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The Late Bronze Age Hoard of Stephani in Preveza, Epirus, NW Greece

The hoard of Stephani[1] in Preveza is a closed assemblage of artefacts that contains two stone and fifteen bronze, mainly broken, tools and/or weapons (ten bronze double-edged axes, one bronze leaf-shaped spearhead and two others that are badly damaged, two bronze unidentifiable cylindrical and pointed rods, as well as two stone tools, perhaps whetstones). Accidentally discovered in 1985 by the farmer Theodoros Kritsimas[2] in a fissure of limestone rocks, in the hilly area that extends between the townlets Stephani and Louros, the hoard was subsequently handed over to the appropriate authorities and the proper financial reward was eventually granted. The hoard of Stephani is on display in the showcase of the Bronze Age in the prehistoric gallery of the Archaeological Museum of Ioannina, along with another hoard of seven bronze objects from Katamachi[3] in Ioannina and alongside other primarily Late Bronze Age finds from Epirus.

Physical and Human Environment

The findspot (Fig. 1) of the assemblage is today called Geladorema and lies in the south foothills of mount Stavros: with its two summits at Valaoritis (541 m.a.s.l.) and Araion (681 m.a.s.l.), this forms in fact the south extension of the Thesprotika mountains (1274 m.a.s.l.). Stretching to the west are the renowned mountains of Zalongo (772 m.a.s.l.) and further to the east the Heliovounia mountains (561 m.a.s.l.), so comprising a semi-mountainous region at the head of the Ambracian gulf. The French physician and traveller F. C. H. L. Pouqueville, as an invited guest of Ali Pasha Tepelenli in Epirus, gives in the early 19th century a rather vivid description[4] of the area adjacent

1 For references relevant to the find, see Andreou 1986, 114 pls. 107. 108; Andreou 1994, 243. 259 fig. 31; Andreou 1997, 35 fig. 3; Tartaron 2004, 63. 154; Kleitsas 2013b, 554 pls. 92. 93. The hoard of Stephani has been the object of the author's study, when compiling his doctoral thesis (2013) at the University of Ioannina, titled »The Metalworking of the Late Bronze Age in Epirus: The Hoards and the Tools«. I would like to take this opportunity to extend my warmest thanks to the Emeritus Ephor of Antiquities of the Hellenic Ministry of Culture, Elias Andreou, not only for his kindness to grant me permission for the study of the hoard of Stephani, but also for our overall collaboration. I am also grateful to Dr. K. Manteli for the translation of the text and Dr. R. D. G. Evely for the proofreading, to K. Ignatiadis and P. Tsigoulis for the photographs of the artefacts, as well as to D. Kalpakis for the digital synthesis.

2 The find was handed over on 16 March 1985 to the local station of the Preveza Police Department and subsequently to the then 12th Ephorate of Prehistoric and Classical Antiquities. Inadvertently, in the first publications it is mentioned that both the Kritsimas brothers handed it over. Theodoros Kritsimas received in 1988 a reward of 100.000 drachmas.

3 Vokotopoulou 1972, 112–119. The hoard of Katamachi was accidentally uncovered by the farmer Donatos Doulis in November 1970 at a cliffy torrent (1017 m.a.s.l.) of mount Alyssos or Vritzacha and subsequently handed over to the appropriate authorities. The following year a reward of 2500 drachmas was given to the finder.

4 Pouqueville 1826, II 256 f. (extract translated by K. Manteli): »The village of

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Fig. 1 Topographic map (scale 1 : 100 000), showing the findspot of the hoard of Stephani (red dot) at the head of the Ambracian gulf

to Stephani, in which the strategic geographical position (Fig. 2) of the site is stressed.

The Ambracian[5] gulf played an important role in the shaping of the settlement network from Palaeolithic times on. It was created as a result of tectonic compression and has undergone constant seismic activity since the Pliocene-Pleistocene, with notable changes in the sea level and a physical infilling as accumulation of various materials. It is surrounded by limestone

Kantza (modern Stephani), where these three routes converge, consists of forty Christian families, which live in this fertile land. Situated just two hundred orguiai (370 m) away from Arethon, a river that whenever the troops of Vizier Ali have to cross it between Amphilochia and Preveza, they build over it a temporary removable bridge made out of planks, the village would have undoubtedly acquired very great importance, if it were not for the shortcomings of the ruling power that opposes any kind of progress, any kind of improvement. There could have been founded here a centre of commercial transactions between Arta, Preveza, Yannina and other parts of Epirus. Its location is all too suitable and the ancient routes that intersected at this point could be reopened or more precisely repaired at rather low expenses, since quite a few among them are in fairly good condition. To proceed from Kantza to Louros we walk, without any doubt, over their ruins«.

5 For the geology, geomorphology, the tectonics, the palaeogeography and sea level in the Ambracian gulf, see Jing – Rapp 2003, 157–161. 192–198, where specialised bibliography is included. This research was carried out in the framework of the Nikopolis Project (1991–1996), which produced a collective volume, three doctoral theses and few articles. This was the first interdisciplinary project

Fig. 2 The findspot of the hoard of Stephani (red dot), with the Ambracian gulf in the background (south) and with Acarnania, the Patras gulf and the western Peloponnese on the left, leaving the Ionian sea on the right

formations of the Mesozoic era, flysches of the Tertiary period and alluvial deposits of the Pliocene and Pleistocene. Today, the north (land) part of the Ambracian gulf is bordered by limestone elevations, which alternate with lower flysch basins. Thus, the topography of the mountains of Zalongo, Stavros and Heliovounia creates a multiple access route (the strait of Stephani and the saddle of Bogortsa), wherefrom the most important natural passes radiate out in all directions into the hinterland. Nowadays, the gulf measures about 35 km × 10 km, corresponding to an area of 40.000 ha, and has a maximum depth of 65 m in its southernmost part. The entrance of the gulf to the west is protected by the headlands of Preveza and Aktion, projecting into the sea: they leave but a small opening for communication with the Ionian sea, measuring 600 m in width and a mere 5 m in depth. This gap is now negotiable by an underwater road tunnel.

The north section of the Ambracian gulf is shaped by the estuaries of the rivers[6] Arachthos and Louros. The former flows through the eastern part of Epirus along a N-S axis, to empty into the northeast part of the gulf. Its uncontrollable runoff caused significant destructions in older times, as is clearly indicated by the occurrence of flood layers in the stratified deposits of ancient Ambracia[7] (modern Arta). On the west side of the gulf the Louros river flows into the sea: its headwaters lie further north. The Louros river valley has served as an important passage way from the Palaeolithic era to modern times. In all likelihood, both these big rivers were probably partly navigable in antiquity. In the interior of the gulf small natural coves shelter several good harbour installations. The sea level has undergone various fluctuations in the area of the gulf. By the beginning of the Holocene (10.000 B.P.) the sea level stood 45 m lower than today and the Ionian sea intruded into the gulf through the strait of Preveza. At the onset of the Bronze Age (4500 B.P.) the sea had reached its furthest penetration into the interior of the gulf, some 12 km further to the

in Epirus, followed by the Thesprotia Expedition (2004–2010) in the valley of river Kokytos (tributary of Acheron).

6 Fouache 1999, 37–54. The sediment discharge of the Louros and Arachthos rivers into the Ambracian gulf is estimated at approx. thirty and eighty m^3 per second, respectively. Nowadays, artificial dams have been constructed that regulate their flow, though not always preventing the risk of destructive floods in periods of heavy rainfall.

7 The town planning of ancient Ambracia is integrally linked with the active agency of the river Arachthos. In the rescue excavations of the ancient city's sectors in modern Arta the presence of the river is evident. It constitutes the formative agent of the city's geological and archaeological stratigraphy. Outside the walls of ancient Ambracia a small sanctuary has been located with bronze figurines of bulls, dedicated in all probability to the deity of the Arachthos river.

Fig. 3 The location of the hoard and its finder Theodoros Kritsimas with the townlet of Louros in the background

north than today, expanding as far inland as the foot of mount Stavros and modern Stephani, reducing most of the area to a rocky shoreline throughout the Bronze Age.

The area of Stephani[8] overlooks the northwest part of the Ambracian gulf, which eventually gives way to the rugged hinterland of Epirus and then extends towards Albania, Macedonia, Thessaly and Acarnania. Along these natural routeways from the Palaeolithic period to recent times human installations[9] are located, which exploit the rich natural resources of the region and

8 Human presence in the area of Stephani is continuous, with the following antiquities known from: site Eli: stone artefacts of the Palaeolithic, Neolithic and Bronze Age (Tartaron 2004, 62); small post-Byzantine settlement (Wiseman et al. 1992, 295); area of the hoard: foundations of rectangular and curved buildings, many stone piles, pottery (Andreou 1994, 243); a small Hellenistic fort with some later repairs (unpublished); ruins of the Roman aqueduct of Nikopolis, which after some enhancement works are today visible from the Ioannina-Preveza national road (Aggeli 2015, 58 f.). There is no more available information about this specific area.

9 For the antiquities of Cassopaia and the four ›Elean‹ colonies in the region in general, see Dakaris 1971. Furthermore, Andreou 1997, 31–47; Katsadima 1997, 17–29; Kontogianni 2006; Konstantaki – Spanodimos 2008, 15–43; Dominguez 2015, 111–143. The Nikopolis Project carried out research in ancient Cassopaia (area between the rivers Acheron and Louros), the emphasis being on the estuary area of the Acheron river.

in various ways control the passages and activities in the environs. Standing out among the nearby prehistoric sites[10] is Thesprotiko (building remains, handmade pottery, stone tools, cist graves and piles of stones), as well as Galatas (building remains, handmade and Mycenaean pottery, stone tools and a radiocarbon dating) to the north. In historic times colonies were established by the metropoleis of the Peloponnese (primarily by Corinth). Social, economic and political organisation within the tribal groups of Epirus came into being from the 4th century B.C. onwards, with the Cassopaeans remaining the dominant tribe in the area between the Louros and Acheron rivers until the Roman conquest of the 2nd century B.C.

The hoard was located (H.G.R.S. 87, X: 220882, Y: 4341285, 90 m.a.s.l.) in a fissure of limestone rocks (Fig. 3), on a hillslope that provides a view over the Ambracian gulf, with Mavrovouni (330 m.a.s.l.) featuring in the foreground. At about the time of concealment, as already mentioned above, the sea washed right up to the foot of mount Stavros, turning this particular hillslope into a rocky coastline, while Mavrovouni itself was an island. According to the most likely version, the possessor of the hoard approached the area through the pass between the mountains of Zalongo and Stavros or between those of Stavros and Heliovounia, more probably from the side of the valley of Thesprotiko than from that of the sea. The hoard includes mainly broken bronze objects, probably collected from sites in Epirus. It is worth mentioning that the valley of Thesprotiko at the point of modern Polystaphylo is connected to the valley of river Acheron. This, in turn, leads through the communities of Lakka Souli northwards to Katamachi, the findspot of the second important prehistoric hoard of seven bronze artefacts from the wider area of Epirus (the third hoard of Rodotopi in Ioannina dates to the Early Bronze Age).

The Hoard of Stephani

The hoard of Stephani (Tab. 1; Fig. 4) is undoubtedly the most important assemblage of Late Bronze Age portable finds in metal across the entire region of Epirus. It contains ten bronze double-edged axes, three bronze spearheads (one leaf-shaped), two bronze cylindrical and pointed rods, as well as two large stone tools, namely whetstones. The hoard is of mixed character in the raw materials used for the manufacture of the artefacts (bronze and stone), as well as in its typologies (tools and weapons) and state of preservation (intact and broken).

The first group of five bronze double-edged axes (cat. 1–4. 7: Figs. 5–14) is provided with an elliptical shaft-hole, uniform curved outline and bevelled cutting edges. One axe is decorated with incised oblique lines (cat. 7: Figs. 9 and 14) on the edges of both faces, while another has triple shallow grooves (cat. 2: Figs. 6 and 11) at the periphery of the two long sides and on each face. Furthermore, the latter axe bears on each narrow side four zones of oblique chevrons in a dense arrangement, which in pairs form a broader herring-bone band (Fig. 15). Two of the axes are intact and functional, another one is intact, albeit markedly worn on the blades, while the remaining two are broken in the middle, whilst also showing extensive wear on the blades. They all belong to the well-known Helladic or Mycenaean type[11] of double-edged axes, which is identified with Buchholz's category IV and Deshayes' type B1a, regarding their first and main classifications.

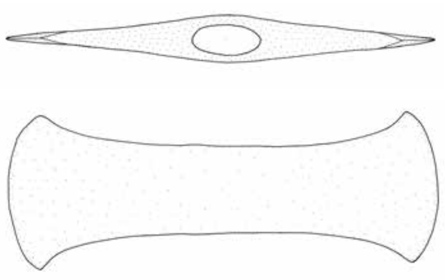
10 Dakaris 1971, 27 f. Dakaris had predicted the occurrence of Late Helladic habitation in the area. For Thesprotiko, see Dakaris 1971, 29 fig. 48; Papadopoulos 1976, 275; Andreou 1994, 242 f.; Tartaron 2004, 66; Konstantaki – Spanodimos 2008, 19. An exploratory excavation in 2007, conducted by the former 33rd Ephorate of Prehistoric and Classical Antiquities in a circular hut of Thesprotiko, unearthed glazed post-Byzantine pottery. Galatas constitutes a new and important prehistoric site: Tartaron 2004, 64 f.

