

# Provenance Determination of Bronze Age Grinding Stones from Punta di Zambrone

---

*Tatjana M. Gluhak<sup>1</sup> – Christoph Schwall<sup>2</sup> –  
Reinhard Jung<sup>3</sup> – Marco Pacciarelli<sup>4</sup>*

**Abstract:** The present study deals with the analysis of several fragments of grinding stones from excavations at Punta di Zambrone, a coastal site in Calabria, southern Italy, as well as with survey finds in the wider region of this settlement. For all grinding stone fragments a Bronze Age dating is ascertained, or at least very probably. The fragments are made of grey, vesicular lavas which are not available in this region. For the determination of the provenance of the grinding stone fragments geochemical analyses were performed. By comparing the major and trace element composition with the geochemical data of volcanic rocks in the Mediterranean, a provenance from the Aeolian Islands can be assumed. Thus, a procurement of rocks as raw material for the production of grinding stones or the finished tools can be attested as early as the beginning of the 2<sup>nd</sup> millennium BC.

**Keywords:** Aeolian Islands, geochemistry, grinding stones, provenance, southern Italy, volcanic rocks

## Introduction

The excavations at Punta di Zambrone,<sup>5</sup> a coastal site in Calabria, southern Italy, yielded stratified fragments of grinding stones made of volcanic rocks dating to the Early and Recent Bronze Age periods in this region. Grinding stones are typical grain processing tools and represent common finds in prehistoric settlements. Volcanic rocks offer excellent conditions for the grinding of grain because of their hardness and vesicular structure. This rock type is conspicuous among the finds, as volcanic rocks do not occur in the region of Punta di Zambrone. Despite the small amount of objects and the fragmentary preservation of the grinding stones, it is worth studying the finds in detail, as geochemical analyses offer the opportunity to determine the provenance of the volcanic rocks on the basis of the major and trace element compositions, which will be compared with all published and available geochemical data of the volcanic rock in the Mediterranean. Two more grinding stones from two sites (Biluscia, Torre Sant'Irene) detected in surveys<sup>6</sup> in the wider region of the settlement (Fig. 1), will be analysed in addition to the Punta di Zambrone finds. As no other comparable excavated Bronze Age sites in this region have been published so far,<sup>7</sup> the

---

<sup>1</sup> tami.gluhak@gmail.com.

<sup>2</sup> Austrian Archaeological Institute, Austrian Academy of Sciences (ÖAW), Hollandstraße 11–13, 1020 Vienna, Austria; christoph.schwall@oeaw.ac.at.

<sup>3</sup> Austrian Archaeological Institute, Austrian Academy of Sciences (ÖAW), Hollandstraße 11–13, 1020 Vienna, Austria; reinhard.jung@oeaw.ac.at.

<sup>4</sup> Dipartimento di Studi Umanistici, University of Naples Federico II, Via Marina 33, 80133 Naples, Italy; marco.pacciarelli@unina.it.

<sup>5</sup> Jung et al. 2015.

<sup>6</sup> The surveys were conducted by M. Pacciarelli, M. R. Varricchio, A. Lo Torto, C. Rombolà, F. Rombolà, F. Staropoli and the Soprintendenza Archeologica della Calabria. The results of these investigations, including the grinding stones (see catalogue below), are part of the unpublished thesis of M. R. Varricchio (cf. Varricchio 1992). We are very grateful to M. R. Varricchio for the permission to use the pictures and drawings.

<sup>7</sup> To be sure, the Soprintendenza per i Beni Archeologici della Calabria has carried out rescue excavations in the urban area of Tropea (cf. Pacciarelli 2000, 82). Some of the resulting finds are exhibited at the Museo Diocesano at Tropea, among which, however, there are no grinding stones. Rescue excavations have also been conducted at Torre Sant'Irene, but remain unpublished up to the present day.

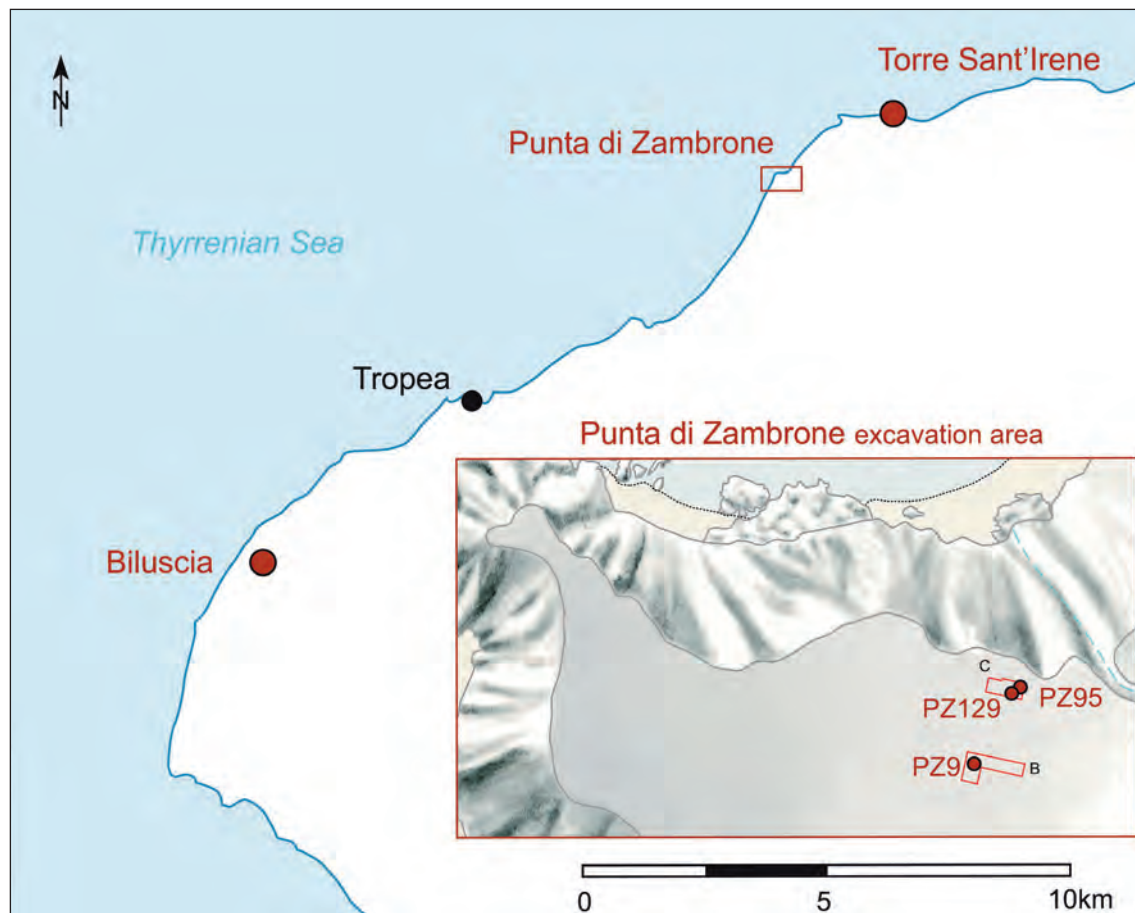


Fig. 1 Map showing the sites of the analysed grinding stones on the Poro promontory in Calabria, southern Italy (map: A. Buhlke)

survey finds, in addition to the finds of the settlement Punta di Zambrone, allow the uncovering of contacts between the entire micro region and volcanic rock sources. Although the question of whether the raw materials for the production of grinding stones or the finished stone tools were brought to the settlement remains open, the geochemical analyses of rather inconspicuous finds like grinding stones allow us to assess the targeted procurement of volcanic rocks and thus highlight regional and supra-regional connections.

