth noting that MH goblets, especially those of the Lianokladhi type[52] produced in Fine Grey Burnished (Grey Minyan) Ware, have high-ribbed stems and strong carinated bodies, but some have low stems and rounded bodies, mostly at the end of the MH period. The Lianokladhi goblets, with rim diameters ranging from c. 20 to 30 cm and deep bowls, are usually larger than the Pteleon goblets, which do not exceed 22 cm in rim diameter[53] (Fig. 4). The high loop handles of Pteleon goblets or the thickening on the lip on goblets of the Lianokladhi type may have been uncomfortable for drinking,[54] but these specific features definitely did not constitute hindrances for that purpose. The thickening on the lip may even have prevented the users of these large and heavy goblets from hurting themselves on sharp edges.

46 Gauss, Kiriatzi 2011, 182, 184 and Tab. 59.

47 Hale 2016, 246. – On the ceramic class termed Fine Grey Burnished: Rutter 1983, 327–328.

48 Gauss, Lindblom 2017, 11–12 and Fig. 1/8.

49 Mylonas 1972–1973, 408. – Thirty-nine goblets were found on the grave floors, 22 others in fragmentary state in the filling of the graves: Mylonas 1972–1973, 270.

50 Goblets with a complete profile: Mylonas 1972–1973, Α-1, Β-10, Γ-49, Γ-51, Δ-69, Ζ-88, Η-95, Ι-100, Ι-103, Λ-125, Λ-128, Λ-132, Μ-137, Ξ-173, Ξ-174, Ξ-176, Ο-209, Ο-213, Ο-216, Υ-232, Υ-233, Υ-234.

51 Shape 61B in Gauss, Lindblom 2017, 11–12 and Fig. 1/8.

52 E.g., Maran 1992a, Pl. 69/1. – Hale 2016, Figs. 14/29, 15/34–36. – Everted, thickened, and hollowed rims and lower body rims are typical MH II–III features in Mitrou: Hale 2016, 289 and Fig. 16; 290 and Fig. 20. – See also Gauss, Lindblom 2017, 11–12 (shape 62B).

53 E.g., Goldman 1931, Fig. 185 and No. 6. – Maran 1992a, Pl. 148/1–3. – Sarri 2010, Pl. 26. – Hale 2016, Fig. 16/21–23.

54 See above Philippa-Touchais 2002, 21.

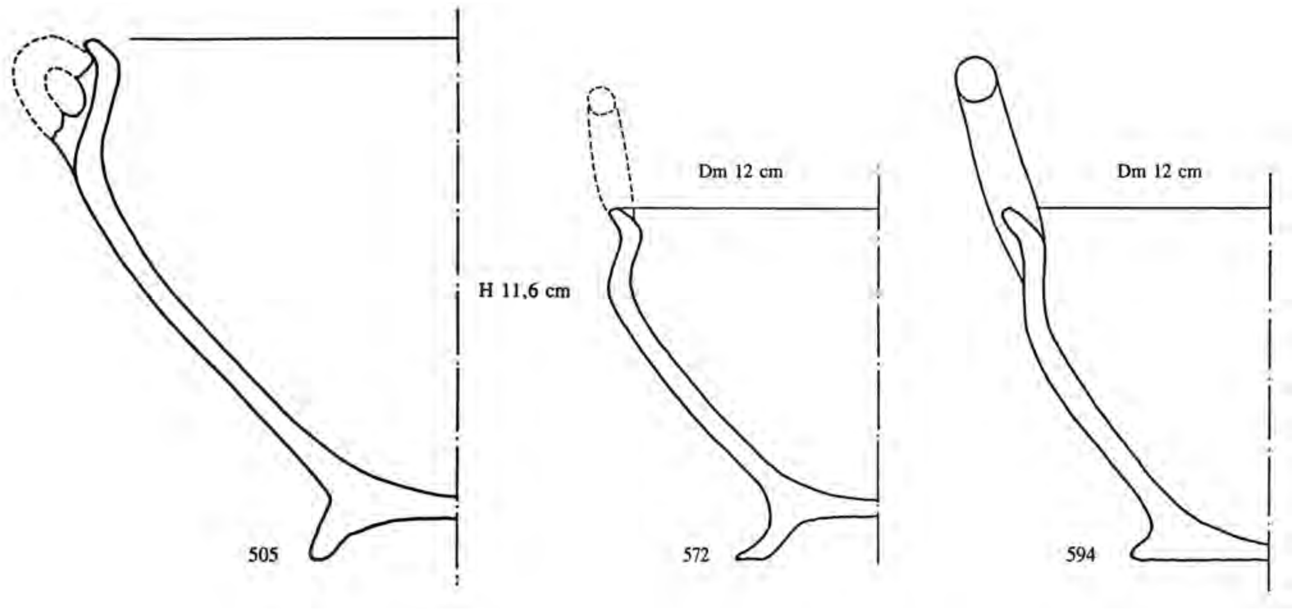

Fig. 5. Three MP Aeginetan drinking vessels. – 1. Bowl with hollowed base. – 2. Footed cup with raised horizontal handle or low pedestalled goblet. – 3. Cup with raised horizontal handle (Siedentopf 1991, Cat. Nos. 505, 572, 594 and Pls. 90, 95, 97).

In some cases, the criteria for identifying individual shapes are more fluid than expected and the identification of goblets may be challenged. Goblets were also produced in Matt-Painted (MP) Wares. The broad production range includes MP vessels in Argive and Aeginetan micaceous wares in the MH period, and Argive and Boeotian bichrome types in MH III and LH I.[55] The difference in profile between the three following Aeginetan MP drinking vases is not very pronounced: a bowl with handle and hollowed, slightly splaying base; a footed cup with a raised horizontal handle that, in my opinion, could be regarded as a possible low pedestalled goblet on the assumption that this vase originally had two high loop handles; and a cup with a raised horizontal handle and splaying base (Fig. 5).[56]

Another question is whether certain MH Aeginetan stemmed/pedestalled bowls, which vary in shape (rounded or carinated bowl, inverted or everted rim) and size, may have been used for drinking and thus can be added to the pedestalled goblets. Aeginetan carinated bowls with horizontal handles or lugs (*Knickrandschalen*) on high pedestal feet are especially likely to have been used as drinking vessels (Fig. 6).[57] Some have an everted rim and general profile similar to the Cycladic burnished pedestalled goblets with strong carination and shallow body.[58] The examples with very shallow bowls might also have served for presenting food, but certainly not for mixing drinks.

In contrast, one may assume that the MH I Aeginetan stemmed bowls and basins with horizontal handles and flat incurved/inturned rims – a feature not suited to drinking – were perhaps used for holding solid or liquid food.[59] In

55 Lindblom, Mommsen, Whitbread [2009]. – Sarri 2010, 77–78, 113, 123 and Pl. 28. – On Boeotian Mainland Polychrome MP (kraters, stamnoi), see also Mathioudaki 2010.

56 Siedentopf 1991, Pls. 90/505, 95/572, 97/594, all classified as *Knickrandschalen und -schüsseln*. – I would like to thank M. Lindblom and W. Gauß for sharing their opinion on these vases and the vases 500–503. – Regarding vase 572, I would point out that the profile of this vase is close to that of the Pteleon goblet with a low foot/pedestal, see for instance an Anatolian Grey Ware example in Pavúk 2007, 209 and Fig. 3/7.

57 See *Knickrandschalen und -schüsseln* in Siedentopf 1991, 35, 87 and Pl. 89, Cat. Nos. 500–503, unknown context. – Shape identified as S-8 Carinated bowl on high pedestal foot in Lindblom 2001, 26–27 and Fig. 4.

58 As an import in Aegina (Group XXXV, Kolonna IX), see Walter, Felten 1981, Pl. 121/435. – Gauss, Smetana 2007, 63 and Fig. 6/XXXV-10 (footed goblet). – For Kean examples of goblets, see Overbeck 1989, 154–155 and Pls. 74–75 (tall or short-stemmed goblets). – Abell, Hilditch 2016, 160 and Fig. 9.2/c.

59 For an Aeginetan MP deep bowl with incurved rim (diam. 30 cm), MH I Early and Late, two vertically pierced lug handles, pedestal foot, found in Lerna, see Zerner 1988, Fig. 6/16. – For a deep MP stemmed bowl with horizontal handles and slightly incurved rim (diam. 44.75 cm), found in Argos (MH I/II), see Philippa-Touchais 2002, Figs. 1/1, 3/5. – For Argive light MP flat-rim basins, see Dietz 1991, 44 (AC/9). – On bowls with incurved rims, and separately preserved pedestal feet from Aegina: Siedentopf 1981, Pls. 79–83 (rims), 87–88 (feet).

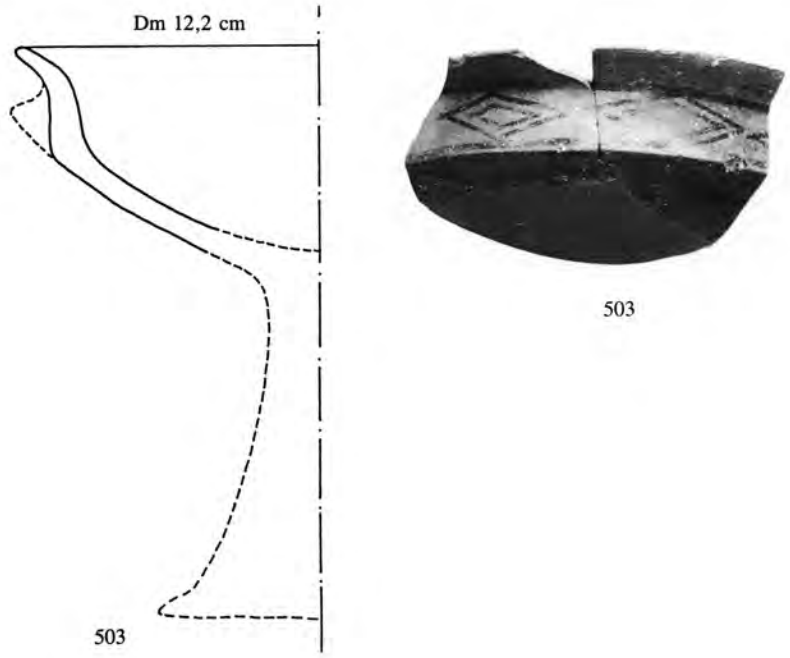

Fig. 6. An Aeginetan MP pedestalled carinated bowl/goblet (*Knickrandschale*) with everted rim and horizontal handles/lugs (Siedentopf 1991, Cat. No. 503 and Pl. 89).

any case, pedestalled vases displayed their contents well, and for this reason they may be seen as performative elements in commensal activities as early as the beginning of the MH period (c. 2000–1850 BC).[60] It is not excluded that large, pedestalled, deep rounded bowls may have served as mixing vessels like the LH kraters. This hypothesis could be confirmed if traces of tartaric acid were to be revealed by future residue analyses on such tableware shapes and by their association with sets of drinking vessels.

3.2. MH (– LH I) Goblet Capacities and Function(s)

In the MH I–II period, the variability in shape and capacity of the goblets can be explained by the fact that they belong to distinct production traditions. The group of the aforementioned Aeginetan MP pedestalled carinated bowls with everted rims (*Knickrandschalen*) can be seen as pedestalled goblets and were most likely used for drinking, since this group shows the smallest capacities (less than 0.5 litres) among the MH assemblages examined here, and their rim diameters mainly range from 15 to 19 cm, as do those of plain burnished MH goblets. These MP pedestalled carinated bowls/goblets were part of a local Aeginetan production, whereas the GM and plain burnished goblets from the same site, including a Lianokladhi goblet reaching three litres in capacity and two Pteleon goblets of c. one litre, were most likely imported from the mainland in MH II.[61] A capacity of three litres is very large for a drinking vessel, but is still well below the capacity of a large MH I/II Aeginetan MP stemmed bowl from Argos,[62] which reaches c. 21 litres, as obtained by calculation methods.

In comparison, in the GCB assemblages from Mycenae, the Pteleon goblet is the smallest goblet (diam. 12.9, h. 13 cm) and it has the lowest capacity (c. 0.36 litres).[63] As mentioned above, 62 goblets have been attributed by Mylonas to the Minyan type.[64] These constitute the most frequent pottery shape represented in this grave circle, ahead of stamnoi, jugs, cups, and other open shapes. The relative height of the stems of the 22 GCB goblets with a complete profile varies greatly, from a very low stem to a stem that constitutes half of the total height in the case of the Pteleon goblet. By contrast, the

60 That is to say, more than 250 years before the changes observed in the foodways of the early Mycenaean period by Lis 2017.

61 Walter, Felten 1981, 175 and Pl. 121/437, 438, 440. – Gauss, Smetana 2007, 63 and Figs. 6/XXXV-4, XXXV-5; 7/XXXV-7: respectively, 1.08, 0.95 and 3.01 litres, see Appendix.

62 Philippa-Touchais 2002, Fig. 3/5. – In comparison, the MH I Aeginetan stemmed bowl from Lerna is smaller (c. 6.45 litres): Zerner 1988, Fig. 6/16.

63 Mylonas 1972–1973, 179 and Pl. 216/Ξ-173. – The goblet varies slightly in height (13–14 cm).

64 Mylonas 1972–1973, 270, 408.

largest goblet from the GCB is ribbed/grooved, reaching a diameter of 27.4 cm and a height of 28.1 cm, with a capacity of three litres.[65] Both goblets are assigned to the MH IIIB phase by Soren Dietz.[66] The distinct capacity range of these two goblet types is striking, as confirmed by the following examples. This might also suggest a functional difference between them. Further in-depth examination of pottery assemblages would allow a better understanding of funerary customs involving drinking at funerals, as well as of funerary ideology and symbolic meaning at the transition from the MBA to the LBA. In this article, attention will, however, focus on settlement contexts.

Similarly, the Minyan goblets from Orchomenos (GM, BM) vary in shape (Lianokladhi, ribbed, Pteleon types). Among the goblets with complete profiles (rim diameters from 17.4 to 25 cm; capacities from 0.7 to 3.52 litres), the Pteleon goblet is again the smallest example,[67] while the largest goblet from Orchomenos belongs to the Lianokladhi type.[68] Moreover, goblets with capacities larger than three litres were uncovered in the settlements of Eleusis, Krisa and Pefkakia (see Appendix 1); here again, these MH II–III goblets are of the Lianokladhi type.[69] In addition to GM Lianokladhi goblets, other goblet types have a capacity larger than three litres. The capacity of two YM goblets from Asine even exceeds four litres in MH III,[70] whereas that of a bichrome MP goblet from Orchomenos approximates three litres (Fig. 7).[71] Furthermore, three other large goblets from Kiapha Thiti and Tsoungiza, dated to MH III and LH I, attributed to various ceramic productions (pale burnished, dark burnished, micaceous and slipped), have capacities between 2.26 and 2.64 litres.[72]

With the exception of Kolonna (Aegina), more than the half of the MH (– LH I) goblets studied here have capacities

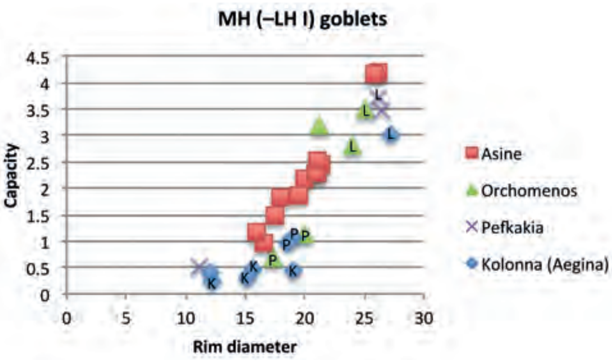

Fig. 7. Rim diameters and capacities of MH(–LH I) goblets. – K = *Knickrandschale*. – L = Lianokladhi type. – P = Pteleon type.

larger than two litres. An increase in goblet capacity probably started in the GM production in late MH II, and then fully developed in other ceramic productions in MH III, the Aeginetan production included. For instance, a MH IIIB Aeginetan MP micaceous goblet uncovered in Asine,[73] with a capacity of c. 2.5 litres and a more rounded shape, has little in common with the MH II Aeginetan MP pedestalled carinated bowls/goblets from Kolonna.

Inasmuch as the capacities of the largest goblets can be up to six times larger than the smallest, the question arises of whether a goblet with a capacity larger than three litres was too large to be regarded as an individual drinking vessel. Were the drinks held in these goblets shared, and how? Could the Lianokladhi goblet from Pefkakia,[74] with a capacity of 3.72 litres, have been used for a purpose other than drinking? Why does a Lianokladhi goblet from Mitrou (rim diam. 29 cm)[75] have an enormous capacity, possibly reaching six litres? While there is no reason to doubt that the Pteleon goblets served as drinking vessels, the large capacities of some Lianokladhi goblets introduce the idea that they may have been used for mixing beverages. Before considering this option, it is worth comparing the capacities of the goblets with those of other pottery shapes such as the kantharoi and cups.

3.3. A Comparison with MH – LH I Kantharoi and Cups

Kantharoi and cups are typical drinking vessels used in the MH period, produced in burnished and MP wares. In contrast to the MH goblets, which mostly have two small and

65 Mylonas 1972–1973, 85 and Pl. 214/Δ-69.
66 Dietz 1991, 202–203, BB-2 (Δ-69); 205, CB-2 (Ξ-173), which is, however, identified as Dark Burnished Ware.
67 Sarri 2010, Pl. 26/2.
68 Sarri 2010, Pl. 15/1. – Gauss, Lindblom 2017, Fig. 1/8 (shape 62B, No. 2).
69 Eleusis: Cosmopoulos 2014a, II, Fig. 12/326. – Krisa: Phialon 2018, Fig. 16, Inv. 6150 (courtesy E. Velli). – Pefkakia: Maran 1992a, Pl. 69/1. – Parallels in Mitrou MH phase 7: Hale 2016, 263 and Tab. 2; 286–287 and Fig. 15/36. – The rim of the Krisa goblet Inv. 6150 is, however, everted and slightly thickened, and not hollowed. – For a Pteleon goblet with a smaller capacity, see Cosmopoulos 2014a, II, Fig. 12/310.
70 Nordquist 1987, Fig. 45/1–2.
71 Sarri 2010, Pl. 28/4.
72 Kiapha Thiti: Maran 1992b, Pls. 22/689, 31/958. – Tsoungiza: Rutter 2015, E49, capacities courtesy of J. Rutter and B. Lis.
73 Nordquist 1987, Fig. 53/10.
74 Maran 1992a, Pl. 69/1. – Gauss, Lindblom 2017, Fig. 1/8 (shape 62B, No. 3).
75 Hale 2016, 286–287 and Fig. 15/36.

narrow vertical handles, MH kantharoi are characterized by two high vertical handles[76] and, generally, by a flat base. However, in some rare cases, LH I kantharoi are also stemmed, as illustrated by an example from the settlement of Tsoungiza.[77] The LH I shape repertoire in Tsoungiza also includes a plain stemmed cup,[78] a shape clearly distinct from contemporary goblets.

Among the best preserved kantharoi found in settlement contexts, the largest examples, in medium coarse (Tsoungiza) and Black Burnished Ware (Kolonna), reach 19.5 and c. 19.7 cm in diameter,[79] for a respective capacity of c. 1.91 and c. 3.91 litres. These capacities are unusually large for kantharoi, and closer to those of some large aforementioned goblets as well as to those of some bowls/basins, two-handled bowls or bowls with horizontal handles potentially used as serving vessels (from 3 to 4.8 litres) from Kolonna and other settlements.[80] Kantharoi of medium size, ranging from 8.5 to 16 cm in diameter, with a capacity that usually does not exceed one litre,[81] are mostly smaller than MH goblets. Moreover, many kantharoi of miniature size, produced in various wares, with a rim no larger than 8.5 cm and a height of 4.5 cm, are characterized by a very low capacity of 0.02–0.13 litres. Kantharoi were likely used for drinking, except perhaps in the case of the largest example from Kolonna. The hypothesis that kantharoi may have been filled with beverages from goblets rather than from jugs should be tested through a contextual analysis.

Some drinking vessels are not sufficiently preserved for us to know if they had one or two high vertical handles. If these vases had only one high vertical handle, and thus were possibly used for drinking and dipping, they would be assigned to the large variety of cups (e.g., carinated, rounded, straight-sided or Vapheio, and panelled cups).[82] One of the largest, best-preserved MH cups is a MH I Late DB carinated and high-swung handled cup from Ayios Stephanos (Laconia), with a rim diameter of c. 16 cm and a capacity of 1.1 litres,[83] as well as a MH III Lustrous decorated rounded cup which may have held up to c. 1.4 litres.[84] However, regardless of ware type (Minyan and burnished, MP, plain, medium coarse) and form, cups usually have a capacity much smaller than one litre, mostly falling between 0.1 and 0.5 litres. The smallest cups (miniature vases) have a diameter of 4 cm for a capacity of 0.03–0.04 litres.[85] Therefore, a majority of the MH – LH I cups are smaller in capacity than the goblets from these periods, which have capacities equal to or larger than 0.5 litres, aside from the group of the Aeginetan MP *Knickrandschalen*. Here again, cups may technically have been filled with beverages held in large goblets, but only a closer examination of the contexts may be able to shed light on the practical use of the latter.

4. Goblets in MH II – LH I Contexts

4.1. Kolonna on Aegina

The fortified and densely occupied Bronze Age settlement of Kolonna on Aegina provided many pottery deposits. MH contexts are described in pottery groups, which are assigned to successive occupation levels.[86] By contrast, Mycenaean pottery comes either from the LH settlement excavated below the later sanctuary of Apollo or from the cemeteries located on a hill, northeast of the sanctuary.[87] Therefore, I will concentrate on the MH corpus.[88]

The MH shape range of tableware comprises bowls of various types, including spouted bowls, and cups, as well as kantharoi and goblets.[89] I assumed above that four MP carinated bowls with reconstructed stems/pedestals (*Knickrandschalen*) were more likely used as drinking vessels with low capacities (from 0.24 to 0.49 litres) because of their

76 On MP kantharoi and kyathoi/cups of similar body shape from Aegina: Siedentopf 1991, Pl. 114.

77 E80, see Rutter in press, also possibly regarded as a Mycenaean lustrous painted goblet. – For a burnished DT stemmed kantharos from a burial in Asine, see Nordquist 1987, Fig. 56/4.

78 See Rutter 2015, 214–215 and Fig. 3/E5.

79 Tsoungiza: Rutter 1990, 395 and Fig. 12.55/A, with a height of 16 cm up to the rim. – Kolonna (Aegina): Walter, Felten 1981, 127 and Fig. 117 (No. 390, Inv. 409).

80 Kolonna (Aegina), MP bowl/basin: Gauss, Smetana 2007, Fig. 7 (2/01-2). – Asine, GM rounded bowl, AM bowl/basin: Nordquist 1987, Figs. 40 (As 2388), 44 (As 5297). – Orchomenos, GM two-handled bowls: Sarri 2010, Pl. 1/1, 11. – Pefkakia, bowls with horizontal handles: Maran 1992a, Pls. 48/1, 138/1–2.

81 Larger kantharoi from Pefkakia: Maran 1992a, Pl. 55/15 (1.57 litres). – Also from Kolonna (Aegina): Walter, Felten 1981, Fig. 116 (No. 389, Inv. 406; c. 1.1 litres).

82 Gauss, Lindblom 2017, 9–10.

83 Zerner 2008, 231 and Fig. 5.14/1237. – See also cups with a diameter of c. 14 cm: Kolonna (Aegina): Siedentopf 1991, Nos. 595, 626 (Inv. 2895, 2926). – Argos: Philippa-Touchais 2002, 23 and Fig. 21/57 (calculated on the basis of a 1:5 scale).

84 Zerner 1988, Fig. 27/ 2. – Capacity calculated with a scale obtained by using cross-multiplication, on the basis of the rim diameter.

85 Asine: Nordquist 1987, Fig. 38/6 (As 2119). – Tsoungiza: Rutter 1990, 397 and Fig. 13/67.

86 *Fundgruppen*, see Walter, Felten 1981, 140–141. – On renamed groups and re-dated occupation levels: Gauss, Smetana 2007, 59 and Fig. B. – Gauss, Kiriatzi 2011, 382 and Fig. 4.

87 Hiller 1975, 9–10.

88 See below. – On LH IIIA2 and LH IIIB kraters without context: Hiller 1975, Pls. 36/360–361, 37/362–364, 38/365, and possibly Pl. 36/357–359 (LH IIIA1–IIIA2 fragments).

89 Kolonna VII to X: Walter, Felten 1981, 123–138, 145–147. – Siedentopf 1991.

everted rims,[90] and thus may be regarded as goblets, in contrast to MP stemmed bowls with incurved rims that were probably serving vessels. However, the lack of information about their context does not allow us to confirm that these bowls/goblets complemented each other in the same set of drinking vessels.

In 'Alt-Ägina III,1', five GM or grey-brown burnished pedestalled goblets (three Pteleon, two Lianokladhi, most likely imported wares from central Greece) and a red burnished goblet (Cycladic import) are considered to be stemmed kraters and one, a stemmed bowl.[91] Five of these goblets (three Pteleon, one Lianokladhi, and the Cycladic one) belong to Group XXXV, which was found on a house floor on the south slope of the settlement (Kolonna IX).[92] This group also includes a pithos, an amphora, a jug, a cup and a kantharos. The capacities of four of these goblets have been calculated (Pteleon: 0.95 and 1.08 litres; Lianokladhi: 3.01 litres; Cycladic: 0.58 litres). The Lianokladhi goblet was large enough to have held beverages which were then distributed into some of the smaller drinking vessels, but its content would not have been sufficient for filling all of them. Thus, the idea that this goblet was used as a drinking vessel shared among two or three prominent participants is a plausible option.

It must be stressed that the largest pottery group of the MH settlement, i.e. Group XXVII (Kolonna VII–VIII), includes 40 pots of various shapes (e.g. pithos, amphora, jugs, as well as ten kantharoi and eight bowls of MP and burnished types), but no pedestalled goblets.[93] Three of the kantharoi may have contained between 0.84 and 3.91 litres.[94] Capacities of more than three litres are very large for kantharoi.[95] One can wonder whether these vases were used as individual drinking vessels, and not as serving ones. In comparison, four kantharoi, also in a well-preserved state but smaller in capacity (from c. 0.21 to 0.27 litres) and size, were found in the niche closed in the wall of another house (Kolonna VIII).[96]

4.2. Orchomenos (Boeotia)

Most pottery finds from the Bronze Age settlement of Orchomenos cannot be associated with structures, despite the large corpus of pottery published and the well-preserved pots. This issue concerns all of the Mycenaean pottery.[97] However, one of the three GM pedestalled goblets found in House K 101–102 and another pedestalled goblet from the same assemblage have been identified in the MH corpus by Kalliope Sarri.[98] The profiles of both goblets (of Lianokladhi and Pteleon type respectively) were preserved so that we were able to calculate their respective capacities (2.8 litres and c. 0.7 litres, after using cross-multiplication). Two further pedestalled goblets may have held more than three litres,[99] but their contexts remain unknown, as is the case for kantharoi with a rather low capacity (less than one litre) and two-handled bowls of various capacities. Kraters are also well represented in the MH pottery corpus, but complete profiles are missing,[100] and their contexts also remain unknown. Kraters were used in quantity in LH I, since the corpus comprises many rim fragments of MP bichrome type, ranging in diameter from 22 to c. 40 cm. The LH I bichrome exemplar, with a rim diameter of c. 40 cm and a reconstructed profile, may have held c. 19.14 litres,[101] which puts beyond any doubt that drinks held in this vase were distributed to many participants on special occasions, but no coherent drinking sets can be reconstructed.

4.3. Pefkakia (Thessaly)

In the MH settlement of Pefkakia, jars and amphorae as well as various drinking vessels – among others – were discovered in House 311B.[102] The best-preserved pedestalled goblet

90 Siedentopf 1991, Pl. 89/500–503 (unknown context).

91 Walter, Felten 1981, 175 and Nos. 437–441 (*kleiner vs. großer Krater auf hohem Ständerfuß*), 435 (*Schale auf hohem Ständerfuß*). – On vessels Nos. 437, 438, 440 (termed as 'footed goblets'): Gauss, Smetana 2007, 63 and Figs. 6/XXXV-4, XXXV-5; 7/XXXV-7.

92 Walter, Felten 1981, 133, 147, 175 and Nos. 435, 437, 438, 439, 440. – There are, however, no other certain architectural remains related to this floor.

93 This pottery assemblage was found in the filling layer of a house, i.e. 'Haus +12.68', at the end of the *Südtorgasse*: Walter, Felten 1981, 123, 146.

94 Walter, Felten 1981, Nos. 378, 389–391. – For No. 378, see Siedentopf 1991, No. 715; according to its narrow flat base, the bowl No. 387 with a capacity of 3.74 litres would not have contained liquid; the question remains open for the bowl No. 391 with a capacity of 1.83 litres.

95 For another large kantharos (3.93 litres), see Siedentopf 1991, No. 726.

96 Walter, Felten 1981, 130, 146 and Cat. Nos. 409–412. – Siedentopf 1991, Cat. Nos. 653–656; 0.28 litres for Nos. 653, 655, if we assume that the heights indicated by the author for these vases include their handles. – Gauss, Smetana 2007, 62 and Fig. 3/XXIX-1–4. – For two other kantharoi Nos. 724, 725, see Siedentopf 1991, 103 and Pl. 112.

97 Mountjoy 1983.

98 This is the *Verbranntes Haus* of the Yellow layer: Sarri 2010, 40 and Pls. 15/5, 26/2 (*korbhenklige Fußschale*).

99 Sarri 2010, Pls. 15/1, 28/4. – Gauss, Lindblom 2017, Fig. 1/8 (shape 62B, No. 2).

100 Sarri 2010, Pls. 39–43.

101 Sarri 2010, Pl. 39/7.

102 Maran 1992a, 24–25.

from the settlement, of Lianokladhi type, comes from this storeroom for vessels.[103] It might have held up to 3.7 litres. This house also yielded fragments of other pedestalled goblets, fragments of bowls, kantharoi and a cup, as well as a juglet and fragments of closed vessels. On the other hand, several kantharoi, with a well-preserved profile, as well as some cups, were found in different MH houses and pits dated from MH to MH – LH I.[104] These drinking vessels, mainly in GM, were not concentrated in a particular room of the settlement, but their regular distribution denotes a regular household use, accompanied by two-handled bowls of various sizes and capacities. The large Lianokladhi goblet from House 311B may have held drinks distributed in kantharoi, but several pedestalled goblets, including this one, were most likely used for drinking on the same occasion.

4.4. Asine (Argolid), Part 1

At Asine, the houses of the Bronze Age settlement yielded significant sets of drinking vessels and tableware. The most important MH pottery assemblages belong to Group D,[105] which includes pedestalled goblets (i.e., stemmed bowls), kantharoi and cups in various pottery classes such as YM, MP, DB Wares. Pottery of this group comes from houses excavated on the Barbouna Slope (Buildings 1 and 2) and in the Lower Town (especially Houses B and D), i.e., the most important houses of the MH village.

It has been stressed that "in both houses [i.e., Buildings 1 and 2] drinking and pouring vessels were found in pairs, but not necessarily in the same fabric".[106] Building 1 provided two pairs of pedestalled goblets (c. 1.9 and c. 3 litres),[107] while Building 2 contained ten pedestalled goblets including three pairs, as well as five kantharoi including two pairs.[108] The capacity of the pedestalled goblets in Building 2 is, on average, a bit smaller (from c. 1.2 to c. 2.3 litres) than that of the goblets from Building 1. On the other hand, some kantharoi are quite large: one of them may have contained up to c. 1.2 litres, and two others c. 0.9 litres.[109] This pottery assemblage is all the more important as it constitutes a coherent set of drinking vessels in a good state of preservation. It also comprises a dipper and a miniature kantharos.[110] Both buildings were occupied in the MH III period, in two successive phases.[111]

In addition, in House B, in the Lower Town, the pottery which had fallen from the upper floor also includes two pairs of vessels, i.e., two pedestalled goblets with a maximum capacity slightly larger than four litres,[112] dated to MH III, and two jugs with a cut-away neck.[113] According to Gullög Nordquist, preserved goblets from Asine can mostly be divided into three capacity groups ranging from 0.85 litres to c. 2 litres,[114] but some goblets have a capacity larger than two litres. By contrast, a pedestalled goblet, which may be associated with either House D or House E in the Lower Town,[115] contained 0.97 litres.

One may wonder whether the goblets were used by a single person in the MH III period. This may be true for

103 Maran 1992a, Pl. 69/1. – Gauss, Lindblom 2017, Fig. 1/8 (shape 62B, No. 3). – I thank J. Maran for drawing my attention to the diversity and quantity of vessels stored in this building; moreover, liquids were stored there in large containers, probably wine and/or oil, which were transferred to smaller vessels (hence the several funnels from this room).

104 E.g. a kantharos (*Tasse*) in House 310B (phase 6 late): Maran 1992a, 30–31 and Pl. 108/4. – A conical shallow cup (*napfartiges Gefäß*) and bowls in House 2, *H-i V-Fläche*: Maran 1992a, 51–52 and Pls. 129/16, 129/17, 130/1. – For further bowls and kantharoi: House 314 (phase 4): Maran 1992a, Pls. 37/1, 38/14, 16; 41/6, 42/9. – House 311A (phase 4): Maran 1992a, Pl. 44/8. – House 310A1 (phase 5), House 310A2 (phase 6 middle), House 310B (phase 6 late): Maran 1992a, Pls. 46/16, 47/1, 48/1, 83/15, 84/1, 2; 85/4, 108/7. – House 316B (phase 5): Maran 1992a, Pl. 52/9. – House 319A (phase 5): Maran 1992a, Pl. 55/3, 8, 15. – Pit 411 (phase 5) and Pit 411/421 (phase 6 middle): Maran 1992a, Pls. 58/6, 98/4, 16; 104/8. – Find C (phase 6 early): Maran 1992a, Pls. 64/10, 65/2. – House 313A (phase 6 middle): Maran 1992a, Pls. 90/9, 11; 91/6. – House 315 (phase 6 middle): Maran 1992a, Pls. 93/9, 94/11, 95/7. – Pit 413 (phase 6 middle): Maran 1992a, Pl. 104/8. – Outside house (phase 6 middle–late): Maran 1992a, Pl. 113/14. – Pit 407 (phase 7): Maran 1992a, Pl. 119/1. – Various (phase 7): Maran 1992a, Pls. 120/16, 121/5, 13. – For goblets from early Mycenaean graves, see Batziou-Efstathiou 2015, 73.

105 Nordquist 1987, 52 and Figs. 45–55. – The author classifies the pottery into six main groups (A–F).

106 Nordquist 1987, 53. – Nordquist 1998. – Nordquist 2002.

107 Nordquist 1987, 52–53 and Figs. 49/2–3 (YM – burnished red fabric), 50/6–7 (both MP and DT).

108 Building 2 contained at least 20 vessels: Nordquist 1987, 52–53 and Figs. 51/1–3, 52/4–5, 53/8–10 (pedestals not preserved), 54/16–17 (pair of goblets), 52/6–7 (pair of kantharoi), 54/13–15 (pair of kantharoi), 52/12 (mini kantharos). – Nordquist 1999, 569. – Nordquist 2002, 130 (three pairs of goblets). – With regard to Nordquist 1987, Fig. 51/2, see Gauss, Lindblom 2017, Fig. 1/8 (shape 61B, No. 1).

109 See Nordquist 1987, Fig. 54/13 (MP type) and Figs. 52/6, 54/15.

110 Nordquist 1987, 52 and Fig. 53/11–12.

111 Rutter in press.

112 On two goblets from Building B: Nordquist 1987, Fig. 45/1–2. – Vessels capacities from Asine are calculated with a scale obtained by using cross-multiplication on the basis of the rim diameter indicated on the vessel drawings in Nordquist 1987.

113 Nordquist 1987, 52 and Fig. 45/1–2, goblets of YM type and DT fabric.

114 Nordquist 2002, 131: "small shape with a capacity of 0.85 to ca. 1.4 litres, while medium-sized goblets can contain between 1.5 and 1.8 litres and a large group holds around 2 litres."

115 Nordquist 1987, 52 and Fig. 47/2. – Gauss, Lindblom 2017, Fig. 1/8 (shape 61B, No. 2).

the goblets with capacities of c. 1–2 litres, undetermined for those with a capacity falling between c. 2 and c. 2.5 litres, and challenged for the two largest ones with capacities slightly larger than four litres. The drinks held in the largest goblets may have been distributed into the smallest kantharoi and the smallest cups, as proposed by Nordquist.[116] However, the drinking set from Building 2 also includes a kantharos (1.22 litres) with a capacity as large as a low pedestalled goblet (1.18 litres). I would support the hypothesis that the large goblets were circulated between the key participants. Finally, the limited number of drinking vessels suggests a number of participants on each occasion not exceeding 20.

4.5. Tsoungiza (Corinthia), Part 1

Tsoungiza was a settlement well occupied in the MH and LH periods. Late MH fragments uncovered in dumps (EU2, EU6),[117] including goblets varying in size,[118] may have been part of tableware sets constituted by goblets, kantharoi, angular cups and dippers,[119] but this discarded material does not provide new information on how these vases may have functioned together. By contrast, drinking vessels and tableware with a complete profile (part of Group E) come from a floor deposit in the burnt destruction horizon of the West Building in EU7,[120] which is assigned to the earlier LH I phase of the settlement. Other vessels of Group E were found in the East Building and dated to the later LH I phase.[121] Goblets, kantharoi and cups of various sizes and capacities, associated with a krater and two dippers in the West Building, constitute consistent tableware sets. Goblets and kantharoi were mostly found in Room 1 of this building, but both shapes also occurred in the pottery assemblage of Room 4, where a rather small krater (E51: 5.36 litres) and other small drinking vessels have also been found. One of the goblets from Room 4 is quite large (E49: 2.64 litres). This goblet may have received beverages from the krater, which is almost exactly twice the size of the goblet in volume, but this would mean that only half of its content would have remained for the other drinking vessels. Another option is that the drinks were poured from jugs directly into this goblet. The final publication of the excavation may help us to assess better how these vases complemented each other.

4.6. Some Additional MH – LH I Assemblages in the Argolid (Lerna, Argos), Laconia (Ayios Stephanos), Messenia (Nichoria), Attica (Kiapha Thiti, Eleusis) and Central Greece (Eutresis, Kirrha, Krisa, Mitrou)

Significant assemblages of drinking vessels and tableware from other MH settlements deserve special attention either because they include vases that are sufficiently well preserved for calculating their capacities (Nichoria, Krisa, Eleusis, Kiapha Thiti) or because they constitute parts of abundant material uncovered in important regional settlements (Lerna, Argos, Mitrou). In one case (Eutresis), goblets were found in a deposit that provides relevant information. However, the review of these assemblages raises more questions than answers.

The MH and LH I pottery from **Lerna** in the Argolid belongs to various ceramic wares,[122] but cannot be related to specific deposits within a building. It includes some vessels with complete profiles, such as two MH I bowls with incurved rims and a LH I goblet of red slipped and burnished class, as well as a MH I stemmed bowl with inturned rim, a MH II spouted deep bowl/jar and a MH III(/LH I) bichrome bowl, of Aeginetan MP class.[123] The small LH I low-stemmed goblet (c. 0.3 litres) was certainly used for drinking, whereas the Aeginetan MH I stemmed bowl with inturned rim (c. 6.45 litres) may have been used for serving food or mixing beverages, as seen above, but they certainly would not have functioned together because of their dates. Were the drinking sets composed of vessels belonging to various ceramic classes? In the case of Lustrous decorated pottery, the numerous small drinking vessels and tableware shapes may have constituted independent sets in MH I and possibly in MH II–III.[124]

In **Argos**, three of the five occupation levels (phases II to IV) excavated in the southeast sector on the Aspis range

116 Nordquist 2002, 131. – On the cup/dipper and smallest kantharos from Building 2: Nordquist 1987, Fig. 53/11–12. – These vases have respective capacities of 0.14 and 0.1 litres.

117 Rutter 1990, 376. – These dumps were not associated with substantial architecture or floor deposits.

118 On MH III Tsoungiza goblets, see Rutter 2015, 215: "rim diameters ranging between 0.19 and 0.35 m".

119 For fragments of goblets (pedestalled, MP or unpainted burnished), see Rutter 1990, 423–431 and Figs. 7–10. – Most likely, some of them had a capacity larger than three litres, if we consider their diameter (c. 25–28 cm) and the heights of water originally reaching c. 13–15 cm. – Except for a deep kantharos ([A]55: 1.9 litres), the other MH III drinking vessels have smaller capacities (ranging from 0.04 to 0.41 litres).

120 Rutter 2015, 209, 214 and Fig. 3. – See also Rutter 1989, 1–2. – Wright 1982, 387.

121 Rutter in press, Tab. 9.12 (M. K. Dabney, J. C. Wright, personal communication). – I warmly thank J. Rutter for sharing data about Tsoungiza pottery, including tables with capacities of vessels (courtesy of B. Lis).

122 Zerner 1986. – On LH I funerary assemblages: Lindblom 2007. – On LH IIIA2 and IIIB Lerna: Wiencke 1998.

123 Zerner 1988, 1 and Figs. 1/5–6, 3/18; 2 and Figs. 6/16, 7/20, 8/21.

124 Lustrous Decorated Ware also includes jars and jugs of gritty or coarse fabric: Zerner 1988, 6–10 and Figs. 24–41.

in date from MH to LH I.[125] Although the architectural remains in this sector include an apsidal house covered by rectangular buildings, there is no deposit clearly related to any of these buildings. Pottery is mostly fragmentary, but some MH MP vessels have complete profiles.[126] Here, too, the question is whether the large stemmed bowls of micaceous fabric contained alcoholic beverages rather than other liquid or solid food,[127] especially that of c. 21 litres. The contents, if it was drink, could have been distributed to kantharoi of standard size, miniature kantharoi, cups,[128] and possibly goblets. The MP goblets are fragmentary, but vary in size, with rim diameters mostly falling between 20 and 30 cm.[129]

Regarding **Ayios Stephanos** in Laconia, which was a well-occupied settlement in MH – LH I,[130] it must be stressed that the material of the MH occupation levels is very fragmentary[131] and that several complete drinking vessels of MP, DB and coarse wares were found in burial contexts ranging from MH to LH IIA.[132] Two floor deposits include drinking vessels but no well-preserved goblets: the first deposit (three cups, five closed vessels and other material) was found in the storeroom of the MH I Late apsidal house in Area Nu/Gamma 1,[133] whereas the second (two bowls and a fragmentary cup) corresponds to a MH II floor deposit in Area Beta.[134] It seems that MH pedestalled goblets with ribbed stems were not used at Ayios Stephanos. Nevertheless, two kantharoi and a conical cup were uncovered in two adjacent MH III/LH I rooms,[135] while four other vases (two kantharoi, a bowl and a base) come from the foundation trench of another wall in Area Nu/Gamma 1.[136] Despite the presence of Mycenaean decorated pottery assigned to LH I, it is not possible to reconstitute coherent sets of drinking vessels that can be exclusively dated to this phase.[137] In addition, most YM and MP drinking vessels (goblets and others) are dated to LH I/IIA or LH IIA and thus cannot be exclusively assigned to LH I,[138] except for rare cases such as a LH I floor deposit that produced a gritty YM carinated cup in Area Lambda.[139]

The Bronze Age settlement of **Nichoria** in Messenia yielded a large amount of pottery ranging in date from MH to LH IIIA1.[140] MH I pottery is associated with Building Unit V-1, nearby pits and other structures such as melting hearths,[141] but it is not related to a specific floor deposit. Vessels with a complete profile are mostly assigned to MH II (bowls and cups of plain or coarse ware). MH III pottery probably overlaps chronologically with the beginning of the LH I phase, since it includes bichrome and polychrome wares in addition to Minyan, plain, MP, lustrous painted and coarse wares. The goblet is the most popular plain shape

125 Philippa-Touchais 2002, 3. – On LH I pottery, see, for instance, the semi-ovoid cup (i.e., panelled cup) in Philippa-Touchais 2002, 23–24 and Figs. 21/67–70, 22, with parallels in Dietz 1991, 94–95 (No. 256) and Fig. 27; 161–163 (AB-15/16).

126 Philippa-Touchais 2002, 4 and n. 5. – On the shape range, i.e., the bowl (*jattes*), kantharos, goblet (*coupe*) and cup, as well as jar and jug: Philippa-Touchais 2002, 5–6. – On further pottery coming from the settlement: Touchais 1998 (pictures but no drawings) and Touchais 2013 (drawings of pottery fragments).

127 The rim diameters of the basins do not exceed 45 cm, the largest ones fall between 35 and 45 cm, the medium/standard ones between 25 and 35 cm, the small ones between 20 and 25 cm: Philippa-Touchais 2002, 6 and n. 15. – For the stemmed basin: Philippa-Touchais 2002, 7–8 and Figs. 1, 3/5.

128 The rim diameters of the kantharoi mostly fall between 13 and 20 cm, those of the miniature kantharoi between 7 and 10 cm, those of the cups between 8 and 18 cm: Philippa-Touchais 2002, 11–12 and n. 41, 49; 16 and n. 60; 21–23 and n. 88, 90, 100. – For examples with complete profiles, see Philippa-Touchais 2002, Figs. 7/21, 9/36, 13/40–42, 21/56–58.

129 Philippa-Touchais 2002, 18. – On some larger examples, with a 1:5 scale: Philippa-Touchais 2002, Fig. 16/43 (rim diam. 31 cm), 51 (rim diam. 37.75 cm).

130 Taylour, Janko 2008, 566–578. – On traces of metal smelting and working in the MH III/LH I period: Taylour, Janko 2008, 102. – On the MH I Late apsidal house (Area Nu/Gamma 1): Taylour, Janko 2008, 112–119.

131 E.g., the MH II pottery from Area Nu/Gamma 1: Taylour, Janko 2008, 112.

132 E.g., vases (1321, 1482, 2212, 2221, 2290, 2313, 2314): Zerner 2008. – On Bronze Age burials: Taylour, Janko 2008, 121–144. – LH I Mycenaean decorated drinking vessels with complete profiles (Vapheio cup and miniature cup) are also associated with burials: Mountjoy 2008, 370–371 and Fig. 6.36/3653, 3659. – For the most recent burial dates to LH IIIA2, see Taylour, Janko 2008, 132. – For LH IIB Mycenaean goblets with complete profiles found in burial contexts, see Mountjoy 2008, 330–331 and Fig. 6.18/3291; and possibly 367–368 and Fig. 6.35/3647.

133 Taylour, Janko 2008, 117. – These are the kantharos 1830, the cup 1889 and the kantharos 1831.

134 Taylour, Janko 2008, 58. – The bowl 1343 has a capacity of c. one litre. – In addition, a MH I carinated cup (1237; c. 1.1 litre) was found in destruction debris in Area Eta: Taylour, Janko 2008, 35.

135 Taylour, Janko 2008, 105. – These three vases have a complete profile (kantharoi R297 and R514, cup R488): Rutter, Rutter 1976, 38–39 and Ill. 11/297; 42, 45 and Ill. 13/514.

136 Taylour, Janko 2008, 107. – The kantharos R246 (Rutter, Rutter 1976, 36–37 and Ill. 10/246) has a capacity of 0.46 litres.

137 A LH I Vapheio cup (3240) was found together with various small finds in a LH IIA fill, but did not constitute a drinking set: Taylour, Janko 2008, 51.

138 E.g., in Area Lambda 1973–77: Zerner 2008, 251–257 and Figs. 5.26/1535–1574, 5.27/1579–1604, 5.28/1607–1619, 5.29/1620–1672.

139 Area Lambda 3/4, 1977: Taylour, Janko 2008, 91. – Mountjoy 2008, 347 and Fig. 6.25/3401.

140 McDonald, Wilkie 1992, with contributions of different authors.

141 Howell 1992, 21–23, 26–27, 50. – MH I pottery is assigned to three different groups (A–C). Group C includes various ware types (e.g., Minyan, plain, painted, coarse).

in LH I and LH II, more so than the conical cups,[142] but only one LH I goblet was complete enough to calculate its capacity (P3193: 1.11 litres).

In Attica, the settlement of **Kiapha Thiti** yielded numerous fragments of drinking vessels dated from MH III to LH IIIA1, some of them imported from Aegina, but few examples with complete profiles. An almost complete preserved goblet and fragments of four other goblets were uncovered with pithos fragments and vessels of various shapes in Trench 101, i.e., behind the gate of the fortification wall, dated to LH I,[143] while a MH III goblet was uncovered with a pithos and various vessels in Trench 154, which revealed a white floor.[144] Both well-preserved goblets, of two different dark fabrics, may have held more than two litres. On the other hand, three smaller goblets from this settlement (capacities falling between c. 0.25 and c. 1.2 litres) are of light fabric.[145] Krater fragments were also uncovered in Kiapha Thiti, but most of these were found in the uppermost filling layers of the settlement.[146] Thus it is difficult to reconstitute coherent tableware sets that would comprise kraters and drinking vessels of various ceramic classes.

The same goes for the assemblages found at **Eleusis**. Among the large quantity of Bronze Age pottery from the acropolis, drinking vessels dated from a phase falling between MH II–III and LH IIIA1 were generally found in pyres, under pyres, in houses – in some cases associated with floors – and in graves. Pottery dated to different phases can be found in the same stratigraphic units (SU).[147] However, drinking vessels with complete preserved profiles were uncovered only in a limited number of SUs.[148] The context of MH II–III fragmentary pedestalled goblets termed as angular bowls by Michael B. Cosmopoulos remains unknown,[149] as is the context of three possible fragments of MH III/LH IA kraters.[150] Consequently, we will only note that the largest drinking vessels are the MH goblets (c. 2.27 to 3.13 litres) as well as a LH IIB Mycenaean Ephyraean goblet (c. 2.17 litres),[151] followed by three other goblets (a LH IB burnished, a MH Pteleon, and a LH IIB Mycenaean one), LH I–II cups, and MH kantharoi of smaller capacities.[152] Another issue is the interpretation of the LH II–III deposits found in the area of the 'Megaron B' (see below).

In central Greece, some drinking vessels are associated with specific buildings. At **Eutresis** in Boeotia, "a very large number of Minyan high-stemmed goblets in a fragmentary condition" were uncovered in House C.[153] Three of these goblets, of Lianokladhi type, have been drawn, but their dimensions are not indicated. If the largest goblet was used as a krater, we would expect an association with several small vessels rather than other goblets.

Several so-called goblets from **Kirrha** in Phocis, published in 1960, are kantharoi or cups.[154] Some of them, mostly of coarse fabric, were uncovered in Rooms f and d (MH Ib

142 Dickinson, Martin, Shelmerdine 1992, 478, 486: LH I: 66 % vs. 6 %, LH II: 40–80 % vs. 5–10 %. – It is questionable whether the conical cups can be interpreted as hints of Minoan influence in the early LH period, already initiated in MH, as suggested by a possible import, a small lustrous painted cup (P2579). – On MM influence on the mainland: Howell 1992, 79.

143 Maran 1992b, 80 and Pl. 22/689.

144 SE 2: Maran 1992b, 108 and Pl. 31/958.

145 Maran 1992b, Pls. 28/866, 31/948 (two MH III or LH I light red to yellow burnished goblets), 1/23 (a LH IIA Mycenaean goblet).

146 Maran 1992b, 182–183, 193. – However, Nos. 444–445 were possibly found in a layer with cooking pots and tableware: Maran 1992b, 52–53. – No. 491 was possibly found in a layer with several drinking vessels: Maran 1992b, 60. – LH I and LH II krater fragments from Kiapha Thiti, as well as the first LH I goblet mentioned above, are attributed to Aeginetan micaceous productions.

147 For instance, pyre 56, with pottery ranging in date from LH I to LH IIIA1/IIIA2, see Cosmopoulos 2014a, I, 20–21.

148 Associated with houses: a LH IIA Vapheio cup on the floor of House I: Cosmopoulos 2014a, I, 34–35 (No. 823). – On an EH III – MH I coarse one-handled cup associated with House B: Cosmopoulos 2014a, I, 34 (No. 28). – On a GM goblet and a fairly coarse cup attributed to a MH III deposit found in House G, S SU 25, locus 2: Cosmopoulos 2014a, I, 35 (Nos. 310, 504). – Associated with pyres: a LH IIA Vapheio cup, LH I semi-globular cups and MP cup, S SU 14: Cosmopoulos 2014a, I, 20–21 (Nos. 694, 824), 22 (No. 695), 23 (No. 695). – On a LH I polished complete goblet in pyre 56, illustrated but not drawn: Cosmopoulos 2014a, I, 16; II, 95 and Pl. 52 (No. 684).

149 Cosmopoulos 2014a, II, Figs. 12–16 (Nos. 326–385), Figs. 18–20 (Nos. 433–462). – On a MH/LH I goblet: Cosmopoulos 2014a, II, 58–59 (No. 414) and Pl. 33.

150 Cosmopoulos 2014a, II, 69 (Nos. 491–493) and Fig. 22. – On a deep bowl with a horizontal strap handle: Cosmopoulos 2014a, II, 69 (No. 490).

151 These are angular bowls: Cosmopoulos 2014a, II, Figs. 12/326, 18/433. – For the Ephyraean goblet, see Cosmopoulos 2014a, II, Fig. 37/900.

152 Capacities calculated for cups vary greatly according to the dimension selected (i.e., rim diam. or vessel h.) for setting the scale. – Kantharoi are also named 'cups' with two high vertical strap handles, see for instance Cosmopoulos 2014a, II, 43–44 and Fig. 12/295–298. – On a large semi-globular cup: Cosmopoulos 2014a, II, Fig. 25/604.

153 This house was nicknamed 'House of the Tippler' by the excavators: Goldman 1931, 36. – For the goblets, see Goldman 1931, 135 and Fig. 185/3–5. – House C at Eutresis is assigned to the first MH level, corresponding to an advanced phase of the MH period: Maran 1992a, 370 and Fig. 25.

154 Dor et al. 1960, Pls. XXXV, XXXIX.

level), and in Room B (MH IIIA level).[155] To date there is a lack of pottery drawings coming from this settlement, but studies of pottery are ongoing. Nevertheless, drinking vessels were most often found either in the trenches opened in the settlement[156] or from graves and their immediate proximity, dated to MH III and LH I–II. Kraters must also be related to grave contexts.[157]

By contrast, drinking vessel assemblages have been discovered in buildings of the neighbouring settlement at **Krisa**. A GM Lianokladhi goblet (Inv. 6150), dated to MH II–III, comes from Building A, and may have held a maximum of 3.18 litres,[158] whereas another deposit in Building D, assigned to the LH I phase, includes a large and a small kantharos, a ring-handled cup, and a dipper.[159] However, there is no association between goblets and other drinking vessels in the MH – LH I contexts, unlike later, in a LH IIIA1 building of this site.

At **Mitrou** in ancient East Lokris (Phthiotis), the GM drinking vessels and bowls illustrating the typological and chronological sequences all come from settlement contexts ranging in date from MH I to MH III.[160] Pottery was found, for instance, on top of the second floor of Building K in MH phase 3, from the fills of pits in MH phase 4, an earthen surface and white plaster dated to MH phase 5, and pits filled during MH phases 6 and 7. However, these vessels are fragmentary. One of the best-preserved examples, a Lianokladhi goblet assigned to Mitrou MH phase 7,[161] may have contained as much as c. six litres.

4.7. A Note on the Studied MH – LH I Settlement Contexts

Among the settlements selected above, only three of them produced floor deposits that included goblets sufficiently preserved for calculating capacities: Kolonna on Aegina, Asine and Tsoungiza. At Ayios Stephanos, the floor deposits have been excavated, but they did not yield well-preserved MH goblets. Elsewhere, ceramic materials come from occupation levels excavated in rooms (e.g., Orchomenos, Pefkakia and Krisa), from wash deposits or dumps (e.g. Nichoria).[162] Additional information on capacities of goblets and other drinking vessels has been provided by the study of ceramic assemblages from Eleusis and Kiapha Thiti. The other relevant assemblages examined above come from major MH settlements such as Lerna and Argos (Argolid), Eutresis (Boeotia), Mitrou (Phthtiotis) and Kirrha (Phocis), but only a limited amount of information on the capacities of drinking vessels or tableware has been gained from reviewing them.

From an architectural perspective, it is difficult to interpret the MH buildings that yielded pedestalled goblets in any other way than as houses for family units, most likely accommodating household activities. Even at Kolonna on Aegina, where the most impressive architectural remains have been excavated, the goblets found in primary deposits cannot be related to a large dwelling or building complex. The relevant set of tableware from Kolonna (Group XXXV, see above), including a goblet of c. three litres, four smaller goblets, other drinking vessels and tableware, was found in a floor deposit. Another plausible option is that commensal activities took place outside the houses. On the mainland, the most consistent sets of drinking vessels have been identified at Asine, Eutresis, Orchomenos and Pefkakia. They most often include goblets of medium and large capacities (1–4.2 litres), in some cases complemented with a limited number of small drinking vessels. In my opinion, the idea that MH settlements may also have hosted commensal activities, providing drinking vases for groups of people larger than the daily-domestic units, should definitely not be ruled out, especially when one takes into consideration the capacities of the largest goblets revealed above. The beverages held in them would certainly have been shared by several participants on drinking occasions. Despite the fact that some part of these beverages may have been dispensed into the smaller drinking vessels, the idea that the largest goblets would have functioned in the same way as the LH kraters has been challenged. Instead, it has been suggested that large goblets may also have circulated among the individuals, probably the most prominent ones.

The introduction of large kraters in LH I at Orchomenos (rim diam. from 22 to c. 40 cm) is the most compelling

155 See Dor et al. 1960, 147–149, Inv. 6276, 6277, 6462, 6478. – Two small jugs (Inv. 6299, 6303) and an amphora (Inv. 6288) were found in other rooms assigned to the MH IIIA level.

156 For instance, goblet Inv. 6284: Dor et al. 1960, 129 (No. 25) and Pl. XLIII. – See also Maran 1992a, 314 and n. 996.

157 Dor et al. 1960, Inv. 6290 (MH IIIA), Inv. 6300 (MH IIIB, but must be re-dated to LH I, see Pavúk, Horejs 2012, 55), Inv. 6470 (MH IIIB).

158 Jannoray, van Effenterre 1938, 113–114 and Fig. 2. – Phialon 2018, 432, 440 and Fig. 16 (drawing Inv. 6150, courtesy E. Velli).

159 See Phialon 2018 (capacities measured by filling vessels with lentils, unlike the computer methods applied in this article). – The deep kantharos Inv. 6096 could contain much more drink that the squat kantharos Inv. 6149 (capacities of 0.88 and 0.23 litres, respectively). – Drawing Inv. 6149, courtesy of E. Velli.

160 Hale 2016.

161 Hale 2016, 286–287 and Fig. 15/36 (c. 5.4 litres with interior rim diam. 29 cm, c. 6 litres with 1:3 scale).

162 On methodological issues regarding floor deposits and classification of fills: Kardamaki 2017, 80. – On the Menelaion of Sparta (occupation levels excavated in rooms), and Athens-Acropolis South Slope (wells), see below.

argument that leads us to believe that drinking events developed then in certain settlements on the Greek mainland. However, no floor deposit from this period can help us to understand how these large kraters may have functioned with other vessels. Research on the ceramic materials from Mitrou and Kirrha is still ongoing. Some preliminary results on LH IIA pottery from Mitrou indicate that a pottery assemblage may include drinking and mixing vessels, i.e., a goblet, two cups and four kraters among others,[163] and therefore a surprisingly high number of kraters compared to that of the drinking vessels. Final publications are, of course, needed to check the completeness of tableware sets, and eventually to identify more accurately how drinking practices developed in settlements from LH I to LH IIA.

5. The LH II–IIIA1 Goblets: Morphology and Capacity

5.1. Mycenaean Drinking Vessels (Goblets, Cups, Kylikes) and Specific Features

Mycenaean goblets have consistent features,[164] and are mostly regarded as wheelmade. They have a concave or domed foot, a deep rounded bowl, an everted rim, and one or two vertical strap handles,[165] as illustrated, for instance, by the examples from the wells on the south slope of the Acropolis at Athens (FS 263, 270, 254, see above, Fig. 3/5–7).[166] Mycenaean pottery became the fine ware *par excellence* in most parts of the Peloponnese as well as in Attica, Euboea and Boeotia from LH IIA onwards, when the first decorated goblets were introduced, or in certain regions, especially in north central Greece, from LH IIB–IIIA1 onwards.[167] Most examined LH goblets are plain/unpainted (unptd), but lustrous monochrome painted and decorated examples are also well preserved. The rim diameter of goblets usually does not exceed 25 cm, but the largest goblet of this study (Menelaion, ET69, see below) has a diameter reaching 25.6 cm and a capacity of 5.88 litres. Nevertheless, most of the goblets examined here are much smaller with rim diameters falling between c. 10 and c. 17 cm, and capacities between 0.2 and 2 litres. Smaller goblets with capacities of less than one litre are even predominant in LH II–IIIA1 assemblages,[168] many of them having a capacity of less than 0.5 litres (Fig. 8). On the assumption that these vessels contained beverages in LH II–IIIA1, the large number of small goblets certainly used as individual vases like cups and kylikes illustrates an obvious shift in the drinking practices of the early Mycenaean period.

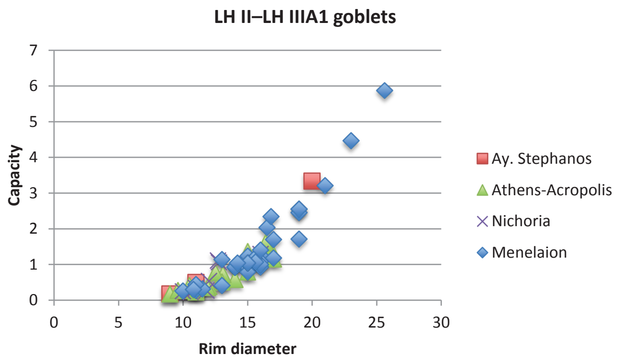

Fig. 8. Rim diameters and capacities of LH II–IIIA1 goblets.

In rare cases, drinking vessels have been regarded indifferently as goblets or stemmed cups, such as LH II 'washy coated' goblets with one handle in Nichoria (P3553, P3554, FS 263[169]). The number of handles does not seem to be a relevant criterion for the term applied to these vessels.[170] Another issue is to distinguish the goblets FS 262 from the cups FS 211, 212 in the decorated Mycenaean pottery. Four vases from Aegina, only preserved in their lower parts, attributed to FS 262 by Stefan Hiller may also correspond to FS 211, 212 (LH IIA), as assumed by Penelope A. Mountjoy,[171] despite the lack of solid stems.[172] In comparison, FS 262 goblets from Laconia and Attica have deep interior profiles and

163 Vitale 2012, 1148 and Fig. 1.

164 E.g., FS 63, FS 70: Dickinson, Martin, Shelmerdine 1992, Fig. 9/8, 9, 12. – Mountjoy 1981, Fig. 8/28.

165 Mountjoy 1986, 204. – On definitions of features: Mountjoy 1986, 201 and Fig. 270.

166 Mountjoy 1981. – Stemless goblets are rare at the Menelaion: Catling 2009, 89. – FS = Furumark's Shape, see Furumark 1972 [1941].

167 On Mycenaean decorated pottery from different regions on the Greek mainland: Mountjoy 1999.

168 In the Palace of Nestor, the kylikes of 'standard' size have capacities falling between 0.75 and 1.2 litres: Blegen, Rawson 1966, 369.

169 Dickinson, Martin, Shelmerdine 1992, 534 and Fig. 9/22.

170 On a handleless goblet, P3193, LH I: Dickinson, Martin, Shelmerdine 1992, 525 and Fig. 9/6. – Also 'conical cups' as a term used for small handleless bowls – a massive and simple shape – many of which have complete profiles.

171 Hiller 1975, 73 and Figs. 14–15, Pl. 6/84–87: *Schale*. – Mountjoy 1999, 506–507 and n. 180 (semi-globular cup, tall type, FS 211), 509 and n. 205 (FS 262 or tall version of FS 211). – On a fifth goblet FS 262 from Aegina, however with wrongly reconstituted foot and handle: Hiller 1975, 76 and Fig. 18, Pl. 7/112, cited by Mountjoy 1999, 509 and n. 205.

172 In previous research, Mountjoy 1986, 34–36 and Fig. 36, refers to a "FS 262. Cup with high handle".

splaying bases, with high handles obviously preserved,[173] which may be seen as a feature distinct from FS 211, 212. The aforementioned semi-globular or tall globular cup (FS 211) is of Mycenaean type and is dated to LH II–IIIA1. Other cup shapes are, for instance, the conical cup (FS 204, FS 230), the shallow cup (FS 219), the Vapheio cup (FS 224), and the high-handled cup (FS 237). The largest LH II–IIIA1 cups of this study, such as a cup from Athens (rim diam.: 17 cm; capacity: 0.74 litres[174]), are smaller than the larger goblets. Moreover, the vast majority of them have capacities smaller than 0.5 litres (Appendix 1). These small capacities are fully consistent with the idea that cups of Mycenaean type were mostly used as individual drinking vessels. By contrast, one may argue for a diversified use of cups produced in coarser fabrics (cooking, eating – stews or soups for instance –, drinking).[175]

LH II and LH III stemmed drinking vases with two high handles are usually named goblets or kylikes, but not kantharoi.[176] The last goblets in the Mycenaean decorated shape repertoire are assigned to LH IIIA1, when the first kylikes characterized by a shallower profile than the goblets in this phase were introduced.[177] In addition, the stems of LH II–IIIA1 goblets are usually shorter and thicker than those of LH IIIA1 kylikes. The term 'goblet' is still used for post-IIIA1 monochrome examples.[178] However, the choice of applying a terminological distinction between 'goblets' and 'kylikes' may be challenged, since LH IIIA2–IIIC decorated examples with a deep profile are named 'kylikes' rather than 'goblets'.[179] Moreover, studies on Minoan pottery from Knossos hint at the possibility of terming 'kylikes' certain LM II drinking vessels also referred as 'goblets', such as examples with Ephyraean decoration.[180]

In LH IIIA1, the rim diameters of Mycenaean decorated kylikes can reach 16.5 cm, but their capacities do not exceed c. 0.8 litres, as calculated in this research.[181] These low capacities confirm that most kylikes were certainly used as individual drinking vessels. It is exceptional that goblets and stemmed bowls look alike, such as a LH IIIA1 monochrome goblet with horizontal handles and a stemmed bowl from the Menelaion (Fig. 9),[182] and thus, there is little reason to believe that LH I–IIIA1 goblets usually functioned as serving vessels rather than drinking ones, as discussed in the introduction of this article.

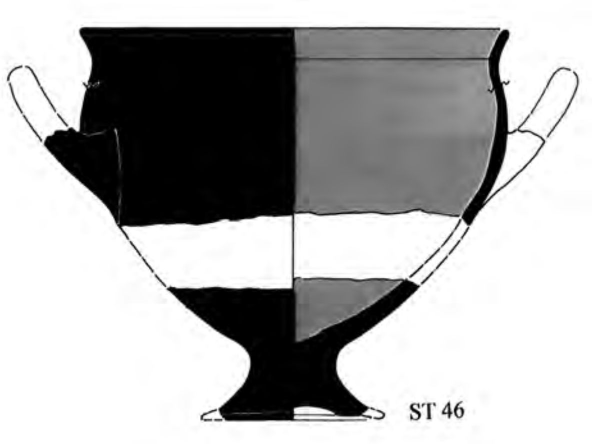

Fig. 9. Goblet ST46, also named stemmed bowl (Catling 2009, 95, 354 and Fig. 107).

5.2. A Comparison with the LH I–IIIA1 Kraters

Whereas kylikes and kraters are clearly distinct shapes, the similarity between some LH IIIA1 goblets and kraters may be pointed out.[183] This is especially true for kraters with an everted fine rim and two vertical strap handles, like some

173 Mountjoy 1999, 256–258 and Fig. 84/34–37 (Laconia), 508–509 and Fig. 180/40 (Attica, where examples of FS 262 have distinct features). – Goblets of type FS 262 are generally larger than cups of type FS 211, but the examples from Aegina are particularly tall, pres. h. 9.5 cm. – On LH IIB goblets varying in size and in shape, e.g. in Laconia (FS 254, 263, 270): Mountjoy 1999, 260–261 and Fig. 85/48–52.

174 Mountjoy 1981, Fig. 7/47 (9864). – I do not include a cup/goblet from Asine: Frizell 1980, Fig. 8/161.

175 For a miniature cooking cup from Tsoungiza (MH IIIB): Rutter 2015, 212–213 and Fig. 2/C40.

176 On LH IIIB kylikes with two or one high handle(s) in Pylos: Blegen, Rawson 1966, Fig. 366 (shapes 30/a–b, 31–32). – Drinking vases with two high handles and a raised base – i.e., without stem – are called cups in Blegen, Rawson 1966, Fig. 355 (shapes 18–19). – For LH IIIA2 "unpainted kantharos cups" (stemless), see Vitale 2008, 232 and Pl. XLIV/f–g.

177 Mountjoy 1986, 51, 64–66.

178 E.g., Tiryns: Podzuweit 2007, 56 and Pl. 22/5–9. – Menelaion: Catling 2009, 123 (WN41–45) and Fig. 165. – Ayios Stephanos (LH IIIA2): Taylour, Janko 2008, 308 and Fig. 6.6.

179 For LH IIIA2 decorated and monochrome kylikes (FS 256, 257, 264, 269) from Attica, see Mountjoy 1999, 540–541 and Figs. 194/184–188, 195/189–196.

180 Hatzaki 2007, 203, 205 and Fig. 6.3/1–4 (1, 3. Ephyraean).

181 E.g., Athens: Mountjoy 1981, Fig. 25/360 (rim diam. 16.5 cm, capacity 0.66 litres). – Nichoria: Dickinson, Martin, Shelmerdine 1992, Fig. 9/31, P3616 (rim diam. 15.5 cm, capacity 0.79 litres).

182 The stemmed bowl CLO20 (see Catling 2009, 100 and Fig. 117) has, however, a thicker rim and wall than goblet ST46, which has an exceptional horizontal handle, and is referred to variously as a stemmed bowl or goblet: Catling 2009, 354 (stemmed bowl), 95 (goblet) and Fig. 107.

183 E.g., Borgna 2004, 265.

Fig. 10. A Mycenaean decorated krater (Catling 2009, Fig. 183/PD8).

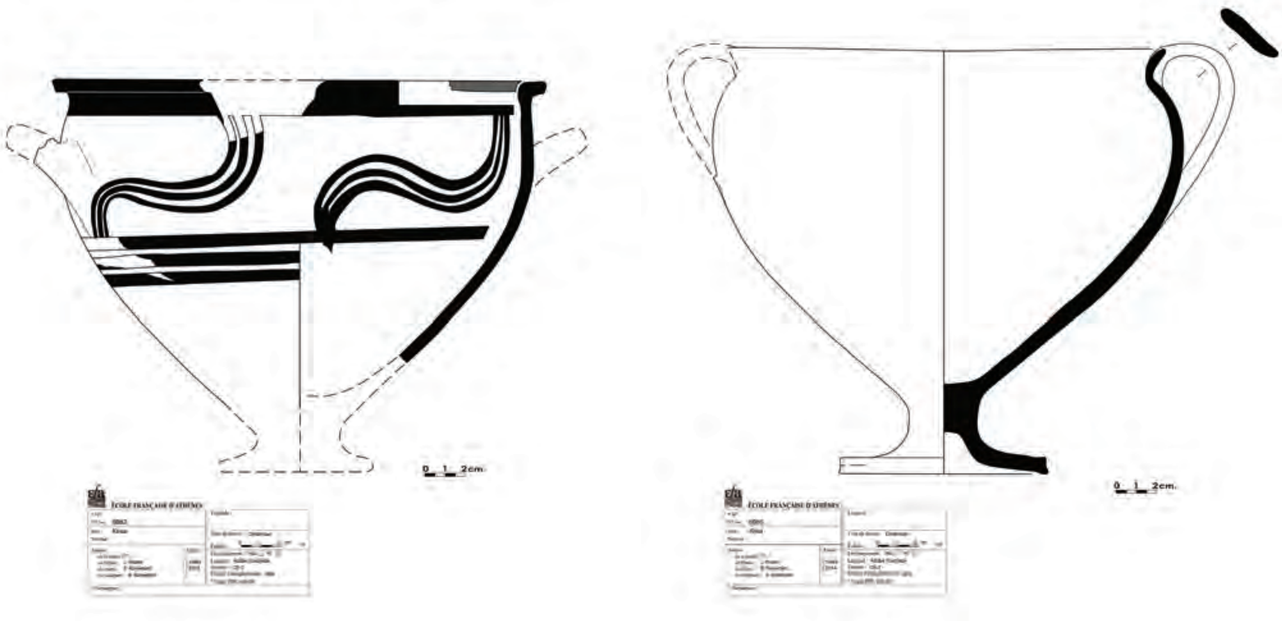

Fig. 11. A small krater and a large goblet from Krisa (Inv. 6082 and 6085, see Phialon 2018, Figs. 35, 37).

examples from Athens, Nichoria or the Menelaion, whose lower parts, however, are often missing.[184] These kraters differ from goblets mostly due to their larger size and ring base (Fig. 10).[185] The krater rim diameters are usually larger than 25 cm, but some smaller examples do exist.[186] Conversely, goblets with diameters slightly larger than 25 cm have also been identified.[187]

The introduction of large quantities of kraters in ceramic assemblages on mainland sites goes back to LH I.[188] The best-preserved early examples include a part of a large bichrome MP krater from Orchomenos (rim. diam. c. 35.6, calculated with a 1:3 scale) and a small, plain, pale burnished krater from Tsoungiza (rim diam. 24.5–25.7 cm).[189] In contrast, all LH II–IIIA1 kraters are Mycenaean plain or decorated vases. As stated at the beginning of this article, Late Bronze Age kraters were certainly used in commensal activities for holding alcoholic beverages, and most likely for mixing wine with water. The krater is considered to be the symbol of the distribution of drinks in the Late Bronze Age[190] and as the main vase of the banquet, also from the Early Iron Age and Archaic period onwards.[191] It was the focal point of the symposion in Ancient Greece.[192] The possibility that other open vases may have been used as mixing vessels should, however, not be excluded.[193] Once again the question of whether the large goblets could have been good candidates arises, but this time for LH II–IIIA1.

In this study, LH II–IIIA1 Mycenaean decorated, monochrome, unpainted, burnished, polished or rough goblets mainly come from Nichoria (Messenia), Athens-Acropolis South (Attica), and the Menelaion of Sparta (Laconia). The rim diameters of most goblets from Nichoria and Athens range from c. 10 to 17 cm, while their capacities fall between c. 0.25 and c. 1.5 litres, but some goblets from the Menelaion are larger in size and capacity, with rim diameters of 21 cm or more and capacities exceeding three litres. A goblet from the Menelaion (ET69), which reaches 25.6 cm in diameter and held 5.88 litres,[194] is even larger in size and capacity than the largest MH goblets from Asine,[195] and appears to fix the upper limit of goblet capacities at c. six litres.[196] A Mycenaean undecorated goblet from Krisa (c. 4.08 litres) can be added to the largest LH II–IIIA1 goblets.[197] One may wonder why LH I–IIIA1 goblets and kraters are highly variable in shape, size and capacity, and also why some large goblets may have held as much drink as some contemporary small kraters, as attested by two LH examples from Krisa (Fig. 11).[198]

In my opinion, it is quite likely that goblets that held more than three litres contained a mixture of wine and water, just like kraters. However, the fine and everted form of their rims again suggests that these goblets were not primarily used as mixing vessels but as drinking vessels. The hypothesis that goblets with a large capacity may have circulated among the participants at drinking occasions rather than having been used in a manner similar to the kraters must be further explored by a detailed contextual study. This use may have coexisted with that of kraters. By way of comparison, the capacities of nine LH II–IIIA1 kraters examined

184 Mountjoy 1981, Fig. 7/41 (Inv. 9879, LH IIB–IIIA1, at the latest). – Dickinson, Martin, Shelmerdine 1992, Fig. 9/26 (P3578, FS 6, LH IIIA1). – Catling 2009, Figs. 89–90 (ET25–31), 164 (WN15 to WN19, LH IIIA1).

185 E.g., at the Menelaion, Catling 2009, Fig. 183 (PD8, LH IIIA1). – For an example with horizontal handles, see Catling 2009, Fig. 130 (V6, LH IIIA1).

186 Krater ET26 from the Menelaion, rim diam. 24 cm. – Krater X7 from the Menelaion (Catling 2009, 112 and Fig. 142) could also be regarded as a large two-handled bowl. – Krisa, krater Inv. 6082, rim diam. 24.2 cm.

187 E.g., Krater ET69: Catling 2009, 89 and Fig. 93.

188 Rutter 1990, 440 and n. 50, especially in Tsoungiza. – On Korakou LH I kraters: Davis 1979. – However, special ceramic vessels were certainly in use earlier than LH I for holding drinks consumed by a group, such as the EH psykter from Tiryns: Morris 2008, 120, with reference to Müller 1938, 37 and Fig. 34, Pls. XXII/9, XIII.

189 Orchomenos: Sarri 2010, Pl. 39/7. – Tsoungiza: Rutter 2015, 214, E51.

190 "The Mycenaean krater, the most meaningful symbol of drink distribution, is a monumental version – again a kind of primus inter pares – of the individual drinking vessel [...]": Borgna 2004, 265.

191 Coulié 2013, 39, 275: "vase-roi du banquet". – On the reclining banquet in the Archaic period: Coulié 2013, 124.

192 On the symposion in the Archaic age as a practice and social institution: Schmitt-Pantel 1990, 15. – On the symposion as a part of the banquet: Esposito 2015, 13–14. – On the iconography of the krater as a focal point of the image: Lissarague 1990, 197.

193 Kotsonas 2011, 946 assumes that "diverse open vessels could [...] have served for the mixing of wine and water at this early date", i.e., in Iron Age Crete, with reference to Nestor's large 'depas' ('Iliad' XI, 628–641).

194 See Catling 2009, 89 and Fig. 93.

195 Catling 2009, 344–347, esp. 346: "With the exception of ET69 (H. 0.258 and almost a krater), none exceeds 0.19 cm in diameter". But, see also ET107, with a rim diam. of 23 cm and a capacity of c. 4.47 litres.

196 See also the MH goblet from Mitrou (c. six litres) in Hale 2016, 286–287 and Fig. 15/36.

197 Phialon 2018, Fig. 37, Inv. 6085.

198 LH IIIA1 krater Inv. 6082 (FS 279), LH II goblet Inv. 6085 (FS 263): Phialon 2018, Figs. 35, 37.

in this research fall between 3.89 and 19.43 litres[199] (Fig. 12); they largely exceed the capacities of most LH goblets. The difference with the MH goblets (see Fig. 7) is generally less pronounced.

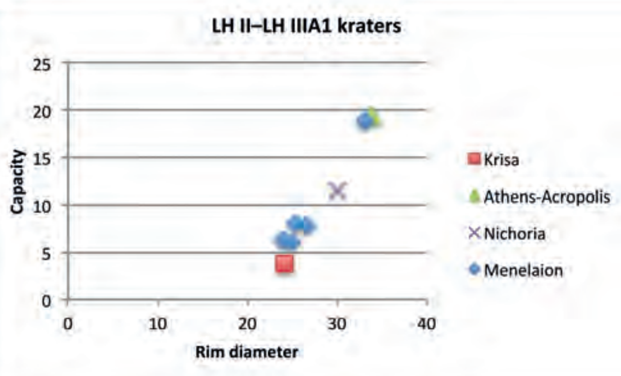

Fig. 12. Rim diameters and capacities of LH II–IIIA1 kraters.

6. Goblets in LH II–IIIA1 Contexts

6.1. Tsoungiza (Corinthia), Part 2

The introduction of the krater in tableware sets is attested for the first time at Tsoungiza in LH I, a settlement already occupied in the MH period. This shape is also identified among the pottery fragments from a layer in EU10, which was probably the fill of a large pit dated to LH IIA.[200] Kraters of this phase were larger than krater E51, but their fragmentary state does not allow us to calculate their capacities.[201] Moreover, the LH IIA assemblage of Tsoungiza comprises numerous fragments of goblets and cups that may have been used in association with these kraters. The two LH IIA goblets with a complete profile have a capacity lower than the large LH I goblet E49 (F16 and F23: 0.49 litres and 1.85 litres respectively; E49: 2.64 litres), and were certainly used as individual drinking vases in a larger set.

6.2. Asine (Argolid), Part 2

The settlement of Asine, already examined above, has yielded several MH goblets in well-defined contexts, some of them characterized by a capacity exceeding two litres. Among the LH vessels, a goblet with a capacity of 2.11 litres can be attributed to the LH IIB–IIIA1 phase.[202] Like other smaller drinking vessels,[203] this goblet was uncovered in Stratum 2 of Room D on the southwest slope of the Barbouna Hill. A LH IIIA1 krater rim fragment belongs to the same assemblage.[204] Its diameter, estimated as 32 cm, is even larger than the diameter of the large LH IIIB krater from this settlement[205] and may exceed ten litres. This krater was large enough to contain drinks distributed to several drinking vessels, possibly including the goblet with a capacity of c. two litres, which may have been used as an individual or shared vase. In comparison, a large conical bowl of max. 3.4 litres was perhaps used for serving food in LH IIB–IIIA.[206]

6.3. Nichoria (Messenia)

In early Mycenaean times, LH II pottery comes mainly from three pits filled with debris,[207] including some cups and a goblet with a complete profile.[208] LH II goblets have rather small capacities, as attested by nine examples (0.23 to 1.3 litres). Area IV was the 'core' of the settlement, already well inhabited in the MH period.[209] This area was occupied by Building Unit IV-4A in the LH IIIA1 phase.[210] Inventoried pottery from this phase comes from wash deposits in the area of Unit IV-4A. Two kraters (P3578, P3578) may have been associated with Unit IV-4A,[211] without being directly related to a specific tableware set. However, goblets, cups and kylikes are well represented among the LH IIIA1 pottery shape range described in the catalogue, which also possibly includes dippers. Based on its large preserved part, the capacity of krater P3578 was certainly greater than 11.5 litres. By comparison, the capacities of LH IIIA1 drinking

199 Krisa, Inv. 6082: Phialon 2018, 455–456, 465, 477–478 and Fig. 35. – Athens-Acropolis South Slope: Mountjoy 1981, Fig. 7/41. – The question arises whether the large MP bowl with four handles from Kolonna (Siedentopf 1991, 94 and Pl. 97/599) may be regarded as a krater, possibly of LH I date rather than MH III. – On the other hand, I would rather identify the vase X7 from the Menelaion as a late two-handled bowl than as a krater (2.79 litres).