11 Hawkes 1936/1937, 141–159; Buchholz 1959; Buchholz 1960, 39–71; Deshayes 1960, 253–261 pls. 34. 35. 60; Branigan 1968, 30 f. 89 fig. 8; Nilsson 1971, 194–235; Branigan 1974, 21 f. 164 f. pls. 10. 12. 28; Harding 1975, 185. 187. 190–193 pls. 13. 14; Buchholz 1983, 43–134; Mavriyannaki 1983, 195–228; Evely 1993, 41–55 pls. 13–15; Lowe Fri 2011. Quite interesting data can also be found in the doctoral dissertations by Davaras 1969; Nikolaidou 1994; Maragoudaki 2010; Blackwell 2011; Kleitsas 2013a.

No.	Cat. no.	Inv. no.	Material	Artefact
1	1	7505	Bronze	Double axe, Helladic type
2	2	7506	Bronze	Double axe, Helladic type
3	3	7507	Bronze	Double axe, Helladic type
4	4	7508	Bronze	Double axe, Helladic type
5	5	7509	Bronze	Double axe, ›Ermones-Kierio‹ type
6	6	7510	Bronze	Double axe, ›Ermones-Kierio‹ type
7	7	7511	Bronze	Double axe, Helladic type
8	8	7512	Bronze	Double axe, ›Ermones-Kierio‹ type
9	9	7513	Bronze	Double axe, ›Ermones-Kierio‹ type
10	10	7514	Bronze	Double axe, ›Ermones-Kierio‹ type
11	11	7515	Bronze	Probable leaf-shaped spearhead
12	12	7516	Bronze	Leaf-shaped spearhead
13	13	7517	Bronze	Probable leaf-shaped spearhead
14	14	7518	Bronze	Cylindrical pointed rod
15	15	7519	Bronze	Cylindrical pointed rod
16	16	9468	Stone	Trapezoidal whetstone
17	17	9469	Stone	Rectangular whetstone

Tab. 1 Catalogue of the seventeen bronze and stone artefacts from the hoard of Stephani

Fig. 4 The hoard of Stephani in Preveza, containing fifteen bronze and two stone artefacts (scale 1 : 8)



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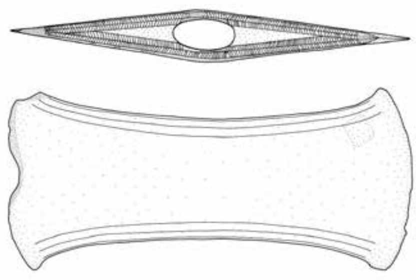

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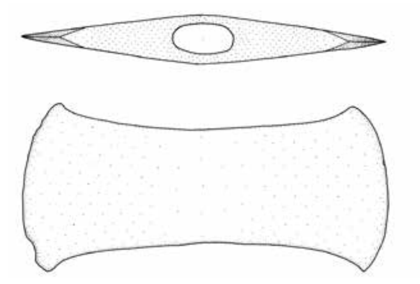

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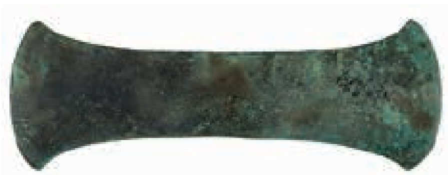

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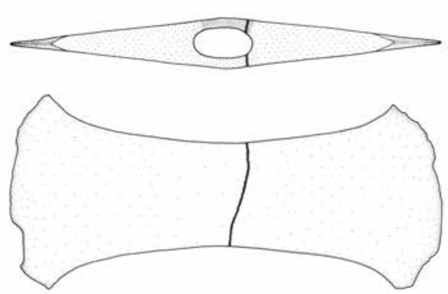

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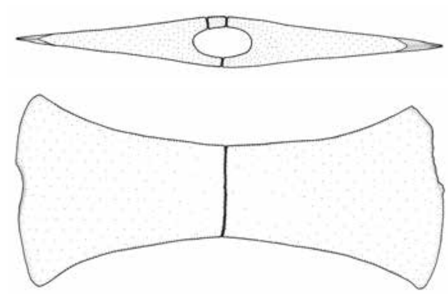

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Figs. 5–9 Drawings of the five cast bronze double-edged axes of the Helladic type (cat. 1–4. 7; scale 1 : 4)

Figs. 10–14 Photos of the five cast bronze double-edged axes of the Helladic type (cat. 1–4. 7; scale 1 : 4)

Fig. 15 Cast bronze double-edged axe, bearing herring-bone decoration on the narrow sides (cat. 2; scale 1 : 2)

Other groups[12] of bronze double-edged axes are to be found in the hoards of Katamachi in Ioannina (five), Anthedon (four) and Orchomenos (seven) in Boeotia, the Acropolis of Athens (thirteen), ›Tsountas‹ (nine) and ›Mylonas‹ (four) hoards at Mycenae, the ›tomb of the tripods‹ at Mycenae (twenty), the hoard of Kozman Dere in the sea of Marmara (three) and the shipwreck of cape Gelidonya (three) in Turkey. All of the above assemblages are securely dated to the Late Helladic IIIB–C period in Helladic terms. Isolated examples come from quite a number of sites in the Helladic area, with similar instances also occurring in much the same time span outside it (in Albania, Israel, Cyprus, Turkey, Italy, Croatia, Serbia, Bulgaria, Ukraine, Russia, France, England,

12 Bass 1967, 94–96; Spyropoulos 1970, 263 f.; Spyropoulos 1972, 9–13. 51 f. 58. 65–72. 134 f. 221 pls. 1–3. 17–20. 34; Harmankaya 1995, 226. 242; Onassoglou 1995, 37–41. 48 f. figs. 57. 58 pls. 10. 12–15. These are assemblages that include more than two bronze double-edged axes.

Ireland and elsewhere). Both their utilitarian and symbolic functions should be taken into account in any discussion (production, consumption, use, deposition, recycling etc.).

The largest quantity of bronze double-edged axes of the Helladic type is encountered at Mycenae (about thirty-five specimens). There follows Epirus with twenty-three occurrences[13] (hoard of Stephani in Preveza: five, hoard of Katamachi in Ioannina: five, Dodona in Ioannina: six, Terovo in Ioannina: two, Christoi in Ioannina: one, Hagios Georgios in Thesprotia: one, Giromeri in Thesprotia: one, unknown sites: two). In a spectacular and unexpected third position comes Albania with fifteen specimens[14] of bronze double-edged axes. Epirus and south Albania share a common preference in the production or consumption of these particular artefacts. Two stone moulds[15] for the production of the type come respectively from the lacustrine settlements of Maliq and Sovjan in the Korca valley in southeast Albania, where metallurgical activities were practised during the end of the Late Bronze Age (Maliq IIId and Sovjan 5c1) and probably on into the Early Iron Age.

Bronze double-edged axes appear generally in Crete in the Early Minoan II–III period, having a circular shaft-hole, while from the Middle Minoan III/Late Minoan I onwards an elliptical one. In the course of the Late Bronze Age and especially during its third phase they spread not only throughout the remaining Helladic area, but also outside it, as mentioned before. The utilitarian specimens are divided into two categories: with an almost rectangular body and angular cutting edges or with a curved outline and bevelled cutting edges. Stone bivalve moulds with provision for a core were often used for the manufacture of the type. The recorded occurrences of such moulds[16] outside Crete (Sesklo in Magnesia, Kolona on Aigina, Paroikia on Paros, Phylakopi on Melos, Hagia Eirini on Keos, Enkomi on Cyprus, Troy in Turkey, Maliq and Sovjan in Albania) are dated to various phases within the Late Bronze Age (under Minoan or Mycenaean influence).

All the above mentioned moulds reproduce approximately the same rectangular double-edged axe with rather straight and angular blades. This may well mean that the bevelled cutting edges, the main differentiating feature between the two basic axe groups, are the outcome of forging, applied to the objects after casting and extraction from the mould. Such a viewpoint would mean that we are in fact dealing with one, single and uniform type of double-edged Helladic axe, since minor differentiations in the form are to be better associated with the shaping of the artefact that the hammer and the anvil of an experienced metalsmith imparts.

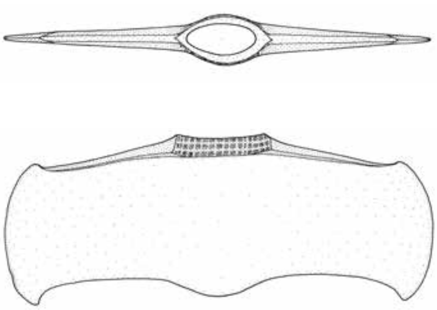
The second group of five bronze double-edged axes (cat. 5. 6. 8–10: Figs. 16–25) is provided with an elliptical/eye-shaped shaft-hole, a strongly

13 For the remaining thirteen cases, apart from the hoards of Stephani in Preveza and Katamachi in Ioannina, see Evangelidis 1952, 290; Buchholz 1959, 47. 50 pl. 9; Dakaris 1961/1962, 196 pl. 225; Hammond 1967, 334 f. fig. 22; Dakaris 1968, 57 pl. 38; Papadopoulos 1976, 299–301. 330 f. pls. 12. 13; Kalligas 1980, 353 f. pl. 157; Buchholz 1983, 72–74. 114; Dousougli 1989, 276; Soueref 2001, 60–62. 64 f. 77 f. 108–110. 225. 256. 258. These are accidental and isolated finds, especially so, given the disturbance of strata at Dodona.

14 Bunguri 2012, 7–45. They derive from the sites: Xarë, Shalës, Sopik, Shënvasil, Sarandë, Kudhës (two), Qafë Marinës, Staraveckë, Kapshticë, Sovjan, Podgorie (two), Lleshan and Shëngjergj. All these sites are situated in the south part of Albania, which borders Epirus, while in the north part of the country (mainly in the area of Shkodra) and in neighbouring Montenegro the ›Albanian-Dalmatian‹ single-edged axes prevail from the 12th century B.C. onwards: Prendi 1958, 207–217; Vulpe 1960, 165–187; Prendi 1984, 19–45; Žeravica 1993, 32–44 pls. 9–11.

15 Léra 2003, 34; Bunguri 2012, 14. 41 f.; Kleitsas forthcoming. The two moulds of Albania are of exceptional importance, as they force us to revise the established views about the existence of distinct Helladic or Creto-Mycenaean products, although it is also true that moulds may travel around in the hands of itinerant smiths.

16 Reinholdt 1987, 32. 38 f. 44–47. 71. 85 pls. 6. 10. 12. 14. 31. 44.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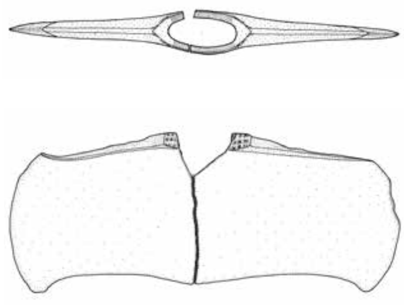
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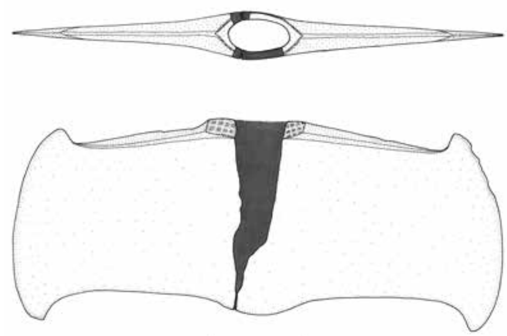
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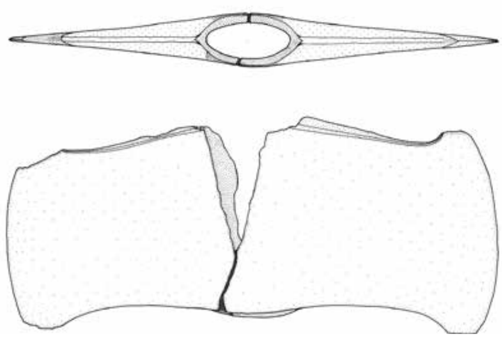
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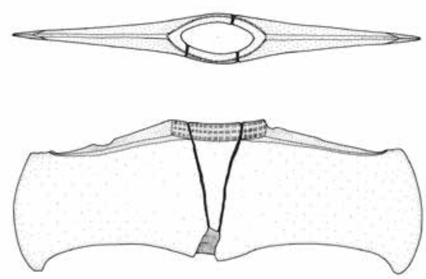
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Figs. 16–20 Drawings of the five cast bronze double-edged axes of the ›Ermones-Kierio‹ type (cat. 5. 6. 8–10; scale 1 : 4)

Figs. 21–25 Photos of the five cast bronze double-edged axes of the ›Ermones-Kierio‹ type (cat. 5. 6. 8–10; scale 1 : 4)

curved outline and bevelled cutting edges. Moreover, on its upper narrow edge it has a slightly elevated profile, making a dorsal ridge and incorporating an elevated collar around the socket, which last is decorated with vertical net pattern. One of the axes is intact and functional, while the remaining four are broken in the middle and worn to a lesser or greater extent on the blades and other parts of the body. Their slender features most probably account for their reduced durability under more demanding task conditions. All of them belong to the distinctive typological group[17] ›Ermones-Kierio‹ (named after the specific findspots in Corfu and Karditsa, Greece), which comprises bronze double-edged axes with both a relatively limited geographical, as well as chronological distribution.

17 Buchholz 1960, 41. 51, illustrates three specimens from Naxos, Kertsch and Hungary; Deshayes 1960, 258 pl. 35, classifies three specimens from Naxos, A total of twenty-nine specimens of the ›Ermones-Kierio‹ type[18] were found at twenty-two different sites: an unknown site on Naxos, another unknown site in Acarnania, Kechropoula in Acarnania, Charadiatika on Lefkas (two), Ermones on Corfu, Stephani in Preveza (five), Dodona in Ioannina (two), Kierio in Karditsa (two), Zerelia in Magnesia, Anagennisi in Larissa and Hagios Mamas in Chalkidiki. Outside the Helladic territory the type occurs at the sites Navaricë, Nepravishtë and Vilë in Albania, Kravari in F.Y.R.O.M., an unknown site in Croatia, Užice, Niš and Staničenje in Serbia, Royak in Bulgaria, an unknown site in Hungary and at Kertsch in Crimea. A questionable specimen comes from Gezer in Israel. Minor shape differentiations concern the straight or curving outline of the lower part, the occurrence or not of a raised midrib on the dorsal ridge and the raised collar, decorated with net pattern or left plain. The axe from Vilë bears on the dorsal ridge a single herring-bone band, comparable to that seen on the double axe (cat. 2) from the first group of axes.