### Archaeological Background of the Grinding Stone

In total, five fragments of grinding stones were analysed. Three of them were found during the excavations at Punta di Zambrone (from stratigraphic units PZ9, PZ95 and PZ129; Fig. 2–3; see catalogue below: cat. nos. 1–3). The fragmentation of the finds makes an exact determination as to which part of the tool the fragment originally belonged to difficult, but cat. no. 1 from PZ9 and cat. no. 3 from PZ129 can be determined as fragments of an upper part of a grinding stone. The small sizes of cat. no. 2 (PZ95) preclude distinguishing between an upper or lower stone.<sup>8</sup> In general, the contexts of the objects indicate that the fragments represent deposits of ordinary waste products. The

<sup>8</sup> Due to the small size of fragment PZ95, which shows a preserved grinding surface, it cannot be totally excluded that it belongs to another stone tool (e.g. a pounder), even if an affiliation to an upper or lower stone of a grinding stone is most likely because of the plain grinding surface and the vesicular volcanic rock.

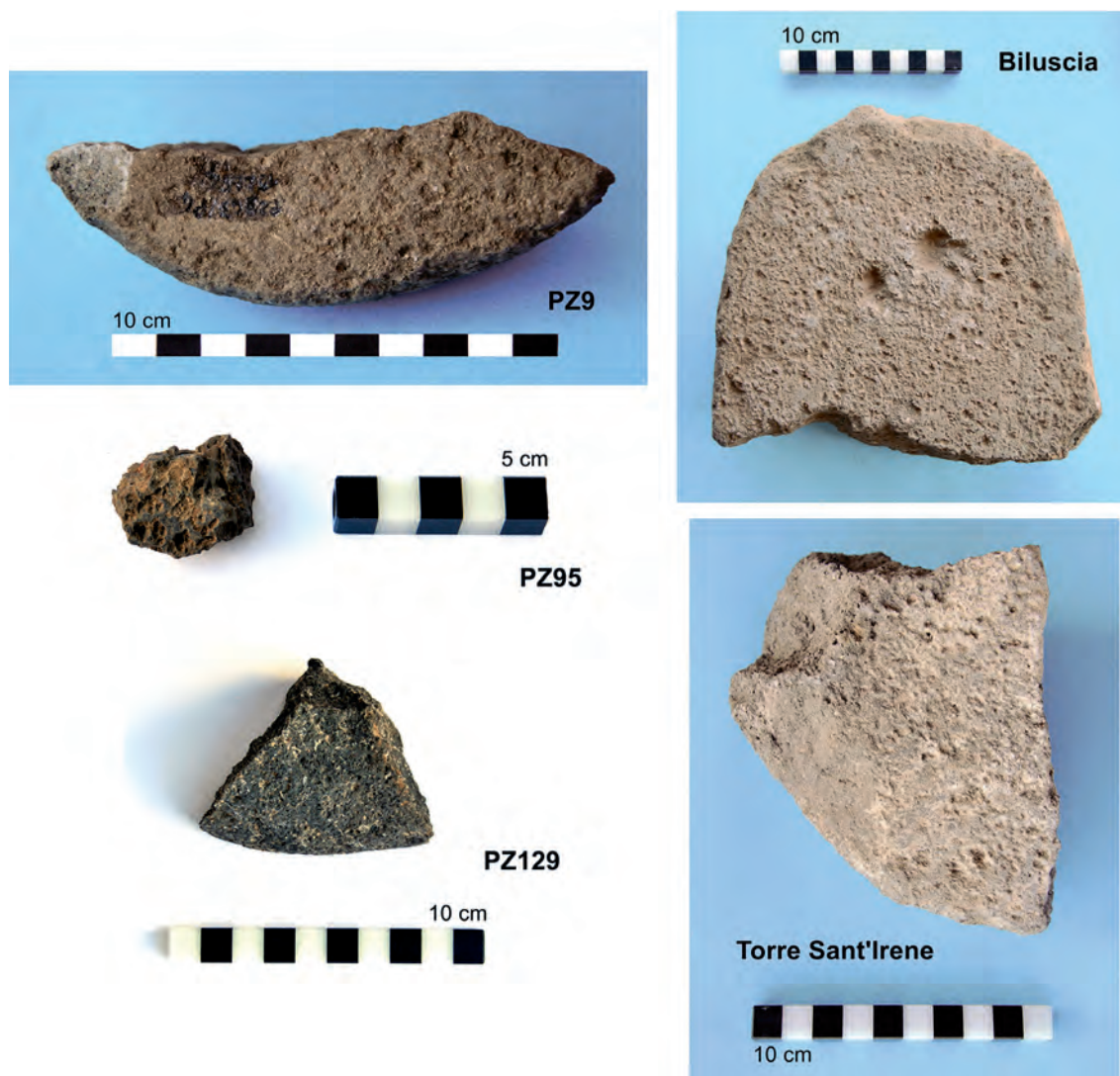


Fig. 2 Pictures of the grinding stone fragments from Punta di Zambrone, Biluscia and Torre Sant'Irene (pictures: R. Jung)

finds cat. nos. 2 (PZ95) and 3 (PZ129) seem to be related to layers of a ditch filling in Area C.<sup>9</sup> Cat. no. 3 (PZ129) was found in an ashy layer deposited as fill in the fortification ditch, whereas the tiny fragment PZ95 was detected in an upper level of the successive fill layers of that ditch. These are secondary deposits of material originating, with high probability, from the interior of the settlement. In the case of stratigraphic unit PZ95, the layer was disturbed by modern agricultural ploughing activities. For both objects (cat. nos. 2 and 3) a dating to Recent Bronze Age 2, around 1200 BC, is assumed.<sup>10</sup> Grinding stone cat. no. 1 (PZ9) was also found in a layer disturbed by modern ploughing activities in Area B above the intact Early Bronze Age 2 occupation layers.<sup>11</sup> Nevertheless, the consistency of the excavated finds of the uppermost layers and the lack of later Recent Bronze Age finds indicate a dating to the Early Bronze Age 2 period between 1900–1700 BC.

<sup>9</sup> For an overview of the ditch segment in Area C see: Jung et al. 2015, 61, fig. 5.

<sup>10</sup> For a chronological chart of the Bronze Age Period of Tyrrhenian Italy see Pacciarelli 2000, 68, fig. 38; for the absolute chronology of the successive fill layers of the Punta di Zambrone ditch see Weninger et al., this volume.

<sup>11</sup> Note, however, that stratigraphic unit PZ9 in Area B was disturbed to a lesser extent than stratigraphic unit PZ95 in Area C.

