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Cover: The Bronze Age site of Goutsoura seen from the south. Photo: Björn Forsén

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The Middle Palaeolithic Bifacial Tools from Megalo Karvounari

Nena Galanidou, Christina Papoulia and Stefanos Ligkovanlis

Introduction

The *terra rossa* formation of Megalo Karvounari[1] has repeatedly been the focus of Palaeolithic investigations, from its discovery by Eric Higgs' survey team in 1962[2] to the most recent work conducted by Björn Forsén's survey team in the course of the Thesprotia Expedition in 2005.[3] The site is one of numerous stone-tool bearing red-beds present in the coastal karst of western Epirus. They have been the subject of a long-standing debate on the subject of their geomorphological history and archaeological significance.[4] There is now a wide consensus that these open-air sites are associated with Pleistocene 'perennially spring-fed poljes', that is enclosed basins and depressions, and 'seasonally rain-fed loutses', that is smaller and shallower depressions on limestone plateaus.[5] Coupled with the region's caves and rockshelters, they make up the two pillars upon which interpretations of the Epirotic Palaeolithic settlement pattern have been founded for precisely half a century.

Today's badlands have been vividly envisioned in the past as the remains of Pleistocene oases 'comprising streams, swamps, and lakes, and attracting animal populations as well as lake-dweller hominins' in an otherwise rather bare karstic region.[6] Glimpses of such a potential can still be seen after rainfall, when parts of the Megalo Karvounari basin retain water in pockets that temporarily transform what is otherwise a semi-desert landscape covered with patches of pine trees, prickly oak and hawthorn bushes, and ferns (Fig. 1).[7]

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[1] This research was made possible due to the financial support received from the Thesprotia Expedition which is gratefully acknowledged by all three authors. John McNabb has kindly offered valuable comments on an earlier version of this manuscript. We are also grateful to Karen Ruebens who shared her views regarding the *Keilmesser* tools and provided useful references, Andreas Darlas who communicated with us his views upon the Mousterian of Greece, Vicky Elefanti who shared information on the Lakonis lithic assemblage and Vivian Staikou who contributed to our literature review. All lithic artefacts were drawn by Christina Papoulia and inked by Nikoletta Dolia. Fig. 2 is by Esko Tikkala, whereas Figs. 6, 8, 10 and 14 were made by Sarianna Silvonen in the field. All other photographs are by Christina Papoulia.

[2] Dakaris *et al*. 1964.

[3] Forsén *et al*. 2011, 76; Ligkovanlis 2011.

[4] Bailey *et al*. 1992; Dakaris *et al*. 1964; Higgs and Vita-Finzi 1966; Papagianni 2000; Runnels and van Andel 2003; van Andel and Runnels 2005; Tourloukis 2009; Zhou *et al*. 2000; Papaconstantinou and Vassilopoulou 1997; Papagianni 2000.

[5] van Andel and Runnels 2005, 369 and 379; Ligkovanlis 2014.

[6] van Andel and Runnels 2005, 371.

[7] Until recently Megalo Karvounari functioned as the waste disposal area of the wider Paramythia region; no doubt it will offer a wealth of twentieth-century material culture for the archaeologist of the future to study along with prehistoric artefacts.

Fig. 1. Southwestern part of Megalo Karvounari after a rainstorm in September 2009, looking northeast. In the background the Paramythia mountain range.

Megalo Karvounari is a palimpsest site encompassing multiple episodes of lithic artefact deposition belonging to at least three components: a rich Middle Palaeolithic one,[8] a distinctive early Upper Palaeolithic (i.e. Aurignacian) one[9] and one that we suggest dates to the Holocene and has not been described in any detail as yet. In this study we contribute to the discussion of the Epirotic *terra rossa* sites by presenting the Middle Palaeolithic bifacially worked tools that came to light through the surface collection activity in the southwestern sector of Megalo Karvounari (Fig. 2). We shall examine the typological and technological attributes of these tools and place them in the context of the site, the region and the Greek Palaeolithic.

We shall then review the archaeological and chronological attributes of the limited record of bifacially worked tools in the Greek peninsula, including handaxes and bifacially retouched points on elongated flakes. Whereas the latter group of tools is part of a 'Mousterian with foliates and bifaces' that is known to have spread across northern Europe through the northern Caucasus,[10] the handaxes, larger or smaller, have been ascribed to a variety of taxonomic entities such as the 'Acheulean', the 'Mousterian', the 'Micoquian', and the 'Mousterian of Acheulean Tradition' (MTA). In Greece, these terms are loosely defined by individual scholars, if they are defined at all. This has led to confusion over their application. These cultural labels are important as they carry implicit assumptions about the hominin species who produced the stone tool assemblages. Here, we shall disentangle the cloud of terminology and spell out the emerging properties of the biface industries present in the Greek record.

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[8] Papaconstantinou and Vasilopoulou 1997; Papagianni 2000; Ligkovanlis 2011.
[9] Forsén *et al*. 2011, 76; Ligkovanlis 2011.
[10] Bar-Yosef 2006, 469, fig. 1

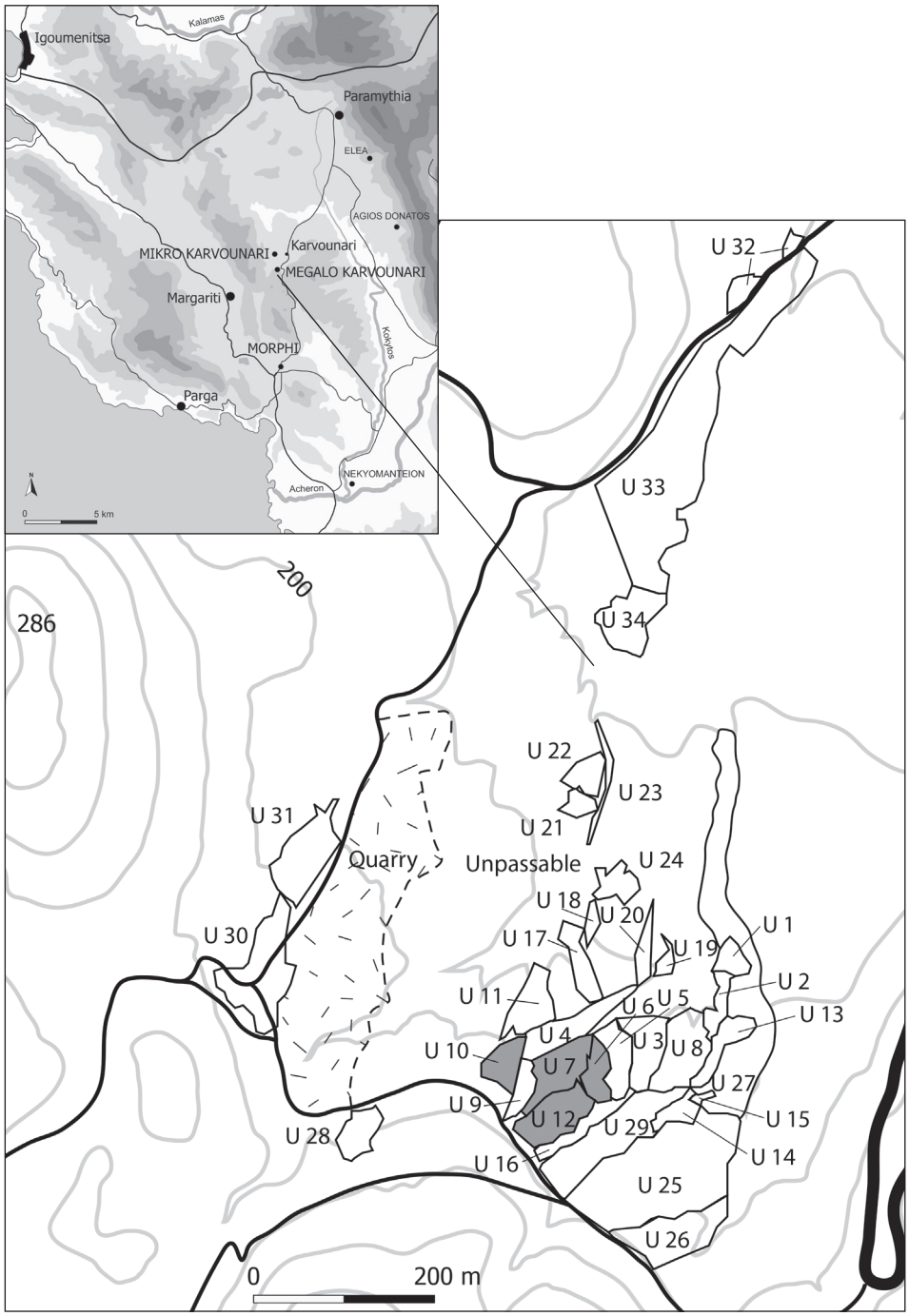


Fig. 2. Plan of Megalo Karvounari with Units 6, 7, 10 and 12 shaded.

