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Agia Marina and Peristereònas: Two New Epipalaeolithic Sites on the Island of Lemnos (Greece)

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Abstract
The surveys carried out along the coasts of the island of Lemnos (Greece) have led to the discovery of new Late Epipalaeolithic sites at Agia Marina and Peristereònas. Peristereònas yielded a knapped stone assemblage that is strictly comparable with that from Ouriakos, a site located along the south-eastern coast of the same island, while the artefacts from Agia Marina are more problematic to interpret because they are probably to be attributed to a slightly different period. However, the most characteristic artefacts recovered from the sites are represented by microlithic geometrics obtained by abrupt, bipolar, or direct retouch, end scrapers, and different types of exhausted cores and technical pieces, which help us reconstruct the operational sequence employed for the manufacture of the armatures. The aim of the paper is to contribute to the interpretation of the characteristics of the Late Epipalaeolithic assemblages discovered on the island and to frame them into the general picture of the end of the Pleistocene in this part of the Aegean. The artefacts from the sites show unique characteristics, without parallels to the knapped stone assemblages of the same period so far recovered along the coasts of the Aegean Sea, the eastern Mediterranean, the Levant, and the Black Sea.

Keywords Island of Lemnos · Aegean Sea · Epipalaeolithic · Younger Dryas · Lithic assemblages · Sea level rise

Introduction

Excavations carried out during the last 11 years at Ouriakos, an open-air site located along the south-eastern coast of the island of Lemnos (Greece), and the surveys that followed its discovery, have improved our knowledge of the Epipalaeolithic in this part of the northeastern Aegean Sea (Efstratiou, 2014; Efstratiou et al., 2014).

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Lemnos is very important for the study of the events that took place in the region between the end of the Pleistocene and the beginning of the Holocene. This is due mainly to the location of the island in the centre of three different geographic, climatic, and cultural zones: (1) the southern periphery of the Balkan Peninsula, in the north and west; (2) the Marmara and Black Seas, in the north-east; and (3) the Aegean, in the south (see Kaczanowska & Kozłowski, 2013, pp. 17–18).

The complexity of the area under study results from a series of dramatic environmental changes that took place around the end of the Late Pleistocene, when the Younger Dryas cold event (henceforth YD) was followed by the gradual climatic amelioration that characterises the beginning of the Holocene (Benjamin et al., 2017; Pavlopoulos et al., 2011, 2013). The consequent sea level rise (Perissoratis & Conispoliatis, 2003; Papoulia, 2017; Seeliger et al., 2021) led to the disappearance of some territories which may have been exploited by groups of Late Pleistocene hunter-gatherers. Owing to the limited data at our disposal regarding the YD in the region (Özdoğan, 2019), the analysis of the knapped stone assemblages retrieved from the sites discussed in this paper is expected to improve our knowledge of some aspects of the archaeology of the study period. The YD is thought to have been an arid and cold event, during which climatic stress led to increasing human mobility, and consequently to important cultural changes (Grosman & Belfer-Cohen, 1999).

The surveys carried out during the last decade along the eastern and northern coasts of the island of Lemnos, and those of the north-western Anatolian Peninsula, have led to the discovery of a few Epipalaeolithic sites, whose assemblages can be compared with those from Ouriakos (Fig. 1). Ouriakos is the only Lemnos Epipalaeolithic site from which one radiocarbon date has been obtained from an unidentified burnt mammal bone fragment (GrA-53229: 10,390 ± 45 BP; 12,483–12,001 cal BP [94.4%]) (Efstratiou et al., 2014, p. 3).

The retouched knapped stone artefacts retrieved from Ouriakos consist almost exclusively of lunates of microlithic dimension (length range: 1.25–2.50 cm) obtained by abrupt, bipolar retouch, without the microburin technique, a few end scrapers, different types of exhausted cores, and technical pieces most of which are made from hydrothermal siliceous rocks and radiolarian chert. Their characteristics help us interpret the activities that took place within the site and its function(s) and follow the operational sequence employed for the manufacture of the geometric armatures (Efstratiou et al., 2014). The raw materials used for making the knapped stone artefacts retrieved from all the Lemnos Epipalaeolithic sites discussed in this paper are available in the geological formations of the island (Innocenti et al., 2009), which outcrop a few kilometres from the sites (Fig. 2).

The Sites

Agia Marina

The first knapped stone artefacts were discovered in 2012, a few hundred metres southeast and south-southeast of the small church of Agia Marina (Fig. 3), along the same coast where the Bronze Age settlement of Poliochni is located (Bernabò

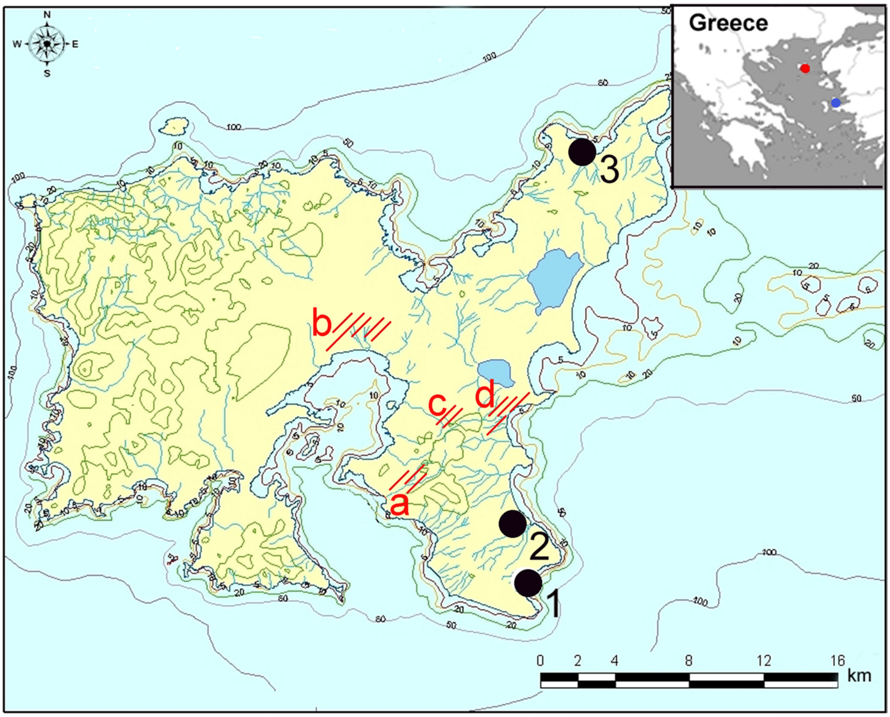

Fig. 1 Lemnos: Distribution map of the Epipalaeolithic sites and the knappable raw material sources reported in the text. Ouriakos (n. 1), Agia Marina (n. 2), Peristereònas (n. 3), Havouli Valley (**a**), Varos (**b**), Rossoupouli (**c**), and Agios Ioannis Prodromos (**d**). Note the position of Lemnos (red dot) and the Karaburun Peninsula (blue dot) (drawing by E. Starnini)

Brea, 1976), c. 2.5 km south of it as the crow flies. The landscape south of the Agia Marina church is characterised by a gentle slope, which declines from c. 50 to c. 15 m towards the Aegean Sea. It is incised by a few short, seasonal streams, which flow from west to east. At present, the area is clear from trees and uncultivated. Most of its surface is covered with *Centaurea spinosa* bushes, which make the territory difficult to walk and survey. However, the presence of sand spots free from vegetation has led to the discovery of a few archaeological sites and isolated artefacts. Epipalaeolithic finds have been recovered from six different findspots, which have been labelled Site 1 to Site 6.

