Early Bronze Age Pottery Workshops Around Pergamon: A Model for Pottery Production in the 3rd Millennium BC

Barbara Horejs[1] – Sarah Japp[2] – Hans Mommsen[3]

Abstract: Surveys have revealed new insight into the prehistory of western Anatolia at the Bakırçay Valley and its hinterland. These surveys, conducted between 2008 and 2014, have at the outset focussed on the prehistory of the region, which has long been overshadowed by the famed ancient city of Pergamon that dominates the landscape and regional scholarship. This contribution presents the first results of archaeometric pottery studies and also a preliminary model for pottery production in the early 3rd millennium BC. From its typology, and also a macroscopic examination of wares and fabrics, this collection of pottery from the Early Bronze Age (EBA) is rather homogenous. However analysis of the material by Neutron Activation Analysis (NAA) reveals that the material may have originated from different sources. Altogether 112 prehistoric pottery fragments stemming from 12 sites in the area surrounding Pergamon were examined by Neutron Activation Analysis, of which 48 can be dated to the Early Bronze Age. These are presented in detail. The analysis reveals that prehistoric pottery workshops in the region of Pergamon operated over an extended period and used the same clay sources and/or the same clay recipes. However it also appears that some workshops were only active during a specific period. Presumably these workshops did not trade their products over vast distances, but satisfied local needs. Imports are hardly detectable in the Early Bronze Age pottery of the Bakırçay Valley, which fits into the overall social and economic picture of this micro-region during the 3rd millennium BC.

Keywords: Early Bronze Age, Bakırçay Valley, pottery production, NAA, Pergamon, archaeometry

Introduction

The prehistoric period has never been the focus of research in the area of the famed city of Pergamon, including the greater Kaykos or Bakırçay Valley. Aside from day-trips by W. Dörpfeld in 1908 and K. Bittel in the 1940s,[4] our information about the prehistory of the region is largely based on a single survey conducted by J. Driehaus and published as an article in 1957.[5] The glory of Hellenistic Pergamon seems to have captured the attention of all archaeological research in this area over the past 50 years, and as a result the prehistory of this part of western Anatolia has remained almost completely unknown. It is this deficiency that forms the starting point of our archaeological and environmental survey, which incorporates a broad spectrum of archaeological, archaeometric, and geoarchaeological analyses to examine old finds alongside new material and new sites. The aim of this project is to examine (1) settlement in the area and how it changed over time, (2) the environmental conditions in the valley and at the coast, (3) access to raw materials and their use in combination with potential sources in the region, and (4) how the region was integrated into the wider Aegean-Anatolian world. To date, the project has focused on the earliest permanent settlements in the region, including site clustering, the intensity of habitation, and how the settlement pattern has shifted over time. Investigations conducted between 2008 and 2014 have included archaeological surveys (intensive and extensive), geophysical prospection, and

1 Institute for Oriental and European Archaeology, Austrian Academy of Sciences; barbara.horejs@oeaw.ac.at.
2 c/o Pergamongrabung, Deutsches Archäologisches Institut; sarah.japp@dainst.de.
3 Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn; mommsen@hiskp.uni-bonn.de.
4 Dörpfeld 1908; Dörpfeld – Hepding 1910; Bittel 1950.
5 Driehaus 1957.

geoarchaeological analyses (drilling and source analysis).[6] This contribution presents one aspect of EBA settlement and communities in the Bakırçay Valley along with an archaeometric analysis of pottery in the region, including old and new assemblages.

The Environmental and Archaeological Context

The Bakırçay (*Kaykos*) River is the defining feature of this micro-region, as demonstrated by the results of palaeogeographic investigations.[7] Most of the settlements in the valley are located at the edge of the flood plain, at natural elevations or in the immediate coastal zone of the bay (Fig. 1). Presumably, regular flooding did not allow using the plain for purposes such as transport, meaning also that cultivation or pastoralism could only have taken place at the edge of the plain and at the transition zone to the adjacent ridges.[8] However the exceptional location of Yeni Yeldeğirmentepe in the middle of the flood plain suggests a certain stability in the river's course and water level, at least from the Late Chalcolithic through the Early Bronze Age (4th–3rd millennium BC). Spatial analysis of the character of the landscape in the Gümüşova Valley by D. Knitter using fuzzy logic and environmental data in a GIS demonstrated the limited extent of potential agricultural space.[9] Various natural resources were exploited by communities in the region, including cherts, radiolarite, and flints (for knapped stone tools),[10] serpentinite and basalt (for ground stone tools), andesite (for grinding stones), and clay (for spindle whorls and pottery). Some of these local sources have been identified by the geological investigations of D. Wolf, including a basalt source at Erigöl Tepe in the middle Bakırçay Valley, cherts and flints in various areas, as well as clay sources.[11] Exotic raw materials, including obsidian, are thus far completely absent during the EBA.[12] Only two metal objects dating to this period have been recovered in the valley; they are made of arsenical copper and from Mehofer's analyses probably derive from regional western Anatolian copper deposits.[13]

Altogether nine archaeological sites dating to the Early Bronze Age (EBA 1) or the Late Chalcolithic–Early Bronze Age 1 transition have been identified (Fig. 1). Four are situated at the Aegean coast (Başantepe, Üyücektepe, Psaltıderesi Höyük, and Elaia), two sites are located in the lower Bakırçay Valley (Çiftlik and Yeni Yeldeğirmentepe), and three sites have been identified at the edge of the Yunt Mountain along small river valleys (Gavur Evleri, Üveçiktepe, Bağlı Tepe). The sites are interpreted as settlements based upon a variety of indicators (collected domestic materials, geophysics, architectural remains at the surface, drillings, etc.), although to what extent they were occupied on a permanent or seasonal basis cannot be determined with certainty. The sites are assigned to this period on the basis of pottery studies, argued elsewhere in detail.[14] Due to the lack of excavated sites in the Bakırçay Valley, this pottery chronology is dependent on the excavated material of key sites in the broader region such as Thermi, Troy, Yortan, Liman Tepe, Bakla Tepe, Çukuriçi Höyük, and Beycesultan,[15] to mention only a few. These studies provide a

---

6 For annual reports see Horejs 2010b; Horejs 2011a; Horejs 2012; Horejs 2013; Horejs 2014b; Horejs 2015; Horejs et al. 2016.

7 Seeliger et al. 2011; Schneider et al. 2012; for the Gümüşova Valley see Horejs 2015.

8 For detailed results see also Horejs 2010a; Horejs 2014c.

9 Horejs 2014b, 110–111, figs. 32–34.

10 Horejs 2015, 145.

11 Horejs 2013, 207.

12 Knitter et al. 2013.

13 Horejs 2014c, 115, fig. 6; Mehofer in preparation.

14 E.g. Horejs 2014c.

15 Lamb 1936; Bittel 1939–1941; Kâmil 1982; Korfmann 2001; Kouka 2002; Erkanal 2008a; Erkanal 2008b; Ünlüsoy 2008; Horejs et al. 2011.

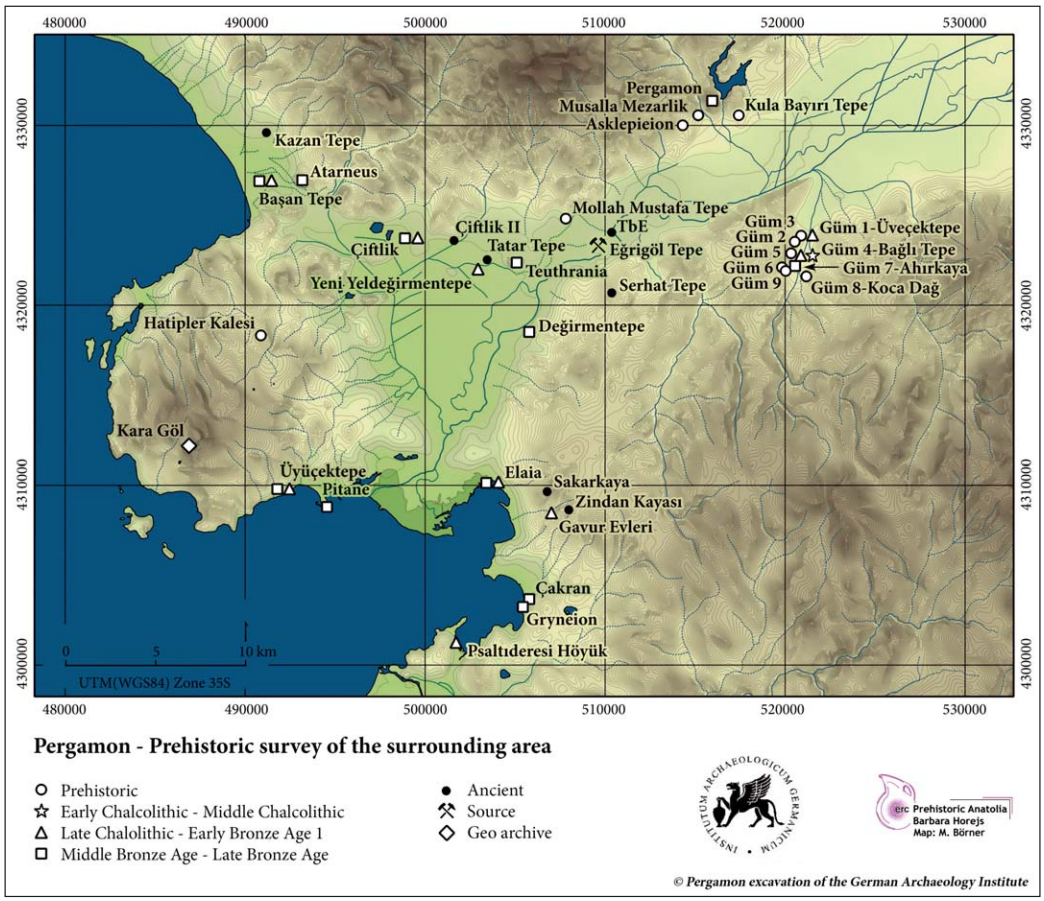

Fig. 1 Prehistoric sites in the Bakırçay Valley based on the Prehistoric Survey Project (map by DAI Pergamon and ERC Prehistoric Anatolia/M. Börner)

detailed chronology of all catalogued sites for the first centuries of the 3rd millennium BC, defined as EBA 1 from the radiocarbon-based sequences at Çukuriçi IV–III and Troy I.[16]

The EBA Pottery Assemblage

Pottery comprises the foremost category of finds recovered from our surveys and also from former investigations in the region. All this material is kept at the Pergamon depot. This pottery has been studied in all its conventional aspects such as shape, type, and measurements to develop a regional typology. From a total of 648 diagnostic ceramics, 198 pieces can be dated to the EBA or to the transition from the Late Chalcolithic to the EBA. The statistical averages are, in general, distorted because of selection and storage practices employed in the first of half of the 20th century. In addition, our recent surveys had to follow selection strategies in the field. Comprehensive statistical analyses are only possible with material from sites that have been intensively surveyed (e.g. Yeni Yeldeğirmentepe or Değirmentepe).[17] In spite of these difficulties, the assemblage of

[16] Horejs – Weninger 2016.
[17] E.g. Horejs 2012.

around 200 diagnostic ceramics dated to the late 4th and 3rd millennia BC allow some general remarks on pottery from the period.

First, the entire sample of ceramics is handmade. The typical domestic assemblage is composed of shallow bowls with open or carinated mouth (inverted or regularly rounded rims and horizontal tubular lugs), deep bowls with slightly curved or vertical body, necked jars, jugs, narrow-mouthed vessels, s-shaped jars, tripod cooking pots, and probably also pithoi[18] (Pls. 1–6). The majority of fine to medium wares are fine-burnished or polished with dense and usually plain and often shiny surfaces. A few tablewares are decorated with incised linear motifs, comparable to Troy I and Çukuriçi IV. Fine to medium wares mostly feature dark-coloured surfaces (grey, dark brown, black) with light breaks (red, orange, brown), whereas the majority of medium to coarse wares are entirely brown or red without slip (Plate 7). Coarse wares are frequently smoothed or medium- to coarsely-burnished, sometimes decorated with small vertical knobs.[19] In addition, all sherds have been defined macroscopically to categorise ware groups and to systematically define the technological properties of ceramics in the valley. Macroscopic classifications of hardness, porosity, break, colour, temper, and surface treatment have allowed us to delineate a local system of pottery ware groups (Plate 7).[20] This analytical tool has been used to assess the ceramic assemblages at various sites, including Çukuriçi Höyük in the neighbouring region.[21] From these studies, samples were selected for further archaeometric analysis. In the course of examining early pottery production in the environs of Pergamon, an archaeological-archaeometric project on the prehistoric pottery was initiated and conducted by S. Japp and H. Mommsen.[22]

Provenancing and Neutron Activation Analyses (NAA) of Pottery and Data Evaluation

For discerning pottery production sites on the basis of pottery from archaeological surveys or excavations, a well-established and widely accepted method is analysing the elemental composition of the clay. The principles of this method have been described many times[23] and are only briefly summarised here. This method is more robust if more elements are included in the analysis, especially if the number of experimental uncertainties (formerly called experimental errors) is rather low. The aim is to define the composition of the clay or clays used in the production workshop, which are generally different for different sites or regions and thus point to the place of origin of the clay. From its comparison to a human fingerprint, the method has also been called, 'chemical fingerprinting'.

Firing does not change the elemental composition of a ceramic object, except for some volatile elements such as or Br. Thus the pattern that is measured corresponds to the composition of the clay paste prepared by the ancient potter. The length of time during which the object has remained buried also does not alter the composition, aside from specific elements like Ca, which may be leached or deposited particularly at the surface layers, or Ba, which is sometimes introduced into the ground by the use of fertilisers. Also the alkali elements Na, K, Rb, and sometimes Cs can be affected.[24] If, at a single workshop, different clay pastes were prepared, and adjustments in preparation affected several elements of the production process, or if different clays were mixed

18 The majority of pithoi seem to date to the 2nd millennium BC, but a few examples might be dated to the EBA.
19 For more details see Horejs 2010a.
20 Horejs et al. 2010c.
21 See Röcklinger – Horejs, this volume.
22 This project was part of the archaeological-archaeometric analysis of pottery excavated in Pergamon and its surroundings that was set up within the framework of the scientific program of the Pergamon Excavation of the German Archaeological Institute: see Pirson 2008, 141–142. The results of the first two sample sessions of Hellenistic and Roman pottery have already been published in Japp 2009; Mommsen – Japp 2009; Schneider – Japp 2009.
23 Perlman – Asaro 1969; Harbottle 1976; Wilson 1978; Mommsen 1986; Mommsen 2007.
24 Schwedt et al. 2006; Schwedt – Mommsen 2007.

together, then different patterns may be detected in products from the same workshop.[25] On the other hand, if different workshops across a region used the same clays and the same clay preparation techniques or the same untreated clay, then the same pattern will be evident across the entire area. One example is the mud deposited along the river Nile, whose composition is remarkably similar throughout the valley.[26]

We can therefore assume that ceramic objects featuring the same elemental composition originated from the same geographical site or area, or sometimes from the production series of a single workshop. However, the location of this workshop is often unresolved. Its geographical location can be determined only by analysing material from the sites in question, for instance reference material such as samples from local clay beds or samples of kiln wasters or other locally produced pieces, which are even more telling than the composition of the prepared clay pastes. In the absence of such material, distribution models are considered. If pottery with a given composition is found at a site in large numbers, and if its occurrence decreases with distance from the site, then it is likely that it was produced at that site. Similarly, if the composition of pottery at a single site is identical across very different time periods, or across different ware types, then the material was likely produced at that site, as it is unlikely that imports from different periods or across ware types would be identical in composition.

An archaeometric method well-adapted to the 'chemical fingerprinting' of pottery is Neutron Activation Analysis (NAA). The method examines minor and trace elements from pottery samples and has been routinely applied in Bonn for around 25 years.[27] Samples of about 80mg are obtained from pottery pieces by drilling into the sherd with a corundum (pure aluminium oxide, sapphire) drill bit. Reasonable efforts were made to avoid temper or large, non-plastic inclusions during drilling. The resultant powder is pressed into pills using pure cellulose as a binder. After pressing, a set of these samples, along with several pills of the Bonn pottery standard,[28] is sent to the Reactor Institute in Delft, Netherlands to be analysed. From 2010, samples are exposed to neutron irradiation with a duration of 10h using a neutron flux of $5 \cdot 10^{12}$ neutrons/(cm^2s). The samples are then returned to Bonn, where each pill is monitored with various sensors at intervals of four and seven days following the irradiation in order to identify different energy ranges. After 20 days, a third measurement is conducted in order to detect isotopes with a longer half-life. If present at concentrations above the detection threshold, up to 25–30 elements can be identified using this procedure.

To identify pottery of the same composition and, hence, the same origin, at Bonn we have developed a statistical procedure that assesses the composition of pottery by groups of elements. Compared to Principal Component Analysis (PCA) or Cluster Analysis (CA), this process is able to incorporate two features that are central to determining pottery provenance.[29] First, the experimental uncertainties of NAA are different for different elements. This can be assessed by determining the statistical group forming calculations. Second, clay preparation procedures vary in the amount of additives for tempering material, and minor or trace elements like sand and calcite may dilute or enhance concentration values, thus increasing or decreasing all values at a constant rate (the so-called 'dilution' or 'enhancement' factor).[30] We consider the impact of this effect by calculating a best relative fit factor for each individual sample pattern with respect to the average pattern of the group. This results in a more sharply-defined pattern for each group and allows for sufficient distinction between them.

---

25 For an example of clay mixing see Schwedt – Mommsen 2004.
26 Mommsen 2006.
27 Mommsen et al. 1991.
28 Composition given in Mommsen – Sjöberg 2007.
29 Beier – Mommsen 1994; Mommsen et al. 2002; Mommsen – Japp 2014.
30 Mommsen – Sjöberg 2007.

The Samples and the Grouping Results

Altogether 112 samples from 12 sites were subjected to NAA.[31] Tab. 1 lists the analytical raw data for 30 elements. Using the statistical method developed at Bonn to group together samples of similar composition, five groups of more than three samples each were identified (Ul18, Ul64, Ul73, Ul91, and PegK. Ul stands for 'not located', and PegK is a known group that is assigned, with high probability, to the settlement of Elaia[32]). From the calculations, another three groups of three samples each were identified, as well as five samples that could be chemically paired. Another seven samples belong to existing groups in the Bonn database, and 12 samples (11%) are chemical loners. Nothing can be concluded from these single pieces; they may be members of groups not yet identified, or they may have been contaminated: by the ancient potters, in the course of sampling, or by our laboratory. The concentration values of these chemical singles are listed in Tab. 1. The average composition for all 30 elements and the values by which the main groups were assembled are listed in Tab. 2. Tab. 3 provides an overview of the number of samples allocated to each chemical group and their distribution across different sites, which is interpreted and discussed below. Tab. 4 lists the individual members of each chemical group and gives the best relative fit factor for each sample with respect to the average grouping value. This factor must be applied to reproduce the average grouping values from the raw data given in Tab. 1. The extent to which the resulting groups can be separated is reflected in the composition values given in Tabs. 3 and 4. A discriminant analysis is one way to show the compositional differences of the groups mathematically. Fig. 2 gives the result of the four new groups containing more than five members. As the results indicate, each can be clearly distinguished from the other.