The Megalo Karvounari bifaces in their site context

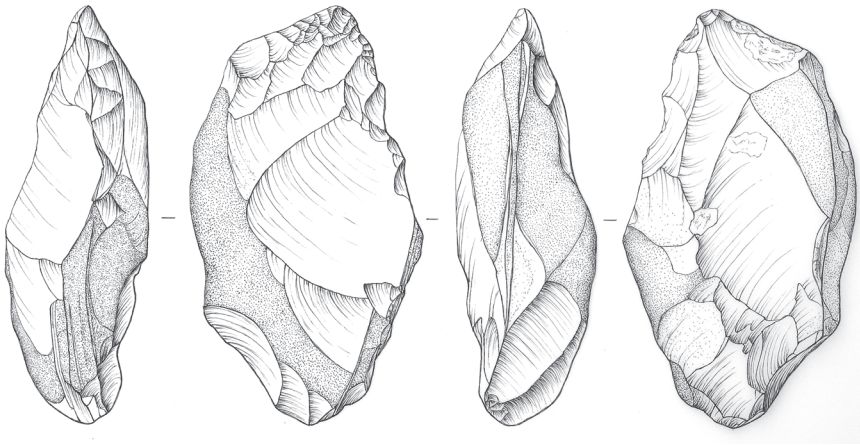
Recovery and study methods

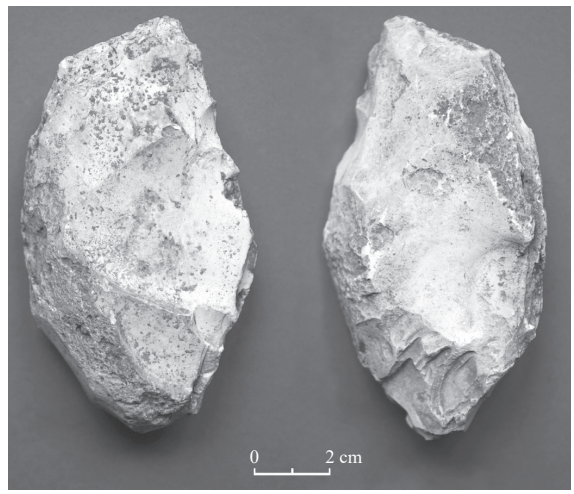
Most of the sites identified during the survey conducted by the Thesprotia Expedition were intensively searched in 10x10 m or 20x20 m squares.[11] At Megalo Karvounari, PS 22, (and its twin site Mikro Karvounari, PS 23), the very undulating and uneven terrain prompted a somewhat different strategy to the one used at other sites in the Kokytos valley located in flat areas with a smoother relief. The two *terra rossa* sites were instead subdivided into units of variable spatial extent, each defined and delimited by the presence of landscape features such as gullies or ridges. Within each spatial unit, all flint pieces which seemed to be probable artefacts were collected, as well as a few samples of different types of raw material nodules. Artefacts were bagged with reference to their specific spatial unit which provides the minimum provenance unit for the majority of Megalo Karvounari finds except for the finds of Unit 24; this was further subdivided into 10x10 m squares.

The bifacially worked tools and the diagnostic tools, cores and debitage recovered from the site in summer 2005 are presented and illustrated. In order to contextualize these surface finds and given that the PS 22 stratigraphy is poorly researched, greater emphasis was placed on the horizontal scale of reference, that is on units in close spatial association with Units 6 and 12, where the backed bifaces were found (Fig. 3). In particular, the lithic assemblage from Units 4, 5, 7, 8, 9, 10 and 16, those surrounding the biface-bearing units, was examined in terms of artefact technology, typology, surface alterations and metrical attributes. Measurements of artefacts were taken at their longest point parallel to

Fig. 3. Part of Megalo Karvounari, Unit 6, view towards the north.

[11] Forsén *et al*. 2011, 76; Forsén *et al*., this volume.





Figs. 4-5. Backed biface of Keilmesser type, MK6.1, from Unit 6.

their flaking axis (length), at their widest point perpendicular to their flaking axis (width) and at their thickest point (thickness). Additionally, each bag from the rest of the units of the entire site was opened and, through a judgemental sampling strategy, a number of diagnostic tools of the earliest component were also included in this study.

The two Keilmesser (asymmetric backed bifaces)

The Megalo Karvounari tool inventory contains two bifacially worked tools that fall within the definition of backed bifaces or *Keilmesser* types, a group of bifacially worked tools that dominate the Micoquian or *Keilmessergruppe* techno-complexes of northwestern, central and eastern Europe.[12] Bifaces of this type are characterised by natural backing, assymetric, non-covering retouch and a rectangular cutting edge. To the east of the Rhine *Keilmesser* dominate the Micoquian assemblages, although they occasionally occur in different Middle Palaeolithic assemblages to the west of the Rhine.[13]

[12] Jöris 2006.
[13] Ruebens 2013; Ruebens 2006, 69.

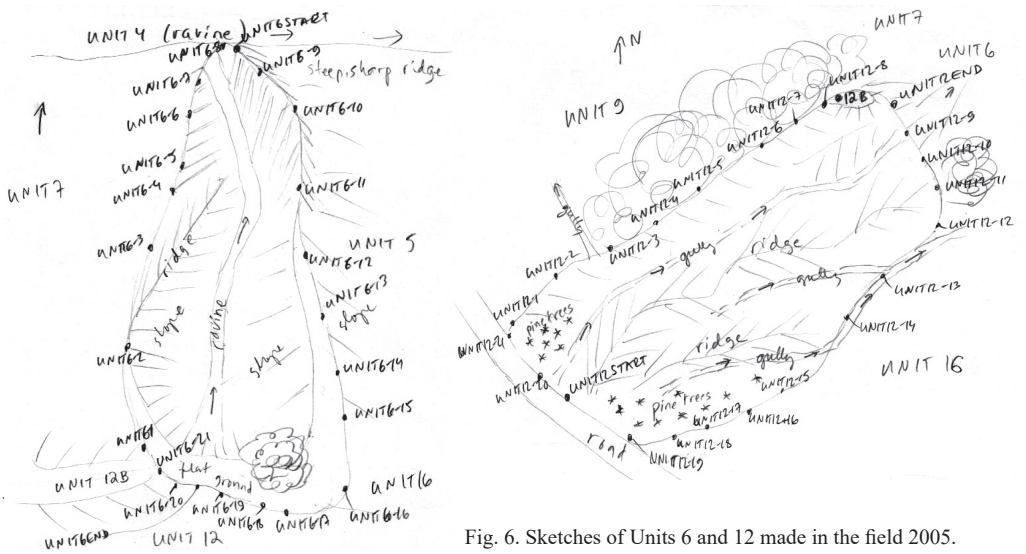


Fig. 6. Sketches of Units 6 and 12 made in the field 2005.

MK6.1 (Figs. 4-5), from Unit 6, which is an elongated unit situated in the southern part of the site comprising a ravine to the north of the dirt road (Fig. 6), was produced on a relatively flat, fine-grained flint cobble. It has a heavy white patina and a chalky off-white cortex. It preserves about 25% of its cortex on each face and allows us to assume the initial shape of the flint nodule, which must not have differed much in size from the end-product. Its dimensions are 11×6.1×3.8 cm. The artefact's retouch is bifacial though not covering. Its upper face, in particular its distal end and its right lateral edge, have been more intensively retouched by means of shorter or longer, continuous, scaled removals, while the left lateral has only minor working and preserves most of its initial cortex, subsequently forming a natural back. The biface falls within the definition of the *Keilmesser* types discussed above.[14]

The second backed biface, MK12.1 (Figs. 7-8) comes from Unit 12, defined by the dirt road and just to the north of Unit 6 (Fig. 6). It is a large (8.2×6.5×2.7 cm) tool on a cortical cobble whose small part of preserved cortex forms a natural back. The edge opposite the cortical back has a convergent tip formed by denticulated and bifacial short retouch. The tip has been partially broken. In typological terms, this second bifacially worked tool also bears significant affinities with the backed bifaces of several Micoquian industries of northwestern, central and eastern Europe. This artefact is also made of flint and is highly patinated.

Judging by the type and colour of patination, it is possible, though not certain, that the raw material used in both cases was the fine-grained light blue/grey flint which is often encountered in the Middle Palaeolithic artefacts of Megalo and Mikro Karvounari. It is still abundant in the form of unworked, usually small, nodules at several sites in the Kokytos valley today.[15]