200 Rutter 1993, 53, 56. Pit in EU 10.

201 A krater/goblet body sherd (diam. 27 cm) and a MP (spouted) krater base: Rutter 1993, 65, 80 and Fig. 6/18; 71, 84 and Fig. 7/33.

202 Frizell 1980, Fig. 8/161, i.e., stemmed globular cup FS 263, 264. – In contrast to the capacity of c. 0.9 litres of the Ephyraean goblet: Frizell 1980, Fig. 15/134.

203 Three handleless cups are sufficiently well preserved for calculating their capacities (0.35 litres, 0.04 litres, 0.26 litres), see Frizell 1980, 49 and Fig. 8/148, 149, 152. – On a kylix or carinated cup FS 267 (0.27 litres): Frizell 1980, Fig. 9/169.

204 Frizell 1980, 48 and Fig. 7/141.

205 Frizell 1980, 57 and Fig. 10/196 (est. diam. 28 cm, from Room E).

206 Frizell 1980, Fig. 12/253 (Room F, Stratum 3).

207 Aschenbrenner et al. 1992, 363 (P3435–73).

208 This goblet (P3472), which may have held up to 1.06 litres, has one of the largest capacities calculated for the drinking vessels from Nichoria, half of which do not exceed 0.6 litres.

209 Aschenbrenner et al. 1992, 408 and Fig. 7/35–36.

210 Dickinson, Martin, Shelmerdine 1992, 488.

211 In L23 Wcd and L23 Xd: Dickinson, Martin, Shelmerdine 1992, 534–535.

vessels mostly fall between 0.16 and 0.42 litres.[212] The beverages held in these two kraters were certainly distributed into such drinking vessels, goblets included, on special occasions that took place in LH IIIA1, but no concrete set can be reconstructed with certainty. Despite this, the increasing number of LH II and LH IIIA1 fragmentary drinking vessels suggests that drinking events became larger during these periods.

6.4. Krisa (Phocis)

In the settlement of Krisa already occupied in the MH period, the later Building F, which was built above Building A (context of a GM goblet), also yielded drinking vessels and tableware that constitute a coherent set used in LH IIIA1. Three goblets, a kylix, and two cups, as well as a small Mycenaean decorated krater (Inv. 6082) and a hydria (Inv. 6133), were uncovered in Rooms g and h of Building F. The size of this set thus remains modest. The capacity of this krater is low (3.89 litres), but higher than the goblets belonging to this assemblage (capacities ranging from 0.54 to 1.62 litres), which are of various ceramic classes.[213] In contrast, the LH II goblet Inv. 6085, which comes from an unknown deposit, had a maximum capacity of 4.08 litres,[214] and thus was slightly larger than the LH IIIA1 krater (see Fig. 11).

6.5. Athens-Acropolis South Slope (Attica)

The four wells excavated on the south slope of the Acropolis at Athens yielded many mendable fragments and large fragments of various shapes in ceramic classes, such as Mycenaean pottery, burnished household ware and, more rarely, MP pottery.[215] Along with the remains of a LH I house north of the Erechtheion,[216] this material is the best evidence that the Acropolis was inhabited in the early Mycenaean period. Among the drinking vessels, cups, dippers, goblets, and kylikes are well represented.[217] The decorated Mycenaean pottery is clearly dated to LH IIA to LH IIIA1. This household equipment had been thrown into these wells by LH IIIA1 at the latest, and the pottery produced at an earlier date may have been used until this phase, i.e., during more than 50 years, since there is no stratified LH IIA layer in the filling of the wells that may be separated from a LH IIB–IIIA1 layer.[218] Alternatively, LH IIA fragments in these wells may have come from rubbish fills, like the GM and MP fragments of LH I date,[219] and only been thrown into the wells in LH IIIA1.

Matt monochrome and MP decorated fragments of six kraters also come from these wells – two of them with rim diameters of 20 and 30 cm, and a third with a spout and a rim diameter estimated as c. 27 cm.[220] In addition, an unburnished krater with a rim diameter of 34 cm and a nearly complete profile would have held a maximum of 19.4 litres.[221] These kraters, especially the ones with a diameter exceeding 25 cm, certainly contained drink that was distributed into the smaller drinking vessels, goblets included, since goblet capacities ranged mostly from c. 0.2 to c. 0.8 litres, with the exception of a matt monochrome goblet (1.61 litres) and two burnished goblets (FS 263, 1.46 and 1.38 litres).[222] The high number of drinking vessels from these pits as well as the large size of some kraters point to the existence of large drinking events on the Acropolis.

6.6. The Menelaion of Sparta (Laconia)

Several LH IIB or LH IIIA1 deposits from the Menelaion of Sparta were associated with substantial buildings remains (mansions and buildings on the Menelaion Hill and on the Aetos South Slope, as well as structures on the North Hill). Consistent LH IIIA1 assemblages of drinking vessels were uncovered in rooms in Mansion 2 on the Menelaion Hill.[223] Room VII of Mansion 2 yielded krater fragments, goblets, kylikes, and cups,[224] which may have been used with bowls and cooking pots on special occasions. This set could have been completed by vessels from other rooms, such as Room V (among others, a well-preserved krater, goblets

212 See Appendix for two larger drinking vessels: goblet P3577 (1.03 litres), and kylix P3616 (0.79 litres). – The bowl P3629 (4.75 litres) is not identified as a drinking vessel.

213 LH IIIA1 Mycenaean decorated kylix (Inv. 6086), goblet (Inv. 6087), and cup (Inv. 6151). – Two burnished goblets probably produced in LH II, Inv. 6130, 6132, and a semi-coarse cup. – Small differences in capacity are observed between the manual filling of vessels with lentils (Phialon 2018, catalogue) and the use of computer methods in the present study.

214 Jannoray, van Effenterre 1938, 127 (No. 28) and Pl. XXIII/2.

215 Mountjoy 1981, 13.

216 Iakovidis 2006, 73–75.

217 There is no kantharos identified in the shape repertoire, but the two-high-handled open vase No. 86 (see Mountjoy 1981, Fig. 10) is assimilated to the goblet types (FS 272), as are goblets with a high handle (e.g. Mountjoy 1981, Nos. 380, 382, FS 270).

218 Mountjoy 1981, 74–75.

219 Mountjoy 1981, 18, 62 and Fig. 33.

220 Mountjoy 1981, 40 (No. 279, spouted; Nos. 280, 281, two other rims), 59, 62.

221 Mountjoy 1981, Fig. 7/41. – With a large height of water reaching c. 28.2 cm.

222 Mountjoy 1981, 59 and Fig. 30/405; 62 and Figs. 20/237, 28/384. – Goblets are mostly unpainted and burnished, polished or of rough surface, but some lustrous decorated examples occurred in these wells.

223 Catling 2009, 17, 34–36, 50–51 (Rooms I to X, lower platform), and Figs. 22–24. – Pantou 2014, 393 and Fig. 16.

224 Catling 2009, 108–110.

and cups[225]) or possibly Room II (two fragmentary kraters, goblets, small drinking vessels, two dippers and a jug[226]). The capacity of krater V6 (rim diam. 26.5–27 cm) is close to eight litres, and krater II15 may have held 18.8 litres.[227] Other krater fragments from Mansion 2 vary in size and shape.[228] The capacities of the largest ones, with rim diameters falling between 28 and 32 cm, may have exceeded ten litres.[229]

These kraters are obviously larger in size than the goblets, even the largest ones, as illustrated by three goblets from Room II (II13, II17, II18), with rim diameters of 24, 21 and 23 cm, and also in capacity (goblet II17: 3.21 litres). Drinks held in these kraters were certainly distributed to smaller drinking vessels, goblets included. Goblets from the Menelaion also vary in size and capacity. For instance, goblets from Mansion 2 have capacities ranging from 0.93 litres to 3.21 litres. Goblet V18 with a capacity of c. 1.04 litres comes from the same room as krater V6. The small so-called krater X7, with a capacity of less than 2.8 litres, was obviously not used with the largest goblets of this settlement. We would rather consider this vessel to be a late two-handled bowl. However, three small kylikes from Room X (X3–X5), with capacities of 0.28 or 0.35 litres, could have received drinks from 'krater' X7.

The rim diameters and capacities of kraters and goblets from the Menelaion are, in some cases, very close. LH IIIA1 kraters can have rim diameters smaller than 26 cm, such as two examples from the East Terrace, ET25 and ET26, with a rim diameter of 25.4 and 24 cm,[230] and a capacity of c. 8 and c. 6.24 litres. These kraters are close in capacity and size to the large semi-monochrome goblet ET69 (rim diam.: 25.6 cm, capacity: 5.88 litres).[231] Liquid held in kraters ET25 and ET26 was certainly not distributed into large goblets such as ET69, but rather into smaller goblets, kylikes and cups, also uncovered in large numbers on the East Terrace. The same interpretation can be proposed for drinking vessel NB33 (rim diam. 26 cm) from the North Building.[232] On the other hand, larger fragmentary kraters with diameters falling between 28 and 33 cm (ET27–ET31)[233] could have held much more drink than kraters ET25 and ET26. Their beverages could have been distributed into various vases, including the largest goblets from this assemblage.

Finally, a large quantity of fragmentary pottery was also uncovered in Building B on the Aetos South Slope.[234] It includes drinking vessels dated to LH IIB–IIIA1 and fragments of two kraters.[235] Krater AB25 (est. body diam. 40 cm) was certainly large enough to contain drink distributed later into numerous drinking vessels of various shapes and sizes, goblets included. Consequently, most goblets were used as individual vases in various built spaces of the Menelaion. The large corpus of LH IIIA1 pottery consisting mainly of drinking vessels suggests that hundreds of people might have taken part at drinking events in this place.

6.7. Ayios Stephanos

Despite the numerous LH II and LH IIIA1 fragmentary drinking vessels uncovered at Ayios Stephanos, a settlement also occupied in the MH period, there are only a few well-defined deposits that yielded coherent associations of drinking vessels and tableware. These are two fragmentary vessels dated to LH IIA in Area Beta. Both are older than the LH IIB deposit where they were found,[236] but they were produced in the same phase as the LH IIA forge used for melting and working metal in this area.[237] Two other deposits were uncovered in Area Lambda/Beta: the first corresponds to a LH IIA deposit in Room 10A consisting of a gritty MP hydria and a cup;[238] the second, to a LH IIB floor deposit including a cup.[239] Regarding the LH IIIA1 phase, one deposit in Area Beta, on the southwest terrace yielded fragmentary pottery: two dippers, a kylix, a goblet and a basin.[240]

225 Catling 2009, 106–107.

226 Catling 2009, 103–104.

227 This LH IIB krater may have been similar in shape to a LH IIIA1 krater from Iklaina, see Shelmerdine 2011, Pl. 12/434 (rim diam. 34 cm, base diam. 13 cm, h. 32 cm), capacity of 13.66 litres, with 1:3 scale, but 17.8 litres with rim diam. 34 cm.

228 On two krater fragments from Room III: Catling 2009, 104–105.

229 Catling 2009, Figs. 124, 135: krater II16 with est. diam. 32 cm; krater VII10: diam. 30 cm; krater VII11: diam. 28 cm.

230 Catling 2009, 88.

231 Catling 2009, 89.

232 Catling 2009, 114.

233 Catling 2009, 88.

234 On assemblages assigned to the three first phases of the building: Catling 2009, 198. – There are four phases, the latest (Building B4) dates to LH IIIB.

235 Catling 2009, 209–211. – The rim diameters of goblets from Building B do not exceed 19 cm.

236 Area B 3, 8, 9 and 10, 1974–77: a LH IIB floor deposit including two LH IIA goblets and two monochrome ring-handled cups, see Taylour, Janko 2008, 52–53 and Figs. 1.28/3268, 3281 (goblets), 3295–3296 (ring-handled cups with complete profiles).

237 Taylour, Janko 2008, 53, 56.

238 Taylour, Janko 2008, 80.

239 Taylour, Janko 2008, 74. – The two well-preserved goblets from this area, one (3667) dated to LH IIA, the other (3674) to LH IIB, were not associated with this floor deposit, but found in a wash layer (3672) or without precise context (3667). – For a ring-handled cup with complete profile found in the same area, see Taylour, Janko 2008, No. 373. – On MH III metallurgical activities: Taylour, Janko 2008, 575.

240 Taylour, Janko 2008, 51. – It is reported that the dipper 3305 with a complete profile was found southwest of Step I in Area Beta. – I wonder whether the kylix 3313 (FS 267), whose parallels are assigned to LH IIIB1 (see Mountjoy 2008, 334), might be an intrusion.

6.8. A Note on the Studied LH II–IIIA1 Settlement Contexts

Most of the architectural units that provided drinking vessels considered above are named 'buildings'. This neutral term does not involve a reflection on the function of these structures or on the people, products or activities they hosted. Certainly, drink consumption may have taken place outdoors. However, a more detailed approach to the main buildings that yielded kraters, goblets and other drinking vessels may contribute to a better understanding of Mycenaean drinking practices and social behaviour.

The two successive mansions respectively dated to LH IIB–IIIA1 and LH IIIA1 at the Menelaion of Sparta were the largest and most complex buildings preceding the LH IIIA2–IIIB palatial period on the Greek mainland.[241] Rooms in Mansion 1 may have served various functions: domestic, administrative and ceremonial; some of these rooms had been used solely as stores or workrooms. Thus, Mansion 1 was interpreted as the most likely seat of an early Mycenaean chieftain in Laconia.[242] From an architectural perspective, it may have hosted large-scale social events.[243] Mansion 2, which seems to have benefited from an even larger storage capacity than Mansion 1,[244] was still at the centre of the regional authority. The Menelaion thus appears more powerful than the settlement of Ayios Stephanos in LH II–IIIA1.[245] The Menelaion might have been a privileged place for feasting ceremonies. This view is supported by the large amounts of drinking vessels and tableware uncovered there,[246] notably on the East Terrace, in rooms of Mansion 2, as well as in the area of the North Building. Therefore, in my opinion, occasions of large-scale food and drink consumption for the entire community might have taken place outdoors, as they did indoors in LH IIIA1.[247]

The question arises whether the smaller Unit IV-4A at Nichoria in Messenia and Building F at Krisa in Phocis, occupied in LH IIIA1,[248] could also have been the venue for such activities. The term 'megaron' has been applied by the excavators to both buildings,[249] although neither unit reached the architectural complexity of the Menelaion and neither settlement functioned later as a palatial centre.

The assemblages of ceramic drinking vessels collected at both sites offer a contrasting view. Even if the pottery from Unit IV-4A comes from wash deposits, the diversity of shapes (e.g., goblets, cups, kylikes, krater, bowls) and the large amount of inventoried material[250] suggests that drinking consumption at Nichoria was organized on a large and possibly regional scale. By contrast, only a few ceramic vases from Krisa were inventoried in the 1930s. Eleven of them come from the LH IIIA1 occupation level of Building F, but their dates are not homogeneous; no more than nine vases, including three or four LH IIIA1 drinking vessels and a LH IIIA1 krater (3.89 litres), may have functioned together,[251] and thus used by a limited group of individuals, i.e., a prominent family or the local elite.

Another issue is whether drinking vessels from the studied settlements may have been used in rituals or ceremonies. The only ceramic assemblage that has been found in a context that may have included religious activity comes from Eleusis, and more precisely from the area excavated under the Telesterion. It was found in association with the platform of 'Megaron B' and includes fragments of eight goblets, four kylikes, four cups, a large bowl or krater, another bowl or cup, three jars and an alabastron, ranging in date from LH IIB/IIIA1 to LH IIIA–B.[252] According to Cosmopoulos, this assemblage and other finds from the interior of Megaron B suggest "that the building was used as a family residence" while it also served for cultic activity because of its special architectural features and the evidence of burned animal sacrifices.[253] Thus, the use of drinking vessels seems to have been limited to the sphere of the local ruling elite. On the assumption that vessels and burned animal bones

241 Darcque 2005, 141 and Fig. 133 (Mansion 1: 517 m²; Mansion 2: 800 m²) and Plans 88–89. – Catling 2009, 12 (Mansion 1: 650 m²).

242 Catling 2009, 449–450.

243 Pantou 2014, 382, 388, especially "in the central and east wings of Mansion 1 and the open space around it".

244 Catling 2009, 451.

245 Taylour, Janko 2008, 572, 590, 592–595.

246 Catling 2009, Figs. 89–150.

247 On "the largest variety of cooking forms" in LH IIB/IIIA1 at the Menelaion and "the appearance of an established culinary vocabulary": Lis 2017, 206, 211. – However, according to Pantou 2014, 392, Mansion 2 was less accessible and open in plan than Mansion 1. – On the plausible idea that banqueting may have taken place in the courtyard (Court 58) at the Palace of Nestor, Pylos (LH IIIB): Bendall 2011, 120.

248 Darcque 2005, 142 and Fig. 133 (Nichoria, IV-4A: 133 m²; Chrysso/Krisa, F1: 113 m²). – Phialon 2018, 445 (Ensemble F).

249 Nichoria: Aschenbrenner et al. 1992, 407 and Fig. 7/36. – Krisa: Jannoray, van Effenterre 1937, 319.

250 Dickinson, Martin, Shelmerdine 1992, 488, 534–537 (P3556–P3645).

251 LH II and IIIA1 goblets, cups and kylix, a LH IIIA1 hydria, a MH bowl and a LH IIIC amphora or hydria: Phialon 2018, 445–449 and Figs. 18–19.

252 E SU 5, locus 1: Cosmopoulos 2014a, I, 93–95. – Another consistent deposit providing fragments of drinking vessels and tableware on the South Slope of the Acropolis (S SU 34, locus 1), assigned to LH IIIA1–IIIA2, includes fragments of various shapes (a krater, two mugs, a goblet, two kylikes and a jar), but cannot be related to architectural remains: Cosmopoulos 2014a, I, 51.

253 Cosmopoulos 2014a, I, 455. – On a small collection of burned animal bones from a drain excavated in this area of the Megaron B: Cosmopoulos 2014a, I, 107–108.

were remains of feasting,[254] this drinking occasion was restricted to a small circle of people, and it may have started with an animal sacrifice.[255]

7. Conclusions

The pottery examined in this research includes over a hundred goblets with complete or nearly complete body profiles, i.e. 90 % preserved, ranging in date from the MH to the LH IIIA1 period, whose capacities have been calculated. Goblets have been compared to other open shapes such as rounded or conical bowls, with or without handles, cups of various types, dippers, kantharoi and kylikes, as well as stemmed bowls, kraters and basins. The capacities of more than 400 vessels attributed to these shapes have been calculated besides the capacities of the goblets (Appendix 1). In addition to individual shapes, this study investigated assemblages and settlement contexts. However, only a few floor deposits included well-preserved goblets as part of consistent tableware sets in the twelve main settlements selected (Asine, Athens-Acropolis South Slope, Ayios Stephanos, Eleusis, Kiapha Thiti, Krisa, Menelaion, Nichoria, Orchomenos, Pefkakia, Tsoungiza, and Kolonna on Aegina).

This research first focused on the function of the stemmed vessels regarded as pedestalled goblets in the MH period. I argued that most MH II–III pedestalled goblets (plain, ribbed/grooved, Lianokladhi, Pteleon), as well as the MH Aeginetan pedestalled carinated bowls with everted rim and horizontal handles/lugs, must be regarded as drinking vessels for the reasons recalled hereafter. By contrast, I did not exclude the possibility that MH I/II stemmed bowls/basins with large rim diameters and incurved rims, especially some examples from Kolonna on Aegina, Lerna and Argos, may have been used as serving vessels for liquid or food. The consumption of drink by large numbers of people may have taken place early in the MH period, as suggested by a MH I group from Kolonna VII–VIII that comprised forty vessels, including ten kantharoi and eight bowls,[256] although coming from uncertain contexts.

The use of large goblets such as the Lianokladhi goblets seems to emerge already in the MH II period in central Greece and Thessaly. Goblets with various capacities may have functioned together in the MH II–III periods at Kolonna on Aegina, at Orchomenos and Pefkakia in central Greece, and at Asine in the Argolid. This variability in size and capacity has been interpreted in terms of drinking and social practices. Because of the large capacity of some MH II–III goblets, falling between c. three and c. six litres, I assumed that the beverages held in the largest goblets were shared by the participants in commensal activities. This has raised the question of how these beverages were shared. When assemblages included drinking vessels of smaller sizes and capacities, there was always a possibility that drinks from the large goblets were poured into these small vases. MH II–III deposits from Asine, Orchomenos, Pefkakia and other sites included several pedestalled goblets of various wares and a limited number of smaller drinking vessels. A close examination of these settlement contexts leads us to suggest another option: the largest goblets (c. 3–4 litres), and possibly the other large ones (c. 2–3 litres), may also have been used as drinking vessels passing from hand to hand, most likely between the key persons at these commensal occasions, functioning together with other goblets and drinking vases, rather than as mixing vessels whose contents would have been distributed into smaller drinking vessels.

Considering the assemblage from Building 2 at Asine (MH III), I estimate that between fifteen and twenty people were probably involved in social drinking on this occasion, on the assumption that two individuals could have shared the drinks held in the largest goblets.[257] However, the pairing of eating and drinking vessels in this settlement would rather support the idea of an individual use of the goblets, by the host and the guest, for instance.[258] This is plausible for the goblets with capacities of less than two litres, but questionable for the larger ones. Drinks were certainly distributed/poured into individual drinking vessels from jugs.[259] High and massive goblet stems may have guaranteed a good display of the drinks at special occasions, gathering some fifteen people and surpassing the frame of daily-domestic units. If MH II–III goblets were used as mixing vessels, as in the case of the LH kraters, one would expect a larger number of small drinking vessels in the studied assemblages, which is not the case. In addition, the capacities of MH pedestalled goblets rarely exceed four litres, while LH I–IIIA1 kraters generally have a capacity larger than five litres. The upper capacities of LH mixing bowls may be explained by the increasing size of groups sharing drinks in commensal and feasting events from the MH to the LH IIIA1 periods.[260]

254 "The pottery associated with these bones includes open vases, kylikes, and goblets; although it cannot be excluded that these were remains of feasting, the sample is not sufficient to support this claim": Cosmopoulos 2014b, 412.

255 On rituals of social drinking in the Homeric world, even in a domestic setting: Papakonstantinou 2009.

256 Walter, Felten 1981, 123, 146.

257 On the assemblage in Building 2, with eight goblets, among which three or four with max. capacities exceeding two litres, and five kantharoi: Nordquist 1987, 52–53 and Figs. 51–54.

258 Nordquist 2002, 30.

259 For instance, assemblages with low and high pedestalled goblets and jugs from House B in Asine, or possibly from jars from Building 1 on the Barbouna Slope, see Nordquist 1987, 52.

260 On funerary evidence, see mainly Wright 2004, 154–155.

In MH III and LH I, the participants in social drinking events that took place in the settlements seem to have been the local elites.[261] During the Shaft Grave period, funerary assemblages comprised numerous drinking vessels, especially in the Argolid, as illustrated by the material from Mycenae.[262] Drinks and meals were consumed in quantity at the funerals, such as at Lerna.[263] This practice was obviously related to the emergence and display of high status individuals.[264] A new study of funerary drinking assemblages focusing on the capacity of the vessels would surely lead to a better understanding of the development of consumption practices from late MH to LH IIIA1, as has been initiated for LH I cooking pots in Lerna,[265] and it would refocus attention on metal vessels, such as the LH IIIA silver drinking vessels from Dendra.[266]

The introduction of the krater in LH I assemblages may be interpreted as a major change in drinking practices, involving a common vessel used for mixing liquids before they are shared among several participants. The size and capacity of kraters varied greatly in early Mycenaean times. Drinks held in kraters were not necessarily distributed into all the drinking vessels from the same assemblage, as suggested by LH I examples from Tsoungiza: the krater of Room 4 (5.36 litres) would soon have emptied if it had served the largest goblet (2.64 litres).[267] On the other hand, it must be assumed that the largest kraters of the studied periods may have held up to 18–19 litres: the exemplars come from Orchomenos (LH I), Athens (LH II–IIIA1), and the Menelaion (LH IIB).[268] Goblets of any size and capacity from these settlements may have received beverages from these large kraters. On the assumption that kraters contained wine mixed with water, it is very difficult to assess how much beverage people actually consumed in commensal occasions, possibly around 0.2–1 litre for most of them, as suggested by drinking vessels of these sites, and certainly no more than 2.5–3 litres.

In LH II–IIIA1, the drinking vessels, i.e., goblets, cups and kylikes, that were uncovered by their hundreds in the occupation levels of the two mansions at the Menelaion of Sparta, in the wash deposits of the settlement at Nichoria and in the wells on the south slope of the Acropolis in Athens, were certainly used in commensal activities most likely involving not only the ruling families but larger groups with a less privileged status. This is a significant shift observed in Mycenaean drinking practices. As was the case earlier in Minoan Crete,[269] these events were certainly connected with the development of power and increasing complexity of social interactions. However, the use of goblets implies specific drinking practices in Mycenaean Greece. The wide range of goblet capacities in the same assemblages may be interpreted as the coexistence of new and old drinking practices but also as a possible hint of increasing inequality in social behaviour, involving differentiated ways of drinking, in the Mycenaean chiefdoms or principalities.[270]

In LH II–IIIA1, most of the goblets have a capacity smaller than one litre[271] and they obviously served as individual drinking vessels. However, some of them may have held more than three litres, for instance at the Menelaion near Sparta.[272] The drinks contained in these goblets were most likely shared, as was suggested above for the MH goblets. The same interpretation has been supported for the large kylikes from the later Palace of Nestor.[273] Drinks held in large goblets and kylikes may have been shared by passing these vases among the participants taking part in the activity of social drinking. It is not excluded that smaller

261 Nordquist 2002, 133. – Rutter 2012, 81.

262 Karo 1930–1933. – Mylonas 1972–1973. – Dietz 1991. – By contrast, they are found in a limited number in the graves of the settlements studied in this article, such as two assemblages from graves dug into houses on the Barbouna Hill in Asine at the end of LH I: Nordquist 1987, 52. – On kantharoi with complete profiles from graves in Orchomenos: Sarri 2010, 51 and Pls. 6/10, 8/2, 9/8.

263 As regards LH I Lerna, the total available capacity of the Aeginetan CP "would thus amount to some 500 litres": Lis 2008, 143. – For Aeginetan cooking pots from Lerna VI, see Lindblom 2007, Fig. 10.

264 Whittaker 2008, 93. – On formalised drinking ceremonies in the late MH related to the warrior lifestyle of the newly-established or emerging elites: Whittaker 2008, 95.

265 On capacities of cooking pots in LH I Lerna (funerary context), see Lis 2008, 143: average extant pot capacity of four to five litres.

266 Wright 2004, 145 and Fig. 4 (Tomb 10, Shaft II). – This new study will also allow us to tackle possible gender differences in feasting, see comment Wright 2004, 129. – Sets of vessels, including goblets, were uncovered in both MH (– LH I) female and male graves in Asine: Nordquist 1999, 572. – Nordquist 2002, 126–127 (also children), 133.

267 For these two vases, see Rutter 2015, E51, E49.

268 Orchomenos: Sarri 2010, Pl. 39/7. – Athens: Mountjoy 1981, Fig. 7/41. – Menelaion: Catling 2009, Fig. 124/II15.

269 Hamilakis 1996, 25. – According to the author, these social processes (feasting and drinking ceremonies and intra-elite gift exchange) already took place in the proto-palatial period. – As regards the Cyclades, in LC II Ayia Irini, the conical cups were still the most common drinking shape, but abundant imported Mycenaean tableware, including Mycenaean goblets, suggests that similarities in drinking practices to those on the mainland existed: Abell, Hilditch 2016, 165.

270 The term 'principalities' ('princes') is indeed used by Touchais 2008b, 279, 281, and also Dickinson 1994, 304, but 'chiefdoms' ('chiefs') by Wright 2004, 155, 166, for the early Mycenaean period.

271 In Tsoungiza, goblets downsized to a smaller diameter range in the early LH I: Rutter 2015, 215.

272 ET69 is the goblet with the largest capacity calculated here (5.88 litres): Catling 2009, 89 and Fig. 93.

273 Dabney, Halstead, Thomas 2004, 203. – Vitale 2008, 232. – One of these kylikes holds seven litres: Blegen, Rawson 1966, 371 (29i).

drinking vessels with three or four handles[274] were intended to be shared in the MH and LH periods, but the capacity is definitely a relevant criterion for tracking this practice. Circulating cups and circulation of wine are practices attested much later in Archaic banquets.[275] Sharing drinking vessels may have reinforced the notion of belonging to peer-elites. If large-scale feasting and drinking ceremonies were part of a social strategy by the elites for consolidating and legitimating their power,[276] the method of sharing the drinks by passing vases among the participants certainly aimed at the same objective.

This hypothesis is supported by the gesture of an individual depicted on the Campstool Fresco at Knossos, holding a goblet and handing it towards another individual who is opening his hand to receive it.[277] Thus, this custom may also have occurred in LM II–IIIA Crete. In this context, the reconstruction of the banqueters associated with the Lyre Player in the LH IIIB megaron fresco at Pylos should perhaps be revisited, with only one person in each pair holding a drinking vessel instead of everyone doing so.[278] The scenes depicted on these two Late Bronze Age frescoes illustrate the consumption of drinks on special occasions, during formal drinking ceremonies, but not directly large-scale feasting activities based on the consumption of food.[279] Formal drinking ceremonies may have been specific moments in the unfolding of feasts.[280] Ultimately, this raises the question of whether the use of large drinking vessels may have been linked to specific ritual practices associated with religious celebrations in palatial times. The same question arises for post-palatial practices, in particular with regard to a figure holding a large kylix, identified as female, on a LH IIIC Early amphora.[281]

Another issue is whether the men depicted in pairs and in a limited number on the Knossian and Pylian frescoes represent a privileged circle of peer-elites drinking in independent ceremonies,[282] or whether this group was only a small part of a large number of feasting participants that may also have involved women and children, since the quantity of feasting provisions listed by the palace at Pylos might have been gathered for "a thousand and more people".[283] The consumption of drink was a highly appreciated activity in social and ritual spheres. Wine was one of the major distributed commodities in the kingdoms of Knossos and Pylos.[284] To this extent, feasting ceremonies may be regarded as acts of social integration into the palatial authority. It was a growing phenomenon in LH II–III, as attested by the LH II–IIIA1 drinking assemblages from the Menelaion, Nichoria and Athens,[285] in the LH IIIB1 settlement at

274 For a LH IIIA2 unpainted three-handled kylix from Mitrou, see Vitale 2008, 232 and Pl. XLV/d. – For a three-handled kylix (FS 259) from Pefkakia, see Batziou-Efstathiou 2015, 66 and Fig. 42. – For a LH I–II burnished goblet from Krisa (Inv. 6132), see Phialon 2018, 449, 453, 492 and Fig. 69.

275 Wecowski 2014, 121–124.

276 Hamilakis 1996, 25.

277 Evans 1935, 379–390 and Figs. 323–325, Pl. XXXI. – Wright 2004, 164 and Fig. 15.

278 On a fresco with men at table, very fragmentary (Throne Room): Lang 1969, 80–81 (44 H 6) and Pls. 28, 125–126, A. – Wright 2004, 163 and Fig. 13 (courtesy L. R. McCallum). – However, drinking vessels which were found in pairs in Room 8/00 at Tiryns (LH IIIC Early) lead Stockhammer 2011b, 221, 224 to assume that this "placement" was "an obvious reference to palatial feasting". – For the LH IIIB feasting fresco at Pylos, see Stockhammer 2011b, 213 and Fig. 3; however, on a mug likely "to be passed around among the heads of the elite families of this time" because of its large capacity (c. 3 litres, vs. the kylikes having a capacity of only 0.35–0.55 litres), see Stockhammer 2011b, 224. – Stockhammer 2008, 164, Pl. 49.

279 No ritual dining is depicted, but preparation for feasting is suggested by the depictions of hunting scenes and supply of tripods at Pylos: Lang 1969, 70–71 (21 H 48) and Pls. 15, 116, 122. – Shaw 1997, 496. – Pini 2008, 232. – For Tylissos (Crete), see Shaw 1972, 184 and Fig. 13. – Wright 2004, 157 and Fig. 8. – For Ayia Irini (Kea), see Morgan 2018, 288–289 and Figs. 9–10/a.

280 As emphasized by Constantinidis 2008, 65, the "preparations of feasts would not have been limited to food and drink alone but to festive clothing (including jewellery and the use of perfumes), music, spaces and seating arrangements as well." – For an interpretation of the frescoes from the Throne Room at Pylos, see McCallum 1987, 296: "These three activities of procession, sacrifice, and banquet probably represented highlights of a major festival [...]". – Feasts are also "dynamic social practices": Girella 2008, 177.

281 Güntner 2000, 22 and Pl. 5/1a–b. – For a LH IIIC krater fragment from Lefkandi decorated with a person dressed in a long robe, seated in front of a krater containing a kylix, see Crouwel 2006, 240–241, 249 (B2b), Pls. 59, 71. – Crouwel, Morris 2015, 166. – Nevertheless, the socio-political background is completely different in the post-palatial period, characterized with "permeable hierarchies", and as regards the pictorial pottery, with "increasing depictions of competition": Stockhammer 2011a, 219. – In comparison, it has been demonstrated that, in the 6th and 5th centuries BC, large drinking vessels were handled in specific rituals during religious celebrations, and were also related to hero cult and heroized funerary contexts: Tsingarida 2011, 73.

282 "Drinking was obviously a central activity of feasting but could also be an independent ritual, such as for divinities or the dead": Shelton 2008, 227.

283 On the number of participants, see above, in introduction: Palaima 2004, 229. – Later, in the Archaic period, "Greek commensality was essentially an all-male activity": Murray 1990, 6.

284 Palmer 1994, 84–85.

285 And particularly in LH IIB–IIIA1, when "the idea of a feasting service seems to have been crystallized": Thomas 2011, 302. – However, goblets with capacities larger than three litres occurred only rarely in the LH II–IIIA1 drinking vessel assemblages.

Tsoungiza, for instance,[286] and at its climax in the LH IIIB2 palatial context at Pylos. The present volumetric study on goblets, kraters and other tableware has endeavoured to address issues not merely about the function and use of pottery shapes, but also about the development of drinking practices in a diachronic approach.

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Appendix 1

Supplementary data on the capacities of drinking vessels and tableware obtained by calculation methods can be found at:
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Appendix 1.
Supplementary Data: Capacities of Drinking Vessels and Tableware

Thoughts on the Capacities of Goblets and Consumption Practices in Middle Helladic and Early Mycenaean Settlements

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The following tables contain the capacities of drinking vessels and tableware obtained by calculation methods. The sites are listed in alphabetical order.

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List of abbreviations:
AM = Argive Minyan
BM = Brown Minyan
DB = Dark Burnished
DT = Dark Tempered
GM = Grey Minyan
MP = Matt-Painted
RM = Red Minyan
YM = Yellow Minyan

1. Asine

Note: Buildings 1 and 2 dated to MH IIIA and MH IIIB respectively: Dietz 1991, 292. – Nordquist 2002. – Rutter in press.

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Group/date
Nordquist 1987 (scales for calculating capacities based on rim diam.).					
Fig. 35	cup	GM (hm)	13.1	0.75	Group A, EH III/MH I
Fig. 37/1	rounded bowl	GM (hm)	15.6	1.85	Group B, MH
Fig. 37/2	rounded bowl	GM (hm)	c. 18	rest. c. 2.91	Group B, MH
Fig. 38/6 (As 2119)	small cup	GM (hm)	4	0.03	Group B, MH
Fig. 39	kantharos	DB (hm)	7.9	0.17	Group B, MH
Fig. 40 (As 2388)	rounded bowl	GM (hm)	19.2	3.55	Group C, MH
Fig. 44 (As 5297)	basin/bowl	AM (hm?)	29	4.80	Group C, MH III
Fig. 45/1	(pedestalled) goblet	YM, DT fabric (hm)	26.1	rest. c. 4.20	Group D, MH III
Fig. 45/2	(pedestalled) goblet	YM, DT fabric (hm)	25.8	rest. c. 4.17	Group D, MH III
Fig. 47/1	pedestalled goblet	YM (hm)	21	2.29	Group D, MH III
Fig. 47/2	pedestalled goblet	DB	16.6	0.97	Group D, MH III
Fig. 48/1	two-handled bowl	MP, burnished DT fabric (hm)	12	0.46	Group D, MH III
Fig. 48/2	basket-handled cup	MP, burnished DT fabric (hm)	8.1	0.17	Group D, MH III
Fig. 48/3	kantharos	GM	11.9	0.30	Group D, MH III
Fig. 49/2	(pedestalled) goblet	YM (hm)	17.9	1.83	Group D, MH IIIA
Fig. 49/3	low pedestalled goblet	burnished red fabric (hm)	21.7	rest. c. 3.06	Group D, MH IIIA
Fig. 49/4	low pedestalled goblet	DT burnished (hm)	21.3	rest. c. 2.47	Group D, MH IIIA
Fig. 50/6	low pedestalled goblet	MP, semi-fine DT fabric (hm)	19.5	1.87	Group D, MH IIIA
Fig. 50/7	low pedestalled goblet	MP, semi-fine DT fabric (hm)	19.9	rest. c. 2.19	Group D, MH IIIA
Fig. 51/2	pedestalled goblet	late, mottled DB fabric (hm)	20.9	2.28	Group D, MH IIIB
Fig. 51/3	low pedestalled goblet	YM (hm)	16	1.18	Group D, MH IIIB
Fig. 52/6	kantharos	DT (hm)	15.2	0.91	Group D, MH IIIB
Fig. 53/10	(pedestalled) goblet	MP, Aeginetan/gold mica fabric (hm)	21	rest. c. 2.53	Group D, MH IIIB
Fig. 53/11	dipper	MP, white-slipped DT fabric (hm)	8.9	0.14	Group D, MH IIIB
Fig. 53/12	two-handled cup	MP, fine DT fabric (hm)	7.6	0.10	Group D, MH IIIB
Fig. 54/13	kantharos	MP (hm)	16	rest. c. 1.22	Group D, MH III
Fig. 54/15	kantharos	MP (hm)	14.4	rest. c. 0.92	Group D, MH III
Fig. 54/16	goblet	MP (hm)	17.5	1.47	Group D, MH IIIB
Fig. 59	straight-sided cup (Vapheio)	panelled decoration	7.2	0.09	Group F, LH I
Frizell 1980 (scale: 1:3).					
4/54	carinated goblet, FS 261	unptd Myc.	14	0.52	LH IIB–IIIA1
6/83	small conical cup, FS 204	decorated Myc.	10.3	0.06	LH II B
8/148	small handleless cup	brick red fracture, pinkish slip	11.5	0.35	LH IIB–IIIA1
8/149	small handleless cup	pinkish buff fracture, buff slip	8	0.04	LH IIB–IIIA1
8/152	conical handleless cup, FS 204	unptd Myc.	12	0.26	LH IIB–IIIA1

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Group/date
8/161	stemmed globular cup/ goblet, FS 263 or 264	unptd Myc.	19.95	2.11	LH IIB–IIIA1
9/169	stemmed carinated cup, FS 267	unptd Myc.	12	0.27	LH IIB–IIIA1
11/241	cup, FS 224 (Vapheio)	buff fracture and slip, brown paint	13	0.62	LH IIB
12/249	conical cup, FS 208	rather coarse fabric, brick red fracture	12	0.27	LH IIB–IIIA1
12/253	deep conical bowl	pinkish fracture with buff core, buff slip	22	3.40	LH IIB–IIIA1
15/134	goblet, FS 254, Ephyraean	decorated Myc.	est. 14	0.93	LH II B

2. Athens-Acropolis South Slope, wells

Bibliographical reference/ inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
MOUNTJOY 1981 (scale: 1:3, if not specified).					
Fig. 7/41 = 9879	krater	burnished (deep pink)	34	1:6 scale rest. c. 19.43	LH II–IIIA1
Fig. 7/45 = 9786	cup	burnished (buff, pink)	15.3	0.41	LH II–IIIA1
Fig. 7/46 = 9787	cup	burnished (deep pink)	12–13	0.32	LH II–IIIA1
Fig. 7/47 = 9864	cup, shallow	burnished (buff)	17	0.74	LH II–IIIA1
Fig. 7/49 = 9790	spouted conical bowl	burnished (pink-buff)	23.5	1:6 1.75 (below the spout)	LH II–IIIA1
Fig. 8/52 = 9874	goblet, FS 270	burnished (buff)	10.5–10.7	0.28	LH II–IIIA1
Fig. 8/53 = 9841	goblet, FS 270	burnished (buff)	14	0.59	LH II–IIIA1
Fig. 8/56 = 9863	goblet, FS 263	burnished (orange, brown)	15	1:3 rest. c. 0.80	LH II–IIIA1
Fig. 8/57 = 9842	goblet, FS 263	burnished (pink-buff, brown)	16.8	1.42	LH II–IIIA1
Fig. 8/58 = 9839	goblet, FS 263	burnished (buff, deep orange)	13.1–14.3	0.72	LH II–IIIA1
Fig. 8/59 = 9840	goblet, FS 263	burnished (pink)	15–17.8	1.37	LH II–IIIA1
Fig. 10/85 = 9865	goblet, FS 263	polished (buff, pink)	17	1.16	LH II–IIIA1
Fig. 10/90 = 9875	goblet, FS 270	polished (buff)	11–11.5	0.30	LH II–IIIA1
Fig. 10/91 = 9878	lipless conical bowl, FS 204	polished (buff)	11.7	0.31	LH II–IIIA1
Fig. 10/92	lipless conical bowl, FS 204	polished (pinkish)	12.6	0.27	LH II–IIIA1
Fig. 10/93 = 9857	lipless conical bowl, FS 204	rough (pink)	11.9	0.30	LH II–IIIA1
Fig. 10/94 = 9858	lipless conical bowl, FS 204	rough (orange, buff slip)	11.5	0.25	LH II–IIIA1
Fig. 10/95 = 9859	lipless conical bowl, FS 204	rough (buff)	11	0.30	LH II–IIIA1
Fig. 10/96 = 9869	lipless conical bowl, FS 204	rough (buff)	11.5	0.29	LH II–IIIA1
Fig. 10/97 = 9860	lipless conical bowl, FS 204	rough (buff)	12.3	0.27	LH II–IIIA1
Fig. 10/98 = 9789	lipless conical bowl, FS 204	rough (buff)	11	0.17	LH II–IIIA1
Fig. 10/99 = 9861	cup	rough (pink, buff slip)	6.3	0.04	LH II–IIIA1
Fig. 10/100	goblet, FS 272	rough (orange)	11	0.24	LH II–IIIA1
Fig. 15/167	shallow cup, FS 219	Myc. decorated	11	rest. c. 0.27	LH IIIA1
Fig. 15/170	cup, miniature	Myc.	4.6	0.02	LH II–IIIA1
Fig. 15/171	conical cup, FS 230	Myc. decorated	11	rest. c. 0.22	LH IIB–IIIA1
Fig. 15/177 = 9783	goblet, Ephyraean, FS 254	Myc. decorated	13	0.51	LH IIB
Fig. 15/183	goblet, FS 270	Myc. decorated	12	0.39	LH IIB
Fig. 17/191	goblet, FS 270	burnished (pinkish)	9	rest. c. 0.18	LH II–IIIA1
Fig. 17/195 = 9753	basin	burnished (buff)	26	2.22	LH II–IIIA1
Fig. 20/232 = 9764	goblet, FS 270	burnished (buff)	11.9–12.8	0.36	LH II–IIIA1
Fig. 20/233	goblet, FS 270	burnished (pink)	11	0.26	LH II–IIIA1
Fig. 20/237 = 9762	goblet, FS 263	burnished (buff)	16.6–18	1.46	LH II–IIIA1
Fig. 21/244 = 9766	cup/bowl	standard (buff)	9.2–9.3	0.21	LH II–IIIA1
Fig. 21/245 = 9765	lipless conical bowl, FS 204	rough (pinkish)	11.2	0.26	LH II–IIIA1

Bibliographical reference/ inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Fig. 21/246	lipless conical bowl, FS 204	rough (pinkish, orange slip)	11.4	0.26	LH II–IIIA1
Fig. 21/247	lipless conical bowl, FS 204	rough (buff)	12.6	0.26	LH II–IIIA1
Fig. 21/249 = 9763	goblet, FS 263	rough (buff)	12.5–12.8	0.78	LH II–IIIA1
Fig. 25/323	shallow cup, FS 219	Myc. decorated	12	[c. 0.32]	LH IIIA1
Fig. 25/333	conical cup, FS 230	Myc. decorated	11 [but 9 with 1:3]	rest. c. 0.19	LH IIB–IIIA1
Fig. 25/360	kylix	Myc. decorated	16.5	0.66	LH IIIA1
Fig. 28/378	goblet, FS 270	burnished (orange)	10.5–11	0.42	LH II–IIIA1
Fig. 28/379	goblet, FS 270	burnished (buff)	9.6–10	0.28	LH II–IIIA1
Fig. 28/384	goblet, FS 263	burnished (grey fired orange)	16	1.38	LH II–IIIA1
Fig. 28/392 = 9756	goblet, FS 270	standard (buff with mica, orange slip)	11–11.6	0.32	LH II–IIIA1
Fig. 29/388 = 9754	basin	burnished (buff)	26.5	1.87	LH II–IIIA1
Fig. 30/405	goblet	matt monochrome (buff, orange)	16.4	1.61	LH II–IIIA1

3. Ayios Stephanos

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Zerner 2008 (scale drawing for calculating diameter and capacity: 1:3).					
1237	carinated cup	DB	16.5	1.1	MH I Late
1343	rounded bowl	DB	13	1.03	MH II
1507	one-handled rounded cup	coarse, local	8.9	0.26	MH III Late
1519	carinated cup with tripod base	DB	[c. 9.3]	0.14	LH I/IIA
1614	goblet, rounded	YM, gritty	16.5	1.57	LH I/IIA
1649	goblet, rounded	MP, gritty	15	1.4	LH I/IIA
1830	carinated cup	DB	8.4	0.2	MH I Late
1831	carinated cup/ kantharos	DB	12.4	0.53	MH I Late
1889	rounded cup	coarse, local	11	0.75	MH I Late
2007	carinated cup	DB	[c. 7.7]	0.11	MH III Early
2131	conical cup	Minoan, fine	8	0.08	LH I Early
2211	angular cup	DB	6	0.04	MH
2290	straight-sided cup	Minoan, fine	10.5	0.3	MH III Early
3005	goblet	monochrome	11	0.5	LH IIA
3240	Vapheio cup, FS 224	Myc. decorated	9.2–10.2	0.33	LH I
3295	ring-handled cup, FS 237	monochrome	9	0.04	LH IIB
3296	ring-handled cup, FS 237	monochrome	9	0.05	LH IIB
3301	cup, FS 219	Myc. decorated	11.2	0.27	LH IIIA1
3305	dipper, FS 236	coarse, unptd	10.4	0.24	LH IIIA1
3306	dipper, FS 236	standard, unptd	8.8	0.25	LH IIIA1
3313	kylix, FS 267	Myc. unptd	10.5	0.14 [min., irregular height]	LH IIIA1 [?]
3401	carinated cup	YM, gritty	12.3	0.6	LH I Early
3511	cup, FS 211	Myc. decorated	11	0.37	LH IIA
3538	bowl	unptd, gritty	8	0.11	LH IIA
3645	Vapheio cup, FS 224	Myc. decorated	c. 10	0.3	LH IIA
3646	conical cup, FS 204	unptd	9.9–10.2	0.1 [min., irregular height]	LH IIA
3658	straight-sided cup	Myc. decorated	12.5	0.45	LH I
3660	miniature cup	Myc. decorated	9.6	0.19	LH I
3662	goblet, FS 270	unptd	9	0.17	LH I
3667	goblet, FS 263	monochrome	20	3.34	LH IIA
3673	ring-handled cup, FS 237	monochrome	7.4	0.04	LH IIB
3674	goblet, FS 263	monochrome	14.8	0.86	LH IIB
3675	cup, FS 219	Myc. decorated	11.2	0.19	LH IIIA1
Rutter, Rutter 1976 (scale drawing for calculating diameter and capacity; date: parallels in Zerner 2008).					
R63	carinated cup	Dark Minyan/DB	[11.5]	0.36	MH III Early
R168	high-handled cup	coarse	[14.9]	0.55 [min., irregular height]	MH III Early
R246	kantharos	MP, gritty	[13.4]	0.76	MH III/LH I
R247	kantharos	MP, white-slipped	[10]	0.28 [min., irregular height]	MH III/LH I

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
R413	rounded cup	dark-on-light, fine Minoanizing	[15.1]	0.8	MH III – LH II
R488	conical cup	fine, unptd, Minoanizing	[13.1]	0.21	MH III – LH II

4. Eleusis

Note: GM = grey, polished in Cosmopoulos 2014a. – * = angular bowls in Cosmopoulos 2014a.

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Cosmopoulos 2014a (scales for calculating capacities based on rim diam. or height, then indicated).					
Fig. 1/27	two-handled bowl	(semi-)fine, DB	11	0.35	EH III/MH I
Fig. 1/28	one-handled cup	(semi-)coarse, burnished	5.5 h. 4.8	0.06	EH III/MH I
Fig. 4/119	bowl with incurved rim	(semi-)fine, MP	h. 8	0.52	MH II
Fig. 11/295	kantharos	GM, fine	8	0.25	MH I
Fig. 11/296	kantharos	GM, fine	7.9 h. 6	0.23	MH I//II
Fig. 12/297	kantharos	GM, fine	h. 6.3	0.30	MH I
Fig. 12/298	kantharos	GM, fine	p.h. 6.4	c. 0.25	MH I
Fig. 12/310	(pedestalled) goblet*	GM, fine	17	0.73	MH IIIA
Fig. 12/326	(pedestalled) goblet*	GM, fine	25	c. 3.13	MH II (or MH III)
Fig. 17/386	kantharos	GM, fine	11 h. 4	0.22	MH II (or MH IIIB?)
Fig. 17/387	bowl or kantharos?	GM, (semi-)fine	9.2	0.19	MH IIIB
Fig. 18/419	semi-globular cup, FS 212	polished	10	0.25	MH III/LH IA
Fig. 18/420	semi-globular cup, FS 212	unptd	9.4 h. 5.9	0.20	MH III/LH I
Fig. 18/433	goblet	coarse	22.8	c. 2.27	MH IIIB
Fig. 25/604	cup with straight rim	MP, fine, polished	16	rest. c. 1.19	LH IB
Fig. 25/605	Vapheio cup	Mainland Panelled Style	8.7	0.11	MH IIIB/LH I
Fig. 28/680	Vapheio cup	yellow Minyan	14	0.50	LH I
Fig. 28/683	Vapheio cup	(semi-)fine, unptd	9.4	0.19	LH I
Fig. 28/685	low pedestalled goblet*	(semi-)coarse, red burnished	12.8	0.75	LH IB
Fig. 28/686	shallow bridge-spouted bowl	(semi-)coarse, burnished	17.6	0.84	LH I
Fig. 29/694	semi-globular cup, FS 211	Myc. decorated	12.2	rest. c. 0.71	LH IB
Fig. 29/695	tall globular cup, FS 211	Myc. decorated	13–14.7 h. 12	0.96	LH I
Fig. 34/823	Vapheio cup, FS 224	Myc. decorated	12.5	0.58	LH IIA
Fig. 34/824	Vapheio cup, FS 224	Myc. decorated	14	0.74	LH IIA
Fig. 36/870	high-handled cup, FS 237	Myc. decorated	7.8	0.05	LH IIB
Fig. 36/876	goblet, FS 254	Myc. decorated	8	0.13	LH IIB
Fig. 36/877	small goblet, FS 261	Myc. decorated	7.5	0.11	LH IIB
Fig. 37/900	Ephyraean goblet, FS 254	Myc. decorated	17–18	rest. c. 2.17	LH IIB

5. Kiapha Thiti

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Maran 1992b (scale: 1:3).					
Pl. 1/23	goblet, FS 254	Myc. pottery	17	1.23	LH IIA
Pl. 4/147	cup, FS 219	Myc. pottery	12	c. 0.30	LH IIIA1
Pl. 22/689	goblet	gold mica pottery with red or black slip	22.5	c. 2.39	(MH III or) LH I
Pl. 23/735	cup with high vertical handle or kantharos	light red to yellow burnished pottery	11.2	0.26	MH III or LH I
Pl. 28/866	goblet	light red to yellow burnished pottery	12	0.63	MH III
Pl. 31/948	goblet	light red to yellow burnished pottery	12	0.26	MH III
Pl. 31/958	goblet	DB pottery	22	2.26	MH III

6. Kolonna (Aegina)

Bibliographical reference/ inv. number	**Shape**	**Class**	**Rim diameter (cm)**	**Capacity (litre)**	**Group/date**
Walter, Felten 1981 (scales for calculating capacities based on height).					
Fig. 119.387, Kat. Nr. 387, Inv. 404	conical basin or bowl	reddish-grey burnished	rim diam. 12.7 h. 11.4	3.74	Kolonna VII Group XXVII
Fig. 116, Kat. Nr. 389, Inv. 406	kantharos	brown-black burnished	rim diam. 7.6 h. 11.2 (with handle)	1.11	Kolonna VII Group XXVII
Fig. 117, Kat. Nr. 390, Inv. 409	kantharos	black burnished	rim diam. 19.7 h. 23.8 (with handle)	3.91	Kolonna VII Group XXVII
Fig. 118, Kat. Nr. 391, Inv. 407	two-handled bowl	grey-brown burnished	rim diam. 16.2 h. 12.5	1.83	Kolonna VII Group XXVII
Siedentopf 1991 (scales for calculating capacities based on rim diam.).					
353, Inv. 2653 (666) cf. Nr. 443	spouted bowl	MP	21.2	c. 8.29	Kolonna IX–X [no group]
500, Inv. 2800a-b	(pedestalled) carinated bowl/goblet	MP	c. 15.6	c. 0.49	MH
501, Inv. 2801a-b	(pedestalled) carinated bowl/goblet	MP	c. 19	c. 0.44	MH
502, Inv. 2802	(pedestalled) carinated bowl/goblet	MP	c. 15.2	c. 0.3	MH
503, Inv. 2803	(pedestalled) carinated bowl/goblet	MP	c. 12.2	c. 0.23	MH
505, Inv. 2805	carinated bowl with handle and raised base	MP	16	1.13	MH
572, Inv. 2872	footed cup or low pedestalled carinated goblet	MP	12	0.41	MH
594, Inv. 2894	cup with raised horizontal handle	MP	12	0.4	MH
595, Inv. 2895	cup with high handle	MP	14	1.02	MH
599, Inv. 2899	bowl (or krater?)	MP	c. 30	7.57	MH (or LH I?)
626, Inv. 2926	kyathos / high-handled cup	MP	14.2	0.86	MH
653, Inv. 2953 (134) cf. Nr. 409	kantharos	MP	[see Gauss, Smetana 2007, XXIX-1]		Kolonna VIII (*der frühe Stil*) Group XXIX
655, Inv. 2955 (136) cf. Nr. 412	kantharos	MP	[see Gauss, Smetana 2007, XXIX-4]		Kolonna VIII Group XXIX
715, Inv. 3015 (410) cf. Nr. 378 [Walter, Felten 1981, Fig. 111]	kantharos	MP	12.6	0.84	Kolonna VII–VIII Group XXVII
724, Inv. 3024	kantharos	MP	13.5	0.60	MH
725, Inv. 3025	kantharos	MP	13.5	0.57	MH
726, Inv. 3026 (537) cf. Nr. 424	kantharos	MP	– h. 16.2	3.93	Kolonna IX (no indication in Walter, Felten 1981)

Bibliographical reference/ inv. number	**Shape**	**Class**	**Rim diameter (cm)**	**Capacity (litre)**	**Group/date**
737, Inv. 3037	kantharos	MP	13.5–14	0.76	MH
739, Inv. 3039 (170) cf. Nr. 434	kantharos, one-handled cup in the shape of a kantharos	MP	c. 12	0.5	Kolonna IX Group XXXV
773, Inv. 3073	cup	MP	c. 9	0.38	MH
776, Inv. 3076	cup	MP	c. 9	0.40	MH
777, Inv. 3077 (399) cf. Nr. 423	cup	MP	8.4	0.49	Kolonna IX Group XXXI
Gauss, Smetana 2007 (scale drawing for calculating diameter and capacity: 1:3 scale).					
XXIX-1 cf. 653, Inv. 2953 (134) cf. Nr. 409	kantharos, carinated	MP	8.7	0.24	Phase H, MH I
XXIX-2 (cf. Nr. 410)	kantharos, carinated	MP	9.2	0.25	Phase H, MH I
XXIX-3 (cf. Nr. 411)	kantharos, carinated	MP	8.4	0.21	Phase H, MH I
XXIX-4 cf. 655, Inv. 2955 (136) cf. Nr. 412	kantharos, carinated	MP	9	0.27	Phase H, MH I
XXVIII-26	cup	painted (and burnished)	8	0.20	Phase H, MH I
8b/11-3	cup, handleless straight-sided	painted light-on-dark, prob. Cycladic import	11.3	c. 0.66	Phase H, MH I
8b/11-8	bowl/basin, straight-sided	painted and burnished in red color	21.9	1.08	Phase H, MH I
8b/11-10	kantharos	painted in brown or black and burnished	rest. 8.9	c. 0.23	Phase H, MH I
FG 63-1	cup, handleless straight-sided	unptd	7.7	0.21	Phase H, MH I
FG 63-2	cup, handleless straight-sided	unptd	rest. 6.8	0.13	Phase H, MH I
FG 63-3	cup, handleless straight-sided	unptd	6.9	0.12	Phase H, MH I
FG 63-11	bowl with incurved rim	unptd	13.7	0.75	Phase H, MH I
FG 89-14	cup	unptd	5.1	0.03	Phase H, MH I
XXVII-35 (cf. Walter, Felten 1981, Nr. 383)	bowl with incurved rim	painted red (Cycladic?)	13.5	0.52	Phase H, MH I
XXVII-38 (cf. Walter, Felten 1981, Nr. 386)	bowl	painted	18.5	1.02	Phase H, MH I
XXXV-4 (cf. Walter, Felten 1981, Nr. 437)	pedestalled goblet	GM	19.1	1.08	Phase I, MH II

Bibliographical reference/ inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Group/date
XXXV-5 (cf. Walter, Felten 1981, Nr. 438)	pedestalled goblet	GM	18.5	0.95	Phase I, MH II
XXXV-8 cf. 739, Inv. 3039 (170) cf. Nr. 434	kantharos, carinated	MP	12.2	no interior profile	Phase I, MH II
XXXV-7 (cf. Walter, Felten 1981, Nr. 440)	pedestalled goblet	burnished	27.3	3.01	Phase I, MH II
XXXV-9	kantharos	burnished	7.8	0.16	Phase I, MH II
XXXV-10 (cf. Walter, Felten 1981, Nr. 435)	pedestalled goblet	painted, Cycladic import, *highly burnished	17	0.58	Phase I, MH II
2/01-2	bowl/basin	MP	27	3.09	Phase I, MH II
2/01-3	cup, handleless	unptd	8.1	0.16	Phase I, MH II
2/01-15	cup, handleless	painted?	6.3	0.08	Phase I, MH II
12a/11-1	pedestalled goblet	grey burnished, 'GM'	17.9	0.79	Phase I, MH II
12a/11-2	kantharos, carinated	burnished	9.3	0.22	Phase I, MH II
12a/11-3	cup, handleless	unptd	8	0.13	Phase I, MH II
12a/11-6 Pr 199	cup, one-handled carinated	MP	9.2	0.16	Phase I, MH II
Q3/87-22	cup with incurved rim, handleless	painted	10.7	0.16	Phase I, MH II
Q3/89-3	cup with incurved rim, handleless	painted	9.9	0.10	Phase I, MH II
Q3/90-6	cup with flaring rim, handleless	unptd	12.3	0.09	Phase I, MH II
Q3/90-10	cup with incurved rim, handleless	unptd	10.1	0.09	Phase I, MH II
Q3/105-1	cup, straight-sided	painted	8.7	0.18	Phase I, MH II
Q3/105-2	cup, one-handled straight-sided,	light-on-dark, Minoan type	8.4	0.18	Phase I, MH II
FG 89-14	cup, miniature, one-handled	unptd	5	0.03	Phase J, MH III
Q6/18-6	Vapheio cup	mainland polychrome painted	11.4	0.33	Phase K, LH I
Q6/18-22	Vapheio cup	unptd	8.7	0.13	Phase K, LH I

7. Krisa

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Phialon 2018 (capacities measured by filling with lentils, unlike computer methods applied here). – For Inv. 6149, 6150: Jannoray, van Effenterre 1938; drawings courtesy E. Velli.					
Inv. 6027	kantharos	GM	7.7	0.12	MH III
Inv. 6082	krater	Myc. decorated	24.2	3.89	LH IIIA1
Inv. 6083	goblet, FS 254	burnished	15.7–17.7	1.33	LH II
Inv. 6085	goblet, FS 254	burnished	21.1–23.5	4.08	LH II
Inv. 6087	goblet, FS 254 or 255	Myc. decorated	12–13	0.54	LH IIIA1
Inv. 6088	goblet, FS 255	unptd	11.8	0.44	LH (IIB–)IIIA1
Inv. 6096	kantharos	YM imitation, semi-coarse	12.2–13	0.88	MH III or LH I
Inv. 6098	kantharos	GM	10	0.18	MH II–III
Inv. 6099	cup	semi-coarse	12–12.5	0.75	MH III or LH I
Inv. 6101	cup with pointed base	semi-coarse	7.7	0.26	MH (LH IIIA1?)
Inv. 6117	ring-handled cup	semi-coarse	8	0.17	LH I
Inv. 6130	goblet	pale burnished	14.5–15.2	1.62	LH II
Inv. 6132	four handled goblet	burnished	17	1.18	LH I–II
Inv. 6135	conical cup/bowl	semi-fine	12.2	0.30	LH
Inv. 6142	ring-handled cup	MP	6.1	0.16	LH I
Inv. 6143	dipper	pale burnished	10.5	0.44	LH I
Inv. 6149	kantharos	GM	11.5	0.23	MH III
Inv. 6150	pedestalled goblet	GM	24.5	3.18	MH II–III
Inv. 6151b	cup	Myc. decorated	11.3	0.25	LH IIIA1

8. Menelaion

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Menelaion Hill incl. East Terrace, South Slope, construction level oustide Mansion 2, Mansion 2: Rooms II, III, V, VII, VIII, X, North Building, Terrace Houses, Post Hole deposit; Aetos South Slope incl. Building B: Catling 2009 (scale: 1:3).					
ET25 [P1141]	krater, FS 7 (fragm.)	Myc. decorated	c. 25.4	rest. c. 8.00	LH IIIA1
ET26 [P786+644]	krater, FS 7 (fragm.)	Myc. decorated	c. 24	rest. c. 6.24	LH IIIA1
ET34 [P604]	shallow cup, FS 219	Myc. decorated	14 (with 1:3)	0.37	LH IIIA1
ET35 [P1519]	shallow cup, FS 219	Myc. decorated	12.2	0.24	LH IIIA1
ET39 [P4907]	shallow cup, FS 219	Myc. decorated	13.5	c. 0.31	LH IIIA1
ET43 [P1102]	cup, carinated	Myc. decorated	12.4	0.29	LH II–IIIA1
ET47 [P783+1108]	cup, very shallow	Myc. decorated	12	0.12	LH II–IIIA1
ET50 [P730]	goblet, FS 254, stemless	Myc. decorated	16.5	2.03	LH IIB
ET63 [P221]	goblet	monochrome	15	1.13	LH (IIB–)IIIA1
ET64 [P779]	goblet	monochrome	14	0.92	LH (IIB–)IIIA1
ET69 [P724]	goblet	semi-monochrome	25.6	5.88	LH IIB(–IIIA1)
ET70 [P280]	goblet	semi-monochrome	19	2.55	LH IIB(–IIIA1)
ET71 [P1120]	goblet	semi-monochrome	19	2.46	LH IIB(–IIIA1)
ET74 [P722]	goblet	semi-monochrome	14	0.93	LH II(A–)B
ET78 [P586]	kylix	Myc. decorated	14.5	0.57	LH IIIA1
ET107 [P224]	goblet, tall	plain	23	c. 4.47	LH II–IIIA1
ET109 [P770]	goblet	plain	16	1.25	LH II–IIIA1
ET110 [P1520]	goblet	plain	15	0.92	LH II–IIIA1
ET116 [P729]	goblet with high-handles, FS271 or 272	plain	15	0.79	
ET124 [P744]	carinated kylix	plain	10.5	0.21	LH IIIA1
ET125 [P1967]	carinated kylix	plain	12	rest. c. 0.37	LH IIIA1
ET126 [P319]	carinated kylix	plain	11	0.26	LH IIIA1
ET129 [P214]	carinated kylix	plain	10	0.22	LH IIIA1
ET130 [P705]	carinated kylix	plain	12	0.39	LH IIIA1
ET131 [P1525]	carinated kylix	plain	11	0.27	LH IIIA1
ET132 [P218]	carinated kylix	plain	11	0.30	LH IIIA1
ET138 [P771]	dipper	plain	12.5	0.38	LH II–IIIA1
ET140 [P392]	conical cup	plain	11.6	0.25	LH II–IIIA1
ET142 [P727]	conical cup	plain	10.8	0.20	LH II–IIIA1
ET143 [P1783]	conical cup	plain	9.6	0.12	LH II–IIIA1
ET144 [P707]	conical cup	plain	9.5	0.19	LH II–IIIA1
ET149 [P213]	bowl	plain	34 base 10	4.53	LH II–IIIA1
ST25 [P1523]	Vapheio cup, FS 224	Myc. decorated	10	0.28	LH II–IIIA1
ST46 [P1768+?P1774]	goblet with horizontal handle/stemmed bowl, FS 304	monochrome	19	rest. c. 1.72	LH IIIA1
ST52 [P2085]	goblet	semi-monochrome	17	rest. c. 1.70	LH II–IIIA1
ST54 [P1037]	goblet	semi-monochrome	15	rest. c. 1.14	LH II–IIIA1
ST55 [P1027]	goblet	semi-monochrome	15	rest. c. 1.24	LH II–IIIA1

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
ST61 [P884]	kylix	Myc. decorated	12	0.42	LH IIIA1
ST78 [P865]	goblet	plain	16.8	2.34	LH II–IIIA1
ST82 [P1941]	goblet	plain	13	1.14	LH II–IIIA1
CLO20 [P929]	stemmed bowl, FS 304	monochrome	17.5	pres. 2.21	LH IIIA1
CLO22 [P1137]	bowl or basin, FS 295	monochrome	22	1.29	LH IIIA1
CLO39 [P807]	shallow angular bowl	plain	18	rest. c. 0.73	LH II–IIIA1
CLO44 [P788]	conical cup	plain	11	0.19	LH II–IIIA1
CLO45 [P903]	conical cup	plain	10.8	0.15	LH II–IIIA1
II15 [P1070]	krater	Myc. decorated	rest. 33.15	18.80	LH IIB
II17 [P1062+1312]	goblet	plain	21	3.21	LH II–IIIA1
II22 [P992]	goblet	plain	11	0.28	LH II–IIIA1
II23 [P1361]	goblet	plain	11.5	0.32	LH II–IIIA1
II24 [P945]	shallow angular dish	plain	22.3	rest. c. 1.26	LH II–IIIA1
II25 [P1412]	conical cup	plain	11–16	0.20	LH II–IIIA1
II26 [P1061]	conical cup	plain	9	0.11	LH II–IIIA1
II28 [P1307]	dipper	plain	5.8	0.04	LH II–IIIA1
III12 [P1360]	cup (ring-handled?)	plain	16	0.66	LH II–IIIA1
III13 [P1134]	goblet or cup, FS 219	plain	12	rest. c. 0.2780	LH II–IIIA1
III16 [P1379]	conical cup	plain	11	0.22	LH II–IIIA1
III17 [P601]	conical cup	plain	11	0.20	LH II–IIIA1
III18 [P1378]	conical cup	plain	10.2	0.15	LH II–IIIA1
III19 [P699]	small saucer	plain	7	0.03	LH II–IIIA1
III21 [P1366]	shallow angular dish	plain	27.6	2.96	LH II–IIIA1
III22 [P66 + 733]	shallow angular dish/ bowl	plain	13	0.24	LH II–IIIA1
IV6 [P275]	shallow cup, FS 219	Myc. decorated	12.7	0.33	LH IIIA1
IV8 [P125]	mug, FS 237	Myc. decorated	15.5 base 11.4	1.33	LH IIIA1
IV19 [P274]	conical cup	plain	12.4 base 3.9	0.25	LH II–IIIA1
V6 [P787]	ring-based krater, FS 279	Myc. decorated	26.5–27 base 12	7.94	LH IIIA1 Mountjoy no. 75 LH IIB Catling 2009, 345
V18 [P791]	goblet	plain	15	rest. c. 1.04	LH II–IIIA1
V20 [P979]	cup	plain	8	rest. c. 0.08	LH II–IIIA1
V22 [P988]	conical cup	plain	9.3	0.11	LH II–IIIA1
V23 [P1068]	conical cup	plain	10.8	0.17	LH II–IIIA1
VII14 [P860]	dipper, FS 236	Myc. decorated	10	0.20	LH IIIA1
VII18 [P1414]	kylix, FS	Myc. decorated	15	0.63	LH IIIA1
VII23 [P1296]	goblet	semi-monchrome	16	0.93	LH IIB(–IIIA1)
VII24 [P1321]	bowl with raised base, handleless	semi-monchrome	11	0.44	LH II–IIIA1
VII30 [P1338]	goblet	plain	16	1.09	LH II–IIIA1

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
VII31 [P1319]	goblet	plain	16	1.00	LH II–IIIA1
VII34 [P1310]	goblet	plain	15.5	1.16	LH IIIA1
VII49 [P1303]	carinated kylix, FS 267	plain	12	0.24	LH IIIA1
VII50 [P1285]	carinated kylix, FS 267	plain	11.5	0.27	LH IIIA1
VII51 [P1292]	carinated kylix, FS 267	plain	10	0.23	LH IIIA1
VII56 [P1277]	cup	plain	12	0.32	LH II–IIIA1
VII57 [P1356]	cup	plain	12	0.17	LH II–IIIA1
VII60 [P1342]	conical cup	plain	11	0.21	LH II–IIIA1
VII61 [P1288]	conical cup	plain	10.5	0.15	LH II–IIIA1
VII62 [P1305]	conical cup	plain	16.5	0.19	LH II–IIIA1
VII63 [P1325]	conical cup	plain	10.2	0.15	LH II–IIIA1
VII64 [P1275]	conical cup	plain	9.4 base 3	0.10	LH II–IIIA1
VII65 [P1304]	conical cup	plain	12.5	0.30	LH II–IIIA1
VII66 [P1359]	dipper?	plain	10	c. 0.35	LH II–IIIA1
VII67 [P1300]	shallow angular dish	plain	12.6	2.17	LH II–IIIA1
VII68 [P1255]	shallow angular dish	plain	29	2.98	LH II–IIIA1
VII70 [P1339]	shallow angular dish	plain	22	1.59	LH II–IIIA1
VII71 [P1286 and 1069]	spouted basin	plain	29	3.48 (below the spout)	LH II–IIIA1
VIII4 [P949+950]	shallow cup, FS 219	Myc. decorated	12.5	0.30	LH IIIA1
VIII9 [P948]	carinated kylix	plain	12	0.36	LH IIIA1
X3 [P583]	carinated kylix	plain	11.6	0.35	LH IIIA1
X4 [P693]	carinated kylix	plain	11.6	0.29	LH IIIA1
X5 [P694]	carinated kylix	plain	11	rest. c. 0.28	LH IIIA1
X7 [P303]	krater or bowl	plain	18	2.80	LH II–IIIA1
NB37 [P361]	shallow cup, FS 219	Myc. decorated	14	rest. c. 0.24	LH IIIA1
NB41 [P451]	stemless carinated goblet, one-handled	monochrome	16 base 7.5	1.41	LH II–IIIA1
NB46 [P357]	goblet, FS 254 or 255	Myc. decorated	19	rest. c. 2.55	LH IIIA1
NB80 [P216]	goblet	plain	17	1.18	LH II–IIIA1
NB81 [P302]	goblet	plain	15.6	1.07	LH II–IIIA1
NB82 [P589]	goblet	plain	15.5	1.46	
NB83 [P1343]	goblet	plain	15	pres. c. 1.05	
NB84 [P219]	goblet	plain	14.2 base 8	1.05	
NB90 [P1415]	goblet	plain	10	rest. c. 0.26	
NB93 [–]	stemless rounded bowl, horizontal handles, FS279	plain	15	1.05	
NB94 [P585]	carinated kylix, FS 267	plain	13.4 base 6.3	0.57	LH IIIA1
NB99 [P1363]	carinated kylix, FS 267	plain	11.5	0.34	LH IIIA1
NB100 [P1362]	carinated kylix, FS 267	plain	11	0.31	LH IIIA1
NB102 [P606]	conical cup	plain	11.8	0.22	LH IIIA1

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
NB103 [P453]	conical cup	plain	11–11.8	0.18	LH IIIA1
NB106 [P1385]	conical cup	plain	10.8	0.18	LH IIIA1
NB107 [P362]	conical cup	plain	10.4	0.20	LH II–IIIA1
NB108 [P485]	conical cup	plain	10.2	0.17	LH II–IIIA1
NB109 [P4936]	conical cup	plain	10.2	0.19	LH II–IIIA1
NB111 [P473]	conical cup	plain	9.5	0.14	LH II–IIIA1
NB112 [P619]	conical cup	plain	9.4	0.13	LH II–IIIA1
NB113 [P222]	shallow angular bowl or dish	plain	30	3.37	LH II–IIIA1
NB116 [P356]	shallow angular bowl	plain	24	1.71	LH II–IIIA1
TH54 [P2]	cup	plain	13	0.44	LH II–IIIA1
TH66 [P3]	conical cup	plain	12.1 base 4.3	0.32	LH II–IIIA1
TH67 [P15]	conical cup	plain	9.5 base 3.6	0.14	LH II–IIIA1
PH8 [P1082]	carinated bowl with rounded base	plain	11	0.37	LH II–IIIA1
PH15 [P1081]	bell cup, FS 221	Minoan import	9	0.18	LM IB
PH24 [P1092]	goblet	plain	10.8	0.30	LH II–IIIA1
PH25 [P1084]	goblet	plain	13	0.43 0.42	LH II–IIIA1
PH30 [P4605]	conical cup	plain	11	0.15	LH II–IIIA1
PD8 [P520+532+628]	krater, FS 7	Myc. decorated	25	c. 6.07	LH IIIA1
PD15 [P534]	shallow cup	Myc. decorated	11	0.18	LH IIIA1
AB53 [P3787]	kylikes, FS 267	plain	13 5.8	0.43	LH IIIA1
AB54 [P4155]	kylikes, FS 267	plain	12 6	0.41	LH IIIA1
AB56 [P3759]	kylikes, FS 267	plain	12 base 6	0.26 0.25	LH IIIA1
AB69 [P3010]	conical cup, FS 204	plain	10.5	0.18 0.17	LH IIB–IIIA1
AB70 [P3958]	conical cup, FS 204	plain	10.5	0.22	LH IIB–IIIA1

9. Nichoria

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date/group
Dickinson, Martin, Shelmerdine 1992. – Howell 1992 (1:2 scale).					
P2119(a)	bowl	Minyan, grey	14	1.30	MH I, Group C (Early)
P2151(η)	bowl	Minyan, brown	15	2.05	MH I, Group C
P2378(θ)	bowl	coarse ware	10	0.52	MH I, Group C
P2498(k)	small bowl or cup	plain ware	9.8	0.44	MH II
P2508(k)	bowl	plain ware	18.9	1.23	MH II
P2515	small bowl	plain ware	14.8	0.22	MH II
P2579 (k)	small cup	painted, lustrous, Minoan import?	8.6	0.18	MH II
P2679(k)	bowl or cup	coarse ware	12.4	0.72	MH II
P2680(k)	bowl or cup	coarse ware	11.6	0.59	MH II
P2681(k)	cup	coarse ware	9.6	0.40	MH II
P2686	deep bowl or jar	coarse ware	18.4	3.02	MH II
P2751	small shallow cup	plain ware	9	0.13	MH III
P2816	open dish	painted, lustrous	11	0.31	MH III
P3193	goblet	plain	restored 12.7	1.11	LH I
P3195	conical cup	plain	c. 11	0.20	LH I
P3340	goblet with high-swung handle	plain	12	0.54	LH IIA deposit
P3345	goblet	plain	16	rest. c. 1.30	LH IIA deposit
P3353	conical cup, FS 204	plain	9	0.14	LH IIA deposit
P3373	conical cup, FS 204, or lamp	plain	11.7	0.23	LH II
P3434	rounded cup, closest to FS 211	plain	13	0.43	LH II
P3453	rounded cup, closest to FS 211	washy coated ware	10.4–10.9	0.21	LH II
P3454	conical cup, FS 204	washy coated ware	9	0.11	LH II
P3459	rounded cup, closest to FS 211	plain	12	0.48	LH II
P3460	conical cup, FS 204	plain	12	0.23	LH II
P3461	conical cup, FS 204	plain	10	0.21	LH II
P3462	conical cup, FS 204	plain	10.4	0.18	LH II
P3467	scoop or ladle	coarse	6.4	0.08	LH II
P3472	goblet, FS 263	washy coated ware	12.8 (restored)	1.06	LH II
P3487	goblet	plain	11	c. 0.34	LH II
P3495	conical cup, FS 204	plain	11	0.17	LH II
P3528	conical cup, FS 204	plain	11	0.18	LH II
P3552	goblet, FS 263	washy coated ware	11.8 (?)	0.27	LH II
P3553	goblet, FS 263, or stemmed cup	washy coated ware	10.6	0.23	LH II
P3554	goblet, FS 263, or stemmed cup	washy coated ware	10 (?)	0.25	LH II
P3577	goblet	painted	15.5	1.03	LH IIIA1

Inv. number	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date/group
P3578	krater, FS 6	Myc. decorated	30	> 11.5	LH IIIA1
P3580	cup	Myc. decorated	11.7 [with 1:2]	c. 0.25	LH IIIA1
P3581	cup, FS 219	Myc. decorated	11	0.16	LH IIIA1
P3585	saucer	plain	7.8	0.03	LH IIIA1
P3614	kylix, FS 264	unptd	12.5	0.42	LH IIIA1
P3615	kylix, FS 264	unptd	13.1	0.35	LH IIIA1
P3616	kylix, FS 264	unptd	15.5	0.79	LH IIIA1
P3617	kylix, FS 264	unptd	12.5	0.31	LH IIIA1
P3629	strap-handled bowl (cf. FS 295)	unptd	30.5	4.74	LH IIIA1
P3630	cup	unptd	12.8 [with 1:2]	c. 0.14	LH IIIA1
P3631	cup	unptd	8 [with 1:2]	c. 0.07	LH IIIA1
P3632	cup, FS 219 (handleless)	unptd	15	0.39	LH IIIA1
P3633	cup or dipper	unptd	8.9 [with 1:2]	c. 0.14	LH IIIA1
P3634	cup	plain	10 [with 1:2]	c. 0.23	LH IIIA1
P3642	dipper	coarse or domestic	14	0.38	LH IIIA1

10. Orchomenos

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Sarri 2010 (classes cf. Sarri 2010, scales for calculating capacities based on rim diam.).					
1/1	two-handled bowl	GM Coarse (GA3)	13.5	3.67	MH
1/11	two-handled bowl	GM (A4)	20	3.00	MH
2/2	two-handled bowl	GM (hm)	13	0.72	MH
2/6	two-handled bowl	GM Coarse (GA1?)	15.5	0.98	MH
3/13	two-handled bowl	MP (RM, D1 a2)	11.1–11.8	0.37	MH
4/7	kantharos	GM	9	0.26	MH
5/12	kantharos	GM (A8) to BM (B2)	15	0.83	MH
6/9	kantharos	GM (A5)	14	c. 0.33	MH
8/14	kantharos	GM (A5)	9.7–8.2	0.14	MH
8/25	kantharos	BM (B1) to RM (D2 M1)	9.5	0.17	MH
10/11	basket-handled cup	GM Coarse (GA1)	9.5	0.37	MH
11/10	Vapheio cup	GM (A1)	6	0.05	MH
11/11	cup with high handle	GM Coarse (GA1)	> 8.5	0.17	MH
11/12	kantharos	GM (A3)	8	c. 0.16	MH
11/13	carinated cup	GM (A8)	6	0.12	MH
11/21	cup	coarse ware	7.5	0.21	MH
15/1	pedestalled goblet	BM (B2) to RM (D2)	25	3.52	MH
15/5	pedestalled goblet	GM (A1)	24	c. 2.8	MH
26/1	pedestalled goblet	BM (B1)	20	c. 1.12	MH
26/2	pedestalled goblet	GM (A3)	17.4	0.7	MH
28/4	pedestalled goblet	bichrome MP (RM, D2 d)	21.2	3.18	MH
31/8	bowl with everted rim	GM (A1)	15	0.66	MH
39/7	krater	bichrome MP (RM, D1)	[35.6 with 1:3 scale]	rest. c. 19.14	(MH–)LH I
48/2	bowl with horizontal handles	(RM, D1)	10.7	0.28	MH

11. Pefkakia

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Phase/date
Maran 1992a (1:3 scale).					
35/23	bowl with everted rim		12.3	0.49	Phase 4, MH
37/1	bowl with everted rim	GM Fine	20.55	c. 2.41	Phase 4, MH
37/13	cup	GM Coarse	7.8	0.20	Phase 4, MH
38/14	straight-sided cup		7.35	0.08	Phase 4, MH
38/16	straight-sided cup		13.65	0.62	Phase 4, MH
41/6	kantharos	GM Fine	12.6–13.35	0.75	Phase 4, MH
42/9	bowl with incurved rim		11.7	0.50	Phase 4, MH
44/8	bowl with everted rim		10.8	0.46	Phase 4, MH
45/4	straight-sided cup		9.6	0.16	Phase 4, MH
46/16	two-handled bowl	GM Fine	15.6	1.82	Phase 5, MH
47/1	two-handled bowl	GM Fine	17.4	2.29	Phase 5, MH
48/1	bowl with horizontal handles		27	4.55	Phase 5, MH
52/9	cup	? coarse	11.1 (restored)	0.44	Phase 5, MH
55/3	(two-)handled bowl	GM Fine	13.5	0.83	Phase 5, MH
55/8	(two-)handled bowl	GM Fine	18.3	2.60	Phase 5, MH
55/15	kantharos	GM Fine	15.3	1.57	Phase 5, MH
58/6	(two-)handled bowl	GM Fine	12.3	c. 2.09	Phase 5, MH
64/10	kantharos	GM Fine	15.9	0.86	Phase 6 early, MH
65/2	goblet		11.1	0.50	Phase 6 early, MH
68/7	two-handled bowl	GM Fine	15.6	1.96	Phase 6 early, MH
68/9	(two-)handled bowl	GM Fine	14.7	0.92	Phase 6 early, MH
69/1	pedestalled goblet	GM Fine	26.1	3.72	Phase 6 early, MH
69/8	kantharos	GM Fine	15	c. 0.72	Phase 6 early, MH
69/10	bowl with everted rim	GM Fine	10.8	0.54	Phase 6 early, MH
70/15	bowl with everted rim	GM Coarse	15	0.56	Phase 6 early, MH
71/11	kantharos	fine ware with red to brown polished slip	15–15.3	0.68	Phase 6 early, MH
71/12	kantharos		10.8	0.45	Phase 6 early, MH
83/15	(cup or) kantharos	GM Coarse	8.7	0.23	Phase 6 middle, MH
84/2	kantharos	black polished	15.9	0.96	Phase 6 middle, MH
85/4	bowl with everted rim		17.4	1.19	Phase 6 middle, MH
90/9	kantharos	GM Fine	12.2–12.6	1.07	Phase 6 middle, MH
90/11	(cup or) kantharos	GM Coarse	8.25	0.21	Phase 6 middle, MH
93/9	(cup or) kantharos	light red to yellow burnished pottery	10.5	c. 0.61	Phase 6 middle, MH
94/11	(two-)handled bowl	GM Fine	18.15	2.39	Phase 6 middle, MH
94/19	(two-)handled bowl	GM Fine	18.6	2.40	Phase 6 middle, MH
95/7	(cup or) kantharos	GM Coarse	10.8	0.61	Phase 6 middle, MH
98/4	cup	light red to yellow burnished pottery	8.55	0.22	Phase 6 middle, MH
103/16a	(cup or) kantharos	GM Fine	8.4	0.14	Phase 6 middle, MH

Bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Phase/date
108/4	kantharos	light red to yellow burnished pottery	8.85	0.53	Phase 6 late, MH
108/7	bowl with horizontal handle(s)	fine ware with red to brown polished slip	17.25	1.77	Phase 6 late, MH
113/14	(cup or) kantharos	GM Fine	6.75	0.13	younger than or the same age as Phase 6 middle
120/16	kantharos	black polished	15.45–15.75	0.64	Phase 7, MH/LH
121/5	(cup or) kantharos	black polished	9.3	0.14	Phase 7, MH/LH
121/13	(two-)handled bowl	red polished ware	19.8	1.44	Phase 7, MH/LH
126/8	kantharos	MP	6	0.07	Phase 7, LH (I?)
127/13	kantharos		11.1–11.25	0.64	Phase 7, MH(III)
128/16	bowl (with horizontal handles)		10.05	0.17	Phase 7, MH(III)
129/16	bowl		7.5	0.23	Phase 7, MH/LH
129/17a-b	conical shallow cup*		10.2	0.11	Phase 7, MH/LH
130/1	bowl with horizontal handles		34.5	9.65	Phase 7, MH/LH
132/7	bowl with incurved rim		18	1.17	Phase 7, MH/LH
133/16	two-handled bowl		16.05	1.73	Phase 7, MH/LH
133/19	two-handled bowl		18.9	2.34	Phase 7, MH/LH
134/2	cup		9.6	0.29	Phase 7, MH/LH
137/7	kantharos		12.9–13.5	0.53	Phase 7, MH/LH
137/8	kantharos		14.7–15	0.69	Phase 7, MH/LH
138/1	bowl with horizontal handles		25.95	4.29	Phase 7, MH/LH
138/2	bowl with horizontal handles		23.7	3.02	Phase 7, MH/LH
138/8	cup		rest. 7.8	c. 0.10	Phase 7, MH/LH
138/9	cup		9.75	c. 0.20	Phase 7, MH/LH
140/5	kantharos*		15.9	0.9	Phase 7, MH/LH
Theocharis' excavation: Maran 1992a.					
142/1	pedestalled goblet		26.4	3.46	MH
142/2	cup		9	0.21	MH
142/3	kantharos		c. 7.5	0.10	MH

12. Tsoungiza

Note: Capacities of the LH I pottery calculated by B. Lis.