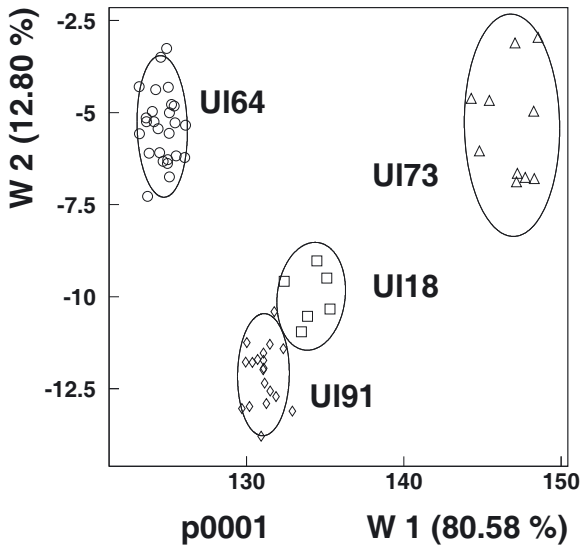

Fig. 2 Results of a discriminant analysis (using all elements given in Tab. 2 except As, Ba, Br, and Na) of the samples of the four new, larger groups with more than five members, after correcting the individual samples using their best relative fit factor. The discriminant functions W1 and W2 comprise 81% and 13% of the between-group variance. The ellipses are the 95% confidence limits. The four groups are well separated.

[31] The analysis was conducted at the Helmholtz-Institut für Strahlen- und Kernphysik at the University in Bonn between 2011 and 2014.

[32] Mommsen – Japp 2009.

Archaeological Discussion of the Chemical Groups

From the start it should be emphasised that macroscopic examination of neither the fabric – matrix and temper – nor the surface treatment offered any hint of the resultant chemical groups. Rather, it seems that in each case, the clay was tempered artificially and that the type of temper was not necessarily consistent within each group. It is unsurprising that firing provided no clear criterion for grouping the fragments together, as pieces of variously-coloured fringes or cores and evidence of reduced firing were present in all groups. The same is true for vessel shapes and types. Therefore it is not currently possible to infer workshop specialisation from functional groups or forms.

The 48 samples that are dated to the Early Bronze Age cluster into three of the new groups, while one sample belongs to a group that is already known. Four samples can be grouped into two pairs; however, isolating their production centre is problematic. One of the three new groups (group Ul91; Tab. 4) is mainly comprised of samples from the Gümüşova Valley, a distinct area in the upper Kaykos Valley. By exception, two fragments derive from the neighbourhood of Elaia, a settlement on the Aegean coast southwest of Pergamon (Fig. 1). Most likely, the potter's workshop was situated in the Gümüşova Valley, and from the dating of the sherds was active from the Early Chalcolithic period until the Early Bronze Age in the 3rd millennium BC. It should be emphasised that 18 of the 33 samples – 55% of the samples collected during the surveys in the valley – belong to this group. The rest of the pottery that was analysed from the valley derives from other workshops in the region. From these results, we can presume that even if the valley was rather secluded, there was contact with other areas and exchange took place. It is worth mentioning that this is the only group in which the potter's atelier was active solely in earlier periods. All of the other potential workshops in the main valley demonstrate continuities, while in the Gümüşova Valley, pottery production ceased around the middle of the 3rd millennium BC. There is, however, at least one settlement of the Late Bronze Age in the area.

To the second group are assigned a limited number of samples (group Ul18; Tab. 4), and these seem to be restricted to the upper Kaykos Valley, more than likely products of another workshop. These six samples come from Ayazköy, a settlement in the upper Kaykos Valley east of Pergamon (five samples), and Değirmentepe on the southwestern fringe of the Kaykos Valley (one sample). Only a single piece is assigned to the Early Bronze Age; all of the other samples are products of the Chalcolithic period and the Late Bronze Age, respectively. The workshop that fabricated these pieces was surely active over a longer period, however the gaps of time in-between the different periods has yet to be finally confirmed.

The third group (group Ul64; Tab. 4) features samples from three sites, two of which are situated in the Kaykos Valley. Eight samples were recovered from Çiftlik at the northwestern section of the Kaykos Valley, of which six belong to the period of the Chalcolithic to the Early Bronze Age. Fourteen fragments were recovered from Yeni Yeldeğirmentepe and include 13 from the Early Bronze Age or the period of the Late Chalcolithic period to the Early Bronze Age. Another three pieces were recovered from Başantepe near the coast to the north of the Kane peninsula. Four additional pieces, of which two are assigned to the period of the Late Chalcolithic to the Early Bronze Age, might also belong to this group from their chemical structure, which varies only slightly. This workshop was presumably situated in the lower Kaykos Valley or at the northern Kane peninsula and was active at least during the early and the late phases of the Bronze Age.

It is significant that the Bronze Age samples recovered from Pergamon do not fit into these groups, but for now remain chemical singles. Clearly the production sites in the lower and the upper Kaykos Valley did not supply Pergamon, where other workshops were in charge of production – presumably at Pergamon itself.

Imports during the Early Bronze Age in this region are rare. One Early Bronze Age fragment from Yeni Yeldeğirmentepe (YELD 16) demonstrates similarities with samples from a chemical group that probably originated at Ephesos (EphI).[33] This group is comprised of material stemming

[33] Kerschner 2002; Mommsen et al. 2007, 26.

Sample	Factor	As	Ba	Br	Ca %	Ce	Co	Cr	Cs	Eu	Fe %	Ga	Hf	K %	La
ATAR 22	1.000	14.0	2829.	2.06	7.82	63.5	23.4	219.	8.98	1.15	5.17	21.8	4.09	2.87	30.7
AYAZ 01	1.000	13.2	899.	2.39	2.17	88.9	10.2	141.	19.1	1.19	3.22	28.1	4.67	4.24	43.4
AYAZ 02	1.000	45.6	1351.	4.42	2.40	85.5	17.2	102.	11.8	1.46	4.08	23.3	5.65	2.45	41.9
AYAZ 03	1.000	33.7	1062.	3.13	2.47	89.8	20.0	106.	12.7	1.54	4.35	18.0	5.89	2.32	44.4
AYAZ 04	1.000	27.4	1642.	8.74	2.64	67.7	14.7	68.6	8.57	1.20	3.54	25.9	5.51	2.27	34.0
AYAZ 05	1.000	31.7	1396.	5.47	4.25	78.3	18.8	99.9	8.75	1.31	3.90	24.6	5.04	2.34	37.9
AYAZ 06	1.000	151.	1711.	4.02	1.89	79.3	16.2	86.9	14.3	1.17	3.61	17.1	5.31	2.61	39.8
AYAZ 07	1.000	92.0	2157.	6.85	2.68	77.2	16.3	63.6	6.79	1.29	3.76	25.7	6.42	2.42	38.8
AYAZ 08	1.000	34.2	1522.	5.14	2.26	81.8	19.2	119.	10.7	1.29	4.25	19.7	5.14	2.40	37.8
AYAZ 09	1.000	42.1	2901.	5.08	2.58	75.1	19.7	117.	9.96	1.46	4.62	30.3	5.48	2.55	38.6
AYAZ 10	1.000	38.4	2476.	2.83	2.32	76.1	19.3	54.1	4.72	1.27	3.85	28.9	6.03	2.34	40.6
AYAZ 11	1.000	21.9	2120.	3.88	2.49	85.8	17.0	57.5	6.77	1.40	3.78	31.7	5.80	2.49	43.8
BASA 01	1.000	71.5	2806.	4.12	1.48	94.0	16.2	69.9	6.52	1.21	3.38	14.2	5.88	2.51	52.1
BASA 02	1.000	39.9	2051.	3.17	1.50	82.3	15.1	61.2	5.10	1.05	3.32	17.8	6.65	2.74	38.2
BASA 03	1.000	33.2	2236.	4.13	2.02	126.	24.7	89.5	7.21	1.30	4.53	18.9	7.63	2.75	46.6
BASA 04	1.000	67.0	2959.	6.71	1.54	111.	15.5	53.1	4.97	1.23	3.09	16.9	6.31	2.57	47.5
BASA 05	1.000	24.7	1967.	4.70	1.64	73.9	9.40	45.7	5.42	0.96	3.00	18.1	5.80	2.28	38.6
CIFT 01	1.000	36.0	2052.	2.73	1.96	87.5	15.9	66.3	3.97	1.07	3.70	25.8	7.35	2.22	42.1
CIFT 02	1.000	60.9	1758.	2.76	1.61	103.	19.3	59.6	4.22	1.16	3.49	21.6	6.65	2.60	43.8
CIFT 03	1.000	13.7	2932.	10.4	1.75	99.1	16.3	63.0	3.78	1.44	3.84	23.3	5.82	2.67	50.7
CIFT 04	1.000	103.	3193.	3.45	1.49	76.2	9.84	57.8	4.63	1.18	3.73	24.4	5.39	2.57	46.5
CIFT 05	1.000	27.5	1668.	1.13	1.58	118.	13.3	60.0	5.56	1.30	3.68	25.2	5.90	3.01	46.2
CIFT 06	1.000	20.6	2231.	8.43	1.35	90.4	15.2	65.9	5.41	1.29	3.41	22.5	5.64	2.80	46.6
CIFT 07	1.000	35.9	4466.	8.78	1.59	74.6	14.3	138.	11.8	1.22	3.19	25.2	5.76	2.36	36.8
CIFT 08	1.000	21.1	2719.	12.4	1.42	96.3	15.1	74.1	9.74	1.39	3.61	19.0	5.25	3.04	48.2
CIFT 09	1.000	178.	2055.	4.13	1.63	106.	13.5	65.1	4.69	1.11	3.86	44.7	5.70	2.88	43.8
CIFT 10	1.000	28.1	3260.	5.34	1.60	69.8	6.52	39.5	3.57	1.21	3.27	23.7	5.06	2.08	43.3
DEGI 01	1.000	16.0	733.	1.61	2.04	75.5	13.8	157.	13.1	1.18	2.73	20.9	4.88	2.85	36.7
DEGI 02	1.000	53.0	820.	3.77	1.52	80.4	17.4	101.	10.9	1.42	4.17	15.8	5.84	2.25	41.0
DEGI 03	1.000	17.5	1191.	2.04	3.28	79.1	15.2	95.7	13.4	1.17	3.01	19.1	4.73	2.96	36.6
DEGI 04	1.000	31.9	961.	2.39	6.06	77.7	15.1	147.	15.4	1.22	2.87	23.5	6.55	2.47	36.5
DEGI 05	1.000	58.9	892.	3.07	3.50	83.8	14.2	143.	43.1	1.18	3.13	26.6	5.59	3.75	40.5
DEGI 06	1.000	29.3	1154.	2.03	3.37	92.4	14.7	111.	17.9	1.47	3.20	25.6	6.19	2.99	45.7
DEGI 07	1.000	12.4	1048.	1.97	3.34	83.2	18.3	156.	18.2	1.34	4.17	32.3	5.66	2.75	40.9
DEGI 08	1.000	37.1	1191.	3.01	3.11	84.9	14.8	149.	20.5	1.31	3.29	35.3	5.58	2.76	41.8
DEGI 09	1.000	19.0	1009.	1.78	2.36	85.9	14.3	138.	18.8	1.34	3.40	22.9	5.38	2.76	43.4

Tab. 1 Raw concentration data of 112 samples used in this study. Samples are original to the following 12 sites: Atarneus (ATAR), Ayazköy (AYAZ), Başantepe (BASA), Çiftlik (CIFT), Değirmentepe (DEGI), Elaia (ELAI), Erigöl Tepe (ERIT), Gümüşova Valley (GUEM), Hatiplar Kalesi (HAKA), Teuthrania (TEUT), and Yeni Yeldeğirmentepe (YELD). The table provides the concentration values C of 30 elements in µg/g (ppm), if not indicated otherwise, and also the average measurement uncertainties (errors), also in % of C

Lu	Na %	Nd	Ni	Rb	Sb	Sc	Sm	Ta	Tb	Th	U	W	Yb	Zn	Zr	Sample
0.45	0.49	24.8	229.	155.	0.68	21.3	4.70	0.80	0.62	11.4	3.06	2.03	2.81	117.	178.	ATAR 22
0.47	0.49	27.3	118.	224.	1.02	20.0	4.86	1.17	0.69	18.3	3.43	3.37	3.15	63.6	153.	AYAZ 01
0.37	1.73	31.7	113.	124.	1.89	15.4	5.27	0.93	0.78	18.1	3.15	2.26	2.42	68.6	201.	AYAZ 02
0.41	1.66	32.4	86.8	131.	1.88	17.1	5.67	0.96	0.79	18.7	3.28	2.43	2.60	76.7	221.	AYAZ 03
0.31	1.64	20.4	68.2	95.5	1.66	13.9	3.92	0.83	0.60	14.7	2.43	2.05	1.92	63.1	206.	AYAZ 04
0.34	1.52	25.4	107.	104.	1.62	14.1	4.54	0.79	0.74	15.6	3.25	1.61	2.22	58.7	186.	AYAZ 05
0.34	1.44	27.0	112.	129.	7.03	12.9	4.09	0.80	0.64	17.0	2.90	3.02	2.14	86.7	205.	AYAZ 06
0.31	2.01	26.7	25.5	116.	1.96	14.2	4.36	0.89	0.58	16.0	2.52	1.66	2.12	66.5	271.	AYAZ 07
0.35	1.67	24.6	99.2	119.	2.02	15.2	4.58	0.90	0.63	17.2	3.28	2.20	2.06	76.6	197.	AYAZ 08
0.39	1.59	29.3	92.7	114.	1.84	16.9	5.01	0.89	0.74	16.2	3.66	2.52	2.40	74.5	194.	AYAZ 09
0.39	2.00	28.3	53.0	89.0	1.24	14.0	4.67	1.04	0.75	17.4	2.81	2.56	2.52	62.8	211.	AYAZ 10
0.35	1.94	28.8	35.2	111.	1.45	14.7	4.94	0.89	0.71	16.2	2.62	2.56	2.36	61.3	253.	AYAZ 11
0.36	1.66	31.4	47.5	118.	9.34	11.9	5.20	0.94	0.63	22.5	3.79	3.25	2.30	50.9	215.	BASA 01
0.32	1.49	25.9	37.5	119.	5.53	10.8	4.31	0.89	0.47	21.1	3.24	3.19	2.07	49.5	223.	BASA 02
0.35	1.52	32.2	42.6	128.	1.60	15.4	5.70	1.35	0.55	37.1	5.70	4.47	2.32	62.0	241.	BASA 03
0.35	1.57	30.2	63.1	111.	5.92	11.0	5.26	0.89	0.59	21.1	3.39	4.14	2.27	41.2	197.	BASA 04
0.28	1.82	22.2	--	92.2	0.80	10.9	3.66	1.03	0.45	25.2	3.60	1.99	1.89	55.0	180.	BASA 05
0.33	1.62	23.2	51.6	91.2	1.66	13.0	4.11	0.93	0.53	23.7	4.07	2.84	2.10	60.0	276.	CIFT 01
0.36	1.62	29.2	37.4	109.	1.21	13.1	4.67	0.93	0.68	22.9	3.71	2.61	2.27	54.4	230.	CIFT 02
0.38	1.42	35.6	32.9	98.5	1.12	15.5	5.92	0.88	0.73	22.3	4.59	3.20	2.54	60.7	216.	CIFT 03
0.32	1.61	28.3	63.1	107.	2.14	13.2	4.76	0.89	0.61	22.7	4.23	3.58	2.25	54.6	192.	CIFT 04
0.39	1.92	28.8	48.3	117.	1.25	14.6	5.09	0.98	0.69	24.7	4.37	2.92	2.49	60.3	206.	CIFT 05
0.35	1.38	29.1	93.7	114.	1.25	14.6	5.17	0.90	0.61	22.1	4.74	3.43	2.36	59.0	219.	CIFT 06
0.38	1.10	26.1	64.0	110.	3.02	15.7	4.39	1.06	0.59	16.5	3.82	3.21	2.65	66.2	216.	CIFT 07
0.39	0.82	33.3	--	141.	3.02	16.0	5.60	1.10	0.83	21.6	4.41	5.15	2.61	70.3	166.	CIFT 08
0.40	1.71	26.3	--	108.	1.65	14.2	4.38	1.00	0.64	23.5	3.66	3.83	2.29	58.5	185.	CIFT 09
0.37	1.47	27.0	--	81.5	0.86	15.0	4.82	0.92	0.61	23.7	4.24	3.64	2.44	62.7	196.	CIFT 10
0.39	1.25	28.7	58.7	148.	2.39	16.4	5.02	1.00	0.72	16.0	3.24	2.10	2.57	56.1	167.	DEGI 01
0.34	1.87	33.9	93.7	122.	2.41	15.7	5.93	0.88	0.64	18.5	3.21	1.44	2.40	77.2	215.	DEGI 02
0.43	1.01	28.2	56.3	162.	1.24	14.9	5.10	1.00	0.69	16.4	3.07	2.19	2.80	60.2	137.	DEGI 03
0.38	1.23	27.8	69.4	138.	3.40	14.4	5.04	1.00	0.64	17.7	4.30	2.35	2.54	65.7	248.	DEGI 04
0.43	0.85	31.1	101.	227.	2.03	16.3	5.31	1.15	0.65	18.2	3.19	3.08	2.78	71.8	191.	DEGI 05
0.45	1.36	34.2	62.1	171.	3.58	17.0	6.06	1.07	0.89	18.8	4.39	3.11	3.17	76.8	199.	DEGI 06
0.43	1.08	30.7	109.	156.	3.81	17.3	5.51	1.04	0.74	18.2	3.41	3.19	2.84	85.6	221.	DEGI 07
0.42	1.10	29.4	33.7	148.	4.18	16.3	5.33	1.05	0.70	19.4	3.65	3.22	2.63	75.2	201.	DEGI 08
0.41	0.99	29.9	81.5	157.	4.09	16.6	5.52	1.05	0.65	19.0	3.49	3.19	2.79	75.9	217.	DEGI 09