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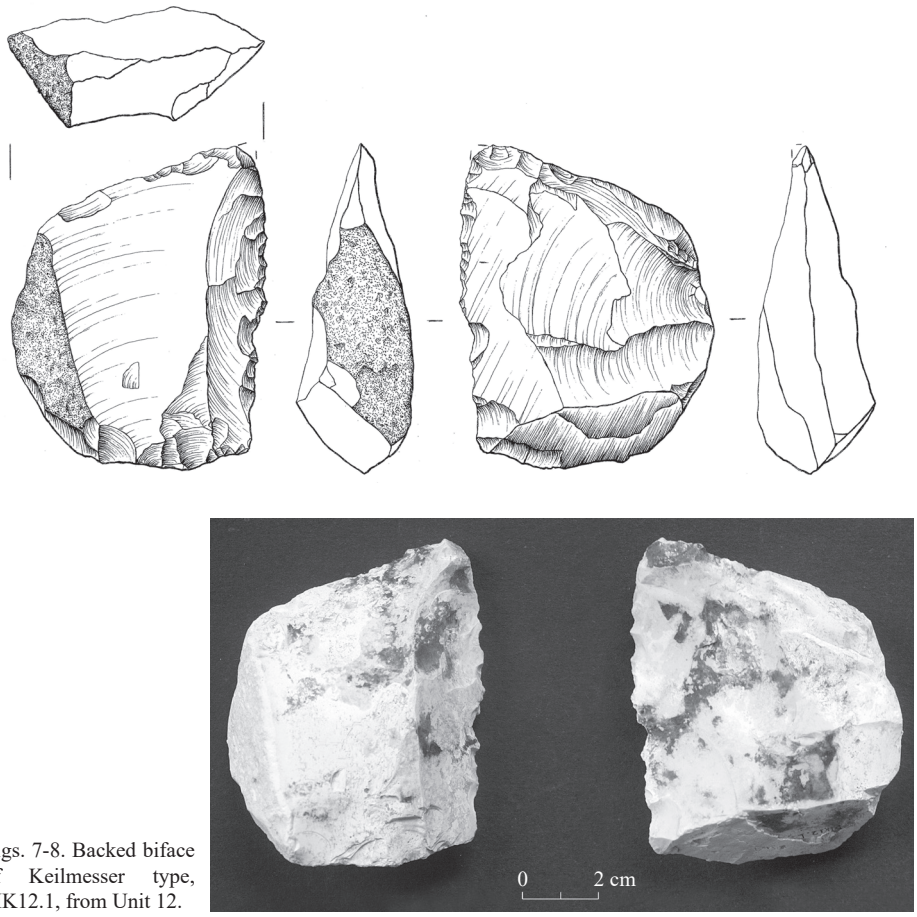
[14] See also Jöris 2012.
[15] Papoulia 2011.



Figs. 7-8. Backed biface of Keilmesser type, MK12.1, from Unit 12.

Although the stratigraphic correlation of the two backed bifaces from Megalo Karvounari cannot be established they were found in close spatial association in two bordering units characterised by gentle slopes and mini-gullies dissecting the surface. A Lower Palaeolithic, i.e. an Acheulean, presence cannot be proposed, based either on the biface from Unit 6 or on the second, backed biface from Unit 12. The bifacial elements belong to a Middle Palaeolithic assemblage associated with the earliest phase of hominin presence on site. Their very presence here could prove to be a starting-point for building up Greece's Recent Micoquian inventory and could guide further interpretations into finer industrial and perhaps geographical subdivisions of the Greek Middle Palaeolithic record. Before moving onto this discussion, however, we will first examine their accompanying finds.

The two Quina scrapers

Among the retouched tools from Unit 7, a rectangular unit which lies directly to the west of Unit 6 and to the south of Unit 4 (Figs. 2 and 9) and consists of a series of gullies interspersed with ridges and a forested area in its south (Figs. 10b, 11), there is a bifacially worked scraper with invasive, scaled and stepped retouch that preserves part of its cortex on the distal part of its dorsal face (5×3.8×1.2 cm, Fig. 10; Fig. 11b). This particular

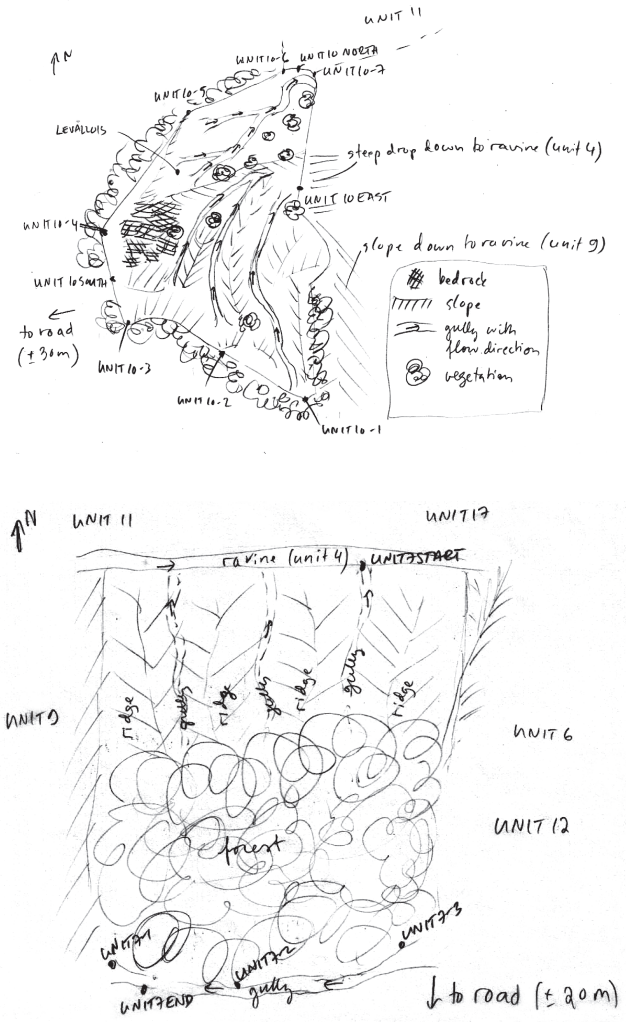


Fig. 9. Sketches of Units 7 and 10 made in the field 2005.

tool is classified as a *Quina* scraper. A similar, but larger, tool (9.1×4.8×22.3 cm, Fig. 10a, 11) was recovered from Unit 10, a little more to the west of the site (Fig. 14), but still in very close proximity to the previously mentioned *Quina* scraper and the biface. This tool, again, has been bifacially retouched in the same manner as the smaller one from Unit 7. It has less invasive yet still stepped retouch, especially on its right lateral, and preserves part of its cortex on the distal left part of its dorsal face. This artefact is a more 'text-book' example of a *Quina* scraper as described and illustrated by Bordes and Debénath and Dibble.[16]

As with the bifaces seen above, *Quina* scrapers are extremely rare finds in Greece. A few examples from the oldest Middle Palaeolithic layers of the Theopetra Cave have been reported,[17] though Darlas has disputed this.[18] A *Quina* scraper was also recovered from Sardinia in western Greece.[19] A few *Quina* scrapers were assigned to the oldest 'Classic Mousterian' industries recovered from the open-air sites of Elis in the western Peloponnese by the French surface survey.[20] *Quina* scrapers are also reported to derive from the enigmatic and industrially mixed Initial Upper Palaeolithic horizon of Lakonis I, a site with continuous occupation from 120 to 43ka.[21] Given the small number of the *Quina* scrapers and our inability to establish distinct stratigraphic associations between the Megalo Karvounari Middle Palaeolithic finds, it is not clear whether these two tools

[16] Bordes 1961; Debénath and Dibble 1994.
[17] Panagopoulou 2000.
[18] Darlas 2007.
[19] Darlas and Papaconstantinou 2004.
[20] Chavaillon *et al*. 1969.
[21] Elefanti *et al*. 2009.

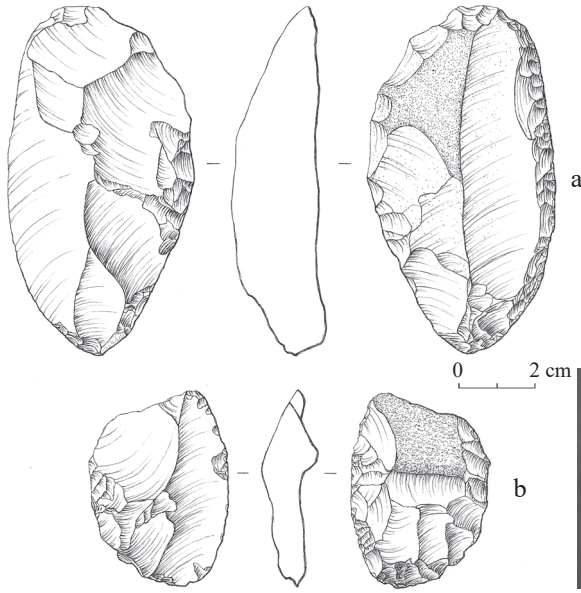


Fig. 10. *Quina* scrapers from Unit 10 (a) and Unit 7 (b).

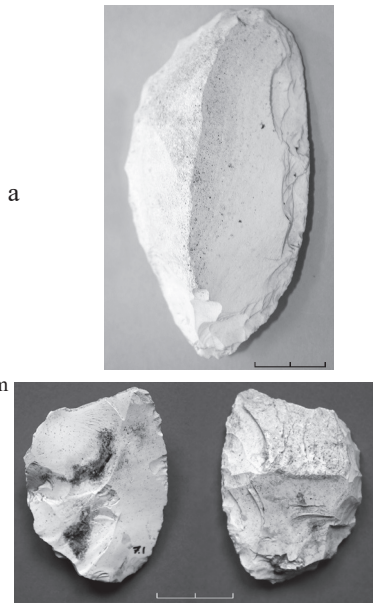


Fig. 11. *Quina* scrapers from Unit 10 (above) and Unit 7 (below).

are suggestive of a discrete *Quina* Mousterian presence in northwestern Greece or are part of a different technocomplex. Recent Micoquian assemblages do include *Quina* elements.

Other Middle Palaeolithic finds from Megalo Karvounari

The two *Keilmesser* and the two *Quina* scrapers derive from four neighbouring Units, 6, 7, 10 and 12, that extend across an area of 9750 square meters in the southwestern sector of Megalo Karvounari. Units 6, 7 and 12 border each other and could be merged into a single larger unit bounded by the dirt-road to the southwest and sloping to the north (Fig. 2). They are separated from Unit 10 by Unit 9, which produced only two artefacts.