Site 1 (Fig. 4, top) is the most important Epipalaeolithic site discovered in the area. It is an oval, elongated sand spot, slightly sloping eastwards, located along the earth road that leads to the Fissini Towers. This findspot showed evidence of two distinct lithic scatters, called Spot 1 and Spot 2, from which come a consistent number of knapped stone artefacts. Most of them were recovered from the site's surface in a horizontal position, while a few others were found inclined or vertical, partly embedded in the topmost horizon of a concreted, Pleistocene dune. This fact shows that some of the artefacts moved slightly from their original position because

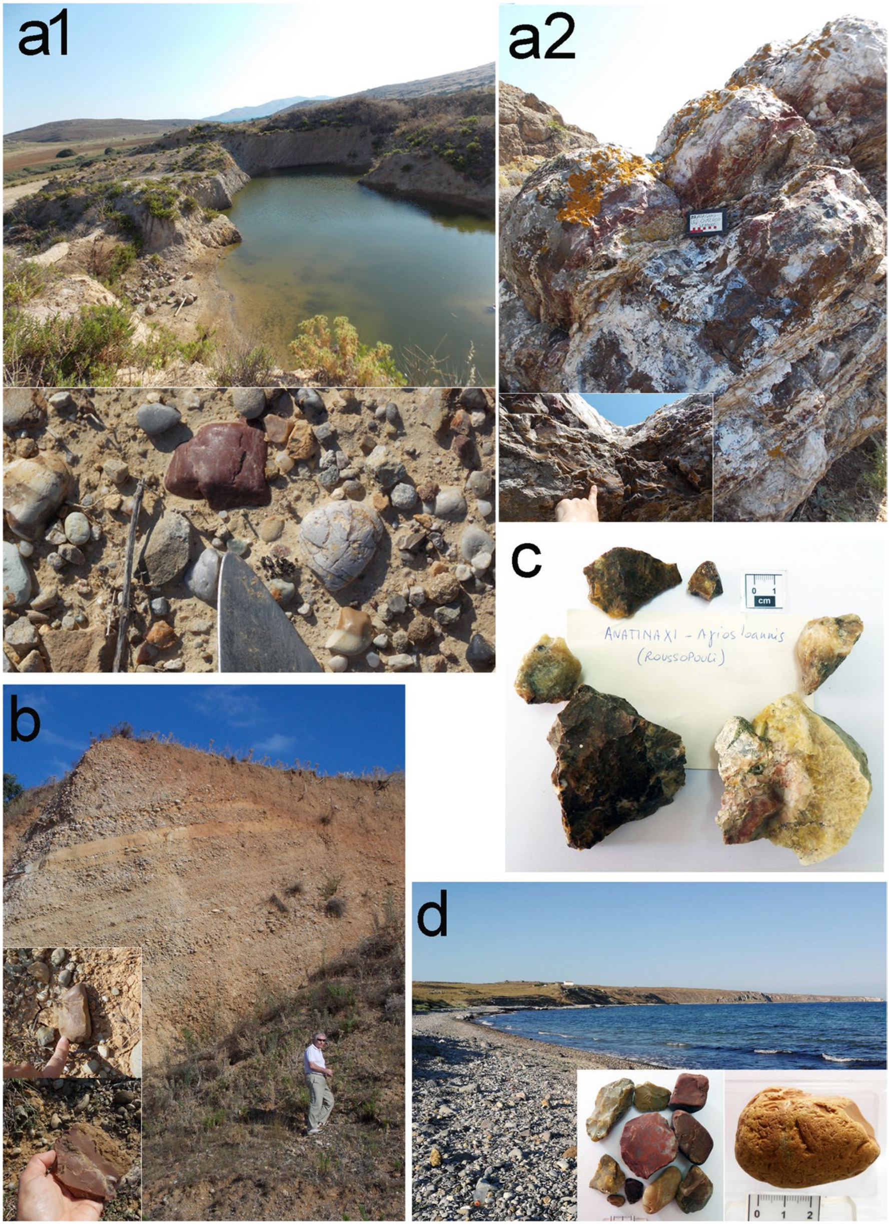

Fig. 2 Lemnos: Knappable raw material sources identified in the island. Havouli Valley (**a1**, top): gravel quarry exploiting the Ifestia geological formation with chert pebbles (**a1**, bottom) outcropping along the river terraces, (**a2**) outcrop of hydrothermal siliceous rocks in the local volcanic formation. Varos (**b**): modern gravel quarry opened in the sedimentary Ifestia Unit rich in chert and radiolarite pebbles. Rossoupouli (**c**): samples of hydrothermal siliceous rocks from the local volcanic formation; and Agios Ioannis Prodromos Bay (**d**): chert pebbles from the beach, and typical of the characteristic wear of beach pebble cortex (photographs by E. Starnini, 2019–2021)