Sample	Factor	As	Ba	Br	Ca %	Ce	Co	Cr	Cs	Eu	Fe %	Ga	Hf	K %	La
DEGI 10	1.000	12.2	871.	2.91	3.33	85.2	16.4	114.	18.6	1.37	3.98	31.2	6.15	2.50	42.3
DEGI 11	1.000	17.8	838.	2.33	1.94	79.9	14.8	138.	33.2	1.23	3.31	31.4	5.50	3.03	39.7
DEGI 12	1.000	18.1	1213.	2.57	3.42	80.4	15.8	128.	17.5	1.30	3.41	26.9	5.94	2.61	40.8
DEGI 13	1.000	23.4	1587.	5.88	3.14	84.2	12.6	97.4	12.9	1.40	2.74	29.9	6.69	2.85	41.0
DEGI 14	1.000	16.1	1304.	3.45	1.64	100.	14.6	113.	14.9	1.53	3.77	32.4	5.93	3.17	49.7
DEGI 15	1.000	30.3	1384.	3.86	5.00	80.4	14.4	84.1	16.3	1.26	3.46	23.5	5.46	2.64	39.7
DEGI 16	1.000	10.7	937.	2.76	2.42	96.2	20.4	153.	17.3	1.48	4.18	23.9	7.17	2.69	47.5
DEGI 17	1.000	16.3	1180.	2.69	1.72	97.3	14.6	99.1	15.0	1.50	5.22	37.8	6.32	2.74	48.3
ELAI 64	1.000	16.0	703.	8.02	4.57	71.9	12.1	85.2	9.61	1.15	2.87	23.4	8.64	2.15	34.5
ELAI 65	1.000	36.9	679.	9.23	2.38	48.4	10.9	70.7	24.6	0.84	3.06	26.0	4.20	2.84	19.2
ELAI 66	1.000	11.7	1220.	8.72	5.48	76.4	14.5	64.4	5.70	1.35	3.02	29.8	5.37	2.43	36.5
ELAI 67	1.000	11.8	1065.	3.59	2.79	75.3	12.9	70.6	4.86	1.31	3.50	39.7	5.88	2.38	40.0
ELAI 68	1.000	33.5	787.	5.97	1.48	47.2	10.3	65.6	28.5	0.86	2.73	23.7	4.29	3.34	20.9
ERIT 01	1.000	19.0	983.	1.57	2.49	90.6	16.3	217.	22.2	1.42	2.98	32.1	5.99	2.91	43.8
ERIT 02	1.000	15.2	1141.	2.42	1.96	88.9	18.6	190.	17.3	1.35	3.66	23.2	6.73	3.11	43.8
GRYN 07	1.000	36.5	825.	13.5	2.82	94.4	24.2	213.	12.7	1.67	4.86	35.4	7.54	2.47	46.5
GUEM 01	1.000	11.7	947.	1.92	5.28	94.4	17.6	133.	13.8	1.41	4.92	19.2	5.81	3.54	45.8
GUEM 02	1.000	19.5	1450.	3.07	2.47	102.	29.8	168.	21.8	1.74	5.85	49.9	6.42	3.38	48.5
GUEM 03	1.000	13.2	1263.	2.97	2.14	100.	24.5	128.	10.3	1.53	5.41	44.5	6.79	3.55	48.1
GUEM 04	1.000	9.95	948.	8.63	4.02	84.9	22.3	147.	15.5	1.47	4.13	33.0	6.24	2.35	41.8
GUEM 05	1.000	11.6	852.	0.73	3.06	99.7	18.0	143.	14.3	1.47	4.99	29.4	5.91	4.12	48.2
GUEM 06	1.000	9.25	1483.	3.50	2.38	88.9	15.7	86.9	6.76	1.46	4.42	22.0	6.62	2.64	44.6
GUEM 07	1.000	33.3	1810.	2.46	2.22	89.1	15.8	90.5	6.80	1.40	4.00	17.9	6.83	2.44	44.1
GUEM 08	1.000	11.1	1432.	3.12	2.13	86.9	14.0	73.9	5.72	1.30	3.95	21.9	6.24	2.21	41.9
GUEM 09	1.000	21.5	1912.	5.53	1.14	57.4	13.5	58.4	5.69	0.83	3.41	16.4	6.11	2.60	23.9
GUEM 10	1.000	10.1	1778.	2.33	2.79	79.2	13.9	73.8	5.93	1.38	3.66	20.6	5.67	2.15	41.2
GUEM 11	1.000	11.9	1698.	3.29	2.11	86.7	14.7	78.1	5.80	1.35	3.70	25.9	6.37	2.23	39.8
GUEM 12	1.000	30.6	1617.	5.45	2.55	83.0	14.6	74.1	5.73	1.31	3.64	16.9	6.21	2.50	41.8
GUEM 13	1.000	15.6	1198.	3.65	2.14	85.5	13.8	86.3	6.91	1.39	3.73	14.3	6.69	2.41	42.5
GUEM 14	1.000	16.2	1593.	7.67	2.34	85.9	15.1	78.7	5.78	1.32	3.57	17.9	6.39	2.22	41.3
GUEM 15	1.000	15.3	1418.	2.34	1.95	77.4	17.1	81.1	7.12	1.32	3.64	19.8	6.55	2.29	39.3
GUEM 16	1.000	8.38	1610.	3.83	1.87	84.0	15.9	76.8	6.32	1.18	3.64	16.9	5.86	2.44	38.4
GUEM 17	1.000	43.6	1270.	4.75	2.04	85.6	11.4	102.	7.10	1.38	3.62	16.6	6.83	2.55	41.4
GUEM 18	1.000	27.0	1683.	8.83	2.07	87.7	12.5	78.6	6.60	1.40	3.62	16.1	6.44	2.42	42.8
GUEM 19	1.000	22.8	1874.	3.38	1.98	83.9	11.3	78.4	5.51	1.39	3.37	20.1	6.64	2.51	42.7
GUEM 20	1.000	17.2	1524.	2.39	1.19	66.4	10.8	71.5	6.71	0.94	2.91	29.4	5.19	2.70	30.7
GUEM 21	1.000	9.49	1341.	5.21	2.14	80.6	13.9	84.1	6.75	1.39	3.77	22.3	6.89	2.67	43.5
GUEM 22	1.000	8.29	1457.	2.93	2.22	80.0	17.9	89.6	7.75	1.27	3.76	22.0	6.54	2.35	38.9
GUEM 23	1.000	12.3	2244.	2.15	2.95	83.8	20.5	76.5	6.23	1.42	3.71	17.6	6.30	2.73	41.3

Tab. 1 continued

Lu	Na %	Nd	Ni	Rb	Sb	Sc	Sm	Ta	Tb	Th	U	W	Yb	Zn	Zr	Sample
0.46	0.82	30.2	125.	140.	1.39	15.4	5.52	1.15	0.75	18.9	3.66	3.11	2.98	81.6	205.	DEGI 10
0.42	0.64	28.8	104.	179.	1.59	16.3	5.12	1.03	0.62	16.8	3.06	2.97	2.81	71.4	199.	DEGI 11
0.44	1.26	32.3	48.5	143.	3.92	15.4	5.29	0.94	0.67	17.8	3.35	3.10	2.64	74.3	232.	DEGI 12
0.45	1.13	27.4	82.6	141.	2.81	15.4	4.77	1.07	0.80	17.7	3.49	2.72	2.92	71.0	245.	DEGI 13
0.49	1.08	35.6	57.6	184.	2.26	17.6	5.49	1.23	0.79	20.8	4.76	3.51	3.35	68.7	226.	DEGI 14
0.41	1.13	24.9	90.7	140.	3.00	13.9	4.47	1.00	0.74	18.4	3.32	3.54	2.54	59.5	199.	DEGI 15
0.54	0.69	36.7	105.	150.	1.16	16.8	5.65	1.30	0.89	21.6	4.45	4.22	3.53	78.6	252.	DEGI 16
0.50	0.53	30.3	62.2	175.	1.84	17.1	5.61	1.21	0.90	20.3	3.23	3.25	3.32	91.1	259.	DEGI 17
0.35	1.46	21.1	97.6	117.	0.72	10.2	3.63	0.75	0.57	16.9	2.88	1.98	2.05	59.2	296.	ELAI 64
0.50	0.45	15.5	73.3	173.	2.16	12.3	3.54	1.55	0.71	27.2	2.07	2.11	3.42	64.4	139.	ELAI 65
0.35	2.34	23.5	--	119.	0.82	11.5	4.18	0.70	0.61	15.2	3.36	2.34	2.30	58.8	183.	ELAI 66
0.40	2.34	26.7	63.2	122.	0.97	13.6	4.56	0.81	0.62	17.7	3.10	3.09	2.50	61.0	220.	ELAI 67
0.48	0.53	17.2	--	192.	1.66	12.3	3.67	1.60	0.78	28.7	2.37	2.36	3.32	68.5	159.	ELAI 68
0.48	0.71	27.9	95.8	173.	3.53	18.8	5.23	1.22	0.84	20.5	4.91	3.33	3.16	67.3	227.	ERIT 01
0.44	1.20	27.4	118.	174.	4.17	17.2	4.82	1.11	0.72	19.9	4.50	3.79	2.68	70.4	251.	ERIT 02
0.61	1.14	32.2	157.	152.	2.14	19.7	6.15	1.24	1.15	16.8	3.16	3.91	4.17	97.7	289.	GRYN 07
0.50	1.08	33.3	113.	187.	1.18	19.9	5.88	1.14	0.81	18.2	4.40	3.71	3.31	89.6	229.	GUEM 01
0.62	0.95	39.5	92.4	187.	1.03	25.0	7.21	1.45	1.04	20.4	3.83	3.97	4.05	136.	194.	GUEM 02
0.61	1.20	34.1	92.1	168.	0.87	21.8	6.28	1.37	0.82	22.4	4.22	3.47	3.61	109.	263.	GUEM 03
0.49	1.57	29.2	164.	137.	1.04	16.8	5.73	1.02	0.92	16.2	3.28	3.21	3.39	79.1	239.	GUEM 04
0.53	1.05	35.8	132.	212.	1.07	21.2	6.14	1.20	0.83	19.4	4.48	4.24	3.23	85.4	213.	GUEM 05
0.43	2.07	31.2	90.5	135.	0.81	15.3	5.43	0.97	0.70	20.5	3.69	2.79	2.73	61.1	225.	GUEM 06
0.40	1.83	28.8	55.6	142.	0.78	14.6	5.36	1.03	0.67	20.6	4.03	2.92	2.58	65.5	250.	GUEM 07
0.35	1.82	28.5	--	121.	0.72	14.1	4.99	0.80	0.69	19.0	3.89	3.02	2.37	61.6	255.	GUEM 08
0.29	1.32	15.4	93.8	127.	1.01	11.6	2.75	0.90	0.44	18.0	3.23	2.38	1.78	60.1	214.	GUEM 09
0.38	1.76	29.6	34.5	118.	0.62	13.2	5.10	0.79	0.81	17.9	3.20	2.66	2.45	72.8	197.	GUEM 10
0.35	1.72	29.1	38.0	119.	0.76	13.5	4.90	0.84	0.67	18.5	3.17	2.43	2.39	63.4	233.	GUEM 11
0.34	1.94	28.4	63.4	123.	0.79	13.0	4.89	0.89	0.71	19.5	3.58	2.64	2.45	61.8	167.	GUEM 12
0.39	1.75	29.9	81.7	130.	0.89	13.8	5.18	0.91	0.66	19.5	3.36	2.75	2.57	65.3	253.	GUEM 13
0.35	1.79	31.6	32.9	132.	0.66	13.2	5.23	0.86	0.68	19.0	2.99	2.63	2.34	65.5	235.	GUEM 14
0.39	1.75	30.8	57.3	122.	0.97	13.3	5.21	0.82	0.63	16.8	3.00	3.31	2.60	73.6	223.	GUEM 15
0.35	1.66	28.0	30.5	112.	0.68	12.5	4.73	0.82	0.62	17.8	3.18	2.68	2.33	67.5	215.	GUEM 16
0.39	1.72	32.1	33.8	140.	0.97	13.9	5.70	0.89	0.78	20.2	3.70	3.06	2.55	58.0	249.	GUEM 17
0.42	1.90	34.7	42.3	132.	0.79	13.7	5.88	0.81	0.84	18.9	3.11	2.68	2.73	57.7	223.	GUEM 18
0.38	1.92	30.5	57.3	125.	0.81	12.6	5.51	0.80	0.74	18.9	3.22	2.59	2.54	63.6	242.	GUEM 19
0.36	1.36	20.4	35.1	129.	0.89	10.7	3.82	0.96	0.57	15.7	2.13	2.46	2.48	67.4	156.	GUEM 20
0.43	2.07	34.8	--	134.	0.75	14.3	5.85	0.89	0.78	18.9	4.46	3.41	2.76	64.1	233.	GUEM 21
0.34	1.76	26.5	58.7	126.	0.77	13.8	4.56	0.85	0.65	17.8	3.08	2.84	2.31	84.3	247.	GUEM 22
0.37	1.81	27.8	70.2	131.	0.94	13.7	4.98	0.90	0.66	18.4	3.42	3.32	2.50	90.2	244.	GUEM 23

Sample	Factor	As	Ba	Br	Ca %	Ce	Co	Cr	Cs	Eu	Fe %	Ga	Hf	K %	La
GUEM 24	1.000	13.4	1652.	3.79	3.00	115.	20.9	83.1	6.83	1.21	4.23	28.3	6.13	2.44	38.0
GUEM 25	1.000	13.5	1607.	3.33	2.38	87.2	15.6	78.9	5.73	1.44	3.85	24.8	6.15	2.44	41.0
GUEM 26	1.000	9.05	1715.	6.53	3.02	80.2	13.3	75.3	5.57	1.40	3.85	22.1	6.53	2.40	42.2
GUEM 27	1.000	6.14	953.	1.60	3.34	70.1	22.1	160.	9.90	1.37	4.18	25.4	4.95	2.64	35.0
GUEM 28	1.000	14.4	1043.	1.21	2.85	83.7	16.5	157.	17.4	1.39	3.63	30.3	6.46	3.03	40.8
GUEM 29	1.000	8.27	777.	1.67	5.46	88.3	22.9	207.	12.2	1.38	4.76	29.9	5.44	2.93	42.2
GUEM 30	1.000	22.9	888.	1.25	3.85	88.4	13.6	127.	16.9	1.31	4.06	29.4	6.12	3.52	43.9
GUEM 31	1.000	4.79	777.	0.99	3.87	94.7	18.2	140.	14.0	1.39	4.69	28.1	5.15	3.77	46.8
GUEM 32	1.000	11.0	2276.	4.49	2.22	100.	17.9	135.	8.30	1.34	4.06	20.6	8.68	2.76	37.2
GUEM 33	1.000	7.62	1350.	2.15	2.72	82.9	15.7	89.4	6.90	1.45	4.13	27.6	6.87	2.24	40.8
HAKA 01	1.000	4.41	3121.	16.6	5.24	81.4	14.6	164.	29.1	1.41	3.93	22.4	6.60	2.77	42.8
TEUT 01	1.000	12.1	1363.	4.72	3.34	81.3	17.1	99.5	18.4	1.26	3.43	14.9	5.24	2.49	39.9
TEUT 02	1.000	14.5	1141.	2.00	2.50	82.2	17.8	95.5	18.6	1.33	3.86	21.6	6.01	2.42	40.5
TEUT 03	1.000	10.2	799.	2.47	2.59	83.9	16.6	121.	16.9	1.28	3.89	22.6	5.67	2.71	41.1
TEUT 04	1.000	33.2	1464.	2.21	2.88	78.3	13.0	81.0	14.4	1.20	3.53	17.7	6.20	2.46	37.4
TEUT 05	1.000	8.73	956.	1.90	2.97	87.3	13.7	111.	13.7	1.34	3.06	26.3	5.82	2.75	44.6
YELD 01	1.000	138.	2158.	7.45	1.95	67.6	7.48	67.8	5.98	1.32	3.13	16.5	5.69	2.31	44.5
YELD 02	1.000	198.	1795.	4.10	1.80	99.0	13.2	46.1	4.78	1.14	3.19	15.0	5.27	2.69	44.3
YELD 03	1.000	183.	1528.	31.6	2.00	79.0	13.8	55.8	4.94	0.98	3.83	18.6	5.70	2.69	38.1
YELD 04	1.000	11.7	1406.	2.18	1.87	69.7	8.35	43.1	4.99	1.08	3.43	17.0	5.25	2.94	41.3
YELD 05	1.000	69.5	1989.	7.51	--	71.3	11.7	55.3	3.86	1.23	3.32	12.6	5.21	2.38	44.3
YELD 06	1.000	44.6	1298.	12.1	0.83	85.5	12.6	47.1	5.42	1.14	3.44	12.2	5.69	2.88	43.5
YELD 07	1.000	41.9	1080.	37.0	1.56	133.	20.3	56.1	4.66	1.41	3.45	8.74	5.90	2.25	57.3
YELD 08	1.000	97.9	1730.	3.44	1.06	91.4	13.8	88.4	9.35	1.04	3.10	12.8	5.87	2.32	39.7
YELD 09	1.000	43.5	1512.	13.0	0.90	100.	9.02	57.9	5.02	1.21	3.32	14.0	6.16	2.60	63.8
YELD 10	1.000	112.	1276.	2.58	0.96	81.5	12.7	74.4	6.29	1.34	3.45	15.9	5.86	2.23	45.5
YELD 11	1.000	104.	1663.	2.77	1.42	72.8	9.60	54.4	7.77	1.14	3.46	17.7	5.67	2.70	43.5
YELD 12	1.000	151.	1245.	15.3	1.44	77.3	11.3	80.6	5.37	1.18	3.25	16.1	6.24	2.37	40.9
YELD 13	1.000	289.	1560.	2.92	1.52	82.1	14.6	75.2	4.64	1.25	3.65	9.89	6.07	2.87	43.7
YELD 14	1.000	84.0	2192.	4.05	0.74	59.9	7.15	58.9	4.88	0.99	3.58	18.2	5.67	3.00	37.4
YELD 15	1.000	136.	1780.	7.02	0.90	79.2	11.9	66.5	5.70	1.07	3.30	13.1	5.44	2.67	38.0
YELD 16	1.000	33.7	1740.	12.9	2.00	87.6	22.9	209.	7.68	1.50	4.96	28.7	4.90	3.34	41.1
YELD 17	1.000	196.	1660.	10.0	1.96	121.	12.0	49.8	4.85	1.18	3.24	17.7	5.65	2.47	74.3
YELD 18	1.000	172.	1515.	20.1	1.47	83.7	9.45	39.5	4.65	1.11	3.16	18.2	5.68	2.71	45.8
YELD 19	1.000	139.	1679.	10.3	1.62	144.	28.4	59.3	5.07	1.23	3.82	21.1	6.03	2.70	44.4
YELD 20	1.000	116.	2302.	4.42	1.77	86.5	8.93	57.7	6.66	1.08	3.40	12.2	6.11	2.29	49.1
YELD 21	1.000	52.9	685.	1.52	2.87	87.0	25.2	234.	14.6	1.27	4.72	31.4	5.49	4.20	40.6
ave.error		0.23	49.	0.52	0.19	0.43	0.10	0.65	0.11	0.021	0.012	4.2	0.058	0.055	0.13
in%		0.5	3.1	10.	7.7	0.5	0.6	0.7	1.1	1.6	0.3	19.	1.0	2.0	0.3