Unit 6 has also yielded six flakes, a broken laminar flake, a couple of core fragments and four retouched flake tools (Fig. 12). In particular, two out of the three whole flakes

Units	Cores	Flakes	Levallois flakes	Laminar flakes	Tools	Other	Core fragments	Total
4	-	8	-	3	5	-	-	16
5	1	21	-	7	4	-	6	39
6	-	6	-	1	5	-	2	14
7	4	16	2	9	9	-	6	46
8	6	19	2	4	12	-	9	52
9	1	1	-	-	-	-	-	2
10	6	59	4	13	23	-	10	115
12	3	17	1	6	22	-	9	58
12b	3	8	-	7	4	2	1	25
16	3	12	-	-	3	-	2	20
Total	27	167	9	50	87	2	45	387

Fig. 12. Megalo Karvounari: lithics inventory of Units 4-10, 12, 12b and 16.

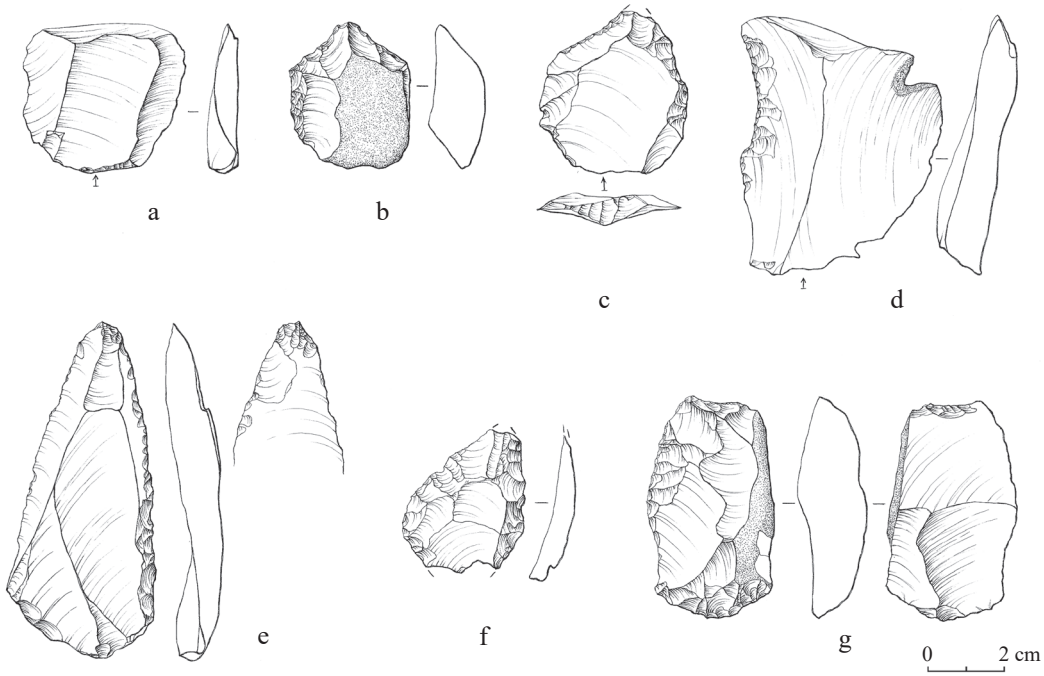


Fig. 13. Flake and tools from Units 6 (a-d) and 7 (e-g). a) Flake, b) nosed endscraper, c) retouched Levallois flake, d) single concave scraper, e) retouched Levallois point, f) dejeté scraper, g) bifacially worked proximal endscraper.

Tool types / Units	4	5	6	7	8	9	10	12	12b	16	Total
Naturally backed knife	1	-	-	-	1	-	4	5	2	-	13
Backed knife	-	1	-	-	-	-	-	-	-	-	1
Backed biface (*Keilmesser*)	-	-	1	-	-	-	-	1	-	-	2
Levallois Point	-	-	-	-	1	-	2	-	-	-	3
Retouched Levallois point	-	-	-	1	1	-	-	-	-	-	3
Pseudo-Levallois point	-	1	-	-	-	-	1	-	-	-	2
Retouched pseudo-Levallois point	-	-	-	-	1	-	1	-	-	-	3
Denticulate	1	1	-	-	2	-	1	3	-	-	8
Notch	-	-	-	1	-	-	-	-	-	-	1
Retouched flake	2	1	1	2	3	-	7	8	-	3	27
Retouched Levallois flake	-	-	1	1	-	-	-	-	-	-	2
Quina scraper	-	-	-	1	-	-	1	-	-	-	2
Single scraper	-	-	1	-	-	-	3	1	-	-	5
Transverse scraper	-	-	-	-	2	-	-	3	-	-	4
Dejeté scraper	-	-	-	1	-	-	2	1	-	-	3
Endscraper	-	-	-	-	-	-	-	-	1	-	1
Proximal endscraper	-	-	-	1	-	-	-	-	-	-	1
Nosed endscraper	1	-	1	-	-	-	-	-	-	-	2
Piercer	-	-	-	-	-	-	1	-	1	-	2
Truncation	-	-	-	-	1	-	-	-	-	-	1
Composite tool (side-scraper & partial truncation)	-	-	-	1	-	-	-	-	-	-	1
Total	5	4	5	9	12	-	23	22	4	3	87

Fig. 14. Megalo Karvounari: Middle Palaeolithic tool repertoire.

have a flat platform (7.2×4.4×2.1 and 2.1×2.7×0.6 cm), the smaller of which also has a step fracture, while the third (Fig. 13c) has a facetted platform and a hinge fracture (3.8×4.2×0.9 cm, Fig. 13a). The tools are a nosed endscraper made on a thick cortical flake (3.8×3.1×1.4 cm, Fig. 13b), a retouched Levallois flake with a facetted platform (4.2×3.8×0.8 cm, Fig. 13c), a concave lateral scraper on a large flake with a flat platform and a hinge fracture (6.5×5.6×1.5 cm, Fig. 13d) and a broken retouched flake with a punctiform platform (7.4×5.9×1.2 cm) (Fig. 14).

The neighbouring units of Unit 6 have yielded a large number of Middle Palaeolithic artefacts such as Levallois points and *Quina* scrapers. In particular, Unit 7 has yielded, among others, a notched piece (3.3×1×0.8 cm), four marginally retouched flakes, a side-scraper with a partial truncation and a facetted platform (4.4×2.2×0.6 cm), an elongated retouched Levallois point with a facetted platform and inverse distal thinning (8.7×4×1 cm, Fig. 13e), a *dejeté* scraper (4.1×3.2×0.7 cm, Fig. 13f) and a bifacially worked proximal endscraper which preserves part of its cortex on its right lateral (forming a natural back) and has a relatively lighter degree of patination (5.8×3.3×1.7 cm, Fig. 13g). Since the retouch removals are of a scaled rather than stepped morphology, this scraper has not been classified as *Quina*, although the overall shape and the type of inverse flat thinning does not differ much in principle from the two *Quina* scrapers encountered at the site (Figs. 10-11). Unit 7 is a part of the site where signs of rapid and extreme erosion were present.

Unit 10 has a large number of artefacts and is dominated by Middle Palaeolithic cores, tools and debitage, with just a few post-Middle Palaeolithic elements (i.e. three bladelet cores, a couple of scrapers and a few debitage fragments). Among the most characteristic Middle Palaeolithic tools is a retouched Levallois point (4.6×2.7×0.6 cm, Fig. 15a) and a *dejeté* scraper (4.4×3.3×1 cm, Fig. 15b). There is also a small borer with a facetted platform (2.8×2.1×0.7 cm), a broken pseudo-Levallois point with a facetted platform (5.3×3.5×0.9 cm), a single-scraper with a dihedral platform (2.9×3.4×0.9 cm), a denticulate (3×2×0.7 cm), several naturally backed knives, and retouched flakes with

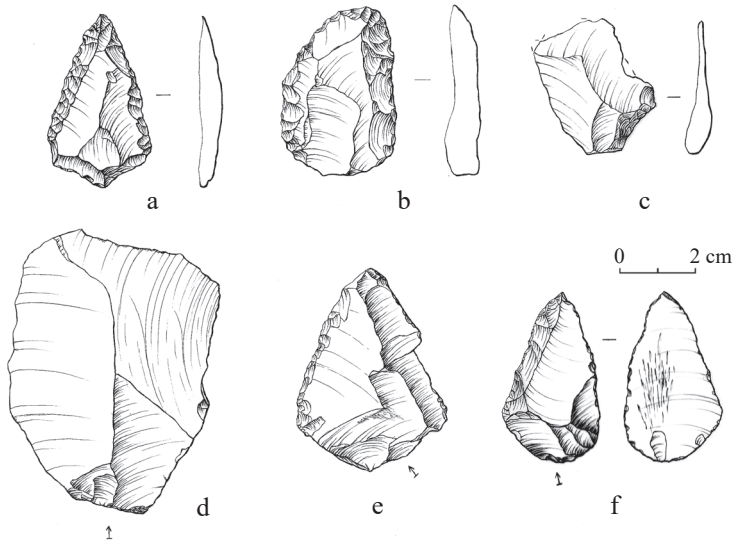


Fig. 15. Flakes and tools from Units 8 (d-f) and 10 (a-c). a) Retouched Levallois point, b) *dejeté* scraper, c-d) flakes, e) transverse scraper, f) retouched flake or atypical point.