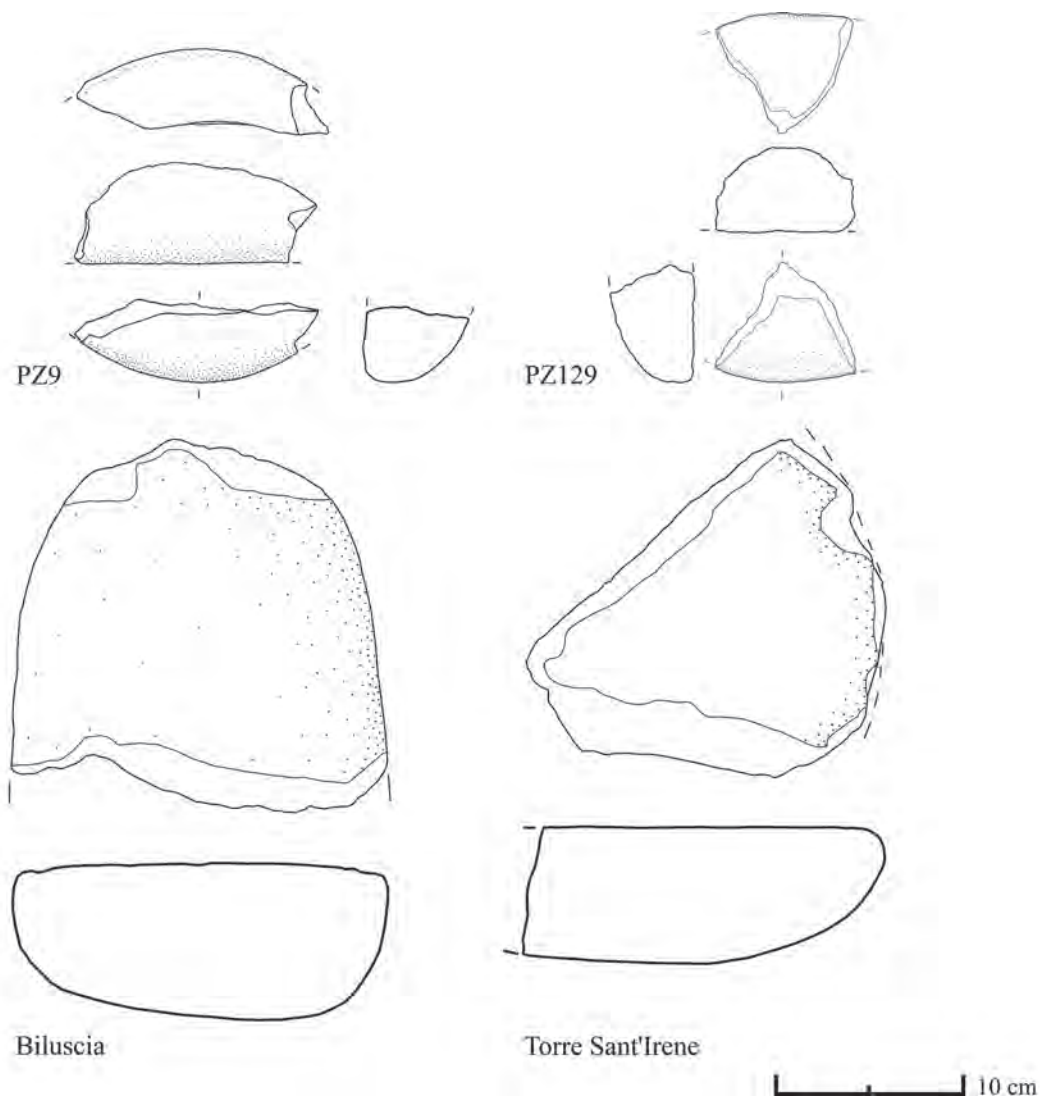


Fig. 3 Drawings of the grinding stone fragments from Punta di Zambrone (1–2), Biluscia (3) and Torre Sant'Irene (4). Scale 1:4 (drawings and design: 1–2 F. Corpaci, N. Insolubile; 3–4 M. R. Varricchio)

Two fragments of grinding stones from two surveyed coastal sites, Biluscia and Torre Sant'Irene,<sup>12</sup> on the Poro promontory (Fig. 2–3) are included in the present study. Because of its elongated shape and the cross section, the object from Biluscia can be classified as an upper, mobile part of the device. The fragment from Torre Sant'Irene, however, can be determined by the size and longitudinal section as a fragment of a lower part. The finds of both sites indicate a dating particularly to Middle Bronze Age 1–2, whereby several ceramic finds indicate that the sites were already occupied in Early Bronze Age 2.<sup>13</sup> Moreover, in Biluscia the Recent Bronze Age period is also attested by finds.

However, despite the small number of fragments and the fact that two samples are survey finds as well as that the pieces are derived from disturbed layers, it can be assumed that the use of grinding stones made of volcanic rocks appears as early as Early Bronze Age 2 at sites situated on the coastline of the Tyrrhenian Sea.

<sup>12</sup> For more detailed information about the sites see Pacciarelli 2000, 74–85.

<sup>13</sup> Pacciarelli 2000, 77, fig. 41.

### Provenance Determination

The provenance determination of volcanic rock grinding stones based on their geochemical composition is a crucial method for revealing regional and supra-regional contacts.

#### Method

The fragments of the grinding stones were sampled by chipping off rock pieces. Due to the small amount of sampled material, it was not possible to produce thin sections and the analyses had to be constrained to the determination of the geochemical compositions. For this purpose, the sample was cleaned in an ultrasonic bath, dried, crushed and ground to powder in an agate mill. The powder was used to produce lithium tetraborate glass beads for wavelength dispersive X-ray fluorescence (XRF) major element measurements. For analysing the trace elements by laser ablation-ICP-MS, c. 40mg of powder was melted to glass beads on an iridium-strip heater. The major element measurements were conducted in a 2002 model analytical MagXPRO wavelength-dispersive X-ray spectrometer with a Rh-X-ray tube and a maximum excitation of 3.2kW. The trace element measurements were performed in an Agilent 7500 CE quadrupole Inductively Coupled Plasma Mass Spectrometry (ICP-MS) system, coupled with an ESI New Wave Research NWR193 (ArF-excimer) laser ablation system with 193nm wavelength. Three spots, each with a diameter of 100µm were measured on every glass bead using a pulse-rate of 10Hz and laser energy densities of 6J/cm<sup>2</sup>. The carrier gas was Argon. <sup>29</sup>Si served as the internal standard, its values being taken from the XRF measurements. NIST SRM 610, 612 and MPI-DING KL2G were taken as reference materials. The USGS-BCR-2G was measured for quality control purposes. The values of the reference materials were taken from the GeoReM Database published ‘preferred values’.<sup>14</sup> The measured values are compiled in Tab. 1.

|                                    | <b>PZ9<br/>(Cat. no. 1)</b> | <b>PZ95<br/>(Cat. no. 2)</b> | <b>PZ129<br/>(Cat. no. 3)</b> | <b>Biluscia<br/>(Cat. no. 4)</b> | <b>Torre<br/>Sant’Irene<br/>(Cat. no. 5)</b> |
|------------------------------------|-----------------------------|------------------------------|-------------------------------|----------------------------------|----------------------------------------------|
| SiO <sub>2</sub> (wt%)             | 55.31                       | 54.93                        | 52.60                         | 52.87                            | 53.34                                        |
| Al <sub>2</sub> O <sub>3</sub>     | 18.41                       | 16.88                        | 17.77                         | 18.49                            | 18.45                                        |
| Fe <sub>2</sub> O <sub>3</sub> (t) | 8.68                        | 9.11                         | 8.04                          | 9.70                             | 7.50                                         |
| MnO                                | 0.16                        | 0.16                         | 0.15                          | 0.17                             | 0.15                                         |
| MgO                                | 3.11                        | 4.43                         | 5.18                          | 4.48                             | 4.24                                         |
| CaO                                | 8.41                        | 9.17                         | 9.76                          | 10.05                            | 9.09                                         |
| Na <sub>2</sub> O                  | 2.93                        | 2.14                         | 2.54                          | 2.26                             | 2.63                                         |
| K <sub>2</sub> O                   | 1.96                        | 2.20                         | 2.77                          | 1.08                             | 3.34                                         |
| TiO <sub>2</sub>                   | 0.76                        | 0.72                         | 0.83                          | 0.71                             | 0.80                                         |
| P <sub>2</sub> O <sub>5</sub>      | 0.26                        | 0.26                         | 0.35                          | 0.18                             | 0.45                                         |
| LOI                                | 0.24                        | 0.44                         | 0.06                          | 0.72                             | 0.35                                         |
| Sc (ppm)                           | 25.00                       | 25.58                        | 23.89                         | 37.26                            | 24.51                                        |
| V                                  | 277.70                      | 230.59                       | 235.92                        | 300.59                           | 232.62                                       |
| Cr                                 | 4.56                        | 13.81                        | 26.60                         | 12.18                            | 35.91                                        |
| Co                                 | 20.32                       | 17.96                        | 18.96                         | 26.28                            | 24.21                                        |
| Ni                                 | 6.43                        | 10.95                        | 19.76                         | 12.49                            | 23.43                                        |
| Cu                                 | 67.19                       | 60.88                        | 41.68                         | 93.21                            | 23.69                                        |