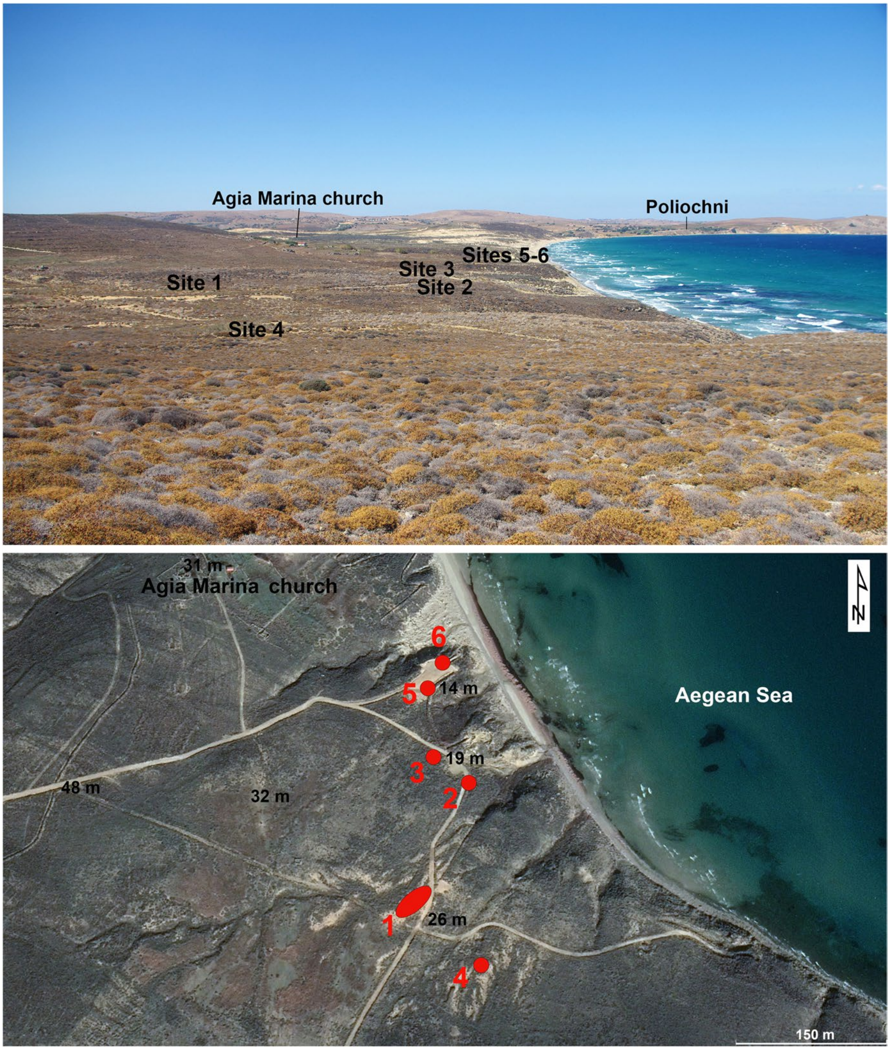

Fig. 3 Agia Marina: Distribution maps of the prehistoric sites discovered in the area (photograph by P. Biagi, 2018, drawing by E. Starnini)

of natural processes. The dune deposit, c. 70-cm thick, covers the fissured limestone and sandstone basements (Anifadi et al., 2016), which is typical of the geology of the area (Fig. 4, bottom).

Site 1 (27 m asl) is located on a terrace c. 100-m wide delimited to the north and south by two narrow, seasonal streams. The site looks like an oval spot of concreted sand (light olive-brown: 2.5Y5/3) on the top of which two scatters of artefacts were recovered. The western one (Spot 1) covers an area of c. 300 sq. m., while the eastern one (Spot 2) c. 150 sq. m. (Fig. 5). The artefacts were collected from the surface during separate surveys conducted between 2012 and 2021 following different

Fig. 4 Agia Marina, Site 1: Erosion area of the surface collection with the location of Spot 2 (top) and fissured bedrock below the sandy soil (bottom) (photographs by P. Biagi, 2021)

methods. Two systematic collections were made in 2013 and 2021. During the 2013 season, 204 artefacts were retrieved from the western Spot 1. Their position was recorded according to squares of 1 × 1 m covering an area of 18 × 18 m. The artefacts were collected either from the eroded surface or from the topmost part of the concreted sand deposit, which is most probably a Pleistocene fossil dune (Fig. 4).

During the 2021 season, a further assemblage of 174 artefacts was collected from the entire surface of the site. On this occasion, the position of each piece was recorded by a Garmin-GPS device (see supplementary databases 1 and 2). The distribution map of all the artefacts from the two spots is shown in Fig. 5. Besides

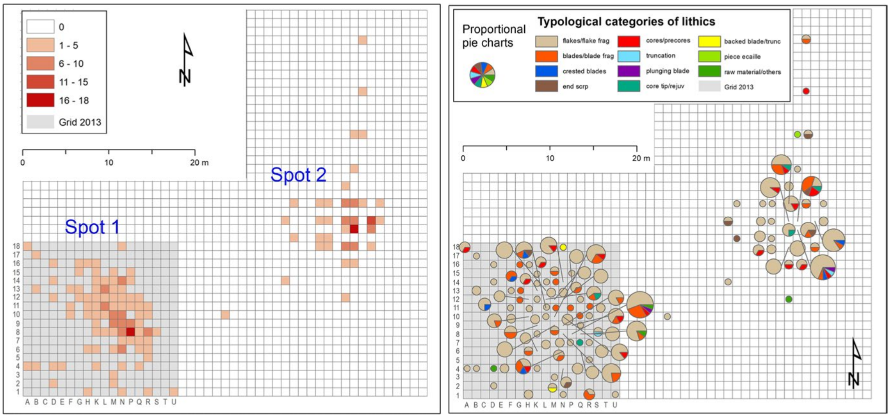

Fig. 5 Agia Marina, Site 1: Distribution maps of the artefacts according to the numbers (left) and typology (right) within the grid. Note the two clusters corresponding to the scatters (Spot 1 and Spot 2) identified on the surface (scattergrams by A. Eleftheriadou)

debitage, debris, and other pieces discarded during the different stages of core knapping and maintenance, only a few, irregular, unretouched bladelets and microbladelets were found. The retouched artefacts are even fewer, represented by a few end scrapers and backed tools (Fig. 7, nn. 3, 4, and 6; Fig. 12, n. 1; Fig. 14, nn. 1–3, 5–7).

The surface collections made from Site 1 during the last 10 years yielded altogether 420 artefacts, most of which come from the two spots reported above (see Fig. 5). They are most probably to be interpreted as manufacturing areas, due to the presence of exhausted, discarded cores, technical artefacts, debitage, and debris pieces (Keeley, 1991, p. 258). Moreover, no difference has been observed in the typological composition of the artefacts from the two spots. Consequently, the techno-typological analysis has been performed on the entire assemblage.

The analysis of the lithic assemblage has taken into consideration the following main features of the artefacts: (1) morphology and size of the striking platforms, where preserved, (2) number and debitage axis of the negative scars, (3) presence of cortex, and (4) dimensions. The last-mentioned included the recording of the maximum length, width, and thickness of all the artefacts, and the attributes of the knapping technology (platform, bulb, etc.). The artefacts were also divided into cores, fragments, angular wastes, debris, flakes, and blades (see supplementary databases 1 and 2). These data, along with the presence of cortical pieces (divided into distinct percentage categories), allow for the reconstruction of the reduction sequences and the "*chaîne opératoire*".

In several cases, traces of crushing have been observed at the lower end (tips) of the cores (Fig. 7, n. 1b; Fig. 11, n. 10b), a marker of the use of direct percussion on an anvil using a hard hammer. The angle between the striking platform of the cores and the flaking surfaces is less than 90°. The main debitage goal was to detach small, narrow laminar blanks with a triangular cross-section (Fig. 7, nn. 7 and 11) to be abruptly retouched to obtain backed microbladelets (Fig. 10, nn. 5, 6, and 12) or microlithic geometric armatures. Among these latter are 1 lunate (Fig. 10, n. 7), 3 backed points (Fig. 7, n. 4; Fig. 9, n. 10; Fig. 10, n. 9), and 1 backed and truncated piece (Fig. 7, n. 3).