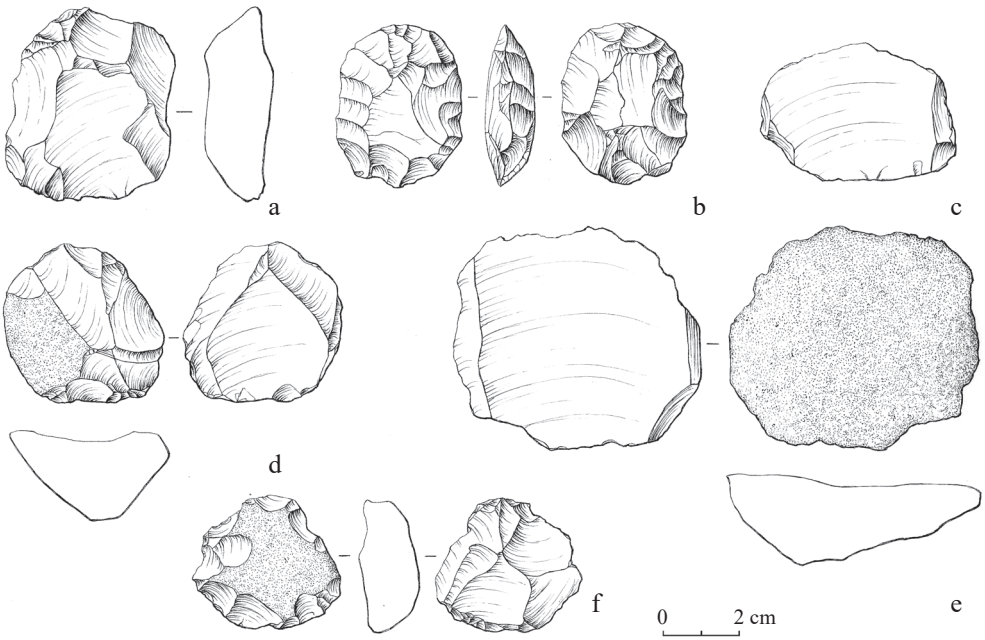


Fig. 16. Levallois cores (a, b: Unit 10, c, e: Unit 20, d, f: Unit 8).

centripetal or convergent negative scars. Among the debitage there are several Levallois flakes like the one with a dihedral platform in Fig. 15c (3.6×2.8×0.7 cm). The majority of the platforms both on the retouched pieces and the unretouched whole flakes are either facetted or dihedral. There are also a few cortical or flat, and only a couple of punctiform ones. Among the cores there are two recurrent centripetal Levallois cores measuring 5.2x4.5x1.8 cm and 4.3x3.4x1.5 cm respectively (Figs. 16a-b).

Units 12 and 16, on the southern borders of Unit 6, provide the same picture of a predominant Middle Palaeolithic component with a high degree of Levallois products and the typical Mousterian tools such as single, *dejeté* and transverse scrapers, denticulates, naturally backed knives and retouched flakes. Apart from the abundant Levallois flakes and retouched flake blanks (e.g. Fig. 17d), there are also blade-like (i.e. laminar flake) blanks and tools which in the Middle Palaeolithic contexts of the Epirotic sites are usually classified as elongated or 'laminar' blanks and are the products of either recurrent parallel Levallois or Middle Palaeolithic cores aimed to production of laminar blanks (Fig. 17e).[22]

The 13 retouched tools from Unit 8 include a transverse scraper on a pseudo-Levallois point with a facetted platform (Fig. 15e, 4.1×5.1×0.9 cm), two more 'atypical' points with a facetted and a dihedral platform (e.g. Fig. 15f, 4.5×4.1×0.9 and 4.3×2.9×0.9 cm), a transverse scraper (2.8×4×1.1 cm), a denticulate (4.4×2.8×0.8 cm) and a few retouched blanks. Among the 23 debitage products there are several Levallois flakes, such as the large one with a dihedral platform in Fig. 15d (7.4×5.5×0.9 cm). A few more cores from Unit 8 demonstrate the presence of hominins using Middle Palaeolithic technology. In particular, a lineal Levallois core (4.2×4.2×2.1 cm, Fig. 16d) with a fixed perimeter,

[22] For discussion, see Papagianni 2000; Ligkovanlis 2011; Papoulia 2011.

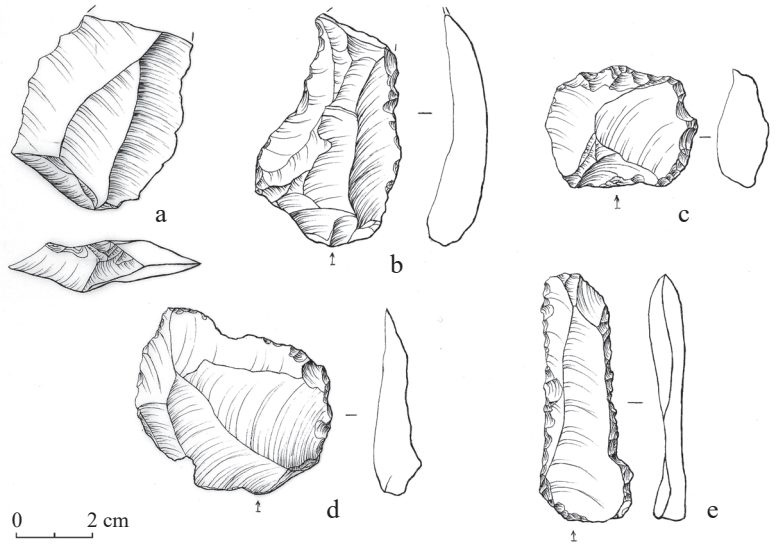


Fig. 17. Flake and tools from Units 5 (a-c), 12 (d) and 16 (e). a) Flake, b) retouched laminar flake, c) denticulated scraper, d) retouched Levallois flake, e) retouched laminar flake.

preserving 25% of the cortex on its lower face, and a recurrent centripetal Levallois core (4×3.9×1.5 cm, Fig. 16f) preserving just under 50% of the cortex on its lower face, are among the most characteristic examples.

Unit 5, situated between Units 6 and 8, has yielded just a few finds; they include, however, a number of Middle Palaeolithic artefacts such as a broken Levallois flake with a dihedral platform (4.9×4.1×1.4 cm, Fig. 17a), a marginally retouched laminar flake with a dihedral platform (6×3.7×1.3 cm, Fig. 17b) and a denticulated scraper with a flat platform (3.3×3.9×1.4 cm, Fig. 17c). The intense Middle Palaeolithic presence of the site continues further to the north in Units 2, 18, 24[23] and 21, which have yielded some of the most elaborate examples of Mousterian scrapers with unifacial scaled and stepped retouch (Fig.18).

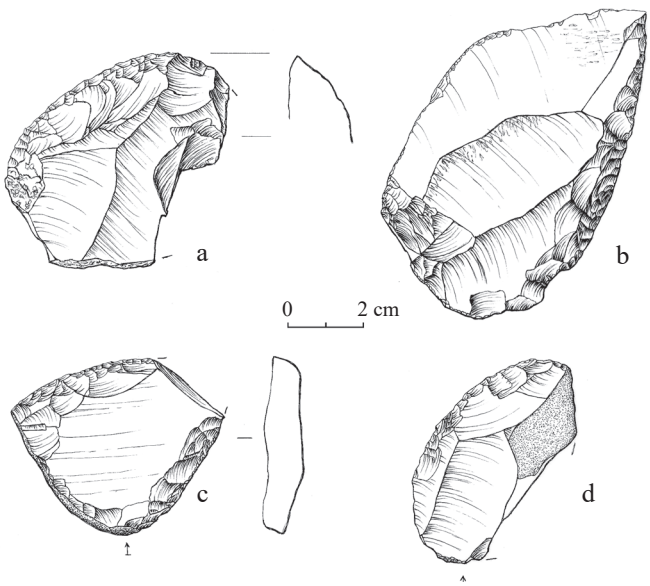


Fig. 18. Scrapers from Units 2 (c), 18 (a) and 21 (b, d). a, d) Transverse scrapers, b) single scraper, c) dejete scraper.

[23] For the lithic assemblages of Unit 24 in particular, see Ligkovanlis 2011.

Interpreting the Middle Palaeolithic component of Megalo Karvounari

The publications of the older[24] and the recent[25] collections from the red-bed sites just to the west of the Kokytos valley, namely Mikro Karvounari, Megalo Karvounari and Morphi, have suggested the presence of Middle Palaeolithic hominins in the region, though later industrial components left behind by anatomically modern humans are also present. The archaeological context of the bifacially worked tools from Megalo Karvounari offers evidence for significant techno-typological associations with the *Quina* Mousterian assemblages and the *Keilmessergruppe* (KMG) assemblages of the central and eastern European Micoquian.

In the absence of any chrono-stratigraphic information, the Middle Palaeolithic of Megalo Karvounari cannot be subdivided into further variants in terms of technological, metrical or typological characteristics of the lithic finds. The industrial variability exhibited and large number of artefacts present do imply either an intensive presence or repeated visits by several groups of Middle Palaeolithic hominins. The rarity of backed bifaces, and the dissimilarity in comparison between the two found, requires some explanation. A parsimonious explanation would be that the backed bifaces from Megalo Karvounari were part of a tool repertoire which depended more on Levallois and Mousterian points for the hunt, and on several types of scrapers for the processing of meat and hides. Such tools might have served as handy tools (also known as expedient tools[26]) in a more opportunistic manner, for the Middle Palaeolithic hominins of the Kokytos valley sites. We clearly need a larger and more representative sample of Middle Palaeolithic artefacts from a primary deposition at Megalo Karvounari in order to understand what was in play here. If such an explanation, that they are *ad hoc* responses possibly to the form of the original blank, were proved to be true, then their link to the KMG would effectively be weakened.