<sup>14</sup> Online <<http://georem.mpch-mainz.gwdg.de/>> (last accessed 23 March 2020).

|    | <b>PZ9<br/>(Cat. no. 1)</b> | <b>PZ95<br/>(Cat. no. 2)</b> | <b>PZ129<br/>(Cat. no. 3)</b> | <b>Biluscia<br/>(Cat. no. 4)</b> | <b>Torre<br/>Sant'Irene<br/>(Cat. no. 5)</b> |
|----|-----------------------------|------------------------------|-------------------------------|----------------------------------|----------------------------------------------|
| Ga | 17.68                       | 16.37                        | 15.48                         | 16.76                            | 16.20                                        |
| Rb | 54.03                       | 73.63                        | 123.90                        | 28.74                            | 99.19                                        |
| Sr | 669.57                      | 782.99                       | 569.62                        | 644.99                           | 776.61                                       |
| Y  | 27.75                       | 16.04                        | 23.62                         | 20.31                            | 26.75                                        |
| Zr | 85.99                       | 99.07                        | 176.67                        | 57.42                            | 185.57                                       |
| Nb | 6.56                        | 6.96                         | 21.24                         | 3.91                             | 24.09                                        |
| Ba | 501.34                      | 576.17                       | 1174.33                       | 419.28                           | 1176.89                                      |
| La | 22.28                       | 23.82                        | 41.19                         | 16.65                            | 44.17                                        |
| Ce | 41.65                       | 46.31                        | 80.82                         | 30.61                            | 86.14                                        |
| Pr | 4.84                        | 5.32                         | 9.12                          | 3.81                             | 9.70                                         |
| Nd | 19.61                       | 21.10                        | 34.73                         | 16.15                            | 36.96                                        |
| Sm | 4.23                        | 4.05                         | 6.52                          | 3.62                             | 7.04                                         |
| Eu | 1.18                        | 1.18                         | 1.62                          | 1.05                             | 1.70                                         |
| Gd | 3.76                        | 3.42                         | 5.78                          | 3.32                             | 5.68                                         |
| Tb | 0.52                        | 0.53                         | 0.78                          | 0.48                             | 0.75                                         |
| Dy | 3.23                        | 2.96                         | 4.51                          | 2.95                             | 4.48                                         |
| Ho | 0.65                        | 0.53                         | 0.85                          | 0.58                             | 0.82                                         |
| Er | 1.96                        | 1.69                         | 2.36                          | 1.78                             | 2.44                                         |
| Tm | 0.29                        | 0.21                         | 0.32                          | 0.25                             | 0.32                                         |
| Yb | 1.95                        | 1.53                         | 2.23                          | 1.61                             | 2.19                                         |
| Lu | 0.29                        | 0.25                         | 0.34                          | 0.24                             | 0.34                                         |
| Hf | 2.34                        | 2.44                         | 4.25                          | 1.57                             | 4.34                                         |
| Ta | 0.37                        | 0.39                         | 1.15                          | 0.19                             | 1.24                                         |
| Th | 5.80                        | 6.81                         | 18.63                         | 3.73                             | 19.78                                        |
| U  | 1.94                        | 1.85                         | 4.56                          | 0.93                             | 4.91                                         |

Tab. 1 Major (LOI-free) and trace element composition of the analysed grinding stone fragments

## Results

The provenance determination is based on the procedure of Gluhak – Schwall 2015. All fragments of grinding stones are grey, vesicular volcanic rocks. The volcanic rocks are classified using the ‘total alkali silica’ (TAS) diagram by their SiO<sub>2</sub> content and the sum of Na<sub>2</sub>O and K<sub>2</sub>O (Fig. 4). Three grinding stone fragments (PZ9, PZ95, Biluscia) plot in the field of basaltic andesites (field ‘E’), the remaining two (PZ129, Torre Sant’Irene) in the field of trachyandesites (field ‘B’). In accordance with the Na<sub>2</sub>O/K<sub>2</sub>O ratios, both can be classified as shoshonites (Na<sub>2</sub>O – 2 ≤ K<sub>2</sub>O). The TAS diagram already shows that for the basaltic andesites PZ9, PZ95 and Biluscia a provenance from only the Aeolian Islands, Sardinia or the Hyblean Mountains on Sicily can be assumed. The plotting of both shoshonites within the TAS diagram indicates a provenance from the Aeolian Islands or the island of Ustica (Fig. 4). The Na<sub>2</sub>O/K<sub>2</sub>O ratios in figure 5 clearly demonstrate that for the grinding stones only a provenance from the Aeolian Islands and Sardinia is possible. Only the fragment from Biluscia could show chemical similarities to lava from the Hyblean Mountains. The comparison of the TiO<sub>2</sub> content of the grinding stones with the values of the Hyblean Mountains (Fig. 6) shows that the Sicilian rock sources of the Hyblean Mountains and Mount Etna have