The main concentration of ›Ermones-Kierio‹ type axes (Fig. 26) is noted in the wider region of western Greece (Epirus, Acarnania, the Ionian islands and Thessaly), where their principal centres of production were presumably located. Their main distribution northwards reaches up to the Danube area. This specific type of axe can be characterised as ›Balkan‹, since its use was not favoured in the Mycenaean world, where the stouter type of Helladic bronze double-edged axe prevails. Indeed, the markedly bevelled edges to the blades and the moulded elements are common in regions further to the north and outside the Mycenaean world. Until now, no known occurrence exists of a stone casting mould for the production of the type. Therefore, if this is not an accident of discovery, we may infer that single-use clay moulds or more probably still ›sand-casting‹ (›flask-technique‹) in moulding boxes were employed, traces of which are not usually preserved.

For the most part, the artefacts of this type are accidental and isolated finds. Exceptional is the case of a small set from Charadiatika on Lefkas (two axes of the type) in the area of Steno-Nydri with its important prehistoric habitation and a second occasion from Ermones on Corfu (axe and chisel), where a prehistoric settlement of the Bronze Age is also situated. However, only four

Royak and Gezer into type B3; Branigan 1974, 21 f. 165, attributes seven axes into the fourth type that appears in the Middle Bronze Age; Harding 1975, 190–193, places fourteen axes in the ›Ermones‹ type and argues for the existence of a production centre in Epirus; Kilian 1976, 118. 121. 128, illustrates a distribution map with eleven specimens of the ›Kierio‹ variant; Buchholz 1983, 81–90. 115–117, allocates seventeen axes to the ›Ermones‹ type and highlights in a map their main distribution across northwest Greece and Albania; Harding 1984, 127–129, classifies eighteen axes to the ›Ermones-Kierio‹ type with a distribution map; Bouzek 1985, 44 f., refers to fifteen specimens of the ›Ermones‹ type and points out the overall lack of context.

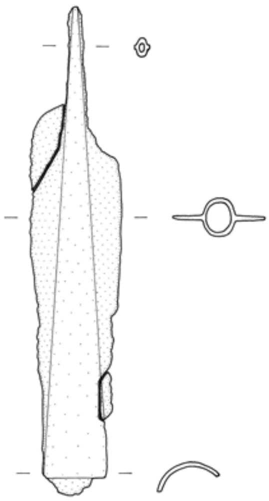
18 1. Naxos in the Cyclades, Greece: Buchholz 1960, 41. 51; Deshayes 1960, 258; Buchholz – Karageorghis 1971, 52. 266; Buchholz 1983, 89 f. 116; Dietz et al. 2015, 30 f. pl. 10; 2. Acarnania, Greece: Buchholz 1983, 84. 117; 3. Kechropoula in Acarnania, Greece: Dörpfeld 1927, 328 pl. 79; Buchholz 1983, 84. 117; 4. Charadiatika on Lefkas, Greece: Dörpfeld 1927, 328; Hammond 1967, 335 f.; Buchholz – Karageorghis 1971, 52. 266; Buchholz 1983, 83 f.; Zachos – Dousougli 2003, 97; 5. Ermones on Corfu, Greece: Dontas 1965, 380 pl. 438; Buchholz 1983, 84 f. 116; Souyoudzoglou-Haywood 1999, 12; 6. Dodona in Ioannina, Greece: Evangelidis 1959, 114 pl. 100; Buchholz 1983, 85 f. 116; 7. Kierio in Karditsa, Greece: Kilian 1975, 13. 18 pl. 95; Buchholz 1983, 88 f. 117; 8. Zerelia in Magnesia, Greece: Buchholz 1983, 89; 9. Anagennisi in Larissa, Greece: Unpublished; 10. Hagios Mamas in Chalkidiki, Greece: Schalk 2016, 329–334; 11. Navaricë in Albania: Buchholz 1983, 86; Prendi 1993, 24; Bunguri 2012, 12 f. 43. 45; 12. Nepravishtë in Albania: Budina 1974, 366; Prendi 2002, 93. 95; Bunguri 2012, 13. 43; 13. Vilë in Albania: Prendi 1977/1978, 37. 57; Prendi 1982, 220 f.; Bunguri 2012, 13. 43. 45; 14. Kravari in F.Y.R.O.M.: Hammond 1972, 299 f. fig. 13; Buchholz 1983, 86 f. 117; 15. Dalmatia in Croatia: Buchholz 1983, 86. 116; 16. Užice in Serbia: Parović-Pešikan 1994/1995, 3–5; 17. Niš in Serbia: Garašanin 1958, 49 f.; Buchholz 1983, 87 f. 117; Antonović 2014, 85 pl. 36; 18. Staničenje in Serbia: Harding 1975, 193 pl. 14; Buchholz 1983, 88. 117; Antonović 2014, 85 pl. 36; 19. Royak in Bulgaria: Deshayes 1960, 258 pl. 35; Chernykh 1978, 204 f.; Panayotov 1980, 186–190. 196 f.; 20. Hungary: Buchholz 1960, 41. 51; Buchholz 1983, 90; 21. Kertsch in Crimea: Buchholz 1960, 41. 51; Buchholz 1983, 90; 22. Stephani.

Fig. 26 Distribution map of ›Ermones-Kierio‹ cast bronze double-edged axes in the Balkans

specimens of the type are relatively securely dated. The hoard of Kierio[19] in Karditsa numbers seven bronze objects, ascribed on typological grounds mainly to the Late Helladic IIIC Early period. To roughly the same phase also belong the finds from the burial mound of Navaricë in south Albania. Finally, distinctive is the case of the well-dated axe from Hagios Mamas[20] in Chalkidiki, found in stratum 8 of the prehistoric tell settlement there, synchronised to the Late Helladic I phase: thus, this becomes the earliest manifestation of the type, to date.

The dating traditionally assigned to the type tends to be towards the end of the Late Bronze Age. According to another view, two groups of bronze double-edged axes can be distinguished within the ›Ermones-Kierio‹ type: an early and the later one. Based on the available evidence, we can contend that the type appears at the beginning of the Late Bronze Age and survives until its end. Its morphological features do not undergo changes noticeable enough, to substantiate the creation of distinct stages of typological evolution, but it does seem that most known specimens belong to the final phases. This is a type of

19 Kilian 1975, 13. 18 pls. 1. 95. It contains two axes of the type, a flat chisel widening in the middle, a leaf-shaped spearhead (Avila 1983, 60 f. pl. 18), a four-faceted arrowhead with cylindrical shaft (Buchholz 1962, 25. 27) and fragments of two bronze fibulae (Sapouna-Sakellarakis 1978, 37–39 pls. 1. 2).
20 Hänsel – Aslanis 2010, 188–200. 286 f.; Hänsel et al. 2010, 309–313. 346 f. 371. 377; Schalk 2016, 329–334.



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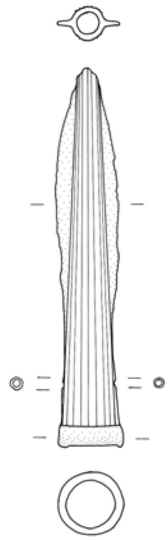

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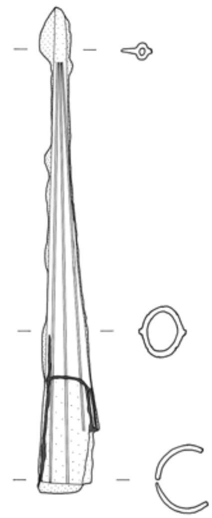

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Figs. 27–29 Drawings of the three cast bronze (leaf-shaped) spearheads (cat. 11–13; scale 1 : 3)

Figs. 30–32 Photos of the three cast bronze (leaf-shaped) spearheads (cat. 11–13; scale 1 : 3)

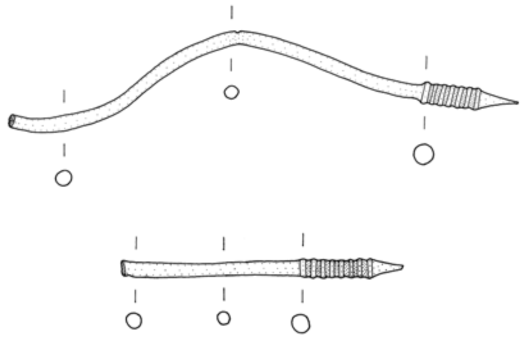
axe that was developed under the clear influence of Creto-Mycenaean double-edged axes, but that followed its own course in the Balkan area with hybrid traits. Overall, these specific products did not turn out to be as competitive as the Mycenaean ones, which had already been established in the areas of the Mycenaean periphery, as well as outside it.

The hoard of Stephani also includes three cast bronze spearheads (cat. 11–13: Figs. 27–32). They all probably belong to the type with a leaf-shaped blade and have a conical hollow socket. The first is broken: the lower part of its socket and blade tip are both missing. The object was cast and then hammered, with the socket formed later around a conical core. The second one is intact and functional, with a leaf-shaped blade and an eighteen-sided fluted socket that ends in a plastic ring. It also has two opposed holes for the fastening of the wooden shaft by a pin or a peg. It finds exact parallels in two spearheads[21] from the Mycenaean cemetery of ›Iolkos‹ in Nea Ionia, Volos. The third piece is also broken, with bits missing from all over the blade and lower part of the socket, as well as being distorted at the tip of the blade too. It is decorated with ten pairs of shallow engraved lines on main axis. It was also cast and hammered, while the socket was formed later around a conical core. Only three moulds[22] for the production of bronze spearheads are known in the Helladic area (from the tell settlement of Kastanas in Thessaloniki, the lower city of the Mycenaean citadel of Tiryns and from the Mycenaean settlement of Stavros in Chalandritsa, Achaia). This paucity may suggest that the ›lost-wax‹ or ›sand-casting‹ techniques were more probably employed.

The radiocarbon sample (KIA-26337: 3230 ± 24 B.P.) on *Hordeum vulgare*, possibly belonging to stratum 8, produced a range of approx. 1550–1430 cal. B.C. The axe was found in area 2 of building 4 that has been interpreted as a habitation and food preparation space. I warmly thank my colleague Dr. E. Schalk, who has undertaken the publication of the small finds from Hagios Mamas, for all the useful information and her overall help and discussion.

21 Theocharis – Theochari 1970, 200–203; Avila 1983, 14–16 pl. 4 (Typenreihe A); Leshtakov 2015, 34. 332 (type A.VIII.2.a). They derive from the cist grave 6 (the smallest one) and cist grave 18 (the largest one) respectively, being dated on the basis of Mycenaean pottery and bronze weapons to the Late Helladic IIB–IIIA period.

22 Hochstetter 1987, 20 f. pls. 5. 28: stone mould from stratum 16 (Late Helladic IIIA2–IIIB1) of Kastanas; Rahmstorf 2008, 81 pls. 35. 90: clay mould of the Late Helladic IIIB period from Tiryns; Soura 2017, 483–495: stone mould as a surface find from Chalandritsa (settlement of Late Helladic IIIB–C period).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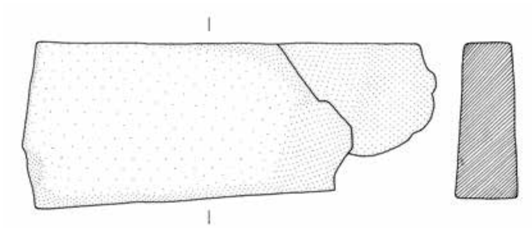
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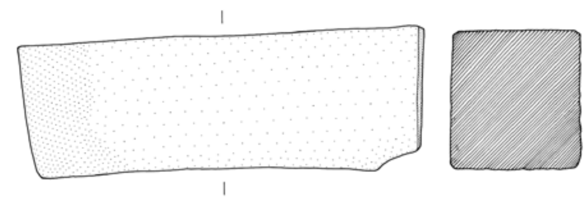
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Fig. 33 Drawings of the two cast bronze cylindrical and pointed rods (cat. 14. 15; scale 1 : 3)

Fig. 34 Photos of the two cast bronze cylindrical and pointed rods (cat. 14. 15; scale 1 : 3)

Figs. 35. 36 Drawings of the two large stone tools or whetstones (cat. 16. 17; scale 1 : 3)

Figs. 37. 38 Photos of the two large stone tools or whetstones (cat. 16. 17; scale 1 : 3)

Also present in the hoard are two cast bronze cylindrical and pointed rods (cat. 14. 15: Figs. 33. 34). Both are broken, missing one end, while their other end is formed into a conical-pointed tip with seven and eight plastic rings underneath it. The larger rod is bent in the middle, but the smaller one remains straight. These two particular objects are neither easily identified nor classifiable into specific types. From their shape, they probably are parts[23] of large pins, perhaps topped by an additional element of a different material, set on the conical-pointed end above the plastic rings.

Finally, the hoard of Stephani contains two large stone tools (cat. 16. 17: Figs. 35–38). The former is a hexahedral whetstone of overall trapezoidal shape and section. This is broken and a large part of it is missing. The main surface is rough and suitable for the sharpening of metal artefacts, while its back side is crudely worked. The latter is also a hexahedral tool with an overall rectangular section, likewise made of hard stone with roughly shaped surfaces and a recess on one side. This too is probably a whetstone. These two artefacts stand out due to their large size (as opposed to smaller common, pendant whetstones). They are so important, because they constitute indirect evidence for the practice of metalworking activities in the region, which have not yet been attested in Epirus, but are mainly conjectured from the quantitative and qualitative characteristics of the bronze objects.