The significant production and/or use of points at the Kokytos valley has been implied by some of the Levallois and Mousterian points, bearing macroscopically visible impact fractures, which are concentrated at the three sites of Mikro Karvounari, Megalo Karvounari and Morphi. Most probably hafted on wooden shafts and used as spears, these tools allowed Middle Palaeolithic people to hunt large mammals efficiently, not only at close quarters but also from a 'safer' distance by throwing the hunting tool.[27] Thus, the use of bifaces might perhaps not have been as essential – at least for the hunt – to the Middle Palaeolithic hominin groups who made use of the Epirotic resources. Lastly, it is worth noting that none of the assemblages from the Kokytos valley include any indications of any pre-Middle Palaeolithic presence in these three multicomponent sites, nor can the MK6.1 biface indicate such a presence.

The Kokkinopilos bifaces

The eroding *terra rossa* deposits of Kokkinopilos, situated near the sources of the River Louros in south Epirus, are in terms of context homologous to the Megalo Karvounari

[24] Papaconstantinou and Vassilopoulou 1997; Papagianni 2000.
[25] Ligkovanlis 2011; Papoulia 2011.
[26] Binford 1979; Binford 1980.
[27] Papoulia 2011.

ones and have to date yielded the most complete biface record in Greece. It consists of ten published and illustrated tools from the Lower and the Middle Palaeolithic. Higgs' survey team[28] was the first to discover a handaxe tip from the site. This was studied by Mellars and published in the 1964 report as being from a rather thick handaxe, heavily patinated and recently broken. It is made on a nodule of dark, blue-grey flint.[29] In 1991, an elongated 'Micoquian handaxe' was recovered: measuring 21.5×11.4×6.5 cm, it is the largest one yet to come from the Greek sites.[30] Runnels and van Andel have supported an argument that the artefact was found in situ and, based on geological observations of the red-bed formations, they have dated it to 250±50ka (U/Th).[31]

Two more bifaces have been found at Kokkinopilos by Vangelis Tourloukis, one of which is described as an 'amygdaloid à talon with a cortical base made of fine-grained bluish/grey flint […] typologically, it can be described as a typical Acheulean biface'.[32] This particular handaxe is a surface find associated with reworked deposits. The second biface or 'bifacial core' has been described as a 'thick biface with a cordiform aspect'[33] made on a flake-blank with a partial, flat bifacial retouch; it measures 13.02×10×4.9 cm. This second one was found embedded in a 'non-reworked' deposit which has returned a minimum age of 207-220ka (post-IR/IRSL).[34] Based on the published photograph, the retouch extends unifacially on the right lateral and bifacially on its distal. It forms a rounded and thin distal end, opposite to a thick, blunt back. This second bifacially worked tool has typological affinities with the *Keilmesser* group already discussed above, and could possibly be part of the Middle Palaeolithic at Kokkinopilos.

Kokkinopilos is also one of the few sites in Greece with leaf points (Appendix II). The corpus consists of six leaf points recovered from the surface plus three more recovered from the excavated sediments of Site β.[35] Similar finds are encountered in other Epirotic sites (e.g. Morphi). Beyond Epirus, the occasional leaf point is present in various sites of Greece, mostly open-air ones, and they date to a late Middle Palaeolithic (40ka BP) and/or what is perhaps a transitional phase to the Early Upper Palaeolithic.[36] Assemblages with leaf points are not very common in the Greek record, but seem to be a significant component of the Middle Palaeolithic industries of the northern Balkans and the Crimea.[37]

On terms and semantics

As can be seen in Appendices I and II the bifaces in the southern part of the Balkan peninsula largely derive from the surface rather than closed stratified contexts and their

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[28] Dakaris *et al*. 1964, 134.
[29] Dakaris *et al*. 1964, 134.
[30] Runnels and van Andel 1993.
[31] Runnels and van Andel 1993; Zhou *et al*. 2000; Runnels and van Andel 2003.
[32] Tourloukis 2010, 71.
[33] Tourloukis 2010, 72.
[34] Tourloukis 2009; Tourloukis 2010; Tourloukis and Karkanas 2012; Tourloukis *et al*. 2015.
[35] Higgs 1963; Dakaris *et al*. 1964; Higgs and Vita-Finzi 1966; Papagianni 2000.
[36] Darlas 2007.
[37] Monigal 2006.

presence is rather sparse and discontinuous, a fact that does not come as a surprise given the corresponding record in its northern part. Bifaces and, in particular, handaxes are rarely found in Palaeolithic sites of the Balkans, south and north, whereas a variety of other types of bifacially worked implements and leaf points have been excavated from Middle Palaeolithic sites of the region.[38] A few small bifaces, possibly deriving from Middle Palaeolithic contexts, have also been found at Punikve in Croatia.[39]

Beyond adding points to the map, it is important to agree upon the semantics of the taxonomic entities used to identify and interpret bifaces. There are no excavated Lower Palaeolithic sites in continental Greece, and out of a total of five excavated and radiometrically dated Middle Palaeolithic cave sites, only the lithic assemblage from Asprochaliko has been thoroughly published, whereas for the most recently excavated sites, Kalamakia, Theopetra, Lakonis 1 and Klisoura Cave 1, we are forced to rely on preliminary site reports.[40] Given the absence of any excavated Lower Palaeolithic record, and with only a Middle Palaeolithic record which is still 'under construction' to refer to, such a discussion would benefit from the wisdom garnered in other parts of Europe [by Marie Soressi (southwest France), Olaf Jöris (Germany), Karen Ruebens (Netherlands, Belgium, west and north France) and Katherine Monigal (Crimea)], where longer traditions of research and more complete records have resulted in a better command of regional techno-complexes and their variants.

As can be seen in Appendix I, four discrete taxonomic entities, the "Acheulean", the "Mousterian", the "Micoquian" and the "Mousterian of Acheulean Tradition" (MTA), have been identified in continental Greece. The adjectives accompanying the entities, e.g. "advanced", "developed", "late", "later", "latest", "earliest", "*sensu lato*", capture the difficulty in positioning the bifaces with any greater degree of chrono-stratigraphic precision and thereby placing them in an orderly sequence with interpretative value. In the few instances of certainty, this is expressed using the word "typical", which almost invariably refers to the Acheulean.[41]

The earliest hominin known to have inhabited continental Greece is *Homo heidelbergensis*, represented by the Petralona Cave cranium in central Macedonia, dated to the late Middle Pleistocene.[42] Judging by archaeological finds in other parts of Europe, the stone industries associated with this hominin generally fall within the Acheulean techno-complex.

From at least the onset of the Upper Pleistocene onwards, continental Greece was inhabited by human groups that used Middle Palaeolithic industries. The oldest stratified evidence of these comes from the Theopetra Cave, TL-dated on burnt flints to the transition between MIS 6 and MIS 5 (Fig. 19). It is not known whether a single hominin species produced all the Middle Palaeolithic industries. Sites such as Kalamakia and Lakonis 1, where Middle Palaeolithic artefacts have been found in contexts containing Neanderthal bones and teeth,[43] offer an empirical basis for the hypothesis that it was *Homo neanderthalensis* who created the Middle Palaeolithic material culture. Neanderthals were

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[38] Kozlowski 1998; Kozlowski 2003.
[39] Malez 1979.
[40] Darlas 2007.
[41] Dakaris 1964; Kopaka and Matzanas 2009; Tourloukis 2010.
[42] Grün 1996; Hennig *et al.* 1982; Latham and Schwarcz 1992.
[43] Darlas and de Lumley 1999; Darlas 2007; Harvati *et al*. 2003; Harvati *et al*. 2013.

Site	Layer or Unit	Date (ka)	Method	Reference
Asprochaliko	18	a) 102,000±14,000 b) 96,000±11,000	a-b) TL	Huxtable *et al.* 1992
	14	>39,900	^{14}C- Conv.	Bailey *et al.* 1983
Theopetra	II2	124,000±16,000 (mean age deduced from 2 samples)	TL	Valladas *et al.* 2007
	II4	129,000±13,000 (mean age deduced from 7 samples)	TL	Valladas *et al.* 2007
	II11	a) 57,000±6000 b) 45,750±750	a) TL b) ^{14}C-AMS (A-BOX)	a)Valladas *et al.* 2007 b) Facorellis *et al.* 2013
Klisoura Cave 1	XXc	60,250±2700	^{14}C-AMS (A-BOX)	Kuhn *et al.* 2010
	XVII	a) 62,290±3930 b) 56,140±1450	a-b) ^{14}C-AMS (A-BOX)	Kuhn *et al.* 2010
	VII	48,990±1770	^{14}C-AMS (ABOX)	Kuhn *et al.* 2010
Kalamakia	II (beach rock underlying the cultural sequence)	109,000+14,000/-13,000	U/Th	de Lumley *et al.* 1994
	IV	>39,000	^{14}C-AMS	Harvati *et al.* 2013
Lakonis I	IV (beach rock underlying the cultural sequence)	120,000-130,000	TL, U-Series	Panagopoulou *et al.* 2002-2004
	Ib	a) 39,640±1000 b) 43,335±1800 c) 43,150±1790	a) ^{14}C- Conv. b-c) ^{14}C-AMS	Elefanti *et al.* 2009

Fig. 19. Dates of Greek Palaeolithic sites. All ^{14}C dates are uncalibrated.

thus well established in continental Greece from the Last Interglacial (MIS 5e) and we have a good reason to associate the "Mousterian" and the "MTA" industries with them.