Inv. number/ bibliographical reference	Shape	Class	Rim diameter (cm)	Capacity (litre)	Date
Rutter 1989. – Rutter 1990. – Rutter 1993. – Rutter 2015. – Rutter in press.					
A54 = Fig. 12/54	kantharos	medium coarse, burnished	12	0.41	MH IIIA
A = Fig. 12/55	kantharos	medium coarse	19.5 (est.)	1.91	MH IIIA
A = Fig. 13/63	miniature kantharos	fine, burnished	8.5	0.12	MH IIIA
A = Fig. 13/67	angular cup	medium coarse	4	0.04 min.	MH IIIA
B126 = Fig. 13/126	miniature kantharos	MP, fine, light red	7.5	c. 0.13	MH IIIA
B = Fig. 13/127	dipper (?)	MP	9	0.13	MH IIIA
B149 = Fig. 13/149	miniature kantharos	medium coarse, pale burnished	7	0.06	MH IIIA
Fig. 13/153	angular cup	medium coarse, light red	c. 8	0.12	late MH
Fig. 13/154	dipper	medium coarse, burnished	8.5	0.14	late MH
E5	stemmed cup	plain, pale burnished	9.6 x 11.6	0.3	earlier LH I
E7	dipper	plain, pale burnished	9.1–10.5	0.23	earlier LH I
E8	kantharos	plain, pale burnished	12.2–16.1	0.97	earlier LH I
E9	kantharos	plain, pale burnished	8.9–10.7	0.28	earlier LH I
E11	goblet	plain, pale burnished	16.2–17.85	1.59	earlier LH I
E41	semi-globular cup	MP, fine	7.6–8.9	0.15	earlier LH I
E46	dipper	plain, pale burnished	9 (est.)	0.22	earlier LH I
E47	miniature kantharos	plain, pale burnished	5.7 (est.)	0.03	earlier LH I
E49	goblet with lugs	plain, pale burnished	22 (est.)	2.64	earlier LH I
E51	krater	plain, pale burnished	24.5–25.7	5.36	earlier LH I
E65	straight-sided cup	MP, fine	13.5	0.58	later LH I
E70	dipper	plain, pale burnished	8.4 (est.)	0.17	later LH I
E80	stemmed kantharos / goblet	Myc. lustrous painted	10 (est.)	0.53	later LH I
E85	straight-sided cup	plain, GM	6.1–7.4	0.05	later LH I
E107	conical cup	plain, pale unfinished	10.5 (est.)	0.14	miscellaneous
F = Fig. 6/16	one-handled goblet	Myc. lustrous painted	10.9 (est.)	0.49	LH IIA
F = Fig. 7/23	goblet	Myc. fine unptd	17.5 (est.)	1.85	LH IIA

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Keltischer oder etruskischer Einfluss? Ein späthallstattzeitlicher Armreif mit gegenständiger Kopfzier aus Möllbrücke (Kärnten)

Paul Gleirscher

Zusammenfassung

Auf einem namenlosen Höhenrücken bei Möllbrücke westlich von Spittal/Drau wurde 2012 ein bronzener Armreif mit doppelter gegenständiger Kopfzier gefunden. Es könnte sich um eine kultische Deponierung handeln. Der Armreif gehört zur Gruppe der massiven Knotenarmreifen der Späthallstattzeit und datiert ins ausgehende 6. oder 5. Jh. v. Chr. Für Arm- und Fußringe mit Kopfzier lassen sich eine Reihe an Vergleichsfunden beibringen, insbesondere aus dem Bereich des frühkeltischen Kulturkreises. Kopf- bzw. Gesichtsappliken („Masken") vergleichbarer Zeitstellung sind aber auch im südalpinen Raum in unterschiedlichen Ausformungen belegt. Während sie in Oberitalien als etruskischer Einfluss gelten, sieht die slowenische Forschung darin – insbesondere mit Blick auf zwei Fingerringe aus Vače – einen frühen keltischen Einfluss. Weil auch der Südostalpenraum damals wesentliche Impulse seitens der etruskischen Kultur erfahren hat, ist aber auch ein direkter mediterraner Einfluss für das Aufkommen der Kopfzier zu erwägen. Der Armring aus Möllbrücke ist vom Typ her jedenfalls ein lokales Produkt. Gesichtsappliken gelten zum einen als Ausdruck apotropäischer Vorstellungen, zum anderen als Bilder von Göttern, Heroen und Dämonen. Außerdem werden in ihnen symbolisch Köpfe von im Kampf getöteten Kriegern gesehen (*têtes coupées*).

Schlüsselbegriffe

Armreif, Späthallstattzeit, Südostalpenraum, Kopf-/Gesichtsappliken („Masken"), keltisch, etruskisch.

Abstract – *Celtic or Etruscan Influence? A Late Hallstatt Period Bracelet with Opposing Head Applications from Möllbrücke (Carinthia)*

On a nameless ridge near Möllbrücke west of Spittal/Drau a bronze bracelet with double opposing head applications was found in 2012. It is likely to be a cultic deposit. The bracelet belongs to the group of the massive bracelets with knots (*Knotenarmreifen*) of the Late Hallstatt period and dates to the later 6th or 5th century BC. There are numerous comparable objects for bracelets and foot rings with a head application, especially in early Celtic art, but contemporaneous applications in the form of heads or faces ('masks') are also known in the southern Alpine area in different forms. While they are regarded as an Etruscan influence in northern Italy, Slovenian researchers detect an early Celtic influence, especially with regard to two finger rings from Vače. However, it seems that a direct Mediterranean influence for the emergence of the decoration with heads/faces ('masks') has to be considered as well, as significant influence from the Etruscan civilization reached the southeastern Alpine area at that time. The bracelet from Möllbrücke is a local product. Applications in the form of heads/faces ('masks') are regarded as an expression of apotropaic ideas on the one hand, and as images of gods, heroes and demons on the other. Additionally, they are interpreted as symbols for the heads of warriors who were killed in combat (*têtes coupées*).

Keywords

Bracelet, Late Hallstatt period, southeastern Alpine area, applications in the form of heads/faces ('masks'), Celtic, Etruscan.

1. Fundort und Beschreibung

Auf ihrem Weg von Lienz nach Spittal trennt die Drau die Gailtaler Alpen im Süden von der Kreuzeckgruppe im Norden. Kurz vor Spittal erreicht sie bei Sachsenburg eine Talenge, ehe sie ins Lurnfeld gelangt, wo die Möll mündet. Ausgehend vom Salzkogel (2493 m ü. NN) erreicht hier ein langgezogener Höhenrücken das Lurnfeld. Vis-à-vis befindet sich am Südufer der Drau die in napoleonischer Zeit zerstörte mittelalterliche Festung der Salzburger Erzbischöfe, die ältere „Vorläufer" haben dürfte.[1] Teurnia in keltischer und römischer Zeit (heute St. Peter in Holz)[2] und später das unweit östlich gelegene Spittal verdanken ihre zentralörtliche Bedeutung ihrer Lage an der Drau, an den Routen nach Norden über die Tauernpässe, vom Hochtor über den Mallnitzer Tauern bis zum Katschberg.

1 Kohla 1973, 282–283.

2 Zusammenfassend, mit Blick auch auf die Fundstätten im Umland: Glaser 1992. – Glaser 2002. – Vgl. zur spätantiken Stadt und zum Übergang ins Frühmittelalter auch Gleirscher 2018b, 22–27, 34–37, 86–89, 114–115, 122–126, 230–231, 243–245, 285–286.

Auf dem genannten namenlosen Höhenrücken zwischen Sachsenburg und Möllbrücke (Abb. 1) hat Kurt Scheuch sen. aus Mühldorf, dem für das Überlassen des Objektes zur wissenschaftlichen Untersuchung herzlich gedankt sei, einen außergewöhnlichen Armreifen aus massiver Bronze gefunden. Die Fundstelle liegt nordseitig am Grat, rund 250 m über dem Talboden. Im Gelände zeigen sich heute keinerlei Auffälligkeiten. Der Höhenrücken ist relativ schmal und bietet beste Ausblicke ins Drautal nach Sachsenburg, ins untere Mölltal und ins Lurnfeld. Wiederholt zeigen sich Felsausbisse mit Gletscherschliff, mitunter schroffe Abbruchkanten. Ansatzweise lassen sich an verschiedenen Stellen „Verebnungen“ ausmachen, an einer bereits höher gelegenen Stelle „Terrassierungen“ und eine Art Wallkante.[3] An der Fundstelle des Armreifens (Quote ca. 800 m ü. NN), die auf Höhe des Draukraftwerkes von Sachsenburg liegt, haben sich weder beim Finden noch im Rahmen einer Begehung Hinweise auf weitere zugehörige Funde oder auf einen Befund, etwa Spuren eines verschliffenen Brandgrabes oder auf einen Kultplatz mit regelmäßig geübten, noch heute nachweisbaren Deponierungen, ergeben.

Abb. 1. Höhenrücken zwischen dem Drautal und dem Mölltal westlich von Spittal an der Drau (Foto: P. Gleirscher).

Der Armreif stammt, soweit die Nachuntersuchung Aussagen zulässt, offenbar aus keinem Grab und jedenfalls nicht aus einer Siedlung. Einer Deutung als Verlustfund steht somit eine Einschätzung als Einzeldeponierung mit religiösem Hintergrund gegenüber.[4] Träfe Letzteres zu, ließe er sich der Gruppe jenes Ringschmuckes anschließen, der im Verlauf der jüngeren Eisenzeit aus kultischen Gründen vergraben wurde. In ihrer schillerndsten Variante wird diese Form der Deponierung im Alpenraum am Hortfund aus Erstfeld (Kanton Uri) sichtbar, wo man 1962 im Lochertal an der Route über den St. Gotthardpass im Zuge von Arbeiten zur Wildbachverbauung gleich auf sieben neuwertige Arm- und Halsreifen aus Gold gestoßen ist, die unter einem Felsblock niedergelegt worden waren.[5] Sie weisen zugleich Merkmale von Goldbarren auf, was sich aus der pro Stück verwendeten und normierten Goldmenge erklärt. Es dürfte sich um die Bestückung eines oder mehrerer hölzerner keltischer Kultbilder aus der Zeit um 400 v. Chr. (ausgehende Stufe La Tène A) handeln. Einer der drei Armreifen zeigt eine typisch keltische Maskenzier.

Der Armreif aus Möllbrücke (Abb. 2) hat einen äußeren Durchmesser von 7,3 cm. Er ist durchschnittlich 0,7 cm breit und 0,5 cm stark, die lichte Weite beträgt 6,3 cm. Er besteht aus massiver Bronze, wurde im Guss in verlorener Form hergestellt und ist dementsprechend nachgearbeitet. Der Querschnitt ist D-förmig. Die Verzierung des Armreifens ist völlig symmetrisch aufgebaut. Gegenüberliegend bestimmen zwei, durch einen Knoten und zwei an diesen anschließende, feine Rippen getrennte und Kopf-an-Kopf angebrachte Köpfe das Erscheinungsbild des Armreifens. Je zwölf Knoten zieren den Armreif zwischen den beiden Kopfgruppen, wobei zwischen den Knoten jeweils zwei feine Rippen herausgearbeitet sind. Die vier, in zwei Gruppen jeweils gegenständig angeordneten Köpfe sind überaus gleichförmig gearbeitet. Drei davon sind 1 cm lang, einer 1,2 cm. Haare bzw. Frisur sind durch einen Wulst mit zum Scheitel hin gegenständig geführten Querkerben wiedergegeben, die Augen durch schräg nach unten führende, über der Nase zusammenstoßende Schlitze. Deutlich plastisch herausgearbeitet ist die Nase. Der leicht geöffnete, waagrechte Mund schließt das Gesicht jeweils zum markant gearbeiteten Kinn hin ab. Die einfache und gleichartige Ausführung aller vier Köpfe besticht durch ihre Reduktion ebenso wie durch den maskenhaften Gesichtsausdruck.

Der Armreif aus Möllbrücke gehört zur Gruppe der massiven Knotenarmreifen oder geperlten Armreifen mit scheibenförmiger Zwischenzier und datiert demnach in die ausgehende Hallstattkultur. Diese umfasst im Südostalpenraum nach der auf Stane Gabrovec zurückgehenden Definition[6] die Stufe der Certosafibeln (entspricht Hallstatt D2/3) und die Stufe der Negauer Helme (entspricht La Tène A–B1); beide werden in einen älteren und in einen jüngeren Abschnitt unterteilt. Dendrochronologische Messungen

3 Vermutlich angesprochen bei Kohla 1973, 218.

4 U. a. Stöllner 2002.

5 Ausführlich Guggisberg 2000.

6 Zuletzt Gabrovec 1987.

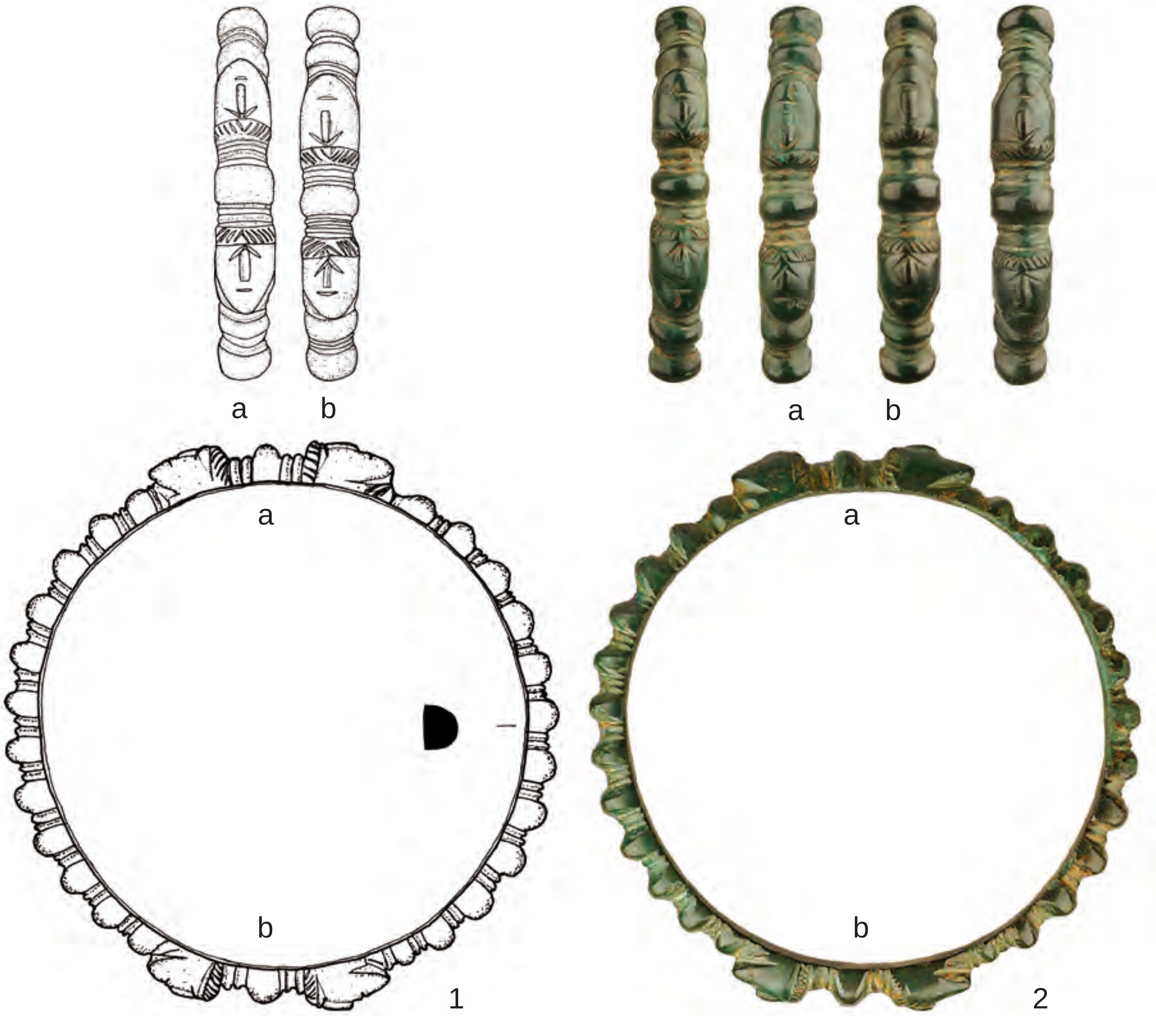

Abb. 2. Armreif aus Möllbrücke. Bronze, Maßstab 1:1 (Zeichnung: H. Mühlbacher, Foto: K. Allesch, beide Landesmuseum für Kärnten).

an den Bauhölzern der Grabkammer in Grabhügel 352 im Areal Hallersbichl am Dürrnberg bei Hallein haben ergeben, dass diese im Herbst des Jahres 464 v. Chr. geschlagen wurden.[7] Weil das aussagekräftige Inventar des Grabes noch der Stufe Hallstatt D3 zuzurechnen ist und am Dürrnberg Latène A-zeitliche Funde bestens vertreten sind, kann der Beginn der Stufe Latène A nicht vor 460/450 v. Chr. angesetzt werden. Damit hat sich auch jene Diskrepanz aufgelöst, die bezüglich des ersten Auftretens von durchbrochenen Gürtelhaken oder Fühlatènefibeln zwischen Oberitalien und dem keltischen Kerngebiet nördlich der Alpen eine zeitliche Verschiebung von bis zu fünfzig Jahren angesetzt hatte.

Aus Slowenien liegt für den Südostalpenraum zur absolutchronologischen Einordnung der Certosa-Stufe (entspricht Stufe Hallstatt D2/3)[8] mittlerweile die ^{14}C-Datierung eines Oberschenkelknochens aus Grab 2 im Grabhügel von Grofove njive bei Drnovo südlich von Krško vor. Sie ergab ein kalibriertes Alter zwischen ca. 540 und 410 v. Chr.[9] Und eine ^{14}C-Datierung weist ein überaus reich ausgestattetes Kriegergrab aus Novo mesto/Kandija (Hügel IV/Grab 3) bzw. mit diesem den Horizont der Negauer Helme (entspricht La Tène A–B1)[10] nunmehr in die Zeit zwischen 375 und 350 v. Chr.[11] Das Ende der Späthallstattkultur bzw.

7 Sormaz, Stöllner 2005, 364–365 und Abb. 4; 367–372. – Zum Grab: Egg, Zeller 2005.

8 Teržan 1976, 437. – Dular 2003, 136–143.

9 Pavlovič 2014. – Teržan, Črešnar 2014, 720–721.

10 Teržan 1976, 439–442. – Dular 2003, 143–150.

11 Dular 2003, 144 und Abb. 87/5–6.

der Beginn der Keltenzeit wird in Unterkrain (Dolenjsko) demnach zwischen ca. 350 und 325 v. Chr. angesetzt.[12] Der massiv gefertigte, geschlossene Armreif mit Knotenzier und scheibenförmiger Zwischenzier aus Möllbrücke stellt hinsichtlich der Grundform ein lokales Produkt dar.[13] Arm- und Fußreifen mit Knotenzier zählen in offener und geschlossener Ausführung bzw. bei vergleichbarer Formgebung auch in blecherner Ausführung zu den charakteristischen Schmuckstücken der Späthallstattkultur im Südostalpenraum.

In einem Frauengrab der Zeit um 550/500 v. Chr. aus Lopanec bei Kaplja vas (Hügel 2/Grab 1)[14] fanden sich zwei massive perlverzierte Fußreifen (lichte Weite 10 cm) zusammen mit einer älteren Fibel und einem ebenso älteren Paar offener gerippter Armreifen mit sich überlappenden, spitz zulaufenden Enden. In der Certosa-Stufe treten dem Armreifen aus Möllbrücke im weiteren vergleichbare Armreifen auf, beispielsweise im Hügelgräberfeld Znančeve njive in Novo mesto. Anstelle der schmalen scheibenförmigen Zwischenzier haben die Armreifen aus Grab 8 in Hügel 2 allerdings eine perlverzierte Zwischenscheibe,[15] während die Fußreifen aus demselben Frauengrab allein eine glatte Knotenzier aufweisen.[16] Die Certosafibel erhellt eine frühe Stellung des Grabes innerhalb der Certosa-Stufe, demnach während der 2. Hälfte des 6. Jhs. v. Chr. Unweit von Vače wurden in Velika Kostrevnica mehrere Körpergräber beobachtet. Darf man den überlieferten Grabinventaren Glauben schenken, so fanden sich in einem in den Certosa- bzw. frühen Negauer-Horizont (2. Hälfte 6./5. Jh. v. Chr.) zu datierenden Grab Reiterelemente und auch ein massiver geperlter Fuß- oder Armreif mit zarten Zwischenrippen,[17] trotz Scharnierkonstruktion jenem aus Möllbrücke vergleichbar.

Im weiteren vergleichbare, allerdings nicht geschlossene Arm- (lichte Weite ca. 6 cm) und Fußringe (lichte Weite ca. 10 cm) stammen mit hoher Wahrscheinlichkeit aus gestörten späthallstattzeitlichen Gräbern am Sattel unterhalb des Ajdovski gradec bei Vranje.[18] Das Muster aus halbkugeligen Knoten („Perlen“) wird von feinen doppelten Rippen unterbrochen. Das kleine Fragment eines Armreifens aus Grab 18 von Paularo in Friaul zeigt Knoten und eine scheibenförmige Zwischenzier; das Frauengrab datiert um die Mitte des 6. Jhs. v. Chr.[19] Dem sind zwei weitere Fragmente aus dem Gräberfeld in San Pietro al Natisone anzuschließen.[20]

2. Vergleiche zur Zier

Verschiedene Typen zeitgleicher Arm- und Fußreifen sowie Fingerringe zieren mitunter Kopfappliken. Ein großer, dünner, massiver Arm- oder Fußreifen aus Bronze (Abb. 3/3) stammt den Angaben des Finders zufolge aus einem Männergrab in Volčje nijve bei Mokronog.[21] Biba Teržan tendiert zur Einschätzung, wonach es sich um einen geschlossenen Grabfund aus der Späthallstattzeit (Stufe Certosa bzw. Stufe der Negauer-Helme) handelt.[22] In starker Stilisierung zeigt der Ring vier gegenständig angeordnete Doppelköpfe, von denen Augen und Ansätze einer Frisur zu erkennen sein dürften. Die starke Stilisierung erinnert an die Köpfe bzw. Gesichter auf einem Fußring aus dem La Tène A-zeitlichen Grab 2 in Hügel VII von Beuren/Kupp (Abb. 4/2)[23] sowie auf einem Halsring aus dem La Tène A-zeitlichen Grab 2 in Hügel IX von Theley (Abb. 4/3)[24], beide im Saarland gelegen.

Ein bronzener Armreif mit zwei stark stilisierten, gegenständigen Kopfdarstellungen wurde auch im La Tène A-zeitlichen Grab 7 von Schwierberdingen (Abb. 3/1) in Baden-Württemberg, im Übrigen zusammen mit einer bemerkenswerten Maskenfibel (vgl. Abb. 9/7) gefunden;[25] Carola Metzner-Nebelsick vermutet für die Trägerin rituelle Kompetenzen.[26] Zwei gewissermaßen gegenständig angeordnete, dem Armreif aus Schwieberdingen an die Seite zu stellende Köpfe zieren einen spiralförmigen bronzenen Armreif, der aus Grab 2 in Grabhügel III von Novo mesto-Kandija (Abb. 3/4) stammt und dort unter anderem mit einem vergleichbaren, in stilisierten Schlangenköpfen endenden Armreif vergesellschaftet war.[27] Wie am Stück aus Möllbrücke findet sich die gegenständige Kopfdarstellung auf einem südalpinen Typ von Armreifen, der wohl als venetisch anzusprechen ist. Die Gesichter der kleinen Köpfe auf dem Armreifen aus Novo mesto sind durch einfache

12 Teržan im Druck.
13 Für Hinweise danke ich D. Božič, Ljubljana.
14 Dular 2003, 262 und Taf. 84/5–6.
15 Typ IVc nach Tecco Hvala 2012, 301 und Abb. 111/12.
16 Dular 2003, 136 und Abb. 80A/6–7 (Armreifen), 16–17 (Fußreifen).
17 Teržan 2009, 88 und Abb. 5/B5.
18 Logar 1980, 298 und Abb. 2/2–5; 3/3–5.
19 Vitri 2001, 28–29 und Abb. 8/12. – Corazza, Vitri 2001, 49 und Abb. 52.
20 Pettarin 2006, Taf. 21/327–328.
21 Teržan 2009, 88 und Abb. 6/4. – B. Teržan, Ljubljana, hat das Stück dankenswerter Weise zwischenzeitlich überprüft und auch einen vierten Doppelkopf identifiziert.
22 Teržan 2009, 88.
23 Cordie-Hackenberg 1992a, 146 und Abb. 1/2.
24 Cordie-Hackenberg 1992b, 174–175 und Abb. 5.
25 Stroh 1935, 292–293. – Binding 1993, 54–55 und Abb. 17/2.
26 Metzner-Nebelsick 2007, 717 und Abb. 4/5–6.
27 Knez 1986, 83–84 und Taf. 23/21. – Teržan im Druck, Abb. 13–14.

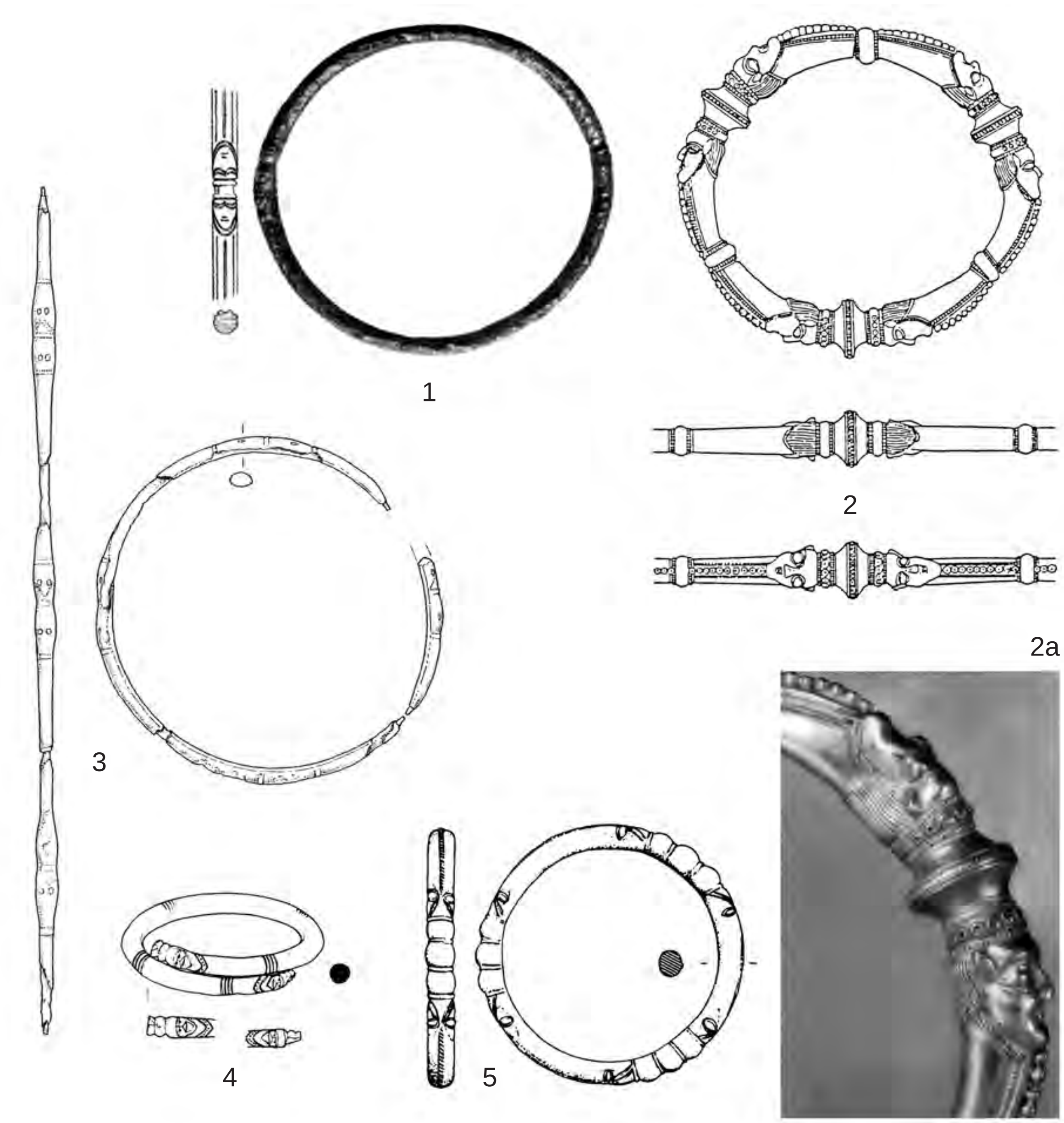

Abb. 3. Kopfdarstellungen auf frühlatènezeitlichem Ringschmuck. – 1. Schwieberdingen. Bronze, Maßstab 1:2 (Metzner-Nebelsick 2007, 717 und Abb. 4/5–6). – 2. Bad Dürkheim. Gold, Maßstab 1:2 (Joachim 1992, 182 und Abb. 1). – 2a. Bad Dürkheim. Gold, Maßstab 2:1 (Megaw, Megaw 1989, 73 und Abb. 78). – 3. Volčje njive. Bronze, Maßstab 1:2 (Teržan 2009, 88 und Abb. 6/4). – 4. Novo mesto-Kandija, Hügel III/Grab 2. Bronze, Maßstab 1:2 (Knez 1986, 83–84 und Taf. 23/21). – 5. Speikern. Bronze, Maßstab 1:2 (Binding 1993, 90 und Abb. 34/9).

geometrische Gravur kenntlich gemacht. Ob sie auch einen Schnauzbart haben, ist nicht eindeutig zu entscheiden. Offen muss auch bleiben, ob man den jeweils ersten Knoten zu den Enden der Armreifen hin als Hüte oder Baskenmützen ähnliche Kappen verstehen darf, wie Teržan vorgeschlagen hat. Das erscheint fraglich, wenn man den Blick auf die vergleichbaren Armreifen der venetischen Este-Kultur richtet, wie beispielsweise jenen aus Grab 8 im Gräberfeld Este-Casa Alfonsi.[28]

Teržan hat für die Kopfdarstellung bereits den Vergleich zu frühlatènezeitlichen Armreifen mit Pufferenden der *Kelten* gezogen, die zwischen dem mittleren Rheinland, der Nordschweiz und dem Dürrnberg bei Hallein

28 Chieco Bianchi, Calzavara Capuis 1985, Taf. 258/3.

Abb. 4. Kopfdarstellungen auf frühkeltischem Ringschmuck. Ohne Maßstab. – 1. Reinheim. Gold (Krausse, Beilharz 2012, 103 und Abb. 107). – 2. Beuren, Kupp-Hügel VII/2. Bronze (Cordie-Hackenberg 1992a, 146 und Abb. 1/2). – 3. Theley, Hügel IX/2. Bronze (Cordie-Hackenberg 1992b, 174–175 und Abb. 5).

nachgewiesen und von Rudolf Echt zusammengestellt worden sind.[29] Dabei favorisierte sie die Vorstellung, dass mit Blick auf den Armreif aus Novo mesto nicht der Armreif, sondern die Idee ihren Weg von den *Kelten* in den Südostalpenraum gefunden hat, begleitet von echten Importen, die sie als Gastgeschenke interpretiert, wobei dieser Weg auch über die venetische Este-Kultur oder über die Bernsteinstraße geführt haben kann, wie das Verbreitungsbild der durchbrochenen Gürtelhaken bzw. der Fibeln vom Typ Altmark-Kowałowice besonders eindringlich erhellt.[30]

Schließlich sind aus dem nordalpinen Raum zwei Armringe mit je drei Gruppen stilisierter Köpfe zu nennen. Bis zum äußersten stilisiert erscheinen die gegenständigen, durch jeweils eine dreiteilige Knotengruppe getrennten Gesichter auf einem bronzenen Armreifen im La Tène A-zeitlichen Grab von Speikern bei Nürnberg (Abb. 3/5).[31] Demgegenüber sind die drei gegenständig angeordneten Kopfgruppen am goldenen Armring (Abb. 3/2, 2a) aus dem reichen Latène A-zeitlichen Grab der „Fürstin“ von Bad Dürkheim in der Pfalz (ca. 450–400 v. Chr.) in herausragender Qualität gearbeitet und lassen an der mediterranen und damit wohl etruskischen Vorlage keinerlei Zweifel.[32] Das Grab enthielt denn auch neben etruskischem Trinkgeschirr, zwei Trinkhörnern und einem zweirädrigen Wagen kostbaren Schmuck aus Gold und Bernstein.[33] Der aus sechs identischen Elementen aus Goldblech zusammengesetzte Armring zeigt zwischen drei Knoten jeweils eine Gruppe aus zwei gegenständig orientierten Köpfen, die durch einen Wulst getrennt sind. Die Köpfe sind in leichter Stilisierung dennoch einigermaßen naturalistisch ausgeführt, zeigen Augen, Nase, Mund, (tiergestaltige?) Ohren und die Frisur.[34] Ähnlich fand sich in dem reichen, etwas jüngeren Latène A-zeitlichen „Fürstinnengrab“ aus Reinheim im Saarland (ca. 380 v. Chr.) u. a. mediterranes Trinkgeschirr und kostbarer Goldschmuck, darunter Ringschmuck mit etruskisierenden Köpfen (Abb. 4/1).[35] Aus Bronze wäre schließlich ein frühlatènezeitlicher Armreif aus La Charme aux Bois bei Troyes in den Ardennen zu nennen, den Vincent und Ruth Megaw mit Fragezeichen erst dem 3. Jh. v. Chr. (Stufe La Tène B2) zugerechnet haben, ohne dessen älteres „Formular“ zu verkennen.[36] Eine Datierung noch ins 4. Jh. v. Chr. dürfte zutreffender sein.

Dieses Bild, von engsten Beziehungen zu Vorlagen aus dem mediterranen und damit insbesondere etruskischen Raum verdichtet sich bei der Betrachtung von Fingerringen mit Kopf- bzw. Gesichtszier. In Litija bei Vače in Unterkrain wurden bereits im 19. Jh. in einem Grab an derselben Hand zwei massive bronzene Fingerringe gefunden; es gab keine weiteren Grabbeigaben oder Trachtelemente. An einem der beiden Ringe (Abb. 5/1)[37] stoßen zwei schnauzbärtige Köpfe an einer ursprünglich mit einer Einlage aus Koralle gefüllten Fassung aneinander. Am Kinn gehen beide Köpfe in ein weiteres, jeweils anschließendes Gesicht über. Am anderen, unwesentlich kleineren Ring stoßen zwei Köpfe direkt gegenständig aneinander.[38] Die Köpfe auf den beiden Fingerringen aus Vače sind der Form der Ringe angepasst und erscheinen entsprechend länglich. Sie sind zudem stark stilisiert, haben Augen in Form von Kreisaugenstempeln, eine Frisur in Wulstform mit Schrägstrichen, eine leicht plastische Nase und eine Mundritzung mit einem

29 Echt 1999, 40–53.
30 Teržan im Druck.
31 Binding 1993, 90 und Abb. 34/9.

32 Joachim 1992, 182 und Abb. 1.
33 Rieckhoff, Biel 2001, 292. – Krausse, Beilharz 2012, 102–103 und Abb. 103–104.
34 Joachim 1992, 182 und Abb. 1.
35 Echt 1999. – Vgl. u. a. auch Rieckhoff, Biel 2001, 341–343 und Taf. 22–23. – Krausse, Beilharz 2012, 103 und Abb. 107.
36 Megaw, Megaw 1989, 135 und Abb. 206.
37 Megaw 1965–1966, 164–165/Nr. 35 und Taf. 15/4, 6. – Vgl. auch Starè 1953, 264 und Taf. 9/2. – Božič 1983, 105 und Abb. 46. – Dular 1999, 116 mit Abb.
38 Megaw 1965–1966, 164–165/Nr. 34 und Taf. 15/5–6.

Abb. 5. Kopfdarstellungen auf einem Fingerring und einer Fibel aus dem 5. Jh. v. Chr. Bronze, Maßstab 2:1. – 1. Vače (Dular 1999, 116). – 2. Berlin-Niederschönhausen. Ohne Maßstab (Hess 2015b, 332 und Abb. 19).

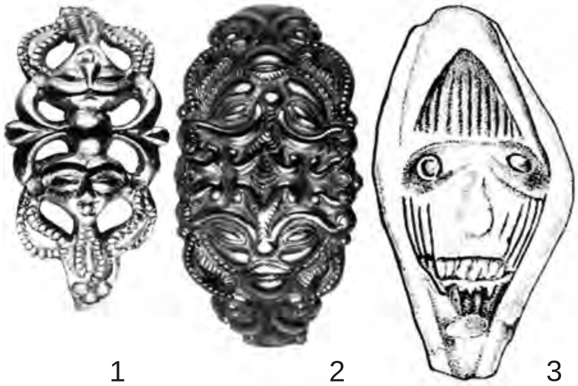

Abb. 6. Fingerringe aus dem 5. Jh. v. Chr. – 1. Sardinien. Gold, Maßstab 2:1 (Megaw 1965–1966, 97, 160/Nr. 19 und Taf. 1/1–4). – 2. Rodenbach. Gold, Maßstab 2:1 (Blümel 2010, 152). – 3. Straubing, Asterweg. Bronze, Maßstab 2:1 (Tappert 1994, 56–57 und Taf. 2/1).

durch senkrechte Kerben angezeigten Schnauzbart. Sie gelten bis heute als singulär und wurden nach der Einschätzung von V. Megaw vermutlich vom gleichen zweitklassigen regionalen Handwerker hergestellt.[39] Megaw hat mit Blick auf den Ring mit der Koralleneinlage zwischen den beiden Köpfen auch bereits auf etruskische Vorlagen – er nennt goldene Fingerringe aus dem 5./4. Jh. v. Chr. aus Vulci und Bologna[40] – hingewiesen und eine Deutung der Fingerringe als Ausdruck frühkeltischer Kunst im späthallstättischen Südostalpenraum eher bezweifelt.[41]

Janez Dular hat die beiden Fingerringe aus Vače zuletzt der 2. Hälfte des 5. oder dem 4. Jh. v. Chr. zugewiesen.[42] Stilistisch gesehen erwog er – ebenso wie Teržan, die zugleich auf mehrere frühlatènezeitliche Gräber im Areal südöstlich um Hügel I hinweist[43] – eine Inspiration seitens der frühkeltischen Kunst. Etruskische Vorbilder sind für die frühlatènezeitlichen Fingerringe bei den *Kelten* nicht zu übersehen. Das gilt für den goldenen Fingerring aus dem Latène A-zeitlichen „Fürstengrab“ von Rodenbach in der Pfalz (Abb. 6/2),[44] ein Kriegergrab aus der Zeit um 400 v. Chr. mit goldenem Schmuck und mediterranem Trinkgeschirr ebenso wie für den etwa zeitgleichen Fingerring mit Maskenzier aus einer Siedlungsgrube am Aster Weg (Lehmgrube Jungmeier, Objekt 15) in Straubing in Niederbayern (Abb. 6/3).[45] Für den Fingerring aus Rodenbach hat V. Megaw auf ein Vergleichsstück aus Sardinien (Abb. 6/1) hingewiesen.[46] Zwei Erklärungsmodelle stehen sich also gegenüber.

Was die Zier mit gegenständigen Köpfen bzw. Gesichtern betrifft, ist schließlich auf die Bügelzier Latène A-zeitlicher Fibeln hinzuweisen. Auf einer Maskenfibel aus Berlin-Niederschönhausen (Abb. 5/2)[47] sind die beiden Köpfe länglich gehalten. Die elliptischen Augen zeigen senkrechte Pupillenschlitze, einer der Köpfe trägt einen Vollbart, der direkt in die Kurzhaarfrisur übergeht. Am Fußende der Fibel findet sich ein Widderkopf in prominenter Ausführung. Eine gleichartige Maskenfibel aus dem Umfeld der Heuneburg an der oberen Donau zeigt auch am hochgezogenen Fibelfuß einen weiteren Kopf.[48] Das etwas abgenutzte Objekt lässt am Kopf am Fußende der Fibel noch einen Schnauzbart erkennen.

3. Appliken von Köpfen bzw. Gesichtern („Masken“)

Das Aufkommen menschlicher Figuren und Köpfe bzw. Gesichter („Masken“) geht sowohl bei den Völkern und Stämmen im Südalpenraum wie auch bei den nordalpinen *Kelten* auf einen mediterranen und damit insbesondere auf einen Einfluss seitens der Etrusker zurück. Besonders

39 Megaw 1965–1966, 165.
40 Megaw 1965–1966, 103 und Taf. 4/1–5.
41 Zustimmend Tappert 1994, 56–57.
42 Dular 1999, 116. – Vgl. zuerst von Hochstetter 1883, 167 und Abb. 9.
43 Teržan 2009, 87–88.
44 Megaw 1965–1966, 101–102 und Taf. 2/1–4. – Zuletzt Blümel 2010, 152 mit Abb. – Zum Grab: Engels 1972.
45 Tappert 1994, 56–57 und Taf. 2/1. – Freundlicher Hinweis D. Božič, Ljubljana.
46 Megaw 1965–1966, 97, 160/Nr. 19 und Taf. 1/1–4.
47 Hess 2015b, 332 und Abb. 19.
48 Hess 2015b, 331–332 und Abb. 14.

deutlich lassen sich diesbezüglich beispielsweise für Köpfe mit spitzen Ohren antike Satyrbilder als Vorbilder erkennen.[49] Matthias Jung hat kürzlich gezeigt, dass etruskische Kippfiguren, an denen Floral-Ornamentales in Figürliches übergeht, was Paul Jacobstahl als *Cheshire-Style* bezeichnet hatte, das Vorbild der „keltischen Palmettengesichter“ waren.[50] Dabei bleibt es eine weitere, ebenso wesentliche Frage, inwieweit in Mitteleuropa mit den mediterranen Vorlagen auch mediterrane Inhalte rezipiert wurden, oder es zu einer „selektiven Rezeption und Transformierung“[51] kam, wie Hans Nortmann meint.

Das prägnanteste und – abgesehen von der Steinzeit – älteste Gesicht aus dem Ostalpenraum stellt die bronzene „Maske“ aus dem Kröllkogel in Kleinklein in der Weststeiermark (Abb. 7) dar.[52] Das „fürstliche“ Grab datiert in eine fortgeschrittene Phase des Horizontes Hallstatt D1 (entspricht Stufe der Schlangenfibeln), demnach in die Zeit um 580/550 v. Chr.[53] Auch wenn die „Maske“ aus Kleinklein 17,3 cm hoch und damit fast zwanzigmal größer ist als die Köpfe auf dem Armring aus Möllbrücke, zeigt das Gesicht aus Kleinklein in ähnlicher Weise eine durch ein Zickzackband angedeutete Frisur, leicht nach unten ziehende Augenschlitze, eine plastisch gearbeitete Nase und eine waagrechte Mundöffnung. Nach früheisenzeitlichen Vorbildern bei den Etruskern dürfte sie einst entweder auf einem hölzernen Behälter befestigt gewesen sein, der den Leichenbrand enthielt, oder zusammen mit den beiden linken Händen eine hölzerne Stele geziert haben, die den Toten darstellen sollte; eine Deutung, die Markus Egg und Jasmin Munir zuletzt favorisiert haben. Die technischen Merkmale lassen keinerlei Zweifel daran, dass die „Maske“ und die Hände nicht in Etrurien, sondern vor Ort hergestellt wurden. Es ist längst bekannt, dass im Südostalpenraum wie auch bei den Rätern in Alt-Tirol während der Hallstattkultur reichlich Fremdes kopiert bzw. in lokalem Kolorit hergestellt wurde.[54]

Blickt man nach Etrurien, erinnert die Ausführung der Gesichter am Armreif aus Möllbrücke, vor allem was die Umsetzung von Frisur, Nase und Mund betrifft, zudem an ein Köpfchen auf einem goldenen Diadem aus dem Arsenale Militare in Bologna (Abb. 8/1).[55] Dem könnte man den Kopf auf einem bronzenen Gürtelhaken aus Etrurien (Abb. 8/2)[56] ebenso anschließen wie die etwas naturalistischere Ausführung auf einem Anhänger aus Goldblech aus dem Gräberfeld Bucacce in Bisenzio.[57] Sie alle haben allerdings in naturalistischer Sichtweise hervorquellende, linsenförmige Augen. Wie wiederholt festgestellt wurde, ergibt sich daraus insofern ein gewisses Problem, als die etruskischen Vergleichsstücke ins 7. bis frühe 6. Jh. v. Chr. datieren, demnach um gut hundert Jahre zu alt sind, um als

Abb. 7. Kleinklein, Kröllkogel, „Totenmaske“. Bronze, Maßstab 1:4 (Egg 2013, 466–467).

1 2

Abb. 8. Köpfe auf Kleinkunst aus Etrurien. – 1. Detail eines goldenen Diadems aus Bologna, Arsenale militare. Ohne Maßstab (Von Hase 1973, 55 und Taf. 4/4). – 2. Detail eines bronzenen Gürtelhakens ohne Fundort, Museum Florenz. Ohne Maßstab (Von Hase 1973, 59 und Taf. 8/1).

49 Jacobsthal 1944, 21. – Megaw 1965–1966. – Von Hase 1973. – Frey 2002b, 202.
50 Jung 2008.
51 Nortmann 2016, 222–223.
52 Egg 2013, 466–467. – Egg, Munir 2013, 166–174.
53 Teržan, Črešnar 2014, 719–724.
54 Siegfried-Weiss 1979, 126–130. – Egg 1996, 265–273 und Abb. 146–150. – Für Slowenien: Gabrovec 1992. – Für das Rätergebiet: Gleirscher 1993a. – Gleirscher 1993b.
55 Von Hase 1973, 55 und Taf. 4/ 4.
56 Von Hase 1973, 59 und Taf. 8/1.
57 Von Hase 1973, 55 und Abb. 1.

Abb. 9. Köpfe in der Kleinkunst der frühen *Kelten*. Bronze. – 1. Völkermarkt, Führholz. Maßstab 2:1 (Wedenig 1990, 192 und Abb. 29–30). – 2. Hallein, Dürrnberg. Maßstab 1:2 (Penninger 1972, 78/Nr. 3 und Taf. 42/A3). – 3. Stupava. Maßstab 1:1 (Megaw 2010, 611 und Abb. 1–2). – 4. Ossarn. Maßstab 2:1 (Megaw 2010, 616 und Abb. 15a). – 5. Rascheid. Ohne Maßstab (Haffner 1992, 157/Nr. 42). – 6. Thomm. Ohne Maßstab (Haffner 1992, 157/Nr. 44). – 7. Schwieberdingen. Ohne Maßstab (Binding 1993, 54–55 und Abb. 17/2).

unmittelbare Vorbilder für die Köpfe bzw. Gesichter auf dem Ringschmuck der *Kelten* oder im Südostalpenraum gelten zu können. Friedrich-Wilhelm von Hase meinte, dass entsprechende Importstücke nördlich der Alpen bis ins 5. Jh. v. Chr. im Umlauf gewesen sein müssten und spät, aber doch, die Ausbildung des frühkeltischen Stiles nachhaltig beeinflusst hätten.[58] Besteht tatsächlich ein Hiatus, ist an eine regionale Neuschöpfung des Bildtypus zu denken.

Für die Darstellung eines Kopfes, die Haare, Augen, Nase und Mund hervorhebt, finden sich im Bereich der frühkeltischen Kunst zahlreiche Belege, etwa der von Ulrike Binding als naturalistisch eingestufte Kopf auf der Maskenfibel aus Schwieberdingen bei Stuttgart (Abb. 9/7).[59] Unter den Kopfappliken auf frühlatènezeitlichen Gürtelhaken könnte man als Beispiel das Latène A-zeitliche Exemplar von Stupava unweit Bratislava (Abb. 9/3) heranziehen, mit durch einen Kreisstempel gefertigten Pupillen und im Vergleich zu Möllbrücke deutlich plastischerer Gesamtausführung.[60] Pupillen in Form von Kreisaugenstempeln – und keine linsenförmigen, hervorquellenden Augen – finden sich auch an den beiden Köpfen einer Fibel aus Parsberg in der Oberpfalz,[61] für die zur Diskussion steht, ob ein Mensch oder ein Tier (Fabelwesen) dargestellt ist, sowie auf einer Maskenfibel aus einem Mädchengrab aus der Zeit um 400 v. Chr. in Ossarn in Niederösterreich (Abb. 9/4),[62] für die diskutiert wird, ob der Kopfaufsatz als Tierohren („behelmter Vogelmann" nach Megaw) oder als Mistelkrone (nach Frey) zu deuten ist. In der frühkeltischen Kunst können die Augen sowohl linsenförmig und hervorquellend, wie auch in Etrurien, oder in hallstättischer Tradition auf

58 Von Hase 1973, 60.

59 Binding 1993, 87 und Abb. 33/1 sowie Kat.-Nr. 174a mit Taf. 4/4.

60 Megaw 2010, 611 und Abb. 1–2.

61 Binding 1993, 90 und Kat.-Nr. 143 mit Taf. 4/2. – Hess 2015a, 156. – Detailfoto u. a. bei Frey 1993, 156–157 und Abb. 118. – Frey 2002a, 178 und Abb. 143. – Frey 2002b, 201. – Megaw 2010, 611 und Abb. 6.

62 Frey 1996, 206–207 und Abb. 9/1 (Grab 17). – Vgl. auch Megaw 2010, 616 und Abb. 15a.

Kreisaugenstempel reduziert ausgeführt sein. Das „Hallstättische“ illustriert in diesem Zusammenhang am besten der Vergleich der Augen der beiden süditalischen Löwen und des vor Ort nachgemachten Löwen auf dem Kessel aus dem Fürstengrab von Hochdorf.[63]

Dem sind mit Blick auf den Armreifen aus Möllbrücke stilisierte menschliche Köpfe auf frühlatènezeitlichen Anhängern aus dem südostalpinen Raum anzuschließen, mit einer Frisur aus seichten Kerben, einer leicht herausgearbeiteten Nase, einem eingeritzten Mund und Augen in Form von Kreisaugenstempeln (Abb. 10/4).[64] Bereits Gero von Merhart hat halbplastische Bronzefigürchen aus dem mittleren Alpenraum (Abb. 11/1) erörtert, darunter Adoranten.[65] Ihre Ausführung ist auf das Wesentlichste reduziert und einigermaßen stilisiert. Die hier interessierenden Köpfe sind durch Augen in Form von Kreisaugenstempeln, eine plastische Nase und einen Mundschlitz sowie seitlich und anatomisch beliebig angesetzte Ohren gekennzeichnet. Von Merhart erkannte die Figürchen als heimische Produkte des 5. und 4. Jhs. v. Chr. und leitete die Motive – Adoranten und Caestuskämpfer – von Einflüssen aus der venetischen Kultur ab. Mit entsprechenden Veränderungen im Kult sind sie als mediterran-etruskischer Einfluss einzuschätzen.[66] Ein ähnliches, plastisch gefertigtes Figürchen stammt aus Hügel I/Grab 2 in Stična in Slowenien, auch wenn man über den Grabverband wird diskutieren müssen.[67] Die Frisur wird wie bei der „Maske“ aus Kleinklein (Abb. 7) durch ein Zickzackband hervorgehoben – wenn damit nicht eine Kopfzier gemeint ist –, die Augen sind lochförmig, der Mund als Schlitz gestaltet, die Nase wenig profiliert. Hier zeigt sich, wie beispielsweise auch in der Situlenkunst, eine parallele Entwicklung vom mittleren Alpenraum bis in den Südostalpenraum.

Grobschlächtige Appliken menschlicher Köpfe mit Augen in Form von Kreis(augen)stempeln, plastischen Nasen und Mündern, die wiederholt Zähne erkennen lassen, prägen das Erscheinungsbild frühlatènezeitlicher bronzener Anhänger im Bereich der rätischen Fritzens-Sanzeno-Kultur (Abb. 10/1). Während ich am Beginn einer zuletzt regen Diskussion eine Deutung als Raitia-Bilder und damit einen Bezug zu einer allumfassenden, der griechischen Artemis vergleichbaren Mutter- und Stammesgottheit vorgeschlagen habe,[68] sprach Markus Egg[69] zeitgleich und neutraler von einer „Herrin der Pferde“.[70] Für eine vergleichbare Kopfapplike auf einer Halbmondfibel aus Völs am Schlern in Südtirol (Abb. 10/2) hat Lorenzo Dal Ri eine Interpretation in Form einer stark stilisierten geflügelten Figur vorgeschlagen, die Kopfappliken mit den deutlich kenntlichen Zähnen mit einem Gorgoneion verglichen.[71]

Mit dem Motiv „Herrin/Herr der Tiere“, der *Potnia Theron* bzw. des *Despotes Theron* haben sich letzthin Bettina Arnold und Derek B. Counts ausführlich beschäftigt und dazu auch einen Sammelband herausgegeben.[72] Sie führen das Motiv des Mischwesens aus menschlichen und tierischen Elementen bis ins Paläolithikum zurück. Über den Vorderen Orient gelangte das Motiv bekanntlich nach Griechenland, wo die weibliche Variante in Form der archaischen Artemis eine dominante Stellung einnimmt, und weiter nach Italien, wo Löwen und Vögel als Begleittiere überwiegen, die weibliche Figur wiederholt geflügelt erscheint und damit auch selbst zum Mischwesen wurde. Die mediterranen Vorbilder datieren ins 7./6. Jh. v. Chr., woraus sich mit Blick auf die Etrusker eine Art Lücke zur Entstehung der Latènekultur um die Mitte des 5. Jhs. v. Chr. ergibt, nicht aber mit Blick auf den zirkum- und inneralpinen Raum.

Jennifer M. Bagley hat sich in diesem Zusammenhang ausführlich mit den frühlatènezeitlichen durchbrochenen Gürtelhaken der Variante Castaneda beschäftigt, die im zirkumalpinen Raum beheimatet sind.[73] Am Paradebeispiel aus Hölzelsau bei Kufstein sind die Augen der Pferdeköpfe in Form von Kreisaugenstempeln gemacht, also nicht linsenförmig keltisch. Was die Vergleichbarkeit der „Herrin der Tiere“ bei den *Kelten* nordwärts der Alpen und einer

63 Biel 1985, 119–129. – Gauer 1985, 126–129. – Megaw, Megaw 1989, 42 und Abb. 35–36.

64 Corazza, Vitri 2001, 48–56 und Abb. 58 (Paularo, Grab 18), 65 (Vače), 66 (Sv. Lucija). – Gleirscher 2018a, 66–67.

65 Von Merhart 1932. – Ergänzungen bei Kromer 1974. – Wells 1978. – Vitri 1997, 582/Nr. 27 und Abb. 14/2. – Deutlich reduzierter und von anderem Typ, mitunter mit Augen aus Kreisaugenstempeln, sind mehrere bronzene Figürchen aus Šmarjeta: Dular 1980, Abb. 11/4. – Vgl. dazu Szilágyi 1992, 223–224 und Abb. 1–2.

66 Gleirscher 1993b, 83–85 und Abb. 11–12; 91 und Abb. 22.

67 Wells 1981, 48 und Abb. 29/g–h. – Vgl. bereits Wells 1978. – Zur Problematik der Grabinventare der Sammlung Mecklenburg: Weiss 1993. – Božič 2009. – Božič 2010.

68 Gleirscher 1986. – Mit Vertiefung: Gleirscher 2002a, 205–206 und Taf. 147/A. – Gleirscher 2002b, 614–618. – Vgl. auch Gleirscher 2009, 37–66. – Gleirscher 2011, 123–132. – Weiters Teržan 1990, 86–87.

69 Egg 1986a. – Vgl. auch Gamper 2006, 368–369: Göttin, die zwei Pferde am Halfter oder am Zügel hinter sich herführt.

70 Grundsätzlich zustimmend und wiederholt als „Herr/Herrin der Tiere“ angesprochen, u. a. bei: Teržan 1990, 88. – Metzner-Nebelsick, Nebelsick 1999, 80–82, 93–99. – Kossack 1993, 150. – Kossack 2002, 312. – Marzatico 2002. – Marzatico 2012, 320–322. – Rossi 2005, 26. – Appler 2006, 14. – Lang 2010, 21–22. – Dal Ri 2012, 153–156. – Ablehnend Tomedi 2002, 1226–1227, 1230.

71 Dal Ri 2012, 149–153, 157. – Vgl. zur Fibel auch Teržan 1990, 88 und Abb. 16.

72 Counts, Arnold 2010. – Vgl. zusammenfassend auch Bagley 2013, 70–72. – Bagley 2014, 210–239.

73 Bagley 2013.

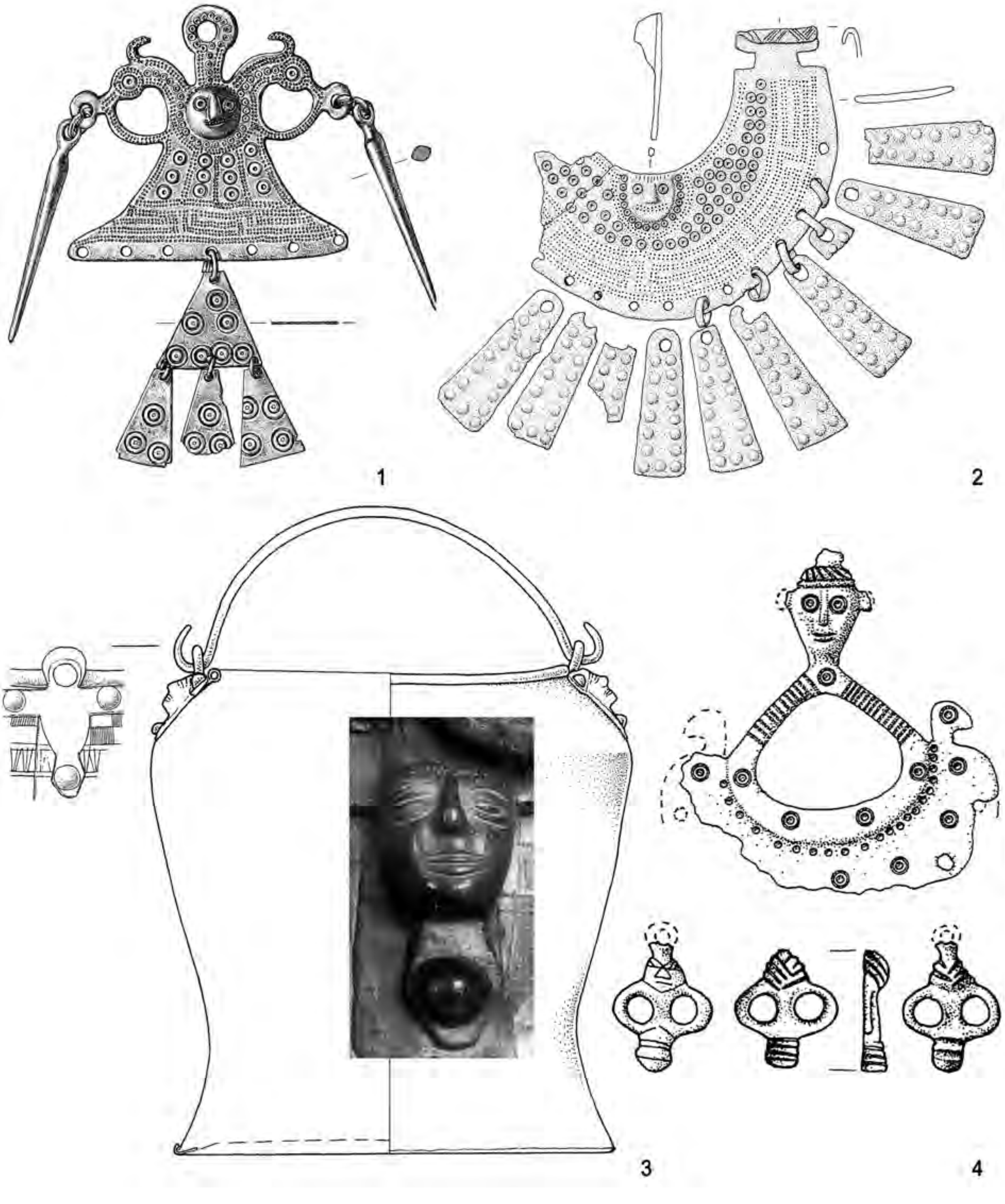

Abb. 10. Gesichtsappliken aus dem mittleren Südalpenraum, 5./4. Jh. v. Chr. Bronze. – 1. Fundort unbekannt, wohl Nonsberg. Maßstab 1:2 (Egg 1986a). – 2. Völs am Schlern, Peterbichl. Maßstab 1:2 (Dal Ri 2012, 149–153, 157). – 3. Valle di Cadore, fondo Chiamulera. Maßstab 1:3 (Calzavara 1984, 866). – 4. Paularo, Misincinis. Maßstab 1:1 (Corazza, Vitri 2001, 48–56 und Abb. 58).

Abb. 11. Figürchen und Gesichtsapplik aus dem Südostalpenraum, 5./4. Jh. v. Chr. Bronze. – 1. Gramais, Parzinspitze. Maßstab 1:1 (Von Merhart 1932, 57 und Abb. 1). – 2. Vinica. Maßstab 1:1 (Božič 1999b, 179). – 3. Idrija pri Baca. Maßstab 1:2 (Božič 1999a, 176). – 4. Šmarjeta. Maßstab 1:1 (Dular 1980, Abb. 11/4).

weiblichen Muttergottheit bei den inneralpinen, von den Etruskern stark beeinflussten Kulturgruppen anbelangt, wurde wiederholt auf die Nähe zur griechischen Artemis hingewiesen.[74] So erkennt Rudolf Echt das Motiv in seiner weiblichen und männlichen Ausprägung am Armring aus dem Grab der Fürstin von Reinheim, an dem beide Elemente kombiniert und demnach eigenen Vorstellungen angepasst erscheinen.[75]

Dem ist die bereits erwähnte bronzene Statuette des Hornbläsers aus Idrija bei Bača unweit von Tolmin im Isonzotal/Sočatal (Abb. 11/3) anzuschließen. Sie wurde 1887 in einem Brandgrab gefunden und dank des Negauer Helmes dem 5. (Egg) bzw. 4. (Guštin und Božič) Jh. v. Chr. zugewiesen.[76] Das naturalistische Gesicht erfährt durch die in Form von Kreisaugenstempeln gefertigten Augen einen besonders eigentümlichen „südostalpinen" Charakter, wird zur Mischung aus mediterraner Plastik und stilisierter, südostalpiner Darstellungsweise. In unserem Zusammenhang ist zudem auf den Arm- und Fußring der Statuette hinzuweisen, beide linksseitig getragen. Das entspricht Beobachtungen zu Männergräbern in Unterkrain, wobei für diese Armringe Legierungen aus Blei und Zinn charakteristisch sind. Dem entspricht die Umsetzung der Augen am Kopf auf einer Dreiknopffibel aus dem 4. Jh. v. Chr. aus Vinica (Abb. 11/2).[77] Ihre Fußbildung erinnert noch an frühe Dreiknopffibeln der Picenter aus der 2. Hälfte des 6. Jhs. v. Chr.[78]

Auf einer bronzenen Situla aus dem Cadore im Veneto (Abb. 10/3), die einem südalpinen Situlentyp des 4. Jhs. v. Chr. zuzuordnen ist, tragen die Attaschen eine plastische Kopfzier.[79] Während die Kopfappliken mit keltischem anstelle von etruskisch-italischem Einfluss erklärt werden,[80] lassen sich für muschelförmig gestaltete Attaschen an gleichartigen Situlen zweifelsfrei etruskische Vorbilder ausmachen.[81] Das wird man deshalb auch für die Kopfappliken erwägen müssen, insbesondere mit Blick auf eine Attaschenzier auf einem Eimer aus einem Grab in Bologna/Arnoaldi.[82] Aus Padua und aus Mel unweit von Belluno

74 *Kelten*: Echt 1999, 45. – Bagley 2013, 74–75. – Räter: Gleirscher 1986. – Gleirscher 2002a, 206–207. – Gleirscher 2002b, 616–617. – Noriker: Gleirscher 2009, 37–38. – Gleirscher 2011, 125–126. – Teržan 2011. – In diesem Sinn u. a. auch Guggisberg 2000, 277. – Vgl. weiters Guggisberg 2010.

75 Echt 1999, 253–270. – Zustimmend Guggisberg 2000, 256–262 oder Bagley 2013, 75.

76 Guštin 1980. – Egg 1986b, 114–115 und Abb. 53/2; Taf. 290/b. – Beste Abbildung bei Božič 1999b, 179.

77 Gabrovec 1966, 70 und Taf. 14/1. – Božič 1999a, 176.

78 Seidl 2005, 58 und Abb. 1/ 4. – Preložnik 2007, 124 und Abb. 1.

79 Calzavara 1984, 866.

80 Ruta Serafini 1998, 52 spricht von einer keltischen Sitte im Zusammenhang mit Kopftrophäen. – Turk et al. 2009, 53–54 und Abb. 6.

81 Turk et al. 2009, 53–54 und Abb. 7–9.

82 Macellari 2003, 95 und Taf. 7/1; 85.

sind Kopfappliken aus Bronzeblech bekannt geworden, die ein Gesicht in naturalistischer Ausführung zeigen, mit ovalen Augen samt Augenbrauen sowie plastisch modellierter Nase und Mund.[83] Sie werden dem 2./1. Jh. v. Chr. zugeordnet und sind demnach deutlich jünger als die Köpfe auf dem Armreif von Möllbrücke. Späthallstattzeitlich sind hingegen die in Reihen gegenständig angeordneten Köpfe auf bronzenen Blechen von Zeptern aus den Gräbern 10 und 11 in Alpago-Pian de la Gnela unweit von Belluno.[84]

Unzweifelhaft der frühkeltischen Kleinplastik zuzuordnen ist hingegen ein 2,9 cm hohes Figürchen, das in Führholz bei Völkermarkt (Abb. 9/1) in einem von der beginnenden Eisenzeit bis gegen 300 v. Chr. belegten Hügelgräberfeld gefunden wurde.[85] Das Kriegergrab der Stufe Latène A (ca. 450–380 v. Chr.) ist nach Einschätzung von Reinhold Wedenig ein Flachgrab, wahrscheinlicher aber ein verschliffenes Hügelgrab. Die Ausstattung umfasst u. a. eine kleine Bronzeplastik, deren funktionale und ikonografische Ansprache bis heute nicht überzeugend geglückt ist,[86] weil das Objekt stark unter dem Feuer des Scheiterhaufens gelitten hat.[87] Die 2,9 cm hohe bronzene Figur lässt jedenfalls einen Mann im Knielaufschema erkennen, dessen Gesicht unzweifelhaft Züge keltischen Kunsthandwerks zeigt (vgl. Abb. 9/2–3, 5–7).[88] Zu nennen sind insbesondere die hervorquellenden linsenförmigen Augen sowie der durch Einstiche wiedergegebene Schnauzbart.[89] In Führholz ließen sich auch eine Reihe weiterer frühlatènezeitlicher Objekte in späthallstattzeitlichem Kontext nachweisen, etwa eine Latène B1-zeitliche Fibel und ein durchbrochener Latène A-zeitlicher Gürtelhaken im Umfeld von Hügel 77.[90] Aus Kärnten ist dem von der Gurina bei Dellach im Gailtal ein Latène A-zeitlicher Armreif anzuschließen.[91]

Aus dem keltischen Kulturkreis könnte man dem Gesicht des Männchens aus Führholz den Kopf auf dem Gürtelhaken aus Grab 229/1 vom Dürrnberg bei Hallein anschließen, mit längsovalen hervorquellenden Augen.[92] Demgegenüber könnte man den kleinen, etwas grobschlächtigen Kopf an einem Fingernagelreiniger aus dem La Tène B1-zeitlichen Grab 44/1 vom Moserstein am Dürrnberg bei Hallein (Abb. 12/1) wiederum als Vergleich zu den Köpfen am Armreif von Möllbrücke nennen;[93] dieser ist aber in stilistischer Hinsicht ob der Kleinheit nicht überzubewerten. Ludwig Pauli sah in der Maskenverzierung eine Bestätigung für die Integration des hallstättischen Toilettegerätes in die Latènekultur.[94] Inzwischen sind aus dem östlichen Oberitalien eine Reihe vergleichbarer Fingernagelschneider (Abb. 12/2–3) – von den Bearbeitern als „lanzettförmige Anhänger" eingestuft – aus dem 5. Jh. v. Chr. bekannt geworden, in zwei Fällen mit gegenständig verdoppeltem Kopfaufsatz, wobei die Stilisierung der Gesichter vor allem an einem Exemplar aus Este wiederum den Gesichtern am Armreif aus Möllbrücke anzuschließen ist.[95]

Für den Armring aus Möllbrücke stellt sich wie für die anderen, mit gegenständigen Köpfen bzw. Gesichtern verzierten Fuß-, Arm- und Fingerringe aus dem Südostalpenraum somit zunächst die Frage, inwieweit es sich dabei weniger um einen kulturellen Einfluss aus der frühkeltischen Kultur nördlich der Alpen, wie gemeinhin angenommen wird, als vielmehr um eine direkte Rezeption etruskischer Vorlagen handeln könnte, wie das V. Megaw im Gegensatz zur slowenischen Forschung mit Blick auf die beiden Fingerringe aus Vače vorgeschlagen hat. Sowohl die Darstellung der Gesichter wie auch Fingerringe waren im Südostalpenraum fremd.[96] Stilistisch gesehen mögen die Gesichter auf dem Armreif aus Möllbrücke einen direkten Einfluss aus Italien auf die Kulturentwicklung in den südalpinen Tälern untermauern, der im ausgehenden 6. Jh. einsetzte und im 5. Jh. v. Chr. besonders intensiv war, wie gezeigt wurde.

83 Calzavara 1984, 855.
84 Gangemi 2015, 176 und Abb. 1.
85 Wedenig 1990, 184–193.
86 Herr der Tiere: Guggisberg, Stöllner 1996. – Stöllner 2010, 301 und Anm. 54. – Zustimmend Bagley 2013, 70. – Skythischer Krieger: Teržan 1998, 532–533.
87 Vgl. zu Fragen der Rekonstruktion auch Fürhacker, Pfeifer-Schäller, Wedenig 2004, 110–111 und 115–116.
88 Haffner 1992, 157/Nr. 42 (Rascheid), 44 (Thomm).
89 Wedenig 1990, 192 und Abb. 29–30. – Wedenig 1994, 6 (Detailzeichnung zum Kopf). – Wedenig 1999, 15–16 und Abb. 12. – Wedenig 2005, 30 und Abb. 26.
90 Wedenig 1997, 76 und Taf. 5/7–8. – Wedenig 2005, 24 und Abb. 12/oben. – Gleirscher 2001, 212–213 und Abb. 3. – Zur Belegungszeit: Wedenig 1999, 5–6 und Abb. 4. – Wedenig 2005, 20–23 und Abb. 5. – Vgl. zu frühkeltischen Funden in späthallstättischem Ambiente in der Steiermark: Tiefengraber 2015, 596–603 (allerdings auch mit einer Reihe von späthallstättischen Fibeln mit italischen Wurzeln). – Für Slowenien vgl. zuletzt Teržan 2009, 86 und Anm. 1–3. – Teržan im Druck. – Für Friaul: Vitri 2001, 27–30. – Corazza, Vitri 2001, 58–66 und Abb. 71 (Paularo, Grab 34) . – Oriolo et al. 2015, 32–47.
91 Jablonka 2001, 132 und Taf. 92/19. – Vgl. Pauli 1978, 165–168.
92 Megaw, Megaw, Neugebauer 1989, 495 und Abb. 7/3.
93 Penninger 1972, 78/Nr. 3 und Taf. 42/A3. – Gleirscher 2018a, 62 und Abb. 2/4; Abb. 3. – Foto: Moser 2010, 76/unten. – Vgl. auch Crummy 2001.
94 Pauli 1978, 260–261.
95 Nascimbene 2015, 169 und Abb. 2. – Voltolini 2015, 172 und Abb. 1. – Gleirscher 2018a, 65–66 und Abb. 6–7.
96 Worauf Biba Teržan hinweist.

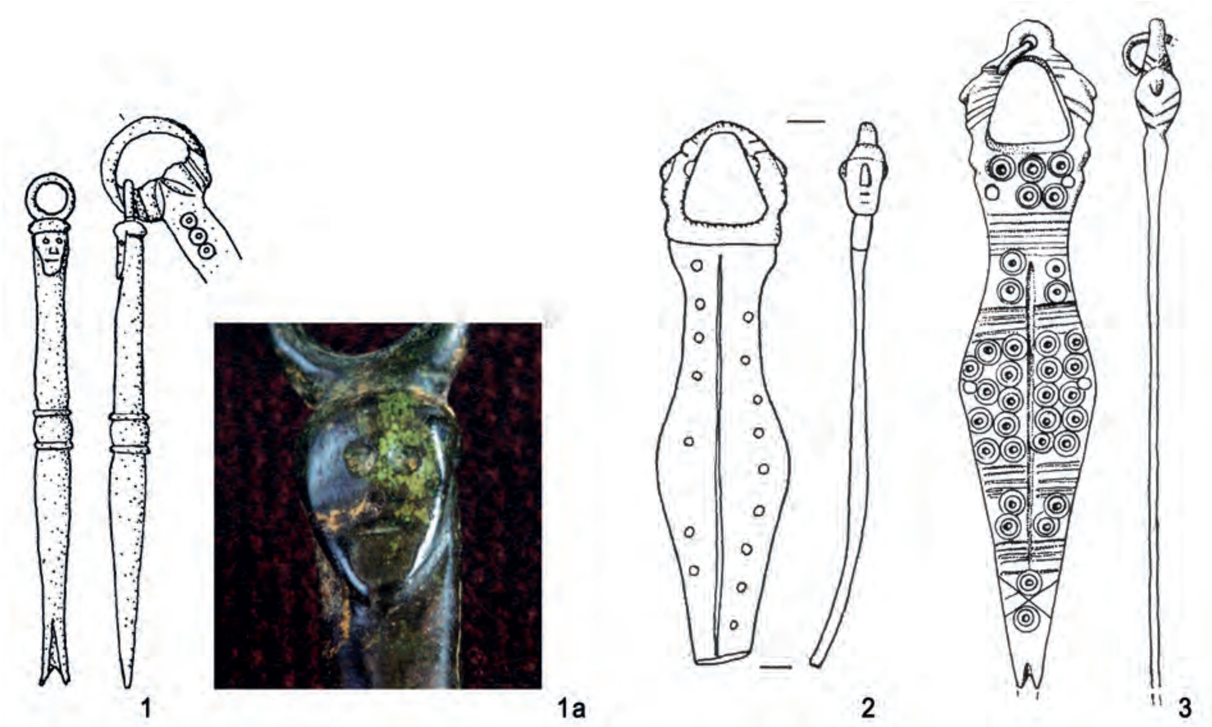

Abb. 12. Köpfe auf frühlatènezeitlichen Fingernagelreinigern. Bronze, Maßstab 1:1. – 1. Dürrnberg bei Hallein (Penninger 1972, 78/Nr. 3 und Taf. 42/A3). – 1a. Dürrnberg bei Hallein (Foto: Moser 2010, 76/unten, Detail). – 2. Este (Voltolini 2015, 172 und Abb. 1). – 3. Pieve d'Alpago, Pian de la Gnela (Voltolini 2015, 172 und Abb. 1).

4. Zur Deutung der Köpfe bzw. Gesichter („Masken")

Es bleibt die wesentlich schwierigere Frage nach der Deutung der Köpfe bzw. Gesichter („Masken"). Menschliche und tierische Köpfe, oft als Mischwesen bzw. Phantasiegeschöpfe kombiniert, zählen zu den Merkmalen frühkeltischen Kunsthandwerks.[97] Sie finden sich einzeln oder vervielfacht vor allem auf Fibeln und Gürtelhaken, aber auch auf Ringschmuck, Waffen und Trinkgeschirr. Hinter diesen Köpfen bzw. Gesichtern wurde zum einen ein apotropäischer Sinn vermutet, das Bild mit einem Abwehrzauber verbunden.[98] Georg Kossack verstand die frühkeltischen „Masken" in Verbindung mit Tierfiguren oder Teilen von deren Leibern zum anderen und mit Blick nach Mittelitalien als Gestalten dämonischen Charakters oder aus dem Mythos.[99] In der Darstellung erkannte er „den Grundgedanken der Metamorphose menschlichen Seins, den Glauben an die Lösbarkeit und die Verwandlung der Seele (*alter ego*) oder an die Epiphanie der Gottheit in Tiergestalt, die hier als Mischwesen differente Eigenschaften in sich vereinigt."[100] Dabei folge die nunmehr spiegelbildliche Wiedergabe des seit der Hallstattzeit bekannten Motivs (Vogelpferd etc.) mediterranem Einfluss.