The phenomenon of hoarding of bronze or other artefacts characterises the Late Bronze Age in almost the entire European continent. Towards the end of the same era and before the introduction of iron technology, production and consumption but also recycling and deposition of bronze objects became

23 Novotná 1980, 107–110 pls. 26–33: for the ›Malá Vieska‹ type of large-sized (60–70 cm in length) pins in Slovakia, which often appear in hoards and are dated to the 13^{th}–12^{th} century B.C. (Späte Hügelgräberzeit – Frühe Urnenfelderzeit or Bz D – Ha A1). Novotná 1980, 14. 16 pl. 1: for a similar form of a smaller pin (›cyprische‹ Schleifennadeln) from Hurbanovo, which had also probably attached to it a head of organic material.

massive and usually associated with the coming period of generalised crisis. The main distinction between utilitarian and ritual or votive deposits[24] is based on several criteria, such as the location of the hoard, the level of ease or difficulty of accessing it and the relation to soil (dry-land) or water (wet-land) environment and context. Moreover, the composition of the hoard, the state of preservation of the objects (intact or broken) and eventually their dating. Extremely difficult is usually the dating of the deposition, when it comes to standardised objects with long period of production and consumption or use, like is the case of Stephani.

The hoard of Stephani does not easily reveal the character of its composition and the purpose of its deposition. It is likely a utilitarian deposit, but its ritual character cannot be ruled out. In the second case, the fragmentation of the objects should be interpreted as deliberate human action in the context of their ritual ›death‹ and not simply as a result of intensive use and subsequent collection for recycling. There is also a correlation between the two equal sets of five axes, as well as the other artefacts, which could be explained as a ritual deposition rule. Finally, we should not overlook the fact that the hoard was located on a steep and hard to access slope with rocky surface, which is related to the water element, since a small torrent passes next to it, flowing into the Ambracian gulf immediately below (during the Bronze Age the sea had reached its furthest penetration into the interior of the gulf, expanding as far inland as modern Stephani).

The hoard of Stephani could also be the stock-in-trade of an itinerant metalsmith, who collected broken bronze objects[25] for ›pooling‹, recycling and the subsequent manufacture of new artefacts. Leaving the two large stone tools aside, four out of the fifteen bronze objects of the assemblage are intact and functional, hence still suitable for barter. The weight in total is about 14 kg (bronze: 12.708 g and stone: 1335 g), a fact that makes its transport over long distances rather difficult. Admittedly, one cannot exclude the chance that the bronzesmith's base lies but a short distance away, all the more so as prehistoric settlements are known to exist in the adjacent area. The findspot of the hoard at the head of the Ambracian gulf perhaps reflects the intention to move it away from Epirus toward some specialised foundry of the Helladic area further south, since such metallurgical activity is archaeologically not attested yet in the wider area of Epirus.

The dating of the hoard to the 13th–12th century B.C. is only indirectly ascertained through typological parallels. As we have already seen, assemblages with more than two bronze double-edged axes of the Helladic type are exclusively dated to the Late Helladic IIIB–C period, when the type attains its widest distribution. Axes of the ›Ermones-Kierio‹ type are dated on the basis of the Kierio hoard to the Late Helladic IIIC phase, which fits with the slender and weak features of the five Stephani axes, marking the degeneration of the type in the final stages of its existence. Finally, the intact functional bronze leaf-shaped spearhead (cat. 12) can be dated to the Late Helladic IIB–IIIA period, but the chronological range of ›Typenreihe A‹ (Avila) is based on a small sample (only four spearheads and all of uncommon sorts).

Late Helladic IIIB–C is a period of great upheavals and insecurity throughout the Aegean world. Assigned to about the same period are all the Helladic hoards, the list of which is as follows: ›Acropolis‹ of Mycenae (a distinctive case with earlier finds), ›Tsountas‹ at Mycenae (in fact two assemblages), ›Poros Wall‹ and ›Mylonas‹ at Mycenae, Tiryns in the Argolid (another distinctive case, also including earlier finds), Orchomenos and Anthedon in Boeotia, the Acropolis of Athens and Kanakia on Salamis. Three more hoards[26] of bronze

24 Hansen 1994; Hänsel 1997, 11–22; Bradley 1998; Hansen 2005, 211–230; Vachta 2016, 93–117; Hansen forthcoming. Metal hoards in Europe and the Balkans are usually interpreted as social/communal votive deposits, regulated by specific ritual rules or selection patterns, regarding topography, the artefacts and their state of preservation.

25 We do not share Tartaron's (2004, 154) view that the contents of the hoard of Stephani are probably funerary offerings from looted graves of the Bronze Age. The deposition of bronze double-edged axes in graves is not commonly practised in mainland Greece, as these objects were primarily associated with heavy manual labour, while it is not at all encountered in the area of Epirus (Kleitsas 2017, 251–264). The most characteristic exception appears in the definite case of the ›tomb of the tripods‹ at Mycenae.

26 Benton 1934/1935, 71–73; Mastrokostas 1965, 343 f. pl. 410; Kilian 1975, 13. 18 pls. 1. 95.

objects come from the periphery of the Mycenaean world: Polis in Ithaka in the Ionian sea, Psorolithi of Kalydon in Aetolia and Kierio of Karditsa in Thessaly. The group of the fifteen known Late Bronze Age hoards in the Helladic area includes those of Stephani in Preveza and Katamachi in Ioannina. We will not discuss further here the complex phenomenon[27] of utilitarian *versus* ritual deposition in the Aegean.

Traces of Manufacture and Use

Macroscopically examined, several of the bronze objects show on the surface traces of the various stages[28] in the manufacturing process. We are mainly referring to defects, visible to the unaided eye, accompanying the casting process in stone, clay (›lost-wax‹) and more rarely in metal moulds or earthen casts[29] (›sand-casting‹ or the ›flask technique‹). The application of hammering and finishing techniques (grinding or polishing) on the artefacts after the solidification of the metal and its extraction from the mould are also so detectable. By hammering, small defects on the surface can be rectified, the mass can be condensed and objects can be given their final shape. The remaining manufacturing defects, impossible to erase and self-evident, are exactly the ones we focus on. Some could affect to a greater or lesser degree the practical function or aesthetic appearance of the artefacts. The casting defects encountered are numerous: they mainly are associated with the degree of mould preheating, its partial filling, the unsuitable temperature of the molten metal and defects in the ›recipes‹ of the alloy, the unintended addition of dirt or slag inclusions in the solid metal, as well as other predictable and unpredictable factors that often impact on this process. All in all, they provide important information about the level of the technological expertise of the ancient manufacturers at the setting of the Late Bronze Age in the region.

Examining use-wear traces that appear primarily on the blades of bronze objects and less on their body, comprises another avenue of approach. However, it is not easy to determine either the exact duration of use or the material, on which the tool was used, since the cutting edges were sharpened at regular intervals with whetstones. Moreover, double axes are provided with two blades, a feature that doubles the period of use of the tool, until the next sharpening of the blades is required. Modern experimental methods[30] have tested the manufacture and durability (use-wear) of bronze double-edged axes on various materials, such as wood, stones and animal bones. However, experimental archaeology has to address quite a few theoretical issues, as we are not yet in a position to securely reconstruct the manufacturing process or

27 Spyropoulos 1972; Knapp et al. 1988, 233–262; Borgna 1995, 7–55; Jung 2007, 232–239; Kleitsas 2013a, 53–66.
28 Generally, see Coghlan 1975, 50–74. Especially for Minoan double axes: Lowe Fri 2011, 7–34. Here, casting defects are codified, using the following terms: casting joints, impressions of sand, scabs, dirt inclusions, gas- and blowholes, traces of runners, wedging grooves, shrinkage cavities, hot tears, hot cracks or cold tears, cold lapping etc.
29 Lowe Fri 2011, 13 f. This specific type of bivalve mould has not been archaeologically attested, since it is made of perishable materials (wood and sand). Its use involves the manufacture of the object's pattern, as probably is the case of a lead axe from Sesklo (Tsountas 1908, 354 f.) and three lead spearheads from Tiryns (Kilian 1984, 56 f. 72), objects that do not seem to fulfil a plausible practical function. Six clay replicas of double-edged axes on display in the Museum of Pavlos and Alexandra Kanellopoulou in Athens could have served the exact same purpose of patterns, unless of course they were votive offerings, as this was not uncommon practise in Minoan sanctuaries.
30 Lowe Fri 2011, 35–74. This is the only published systematic study for the Helladic area. As part of it test experiments were performed, using bronze double-edged replica axes on Scotch fir, birch and oak trees, sandstone and granite, lamb and cattle bones. The test on hard granite failed completely.

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Fig. 39 Cast bronze leaf-shaped spearhead with various shrink holes on the surface (cat. 12)

Fig. 40 Cast bronze double-edged axe of the Helladic type with cold lapping defect (cat. 2)

use of any authentic prehistoric cast bronze artefact. Unquestionably though, use-wear analysis generates important information about the manufacturing defects and probable uses of various objects.

The cast bronze artefacts of the hoard of Stephani do not preserve any specific traces of the manufacturing process, as for example do the rest of the bronze double-edged axes from Epirus. Five of the double-edged axes and the solid cast spearhead (cat. 12: Fig. 39) bear minute irregular pits on the surface, mainly interpreted as shrink holes or otherwise caused by the unintended presence of dirt inclusions during the casting process. The double-edged axe (cat. 2: Fig. 40) with herring-bone decoration on the narrow sides shows extensive wear on one blade that appears as a sharp colour differentiation. This defect[31] is most probably due to the low temperature and poor fluidity of the molten metal (cold lapping) that as a result did not adequately fill the mould. The other two spearheads have a hollow socket, which was contrived around a conical core, as indicated by the joint, where the two ends of the sheet meet. All the bronze objects of the hoard were hammer-worked and have received a finishing surface treatment by grinding and/or polishing.

Decoration is applied in the course of casting or after the solidification of the metal. The group of the five ›Ermones-Kierio‹ double-edged axes displays several plastic features on the elevated collar, which would have been difficult to achieve in a bivalve stone mould. In all probability, these particular objects were manufactured in clay moulds of a single use or by ›sand-casting‹, which would have facilitated the shaping of the plastic elements. On the other hand, the herring-bone decoration on the narrow sides of a double-edged axe (cat. 2) was probably engraved on after the removal of the object from the mould with the use of a small chisel and a hammer. Possibly, the oblique lines at the edges of another double-edged axe (cat. 7) and the linear decoration on a spearhead (cat. 13) were also rendered in the same way.

The most extreme trace of use-wear is the fracturing and final discard of the artefact. Ten out of the fifteen bronze objects of the hoard are fractured, unusable and beyond repair, while another one bears extensive wear and discolourations. Smaller or bigger areas of wear and chipping occur on the blades of the aforementioned axes, implying an intensive use that preceded fracture. Furthermore, two double-edged axes preserve traces of sharpening in the form of fine shallow scratches on the blades, running at right angles to the main axis of the tool. The bronze double-edged axes of Epirus, as it seems, were primarily used as heavy tree-cutting tools[32] in the lush forests of the region. The two cutting edges (a sharpened and a blunter one)[33] could have been employed in the two principal tasks of tree-felling (cutting and splitting), but whether such an approach was actually followed, remains unproven. Further experimental work is required to furnish us with more[34] information.

C. N. K.

31 Lowe Fri 2011, 26. It does not correspond to a common manufacture defect.
32 Hom. Il. 3, 60; 13, 390 f. 612; 15, 711; 17, 520 f.; 23, 114 f. 851. 856–858. 882 f. Hom. Od. 3, 442 f.; 5, 234–236; 9, 391–393. In Homer, the axe appears to be put to various uses: as a wood-cutting implement; as a shipwright tool; as a military weapon; as an instrument of bull sacrifice (›βούφονον‹); as a prize signifying probably an ingot, and as a standardised quantity of raw material. All these could certainly constitute plausible functions for axes.
33 Trevor Hodge 1985, 307 f. (not characteristic for Epirote axes).
34 Mangou – Ioannou 1999, 97: chemical analysis (AAS) on thirteen artefacts from Epirus. Zachou 2007, 44 f. 50 f. 88. 107. 110 f.: metallography on four artefacts from Liatovouni grave 59. The funding for all the following analyses in 2009 was supplied by the Institute for Aegean Prehistory (INST.A.P.-U.S.A.). I warmly thank them for their support.