The "Micoquian" is a fluid term describing dissimilar assemblages from both western Europe and the central and eastern part of the continent.[44] To the west of the Rhine the term can refer to assemblages of handaxes which include long pointed handaxes often with concave sides such as are found at the type site of La Micoque dated to MIS 9 and probably made by *Homo heidelbergensis*. To the east of the Rhine it refers to Neanderthal industries spanning the Last Interglacial and both climatic phases of the early glacial (130-40 ka BP), although backed bifaces from this age range do occur west of the Rhine river. Karen Ruebens has provided a historiographic overview of this taxonomic entity in its eastern/Neanderthal usage from its first definition by Otto Hauser in 1916.[45] The Micoquian, unless explicitly divided into "Early" and "Recent",

[44] Otte 2010.
[45] Ruebens 2012; Ruebens 2013.

has thus become a source of confusion.[46] However, Katherine Monigal, working further east on the Crimean Peninsula, has convincingly argued that the Recent Micoquian or *Keilmessergruppe* (KMG) was present in eastern Europe earlier than in central Europe, refuting the long-held assumption[47] that the latter was the core region for the Micoquian. In her own words: "The Micoquian was in the Crimea during the Last Interglacial, when the Crimea was an island. It must therefore have arrived at an earlier time – from where, however, is ambiguous".[48]

"Recent Micoquian" or *Keilmessergruppe* (KMG) that are found mainly in northwestern Europe (e.g. the Netherlands, Belgium – an important MTA/KMG transitional zone),[49] but also in central and eastern Europe (e.g. Germany, Poland, Czech Republic), are dominated by bifacial tools, though not always "handaxes",[50] while "Mousterian" assemblages in general tend to lack bifaces. They reappear in Middle Palaeolithic contexts of western Europe at about 115ka years before present. Since these industries seemed to follow an older tradition (i.e. the Lower Palaeolithic use of handaxes), Denis Peyrony named them "Mousterian of Acheulean Tradition" (MTA) in the 1920s.[51] Handaxes are the hallmark of the MTA and have been classified in several categories by François Bordes.[52] They are usually small, retouched all around their perimeter, and display significant regional variability. The most common sub-categories according to shape are the cordiform and triangular.[53]

The KMG, on the other hand, is dominated by backed bifaces with asymmetric retouch, the type fossil of which is the *Keilmesser* (i.e. the bifacially worked backed knife). Bosinski has provided a detailed typelist for the KMG of central Europe.[54] A different category of bifacially worked tool comprises the foliates or leaf points that are encountered at several European and Greek Middle Palaeolithic sites. The earliest evidence comes from eastern Europe.[55] Sporadically present in the KMG but almost totally absent from the MTA of western Europe, they form the dominant type of several supposed transitional industries. There are, however, some assemblages in northwestern Europe, such as the Belgian sites of Oosthoven, Grotte du Docteur and Ramioulle, which contain both MTA and KMG bifacial elements.[56] The industrial differences in these cases certainly imply behavioural and cultural differentiations among late Neanderthal groups.[57] A number of microscopic use-wear studies have proved that such tools had been used in wood or bone modification, meat butchering, hide scraping and procurement of both faunal and floral resources. In some cases they could also have been hafted.[58]

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[46] Conard and Fischer 2000. See also: Mania 1990; Veil *et al*. 1994; Jöris 2004
[47] E.g. Bosinski 1967.
[48] Monigal 2006, 196.
[49] Ruebens 2006; Ruebens and van Peer 2011.
[50] Jöris 2004; Jöris 2006; Richter 1997; Richter 2004.
[51] Peyrony 1920.
[52] Bordes 1961.
[53] Sorressi 2002.
[54] Bosinski 1967.
[55] Bordes 1961; Kozlowski 2003.
[56] Ruebens 2006; Ruebens 2007; Ruebens 2012.
[57] Ruebens 2012.
[58] E.g. Rots 2009; Soressi 2002.

Small-sized bifaces form part of the Greek Middle Palaeolithic, as do a number of leaf points made on large elongated flakes by means of direct percussion.[59] The bifacially worked leaf points from Epirus, Thessaly and the Peloponnese present significant affinities with those of the Danubian sites of Central Europe[60] and can perhaps more accurately be attributed to Late Middle Palaeolithic and transitional industries of the region. The elongated and pointed "Micoquian" handaxe from Kokkinopilos is a good example of the type encountered in La Micoque, France, and in many respects could be regarded as fully Acheulean, relating to the MIS 9 handaxes from the French type site. Runnels has assigned it Late Acheulean affinities, though he has also argued that such types were "not unknown" in the early Middle Palaeolithic.[61] The stratified biface from Theopetra Cave has been associated with a Micoquian techno-complex; however, a southern extension of the central European Micoquian industries was regarded as "ill-advised" in 1999 due to the state of research and the controversial definitions of the "Micoquian".[62] An MTA, rather than a Micoquian, association has been preferred for a small triangular *Faustkeil* from Gavdos, which has been reported though not yet fully published.[63] In our view, the significantly small presence of highly symmetrical handaxes with covering bifacial retouch eliminates any possibility of associating the Greek Middle Palaeolithic with the MTA.

Discussion

The two backed bifaces from Megalo Karvounari are the first of their kind to have been identified in the Greek Palaeolithic record. They appear to be part of a techno-complex that contains bifaces, though without being dominated by them. Because the backed bifaces derive from an open, unstratified context with poor chronological control, it is impossible to place them with higher precision within a taxonomic entity and seek affinities with the corresponding industries excavated in territories to the north, northeast and northwest of the Balkans. Despite this, their existence enriches the Greek Middle Palaeolithic record, pointing to a greater variability than that previously reported in the latest synthesis of the Greek Middle Palaeolithic by Darlas, who correctly identified two variants, a typical Mousterian and a more problematic as to its chronostratigraphic position Mousterian with bifacial foliates.[64]

The bifaces from Megalo Karvounari may indeed constitute evidence for the presence of a Recent Micoquian (KMG), which continues further south than previously thought, or some kind of a mixed industry in the southern Balkan Peninsula (or both). Alternatively, they could be regarded as an *ad hoc* response to raw material availability to fulfil the immediate needs of the Middle Palaeolithic people. The fundamental question that remains unanswered is whether Megalo Karvounari is merely a palimpsest of temporally separate events of use, by hominins equipped with an all-inclusive Mousterian industry

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[59] Runnels 1995, 711.
[60] Chavaillon *et al*. 1969, 149.
[61] Runnels 1995.
[62] Panagopoulou 1999.
[63] Kopaka and Matzanas 2009.
[64] Darlas 2007.

containing the odd *Quina* scraper and *Keilmesser* or, whether the four tools published here offer evidence of different variants coexisting at a single site. In Moravia, Micoquian tool inventories contain high percentages of sidescrapers, some of them shaped by means of flat or *Quina* retouch.[65] It is thus not impossible that at Megalo Karvounari we are beginning to see fragments of an emerging Recent Micoquian techno-complex.

In the light of the new evidence from Megalo Karvounari and our review of published data, a marked scarcity of bifacially worked elements in the Lower Palaeolithic tool inventory from continental Greece, reflecting the scarcity of early sites,[66] is becoming apparent. The majority of bifaces in continental Greece come from Middle Palaeolithic contexts and date to after the Last Interglacial. Their metrical characteristics, in most cases, agree with such a pattern (Appendix I). In general, they seem to correspond with Middle Palaeolithic assemblages from central and eastern Europe, and differ significantly from the Acheulean assemblages of insular Greece.[67] Continental Greece has not yet yielded a robust signal of biface association with pre-Middle Palaeolithic populations other than Palaeokastro at western Macedonia, where a large handaxe was found by Higgs, and Kokkinopilos a little further to the south, whose handaxe-bearing layers are dated to the late Middle Pleistocene. The Early Micoquian handaxe,[68] the broken handaxe tip[69] and the amygdaloid à talon[70] fall within the Acheulean definition. The fourth large backed biface from Kokkinopilos in terms of morphology and technology is better placed in the Recent Micoquian though its layer has been dated to the late Middle Pleistocene.[71]

The questions that naturally arise from discussions of bifaces in Middle Palaeolithic contexts, focus on when bifaces first appear in the Greek record; which hominins made them; and whether they represent the survival of old technological traditions into a later period, or the re-invention of this tool form during the Upper Pleistocene by Neanderthals. None of these possibilities can be excluded, since the Greek data are sparse and inconclusive. The issue is further complicated by the existence of lithic assemblages that contain elements of more than one variant, and the absence of reference records from the Middle Pleistocene and the Early part of the Upper Pleistocene.[72]