The numbers of the different types of artefacts and tools from the two spots is shown in Table 1. The dimensional diagrams developed measuring the length, width, and thickness of 145 complete, unretouched pieces show that the assemblage consists mainly of blanks of hypermicrolithic (<1.25 mm) and microlithic (1.25–2.50 mm) dimensions, which together represent 79% of the total (Fig. 6).

The cores are represented by single-platform flake and single-platform blade, unipolar types, though a few opposed-platform and bipolar specimens are also present (Fig. 7, nn. 1 and 2; Fig. 8, nn. 1, 9, and 10; Fig. 9, n. 7; Fig. 10, nn. 10, 15, and 16; Fig. 11, nn. 2 and 10; Fig. 13, n. 2; Fig. 14, n. 8; Fig. 15, nn. 7–9). Several microcores are on small pebbles (Fig. 12, n. 8; Fig. 15, nn. 4 and 10). The core platforms are prepared (Fig. 7, n. 1a; Fig. 11, n. 10a; Fig. 14, n. 8) and rejuvenated (Fig. 13, n. 2). Most of the cores display hinge fracture negatives (Fig. 7, nn. 1 and 2; Fig. 11, n. 2; Fig. 14, n. 8; Fig. 15, nn. 9 and 10) and preserve cortical faces in varying proportions (Fig. 10, n. 16; Fig. 12, n. 8; Fig. 15, n. 8). Core preparation and core management pieces, among which are decortication flakes (Fig. 7, n. 10; Fig. 12, n.

Table 1 Agia Marina: number and type of artefacts recovered from each site

Artefact type	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Cores	25	2	7	-	4	3
Pre-cores	3	-	-	-	-	-
Burins	-	-	-	-	-	1
End scrapers	10	-	-	-	-	2
Truncations	1	-	-	-	-	-
Borers	1	-	-	1	-	-
Backed blades	6	-	1	-	-	-
Backed points	3	-	-	-	-	-
Backed blades and Truncation	1	-	-	-	-	-
Geometric microliths (lunates)	1	1	1	-	-	-
Geometric by-products	2	-	-	-	-	-
Side scrapers	2	-	-	-	1	-
Pièces écaillées	1	-	-	-	-	-
Crested blades	13	-	1	-	-	1
Plunging blades	2	-	-	-	-	-
Core trimming flakes/blades	7	-	-	-	-	1
Tablets	2	-	-	-	-	-
Raw material pieces	3	1	-	-	-	1
Decortication pieces	10	-	-	-	-	-
Unretouched blades	59	2	3	-	2	1
Unretouched flakes	268	5	56	-	22	52
Total	**420**	**11**	**69**	**1**	**36**	**62**

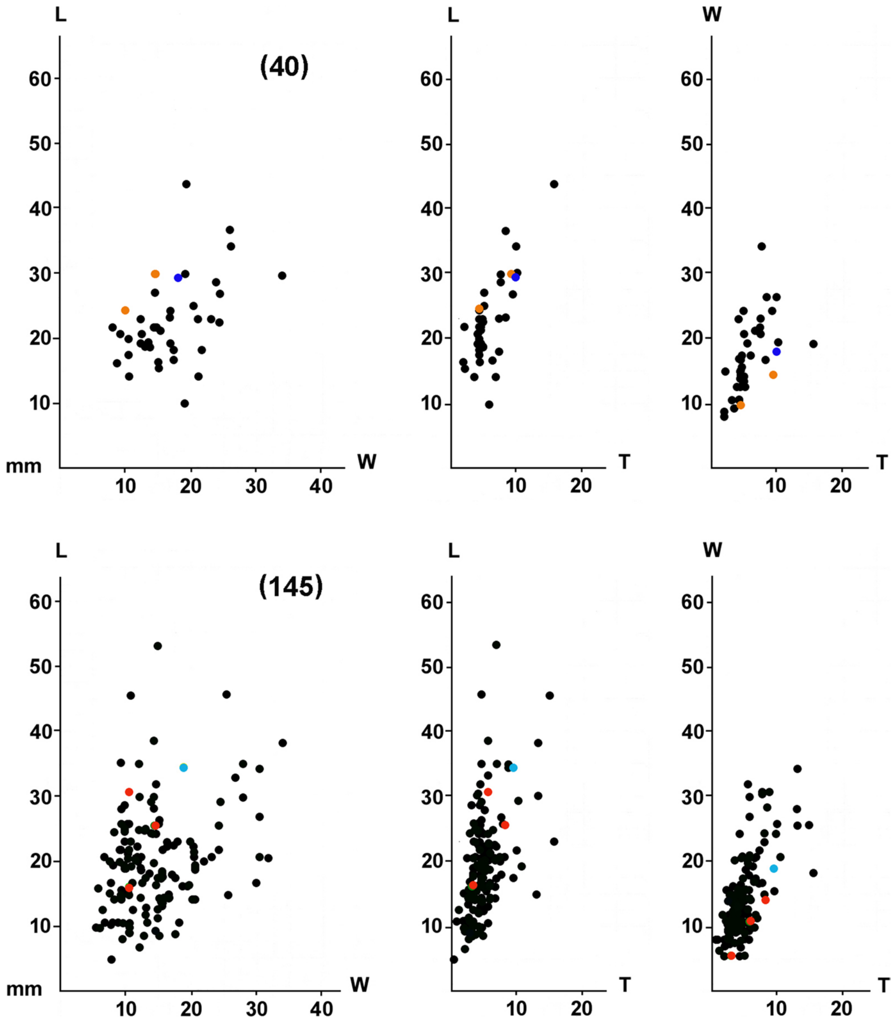

Fig. 6 Agia Marina (bottom) and Peristereònas (top): Dimensional (length (L)/width (W)/thickness (T)) scatterplots of the complete, unretouched artefacts (black dots), plunging bladelets (blue dots), crested bladelets (brown and red dots) (drawing by P. Biagi)

6), platform tablets (Fig. 9, n. 13), crested blades (Fig. 7, n. 8; Fig. 9, nn. 2 and 8; Fig. 10, nn. 8 and 14; Fig. 11, nn. 3 and 9), core-tip rejuvenation flakes (Fig. 12, n. 9), core-front flakes and blades (Fig. 7, n. 5; Fig. 11, n. 1), core side-rejuvenation blades and flakes (Fig. 9, n. 11; Fig. 11, nn. 4 and 5; Fig. 13, n. 3), and irregular or broken discarded blanks (Fig. 7, nn. 7, 9, 11, and 12; Fig. 8, nn. 3 and 8), are all represented. One heavily broken pebble with percussion scars was probably employed as a hammerstone (Fig. 13, n. 1). The butts of the laminar products are rarely punctiform (6) (Fig. 10, n. 3; Fig. 11, n. 8; Fig. 12, n. 6; Fig. 15, n. 5), most of them are dihedral (18), and a few thinned (4), flat (3), and facetted (1).