Otto-Herman Frey wiederum, der sich wiederholt mit der Kunst der *Kelten*, ihrer Entwicklung und Fragen zu ihrem Inhalt beschäftigte,[101] sprach von menschenköpfigen Fabelwesen,[102] wies aber zugleich darauf hin, dass uns die Deutung der Geisteswelt der frühen *Kelten* im Einzelnen weitgehend verschlossen bleiben werde; der Bogen reiche von der Darstellung realer Menschen und Tiere bis hin zu Dämonen und Göttern.[103] Eine Deutung der menschlichen Köpfe innerhalb der frühkeltischen Kunst hätte im Rahmen von *pars pro toto*-Vorstellungen zu erfolgen. Hinter den Köpfen sah Frey wohl anthropomorph gedachte Götter, hinter den Mischwesen Dämonen, apotropäische Gottheiten oder regionale Heroen, die von mystischen Ungeheuern

97 Z. B. Jacobsthal 1944. – Megaw, Megaw 1989, zu Menschenköpfen bes. 89–75. – Weiters Frey 2002b, 197–205. – Frey 2007b. – Vgl. zuletzt u. a. Egri 2014, 79–83. – Bagley 2014. – Nortmann 2016, 213–218. – Unter psychologischen und ethnografischen Aspekten: Wells 2012. – Hess 2015a. – Lamb 2019, 87–91.
98 Megaw 1970, 38. – Pauli 1975, 205. – Binding 1993, 123.
99 Kossack 1993, 151–152.
100 Kossack 1993, 152.
101 U. a. Frey 1993. – Frey 2002b. – Frey 2007a. – Frey 2007b.
102 Frey 2002b, 202.
103 Frey 2002b, 204.

beschützt werden.[104] Zudem wies er drauf hin, dass menschliche Köpfe bei den *Kelten* das Zentrum der Lebenskraft symbolisieren. Kommen dazu Insignien, sind darin magische Wesen zu vermuten. Wesentlich bleibe dabei, dass die *Kelten* trotz des Rückgriffs auf Stilmittel der etruskischen Kunst stets Symbole aus ihrer eigenen Welt wiedergaben.[105]

In der auch in diesem Zusammenhang relevanten Frage nach der Erscheinungsform keltischer Götter in vorrömischer Zeit gelangte Frey zu einem differenzierten Bild.[106] Während es seiner Einschätzung nach in spätkeltischer Zeit zweifellos auch anthropomorphe Götterbilder gab,[107] sowohl in der Großplastik wie auch in der Kleinkunst, außerdem durch Berichte antiker Autoren belegt, bleibe deren Nachweis für die ältere Latènezeit schwieriger. Die Großplastik des ausgehenden 6. und 5. Jhs. v. Chr. lässt auch ihn unzweifelhaft einen Ahnenkult für Anführer erkennen,[108] doch sind bereits für die Frühlatènezeit zudem Götterbilder zu vermuten, etwa in der janusartigen Stele von Holzgerlingen in Württemberg.[109] Und noch deutlicher lasse die frühkeltische Kleinkunst göttliche und dämonische Wesen erkennen, etwa in geflügelten Figuren als „Herren/Herrinnen der Tiere/Dämonen", vielleicht auch auf Köpfe bzw. Gesichter reduziert, die sich bis in spätkeltische Zeit finden.[110] Brennus, so wird überliefert, wäre 279 v. Chr. beim Betreten eines Tempels in Gelächter ausgebrochen, als er sah, dass die Griechen anthropomorphe Götterbilder fertigten (Diodor 22, 9, 4) – eine literarische Bestätigung chiffrierter Gottesbilder der *Kelten* während der Früh- und Mittellatènezeit, wie sie in der keltischen Kleinkunst begegnen?[111]

Die Zusammenschau der figürlich verzierten, frühlatènezeitlichen Fibeln durch Binding hat gezeigt, dass für die Deutung von Köpfen (bzw. Gesichtern oder „Masken") nach wie vor zwei Muster zu verfolgen sind. Denkt man nicht an inhaltslose Variationen der Kunsthandwerker, könnten einerseits – und darauf weisen „Kronen" aus Mistelblättern (Abb. 9/2, 4–6) – Bilder von Göttern[112] oder von vergöttlichten Herrschern bzw. Heroen gemeint sein, andererseits Köpfe von im Kampf getöteten Kriegern, *têtes coupées* (Abb. 9/7).[113] Das Tragen derartiger Schmuckstücke hätte im zweiten Fall wie der Besitz echter Trophäen die Kräfte der getöteten Feinde auf den Träger der Trophäe bzw. des Schmuckstückes übertragen. Ein allerdings erst spätlatènezeitlicher Anhänger mit dem Kopf eines *Kelten* aus Pocking unweit von Passau in Niederbayern (Abb. 13/2)[114] – mit einem vergleichbaren Köpfchen von der Riegersburg in der Oststeiermark (Abb. 13/1), wenn auch ohne Öse[115] – ist jedenfalls nur im Rahmen des Kopfkultes der *Kelten* zu erklären.

Abb. 13. Spätkeltische Anhänger in Form von *têtes coupées*. Bronze, Maßstab 1:1. – 1. Riegersburg (nach Kramer 1994, 333 und Abb. 2/1). – 2. Pocking (nach Kramer 1994, 333 und Abb. 2/2).

Marina Sarah Hess vermutet hinter den wiederkehrenden Motiven der frühkeltischen Kunst Chiffren, deren Botschaften sich uns entziehen.[116] Menschliche Gesichter anstelle von vollständigen Körpern, die rar und ohne göttliche Attribute bleiben, hätten, sofern es sich um Elemente der Kleidung handelt, die am Körper getragen werden, wohl einen magischen oder apotropäischen Charakter gehabt. Anthropomorphe Gesichter, deren Vorbilder aus dem orientalischen oder etruskischen Raum stammen, stehen für eine Geschichte der schrittweisen Begegnung zwischen Mensch

104 Frey 1993, 157. – Frey 2002b, 202–203. – Vgl. auch Megaw 2010, 617–618, mit Literatur.
105 Frey 1993, 160–161.
106 Frey 2007b.
107 Frey 2007b, 203–204, 207.
108 Frey 2007b, 204–205.
109 Frey 2007b, 205. – Vgl. dazu Hatt 1980, 60. – Binding 1993, 122.
110 Frey 2007b, 205–207.
111 Frey 2007b, 207.
112 So schon Jacobsthal 1944, 23. – In diesem Sinn auch Frey 1993, 155.
113 Lambrechts 1954, 22–25. – Binding 1993, 86, 95, 119–123. – So auch Frey 2002a, 178. – Zur archäologischen Überlieferung: Müller 2002, 114, 129, 149–152.
114 Dannheimer, Gebhard 1993, 325/Nr. 411.
115 Kramer 1994.
116 Hess 2015b, bes. 331–336.

und (mythologischem) Tier, einen Mythos, der dem latènezeitlichen Betrachter bekannt war, deren Botschaft sich der modernen Forschung aber nach wie vor entzieht.

Jean-Jacques Hatt hat in Bezug auf doppelköpfige Bilder in ersterem Sinn vorgeschlagen, diese als Darstellungen des Janus zu interpretieren und mit dem Gott Esus gleichzusetzen.[117] Die bereits genannte janusartige, 2,30 m hohe frühlatènezeitliche Sandsteinstele aus Holzgerlingen in Baden-Württemberg[118] dürfte jedenfalls einen heroisierten Ahnen mit einer Mistelblattkrone darstellen, der in „symmetrischer" Verdoppelung gleichsam in alle Richtungen schaut. Dem dürfte ein mittellatènezeitlicher zweigesichtiger Kalksteinkopf aus dem Heiligtum von Roquepertuse in Südfrankreich anzuschließen sein.[119] Eine nicht näher bestimmbare frühlatènezeitliche Kleinbronze mit janusartigem Doppelgesicht und Mistelblattkrone stammt schließlich aus Lacoste bei Mouliets-et-Villemartin bei Bordeaux an der Atlantikküste.[120]

5. Ergebnis

Der bronzene Knotenarmreif mit zwei gegenständigen Kopfgruppen aus Möllbrücke datiert ins 5. Jh. v. Chr. Es handelt sich um einen südostalpinen Typus von Armreifen, dem die beiden gegenständigen, stark stilisierten Kopfgruppen eingefügt wurden. Der maskenhafte Gesichtsausdruck der Köpfe findet in der bronzenen „Maske" aus dem Kröllkogel in Kleinklein eine frühe, etruskisch beeinflusste Parallele, noch aus der 1. Hälfte des 6. Jhs. v. Chr. Wie schon V. Megaw mit Blick auf vergleichbare frühlatènezeitliche Fingerringe aus Vače erwogen hat, könnte auch für das Aufkommen von Doppelgesichtern im Südostalpenraum im 5. Jh. v. Chr. ein direkter etruskischer Einfluss anzunehmen sein, auch wenn ein vergleichbarer Prozess der Darstellung von Köpfen bzw. Gesichtern („Masken") auf zeitgleichem Ringschmuck der *Kelten* stattgefunden hat. Doch mag beides unabhängig voneinander auf etruskische Inspiration zurückzuführen sein, für den Südostalpenraum trotz nachgewiesener Kontakte zur Welt der *Kelten* nördlich der Alpen, zumal das Aufkommen von Appliken in Form von Köpfen bzw. Gesichtern („Masken") im Südostalpenraum, verbunden mit dem Aufkommen der Situlenkunst und vielen anderen Neuerungen aus dem mediterranen Raum längst in massivem Umfang nachgewiesen ist. Inwieweit für die Deutung dieser Köpfe auf Ringschmuck apotropäische Vorstellungen zu vermuten sind oder an Darstellungen von Göttern und Heroen, die dann bei den *Kelten* jedenfalls Kronen aus Mistelblättern haben sollten, zu denken ist, oder auch an Dämonen, bleibt wohl eine kaum und nicht generell zu lösende Frage. Auch an eine Deutung als symbolische Darstellung von Köpfen von im Kampf getöteten Kriegern, *têtes coupées*, wurde gedacht. Den Köpfen (Gesichtern, „Masken") fehlen jedenfalls jegliche nichtmenschliche Merkmale oder Attribute.

117 Hatt 1980, 60. – Nicht ausgeschlossen bei Binding 1993, 122.
118 U. a. Frey 1993, 155 und Abb. 135. – Rieckhoff, Biel 2001, 191 mit Abb.
119 Dannheimer, Gebhard 1993, 344/Nr. 467c.
120 Sireix et al. 2002.

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Archaeological Prospection of Coastal and Submerged Settlement Sites. Re-Evaluation of the Roman Site Complex of Vižula, Croatia

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Abstract

For many decades the *villa maritima* of Vižula had been considered as one of the largest of its kind in Istria, Croatia. In order to prove this theory, large-scale archaeological prospection was applied in Vižula from 2014 onwards, including geophysics (Ground Penetrating Radar) and remote sensing (Airborne Laser Scanning/Airborne Laser Bathymetry). Integrating the results of these non-invasive techniques with terrestrial and underwater surveys and excavations provided an opportunity to evaluate this architecture from a different perspective. Our research indicates that instead of a single luxurious residence, several contemporary complexes existed on Vižula, namely two *villae maritimae* and two *villae rusticae*. Furthermore, the results show that the combined methodology is able to integrate detail and context into an interpretative coherent model of a landscape going far beyond the analytical capabilities of each individual method.

Keywords

Mediterranean, Roman *villa maritima*, archaeological prospection, ALS/ALB, GPR, underwater archaeology, integrated interpretation of prospection data.

Zusammenfassung – *Archäologische Prospektion von Siedlungen im Küstenbereich. Neubewertung der römischen Architektur von Vižula, Kroatien*

Viele Jahrzehnte lang galt die *villa maritima* von Vižula als eine der größten ihrer Art in Istrien, Kroatien. Um diese Theorie zu überprüfen, wurde seit 2014 großflächige archäologische Prospektion in die Erforschung von Vižula einbezogen, und das Gebiet mittels Geophysik (Bodenradar) und Fernerkundung (Luftbild, Airborne Laser Scanning / Airborne Laser Bathymetrie) untersucht. Die Integration der Ergebnisse dieser nicht-invasiven Techniken in die Resultate der terrestrischen und Unterwasserausgrabungen bot die Gelegenheit, diese Architektur aus einer neuen, gesamtheitlichen Perspektive zu bewerten. Unsere Forschungen deuten darauf hin, dass statt einer einzigen luxuriösen Residenz mehrere zeitgenössische Komplexe auf Vižula existierten, nämlich zwei *villae maritimae* und zwei *villae rusticae*. Darüber hinaus zeigen die Ergebnisse, dass eine kombinierte Interpretation von integrierter Prospektion und Ausgrabungen Resultate ermöglicht, die weit über die analytischen Möglichkeiten der einzelnen Methoden hinausgehen.

Schlüsselbegriffe

Mittelmeer, römische *villa maritima*, archäologische Prospektion, ALS/ALB, GPR, Unterwasserarchäologie, integrierte Interpretation von Prospektionsdaten.

1. Introduction

Past settlement sites sometimes offer themselves to the naked eye of the researcher, as architectural remains are still visible and give an impression of fortifications, antique buildings, funeral monuments or temples. The same is true for the so-called *villae maritimae* – large, luxurious country residences emerging during the 2nd century BC on the Campanian coast in Italy.[1] Slightly later, these representative country estates are also found on the Croatian coast, mainly situated on the west side of Istria.[2] One of them, the so-called *villa maritima* of Vižula, is the subject of this paper.

Archaeological research into such large monuments is confronted with very specific problems. A *villa maritima*

1 D'Arms 1970.

2 The most recent list of *villae maritimae* in Croatia including relevant publications can be found in Teichner, Ugarković 2012, 118–120. – See also the summary in Bowden 2018.

can have a size that is – also by today's standards – of overwhelming dimensions.[3] Such 'large-scale' *villae* can hardly be documented through excavations. Archaeological investigations therefore need to follow different approaches. Moreover, *villae maritimae* were built on the shore line, in an effort to integrate land and sea into their architecture.[4] Due to the general rising level of the Mediterranean Sea, today those architectural features are often partly submerged. This conceals the original relationship between the architecture and the landscape and the remains of these sites are seated both in terrestrial and underwater environments. This fact is often reflected in archaeological fieldwork, where different teams of specialized researchers work separately from each other. As a result, fragmentary information makes an integrated interpretation of such monuments difficult.

The Roman remains on the peninsula of Vižula highlight this problem. The site complex is unique in its size. The extent of over 20 ha makes it difficult for archaeologists to pay attention to each and every aspect of the site and to come to a coherent interpretation of its function. As a result, it was unclear whether the documented remains represent a single large Roman complex or several smaller ones.

This paper is an attempt to re-evaluate the Roman architecture of Vižula and to present a new interpretation of its remains based on an integrated approach combining large-scale archaeological prospection with the results of underwater and terrestrial excavations. After an introduction of the archaeological site of Vižula and its research history, the applied methods are presented and their results described in detail. Finally, a re-evaluation of the site is discussed both on the basis of the results obtained and considering the relationship with the past landscape.

2. The Peninsula of Vižula

2.1. Geographical Setting

The small peninsula of Vižula comprises an area of almost 24 ha. It is located on the southern tip of Istria, approximately 10 km south of the modern town of Pula (Fig. 1). Administratively, Vižula belongs to the small town of Medulin, which today is mainly a tourism-oriented centre. Facing the sea, Vižula overlooks Medulin Bay, which has a total length of 8 km. The inner part of the bay, where Vižula is located, is very shallow with water depths of less than 10 m.

The peninsula shows a naturally rising terrain that reaches its highest point in the centre with a height of about 13.5 m above sea level. It is connected to the mainland by a narrow 80 m-wide land bridge called Burle. Vižula is to a large extent covered with dense vegetation in the form of shrubs and evergreen trees and is used during the warm part of the year as a recreational and bathing area.

The Roman architectural remains are preserved both on land and under water. Especially along the seashore and in the very shallow waters, remains of various settlement features are visible to the naked eye over a length of more than 1 km (Fig. 2). In the tidal zone the waves and currents have completely removed walls, leaving only the remains of stone foundations. In many cases, the force of the waves has also destroyed original floors down to the lowest construction layers. In particular, objects located on the southern side of Vižula, which are exposed to the stormy SE wind (croat. *jugo*), have suffered severe damage.

Topographically, a narrow coastal strip of the intertidal zone (with tides of c. 0.5–1 m) is often accompanied by a 2 m-high terrace. It was formed by the erosion of the coastal strip, where the natural vegetation and soils have disappeared. The exposed profile of the terrace shows its stratification and architectural remains (Fig. 2). Walking further inland, they soon disappear below the sediments or the dense Mediterranean vegetation of the higher ground. Only the areas next to a modern path, which traces the outline of the peninsula parallel to the coastline, are cleared of macchia (Fig. 3).

2.2. Research History

The history of Vižula is mainly reconstructed on the basis of archaeological finds, as written or graphic sources rarely refer to the region. The oldest settlement traces on the peninsula date to prehistory. A Neolithic settlement located on the north side of Vižula was partially excavated in the late 1960s[5] and published in 2004.[6] Other prehistoric finds are scattered over large parts of Vižula and were also uncovered during underwater excavations in the area of the Roman pier (Object F in Fig. 4).[7]

The archaeology of the peninsula is dominated by Roman architectural remains, already mentioned in literature at the beginning of the 20th century.[8] In the mid-1990s the peninsula's terrain was systematically surveyed and Roman settlement remains were documented along the seashore over a length of approximately 1.2 km.[9] In order to clearly identify individual architectural elements visible on the surface, a nomenclature of the site was introduced (archaeological zones 1–6; Fig. 4). The survey was followed

3 Compare, e.g., *villae* in the catalogue section of Lafon 2001.

4 As early as 1910 A. Gnirs tried to classify the villas according to their location on the Istrian coastline.

5 Bačić 1969.

6 Codacci 2004.

7 Unpublished underwater excavation report 2008.

8 Summarized in Giradi Jurkić 2008a, 5–8.

9 Džin 1995.

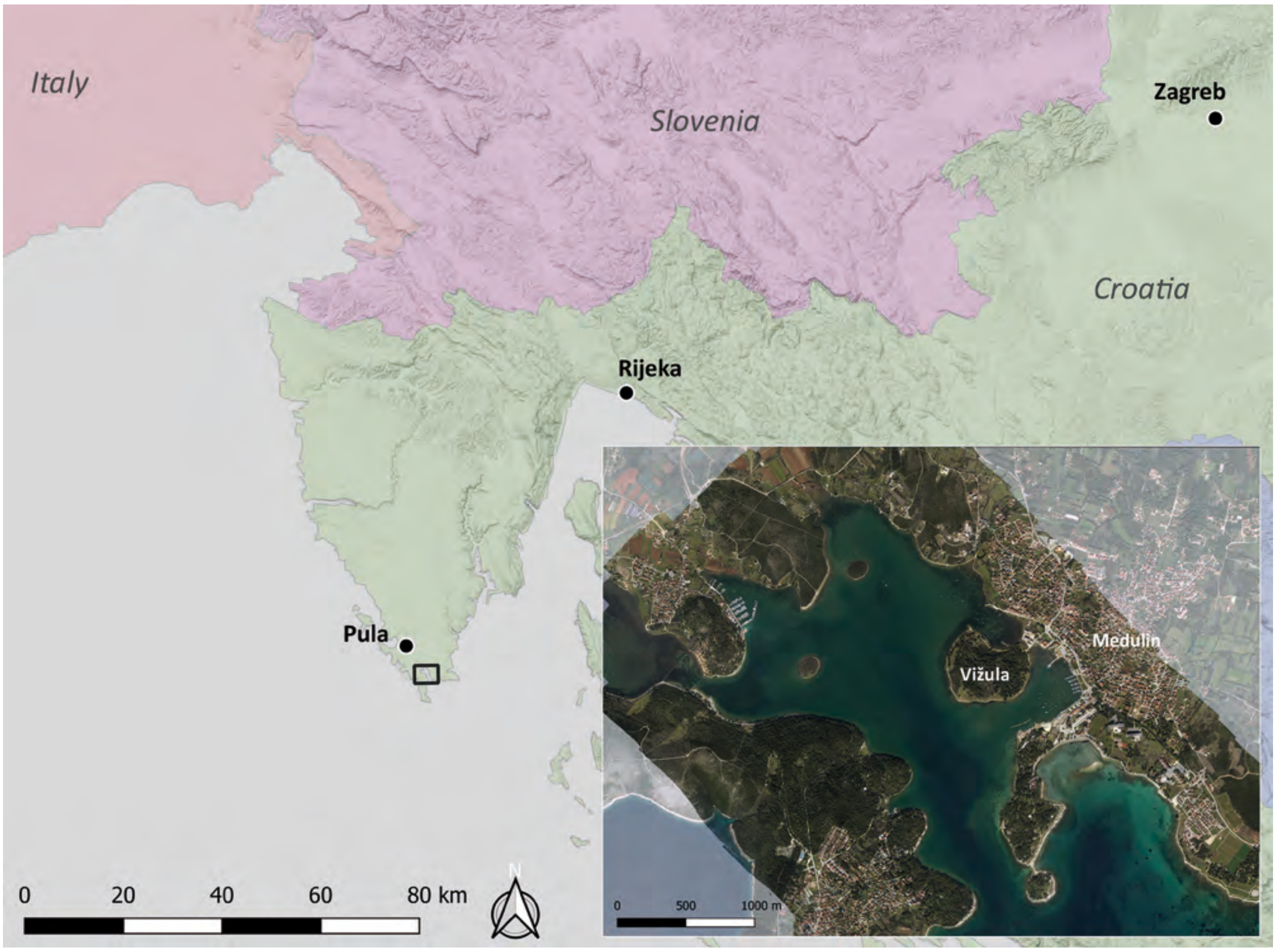

Fig. 1. Vižula is located in the south of the Istrian peninsula, next to the town of Medulin (Layout: M. Doneus, © Orthophotograph acquired during the ALS flight mission 2018).

Fig. 2. Roman buildings are visible at numerous locations along the coast of Vižula (Photos: N. Doneus).

Fig. 3. Left: A modern path leads around the peninsula and is bordered by large pine trees. – Right: By contrast, the centre of the peninsula is dominated by dense vegetation (Photos: M. Doneus).

Fig. 4. Distribution of archaeological zones in Vižula. – 1–6. Terrestrial zones. – A–H. Underwater objects (Graphic: N. Doneus, © Orthophotograph acquired during the ALS flight mission 2018).

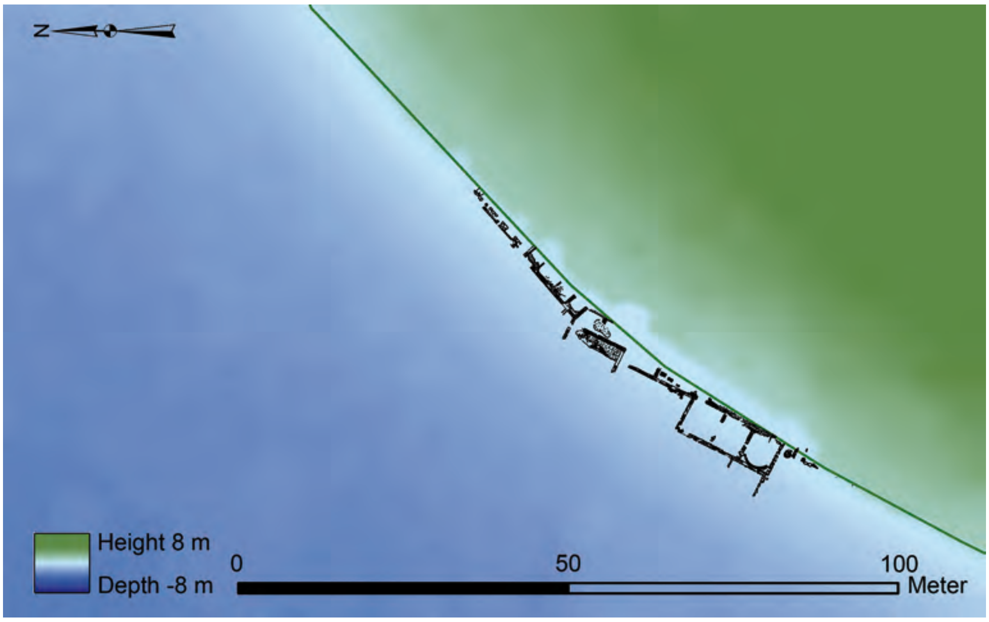

Fig. 5. Object A, state of research 2014. – The green line marks the 0 height and today's coastline (Graphic: N. Doneus).

by archaeological excavations, concentrating exclusively on zone 2, the area of the presumed main residential building (*villa maritima*).

First notes referring to Roman structures underwater date back to the end of the 1970s but it was not until 1995 that systematic underwater research began at Vižula.[10] A different naming strategy was used during that research (objects or building complexes A–H;[11] Fig. 4), since the nomenclature of terrestrial archaeological zones did not meet the needs of the underwater excavations.

Altogether, eight different objects were defined (Objects A–H), four of them settlement objects (A, B, D and E), two piers (C and F) and a road (H); while today all of the settlement features are only partly submerged, the two piers and the road are completely covered by water.

The visible remains of Object A are located on the beach, in the intertidal zone (Fig. 5).[12] Several small rooms of a building have been documented, most of them with remains of waterproof mortar, *opus spicatum*, floor mosaics or hypocaust heating. An interpretation as a thermal part of a small *villa* has been suggested.[13] Finds provide a dating range from the 1st to the 4th century AD.

Originally a *porticus* was attached to the NE and SW sides of the object, running parallel to the coast. Its length in the NE direction was unknown in 2014. On the SW side the portico could be followed for about 120 m, where it seems to connect with Object B. The size of architectural remains and the quality of the uncovered archaeological finds suggest an interpretation of Object B as a *villa maritima* (Fig. 6).[14] Since 1995, visible remains were documented and partially excavated, with the excavations mainly concentrating on the southern part of the large complex.[15]

Excavations have covered a total of about 0.2 ha and revealed Roman construction phases from the 1st, 2nd/3rd and 4th centuries AD.[16] The walls were constructed in *opus isodomum*, *opus incertum* or *opus mixtum*. Floor surfaces are partly preserved in the form of stone plates, mosaic floors (*opus tessalatum*, *opus sectile*) or a combination of both (*opus scutulatum*). Also, numerous frescoes and marble remains,[17] statue fragments etc. speak of an exclusive interior. In total, the complex extends over three or four terraces with a height difference of approx. 1 m each. In the post-Roman period the building seems to have been used for a short period of time, as the traces of fireplaces from the 6th century reveal.[18]

10 Orlić 1995.
11 Jurišić 2006, map 1.
12 To provide a better comparison of the individual objects, Figures 5–9 are printed in the same scale and relative orientation.
13 Miholjek 2012, 527.
14 Džin 1995.
15 Girardi Jurkić et al. 2012 with older literature. – Džin 2013, 70–71.
16 Girardi Jurkić 2008a, 8–15.
17 Gobić Bravar 2006.
18 Girardi Jurkić 2008b.

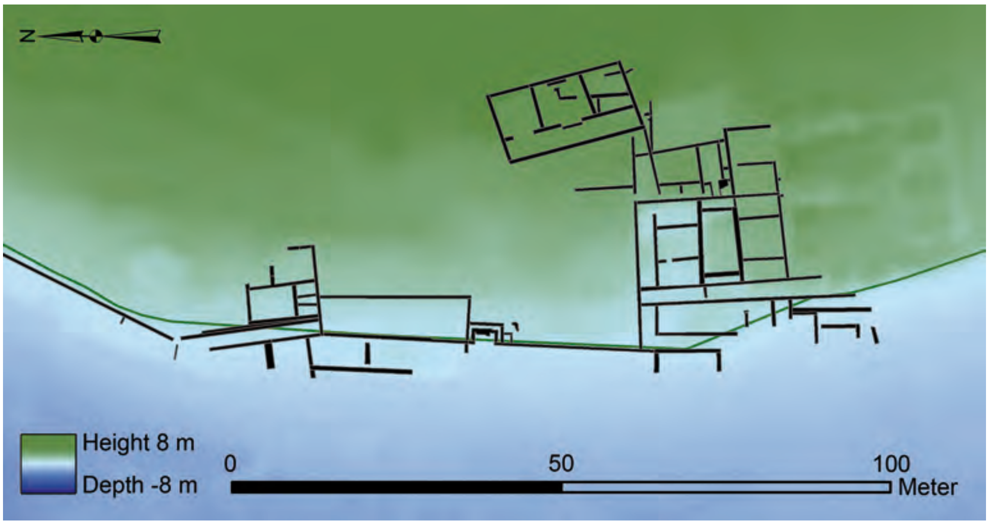

Fig. 6. Object B, state of research 2014. – The green line marks the 0 height and today's coastline (Graphic: N. Doneus).

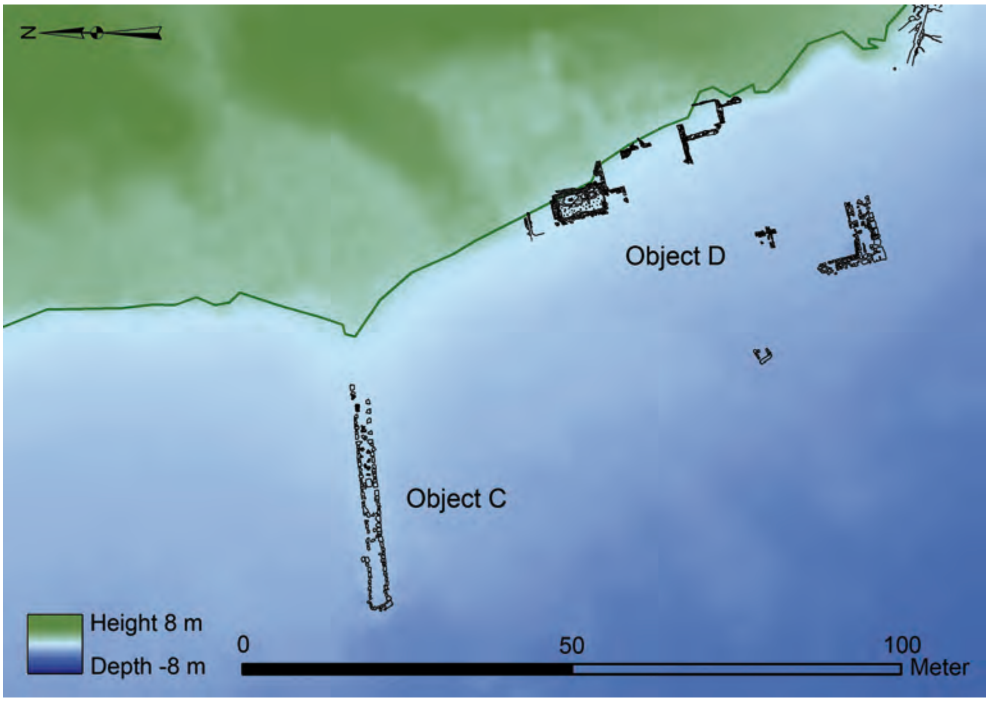

Fig. 7. Objects C and D, state of research 2014. – The green line marks the 0 height and today's coastline (Graphic: N. Doneus).

Some 100 m further south, the remains of a pier were located and named Object C (Fig. 7). The pier is submerged and lies in front of a disused quarry (Fig. 11). Results of underwater excavations next to the pier did not reveal any Roman or other kind of archaeological finds.[19]

Southeast of the pier, on the beach and in the shallow water, there are further remains from Roman times (Object D) which include several rooms of a residential building as well as a cistern with the dimensions 6.5 × 3.2 m (Fig. 7).[20]

19 Orlić 1995, 69–70. – Jurišić 2006, 303.

20 Miholjek 2012, 530.

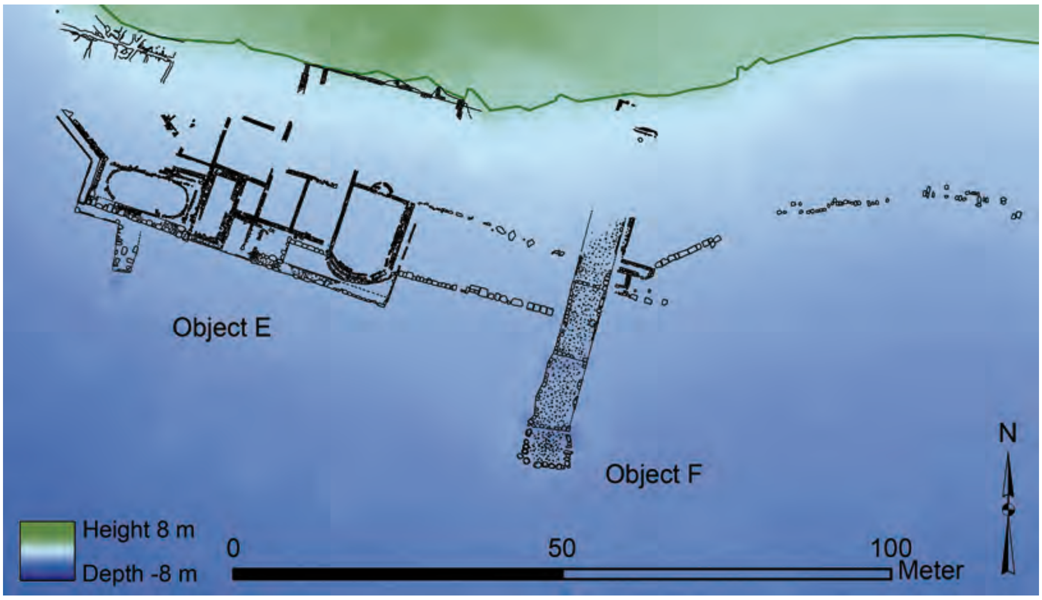

Fig. 8. Objects E and F, state of research 2014. – The green line marks the 0 height and today's coastline (Graphic: N. Doneus).

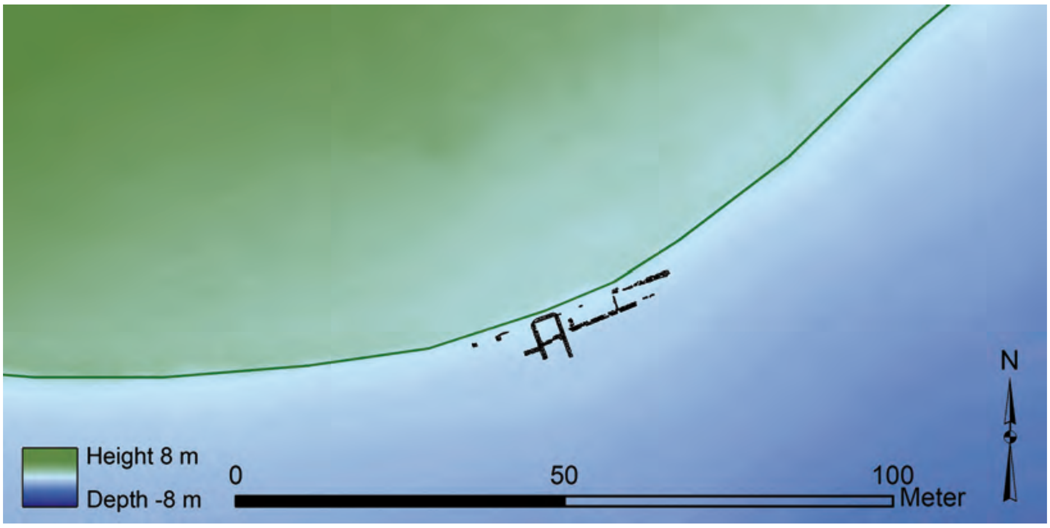

Fig. 9. Object G, state of research 2014. – The green line marks the 0 height and today's coastline (Graphic: N. Doneus).

Object E refers to parts of a larger complex 50 m further east (Fig. 8). The location is similar to others, as some parts are visible below water and on the beach, while others are still hidden under ground. The complex is bounded towards the sea by up to 2 m-thick walls. It comprises several large rooms and has an adjoining pier (Object F) on the east side of the building.[21]

The last Roman settlement object is located about 300 m further on the southern side of Vižula (Object G). As in the other cases, Roman walls can be seen in the beach area and indicate several rooms of a residential building (Fig. 9).

The Roman road (Object H) is today completely submerged in the shallow water between Vižula and its hinterland (Fig. 4).[22] Its course is recognizable underwater over a length of about 200 metres. Excavations have provided

21 Miholjek 2006, 294–297.

22 Miholjek 2006, 298.

information about its construction and small finds from the 1st to the 5th centuries AD.[23] On Vižula itself the road is hidden by dense vegetation and sediments, while its remains in the urban area of Medulin have completely disappeared below modern buildings.

The nearby Burle burial ground is also part of the Roman heritage of Vižula (Fig. 4). It is situated next to the land bridge that today connects Vižula with the mainland. Systematic excavations between 1979 and 2000 revealed more than 300 cremation and skeletal burials dating from the 1st to the 6th century AD.[24]

3. Integrating Archaeological Research in Vižula

As can be observed from the previous chapter, our archaeological knowledge on the peninsula of Vižula is mainly based on excavations. Depending on the environment (terrestrial or underwater), independent groups of archaeologists were involved in the research, a situation, which is also reflected in the two different naming schemes or nomenclature for the archaeological features (Fig. 4). Only starting in 2014 were attempts made to integrate the archaeological research and to augment the structural information of the peninsula using large-scale archaeological prospection. Consequently, areas around Objects A, D–E and G were surveyed by high-resolution ground penetrating radar systems in 2014 and 2015.[25]

What is more, the EU-funded project "Archaeological Park Vižula" (2017–2019)[26] offered an opportunity to further intensify the integrative approach. As well as additional underwater and terrestrial excavations, it also enabled the acquisition of remote sensing data by means of Airborne Laser Scanning (ALS) and Airborne Laser Bathymetry (ALB). All structures – terrestrial and underwater – interpreted from the ALS/ALB-based digital terrain models (DTM) were visited and verified in summer 2018 and winter 2019 by the Croatian and Austrian team members. In addition, between 2014 and 2018, Vižula was field-surveyed three times, in order to map newly eroded and thus visible architectural elements. At the same time, the documentation of underwater structures has proceeded further and delivered more information on individual buildings. The focus of this publication lies on these results, together with information from geophysical prospection and remote sensing.

3.1. Airborne Laser Scanning/Airborne Laser Bathymetry

Laser scanning, often referred to as LiDAR (Light Detection And Ranging), has seen increasing use in archaeology over the past two decades. Today, it has become an important component for modelling objects and terrain[27] from airborne (referred to as Airborne Laser Scanning, or ALS) and terrestrial (referred to as Terrestrial Laser Scanning, or TLS) platforms.[28] As active remote sensing devices, laser scanners typically send out infrared pulses towards a target surface, the backscattered echoes of which are recorded, resulting in dense point clouds of the scanned surfaces. The ability of laser scanners to record surfaces even under dense vegetation has made them viable tools for the detection of archaeological and palaeoenvironmental features in woodlands and dense macchia.

For coastal and/or submerged settlement sites the development of scanners utilizing green lasers with small footprints is of special interest. They have the capability to penetrate clear water and consequently measure the underwater topography (= Airborne Laser Bathymetry, ALB) in high detail, resulting in digital surface and terrain models with a raster width of 0.5 m, combining the topography of underwater and terrestrial surfaces as well as the intertidal zone.[29]

Within the framework of the project "Archaeological Park Vižula" a flight mission was carried out in March 2018 covering – beside Vižula – the whole of Medulin Bay.[30] Approx. 17 km^2 were documented with an airborne RIEGL VQ-820-G laser scanner and an IGI 50 mm Digicam camera. The laser scan measurements resulted in a digital model of the terrestrial and underwater topography with a planimetric resolution of 50 cm in waters at depths of up to 10 m. To optimize the data for archaeological purposes, the acquired georeferenced point cloud was further processed in the collaboration with the Technical University of Vienna. Details on the scanner settings and the ground point filtering process were specified in a recent publication.[31]

For the Roman architecture of Vižula, the inclusion of ALS/ALB in the archaeological research allowed systematic landscape-based archaeological interpretation of potential terrestrial and submerged structures. Interpretation and mapping of the relevant structures was based on standard visualization techniques such as hillshade, slope, openness,

23 Miholjek 2012, 527–530.

24 Džin 2008.

25 In the evaluation of prospection results, the naming strategy A–H was used and extended for new buildings (Object I).

26 The project was funded by the European Regional Development Fund, Competitiveness and Cohesion OP 2014–2020 and led by the Municipality of Medulin with the aim of preserving and presenting the site to the public.

27 Cf. Crutchley 2010. – Doneus, Briese 2011. – Opitz, Cowley 2013. – Fernandez-Diaz et al. 2014.

28 Grussenmeyer et al. 2016.

29 Doneus et al. 2013. – Doneus et al. 2015. – Menna, Agrafiotis, Georgopoulos 2018.

30 An evaluation of complete ALS/ALB data, with the focus on Medulin Bay, will be presented in a separate publication.

31 Doneus, Mandlburger, Doneus 2020.

Fig. 10. Overview of the geophysical survey on Vižula (Graphic: N. Doneus, © Orthophotograph acquired during the ALS flight mission 2018).

local relief model and combinations thereof.[32] Furthermore, the detailed DTMs facilitated integration of a landscape context into the site-based interpretation.

3.2. Geophysical Prospection: High-Resolution GPR

Geophysical prospection uses diverse methods (geomagnetic, ground penetrating radar, resistivity and electromagnetic induction surveys) for the documentation of archaeological structures hidden in the shallow subsurface. The choice of the method depends on the soil, geology and structure of the site. Modern geophysical hardware and software are highly efficient and capable of excellent imaging quality.[33] Magnetics and ground-penetrating radar are currently the most frequently applied methods in the context of large-scale geophysical archaeological prospection. Magnetic measurements are most suitable for the mapping of archaeological structures which cause anomalies in the Earth's magnetic field in large, open and unobstructed areas.[34] GPR provides detailed three-dimensional information about the approximate depth, shape and location of archaeological structures and is especially valuable in the study of ancient cities.[35] Measurements with motorized multi-channel geophysical systems permit quick and cost-effective examination of large areas. More important, however, is the fact that in combination with other prospection and archaeological methods, large-scale geophysical prospection makes detailed research at the landscape level possible.

A first application of geophysical prospection in Vižula took place in the year 2014, followed by a second GPR campaign in 2015 (Fig. 10). Both campaigns were conducted by the Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology (LBI ArchPro).

32 Hesse 2010. – Challis, Forlin, Kincey 2011. – Kokalj, Zakšek, Oštir 2011. – Bennett et al. 2012. – Doneus 2013. – Kokalj, Zakšek, Oštir 2013. – Kokalj, Somrak 2019.

33 Bevan, Smekalova 2013. – Novo 2013. – Schmidt et al. 2015. – Cozzolino et al. 2018.

34 E.g. Doneus et al. 2018.

35 E.g. Neubauer et al. 2012. – Doneus, Doneus, Ettinger-Starčić 2017. – Trinks et al. 2018.

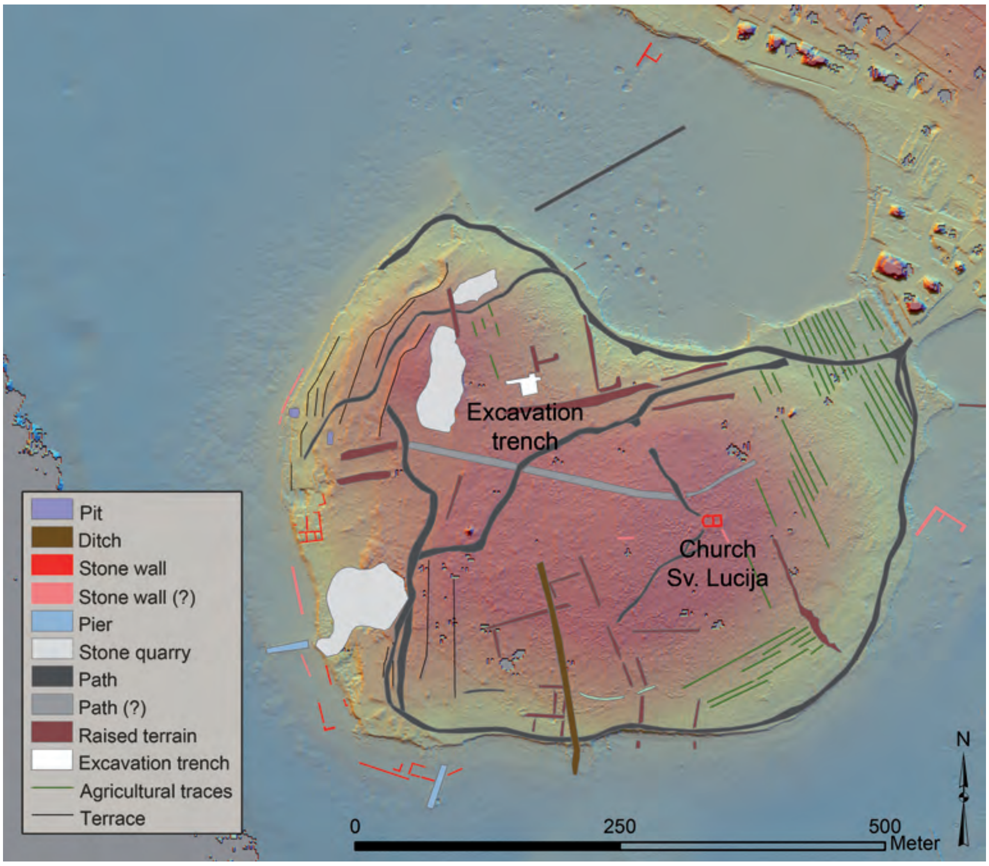

Fig. 11. Overview of ALS/ALB results (Graphic: N. Doneus). – See also the visualization of the ALS data on Figure 24.

The focus was on the areas next to Objects A, D–E and G. In the first year, the measurement was conducted using a motorized Sensors & Software multichannel system with a six-channel 500 MHz array (SPIDAR) and a measuring grid of 0.05 × 0.25 m. In the second year a different motorized system was applied, including a 16-channel 400 MHz MALÅ Imaging Radar Array (MIRA) with 8 cm cross-line spacing. A total of six working days were spent on Vižula in 2014 and 2015 to measure 1.8 ha. To obtain exact geographic positioning, an RTK-GNSS system, which is also linked to real-time navigation software, was used. Here, large trees, with their wide and dense crowns, have to some extent caused problems with the positioning signal, resulting in small and patchy GPR measuring areas, as next to Object A (Fig. 13). Processing and visualization of the collected data was carried out using the software ApRadar, a collaborative in-house development of the LBI ArchPro and its partner ZAMG.

4. Results

The interpretative mapping of the ALS-based DTM from Vižula clearly shows – in contrast to the aerial photographs – past landscapes containing terraces, pathways, stone quarries, walls and relics of past agricultural use (Fig. 11). However, the results are skewed: the DTM reveals only a fragmentary image of the Roman heritage of Vižula, as features of Roman origin found during field surveys were not visible in any visualization of the ALS-based DTM.

Also, submerged architecture, like the Roman road north of Vižula, was recognizable only in isolated areas (Fig. 12). This is mainly due to the fact that thick sediment packages are deposited in the shallow water covering archaeological objects. Another bias of the dataset results from the fact that ALS allows us to reveal archaeological traces that are still visible in relief. Therefore, many traces visible in the ALS data are of rather younger date. The data, on the other hand, provide valuable indications with regard to large-scale human intervention in the relief and will be discussed below.

Furthermore, geophysical results are also affected by soil properties, the predominant vegetation and the type of landscape cultivation. In addition, the duration and intensity of occupation periods influence the visual appearance of single archaeological layers in the prospection data. In Vižula, it is evident that post-Roman times played a minor

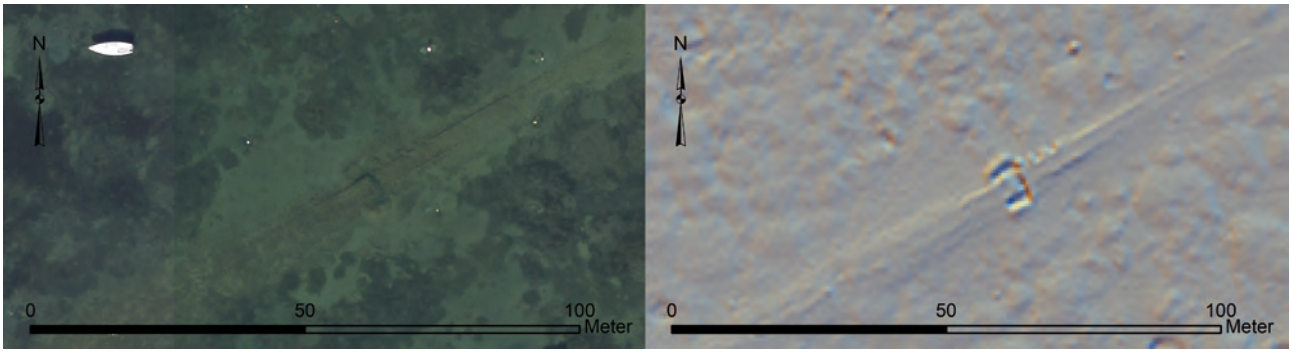

Fig. 12. Submerged Roman road and excavation trench visible in aerial photograph (left) and ALB data (right) (Graphic: N. Doneus, © Orthophotograph acquired during the ALS flight mission 2018).

role for the visibility of Roman remains, since the site does not seem to have been inhabited since the Migration period. Here, the soil type (*terra rossa*[36]) and its high water content had more influence on the prospection data.[37]

In 2018, some of the GPR results were verified in targeted, small-scale excavations.[38] The results showed that in some areas the GPR interpretation perfectly matched the excavated features (Object I, Fig. 17), while other excavated structures were hardly visible in the GPR data (Object G, Fig. 20). Individual survey areas are discussed in the following.

4.1. Object A

Structures of the building have been found underwater and in the intertidal zone. Only smaller extents were visible through geophysical measurements. Object A has a width of almost 50 m with outer walls recognizable by the increase of c. 20 cm in thickness (Fig. 13/1). In addition, this is confined on both the northern and the southern sides by a *porticus* with a wall width of 80–90 cm (Fig. 13/2). GPR data were able to confirm that further parts of the building are hidden between 10 and 90 cm below the surface. While the orientation clearly suggests that these walls are part of the excavated building, their low number plus the very small number of preserved floor surfaces provided only few indications of the size and layout (Fig. 13).

Approximately 70 m south of Object A, GPR data indicate further settlement features. These are several round structures with a diameter of about 2 m with a channel in between (Figs. 13/3, 14). In contrast to the walls of the *villa*, which appear directly below the surface in the GPR data, the structures mentioned here are only weakly visible at a depth of between 50 and 70 cm. However, the section is too small to be considered with certainty as a production part of the *villa* and the features cannot be spatially assigned to a separate building.

4.2. Object B

Similar to most of the other known buildings on Vižula, Object B is partly submerged. While the dense vegetation surrounding the excavated area did not allow geophysical measurements, the ALS-based DTM reveals further structures of the *villa maritima*.

An older and obviously forgotten excavation of Object B, nowadays almost completely covered by vegetation, was detected in the ALS data (Fig. 15). In an area of 25 × 25 m several excavated walls are visible and correspond in orientation with the already known layout of Object B. Based on the topographical data it can be seen that the excavation trench was not filled in and levelled after completion of the work, the walls were left uncovered and the excavated soil deposited on the outside of the walls. The inside of the individual rooms seems to be elevated in comparison to the excavated walls, so that here, perhaps, the archaeological layers are still partly in situ. The exact date of the excavation is unknown. Presumably it is an excavation from the beginning of the 20th century. An indication for this can be found in the photo collection of the Austro-Hungarian

36 Durn 2003.

37 In addition to GPR measurements, a preliminary geoarchaeological evaluation was taken in December 2015 by Petra Schneidhofer, LBI ArchPro for better understanding of the geophysical response to the prevailing environmental settings. Investigations included soil and sediment analyses as well as in-situ measurements of magnetic susceptibility, dielectric permittivity and electrical conductivity.

38 The documentation of the excavations 2017–2019, including the location of the test trenches, stone walls etc., is still in progress and could therefore not be integrated into the figures of this publication. Those results will be published separately.

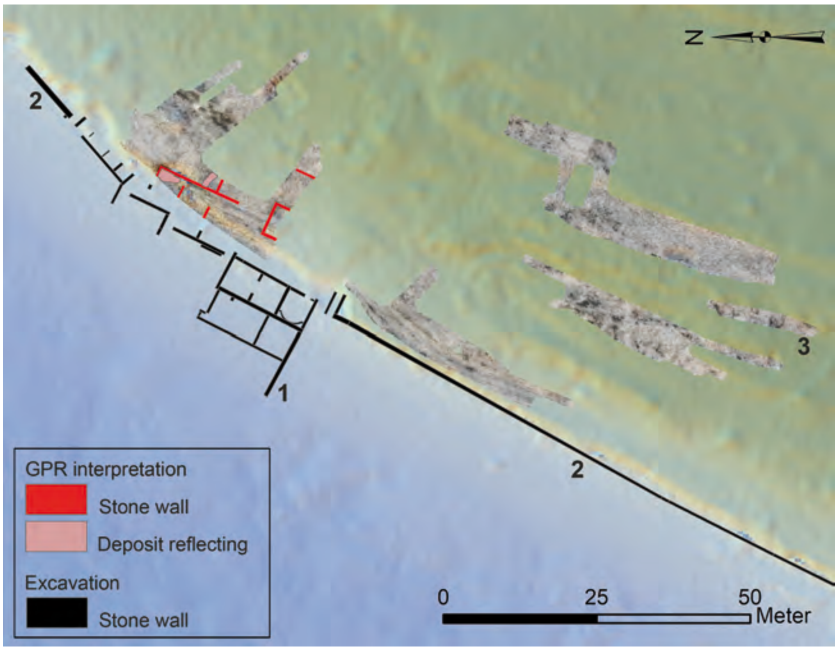

Fig. 13. Interpretation of the GPR data and underwater excavation results of Object A. – 1. Outer walls. – 2. *porticus*. – 3. Production part of the *villa* (?) (Graphic: N. Doneus).

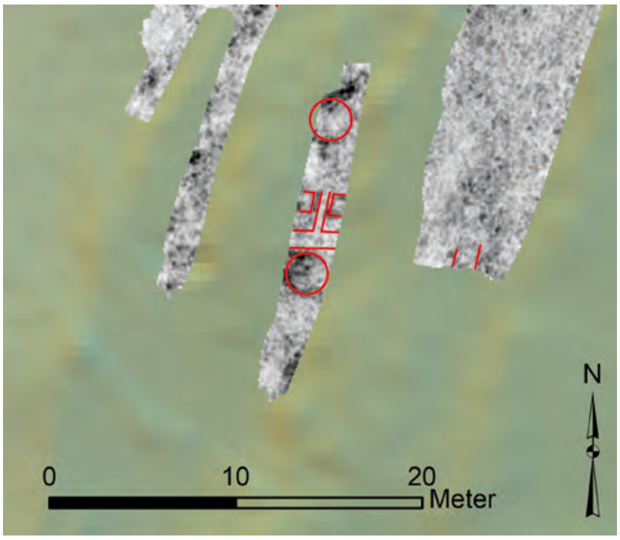

Fig. 14. Settlement features south of Object A (Graphic: N. Doneus).

artillery officer Richard Schuster.[39] Mr. Schuster's note "Multicoloured mosaic fragment from the caldarium of the 'Crispus-Villa' is in my possession."[40] suggests that he not only documented Vižula photographically between 1914 and 1917, but that he also carried out his own excavations.

Today, the mosaic is lost.[41] Another indication of an old excavation is perhaps visible in the ALS-based DTM on the north side of Object B, at the point of contact between the building and the *porticus* (Fig. 16/5). Here, ALS data indicate a (partial) ground-plan measuring approx. 7 × 8 m.

The layout of the building complex B seems to be half known. The side facing the sea extends about 120 m in a north-south direction and has a *porticus* (Fig. 16/1) in front of the residential areas. In addition to the residential wing to the south (Fig. 16/2), the building must have had at least one further wing, probably on the north side. This is not only indicated by wide stairs, which were positioned roughly in the middle of the complex and led to the sea (Fig. 16/3), but also by the current absence of a kitchen or thermal facilities. The southern residential wing had a width of 50 m and a length of more than 40 m. Different orientations of individual rooms are an indication of rebuilding through time, the four rooms from the 4th century AD (Fig. 16/4) in particular do not fit in their orientation with the older layout.[42]

The ALS data also show man-made terraces to the north of Object B (Fig. 16). They correspond to the previous excavation results, which indicate that the *villa* was built on three or four terraces. The difference in height between each of the terraces is about 1 m.

39 Bader 2016, 210–211.

40 Bader 2016, 211: "Mehrfarbiges Mosaikfragment aus dem Caldarium der 'Crispus-Villa'. Ist in meinem Besitz."

41 Personal comm. Andrej Bader.

42 For details see Girardi Jurkić et al. 2012 with older literature.

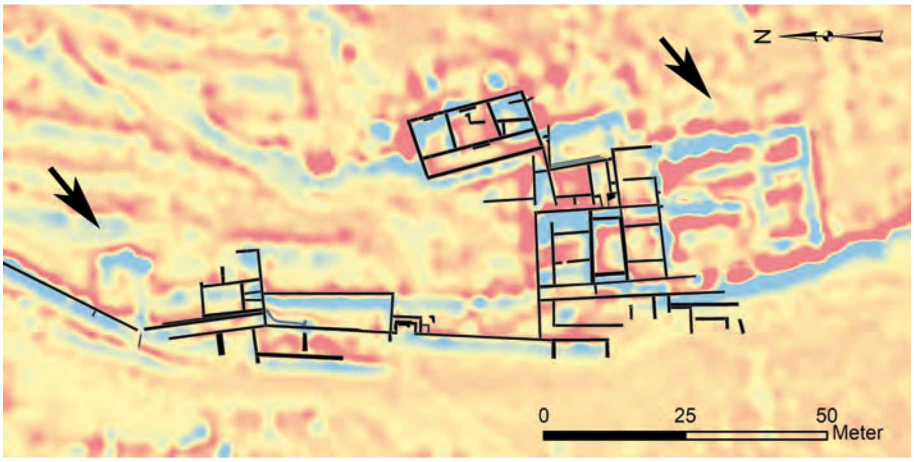

Fig. 15. Old excavation trenches north and south of Object B in the ALS data (Graphic: N. Doneus).

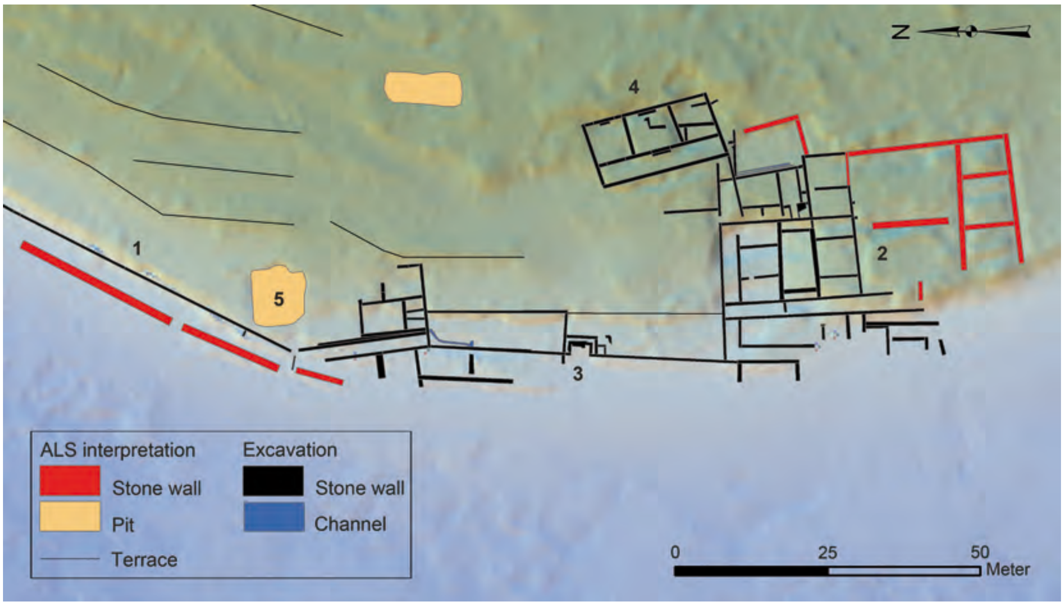

Fig. 16. Interpretation of the ALS data and excavation results of Object B. – 1. *porticus*. – 2. Southern part of the *villa*. – 3. Stairs. – 4. Building extension from the 4th century AD. – 5. Old excavation trench (Graphic: N. Doneus).

4.3. Object C

The remains of a submerged pier are known as Object C (Figs. 4, 7) and are located in front of a former quarry. In the quarry soft chalk limestone was exploited.[43] This type of stone was used in Roman but also in more recent periods, such as during the Venetian Republic.[44]

The pier (Object C) logistically offers itself for the transport of stone material from the quarry. For this reason both were considered to belong together. During underwater excavations no Roman material was found; therefore a more recent dating of the pier was proposed.[45] Other publications in the past also suggested a potential Roman dating of both the quarry and the pier.[46] The interpretation as a Roman quarry also corresponded to the idea that of all the

43 Information taken from the unpublished report: B. Cvetko Tešović, M. Juračić, Kamenolom Vižula. Geološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu.
44 Crnković 1991.

45 Orlić 1995, 69–70. – Jurišić 2006, 303.
46 Girardi-Jurkić 2013, 47.

buildings on Vižula only Object B had a residential character, while the architecture extending further southwards (Objects D–F) was addressed as supporting facilities for production and transport.[47] According to the new results, however, this assumption no longer seems convincing and the dating of both the pier and the quarry to a post-Roman period is probable.

Apart from the fact that no Roman material was found underwater, the pier is made of loose stones without a mortar compound, which is neither the Roman style nor the Roman standard in the region. The construction renders it unlikely that the pier could survive centuries given the strong sea currents. Furthermore, the Italian map from the early 19th century published by Andrej Bader in 2013,[48] with the mole drawn in, indicates that it was functional at that time.

In addition, the quarry is located between Objects B and D–F, which are only about 150 m apart. Contrary to the original opinion that only Object B was a luxurious *villa*, today we can assume that complex D–E also had an exclusive residential character (see section 5.1). Consequently, a quarry in operation between two luxury *villae* contradicts the idea of representative living, as the quarry causes a high environmental impact and is therefore difficult to combine with the idea of a luxurious retreat or *otium*.[49] Moreover, the excavation finds from Vižula do not contain any evidence of stonemasonry activities during the Roman period. At present, there is also no evidence that the Roman pier (Object F) was ever used for the transport of extracted stone material. If loading and possible direct processing of stone material had ever taken place next to the pier, a corresponding composition of the find material would have been revealed.[50] For all of these reasons, it seems probable that the quarry and the pier can be dated to the Middle Ages or post-medieval times.

ALS results show that there are at least two more stone quarries on Vižula (Fig. 11). However, there are no written or graphic sources that would confirm dating of any of them in the Middle Ages or later.

4.4. Objects D–F and I

As detailed in chapter 2.2 on the research history, Object D and Object E had been regarded as two independent buildings (Fig. 4). Based on our results from underwater surveys and the mapping of the walls in the beach area between 2014 and 2018, this interpretation has to be revised: the revealed evidence strongly suggests that Objects D and E are two parts of the same building (Fig. 17). After mapping all of the surveyed walls, Objects D and E both have the same width of approx. 50 m facing the sea and were originally connected; the distance between them amounts to 35 m. The width of 50 m is strikingly similar to the width of the south wing of Object B (Fig. 16/2). Objects D and E are oriented at about 45 degrees to each other. Another common feature is the construction of the outer walls facing the sea: they were built directly on the waterfront and were therefore strongly exposed to the impact of the waves. This fact was compensated for by the construction of extra strengthened or doubled walls with a width of 1.5 to 2 m (Fig. 17/1). A similar wall construction is not known from other locations on Vižula. In addition, Object E has an approximately 7 m-long wall constructed perpendicular to the building (Fig. 17/2). This small construction probably did not serve as a short pier but provided support for the building in the back. The underwater excavation showed a massive construction, partly built of stone blocks with a thickness of 0.5–0.9 m and a width of at least 2 m.[51]

The width of the two parts is not only given by the layout of the walls, but also indicated by the position of the waste water pipes, which run along the outer walls of D and E; the same situation was observed for Object B.

The GPR measurements allow reconstruction of the size of the residential part D, which measures 50 × 55 m. Object D also overlaps with a newly discovered building I in the 'back' of the large complex (Fig. 17). The extent of part E could not be determined by the GPR measurements. Also, an overlap between Objects E and I cannot be observed in the GPR data. Altogether, it can be assumed that part E has the same width of 50 m as D but a slightly smaller length of less than 50 m.

Both D and E have generously measured rooms of similar size to those in Object B. While mosaics from the 2nd/3rd century were discovered during excavations in 2018 in Object D,[52] similar remains are completely missing in the submerged part of Object E, as it is heavily eroded, leaving only the remains of the lowest wall foundations. This is the reason why neither waterproof mortar nor hints of decoration could be documented in situ. However, fragments of bricks, marble, frescos and mosaics were found in the two underwater excavation trenches next to the building (Fig. 17/2).[53]

Given the bad state of preservation, the interpretation of Object E can only be based on the layout of the building. The ground plan suggests – with all due caution – an

47 Miholjek 2006, 294.

48 Bader 2013, 207.

49 Marzano, Métraux 2018, 25–27.

50 Parica 2012.

51 Unpublished underwater excavation report 2012.

52 The terrestrial excavation in 2018 was located next to the walls of Object D, which were already visible in the beach area (see Fig. 7).

53 Unpublished underwater excavation report 2012.

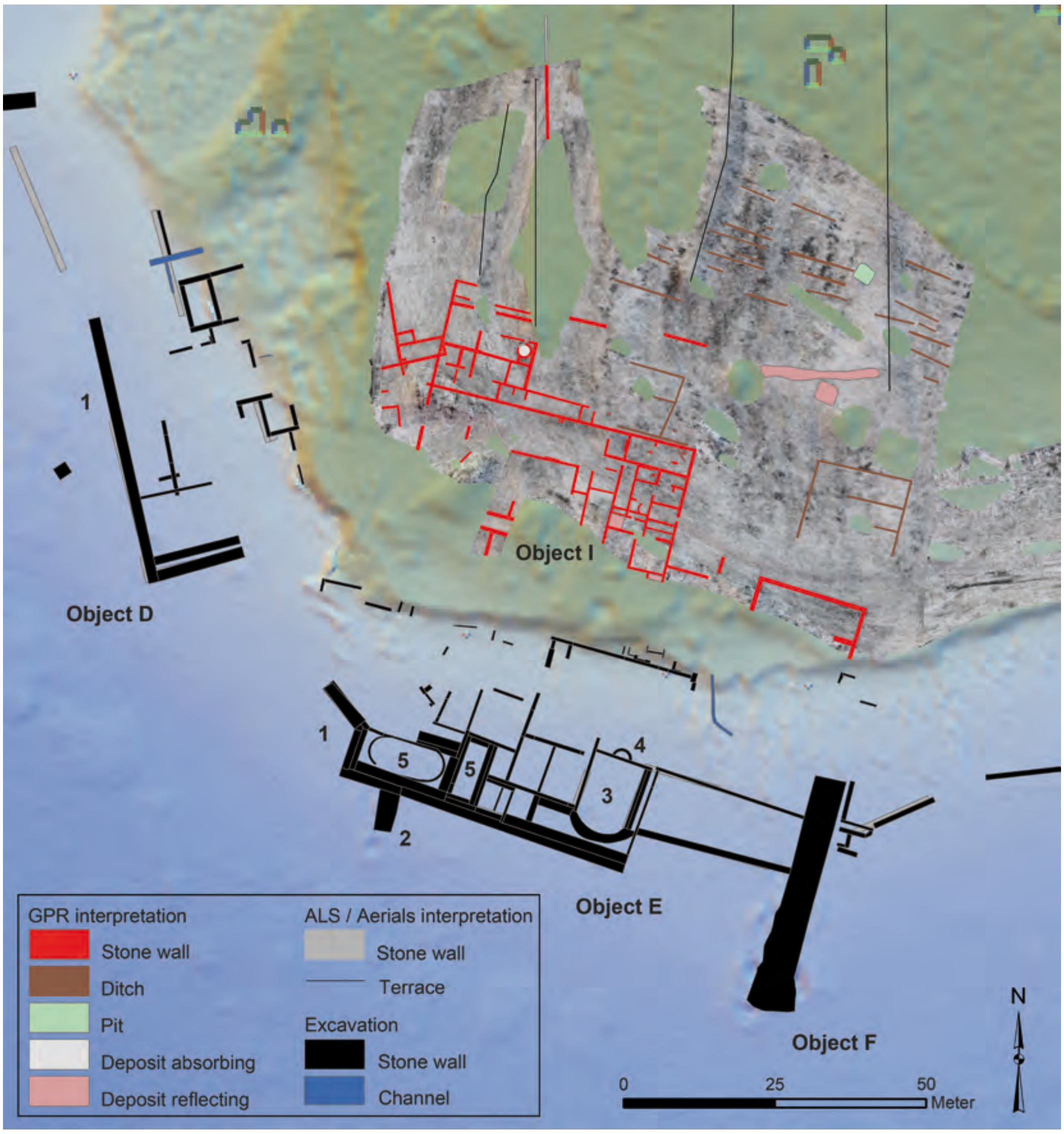

Fig. 17. Interpretation of the GPR data and underwater excavation results of Objects D–E, F and I. – 1. Outer walls. – 2. Support wall. – 3–5. Thermal part (Graphic: N. Doneus).

interpretation as the thermal part of a *villa*. The warm-water bath (*caldarium*) is possibly located in the SE, at the edge of the building (Fig. 17/3), and measures about 12.5 m in length and 8.5 m in width. The small apse measuring 2.5 × 1 m could suggest a small piscina or a *nympheum* (Fig. 17/4). Two possible further basins of 15 m and 9 m in length are located on the SW side of the building (Fig. 17/5). A similarity can be found in the small bathing complex of *villa* Barcola near Trieste, for which a dating between the 1st century BC and the 1st century AD has been suggested.[54] The layout and form of the rooms also resembles that of the *villa* Porto Saturo[55] near Tarento, although the *villa* is dated to the 3rd or early 4th century and is therefore probably considerably younger than Object D–E. Given the significant erosion of the building, it can be assumed that the layout of Object E, as we see it today, belongs to the oldest part of the building. Based on the oldest finds from the underwater excavation, this would be the 1st century AD. Any later modifications have been completely destroyed by the sea.

A pier (Object F) adjoins the residential section E on its eastern side (Fig. 17). The area between the building and the pier consists of a 25 m-long platform, which was artificially

54 Fontana 1993. – Lafon 2001, 446 dates the area (Villa del peristilo) between 75 BC and AD 25.

55 Gualtieri 2018, Fig. 10.4.

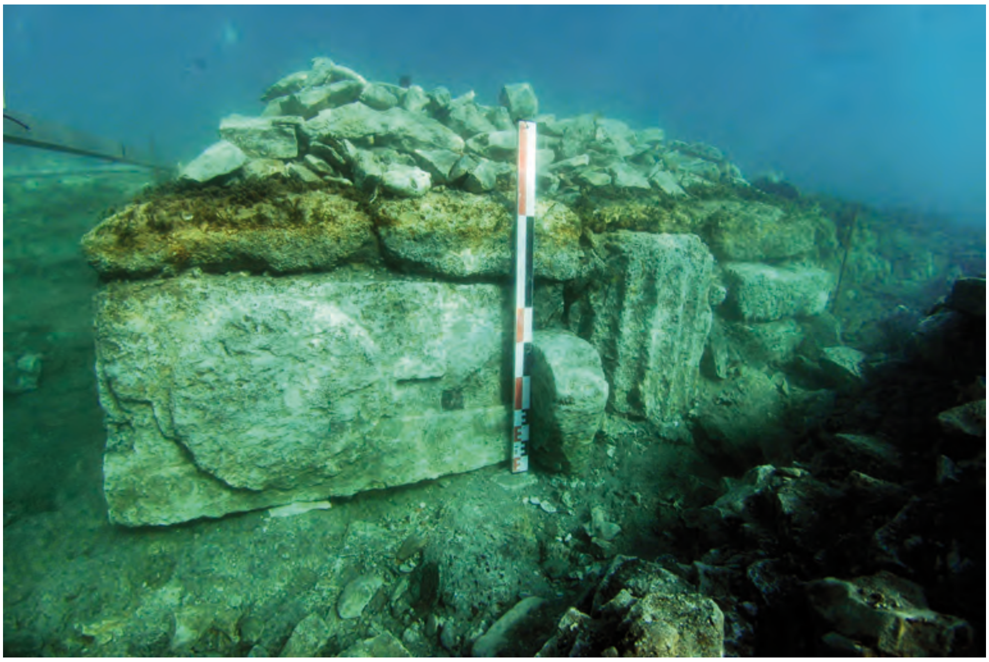

Fig. 18. The use of architectural elements for the construction of the Roman pier, Object F (© HRZ, Croatian Conservation Institute).

filled-up and levelled. Erected stone blocks connect to the east of the pier for a length of about 50 m and indicate with their location the course of the coast in Roman times.

The pier is a 40 m-long and 5 m-wide construction, built in three parts. The outer shell is made up of larger stone blocks, the inside is filled with smaller stones, dismantled architectural elements and other 'waste' (Fig. 18). The covering of the pier is partially preserved and consists of large stone plates. The construction and the size of the object is highly comparable with other Roman piers in Istria.[56] The common feature is the seemingly standardized size, with a width of 5–6 m on land, which is enlarged on the pier front. The length is variable and adapted to the respective topographical conditions underwater.

The GPR measurements, which focused on the hinterland of Object D–E, have resulted in the discovery of a completely unknown building (referred to as Object I). Unlike Object D–E, which was built along the shoreline, Object I is positioned towards the inland at a distance of about 20 to 30 m from today's beach (Fig. 17). Stone walls are visible directly under the surface up to a depth of 120 cm in the GPR data. It is an independent building, which can be determined both from its different orientation and also from its layout (Fig. 19). Object I has an extent of 45 m in width and a length of at least 40 m. The GPR data show two residential wings. The one to the north (15 × 17 m) is divided into several small rooms (Fig. 19/1). In one of them, a round structure with a diameter of about 2.5 metres can be identified, which was confirmed as a kitchen oven in the excavation of 2018 (Fig. 19/2). On the western side of the residential part there is an overlap with Object D (Fig. 19/3). While both buildings show a different orientation and, most probably, did not function contemporaneously, the chronological relationship between the two of them is not entirely clear. A second residential part, located on the east side of Object I (Fig. 19/4) has a width of about 12 m and a length of more than 20 m. One of the rooms might be a small storage facility (Fig. 19/5).[57] The ground plan of the *villa* is not visible in the GPR data, which is why the location of an inner courtyard is also currently missing, but it can be expected, since a courtyard is a common feature among comparable small *villae*.[58] Object I is a type of small *villa rustica*, which in Istria was

56 See Veštar near Rovinj for details or a summary for Roman piers in Istria in Pflederer 2014, 48 or Koncani Uhač 2018, 198–200. Both piers in Verige Bay (Gnirs 1915, Fig. 54) are of the same design as the one in Vižula, which can be seen in aerial photographs. However, they have never been a main subject of archaeological research, not even during underwater excavations in 1996–1997 in Verige Bay (Bloier 2013).

57 See comparable storage facilities in Groh, Sedlmayer 2017, Fig. 78.

58 A detailed description of *villae rusticae* in Istria is offered by Matijašić 1998, 115–239.

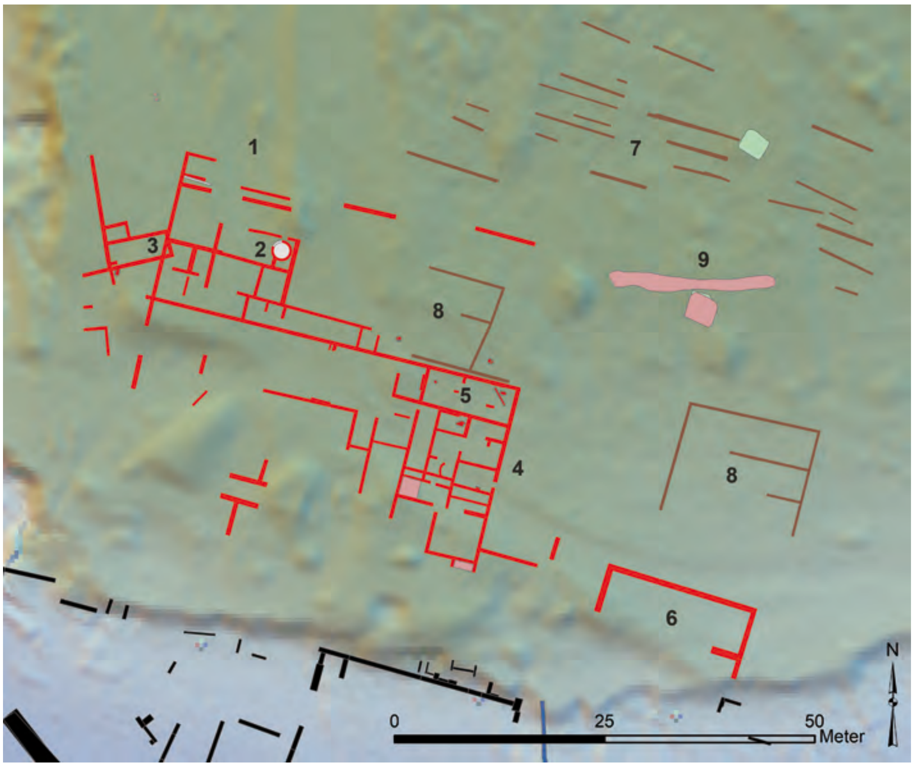

Fig. 19. Interpretation of the GPR data of Object I. – 1. Northern part of the *villa*. – 2. Kitchen oven. – 3. Overlap with Object D. – 4. Eastern part of the *villa*. – 5. Storage (?). – 6. Cistern (?). – 7–8. Ditches. – 9. Path (Graphic: N. Doneus).

usually designed for combined residential and production (e.g. oil/wine) purposes.[59] In terms of size, the object can be best compared with the first phase of the *villa* in the Bay of Verige, Brijuni Island, which, according to Anton Gnirs' documentation, is almost the same size.[60] Remains of oil/wine or any other kind of production are currently not known from the Object I.

Approximately 15 m east of Object I, a separate 17 × 5 m-large rectangular structure can be seen in the GPR data (Fig. 19/6). Its 60 to 80 cm-wide walls are thicker than the walls of the residential complex (30–50 cm), indicating a different function. Inside the object, there is no traceable inner partition, but the data indicate a preserved floor surface. The walls are preserved to a depth of almost 1.5 m. The simple rectangular shape of the object and the massive outer walls, in combination with the lack of interior division and a highly visible floor surface in the GPR data, allow different interpretations. One is an interpretation of the object as a cistern. Comparable water reservoirs can be found in Objects B and D and show the same construction method with 60–90 cm-strong walls, accompanied with waterproof mortar and *opus spicatum*.[61] If this interpretation is correct, it is, for the time being, the only known stand-alone cistern on Vižula and also much larger than comparable features from Objects B and D. On the other hand, the rectangular shape and the considerable size of the object are also reminiscent of a simple rectangular water basin, which could originally have been incorporated into a larger garden design of the *villa* Object D–E.[62]

Northeast of Object I, many 20 to 30 cm-wide ditches can be found in the GPR data, which were obviously carved into the underlying rock (Fig. 19/7). Most of them run parallel in the same northeast-southwest orientation as Object I at a distance of between 1.5 and 2.5 m from each other. In two cases ditches form rectangles (Fig. 19/8) in the same orientation as Object I; one of them is directly adjacent to the *villa*. Both create individual 'plots' of about 3.5–4.5 m width and 15 m length. An overlap between the ditches and the walls of Object I could not be observed. All of the ditches form a system, which seems to indicate evidence of Roman

59 Matijašić 1998, 115–239.

60 Gnirs 1908, Fig. 9.

61 For Object D, see Miholjek 2012, 530.

62 See, for example, the typology of water basins by Farrar 2000, Fig. page 72.

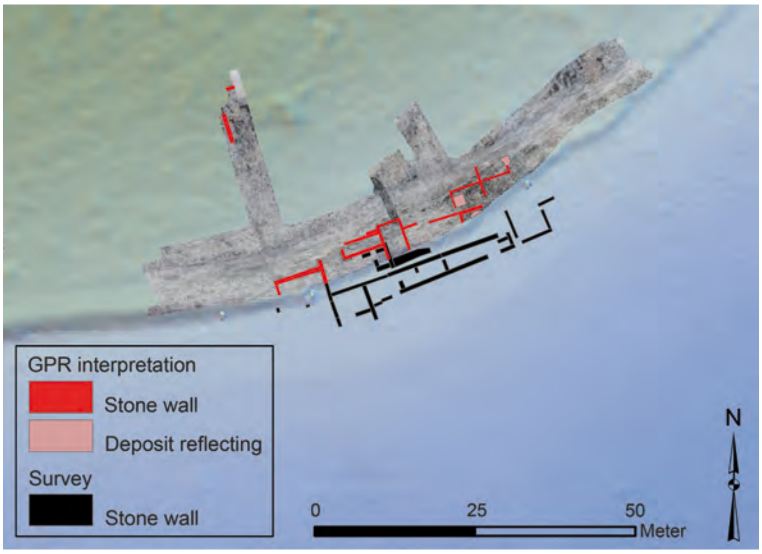

Fig. 20. Interpretation of the GPR data and survey results of Object G (Graphic: N. Doneus).

agriculture, viticulture and/or garden use. Similar features were uncovered in France, England and Italy[63] with a high probability of being connected to Roman wine cultivation.

Between the ditches an old path or a street is visible in the data, accompanied with a 3.3 × 3.2 m-large rectangular structure of unknown function (Fig. 19/9). The same path is partly visible in the ALS data, too (Fig. 23).

North of Object I, at least one wall is visible in the GPR data and aerial photographs (Fig. 17), which indicates the continuation of Roman architecture further inland. The same orientation can be observed in the four, N-S-oriented artificial terraces visible in the ALS-based DTM (Fig. 17).

4.5. Object G

Object G is located circa 300 m east of Objects D–E and I. The entire area in between was subjected to a geophysical survey (Fig. 10) without finding any connecting architecture. This confirms the results of the coastal survey, as no walls are visible there either. In the area of Object G, GPR measurements were able to document several previously unknown walls 30 to 80 cm under the ground. This proves that parts of the building are still preserved (Fig. 20). The interpretation suggests that the object is about 45 m wide and over 40 m long. A small-scale excavation in 2018, which revealed the NW corner of Object G, confirmed the GPR results and thus the approximate total size of the building. The different orientation of the walls in the south of the building is to be understood as an indication of the multiphase nature of the building.