Tab. 1 continued

Lu	Na %	Nd	Ni	Rb	Sb	Sc	Sm	Ta	Tb	Th	U	W	Yb	Zn	Zr	Sample
0.32	1.87	26.9	76.3	110.	0.92	16.2	4.45	0.92	0.59	17.5	2.98	2.36	2.09	95.1	235.	GUEM 24
0.37	1.69	28.0	63.2	122.	0.68	13.8	5.17	0.87	0.71	18.9	3.06	2.48	2.41	80.9	240.	GUEM 25
0.37	1.89	31.6	42.7	120.	0.76	13.9	4.96	0.91	0.71	19.1	3.82	2.25	2.47	72.6	263.	GUEM 26
0.42	1.62	25.8	170.	129.	0.70	16.7	4.48	0.87	0.66	14.3	3.18	2.46	2.59	95.6	224.	GUEM 27
0.41	1.09	30.3	89.4	164.	3.90	17.0	4.90	1.00	0.62	19.7	3.93	3.19	2.71	78.7	252.	GUEM 28
0.50	0.29	31.0	182.	175.	0.75	21.6	5.52	1.15	0.71	17.2	3.41	2.70	3.29	88.6	198.	GUEM 29
0.47	0.88	29.6	61.3	196.	1.03	19.4	5.30	1.14	0.73	18.2	3.52	3.52	2.93	78.9	223.	GUEM 30
0.51	0.82	33.2	111.	197.	0.90	20.5	5.65	1.13	0.81	17.8	3.51	2.86	3.23	89.3	200.	GUEM 31
0.40	1.24	28.3	115.	152.	1.29	15.8	5.07	1.34	0.64	24.0	4.00	3.21	2.47	87.2	278.	GUEM 32
0.40	1.74	31.3	75.1	128.	0.78	15.0	5.01	0.91	0.67	19.1	3.23	2.70	2.58	87.8	275.	GUEM 33
0.40	1.70	25.6	98.6	176.	0.70	14.5	4.93	1.21	0.83	18.6	4.43	3.76	2.93	65.8	269.	HAKA 01
0.39	1.15	27.9	85.1	135.	1.90	13.7	4.97	0.96	0.62	18.5	3.52	2.82	2.46	69.6	184.	TEUT 01
0.40	1.32	30.3	--	138.	3.95	14.9	5.23	1.00	0.68	17.4	3.26	2.98	2.75	79.8	210.	TEUT 02
0.45	0.89	30.1	79.2	149.	1.59	16.5	5.29	1.16	0.73	18.3	3.48	2.65	3.01	78.3	198.	TEUT 03
0.35	1.20	26.3	65.3	122.	3.73	12.8	4.58	0.91	0.65	21.1	2.83	3.17	2.28	69.2	242.	TEUT 04
0.39	1.49	32.7	73.7	148.	3.26	14.2	4.96	0.98	0.62	19.5	4.04	2.50	2.65	86.5	249.	TEUT 05
0.32	1.50	30.4	30.3	134.	1.48	12.3	5.37	1.00	0.72	22.6	4.28	2.29	2.50	60.5	221.	YELD 01
0.32	1.58	29.2	462.	121.	1.39	12.0	4.93	0.89	0.57	22.4	3.49	2.00	2.14	67.8	210.	YELD 02
0.29	1.59	26.4	170.	118.	1.64	11.8	4.12	0.93	0.51	21.7	3.45	1.99	1.81	62.0	189.	YELD 03
0.31	1.78	26.3	55.5	121.	1.12	11.5	4.40	0.96	0.54	24.6	3.52	2.21	2.09	49.0	160.	YELD 04
0.35	2.80	31.4	60.8	91.4	2.18	14.2	5.75	0.85	0.65	21.5	3.25	1.70	2.05	53.5	193.	YELD 05
0.30	2.88	33.3	43.8	139.	1.36	11.2	5.61	0.99	0.65	23.6	3.24	1.71	1.99	59.8	203.	YELD 06
0.45	2.51	39.7	36.5	108.	1.20	13.2	7.16	0.95	0.86	26.6	2.15	1.59	2.88	50.3	208.	YELD 07
0.28	2.89	27.9	97.0	113.	5.28	10.9	4.70	0.98	0.61	18.7	2.77	1.63	1.76	65.1	226.	YELD 08
0.33	2.86	35.9	33.1	125.	1.58	12.3	5.89	1.00	0.63	25.9	3.18	1.79	2.27	52.3	261.	YELD 09
0.36	2.60	33.5	--	124.	2.59	13.3	5.92	1.01	0.70	20.8	2.88	1.93	2.42	58.0	208.	YELD 10
0.33	2.68	31.8	--	120.	7.39	12.3	5.23	0.94	0.63	23.1	2.99	1.85	1.94	61.0	188.	YELD 11
0.33	2.73	31.2	31.2	115.	2.85	12.1	5.14	0.91	0.64	21.1	2.89	1.87	2.10	51.5	233.	YELD 12
0.34	3.04	32.2	56.6	104.	4.63	13.6	5.58	0.86	0.75	19.4	4.31	1.95	1.83	72.8	204.	YELD 13
0.28	2.33	24.3	80.9	113.	1.65	11.5	4.15	0.91	0.50	22.2	3.54	2.18	2.05	47.6	230.	YELD 14
0.33	2.12	26.7	33.1	101.	2.71	12.6	4.65	0.86	0.57	20.3	3.25	2.05	2.13	61.5	220.	YELD 15
0.50	0.42	35.4	214.	165.	2.72	18.3	6.81	1.26	1.00	18.1	5.29	3.99	3.89	103.	167.	YELD 16
0.34	1.70	37.5	43.1	119.	2.59	11.7	5.49	0.89	0.59	28.6	3.19	2.30	2.18	57.8	197.	YELD 17
0.30	1.58	29.8	32.9	129.	6.61	11.0	4.72	0.86	0.55	23.3	3.51	1.81	2.06	55.0	179.	YELD 18
0.37	1.52	31.4	--	114.	2.03	12.3	5.13	1.01	0.57	23.2	4.09	2.45	2.38	54.4	221.	YELD 19
0.31	1.59	30.1	47.6	123.	2.00	11.5	4.62	0.92	0.51	23.3	3.76	2.57	2.14	59.4	224.	YELD 20
0.50	0.51	32.4	177.	224.	1.32	22.1	5.13	1.20	0.67	17.9	4.19	3.11	3.11	91.0	235.	YELD 21
0.013	0.011	1.3	26.	2.6	0.040	0.018	0.025	0.040	0.051	0.080	0.23	0.26	0.059	1.5	20.	ave.error
3.4	0.7	4.6	32.	1.9	1.9	0.1	0.5	4.0	7.5	0.4	6.6	9.3	2.3	2.2	9.2	in%

	Ul18 6 samples		Ul64 26 samples		Ul73 10 samples		Ul91 19 samples		Ul71 3 samples		Ul74 3 samples		Ul98 3 samples		X012 3 samples		PegK 15 samples	
	M	σ (%)	M	σ (%)	M	σ (%)	M	σ (%)	M	σ (%)	M	σ (%)	M	σ (%)	M	σ (%)	M	σ (%)
As	40.0	(20.)	95.1	(75.)	21.6	(51.)	16.7	(58.)	46.9	(82.)	9.31	(42.)	21.7	(57.)	18.8	(29.)	20.2	(47.)
Ba	1504.	(47.)	1953.	(28.)	1418.	(87.)	1566.	(18.)	1963.	(11.)	857.	(10.)	779.	(29.)	1363.	(21.)	1248.	(37.)
Br	4.48	(24.)	6.00	(79.)	2.84	(84.)	4.03	(46.)	6.51	(41.)	1.21	(52.)	7.45	(86.)	4.04	(48.)	3.33	(55.)
Ca %	2.60	(39.)	1.52	(22.)	2.98	(45.)	2.34	(16.)	2.59	(7.0)	4.08	(29.)	4.35	(39.)	2.20	(45.)	2.84	(15.)
Ce	81.7	(5.4)	85.8	(14.)	83.1	(1.9)	83.8	(4.4)	76.6	(8.1)	96.2	(1.0)	91.5	(2.7)	93.5	(3.5)	82.4	(2.8)
Co	18.7	(6.5)	12.7	(23.)	16.0	(7.2)	14.6	(15.)	15.9	(3.3)	18.0	(2.4)	22.3	(8.3)	13.9	(3.0)	15.7	(13.)
Cr	107.	(8.0)	60.4	(16.)	153.	(15.)	80.5	(6.9)	63.3	(13.)	138.	(2.6)	171.	(17.)	103.	(6.0)	100.	(7.7)
Cs	10.8	(9.6)	5.42	(22.)	17.5	(12.)	6.20	(8.6)	7.39	(18.)	14.0	(0.9)	13.9	(16.)	14.2	(3.1)	16.3	(20.)
Eu	1.41	(3.5)	1.18	(7.4)	1.31	(2.1)	1.37	(3.3)	1.29	(4.3)	1.42	(1.5)	1.59	(2.5)	1.47	(1.4)	1.31	(2.1)
Fe %	4.22	(4.0)	3.45	(6.1)	3.44	(11.)	3.75	(5.0)	3.69	(0.8)	4.87	(2.5)	4.41	(5.2)	3.87	(28.)	3.58	(8.2)
Ga	21.4	(25.)	16.5	(28.)	27.0	(14.)	21.1	(23.)	27.4	(15.)	27.2	(19.)	28.7	(24.)	33.1	(17.)	24.1	(24.)
Hf	5.49	(4.0)	5.82	(9.6)	5.97	(9.2)	6.41	(3.4)	5.90	(6.5)	5.62	(6.4)	6.72	(7.0)	6.33	(12.)	6.06	(9.0)
K %	2.38	(5.5)	2.63	(9.9)	2.74	(4.6)	2.41	(5.9)	2.38	(2.0)	3.81	(5.7)	2.46	(2.9)	2.92	(7.6)	2.47	(5.7)
La	40.2	(4.3)	44.0	(6.7)	40.8	(2.9)	41.5	(2.5)	38.7	(8.9)	46.9	(1.1)	45.2	(3.5)	46.1	(4.6)	40.8	(3.0)
Lu	0.37	(4.1)	0.33	(6.4)	0.42	(4.2)	0.38	(5.4)	0.32	(3.6)	0.51	(3.1)	0.53	(8.9)	0.48	(3.0)	0.38	(5.3)
Na %	1.67	(7.2)	1.88	(32.)	1.07	(18.)	1.81	(5.4)	1.86	(7.4)	0.98	(14.)	1.02	(66.)	0.92	(39.)	1.35	(19.)
Nd	29.6	(11.)	29.4	(8.9)	29.5	(6.3)	30.1	(6.0)	25.1	(14.)	34.2	(3.5)	33.1	(11.)	31.0	(9.1)	30.2	(8.2)
Ni	98.8	(25.)	52.5	(47.)	79.6	(32.)	56.1	(47.)	42.8	(56.)	118.	(25.)	165.	(18.)	67.8	(36.)	79.0	(35.)
Rb	119.	(4.7)	115.	(11.)	150.	(8.2)	126.	(3.4)	107.	(7.1)	198.	(4.3)	145.	(1.8)	166.	(8.2)	132.	(6.2)
Sb	1.94	(14.)	2.91	(77.)	3.55	(21.)	0.79	(14.)	1.69	(16.)	1.05	(14.)	1.40	(40.)	2.32	(27.)	3.10	(39.)
Sc	15.7	(3.3)	12.7	(8.3)	16.5	(3.8)	13.7	(3.3)	14.2	(1.7)	20.5	(1.5)	18.2	(3.5)	16.6	(1.5)	14.2	(3.8)
Sm	5.15	(9.0)	5.00	(10.)	5.12	(6.3)	5.18	(4.9)	4.39	(8.0)	5.89	(2.5)	6.22	(6.9)	5.27	(3.4)	5.10	(5.4)
Ta	0.89	(4.1)	0.93	(4.8)	1.06	(6.7)	0.87	(4.9)	0.87	(4.0)	1.15	(3.8)	1.15	(4.6)	1.17	(3.2)	0.96	(4.8)
Tb	0.72	(9.0)	0.61	(11.)	0.68	(7.6)	0.70	(8.1)	0.63	(8.8)	0.81	(6.9)	0.99	(11.)	0.83	(7.7)	0.70	(7.1)
Th	17.3	(5.5)	22.2	(6.6)	18.7	(3.2)	18.9	(3.4)	15.6	(1.8)	18.5	(2.5)	16.8	(3.5)	19.5	(3.0)	18.8	(7.4)
U	3.30	(6.6)	3.67	(12.)	3.87	(13.)	3.42	(9.9)	2.52	(8.5)	4.10	(12.)	3.12	(4.9)	3.81	(19.)	3.38	(14.)
W	2.06	(19.)	2.59	(30.)	3.07	(11.)	2.79	(12.)	2.08	(20.)	3.55	(18.)	3.34	(10.)	3.15	(8.9)	2.69	(19.)
Yb	2.34	(5.4)	2.18	(6.6)	2.76	(5.1)	2.51	(3.2)	2.13	(6.7)	3.26	(3.0)	3.71	(6.8)	3.19	(1.9)	2.59	(5.6)
Zn	71.8	(8.1)	57.2	(11.)	73.6	(8.0)	68.1	(14.)	63.6	(5.9)	88.1	(4.7)	85.3	(9.2)	76.8	(15.)	81.9	(12.)
Zr	202.	(9.5)	206.	(13.)	226.	(9.9)	234.	(9.6)	242.	(11.)	213.	(11.)	267.	(8.2)	243.	(9.5)	218.	(25.)

Tab. 2 Average concentrations M of elements in µg/g (ppm), if not indicated otherwise, and root mean square deviations σ in % of M of groups formed with the dataset of 112 samples from the region of Pergamon. The individual sample data have been corrected with a best relative fit factor with respect to the average values M. These factors are listed in Tab. 4. Ul-No and X-No groups stem from workshops that are not yet geographically defined. PegK is with high probability assigned to Elaia

Site	Ul18	Ul64	Ul73	Ul91	Ul71	Ul74	Ul98	X012	PegK	Specials	Chemical sample pairs	Singles	Totals
Ayazköy	**5**				3							3	11
Başantepe		3+1-										1	5
Çiftlik		**8**+1-	1										10
Değirmentepe	1		5					3	2		Degi 1+3, 5+11, 15+[Elai 45]	1	17
Elaia				1+1-							65+68	1	5
Gümüşova Valley			1+1-	**18**		3	1		1	2:PegL, 3:PegA, 20:X001, 27:TroB, 29:Pege		3	33
Teuthrania			1						4				5
Yeni Yeldeğirmentepe		**14**+2-								16:EphI	9+17	2	21
Erigöl Tepe			2										2
Grynaion							1						1
Atarneus										22:TroA/MYBE			1
Hatiplar Kalesi												1	1
Totals	6	25+4- [+ 1 ext.]	10+1-	19+1-	3	3	2 [+ 1 ext.]	3	7 loc. [+ 8 other, ext.]	6 located + 1 unknown	9+[1 ext.]	12	112

Tab. 3 Distribution of the 112 Bronze Age samples from sites in the region of Pergamon into NAA elemental concentration patterns. Bold numbers highlight possible production places of the NAA group. - designates samples that are only associated to the group. The samples and groups not treated here will be discussed in a forthcoming paper. For the specials in the Peg-groups see Mommsen – Japp 2009

Name	Totals	Members (fit factor)
		Existing groups
EphI	1	YELD **16** (1.03)
TroA/MYBE	1	ATAR 22 (0.99)
PegA	1	GUEM 03 (0.98)
PegK	7	DEGI 06 (0.90), 10 (0.94), GUEM 22 (1.04), TEUT 01 (1.03), 02 (0.99), 04 (1.06), 05 (0.98)
PegL	1	GUEM 02 (0.92)
Pege	1	GUEM 29 (0.96)
TroB	1	GUEM 27 (1.00)
X001	1	GUEM 20 (1.03) (data see table of raw data) (+ 3 other)
		New groups
Ul18	6	AYAZ 02 (0.99), 03 (0.94), 05 (1.07), **08** (1.02), 09 (0.97), DEGI 02 (1.00)
Ul64	25 (+ 1)	BASA **01** (0.97), **02** (1.05), **04** (1.01), CIFT **01** (1.00), **02** (0.98), 03 (0.92), **04** (1.00), **05** (0.92), 06 (0.97), 08 (0.88), **09** (0.95), YELD **01** (0.98), **02** (1.03), **03** (1.04), **04** (1.03), **05** (1.04), **06** (0.99), **10** (0.97), **11** (1.00), **12** (1.03), **13** (0.99), 14 (1.06), **15** (1.06), **18** (1.04), **20** (1.01) + other ATAR 18 (0.96),
Ul64- (assoc.)	4	BASA **05** (1.09), CIFT **10** (0.99), YELD **08** (1.06), **19** (0.92)
Ul73	10	CIFT 07 (1.10), DEGI 04 (1.07), 07 (0.97), 08 (1.00), 09 (0.99), 12 (1.02), ERIT 01 (0.92), 02 (0.95), GUEM 28 (0.98), TEUT 03 (0.99)
Ul73- (assoc.)	1	GUEM 30 (0.93)
Ul91	19	ELAI **67** (1.06), GUEM **06** (0.93), **07** (0.94), **08** (1.02), 10 (1.04), **11** (1.03), **12** (1.02), **13** (0.98), **14** (1.02), 15 (1.02), 16 (1.07), **17** (0.96), 18 (0.97), **19** (1.01), **21** (0.95), 23 (0.99), 25 (1.00), 26 (1.00), 33 (0.97)
Ul91- (assoc.)	1	ELAI **66** (1.12)
		Triples
Ul71		AYAZ 04 (1.04), 07 (0.99), 11 (0.97)
Ul74		GUEM 01 (1.01), 05 (0.98), 31 (1.01)
Ul98		GRYN 07 (0.96), GUEM 04 (1.05) + other ELAI 55 (0.99)
X012		DEGI 13 (1.07), 14 (0.96), 17 (0.97)
		Pairs (data see table of raw data)
=197		DEGI 01 (1.01), 03 (0.99)
=14		DEGI 05 (0.99), 11 (1.01)
=179		DEGI 15 (0.99) + other ELAI 45 (1.01)
=210		YELD **09** (0.99), **17** (1.01)
=81		ELAI **65** (1.01), **68** (0.99)
		Singles (data see table of raw data)
		AYAZ 01, **06**, **10**, BASA **03**, DEGI 16, ELAI **64**, GUEM 09, 24, 32, HAKA 01, YELD 07, 21

Tab. 4 List of members of the different groups and their best relative fit factor with respect to the average grouping values. The 48 pieces dated to the EBA are shown in bold

from the late Classical to the Hellenistic period, as well as a single Archaic piece, although this chronological disparity has yet to be explained. The production of EBA pottery is attested at Çukuriçi Höyük, and thus several pieces may originate from that site.[34] This question will necessitate further analyses in future.