Cat. no.	Sample no.	Fe	Co	Ni	Cu	As	Se	Ag	Sn	Sb	Te	Pb
2	MA-092040	<0.02	<0.01	0.18	91	0.23	0.008	0.007	8.7	0.009	<0.005	0.14
4	MA-092892	<0.01	<0.01	0.09	85	0.17	0.025	0.003	14.1	0.016	<0.005	0.07
6	MA-092891	0.10	<0.01	0.16	86	0.29	0.005	0.027	13.5	0.008	<0.005	0.06
10	MA-092096	<0.02	0.01	0.28	86	0.24	0.017	0.002	12.7	0.009	0.006	0.10
11	MA-092101	0.23	<0.01	0.02	87	0.28	0.011	0.011	12.8	0.008	0.007	<0.01
13	MA-092043	0.09	<0.01	0.04	88	0.30	0.010	0.004	11.1	0.012	0.008	0.03
14	MA-092099	<0.02	<0.01	0.10	90	0.11	0.011	0.010	9.9	0.005	0.010	0.05

Tab. 2

Cat. no.	Sample no.	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{208}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{206}Pb/^{204}Pb$
2	MA-092040	2.0666	0.83565	38.785	15.683	18.768
4	MA-092892	2.0610	0.83179	38.852	15.680	18.851
6	MA-092891	2.0639	0.83344	38.847	15.687	18.822
10	MA-092096	2.0603	0.83196	38.832	15.680	18.848
11	MA-092101	2.0597	0.83334	38.652	15.638	18.765
13	MA-092043	2.0566	0.82794	38.968	15.688	18.948
14	MA-092099	2.0613	0.83251	38.847	15.690	18.846

Tab. 3

Tab. 2 Chemical composition of the seven objects from Stephani analysed by EDXRF. All values are given in mass percent. Zn and Bi were always below the detection limit of 0.2 and 0.01 %

Tab. 3 Lead isotope ratios of the seven objects analysed. The precision is around ± 0.003 % for the ratios $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$ and up to ± 0.05 % for ratios with ^{204}Pb in the denominator

Chemical and Lead Isotope Analyses

The laboratory at the Curt-Engelhorn-Zentrum für Archäometrie (CEZA) at Mannheim (Germany) analysed seven of the fifteen copper alloy artefacts from the hoard of Stephani. Samples consisted of less than 20 mg, taken from the interior of the objects by means of stainless steel drills. Energy dispersive X-ray fluorescence spectrometry (XRF) served for the measurement of major, minor and trace element concentrations, while lead isotope ratios were obtained by means of multi-collector inductively-coupled plasma mass spectrometry[35] (MC-ICP-MS). The results are given in Tables 2 and 3.

All seven objects investigated, consist of good tin-bronze, with a tin content oscillating between 8.7 and 14.1 %. Such an amount of tin is suited to producing a hard and readily-workable bronze. Mycenaean bronzes from other regions in Greece show comparable tin ratios[36]. Furthermore, we have lead isotope data at our disposal for the same seven objects from the hoard of Stephani. Other research projects arguably have shown that a combination of trace element and lead isotope data provides reliable evidence for identifying the production region of individual copper alloy objects[37]. Important precondition for a successful application of such an approach is not only the availability of comparative archaeometric data from coeval artefacts and from potential ore deposits, but also a typological evaluation of the analysed artefacts, including those used as reference data.

As the lead content of all seven analysed artefacts is well below 1 % (0.14 % being the highest measured value: cat. 2), we can exclude the deliberate addition of lead to the alloy. Instead, we can assume that such small amounts of lead are impurities of the copper and should relate to the copper ore deposits. It is thus possible to use the measured lead isotope ratios for direct comparison

35 Lutz – Pernicka 1996, 313–323; Niederschlag et al. 2003, 61–100.
36 Kayafa 2006, 217 fig. 11, 1.
37 Pernicka 1995, 61; Jung – Mehofer 2013, 175–193; Pernicka 2014, 239–268.

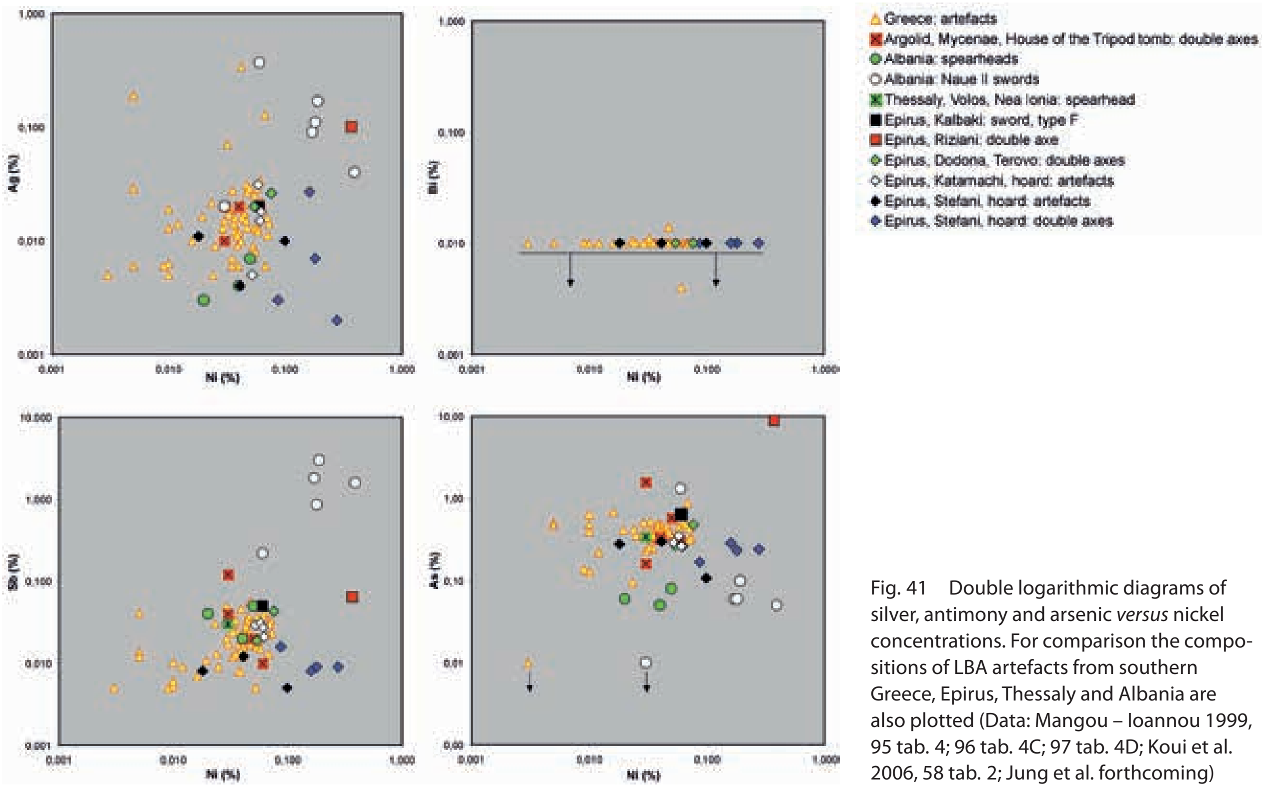

Fig. 41 Double logarithmic diagrams of silver, antimony and arsenic *versus* nickel concentrations. For comparison the compositions of LBA artefacts from southern Greece, Epirus, Thessaly and Albania are also plotted (Data: Mangou – Ioannou 1999, 95 tab. 4; 96 tab. 4C; 97 tab. 4D; Koui et al. 2006, 58 tab. 2; Jung et al. forthcoming)

with other bronze artefacts, which do not contain added lead, but also with ores from different deposits.

A crucial problem in evaluating the archaeometric results is the date of the hoard. Metal hoards can be the result of an accumulation of objects over a considerable period of time, sometimes extending into centuries. Examples from different European regions[38] illustrate this phenomenon quite well. In Mycenaean Greece, the hoard found in the lower town of Tiryns[39] is perhaps the best example for such a practice. The hoard of Stephani includes mainly objects with extended production periods. The well-preserved spearhead (cat. 12) with its fully cast and fluted socket is an exceptional example of this. The exact parallel from the older interment in cist tomb 6 at Nea Ionia[40] (Volos) provides a date to Late Helladic IIB for this type. However, this date can only offer a *terminus ad quem* for the accumulation process and not a deposition date for the whole collection. It may well be that the hoard assemblage was deposited in a later phase of the Late Bronze Age.

Both typological groups of double axes from the hoard of Stephani share similar trace element compositions and lead isotope ratios. Regarding the double axes of Mycenaean type, those from the eponymous tomb inside the ›House of the Tripod Tomb‹ at Mycenae are the only typological parallels, for which analytical data[41] are also available. As the pit of the tomb cuts into the ruin of a house abandoned at the end of Late Helladic IIIB and as the grave goods did not include any pottery, the double axes have a *terminus post quem*, calculated from pottery[42] found inside the house. Apart from two outliers with very high antimony and arsenic concentrations respectively, these double axes used as grave goods fit rather well with the majority of Mycenaean artefacts that come from southern continental Greece[43] and date to the Late Helladic IIIB and IIIC periods (Figs. 41. 42). However, the double axes from the hoard of Stephani are set apart from the main group of Mycenaean artefacts

38 Moscetta 1988, 64–69; Vachta 2016, 103–110.
39 Maran 2006, 128–141.
40 Avila 1983, 14 f. pl. 4, 29. For the stratigraphic context, see Theocharis – Theochari 1970, 202 f. figs. 2. 3 drawing 1 (interment I); for the pottery, see also Mountjoy 1999, 833–835 fig. 334, 36. 41.
41 Gale 1995, 52 tab. II; Mangou 1995, 51 tab. I; Mangou – Ioannou 1999, 95 tab. 4A. For trace element analyses the laboratory of the National Archaeological Museum in Athens used Atomic Absorption Spectrometry (AAS). Comparative measurements made at Mannheim on some of the objects analysed in Athens revealed that for the elements silver and nickel the results of both labs are well comparable, while for arsenic and especially for antimony we can observe systematic offsets. Antimony concentrations tend to be higher in the Athens AAS data.
42 Onassoglou 1995, 24–27 drawings VII–IX; 30 f. figs. 1–6. 43 b; 44, 1. 2.
43 Analysed in another program by R. Jung and M. Mehofer at the Mannheim lab (see Jung – Mehofer 2013, 175–193; Mehofer – Jung 2017, 389–400).

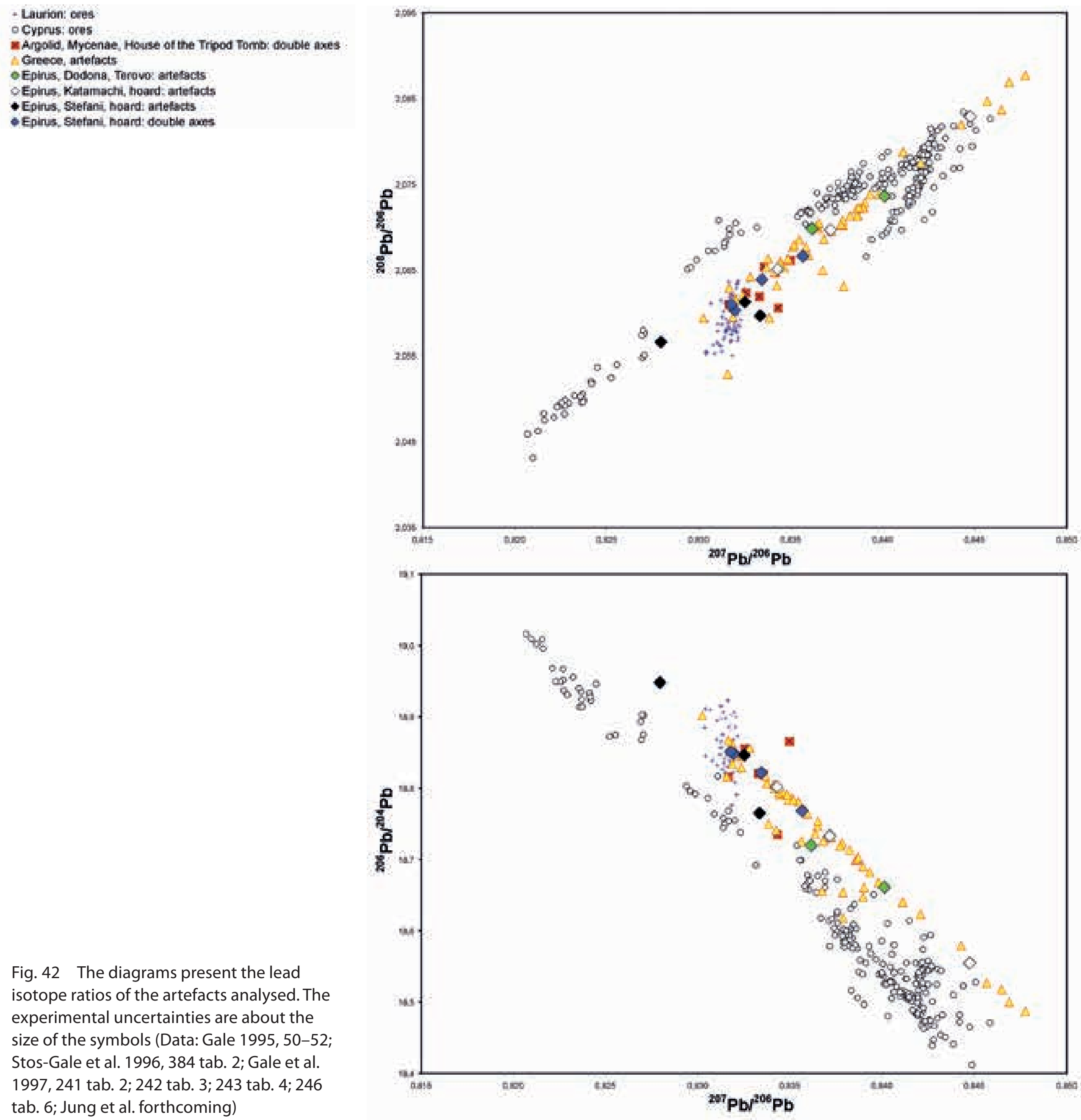

Fig. 42 The diagrams present the lead isotope ratios of the artefacts analysed. The experimental uncertainties are about the size of the symbols (Data: Gale 1995, 50–52; Stos-Gale et al. 1996, 384 tab. 2; Gale et al. 1997, 241 tab. 2; 242 tab. 3; 243 tab. 4; 246 tab. 6; Jung et al. forthcoming)

by their high nickel concentrations and partially also by rather low arsenic and antimony concentrations, although some Mycenaean artefacts from southern Greece do show comparable antimony and arsenic values. The lead isotope data place the four analysed double axes from Stephani (two of Mycenaean and two of ›Ermones-Kierio‹ type) into the main group of Late Bronze Age bronze objects from Mycenaean Greece, to which also three of the four analysed double axes from the burial inside the ›House of the Tripod Tomb‹ belong. However, the fact that the trace element compositions of the four double axes from Stephani (cat. 2. 4. 6. 10) differ markedly from the elemental range of Mycenaean bronzes from southern Greece suggests that none of them contains copper from those sources, supplying the southern metal workshops.