Surface finds offer no mosaic and fresco remains or other references to a sophisticated decoration of the object. If we also consider the size of the building, the conclusion can be drawn that Object G is a second *villa rustica* on Vižula. It is of the same size and probably also function as Object I.

4.6. Further Results

Various visualizations of the ALS-based DTM of Vižula show a wide range of traces of human interventions in the past. Amongst others, a former excavation from the 1960s,[64] which uncovered a Neolithic settlement, could be re-located by the relief-traces of the trenches (Fig. 11).

On the topographically highest point in the centre of Vižula, the DTM shows the ground plan of a building (Fig. 11) measuring 19 × 11 m and seemingly divided into two parts. At least two paths lead to the building, both of them almost invisible in the terrain today. It is likely that the building represents the remains of the church Sv. Lucija, which was mentioned in written texts from 1570[65] and possibly marked on a map from 1563.[66]

Other anthropogenic structures can also be identified in the surface relief of Vižula. Three quarries have been located on the west side of the peninsula (Fig. 11). On the east side numerous parallel lines at a distance of 4 to 6 m from each other were identified (Fig. 21). These most likely represent traces of past cultivation of Vižula.

Written and image sources from the Middle Ages and early modern times referring to Medulin are available, but

63 Boissinot 1995 presents traces of Hellenistic vineyards in this publication. – Brown et al. 2001. – Volpe 2009.

64 Bačić 1969.

65 Personal comm. Andrej Bader.

66 Bertoša 2013, 108.

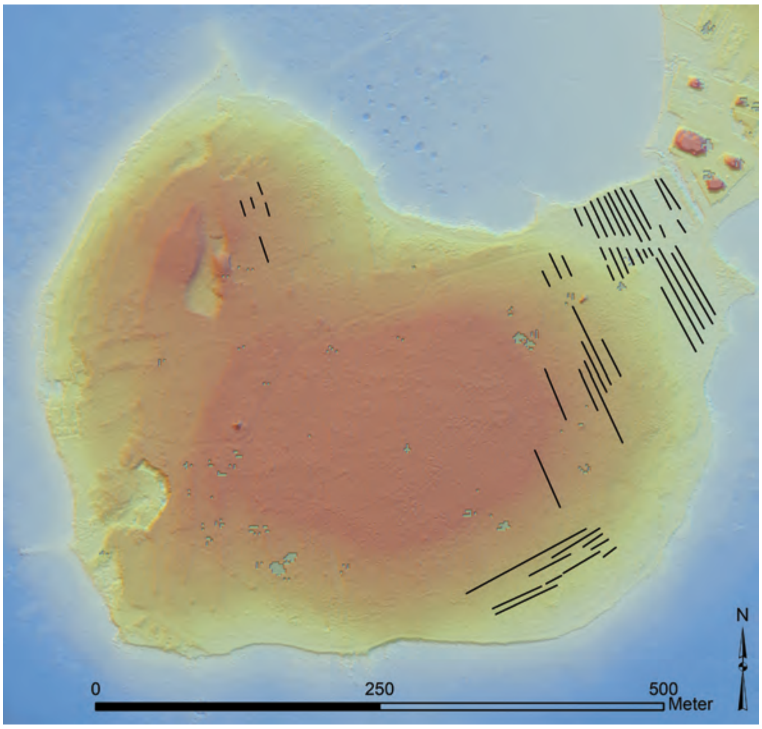

Fig. 21. Agricultural traces in the form of parallel lines on Vižula (Graphic: N. Doneus).

Vižula itself is rarely mentioned.[67] The youngest settlement remains on the peninsula – except the church Sv. Lucija from the Middle Ages – date to the 6th century AD. Whether other settlements recurred in the following centuries is not recorded and the cadastral plan from 1820 also shows an unoccupied and seemingly unused peninsula.[68] Vižula must have had a certain agricultural value over the centuries, despite the lack of actual settlement activities on the peninsula.[69] However, this could not be proven during a survey and apart from a single planted olive tree, no hints of more recent agricultural use were found.

Nevertheless, the traces found in the ALS-based DTM may be agricultural in origin. Neither their age nor their original agricultural significance is currently clear. It cannot be denied that at first sight these features have similarities with Roman vineyards in other provinces even though the measured distances between individual lines may vary.[70] Roman viticulture appears in the form of long, parallel trenches, similar to the GPR results next to Object I (Fig. 19/7). From the ALS data, however, it is not clear whether the lines, which appear as a combination of slight elevation and depression, actually display ditches below or banks above the general relief. At the same time, ALS data from the nearby area show similar patterns – parallel lines at a distance of 5–6 m – in areas of modern olive tree plantations (Fig. 22). As there are no comparable results in the region for either wine or olive tree cultivation in the Middle Ages and post-medieval periods,[71] it may also be that these relics originate from more recent history.

5. Discussion

The long settlement history (1st–5th/6th century) certainly implies changes in the layout or purposes of individual buildings. However, the analysis of individual construction or chronological phases would go beyond the scope of this paper. Furthermore, due to the high erosion of the submerged features, underwater excavations offer hardly any possibilities for dating individual phases on the basis of finds in stratigraphic layers. Results from terrestrial excavations from the years 2017–2019 are currently being evaluated and will be published separately. Without taking these into consideration, it would also not be possible to determine the chronological development of single buildings at

67 Summary in Bertoša 2013.

68 Percan 2013, 163.

69 The use of the peninsula for sheep farming is known at least for the 19th century. Personal comm. Andrej Bader.

70 Boissinot 1995. – Brown et al. 2001. – Volpe 2009.

71 See a similar lack of sources for France in Boissinot, Puig 1995. – Traces of Roman agriculture are known from the Premantura peninsula, on the opposite side of Medulin Bay, but they have been preserved in the form of individual plant pits: Matijašić 2012.

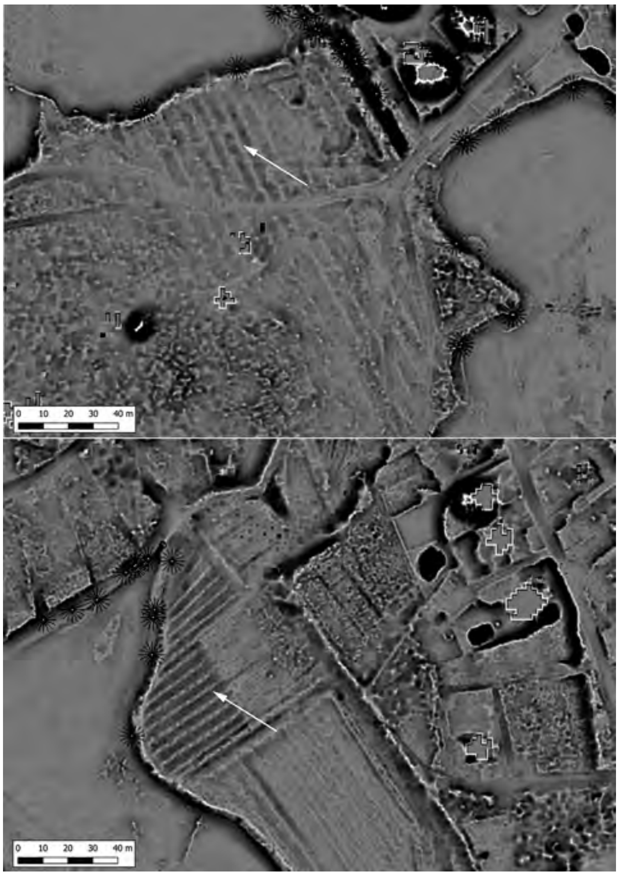

Fig. 22. A comparison between the agricultural traces found on Vižula (top) and a modern olive tree plantation in Medulin (bottom) (Graphic: M. Doneus).

the moment. Regardless of these limitations, the new results presented here provide enough evidence for discussion.

5.1. Roman Architecture and Landscape Context

Due to the fact that the peninsula of Vižula forms a consistent area with Roman architecture spread all along the coastline, its interpretation has always been more difficult than other smaller sites. For a long time, the Roman architecture of Vižula was considered to belong together and to be one of the largest of its kind in Istria.[72] Object B was doubtless identified very early as a *villa maritima* and this probably had a biasing impact on the interpretation of other architectural elements scattered all over the peninsula. The idea that "…some higher developed object in its centre (serves) as the central link…"[73] originates from the publication by Gnirs dealing with Roman *villae* in Istria in 1910. As a consequence, a central object was also assumed for Vižula and all the other Roman remains automatically became 'background'. This seemed to be further confirmed by the fact that none of the other buildings could compare in their size, quality or luxurious interior with Object B. Therefore, they were assigned secondary importance and were interpreted as the *villa maritima's* supporting buildings for production, storage and transport.

An integrated view of Vižula's architecture, overcoming the border between underwater and terrestrial research and including archaeological prospection, provides an opportunity to evaluate this architecture from a new and different perspective. As could be shown throughout this paper, it became apparent that some of the objects needed to be reinterpreted and that the building remains of Objects A to G cannot be assigned to a single Roman complex. The Roman architecture of Vižula rather belongs to several individual sites with different functions. For some of these objects we would therefore like to offer a new interpretation:

- Objects A and B belong to one large complex, where Object B is the luxurious residence (*villa maritima*) and Object A an accompanying unit.
- Object C is a post-Roman (maybe modern) pier.
- Objects D and E belong together and form a second luxurious residence on Vižula (*villa maritima*); the Roman pier (Object F) directly adjoins the residential premises.
- Object I is an independent building (*villa rustica*).
- Object G is also an independent smaller object (*villa rustica*).
- Object H refers to the Roman road.

The building complexes, both the *villae maritimae* and the *villae rusticae*, are oriented parallel to the coastline. Therefore, each complex has a different absolute orientation (Fig. 23) and the *villae maritimae* even have different orientations within their buildings. Despite a similar orientation towards the coast, a difference between the two *villae* types can be seen in their location: while the two *villae maritimae* are positioned directly adjacent to the sea, the two *villae rusticae* lie slightly more inland having no direct contact to the shore.

The new interpretation of Object D–E as a second *villa maritima*, and consequently the merging of two parts of the building into a single object, leads to the recognition of the regularities in the location of the objects on Vižula: it is remarkable that along the coast equal distances of 120 m between the individual buildings are respected (excluding the *villae rusticae*). Measured from the outer walls of single

72 Begović Dvoržak, Dvoržak Schrunk 2004, 68.

73 Gnirs 1910, 123: "…und irgendein höher entwickeltes Objekt in ihrer Mitte (diente) als zentrales Glied."

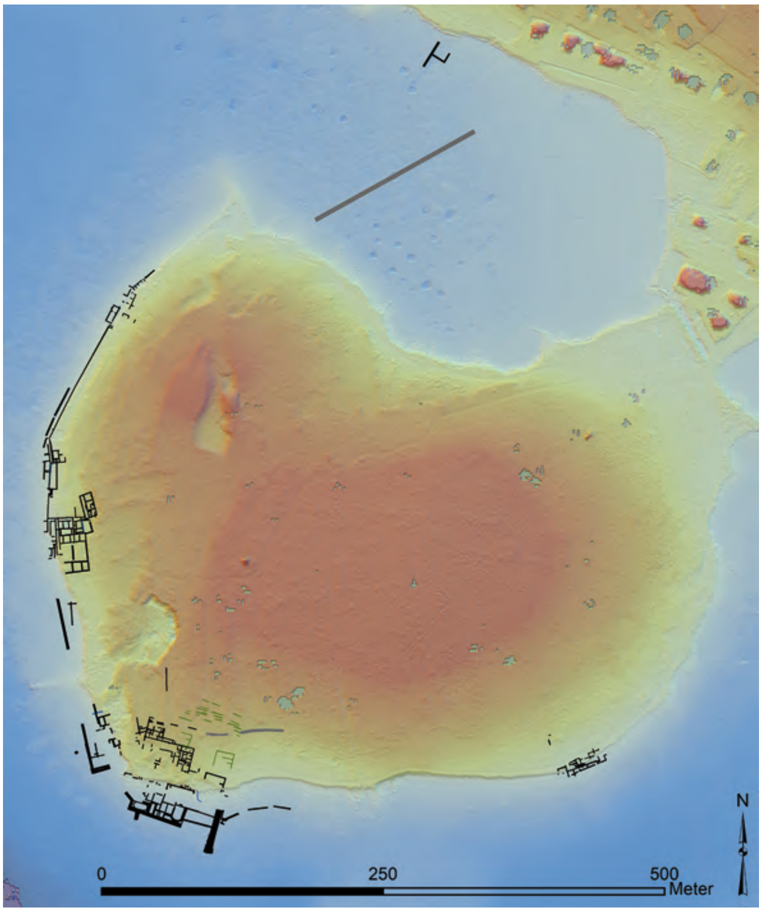

Fig. 23. Overall view of the Roman heritage on Vižula based on prospection, excavation and survey results (Graphic: N. Doneus).

buildings, a distance of 110 m lies between the road (Object H) and Object A, followed by 120 m spaces between Objects A and B as well as between Objects B and D–E. This speaks for a deliberate planning but also for an exact land division in this coastal section. The two smaller Objects I and G do not seem to have been included in this concept.[74]

There also seems to be a certain uniformity in the sizes of individual buildings. With the overall length of Object B, the distance of 120 m is repeated. Object D–E, measured in a straight line between the outer SE and NW corner of the building, is about 130 m wide. The two *villae rusticae* are quite similar in size, 45 m wide and just over 40 m long. Also the two *villae maritimae* are very similar in their dimensions, as the width of each residential wing amounts to 50 m in each of them. Compared to each other, the size of a *villa rustica* almost exactly corresponds to the size of a single residential wing of a *villa maritima*; or in other words, the total size of a *villa rustica* is at most half of the size of a main residentual building in a *villa maritima*.

The chronological question of the architecture of Vižula is currently not resolved. So far, only a few individual construction periods of Object B are known and they include four centuries of Roman settlement activities. The observed distance of 110–120 m between Objects A, B and D–E indicates planned building acitivities and a simultaneity of at least the *villae maritimae*. Objects A and B are connected with a *porticus* running along the coast. Due to this common architectural aspect, the two buildings are connected with each other – at least during one construction phase – and are thus in contemporary use. Although Object A shows remains of high quality decoration (e.g. mosaics from the 1st/2nd century), the size of its individual rooms is relatively small compared to Object B. That suggests that A is an accompanying object of the main residential building (Object B).

The spatial and temporal relationship between the two *villae maritimae* also requires further research. If the dating of the quarry to the post-Roman period is correct, the quarry complex could also have destroyed a possible

74 The question of how exactly the land was allocated to *villae* of different sizes and functions and whether a pattern can be identified can only be addressed on a larger scale. For this topic, see, for example, Schucany 2011.

architectural connection between Objects B and D–E. The latest ALS data (Fig. 11) and underwater survey results have shown that further Roman walls, hidden in the shallow water sediments, cannot be completely excluded.

In the older literature Vižula is sometimes referred to as a luxurious imperial *villa* of the 4th century i.e. the '*villa* of Crispus'.[75] This hypothesis is based on the note of Ammianus Marcellinus, who reported the death of Crispus in Pula.[76] In this context, the *villa* on Vižula is supposed to be the location where the Emperor Constantine the Great imprisoned his son Crispus before he was executed in the year 326. However, this theory could not be confirmed, as so far just a single small residential wing in Object B can be dated to the 4th century. No other currently known architecture from Vižula matches the layout of a luxurious *villa* from the 4th century.

While a construction at the beginning of the 1st century AD is assumed for Object B, we can only speculate about the date of construction for Object D–E. A certain contemporaneity with Object B is probable and there is little reason not to consider the origin of Object D–E during the same time. Support for this date is based on finds dating to the 1st century from underwater excavations next to Object D–E. The same is true for the end of use, as there are again just rough indicators for the length of use of Object D–E until the 4th or 5th century AD.

The absence of a *vivarium*, at both Object B and D–E, is maybe the result of the strong sedimentation rate underwater. A fishpond usually accompanies *villae maritimae* of the 1st century AD and may therefore be discovered during further research.[77]

Although the architecture of Vižula can be compared in its size to that of Verige Bay, Brijuni,[78] which is the largest and most impressive of its kind in Istria, it does not reach its variety and level of sophistication. This may be due to chronological reasons or to the different status of the owner.

The dating of the *villae rusticae* is likewise difficult. It is quite possible that *villa rustica* I was overlain by the later luxury building D–E, as such examples are known from Istria.[79] For the dating of the second *villa rustica* G, perhaps the evaluation of the latest excavation results will provide new evidence.

A better dating of the individual objects would not only help to explain their relationship to each other but also contribute to a better understanding of the agricultural use of Vižula in Roman times. Traces of agriculture can be made visible through various ALS visualizations which allow us to enhance features in low relief and therefore to identify archaeological contexts otherwise not visible. Of special interest is the so-called local relief model,[80] which highlights even extremely shallow local terrain variations. The calculation of relative terrain variations is thereby calculated for the local neighbourhood (kernel) of each raster element of the DTM. The size of the kernel is determined by the user. To be able to identify archaeological structures, the kernel size is usually set to values between 10 and 25 metres. Large kernel sizes emphasize larger-scaled 'background' structures. Using a large kernel size of 50 m will therefore highlight general trends in the topography.

In Vižula, the local relief model calculated with a kernel size of 50 m reveals two different areas (Fig. 24). The area parallel to the western coast up to a distance between 150 and 200 m inside the peninsula is terraced. This area includes both *villae maritimae* as well as Objects A and H (Roman road). The centre and eastern part of Vižula display a different general topography: it is a topographically smoother landscape without terracing. The DTM shows parallel linear structures in the eastern end of the peninsula and shallow linear banks, which have the same orientation. In the area of the *villa rustica* (Object G) plant rows are oriented parallel with the *villa*. Towards the north, the plant rows seem to be bounded by a straight, bank-like structure.

Based on these observations, the central and eastern area might be interpreted as an agri- or horticultural area. If it is of Roman origin, then it might indicate a split use of the peninsula: a representative western part dominated by *villae maritimae* and accompanying buildings with outlooks towards Medulin Bay and an agri- or horticulturally used central and eastern part with two *villae rusticae*. This hypothetical reconstruction, however, needs confirmation from further research.

5.2. Coastal Changes

During the last millennia, a gentle, slowly progressing change of the Istrian coastline took place under the influence of natural factors like sedimentation, erosion and the continuous rise of the sea level. Anthropogenic factors have

75 A summary of the relevant literature can be found in Girardi-Jurkić 2013, 51.

76 Pohlsander 1984, 99.

77 E.g. Verige Bay, Brijuni in Jurišić 1997.

78 Even though the *villa* in Verige Bay is covered in many different publications, the original one by Gnirs 1915 still deserves to be mentioned, as it provides a large quantity of detailed information not mentioned in later publications.

79 Gnirs 1915, 116.

80 Hesse 2010.

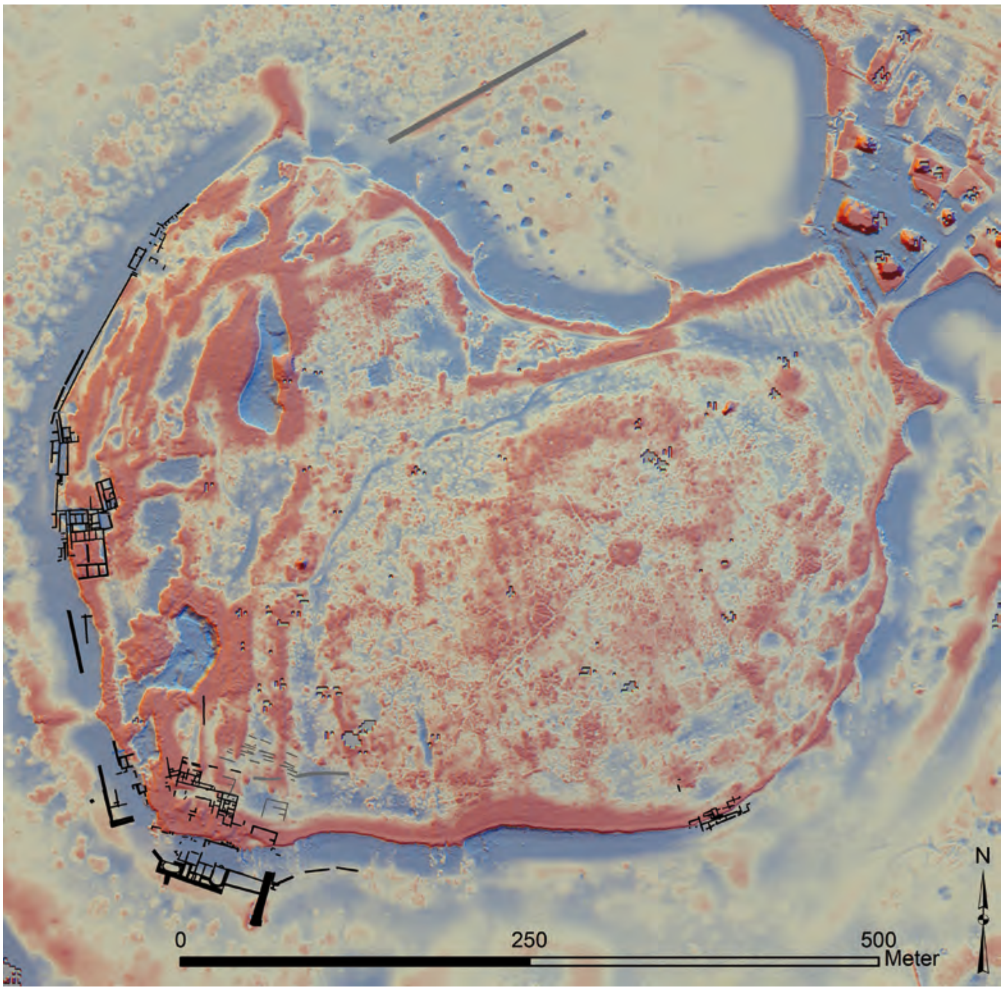

Fig. 24. Calculating a local relief model with a kernel size of 50 m reveals a division of Vižula into two areas, which might result from a different landscape use (Graphic: M. Doneus).

also exerted their influence on the regional-scale landscape change, most importantly through agricultural use and the exploitation of raw materials. In recent decades, building activities for the needs of an enormous tourism industry have caused the most significant changes.

Considerations about the course of the coast in ancient times have been integrated into Croatian archaeological research for a long time.[81] Geological research indicates that the Adriatic coast from the Gulf of Trieste to southern Istria has tectonically subsided by about 1.5 m since Roman times.[82] In general, Sanja Faivre et al. 2010[83] estimate a sea level rise of 1–1.5 m for Istria. Erica Florido et al. 2011,[84] however, suggest a rise in sea level in Istria since Roman times of about 1.6 m ± 20 cm. These general considerations are valid for whole regions, but represent only one component responsible for coastal changes on local scales. For Vižula, it would be particularly important to investigate erosion and sedimentation processes to model the water depth in Roman times, as it is precisely these forces that have most changed the underwater topography. The shallow water surrounding the peninsula shows thick layers of deposited sediments, which indicates strong inland erosion. Stormy SE winds play an important role in this process by eroding land sediments and transporting them into the sea.

Over time, these processes uncovered the architectural elements in the intertidal zone, but at the same time buried

81 Kozličić 1986, Tab. XXI. – A summary of the current literature can be found in Vacchi et al. 2016.

82 Antonioli et al. 2007.

83 Faivre et al. 2010.

84 Florido et al. 2011.

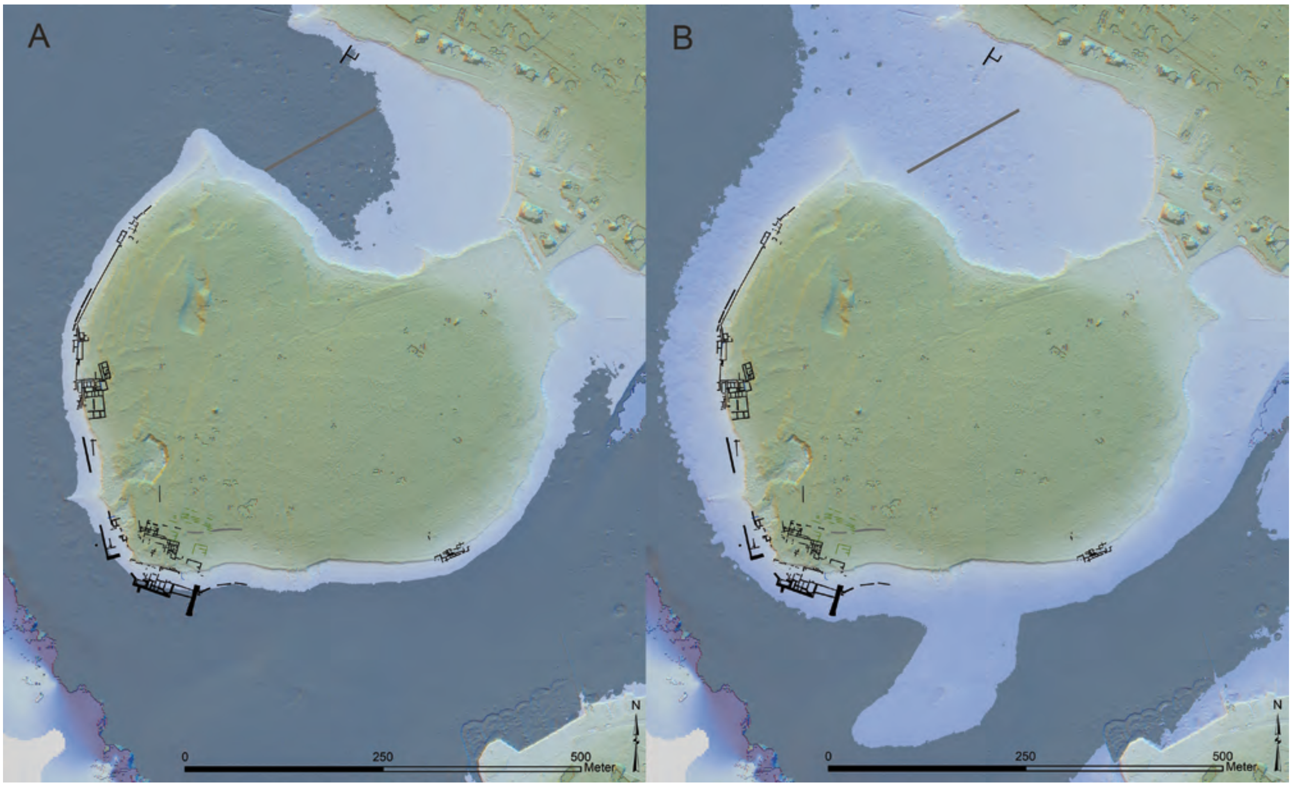

Fig. 25. Different visualizations of the coastal area based on modelling a lower sea level at –1.5 m (A) and –3 m (B) based on ALS/ALB data (Graphic: N. Doneus).

submerged parts under a thick layer of deposited sediments. Marijan Orlić[85] mentions that underwater sediments containing archaeological finds are up to 2 m thick and, based on experience from underwater excavations, it is shown that within less than a year up to 5 cm of sediment can be deposited in the shallow sea. For this reason, a GIS modelled effect of a changing sea level based on ALS/ABT data can provide only limited information about the actual underwater topography during Roman times. This is shown very clearly in Figure 25/A where the sea level is lowered by 1.5 m. The indication, that today's underwater topography does not correspond with the relief during Roman times is visible especially in the course of the Roman road, which, according to ALS/ALB, is situated in the sea. Such visualizations should therefore only be understood as a tool for improved presentation and are – without further geoarchaeological data – not suitable for reconstruction of the sea level changes on a local scale.

Despite all these limitations, some conclusions can be drawn about the topographic changes on Vižula. The current dimensions of the peninsula are about 200–500 m by 600 m (about 24 ha). Today's narrow land bridge, which is surrounded to the east and west by shallow, muddy water, was probably as wide as the peninsula itself during Roman times. Evidence for this assumption can be found in the position and course of the Roman road, which today has become completely submerged. Also, the *villa* of Nježin vrt,[86] which is the nearest known neighbour in the north of Vižula, is partly submerged today (Fig. 23). The oldest burials from the Burle cemetery from the SW part of the necropolis (Fig. 4) also lie below today's sea level.[87]

South of Vižula, the coastline towards Medulin Bay was also different. This is relevant both for interpretation of the building complexes, and for the Roman shipping. Today, the peninsula of Vižula does not offer a safe anchorage. The S and SE winds make anchoring impossible during stormy weather. In Roman times, however, an anchorage was available, made possible by an underwater land elevation (Fig. 25/B). This elevation – regardless of whether it reached above the sea level or not – served as a natural breakwater and

85 Orlić 1995, 67.

86 In the beach area and the shallow water several stone walls are visible, accompanied by small Roman finds.

87 Džin 2008, 16.

made it possible to dock at the Roman pier (Object F). This underwater elevation also explains why the pier was built at this very spot. Nevertheless, it does not seem appropriate to speak of a Roman harbour, as protection is inadequate and the available space for ships is limited. In this sense, it would be better to interpret the pier as a landing point that allowed direct access to the *villa* from the sea. Whether the sea water was actually as shallow as Mario Jurišić[88] suggested, allowing only a 'small' coastal navigation and boats with a depth of max. 1 m (about 10 m length), cannot be verified at the present.

6. Conclusion

The Roman heritage of Vižula is unique among archaeological sites in Istria as an unusually high number of architectural remains are not just preserved but also accessible for modern research. The extension of the Roman architecture to more than 1 km in length makes it difficult for archaeologists to consider every aspect of the site. Furthermore, the remains themselves are difficult to interpret, as Xavier Lafon pointed out in 2009: "Are we dealing with a whole or a part, knowing that the same elements can occur in complexes of a very different nature…".[89] In Vižula's case, this is particularly true of the submerged architecture, which presents itself 'naked', without any decoration or other indication of function. In addition, it should also be remembered that each *villa maritima* has its own character. Building layouts may follow generally accepted rules of fashion, functionality or the predominant construction technique, and yet each of these luxurious properties is unique. This makes it extremely difficult to classify them on the basis of floor plans alone.

But it is not only the size or the state of preservation of archaeological features that makes the documentation and interpretation of Vižula difficult; single archaeological methods also reached their limits here. Due to the size of the site, archaeological excavations have limited potential to advance research at an affordable tempo. Archaeological prospection, as efficient as it may be compared to the excavations, was not always successful due to prevailing landscape conditions (dense vegetation and terrestrial/underwater soil conditions).

Nevertheless, the experience from Vižula shows that it is always beneficial for research when different field methods are combined. Without the combination of the underwater and terrestrial research, integrated prospection and the consideration of the topography in the two different habitats, it would not have been possible to decode the architecture of Vižula.

88 Jurišić 2006, 310.

89 Lafon 2009, 164: "A-t-on affaire à un ensemble ou à une partie, sachant que les mêmes éléments peuvent prendre place dans des complexes de nature très différente…".

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New Synthesis of Early Medieval Iron Hoards from Slovakia

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Abstract
The aim of this article is to present a theory on early medieval hoards of iron implements from the region of Slovakia. The chronological range is from the end of the 8th to the beginning of the 10th century. 74 known hoards will be classified using a statistical factor analysis, principal component analysis. This type of analysis enables identification of the variability and the most common iron implements and their combinations that appear in early medieval hoards. Attention will also be focused on the occurrence of specific objects in a hoard, for example warriors' equipment, agricultural tools or axe-shaped bars, as well as the locations and contexts in which the depots were found. An examination of the excavation circumstances will also be included in order better to understand the results of the principal component analysis. This study will provide a more complete picture of hoards in Slovakia with particular emphasis on hoards of iron implements. It will enable the formation or creation and deposition of hoards in particular places to be interpreted and better understood. The use of statistical methods will further enable a deeper understanding of the theory of hoards in the early medieval period.

Keywords
Early medieval period, hoard, iron implements, axe-shaped bars, principal component analysis, Slovakia.

Zusammenfassung – *Neue Synthese frühmittelalterlicher Eisenhortfunde aus der Slowakei*
Ziel des Artikels ist es, eine Theorie zu frühmittelalterlichen Hortfunden bestehend aus Eisengegenständen aus der Slowakei vorzustellen. Der chronologische Rahmen reicht vom Ende des 8. bis zum Beginn des 10. Jhs., der geografische Bereich liegt vor allem im Hochgebirge und in unmittelbarer Nähe der Zentren Großmährens, im Nordwesten und vereinzelt in der Südslowakei. Die in dieser Studie enthaltenen 74 Hortfunde wurden mit der Hauptkomponentenanalyse (PCA) statistisch analysiert. Mithilfe dieser Methode können wir die häufige Korrelation zwischen gehorteten Artefakten erkennen. Die PCA isolierte zuerst drei Gruppen von Hauptkomponenten (drei Faktoren), die Hortfunde in der Slowakei charakterisieren. Die typischsten Artefakte in den untersuchten Horten sind landwirtschaftliche Werkzeuge (erster Faktor), dann folgt der zweite Faktor mit handwerklichen Werkzeugen und der dritte, der bipolare Faktor, mit Haushaltswerkzeugen, Kriegerausrüstung, Sicheln und Axenbarren. Diese Faktoren wurden auch in Bezug auf die Ausgrabungsumstände und die Fundkontexte (Siedlungen, Burgwälle oder unbekannte Verhältnisse) untersucht. Auf diese Weise war es möglich, jeden Faktor mit bestimmten Umständen zu verbinden. Die Analyse ermöglicht es, die Variabilität und Häufigkeit der Eisengegenstände sowie ihre Kombinationen, die in frühmittelalterlichen Horten auftreten, zu identifizieren. Die Verwendung der PCA in dieser Studie kann als neuer Ansatz zum Verständnis frühmittelalterlicher Horte in der Slowakei sowie des umfassenderen Phänomens der Hortfunde in der Archäologie angesehen werden. Dies könnte auch eine neue Möglichkeit sein, die potenzielle Beziehung zwischen dem Menschen und den verwendeten Werkzeugen zu verstehen.

Schlüsselbegriffe
Frühmittelalter, Hortfund, Eisengegenstände, Hauptkomponentenanalyse, Slowakei.

1. Introduction

The problem of hoards and hoarding has been dealt with by a number of scholars, both archaeologists and historians, and is also the topic of this article. The aim of this paper is to give a brief synthesis of our research into the patterns of hoards and the hoarding of iron in early medieval Slovakia. Early medieval hoards in Slovakia mainly contain iron implements: a wide range of tools, from agricultural tools through craft tools to axe-shaped bars, which form a special group of hoards of iron implements.

Principal component analysis (factor analysis) (in the following, PCA/FA) is used here, because the two main research questions for this article could be answered with the help of statistics. The first question is about the (possible) relationship between the tools in the hoard: is there some relationship between the tools? Which were most frequently put into the hoard together and which are never found in one hoard? The second question concerns the value: is it possible to define some value of iron based on the iron implements in hoards? Why did people in early medieval times deposit iron instead of precious metals such as gold or silver?

By using multivariate statistical methods, it is possible to discover the connection or correlation between tools in hoards. This relationship between a wide range of tools reveals another type of information: information about the most typically used tools in hoards, what kinds of tools are found together in one hoard and what kinds of tools are never found together. For synthesis, in general, means creating and connecting new archaeological structures. The structures express order, regularity or relation in the studied sources,[1] in this case, early medieval hoards with iron implements. A great advantage in using PCA/FA is that it has the ability to organize not only descriptors (tools in hoards, the circumstances) but also objects like sites, where the hoards were found (see sections 5 and 6).[2]

This article focuses on the Slovakian hoards which were already published. The first analysis was carried out by publishing the specific hoards, where the dating, types of tools, typology or find circumstances are reported. I decided to look at them in another way: the focus is only on the kind of artefacts/tools which were found in the hoard. For example, does the hoard contain axe-shaped bars, axes, coulters etc.? Also important are the find circumstances, for it is possible that the location may be a means for understanding the whole process of hoarding in early medieval times. With the help of PCA it is possible to predict what kind of hoard was found in specific places and whether the hoards with agricultural tools were found in settlements or not.

2. Understanding Hoards

This article defines hoarding in a way that enables us to separate hoards from other archaeological features. The paper works with hoards containing at least two artefacts. The hoard itself can be viewed not just as an archaeological feature, but also as an artefact, more specifically a composite artefact. Composite artefacts are made up from other artefacts and are intentionally created or modified by humans.[3] According to Evźen Neustupný's definition of artefacts, a hoard can be understood as a witness or manifestation of past societies and extinct cultures.[4]

The distribution of hoards in many cases seems to mirror the intention behind their deposition. Typically we distinguish between votive and non-votive (ritual and non-ritual) hoards. According to Richard Bradley, votive hoards are frequently found in places of no return like swamps, by or in rivers, etc.[5] Some of the Slovakian hoards with iron implements considered here seem to belong to this group, for example one from the Moravský Ján (36)[6] site, which was deposited next to the river Morava, and one from the Zádiel (71)[7] site, which was deposited by the forest stream. A further, no less interesting hoard from Bratislava I (18) was found within a circle of skeletons and might also be considered a votive hoard.[8] It may also be classified as a hoard deposited near graves, which have been known from examples since ancient times, said to be due to the 'protection' the dead provide for the valuables.[9] Non-votive (non-ritual) hoards were usually interpreted as the concealment of possessions from plundering foreign armies. For example, during civil disorder and dangerous times in Great Moravia, temporary hiding places were created. For a number of reasons, many of these fortunes were never recovered, until the present, when they were found during excavations, accidently or by treasure hunters. One of the main problems of hoard evidence is that it only shows us those hoards which were not recovered. Those which were recovered of course escape our knowledge. These kinds of hoards are also known by the term '*Angstdepot*' – hidden out of fear.[10]

Before getting into details, we have to clarify the terminology: what is a hoard? At the beginning of the 20th century, in 1903, Oscar Montelius established the first definition of a hoard as "... a definite find... [which] can be viewed as the sum or collection of items which were found in such circumstances that they can be considered to have been deposited together at one time. Most items from older time periods, which are important for this question, are usually found in old settlements or in graves. Others were placed as a 'depot', in the ground or in the water. Items that were accidentally lost are not really relevant here as they are mostly found on their own."[11]

The 'Encyclopedic Dictionary of Archaeology' states that a hoard is "[a]ny collection of objects, buried at one time. A deliberate deposit of complete or broken objects buried in the ground for subsequent recovery or as a symbolic act. A hoard often included valuables or prized possessions."[12] This definition essentially covers most research on hoards. Bohuslav Novotný, who edited the 'Encyclopedia of Archaeology' in 1986, revised Montelius' hoard definition as "[i]ntentionally hidden or saved artefacts, deposited

1 Neustupný 2007, 21.
2 Neustupný 2007,135.
3 Neustupný 2007, 31–32.
4 Neustupný 2010, 38.
5 Bradley 1990, 11.
6 Bartošková 1986, 33. – Zábojník 2009, 103. – All mentioned sites are marked in Figure 1 and are listed in the catalogue (Appendix 1). The numbers given in the text correspond to those on the map and in the catalogue.
7 Bartošková 1986, 60.
8 Bialeková 1990, 110.
9 See Gorecki 1995.
10 Künzl 1996, 469.
11 Montelius 1903, 10.
12 Kipfer 2000.

for a particular reason, not just due to their value (amount, material or type)".[13] How to understand the term depot is the particular subject of many studies and scientific analyses, which are not the subject of the present paper, and that is why the first basic definition and the definition which corresponds to the geographical area under investigation were chosen.

Can we indeed consider a couple of finds as a hoard without taking into account any other circumstances? Among others, the database contains a hoard from Modra (35). This hoard is not clearly considered a hoard. Despite having been included in the sample used here, it can be interpreted as two finds which were found together, but not necessarily deposited together.[14] In the archaeological terminology of middle Europe a distinction is made between the terms *depot – Hortfund* (hoard) and *hromadný nález – Mehrfund* (multiple find: two or more finds found together at one place). Manfred K. Eggert divided the hoards into three categories, namely closed depots (*Geschlossene Horte*), unclosed depots (*Nichtgeschlossene Horte*) and isolated findings, as likely depots (*Einzelfunde mit Hortcharakter*).[15] The question whether to consider regarding one or two objects as a depot or as a closed finding unit divides the professional public to this day. In my personal opinion, it depends on the circumstances of location and placement, whether the hoard was found by a well, by a wall, etc.

We must also consider the main reason leading to the need to store valuables. Colin Renfrew dealt with the idea of 'value', which could eventually lead to the deposition of hoards. According to Renfrew, the concept of value is created in the human brain, but this would not be possible without any physical experience and knowledge of material properties.[16] Changes in material culture can be understood as indicators of progress, of societal changes and as a basic part of human nature. This theory is observable throughout the whole history of humankind. We are able to study artefactual changes in hoards through the millennia. Most hoards contain artefacts typical for a particular age or period. Novelties like imports are often found in hoards as they are valuable and less easily attainable.

3. Hoards of Iron Implements in Slovakia

In 1986, Andrea Bartošková compiled hoards with iron implements from throughout Slovakia as well as similar types of hoards from former Czechoslovakia.[17] Subsequently, the evidence from some local sites like Bojná[18] or Pobedim[19] and other new sites was published. To date, 74 hoards with iron implements from Slovakia have been published. Most of them were already compiled in Bartošková's publication. A characteristic feature of hoards from Slovakia is the presence of iron tools and other iron objects. We see a large spectrum of artefacts, from agricultural tools, craft tools and household items to a range of weapons or ingots like axe-shaped bars and other implements. Occasionally hoards also contain bronze objects, for example in the case of Moravský Ján, which has been interpreted as proof of contacts with the Avarian Khaganate (see section 4).[20]

The distribution of hoards in Slovakia shows that most are located in the northwestern part, with only some in the southern part. Most were found in the mountains and geographically close to the centres of Great Moravia.[21] The distribution of hoards with iron implements in Slovakia is shown on the map (see Fig. 1).

Our knowledge of the hoards of Slovakia depends partly on the circumstances of excavation (find circumstances) and their subsequent interpretations. Hoards of iron implements have been discovered in hillforts (fortified strongholds), in features in unfortified settlements and in two cases in the upper part of grave fillings, but most have been found randomly and we lack all further information concerning the find spot and context. Others were excavated many decades ago without proper documentation. In these cases, interpretation is very problematic and we depend entirely on what can be deduced from the artefacts contained in the hoards. This study focuses on published hoards that have been documented, i.e. the type of artefacts, the statement of preservation, the find circumstances, dating, etc. have already been analysed. Unfortunately, a lot of hoards were documented in statements as they were brought to archaeologists or discovered by detectorists, which is forbidden by law in Slovakia.

The hoards are further separated in terms of excavation circumstances and according to the context in which they were found. It was decided to differentiate between unknown (without detailed information), settlement, hillfort (strongholds) and out of the settled area. Hoards that fall into the category of natural context are those that have no connection to a hillfort or settlement, but were, for example,

13 Novotný 1986, 190.
14 Farkaš 2001.
15 Eggert 2001, 79.
16 Renfrew 2009, 134.
17 Bartošková 1986.
18 Pieta 2007. – Turčan 2012.
19 Bialeková 2008.
20 Zábojník 2009, 103.
21 See Macháček 2013.

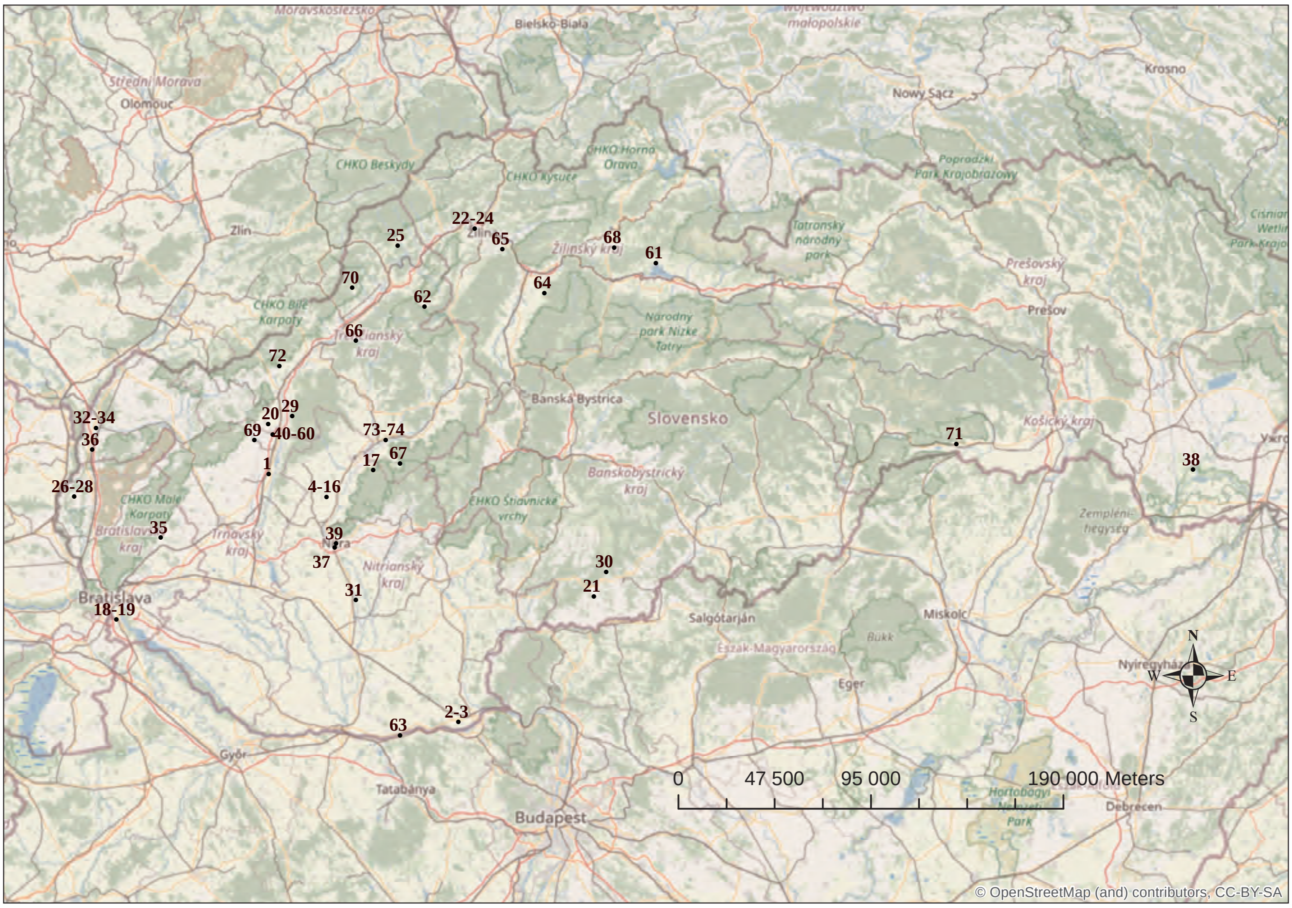

Fig. 1. The distribution of hoards with iron implements in Slovakia. – 1. Bašovce. – 2–3. Bíňa I–II. – 4–16. Bojná I–XIII. – 17. Bošany. – 18–19. Bratislava I–II. – 20. Čachtice. – 21. Čebovce. – 22–24. Divinka I–III. – 25. Dolná Mariková. – 26–28. Gajary I–III. – 29. Hrádok. – 30. Horné Plachtince. – 31. Komjatice. – 32–34. Kúty I–III. – 35. Modra. – 36. Moravský Ján. – 37. Nitra-Šindolka. – 38. Oborín. – 39. Palánok. – 40–60. Pobedim I–XXI. – 61. Prosiek. – 62. Pružina. – 63. Radvaň nad Dunajom. – 64. Sklabiňa. – 65. Stráňavy. – 66. Trenčianske Teplice. – 67. Veľký Klíž. – 68. Vyšný Kubín. – 69. Vrbové. – 70. Vršatské Podhradie. – 71. Zádiel. – 72. Zemianske Podhradie. – 73–74. Žabokreky nad Nitrou I–II (Map: ArcGis Basemap).

found in connection with a river or stream. A further group of hoards, which could be considered as votive hoards, were found in graves. As this group was too small to be used on its own in statistical analysis, it was therefore included into the also relatively small category of natural contexts. With the help of PCA/FA, this study will attempt to recognize the main features which characterize early medieval hoards in Slovakia.

In the process of analysis I created a database which contains published hoards of iron implements from Slovakia. It includes 74 hoards with 41 artefacts, in other words, variables. Because some artefacts only appear in one or only a few cases, such artefacts were combined into logical groups, according to their characteristics or usage. In this paper, data from hoards containing at least two artefacts were used.

4. Historical Background

Hoards classified as early medieval here date between the end of the 8th century and the 9th century, occasionally also to the beginning of the 10th century. During this period, southern and parts of western and eastern Slovakia were under the control of the Avarian Khaganate, which disintegrated at the beginning of the 9th century (AD 803).[22]

The Avarian Khaganate fell as the consequence of the conquests of Charles the Great (Charlemagne), but also due to pressure from the Slavs of the middle Danube, who controlled the Nitra chiefdom on the northern borders of the khaganate. With the collapse of the khaganate, the spotlight shifted to the Nitra chiefdom. The period until the first third of the 9th century saw the appearance of many hillforts.

22 Zábojník 2009, 17.

During this time, the whole geopolitical situation in central Europe was changing.

The conqueror of the Nitra chiefdom in 833 was Mojmír I, from the chiefdom of Morava. This led to the establishment of Great Moravia with Nitra remaining an administrative centre until AD 1110/1113, during the Arpad dynasty of the Hungarian kingdom.[23] After Great Moravia had been established, a phase of new central hillfort settlements such as at Mikulčice and Staré Město u Uherského Hradište followed, which also saw the renewal of the Nitra hillfort.[24]

Practically throughout its whole existence, Great Moravia was at war with the Frankish Empire, which regarded the Great Moravian area as its own. They demonstrated their claim on this territory through numerous military actions as well as in political relations. The influence and power of the Frankish kings in internal political issues can be seen in the dethroning of Mojmír I (conqueror and first ruler of Great Moravia between 833 and 846) and the enthronement of his nephew Rastislav I (846–870) as the new chief of Great Moravia.[25] The latter was later dethroned by his nephew Svätopluk, with the help of the East Frankish prince Carloman of Bavaria.[26]

Svätopluk's reign is known as an epoch of large-scale expansion of Great Moravian land to the north and to the east to the river Tisa. His ambitions also led him into the areas of the Eastern Mark and Pannonia.[27] After Svätopluk's death in 894, the gradual decline of Great Moravia began. The whole chiefdom was weakened by internal political conflicts between Svätopluk's sons Mojmír II and Svätopluk II and by attacks from Hungarian tribes.[28] However, a range of other factors also contributed to the fall of Great Moravia, including economic factors and environmental changes.[29]

An interesting situation can be observed with the Great Moravian centres of Pohansko, Mikulčice and Staré Město u Uherského Hradište in the Czech Republic, which fell with Great Moravia and were not rebuilt by the Přemysl dynasty. This is unusual in comparison to Great Moravian hillforts in Slovakia, as most of those were not destroyed and survived the fall of Great Moravia, which, as Tatiana Štefanovičová suggests, may have been due to agreements between local and Hungarian chiefs.[30]

23 Steinhübel 2004, 327.
24 Beranová 1988, 146.
25 Múcska, Daniš, Ševčíková 2006, 85.
26 Steinhübel 2004, 127–128.
27 Steinhübel 2004, 138–139.
28 Kouřil 2016, 109, 110–124.
29 Štefan 2011, 334–335.
30 Štefanovičová 2008, 139–141.

5. Principal Component Analysis (Factor Analysis)

In general, using statistics in archaeology means looking for regularities in time and in space. Statistics are used for work with a large or huge amount of direct data. They are used for testing hypotheses. I decided to use PCA/FA for finding commonalities between artefacts found in early medieval hoards and iron implements from Slovakia.

Two types of dimensional analysis are commonly used in archaeology: principal component analysis and the closely related factor analysis. PCA/FA is an explorative statistical method; it creates more factors-structures. In archaeology, factor analysis has been used by the pioneer of processual archaeology Lewis R. Binford since the 1960s as a new method for classifying artefacts.[31]

Principal component analysis and factor analysis are generic names given to a class of multivariate approaches used to quantify the structure underlying data matrices. They both seek to define a set of common underlying dimensions that structure the data. These methods are effectively exploratory data analyses, in that they do not explicitly evaluate previously defined null hypotheses. Instead, they look at shared variation among a set of variables that can be mathematically modelled. They then produce a measure of the amount of shared variation that can be tied to hypotheses of interest given an appropriate analytic and theoretical structure, but that are not formal statistical tests in and of themselves. PCA and FA are closely related means of identifying 'new' dimensions that capture the essence of the correspondence among the original variables.[32]

PCA/FA uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components in groups called factors. The number of principal components is less than or equal to the number of original variables. This transformation is defined in such a way that the first principal component has the largest possible variance (that is, it accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components. The resulting vectors are an uncorrelated orthogonal basis set. PCA/FA is sensitive to the relative scaling of the original variables.[33]

PCA/FA is one of the basic methods for compressing data: from the original number of variables (n) it can compress to a representative of variables (m) and thus we are

31 Binford 1962, 218–220.
32 VanPool, Leonard 2011, 286.
33 Weber 1997, 203.

able to explain enough of the variabilities from the basic database. The system of newly created variables (principal components) contains linear combinations from the original variabilities. The first component is the biggest and represents the biggest part of the database; the others have smaller values and they contribute to a cumulative picture of variance.[34]

Mechanically, factor analysis and principal component analysis both allow variance maximizing rotation (VARIMAX), a fancy way of saying that they allow the data to be structured around the components that explain the most variation. In truth, variance maximization rotation (VARIMAX) in principal component analysis is not really part of the method but is based on a 'borrowing' of the technique from factor analysis.[35]

PCA/FA was undertaken using IBM SPSS Statistic 24 with Varimax rotation, which minimizes the number of variables and defines the largest variance, thus creating simple structures. The possible values are between –1 and 1, whereby 1 indicates the highest possible correlation of variables, 0 means there is no observable correlation, and –1 means the mutual exclusion of variables.[36]

6. The Database

The database used in this study consists of 74 hoards of iron implements, which includes simpler hoards with only one kind of artefact and more complex hoards with more than one type. An artefact is a variable or descriptor of the hoard, which defines the hoard itself. The sites where these hoards were found are contexts. Some rare variables/descriptors have to be included in other groups of variables.[37] The database contains rows – the hoards (objects) themselves, like the name of the site – and columns – the artefacts, which were found in the hoard (variables). This version of the database is a binary matrix. This means that the focus is on the presence (1) or absence (0) of the artefacts.

The database (or descriptive matrix) contains 11 variables and groups of variables. The independent variables are sickles, ploughshares, coulters, scythes and axe-shaped bars. They were left as they are, because they appear in more than 25 % of the hoards. Some variables had to be put into the groups of variables. Todd L. VanPool and Robert D. Leonard state that "[i]f the researcher wishes to evaluate some proposed structure that may characterize the data, then the pertinent variables should be included."[38] However, the inclusion of additional variables increases the likelihood of including variables that do not meaningfully correspond with any other variables, meaning that the principal component or factor analysis will not provide useful data reduction for them. The groups are blacksmiths' tools (Blacksm_tools: tongs, hammers, anvils, files, borers etc.), woodworking tools (spikes, drawknives, linchpins, saws, chisels), weapons (swords, lance heads, arrow heads), other small agricultural tools (Other_agr_tool: spuds, drawshares, hoes, shares), equestrian equipment (E_equip: spurs, stirrups, mountings, snaffles) and household tools (Househ_tool: bucket parts, knives, scissors, keys, cauldrons, Silesian basins). Using the application Compute Variable, weapons and equestrian equipment were computed together and the category warriors' equipment (War_equip) was created.

Factors are here defined as groups of principal components that were determined to characterize hoards. The created factors will be compared with the find circumstances, which means hillfort (fortified settlement), settlement (unfortified settlement), outside the settled area (graveyard, natural environment) and unknown find circumstances.

7. Results

The principal component analysis generated a correlation matrix (Tab. 1) which shows correlations between the variables. The base value is 1, which is the maximum possible value. This value can be achieved by every variable when correlated just with itself. When comparing the correlation of one direct variable with others, the value is in general approximately ± 0.5. For example, the ploughshare has a maximum value with itself, but the second largest value, 0.712, which is understood as a high correlation, is with Other_agr_tool. This value means that the probability of a ploughshare and other small agricultural tools (Other_agr_tool) appearing together is more than 70 %.

At the other end of the spectrum, the lowest value between variables can be seen in the correlation between the group warriors' equipment (War_equip) and axes, which is 0.095. This shows that warrior equipment and axes almost never appear together in one hoard, which proves that axes were mostly used as crafting tools and not as weapons. The highest negative values indicate common elimination variables (mutually exclusive variables) in one specific hoard. This common elimination is, for example, noticeable between household tools (Househ_tool) and axe-shaped bars: –0.412.

34 Mazuch, Hladík, Skopal 2017, 223.
35 Jolliffe 2002, 166.
36 Weber 1997, 203. – Neustupný 2007, 142–143.
37 Neustupný 1997, 237–238.
38 VanPool, Leonard 2011, 292–293.

Correlation	Axe-shaped bar	Plough-share	Coulter	Sickle	Scythe	Axe	Other_agr_tool	Blacksm_tools	Househ_tool	Woodw_tool	War_equip
Axe-shaped bar	1.000	–.224	–.141	–.455	–.140	–.127	–.288	–.097	–.412	–.023	–.359
Ploughshare	–.224	1.000	.598	.324	.572	.341	.712	.307	.327	.459	.168
Coulter	–.141	.598	1.000	.298	.478	.402	.480	.516	.303	.365	.217
Sickle	–.455	.324	.298	1.000	.408	.189	.338	.229	.507	.375	.212
Scythe	–.140	.572	.478	.408	1.000	.351	.502	.233	.387	.413	.372
Axe	–.127	.341	.402	.189	.351	1.000	.394	.569	.386	.473	.095
Other_agr_tool	–.288	.712	.480	.338	.502	.394	1.000	.363	.253	.363	.165
Blacksm_tools	–.097	.307	.516	.229	.233	.569	.363	1.000	.423	.535	.238
Househ_tool	–.412	.327	.303	.507	.387	.386	.253	.423	1.000	.349	.464
Woodw_tool	–.023	.459	.365	.375	.413	.473	.363	.535	.349	1.000	.238
War_equip	–.359	.168	.217	.212	.372	.095	.165	.238	.464	.238	1.000

Tab. 1. The correlation matrix shows correlations between the variables. The value between –1 and 1 presents the correlation between every single artefact or groups of artefacts (for example Other_agr_tool and axe-shaped bars).

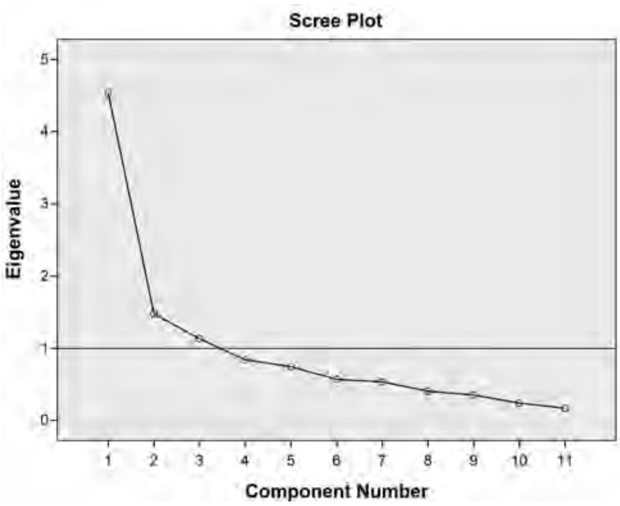

Fig. 2. The scree plot shows all 11 variables/components decreasing from the highest to the lowest value. The three highest variables are above 1 and the fourth is already below.

	1	2	3
Ploughshare	**.875**	.192	.120
Other_agr_tool	**.823**	.179	.139
Scythe	**.676**	.210	.293
Coulter	**.627**	.432	
Blacksm_tools	.145	**.853**	.143
Axe	.249	**.754**	
Woodw_tool	.330	**.683**	.132
Axe-shaped bar	–.171	.143	**–.781**
Househ_tool	.108	.429	**.724**
War_equip		.187	**.688**
Sickle	.351	.107	**.637**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization (rotation converged in 6 iterations).

Tab. 2. Rotated component matrix with three principal components: 1st factor with agricultural tools, 2nd factor with craft tools and 3rd bipolar factor with household tools, warriors' equipment and sickles vs. axe-shaped bars.

The scree plot shows all 11 variables/components decreasing from the highest to the lowest value (Fig. 2). The three highest variables are above 1 and the fourth is already below it (Graph 1). These three variables were selected for another part of PCA/FA where they were rotated by Varimax rotation and extracted as three factors (groups of components), which characterize hoarding in Slovakia (Tab. 2). Every factor is created from several variables with the highest factor coefficients or correlations (values closest to 1). The first factor comprises agricultural tools, the second craft tools, the third is the bipolar factor. Every site also has a factor score typical for the direct factor with principal components. The factor score represents a value, and for every site and every hoard this value is the highest only for one factor, while for the others it is low. For example, the hoard from Čebovce (21) is typical for the factor with agricultural tools; it has the highest factor score for this factor.

7.1. Agricultural Tools

The first factor is made up of only agricultural tools, which have the highest factor coefficient (Tab. 2). The direct artefacts within this factor are ploughshares (0.875), coulters (0.627), scythes (0.676), and other small agricultural tools (Other_agr_tool) like drawshares, shares, spuds, hoes, mattocks (0.823). These kinds of tools are most commonly found in hoards with iron implements from Slovakia. After generating factor coefficients in the descriptive matrix, every site (hoard) also has a factor score typical for the direct factor. The highest factor scores were observed in hoards from Čebovce (21), Bratislava II (19), Divinka II (23), Bojná X (13), Vršatské Podhradie (70), Žabokreky nad Nitrou II (74), Palánok (39) and Gajary III (28). Common features of these hoards, aside from their high values, are also the variety and number of artefacts within the hoards.

The excavation circumstances (Fig. 3) are mostly unknown and only a minority of hoards were found in early medieval settlements. The connection of hoards with agricultural tools is understandable, as agricultural production was also concentrated around settlements. On the other hand, only a few hoards containing agricultural tools were found in hillforts.

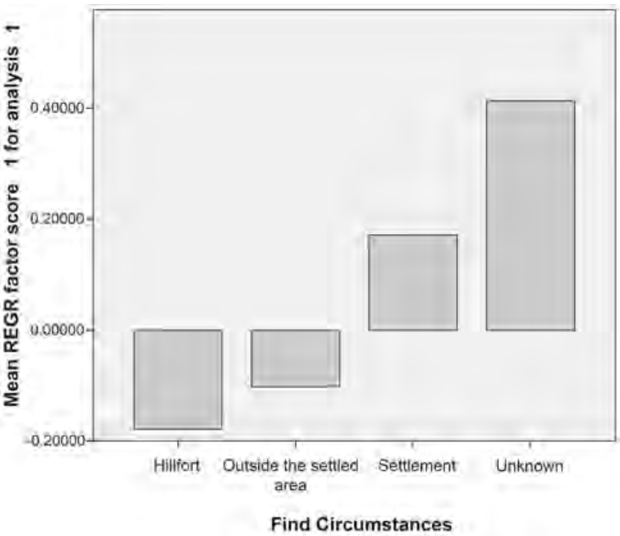

Fig. 3. Factor 1: Agricultural tools and find circumstances.

7.2. Craft Tools

The second most common factor is represented by craft tools, including blacksmiths' tools (Blacksm_tools) like hammers, spikes, wimbles, tongs etc. (0.853); axes (0.754) and woodworking tools (Woodw_tool) like spikes, drawknives, linchpins, saws, chisels (0.683) (Tab. 2). Hoards with the highest factor score in this factor are Horné Plachtince (30), Pružina (62, Fig. 4) and Zemianske Podhradie (72). Similarly to what was observed in the first factor, a commonality amongst hoards with a high factor coefficient of craft tools is the number of this type of artefact in these hoards.

The excavation circumstances are also similar to those for the previous factor (Fig. 5). Most hoards of this factor were found without any detailed contextual information, the circumstances being unknown. However, a connection between craft tools and the location of hoards outside the settled area can be established. The hillforts and settlements are mutually exclusive with unknown and out of the settled area; in other words, this factor was not found in settlements or hillforts.

7.3. Bipolar Factor

The bipolar factor presents four kinds of artefacts: axe-shaped bars (–0.781); household tools (Househ_tool) like keys, scissors, bucket parts, cauldron, knives and Silesian basins (0.724); warriors' equipment (War_equip) containing weapons like lance heads, swords and arrow heads as well as equestrian equipment like mountings, spurs, snaffles and stirrups (0.688), and sickles (0.637). The bipolar factor indicates the mutual exclusion of axe-shaped bars and household tools, warriors' equipment and sickles. The bipolar factor represents two structures. The first represents the combination of household tools, warriors' equipment and sickles, which appear together in one hoard. The second represents axe-shaped bars, which reflect negative values and common elimination from other variables (Fig. 4). Mostly they constitute the only artefact in a hoard and are not hoarded with other artefacts or groups of artefacts. Interestingly, the number of hoards only containing axe-shaped bars and no other artefacts is quite high. Examples include most hoards from Pobedim I, IV–XXI (41, 44–61) and some hoards from Bojná I, VI–VIII, XII, XIII (4, 9–11, 15, 16) and Bíňa I, II (2–3). The hoards with the highest positive factor score include Bojná V (5), Bojná XI (14), Kúty I (32), Gajary II (27), Horné Plachtince (30), etc. These hoards also have in common a quite low variation of contents and, in general, a small number of artefacts.

Moreover, this mutual exclusion is also reflected in the excavation circumstances, with a contrast between settlements, hillforts and unknown and natural contexts (Fig. 6).

Fig. 4. Hoard with iron implements from Pružina (Photo: K. Pieta, Archaeological Institute at Slovak Academy of Sciences in Nitra, 2008).

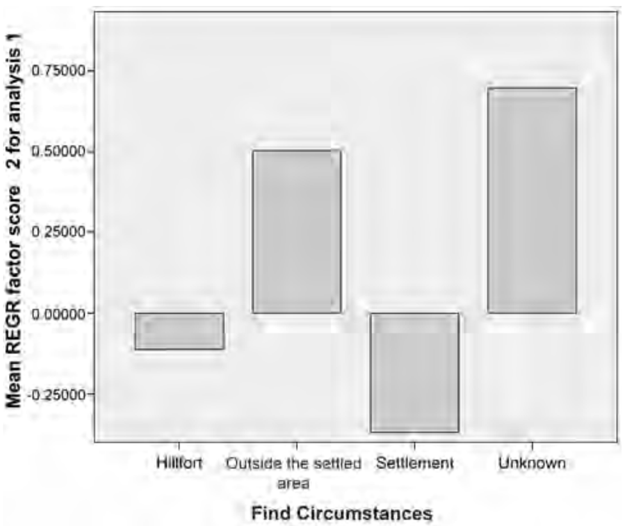

Fig. 5. Factor 2: Craft tools and find circumstances.

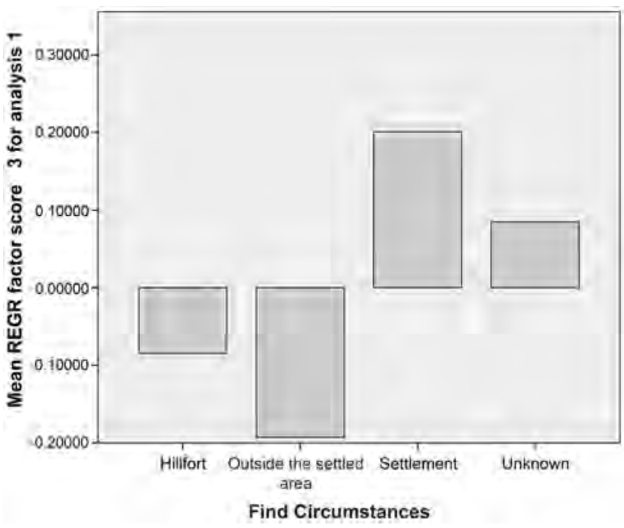

Fig. 6. Factor 3, bipolar factor: household tools, warriors' equipment and sickles (positive values) vs. axe-shaped bars (negative values) and find circumstances.

Household tools, warriors' equipment and sickles are part of hoards in settlements, out of the settled area and with unknown circumstances, and to some extent at hillforts, whereas axe-shaped bars occur in hoards found in hillforts and two were found in graveyards.

8. Interpretations: The Results of Principal Component Analysis/Factor Analysis

PCA/FA generates three main factors, which show us the most deposited tools or groups of tools. Two of them show us two types of tools. The first is represented by the agricultural tools, three of which were used for the cultivation of fields and preparing the soil for seeding (ploughshare, coulter, Small_agr_tool: drawshares, shares, spuds, hoes, mattock). Only one (scythe) is a tool for scything, from which it can be understood that the main use was for harvesting. The second factor contains tools which could be characterized as craft tools (Blacksm_tools: hammers, spikes, wimbles, tongs, etc.; Woodw_tool: spikes, drawknives, linchpins, saws, chisels; axes).

At a first glance at the tools, we are dealing with common, everyday tools, but it shows us some form of dependence between humans and things. According to Ian Hodder, there are two forms of dependence. Humans use the things that allow humans to be, live, socialize, eat and think. The second form of dependency involves some form of constraint. Human beings depend on things, both in the sense of relying on things and in the sense of being contingent on the particular things relied upon. Sometimes humans seem to reflect on their dependence on things, and at other times they seem hardly aware of it and take them for granted.[39]

This kind of dependency can also be explained by Renfrew's theory of cultural systems. Renfrew created a theory of systems, subsystems and feedbacks as a reaction to what comes into the system and what goes out. The cultural system is defined by several subsystems: the subsistence subsystem, the technological subsystem, the social subsystem, the projective or symbolic subsystem and the trade and communication subsystem.[40] The feedback occurs between the subsystems. It is a reaction to changes in subsystems. Positive feedback leads to an upgrading and creates an exponential rise or fall. Negative feedback has a tendency to bring stability and preservation.[41]

The domination of agricultural tools and craft tools in hoards could be understood as the effort of bringing stability during the collapse of the first two subsystems: the subsistence subsystem and the technological subsystem. The subsistence subsystem means actions which are related to the distribution of food resources. The human being and the food resources and food units themselves are components of the subsystem which are interrelated by these specifically subsistence-oriented activities. The technological subsystem means human activities which result in the production of material artefacts. The components are the men, the material resources and the finished artefacts.[42] Without agricultural tools, the soil cannot be properly prepared for seeding, which has an impact on food production. Human beings were dependent on the agricultural tools. For example, without the ploughshare and coulter, there could be no stump jumper. Without blacksmiths' tools, the smith could not work with iron and would be unable to create or repair other kinds of tools as needed.

The bipolar factor contains two structures: axe-shaped bars and, on the other hand, warriors' equipment (War_equip: weapons: lance heads, swords, arrow heads, and equestrian equipment: mountings, spurs, snaffles, stirrups), household tools (Househ_tool: keys, scissors, bucket parts, cauldron, knives, Silesian basins) and sickles. Warriors' equipment and household tools are also found at settlements and at hillforts. It can be understood as part of the estate of bands of warriors at the hillforts. On the other hand, based on finds of weapons at the settlements, Ivo Štefan also assumes bands of warriors within the settlements, the so-called *Bauernkrieger.*[43]

It is interesting that there is a common exclusion between axe-shaped bars and sickles. The sickle is primarily used for harvesting, but in early medieval times was also put into graves. According to Zuzana Borzová, the sickle in early medieval graves can have several meanings. It can be intended to point to the status of an individual in the grave as a peasant or farmer; it can also have a magical-ritual meaning, or, together with household tools and weapons, can point to the warrior status of the interred. Most of the graves with household tools, weapons and sickles were those of males and dated to the Avar Khaganate and Great Moravian period.[44] The factor combining household tools, warrior equipment and sickles could also be understood that way, namely that hoards with these three components may have belonged to the property of a warrior, but may also have some magical-ritual meaning. Where the hoard was discovered outside the settled area, this can also have similar implications.

39 Hodder 2017, 17–19.
40 Renfrew 1972, 22–23.
41 Renfrew 1972, 36–37.
42 Renfrew 1972, 22.
43 Štefan 2011, 337–338.
44 Borzová 2006, 210–211, 216–217.

The problem of axe-shaped bars remains unsolved. Especially in Slovakia, they are found in hoards at hillforts, but they were also discovered at settlements or graveyards (outside the settled area). The exact position in the hillfort, settlement or graveyard could be understood as some orientation point for future recovery. If the hillforts were interpreted as the centre of power and craft, the huge concentration of axe-shaped bars has to have a different meaning. Specific places where hoards with axe-shaped bars were found are walls close to the gates of hillforts. These places could be understood as orientation points meant to facilitate the later recovery of the hidden objects. These were intended not just as a source of iron, as an ingot, but maybe also as a tool to be exchanged for other items. This view can be countered by the question of why they are concentrated only in the central part of central Europe, mostly in the area of foreign Great Moravia. In general, the hoards with axe-shaped bars are dated to the 9th century or to the first half of the 9th century.[45] This is supported by cases such as the Pobedim hillfort, where numerous hoards with axe-shaped bars and equestrian equipment were found to have been hidden in the context of the hillfort's collapse. New dendrochronological data from Pobedim have yielded new information about activities in the Pobedim hillfort, where building activity by the walls was renewed at the end of 9th century. The same situation was also identified in Bojná.[46] Because of this dendrochronological data, it is possible that the dating of the hoards with iron implements in Pobedim, and possibly in Bojná too, needs to be moved to end of the 9th century, to the time of the fall of Great Moravia.

The economy of Great Moravia was not on the high level of empires such as the Frankish Empire or the Byzantine Empire. It was based on the economy of pre-state organizations.[47] In the first stages of organization as a state, the leader had to secure and continually strengthen loyalty to him and reinforce his legitimacy. The legitimacy of the ruler is the belief held by the elites and the population that the ruler is a proper and legitimate ruler, and this legitimacy passes to his decisions or to the government system. If support falls below the necessary threshold, it leads to a fall.[48] Hoards with axe-shaped bars were mostly found at hillforts, which were the domain of local chiefs. They could be used as some kind of gift from the leader to his subjects, minor or local chiefs. Occasionally axe-shaped bars and warriors' equipment are found in one hoard.

According to Jiří Macháček, the Great Moravian economy was based on the power of the leader, who was the 'contact person' on the Great Moravian side. The leader of Great Moravia established and coordinated the market; in known sources it is called the 'Moravian market'. Sources suggest that this leader played a central role in the trade network as the primary (possibly even the only) figure controlling the flow of foreign goods into the country.[49] In the inner market of Great Moravia, axe-shaped bars could be used on the basis of the '*Gewichtsgeldwirtschaft*' and the coin-based financial system. In the coin system, the total value is represented in one single coin, while the system of *Gewichtsgeldwirtschaft* is based on the standard value and the weight of the metal accepted in the area. The origins of this system, however, extend to the Muslim Caliphate, where a standard metal weight system was used.[50]

The hoards with axe-shaped bars could be understood through comparison with early medieval hack-silver hoards (*Hacksilberhortfunde*). The hiding of hack-silver hoards is probably related to the transition from pre-state societies (chiefdoms) to the first state organizations. Areas that did not benefit economically from their own natural resources were reliant on other means of generating wealth, which mainly involved plundering and redistributing goods.[51] According to Przemysław Urbanczky, in connection with fragmented silver depots, they primarily served as a donation to gain political loyalty and thus later to the voluntarily supply of the necessary food, such as grain and meat. Silver was not given simply as the daily rate for warriors, but as a reward for participation in a joint military campaign and in the hope of securing military support for the next expedition. Hiding of it can be seen as a kind of response to the economic situation or storage of a dowry. It could also have been a simple way of securing the sum needed for some important transaction, of setting aside provisions for hard times, or a means of fulfilling the very need of amassing a fortune.[52] On the other hand, the elite of Great Moravia was well known for its jewellery and artefacts made from silver, gold and bronze. Nevertheless, only a few bronze artefacts were put into the hoards. The value of iron dominates.

9. Conclusion

With the help of the statistical method principal component analysis, it was possible to isolate primary basic factors (groups of principal components) which characterize

45 Bialeková 2008.
46 Henning et al. 2015, 340–342. – Bialeková 2017, 12–13.
47 Smith 2004, 78–79.
48 Tainter 2009, 44.
49 Macháček 2015, 472–473.
50 Kilger 2011, 264–265.
51 Urbanczyk 2009, 501–502.
52 Urbanczyk 2009, 506–508.

Slovak hoards of iron implements from the early medieval period. Resulting factors were determined by artefacts, which, together with the hoards' other properties and the excavation circumstances, provide a more complete picture of the phenomenon of hoards. The factors were agricultural tools, craft tools and the bipolar factor. Every factor was found to have typical excavation circumstances according to which they could be linked with settlements, hillforts, areas outside the settled area (natural environments, graveyards) and unknown circumstances.

Hoards with iron implements were found to be concentrated in the western and particularly the northwestern part of Slovakia, close to the centres of Great Moravia. These hoards are generally dated to the 9th century, but could possibly be even more precisely assigned to the middle part of the 9th century, due to the unrest caused by Mojmír I's conquests during this time. Some of the hoards were dated to the transition from the 9th to the 10th century.

The reasons and motivations people may have had for burying hoards and hiding their fortunes were also addressed. It was suggested that these may have been related to religion or fear in dangerous times. One possibility could be that the survival of the people depended on these tools. Without agricultural tools, they were not able to cultivate land; without cultivated land, there was no harvest and no possibility to provide food. It is not possible to ascertain with certainty whether or not the tools were used in every case.

Hoards of iron implements are not usually hidden in a box or any other type of case. Only a few of the hoards were hidden in this way. For example, the hoard from Moravský Ján (36) was hidden in a cauldron.[53] Accordingly, it is possible to hypothesize some intention to preserve the tools for the future.

The presence of weapons and warriors' equipment in hoards is particularly interesting as it is uncommon and begs the question of why a warrior's essential equipment would be buried in a hoard. Compared to the finds of sickles and household tools, which were also found in settlements and graves from the Great Moravian period, this type of equipment is a status symbol indicating class or dignity.[54] We can also consider some ritual meaning of hoarding or the hoarded property of a warrior. According to Hans Peter Hahn, the real value of artefacts can lie in their symbolical value. The symbolical value is many times more significant than the real value of iron.[55]

Similarly, agricultural and craft tools are a further necessity, without which humankind could not survive. But Hahn refers to these kinds of tools as temporary objects ('*Übergangsobjekte*'). They may be single everyday tools, which create stable relations in society, and private personal things, which make human beings the way they are.[56] Similarly, in the present era, we often put some money aside in case of unexpected expenses or 'just in case'. So the difference between 'them' and 'us' is not so great. We save money and, on many occasions, we save precious items after the demise of our grandparents or great-grandparents just because of their symbolic or emotional meaning to us, which no one else can understand.

Inevitably, the results of this study lead to the need for a closer examination of why hoards were buried, why particular locations were chosen and why they contained specific artefacts and combinations of artefacts. We will never be able to see into the head of early medieval people or to understand why they did this or that.

Early medieval hoarding could be a consequence of many other factors: civil war between two sons of Svätopluk, the violent situation on the borders with the Frankish Empire or Magyar tribes on the other part. Hoards could be understood as a negative feedback resulting from changes in the system, which led to the fall of the system or its indefensibility, as happened during the fall of Great Moravia. These hoarded artefacts could represent some kind of hope: when this catastrophe has passed, we can start all over again.

53 Zabojník 2009, 103
54 See Hanuliak 2004.
55 Hahn 2015, 13.
56 Hahn 2015, 10–11.

Appendix 1.
Catalogue of sites with iron implements in Slovakia. For a map showing all sites see Figure 1.

0. Archaeological site
a. Administrative department
b. Circumstances of discovery
c. Artefacts
d. Reference

1. Bašovce
a. Trnava district.
b. Settlement.
c. 4 axe-shaped bars.
d. Bialeková 1990, 111.

2. Bíňa I.
a. Nitra district.
b. Superposition above the grave.
c. 101 axe-shaped bars.
d. Bialeková 1990, 109.

3. Bíňa II.
a. Nitra district.
b. Settlement, under millstone.
c. 60 axe-shaped bars.
d. Turčan 2012, 22–24.

4. Bojná I.
a. Nitra district.
b. Western part of hillfort.
c. 15 axe-shaped bars, 1 coulter.
d. Pieta, Ruttkay 2007, 35.

5. Bojná II.
a. Nitra district.
b. Western part of hillfort.
c. 1 sickle, 6 parts of buckets, 2 fragments of spurs, 1 belt mounting, 2 knives, fragments of iron, 2 spikes, 1 flax napper.
d. Pieta, Ruttkay 2007, 35.

6. Bojná III.
a. Nitra district.
b. Southern part of hillfort.
c. 5 spurs.
d. Pieta, Ruttkay 2007, 35.

7. Bojná IV.
a. Nitra district.
b. Hillfort.
c. 1 sickle knife, 1 knife, 1 graving knife, 2 axe-shaped bars.
d. Pieta, Ruttkay 2007, 31–35.

8. Bojná V.
a. Nitra district.
b. By the wall of hillfort.
c. 3 deformed sickles, 1 saw, 1 part of an axe, 1 bucket holder, fragment of 1 knife, 2 axe-shaped bars.
d. Pieta, Ruttkay 2007, 35.

9. Bojná VI.
a. Nitra district.
b. Part of hillfort known as Bojná III.
c. 94 axe-shaped bars.
d. Bialeková, Kamhalová 2000, 34. – Pieta 2007, 15.