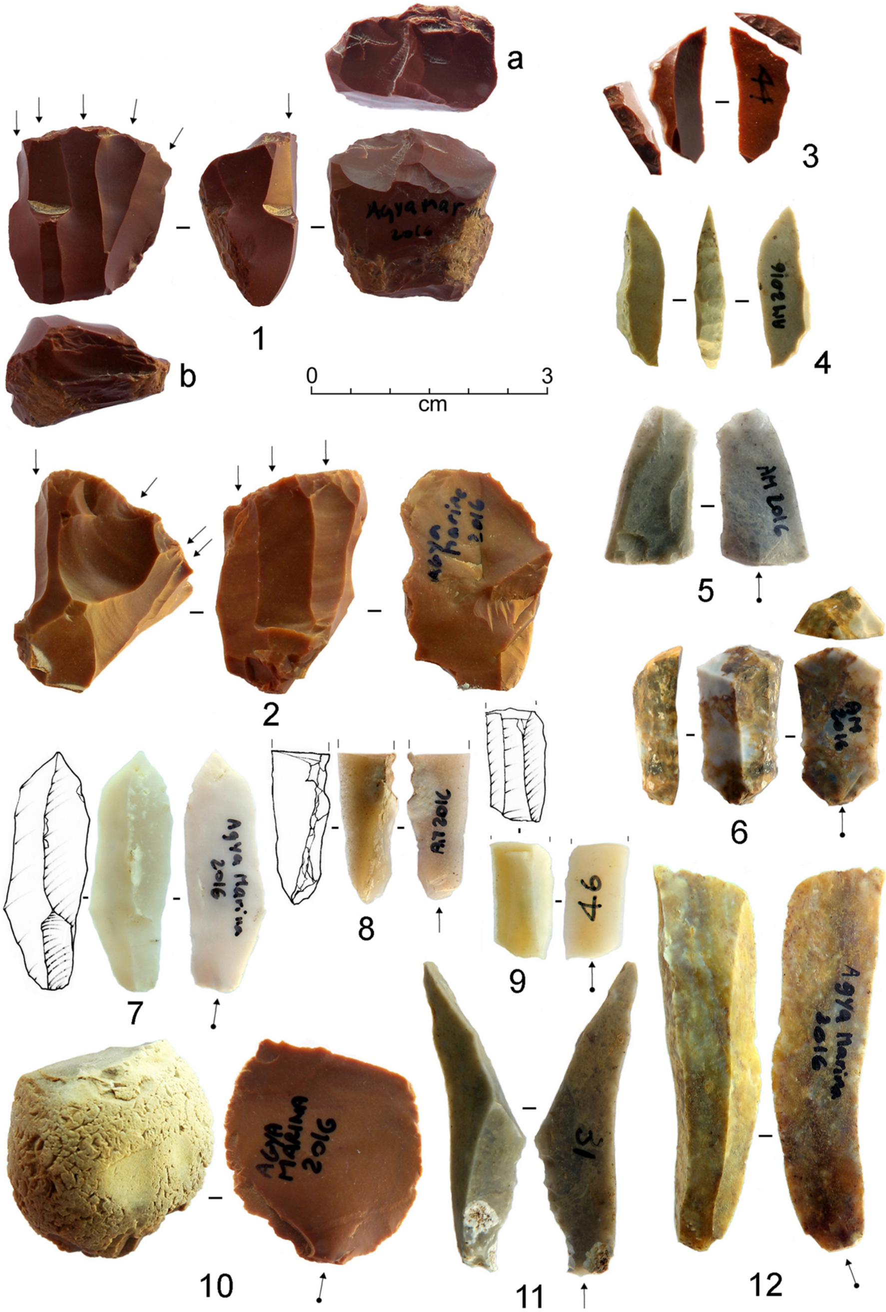

Fig. 7 Agia Marina, Site 1: Surface collections 2016 and 2021. Microbladelet cores (nn. 1 and 2), geometric microliths (backed microbladelet and truncation n. 3, backed point microbladelet n. 4), unretouched microbladelet (n. 5), long end scraper (n. 6), crested microbladelets (n. 8), unretouched microbladelet and bladelet (nn. 7 and 11), corticated microflake from beach pebble (n. 10), and trapezoidal cross-section bladelets (nn. 9 and 12) (photographs and drawings by E. Starnini)

Fig. 8 Agia Marina, Site 1: Surface collection 2016. Microbladelet cores (nn. 1, 9, and 10), unretouched bladelets (nn. 3 and 8). Site 2: core on pebble (n. 2), bidirectional core (n. 5), hypermicrolithic lunate (n. 4), backed bladelet (n. 6). Site 3: lunate (n. 7). Site 4: Surface collection 2017. Probable straight perforator (n. 11) (photographs and drawings by E. Starnini)