The pointed rod (cat. 14) from Stephani resembles the double axes in its trace element composition, as well as in its lead isotope ratios. We can thus ascribe it to the same compositional group. The two analysed fragmentary spearheads (cat. 11. 13) from Stephani show the split socket that is characteristic for Mycenaean spearhead production and constitutes a typological trait that sets them apart from western and central Balkan spearheads in general and from specific northwestern Greek spearheads in particular. One of the two analysed spearheads (cat. 11) belongs with the main group of bronzes from southern Mycenaean Greece. This applies both to its lead isotope ratios and to its trace element concentrations. Given the fact that none of the other six objects tested here directly relates to the metal that was in circulation in southern Greece, we tend to interpret this spearhead as a weapon imported to Epirus rather than as a local product, manufactured with copper imported from eastern Mediterranean via southern Greece. The second analysed spearhead (cat. 13) has a silver concentration (0.004 %), which is somewhat lower than the silver concentrations of the main group of southern Mycenaean bronzes. Moreover, its $^{207}Pb/^{206}Pb$ ratio clearly separates it from all those Mycenaean artefacts. In conclusion, it neither is a southern import itself nor was it produced by using copper imported from the south. We did not analyse the third and best preserved spearhead (cat. 12), but the team of the laboratory in the National Archaeological Museum in Athens has analysed[44] its exact parallel from tomb 6 at Nea Ionia. Not all relevant trace elements have been measured, but the arsenic, antimony and nickel concentrations fit well with the main group of Mycenaean artefacts from southern Greece. It is therefore possible that also the fluted spearhead from the hoard of Stephani is an import from the heartland of Mycenaean Greece.

Further interpretation of the analytical data comes up against the difficulty that only few publications of other such data from northwestern Greece exist today. The sole exception, providing both trace elemental data and lead isotope ratios, is the Submycenaean (or Early Protogeometric) cist tomb from Kouvaras in Acarnania with five analysed bronze artefacts. In terms of trace elements and of lead isotope ratios, the type-F sword[45] from this tomb is a clear member of the main group of southern Mycenaean artefacts. By contrast, the bimetallic knife and the Allerona-type sword[46] show lead isotope ratios that lay far beyond the range of the artefacts from Stephani.

The bronze hoard from Katamachi[47], which mainly consists of Mycenaean-type double axes, but includes one socketed chisel and one anvil in addition, offers a totally different picture, regarding the chemical composition and lead isotope ratios of the single objects. This assemblage will be treated in detail on another occasion, but we briefly mention the main results of its archaeometric analysis[48] here. Regarding the trace element concentrations, the two analysed double axes, as well as the other two implements, all fall into the range of the main group of Mycenaean artefacts from southern Greek sites (Fig. 41). The lead isotope data of the chisel, the anvil and one of the double axes confirm this assignation to the southern Mycenaean bronze production (Fig. 42), but the second double axe does not fit with this group. These analytical results of the hoard of Katamachi suggest that people in Epirus did have access to Mycenaean bronze products or to raw metal imported via southern Greek regions. The notable difference in analytical results between the two Epirote hoards may be due to chronological factors, but we will postpone this discussion to a future paper.

The National Archaeological Museum in Athens has also analysed the Mycenaean-type double axes from Terovo and Riziani, as well as a short sword of

44 Mangou – Ioannou 1999, 96 tab. 4C (Archaeological Museum of Volos, inv. 4439).
45 Stavropoulou-Gatsi et al. 2012, 252 f. fig. 6 b; 256 f. figs. 9. 10; Jung et al. 2017, 87 f. fig. 7 b; 92–95 figs. 10. 11.
46 Stavropoulou-Gatsi et al. 2012, 252–254 figs. 6a. 8; 256–259 figs. 9. 10; Jung et al. 2017, 85 fig. 6; 87 f. fig. 7a; 92–97 figs. 10. 11.
47 Vokotopoulou 1972, 112–119.
48 Six artefacts from the Katamachi hoard have already been analysed with AAS and published (Mangou – Ioannou 1999, 97 tab. 4E). We have re-analysed four of the objects by XRF and MC-ICP-MS in the framework of our project at the Mannheim laboratory. In order to base the archaeological conclusions on comparable results, we use only these new analyses in our discussion.

Sandars' type F from Kalbaki, by Atomic Absorption Spectrometry (AAS)[49]. We have also analysed the first artefact in the framework of our project. Although the Athens AAS results are not fully compatible with the XRF results we are discussing here, in the specific cases no interpretative differences arise. The sword may be an import, as its trace element concentrations fit with those of southern Mycenaean finds analysed by XRF at Mannheim (Fig. 41). The same is true for the Mycenaean-type double axe from Terovo and for a third one from Dodona (Fig. 41). The latter has not been analysed in the Athens laboratory. The trace element concentrations and the lead isotope ratios of the Dodona and Terovo double axes group them with the bulk of Mycenaean bronzes from southern Greece analysed at Mannheim (Figs. 41. 42). By contrast, the relevant trace element concentrations of the Mycenaean-type double axe from Riziani do not coincide with any of the artefact groups from Epirus or southern Greece, while the differences are far too large to be solely due to the use of a different analytical method (Fig. 41).

A group of weapons from Albania offers a final possibility of comparing the Stephani objects to artefacts from a neighbouring region. The laboratory of the National Archaeological Museum in Athens published its AAS results[50] for these objects some years ago. The Albanian finds include different sword types, belonging to the Naue II family, as well as spearheads of apparently regional types[51]. Although no lead isotope analyses are available for these Albanian weapons, it is indicative that neither the swords nor the spearheads match the groups of the Stephani hoard. The differences in trace element concentrations have magnitudes that go beyond the detected offsets between the XRF and AAS methods. Regarding the Naue II swords, a chronological factor may be involved, as these weapons[52] came into use in Greece not earlier than the middle of Late Helladic IIIB, while the Stephani hoard most probably postdate this period (see above).

If we go beyond Albania and search for compositional data from other bronzes still further to the north, we can compare the alloys of the Stephani bronzes to those of some recently published bronzes[53] from Bosnia. Those weapons and implements represent various Urnfield types and date to different phases, ranging from Ha A1 to Ha B3. While the arsenic and nickel concentrations do show a certain overlap between the bronzes from Bosnia and the Stephani bronzes, the differences in the other trace element concentrations are too large to suggest a common origin of their copper.

Keeping in mind the still rather limited insight that the analytical results of the Stephani bronzes offer, we can draw some conclusions, regarding the Late Bronze Age copper workshops in Epirus. First, the analytical evidence suggests that those workshops operated in a way that was partly independent from the metal circulation in southern Mycenaean Greece. They often used copper of a so far unknown provenance. Moreover, the raw copper used in Late Bronze Age Epirus seems to have originated from ore deposits other than those providing the copper used in Albania at the end of the Late Bronze Age. This evidence may suggest that most of the bronzes assembled in the hoard of Stephani are products of one or more regional Epirote workshops. The typological traits of some of their products reflect relations to Balkan regions, while others show clear Mycenaean influence. The analytical results of objects from the hoard in combination with those of other Late Bronze Age finds from the region suggest that at the time when Stephani hoard was assembled, the people of Epirus only occasionally imported finished products from the realm of the Mycenaean kingdom further south.

R. J. – M. M.

49 Mangou – Ioannou 1999, 97 tab. 4D (Archaeological Museum of Ioannina, inv. 116, 439 and 3333). For the compatibility of results between Mannheim (XRF) and Athens (AAS) see n. 41. Unfortunately, no lead isotope analyses were carried out on these artefacts by the National Archaeological Museum in Athens. For the objects, see Buchholz 1959, 50; Dakaris 1961/1962, 196 pl. 225; Kilian-Dirlmeier 1993, 85 pl. 33, 210.
50 Koui et al. 2006, 58 tab. 2.
51 Koui et al. 2006, 53 figs. 3. 4; 58 tab. 2.
52 Jung 2006, 177–179 pl. 15, 2. 4.
53 Gavranović – Mehofer 2016, 87–107.

Cat. no.	Sample no.	Object	Sampled section
4	MA-092892	double axe	cutting edge
6	MA-092891	double axe	cutting edge
10	MA-092096	double axe	near the shaft-hole
11	MA-092101	spearhead	socket-blade
14	MA-092099	pointed rod	shaft

Tab. 4 List of the five objects from the hoard of Stephani metallographically analysed

Metallographic Analyses

Within the framework of this co-operation eighteen objects (including those from the hoard of Stephani), found in the wider region of Epirus, were examined and sampled for analysis. Out of these, five artefacts from the hoard of Stephani (Tab. 4) were chosen for metallographic analysis.

The samples were cut out with a goldsmith's saw. Subsequently, the objects were restored. The total width of each sample lies within 1–3 mm, while their length depended on the objects. Generally, only those sections of an object are sampled, which show a high probability of being treated with a special smithing technique[54]. The samples were cast into resin and afterwards ground and polished, in order to examine the microstructure[55] of the items and so to determine the production techniques used. Working metal by casting, forging, annealing, cold hammering and other techniques leaves characteristic structures in the microstructure of the metal, which can be recognised in a cross-section. Techno-typological features identified in this way can help to define the quality and origin of individual artefacts. It is also possible to categorize assemblages and even, under ideal circumstances, to identify[56] workshops or similar technological circles.

The samples are characterised by using metallographic parameters. These are: the internal structure of the object (this includes the identification of various metal structures and non-metallic particles in the object), impurities (i. e. non-metallic inclusions in various areas), hardness as well as the chemical composition of the metal. The analyses were carried out in the metallographic laboratory of the Vienna Institute for Archaeological Science (VIAS) at the University of Vienna, Austria. The samples were analysed[57] with a scanning electron microscope (Zeiss EVO 60 XVP, EDX-Inca 400, Oxford Instruments).

The examined double axes (cat. 4. 6. 10: Figs. 43–45) are broken in two pieces, with parts of the objects missing. This damage may be seen as the result of an intentional destruction. The surfaces of the objects are very well ground and polished. Some are decorated with patterns composed of small grooves (cat. 2). Two axes were sampled at the cutting edge, because one can assume that this section is hammered, annealed and ground, while on the other parts of the object no specific smithing technique may have been used. The cutting edges of the two examined axes (cat. 4. 6) were hammered and ground, which proves that the objects were prepared for everyday use. The analyses further show that several circles of hammering and annealing were carried out. We can observe recrystallised grains with numerous annealing twins and elongated sulfides. As a final step the cutting edges have been intensively cold worked. The hardness testing of the samples revealed that levels of 171 HV 0.3/15 (cat. 4) to 205 HV 0.3/15 (cat. 6) were reached. This is nearly as good as unhardened steel. A sample taken near the shaft-hole of the third double axe (cat. 10) proves that this section was also hammered and annealed. It has to be

54 Sperber 2004, 329; Jung – Mehofer 2013, 183.
55 Schumann 2005, 75–94.
56 Mehofer 2015, 235.
57 Mehofer – Kucera 2005, 56–63.

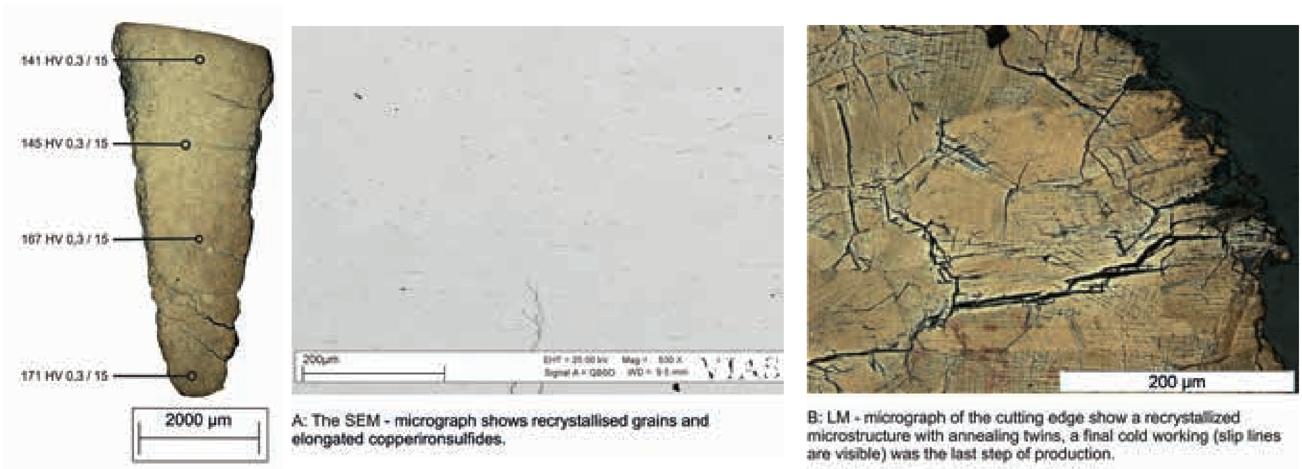

Fig. 43 Micrographs showing overview of the hardness testing and the microstructure (cat. 4)