Conclusions

In this paper we have presented a series of bifacially worked tools and related artefacts recovered from the *terra rossa* site of Megalo Karvounari, located in the Kokytos valley. We have suggested that the bifacial elements belong to a Middle Palaeolithic assemblage associated with the earliest phase of hominin presence on-site. Our review of the Middle Palaeolithic component from the site suggests that this is an industry whose Middle Palaeolithic tool-kit also contains *Quina* scrapers and backed bifaces of the *Keilmesser*

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[65] Svoboda *et al*. 1996, 85.
[66] Galanidou 2004; Galanidou 2014.
[67] Galanidou 2013; Galanidou *et al.* 2013.
[68] Runnels and van Andel 1993.
[69] Dakaris *et al*. 1964.
[70] Tourloukis 2009.
[71] Tourloukis *et al* 2015.
[72] Galanidou 2014.

type. Both are amongst the first handful of indisputable cases reported on the Greek Peninsula,[73] and we have no reason to suggest that they were produced and utilised by any species other than the Neanderthals, who were well established in most parts of continental Greece from MIS 5e onwards. The fact that these tools are surface finds from an artefact-rich *terra rossa* site whose stratigraphy is poorly researched leaves open the issue of a finer chronological association of the site's early component. These finds may be linked to a Recent Micoquian technocomplex that is beginning to be identified in the lake-side sites of south Epirus, and whose closest comparanda are recovered from sites to the north of the Balkans. Since there are less than a handful makes it equally plausible that these finds do not carry any techno-cultural significance and were instead isolated tools meeting an immediate need for production guided by the raw material availability in what was otherwise a Middle Palaeolithic industry containing a few *Quina* scrapers.

This chapter began by addressing the multiple problems *terra rossa* deposits present to the Palaeolithic interpretation, due to their being multi-component sites with poor stratigraphic and chronological control. Megalo Karvounari is one such case where dating prospects are limited, preservation of organic remains is non-existent, and elements of earlier technological traditions (e.g. backed bifaces and *Quina* scrapers) are unearthed side-by-side with elements of later ones (e.g. Aurignacian tools). Our picture of this open-air site suffers from interference, yet, as we have seen, out of the blurred picture some individual high-definition snapshots spring into focus in instances of highly identifiable finds, such as the ones presented here. These finds hint at the site's potential and at the same time beg to be placed in a finer context. More on-site work to identify and isolate datable stratigraphic units is the way forward in order to address the issues raised in this chapter. At Kokkinopilos, well-focused geo-archaeological work has produced positive results and a basis for building a chronology of the Epirotic *terra rossa* formations. This pioneering work leads us to believe that it would be well worth attempting a similar geo-archaeological approach to the southwestern sector of Megalo Karvounari. For over twenty years, the Kokkinopilos red-beds have time and again gifted the Palaeolithic archaeologists working in them with yet another biface. It appears that Megalo Karvounari is equally generous.

[73] See Darlas and Papaconstantinou 2004.

Appendix I. The published bifaces recovered from Greek Palaeolithic sites

Site and Region	Description	Raw material and dimensions (cm.)	Chronometric/Stratigraphic dating (ka)	Cultural dating	References [Re-evaluated by]
1. Petrota (Krovili, Θ. 10), Thrace	Biface on primary flake	6.55 x 3.9 x 1.6	-	Middle Palaeolithic - 50ka BP	Efstratiou and Ammerman 1996; Ammerman *et al.* 1999
2. Palaiokastro, western Macedonia	Typical Acheulian handaxe	Trachyte, not published	-	Acheulean [Early Middle Palaeolithic]	Higgs 1964 [Matzanas 2004, 126]
3. Kokkinopilos SS91-3, Epirus	Micoquian handaxe	Flint, 21.5×11.4×6.5	250±50 (U/Th)	Micoquian/ late or developed Acheulean/ early Middle Palaeolithic?	Runnels and van Andel 1993; Runnels 1995; Runnels and van Andel 2003
4. Kokkinopilos, Epirus	Amygdaloid à talon with a cortical base	Bluish-grey fine-grained flint, not published	-	Acheulean	Tourloukis 2009; Tourloukis 2010; Tourloukis and Karkanas 2012
5. Kokkinopilos, Zone C, Epirus	Biface with a cordiform aspect and a partial, flat bifacial retouch made on a flake-blank (or a "bifacial core")	Fine-grained flint, 13.02×10×4.9	207-220 minimum (post-IR IRSL)	Lower Palaeolithic [(Late?) Lower Palaeolithic or (early?) Middle Palaeolithic]	Tourloukis 2009; Tourloukis and Karkanas 2012 [Tourloukis 2010, 73]
6. Ormos Odysseos, Epirus	Small biface - (handaxe)	Not published	-	Early Palaeolithic (i.e Middle and Lower Palaeolithic)	Runnels and van Andel 2003
7. Ziros Lake, Epirus	Bifacial implement	Not published	-	Middle Palaeolithic	Papaconstantinou and Vassilopoulou 1997
8. Astakos, west Greece	Lanceolate biface	Not published	-	-	Darlas 1994
9. Sardinia, west Greece	Small handaxe	Not published	-	Middle Palaeolithic	Darlas and Papaconstantinou 2004
10. Theopetra, Thessaly	Cordiform biface whose lateral edge was re-juvenated by the 'tranchet blow' technique	Not published	-	Middle Palaeolithic	Panagopoulou 1999

Site and Region	Description	Raw material and dimensions (cm.)	Chronometric/Stratigraphic dating (ka)	Cultural dating	References [Re-evaluated by]
11 Nea Artaki, Evia	A series of small amygdaloid and sub-cordiform handaxes	Flint, not published	-	Palaeolithic [Between the end of the Lower Palaeolithic to 50 ka BP]	Sarantea-Micha 1986; Sarantea-Micha 1996 [Matzanas 2004]
12. Megalopolis, Peloponnese	Amygdaloid handaxe	Not published	-	-	Lenormant 1867
13. Vasilaki, Peloponnese	Small and flat, almost ovate, limande-like handaxe	Not published, 8.5x4.6x1.5	-	Middle Palaeolithic [Late Acheulean or the early Mousterian]	Reisch 1984 [Matzanas 1998]
14. Lakonis I (Ia), Peloponnese	Bifacial tool	Not published	Initial Upper Palaeolithic – 48-42 ka BP (^{14}C-AMS)	Affinities to the Bohunician of Central Europe which is dated to between 43-35 ka ^{14}C BP	Elefanti *et al.* 2009
15. Preveli 2, Preveli 3, Preveli 7, Preveli 8, Kotsifos 1, Timeos Stavros 1, Timeos Stavros 4, Gianniou 1, Crete	39 triangular, sub-triangular, cordiform or ovate bifaces and biface á gibbosité form	Quartz, not published	72-107ka, 120ka minimum	Acheulean *sensu lato*	Strasser *et al.* 2010; Strasser *et al.* 2011
16. Sarakiniko (Θ. 64A), Gavdos, Crete	Sub-cordiform handaxe	Limestone, 13.3×9.4×2.8	-	Typical tool of advanced Acheulean industries (200-120 ka BP)	Kopaka and Matzanas 2009; Kopaka and Matzanas 2011
17. Kopanelos (Θ. 62A), Gavdos, Crete	Handaxe-cleaver	Granodiorite(?), 11.2×7.8x5.2	-	Acheulean (200-120 ka BP)	Kopaka and Matzanas 2011
18. Ayios Pavlos (Θ. 26E), Gavdos, Crete	Part of a small triangular *Faustelkeil*	Quartz, not published	-	Middle Palaeolithic (75-35 ka BP)	Kopaka and Matzanas 2009; Kopaka and Matzanas 2011
19. Rodafnidia, Lesvos	18 handaxes	Fossiliferous flint and andesite, not published	-	Acheulean	Galanidou *et al.* 2013

Appendix II. Middle Palaeolithic leaf points from Greece

Site and Region	Raw Material	Number of leaf points	References
Palaeokastro / Siatista, w. Macedonia	Not published	1	Dakaris *et al.* 1964
Kokkinopilos, Epirus	Flint	9 (6 are surface finds and 3 fragments from the test trench of site b)	Higgs 1963; Dakaris *et al.* 1964; Higgs and Vita-Finzi 1966; Papagianni 2000
Kouklioi / Ioannina, Epirus	Flint	1	Papaconstantinou and Vassilopoulou 1997
Galatas / Louros Valley, Epirus	Flint	1	Runnels 1995; Papagianni 2000
Ayia / Louros Valley, Epirus	Flint	2	Papagianni 2000
Morphi, Epirus	Flint	1	Higgs and Vita-Finzi 1966; Papagianni 2000
Sardinia, Amphilochia	Flint	2	Darlas and Papaconstantinou 2004
Theopetra Cave, Thessaly	Not published	"A small number of leaf points including mainly bifacial but also unifacial specimens"	Panagopoulou 1999
Plastiras Lake / Karditsa, Thessaly	Flint	2	(http://www.dimoskarditsas.gov.gr/wp-content/uploads/2013/10/ArxaiologikoMouseioKarditsas.pdf)
Peneios river banks, Thessaly	Not published	6	Theocharis 1967; Runnels 1988
Southern Argolid, Peloponnese	Not published	3	Pope *et al.* 1984; Runnels 1988; Kardulias and Runnels 1995
Amalias no. 17 / Elis, Peloponnese	Not published	1	Chavaillon *et al.* 1967; Runnels 1988
Corfu site 18, Ionian Sea	Not published	1	Sordinas 1969; Runnels 1988

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