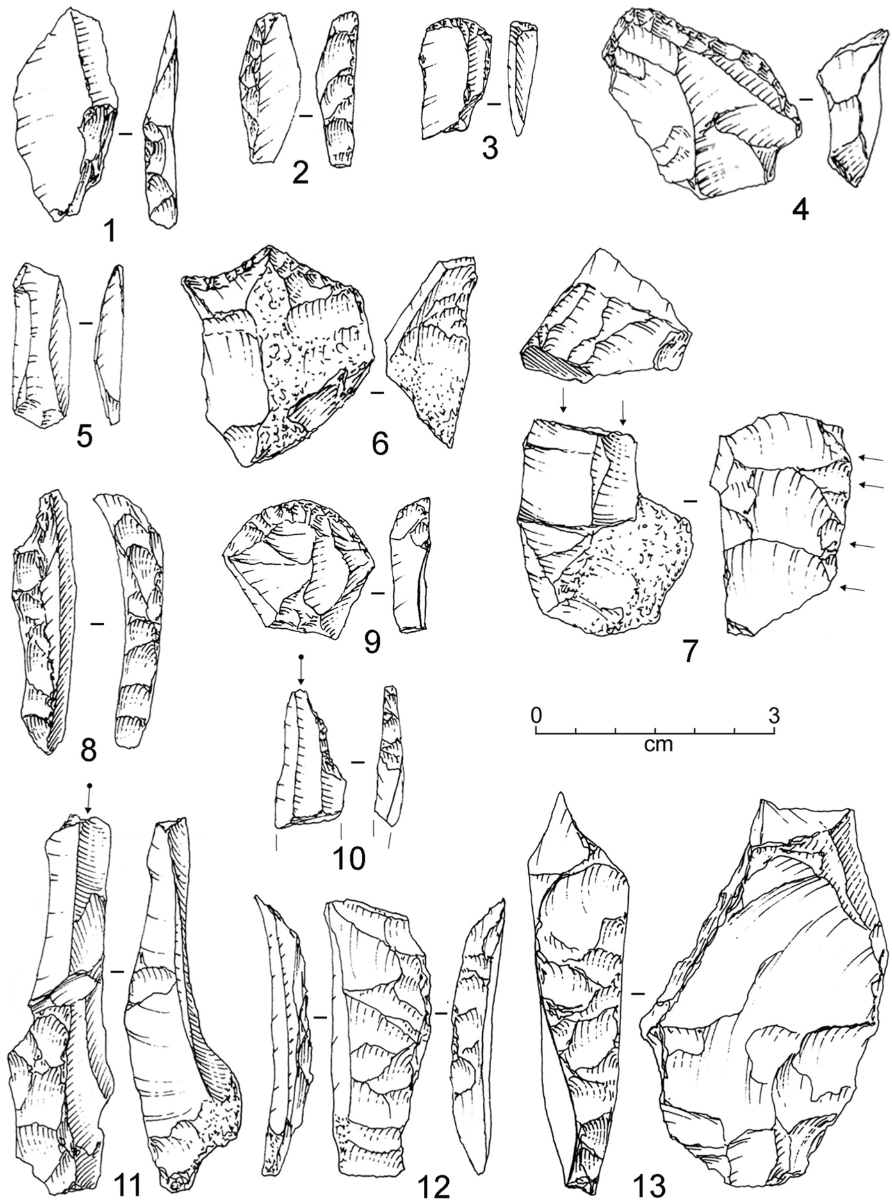

Fig. 9 Agia Marina, Site 1: Surface collection 2013. Crested microbladelets and bladelets (nn. 1, 2 and 8), long end scraper (n. 3), side and transverse scrapers (nn. 4 and 6), unretouched, trapezoidal cross-section microbladelet (n. 5), microflake core (n. 7), short end scraper (n. 9), partial backed point (n. 10), plunging crested bladelet (n. 11), core trimming bladelet (n. 12), and core tablet (n. 13) (drawings by P. Biagi and G. Almerigogna)

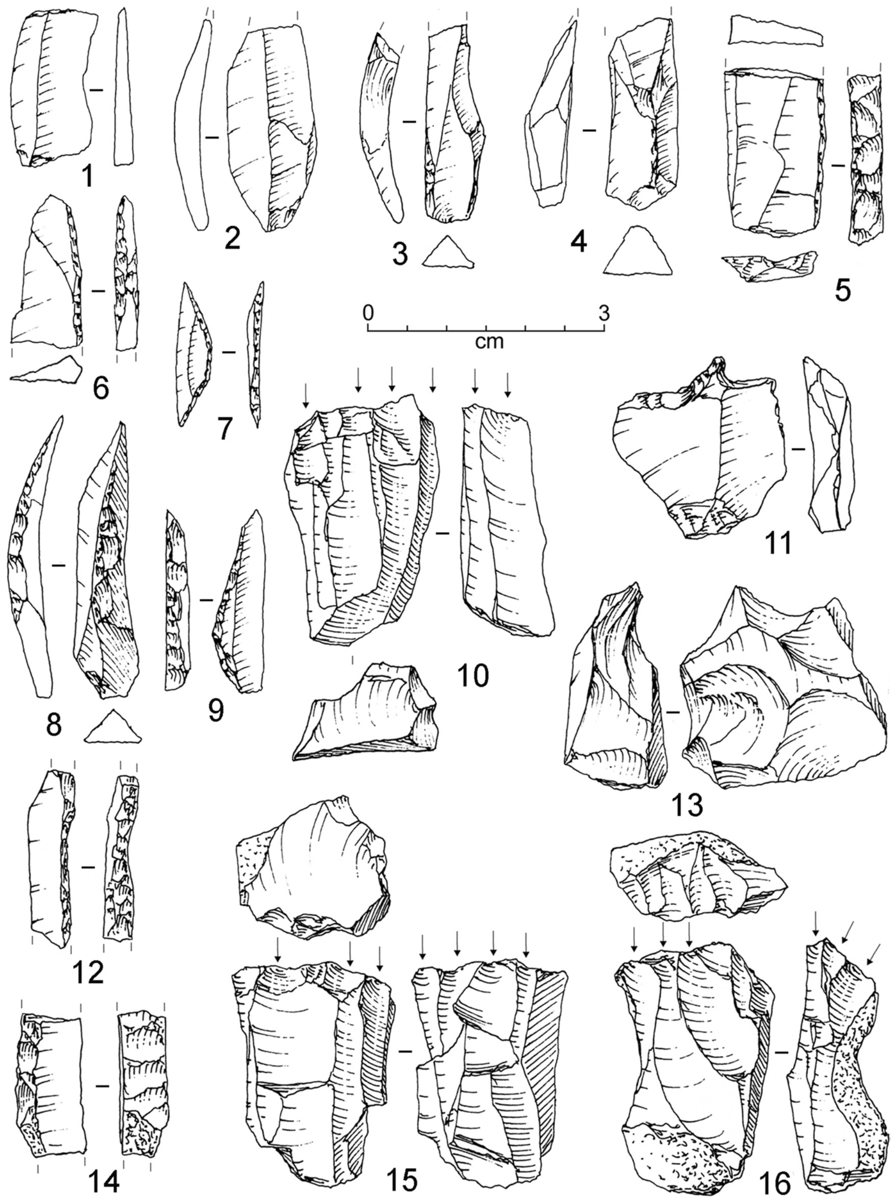

Fig. 10 Agia Marina, Site 1: Surface collections 2012 and 2013. Unretouched bladelets (nn. 1–3), crested bladelets (nn. 4, 8, and 14), backed bladelets (nn. 5, 6, and 12), lunate (n. 7), backed point (n. 9), micro-bladelet cores (nn. 10, 15, and 16), straight borer (n. 11), and core tablet (n. 13) (drawings by P. Biagi and G. Almerigogna)

Fig. 11 Agia Marina, Site 1: Surface collection 2013. Core rejuvenation bladelet (n. 1), microbladelet and microflake cores (nn. 2 and 10), crested microbladelets (nn. 3 and 9), lunate by-product, core side rejuvenation microflake (n. 4), core rejuvenation flakelet (n. 5), unretouched bladelets (nn. 6 and 8), and raw material pebble fragment (n. 7) (photographs and drawings by E. Starnini)