A Model for Pottery Production in the Early 3rd Millennium BC

From a preliminary view of the archaeological and archaeometric analyses, several workshops were active across the Bakırçay Valley. Some of the ateliers worked only during a specific period in prehistory, while others were in production over a longer period of time. We do not detect any specialisation in certain forms or functional groups. Presumably, these workshops did not trade their products across vast distances but instead satisfied local needs. This is supported by the fact that none of the existing prehistoric samples in the Bonn database can be assigned to the new groups. It is already assumed that the production of these products differs markedly, in terms of clay recipe, between early periods and during later – Hellenistic to Byzantine – periods. Moreover, pottery imports were uncommon in the region of Pergamon during the Early Bronze Age.[35] It seems that, in this period, workshops scattered across the Bakırçay Valley produced the necessary table, cooking, and storage wares for the local population, satisfying demand almost entirely.

Across the upper, central, and lower Bakırçay Valley, including the coastal area and the Gümüşova Valley, communities were generally connected in their preferences for pottery styles. Production, however, was mainly local. This is well-attested, for instance, in the Gümüşova Valley. The ongoing examination of various lithics and their sources might shed light on the extent of connectivity between communities in the region, especially with regard to the regional exchange of raw materials.

The analyses detailed here are consistent with the results of other studies conducted in the region, and fit well into an initial, overarching picture of the societies of the Bakırçay Valley. In contrast to neighbouring regions such as the northeastern Aegean, the Troad to the north, and the central Aegean coast to the south, which were highly dynamic during the period, the Bakırçay Valley appears to have been socially and culturally isolated. Early Bronze Age communities in this area seem not to have been integrated into supra-regional networks. This is especially evident in the exchange of certain raw materials. For instance, at 3rd millennium sites in the Bakırçay Valley there is a complete lack of obsidian and other characteristic EBA innovations such as weights.[36]

While settlements in our region are served by local workshops, they also share typical Early Bronze Age pottery and metal styles and technologies that are identified with the northeastern Aegean *koiné*, as defined by O. Kouka.[37] At the same time, the region seems to have been excluded from the main exchange routes of the Anatolian Trade Network model outlined by V. Şahoğlu.[38] In this network, not only luxury objects but also raw materials, innovations, and technological knowledge were exchanged, demonstrating the rise of elites during the developed EBA from c. 2600 BC. Our examination of EBA pottery in the Bakırçay Valley provides initial insight into a previously unknown regional production of the 3rd millennium BC. From the presence of common styles and technologies of the eastern Aegean *koiné*, communities in this region were integrated into greater networks of the eastern Aegean and western Anatolia, but primarily turned to local, autochthonous networks to serve their needs.

---

34 Cf. Peloschek, this volume; Röcklinger – Horejs, this volume.
35 For the limited number of imports during the Late Bronze Age see Horejs 2011b; Horejs 2014a.
36 Cf. Rahmstorf 2006; Knitter et al. 2013; Horejs 2016.
37 Kouka 2002; Kouka 2008.
38 Şahoğlu 2005.

Acknowledgements: We would like to thank the Pergamon Excavation of the German Archaeological Institute and Felix Pirson for allowing samples to be sourced from the campaigns 2011, 2013, and 2014. We would also like to express our gratitude to the Turkish Antiquities Authority and the Bergama Müze for permission to export the samples to Germany and to conduct the Neutron Activation Analysis. We further thank Maria Röcklinger for assisting in the work, Mario Börner for creating the map, and the entire survey teams working in Pergamon between 2008 and 2015. The Prehistoric Survey Project was funded by the European Research Council (ERC Prehistoric Anatolia, 263339) and the Austrian Research Fund (START project Y 528). Finally, we would like to thank the staff at the Reactor Institute Delft, Delft University of Technology for assistance in irradiating the samples.

References

Beier – Mommsen 1994
Th. Beier – H. Mommsen, Modified Mahalanobis filters for grouping pottery by chemical composition, Archaeometry 36, 1994, 287–306.

Bittel 1939–1941
K. Bittel, Ein Gräberfeld der Yortankultur bei Babaköy, Archiv für Orientforschung 13, 1939–1941, 1–28.

Bittel 1950
K. Bittel, Zur ältesten Besiedlungsgeschichte der unteren Kaikosebene, Istanbuler Forschungen 17, 1950, 10–29.

Driehaus 1957
J. Driehaus, Prähistorische Siedlungsfunde in der unteren Kaikosebene und am Golfe von Çandarlı, Istanbuler Mitteilungen 7, 1957, 76–101.

Dörpfeld 1908
W. Dörpfeld, Ausgrabungen in Pergamon. Technisches und Architekturtagebuch Pergamon 1908, 16–23.

Dörpfeld – Hepding 1910
W. Dörpfeld – H. Hepding, Die Arbeiten zu Pergamon 1908–1909, Mitteilungen des Deutschen Archäologischen Instituts, Athenische Abteilung 35, 1910, 345–526.

Erkanal et al. 2008
H. Erkanal – H. Hauptmann – V. Şahoğlu – R. Tuncel (eds.), The Aegean in the Neolithic, Chalcolithic and the Early Bronze Age. Proceedings of the International Symposium in Urla – Izmir (Turkey), October 13th–19th 1997 (Ankara 2008).

Erkanal 2008a
H. Erkanal, Die neuen Forschungen in Bakla Tepe bei Izmir, in: Erkanal et al. 2008, 165–177.

Erkanal 2008b
H. Erkanal, Liman Tepe: new light on prehistoric Aegean cultures, in: Erkanal et al. 2008, 179–190.

Harbottle 1976
G. Harbottle, Activation analysis in archaeology, in: G. W. A. Newton (ed.), Radiochemistry 3 (London 1976) 33–72.

Horejs 2010a
B. Horejs, Bronzezeitliche Besiedlungsmuster im Kaikostal. Interpretationen erster Surveyergebnisse im Umland von Pergamon (Türkei), in: B. Horejs – T. Kienlin (eds.), Siedlung und Handwerk. Studien zu sozialen Kontexten in der Bronzezeit. Beiträge zu den Sitzungen der Arbeitsgemeinschaft Bronzezeit auf der Jahrestagung des Nordwestdeutschen Verbandes für Altertumsforschung in Schleswig 2007 und auf dem Deutschen Archäologenkongress in Mannheim 2008, Universitätsforschungen zur Prähistorischen Archäologie 194 (Bonn 2010) 47–67.

Horejs 2010b
B. Horejs, Yeni Yeldeğirmentepe, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2008, Archäologischer Anzeiger 2009, 2, 2010, 168–174.

Horejs 2010c
B. Horejs, Possibilities and limitations in analysing ceramic wares, in: B. Horejs – R. Jung – P. Pavúk (eds.), Analysing Pottery. Processing – Classification – Publication (Bratislava 2010) 15–27.

Horejs 2011a
B. Horejs, Yeni Yeldeğirmentepe, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2009, Archäologischer Anzeiger 2010, 2, 2011, 164–168.

Horejs 2011b
B. Horejs, Bergama and the Bakırçay Valley in prehistory, in: Önen et al. 2011, 24–36.

Horejs 2012
B. Horejs, Prähistorische Surveys am Yeni Yeldeğirmentepe und im Umland von Pergamon, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2010, Archäologischer Anzeiger 2011, 2, 2012, 146–150.

Horejs 2013
B. Horejs, Der prähistorische Umlandsurvey, in: F. Pirson, Pergamon – Bericht über die Arbeiten der Kampagne 2011, Archäologischer Anzeiger 2012, 2, 2013, 204–208.

Horejs 2014a
B. Horejs, The 2nd millennium BC in the Bakırcay (Kaykos) Valley. An overview, in: N. Çınardalı-Karaaslan – A. Aykurt – N. Kolankaya-Bostancı – Y. H. Erbil (eds.), Anadolu Kültürlerine Bir Bakış. Armağan Erkanal'a Armağan / Some Observations on Anatolian Cultures. Compiled in Honor of Armağan Erkanal (Ankara 2014) 257–274.

Horejs 2014b
B. Horejs, Der prähistorische Umlandsurvey, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2012, Archäologischer Anzeiger 2013, 2, 2014, 109–117.

Horejs 2014c
B. Horejs, Pergamon and the Kaikos Valley in prehistoric times, in: F. Pirson – A. Scholl (eds.), Pergamon. Anadolu'da Bir Helenistik Dönem Başkenti / Pergamon. A Hellenistic Capital in Anatolia (Istanbul 2014) 106–119.

Horejs 2015
B. Horejs, Der prähistorische Umlandsurvey, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2013, Archäologischer Anzeiger 2014, 2, 2015, 141–146.

Horejs 2016
B. Horejs, Neue Gewichtssysteme und metallurgischer Aufschwung im frühen 3. Jahrtausend. Ein Zufall?, in: M. Bartelheim – B. Horejs – R. Krauß (eds.), Von Baden bis Troia. Ressourcennutzung, Metallurgie und Wissenstransfer. Eine Jubiläumsschrift für Ernst Pernicka, Oriental and European Archaeology 3 (Rahden/Westf. 2016) 251–272.

Horejs – Weninger 2016
B. Horejs – B. Weninger, Early Troy and its significance for the Early Bronze Age in western Anatolia, in: E. Pernicka – S. Ülüsöy – St. Blum (eds.), Early Bronze Age Troy. Chronology, Cultural Development and Interregional Contacts. Proceedings of an International Conference held at the University of Tübingen, May 8–10 2009, Studia Troica Monographien 8 (Bonn 2016) 123–145.

Horejs et al. 2011
B. Horejs – A. Galik – U. Thanheiser – S. Wiesinger, Aktivitäten und Subsistenz in den Siedlungen des Çukuriçi Höyük. Der Forschungsstand nach den Ausgrabungen 2006–2009, Praehistorische Zeitschrift 86, 1, 2011, 31–66.

Horejs et al. 2016
B. Horejs – B. Milić – P. Pavúk, Der prähistorische Umlandsurvey, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2014, Archäologischer Anzeiger 2015, 2, 2016, 134–139.

Japp 2009
S. Japp, Archäometrisch-archäologische Untersuchungen an Keramik aus Pergamon und Umgebung, Istanbuler Mitteilungen 59, 2009, 193–268.

Kâmil 1982
T. Kâmil, Yortan Cemetery in the Early Bronze Age of Western Anatolia, British Archaeological Reports International Series 145 (Oxford 1982).

Kerschner 2002
M. Kerschner, Die nichtlokalisierten chemischen Muster I und J und ihre Einordnung in die Keramikproduktion des südlichen und mittleren Ioniens, in: M. Akurgal – M. Kerschner – H. Mommsen – W.-D. Niemeier, Töpferzentren der

Ostägäis. Archäometrische und Archäologische Untersuchungen zur Mykenischen, Geometrischen und Archaischen Keramik aus Fundorten in Westkleinasien, Ergänzungshefte zu den Jahresheften des Österreichischen Archäologischen Institutes 3 (Wien 2002) 51–55.

Knitter et al. 2013
D. Knitter – H. Blum – B. Horejs – O. Nakoinz – B. Schütt – M. Meyer, Integrated centrality analysis: A diachronic comparison of selected western Anatolian locations, Quaternary International 312, 2013, 45–56.

Korfmann 2001
M. Korfmann, Troia als Drehscheibe des Handels im 2. und 3. vorchristlichen Jahrtausend, in: Troia – Traum und Wirklichkeit. Exhibition Catalogue Stuttgart, Braunschweig, Bonn (Stuttgart 2001) 355–368.

Kouka 2002
O. Kouka, Siedlungsorganisation in der Nord- und Ostägäis während der Frühbronzezeit (3. Jt. v. Chr.), Internationale Archäologie 58 (Rahden/Westf. 2002).

Kouka 2008
O. Kouka, Zur Struktur der frühbronzezeitlichen insularen Gesellschaften der Nord- und Ostägäis. Ein neues Bild der sogenannten „Trojanischen Kultur“, in: Erkanal et al. 2008, 285–300.

Lamb 1936
W. Lamb, Excavations at Thermi in Lesbos (Cambridge 1936).

Mehofer in preparation
M. Mehofer, Spätchalkolithische und frühbronzezeitliche Metallurgie auf dem Çukuriçi Höyük. Metallverarbeitung im 4. und 3. Jt. v. Chr. in Westanatolien (in preparation).

Mommsen 1986
H. Mommsen, Archäometrie (Stuttgart 1986).

Mommsen 2007
H. Mommsen, Tonmasse und Keramik. Herkunftsbestimmung durch Spurenanalyse, in: G. Wagner (ed.), Einführung in die Archäometrie (Berlin 2007) 179–192.

Mommsen et al. 1991
H. Mommsen – A. Kreuser – E. Lewandowski – J. Weber, Provenancing of pottery. A status report on neutron activation analysis and classification, in: M. Hughes – M. Cowell – D. Hook (eds.), Neutron Activation and Plasma Emission Spectrometric Analysis in Archaeology. Techniques and Applications, British Museum Occasional Paper 82 (London 1991) 57–65.

Mommsen et al. 2002
H. Mommsen – Th. Beier – A. Hein, A complete chemical grouping of the Berkeley neutron activation analysis data on Mycenaean pottery, Journal of Archaeological Science 29, 2002, 613–637.

Mommsen et al. 2006
H. Mommsen – M. R. Cowell – Ph. Fletcher – D. Hook – U. Schlotzhauer – A. Villing – S. Weber – D. Williams, Neutron activation analysis of pottery from Naukratis and other related vessels, in: U. Schlotzhauer – A. Villing (eds.), Naukratis: Greek Diversity in Egypt, The British Museum Research Publication Number 162 (London 2006) 69–76.

Mommsen et al. 2007
H. Mommsen – A. Schwedt – E. Trinkl, Herkunftsbestimmung der beiden Amphoren Panathenäischer Form KK 15 und KK 17 durch Neutronenaktivierungsanalyse, in: V. Mitsopoulos-Leon – C. Lang-Auinger (eds.), Die Basilika am Staatsmarkt in Ephesos. 2. Teil: Funde klassischer bis römischer Zeit, Forschungen in Ephesos IX/2/3 (Wien 2007) 26–27.

Mommsen – Japp 2009
H. Mommsen – S. Japp, Neutronenaktivierungsanalyse von 161 Keramikproben aus Pergamon und Fundorten der Region, Istanbuler Mitteilungen 59, 2009, 269–286.

Mommsen – Japp 2014
H. Mommsen – S. Japp, Statistical interpretation of elemental concentration data and the origin of Pergamene pottery, in: H. Meyza (ed.), Late Hellenistic to Mediaeval Fine Wares of the Aegean Coast of Anatolia. Their Production, Imitation and Use (Warsaw 2014) 31–40.

Mommsen – Sjöberg 2007
H. Mommsen – B. L. Sjöberg, The importance of the 'best relative fit factor' when evaluating elemental concentration data of pottery demonstrated with Mycenaean sherds from Sinda, Cyprus, Archaeometry 49, 2007, 357–369.

Önen et al. 2011
E. Önen – M. Mutluer – N. Çetin (eds.), Proceedings of the International Bergama Symposium, 7th–9th April 2011 (Bergama 2011).

Perlman – Asaro 1969
I. Perlman – F. Asaro, Pottery analysis by neutron activation, Archaeometry 11, 1969, 21–52.

Pirson 2008
F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2007, Archäologischer Anzeiger 2008, 2, 2009, 83–155.

Rahmstorf 2006
L. Rahmstorf, Zur Ausbreitung vorderasiatischer Innovationen in der frühbronzezeitlichen Ägäis, Praehistorische Zeitschrift 81, 1, 2006, 49–96.

Şahoğlu 2005
V. Şahoğlu, The Anatolian trade network and the Izmir region during the Early Bronze Age, Oxford Journal of Archaeology 24, 4, 2005, 339–361.

Schneider et al. 2012
St. Schneider – D. Knitter – B. Schütt, Geoarchäologische Untersuchungen im westlichen Kaikostal – Bericht über die Arbeiten in der Kampagne 2010, in: F. Pirson, Pergamon – Bericht über die Arbeiten in der Kampagne 2010, Archäologischer Anzeiger 2011, 2, 2012, 160–166.

Schneider – Japp 2009
G. Schneider – S. Japp, Röntgenfluoreszenzanalysen von 115 Keramikproben aus Pergamon, Çandarlı, Elaia und Atarneus (Türkei), Istanbuler Mitteilungen 59, 2009, 287–306.

Schwedt – Mommsen 2004
A. Schwedt – H. Mommsen, Clay paste mixtures identified by neutron activation analysis in pottery of a Roman workshop in Bonn, Journal of Archaeological Science 31, 2004, 1251–1258.

Schwedt – Mommsen 2007
A. Schwedt – H. Mommsen, On the influence of drying and firing of clays on the formation of trace element concentration profiles within pottery, Archaeometry 49, 2007, 495–509.

Schwedt et al. 2006
A. Schwedt – H. Mommsen – N. Zacharias – J. Buxeda i Garrigos, Analcime crystallisation and compositional profiles. Comparing approaches to detect post-depositional alterations in archaeological pottery, Archaeometry 48, 2006, 237–250.

Seeliger et al. 2011
M. Seeliger – S. Schneider – H. Brückner – B. Schütt – B. Horejs – S. Feuser – M. Zimmermann – F. Pirson, Studying Pergamon's environs. Geoarchaeological research in Elaia and Bakırçay Valley, in: Önen et al. 2011, 48–65.

Ünlüsoy 2008
S. Ünlüsoy, Vom Reihenhaus zum Megaron. Troia I bis Troia III, in: M. O. Korfmann (ed.), Troia. Archäologie eines Siedlungshügels und seiner Landschaft (Mainz 2008) 133–144.

Wilson 1978
A. L. Wilson, Elemental analysis of pottery in the study of its provenance. A review, Journal of Archaeological Science 5, 1978, 219–236.