10. Bojná VII.
a. Nitra district.
b. South wall of hillfort.
c. 32 axe-shaped bars.
d. Šalkovský 2002, 172–173.

11. Bojná VIII
a. Nitra district.
b. Hillfort.
c. 202 axe-shaped bars.
d. Turčan 2012, 16–21.

12. Bojná IX.
a. Nitra district.
b. Hillfort.
c. 1 ploughshare, 2 hoes, 2 spuds, 2 borers, 1 spike chopper, 16 arrow heads, 4 sickles, 2 knifes, 2 coulters, 2 bucket holders, 1 bucket band.
d. Turčan 2012, 21–22.

13. Bojná X.
a. Nitra district.
b. Hillfort.
c. 53 axe-shaped bars, 3 coulters, 3 ploughshares, 3 sickles, 2 hoes, 2 drawknifes.
d. Turčan 2012, 22–23.

14. Bojná XI.
a. Nitra district.
b. Hillfort.
c. 3 ploughshares, 1 scythe, 3 fragments of sickles, 1 linchpin, 2 bucket holders, 1 iron circle, 1 terret, 1 mounting, 1 fragment of spur.
d. Turčan 2012, 23–24.

15. Bojná XII.
a. Nitra district.
b. By the southern wall of hillfort.
c. 23 axe-shaped bars.
d. Šalkovský 2002, 172–173.

16. Bojná XIII
a. Nitra district.
b. Middle part of hillfort.
c. 4 axe-shaped bars.
d. Šalkovský 2002, 172–173.

17. Bošany
a. Trenčín district.
b. Unknown.
c. 15 axe-shaped bars.
d. Bialeková 1990, 109.

18. Bratislava I.
a. Bratislava district.
b. Settlement.
c. 13 axe-shaped bars.
d. Bialeková 1990, 110.

19. Bratislava II.
a. Bratislava district.
b. Hillfort.
c. Ploughshare, coulter, sickle, hoe, borer, axe, small mattock.
d. Kováč 2013, 100–102.

20. Čachtice
a. Trenčín district.
b. Unknown.
c. 4–6 axe-shaped bars, 2 ploughshares.
d. Bialeková 1990, 110.

21. Čebovce
a. Banská Bystrica district.
b. Nearby settlement.
c. 4 sickles, 2 ploughshares, 1 scythe, 1 coulter, 1 axe-shaped bar, 1 hoe.
d. Točík 1983, 207.

22. Divinka I.
a. Žilina district.
b. Hillfort.
c. 1 scythe, 4 sickles, 1 drawknife, 1 chopper, 1 chisel, 1 tail skid, 1 smithing.
d. Turčan 2012, 25–26.

23. Divinka II.
a. Žilina district.
b. Hillfort.
c. Silesian basin, ploughshare, coulter, sickle, scythe, hoe, axe, key.
d. Fusek 2017, 34.

24. Divinka III.
a. Žilina district.
b. Hillfort.
c. Silesian bowls, horseshoe, bucket parts.
d. Fusek 2017, 34–35.

25. Dolná Mariková
a. Trenčín district.
b. Hillfort.
c. ploughshares, scythes, coulters, axe-shaped bars, spurs, arrow heads, a bucket mounting.
d. Borzová 2016, 130.

26. Gajary I.
a. Bratislava district.
b. Settlement.
c. 2 sickles, Bronze mountings.
d. Čilinská 1984, 163. – Zábojník 2009, 91.

27. Gajary II.
a. Bratislava district.
b. Settlement.
c. 8 fragments of sickles, 4 scythes, 2 coulters, 2 scissors, 1 mattock, 1 L-shaped key, 1 Silesian basin, 9 parts of bucket, 3 stirrups, 1 lance head, 2 files.
d. Čilinská 1984, 163. – Bartošková 1986, 11. – Zábojník 2009, 92.

28. Gajary III.
a. Bratislava district.
b. Unknown.
c. 1 mattock, 1 coulter, 2 scythe, 1 ploughshare, 1 scissors, 1 Silesian basin, 1 knife, 1 bucket holder, 1 sword.
d. Čilinská 1984, 164. – Bartošková 1986, 17–18.

29. Hrádok
a. Trenčín district.
b. Hillfort.
c. 247 axe-shaped bars.
d. Bartošková 1986, 18. – Bialeková 1990, 110.

30. Horné Plachtince
a. Banská Bystrica district.
b. Unknown.
c. 3 axes, 1 lance head, 1 chopper, 1 sickle, 1 iron waist, 1 mounting, 1 bucket mounting, 1 arrow head, 73 iron fragments.
d. Turčan 2012, 27–29.

31. Komjatice
a. Nitra district.
b. Settlement.
c. 1 sickle, 1 scissors.
d. Šalkovský, Vlkolinská 1987, 127–171.

32. Kúty I.
a. Trnava district.
b. Settlement.
c. 4 sickles, 1 stirrup, 1 Silesian basin?
d. Bartošková 1986, 22. – Zábojník 2009, 101.

33. Kúty II.
a. Trnava district.
b. Settlement.
c. 1 ploughshare, 1 scythe, 1 sickle, 1 spud, 2 L-shaped keys, 1 stirrup.
d. Bartošková 1986, 22. – Zábojník 2009, 101–102.

34. Kúty III.
a. Trnava district.
b. Unknown.
c. 1 ploughshare, 1 axe, 1 spud, 1 half of scissors.
d. Bartošková 1986, 22–23.

35. Modra
a. Bratislava district.
b. Hillfort.
c. 1 coulter, 1 ploughshare.
d. Farkaš 2001, 155.

36. Moravský Ján
a. Trnava district.
b. By the river Morava.
c. In cauldron, covered by another? 1 ploughshare, 1 mattock, 2 hoes, 1 coulter, 3 knifes, 1 lance head, 2 axes, 1 key, 1 share, 2 hammers, 1 wimble, 2 iron circles, 1 hook, 3 snaffles, 2 stirrups, 1 chain, Bronze artefacts.
d. Bartošková 1986, 33. – Zábojník 2009, 103.

37. Nitra-Šindolka
a. Nitra district.
b. Settlement.
c. 23 axe-shaped bars.
d. Bialeková 1990, 111.

38. Oborín
a. Košice district.
b. Settlement.
c. 1 sickle, pottery.
d. Vizdal 1963, 372–377.

39. Palánok
a. Nitra district.
b. Unknown.
c. 2 ploughshares, 7 sickles, 2 hoes.
d. Henning 1987, 139. – Curta 1997, 258.

40. Pobedim I.
a. Trenčín district.
b. Hillfort.
c. I: 49 axe-shaped bars.
d. Bialeková 2008, 337.

41. Pobedim II.
a. Trenčín district.
b. Hillfort.
c. II: 22 axe-shaped bars, 1 sickle, 1 coulter, half of 1 snaffle, 5 spurs.
d. Bartošková 1986, 38–40. – Bialeková 1990, 111. – Bialeková 2008, 337.

42. Pobedim III.
a. Trenčín district.
b. Hillfort.
c. V: 111 axe-shaped bars, spurs, snaffles, mountings.
d. Bialeková 1990, 111. – Bialeková 2008, 337.

43. Pobedim IV.
a. Trenčín district.
b. Hillfort.
c. VII: 142 axe-shaped bars, iron tools.
d. Bialeková 1990, 111. – Bialeková 2008, 337.

44. Pobedim V.
a. Trenčín district.
b. Hillfort.
c. IX: 42 axe-shaped bars.
d. Bialeková 1990, 111. – Bialeková 2008, 337.

45. Pobedim VI.
a. Trenčín district.
b. Hillfort.
c. X: 7 axe-shaped bars, iron tools.
d. Bialeková 1990, 111. – Bialeková 2008, 337.

46. Pobedim VII.
a. Trenčín district.
b. Hillfort.
c. XI: 50 axe-shaped bars, iron tools.
d. Bialeková 1990, 111.

47. Pobedim VIII.
a. Trenčín district.
b. Hillfort.
c. XVII: 9 axe-shaped bars, iron tools.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

48. Pobedim IX.
a. Trenčín district.
b. Hillfort.
c. XIX: 71 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

49. Pobedim X.
a. Trenčín district.
b. Hillfort.
c. XX: 30 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

50. Pobedim XI.
a. Trenčín district.
b. Hillfort.
c. XXII: 6 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

51. Pobedim XII.
a. Trenčín district.
b. Hillfort.
c. III: 48 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

52. Pobedim XIII.
a. Trenčín district.
b. Hillfort.
c. IV: 222 axe-shaped bars, 117 iron fragments.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

53. Pobedim XIV.
a. Trenčín district.
b. Hillfort.
c. VIII: 65 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

54. Pobedim XV.
a. Trenčín district.
b. Hillfort.
c. XII: 56 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

55. Pobedim XVI.
a. Trenčín district.
b. Hillfort.
c. XV: 9 axe-shaped bars.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

56. Pobedim XVII.
a. Trenčín district.
b. Hillfort.
c. XVI: 124 axe-shaped bars, iron tools.
d. Bialeková 1990, 112. – Bialeková 2008, 337.

57. Pobedim XVIII.
a. Trenčín district.
b. Hillfort.
c. VI: 69 axe-shaped bars.
d. Bialeková 1990, 112.

58. Pobedim XIX.
a. Trenčín district.
b. Settlement.
c. XIII: 17 axe-shaped bars, iron tools.
d. Bialeková 2008, 337.

59. Pobedim XX.
a. Trenčín district.
b. Settlement.
c. XIV: 30 axe-shaped bars.
d. Bialeková 1990, 112.

60. Pobedim XXI.
a. Trenčín district.
b. Settlement.
c. XVIII: 28 axe-shaped bars, iron tools.
d. Bialeková 1990, 112.

61. Prosiek
a. Žilina district.
b. Hillfort.
c. 1 bucket holder, 1 bucket mounting, 1 stirrup, 2 spurs, 1 lance head, 1 coulter.
d. Pieta 2016, 261–265.

62. Pružina
a. Trenčín district.
b. Hillfort.
c. 4 ploughshares, 5 coulters, 4 scythes, 1 hoe, 2 axes, 3 saw, 1 spike, 1 drawshare, 8 spurs, 4 stirrups, 1 knife, 3 snaffles, 4 keys, axe-shaped bars, 4 Silesian basins, c.10 small tools.
d. Borzová 2005, 167. – Pieta 2012, 94–97.

63. Radvaň nad Dunajom
a. Nitra district.
b. Unknown.
c. 2 coulters, plates decorated by little pearls, 6 axes.
d. Čilinská 1984, 164. – Zábojník 2009, 111.

64. Sklabiňa
a. Banská Bystrica district.
b. Unknown.
c. 1 ploughshare, 1 coulter, 1 hoe, 1 chisel-formed stylus, 2 spikes, 1 lance head, iron fragments.
d. Bartošková 1986, 53.

65. Stráňavy
a. Žilina district.
b. Unknown.
c. 4 sickles.
d. Slaná 2017, 44–45.

66. Trenčianske Teplice
a. Trenčín district.
b. Hillfort.
c. 3 sickles, 1 coulter.
d. Nešporová 2003, 97–109.

67. Veľký Klíž
a. Trenčín district.
b. By the forest spring.
c. 42 axe-shaped bars, 4 coulter, 1 sickle, 1 hammer, 1 axe, 1 bucket mounting, 12 parts of bucket circles.
d. Turčan 2012, 30–32.

68. Vyšný Kubín
a. Žilina district.
b. Hillfort.
c. 3 bucket holders, 22 fragments from bucket, 2 sickles, 2 iron circles, iron strips, bucket mounting, iron fragments.
d. Pieta 2016, 271–274.

69. Vrbové
a. Trnava district.
b. Unknown.
c. 14 axe-shaped bars, 6 ploughshares, 6 sickles, 2 chisels, 1 bucket holder, 1 bucket band, 1 coulter, 1 wimble, 1 iron stick, 1 handle, 1 S-profiled mounting.
d. Turčan 2012, 33–35.

70. Vršatské Podhradie
a. Trenčín district.
b. Unknown.
c. 1 scythe, 1 ploughshare, 1 coulter, 3 hoes, 1 wimble, 2 axes, 1 spike, 2 drawshare, 4 tongs, 3 anvils, 1 axe-shaped bar.
d. Bartošková 1986, 59–60.

71. Zádiel
a. Košice district.
b. By the stream.
c. 1 ploughshare, 2 coulters.
d. Bartošková 1986, 60.

72. Zemianske Podhradie
a. Trenčín district.
b. Unknown.

c. 11 axe-shaped bars, 4 belts, 1 scissors, 1 stick, 4 mountings, 2 drawshares, 1 key, 1 bell-formed tool, 1 spur, 1 sickle knife, 2 choppers, 3 knifes, 2 circle mounting, 1 saw, 2 coulters, 3 scythes, 3 ploughshares, 1 stirrup, 1 axe.
d. Turčan 2012, 36–38.

73. Žabokreky nad Nitrou I.

a. Trenčín district.
b. Settlement.
c. 3 sickles, 2 scythes, 1 ploughshare, 1 coulter, 1 cauldron, 6 axe-shaped bars.
d. Habovštiak 1965, 58. – Bartošková 1986, 60–61.

74. Žabokreky nad Nitrou II.

a. Trečín district.
b. Settlement.
c. 8 sickles, 4 scythes, 4 ploughshares, 2 coulters, 1 hoe, 2 spuds, 1 axe, 1 drawshare, 2 chisels, 1 wimble, 1 L-shaped key, fragment of bucket holder, bucket bands, 10 axe-shaped bars.
d. Točík 1963, 601. – Habovštiak 1965, 58. – Bartošková 1986, 62–63.

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Standortwahl des Kalvarienberges im Vorfeld der Burg Červený Kameň (SW-Slowakei)

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Zusammenfassung
Ziel dieser Arbeit ist es, die Möglichkeiten und Applikation der emischen und etischen Perspektive im Rahmen der Landschaftsarchäologie zu präsentieren. Als Beispiel wurde die Umgebung der Burg Červený Kameň (Südwest-Slowakei) gewählt. Der konkrete Einsatz dieser Perspektiven wird an der Standortwahl des heutigen Kalvarienberges gezeigt. Dabei werden die emische und etische Perspektive miteinander konfrontiert. Im Falle der etischen Perspektive soll versucht werden, die Motive des Bauherrn, d. h. die konkreten Impulse und Einflüsse, die zur Errichtung der Kreuzigung Christi auf dem heutigen Kalvarienberg geführt haben, zu identifizieren. Hierfür wird das soziologische Makro-Mikro-Makro-Modell herangezogen. Aufgrund der schriftlichen und kartografischen Quellen kann der konkrete gesellschaftliche Kontext belegt werden, der den Bauherrn beeinflusst hat. Die gesellschaftlich bedingten Aktivitäten des Bauherrn fanden ihren Ausdruck auch in der umliegenden Landschaft vor der Burg. Diese Landschaft spiegelt bis heute, vor allem bei vergleichender Betrachtung der historischen Karten, den geschichtlichen Wandel der menschlichen Mentalität wider.

Schlüsselbegriffe
Červený Kameň, Landschaftsarchäologie, Standortwahl, Sichtbarkeitsanalyse, emische und etische Perspektive.

Abstract – *Site Selection of the Calvary Hill in front of the Červený Kameň Castle (SW Slovakia)*
The main purpose of this article is to present the possibilities and application of emic and etic perspectives within the framework of landscape archaeology. To demonstrate this, the surroundings of Červený Kameň Castle (SW Slovakia) were chosen as an example. The actual application of the above-mentioned perspectives will be demonstrated using the chosen site of today's calvary hill. Using this example, the emic and etic perspectives will be mutually juxtaposed. In the case of the etic perspective, an attempt will be made to identify specific impulses and influences that led to the erection of the Crucifixion on the calvary hill. During this phase, a macro-micro-macro model will be applied. An attempt will be made to understand the past social context which influenced the builder of calvary by means of written and cartographic sources. The socially determined activities of the builder are manifested in the surrounding landscape in front of the castle. This landscape reflects, when compared with old maps, the historical change in human thinking to date.

Keywords
Červený Kameň, landscape archaeology, site selection, visibility analysis, emic and etic perspective.

1. Einleitung

Abseits der Burg Červený Kameň, Südwest-Slowakei, steht heute die Begräbniskapelle der Familie Pálffy, einst eine der mächtigsten Adelsfamilien in Ungarn. Die Kapelle liegt unterhalb eines Berges, auf dessen Gipfel sich das steinerne Werk der Kreuzigung Christi erhebt (Abb. 1). Die Komposition von drei Kreuzen (Christus mit zwei Räubern) und drei Figuren (Mutter Jesu, Maria Magdalena und Apostel Johannes) stammt wahrscheinlich aus der Werkstatt von Stephan Adam Steinmassler (1721–1773/1789).[1] Der felsige Berg ist heutzutage dicht bewaldet, sodass die Kreuzigung weder von dem Burgvorfeld noch von der Burg selbst aus gesehen werden kann. Ihre Existenz verrät nur ein Kreuzweg, dessen Stationen mit steinernen Figuren von dem Burgtor bis zum erwähnten Berg führen. Das Alter des Bildhauerwerkes deutet klar darauf hin, dass der Kreuzweg schon lange Zeit in Verwendung steht, was auch historische Karten aus dem 18. Jh. bestätigen können.

Durch seine Gestaltung unterscheidet sich dieser Kreuzweg mit Kreuzigung nicht von anderen ähnlichen landschaftlichen Denkmälern. Gesamtgesellschaftliche Impulse, die zu ihrer Errichtung führten, haben ihre Auftraggeber jedoch verschiedenartig beeinflusst. Manifestationen konkreter Entscheidungen der Auftraggeber sind in der Landschaft oftmals bis heute vorhanden, jedoch nicht gut

1 Čičo 2002, 136. – Greplová 2010, 38–39.

Abb. 1. Die Kreuzigung auf dem Kalvarienberg (Foto: M. Neumann, 2019).

zu sehen. Es wird hier deshalb versucht, diese zu entdecken und die Wege zu ihrer Identifizierung vorzustellen. Dabei wird der Ansatz der emischen und etischen Perspektive gewählt und diese beiden miteinander in Bezug gesetzt. Bei der ersten, der emischen Perspektive, wird die Errichtung der Kreuzigung zusammen mit dem Kreuzweg als Ergebnis der gesamtgesellschaftlichen Situation dargestellt. Eine ähnliche Aufgabe wird auch die etische Perspektive haben, im Unterschied zur emischen Perspektive jedoch versucht sie mittels „objektiver" Daten zu einer eigenen Interpretation zu kommen. Dazu werden vor allem Methoden der Landschaftsarchäologie (Sichtbarkeitsanalysen) herangezogen. Wenn sich zeigt, dass beide Perspektiven unabhängig voneinander zum gleichen Ergebnis gelangen, wird dadurch die etische Interpretation verifiziert und ihre Applizierbarkeit in der Praxis überprüft.

2. Die topografische Lage

Die Burg Červený Kameň erhebt sich am östlichen Rande des kleinkarpatischen Gebirges zwischen den Gemeinden Častá und Píla (Abb. 2). Gleich bei der Gründung der Burg wurde ein strategischer Platz an der Kreuzung zweier alter Wege gewählt.[2] Dank ihrer Lage hatte sie nicht nur die Funktion einer Wachtburg, sondern wurde auch ein Zentrum der entstehenden Burgherrschaft.[3] Konkreten Einfluss auf die Standortwahl haben die landschaftlichen Determinanten ausgeübt. Westlich des Dorfes Častá befindet sich der Berg Veľké Vápenné (547 m ü. d. M.). Während sein westlicher Hang steil gegen das Tal Suchá dolina abfällt, verliert sich der östliche Hang nur allmählich. Von südwestlicher und nordöstlicher Seite wird der Berg von zwei Bachtälern begrenzt. Über dem südwestlichen Tal, welches der Bach Gidra durchfließt, trennen sich von dem sich mäßig senkenden Hang zwei kleine Ausläufer ab, zwischen denen ein natürliches Plateau entstand. Diese relativ flache und schmale Ebene wurde mindestens seit dem Mittelalter besiedelt.[4] Kurz nach dem ersten Drittel des 13. Jhs. wurde auf dem Felsmassiv im südöstlichen Teil des Plateaus die eigentliche Burg gegründet, die über Jahrhunderte zur neuzeitlichen Festung umgebaut wurde.[5] Bei allen Baumaßnahmen mussten jedoch die natürlichen Bedingungen respektiert werden. So bot der felsige Sporn einen hervorragenden Platz für den Herrensitz, während das flache Plateau zu seinem wirtschaftlichen Hinterland wurde.

3. Die neuzeitliche Baugeschichte

Die alte mittelalterliche Burg mit unregelmäßiger Disposition wurde zwischen 1535–1537 durch den neuen Besitzer,

2 Tibenský 2011, 157.

3 Plaček 2004, 335.

4 Tibenský 2011, 25.

5 Gahér 2017, 279.

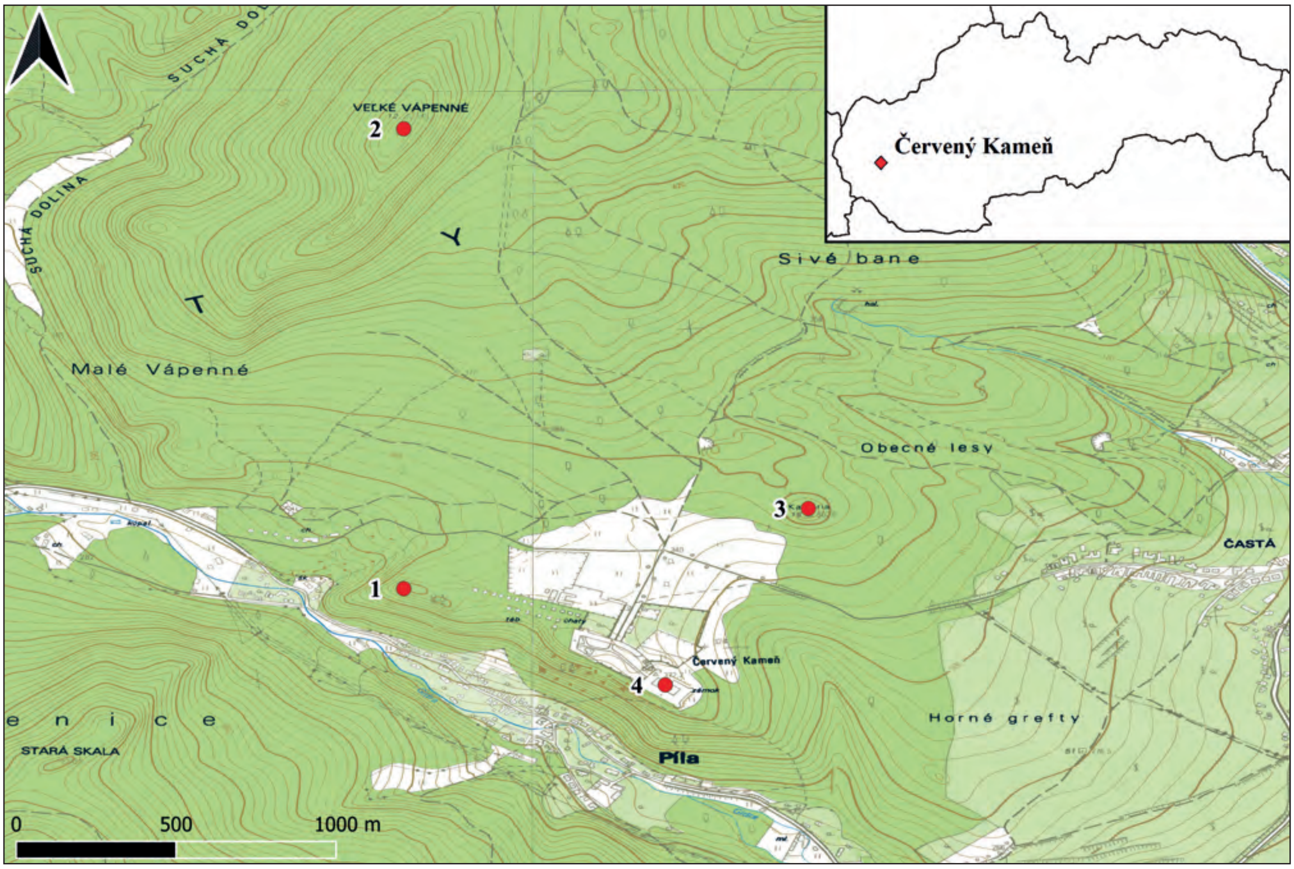

Abb. 2. Topografische Lage der Burg Červený Kameň und ihrer Umgebung. – 1. Sporn Jelení skok. – 2. Berg Veľké Vápenné. – 3. Kalvarienberg. – 4. Burg Červený Kameň (Karte: www.geoportal.sk).

die Familie Fugger, wesentlich umgebaut.[6] Die alte Burg wurde abgerissen und durch eine viereckige Festung ersetzt. Wie sich aus der Handzeichnung von 1570 ergibt, hatte die rechteckige Burg nur einen mehrstöckigen Wohnflügel (Abb. 3, der Flügel mit rotem Dach), der Rest der Burganlage wurde für wirtschaftliche und militärische Zwecke genutzt. Erst in den 80er Jahren des 16. Jhs. baute der neue Besitzer Mikuláš II. Pálffy zwei neue Wohnflügel hinzu – den nordwestlichen und südöstlichen Flügel. Gegen Nordosten blieb der Zentralhof offen, von dem Burggraben trennte ihn nur ein langes eingeschoßiges Gebäude.[7] Diese Gestalt behielt die Burg bis 1663. Auf einer aus dieser Zeit stammenden und von Giuseppe Priami angefertigten Grafik wurde der geplante Umbau des Burgareals erfasst (Abb. 4). Obwohl dieser von Mikuláš IV. Pálffy bestellte Plan hinsichtlich der Festungsausbauten nie realisiert worden ist, wurde hier das ganze Burgareal mit hoher Präzision verbildlicht. Auffallend ist vor allem das bearbeitete Verteidigungssystem von mehreren Festungslinien mit spitzen Hornbastionen. Die Struktur der zwei Vorburgen sollte im

Abb. 3. Handzeichnung der Burg Červený Kameň, um 1570 (Universitätsbibliothek Salzburg, Abteilung für Sondersammlungen, Signatur H 22, Schloss Pibersburg).

6 Menclová, Štech 1954, 17, 22. – Kalus 1999, 253–254. – Plaček 2007, 96–97.

7 Menclová, Štech 1954, 41.

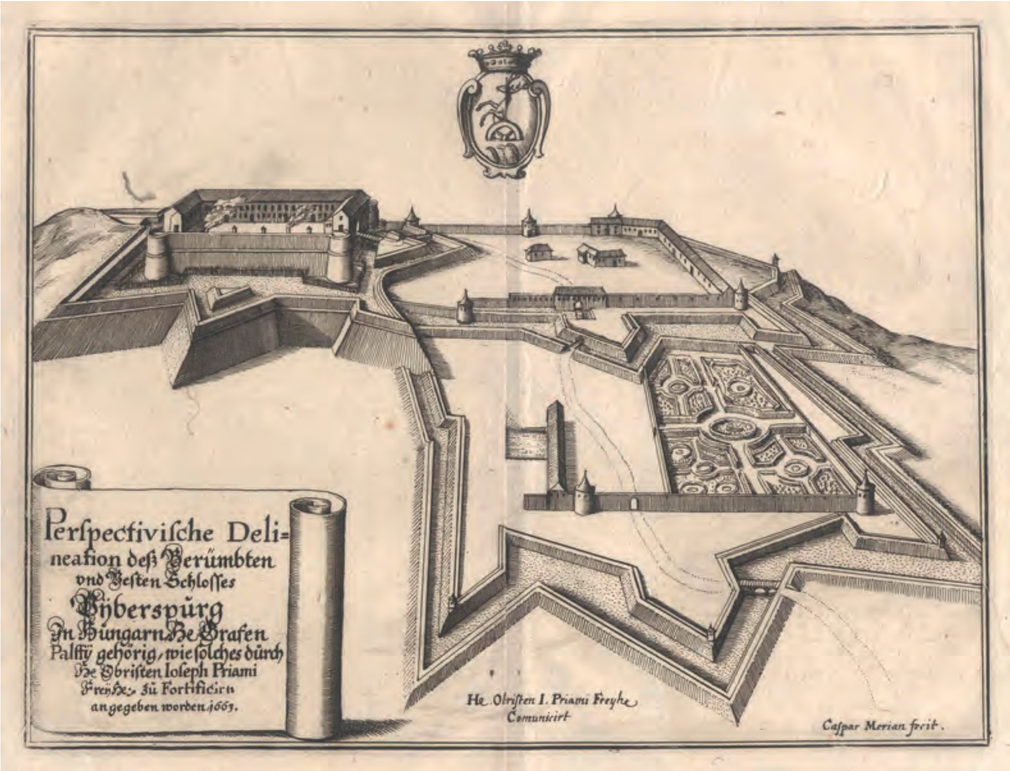

Abb. 4. Entwurf der Burgbefestigung von G. Priami (1663), Blick von Nordosten (Galéria mesta Bratislavy, Signatur C 6254).

Prinzip unverändert bleiben. Im Unterschied zu den noch zu errichtenden Wehrbauten sollte die Hochburg selbst nicht durch die geplanten Baumaßnahmen berührt werden. Aus dem Plan ergibt sich zudem, dass der nordöstliche Burgflügel weiterhin eingeschoßig blieb, während die anderen drei Flügel mindestens zweigeschoßig waren. In diesem Zustand wurde die Burg durch Samuel Mikovíny auf seinem aus dem Jahr 1736 stammenden Stich erfasst (Abb. 5). Mikovínys Werk ist aber auch deshalb bedeutend, da es das Burgvorfeld zum ersten Mal im Zustand vor der ersten militärischen Aufnahme abbildet. Anhand der Grafik lässt sich vermuten, dass das Bild vom heutigen Kalvarienberg aus erstellt worden sein dürfte. Mehrere Informationen lassen sich daraus gewinnen: Man sieht vor der Burg eine breite entwaldete Weide, auf einer Seite grenzt sie an den Wald, auf der anderen stößt sie direkt an eine Allee, die vom Haupttor wegzieht. Die nur mit Einzelbäumen bewachsene Weide (noch ohne Stationen des Kreuzwegs) wird von einem Weg durchkreuzt. Dieser beginnt links im Wald und führt die Weide herab, wo er sich gabelt. Ein Zweig führt direkt zum Burgtor, der andere nähert sich der Allee an und führt wahrscheinlich weiter nach Píla. Die Burg selbst ist zu dem Zeitpunkt offensichtlich durch einen Brand zerstört, denn das Dach fehlt, aber der Grundriss ist klar zu sehen – eine 4-flügelige Anlage mit eingeschoßigem Wirtschaftsgebäude gegen Nordosten war weiterhin vorhanden.

Abb. 5. Stich der Burg Červený Kameň von S. Mikovíny, 1736 (Oravská galéria, Signatur T 475).

Die beschriebene Gestaltung unterscheidet sich wesentlich von dem auf der ersten militärischen Aufnahme erfassten Zustand (Abb. 6). Ins Auge fallen vor allem der (neue)

Abb. 6. Die Burg Červený Kameň und ihre Umgebung auf der ersten militärischen Aufnahme (1782–1784). – 1. Kreuzweg (www.mapire.eu).

Kreuzweg und die dichte Bewaldung des Burgvorfelds. Den einzigen offenen Raum gewährte die schmale Schneise, durch die der Kreuzweg führte. 1758 wurde die Hochburg durch einen Brand vernichtet. Um den Wiederaufbau kümmerte sich in der zweiten Hälfte des 18. Jhs. Rudolf I. Pállfy. Sein Hauptziel war nicht nur die vollständige Erneuerung des alten Herrensitzes, sondern auch die Raumvergrößerung. Er ließ zuerst den südwestlichen Hauptflügel, den sogenannten Fugger-Flügel, wie auch den etwas jüngeren südöstlichen Flügel grundlegend rekonstruieren. Auf beiden Flügeln wurde ein neues Stockwerk hinzugefügt (im Mansarddach). Durch die Aufstockung der südlichen und östlichen Basteien wurden beide Wohnflügel miteinander verbunden. Der nordöstliche Flügel mit dem Burgtor blieb wegen des durch den Brand verursachten Schadens ungenutzt. Der nordöstliche Flügel blieb auch in dieser Zeit nur eingeschoßig.[8] Rudolf I. Pállfy richtete seine Aufmerksamkeit ebenfalls auf die erste und zweite Vorburg wie auch auf den Raum vor dem Burgareal. Der Kreuzweg dürfte genau aus dieser Zeit stammen.[9] Seitdem wurden keine tiefgreifenden Eingriffe in die Gesamtgestalt des Burgareals wie auch der Burg selbst vorgenommen. Der Stand, der heute zu sehen ist, spiegelt also die Bauaktivitäten des Burgbesitzers aus der zweiten Hälfte des 18. Jhs. wider, das bedeutet, dass das Bild, welches alle zur Verfügung stehenden Karten wiedergeben, in wesentlichen Zügen die rudolf'sche Bautätigkeit reflektiert.

Man kann sehen, dass sich vor dem Burgareal mindestens seit der zweiten Hälfte des 18. Jhs. allmählich eine komponierte Landschaft zu bilden begann. Im Burgvorfeld standen die Allee, ein Kreuzweg und die Kreuzigung Christi auf dem Kalvarienberg. Eine rege Bautätigkeit lässt sich anhand des Vergleichs von Mikovínys Stich und der ersten militärischen Aufnahme sehr gut erkennen. Auch chronologisch sind diese Aktivitäten leicht zu erfassen: Ihre obere zeitliche Grenze bilden die Jahre der ersten militärischen Aufnahme (1782–1784), die untere der große Brand von 1758; knapp ein Vierteljahrhundert hat sich also bis heute deutlich in die Landschaft eingeschrieben. Aber welche Faktoren wirkten bei ihrer Gestaltung? Was führte dazu, dass gerade der nördlich des Burgareals gelegene Hügel zum heutigen Kalvarienberg wurde und als Ziel des Kreuzwegs gewählt wurde? Die Antwort auf diese Frage wird im Folgenden ausführlich erörtert.

4. Ziel und Methoden

Unser Ziel ist es, die Hauptmotive des Bauherrn zu verstehen, die zur Errichtung der Kreuzigung auf dem heutigen Kalvarienberg führten. Dabei wird das sog. Makro-Mikro-Makro-Modell angewendet, das zum ersten Mal von James Samuel Coleman beschrieben wurde.[10] Seine Grundzüge sollen im Folgenden näher erläutert werden.

Das Hauptziel der Archäologie ist das Rekonstruieren und Verstehen vergangener menschlicher Gesellschaften in all ihrer Vielfalt. Dies geschieht meistens anhand materieller Hinterlassenschaften, die immer ein Resultat der individuellen menschlichen Handlungen sind, in denen sich die konkrete Handlungsabsicht widerspiegelt. Michael Doneus weist darauf hin, dass man aus einzelnen konkreten Elementen der Mikroebene durch die direkten kausalen Verbindungen Schlüsse über die Struktur der Makroebene ziehen muss.[11] Unter Mikroebene werden dabei einzelne menschliche Handlungen und Aktivitäten als Reaktionen auf konkrete Impulse verstanden (d. h. auf der Ebene eines Individuums), während sich auf der Makroebene die Summe einzelner Reaktionen widerspiegelt (und sie somit eine Struktur bildet). Dadurch entsteht aber eine Spannung, weil das Einbeziehen und Berücksichtigen aller menschlicher Reaktionen bzw. Handlungen in das Gesamtbild auf der Makroebene nicht immer möglich ist. Das führt notwendigerweise dazu, dass das Verstehen der menschlichen Handlung stark verzerrt sein kann. Eine Lösung dafür bietet der strukturell-individualistische Ansatz. Er beruht auf der Annahme, dass auf der Makroebene keine Kausalgesetze existieren, weswegen es zu einem Wechsel auf die Mikroebene kommen muss.[12]

Da das Explanandum auf der Makroebene liegt, während das Explanans auf der Mikroebene liegt, ist eine Transformationsregel für die Ebenenwechsel notwendig.

8 Menclová, Štech 1954, 59–61.
9 Menclová, Štech 1954, 63. – Čičo 2002, 137.
10 Coleman 1990, 1–23. – Opp 2014, 157–160.
11 Doneus 2013, 312.
12 Albert 2008, 22–23. – Balog 2008, 252.

Bei dem ersten Wechsel zur Mikroebene wird die subjektive Wahrnehmung der objektiven Situation berücksichtigt. Dabei wirken verschiedene Faktoren wie Alter, Geschlecht, Ausbildung, Umwelt, soziale Struktur usw. auf das Individuum, die eine ganze Skala von Handlungen zur Folge haben können. Sein Handeln ist aber weiters auch durch vorliegende Möglichkeiten und Einschränkungen begrenzt. Unter diesen Bedingungen erstellt das Individuum nach Kriterien seiner Zweckrationalität auf der Mikroebene konkrete Randbedingungen, welche seine Handlung beeinflussen. Durch subjektive Wahrnehmung, Definition der durchlebten Situation und Selektion der Entscheidung manifestiert der/die AkteurIn seine Wertvorstellungen und Ansichten, was sich schließlich im Priorisieren einer konkreten Handlung widerspiegelt (emische Perspektive). Alle diese Faktoren wirken auf den individuellen Effekt, d. h. die subjektive Handlung einzelner AkteurInnen. Da diese Handlungen auf der Mikroebene liegen, stellt diese von sich selbst kein Explanandum dar. Erst alle zusammengenommenen Handlungen von mehreren AkteurInnen ergeben dann auf der Makroebene eine Makrostruktur, die ein eigentliches Explanandum ist.[13] Weil man in der Abfolge der Ebenenwechsel von der Makroebene durch die Mikroebene wieder zur Makroebene geht, nennt sich dieses Erklärungsmodell Makro-Mikro-Makro-Modell.[14]

Die Handlungen der einzelnen Individuen lassen sich durch Erfassen ihrer Wirkungen erklären. In der Archäologie gehören zu den Wirkungen vor allem Artefakte, Ökofakte und landschaftliche Strukturen.[15] Diese sind mit konkreten Bedeutungen aufgeladen, die ihnen die handelnden AkteurInnen zugewiesen haben. So verfügt auch jedes Artefakt, Ökofakt oder landschaftliche Struktur über einen subjektiv zugewiesenen Sinn, der von den ArchäologInnen nachvollzogen werden kann. Ihre Aufgabe ist es, diesen Sinn bzw. die Absicht des handelnden Individuums möglichst richtig zu erkennen und zu verstehen. So entsteht eine emische Interpretation, die durch die Perspektive der Werte, Meinungen und Absichten des handelnden Menschen geprägt ist.[16] Ihr Gegenpol ist die etische Interpretation, welche durch die dem äußeren Beobachter zugänglichen und ersichtlichen Daten einen „objektiven“ Einblick herstellt. Es ist klar, dass diese Interpretation jeglicher „Insider“-Einblicke in die zeitgenössische Gesellschaft und ihrer Werte entbehrt.

Um die Handlung der AkteurInnen wie auch ihren Einfluss auf die Makrosysteme richtig zu beurteilen und so einer emischen Interpretation den Weg freizumachen, muss man alle Variablen des Makro-Mikro-Makro-Modells untersuchen. Zu diesen gehören vor allem (1) die soziale Situation des Akteurs/der Akteurin, (2) die Entscheidungsregel bei der Auswahl der Handlungsalternativen und (3) die Transformationsregel zwischen Mikro- und Makroebene.

Im Grunde genommen besteht die „soziale Situation“ aus einem breiten Spektrum von verschiedenen Faktoren. Zu ihnen zählen physische und psychische Merkmale des Akteurs/der Akteurin (Körper, Ausbildung, Erfahrungen, Erlebnisse), Gesellschaft (Verhältnisse, Gesetze, Werte, Technologie) und Natur. Jedes dieser Elemente kann auf das Individuum beschränkend oder anregend wirken. Welche dieser Faktoren bei der Beeinflussung der menschlichen Handlung wegweisend sind, lässt sich oftmals nicht genau erschließen. Daher muss man meist eine Hypothese aufstellen, die eine Brücke zwischen Makro- und Mikroebene darstellt.[17] Die oben erwähnten Faktoren bilden also die Rahmenbedingungen, die weitere menschliche Handlungen ermöglichen. In den meisten Fällen hat der/die AkteurIn mehr als eine Handlungsmöglichkeit. Bei der Auswahl der „besten“ möglichen Handlung muss der/die AkteurIn unbedingt anhand einiger selbst selektierter Kriterien entscheiden. Obwohl es viele Ansätze gibt, wie in diesem Fall vorzugehen ist, wird in dieser Arbeit das sog. RREEMM-Modell genutzt. Bei diesem Modell, das für *Resourceful, Restricted, Expecting, Evaluating, Maximizing Man* steht, liegt die menschliche Rationalität im Vordergrund. Der handelnde Mensch, der sich seiner Ressourcen, Möglichkeiten und Einschränkungen bewusst ist, zielt seine Handlung und Erwartungen auf den maximalen Nutzen bei minimalen Kosten ab. Ein solcher Mensch kann daher auch als rationaler Mensch bezeichnet werden. Man muss aber beachten, dass „rational“ nicht notwendigerweise nur eine ökonomische bzw. gewinnbringende Handlung bedeuten muss. Es bieten sich auch andere Formen von Nutzen an – Prestige, Ruhm, Wohlbehagen usw.[18] Eine rationale bzw. wert-erwartende Handlung zielt deshalb auf eine solche Handlungsalternative ab, die mit minimalen Kosten den verlangten und erwarteten Gewinn erreicht.

Im Folgenden wird versucht, die Frage nach der Lage des heutigen Kalvarienberges mithilfe der emischen Perspektive zu beantworten. Zuerst werden die gesamtgesellschaftlichen Bedingungen, die im 17. bis 18. Jh. zur Errichtung

13 Gillessen, Mühlau 1994, 28–29.

14 Greve, Schnabel, Schützeichel 2008, 8.

15 Doneus 2013, 313.

16 Das Konzept von „emics“ und „etics“ wurde von dem Linguisten und Anthropologen K. L. Pike entwickelt: Pike 1990, 31.

17 Mehr zur Konstruktion der Brückenhypothesen in Kunz 2004, 107–133. – Doneus 2013, 315.

18 Doneus 2013, 313.

landschaftlicher Denkmäler religiösen Charakters führten, vorgestellt (Makroebene). Danach wird versucht, diese Bedingungen im damaligen Ungarn bzw. in der Burgherrschaft Červený Kameň zu identifizieren (Mikroebene). Dabei werden solche Haupteigenschaften hervorgehoben, die für die Errichtung der Kalvarienberge von Relevanz waren. Diese werden am Beispiel des Kalvarienberges im Vorfeld der Burg Červený Kameň demonstriert (emische Interpretation). Die Analyse der Standortwahl dieses Kalvarienberges wird auch aufgrund „objektiver" Daten untersucht (etische Analyse). Schließlich werden die Rückschlüsse dieser Analyse durch eine Konfrontation mit der emischen Interpretation falsifiziert oder verifiziert.

5. Gesellschaftsbedingungen des 17.–18. Jhs.

Im 18. Jh. wurde die Errichtung von Kalvarienbergen und Kreuzwegen in Mitteleuropa breit propagiert und unterstützt, besonders durch die Franziskaner.[19] Ihre Aktivität entsprang aus ihren Tätigkeiten im Heiligen Land, wo sie nach dem Abzug der Kreuzfahrer mit der Obsorge über alle Kirchen, Klöster, Hospize und vor allem Leidensstätten Christi (*Custodia Terrae Sanctae*) beauftragt wurden.[20] Von hier aus verbreiteten sie den Kult des Heiligen Kreuzes und der Passion Christi in ganz Europa.[21] Eines der demonstrativsten Mittel, um das Leiden Christi sichtbar zu machen, waren im mitteleuropäischen Raum Kreuzwege und Kalvarienberge. Zur ihrer Verbreitung verlieh der Papst den Franziskanern sogar das Privilegium, neue Kreuzwege zu errichten und sie einzuweihen. Als Vorbild diente den Franziskanern die ursprüngliche *via crucis* in Jerusalem, die von einer Franziskanerkirche zum Kalvarienberg geführt hatte. Da der Passionsweg auf dem Berg Golgotha endete, suchten die Franziskaner bei seiner Nachahmung ebenfalls einen Berg. Wenn das nicht möglich war, platzierten sie die Kreuzigung Christi auf einem künstlich aufgeschütteten Hügel. Das war auch bei dem ersten in der Slowakei entstandenen Kreuzweg der Fall, der 1647 in Trnava (nur 19 km östlich von Červený Kameň) erbaut wurde. Es muss aber darauf hingewiesen werden, dass einen großen Anteil an der Verbreitung von Kreuzwegen in der Slowakei auch der Jesuitenorden hatte, auch was den Fall von Trnava angeht.[22] Abgesehen davon, welcher Orden zur Verbreitung der Kreuzwege mehr beigetragen hatte, galten bei ihrer Konzeption die gleichen Regeln – ein Hügel war in den meisten Fällen notwendig. Dies trifft gleichermaßen für die ältesten slowakischen Kalvarien in Spišská Kapitula (vor 1670), Skalka pri Trenčíne (1676) und Bratislava (1694) zu.[23]

6. Die landschaftliche Situation in der Burgherrschaft Červený Kameň

Das 18. Jh. war auch in Ungarn durch eine stärkere Betonung auf das kirchliche Leben gekennzeichnet. Die Zeit der Rekatholisierung, die im neuzeitlichen Ungarn gleichzeitig mit den Türkenkriegen und antihabsburgischen Aufständen zusammenlief, trug deutlich zur übersteigerten religiösen Wahrnehmung bei. In jener Zeit verbreiteten sich rasch neue kirchliche Feste, Heiligenverehrungen, Prozessionen, Wallfahrten usw. Auf diesem Feld waren vor allem die Jesuiten tätig.[24] Dem Trend entzog sich auch die Herrschaft Červený Kameň nicht. Über das religiöse Leben der hiesigen Bevölkerung berichtete Pavol Jedlička (1844–1917), der Pfarrer von Horné Orešany, in seinem Werk „Kiskárpáti emlékek" (Denkmäler der Kleinen Karpaten). Kurz beschrieb er auch die kirchlichen Denkmäler, die zu seiner Zeit noch im Vorfeld der Burg zu sehen waren. Es ging vor allem um den Kreuzweg, der, wie Jedlička hinweist, unvollendet war. Der Kreuzweg bestand ursprünglich nur aus fünf bis sieben Stationen. Nach heutigem Wissensstand entstand dieser Kreuzweg in den 60er bis 80er Jahren des 18. Jhs.[25] Er war mit einer Kapelle abgeschlossen, die der herrschaftliche Beamte Ján Škultéty und seine Frau Katarína im Jahr 1745 als Dankesbezeigung für eine überwundene Cholera-Epidemie aufbauen ließen.[26] Über der Kapelle auf dem Kalvarienberg befand sich die Kreuzigung Christi, die hier zum ersten Mal im Jahr 1751 erwähnt wurde.[27] Nach Jedlička soll in der Nähe der Kapelle auch ein Eremit gewohnt haben. Bezeugt ist das durch die Chronik der Eremitage und der Kapelle, die Unserer Lieben Frau von Schnee gewidmet ist. Ein ehemaliger Tuchmachergeselle aus Mähren namens František bat nach seiner Romreise, wo er dem Franziskanerorden beigetreten war, Rudolf I. Pálffy um seine Einwilligung, in der Nähe der Burg Červený Kameň als Eremit zu leben. Rudolf ließ ihm im Jahr 1743 unter dem Kalvarienberg (Abb. 7) eine Eremitage aufbauen. Hier lebte er bis 1750, als er durch einen anderen Eremiten, Pierre Aubertin de Richmond,[28] ersetzt wurde. Er ließ hier auch das Gnadenbild der Jungfrau Maria von Sokal aufstellen, was bald einen regen Pilgerverkehr zur Folge hatte. Der unternehmende Eremit organisierte hier systematisch die Verehrung dieses Gnadenbildes. Dank der

19 Čičo, Kalinová, Paulusová 2002, 11.
20 Wohnout 2000, 13.
21 Melvin 2012, 143. – Mikulec 2013, 43.
22 Liszka 2011, 120.

23 Čičo, Kalinová, Paulusová 2002, 15–16.
24 Čičo, Kalinová, Paulusová 2002, 10–12.
25 Čičo 2002, 133.
26 Jedlicska 1882, 116. – Hupko, Janáčková, Tihányi 2012, 144.
27 Čičo 2002, 135.
28 Hupko, Janáčková, Tihányi 2012, 144. – Sedlák o. J., 2.

Abb. 7. Der heute dicht bewaldete Kalvarienberg (weißer Pfeil) vom nördlichen Burgturm aus gesehen. Im Vordergrund liegt die zweite Vorburg (Foto: M. Neumann, 2019).

Abb. 8. Die Kapelle unter dem Kalvarienberg (Foto: M. Neumann, 2019).

Spenden konnte er in den Jahren 1752–1753 zur Kapelle einen Turm mit Glocken hinzubauen, einen Brunnen graben lassen und die Kapelle wie auch seine Eremitage ausweiten.[29] Um die Kapelle kümmerte sich auch der Burgherr Rudolf I. Pálffy. In seinem Testament aus 1756 hinterließ er dem oben erwähnten Eremit 50 Gulden.[30] Auch die Ehefrau des Stifters, Katarína Škultéty, soll den Eremiten beauftragt haben, die Kapelle sauber zu halten. Nach dem Tod von Pierre Aubertin im Juni 1762 begann der allmähliche Verfall der Kapelle und der Eremitage. Mit der Abschaffung der kirchlichen Prozessionen und Wallfahrten durch Josef II. wurde ihr Schicksal besiegelt.[31] Im Jahr 1781 wurden die Kapelle und die Eremitage aufgehoben. Das Gnadenbild der Jungfrau Maria von Sokal gelangte in die Burgkapelle, wo es bis in die Mitte des 20. Jhs. geblieben ist.[32] Somit verloren beide Objekte, Kapelle und Eremitage, ihre ursprüngliche Funktion. Die Eremitage wurde zu einem Wirtshaus, dessen BewohnerInnen mit der Pflege der Kapelle beauftragt wurden. In der zweiten Hälfte des 19. Jhs. wurde auch dieses Haus verlassen, was die Vernachlässigung der Kapelle zur Folge hatte.[33] Deshalb entschloss sich Štefan Pálffy im Jahr 1869, die Kapelle zum Zwecke einer privaten Familiengruft umzubauen (Abb. 8).[34]

Die Bauaktivitäten, die im Burgvorfeld im 18.–19. Jh. stattfanden, sind auf mehreren erhaltenen Quellenarten, vor allem Karten und Grafiken, gut zu sehen. Das gilt auch für natürliche topografische Elemente, in diesem Fall vor allem Erhebungen, Hügel und Anhöhen. Jede dieser Quellenarten kann wichtige Informationen über die vergangene Landschaft liefern. Diese können bisherigen Erkenntnissen gegenübergestellt werden und somit eine Aussage über die Anwendung der oben erwähnten Regeln liefern (d. h. Kreuzigung auf einem Hügel). Im Folgenden soll auf die einzelnen Quellen kurz eingegangen werden.

Aussagekräftige Informationen über die Landschaft im Vorfeld des Burgareals liefern vor allem kartografische Quellen. Obwohl ihre geografische Genauigkeit manchmal schwankend und fraglich ist, spielen diese Quellen bei der Landschaftsrekonstruktion eine unersetzbare Rolle. Da die landschaftlichen Strukturen gesellschaftliche Werte widerspiegeln, stellt ihre Nachverfolgung in der Landschaft unser Ziel dar. Im Folgenden wird die Aufmerksamkeit auf die Gegend der Burg Červený Kameň gelenkt, bzw. auf die erhaltenen Kartierungen, wo das unmittelbare Burgvorfeld abgebildet wurde.

Die erste militärische Aufnahme wurde in Ungarn zwischen 1763–1787 realisiert.[35] Da es sich um eine militärische Aufnahme handelte, sollten durch Ingenieur-Offiziere des Generalstabes vor allem die aus militärischer Sicht wichtigen landschaftlichen Merkmale abgebildet werden, kartografische Genauigkeit stand aus technischen Gründen erst an zweiter Stelle. Auch deshalb wurden in den Karten nur dominante Erhebungen aufgezeichnet. Dieser Nachteil ist aber durch umfangreiche Landschaftsbeschreibungen ausgeglichen, die während der Vermessungsarbeiten zusammen mit den Kartierungen angefertigt wurden. Deshalb besitzt die erste militärische Aufnahme einen hohen Informationswert, jedoch nicht aus kartografischer Sicht.

Die Umgebung von Červený Kameň wurde fast ganz am Ende dieser Kartierung aufgenommen (zwischen 1782–1784). Aus der Aufnahme erschließt sich, dass das ganze Burgareal von Wäldern umringt war (Abb. 6). Nur auf der Nordseite lag eine schmale, aber lange Schneise, die das Burgvorfeld mit den zum Dorf Častá gehörenden Weinbergen verband. Die Schneise respektierte den Verlauf des Kreuzwegs, der vom Haupttor zum Kalvarienberg führte. Der Berg selbst ist aber kaum zu sehen. Die ersten fünf Stationen des Kreuzwegs lagen auf einer Weide nördlich des Burgareals. Danach folgte eine Kapelle, die spätere Familiengruft der Adelsfamilie Pálffy. Der ganze Zyklus wurde durch die Kreuzigung Christi auf dem Kalvarienberg abgeschlossen. Das Burgvorfeld wie auch der Kreuzweg wurde von einem Hauptweg durchquert, der das Dorf Častá mit dem Gidra-Tal verband. Ganz am Ende der Dorfbebauung von Častá trennte sich ein Weg, der im Waldbewuchs kaum zu sehen ist. Mit größter Wahrscheinlichkeit handelte es sich um eine Abkürzung zum Kalvarienberg, was auch seine Richtung klar andeutet. Zwischen Burgareal und Hauptweg sind auf der ersten militärischen Aufnahme keine Verbindungsstrecken zu sehen. Wichtig ist, dass der Wald ganz dicht an die östliche Seite des Kreuzwegs reichte. Der Waldrand grenzte auch an die westliche Mauer des Burgareals, sodass ein wesentlicher Teil des heutigen Parks bewachsen war.

Auf den ersten Blick ist ersichtlich, dass die unmittelbare Burgumgebung mehr als 70 Jahre später eine wesentliche Veränderung erlebte (Abb. 9). Die Karte von 1857 wurde durch den Herrschaftsingenieur Johann Gregorovich angefertigt. Es kann vermutet werden, dass diese Karte wirtschaftlichen Zwecken dienen sollte, weil hier nicht nur

29 Sedlák o. J., 3.
30 Jedlicska 1882, 117.
31 Niederstätter 2007, 142.
32 Hupko, Janáčková, Tihányi 2012, 144.
33 Sedlák o. J., 5.
34 Jedlicska 1882, 116. – Sedlák o. J., 5.
35 Jankó, Porubská 2013, 7–9.

Abb. 9. Die Burg Červený Kameň und ihre Umgebung auf der Karte von J. Gregorovich (1857). – 1–2. Stationen des Kreuzwegs. – 3. Kapelle. – 4. Kalvarienberg (Slovenský národný archív, Fond Pálffy, Zbierka máp a plánov, Signatur 383a).

die Parzellen und Wege, sondern auch der Baumbestand und einzelne Baumarten aufgezeichnet wurden. Da es sich wahrscheinlich um eine Wirtschaftskarte handelt, unterscheidet sich ihre Aussagekraft von einer militärischen Kartierung. Die topografischen Merkmale, etwa jegliche Erhebungen, wurden wie auch bei der ersten militärischen Aufnahme nicht kartiert.

Auf der Karte von 1857 wurde das Vorfeld des Burgareals erheblich gelichtet. Demgegenüber verwuchs die nach Nordosten gerichtete Schneise. Die Waldränder traten von den Burgmauern offenbar zurück. Als neues Element erschien mitten auf der Weide ein langer Weg, der vom Haupttor bis zum Wald führte. Diese Strecke bzw. Allee war schon auf der von 1736 stammenden Grafik Mikovínys zu sehen. Erhalten blieb auch der Kreuzweg, obwohl hier nur zwei Stationen sowie die Kapelle dargestellt wurden. Viel komplexer scheint das aufgenommene Wegenetz: Die Hauptstrecken waren der Weg gegen Norden, der sich im Wald gabelte, und der von ihm abtrennende Weg zum Dorf Častá. Andere Wege, wie es scheint, hatten nur zweitrangige Bedeutung; alle lagen westlich von dem Burgvorfeld. Der nördlichste Fußweg wand sich entlang einem kleinen Gerinne bis zu seiner Quelle unter dem Berg Veľké Vápenné. Diese Quelle ist auf der dritten militärischen Aufnahme als Schindelbründl bezeichnet. Der zweite Fußweg begann bei dem Haupttor, zog sich durch die Weide in den Wald und drehte sich hier gegen Westen bzw. Südwesten. Der Fußweg endete plötzlich im Wald, was aber die ursprüngliche Realität mit größter Wahrscheinlichkeit nicht widerspiegelt. Einen Weg zum Gidra-Tal dürfte auch die zweimal gekurvte Linie zwischen zwei Waldkomplexen westlich der Burg andeuten.

Am Anfang des 19. Jhs. begannen die Arbeiten an der zweiten militärischen Aufnahme (1806–1869). Im Unterschied zur ersten wurde diese durch die Offiziere des Generalstabes viel genauer ausgefertigt. Die Absicht ihres Auftraggebers war die Präzisierung der vorigen Kartierung, was sich auch auf den Karten widerspiegelte, wie etwa eine einheitliche Legende und astronomisch-trigonometrische Vermessung. Eine Neuheit war die Höhenaufzeichnung durch Schraffur. So konnten dominante Erhebungen im Terrain leicht erkannt werden.

In der Umgebung von Červený Kameň wurden die Vermessungsarbeiten erst kurz nach 1857 realisiert (Abb. 10).[36] Die Hauptachse im Burgvorfeld – der gegen Norden führende Weg – wurde hier durch eine lange Allee hervorgehoben. Der Hauptverbindungsweg war eindeutig der Weg nach Častá, was auch die rot gemalte Linie auf der Aufnahme, eine sog. Chaussée der zweiten Klasse, unterstreicht. Andere Wege waren nur von zweitrangiger Bedeutung. In das Gidra-Tal führten laut dieser militärischen Aufnahme zwei Wege, die von der Allee abzweigten. Der südliche ging vom Haupttor quer durch die Weide. Der nördliche war die natürliche Fortsetzung des Hauptweges von Častá. Beide erwähnten Wege knüpften an den vom Berg Veľké Vápenné abfallenden Weg an. So bildeten sie einen breiten Hohlweg, der dann schließlich das Gidra-Tal erreichte. Außerdem aber mündete auch ein Fußweg ins Tal, der den erwähnten Hohlweg von der Nordseite umging. Ein Bündel von Fußwegen befand sich auch östlich von der Allee. Einer von ihnen führte von dem Haupttor entlang dem Kreuzweg direkt zur Kapelle. Hinter ihr erhob sich auf einer schraffierten Anhöhe die Kreuzigung. Der zweite hatte einen nicht identifizierbaren Punkt im Wald zum Ziel. Der dritte der Fußwege führte südöstlich und zweigte gegen das Gidra-Tal bzw. gegen die Weinberge südlich von Častá ab. Es scheint, dass der auf der ersten militärischen Aufnahme von Častá bis zum Kalvarienberg führende Weg verlassen wurde. Dagegen entstand eine neue Verbindung zwischen dem nach Častá abfallenden Hauptweg und den hinter der Dorfbebauung vorliegenden Tennen. Ein Fußweg zweigte nach Westen ab. Erst dieser Fußweg gabelte sich in zwei Richtungen: Einer

36 Jankó, Porubská 2013, 17–19.

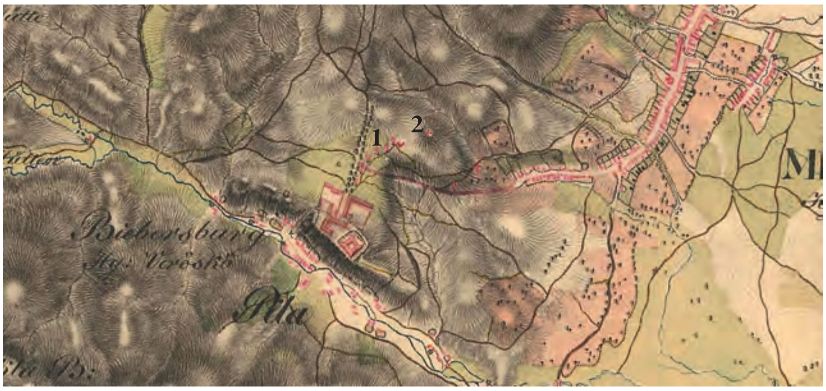

Abb. 10. Die Burg Červený Kameň und ihre Umgebung auf der zweiten militärischen Aufnahme (nach 1858). – 1. Kreuzweg. – 2. Kalvarienberg (www.mapire.eu).

Abb. 11. Die Burg Červený Kameň und ihre Umgebung auf der dritten militärischen Aufnahme (1882). – 1. Kreuzweg. – 2. Kapelle. – 3. Kalvarienberg (www.mapire.eu).

von ihnen führte zu dem nicht identifizierbaren Punkt am Waldrand, der zweite hatte die Kapelle zum Ziel.

Die dritte militärische Aufnahme wurde in den Jahren 1869–1887 realisiert und gehört zu den genauesten österreichisch-ungarischen Aufnahmen. Die Kartierung, veranlasst durch das Reichskriegsministerium, zeichnet sich durch eine sehr präzise Ausfertigung aus. Zum ersten Mal wurden auch Höhenschichtlinien aufgenommen, was die Erhebungen im Terrain noch besser veranschaulichte. Wie auch während voriger Kartierungen, wurden hier die aus militärischer Sicht wichtigen topografischen Elemente gekennzeichnet.[37] Die Umgebung des Dorfs Častá wurde 1882 kartografisch aufgenommen (Abb. 11). In der Nachbarschaft der Burg Červený Kameň ist zu sehen, dass die Hauptdominante des Burgvorfelds, die Allee, erhalten blieb. So war auch der Kreuzweg mit der Kapelle allem Anschein nach unberührt. Das Burgareal wurde noch immer mit dem Dorf Častá durch den Hauptweg verbunden, westlich der Allee hat sich die Situation aber verändert. Von der Kreuzung der Allee mit dem Hauptweg nach Častá führte ein Weg gegen Westen zum Gidra-Tal. Der parallele Weg, beginnend auf der Weide vor dem Burgareal, wand sich durch einen Waldhau ebenfalls zum Gidra-Tal; beide Wege überkreuzten sich dabei aber nicht. Ganz vereinfacht scheint das Fußwegenetz: Außer dem Fußweg entlang dem Kreuzweg war nur noch ein weiterer Fußweg in Verwendung. Dieser begann hinter den Gärten im Dorf Častá, durchkreuzte den Wald und verband sich mit dem Hauptweg an der Grenze zur Weide. Andere Fußwege, z. B. der von Častá direkt zum Kalvarienberg, existierten schon nicht mehr, wie es scheint.

Aus dem Vergleich der Kartierungen kommt heraus, dass der Hügel im Burgvorfeld (der heutige Kalvarienberg) gezielt für die Errichtung der Kreuzigung gewählt wurde. Aus der ersten militärischen Aufnahme ist zu schließen, dass die Umgebung der Kreuzigung und Kapelle absichtlich an die religiösen Zwecke angepasst wurde, was z. B. an der Abkürzung zum Kalvarienberg durch den Wald zu sehen ist. Diese Tatsache, die Errichtung der Kreuzigung auf einer Erhebung, um eine bessere visuelle Verbindung mit der Umgebung zu gewährleisten, kann als Haupteigenschaft solcher religiösen Dominaten betrachtet werden und wird zur Falsifizierung auf der etischen Ebene herangezogen. Aus den alten Kartierungen ist auch abzulesen, dass sich die Landschaft in der Umgebung von Červený Kameň im Lauf der Zeit fortwährend verändert hat. Die

37 Jankó, Porubská 2013, 24–25.

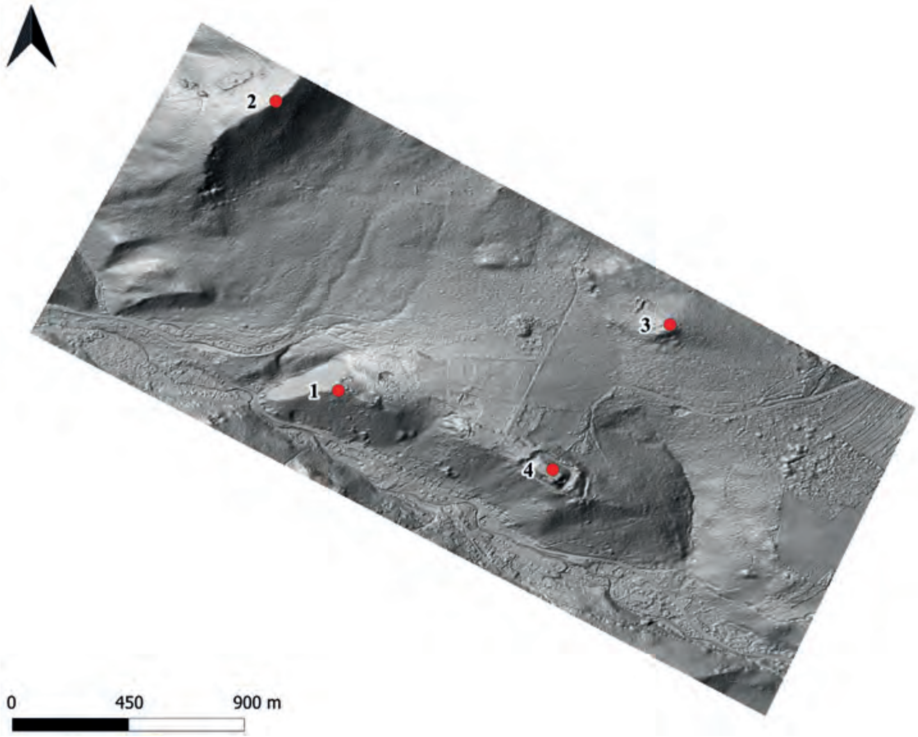

Abb. 12. ALS-basiertes DGM der Umgebung von Červený Kameň. – 1. Sporn Jelení skok. – 2. Berg Veľké Vápenné. – 3. Kalvarienberg. – 4. Burg (Datengrundlage: Národné lesnícke centrum Zvolen, Grafik: M. Neumann, 2019).

deutlichste Veränderung kann man aber eindeutig zwischen der ersten militärischen Aufnahme und der Karte von 1857 sehen. Daraus ergibt sich, dass sich nicht nur die Komposition der Burgumgebung verändert hat, sondern in der Zwischenzeit auch eine gewisse Wertwahrnehmung erfolgt sein muss. Diese Wertverschiebung ist vor allem durch die Errichtung der Kreuzigung, der Kapelle und des Kreuzwegs gekennzeichnet. Der Wandel wurde auch durch die Wegverschiebung begleitet. Als untere zeitliche Grenze für diesen Wechsel kann man das Jahr der Verfertigung des Mikovínys-Stichs (1736) halten. Die „Wechsel"-Zeit fällt also zwischen die Jahre 1736 und 1782/1784.

7. Konfrontation der emischen und etischen Interpretation

In der Umgebung der Burg befinden sich drei mehr oder weniger dominante Erhebungen (Abb. 12). Die höchste ist der Berg Veľké Vápenné mit seinen 547 m ü. d. M. Die anderen zwei, der heutige Kalvarienberg und der Sporn Jelení skok, befinden sich ganz in der Nähe der Burg, nur 600 m von ihr entfernt. Der Sporn Jelení skok (350 m ü. d. M.) liegt über dem Gidra-Tal, nordwestlich der Burg am Rande des Burgplateaus. Unweit der Burg gegen Nord-Nordosten erhebt sich die Anhöhe, die heute als Kalvarienberg (363 m ü. d. M.) bekannt ist. Während der Jelení skok-Sporn und der Berg Veľké Vápenné aus kristallinem Kalk bestehen, ist der Kalvarienberg aus Sandstein und Schiefer gebildet.[38] Alle drei Hügel sind heute dicht mit Eichen- und Weißbuchenwäldern bewachsen und durch Cambisole bedeckt.[39]

Jede der erwähnten Erhebungen hätte als Ziel des Kreuzwegs gewählt werden können. Es wurde schon festgestellt, dass die Kreuzigung Christi so konzipiert und platziert wurde, damit sie aus weiter Entfernung gesehen werden konnte. Um diese Hypothese wissenschaftlich zu untersuchen, wird versucht, dieses Attribut bei jedem ausgewählten Standort mithilfe der Sichtbarkeitsanalyse zu hinterfragen. Dazu wird ein von SRTM (Shuttle Radar Topography Mission) abgeleitetes digitales Geländemodell (DGM) genutzt. Obwohl seine horizontale Auflösung fast 30 m und die Höhengenauigkeit 16 m beträgt, ist dieses Geländemodell bis jetzt das genaueste für die ganze Slowakei.[40] Die Sichtbarkeitsanalyse wird mittels Funktion *viewshed* in QGIS durchgeführt. Als Höhe des Beobachters wurde auf

38 Biely et al. 2002, 74, 76.
39 Bucha et al. 2002, 143–144. – Šály, Šurina 2002, 106–107.
40 Bamler 1999, 148.

allen Beobachtungspunkten die Höhe von 1,75 m festgesetzt (Größe eines Menschen).

Beginnend mit dem Sporn Jelení skok ist anhand der Sichtbarkeitsanalyse deutlich zu sehen, dass dieser Standort nur eine beschränkte Aussicht gewährleistete (Abb. 13). Von dem felsigen Sporn waren nur ein Teil des Gidra-Tals und der gegenüberliegende Hang des Berges Kukla sichtbar. Sogar das Dorf Píla war größtenteils außer Sicht. Außerdem kann nur eines der Dörfer der Herrschaft einen direkten Blick auf den Sporn gehabt haben. Somit war das Potenzial des Jelení skok-Sporns als geeignetem Punkt zur Errichtung eines Kreuzwegs stark verringert. Demgegenüber hatte der 547 m hohe Berg Veľké Vápenné eine günstigere Lage. Von ihm aus kann man visuell leicht eine große Fläche beherrschen (Abb. 14). Die Mehrheit aller auf der Herrschaft befindlichen Dörfer (11 von 16) konnte von diesem Berg aus problemlos gesehen werden. Auch die Burg Červený Kameň selbst mit ihrer Umgebung lag direkt in dieser Sichtbarkeitszone. Als letzter Standpunkt bot sich der heutige Kalvarienberg. Obwohl dieser im Vergleich mit dem Berg Veľké Vápenné um fast 200 m niedriger war, gewährte er gleichfalls eine hervorragende Aussicht (Abb. 15). Mehr als die Hälfte aller Dörfer der Herrschaft (9 von 16) waren von hier aus gut zu sehen. Da sich dieser Berg gleich im Vorfeld des Burgareals befand, steht es außer Zweifel, dass die Burg mit diesem Berg in direktem optischen Kontakt stand (vgl. Abb. 7).

Die Ergebnisse der Sichtbarkeitsanalysen können aus zwei Perspektiven interpretiert werden: (1) aus der Sicht der Angehörigen der Burgherrschaft und (2) aus jener des Bauherrn. Unter der Berücksichtigung des sozialen und zeitlichen Kontexts kann vermutet werden, dass der Bauherr – wahrscheinlich Rudolf I. Pálffy – durch die Errichtung einer religiösen Anlage nicht nur seine persönlichen religiösen Werte zum Ausdruck bringen, sondern auch das religiöse Leben seiner Untertanen zur Zeit der Rekatholisierung wiedererwecken wollte. Je sichtbarer der Kreuzweg mit einem Kalvarienberg wäre, desto ostentativer würde die katholische Ideologie in der Landschaft propagiert. Für diesen Zweck waren nur zwei Erhebungen geeignet – der Berg Veľké Vápenné und der Kalvarienberg. Beide konnten visuell mehr als die Hälfte der Besiedlung kontrollieren. Damit wäre die Absicht von der Rekatholisierung der Landschaft bzw. ihrer Bevölkerung gut erfüllt.

Es kann angenommen werden, dass auch der Herrscher selbst, der durch religiöse Werte geprägt war, die Passion und Kreuzigung Christi von seiner Burg aus sehen wollte. Sehen und Gesehenwerden waren in diesem Kontext von großer Wichtigkeit. Dieser Faktor muss deshalb die Entscheidung des Bauherrn wesentlich beeinflusst haben. Das bringt uns zur eigentlichen Platzierung der Kreuzigung auf dem Kalvarienberg.

Zur Lösung dieses Problems wurde die kumulative Sichtbarkeitsanalyse herangezogen. Mit ihrer Hilfe wurde versucht, die Präferenz eines der zwei dominanten Berge (Veľké Vápenné und Kalvarienberg) nachzuvollziehen. Da der Bauherr seinen Hauptsitz in der Burg hatte, wurde diese bzw. seine vier Burgtürme als Beobachtungspunkte betrachtet. Bei allen wurde eine Standpunkthöhe von 10 m angesetzt, was der Höhe der Türme entspricht. Die Berechnung wurde auf einem von den ALS (Airborne Laserscanning)-Daten abgeleiteten Geländemodell durchgeführt. Die Ergebnisse der kumulativen Sichtbarkeitsanalyse zeigen deutlich, dass von den dominanten Erhebungen in der Umgebung des Burgareals nur der Kalvarienberg und der Berg Veľké Vápenné gut einsehbar waren (Abb. 16). Der Blick auf den über dem Gidra-Tal liegenden Sporn Jelení skok wurde durch die kleine Erhebung mit einem Wirtschaftsgebäude (sog. Schafstall) am westlichen Rande der zweiten Vorburg verdeckt. So öffnete sich dem Beobachter nur der Blick gegen Nordwesten bis nach Südosten. Weiteren Aufschluss könnte die Berücksichtigung der Bautätigkeit des Burgherrn geben. Es kann vermutet werden, dass Rudolf I. Pálffy nach dem Brand von 1758 trotz des dringenden Raumbedarfs absichtlich auf die Aufstockung des nordöstlichen Flügels verzichtete, sodass der Ausblick aus dem Wohnflügel gegen Norden und Nordosten ganz offen war. In dieser Linie stand auch der heutige Kalvarienberg. Sein Vorhaben wäre verständlich – der Burgherr, der sich zu den christlichen Werten bekannte, wollte wahrscheinlich die Szene aus den letzten Stunden Christi immer von seinem Repräsentations- und Wohnflügel aus im Auge behalten. So konnte er nicht nur eindeutig sein Religionsbekenntnis, sondern auch seine politische Zuneigung zur herrschenden katholischen Dynastie offenkundig manifestieren. Diese Auffassung kann bis zur zweiten Hälfte des 19. Jhs. angedauert haben, was eine Schneise auf dem Gipfel des Kalvarienberges belegt, die noch in der Karte von 1857 aufgenommen wurde (Abb. 9). Der absichtsvollen Auswahl des nördlich der Kapelle liegenden Hügels wurden auch andere Landschaftsstrukturen angepasst. Aus der ersten militärischen Aufnahme geht hervor, dass die Waldschneise als eine Visierlücke auf den Kalvarienberg diente. Die Achse des Waldschlages bildeten der Kreuzweg, die Wallfahrtskapelle und ganz am Ende die Kreuzigung Christi. Es ist daher kein Wunder, dass dieser „religiöser Korridor" durch die Gläubigen aus den benachbarten Dörfern zu den am Karfreitag zelebrierten Prozessionen benutzt wurde.[41]

41 Jedlicska 1882, 117.

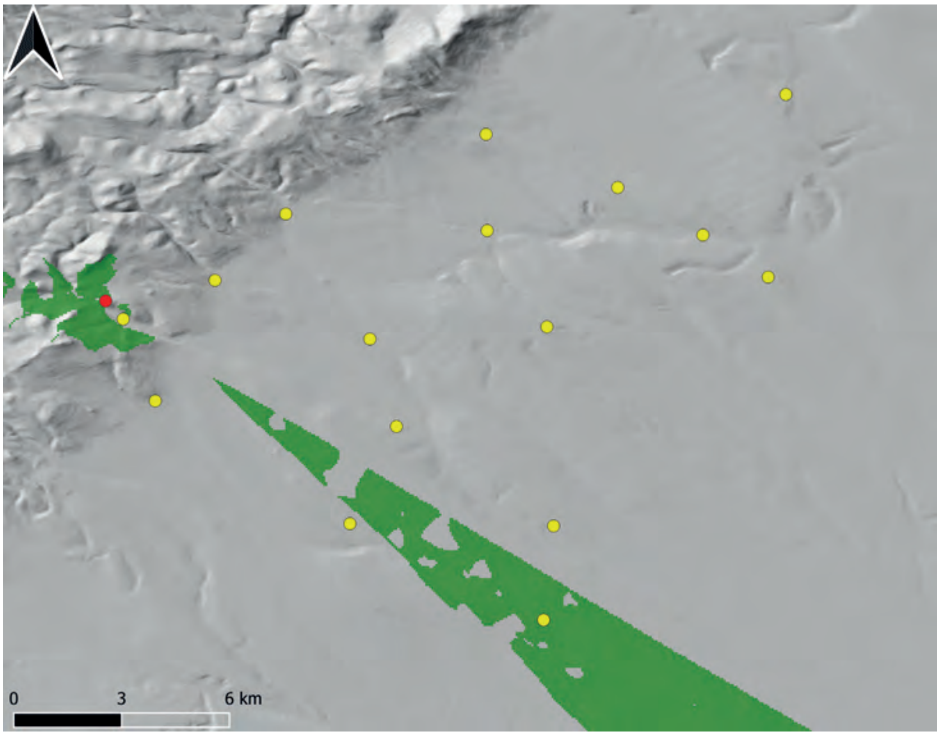

Abb. 13. Sichtbarkeit von dem Jelení skok-Sporn aus. – Roter Punkt: Aussichtspunkt. – Gelbe Punkte: Dörfer (Datengrundlage: www.geoportal.gov.sk, Grafik: M. Neumann, 2019).

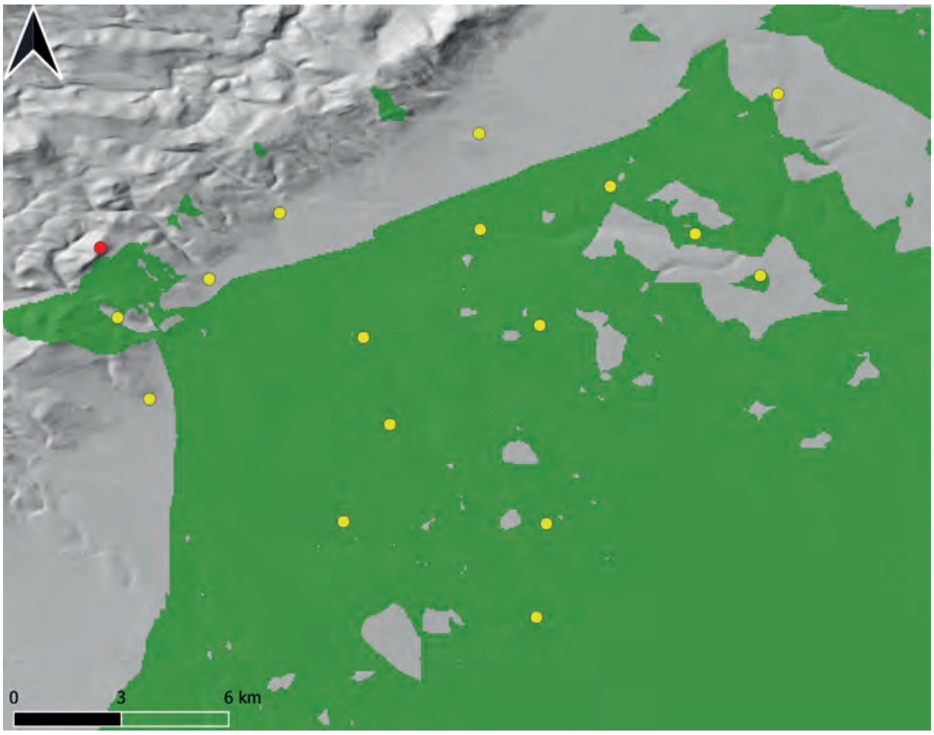

Abb. 14. Sichtbarkeit von dem Berg Veľké Vápenné aus. – Roter Punkt: Aussichtspunkt. – Gelbe Punkte: Dörfer (Datengrundlage: www.geoportal.gov.sk, Grafik: M. Neumann, 2019).

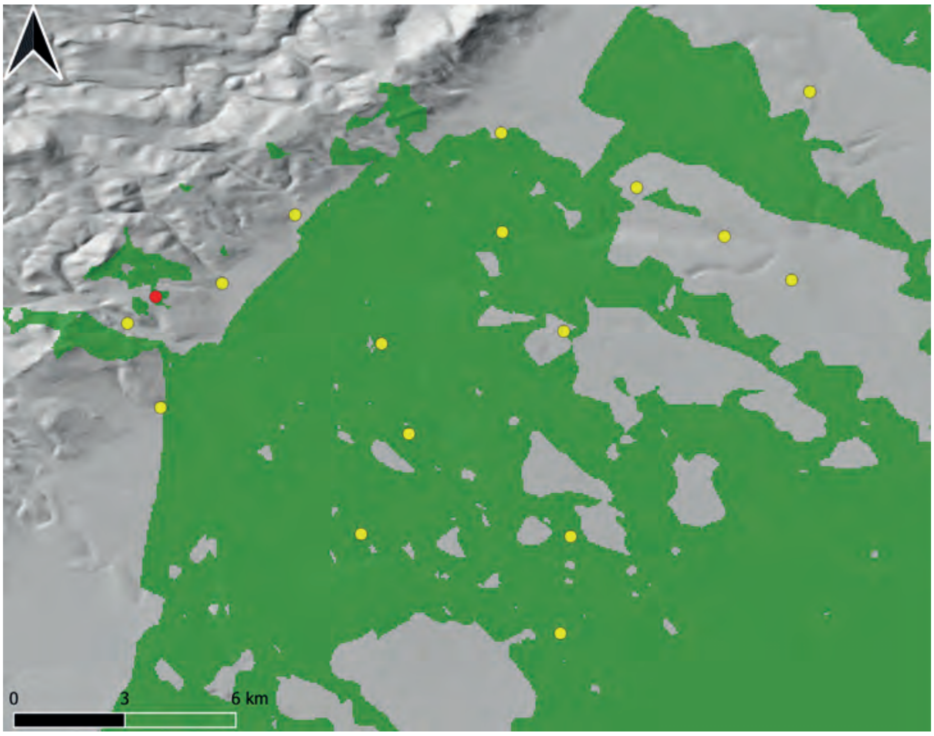

Abb. 15. Sichtbarkeit von dem Kalvarienberg aus. – Roter Punkt: Aussichtspunkt. – Gelbe Punkte: Dörfer (Datengrundlage: www.geoportal.gov.sk, Grafik: M. Neumann, 2019).