Fig. 12 Agia Marina, Site 1: Surface collection 2013. Short end scraper (n. 1), half, tested pebble (n. 2), crested bladelet (n. 3), trapezoidal cross-section bladelet (n. 4), unretouched bladelet (n. 5), decortication microflake from pebble (n. 6), scalene triangular cross-section microbladelet (n. 7), microbladelet and microflake cores (nn. 8 and 10), core-tip (n. 9) (photographs by E. Starnini)

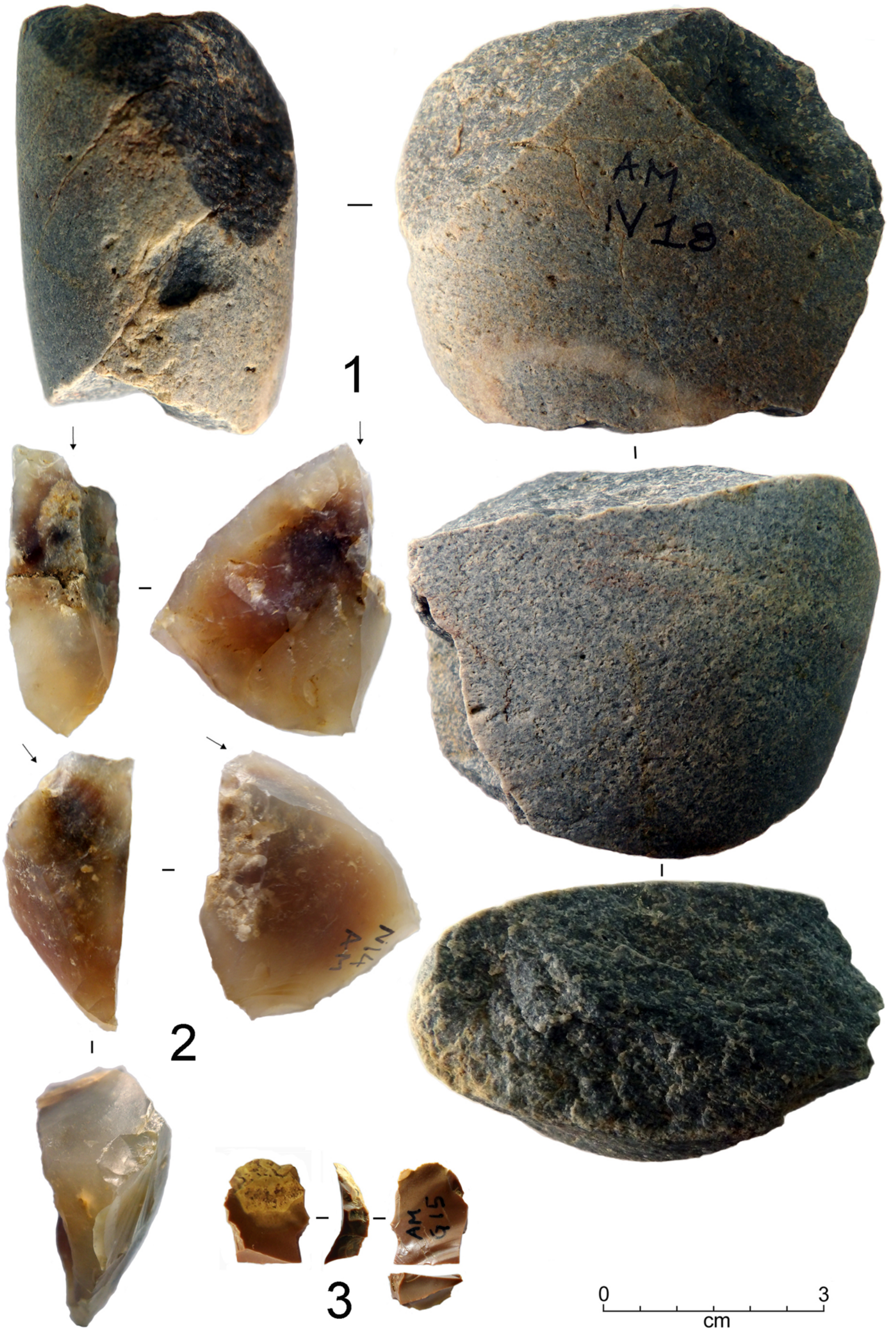

Fig. 13 Agia Marina, Site 1: Surface collection 2013. Fragment of probable quartzite hammerstone (n. 1), flakelet core (n. 2), and core side crested flakelet (n. 3) (photographs by E. Starnini)