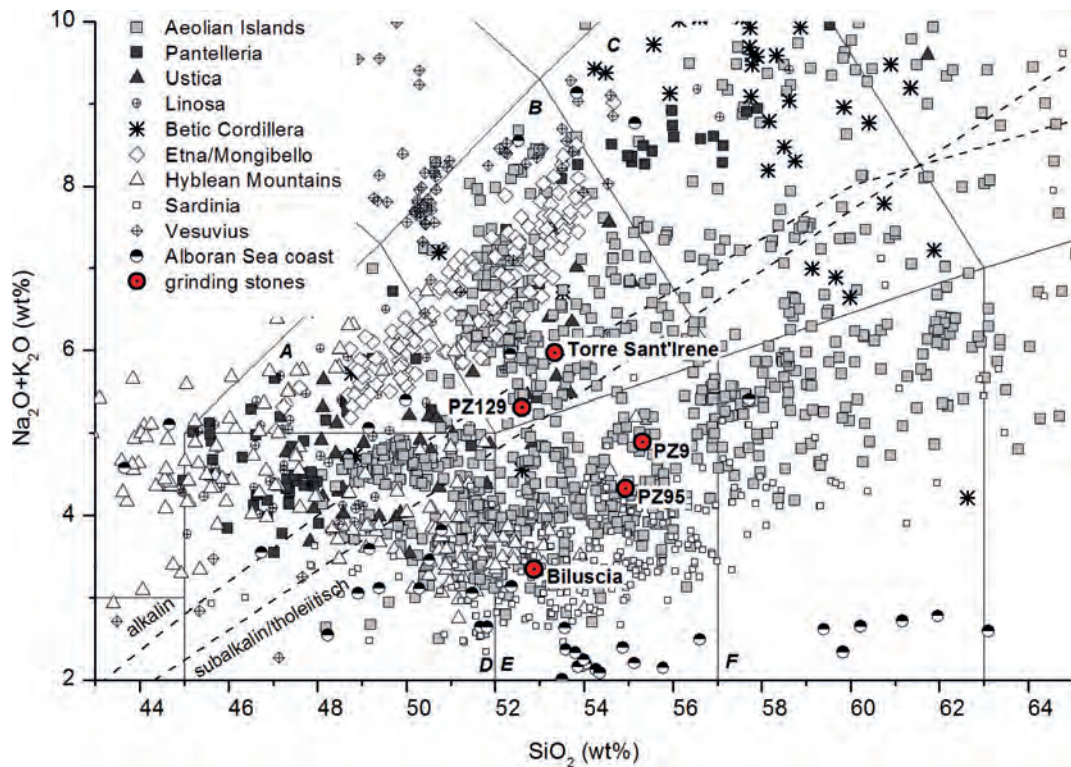


Fig. 4 Classification of the grinding stones in the TAS-diagram. Data for comparison from the Aeolian Islands, Pantelleria, Ustica, Linosa, Betic cordillera, Mount Etna/Mongibello, the Hyblean Mounts, Sardinia, Vesuv and the Alboran Sea compiled from GEOROC. For references see Gluhak – Schwall 2015 (graphics: T. M. Gluhak and Ch. Schwall)

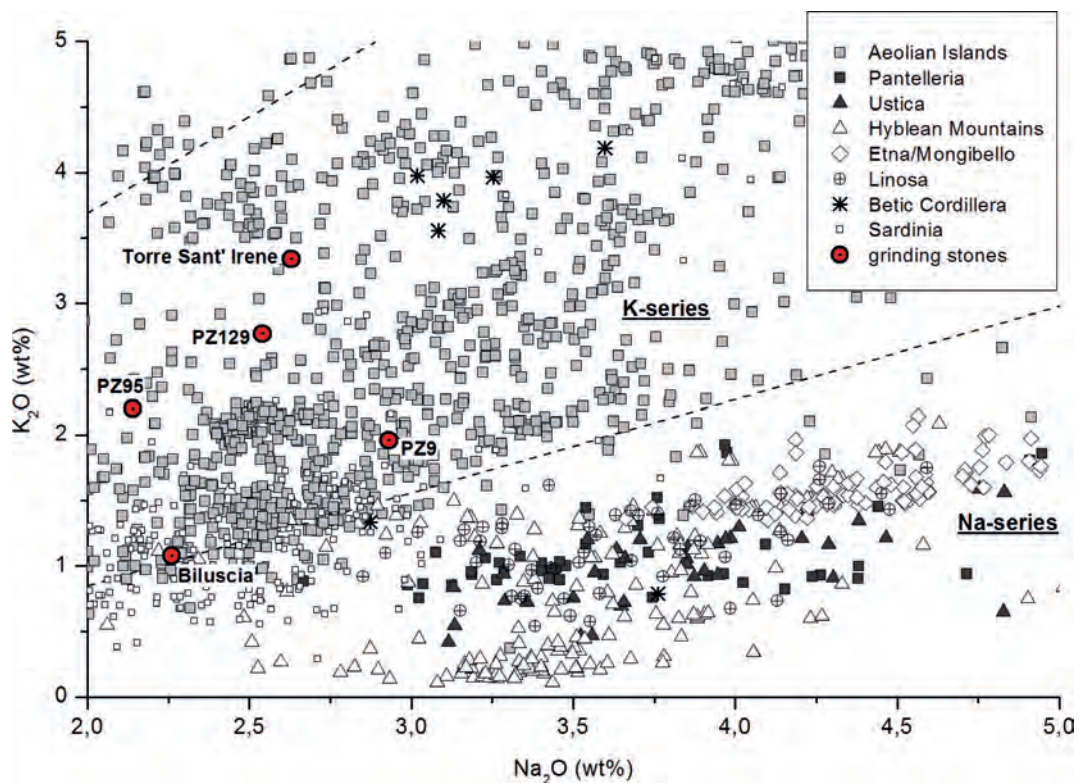


Fig. 5  $\text{Na}_2\text{O}/\text{K}_2\text{O}$  diagram of the grinding stones in comparison to the Hyblean Mounts, the Aeolian Islands, Betic Cordillera, Ustica, Pantelleria, Linosa, Sardinia and Mount Etna/Mongibello. For references see Gluhak – Schwall 2015 (graphics: T. M. Gluhak and Ch. Schwall)

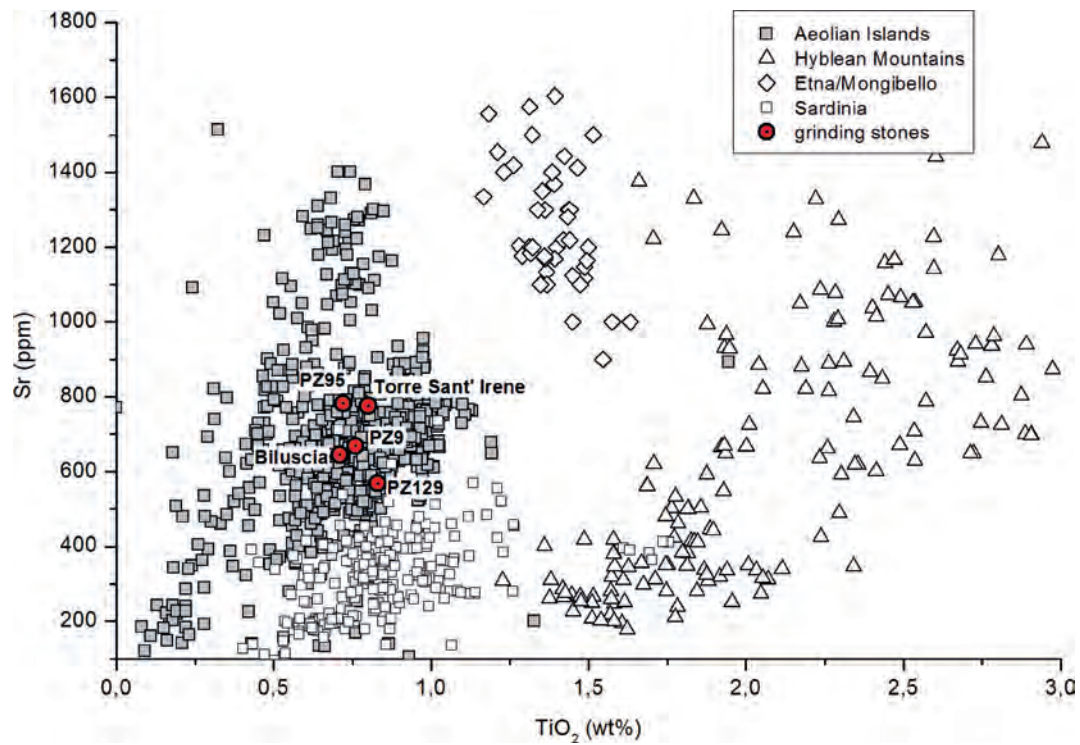


Fig. 6  $\text{TiO}_2$  and Sr content of the grinding stones in comparison to the Aeolian Islands, the Hyblean Mounts, Mount Etna/Mongibello and Sardinia. For references see Gluhak – Schwall 2015 (graphics: T. M. Gluhak and Ch. Schwall)