Catalogue

Sample no.: AYAZ 06
Site: Ayazköy
Object no.: AYAAlt/OF/01/0007
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: regularly rounded lip
Classification: Sb1bA
Applications/Decorations: horizontal loop handle
State of preservation: abraded
Description: polished
Dimensions (in cm):
width: 2
diameter (rim): 16
pres. diameter (rim) in %: 14
wall thickness: 0.6
drill: 0.5
Dated: EBA 1
Ware group: 567
Chemical group: Single
Fabric: F-MF: dark grey; some fine and medium fine light- and dark-coloured particles
Surface: beige-grey, medium fine burnished

Sample no.: AYAZ 08
Site: Ayazköy
Object no.: AYAAlt/OF/01/0014
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: inside bevelled rim
Classification: Sb1bN
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 22
pres. diameter (rim) in %: 3
wall thickness: 0.5
Dated: EBA 1
Ware group: 504
Chemical group: U118
Fabric: F-MF: brown, core continuous red; tempering: medium/fine-medium, bigger pores, several fine and medium fine light-coloured and reddish particles, a few coarse, light-coloured particles
Surface: brownish grey, medium fine burnished

Sample no.: AYAZ 10
Site: Ayazköy
Object no.: AYAAlt/OF/01/0029
Shape: decorated body sherd
Type: plastic decoration
Classification: Dbs11
Applications/Decorations: vertical plastic application
State of preservation: abraded
Description: outer surface with black slip; 5 YR 2.5/1 – 7.5 YR 2.5/1, closed vessel
Dimensions (in cm):
height: 0.1
width: 0.6
wall thickness: 1.9
Dated: Chalcolithic to EBA 1
Ware group: 501
Chemical group: Single
Fabric: MF: reddish-brown slip, break core red, break edges grey-brown; tempering mid/frequent, slightly sandy, several medium fine light-coloured particles, some fine light- and dark-coloured particles
Surface: exterior dark grey burnished, interior light brown

Sample no.: BASA 01
Site: Başantepe
Object no.: BATAlt/OF/01/0016
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: regularly rounded lip
Classification: Sb1bA
Applications/Decorations: horizontal loop handle
Dimensions (in cm):
height: 0.5
width: 2
diameter (rim): 18
pres. diameter (rim) in %: 12
wall thickness: 0.9
drill: 0.6
Dated: EBA 1
Ware group: 505
Chemical group: U164
Fabric: MF: interior fringe grey, exterior fringe ochre (10 YR 4/4), core continuous grey; tempering: mid/frequently, slightly sandy, several fine and medium fine differently coloured particles, mostly white and black, a few coarse white particles (quartz), little fine mica
Surface: grey to greyish brown (~10 YR 4/2), medium fine burnished

Sample no.: BASA 02
Site: Başantepe
Object no.: BATAlt/OF/01/0005
Shape: necked jar
Type: curved wall
Variation: slightly thickened lip
Classification: Nj3C
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 26
pres. diameter (rim) in %: 3
wall thickness: 1
Dated: Late Chalcolithic to EBA 1
Ware group: 504
Chemical group: U164
Fabric: F-MF: orange-brown (5 YR 5/6), core continuous red; medium amount of fine mica, several fine to medium fine, mostly light-coloured particles
Surface: reddish beige, medium fine burnished

Sample no.: BASA 03
Site: Başantepe

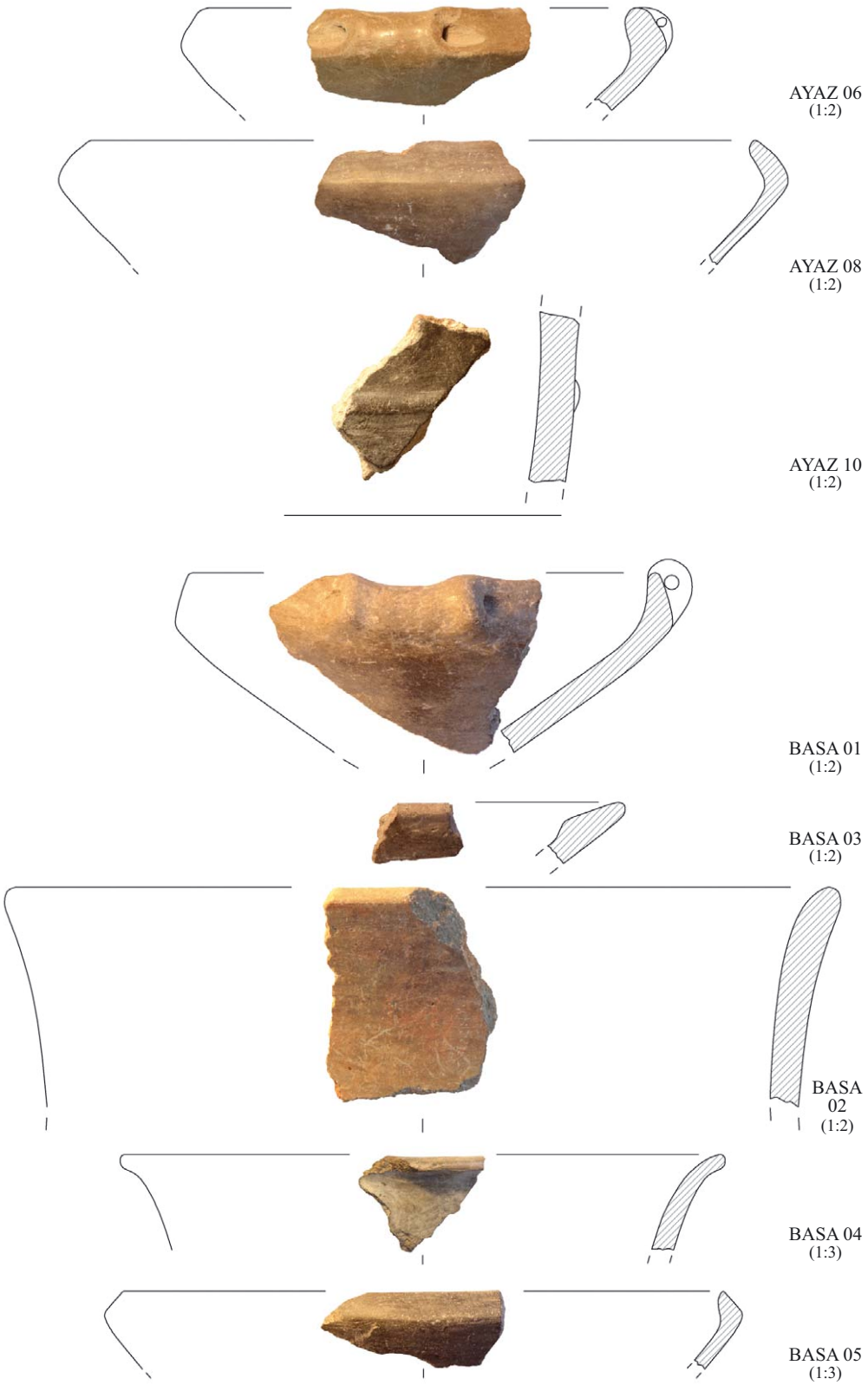

Plate 1 Analysed pottery from Ayazköy and Başantepe (ERC Prehistoric Anatolia/Th. Urban)

Object no.: BATAlt/OF/01/0010
Shape: shallow bowl
Type: open-mouthed
Variation: regularly rounded lip
Classification: Sb10A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): not definable
wall thickness: 0.9
Dated: Late Chalcolithic to EBA 1
Ware group: 508
Chemical group: Single
Fabric: MF: slip, slurry possible, dark grey and brown (7.5 YR 4/4), core brown-grey; several fine and medium fine differently coloured particles, some medium fine mica
Surface: grey, medium fine burnished

Sample no.: BASA 04
Site: Başantepe
Object no.: BATAlt/OF/01/0007
Shape: deep bowl
Type: slightly curved body
Variation: outside wiped lip
Classification: Db1O
State of preservation: well
Dimensions (in cm):
diameter (rim): 30
pres. diameter (rim) in %: 4.5
wall thickness: 1.1
Dating: Late Chalcolithic to EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: greenish grey (2.5 Y 4/3); several fine and medium fine light-coloured (white to orange) particles, little fine mica
Surface: greenish, medium fine burnished

Sample no.: BASA 05
Site: Başantepe
Object no.: BATAlt/OF/01/0011
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: regularly rounded lip
Classification: Sb1bA
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 30
pres. diameter (rim) in %: 7
wall thickness: 0.8
Dated: EBA 1
Ware group: 580
Chemical group: U164- (Th+)
Fabric: MF: greyish-black; medium amount of fine and medium fine mica, several fine and medium fine light-coloured particles
Surface: black smooth, medium fine burnished

Sample no.: CIFT 01
Site: Çiftlik
Object no.: CIFAlt/OF/000/01/0001
Shape: shallow bowl
Type: dome-shaped
Variation: inside bevelled rim
Classification: Sb3P
State of preservation: abraded
Dimensions (in cm):
diameter (rim): not definable
wall thickness: 1.2
Dated: EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: greyish-brown; several fine light-and dark-coloured particles, a few red medium fine particles
Surface: grey, exterior medium fine burnished

Sample no.: CIFT 02
Site: Çiftlik
Object no.: CIFAlt/OF/000/01/0002
Shape: deep bowl
Type: vertical upper body
Variation: inside swollen rim
Classification: Db2F
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 18
pres. diameter (rim) in %: 6
wall thickness: 0.8
Dated: Chalcolithic to EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: brown; several fine light- and dark-coloured particles
Surface: greyish-brown, medium fine burnished

Sample no.: CIFT 04
Site: Çiftlik
Object no.: CIFAlt/OF/000/01/0004
Shape: vertical handle
Type: wide cross-section
Classification: Vh1
State of preservation: abraded
Dimensions (in cm):
height: 1.3
width: 2.7
Dated: Chalcolithic to EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: grey; several medium fine white particles, a few medium fine black particles
Surface: grey, medium fine burnished

Sample no.: CIFT 05
Site: Çiftlik
Object no.: CIFAlt/OF/000/01/0005
Shape: foot
Classification: F0
State of preservation: abraded
Description: oval cross section
Dimensions (in cm):
height: 2.1
width: 4.0
Dated: Chalcolithic to 2nd millennium BC
Ware group: 515

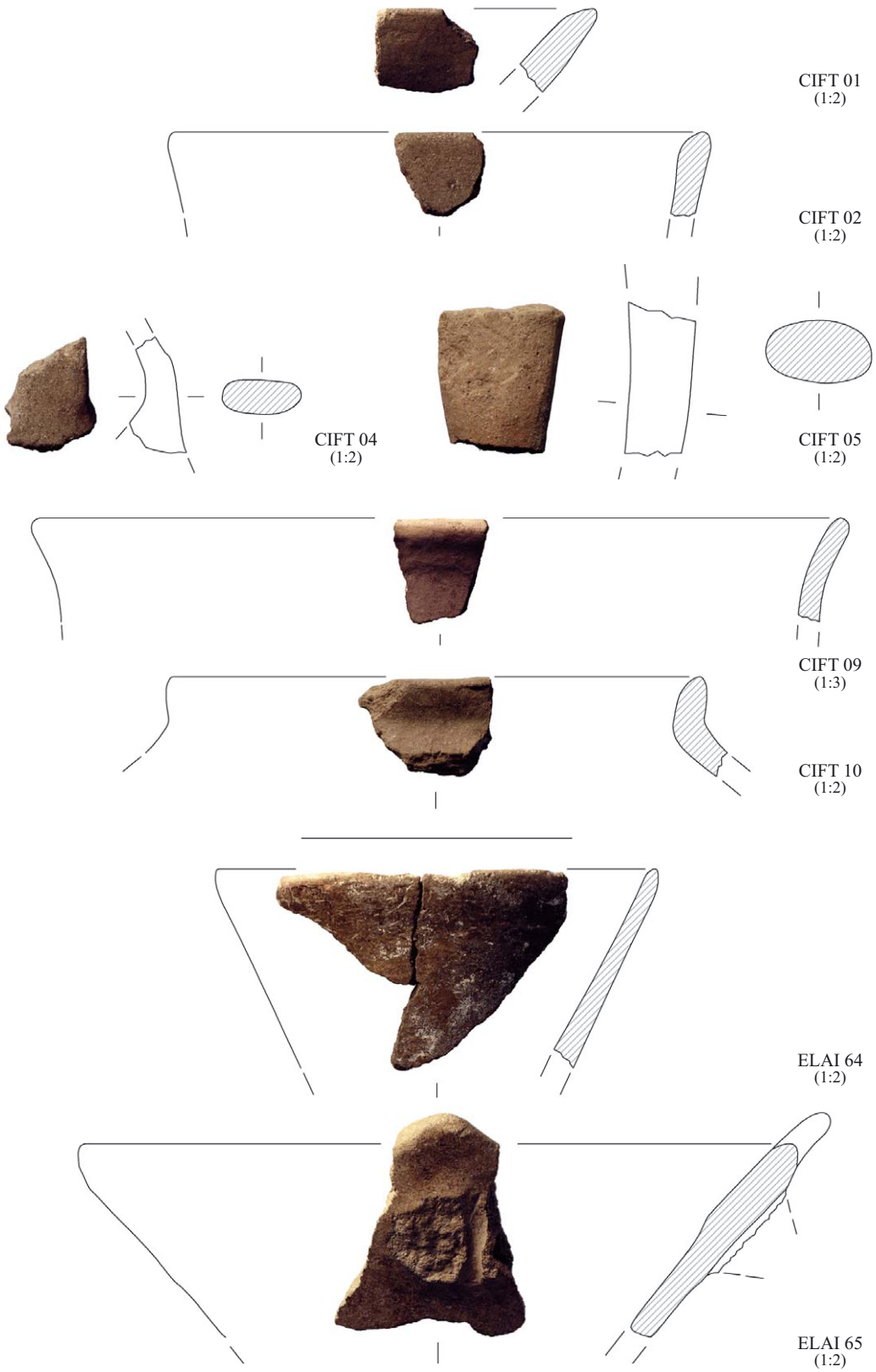

Plate 2 Analysed pottery from Çiftlik and Elaia (ERC Prehistoric Anatolia/Th. Urban)

Chemical group: U164
Fabric: MF: reddish-beige; several medium fine light-coloured particles
Surface: brown, rough

Sample no.: CIFT 09
Site: Çiftlik
Object no.: CIFAlt/OF/000/01/0008
Shape: necked jar
Type: curved wall
Variation: regularly rounded lip
Classification: Nj3A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 42
pres. diameter (rim) in %: 3
wall thickness: 1.0
Dated: Late Chalcolithic to EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: grey; medium amount of medium fine light- and dark-coloured particles
Surface: greyish-brown, medium fine burnished

Sample no.: CIFT 10
Site: Çiftlik
Object no.: CIFAlt/OF/000/01/0009
Shape: necked jar
Type: globular body
Variation: regularly rounded lip
Classification: Nj1A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 18
pres. diameter (rim) in %: 8.5
wall thickness: 1.1
Dated: Late Chalcolithic to EBA 1
Ware group: 505
Chemical group: U164- (Rb-Cr-)
Fabric: MF: grey, core continuous grey; tempering: mid/frequently, slightly sandy, medium amount of medium fine light- and dark-coloured particles
Surface: greyish-brown, rough burnished

Sample no.: ELAI 64
Site: Elaia
Object no.: ELA09OF/206/01/0002
Shape: shallow bowl
Type: funnel-shaped
Variation: regularly rounded lip
Classification: Sb7A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 15
pres. diameter (rim) in %: 23
wall thickness: 0.8
Dated: Middle Chalcolithic to EBA 1
Ware group: 531
Chemical group: Single
Fabric: MF-R: blackish-grey to black; some coarse, differently coloured particles, a few medium fine white particles, little fine mica
Surface: brownish-black, medium fine burnished; burnishing patterns visible

Sample no.: ELAI 65
Site: Elaia
Object no.: ELA09OF/206/01/0006
Shape: shallow bowl
Type: dome-shaped
Classification: Sb3
Applications/Decorations: flannel
State of preservation: abraded
Description: Troy A6 plate
Dimensions (in cm):
diameter (rim): 18
pres. diameter (rim) in %: 8
wall thickness: 1.0
Dated: Late Chalcolithic to EBA 1
Ware group: 534
Chemical group: = 81 Couple with ELAI 68
Fabric: MR-R: grey fringes and ochre core (10 YR 5/3); several fine and medium fine light-coloured particles
Surface: greyish ochre (~2.5 Y 6/3) slip, medium fine burnished

Sample no.: ELAI 66
Site: Elaia
Object no.: ELA09OF/208/01/0005
Shape: narrow-mouthed vessel
Type: narrow-mouthed
Variation: regularly rounded lip
Classification: N1A
Applications/Decorations: beginning of handle/application
State of preservation: abraded
Description: fabric reminds on Kumtepe IB
Dimensions (in cm):
diameter (rim): not definable
wall thickness: 0.8
Dated: Late Chalcolithic to ?
Ware group: 529
Chemical group: U191-
Fabric: MF: greyish-brown to light brown; some fine and medium fine differently coloured particles; a few coarse, differently coloured particles
Surface: light brown, roughly burnished

Sample no.: ELAI 67
Site: Elaia
Object no.: ELA09OF/208/01/0004
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: regularly rounded lip
Classification: Sb1aA
State of preservation: sintered
Dimensions (in cm):
angle: 70°
width: 0.8
diameter (rim): 20–24
pres. diameter (rim) in %: 4–3
wall thickness: 0.6
Dated: EBA 1