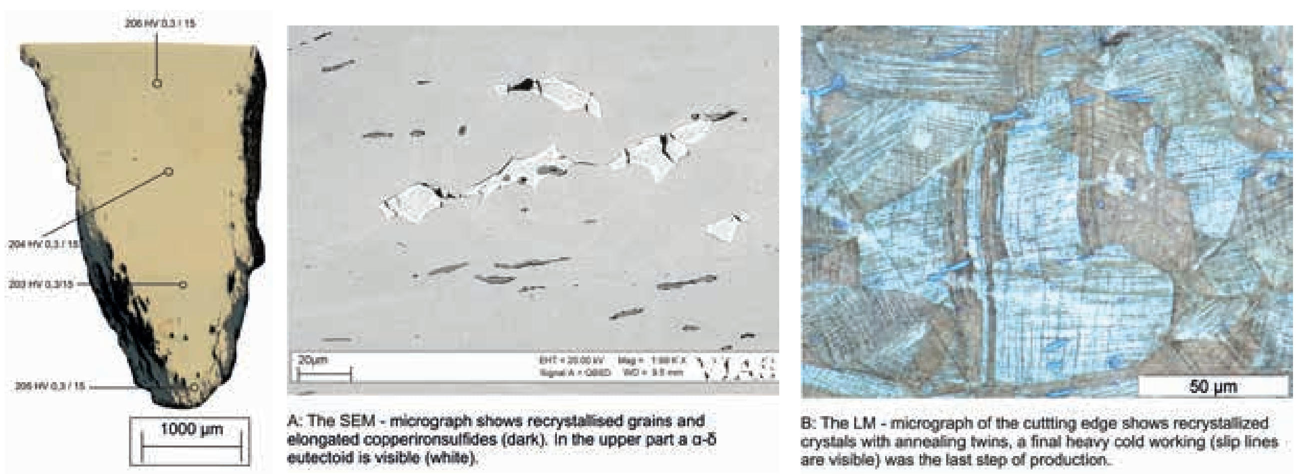

Fig. 44 Images presenting an overview of the hardness testing and the microstructure (cat. 6)

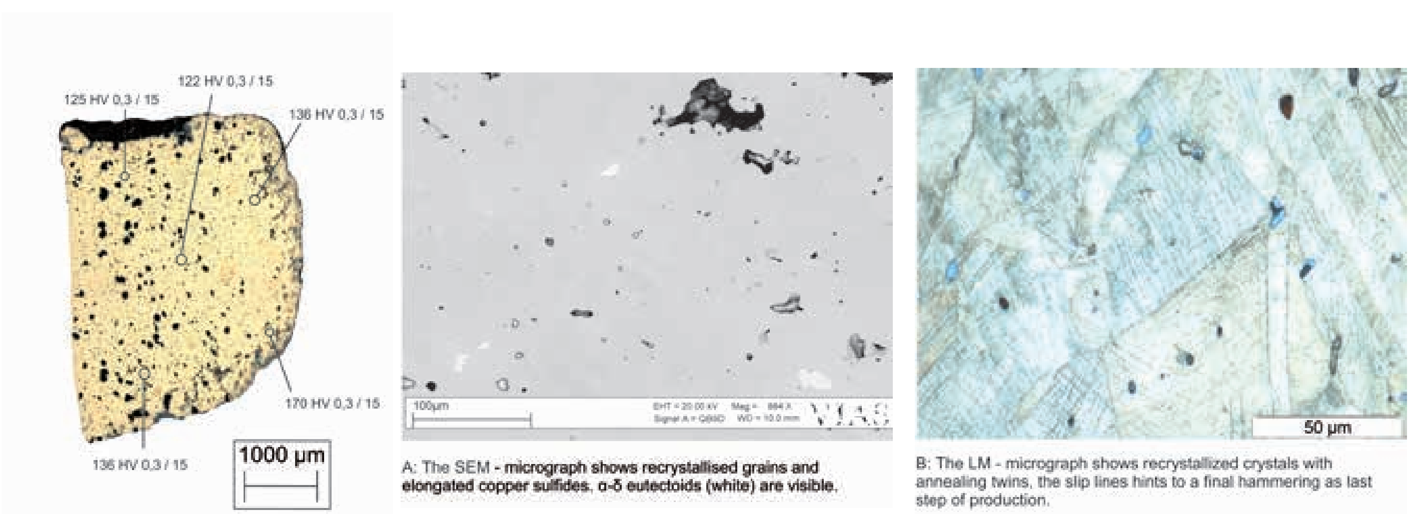

Fig. 45 Micrographs showing overview of the hardness testing and the microstructure (cat. 10)

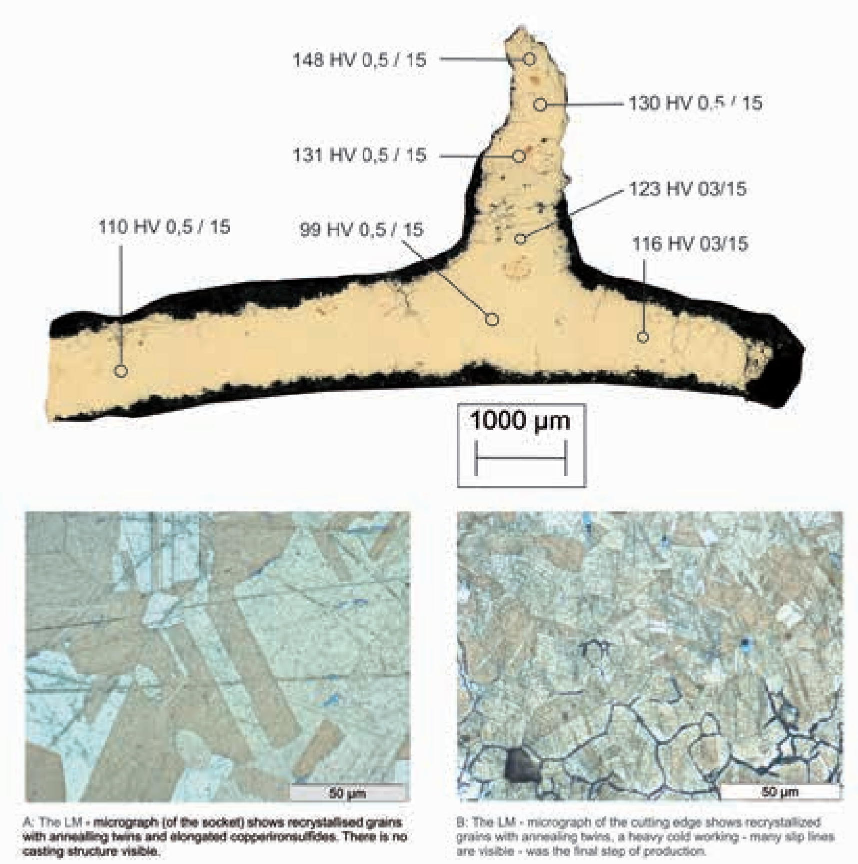

Fig. 46 Photographs showing overview of the hardness testing and the microstructure (cat. 11)

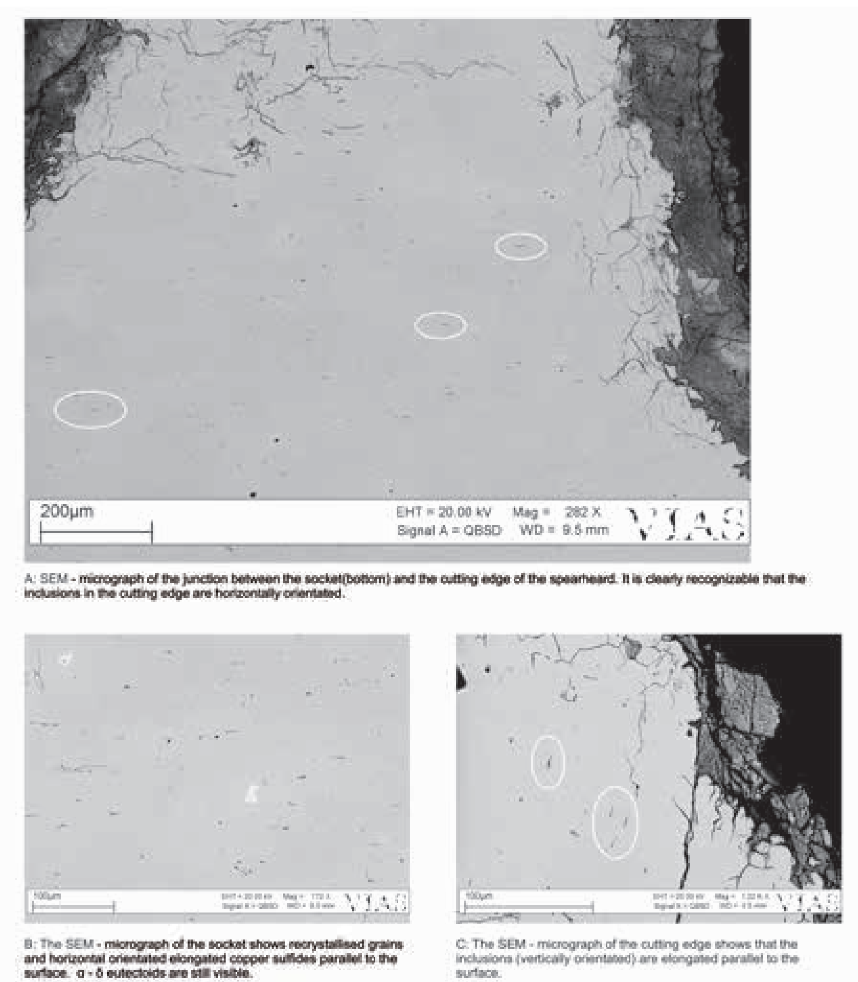

Fig. 47 Micrographs displaying different observable metallographic details (cat. 11)

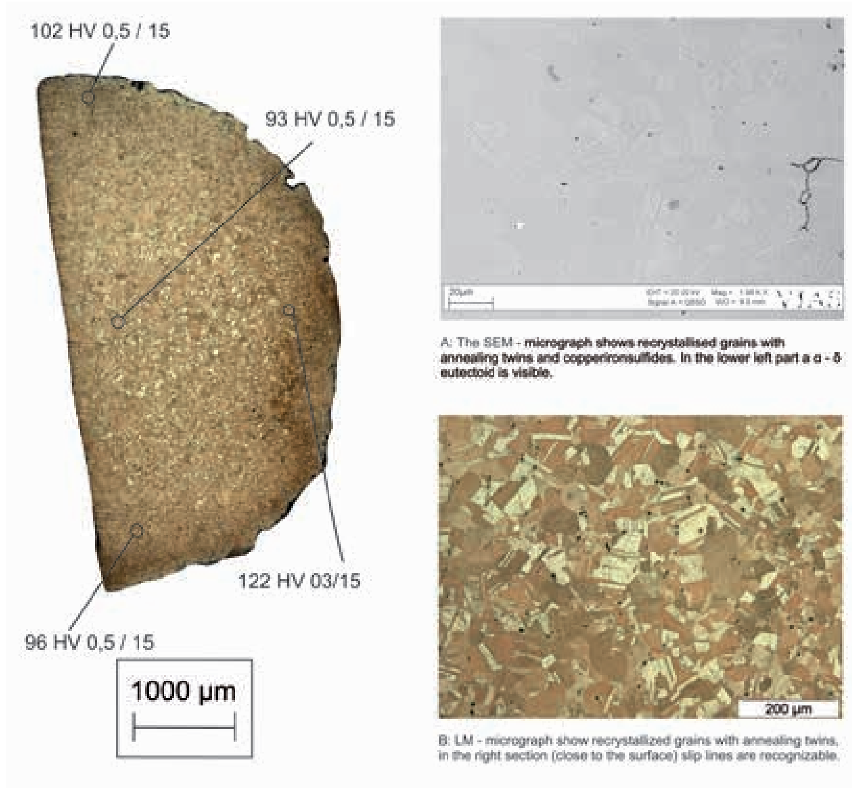

Fig. 48 Images showing overview of the hardness testing and the microstructure (cat. 14)

stated though that here the hammering was not very intensive, because the shrink holes close by still have a globular form. The above described results indicate that the cutting edges were annealed very extensively, while annealing elsewhere of the axe body was not so strong. This is also confirmed by the results of the hardness testing, as the hardness oscillates between 122 and 170 HV 0.3/15. In some of the micrographs we can still observe an α–δ eutectoid as remnant of the former dendritic casting structure.

The spearhead (cat. 11: Figs. 46. 47) was examined to get information about the production technology of this specific artefact group. As described above, one spearhead (cat. 12) was cast whole. In contrast, the socket of the spearhead (cat. 11) was hammered and annealed several times, as is documented by elongated shrink holes and copper-iron-sulfides. In the micrograph of this socket one can observe an α–δ eutectoid, which means that this section was first cast and then hammered. The cutting edge was finally cold hammered, as the value of the hardness testing rises up to 148 HV 0.5/15. In the micrograph of the junction between socket and cutting edge one can see that the inclusions are still horizontally orientated. If the socket was simply cast, they should be globular. Alternatively, if the cutting edge was produced only by forging, their orientation should be vertical. Thus, the evidence supports none of these two possibilities. We may then argue that the blade and the socket of the spearhead were first roughly cast. Subsequently, the socket and the cutting edge were drop forged. Finally, the socket was contrived around a conical core, as can be seen in the pictures of the inner part of the socket.

The micrographs of the pointed rod (cat. 14: Fig. 48) show that this object was intensively hammered, as no shrink holes are visible. It seems possible that the rod was already cast with a circular cross section and then forged, because the sulfidic inclusions are still globular and not elongated. This patterning means that the object was hammered in an even way from all sides.