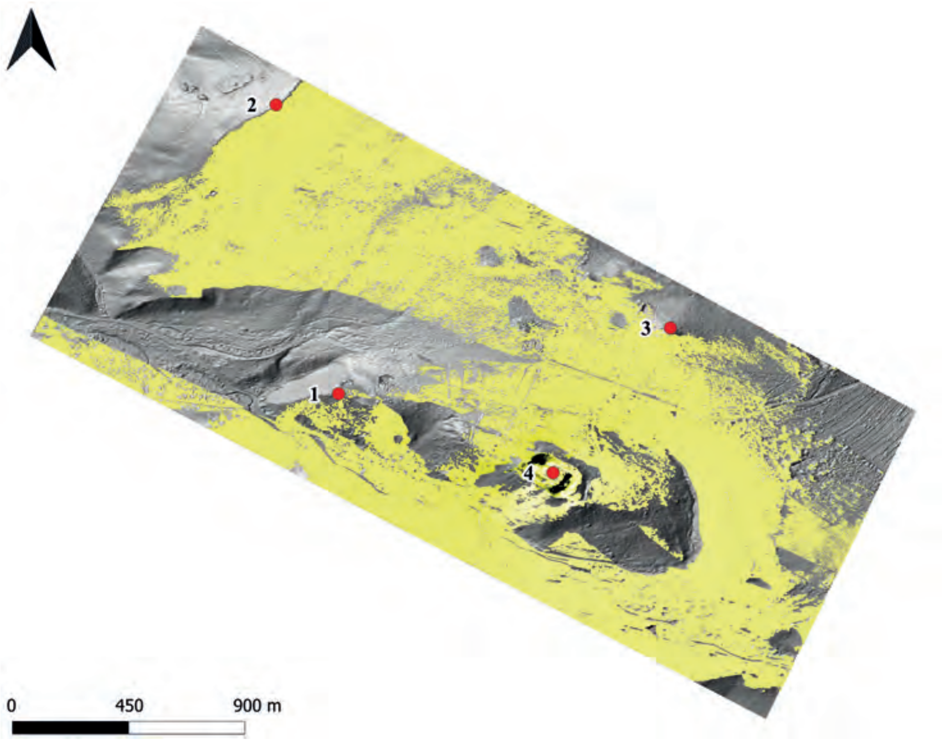

Abb. 16. Kumulative Sichtbarkeitskarte auf dem digitalen Geländemodell. Die gelbe Farbe zeigt die von den vier Burgtürmen aus sichtbare Fläche. – 1. Sporn Jelení skok. – 2. Berg Veľké Vápenné. – 3. Kalvarienberg – 4. Burg (Datengrundlage: Národné lesnícke centrum Zvolen, Grafik: M. Neumann, 2019).

Durch die etische Analyse „objektiver“ Daten, in diesem Fall die der Sichtbarkeitsanalyse, wurde gezeigt, dass die Standortwahl des Kalvarienberges auch ohne emische Analyse eindeutig und problemlos ermittelt werden konnte. Die Auswahl einer Terrainerhebung im nördlichen Burgvorfeld konnte aus historischen (schriftlichen und bildlichen) Quellen sowie durch geeignete Raumanalysen festgestellt werden. Dadurch wurde die Anwendbarkeit der etischen Interpretation im Kontext der Standortwahl bestätigt.

8. Fazit

Es hat sich gezeigt, dass beide Herangehensweisen, die hier angewandt wurden, zum gleichen Ergebnis führten. Dabei haben sich auch die unterschiedlichen Vorteile beider Methoden gezeigt. Die emische Analyse der Standortwahl hat sich vornehmlich mit kartografischen Quellen beholfen. Während ihrer Analyse wurden die Haupteigenschaften des beobachteten gesellschaftlichen Phänomens, die Errichtung der Kalvarien, hervorgehoben. Ein wichtiges Entscheidungselement spielte hier der Faktor „Sehen-und-Gesehenwerden“. Dieses Charakteristikum wurde anschließend auf der Ebene der etischen Analyse verifiziert. Durch die Anwendung der Methode der Sichtbarkeitsanalyse wurden neue Einblicke in die Interpretation der konkreten Ortsauswahl, in diesem Falle des Kalvarienberges, gebracht. Hier wurde festgestellt, dass die Rückschlüsse auf der etischen Ebene in keinem Widerspruch mit den auf der emischen Ebene liegenden Erkenntnissen standen. Somit konnte festgestellt werden, dass auch ohne schriftliche und kartografische Quellen ein wertvolles, aussagekräftiges Ergebnis erzielt werden kann. Es kann vermutet werden, dass diese Methode auch in ähnlichen Situationen zweckmäßig angewandt werden könnte, was anhand weiterer Modellbeispiele überprüft werden muss.

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Rezensionen / Reviews

Rezensionen / Reviews

Joanna Pyzel (Hrsg.), *Ludwinowo, stanowisko 7: Osada neolityczna na Kujawach / Ludwinowo, Site 7: Neolithic Settlement in Kuyavia.* Ocalone dziedzictwo archeologiczne 8 / Saved Archaeological Heritage 8. Profil-Archeo Publishing House and Archaeological Studio, University of Gdańsk Publishing House, Pękowice – Gdańsk 2019, 361 Seiten, Text auf Polnisch und Englisch in zwei Spalten nebeneinander, 48 Schwarzweiß- und 44 Farbabbildungen, 32 Tabellen, 81 Schwarzweißtafeln, CD-ROM mit 19 ergänzenden Dateien: 5 Schwarzweißabbildungen, 1 Farbabbildung, 72 Tabellen, Hardcover, ISBN 978-83-952339-5-1, ISBN 978-83-7865-920-4.

Seit die Herausgeberin dieses umfangreichen Werkes vor 14 Jahren ihre Studie zur bandkeramischen Besiedlungsgeschichte Kujawiens veröffentlichte,[1] ist die Siedlung von Ludwinowo 7 als Schlüsselplatz dieser Region in der Forschung bekannt. Nun hat Joanna Pyzel die mehr als beachtliche Leistung vollbracht, die zu verschiedenen Zeiten und von verschiedenen Ausgrabungsteams mit unterschiedlichen Methoden untersuchten und analysierten Teile zusammenzubringen und durch die völlige Neubearbeitung ein eindrucksvolles Gesamtergebnis vorzulegen. Für dieses anspruchsvolle Projekt konnte sie neben vielen polnischen Kolleg*innen auch mehrere namhafte ausländische Forscher*innen gewinnen, die im Rahmen großer internationaler Projekte wesentliche Beiträge lieferten. Damit gelang neben einer umfassenden Dokumentation auch eine in einigen Abschnitten beispielhafte Analyse der Funde und Befunde, was ich in weiterer Folge wenigstens kurz darzustellen versuchen werde.

Der Fundplatz liegt in einer flachwelligen von der Weichseleiszeit geformten Landschaft mit geringen Höhenunterschieden. Bei dem im Umfeld anstehenden Boden handelt es sich um Braunerde auf diluvialem Sand von guter Qualität und Fruchtbarkeit. Die Siedlungsspuren wurden bei systematischen Begehungen vor dem geplanten Autobahnbau im Jahr 2000 entdeckt und auf einer Gesamtfläche von 9,4 ha in drei Etappen ausgegraben: eine eher kleine Fläche 2000/2001, große Teile 2008/2009 und 2010, zuletzt unter zunehmendem Zeitdruck. Die bandkeramischen Siedlungsreste stellen den Großteil der ausgegrabenen Objekte dar, die zusammen mit den wenigen mittel- und spätneolithischen Befunden Gegenstand dieses Buches sind. Für die ebenfalls wichtigen Befunde von der Bronzezeit bis in vorrömische Zeit sowie die wenigen mittelalterlichen und rezenten Reste gibt es nur unveröffentlichte Manuskripte verschiedener polnischer Forscher*innen.

Die bandkeramischen Befunde werden von der Herausgeberin zusammen mit Bogumil Pilarski und Pawel Cyganiewicz dokumentiert, wobei auch fünf Gruben aufgrund ihrer Form und Tiefe als mögliche Brunnen oder Zisternen angesprochen werden; Holzeinbauten fehlen. 14 Hausgrundrisse sind überwiegend fragmentarisch erhalten und werden leider nur im Planum vorgestellt, einzelne Pfostenprofile sind mit wenigen Fotos dokumentiert. Die Pfostenmaße finden sich in einer Tabelle auf der CD-ROM. Die erhaltenen Maße der 14 Häuser schwanken zwischen einer Länge von 7,8 und 47,6 m sowie einer Breite von 5,3 bis 6,5 m. Die angeführte geringste Breite von 5,3 m bei Haus 10 ist nach Meinung der Rezensentin zu hinterfragen, da die Distanz zwischen den begleitenden Längsgruben eine Hausbreite von min. 6,3 m erlauben würde und es sich bei der einzig erhaltenen Dreipfostenreihe wohl um ein Joch von etwa 4 m Breite (die angegebene Jochbreite 3,2 m ist nicht nachvollziehbar) handelt. Die Jochbreite aller 14 Häuser beträgt in acht Fällen 3,6 m und weist eine insgesamt geringe Schwankungsbreite zwischen (3,2) 3,5 bis 4,6 m auf. Die höchste Jochbreite wurde in dem einzigen sicheren Großbau von min. 47,6 m Länge gemessen, bei dem nach Tabelle 2.1 sogar noch der Nordteil fehlen sollte, während auf Seite 39 in einer Pfostenreihe die Grenze zwischen Nord- und Mittelteil vermutet wird. In jedem Fall handelt es sich um einen sehr eindrucksvollen Großbau, bei dem lediglich der Mittelteil infolge späterer Schäden nicht vollständig erhalten ist. Weitere 17 Hausflächen (Haus 15–31) konnte Pyzel nach der Verteilung der Gruben und der Korrespondenzanalyse deren Inhalte sehr überzeugend rekonstruieren.

Die Dokumentation und Analyse der großen Fundmengen haben verschiedene Autor*innen übernommen, wobei

1 Pyzel 2006.

Pyzel mit der Keramik den Löwenanteil beisteuerte. Die mehr als 32.000 Scherben gehörten zu über 14.000 Gefäßeinheiten. Für diese präsentiert die Autorin eine umfassende technologische Analyse, bei der die Fakten auf übersichtlichen Tabellen und Diagrammen dargestellt werden. Daran anschließend führte sie eine chronologische Analyse der Keramik durch, wobei die in Ludwinowo erfassten Daten zusammen mit jenen anderer Plätze Kujawiens seriiert wurden. Daraus ergab sich für den gegenständlichen Fundplatz eine Zuordnung der Inventare zu den Phasen LBK I, LBK IIa, LBK IIb und LBK III.[2] Die ältere Bandkeramik (LBK I) fand sich nur in drei Inventaren, die mit keinem der Häuser in Verbindung gebracht werden konnten. Für die konkreten Zuordnungen der weiteren Inventare zu Haushalten stellt Pyzel auf Basis der erhaltenen Hausgrundrisse und der Ergebnisse der Korrespondenzanalyse drei Typen der räumlichen Organisation vor. Anschließend diskutiert sie detailreich die einzelnen rekonstruierten Haushalte und deren Datierung (Haus 12 und Haus 16–30). Auf Tabelle 2.9 finden sich in übersichtlicher Weise alle wesentlichen Fakten zu den Haushalten 1–31. Die Ergebnisse der Korrespondenzanalyse der Keramik zusammen mit der Auswertung stratigrafischer Beobachtungen führten zur Erschließung von sechs Siedlungsphasen. Diese werden einzeln besprochen und in einer Grafik zusammengefasst.[3]

Bezüglich der räumlichen Organisation der Siedlung betont Pyzel zunächst, dass es sich nur um eine Gruppe von Haushalten und nicht um eine vollständige Siedlung handle und es schwierig festzustellen wäre, inwieweit das rheinische „Hofplatzmodell“ auch für die bandkeramischen Siedlungen Kujawiens gültig ist. Bei der Anwendung dieses Modells auf Ludwinowo 7 sollten in jedem der beiden Siedlungsteile maximal zwei Hofplätze bestanden haben, eine längere Hausabfolge in diesem Sinne konnte nur im Südosten anhand von hypothetisch rekonstruierten Gebäuden als mögliche Lösung aufgezeigt werden. Die Abfolge sollte nach dem sog. Großvaterprinzip[4] erfolgt sein. Die Autorin betont aber selbst die geringe Tragfähigkeit ihrer Daten für diese Rekonstruktion. Ein sehr auffälliges Merkmal der Siedlung von Ludwinowo 7 ist eine ziemlich große unbebaute Fläche zwischen dem West- und dem Ostteil. Pyzel vermutet darin eine mögliche kommunale Zone, da sich dort auch eine als wahrscheinlicher Brunnen angesprochene große Grube befand. Derartige Freiflächen wurden ja schon mehrfach an bandkeramischen Plätzen beobachtet und dürften einen Dorfplatz darstellen. Besonders interessant an der gegenständlichen Siedlung sind einige auffällige Unterschiede zwischen dem West- und dem Ostteil. So sind die Häuser des Westteils durchgehend NW-SO ausgerichtet, während jene des Ostteils NO-SW orientiert sind. Weiter gibt es markante Unterschiede bei den verwendeten Steinrohstoffen bzw. deren jeweiligen Anteilen. Auch bei der Tiernutzung zeigen sich unterschiedliche Strategien. Überraschenderweise waren bei der Keramik weder technologische noch stilistische Unterschiede erkennbar. Inwieweit sind die beiden Siedlungsteile nun als eine Siedlung anzusehen? Die Autorin vermutet die Nutzung der beiden Siedlungsteile durch zwei verschiedene Menschengruppen, von denen eine die ersten Häuser dieses Platzes im Ostteil errichtete und die zweite Gruppe erst etwas später den Westteil zu bebauen begann. Die oben bereits besprochene Freifläche respektierten offensichtlich beide. Die unterschiedliche wirtschaftliche Struktur der Haushalte der beiden Siedlungsteile lässt sich dadurch schlüssig erklären und hat nach Meinung der Rezensentin einen hohen Grad an Wahrscheinlichkeit.

In den nachfolgenden Kapiteln mit den Ergebnissen der umfassenden Spezialuntersuchungen der Steingeräte und Tierreste werden die eben kurz angesprochenen Fakten noch detailreich präsentiert. Ganz besonders hervorzuheben ist bei all diesen Untersuchungen, dass jeweils die Fakten der einzelnen Haushalte erfasst werden und erst in weiterer Folge die Ergebnisse pro Siedlungsphase und Siedlungsteil zusammen dargestellt werden. Diese Analysen pro Haushalt sowohl für die Steingeräte als auch für die archäozoologischen Reste sind überaus wertvoll, da sie derzeit leider in der bandkeramischen Fachliteratur noch Seltenheitswert besitzen. Die Ergebnisse erlauben einen sehr interessanten Einblick in die interne Wirtschaftsorganisation der Siedlung und deren Veränderung.

Jacek Kabaciński und Małgorzata Winiarska-Kabacińska präsentieren das reiche Silexinventar von etwa 3000 bestimmbaren Stücken zunächst nach deren technologischer Struktur, die in den üblichen Gruppen von Kernpräparation, Abschlagherstellung, Klingenherstellung etc. erfasst sind und deren Anzahl auf einer übersichtlichen Tabelle pro Haushalt, getrennt nach LBK I (+II) und LBK III, angegeben wird. In gleicher Weise wird mit den Rohmaterialen verfahren, wobei der Anteil des von Beginn an dominanten Schokoladefeuersteins in der Phase III bis auf 84 % zunimmt. Bei diesem Rohmaterial sowie bei dem zweitwichtigsten, dem erratischen baltischen Flint, dessen Anteil allmählich abnimmt, ist durch die zahlreichen Reste mit Cortex deutlich, dass diese Rohmaterialien weitgehend unbearbeitet in die Siedlung gelangten. Besonders in den Inventaren der Phase LBK III zeigt sich eine hoch

2 S. 61 und Tab. 2.8.

3 S. 74 und Fig. 2.33.

4 Lüning 2005.

standardisierte Bearbeitungstechnik, wie sie auch aus anderen Plätzen Kujawiens und Großpolens bekannt sein soll. Die wenigen Geräte aus sonstigen Rohmaterialien dürften als Fertigprodukte an diesen Platz gelangt sein. 13 Tafeln mit sehr guten Zeichnungen der einzelnen technologischen Typen und deren verschiedener Ausformung ergänzen diesen Beitrag.

Marcin Szydlowski analysierte die Felssteingeräte. Von den ursprünglich vorhandenen 164 Objekten hatte er bereits den größten Teil aus den Grabungen 2008 und 2009 bearbeitet, die Stücke aus den anderen Grabungen hatte Bogumił Pilarski 2011 analysiert und die Ergebnisse in einem unveröffentlichten Manuskript festgehalten. Einen kurzen Überblick über die Gerättypen, deren Erhaltung, Datierung und Rohmaterial gibt Tabelle 6.1 für 160 Objekte. 25 Dechsel und deren Fragmente sind aus Amphibolit (Aktinolit Hornblendeschiefer) gefertigt, als dessen Ursprungsgebiet Marcin Krystek das Isergebirge in Nordböhmen feststellen konnte.[5] Zwei vollständige Mahlsteine und 17 Fragmente sind aus verschiedenen Rohmaterialien gefertigt. Zwei Abbildungen mit Schwarz-Weiß-Fotos von nur vier Dechseln und einem Lochbeil ergänzen eine ausführliche Beschreibung, in der mehrere Dechseltypen unterschieden werden. Hier hätte man sich eine grafische Ergänzung gewünscht.

Einen bemerkenswert großen Teil des Buches nehmen die umfangreichen Untersuchungen zu den insgesamt fast 18.000 Tierknochenresten ein, wobei insbesondere die Analyse der Funde auf Basis der einzelnen Haushalte sehr verdienstvoll ist und überaus interessante Ergebnisse brachte. Marta Osypińska und Renata Abłamowicz führten die grundlegenden archäozoologischen Untersuchungen durch, wobei sie gleich zu Beginn den weitgehend schlechten Erhaltungszustand der Knochen betonen, der zu einer überproportionalen Erhaltung der großen Fragmente führte. Die üblichen Bestimmungen nach Arten und Schlachtalter zeigen durchwegs eine extreme Dominanz der Rinder, mit Abstand gefolgt von den Ovicapriden, und sehr geringe Anteile von Schweinen und Wildtieren. Die geringe Anzahl der geschlachteten Jungtiere lässt vor allem bei den Ovicapriden Milchnutzung vermuten. Die Ergebnisse einer ausführlichen Analyse der Verletzungsspuren an den Knochen ergibt eine plausible Rekonstruktion der Zerlegung der Tiere sowie Hinweise auf das Braten einzelner Teile über Feuer.

In einem eigenen Abschnitt behandeln die beiden Zoologinnen die Artenzusammensetzung sowie die jeweils erhaltenen Teile der Tiere in den 21 Haushalten, die Tierreste aufwiesen. Die gesamte Artenverteilung fassen sie auch auf einer Grafik (Fig. 7.9) zusammen, die eine durchgehende aber doch variable Dominanz der Rinder zeigt sowie größere Schwankungen bei den Anteilen der übrigen Arten – einschließlich der Nachweise von Pferd in drei Haushalten. Eine weitere Grafik erfasst die Anteile der Haustiere, wobei neben der unterschiedlich ausgeprägten Dominanz der Rinder die recht beachtlich schwankenden Anteile der Ovicapriden und Schweine auffallen. Im nächsten Punkt werden die Artenzusammensetzungen der räumlichen Verteilung und der zeitlichen Abfolge gegenübergestellt. Dies ergab eine beachtliche Differenzierung zwischen dem westlichen und östlichen Siedlungsteil, die sich im Verlaufe der Entwicklung immer weiter verstärkte. Das wird nicht nur im Text ausführlich erläutert, sondern wieder mit zwei Grafiken (Fig. 7.11–12) zusätzlich veranschaulicht. Nach Meinung der Rezensentin ist eine solche wirtschaftliche Differenzierung verbunden mit einer zeitlichen Entwicklung noch nie in so eindeutiger Weise dargestellt worden. Bei den wenigen archäozoologischen Untersuchungen auf Hausbasis wie z. B. in Cuiry-les Chaudardes[6] konnte man nur eine unterschiedliche Struktur der Tiernutzung in den verschiedenen Haustypen feststellen, die aber sehr spezifisch für diese Siedlung sein dürfte, wie der Vergleich mit den wesentlich kleineren Inventaren der ebenso analysierten Siedlung von Mold zeigte.[7]

Eine weitere Analyse der beiden Zoologinnen beschäftigt sich mit den Verbrauchsmustern der Tiere in den beiden Siedlungsteilen, für die zunächst mehrere Modelle vorgestellt werden. Damit zeigen die beiden Autorinnen nochmals die unterschiedliche Entwicklung der beiden Siedlungsteile nach den Modellen. Zusammenfassend halten sie schließlich fest, dass nach den beobachteten Schlachtmustern in beiden Siedlungsteilen immer reichlich Fleisch vorhanden gewesen sein muss. Ein auffälliges Phänomen ist das Fehlen der besten Stücke nicht nur vom Rind, sondern auch von den anderen Haustieren. Man vermutet, dass diese Stücke entweder als Jagdverpflegung aus der Siedlung entfernt wurden oder man diese sogar verhandelte.

Das Erscheinungsbild der in Ludwinowo so dominanten Rinder war besonders in den ersten Phasen noch auffällig den Auerochsen ähnlich. Man vermutet, dass dies durch die Einkreuzung von Wildtieren in den Haustierbestand oder die Einfügung von gezähmten Auerochsenkälbern in die Herde bewirkt wurde. Die allgemein beachtliche Größe der jungsteinzeitlichen Rinder in Mitteleuropa führte der Archäozoologe Erich Pucher schon vor vielen Jahren auf die mögliche Paarung von Auerochsenstieren mit Hauskühen

5 Krystek et al. 2011.

6 Hachem 2011.

7 Schmitzberger 2010.

zurück, was lange heftig umstritten war und erst vor wenigen Jahren auch durch genetische Untersuchungen in beschränktem Ausmaß bestätigt wurde.[8]

Emily V. Johnson von der Universität Exeter unternahm im Rahmen des NeoMilk-Projektes eine ergänzende Analyse der Knochenfettauswertung sowie der Frische der Knochenbrüche. Sie untersuchte mehr als 13.000 Proben, wobei 45 % der markhaltigen Knochen (1813 Stück) frisch gebrochen waren. Dies weist zwar auf eine gewisse Bedeutung der Knochenmarkgewinnung hin, der Anteil der so gebrochenen Knochen ist aber im Vergleich zu anderen bandkeramischen Siedlungen in Deutschland und Frankreich deutlich geringer. Johnson vermutet, dass in Ludwinowo die steigende Kapazität der Milchverarbeitung ein Grund für die geringere Nutzung des Knochenmarks war. Interessanterweise zeigten sich bei der Art der Zerschlagung der Knochen große Unterschiede zwischen den einzelnen Haushalten sowie Veränderungen während der Siedlungsentwicklung (Fig. 7.14).

Das letzte Kapitel der Tierknochenanalysen widmet sich den Perspektiven, die sich aus den Isotopenanalysen für die Erschließung der Praktiken der Rinderhaltung ergeben. Iain P. Kendall, Rosalind E. Gillis, Marie Balasse und Richard P. Evershed gestalteten diesen Abschnitt zunächst mit einer umfassenden Einführung in die Methoden und in die Aussagemöglichkeiten der verschiedenen stabilen Isotope. So ergaben die Analysen der Sauerstoffisotope $\delta^{18}O$, dass die Geburtsperioden von vier Monaten ähnlich waren wie jene in der Siedlung von Bischoffsheim im Elsass. Die Untersuchungen an den Kohlenstoffisotopen $\delta^{13}C$ ließen hingegen auf eine gleichmäßige Fütterung mit Gras und grasähnlichem Futter schließen, im Gegensatz zu Bischoffsheim, wo Laubfutter für den Winter wahrscheinlich gemacht werden konnte. Dieser interessante Unterschied zwischen den beiden bandkeramischen Siedlungen lässt für Ludwinowo eine ausreichend große offene Landschaft in der unmittelbaren und näheren Umgebung vermuten.

Pawel Dąbrowski, Beata Iwanek und Izabela Kdlucka gaben sich alle Mühe, die drei sehr schlecht erhaltenen Siedlungsbestattungen anthropologisch zu analysieren. Die Untersuchungen an den drei Skeletten, die der Linearbandkeramik, der Stichbandkeramik und der Brześć Kujawski-Kultur zuzuweisen sind, ergaben bloß die Grundbestimmungen und ließen keine weiteren sicheren Aussagen zu.

Ganz neue herausragende Ergebnisse erbrachten die Fettrestanalysen an bandkeramischen Gefäßen aus Ludwinowo 7. Für diese innovativen Untersuchungen zeichnet eine internationale Gruppe von Forscher*innen verantwortlich: Mélanie Roffet-Salque, Borys Banecki, Marta Krüger, Jessica Smyth, Richard P. Evershed und die Herausgeberin und Hauptautorin des Buches Joanna Pyzel. Bereits in den ersten Untersuchungen an 117 Scherben aus Ludwinowo zusammen mit Keramik aus anderen Plätzen in Kujawien waren aufsehenerregende Nachweise von Milchverarbeitung gelungen.[9] In weiterer Folge analysierte man nun insgesamt 521 Scherben, überwiegend Randstücke, von verschiedenen Gefäßtypen aus den einzelnen Siedlungsphasen und den beiden Siedlungsteilen von Ludwinowo 7. Geringfügige Konzentrationen von Lipiden zeigten sich auf 204 Fragmenten (39 % der untersuchten Scherben), die von 26 Sieben, 86 kugeligen Gefäßen (Kümpfen), acht Schüsseln und 13 Flaschenhälsen stammten. Die meisten Proben ergaben nur geringe Mengen ungesättigter Fettsäuren, wodurch sich diese Reste als alt erweisen. Auf 43 Scherben gelang der Nachweis von Bienenwachs, wobei in neun Fällen reines Bienenwachs festgestellt wurde. Dieses soll nach dem Brand zur Abdichtung der Gefäße gedient haben. In allen anderen Fällen wurde das Bienenwachs zusammen mit tierischen Fetten nachgewiesen, was auf das Kochen von Tierprodukten zusammen mit Honig zurückgeführt wird. Auch eine Abdichtung mit Wachs und nachheriger Verwendung zur Aufbewahrung nicht-fetter Flüssigkeiten, wie z. B. Wasser, wird in Erwägung gezogen.

Die höchste Konzentration von tierischen Fettresten fand sich bei den Kümpfen, was wohl zurecht auf deren Nutzung als Kochgefäße zurückgeführt wird. Besonders interessant sind aber die Siebreste, von denen etwa ein Drittel tierische Fettreste aufwiesen. Auf Fragmenten der Phasen LBK IIb und LBK III waren erstmals Milchfette von Wiederkäuern nachzuweisen. Es ist dies der erste direkte Beweis für Käseproduktion in der mitteleuropäischen Urgeschichte!

Aus den ersten Besiedlungsphasen dieses Platzes, LBK I und IIa, waren nur allgemein Fette von Wiederkäuern in den verschiedenen Gefäßtypen nachzuweisen. Erst ab der Phase LBK IIb gibt es auch Siebe und die ersten Nachweise von Milchfetten. Die Zunahme dieser Reste in Phase LBK III lässt auf eine steigende Bedeutung der Milchverwertung schließen, die mit den Beobachtungen des Schlachtprofils und der geringeren Bedeutung der Knochenmarknutzung konform geht.

Aldona Mueller-Bieniek, Magdalena Moskal-del Hoyo und Magda Kapcia untersuchten die insgesamt 700 archäobotanischen Proben, von denen nur 24 % botanische Makroreste enthielten. Aufgrund der schlechten Erhaltung waren auch nur ganz wenige Reste von Kulturpflanzen wie Einkorn, Flachs und Erbse festzustellen. Hingegen ergaben die Proben erstaunlich große Mengen an Resten von

8 Pucher, Engl 1997, 89–91. – Scheu et al. 2015, 7–8.

9 Salque et al. 2013.

weißem Gänsefuß (*chenopodium album*), dessen Früchte vermutlich als Nahrung oder Viehfutter gedient haben. Letztere Nutzung wird auch an anderen bandkeramischen Siedlungen vermutet, wo der weiße Gänsefuß zwar die am häufigsten nachgewiesene Wildpflanze ist, aber zahlenmäßig von den Resten der Kulturpflanzen um ein Vielfaches übertroffen wird.[10]

Pyzel stellt in einem knappen Abschnitt die Ergebnisse der 17 untersuchten Radiokarbonproben vor, viele Tierknochenproben waren aufgrund zu geringen Kollagengehalts nicht datierbar. Die Daten von 11 Proben aus Konnexen der Phasen LBK IIb und III bestätigten bloß den erwarteten Zeitraum, gaben aber keine Unterstützung der Phasendatierung.

In dem zusammenfassenden Schlusskapitel zeigt Pyzel die Bedeutung der Siedlung von Ludwinowo 7 vor dem Hintergrund der Forschungssituation zur Bandkeramik in Kujawien auf. Der Forschungsstand dieser Region war eher schlecht, durch den Autobahnbau hatte sich die Anzahl der Fundplätze verachtfacht. Ludwinowo wurde ebenfalls erst bei den dem Autobahnbau vorangehenden Surveys in einer für bandkeramische Siedlungen typischen Lage entdeckt, befindet sich aber etwas abseits der dichteren Nachweise der Region. Die genaue Ausdehnung der Siedlungskammer in der unmittelbaren Umgebung Ludwinowos ist ebenso unklar wie die Größe und Struktur des Siedlungsverbandes, da nur drei weitere eher kleine Plätze dieser Zone durch den Autobahnbau bekannt sind. Ludwinowo ist derzeit die größte ausgegrabene bandkeramische Siedlung in Kujawien und dürfte in ihrer Mikroregion die Funktion eines Zentralplatzes gehabt haben. Dafür sprechen die lange, durchgehende Besiedlungsdauer sowie die Verbauungsdichte. Die Struktur der Siedlung mit dicht verbauten Teilen, die durch große Leerflächen getrennt sind, dürfte das typische Organisationsmodell der bandkeramischen Siedlungen in diesem Teil Kujawiens sein.

Wenn auch noch für die Zukunft weitere Forschungen zur Funktionalität der Häuser, der Organisation der Haushalte und des Dorfes nötig sein werden, so haben doch die hier vorgestellten Ergebnisse und ihre klare Präsentation der Siedlung von Ludwinowo 7 einen herausragenden Platz in der mitteleuropäischen Linearbandkeramikforschung gesichert.

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10 Z. B. Kohler-Schneider, Caneppele 2010.

Louis Godart, Anna Sacconi, *Les archives du roi Nestor: Corpus des inscriptions en linéaire B de Pylos*, Vol. 1: Séries Aa–Fr. Pasiphae 13. Fabrizio Serra Editore, Pisa – Rom 2019; Vol. 2: Séries Gn–Xn. Pasiphae 14. Fabrizio Serra Editore, Pisa – Rom 2020, 836 Seiten (Vol. 1: xxx+386 Seiten, Vol. 2: 420 Seiten), 5 Farbabbildungen, 1181 Farbfotos, Hardcover, ISBN 978-88-3315-191-5, ISSN 1974-0565; E-ISSN 2037-738-X

und

Jean-Pierre Olivier, Maurizio Del Freo, *The Pylos Tablets Transcribed: Deuxième Édition*. Libreriauniversitaria.it edizioni, Padua 2020, xix+381 Seiten, 2 Schwarzweißabbildungen, Paperback, ISBN 978-88-3359-205-3.

Selten ist eine Textedition mit größerer Vorfreude und Spannung erwartet worden als die vollständige Edition der Linear B-Tafeln aus dem mykenischen Palast von Pylos. Exakt achtzig Jahre nachdem der amerikanische Archäologe Carl W. Blegen im Frühjahr 1939 das lange verschollene Pylos auf dem Hügelkamm von Englianos in der griechischen Landschaft Messenien wiederentdeckt hatte und als erster auf dem griechischen Festland auf mit Linear B-Zeichen beschriftete Tontafeln gestoßen war, haben Louis Godart und Anna Sacconi eine lange ersehnte, hochwertige Publikation vorgelegt. Die durch ein den Palast zerstörendes Feuer gebrannten Tafeln dieses Fundortes teilen somit das Schicksal der Linear B-Tafeln aus dem Palast von Knossos, bei denen man zwischen ihrer Entdeckung (1900–1904) und ihrer Vorlage in einer modernen Textedition (1986–1998)[1] eine vergleichbar lange Wartezeit auf sich nehmen musste. Mit der vorliegenden Edition sind nun sämtliche Textzeugnisse der Linear B-Silbenschrift, mit der in der zweiten Hälfte des 2. Jts. v. Chr. eine frühe Form des Griechischen festgehalten worden ist, von den wichtigsten Fundorten (neben Knossos auf Kreta und Pylos in Messenien sind das Theben in Böotien und Mykene in der Argolis) sowohl in Abbildung und Umzeichnung als auch in Transkription vorgelegt.

Wer sich weder vom Gesamtgewicht (ca. 2 kg) oder Gesamtpreis (€ 945) noch vom anachronistisch anmutenden Titel[2] der zweibändigen, 836 Seiten umfassenden Ausgabe abschrecken lässt, wird eine Publikation in Händen halten, bei der sich die jahrzehntelange Erfahrung der beiden Autor/innen mit der Herausgabe von Texten unterschiedlicher Schriften der ägäischen Frühzeit sofort bemerkbar macht: Sowohl die herausragende Qualität der Farbfotografien jeder einzelnen – vollständig oder nur ganz fragmentarisch erhaltenen – Tontafel oder Tonplombe als auch die ausgezeichneten, im Maßstab von 1:1 (bei den Tontafeln und Tonetiketten) bzw. 2:1 (bei Tonobjekten, die zusätzlich zur Inschrift einen Siegelabdruck aufweisen) angefertigten Umzeichnungen ihrer Inschriften lassen keine Wünsche offen. Von gewohnt hoher Qualität sind auch die Transkriptionen der Linear B-Silbenzeichen mit Silben in lateinischen Buchstaben und der ausführliche textkritische Apparat. Zudem finden sich neben der Inventarnummer des Athener Nationalmuseums nützliche Angaben zu Fundort, Schreiberhand und Dimension des jeweiligen Textzeugnisses sowie – im Bedarfsfall – zu den einzelnen zusammengehörigen Bestandteilen der jeweiligen Tafeln bzw. Tafelfragmente.

In Anbetracht der Tatsache, dass die mehrdeutige Schreibweise der Linear B-Schrift in den allermeisten Fällen eine eindeutige Übersetzung verunmöglicht, haben Godart und Sacconi bei dieser Edition auf eine Übersetzung, die zwangsläufig den Charakter einer mehr oder weniger

1 Chadwick et al. 1986–1998. – Die elf Jahre nach dem Tod von Arthur Evans durch John L. Myres veröffentlichte erste ausführliche Vorlage der Linear B-Tafeln aus dem Palast von Knossos (Evans 1952) enthält neben einer umfangreichen Einleitung inklusive einer ausführlichen Besprechung der einzelnen Linear B-Syllabogramme und Logogramme Umzeichnungen und Fotografien einer Vielzahl von Tafeln, nicht jedoch Transkriptionen, da die im selben Jahr erfolgte Entzifferung durch Michael Ventris in diesem Band natürlich noch nicht berücksichtigt werden konnte. Auch die 1951 und 1955 vorgelegten Editionen der Texte von Pylos enthalten in ihrem Hauptteil ausschließlich Umschriften bzw. Umzeichnungen, nicht jedoch Transkriptionen: Bennett 1951. – Bennett 1955.

2 Zwar nimmt der Haupttitel „*Les archives du roi Nestor*“ explizit (S. XI) auf die ursprüngliche Grabungspublikation C. Blegens („*The Palace of Nestor at Pylos*“) Bezug, in der modernen Wissenschaft sind jedoch Bezeichnungen wie „Palast des Minos“ für Knossos oder „Palast des Agamemnon“ für Mykene nicht mehr zeitgemäß. Umso mehr überrascht die zusätzliche Anfügung des problematischen Begriffs „König“.

sicheren Interpretation gehabt hätte, verzichtet. Dies kann durchaus als Reaktion darauf verstanden werden, dass die Beifügung von Übersetzungen und eines ausführlichen philologischen Kommentars durch die beiden Autor/innen bei der Textedition der Linear B-Tafeln aus Theben[3] zu teils heftiger – und vielfach durchaus berechtigter – Kritik[4] geführt hat. Mit dem Fehlen von Übersetzungen und erklärenden Kommentaren ist aber auch der Charakter der Publikation eindeutig festgelegt: Sie dient vornehmlich den Linear B-Spezialist/innen und wird außerhalb der Mykenologie wohl nur in eingeschränktem Ausmaß Verwendung finden (können).

Grundsätzlich teilt sich diese voluminöse Publikation in einen kurzen, anschaulich bebilderten,[5] zwanzig Seiten umfassenden einleitenden Teil – mit Angaben zur Entdeckung des Palastes, zur Publikationsgeschichte des Textcorpus, zu den für die Texte sich verantwortlich zeichnenden Schreiberhänden, zu den Fundstellen der Texte, zu ihrer Datierung und zum vorliegenden Textcorpus an sich (inkl. einer genauen Erklärung der für die Transkription verwendeten Sonderzeichen) – und einen langen Editionsteil, in dem die einzelnen Textserien nach ihrer konventionellen, nach inhaltlichen Kriterien vergebenen, aus zwei Buchstaben bestehenden Bezeichnung in alphabetischer Reihung geordnet sind, wobei innerhalb der einzelnen Serien eine fortlaufende Reihung gemäß der vergebenen Inventarnummern erfolgt. Während in den Editionen der knossischen und der thebanischen Schriftdokumente eine fortlaufende numerische Anordnung entsprechend den jeweiligen Inventarnummern der Tafeln gewählt worden ist, bietet die hier gewählte Anordnung entsprechend den jeweiligen Tafelserien eine deutliche Erleichterung für die Analyse von inhaltlich zusammengehörigen Textgruppen. Der erste Teil der Publikation umfasst hierbei die Serien Aa (Verzeichnisse von Frauen samt ihren Kindern) bis Fr (Verzeichnisse von teils parfümiertem Olivenöl), der zweite Teil die Serien Gn (Verzeichnisse von Wein) bis Xn (fragmentarisch erhaltene Tafeln ohne sichere inhaltliche Zuordnung). Den Abschluss bildet eine Reihe von nützlichen Anhängen. Neben einer tafelartigen Zusammenstellung der in den Texten belegten Silbenzeichen und Logogramme sowie einer nach Schreiberhänden/Schreiberklassen bzw. nach Serien geordneten Erfassung sämtlicher Textzeugnisse sind aus epigrafischer Sicht die bildhafte Aneinanderreihung einzelner Zeichen, die der jeweilige Schreiber verwendet hat, besonders erfreulich, da so die Bandbreite der Zeichenvariationen innerhalb einzelner Schreiberhände anschaulich vor Augen geführt wird. Leider sind diese Zusammenstellungen lediglich für jene Schreiberhände ausgeführt, die bislang nicht als solche identifiziert worden sind. Eine numerische Auflistung der Tafelnummern samt einer hilfreichen Zusammenstellung derjenigen Inventarnummern, die aufgrund von Zusammenfügungen einzelner Bruchstücke nicht mehr geführt werden, beschließt das Werk.

Während der weitaus überwiegende Teil dieser Publikation die in sie gesetzten Erwartungen nahezu uneingeschränkt erfüllt, birgt die Einleitung, für die Godart alleine verantwortlich zeichnet, eine Reihe von unerfreulichen Überraschungen, die im Hinblick auf die Handhabung dieses monumentalen Werkes durchaus einschränkenden Charakter besitzen.

So schlägt Godart nicht nur eine Reihe von neuen Identifikationen bei den Schreiberhänden vor, sondern führt auch eine neue Nummerierung sämtlicher identifizierbarer Schreiber ein. Er wendet sich somit von der traditionellen, in den 40er und 50er Jahren von Emmett L. Bennett Jr.,[6] dem Begründer der mykenischen Epigrafik, entwickelten und in der bislang gültigen, von Bennett und Jean-Pierre Olivier herausgegebenen Textedition[7] durchgängig genutzten, sowie in den 1980er Jahren von Thomas G. Palaima[8] in modifizierter und erweiterter Form fortgeführten Klassifikation ab, bei der die einzelnen Schreiberhände um *styli* und *classes* gruppiert sind. Dieser Bruch mit der bisherigen Forschungstradition ist bei aller Komplexität, die der Klassifikation Bennetts innewohnt, nach Meinung des Rezensenten in dieser Form kaum zu rechtfertigen. Die angeführten Gründe für das Weglassen der Kategorie *styli*, wie das auch in der weiter unten noch zu besprechenden neuen Textedition von Jean-Pierre Olivier und Maurizio Del Freo geschehen ist, sind hierbei durchaus nachvollziehbar,[9] die Einführung einer neuen Nummerierung für sämtliche Schreiberhände, die nicht auf der Zustimmung der Mitglieder des *Comité International Permanent des Études Mycéniennes* basiert, birgt jedoch das Potential für eine gehörige Verwirrung, insbesondere da in der Textedition von Olivier und Del Freo trotz diverser Neuerungen die traditionelle Nummerierung fortgeführt wird.

3 Aravantinos, Godart, Sacconi 2001.
4 S. z. B. Palaima 2002. – Palaima 2003a. – Palaima 2003b.
5 Ein wenig irritierend sind allerdings die beiden ersten Abbildungen, die das Löwentor und das Gräberrund A von Mykene zeigen. Weshalb diese beiden Abbildungen, die weder zeitlich noch geografisch noch inhaltlich zu den pylischen Linear B-Zeugnissen passen, Eingang in eine wissenschaftliche Edition der Texte aus dem Palast von Pylos gefunden haben, erschließt sich dem Rezensenten nicht unmittelbar. Im Fließtext der Einleitung wird auf diese Abbildungen jedenfalls nicht Bezug genommen.

6 Bennett 1947, 22–47, 175–178. – Bennett 1958.
7 Bennett, Olivier 1973. – Vgl. Bennett, Olivier 1976.
8 Palaima 1988.
9 S. XV.

Ebenso problematisch muss eine Reihe von Vorschlägen für neue (so ein und derselbe Schreiber für Jo 438, Jn 829 und die Ma-Serie bzw. für die Tafeln Vn 48, Vn 493 und Vn 865 sowie Un 1314 und Va 15)[10] bzw. geänderte Zuweisungen von Tafeln an bestimmte Schreiber (so unterschiedliche Schreiber für die Vorder- und Rückseite von Tn 316, wobei ersterer mit dem Schreiber der Sa-Serie und des Textes auf Wa 1148 gleichgesetzt wird, letzterer mit einem Schreiber, der auch auf An 39 und An 594 seine Spuren hinterlassen hat)[11] angesehen werden,[12] die, da sie nicht aus der konsensualen Zusammenarbeit eines vielköpfigen Teams hervorgegangen sind, nicht allgemeine Anerkennung finden und somit zu einem Durcheinander in der Forschungsliteratur – so ist zu befürchten – führen werden. Dementsprechend vorsichtig sollten auch die Rückschlüsse beurteilt werden, die auf diesen Neuzuweisungen basieren.

Zusätzlich zu den teils radikalen Änderungen bei den Schreiberhänden stellt Godart die traditionelle Datierung der Linear B-Tafeln aus dem Palast von Pylos in Frage und spricht sich für eine frühere Datierung aus. Während mit der Ausnahme von vier Dokumenten[13] eine Zuweisung sämtlicher Textzeugnisse zum Späthelladisch III B2-Zerstörungshorizont und somit eine Datierung um 1200 v. Chr. im Allgemeinen als akzeptiert gilt, greift Godart die nur sehr gelegentlich vertretene These einer Zerstörung des Palastes um 1250 v. Chr. auf[14] und versucht, sie mit paläografischen Argumenten zu untermauern, indem er eine der vier älteren Tafeln, La 994, vorsichtig demselben Schreiber zuweist, dem die zwei im Thronraum des Palastes gefundenen Tafeln La 632 und La 635 zugewiesen worden sind. Aus diesem Sachverhalt schließt Godart offensichtlich darauf, dass die überwiegende Anzahl der Schriftdokumente des Palastes von Pylos um 1250 v. Chr. anzusetzen wäre, was aber nicht aus weiteren Ausführungen, sondern lediglich aus den Bildunterschriften der Abbildungen des Thronraumes[15] und des Archivkomplexes[16] hervorgeht, die mit einem lakonischen *„Helladique Récent B1 ? : 1250 a.C.“* versehen sind. Dass eine Frühdatierung der pylischen Texte und somit des Zerstörungshorizontes des Palastes zwar ins Spiel gebracht, aber in weiterer Folge nicht ausführlich thematisiert wird, lässt den Rezensenten (und vermutlich auch zahlreiche Leser/innen) ein wenig ratlos zurück. Insbesondere vermisst man sowohl im Text als auch bei den bibliografischen Angaben eine ausgewogene Darstellung der unterschiedlichen Forschungspositionen. Aus den Ausführungen Godarts ist für den Fachfremden jedenfalls nicht nachvollziehbar, wie stark die Datierung der Texte um 1200 v. Chr. in der ägäischen Forschungslandschaft – und das aus guten Gründen – verankert ist.

Diese und andere Bruchlinien mit der bisherigen Forschungstradition haben allem Anschein nach dazu geführt, dass das ursprünglich aus vier Herausgeber/innen bestehende Team auseinandergebrochen ist und sich in zwei Hälften geteilt hat:[17] Zum einen Godart und Sacconi, die sich für die mit Abbildungen versehene Gesamtedition verantwortlich zeichnen, und zum anderen Olivier (†) und Del Freo, die quasi eine Parallelausgabe der pylischen Texte unter dem Titel *„The Pylos Tablets Transcribed. Deuxième Édition“* vorgelegt haben. Zwar sind in dieser Edition weder Abbildungen noch Umzeichnungen der Textzeugnisse enthalten noch kann sie in einigen anderen Aspekten wie dem Einband oder der Qualität des verwendeten Papieres mit der Gesamtedition von Godart und Sacconi mithalten – was sich übrigens auch im Preis recht deutlich niederschlägt –, rein inhaltlich bietet diese Edition der pylischen Texte jedoch den großen Vorteil, dass sie in vielerlei Hinsicht an den jahrzehntelang angekündigten,[18] ursprünglich von Bennett begonnenen, jahrelang gemeinsam mit Olivier ausgearbeiteten und seit 2003 in mehreren Versionen von José L. Melena in Zusammenarbeit mit einem wechselnden Herausgeberteam als *draft version* vorgelegten vierten Band der Grabungspublikation *„The Palace of Nestor at Pylos in Western Messenia“*[19] anknüpft.

Mit dieser Textedition steht der Mykenologie nun ein Arbeitsinstrument zur Verfügung, das nicht nur die Forschungsergebnisse der vergangenen Jahrzehnte im Hinblick auf die Optimierung von Lesungen und auf die Zusammenfügung von Bruchstücken – sogenannten *joins* – an einem Ort vereint,[20] sondern auch – unabhängig von einer Reihe

10 S. XIV–XV.

11 S. XIV–XV.

12 Den geänderten Zuweisungen sind im Anhang am Ende des zweiten Bandes separate Zusammenstellungen gewidmet.

13 Palaima 1988, 111–113, 171–172, hatte ursprünglich aus paläografischen Gründen fünf Texte (Ua 994, Ae 995, Xa 1419, Xa 1420, Xn 1449) ohne gesicherten archäologischen Kontext aufgrund ihres an knossische Traditionen angelehnten Schreibstils zeitlich vorsichtig mit Späthelladisch III A2 in Verbindung gebracht (um 1300 v. Chr.). Da sich aber Xn 1449 als Teil der Tafel Vn 1339 herausgestellt hat, kann diese Vermutung zumindest für diese Tafel nicht zutreffen: Melena 1996–1997, 165–166.

14 S. XVII–XVIII mit explizitem Verweis auf Thomas 2004.

15 S. XXI.

16 S. XVI.

17 Ein Hinweis darauf findet sich in der Einleitung auf S. XXVI.

18 S. z. B. Palaima 1988, 17.

19 Die auf academia.edu zur Verfügung gestellte Version trägt den Zusatz „Draft Version, November 2013“: Bennett, Melena, Olivier 2013.

20 Bislang war der überwiegende Teil der Ergebnisse dieser Arbeit in einer Vielzahl von einzelnen Aufsätzen von J. L. Melena in der Zeitschrift Minos verstreut, s. die jeweiligen Bibliografien beider Editionen.

von Neuerungen – die Forschungstradition auf eine Art und Weise fortführt, wie es für eine möglichst praktikable Benutzung unumgänglich erscheint. So wird zwar in dieser Edition nicht nur auf die Kategorie *stylus*, sondern auch auf die Kategorie *class* gänzlich verzichtet und zudem ebenfalls eine Vielzahl von neuen Schreiberzuweisungen vorgenommen[21] – die in einigen Fällen mit den Schreiberzuweisungen in der Edition von Godart und Sacconi übereinstimmen, in anderen Fällen jedoch von diesen abweichen –, doch fügen sich diese Neuerungen zwanglos in die bisherige Forschungstradition ein. Darüber hinaus findet sich am Ende des Werkes eine Konkordanz, aus der mit einem Blick ersichtlich ist, in welchen Fällen sich die Schreiberzuweisungen in dieser Edition von früheren Zuweisungen unterscheiden. Der Umstand, dass auf eine derartige Konkordanz in der Edition von Godart und Sacconi verzichtet worden ist, kann als großes Manko empfunden werden und spiegelt zugleich recht deutlich die fehlende Wertschätzung wider, die Godart und Sacconi der bisherigen Forschungstradition entgegenbringen.

Doch kehren wir wieder zu der Edition von Olivier und Del Freo zurück. Auch bei diesem Werk ist die jahrzehntelange bzw. jahrelange Erfahrung mit der Edition von Textzeugnissen unterschiedlicher ägäischer Schriften bei den überaus sorgfältigen Transkriptionen unmittelbar erkennbar. Lediglich in Einzelfällen lassen sich Kritikpunkte anführen: So ist z. B. bei der Transkription der Tafel Tn 316 bei dem Logogramm *141 zwischen Gold (AUR) und Silber (ARG) unterschieden worden. Diese Unterscheidung, die auf einen Vorschlag von Godart[22] zurückgeht und der traditionellen Lesung gegenübersteht, die in allen relevanten Logogrammen das Zeichen für Gold erkennt, hat bislang unter den Mykenologen keine allgemeine Zustimmung gefunden. Aus diesem Grund haben sich die Mitglieder des *Signary Commitee* bei der letzten mykenologischen Tagung explizit dafür ausgesprochen, eine derartige Differenzierung bis auf weiteres nicht durchzuführen.[23] Da derartige Beschlüsse als verbindlich angesehen werden sollten, hätte auf die von den beiden Autoren (und auch von Godart und Sacconi) favorisierte Differenzierung besser im textkritischen Apparat verwiesen werden sollen.

Grundsätzlich teilt sich auch dieses Werk in einen kurzen einleitenden Teil und einen ausführlichen Editionsteil. In der Einleitung finden sich zunächst allgemeine Angaben zur Klassifikation und Nummerierung der Texte, zu ihren Fundorten und den Schreiberhänden. Im Anschluss daran werden die Besonderheiten der Transkriptionen, die sich mit der Ausnahme von einigen Modifikationen an die *Wingspread Convention* halten und sich grundsätzlich nur sehr geringfügig von den Transkriptionen bei Godart und Sacconi unterscheiden, und die Bedeutung der Sonderzeichen ausführlich erklärt. Schließlich finden sich noch Erklärungen zu den beiden textkritischen Apparaten sowie zu den Angaben in der allgemeinen Konkordanz und der Liste der Neuklassifikationen bzw. der Anfügungen einzelner Fragmente am Ende der Edition.

Im Editionsteil sind die Texte in Analogie zu der Edition von Godart und Sacconi erfreulicherweise nicht nach Inventarnummern geordnet, sondern nach einzelnen Textserien zusammengefasst. Die jeweiligen Transkriptionen sind mit Angaben zu Fundort und Schreiberhand versehen sowie um zwei ausführliche textkritische Apparate ergänzt, wobei im ersten Angaben zu materiellen Eigenschaften der Tafeln selbst sowie zu epigrafischen und paläografischen Besonderheiten gemacht werden, und im zweiten Informationen zur Dimension und zu angefügten bzw. dislozierten Fragmenten (und eventuell daraus resultierenden Neuklassifikationen) zu finden sind. Mitunter sind auch bibliografische Hinweise vorhanden. Den Abschluss der Publikation, die aufgrund des Fehlens von Übersetzungen oder philologischen Kommentaren – die aber nach Meinung des Rezensenten bei derartigen Texteditionen auch gar keinen Platz haben – ebenfalls vorwiegend innerhalb der Linear B-Forschung genützt werden wird, bilden neben der bereits genannten allgemeinen Konkordanz eine Reihe von nach verschiedenen Gesichtspunkten geordnete Listen sowie zwei Tafeln, auf denen die einzelnen charakteristischen Vertreter der verwendeten Silbenzeichen bzw. Logogramme zusammengestellt sind.

Eine detaillierte Gegenüberstellung der Unterschiede in den beiden Texteditionen bei einzelnen Transkriptionen und bei Zuweisungen von Texten an bestimmte Schreiberhände kann im Rahmen dieser Rezension nicht geleistet werden. Es sei jedoch der Hinweis gestattet, dass nach Meinung des Rezensenten sowohl bei unterschiedlichen Lesungen von Silbenzeichen (so bei Un 1314.3B)[24] als auch bei unterschiedlichen Zuweisungen an Schreiberhände (so im Zusammenhang mit den Schreibern der Tafel Tn 316)[25] die Edition von Olivier und Del Freo aufgrund der stärkeren Einbindung der Forschungstradition im Allgemeinen mit dem größeren Vertrauen bedacht werden sollte. Die

21 Auf S. XIV der Einleitung werden 18 neue Schreiber genannt: vgl. S. VIII.

22 GODART 2009. – Demnach findet sich diese Unterscheidung auch in der Textedition von Godart und Sacconi.

23 NOSCH, LANDENIUS ENEGREN 2017, 837.

24 S. XIV.

25 S. XIV–XV.

gemeinsame Benutzung beider Editionen ist in jedem Fall unerlässlich: Nur aus der ergänzenden Betrachtung der Abbildungen und Umzeichnungen einerseits – deren hervorragende Qualität an dieser Stelle nochmals betont werden soll – und der Transkriptionen beider Editionen andererseits lässt sich der größte Nutzen für die Mykenologie gewinnen. Dass nach jahrzehntelangem Warten nun die Texte aus Pylos in derart vollständiger Form vorliegen, kann als überaus freudiges Ereignis für die gesamte Forschungslandschaft der ägäischen Bronzezeit betrachtet werden, wenn auch die Existenz von gleich zwei Editionen durchaus einen beträchtlichen Wermutstropfen bildet. Dies gilt insbesondere für die in den beiden nun vorliegenden neuen Editionen unterschiedlich erfolgten Nummerierungen der einzelnen Schreiberhände. Um zukünftigen Forschern unnötige Verwirrungen zu ersparen, sei abschließend der Hoffnung Ausdruck verliehen, dass unabhängig einer Reihe von durchaus zu begrüßenden Neuerungen bei der Zuweisung einzelner Texte zu bestimmten Schreiberhänden die traditionelle, in der Edition von Olivier und Del Freo fortgeführten Nummerierung beibehalten werden möge.

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Birgit Schiller, *Handel in Krisenzeiten: Ägyptisch-mykenische Handelsbeziehungen in der Ramessidenzeit.* Archaeopress, Oxford 2018, iv+208 Seiten, 7 Karten, 61 Farbabbildungen, 14 Schwarzweißabbildungen, Paperback, ISBN 978-1-78491-867-5; E-Book ISBN 978-1-78491-868-2.

Birgit Schiller hat mit ihrer 2018 erschienenen Monografie „Handel in Krisenzeiten. Ägyptisch-mykenische Handelsbeziehungen in der Ramessidenzeit" eine Publikation vorgelegt, deren Titel zwar vielversprechend klingt, die geweckten Erwartungen aber leider nicht zu erfüllen vermag.

Dem Vorwort ist zu entnehmen, dass das vorliegende Werk auf der im Sommersemester 2012 an der Humboldt-Universität zu Berlin angenommenen Dissertation der Autorin beruht. Die Einleitung belehrt uns allerdings, dass ein Teil dieser Arbeit scheinbar auf der Magisterarbeit der Autorin basiert (eine Information, die im Vorwort fehlt), welche offenbar die in Ägypten aufgefundene publizierte mykenische Keramik zum Thema hatte. „Handel in Krisenzeiten" scheint somit ein aus zwei akademischen Arbeiten kompiliertes Werk zu sein, dem in der vorliegenden Fassung beileibe nicht anzusehen ist, dass es substanziell überarbeitet wurde bzw. inwieweit die beiden Teile sich komplementär ergänzen und einer übergeordneten Fragestellung dienen.

Die Arbeit gliedert sich in ein mit „Contents" überschriebenes Inhaltsverzeichnis, ein Vorwort, zehn Kapitel zu Handel, mykenischer Importkeramik und ihren Imitationen in Ägypten und Nubien, Krisensymptomen im mykenischen Griechenland, dem Handel mit Olivenöl im Neuen Reich und einer abschließenden Betrachtung, sowie ferner einem Anhang bestehend aus diversen Registern, einem Appendix zur Dokumentation der mykenischen Keramik aus Sesebi und einem Katalog zur mykenischen Keramik in Ägypten, in welchem zwar auch die lokalen Imitationen verzeichnet sind, diese aber im Inhaltsverzeichnis nicht weiter erwähnt werden.

Der Leser wird bei einem Titel wie „Ägyptisch-mykenische Handelsbeziehungen in der Ramessidenzeit" von dieser Struktur zunächst befremdet sein, scheint doch der Inhalt des Buches nur entfernt mit dem im Titel genannten Thema zu tun haben. Nicht nur, dass entsprechende Kapitel zu den ägyptischen bzw. ägyptisierenden Funden auf dem griechischen Festland fehlen, es erschließt sich dem Leser auch nicht, warum die Autorin stattdessen (weitgehend eklektisch) in der Literatur genannte Krisensymptome der mykenischen Gesellschaft am Ende der Spätbronzezeit referiert, ohne diese in einen Zusammenhang mit dem ostmediterranen bzw. ägyptischen Handel zu setzen. Die inhaltlichen Lücken sind generell derart umfassend, dass im Folgenden nur eine kleine, nicht repräsentative Auswahl kommentiert werden kann.

In der Einleitung werden einige Fragestellungen vorgestellt, die durchaus historische Relevanz haben, wie z.B. „Auf welchen Wegen und durch wen wurde die mykenische Keramik nach Nordafrika gebracht?", „Sind die Nachahmungen (in Fayence, Ton, Alabaster, Anm. des Verfassers) erst zu dem Zeitpunkt entstanden, als die Importe aufhörten? Oder sind sie zeitgleich?".[1] Die Verfasserin betont in ihrer Einleitung, dass die „zentrale Frage" ihres Werkes der „Handel zwischen Ägypten und dem mykenischen Raum und seinem Ende in den ‚Krisenzeiten', die im 13. und 12. Jh. v. Chr. im östlichen Mittelmeerraum aufkamen" sei.[2] Leider belässt es die Autorin bei diesen Ankündigungen in der Einleitung. Nirgendwo im vorliegenden Werk wird der Frage nach den Handelswegen und -trägern nachgegangen, geschweige denn diese Frage beantwortet. Auch der Handel zwischen Ägypten und dem ägäischen Raum wird nicht umfassend erörtert. Ein einigermaßen unerwartetes Kapitel über den Handel mit Olivenöl (Kapitel 8) steht ziemlich verloren da und in keiner Weise wird klar, inwiefern der Katalog (für den die Autorin immerhin einige Museen und Archive bereist zu haben scheint) zur Beantwortung der in der Einleitung formulierten Fragen beiträgt. Schlussfolgerungen, welche auf die selbst gestellte Thematik Bezug nehmen, sucht man ebenfalls vergeblich.

Wesentliche Teile des Buches wirken unschlüssig und oft bleibt unklar, worauf die Verfasserin abzielt. Warum unter Kapitel „1.1 Zur Forschungsgeschichte" ein kurzer und etwas eklektischer Überblick über die Arbeiten zur Forschungsgeschichte der mykenischen Archäologie gegeben wird, wie etwa „Progress into the Past: The Rediscovery of Mycenaean Civilization" von William A. McDonald oder „The Discovery of the Greek Bronze Age" von Lesley Fitton, erschließt sich nicht ganz, hätte man doch eher einen Überblick über die Forschung zum Thema der ägyptisch-mykenischen Handelsbeziehungen erwartet. Letzteres wird auch später nicht nachgetragen.

1 S. 1.
2 S. 1.

Kapitel 2 und 9 beabsichtigen den ostmediterranen Handel zu behandeln. Während Kapitel 2 sich dem Handel im 14. und 13. Jh. v. Chr. widmet, behandelt Kapitel 9 (nach den entsprechenden Katalogen, einem dreiseitigen Abriss über „Krisenzeiten" und dem bereits erwähnten Kapitel über den Handel mit Olivenöl) den Handel im 12. Jh. v. Chr. Es geht aus dem Werk nicht hervor, warum sich die Autorin dazu entschlossen hat, in einem Buch über den ägyptisch-mykenischen Handel während der Ramessidenzeit ein Kapitel zum ostmediterranen Handel der späteren 18. Dynastie einzuflechten, und noch viel weniger, weshalb die Abhandlung über den Handel auf zwei Kapitel, welche an den Anfang und den Schluss des Buches gesetzt werden, aufgeteilt wird. Hier wäre eine kohärente Darstellung der Entwicklung der ägyptisch-mykenischen kommerziellen Beziehungen deutlich sinnvoller gewesen. Aktuelle grundlegende Literatur sucht man freilich in beiden Kapiteln vergeblich. Zur zyprischen Keramik in Ägypten kennt Schiller keine aktuellere Literatur als Merrillees von 1968.[3] Bei der Abhandlung über den ägyptischen Außenhandel im Neuen Reich behauptet die Autorin, dass es keinen Text aus Ägypten gäbe, der sich mit dem ägyptischen Außenhandel beschäftige. In diesem Rahmen hätte man durchaus die Reise des Wenamun rezipieren können, der ja ein ganz ausgezeichnetes Beispiel für den Status des ägyptischen Außenhandels in den vielbeschworenen „Krisenzeiten" darstellt.[4] Bei der Diskussion von ägyptischen Schiffsbezeichnungen im Papyrus British Museum 10056 und einer möglichen Lokalisierung des ägyptischen Hafens des Neuen Reichs Peru-nefer verzichtet die Autorin auf die Konsultierung der neuen Bearbeitung des Papyrus durch Roman Gundacker[5] und nennt keinen einzigen Titel der in den letzten Jahren doch umfänglichen Debatte um die Lokalisierung von Peru-nefer.[6]

Das Verständnis wird zudem durch Syntax- und Ausdrucksfehler erschwert: „Es ist möglich, mit Hilfe von eindeutig als solche identifizierbare ausländischer Ware einen Handel zu postulieren.".[7] Dieser Satz stellt den Leser durchaus vor Verständnisprobleme, und wenig später hilft die Aussage „Nach der Identifikation als Ware stellt sich jedoch die Frage, ob sie den direkten Weg zwischen Produktionsort (= Herstellungsland) oder mehrere Zwischenhändler involviert waren."[8] ebenfalls nicht weiter (Grammatikfehler im Original).

3 Merrillees 1968.
4 Schipper 2005.
5 Gundacker 2017.
6 Bietak 2005. – Jeffreys 2006. – Bietak 2009. – Bietak 2010. – Forstner-Müller 2014. – Aston, Bietak 2017.
7 S. 6.
8 S. 6.

Das dritte Kapitel widmet sich der mykenischen und mykenisierenden Importkeramik in Ägypten und beginnt mit einer kurzen Definition von „simple style" und SH IIIC1b-Keramik, die wiederum ohne aktuelle Literatur auskommt. Zur SH IIIC-Keramik sei außerdem auch noch auf die jüngste Publikation von Penelope Mountjoy verwiesen, welche auch ältere Literatur verzeichnet.[9] Im Wesentlichen findet sich in diesem Kapitel eine Auflistung jener ägyptischen Fundorte, an denen mykenische Keramik gefunden wurde. Warum dieser Teil nicht als Teil des Katalogs,[10] sondern in den Fließtext integriert wurde, erschließt sich dem Leser nicht. Es bleibt auch unklar, nach welchen Kriterien in der Literatur genannte Objekte in den Katalog aufgenommen wurden – bei einigen Stücken wird die entsprechende Katalognummer genannt, bei anderen nicht. Dieser Umstand erschwert die Benutzung erheblich. Teilweise finden sich auch schlicht Falschinformationen im Text. Auf Seite 13 behauptet die Autorin, dass in Ägypten „frühestens mit der Regierungszeit Echnatons (1351–1334 v. Chr.) mykenische Keramik nachweisbar ist". Tatsächlich ist mykenische Keramik bereits in der Thutmosidenzeit nachweisbar, wie beispielsweise in Saqqara Grab NE 1 oder Saqqara (Lepsius) Grab 16.[11] Interessanterweise wird später durchaus Gurob Grab 245 mit dem Import aus SH II erwähnt, welches in die Zeit Hatschepsuts oder Thutmosis' III. datiert werden kann,[12] seltsamerweise wird dieses Grab jedoch weder besprochen, noch findet das Objekt Eingang in den Katalog.

Inhaltlich fehlt die Auseinandersetzung mit der neueren Literatur. Zu den Fundkontexten von Gurob und Saqqara fehlt beispielsweise der Artikel von David Aston von 2011[13] und jene von Astrid Hassler von 2010 und 2011.[14] Letzterer Artikel wäre für Schiller insbesondere sinnvoll gewesen, da sie versucht, die Thematik um die mögliche Anwesenheit von Fremden in Gurob breit abzuhandeln. Auch in Details gibt es Falschinformationen. So stammt die einhenkelige mykenische Kanne aus Sedment (Kat.-Nr. Sed 1) aus Grab 53 und nicht aus Grab 263. Diesen Fehler hätte sich die Autorin ersparen können, wenn sie die aktuelle Literatur rezipiert hätte.[15] Und hätte sie die abschließende Publikation von Tell el-Borg konsultiert, wüsste sie, dass nicht nur eine mykenische Scherbe (wie auf Seite 25 angegeben) während der Grabungen gefunden worden ist, sondern

9 Mountjoy 2018.
10 S. 107–179.
11 Höflmayer 2012b, 128–136.
12 S. 19.
13 Aston 2011.
14 Hassler 2010. – Hassler 2011.
15 Franzmeier et al. 2011. – Franzmeier 2017.

tatsächlich 189 Fragmente geborgen werden konnten.[16] Die Bügelkanne aus Grab TT 357 (Kat.-Nr. DeM 6) befindet sich auch nicht im Institut français d'archéologie orientale in Kairo, sondern in Prag.[17]

Kapitel 4 widmet sich der mykenischen und mykenisierenden Importkeramik in Nubien. Es beginnt mit einer unerwarteten Einleitung zur Zweiten Zwischenzeit und der Vertreibung der Hyksos aus Ägypten, um dann zur Rolle Ägyptens in Nubien während des Neuen Reichs zu kommen. Beides überrascht in einem Buch, welches vorgibt, sich mit der Ramessidenzeit zu befassen. Kapitel 4 ist ähnlich wie Kapitel 3 aufgebaut und enthält im Wesentlichen eine Liste von Fundorten, an denen mykenische Keramik gefunden worden ist, verbunden mit mehr oder weniger ausführlichen Beschreibungen von Lage, Fundkontexten etc. Aus Gründen, die weder ausgeführt werden, noch sich dem Leser erschließen, wird der Keramik aus Sesebi besonderes Augenmerk gewidmet. Sie ist mit einer umfassenden Tabelle in Kapitel 4 vertreten, und im Anhang wurden kommentarlos Abbildungen aus Notizbüchern der Grabungsdokumentation (?) angefügt.

Kapitel 5 versucht die beiden vorherigen Kapitel zusammenzufassen, bietet aber keine neuen Erkenntnisse.

In Kapitel 6 werden Imitationen mykenischer Keramik in Ägypten und Nubien aufgeführt, wie in Kapitel 3 und 4 nach Fundorten gegliedert. Dabei ist die eingangs gegebene Definition einer Imitation bereits verwirrend: „Es ist ein Gefäß, das in seiner Form fremden Gefäßformen ähnelt, aber mit ägyptischen Materialien und – nicht nachweisbar – von einem Ägypter in der Zeit des Neuen Reiches hergestellt wurde."[18] Abgesehen davon, dass eine Definition, bei der bereits *a priori* klar ist, dass eine *conditio sine qua non* nicht nachweisbar sein wird (der Ägypter, der das Gefäß herstellt), vielleicht nicht die sinnvollste ist, ist ganz generell die Frage zu stellen, wie mit dem Begriff Imitation und Identität umzugehen ist – eine Frage, mit der sich die Autorin bedauerlicherweise nicht auseinandergesetzt hat. Tatsächlich ist im Neuen Reich zu beobachten, dass in Ägypten ägäische oder zyprische Formen in anderen Materialien „imitiert" werden, wobei eine sogenannte Imitation ohne weiteres auch eine Aufwertung darstellen kann. Base Ring I-Krüge aus Zypern wurden beispielsweise für eine gewisse Zeit in Stein gefertigt und sogar in die Levante bzw. in die Ägäis exportiert.[19] Bei diesen Fragen wäre auch die entsprechende Literatur zu den Themenbereichen *Entanglement* und *Hybridity* zu berücksichtigen, die leider in dem vorliegenden Werk ebenfalls nicht erwähnt werden.[20] Warum auf den Seiten 54–56 im Detail die verwendeten Dekorationsmotive von Fayencebügelkannen aufgeführt werden, wenn man diese nicht anschließend analysiert, bleibt schleierhaft. Wenn man schon diese Tabellen anführen möchte, so hätte sich dies freilich auch für die tatsächlich importierten Gefäße empfohlen.

Kapitel 7 ist mit „Krisenzeiten" übertitelt und behandelt kursorisch und weitgehend eklektisch einige vorgebrachte Erklärungen zum Niedergang der mykenischen Gesellschaft. Das Kapitel steht weitgehend bezugslos zum restlichen Buch und trägt nichts zum weiteren Verständnis des Themas bei. Zu dem möglichen Faktor „Instabilität" schreibt Schiller: „In einem Aufsatz über Pylos wird von Thomas Palaima darauf hingewiesen, dass die Zeit zwischen dem Tod eines Herrschers und der Machtübernahme seines Nachfolgers ein Moment politischer Instabilität oder Schwäche darstellt."[21] Damit ist für die Autorin der Faktor „Instabilität" abgehandelt. Abgesehen von dieser doch einigermaßen trivialen Aussage wird nicht erörtert, wie man sich den Zusammenbruch aufgrund von „Instabilität" vorzustellen hat, ob es archäologische oder historische Hinweise gibt, ja, welche Rolle „Instabilität" bei der Diskussion um das Ende der mykenischen Zeit gespielt hat. Ähnlich lückenhaft ist auch der Rest des Kapitels, welcher SH IIIB- und IIIC-Keramik in Gurob und Qantir diskutiert. Der tiefere Sinn dieses Kapitels hat sich dem Rezensenten nicht erschlossen. Aktuelle Literatur fehlt.[22]

Auch das achte Kapitel befremdet. Schon der erste Satz wirft mehr Fragen auf als er beantwortet: „Dieses Kapitel versucht, den Anteil mykenischer Waren am Gesamthandel bezüglich des Olivenöls festzustellen."[23] Warum wählt die Autorin ausgerechnet Olivenöl als Fallbeispiel? Welche anderen Waren wurden mit dem mykenischen Raum gehandelt und warum sind diese weniger repräsentativ? Wie hängt der Handel mit Olivenöl mit den vielbeschworenen „Krisenzeiten" zusammen? Auf all dies wird weiter nicht eingegangen. Schiller führt stattdessen aus, dass zunächst die ägyptische und mykenische Bezeichnung für Olivenöl diskutiert werden müsse, um im Anschluss lediglich den Begriff aus Linear B zu diskutieren (die ägyptische Bezeichnung folgt erst mehrere Seiten später und nach einem längeren Einschub zum Fassungsvermögen von Bügelkannen unter dem irreführenden Titel „Eigenproduktion und Nachahmungen

16 Hummel 2014.
17 Pavúk 2018 mit älterer Literatur.
18 S. 48.
19 Höflmayer 2011. – Höflmayer 2012a.
20 Maran, Stockhammer 2012. – Stockhammer 2012.
21 S. 63.
22 Dickinson 2006. – Dickinson 2010. – Knapp, Manning 2016.
23 S. 67.

mykenischer Keramik“). Schiller bleibt auch den Nachweis schuldig, dass in den von ihr behandelten Bügelkannen tatsächlich Olivenöl verhandelt wurde. Doch selbst wenn man die (unbestätigte) wissenschaftliche Ansicht teilt, dass in den Bügelkannen vornehmlich Olivenöl gehandelt wurde, bleibt auch dieses Kapitel weit hinter dem Überblick von z.B. Jorrit Kelder zurück (der im Übrigen von Schiller auch nicht zitiert wird).[24]

Das neunte Kapitel ist eine knappe Zusammenfassung des ostmediterranen Handels im 12. Jh. v. Chr., in dem die aktuelle Literatur nicht rezipiert wird. Die Seevölker werden von der Autorin immer wieder angesprochen, doch auch hier setzt sie sich nicht mit der aktuellen Debatte auseinander. Während das 2017 erschienene Werk von Peter Fischer und Teresa Bürge vielleicht tatsächlich zu spät erschienen ist,[25] als dass es noch für das hier besprochene 2018 erschienene Werk berücksichtigt werden konnte, bleibt es unklar, warum Standardwerke wie der bereits 2012 publizierte Sammelband von Ann Killebrew und Gunnar Lehmann[26] oder das bereits 2010 erschienene Standardwerk von Assaf Yasur-Landau[27] nicht rezipiert wurden.

Das zehnte Kapitel stellt schließlich den Versuch einer Zusammenfassung dar. Dennoch wird dem Leser nicht klar, was denn die ursprüngliche Fragestellung der Autorin war, mit welcher Methode diese beantwortet werden sollte (ein Katalog mykenischer Keramik in Ägypten?), und welchen Beitrag das vorliegende Buch zur Forschung geleistet hat.

Dem Fließtext ist ein Register der Gefäßtypen (wohl des Katalogs?) nachgeordnet (ohne Seitenzahlen oder Konkordanz zum Katalog), ein Register der Museen mit mykenischer Keramik aus Ägypten und Nubien (ebenfalls ohne Konkordanz zum Katalog), ein Register der Imitate aus Ägypten und Nubien (ohne Konkordanz zum Katalog), sowie ein Abbildungsverzeichnis. Dem schließt sich ein „Appendix: Dokumentation der mykenischen Keramik aus Sesebi“ an, welcher auf drei Seiten eingescannte Zeichnungen und teilweise unleserliche Beschriftungen von mykenischen Scherben enthält. Es fehlen Abbildungsunterschriften und zumindest irgendeine Form von Erläuterung, warum diese Scans hier abgebildet werden und welchen Sinn sie erfüllen.

Den Abschluss und Hauptteil bildet der Katalog der mykenischen und mykenisch-imitierten Keramik in Ägypten und Nubien. Manche Objekte sind in Zeichnung abgebildet, manchmal findet sich nur ein einzelnes Motiv, manchmal ist das Objekt als Fotografie widergegeben. Teilweise ist die Auflösung bei weitem nicht für den Druck ausreichend und die Objekte erscheinen stark verpixelt. Außerdem ist bei manchen Objekten unter dem Punkt „Datierung“ die Kontextdatierung (z.B. Ramses II.) angegeben, manchmal bezieht sich der Eintrag auf die Datierung des Objektes (SH IIIB).

Dem Katalog folgen drei Google-Earth-Karten mit einer sehr groben Einzeichnung von möglichen Handelsrouten im ostmediterranen Raum und vier Karten des Niltales mit den Fundorten von mykenischer Keramik. Weitere 75 Abbildungen, teilweise aus älteren Publikationen, teilweise von der Verfasserin, in sehr unterschiedlicher Qualität und ohne viel Erkenntnisgewinn, bilden den Abschluss der Arbeit.

Eine wohlwollende Beurteilung des Buches fällt dem Rezensenten schwer. Ganze Themenfelder werden nicht einmal angesprochen. Generell stellt sich auch die Frage, inwieweit eine Fokussierung allein auf die Thematik des mykenisch-ägyptischen Handels überhaupt sinnvoll ist, muss doch die Verfasserin durchaus zugeben, dass diese Betrachtung bei Ausblendung des zyprischen Handels unverständliches Stückwerk bleiben muss. Wünschenswert wäre gewesen, zumindest einen Überblick über den aktuellen Diskurs zum ostmediterranen Handel zu geben, wenn man sich schon aus nicht ganz nachvollziehbaren Gründen ausschließlich auf den Handel mit dem helladischen Festland konzentrieren möchte. Hierfür wären die jüngeren Arbeiten von Reinhard Jung durchaus hilfreich gewesen.[28]

Generell vermisst man die Auseinandersetzung mit der aktuellen Literatur. Das 2012 erschienene umfassende Werk von Caroline Sauvage „Routes maritimes et systèmes d’échanges internationaux au Bronze récent en Méditerranée orientale“[29] sucht man in der Bibliografie vergeblich. Die Überlegungen von Jorrit Kelder wurden ebenfalls nicht rezipiert.[30] Die Bibliografie endet im Jahr 2012, und es wurde keine Literatur aus den fünf Jahren bis zum Erscheinungsdatum des Buches rezipiert oder auch nur nachgetragen.

Auch sprachlich und formal muss das Werk als ungenügend bezeichnet werden. Dass es einen auf der Website des Verlages erwähnten *Peer-review*-Prozess überstehen konnte, überrascht. Das Buch strotzt nur so von Mängeln in Satz, Syntax und Interpunktion (unterschiedliche Schriftgrößen innerhalb eines Absatzes im Fließtext, fehlende Hochstellung von Verweisen auf Fußnoten, überflüssige Leerzeichen zwischen Wortende und folgender

24 Kelder 2009.
25 Fischer, Bürge 2017.
26 Killebrew, Lehmann 2013.
27 Yasur-Landau 2010.
28 S. etwa Jung 2015.
29 Sauvage 2012.
30 Kelder 2010.

Interpunktion). Der wissenschaftliche Apparat weist ebenfalls zahlreiche Lücken auf, regelmäßig fehlen in den Fußnoten die notwendigen Referenzen.

Abschließend kann dieses Werk tatsächlich nicht empfohlen werden. Zur Frage des Handels zwischen Ägypten und dem helladischen Festland während der Ramessidenzeit trägt dieses Buch nichts bei. Wer sich dagegen für einen Katalog mykenischer Keramik in Ägypten interessiert, wird mit dem zwar nicht veröffentlichten, aber online abrufbaren Werk von Beth Ann Judas besser bedient sein (welches im Übrigen auch in der Bibliografie des vorliegenden Buches fehlt).[31]

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Florian Ebeling, Christian E. Loeben (Hrsg.),[1] *O Isis und Osiris – Ägyptens Mysterien und die Freimaurerei*. Museum Kestnerianum 21. Verlag Marie Leidorf GmbH, Rahden/Westfalen 2018, 2. korrigierte Auflage, 519 Seiten, 348 Farb- und 84 Schwarzweißabbildungen, Hardcover, ISBN 978-3-8675-7088-6.

Ab dem 31. August 2017 fand in den Räumen der ägyptischen Sammlung des Museums August Kestner in Hannover die ursprünglich mit einer Laufzeit bis zum 25. Februar 2018 geplante, wegen des großen Erfolges jedoch bis 24. Juni verlängerte Ausstellung „O Isis und Osiris – Ägyptens Mysterien und die Freimaurerei" statt. Der gegebene Anlass war das 300-Jahre Jubiläum der „modernen" bzw. „institutionalisierten" Freimaurerei, das sich auf die Vereinigung von vier englischen Logen zur Großloge von London im Jahr 1717 bezieht. Hannover, das laut dem derzeitigen Großmeister der vereinigten Großlogen von Deutschland, Christoph Bosbach, „zurecht als Hochburg der Freimaurerei in Deutschland bezeichnet werden kann", bot sich als Veranstaltungsort geradezu an. Durch die Fokussierung auf das Ägyptenbild der Freimaurerei handelte es sich jedoch nicht um eine historische, sondern eine kulturhistorische Ausstellung, wozu wiederum das Museum August Kestner, das wiederholt mit kulturhistorischen auf Ägypten bezogenen Sonderschauen erfolgreich war (als herausragendes Beispiel sei an „Köstlichkeiten aus Kairo!" 2008 erinnert), den idealen Rahmen abgab. Das Gestaltungskonzept der Ausstellung wurde mit dem German Design Award 2019 ausgezeichnet.