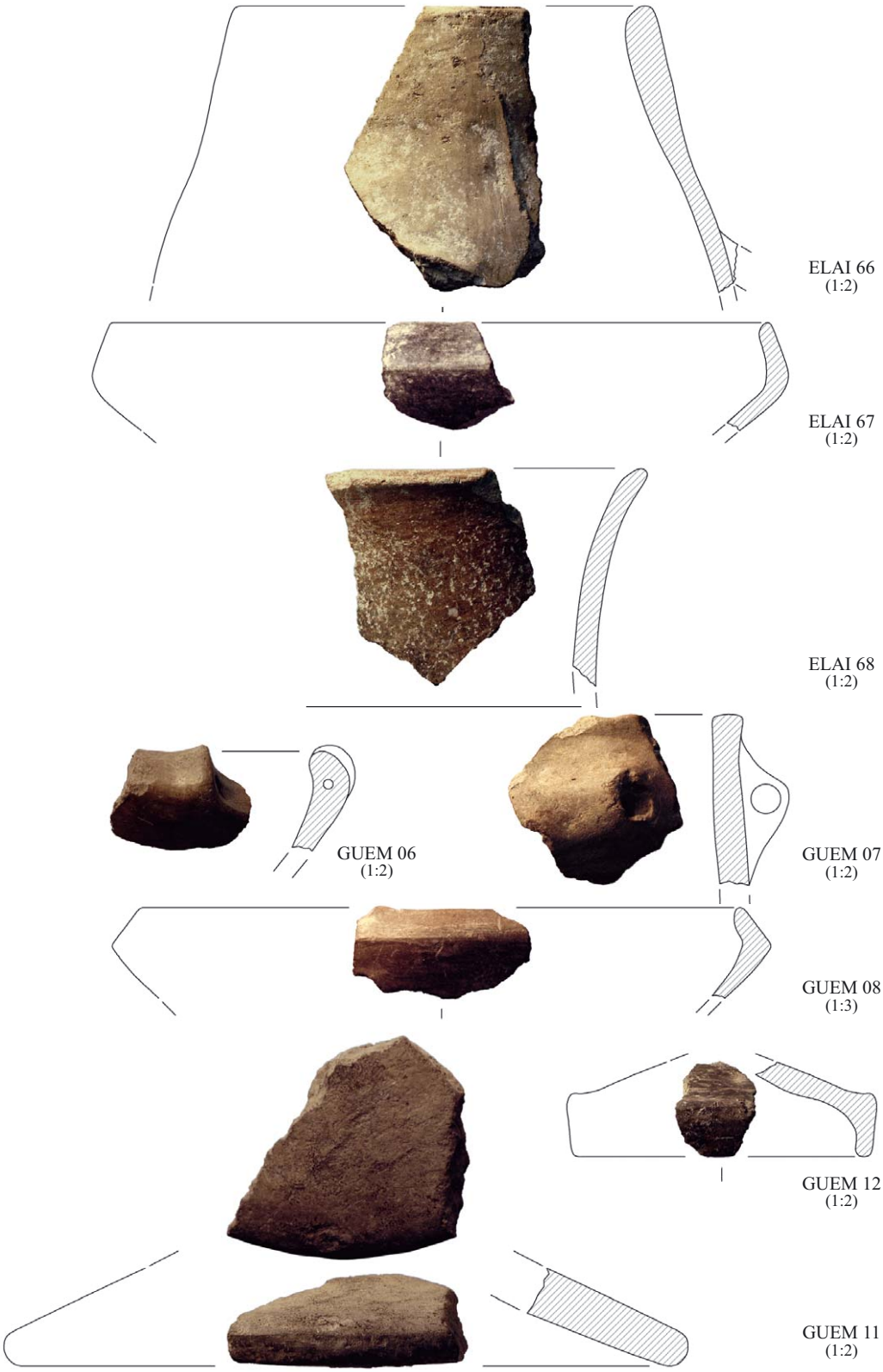

Plate 3 Analysed pottery from Elaia, Bağlı Tepe (GUEM 06, 11, 12), Üveçektepe (GUEM 07) and the Driehaus collection (GUEM 08) in the Gümüşova Valley (ERC Prehistoric Anatolia/Th. Urban)

Ware group: 526
Chemical group: U191
Fabric: F: black fringes, ochre-brown core; several fine and medium fine differently coloured particles, little fine mica
Surface: grey, fine burnished

Sample no.: ELAI 68
Site: Elaia
Object no.: ELA09OF/206/01/0004
Shape: necked jar
Type: curved wall
Variation: regularly rounded lip
Classification: Nj3A
State of preservation: abraded
Description:
Dimensions (in cm):
diameter (rim): 13
pres. diameter (rim) in %: 11
wall thickness: 0.8
Dated: Late Chalcolithic to EBA 1
Ware group: 532
Chemical group: = 81 Couple with ELAI 65
Fabric: MF-R: interior fringe grey, exterior reddish-brown to reddish-ochre; several fine and medium fine light-coloured particles, a few light-coloured coarse particles
Surface: interior ochre to grey, exterior reddish-ochre, engobe, medium fine burnished, burnishing patterns visible

Sample no.: GUEM 06
Site: Gümüşova Valley
Object no.: GÜM04/12/F03/01/0005
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: regularly rounded lip
Classification: Sb1bA
Applications/Decorations: loop handle
State of preservation: well
Description: broken, continuous brown fabric (surface 7.5 YR 5/6; break 7.5 YR 4/4)
Dimensions (in cm):
diameter (rim): not definable
wall thickness: 0.7
Dated: Late Chalcolithic to EBA 1
Ware group: 509
Chemical group: U191
Fabric: F-MF: brown (7.5 YR 4/3), core continuous brown; several medium fine light- and dark-coloured particles, little fine mica
Surface: light brown (7.5 YR 6/3), medium fine burnished

Sample no.: GUEM 07
Site: Gümüşova Valley
Object no.: GÜM01/12/F01/01/0003
Shape: deep bowl
Type: vertical upper body
Variation: squared lip
Classification: Db2D
Applications/Decorations: tubular lug
State of preservation: abraded
Dimensions (in cm):
wall thickness: 0.5
drill: 0.7
Dated: Late Chalcolithic to EBA
Chemical group: U191
Fabric: exterior grey, interior ochre (10 YR 5/4); several fine, medium fine and coarse light-, red- and dark-coloured particles, little fine mica
Surface: grey, burnished

Sample no.: GUEM 08
Site: Gümüşova Valley
Object no.: GÜMI/altOF/01/0014
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: regularly rounded lip
Classification: Sb1aA
State of preservation: well
Dimensions (in cm):
angle: 49°
width: 1.4
diameter (rim): 30
pres. diameter (rim) in %: 6.5
wall thickness: 0.6
Dating: EBA 1
Ware group: 567
Chemical group: U191
Fabric: F-MF: greyish-brown (7.5 YR 3/2); medium amount of fine to medium fine mica, several fine light-coloured particles, some medium fine and coarse red- and light-coloured particles
Surface: grey to beige brown (7.5 YR 5/2), with red stripes in the interior, medium fine burnished

Sample no.: GUEM 11
Site: Gümüşova Valley
Object no.: GÜM04/12/F03/01/0012
Shape: lid
Type: flat lid
Classification: L2
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 15
pres. diameter (rim) in %: 12
wall thickness: 1.5
Dated: EBA 1 to ?
Ware group: 567
Chemical group: U191
Fabric: F-MF: grey; little fine mica, some fine and medium fine light- and dark-coloured particles
Surface: grey, medium fine burnished

Sample no.: GUEM 12
Site: Gümüşova Valley
Object no.: GÜM04/12/F04/01/0004
Shape: lid
Type: slip lid
Classification: L1
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 10

pres. diameter (rim) in %: 9
wall thickness: 0.7
Dated: EBA 1
Ware group: 530
Chemical group: U191
Fabric: MF: exterior dark grey, interior brownish-grey (10 YR 5/3); some fine mica and fine and medium fine light-coloured particles
Surface: exterior black, interior grey, medium fine burnished

Sample no.: GUEM 13
Site: Gümüşova Valley
Object no.: GÜM04/12/F04/01/0002
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: outside wiped lip
Classification: Sb1aN
State of preservation: abraded
Dimensions (in cm):
angle: 62°
width: 0.8
diameter (rim): 20
pres. diameter (rim) in %: 3
wall thickness: 0.6
Dated: EBA 1
Ware group: 567
Chemical group: U191
Fabric: F-MF: orange-brown (7.5 YR 5/6); little fine mica, some fine, medium fine and coarse light- and dark-coloured particles
Surface: brown to reddish-brown (7.5 YR 4/6), medium fine burnished

Sample no.: GUEM 14
Site: Gümüşova Valley
Object no.: GÜM01/12/F01/01/0007
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: regularly rounded lip
Classification: Sb1aA
State of preservation: abraded
Dimensions (in cm):
angle: 67°
width: 1.3
diameter (rim): 26
pres. diameter (rim) in %: 6
wall thickness: 0.9
Dated: EBA 1
Ware group: 567
Chemical group: U191
Fabric: F-MF: grey; several fine light-coloured particles, a few medium fine light- and dark-coloured particles, little fine mica
Surface: grey, medium fine burnished

Sample no.: GUEM 17
Site: Gümüşova Valley
Object no.: GÜM04/12/F03/01/0004
Shape: narrow-mouthed vessel
Type: curved wall
Variation: regularly rounded lip
Classification: N2A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 8
pres. diameter (rim) in %: 25
wall thickness: 0.7
Dated: Middle Chalcolithic to EBA
Ware group: 565
Chemical group: U191
Fabric: MF: ochre (10 YR 5/4); little fine mica, several fine and some coarse, light-coloured particles
Surface: brown (2.5 YR 6/3), medium fine burnished

Sample no.: GUEM 19
Site: Gümüşova Valley
Object no.: GÜM01/12/F01/01/0008
Shape: flannel
Type: triangular
Classification: Fl1
State of preservation: secondary burnt
Dimensions (in cm):
wall thickness: 0.95
Dated: Late Chalcolithic to EBA
Ware group: 541
Chemical group: U 191
Fabric: MF: light brown fringes (10 YR 5/3), grey core; a few coarse and some medium fine light-coloured particles, little fine mica
Surface: beige grey (10 YR 6/3), thick slip, medium fine burnished

Sample no.: GUEM 21
Site: Gümüşova Valley
Object no.: GÜM04/12/F05/01/0005
Shape: vertical handle
Type: strap handle
Classification: Vh12
State of preservation: sintered
Description: big open vessel, red slip inside and outside; medium fine burnished; like WG 519
Dimensions (in cm):
height: 1.5
width: 3.4–4.5
wall thickness: 1.0
Dated: Late Chalcolithic to EBA ?
Ware group: 519
Chemical group: U191
Fabric: F: orange-red to orange-brown (5 YR 5/8–6/8); medium amount of fine mica, several fine and medium fine differently coloured particles, a few coarse, differently coloured particles
Surface: reddish-brown (5 YR 4/6), burnished

Sample no.: YELD 01
Site: Yeni Yeldeğirmentepe
Object no.: YYT08/F07/001/01/0007
Shape: shallow bowl
Type: narrow-mouthed
Variation: regularly rounded lip
Classification: Sb4A
State of preservation: abraded
Description: horizontal tubular lug

Dimensions (in cm):
diameter (rim): 24
pres. diameter (rim) in %: 10
wall thickness: 0.7
drill: 0.9
Dated: EBA 1
Ware group: 507
Chemical group: U164
Fabric: R: brown and grey (10 YR 5/1–2), core brown-grey; several medium fine differently coloured particles
Surface: slurry, grey to greyish brown (7.5 YR 5/1 – 2.5 YR 5/1), medium fine burnished

Sample no.: YELD 02
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/006/01/0001
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: regularly rounded lip
Classification: Sb1aA
State of preservation: abraded
Dimensions (in cm):
angle: 65°
width: 1.1
diameter (rim): 22
pres. diameter (rim) in %: 5
wall thickness: 1.0
Dated: EBA 1
Ware group: 507
Chemical group: U164
Fabric: R: brown to greyish-brown (10 YR 5/2–3), core brown-grey; several medium fine differently coloured particles
Surface: slurry, grey and brown (10 YR 6/2; 10 YR 5/1–2), medium fine burnished

Sample no.: YELD 03
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/003/01/0002
Shape: shallow bowl
Type: narrow-mouthed
Variation: regularly rounded lip
Classification: Sb4A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 24
pres. diameter (rim) in %: 5.5
wall thickness: 0.7
Dated: Late Chalcolithic to EBA 1
Ware group: 507
Chemical group: U164
Fabric: R: brown to greyish-brown (10 YR 5/3), core brown-grey; several coarse, differently coloured particles
Surface: slurry, black to blackish-brown slip (3/10Y), medium fine burnished

Sample no.: YELD 04
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/017/01/0001
Shape: foot
Type: curved base
Classification: F3
State of preservation: abraded
Description: base length: 5.2cm; base thickness: 1.5cm
Dimensions (in cm):
height: 2.0
width: 3.8
Dated: Late Chalcolithic to EBA 1
Ware group: 505
Chemical group: U164
Fabric: MF: red (2.5 YR 5/4–6), core continuous grey; tempering: mid/frequently, slightly sandy, several fine, differently coloured particles, a few coarse differently coloured particles
Surface: grey to brown (7.5 YR 5/1 to 5/4), medium fine burnished

Sample no.: YELD 05
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F05/A/012/01/0001
Shape: foot
Type: curved base
Classification: F1
State of preservation: abraded
Description: base thickness: 4.9; diameter 1.5cm
Dimensions (in cm):
height: 2.0
width: 4.3
Dated: Late Chalcolithic to EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: light brown; several medium fine light- and dark-coloured particles
Surface: light brown, medium fine burnished

Sample no.: YELD 06
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/003/01/0001
Shape: shallow bowl
Type: narrow-mouthed
Variation: regularly rounded lip
Classification: Sb4A
Applications/Decorations: grooved/fluted
State of preservation: sintered
Dimensions (in cm):
diameter (rim): 15
pres. diameter (rim) in %: 4
wall thickness: 0.9
Dated: EBA 1
Ware group: 501
Chemical group: U164
Fabric: MF: reddish slip, break core red, break edges grey-brown; tempering mid/frequent, slightly sandy, several medium fine light- and dark-coloured particles
Surface: exterior partly grey discoloured, interior reddish, burnished

Sample no.: YELD 07
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F05/A/005/01/0002
Shape: base
Type: flattened base

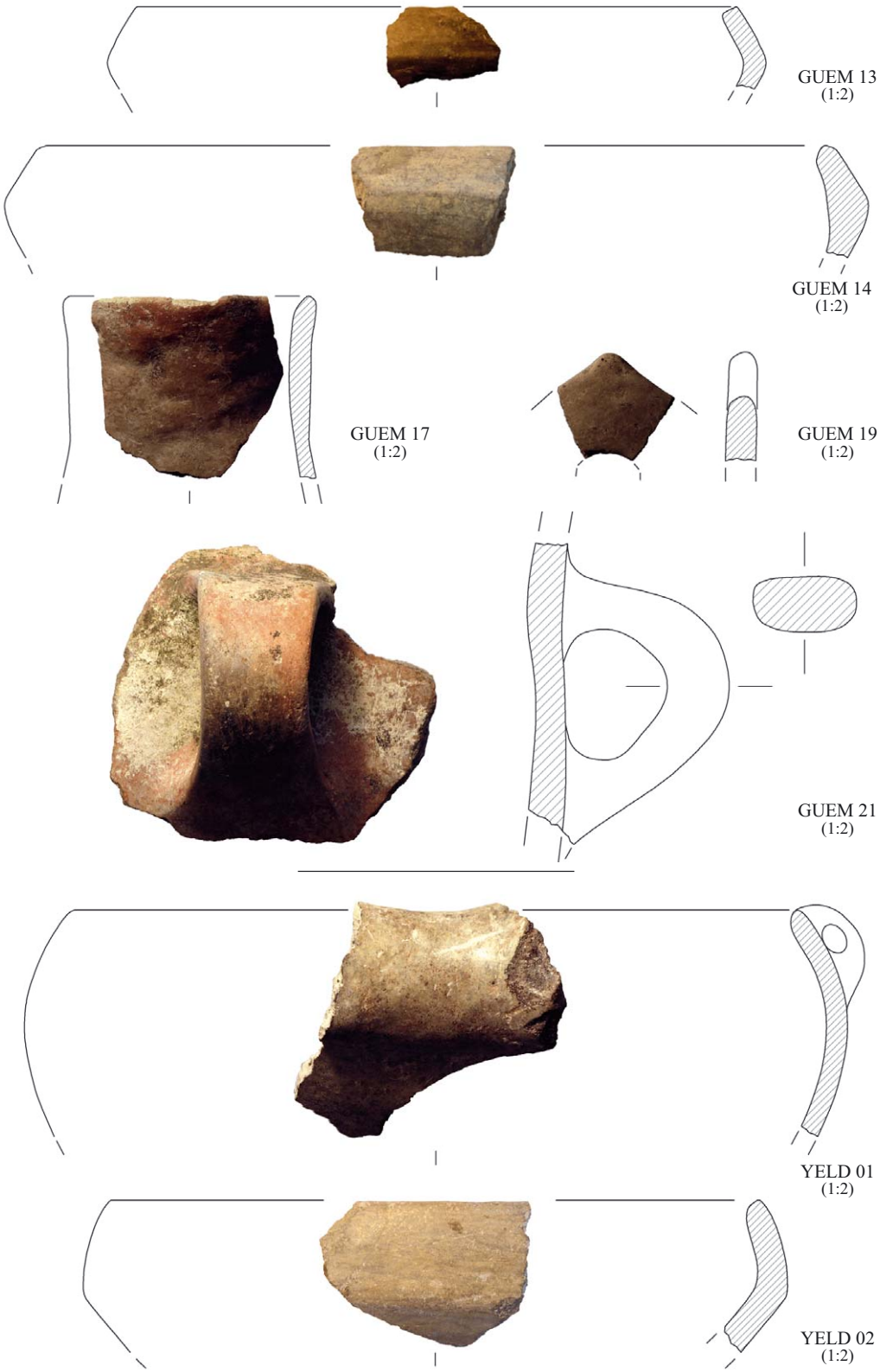

Plate 4 Analysed pottery from Bağlı Tepe (GUEM 13, 17, 21) and Üveçiktepe (GUEM 14, 19) in the Gümüşova Valley and Yeni Yeldeğirmentepe (ERC Prehistoric Anatolia/Th. Urban)

Variation: sharp transition
Classification: B2A
State of preservation: abraded
Description: shallow bowl or deep bowl, straight wall, inside burnished
Dimensions (in cm):
diameter (base): 8
pres. diameter (base) in %: 11
wall thickness: 1.0
Dated: Late Chalcolithic to EBA 1
Ware group: 512
Chemical group: Single
Fabric: MF-R: ochre; several medium fine light- and dark-coloured particles
Surface: interior grey and medium fine burnished, exterior ochre

Sample no.: YELD 08
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/006/01/0003
Shape: application
Type: knob
Classification: A3
State of preservation: secondary burnt
Description: body sherd with slightly horned knob; possibly closed vessel (globular jar)
Dimensions (in cm):
wall thickness: 0.6–1
Dated: Late Chalcolithic to EBA 1
Ware group: 502
Chemical group: U164-
Fabric: MF: light brown, core brown to dark grey; several medium fine light- and dark-coloured particles
Surface: partly black discoloured, otherwise brown, medium fine burnished

Sample no.: YELD 09
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/002/01/0001
Shape: shallow bowl
Type: dome-shaped
Variation: inside bevelled rim
Classification: Sb3N
Applications/Decorations: knob
State of preservation: abraded
Description: shallow bowl is inside and outside medium fine burnished with engobe
Dimensions (in cm):
diameter (rim): 28
pres. diameter (rim) in %: 5
wall thickness: 0.8
Dated: EBA 1
Ware group: 504
Chemical group: =210 Couple with YELD 17
Fabric: F-MF: ochre, core continuous red; tempering: medium/fine-medium, bigger pores, some fine and a few coarse black particles
Surface: brown, medium fine burnished