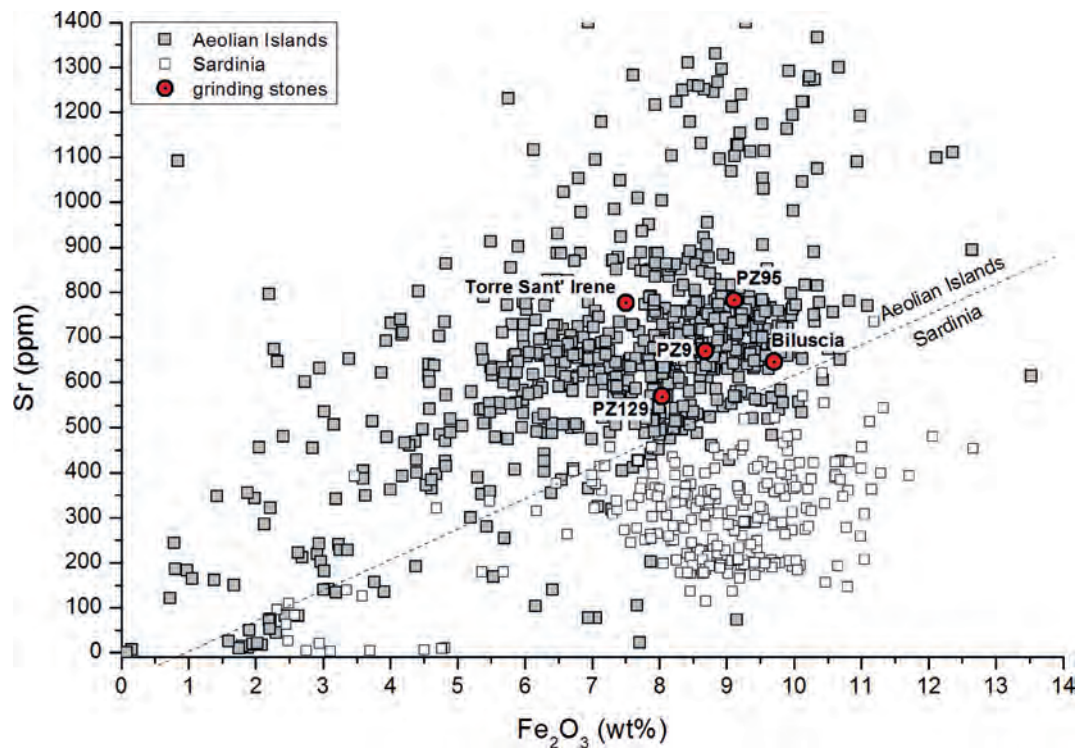


Fig. 7  $\text{Fe}_2\text{O}_3$  and Sr content of the grinding stones in comparison to the Aeolian Islands and Sardinia. For references see Gluhak – Schwall 2015 (graphics: T. M. Gluhak and Ch. Schwall)

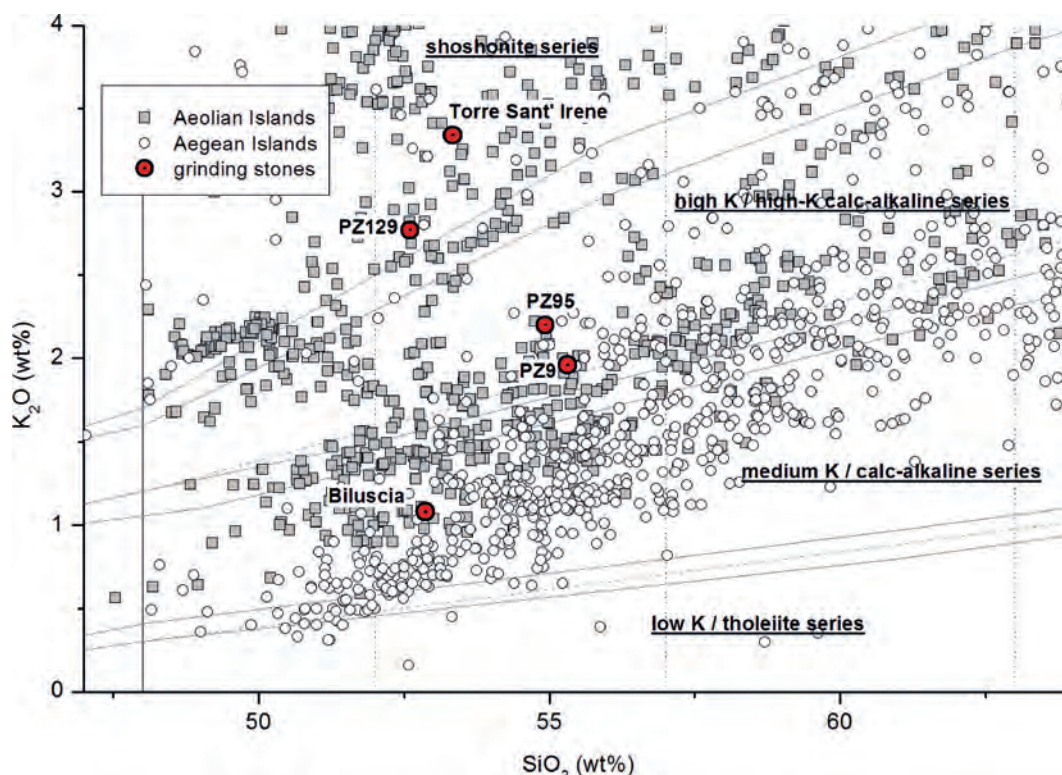


Fig. 8 Comparison of  $\text{SiO}_2/\text{K}_2\text{O}$  ratio of the subduction-related rock grinding stones to rocks from the Aeolian and Aegean islands. For references for Aegean and Aeolian rocks see Gluhak – Schwall 2015 (graphics: T. M. Gluhak and Ch. Schwall)

significantly higher titanium values than the analysed grinding stones. Already, figure 6 strongly suggests a provenance from the Aeolian Islands. However, a provenance from Sardinia can be finally excluded based on the  $\text{Fe}_2\text{O}_3$  and Sr content (Fig. 7).

Gluhak and Schwall describe the problem that the volcanic rocks from the Aeolian Islands cannot be clearly discriminated from the volcanic rocks from the Aegean Islands based on their major and trace element compositions.<sup>15</sup> As an example, the  $\text{SiO}_2/\text{K}_2\text{O}$  content of volcanic rocks from the Aeolian and Aegean Islands is shown in Figure 8. Although the rocks of the Aeolian Islands show a trend of a higher  $\text{K}_2\text{O}$  content than the Aegean Islands, the rocks show a large overlap in their composition, which is also true for the other geochemical components. Nevertheless, the fragments of the grinding stones analysed in the present study have  $\text{K}_2\text{O}$  contents which plot in an area dominated by the Aeolian Islands, particularly shown by PZ129 and the fragment from Torre Sant'Irene.

The comparison of the geochemical composition of the fragments with data from volcanic rocks from the Mediterranean region demonstrates that a provenance from the Aeolian Islands can be assumed without much doubt. However, due to the geochemical similarities of the volcanic rocks from the Aeolian Islands, an affiliation to a particular island is not possible.<sup>16</sup>

### Discussion of the Provenance Determination

As the grinding stones were in all likelihood derived from the Aeolian Islands, contacts must have existed probably as early as Early Bronze Age 2 and can also be attested for the later Recent

<sup>15</sup> Gluhak – Schwall 2015.