Die hier zu besprechende Publikation „O Isis und Osiris – Ägyptens Mysterien und die Freimaurerei" ist jedoch keinesfalls als Ausstellungskatalog im gewöhnlichen Sinn zu verstehen, auch nicht als Begleitbuch. Vielmehr handelt es sich um ein äußerst ambitioniertes, umfangreiches Sammelwerk, das in jeder Hinsicht über die Ausstellung weit hinausweist und als ganz selbständig gelten kann. Die übliche Gliederung in Essays und einen Katalogteil gibt es nicht, auf in der Ausstellung gezeigte Stücke wird an keiner Stelle eingegangen oder auch nur hingewiesen. Nach einem Gruß-, Geleit- und Vorwort wird der umfangreiche Beitragsteil mit einem Überblick über die Entstehung und Entwicklung der frühen Freimaurerei im 18. Jh. von Markus Meumann eingeleitet. Damit ist aber nur der Rahmen abgesteckt für den zentralen Beitrag des Buches, Florian Ebelings langem Essay „Ägyptische Freimaurerei zwischen Aufklärung und Romantik".[2] Ausgehend von der Geschichte der Ägyptenrezeption wird der/die Leser/in tief in die zunehmend verästelte und teilweise schwer verständliche „Ideengeschichte" zu „Freimaurerei und Ägypten" eingeführt. Immer wieder kreist die Darstellung um das Bild, das die Bibel, v. a. in der Genesis, von Ägypten zeichnet, und um die Berichte antiker Autoren, etwa Plutarchs „Über Isis und Osiris", oder das Isisbuch der „Metamorphosen" des Apuleius (besser bekannt als „Der Goldene Esel"). Das im 15. Jh. bekannt gewordene „*Corpus Hermeticum*" des „Hermes Trismegistos", die „*Hieroglyphica*" des Horapollon, schließlich im 17. Jh. der „*Oedipus Aegyptiacus*" von Athanasius Kircher – all dies und noch vieles mehr floss in eine intensive Diskussion zu Wesen und Bedeutung der Überlieferung aus dem Alten Ägypten ein. Aber erst im späteren 18. Jh. kristallisierte sich eine speziell freimaurerische Sichtweise heraus, die die „Mysterien der Ägypter" zum Angelpunkt des Interesses machte. Von kaum zu überschätzender Bedeutung war der Roman „Sethos" des Altphilologen Jean Terrasson, der diese erstmals 1731 erschienene fiktive Geschichte um den Einweihungsweg eines ägyptischen Prinzen als Übersetzung eines griechischen Manuskriptes ausgab. Die vermeintlich authentische Schilderung eines altägyptischen Ritualgeschehens, das sich in unterirdischen Grüften unterhalb der Pyramiden abspielte, wurde in Freimaurerkreisen und weit darüber hinaus vielfach rezipiert und gedeutet, wovon nicht zuletzt die Zauberflöte und ihre zahlreichen Quellen und Anregungen ein anschauliches Zeugnis bieten. Die Suche nach einer verborgenen Tiefendimension der Natur („Weisheitslehre"), die Überwindung der Schrecken des Todes und die Elementenprobe durch Feuer, Wasser, Luft und Erde sind die Konstanten der Initiation. Umfassend, material- und kenntnisreich legt Ebeling die unterschiedlichen Deutungen, Strömungen und Entwicklungen dar, welche in den Teilen der Freimaurerei, die davon überhaupt berührt

1 Mit Beiträgen von Jan Assmann, Edzard Bakker, Winfried Brinkmann, Marcel M. Celis, Florian Ebeling, Thomas L. Gertzen, Thorsten Henke, Kirsten Konrad, Christian E. Loeben, Markus Meumann, Siegfried Schildmacher, Heike C. Schmidt, Hugo Shirley, Darius A. Spieth, Eugène Warmenbol und Holger Wenzel. Mit Übersetzungen ins Deutsche von Irving Wolther. Mit Museumsobjektfotografien von Christian Rose und Christian Tepper.

2 S. 29–125.

wurden, wiederum ganz kontroverse Aufnahme gefunden haben. So ist ein Abschnitt Cagliostros *„Rituel de la Maçonnerie egyptienne"* gewidmet, ein anderer der Loge der „Afrikanischen Bauherren", weitere der Alchemie, den Gold- und Rosenkreuzern oder den hermetischen Ritualen, etwa der „Magier von Memphis". Die „Afrikanischen Bauherren" spielen eine besondere Rolle durch die von ihnen verbreitete Ritualschrift *„Crata Repoa"*, die bis in die Populärkultur gewirkt hat, siehe etwa den Roman „Rinaldo Rinaldini, der Räuberhauptmann" von Christian Vulpius, dem Schwager Goethes. Jedoch auch die der Aufklärung verpflichteten Freimauer setzten sich mit Überlieferungen zum Mysterienkult der Alten Ägypter auseinander. Besonders tat sich dabei die Wiener Loge „Zur wahren Eintracht" und ihr Meister vom Stuhl Ignaz von Born hervor. Die Mitglieder bemühten sich um ernsthafte Studien zur Geschichte der Freimaurerei sowie, als deren Vorläufer, der antiken Mysterienkulte. Born selbst verfasste den umfangreichen Aufsatz „Über die Mysterien der Aegyptier". Es ist verblüffend zu sehen, wie die Paradigmen der josephinischen Aufklärung auf den tradierten Hintergrund des hermetischen Ägyptenbildes projiziert werden. Laut Ebeling war „[d]er eigentliche Zweck von Borns Untersuchung […] der Vergleich der ägyptischen Priester mit den zeitgenössischen Freimaurern: beide hätten sich in einer geheimen Gesellschaft organisiert, um gegen Tyrannei, Repression und Laster und für das Wohl des Volkes zu kämpfen".[3] Denn: „Wahrheit also, Weisheit und das Wohl der Menschen war der Endzweck der ägyptischen Mysterien".[4] Hier bewegt man sich schon sehr nahe an der Diktion der Zauberflöte, die genau dieses seltsame Amalgam aus idealisierter Vernunft und ritualisierter Einweihung zeigt.

Im Anschluss beschäftigt sich Christian E. Loeben mit der Frage, welche Bilder (Illustrationen) dem 18. Jh., und damit den Freimaurern für ihr „Ägyptenbild" zur Verfügung standen.[5] Dabei erweist sich, dass die Tafeln der *„Histoire du Ciel"* von Noël Antoine Pluche (Paris 1739) eine besondere Rolle spielten. Allerdings schöpfte dieser Autor überwiegend aus Bernard de Monfaucons *„L'antiquité éxpliquée et representée en figures"* (Paris 1719–1724). Es handelt sich demnach um die Darstellung von in Europa damals vorhandenen Statuen und Objekten in dem seltsam spätbarocken, der ägyptischen Kunst in unseren Augen so wenig angemessenen Stil, der noch weit in das 19. Jh. hineinwirken sollte. Die Objekte selbst, zumeist in oder bei Rom aufgefunden, sind meistens Produkte eines römisch-ägyptischen Mischstils, den freilich erst Winckelmann von originär pharaonischen Denkmälern zu unterscheiden lernte.

Ergänzend zu Ebelings systematischem Überblickskapitel folgt schließlich ein längerer Aufsatz von Darius A. Spieth über die „para-masonische Organisation des Heiligen Ordens der Sophisiens" in Paris,[6] einer den Freimaurern nahestehenden Gesellschaft, die von Teilnehmern von Napoleons Ägypten-Expedition (1799–1801) begründet wurde. Da die wissenschaftliche Ausbeute dieser Unternehmung heute als ihr unvergängliches Verdienst gilt, das in der *„Description de l'Egypte"* und der Gründung der Forschungseinrichtung *Institut d'Egypte* seinen triumphalen Ausdruck fand, mutet es seltsam an, dass von Teilnehmern ebendieser Expedition eine an den alten Hermetismus angelehnte und „Ägyptische Mysterien" praktizierende Gesellschaft begründet wurde. 1822 legte Jean François Champollion erstmals seine Theorie zur Lesung der Hieroglyphenschrift vor, basierend auf dem während der ägyptischen Expedition gefundenen „Stein von Rosette". Damit trat die Kunde vom Alten Ägypten schlagartig in ein völlig neues Licht und entwickelte sich rasch zur wissenschaftlichen Disziplin der Ägyptologie. 1824 stellten die *Sophisiens* ihre Aktivitäten dauerhaft ein.

Während sich die neue, quellenbasierte Ägyptologie immer weiter von den Vorstellungen entfernte, die jahrhundertelang das Bild vom Alten Ägypten geprägt hatten, war andererseits der Weg freigemacht für allerlei esoterische und okkultistische Vorstellungen. Ein besonders anschauliches Beispiel ist die Sexualmagie und die in Kairo geoffenbarte Religion *Thelema* des Alistair Crawley, die wiederum von Ebeling in seinem Kapitel über die ägyptische Freimaurerei im 19. und 20. Jh. ausführlich besprochen wird.[7] Die Ägyptologie reagierte auf derart phantastische Auswüchse mit einer scharfen Abgrenzung gegenüber allem, was irgendwie im Geruche hermetischer oder esoterischer Wissenschaft stand. Freilich ging damit auch ein beträchtlicher Teil des mit der tradierten Ägyptenerinnerung verbundenen „kulturellen Gedächtnisses" verloren, wie vor allem Jan Assmann immer wieder betont hat, nicht zuletzt in einem Aufsatz im Rahmen dieses Buches im Abschnitt „Freimaurerisches Ägypten im Musikdrama".[8] Die „Zauberflöte", das zentrale Stück in diesem Kontext, wurde mit abnehmendem Wissen um die Hintergründe immer weniger verstanden, was zu einer zunehmenden Abwertung des Textbuches und der Postulierung der absurden „Bruch-

3 S. 81.
4 S. 82.
5 S. 125–132.
6 S. 133–189.
7 S. 239–251.
8 S. 369–384.

theorie“ im Handlungsverlauf führte. Die von Assmann in seiner bahnbrechenden Monografie über die Zauberflöte[9] dargelegte Deutung der Handlung gemäß dem Konzept der *Religio duplex* wird in dem Aufsatz dieses Bandes weiterentwickelt und durch verschiedene neue Ergebnisse ergänzt.

Am Rande soll auch festgehalten werden, dass sich auch die wissenschaftliche Ägyptologie mit der Frage befasst hat, ob es im Alten Ägypten „Mysterien“ im Sinne einer Initiation gegeben hat. Die Diskussion bewegte sich dabei vor allem um die Interpretation des Totenbuches, dem z. B. von der ehemaligen Wiener Ordinaria für Ägyptologie und Afrikanistik, Gertrude Thausing, neben seiner Funktion als „Jenseitsführer“ auch diejenige eines Initiationstextes zur Einweihung unter Lebenden zugeschrieben wurde.[10]

Die großen ideengeschichtlichen Darstellungen des Bandes werden ergänzt durch eine Reihe kleinerer Beiträge, die einen weniger theoretischen, eher an Objekten orientierten oder lokal gefassten Zugang bieten. Medaillen und Plaketten aus Belgien werden vorgestellt (Marcel M. Celis),[11] Pyramiden der Neuzeit rund um Hannover (Christian E. Loeben)[12] oder Landschaftsgärten des 18. Jhs. (Siegfried Schildmacher).[13] Alle diese Beiträge sind, gerade in der Fülle des detailreich behandelten Materials, sehr anregend und informativ. Besonders faszinierend ist jedoch der Aufsatz von Eugène Warmenbol über die ägyptischen Freimaurer-Tempel in Belgien und Nordfrankreich.[14] In einzigartiger Weise und verblüffender Vielfalt trat in der Belgischen Freimaurerei im 19. und frühen 20. Jh. die Tendenz auf, die Versammlungsräume („Tempel“) einzelner Logen als pharaonische Tempelräume zu gestalten. Dabei entstanden kulturgeschichtlich ziemlich einzigartige Werke der Ägyptomanie. Eines der schönsten dieser Gebäude wurde zerstört (Großtempel in der *Rue de Mai* in Antwerpen), etliche jedoch auch sorgfältig renoviert. In dem 2012 erschienenen magistralen Werk des Autors über die Ägyptomanie in Belgien, *„Le lotus et l'oignon“*, wurden einige dieser Freimaurerräume bereits ausführlich behandelt. Dort ist jedoch zum Beispiel der Innenraum des Tempels in der *Rue de Persil* in Brüssel noch ganz in weiß getüncht zu sehen, während die Bilder im vorliegenden Buch bereits die rekonstruierte spektakuläre Polychromie des Raumes zeigen. Originalgroße Reproduktionen der Wände dieses Tempels der Loge *„Les amis philanthropes“* waren in der Ausstellung in Hannover zu sehen, was viel zur starken Wirkung der Ausstellungsgestaltung beitrug. Nicht weniger als acht (!) ägyptisch-freimaurerische Tempel werden besprochen, befindlich in Brüssel, Antwerpen, Lüttich, Mons und Lille.

Im bereits erwähnten Abschnitt über das Musikdrama werden neben der „Zauberflöte“ (Jan Assmann; Kirsten Konrad)[15] die Oper „Osiride“ von Johann Gottlieb Naumann (Florian Ebeling),[16] Mozarts „Thamos, König in Ägypten“ (Holger Wenzel)[17] und, etwas überraschend, „Die Frau ohne Schatten“ von Richard Strauss vorgestellt. Letztere wird als „zweite Zauberflöte“ gedeutet, was zwar den ursprünglichen Intentionen v. a. Hofmannsthals entspricht, von heutigen Opernbesucher/innen aber wohl kaum mehr nachvollzogen werden kann (Hugo Shirley).[18] Mit diesem Beitrag bewegt sich der Band ziemlich weit weg von seiner zentralen Thematik, jedoch wird gerade dieser Artikel bei Leser/innen, die an der Kulturgeschichte der Oper interessiert sind, besondere Aufmerksamkeit erregen.

Abschließend befasst sich noch ein Abschnitt mit einigen Biografien von Freimaurern, die als Forscher oder Sammler in einer speziellen Beziehung zu Ägypten standen, nämlich dem Pionier der ägyptischen Archäologie und Entdecker des wahren „Sethos-Grabes“ (KV 17, Sethos I) Giovanni Battista Belzoni (Christian E. Loeben und Eugène Warmenbol),[19] dem Hannoveranischen Druckereibesitzer und Sammler Friedrich Culemann (Thorsten Henke),[20] dessen umfangreiche, 1887 von der Stadt Hannover erworbene Sammlung auch mehr als 150 ägyptische Stücke umfasste, die heute zu den Sammlungen des Museums August Kestner gehören, dem bedeutenden Ägyptologen Heinrich Brugsch (Heike C. Schmidt)[21] und dem vorwiegend in Berlin und Philadelphia/USA tätigen Ägyptologen Rudolph Anthes (Thomas L. Gertzen).[22]

Ein kurzer lokalhistorischer Annex über Hannover als Zentrum der Freimaurerei in Deutschland (Edzard Bakker und Siegfried Schildmacher)[23] mit interessanten Bemerkungen zum ehemals am Rathaus von Hannover angebrachten „Allsehenden Auge“, das sich auch am amerikanischen Ein-Dollar-Schein findet, beschließt das Buch (Siegfried Schildmacher).[24]

9 Assmann 2005.
10 Thausing 1989, 33.
11 S. 255–281.
12 S. 313–326.
13 S. 327–349.
14 S. 283–312.
15 S. 369–384, 385–406.
16 S. 353–368.
17 S. 407–415.
18 S. 417–429.
19 S. 433–442.
20 S. 443–456.
21 S. 457–474.
22 S. 475–489.
23 S. 501–512.
24 S. 493–500.

Insgesamt bietet der Band eine thematisch breit gestreute Zusammenstellung an Beiträgen, die durch die Klammer Ägypten – Freimaurer zusammengehalten werden. Reich an Informationen und Details, großer Ideengeschichte und skurrilen Abwegen, lokal verorteten Elementen und unzähligen Bezügen zu Geschichte, Literatur, Kunst, Musik, Archäologie und vielem mehr stellt der Band ein Nachschlagewerk und Lesebuch dar, das von den unterschiedlichsten Perspektiven aus Neugierde erwecken kann, und keineswegs ein besonderes Interesse an der Freimaurerei oder ägyptischen Mysterien voraussetzt, um mit Gewinn gelesen zu werden. Durch den umfassenden Anmerkungsapparat ist dem/der Leser/in die Möglichkeit geboten, sich mit den zahlreichen Verzweigungen des Themas weiterführend zu beschäftigen.

Die zweite Auflage unterscheidet sich von der Erstauflage v. a. durch einige Fotografien der Ausstellungsräume, die auf Vacat-Seiten gesetzt wurden. Von der recht großen Zahl an Druckfehlern und Verschreibungen wurden jedoch nur einige wenige korrigiert. Sehr zu bedauern ist, dass auch die falsche Abbildung Nr. 28 auf S. 307, die nicht die „von einer Hohlkehle bekrönte und von zwei Papyrussäulen flankierte Eingangstür des Großtempels in der Rue de Laeken in Brüssel“ zeigt, nicht berichtigt wurde.[25] Das sind jedoch lediglich kleine Schönheitsfehler, die den bleibenden Wert dieser außergewöhnlichen Publikation nicht schmälern.

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25 Abb. 28: Marmorfassung des Throns des Logenmeisters im kleinen Tempel in der *Rue de Laeken* in Brüssel.

Stephan G. Schmid, Sophie G. Horacek (Hrsg.), *“I don’t know what am I myself, it is so very difficult to explain.” Max Ohnefalsch-Richter (1850–1917) und die Archäologie Zyperns.* Studia Cyprologica Berolinensia Band 1. Logos Verlag, Berlin 2018, xvii+574 Seiten, 409 Farb- und Schwarzweißabbildungen, ISBN 978-3-8325-4581-9, ISSN 2567-9228.

Mit diesem Band beginnt eine neue wissenschaftliche Reihe, die sich allein der Kultur des antiken Zypern zuwendet[1] und damit einen kraftvollen Akzent in diesem nicht gerade zentralen Bereich der deutschsprachigen Archäologie setzt, sieht man von einzelnen Bänden der seit 2000 bestehenden „Schriften des Instituts für Interdisziplinäre Zypern-Studien“ an der Universität Münster, der in Österreich 2017 begründeten, im Wiener Verlag Holzhausen erscheinenden Reihe „Κυπριακά. Forschungen zum Antiken Zypern“ sowie den Zypernpublikationen der Österreichischen Akademie der Wissenschaften ab. Mit dem Zypern-Forscher Max Ohnefalsch-Richter (im Folgenden MOR) steht jene Person im Zentrum des Bandes, die von deutscher Seite am meisten mit Zypern verbunden wird, und deren Aktivitäten besonders auch die Berliner Museen, allen voran das Museum für Vor- und Frühgeschichte und die Antikensammlung, bedeutsam betreffen. Der große Sammelband steht in Zusammenhang mit der anlässlich seines 100. Todesjahres präsentierten Ausstellung „Zwischen Königsgräbern und Pfandhaus: Max Ohnefalsch-Richter (1850–1917) und die Archäologie Zyperns“ im Neuen Museum der Staatlichen Museen zu Berlin vom 1. Dezember 2017 bis 4. März 2018. Unterstützt wurde die Drucklegung durch die Botschaft der Republik Zypern in Berlin, die Humboldt-Universitäts-Gesellschaft sowie den Verein Studia Cyprologica Berolinensia e.V.

Dem Band liegt eine klare, fünfteilige Gliederung seines Inhalts[2] mit 22 Textbeiträgen zugrunde. Eröffnet wird mit einem Grußwort des Botschafters der Republik Zypern in Deutschland, Andreas Hadjichrysanthou, einem Vorwort von Hartmut Matthäus sowie dem der Herausgeber.[3] Es soll mit dieser Publikation ein erster Überblick über das international weit verstreute wissenschaftliche Material von MOR und die Möglichkeiten seiner Erschließung gegeben werden,[4] so Stephan G. Schmid, von dem die Initiative dafür ausgegangen war, und Sophie G. Horacek in ihrem Vorwort, das den Lesenden zugleich Einblick in die komplexe weiträumige Quellensituation der äußerst umfangreichen Archivalien gibt.

Bevor es konkret um MOR geht, empfiehlt sich die Lektüre der zwei Beiträge in Teil I, „‚Der politische Stoff‘ – Erkundungen und Expeditionen auf Zypern im 19. und 20. Jahrhundert“,[5] die der archäologischen Erforschung Zyperns im 19. und frühen 20. Jh. (Sabine Rogge) sowie dem sozioökonomischen und politischen Kontext der Archäologie auf Zypern im 19. Jh. (Robert S. Merrillees und Thomas Kiely) gewidmet sind. Das Interesse an Zypern und dessen Auswirkungen thematisiert **Sabine Rogge** in Beitrag I.1,[6] den sie historisch folgerichtig in zwei durch das Jahr 1878 getrennte Teile gliedert, als die osmanische Herrschaft über die Insel jener der britischen wich. Es war der Zeitpunkt, als MOR nach Zypern ging, der für die weite Verbreitung von Kypriaka mitverantwortlich ist. Er agierte im „Ausgrabungsgeschäft“ mit anderen Akteuren, oft Diplomaten – zunächst Franzosen, Briten, Deutsche und: Luigi Palma di Cesnola. Sie und ihre Aktivitäten werden im bis 1878 führenden ersten Teil anschaulich dargestellt, bis in Details der – vergleichsweise wenig von Deutschen – weggebrachten Ausbeute von zypriotischen Antiken an ihre neuen Adressen, mit Nennung der damals noch spärlichen wissenschaftlichen Literatur, wobei die von Ludwig Ross von 1845 bis 1852[7] wahrscheinlich am bedeutendsten ist. Am ausführlichsten widmet Rogge sich dem für die zyprische Archäologie „so bedeutungsschwer[en]“[8] Amerikaner italienischer Abstammung und Diplomaten Luigi Palma di Cesnola.[9] Den zweiten Teil[10] ihres Beitrags zu den archäologischen Aktivitäten ab 1878 eröffnet Rogge mit den britischen Maßnahmen, wonach erst ein generelles Ausgrabungsverbot eingeführt wurde und ab 1887 nur mehr „öffentliche oder wissenschaftliche Körperschaften“[11] Ausgrabungen

1 S. xiii.
2 S. v–vi.
3 S. ix–x, xi–xiii, xv–xvii.
4 S. xvii.
5 S. 1–50.
6 S. 3–29.
7 S. 10, 566.
8 S. 11.
9 S. 11–16.
10 S. 17–27.
11 S. 17.

auf Zypern durchführen durften, was zunächst den *Cyprus Exploration Fund* und das *British Museum* – in Kooperation mit der *British School at Athens* – bevorzugte. Auch wenn die Bedeutung der Arbeiten John Linton Myres', des „,Vaters' der modernen Zypern-Archäologie",[12] hervorzuheben ist, muss Rogge dennoch Missstände in der britischen Phase konstatieren, als einige Briten wie Samuel Brown und Falkland Warren sich Sammlungen zyprischer Antiken zulegten und dafür Grabungen veranstalteten, bei denen bereits MOR als Ausgräber in Erscheinung trat und Kypriaka nach London kamen.[13] Auch Franzosen waren in der britischen Zeit weiter auf der Insel archäologisch aktiv, so Edmond Pottier, Mondry Beaudouin und Paul Perdrizet im Auftrag der *École française d'Athènes*. In der Folge streift Rogge mit Eugen Oberhummer die deutschen Aktivitäten auf Zypern und deren wissenschaftlichen Ertrag,[14] dann die schwedische Zypernforschung[15] mit der *Swedish Cyprus Expedition* und ihrem hohen Standard besonders unter Einar Gjerstad, dem die massenhafte Ausfuhr von Funden für Stockholm gelang, wodurch das *Medelhavsmuseet* heute „die größte und wissenschaftlich bedeutendste Sammlung zyprischer Antiken außerhalb Zyperns beherbergt".[16]

Robert S. Merrillees und **Thomas Kiely** wollen mit ihrem Beitrag (I.2)[17] vor dem Hintergrund aktueller forschungsgeschichtlicher Ansätze, die sich vermehrt sozio-ökonomischen und politischen Aspekten widmen, „eine intensivere Auseinandersetzung von Archäologen mit der Sozialgeschichte ihres Faches" fördern.[18] Ihre Ausführungen zur Forschungsgeschichte[19] sind eine solide Zusammenstellung der neueren, in einzelnen Fällen differenziert und kritisch gesehenen Publikationen, welche gesellschaftliche, politische, sozio-ökonomische, sozialgeschichtliche oder ethnische Verhältnisse, meist mit Implizieren der Archäologie, behandeln. Es folgt eine Darstellung der wirtschaftlichen und politischen Verhältnisse auf der Insel unter osmanischer und britischer Verwaltung mit Einbeziehung von Aspekten des Sozialen und der Religion.[20] Ein Abschnitt zu kyprischen Antiken[21] in dieser Zeitphase – Ruinen und archäologischen Funden – rundet diesen Beitrag ab, in dem auch die Antikengesetze und deren Missachtung erläutert werden.

Auch wenn MOR in den zwei bisher besprochenen Beiträgen mehrmals erscheint, so setzen in Teil II[22] unter dem Titel „Max Ohnefalsch-Richter – Landwirt, Photograph und Altertumskundler – Zwischen Berichterstattung, Existenzangst und Ausgrabung" die Beiträge ein, die sich konkret mit MOR befassen; es ist der eigentlich biografische Teil des Bandes.

Stephan G. Schmid überschreibt seinen Beitrag II.1[23] mit „Max, Magda und Hermann Ohnefalsch-Richter: Beiträge zu biographischen Flickenteppichen"; es geht also auch um MORs Ehefrau und den gemeinsamen Sohn. MORs Leben lässt sich in drei große Abschnitte gliedern: 1850–1878, Kindheit, Jugend, Lehr- und Wanderjahre;[24] 1878–1890, MORs Jahre auf Zypern;[25] 1890–1917, die stark zergliederte Zeit von MORs Rückkehr nach Deutschland bis zu seinem Tod 1917.[26] Der Biograf bedauert die Zäsuren bei der Quellenlage, zumal für die ersten 28 Jahre MORs. Bis auf ganz wenige Ausnahmen ist zudem der Verbleib der an MOR gerichteten Briefe unbekannt. Dennoch kann Schmid ein Bild des jungen MOR mit hinreichend *Background* zeichnen und so die Basis zum Verständnis von dessen weiterem Lebenslauf legen. Der 28-jährige MOR kam „als Berichterstatter"[27] nach Zypern, versuchte sich aber auch in Anderem, zunächst als Forstbeamter, wandte sich jedoch schon 1879 der Archäologie zu[28] und sah sich selbst zudem als „Illustrator und Photograph".[29] MORs archäologische Aktivitäten auf Zypern gliedert Schmid übersichtlich in Abschnitte: die ersten Jahre 1881–1884 „als Archäologe voller Enthusiasmus";[30] der Ausgräber MOR 1885–1886 und dessen Konflikt mit Cesnola sowie seine Rolle im Watkins *vs.* Warren-Prozess.[31] Dabei zeigt sich zu Anfang das Bemühen MORs, über Col. Falkland George Warren die britische Finanzierung seiner Grabungen zu erreichen, indem er den Gewinn für das *British Museum* durch die Funde und Einnahmen durch Fundverkäufe in alle Welt in Aussicht stellte.[32] Deutsches Engagement auf Zypern, das MOR auch angestrebt hatte, war von britischer

12 S. 31.
13 S. 17–18, 21.
14 S. 22–24.
15 S. 24–27.
16 S. 27.
17 S. 31–50.
18 S. 32.
19 S. 33–36.
20 S. 36–44.
21 S. 45–50.
22 S. 51–191.
23 S. 53–128.
24 S. 55–59.
25 S. 59–88.
26 S. 88–113.
27 S. 59.
28 S. 63–64.
29 S. 143.
30 S. 65–75.
31 S. 75–78. – Zum Prozess s. die vorliegende Rezension, S. 345.
32 S. 65.

Seite nicht gewollt.[33] Bemerkenswert ist das frühe Eintreten MORs für ein Antikenmuseum sowie für Denkmalschutz auf Zypern,[34] obwohl er selbst, zwar gesetzeskonform und mit Ausfuhrbewilligung, „am Verkauf oder der Vermittlung von Antiken beteiligt" war,[35] wofür Schmid Beispiele anführt und auch MORs private Sammlung berührt.[36] Wenn MOR es auch nicht zu einer Festanstellung bei den Briten brachte, so stand er dennoch bei der Vielzahl seiner Ausgrabungen auf Zypern in deren Diensten. Seine Aktivitäten konnte er anfangs noch in renommierten deutschen und englischen archäologischen Fachzeitschriften, aufgrund seiner „Ausbildung als Zeichner, Maler und Photograph" bildlich gut dokumentiert, publizieren, dann in solchen benachbarter Fächer.[37] Auffällig ist MORs Konzentration auf Heiligtümer und Nekropolen, wohl wegen der dort erwarteten reicheren Funde als in Siedlungen. Seinen Aufenthalt auf Zypern unterbrach MOR nur 1884 für eine längere Europareise.[38] Danach setzte er seine Grabungstätigkeit in geradezu rasantem Tempo fort,[39] es kam zum Watkins *vs.* Warren-Prozess, welcher MOR sehr geschadet hat, der im Auftrag Warrens im Heiligtum von Phrangissa gegraben hatte, und wonach es zum Bruch mit Warren kam.[40] Bei den Ausgrabungen des *Cyprus Exploration Fund* ab 1888 war MORs Mitarbeit nicht gefragt.[41] Er verlegte sich in der Folge auf die letztlich weder lukrative noch nachhaltige Gründung und Herausgabe von Zeitschriften.[42] In seinen letzten Jahren auf Zypern konnte MOR mit preußischer Finanzierung ausgraben, und die Königlichen Museen zu Berlin bemühten sich um eine Ausgrabungserlaubnis in Dali – nicht ohne vereinzelten englischen Protest.[43] 1890 reiste MOR in den Libanon und nach Syrien,[44] im Oktober des Jahres kehrte er nach Deutschland zurück, was verschiedene Gründe hatte.[45] Für die folgende Zeit besteht eine gute Quellenlage,[46] auf deren Bearbeitung durch Melitta Brönner Schmid in der Folge zurückgreifen konnte. Es geht – für die Jahre 1891–1894 – um MORs Promotion, um Fördergelder, eine Reise in die USA;[47] die Zypern-Expedition 1894/95,[48] MORs „unstetes Leben" 1896–1917.[49] All das wird von Schmid detailreich dargestellt und mit Quellen belegt, so etwa in den Ausführungen zu MORs Publikation „Kypros, die Bibel und Homer" und deren kritischen Rezensionen. Im letzten Teil zu MORs Leben lesen wir von seinen andauernden finanziellen Problemen und den Versuchen, diese zu lösen – durch das Schreiben für Zeitungen, Vorträge, das Beleihen von Teilen seiner Sammlung oder deren Verkauf.[50] Er strebte sogar – erfolglos – noch die Habilitation an, versuchte sich – ebenso erfolglos – als Ausstellungsmacher,[51] wollte als Kriegsberichterstatter nach Südafrika. Seine Eingaben an den Kaiser brachten ihm keine Hilfe, mit einer Stelle in Konstantinopel war er wegen des Konkurses der Firma glücklos, per Gerichtsentscheid aus Nikosia ging ihm eine Geldforderung zu.[52] Eine weitere Zypern-Expedition, mit „desaströsen Auswirkungen", konnte 1910 stattfinden.[53] Schuld an seinen Misserfolgen waren nach MORs Ansicht immer andere, nicht er. Weitere Versuche, an Geld zu gelangen, wie Vortragsreisen und eine Firmenbeteiligung, brachten ihm wenig ein oder scheiterten. Die Beleihung des gesamten Besitzes ermöglichte es MOR mit seiner kränklichen Frau und dem Sohn nach Monaco umzusiedeln.[54] Die zum Teil unerfreulichen Vorkommnisse dort und die sich anbahnende Lebensdramatik MORs bis 1917 beschreibt Schmid ausführlich, bestens mit Bildmaterial versehen wie das ganze Buch. In diesem Beitrag von Schmid folgen zwei vergleichsweise kürzere biografische Abschnitte zu MORs Ehefrau Magda Ohnefalsch-Richter[55] und zu deren gemeinsamen, Ende 1894 geborenen Sohn Hermann Ohnefalsch-Richter.[56] Magda OR begleitete ihren Mann meist und unterstützte ihn – ohne Lohn dafür – bei seinen Unternehmungen,[57] war Schreibkraft, zeichnete, fotografierte, firmierte aber auch als wissenschaftliche Autorin,[58] teilte das unstete Leben ihres Mannes mit ihm. Nach dessen Tod versuchte sie, seinen noch in Monaco, London, Berlin und Zypern verbliebenen Nachlass zu bekommen, der bislang aber nirgends aufgetaucht ist. Magda ORs nur 49 Jahre dauerndes Leben ist gewiss auch für die Frauenforschung

33 S. 66.
34 S. 67.
35 S. 68–69.
36 S. 71.
37 S. 73–74.
38 S. 74–75.
39 S. 75–78.
40 S. 125.
41 S. 79.
42 S. 79–84.
43 S. 84.
44 S. 85–86.
45 S. 86–88.
46 S. 88.
47 S. 89–98.
48 S. 98–100.
49 S. 98–113.
50 S. 101–102.
51 S. 102–105.
52 S. 104–105.
53 S. 106–107 und Kapitel III.8.
54 S. 107.
55 S. 113–121.
56 S. 121–123.
57 S. 115–116.
58 S. 118–119.

von Interesse. Das kurze Kapitel über den Sohn Hermann, der in London ansässig wurde,[59] ist von familiärem Belang. Er verstarb bereits mit 28 Jahren. Eine „Bilanz" resümiert das lange biografische Kapitel von Schmid bis hin zu einer psychologischen Einschätzung von MORs Persönlichkeit.[60]

Robert Born behandelt in Kapitel II.2[61] „Max Ohnefalsch-Richter als Maler" und möchte damit eine „Würdigung von MOR als Maler"[62] versuchen, einer weniger bekannten Seite in dessen Leben. Die Ausbildung dafür dürfte auf das Jahr 1873 zurückgehen. Sein Talent zur Malerei und Zeichnung erweisen Ölgemälde, aquarellierte Federzeichnungen und zeichnerische Aufnahmen etwa antiker Gebäude und Fundobjekte, die Born in seinen Beitrag einbindet. Auch das Abrollverfahren benutzte MOR und erstellte Pausen nach den eigenen Fotos.[63] Kurzzeitig machte er eine Lehre in Fotografie.[64] Der Verbleib von MORs malerischem Werk scheint weitgehend unbekannt.[65] Seine eigenen künstlerischen Arbeiten verwendete er in seinen Publikationen oder gemeinsam mit Fotos bei der Zusammenstellung von Alben.[66] Die künstlerische Qualität seiner Arbeiten ist unterschiedlich.

Die bereits von Robert Born in seinem Beitrag einbezogene Fotografie ist Thema von **Wolfgang Filser** in Kapitel II.3[67] zu „Magda und Max Ohnefalsch-Richter als Photographen" und dem Einsatz der frühen Fotografie in der Archäologie. Dem Beitrag angeschlossen ist ein „Anhang zu einem Photofund im Winckelmann-Institut"[68] in Berlin. Es gefällt, dass Filser an den Anfang seines Beitrags das Foto setzt, auf dem Magda OR in einem Ausgrabungsgelände zu sehen ist,[69] bevor er die frühe Geschichte der Fotografie und die Verbindungen zur Archäologie resümiert. Reisefotografie, Fotobildbände und Bilderreisebücher standen zunächst im Interesse, aber man erkannte rasch die Möglichkeiten der Fotografie als „wissenschaftliches Instrument".[70] In der frühen wissenschaftlichen Fotografie bestimmt oft noch das Pittoreske das Erscheinungsbild von dokumentarischen Fotos.[71] Bereits 1880 eröffneten die Ohnefalsch-Richters ein Fotoatelier in Larnaka.[72] MORs Kenntnisse in Fotografie, dem nassen Kollodiumverfahren, gingen auf die 1870er-Jahre zurück, die von Magda OR erst auf das Jahr 1893.[73] Die Aufnahmen umfassen ein breites Spektrum, hauptsächlich aber archäologische Stätten und Ausgrabungen sowie antike Artefakte, Ausgrabungsfunde. Ein besonderer Zug in MORs bildnerischen Arbeiten sind nach Fotos gefertigte kolorierte Zeichnungen.[74] Auch Ausgrabungsansichten wurden nach Grabungsfotos umgezeichnet und mutierten durch Rekonstruktionen und inhaltliche Veränderungen, also „eine Vermischung der Darstellungsweisen", zur Inszenierung.[75] Solche Abbildungen, darunter Panoramafotografien, die MOR ausführlich kommentierte, konnten programmatischen Charakter haben.[76] Es ist zum besseren Verständnis von Filsers Ausführungen hilfreich, dass Bildkommentare MORs ausführlich zitiert sind, welche die teils gravierenden Abweichungen in den Zeichnungen vom Originalzustand im zugrundeliegenden Foto freimütig beschreiben und deren Instrumentalisierung erklären.[77] Fund- und Ausgrabungssituationen wurden manchmal auch mit im Bild erscheinenden Personen dokumentiert, was in Einzelfällen den Charakter der Selbstinszenierung hat.[78] Wie alle Beiträge ist selbstverständlich auch dieser von Filser bestens mit Bildmaterial versehen. Dies setzt sich naturgemäß auch im Anhang fort, der „30 Glasnegativplatten Max Ohnefalsch-Richters im Winckelmann-Institut" betrachtet, die dort 2017 zufällig entdeckt wurden und in dem Band erstmals veröffentlicht werden. Es sind Kollodiumnegative in eher schlechtem Zustand, aber offensichtlich „die einzigen bislang bekannten Originalaufnahmen von MOR",[79] im Grunde eine kleine Sensation. Sie zeigen neben Ethnografica auch Ausgrabungspläne und eine Kirche, aber hauptsächlich archäologische Funde wie Stelen und Gefäße, die man zum Teil aus den Publikationen MORs und Magda ORs kennt. Bemerkenswert ist die hohe Qualität der Aufnahmen, die hauptsächlich der Zeit von 1878 bis 1890 entstammen. Alle 30 Platten werden im Beitrag als digitalisierte Fotografien mit Beschreibung, Motivanalyse, Datierung und Literaturangaben wiedergegeben.

In Kapitel II.4[80] ist die Bibliografie mit 105 bislang erfassten Publikationstiteln von MOR untergebracht, welche

59 S. 122.
60 S. 124–128.
61 S. 129–141.
62 S. 129.
63 S. 138.
64 S. 131.
65 S. 133.
66 S. 138–141.
67 S. 143–183.
68 S. 168–183.
69 S. 143–144 mit Abb. 1.
70 S. 145.
71 S. 147–148.
72 S. 149.
73 S. 151.
74 S. 153–154.
75 S. 156–163.
76 S. 158–164.
77 S. 161.
78 S. 164.
79 S. 168.
80 S. 185–191.

den Zeitraum von 1879 bis 1915 umfasst. Auf einen Blick erschließt sich die breite Palette der Zeitschriften, Titel, der Umfang der Texte und deren quantitative Häufung in bestimmten Jahren.

Teil III des Buches, betitelt „‚Cypern im Alterthume' – Archäologische Unternehmungen Max Ohnefalsch-Richters", besteht aus neun Beiträgen.[81] „Max Ohnefalsch-Richter, der rechtliche Rahmen und das *Cyprus Museum*" ist der Titel des Beitrags III.1[82] von **Despina Pilides**. Es geht zunächst um die Entwicklung der zyprischen Kulturgutschutzgesetze, ausgehend vom osmanischen Antikengesetz von 1869, das die Vergabe von Ausgrabungserlaubnissen neu regelte, aber schon 1874 durch ein neues abgelöst wurde,[83] das unter britischer Verwaltung gültig blieb und Fundteilung vorsah, während bis dahin Bodenfunde Eigentum der Regierung waren. Raubgrabungen und illegaler Antikenhandel hatten 1905 das erste Antikengesetz unter britischer Verwaltung zur Folge.[84] Mit gesetzlichen Regelungen, Ausgrabungsgenehmigungen, Fundteilung und Ausfuhr von Funden befasst sich der detailreiche Abschnitt zum *Cyprus Museum Committee*,[85] für den Pilides in dessen Sitzungsberichten von 1883 bis 1888 recherchieren konnte und der unter anderem MORs Rolle in diesem dokumentiert, was auch Thema im Resümee zum Watkins *vs.* Warren-Prozess[86] und im Exkurs zu Rantidi[87] ist. „Max Ohnefalsch-Richter und der Katalog des Cyprus Museum" ist Gegenstand des nächsten Abschnitts,[88] der MORs Bemühen um den Katalog und seinen Einsatz für das Museum sowie den Streit um einige Objekte thematisiert. Der in gemeinsamer Arbeit mit John Linton Myres entstandene Katalog erschien 1899.[89] Es folgt ein Abschnitt über „Max Ohnefalsch-Richter als Ausgräber und die Sammlung Cesnola",[90] der von den britischen Kontakten MORs und dessen Beauftragung mit Ausgrabungen durch das *British Museum* ausgeht. Dann geht es um die Auseinandersetzung zwischen MOR und Cesnola wegen dessen Falschangaben zur Ausgrabung in Kourion („*Curium treasure*") und zur zweifelhaften Herkunft von Funden seiner Sammlung,[91] wofür Pilides eine ganze Anzahl von Zeitungsberichten namhaft machen kann und auch die Untersuchungen von Ferdinand Dümmler auf Zypern mit dessen gemeinsam mit MOR durchgeführten Nachgrabungen in Kourion und Golgos einbezieht. Der Text endet mit einer Würdigung von MOR, „der früh für die Reorganisierung des *Cyprus Museum* und für die professionelle Aufbewahrung und Handhabung der Antiken durch Spezialisten eintrat".[92]

Mit dem Zitat „*like herrings in a barrel*", das sich auf die gedrängte Fundsituation der Bildwerke bezieht, übertitelt **Matthias Recke** seinen Beitrag (III.2)[93] zu „Max Ohnefalsch-Richters Ausgrabungen in Tamassos-*Phrangissa* 1885". Es waren dies „die ersten regulären, sich über einen längeren Zeitraum erstreckenden Ausgrabungen vor Ort".[94] Sie wurden über Col. Warren, dem *chief secretary* der Inselregierung, finanziert und von MOR geleitet. MOR ließ die Grabungsverpflichtung gegenüber dem Bankier Charles Watkins in Amathous zugunsten von Phrangissa fallen, worüber es zwischen Watkins und Warren zum Streit um die dort gemachten Funde kam, der gerichtlich zugunsten von Warren entschieden wurde.[95] Die Dokumentation der nur knapp drei Wochen dauernden Grabung wurde von MOR aus Zeitmangel vernachlässigt,[96] eine Nachgrabung ist wünschenswert.[97] Dennoch versucht Recke, der eine „Bearbeitung des gesamten Fundkomplexes"[98] projektiert, eine Beschreibung des Grundrisses sowie eine Zusammenfassung über Art, Verteilung, Bestand und Umfang der Funde.[99] Bedingt hilfreich sind ihm dabei nur spätere Texte MORs und einige Briefe von ihm sowie die acht großformatigen Fotografien von E. A. Carletti, Sammelaufnahmen, die Warren anfertigen ließ, um die Fundstücke zu vermarkten.[100] Die Rekonstruktion des gesamten ursprünglichen Fundbestands ist wegen der weiten Verteilung auf verschiedene Sammlungen und dem Fehlen einer Fundliste MORs äußerst schwierig.[101] Ein Exkurs[102] gilt der Identifizierung der im ausgegrabenen Heiligtum verehrten Gottheit Apollon, die auch in zwei griechisch/phönizischen Bilinguen erscheint.[103] Den Publikationsvorbereitungen durch MOR – hier geht es hauptsächlich um Illustrationen für den geplanten Band –, dem Katalog des *Cyprus Museum*

81 S. 195–384.
82 S. 195–212.
83 S. 195–196.
84 S. 196.
85 S. 198–202.
86 S. 202–203.
87 S. 207.
88 S. 204–207.
89 S. 206, 560.
90 S. 208–212.
91 S. 210–211.
92 S. 212.
93 S. 213–238.
94 S. 213.
95 S. 215.
96 S. 217–218, 223.
97 S. 219, 238.
98 S. 225.
99 S. 219–225.
100 S. 225–229.
101 S. 224–225, 235.
102 S. 222.
103 S. 237.

von 1899 und dem nie gedruckt erschienenen *Tamassos und Idalion*-Manuskript von 1908 widmet Recke eigene Abschnitte.[104] Es folgt die Betrachtung von „Phrangissa nach Max Ohnefalsch-Richter“,[105] wobei die Arbeiten von Olivier Masson und die Ausgrabungen von Hans-Günter Buchholz in Tamassos sowie seine eigenen Forschungen im Rahmen des von Letzterem an ihn übergebenen *Phrangissa*-Projekts apostrophiert werden. „Auswertung, Zusammenfassung und Ausblick“[106] runden den Beitrag von Recke ab.

Mit einem weiteren bedeutenden Grabungsplatz MORs beschäftigt sich das Kapitel III.3 „Idalion“[107] von **Stephan G. Schmid** und **Sophie G. Horacek**. MOR hat in und bei Dali zwischen 1883 und 1895 für verschiedene Auftraggeber in fünf Kampagnen topografisch geforscht und gegraben, wobei die Dokumentation heterogen und – so vorhanden – auf verschiedene Orte verteilt ist.[108] Bemerkenswert ist MORs Versuch, „eine Stadt und ihr Umland als Einheit mit einer holistischen Herangehensweise zu erfassen“,[109] ein Postulat, das bereits Alexander Conze in seiner Antrittsrede an der Universität Wien im Jahr 1869 erhoben hatte. Der Leser staunt über die Genauigkeit einer Karte von Idalion und Umgebung,[110] mit deren Hilfe man unter Verwendung einer georeferenzierten Karte eine dreidimensionale Darstellung des Geländes herstellen konnte.[111] MOR konzentrierte sich bei der Freilegung „vor allem auf Nekropolen und Heiligtümer“,[112] nicht auf die damit verbundenen Siedlungen, und er versuchte, „die Verteilung und Datierung der Nekropolen für das Verständnis und die Rekonstruktion der Stadtgeschichte von Idalion zu nutzen“.[113] Beispielhaft erläutern Schmid und Horacek einige Gräber mit den Funden bis in Einzelheiten[114] sowie zwei Heiligtümer (am Gialias sowie auf der östlichen Akropolis von Idalion)[115] und beziehen MORs Typoskript und Originalfotos sowie weitere Quellen wie Briefe an Salomon Reinach in deren Diskussion ein. Abschließend wird die Bedeutung von MORs Beiträgen zur historischen Topografie des „Königreiches von Idalion“ für dessen zukünftige Erforschung hervorgehoben.[116]

104 S. 229–234.
105 S. 234–235.
106 S. 237–238.
107 S. 239–263.
108 S. 242.
109 S. 239.
110 Abb. 1 auf S. 240; Abb. 3 auf S. 242.
111 S. 242–244 und Abb. 4.
112 S. 244.
113 S. 249.
114 S. 246–249.
115 Gialias: S. 252–258. – Idalion: S. 258–263.
116 S. 263.

„Das Landgut Nisou bei Dali“, einen wichtigen Ort in der Biografie der Familie Ohnefalsch-Richter, behandelt **Stephan G. Schmid** in seinem Beitrag III.4.[117] Der vom Italiener Ricardo Mattei erbaute Gutshof war 1894/95 Wohnsitz der Familie und Geburtsort von Sohn Hermann. Zur Beschreibung können, ausführlich zitiert, zunächst anschauliche Texte von MOR und Magda OR beigebracht werden, die eingängig die örtliche Wasserversorgung erklären.[118] Da die von dem Gutshof durch das Ehepaar Ohnefalsch-Richter angefertigten Fotos verloren gingen und dieser bis auf spärliche Reste heute nicht mehr existiert,[119] bringt Schmid die Schilderung eines anderen, einem Bruder von Luigi Palma di Cesnola gehörenden Gutshofes, in welchem sich auch das Fundmagazin der Cesnola-Familie befand.[120] Dies nimmt Schmid zum Anlass, kurz auf die „Affäre Cesnola“ einzugehen.[121] Eine längere Passage ist Ricardo Mattei und dessen einflussreicher Familie gewidmet,[122] wobei wiederum ein Text zum Gutshof von Mattei zitiert und auf die Bauweise der Gebäude sowie die Wasserversorgung eingegangen wird.[123] Der Tod Matteis, die Veräußerung seines Besitzes und das späte Ende seines Herrenhauses gegen Ende des 20. Jhs., das die Ohnefalsch-Richters hundert Jahre zuvor kurzzeitig bewohnt hatten, beschließen diesen Beitrag von Schmid.

Der Beitrag von **Viola Lewandowski** (III.5)[124] hat „Max Ohnefalsch-Richters Funde aus Marion in Berlin“ zum Thema. Es geht um ein Sammlungskonvolut von 337 Objekten,[125] welches das Berliner Antiquarium 1887 im Pariser Kunsthandel erworben hat und das aus ausgewählten Funden, besonders attischer Keramik, aus einer britisch finanzierten Grabung MORs besteht, *Polis tis Chrysochou (Marion)*, einem der antiken Stadtkönigtümer Zyperns. Nach einer topografischen und historischen Einleitung[126] geht Lewandowski auf die Erforschung des Ortes durch MOR ein,[127] der dort 1885 einige Gräber geöffnet und 1886 fremdfinanziert umfangreich gegraben hat, wobei 441 Gräber geöffnet und grob dokumentiert wurden.[128] Die Funde gingen an die Geldgeber, unter ihnen Charles Watkins. Nach MOR veranstaltete 1889 und 1890 der *Cyprus*

117 S. 265–283.
118 S. 265–267.
119 S. 278–279.
120 S. 268–269.
121 S. 269–271.
122 S. 272–276.
123 S. 276–280.
124 S. 285–302.
125 S. 291.
126 S. 285–287.
127 S. 287–289.
128 S. 288.

Exploration Fund Grabungen in den Nekropolen von Marion, bei denen nochmals zahlreiche Gräber geöffnet, aber nur „äußerst summarisch publiziert" wurden.[129] Ab 1929 führte die *Swedish Cyprus Expedition* unter Einar Gjerstad systematische Grabungen durch, ab 1983 die *Princeton Archaeological Expedition* unter William A. P. Childs, und 2012 kam es im *Princeton University Art Museum* zu einer Ausstellung der inzwischen weltweit verstreuten Funde, auch solcher aus MORs Grabungen.[130] Der Verkaufsverlauf des Fundbestandes hatte „die ursprünglich nach Gräbern geordneten Funde auseinandergerissen" und transportbedingt vielfach erheblich beschädigt.[131] Der Berliner Bestand wird von Lewandowski unter verschiedenen Gesichtspunkten behandelt, etwa unter dem Titel „Objektauswahl, Inventarisierung, Publikation und Verbleib"[132] und der Frage der Rekonstruktionsmöglichkeiten von Grabausstattungen aufgrund der vorhandenen Unterlagen wie Ausgrabungsjournale, Fotografien und Zeichnungen sowie Objektbeschriftungen.[133] Der hohe Anteil attischer Keramik wurde von MOR als Ausdruck enger Beziehungen zwischen Marion und Athen interpretiert, was Lewandowski problematisiert,[134] indem sie MORs Grabungsfunde aus Marion mit jenen der schwedischen und der Princeton-Grabung vergleicht und diese anderen Fundorten auf Zypern gegenüberstellt.[135] Stärken und Schwachstellen von MORs Forschungsarbeiten in Marion und ihre Bedeutung für das Berliner Fundkonvolut sind Gegenstand des abschließenden Abschnitts im Beitrag von Lewandowski.[136]

Mit Kapitel III.6[137] trägt **Daniela Summa** unter dem Titel „Die Kampagne von Rantidi. Schwierigkeiten und Ergebnisse einer wissenschaftlichen Unternehmung" zum Band bei, und schon der Name der Verfasserin und ihre Forschungsstelle verraten, dass es um Inschriften geht. (Hier sei positiv vermerkt, dass am Schluss aller Beiträge eine „Visitenkarte" der jeweils für den Text Zeichnenden abgedruckt ist.) Die meisten der bei den frühen Ausgrabungen auf Zypern gefundenen Inschriften sind in der damals noch unbekannten „kypro-syllabischen Schrift" verfasst, was rasch, hauptsächlich von deutschen Philologen betriebene, Entzifferungsversuche nach sich zog und später zur Integration dieser Inschriften in das *Corpus Inscriptionum Graecarum* führte[138] (die als IG XV 1 [Silbeninschriften] und 2 [alphabetische Inschriften] mit den ersten Faszikeln 2020 erscheinen sollen). MOR stand mit dem im Corpus-Projekt für die zyprischen Inschriften zuständigen Richard Meister ab den 1890er-Jahren in Kontakt und brachte diesem im Jahr 1910 Abschriften von Inschriften aus der „epigraphischen Schatztruhe" Rantidi zur Kenntnis.[139] Wegen einer Grabungskampagne in Rantidi gab es Verhandlungen zwischen MOR und der Berliner Akademie, die Summa mit Korrespondenzmaterial illustrieren kann,[140] und zu der es ab Spätsommer 1910 unter der Leitung von Robert Zahn gekommen ist, wobei MOR aufgrund der Verurteilung wegen Antikenschmuggels im März desselben Jahres[141] nur eine untergeordnete Rolle spielte.[142] Die Ergebnisse der Kampagne waren mit 133 syllabischen Inschriften aus damaliger Sicht bescheiden, und das vermutete „älteste Heiligtum der Paphischen Aphrodite" wurde nicht gefunden.[143] Der Absatz „Das Schicksal der Inschriften"[144] behandelt die – nicht zuletzt durch persönliche und politische Umstände bedingte – bewegte Forschungsgeschichte. „Eine alphabetische Inschrift" auf einem Grenzstein aus der römischen Kaiserzeit als Beleg für eine bislang unbekannte zyprische Stadt Akra rundet den Beitrag von Summa ab.[145]

Artemis Karnava behandelt in Kapitel III.7[146] „Die kypro-syllabischen Inschriften aus Rantidi bei Paphos". Die Autorin bringt zunächst einen Überblick über die Entdeckungs- und Forschungsgeschichte von Rantidi und die Inschriften.[147] Dabei wird auf die Korrekturen der vielfach fehlerhaften Lesungen Richard Meisters durch Terence B. Mitford eingegangen, die auch das Bild Rantidis als vermeintliches Heiligtum von Apollon und Aphrodite korrigiert haben, sowie auf die Editionsarbeiten von Olivier Masson.[148] Ab 1996 folgten amerikanische Surveyprojekte mit kleineren Grabungen, die weitere Inschriften sowie Terrakotta-Figurinen in dem durch ausufernde Bautätigkeit bedrohten Gebiet erbrachten. Die zuletzt erfolgte Grabung des zyprischen Antikendienstes mit Funden bis in das 4. Jh. v. Chr. und die Datierung des Inschriftenmaterials in archaische Zeit scheinen die von Mitford vermutete

129 S. 289.
130 S. 289–290.
131 S. 290.
132 S. 291–295.
133 S. 295–297.
134 S. 297–298.
135 S. 298–299.
136 S. 299–302.
137 S. 303–312.
138 S. 304.
139 S. 305.
140 S. 305–307.
141 S. 330.
142 S. 307.
143 S. 307–308.
144 S. 309–310.
145 S. 310–312.
146 S. 315–323.
147 S. 315–318.
148 S. 317.

Zerstörung des Areals in den Perserkriegen und eine Wiederaufbauphase zu bestätigen.[149] Ein Abschnitt ist der Silbenschrift Zyperns gewidmet.[150] Im Zypern des 1. Jts. v. Chr. gab es mehrere Sprachen und unterschiedliche Schriftsysteme, die Karnava gut verständlich erklärt, bevor sie die Inschriften aus Rantidi fokussiert,[151] die zur alt-paphischen Form der Silbenschriften gehören. Die eher unspektakulären zyprischen Steindenkmäler mit kurzen syllabischen Inschriften sind zum einen Grabsteine und „bezeugen vorwiegend nur ein bis zwei Eigennamen",[152] zum andern wahrscheinlich Weihinschriften mit einer Namensnennung, wohl der weihenden Person. Die von MOR und der frühen Forschung postulierten „Tempel" waren eine Fehlinterpretation, denn die als Weihungen anzusprechenden Inschriften von Rantidi – von denen die meisten auf steinernen Becken („Hundeschüsseln"[153]) erscheinen – geben keinen Hinweis darauf,[154] auch nicht auf eine bestimmte Gottheit. Dennoch sind sie „ein wertvolles Zeugnis für das frühe kyprische Schrifttum", insbesondere „die frühe Form der paphischen Variante einer kyprischen Silbenschrift, das ‚alt-Paphisch'".[155]

Das von **Stephan G. Schmid** verfasste Kapitel III.8[156] wendet sich unter dem Titel „Das Katastrophenjahr 1910 – Max Ohnefalsch-Richters letzter Zypern-Aufenthalt" wieder Biografischem zu – und dem Ende der wissenschaftlichen Ambitionen von MOR. Am Anfang der Geschichte steht ein von preußischer Seite abgelehnter Finanzierungsantrag MORs und seine verbalen Ausfälligkeiten gegenüber den Sachgutachtern in Berlin.[157] Schmid schildert zunächst die Pläne MORs für die schließlich allein mithilfe von Mäzenen[158] zustande gekommene Expedition, die weit über das Archäologische hinausgingen und aus der zeitlichen Distanz MOR eine Vorreiterrolle bescheinigen.[159] Die Umstände und Hintergründe von MORs damaliger Verurteilung als Antikenschmuggler aufzuarbeiten, ist Ziel des zentralen Abschnitts[160] dieses Beitrags. MOR wurden mit dem Gerichtsurteil vom 21. März 1910 alle archäologischen Aktivitäten in Zypern auf immer untersagt.[161] Anlass war ein angeblich Süßigkeiten, moderne Silbersachen und Stoffe für seine Frau in Deutschland enthaltendes Postpaket, in dem allerdings auch kleine Antiken waren. Er bekam neben einer Geldstrafe zwei Monate rigorose Polizeiüberwachung, zudem wurde er der Absicht weiterer unerlaubter Antikenausfuhr verdächtigt.[162] Schmid diskutiert den Sachverhalt ausführlich und belegt ihn mit zeitgenössischen Dokumenten. Wie stark eine von MOR vermutete Intrige gegen ihn zum Tragen kam, muss offen bleiben.[163] Dann ist die deutsche Rantidi-Kampagne und MORs Rolle dabei Thema, wobei Schmid einen „Griffel-Brief" an Richard Meister vom 10. Juni 1910 zur Erläuterung von MORs Aufgeregtheit heranzieht,[164] sowie eine in den Herbst 1910 zurückgehende, durch J. Basil Hennessy 1975 berichtete Episode zu nächtlichen Aktionen MORs.[165] Eine „Nachlese" schildert die schwierige Rückkehr MORs nach Deutschland über Genua, reflektiert Robert Zahns vernichtende Einschätzung MORs in der Berliner Philologischen Wochenschrift vom 4. Februar 1911 und den späteren Vergleich mit Georg Karo, den man nach seiner Ausweisung aus Griechenland im Ersten Weltkrieg der Absicht illegaler Antikenausfuhr bezichtigte.[166]

Stephan G. Schmid gibt in Kapitel III.9[167] einen umfassenden Überblick über „Max Ohnefalsch-Richters archäologische Arbeitsorte auf Zypern", dessen unter fünfzig Punkten von Achna bis Zarukas angeführte Toponyme mit profunden, im Rahmen von zwei universitären Lehrveranstaltungen entstandenen Kommentaren und reichlichen Anmerkungen sowie Literatur versehen sind. Auf einer auf MOR und Magda OR zurückgehende Karte[168] sind alle Orte mit den fortlaufenden Nummern des Textes eingetragen. In den Kommentaren werden – nach einleitenden geografischen Informationen – neben MORs Tätigkeiten gegebenenfalls auch die Unternehmungen anderer und die Forschungsgeschichte angesprochen. 17 Abbildungen begleiten den Text.

Teil IV[169] trägt die Überschrift „Gefunden von: Max Ohnefalsch-Richter – Museale Sammlungen zyprischer Antiken in aller Herren Ländern" und beginnt mit dem Beitrag IV.1[170] „Auf Max Ohnefalsch-Richters Spuren im *British Museum*" von **Thomas Kiely**, in dessen Zentrum

149 S. 318.
150 S. 318–320.
151 S. 320–322.
152 S. 321.
153 S. 318, 322.
154 S. 321.
155 S. 322.
156 S. 325–350.
157 S. 325–326.
158 S. 328.
159 S. 326–329.
160 S. 330–348.
161 S. 332.
162 S. 335–336.
163 S. 342–343.
164 S. 343–347.
165 S. 347–348.
166 S. 348–350.
167 S. 351–384.
168 S. 353.
169 S. 385–495.
170 S. 387–440.

Objekte von zehn Orten stehen, an denen MOR im Auftrag von Charles Newton zwischen Oktober 1880 und Anfang 1883[171] ausgegraben hat, sowie weitere Funde im *British Museum* (BM), bei welchen ein Zusammenhang mit MOR besteht.[172] Quantitativ ist dieses Fundkonvolut kleiner als die späteren Akquisitionen des *Cyprus Exploration Fund* und des Museums selbst, stellt aber einen „wichtigen Meilenstein in der Entwicklung der kyprischen Archäologie hin zu einer mehr oder weniger wissenschaftlichen Disziplin" dar.[173] Die Vorlage der Funde war bisher unvollständig und erfolgt gerade in einem Projekt Kielys.[174] Die originalen Fundberichte und Briefe MORs im Museum existieren nicht mehr und die Aufzeichnungen der Bestandsbücher sind mangelhaft („von Ausgrabungen auf Zypern"), sodass eine genaue Zuordnung der Funde schwierig ist.[175] In seinem aufwendigen Beitrag untersucht Kiely Quellen, die MORs Aktivitäten für das BM betreffen, „um die Bestände an kyprischen Antiken im BM besser im Kontext verstehen zu können".[176] Hinzu kommt die Wahrscheinlichkeit des Vorhandenseins von Funden der von Kiely behandelten Grabungen in anderen Sammlungen als dem BM. Einen Abschnitt widmet der Autor dem Verhältnis zwischen MOR und dem BM,[177] das mit MORs frühen Ausgrabungen im Auftrag von Charles Newton begonnen hatte, die in diesem Abschnitt angesprochen werden. Eine „Dokumentation"[178] definiert die gleich spärliche wie komplizierte Quellenlage sowie den verlorenen ursprünglichen Umfang zweckdienlicher Materialien und demonstriert die damit einhergehende schwierige Rekonstruktion von Provenienz, Fundzusammenhängen etc. anhand von Beispielen. Es zeigt sich, dass selbst die Inventare und Register des BM dazu nur bedingt hilfreich sind.[179] Es folgen ein umfänglicher „Überblick der Fundorte" mit topografischen Erwägungen und Lokalisierungsfragen, gelegentlich unter Einbezug der Grabtypologie,[180] und Diskussion von Fundstücken und Objektgruppen,[181] ein Abschnitt zu anderen Funden „mit MOR-Bezug" im BM und deren Erwerbungsgeschichte[182] sowie ein Anhang in Listenform mit den Funden MORs im BM und ihren Inventargruppen.[183] Auch dieser Beitrag ist mit reichlich Bildmaterial versehen.

Der kurze, auf umfassendere Forschungen zurückgehende[184] Beitrag IV.2[185] trägt den Titel „‚J'ai découvert l'art grec à Chypre'" und hat **Hélène Le Meaux** und **Annie Caubet** als Verfasserinnen, die Korrespondenzen MORs nach Frankreich vorlegen, die im Gesamtbestand seiner Briefe nur einen geringen Teil ausmachen, auch wenn sich zahlreich Briefe und französische Briefpartner erschließen lassen.[186] Die hier untersuchten Schreiben MORs enthalten „wertvolle Informationen zu seinen Ausgrabungen auf Zypern, aber auch zu seinen Bemühungen, Funde zu verkaufen sowie zu seinen Publikationen und jenen anderer Zeitgenossen".[187] In einem Brief von 1886 an Léon Heuzey, Konservator des *Louvre*, stellt MOR sich als „Entdecker der griechischen Kunst auf Zypern" dar – von daher die Überschrift dieses Beitrags. Von MOR in seinen deutsch und französisch verfassten Schreiben gelistete Objekte, die auch aus seinen eigenen Ausgrabungen stammen konnten,[188] tauchten dann im Pariser Kunsthandel auf und wurden zum Teil vom *Louvre* erworben. Der Wert der angebotenen Fundensembles wird von MOR in englischer, deutscher und französischer Währung angegeben, Transaktionen laufen über die *Imperial Ottoman Bank*.[189] In MORs Briefen geht es neben Kaufangeboten auch um Wissenschaftliches.[190]

„Max Ohnefalsch-Richter und die kyprischen Antiken des Louvre" behandeln **Antoine Hermary** und **Hélène Le Meaux** in Beitrag IV.3.[191] Kyprische Antiken waren schon gut zwei Jahrzehnte früher in den *Louvre* gelangt, als Mitte der 1880er-Jahre der erste Ankauf von Objekten aus Grabungen MORs erfolgte – vor allem Terrakottastatuetten aus Achna.[192] Der größte Ankauf erfolgte mit 49 Stücken aus MORs Marion-Grabungen bei der Pariser Auktion von Ende Mai 1887, eine geringe Zahl im Vergleich zu den 337 Objekten, die damals nach Berlin an das Antiquarium gingen und einem bedeutenden Ankauf für das *British Museum*.[193] Es werden einige der bedeutsameren Erwerbungen, versehen mit exemplarischen Abbildungen, vorgeführt – attische Vasen, Grabstatuen, und auch später erfolgte

171 S. 392.
172 S. 387.
173 S. 387.
174 S. 388.
175 S. 388.
176 S. 389.
177 S. 390–393.
178 S. 393–400.
179 S. 400.
180 S. 406–407.
181 S. 401–432.
182 S. 432–439.
183 S. 439–440.
184 S. 445.
185 S. 441–445.
186 S. 444.
187 S. 441.
188 S. 442.
189 S. 443.
190 S. 443–444.
191 S. 447–457.
192 S. 447.
193 S. 448–449.

Erwerbungen kommen zur Sprache.[194] Den 28 Oinochoen mit plastischem Dekor, die in Listenform mit Literatur präsentiert werden, wird wegen ihres wissenschaftlichen Interesses besonderes Augenmerk geschenkt.[195] Dieses Interesse gilt auch anderen Objekten aus MORs Grabungen, die im Beitrag abschließend hervorgehoben werden.[196]

Stephan G. Schmid betrachtet in Beitrag IV.4[197] „Max Ohnefalsch-Richter und die kyprischen Antiken in den Berliner Museen". Er weist anfangs auf die Rolle MORs auch für Sammlungen in Deutschland abseits von Berlin hin und auf Kypriaka, die vor der Zeit MORs nach Berlin gelangt waren. Im Beitrag aber geht es um Objekte der Staatlichen Museen zu Berlin in der Antikensammlung und im Museum für Vor- und Frühgeschichte, viele davon jetzt in der Dauerausstellung im Neuen Museum präsentiert.[198] Schmid geht zunächst auf Funde aus der Zeit vor MOR ein.[199] Die ersten von oder über MOR angekauften Objekte, die Schmid anspricht, stammen von dessen Ausgrabungen im Jahr 1885, hinzu kommt der bedeutende Ankauf auf der Pariser Auktion von 1887.[200] Weitere mit MOR verbundene Erwerbungen gab es in den Folgejahren und bis Mitte der 1890er-Jahre. Der mit MOR verknüpfte Bestand ist insgesamt der größte der Berliner Kypriaka. Den Beständen des Museums für Vor- und Frühgeschichte, deren Schwerpunkt auf der Sammlung Ohnefalsch-Richter/Weisbach liegt, und ihrer wechselvollen Geschichte wird besonderes Augenmerk geschenkt.[201] In der Folge wird „die von MOR im Wesentlichen 1894/1895 auf Zypern angelegte Sammlung" genauer betrachtet.[202] Dabei geht es unter anderem um MORs Erwerbungspraxis und Verkaufsstrategie sowie Fragen der Herkunft und Zusammengehörigkeit von Funden. Eine Rekonstruktion der Sammlung MORs müsste neben dem Berliner Bestand auch die bedeutende Kypriaka-Schenkung Rudolf Virchows im Römisch-Germanischen Zentralmuseum Mainz[203] und das kriegsbedingt verlagerte Material im *Pushkin*-Museum in Moskau berücksichtigen.[204]

In den Bereich der Ethnografie führt uns mit ihrem Beitrag IV.5[205] **Margit Z Krpata**: „*Parallelen in den Gebräuchen der alten und der jetzigen Bevölkerung von Cypern.* Magda und Max Ohnefalsch-Richter und die Ethnographie Zyperns". Das im Titel erscheinende Zitat ist ein Vortragstitel MORs und zugleich die Überschrift eines Artikels von ihm im 23. Band der Zeitschrift für Ethnologie aus dem Jahr 1891. MOR hatte 1890 vor seiner Abreise von Zypern an mehrere Orte Kisten abgeschickt, die neben zypriotischen Antiken auch ethnografisches Material enthielten.[206] Das ethnografische Interesse war bei MOR von Anbeginn vorhanden, die gemeinsam mit seiner Frau Magda später verfasste, 1913 herausgebrachte Monografie über „Griechische Sitten und Gebräuche auf Cypern" etwas bis dahin nicht Dagewesenes. Krpata verweist auf das „Faible des Autors für das Aufspüren von Ähnlichkeiten der zypriotischen Antike mit der Gegenwart",[207] das seinen Sinn für ethnografische Kypriaka bestimmt habe und sich auch im fotografischen Werk des Ehepaares Ohnefalsch-Richter widerspiegelt. Die Verfasserin bringt zunächst einen längeren Abschnitt „Ethnographische Sammlungen – Entstehung und Zusammensetzung",[208] in dem sie Situationen in Wien, Leipzig, Philadelphia, Königsberg, MORs Privatbesitz und Düsseldorf beleuchtet. 1890 hatte MOR einigen Museen die Zusammenstellung einer ethnografischen Sammlung angeboten, wobei in 16 Punkten die materielle und immaterielle Kultur Zyperns der zweiten Hälfte des 19. Jhs. jener des Altertums gegenübergestellt wurde.[209] Es ging überwiegend um Alltagsgegenstände wie Kalebassen (getrocknete Flaschenkürbisse), Keramiken, Flechtwaren und Metallobjekte, von denen die Autorin einige unter Bedachtnahme ihrer Tradition beschreibt.[210] Im Anschluss daran werden die genannten Städte und die in ihnen mit MOR verbundenen Tätigkeiten wie Vorträge und Ausstellungen sowie Ankäufe behandelt. Wien war dabei die erste Verkaufs- und Vortragsstation auf MORs Rückreise 1890. Es fanden mehrere Vorträge statt, die ein gewisses Medien-Echo hatten, und es gab Ankäufe durch verschiedene Institutionen. Exponate von damals waren in einer Zypern-Ausstellung 1997 zu sehen, deren Katalog Krpata mitherausgegeben hat, und von denen die Autorin einige besonders hervorhebt.[211] Der Verbleib der 1891 nach Leipzig gelangten Ethnografica ist derzeit unbekannt.[212] Anfang 1893 sandte MOR viele ethnografische und archäologische Objekte an das *Penn Museum* in Philadelphia, Vereinigte Staaten, wo er im selben Jahr eine Vortragsreise

194 S. 450–453.
195 S. 452–455.
196 S. 455–457.
197 S. 459–468.
198 S. 459.
199 S. 459–460.
200 S. 461.
201 S. 462.
202 S. 463–468.
203 S. 463–464.
204 S. 466–467.
205 S. 469–491.
206 S. 469.
207 S. 469–470.
208 S. 470–479.
209 S. 470.
210 S. 471–472.
211 S. 474–475.
212 S. 476.

absolvierte.[213] Die heutigen Besitzer dieser 1948 (zum Teil) versteigerten Sammlung sind unbekannt, aber es existieren davon Objektfotografien, die das Ehepaar Ohnefalsch-Richter für seine Monografie von 1913 hatte anfertigen lassen.[214] Im Abschnitt zu Ethnografica im Privatbesitz des Ehepaares Ohnefalsch-Richter beschreibt Krpata einige besondere Stücke, deren Verbleib genauso unbekannt ist wie der des gesamten Nachlasses.[215] Ein kurzer Abschnitt gilt den heute stark dezimierten Erwerbungen für das Düsseldorfer Gewerbemuseum – heute Museum Kunstpalast – durch dessen Direktor, den österreichischen Kunsthistoriker Heinrich Frauberger, der im Sommer 1890 gemeinsam mit MOR Zypern bereist hatte.[216] „Dimitris Tsimouris – Töpfer aus Lapithos", dessen einzigartige Erzeugnisse mit 32 Stück die größte Gruppe der 1890 in Wiener Museen verbliebenen Keramiken MORs ausmachen, widmet Krpata einen eigenen Abschnitt.[217] Es folgt ein kurzer, vor allem der Frage des Beitrags von Magda OR nachgehender Text „Griechische Sitten und Gebräuche – eine Koproduktion des Ehepaares Ohnefalsch-Richter" zur Monografie von 1913: „Ein Standardwerk der Zypriologie, in dem sie sich als erste der Volkskunde Zyperns in dieser Ausführlichkeit annahmen."[218] Kurz gestreift wird das Thema der ethnografischen Fotografien des Forscherpaares, werden die für MOR wichtige Vortragstätigkeit und seine Ausstellungen angesprochen,[219] bevor Krpatas eigentlicher Beitrag mit einem knappen „Epilog" endet. Hinzugefügt wurde nämlich noch ein „Nachtrag – ein Kamel in Philadelphia",[220] denn knapp vor Drucklegung war bekannt geworden, dass einige Objekte des *Penn Museums* nicht versteigert, sondern an die *Temple University* abgegeben wurden und manche – entgegen der bisherigen Annahme – im Museum verblieben. Die im Nachtrag diskutierte kleine Keramikstatuette in der *Mediterranean Section* des Museums gehört zu letzterer Gruppe und ist nicht antik, wie von Krpata überzeugend argumentiert wird. An den genannten Orten gegebenenfalls noch vorhandene andere Kypriaka der alten Sammlung wären Gegenstand zukünftiger Recherche.[221]

Kapitel IV.6[222] ist eine übersichtliche Zusammenstellung von „Antiken aus Max Ohnefalsch-Richters Aktivitäten in den Museen dieser Welt", alphabetisch nach Ländern und Orten gegliedert. Eine ausführlichere und kommentierte Darstellung ist geplant.

Teil V – „Dilettanten, Amateure und solche, die es werden wollen" – beschließt den Beitragsteil des Bandes mit einem Text von **Veit Vaelske**: V.1 „‚[…] an ignorant, intrusive, and superserviceable busybody.' Über den archäologischen Parvenü Max Ohnefalsch-Richter".[223] Das der *New York Times* vom 25. Oktober 1885 entnommene Zitat, das MOR als „ignoranten, aufdringlichen und überaus hilfsbereiten Wichtigtuer" charakterisiert, mag die Meinung widerspiegeln, die damals viele von ihm hatten, von vielen, die ihn nicht mochten, aber auch solchen, die ihn und seine Arbeit schätzten. In der archäologischen *community* allerdings erreichte MOR nie die Beachtung und den Stellenwert, die ihm aufgrund seiner Verdienste um die zyprische Altertums- und Landeskunde gebührten, und noch heute kommt er in der wissenschaftsgeschichtlichen Literatur kaum vor, wird er „als ‚Amateurarchäologe' inkriminiert".[224] Vaelske stellt die Frage, warum das so ist. Vorgeworfen wird MOR heutzutage, nicht zu Lebzeiten, seine Ausgrabungsmethode, damals wie heute der „Mangel philologisch-historischer und archäologischer Schulung" und ein Mangel an wissenschaftlicher Fähigkeit – Letzteres bereits von seinem Doktorvater Johannes Adolf Overbeck in Zusammenhang mit seiner Dissertation von 1891. Negative Charaktereigenschaften wie „unbeherrschte Geltungssucht und Konfliktfreudigkeit" trugen gewiss zu MORs Unbeliebtheit bei, zum üblen Ruf nicht zuletzt seine Verurteilung wegen Antikenschmuggels auf Zypern 1910,[225] und angelastet wurden ihm „seine autodidaktische Gelehrsamkeit und mangelhafte akademische Sozialisierung",[226] die zu seiner Marginalisierung beitrugen. Mit dem Fehlen einer universitären Ausbildung für eine archäologische Tätigkeit auf Zypern zu jener Zeit relativiert Vaelske den Vorwurf von MORs mangelnder Schulung und hält dessen Vorgangsweise „der aktiven Aneignung und Autopsie" zur Erschließung zyprischer Altertümer für die angemessenste.[227] Für die „Ablehnung dilettierender Außenseiter" führt der Autor mehrere Gründe an, die er in der institutionalisierten Archäologie und im teils dünkelhaften akademischen Establishment ausmacht. Ausgreifend berührt er auch das Frauenstudium und den Kunstbetrieb, wo er ähnliche Abwehrmechanismen ortet,[228] und bringt Beispiele für „Amateure, Dilettanten und Quereinsteiger" in der Altertumskunde zu MORs Zeit,[229]

213 S. 477.
214 S. 477–478.
215 S. 478.
216 S. 479.
217 S. 481–483.
218 S. 483–484.
219 S. 484–487.
220 S. 488–491.
221 S. 491.
222 S. 493–495.
223 S. 499–510.
224 S. 499.
225 S. 500.
226 S. 501.
227 S. 501.
228 S. 502–503.
229 S. 503–505.

um sodann Parallelen und Unterschiede zwischen Heinrich Schliemann und MOR aufzuzeigen, der den „archäologischen *Newcomer*" Schliemann als Vorbild angesehen hat. In der Gegenüberstellung geht Vaelske der Frage nach, wo MOR „fatalerweise vom Erfolgsmuster anderer Quereinsteiger abgewichen" ist, und gibt Antworten.[230] Nicht eine „Reduzierung auf seine archäologische Dimension" könne MOR gerecht werden, seine Biografie sei „vielmehr in den weiteren Kontext historischer Bedingungen zu stellen" und werde „in ihren Absichten, Strategien und Resultaten nur so verständlich". MOR sei Konzepten seiner Zeit von sozialem Aufstieg und Selbstdarstellung gefolgt, nach welchen „Parvenüs auch ohne professionellen Hintergrund als Unternehmer erfolgreich werden konnten".[231] Hinzu kommt, dass MOR ursprünglich gar nicht der Archäologie wegen nach Zypern gekommen war, sondern dort zufällig zu ihr kam.[232] Er „reihte eine Unternehmung, eine Publikation an die nächste, ersetzte Freunde und Feindbilder durch andere, überlagerte ein Problem mit dem nächsten".[233] Anders als Heinrich Schliemann war MOR kein *„selfmade man"*, als er sich der Archäologie zuwandte. Mit seiner wissenschaftlichen Tätigkeit suchte er Anerkennung und Ruhm zu erreichen, wirtschaftlich war er auf das Establishment angewiesen, akademisch nirgends eingebunden.[234] Es scheint, so Vaelske, als ob MOR „im ständigen, maßlosen Bewusstsein eines Defizits an Sach- wie Geldmitteln und an fachlicher Legitimation gelebt" habe, ein Zustand, der sich mit dem Abhandenkommen seiner letzten Förderer bis zu seinem Tod akut zuspitzte.[235]

Es folgt das Abbildungs-, Abkürzungs- und Literaturverzeichnis. Das Abbildungsverzeichnis[236] ist nach den Beiträgen gegliedert und führt die Abbildungsnummer, den Abbildungsnachweis und die Seite des Erscheinens der Abbildung im Band an. Die Informationen zu den verschiedenen Quellen des 19. Jhs. wie *The Illustrated London News* entnommenen Abbildungen auf den Deckblättern der Teile I–V finden sich auf deren Rückseite. Das Abkürzungsverzeichnis,[237] benannt als „Allgemeine Abkürzungen", enthält zum Großteil, nämlich 49 von 55, Siglen für Publikationen von MOR. Das umfangreiche Literaturverzeichnis[238] besteht aus allen in den 2367 Fußnoten der Beiträge vorkommenden Publikationen mit ihren Siglen und ist auch eine Fundgrube für über das engere Thema Ohnefalsch-Richter hinausgehende Literatur.

An der materialreichen, großzügig mit Bildmaterial ausgestatteten, mit ansprechender Gestaltung selbst des Buchumschlags erstellten Publikation gibt es kaum etwas formal zu bemängeln. Das Lektorat hat bis auf ganz wenige, nur punktuelle Stellen sehr gut gearbeitet. Ein abschließender Durchgang nach dem letzten Umbruch hätte den Beitrag von Summa in der Kopfzeile sicher mit Seite 313 enden lassen, nicht mit 212, den von Kiely gewiss auch in der Kopfzeile mit Seite 440, nicht mit 441. Darüber, ob die Bibliografie von MOR inmitten der Beiträge, und nicht bei den Verzeichnissen erscheinen sollte, kann man diskutieren, muss man aber nicht. Eine große Zypernkarte mit den Arbeitsorten MORs hätte sich eventuell gut am hinteren inneren Buchdeckel gemacht und wäre so beim Lesen rascher zur Hand als Abbildung 2 auf Seite 353. In manchen Fällen hätte man das Format der Abbildungen überdenken können, das manchmal sehr großzügig, manchmal wiederum zu klein bemessen erscheint. Das Format der Abbildungslegenden ist übrigens vorbildlich. Über ein Register hat das Publikationsteam gewiss selbst nachgedacht. Dass die Querverweise in den Fußnoten nur das Kapitel angeben und, wo zutreffend, keine Seiten nennen, werden alle nur zu gut verstehen, die einmal ein derartiges Buch zum Druck gebracht haben. Dass aus dem Kapitel mit den Arbeitsorten MORs auf andere Kapitel mit deren Vorkommen im Band verwiesen wird, umgekehrt aber kaum, ist vertretbar. Eine stichprobenartige Prüfung der Siglen mit ihrem Vorkommen in der Gesamtbibliografie verlief zufriedenstellend. In vereinzelten Anmerkungen wäre neuere Literatur zu nennen.

Diese geringen Bemerkungen sollen nicht den großen Wert des hervorragenden Bandes schmälern, sondern nur zeigen, dass sich der das Buch Besprechende in diesem genau umgesehen hat.

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230 S. 505–507.
231 S. 507.
232 S. 508.
233 S. 509.
234 S. 509–510.
235 S. 510.
236 S. 511–521.
237 S. 522–524.
238 S. 525–574.