Sample no.: YELD 10
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/002/01/0003
Shape: loop handle
Type: cord handle
Variation: horizontal
Classification: Lh1
Applications/Decorations: massive cord handle
State of preservation: well
Description: shallow bowl
Dimensions (in cm):
height: 3
width: 3
drill: 0.5
Dated: Late Chalcolithic to EBA 1
Ware group: 504
Chemical group: U164
Fabric: F-MF: red, core continuous red; tempering: medium/fine-medium, bigger pores, several medium fine white and some medium fine black particles
Surface: brown, medium fine burnished

Sample no.: YELD 11
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/002/01/0002
Shape: jar
Type: s-shaped
Classification: J2
Applications/Decorations: vertical handle 1
State of preservation: secondary burnt
Description: massive and heavy body sherd with vertical handle (inside and outside medium fine burnished) tripod cooking pot?
Dimensions (in cm):
height: 2.3
width: 4.1
wall thickness: 1.4
Dated: Late Chalcolithic to EBA 1
Ware group: 501
Chemical group: U164
Fabric: MF: red slip with brown fringes, break core red, break edges grey-brown; tempering mid/frequent, slightly sandy, several medium fine white particles
Surface: brown, exterior burnished

Sample no.: YELD 12
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/006/01/0005
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: regularly rounded lip
Classification: Sb1aA
State of preservation: well
Description: big and heavy shallow bowl, roughly burnished
Dimensions (in cm):
angle: 55°
width: 1.6
diameter (rim): 42
pres. diameter (rim) in %: 5.5
wall thickness: 1.2
Dated: Late Chalcolithic to EBA 1
Ware group: 507

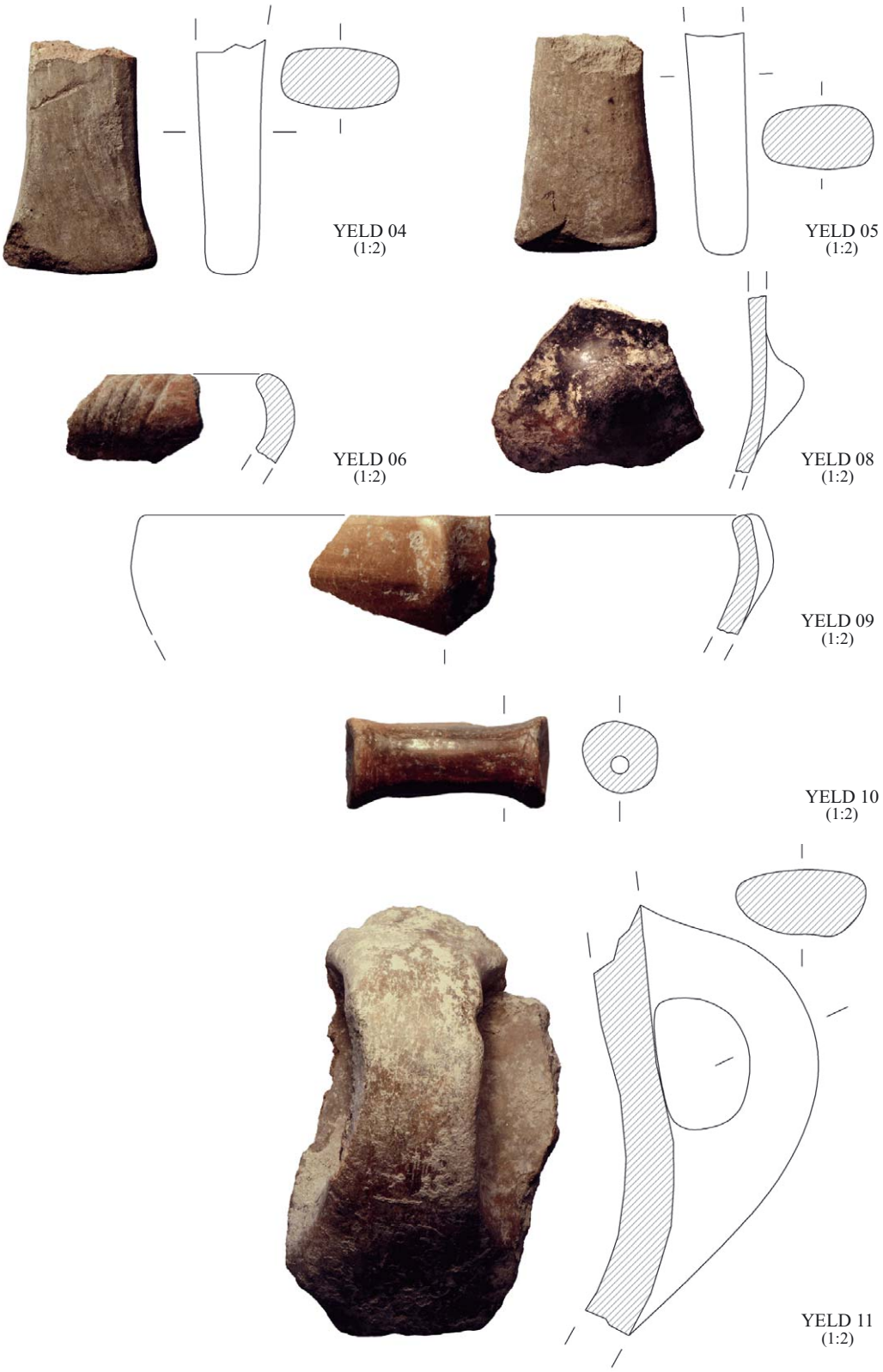

Plate 5 Analysed pottery from Yeni Yeldeğirmentepe (ERC Prehistoric Anatolia/Th. Urban)

Chemical group: U164
Fabric: R: brown, core brown-grey; several fine and medium fine white particles, some medium fine black particles
Surface: slurry, brown, roughly burnished

Sample no.: YELD 13
Site: Yeni Yeldeğirmentepe
Object no.: YYT08/F01/D/002/01/0003
Shape: narrow-mouthed vessel
Type: curved wall
Variation: regularly rounded lip
Classification: N2A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 18
pres. diameter (rim) in %: 3
wall thickness: 0.8
Dated: Late Chalcolithic to EBA 1
Ware group: 524
Chemical group: U164
Fabric: R: beige; some medium fine black particles, medium amount of white particles
Surface: beige, roughly burnished

Sample no.: YELD 15
Site: Yeni Yeldeğirmentepe
Object no.: YYT08/F01/Ost/001/01/0001
Shape: jug
Variation: regularly rounded lip
Classification: Ju0A
State of preservation: well
Description: small and very thin wall
Dimensions (in cm):
diameter (rim): 14
pres. diameter (rim) in %: 6
wall thickness: 0.5
Dated: Late Chalcolithic to EBA 1
Ware group: 505
Chemical group: U164
Fabric: MF: grey, core continuous grey; tempering: mid/frequently, slightly sandy, some medium fine light- and dark-coloured particles
Surface: grey, medium fine burnished

Sample no.: YELD 16
Site: Yeni Yeldeğirmentepe
Object no.: YYT08/F01/F/001/01/0002
Shape: shallow bowl
Type: carinated bowl with short rim
Variation: regularly rounded lip
Classification: Sb1bA
State of preservation: abraded
Dimensions (in cm):
angle: 40°
width: 1.5
diameter (rim): 30
pres. diameter (rim) in %: 6
wall thickness: 0.6
Dated: EBA 1
Ware group: 506
Chemical group: EphI
Fabric: F: grey fringes, reddish-brown core (7.5 YR 4/6); medium amount of fine grey and white particles and medium fine mica
Surface: grey, slightly burnished

Sample no.: YELD 17
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/002/01/0005
Shape: necked jar
Type: curved wall
Variation: regularly rounded lip
Classification: Nj3A
State of preservation: abraded
Dimensions (in cm):
diameter (rim): 32
pres. diameter (rim) in %: 8
wall thickness: 1.2
Dated: Late Chalcolithic to EBA 1
Ware group: 507
Chemical group: =210 Couple with YELD 09
Fabric: R: grey fringes and ochre-brown core (10 YR 5/4), core brown-grey; several fine and medium fine light-coloured particles, several coarse white and red particles, medium amount of fine mica
Surface: slurry, green to greyish-brown (~10 YR 3/2), medium fine burnished

Sample no.: YELD 18
Site: Yeni Yeldeğirmentepe
Object no.: YYT09/F04/A/002/01/0004
Shape: necked jar
Type: curved wall
Variation: regularly rounded lip
Classification: Nj3A
State of preservation: abraded
Description: inside and outside medium fine burnished: jug?
Dimensions (in cm):
diameter (rim): 14
pres. diameter (rim) in %: 6
wall thickness: 0.9
Dated: Late Chalcolithic to EBA 1
Ware group: 512
Chemical group: U164
Fabric: MF-R: black fringes, greenish-grey core (~10 YR 4/4); several fine and medium fine light particles, a few coarse differently coloured particles, medium amount of fine mica
Surface: black, medium fine burnished

Sample no.: YELD 19
Site: Yeni Yeldeğirmentepe
Object no.: YYT08/F01/F/001/01/0001
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: inside bevelled rim
Classification: Sb1aN
State of preservation: abraded
Dimensions (in cm):
angle: 57°
width: 0.9
diameter (rim): 18

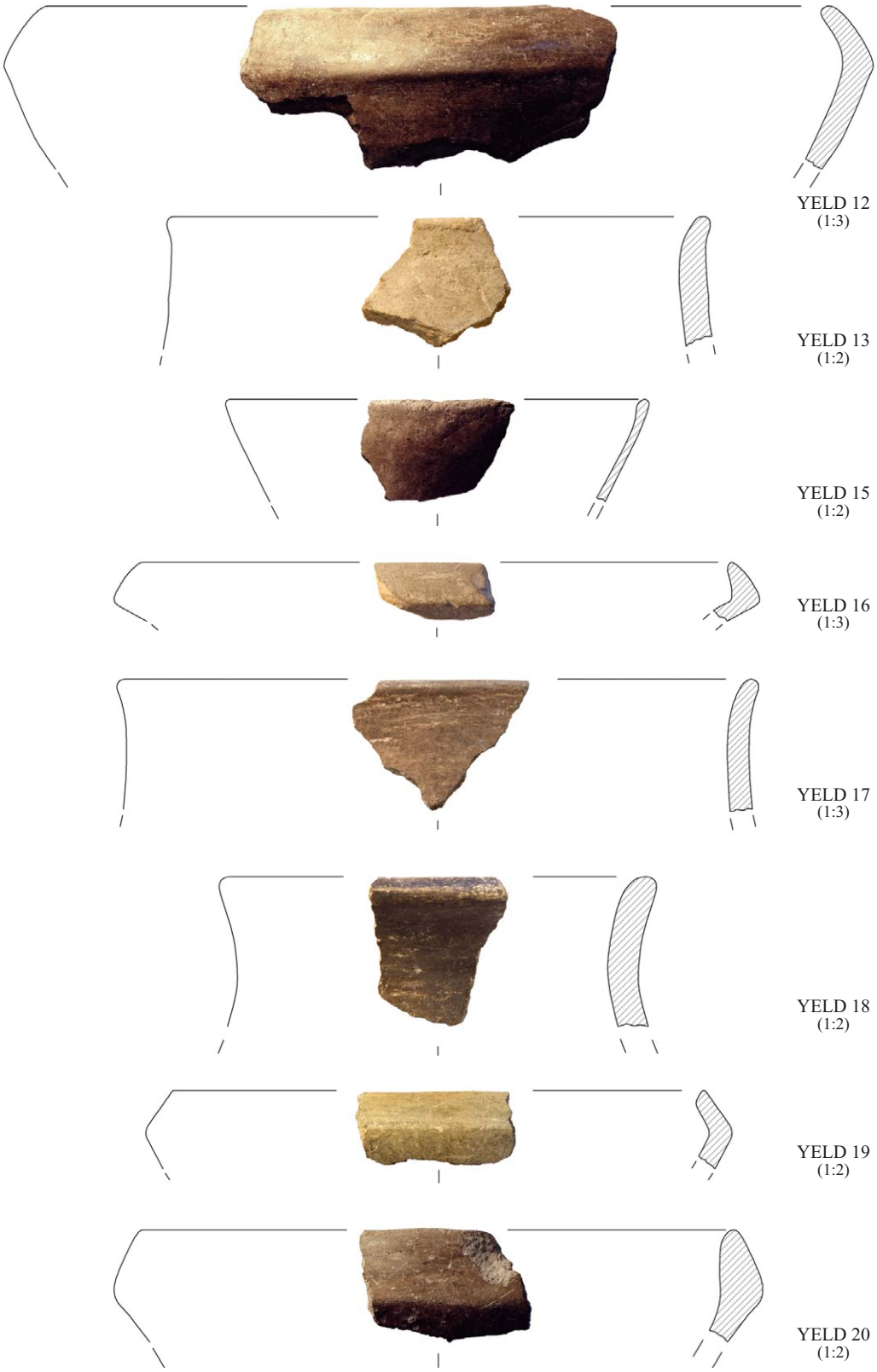

Plate 6 Analysed pottery from Yeni Yeldeğirmentepe (ERC Prehistoric Anatolia/Th. Urban)

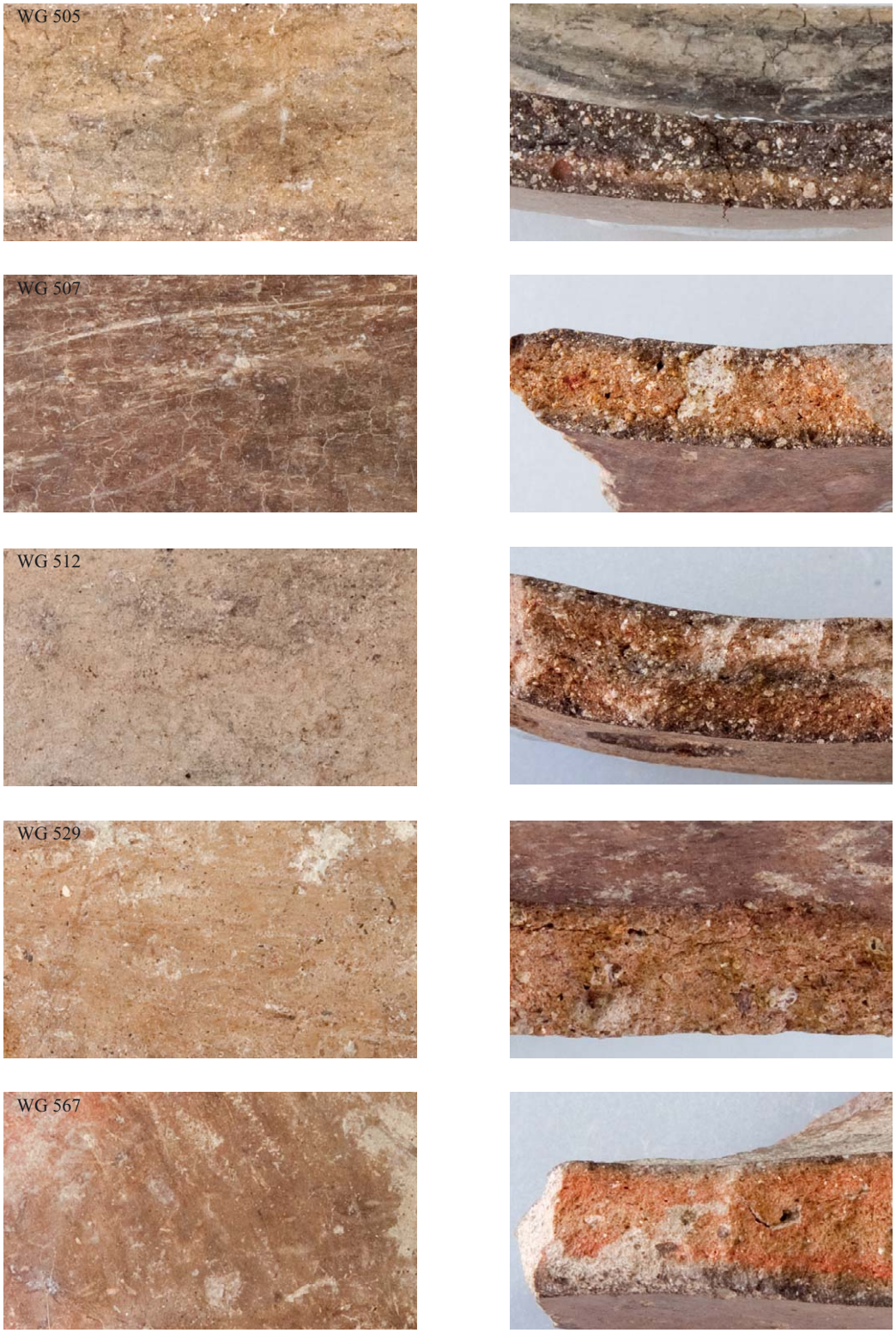

Plate 7 Most frequent ware groups of the Late Chalcolithic/Early Bronze Age, defined in the Prehistoric Pergamon Surveys to represent around 40% of wares across the entire EBA assemblage (ERC Prehistoric Anatolia/Th. Urban, M. Röcklinger)

pres. diameter (rim) in %: 8.5
wall thickness: 0.6
Dated: Late Chalcolithic to EBA 1
Ware group: 505
Chemical group: U164-
Fabric: MF: grey with brown stripes (10 YR 4/3), core continuous grey; tempering: mid/frequently, slightly sandy, several fine and medium fine light-coloured particles, a few coarse fine-coloured particles, medium amount of mica
Surface: interior grey, exterior light beige grey (2.5 YR 5/3), medium fine burnished

Sample no.: YELD 20
Site: Yeni Yeldeğirmentepe
Object no.: YYT08/F07/001/01/0004
Shape: shallow bowl
Type: carinated bowl with long rim
Variation: inside bevelled rim
Classification: Sb1aN
State of preservation: abraded
Dimensions (in cm):
angle: 68°
width: 1.3
diameter (rim): 14
pres. diameter (rim) in %: 10
wall thickness: 1.0
Dated: EBA 1
Ware group: 501
Chemical group: U164
Fabric: MF: ochre to orange to brown slip (7.5 YR 4/6), break core red, break edges grey-brown; tempering mid/frequent, slightly sandy, several fine and medium fine white particles, a few coarse differently coloured particles, medium amount of fine mica
Surface: interior red (5 YR 4/4), exterior brownish beige (10 YR 5/3), burnished