<sup>16</sup> Gluhak – Schwall 2015.

Bronze Age.<sup>17</sup> Although it is not clear whether the raw material for the production of the devices was imported or the finished grinding stones, the volcanic rocks of the grinding stones show clear contacts between the coastal region of the Poro promontory and the Aeolian Islands.

In general, grinding stones are common devices of everyday activities, which can be expected in prehistoric settlements. Excavations of Early to Recent Bronze Age settlements on the Aeolian Islands show that these devices made of volcanic rocks are attested at several sites. Grinding stones dated to the Middle and Recent Bronze Age periods are known from the acropolis of Lipari<sup>18</sup> on the homonymous island. Middle Bronze Age grinding stones were also found at Milazzese on Panarea<sup>19</sup>, Portella on Salina<sup>20</sup>, San Vincenzo on Stromboli<sup>21</sup> and Capo Graziano<sup>22</sup> on Filicudi. Furthermore, some grinding stones from Milazzese on Panarea indicate an even earlier date. Two objects were associated with finds dating between the late Aeneolithic and the initial Early Bronze Age Period.<sup>23</sup> Additionally, grinding stones are also recorded from Milazzo, a site on a peninsula situated in the northeast of Sicily. Early Bronze Age objects are mentioned from hut 3 in the excavation area ‘Viale dei Cipressi’.<sup>24</sup> Additionally, finds are recorded from the ‘Piazza XXV Aprile’ dating to the late Early Bronze Age 2 and the beginning of the Middle Bronze Age.<sup>25</sup> In total, 11 objects made of volcanic rocks, including six fragments of grinding stones (MIL3–5, 8–10), one fragment of a mortar (MIL1) and a possible pestle (MIL6), found at the ‘Piazza XXV Aprile’ have recently been geochemically analysed by wavelength-dispersive XRF.<sup>26</sup> It turned out that the rocks of two grinding stones (MIL3–4) and the possible pestle (MIL6) come from the Aeolian Islands. Only the provenance of the mortar (MIL1) can be assigned to Sicilian rock sources from Mt. Etna. The raw material of one grinding stone (MIL9) is interpreted as procured from the Aegean region, probably from the island of Santorini. This provenance determination is problematic regarding the already discussed difficulties in differentiating clearly between the Aeolian and Aegean volcanic rock sources, especially based on the geochemical data presented.<sup>27</sup>

A further comparable study to determine the provenance of Bronze Age volcanic rock grinding stones was conducted for Apulian finds dating between the 19<sup>th</sup> and 10<sup>th</sup> centuries BC.<sup>28</sup> In total, 23 grinding stones from 10 sites, located along the Adriatic and Ionic coast as well as in the region between Apulia and Basilicata, were analysed.<sup>29</sup> The investigations have revealed that the volcanic rocks were procured entirely from the closest volcanic rock sources at Mount Vulture in northern Basilicata.<sup>30</sup> Despite being coastal sites, the procurement of raw materials for grinding stones was obviously restricted to the mainland volcanic rock sources. Nevertheless, the raw material for the grinding stones was transported over long distances, whether travelling over land or using waterways.<sup>31</sup>

<sup>17</sup> For the following comparisons of different sites on the Aeolian Islands and on Sicily the overall Italian chronological system is used.

<sup>18</sup> Capo Graziano 2 *facies* (cultural group) (Bernabò Brea – Cavalier 1980, pl. 139.1); Milazzese *facies* (Bernabò Brea – Cavalier 1980, pl. 190.1–2, 6, 9–10); Ausonian I *facies* (Bernabò Brea – Cavalier 1980, pl. 217.1).

<sup>19</sup> Milazzese *facies* (Bernabò Brea – Cavalier 1968, pl. 62.3–17).

<sup>20</sup> Milazzese *facies* (Martinelli 2010, 149–150, 159, fig. 82.5; 160, fig. 83.5).

<sup>21</sup> Pers. communication S. Levi.

<sup>22</sup> Milazzese *facies* (Bernabò Brea – Cavalier 1980, 179–180, pl. 106.6–8). Stone tools, named ‘macinelli’ (Martinelli et al. 2010, 293), are also recorded from Filo Braccio on Filicudi dating to Early Bronze Age 1 (Capo Graziano 1 *facies*). However, there is no information about the rock type and it is unclear whether these tools are grinding stones or not.

<sup>23</sup> Aeneolithic to Capo Graziano 1 *facies* (Bernabò Brea – Cavalier 1968, 43, fig. 22).

<sup>24</sup> Capo Graziano 1 *facies* (Levi et al. 2009, 36; pers. communication S. Levi).

<sup>25</sup> Facies Messina-Ricadi (Martinelli 2009, 182, cat. no. 20–21; Di Bella et al. 2018).

<sup>26</sup> Di Bella et al. 2018, tab. 1.

<sup>27</sup> Cf. Gluhak – Schwall 2015, 260, 262–264, fig. 12–13.

<sup>28</sup> Lorenzoni et al. 2000.

<sup>29</sup> Lorenzoni et al. 2000, 877–879, fig. 1.

<sup>30</sup> Lorenzoni et al. 2000, 881.

<sup>31</sup> The example given by Lorenzoni et al. (2000, 881) concerning the Middle Bronze Age grinding stones of the western Sicilian settlement Monte Castellazzo di Poggioreale (phase A) has to be excluded. The stones were taken as

In the present case of the grinding stones from the coastal region of the Poro promontory, procurement of volcanic rocks from the Aeolian Islands by water transport was apparently easier than procurement from sources on the southern Italian mainland. As already shown by the distribution of ceramics, contacts between Calabria and the Aeolian Islands can be assumed from as early as the beginning of the 2<sup>nd</sup> millennium BC.<sup>32</sup> Thus, the analysed fragments of grinding stones provide an important contribution to highlighting contacts of the Bronze Age coastal regions of the Tyrrhenian Sea in southern Italy and, moreover, indicate maritime connectivity, which can be traced presumably as early as the Early Bronze Age 2 phase at the beginning of the 2<sup>nd</sup> millennium BC.

### Catalogue of Finds

**Cat. no. 1:** find no. **PZ9/P4** (Fig. 2–3)

Area: B

Square: G3

Description: fragment of an upper part of a grinding stone (form 2 according to Zimmermann 1988, 725); oval shape reconstructable; plano-convex longitudinal section and cross section; abrasion marks on the grinding surface

Measurements: length (max. preserved) 12.5cm; width (max. preserved) 4.5cm; height (max. preserved) 5.2cm

Material: basaltic andesite

Coordinates: East: 2604694.852m; North: 4285478.634m; height asl: 37.371m.

Stratigraphical context: EBA 2 settlement level, partly disturbed by 20<sup>th</sup> century AD ploughing.

**Cat. no. 2:** find no. **PZ95DD12-13/15** (Fig. 2)

Area: C

Squares: DD12–13

Description: fragment of a grinding surface with abrasion marks; not distinguishable if grinding stone (upper or lower part) or part of another stone tool (e.g. pounder); the vesicular structure of the rock indicates use as a grinding stone

Material: basaltic andesite

Measurements: length (max.) 3.4cm; width (max.) 1.8cm

Coordinates: ---

Stratigraphical context: RBA 2 ashy fill of the fortification ditch, severely disturbed by 20<sup>th</sup> century AD ploughing.