The micrographs of all the Late Bronze Age finds show recrystallised grains, which leads to the conclusion that the smiths mastered the technology of glowing, annealing and homogenising the bronze very well. This technology is necessary to forge a bronze object, without damaging it by too much intensive hammering. Hammering bronze without annealing would cause it to become brittle and break after some time of cold working. The micrographs further indicate that the objects were cast and afterwards hammered at different degrees of intensity. The results of the analysis of the double axes show that they were cast in a two-part mould and then annealed completely (not only the cutting edge) and so reworked. The cutting edges were hammered and annealed several times, increasing the resistance against breaking. As a last step they were cold hammered and not annealed, which increases the hardness of the cutting edge and as a result the usage properties of the axe. These observations further indicate that the double axes could be used for everyday work. The examination of the spearhead (cat. 11) gave a detailed insight into the production technology of these objects. The micrographs make it possible to postulate that the body of the spearhead and a (flat) part of the socket were cast. This was then reworked and probably drop forged to its final shape, to achieve the cutting edge. As a last step the socket was convolved.

It has to be observed here that metallographic analyses of Mycenaean objects dating to the Late Bronze Age are largely missing[58]. We may refer to two analysed greaves and one cauldron from Late Helladic IIIC and Submycenaean contexts from Kouvaras and Kallithea[59]. Their examination allows for the existence of similar forging techniques. The metal of the greaves (made of tin-bronze) was cold hammered, annealed and finally cold hammered again to enhance the hardness of the bronze used. The same technological steps were applied to various Naue II swords, which were found in Achaia and date to Late Helladic IIIC. In a recent research project the metallographic analyses[60] revealed that these swords underwent numerous forging and annealing circles. Even though we have at our disposal just these few analyses for comparison, we can yet recognize the existence and details of a quite well developed system of metalworking for the region of Epirus.

M. M.

Appendix: Catalogue of the Objects from the Hoard of Stephani

1 Bronze double-edged axe, AMI 7505 (Figs. 5. 10)
Length: 22,8 cm; height of blades: 7,9–8,0 cm; mid-point height: 4,6 cm; mid-point thickness: 2,5 cm; hole diameter: 1,5–1,6 cm × 3,5–3,6 cm; weight: 1128 g.
Bronze cast double-edged axe with elliptical shaft-hole. Intact with bevels at the functional cutting edges. Manufacturing defects in the form of small pits as probable indications of dirt inclusions and minor use-wear. Oxidation on the polished surface.

2 Bronze double-edged axe, AMI 7506 (Figs. 6. 11. 15. 40)
Length: 21,1 cm; height of blades: 9,3–9,6 cm; mid-point height: 6,3 cm; mid-point thickness: 2,7 cm; hole diameter: 1,6 cm × 3,2–3,3 cm; weight: 1596 g.
Bronze cast double-edged axe with elliptical shaft-hole and bevels at the cutting edges. Chipped and incomplete for one blade and two bevels, while the other blade is blunted. Several traces of use-wear and alterations of colour

58 With some few exceptions like e. g. Hauptmann et al. 2002, 4–13 figs. 4–12; Koui et al. 2006, 49–59; Papadimitriou 2008, 271–287.
59 Stavropoulou-Gatsi et al. 2012, 260 fig. 11.
60 Jung et al. forthcoming.

differentiation, making the object non-functional. Decoration of three shallow grooves, running along the long sides on both faces. On the narrow sides decoration of two rows of oblique chevrons in dense arrangement, forming in pairs a broader herring-bone band. Oxidation on the polished surface.

3 Bronze double-edged axe, AMI 7507 (Figs. 7. 12)
Length: 19,1 cm; height of blades: 8,7–8,8 cm; mid-point height: 5,9 cm; mid-point thickness: 2,6 cm; hole diameter: 1,6 cm × 3,1–3,2 cm; weight: 1208 g.
Bronze cast double-edged axe with elliptical shaft-hole. Intact with bevels at the functional cutting edges. Minor chipping and use-wear on the surface and blades. Oxidation on the polished surface.

4 Bronze double-edged axe, AMI 7508 (Figs. 8. 13. 43)
Length: 22,8 cm; height of blades: 9,7–10,3 cm; mid-point height: 5,4 cm; mid-point thickness: 2,7 cm; hole diameter: 1,6 cm × 3,1 cm; weight: 1444 g.
Bronze cast double-edged axe with elliptical shaft-hole and bevels at the cutting edges. Broken in the middle, mended from two joining fragments, part of the shaft-hole missing. Chipped and incomplete as to the blades and bevels with several traces of use-wear, making the object non-functional. Oxidation on the polished surface.

5 Bronze double-edged axe, AMI 7509 (Figs. 16. 21)
Length: 22,8 cm; height of blades: 7,3–7,5 cm; mid-point height: 8,5 cm; mid-point thickness: 2,7 cm; hole diameter: 1,6–1,7 cm × 3,8–4,1 cm; weight: 976 g.
Bronze cast double-edged axe with elliptical/eye-shaped shaft-hole. Intact with bevels at the cutting edges, slightly elevated dorsal ridge and raised midrib above. Correspondingly elevated collar with vertical net decoration in relief, curved lower outline. Horizontal scratches of sharpening tool on the surface and minor use-wear on the functional cutting edges. Oxidation on the polished surface.

6 Bronze double-edged axe, AMI 7510 (Figs. 17. 22. 44)
Length: 20,5 cm; height of blades: 6,8–7,3 cm; mid-point height: 7,8 cm; mid-point thickness: 2,3 cm; hole diameter: 1,5–1,6 cm × 3,6–3,9 cm; weight: 823 g.
Bronze cast double-edged axe with elliptical/eye-shaped shaft-hole and bevels at the cutting edges. Slightly elevated dorsal ridge and raised midrib above. Correspondingly elevated collar with vertical net decoration in relief, curved lower outline. Broken in the middle, mended from two joining fragments, two parts of the shaft-hole and collar missing. Considerable use-wear on the blades, bevels and ridge, making the object non-functional. Oxidation on the polished surface.

7 Bronze double-edged axe, AMI 7511 (Figs. 9. 14)
Length: 22,5 cm; height of blades: 9,6–10,2 cm; mid-point height: 4,9 cm; mid-point thickness: 2,6 cm; hole diameter: 1,6 cm × 3,1 cm; weight: 1303 g.
Bronze cast double-edged axe with elliptical shaft-hole and bevels at the cutting edges. Broken in the middle, mended from two large joining fragments and a smaller third one. Chipped and missing two parts of the blades with use-wear, making the object non-functional. Decoration of incised oblique lines on the edges of the faces. Oxidation on the polished surface.

8 Bronze double-edged axe, AMI 7512 (Figs. 18. 23)
Length: 25,8 cm; height of blades: 10,1–10,4 cm; mid-point height: 10,3 cm; mid-point thickness: 2,6 cm; hole diameter: 1,7–1,8 cm × 3,2–3,3 cm; weight: 1307 g.
Bronze cast double-edged axe with elliptical/eye-shaped shaft-hole and bevels at the cutting edges. Slightly elevated dorsal ridge and raised midrib above. Correspondingly elevated collar with vertical net decoration in relief, curved lower outline. Broken in the middle, mended (wrongly) from two joining fragments, two parts of the shaft-hole and collar missing. Use-wear on the blades and ridge, making the object non-functional, traces of whetstone use on the blades. Oxidation on the polished surface.

9 Bronze double-edged axe, AMI 7513 (Figs. 19. 24)
Length: 25,7 cm; height of blades: 9,3–10,6 cm; mid-point height: 9,8 cm; mid-point thickness: 2,9 cm; hole diameter: 1,6–1,8 cm × 3,8–4,5 cm; weight: 1509 g.
Bronze cast double-edged axe with elliptical/eye-shaped shaft-hole and bevels at the cutting edges. Slightly elevated dorsal ridge and raised midrib above. Correspondingly elevated collar with vertical net decoration in relief, curved lower outline. Broken in the middle, mended from two joining fragments, two large parts of the shaft-hole and collar missing. Chipped and incomplete as to the bevels and ridge with only minor use-wear on the blades, making the object non-functional. Oxidation on the polished surface.

10 Bronze double-edged axe, AMI 7514 (Figs. 20. 25. 45)
Length: 21,5 cm; height of blades: 6,2–6,6 cm; mid-point height: 7,1 cm; mid-point thickness: 2,6 cm; hole diameter: 1,7 cm × 3,7–3,8 cm; weight: 937 g.
Bronze cast double-edged axe with elliptical/eye-shaped shaft-hole and bevels at the cutting edges. Slightly elevated dorsal ridge and raised midrib above. Correspondingly elevated collar with vertical net decoration in relief, curved lower outline. Broken in the middle, mended from two large joining fragments and a smaller third one, three small parts at the shaft-hole missing. Chipped and incomplete as to three bevels and ridge with only minor use-wear on the blades, making the object non-functional, traces of whetstone use on one blade. Oxidation on the polished surface.

11 Bronze spearhead, AMI 7515 (Figs. 27. 30. 46. 47)
Length: 19,4 cm; blade width: 3,7 cm; blade thickness: 0,2 cm; socket diameter: 2,5 cm; weight: 158 g.
Bronze spearhead with distinct joint between the two ends of the sheet of the socket. Conical hollow socket with its base distinctly shaped into a ring. Broken, mended up from the main body and two small fragments. Chipped and missing the lower part of the socket and parts of the blade with considerable use-wear, making the object non-functional. Oxidation on the polished surface.

12 Bronze leaf-shaped spearhead, AMI 7516 (Figs. 28. 31. 39)
Length: 15,0 cm; blade width: 2,5 cm; blade thickness: 0,2 cm; socket diameter: 2,0–2,6 cm; diameter of holes: 0,3–0,5 cm; weight: 121 g.
Bronze whole-cast leaf-shaped spearhead. Conical hollow socket with its base distinctly shaped into a ring. In the lower part two small opposed lateral pin-holes for the fastening of the wooden shaft. Fluted, eighteen-sided hollow

socket. Intact and functional with only minor use-wear on the blade. Small irregular pits on the body as probable indications of shrink holes or dirt inclusions. Oxidation on the polished surface.

13 Bronze spearhead, AMI 7517 (Figs. 29. 32)
Length: 19,3 cm; blade width: 1,9 cm; blade thickness: 0,2 cm; socket diameter: 2,3–2,7 cm; weight: 132 g.
Bronze spearhead with distinct joint between the two ends of the sheet of the socket. Conical hollow socket with its base distinctly shaped into a ring. Broken, mended from the main body and three small joining fragments. Chipped and incomplete as to the lower part of the socket and almost the whole of the blade, in addition a crack and extensive use-wear, making the object non-functional. Decorated with ten pairs of shallow engraved lines on main axis. Oxidation on the polished surface.

14 Bronze unidentifiable cylindrical and pointed rod, AMI 7518 (Figs. 33. 34. 48)
Length: 20,3 cm; diameter: 0,5–0,8 cm; weight: 44 g.
Bronze cast cylindrical shaft of an unidentifiable object (probably part of a pin). Underneath the preserved conical tip seven plastic rings. Broken and incomplete at the back, distorted in the middle with an additional crack and minor use-wear. Oxidation on the polished surface.

15 Bronze unidentifiable cylindrical and pointed rod, AMI 7519 (Figs. 33. 34)
Length: 11,2 cm; diameter: 0,5–0,8 cm; weight: 22 g.
Bronze cast cylindrical shaft of an unidentifiable object (probably part of a pin). Underneath the preserved conical tip eight plastic rings. Broken and incomplete at the back with few traces of use-wear. Oxidation on the polished surface.

16 Trapezoidal whetstone, AMI 9468 (Figs. 35. 37)
Length: 16,2 cm; width: 6,0–6,7 cm; thickness: 1,5–2,5 cm; weight: 390 g.
Trapezoidal-hexahedral whetstone. Broken, mended from two fragments and large part missing, chipped and worn in many places. One surface rough and suitable for sharpening use, the other unworked and the narrow sides polished.

17 Rectangular stone tool, AMI 9469 (Figs. 36. 38)
Length: 16,0 cm; width: 5,3–5,7 cm; thickness: 4,3–5,2 cm; weight: 945 g.
Rectangular-hexahedral stone tool with roughly worked surfaces and a small recess on one side. Intact, but considerably chipped and worn. Probably a whetstone.

Abstract

Christos N. Kleitsas – Mathias Mehofer – Reinhard Jung, The Late Bronze Age Hoard of Stephani in Preveza, Epirus, NW Greece

The hoard of Stephani, a remarkable assemblage, was found in 1985 at the head of the Ambracian gulf in Epirus. It consists of seventeen artefacts: ten bronze double-edged axes, three bronze spearheads (one leaf-shaped), two unidentifiable bronze cylindrical and pointed rods and two large stone tools, probably whetstones. The items of the hoard are mainly dated to the final phases of the Late Bronze Age, when the phenomenon of hoarding has yielded similar depositions in the wider Balkan and European regions. Macroscopic observations on typology, manufacture and other matters are combined with metallographic, chemical and lead isotope analyses. This data is used to explore aspects related to the production or manufacture, consumption or use, recycling or deposition of the items, as well as the trading of artefacts and raw materials. The examination of the hoard of Stephani within the geographical and cultural contexts of Epirus in the Late Bronze Age assists the better comprehension of the social structures of the day and the exchange networks of ideas, products and know-how then in operation.

Keywords
Epirus • Stephani • hoard • bronze • analysis

Sources of illustrations
Fig. 1: Hellenic Military Geographical Service • Fig. 2: Google Earth • Figs. 3. 5–9. 16–20. 27–29. 33. 35. 36: C. N. Kleitsas • Fig. 4: photos by K. Ignatiadis with digital synthesis by D. Kalpakis • Figs. 10–14. 21–25. 30–32. 34. 40: K. Ignatiadis • Figs. 15. 37–39: P. Tsigoulis • Fig. 26: D. Kalpakis • Figs. 41. 42: M. Mehofer – R. Jung • Figs. 43–48: M. Mehofer

Abbreviations

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