**Cat. no. 3:** find no. **PZ129/P62/3** (Fig. 2)

Area: C

Squares: CC10–11

Description: fragment of an upper part of a grinding stone (form 2 according to Zimmermann 1988, 725); shape not reconstructable, possibly oval?; plano-convex longitudinal section and cross section; abrasion marks on the grinding surface

---

evidence for a long distance procurement system of volcanic rocks from the eastern sources of Mount Etna and the Hyblean Mountains based on the analyses of Ferla et al. 1984. However, no grinding stone dating to the Bronze Age period of Monte Castellazzo di Poggioreale was analysed in this petrographical and geochemically study (cf. Ferla et al. 1984, 28, tab. 1 in comparison to 38, tab. 2). Moreover, a procurement of volcanic rock grinding stones from eastern Sicily is not assumed before the end of the 7<sup>th</sup> century BC (cf. Ferla et al. 1984, 45; Spatafora 1993, 169).

<sup>32</sup> For the distribution of the Cessaniti pottery see Pacciarelli 2000, 27. – Earlier contacts dating to the Final Neolithic in the 5<sup>th</sup> millennium BC are attested by the distribution of the Diana *facies* on both, the Aeolian Islands and the Poro promontory (Pacciarelli 2011, 265–266, 285–286).

Material: trachyandesite

Measurements: length (max. preserved) 7.4cm; width (max. preserved) 6.4cm; height (max. preserved) 4.4cm

Coordinates: East: 2604707.540m; North: 4285499.569m; height asl: 36.741m.

Stratigraphical context: RBA 2 ashy fill of the fortification ditch.

**Cat. no. 4: Biluscia** (Varricchio 1992, cat. no. 2 / Fig. 2–3)

Area: A

Description: fragment of an upper part of a grinding stone (form 2 according to Zimmermann 1988, 725); elongated oval shape reconstructable; plano-convex longitudinal section and cross section; slightly convex-shaped grinding surface with abrasion marks

Material: basaltic andesite

Measurements: length (max. preserved) 19.3cm; width (max. preserved) 19.4cm; height (max. preserved) 8.0cm

Stratigraphical context: surface find of a site dating to EBA 2, MBA 1/2 and RBA.

**Cat. no. 5: Torre Sant'Irene** (Varricchio 1992, cat. no. 21 / Fig. 2–3)

Area: C

Description: fragment of a lower part of a grinding stone (presumably form 2 according to Zimmermann 1988, 725); presumably oval shape reconstructable; concave-convex longitudinal section; plan-convex cross section; abrasion marks on the grinding surface

Material: trachyandesite

Measurements: length (max. preserved) 18.7cm; width (max. preserved) 17.5cm; height (max. preserved) 7.8cm

Stratigraphical context: surface find of a site dating to EBA 2 and MBA 1/2

## Bibliography

Bernabò Brea – Cavalier 1968

L. Bernabò Brea – M. Cavalier, *Meligunis Lipára III. Stazioni preistoriche delle isole Panarea, Salina e Stromboli* (Palermo 1968).

Bernabò Brea – Cavalier 1980

L. Bernabò Brea – M. Cavalier, *Meligunis Lipára IV. L'acropoli di Lipari nella preistoria* (Palermo 1980).

Bernabò Brea – Cavalier 1991

L. Bernabò Brea – M. Cavalier, *Meligunis Lipára VI. Filicudi insediamenti dell'età del Bronzo* (Palermo 1991).

Di Bella et al. 2018

M. Di Bella – F. Italiano – M. C. Martinelli – P. Mazzoleni – S. Quartieri – G. Tigano – A. Tripodo – G. Sabatino, *Archaeometric characterization of prehistoric grindstones from Milazzo Bronze Age settlement (Sicily, Italy)*, *Archaeological and Anthropological Sciences* 10, 2018, 1571–1583. doi:10.1007/s12520-017-0483-8

Ferla et al. 1984

P. Ferla – R. Alaimo – G. Falsone – F. Spatafora, *Studio petrografico delle macine di età arcaica e classica da Monte Castellazzo di Poggioreale (Sicilia occidentale)*, *Sicilia Archeologica* 56, 1984, 25–52.

Gluhak – Schwall 2015

T. M. Gluhak – Ch. Schwall, *Provenance analyses of the volcanic rock grinding stones from the Greek colony Seliunte, Sicily (Italy). Constraints and possibilities*, *Archaeometry* 57, 2, 2015, 246–268.

Jung et al. 2015

R. Jung – M. Pacciarelli – B. Zach – M. Klee – U. Thanheiser, *Punta di Zambrone (Calabria) – a Bronze Age harbour site. First preliminary report on the Recent Bronze Age (2011–2012 campaigns)*, *Archaeologia Austriaca* 99, 2015, 53–110.

Levi et al. 2009

S. T. Levi – B. Prosdocimi – G. Tigano – A. Vanzetti, Il villaggio protostorico di Viale dei Cipressi e la facies Capo Graziano, in: G. Tigano (eds.), *Mylai II. Scavi e ricerche nell'area urbana (1996–2005)* (Messina 2009) 23–136.

Lorenzoni et al. 2000

S. Lorenzoni – M. Pallara – E. Zanettin, Volcanic rock Bronze Age millstones of Apulia, southern Italy. Lithology and provenance, *European Journal of Mineralogy* 12, 2000, 877–882.

Martinelli 2009

M. C. Martinelli, L'insediamento specializzato in Piazza XXV Aprile a Milazzo (ME), in: G. Tigano (ed.), *Mylai II. Scavi e ricerche nell'area urbana (1996–2005)* (Messina 2009) 175–186.

Martinelli 2010

M. C. Martinelli, Archeologia delle Isole Eolie. Il villaggio dell'età del Bronzo Medio di Portella a Salina. Ricerche 2006 e 2008. In omaggio a Luigi Bernabò Brea nel centenario della nascita (Milazzo 2010).

Martinelli et al. 2010

M. C. Martinelli – G. Fiorentino – B. Prosdocimi – C. d'Oronzo – S. T. Levi – G. Mangano – A. Stellati – B. Wolff, Nuove ricerche nell'insediamento sull'istmo di Filo Braccio a Filicudi. Nota preliminare sugli scavi 2009, *Origini* 32 Nuova Serie IV, 2010, 285–314.

Pacciarelli 2000

M. Pacciarelli, Dal villaggio alla città. La svolta protourbana del 1000 a.C. nell'Italia tirrenica, *Grandi contesti e problemi della Protostoria italiana* 4 (Florence 2000).

Pacciarelli 2011

M. Pacciarelli, L'Eneolitico della Calabria tirrenica. Nuovi dati sull'articolazione cronoculturale, *Origini* 33 Nuova Serie V, 2011, 249–302.

Spatafora 1993

F. Spatafora, Un gruppo di macine da Monte Castellazzo di Poggioreale, in: *Studi sulla Sicilia Occidentale in onore di Vincenzo Tusa* (Padua 1993) 165–171.

Varricchio 1992

M. R. Varricchio, L'età del bronzo medio e recente nel Promontorio di Tropea (Tesi di laurea in Lettere, La Sapienza University Rome, Rome 1992).

Zimmermann 1988

A. Zimmermann, Die Funde. Steine, in: U. Boelcke – D. v. Brandt – J. Lüning – P. Stehli – A. Zimmermann (eds.), *Der bandkeramische Siedlungsplatz Langeweiler 8. Gemeinde Aldenhoven, Kreis Düren, Beiträge zur Neolithischen Besiedlung der Aldenhovener Platte III.2, Rheinische Ausgrabungen* 28 (Cologne 1988) 569–787.