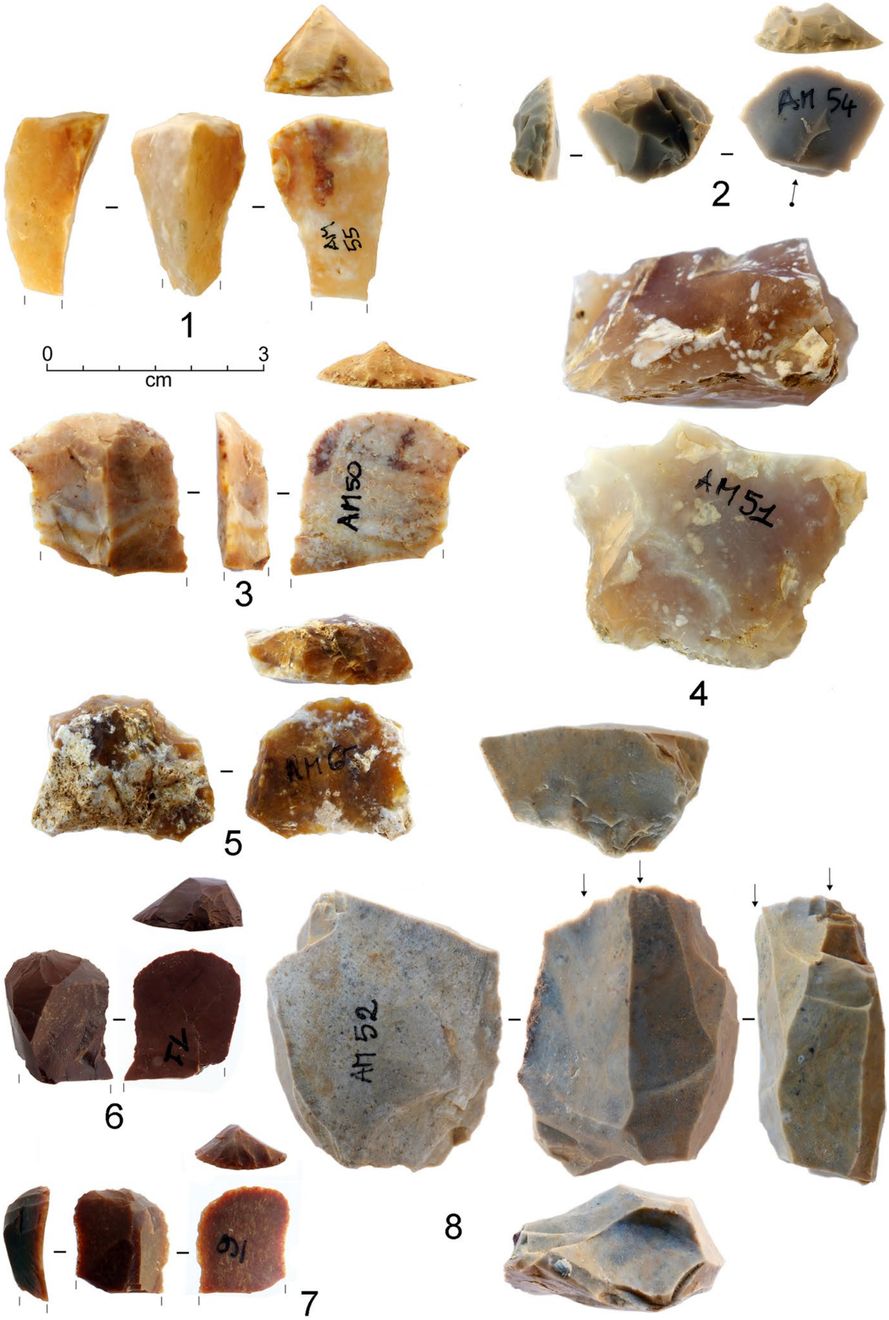

Fig. 14 Agia Marina, Site 1: Surface collection 2013. Long end scrapers (nn. 1, 3, 6, and 7), short end scrapers (nn. 2 and 5), *pièce écaillée* (n. 4), and bladelet core (n. 8) (photographs by E. Starnini)

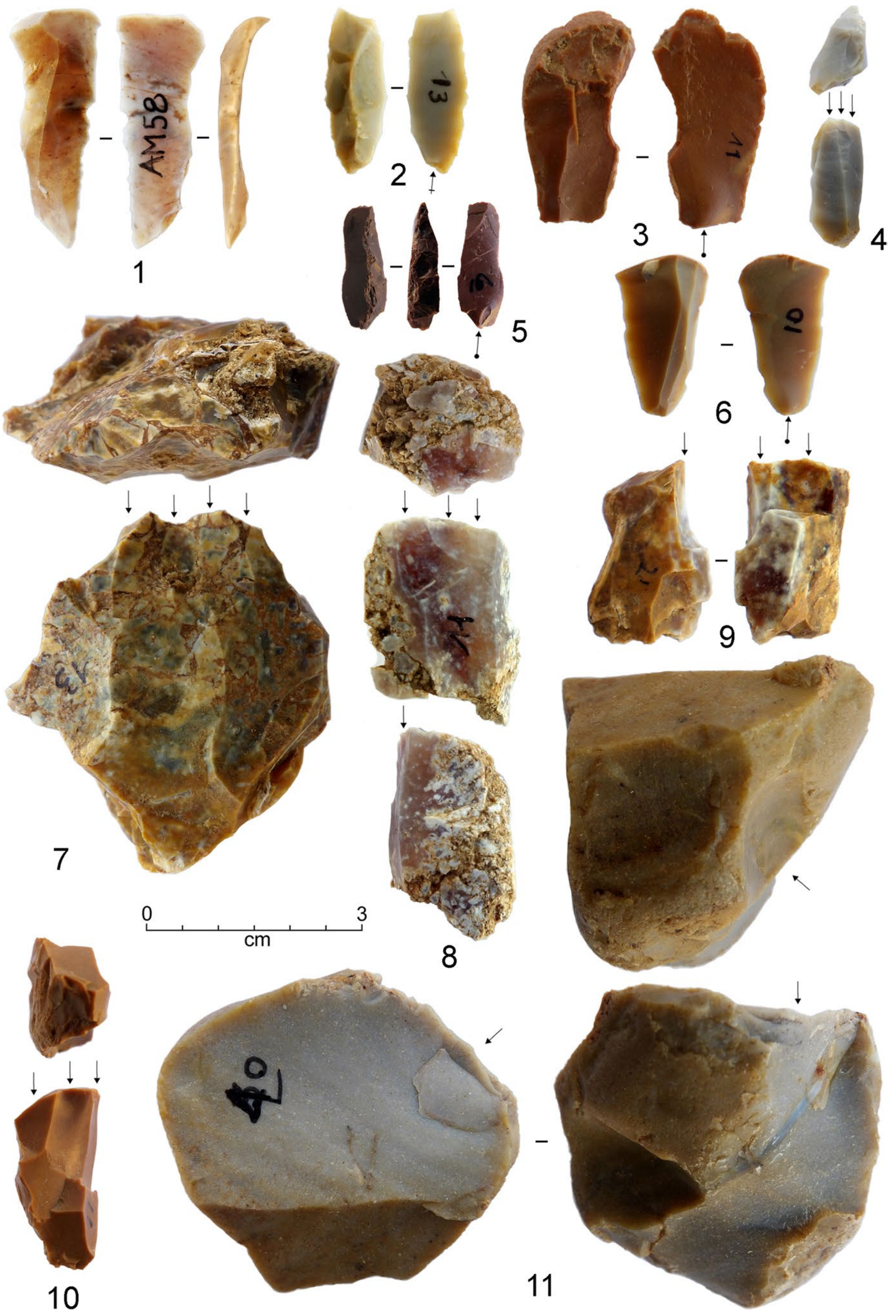

Fig. 15 Agia Marina, Site 1: Surface collections 2013 and 2021. Unretouched bladelets (nn. 1–3), microbladelet, microflake and flakelet cores (nn. 4, 7–10), crested microbladelet (n. 5), plunging microbladelet (n. 6), and tested beach pebble (n. 11) (photographs by E. Starnini)

Other than lunates and backed tools, the site yielded 9 end scrapers made from microflakes, flakes, and thick flakes. They are represented by long (Fig. 7, n. 6; Fig. 14, nn. 1, 3, 6, and 7), short (Fig. 12, n. 1; Fig. 14, nn. 2 and 5), and carinated types.

As reported above, no substantial difference has been noticed in artefact typology, technology, and raw material use between Spot 1 and Spot 2, except for the number of finds and the state of preservation of the deposit. Spot 2 is smaller and looks more eroded than Spot 1. Therefore, we can interpret the lithic clusters as two distinct, more or less contemporaneous knapping floors, showing the ephemeral settling of one or more groups of mobile hunters.

Site 2 (17 m asl): c. 50-m south-southeast of Site 3, a small assemblage of 69 knapped stone artefacts was collected in 2015 from the surface in a small area without vegetation, just south of the same road (Fig. 3, Site 2). It includes 7 cores (Fig. 8, nn. 2 and 5), 1 lunate obtained by abrupt, bipolar retouch (Fig. 8, n. 7), and 1 backed bladelet (Fig. 8, n. 6).

Site 3 (19 m asl): A small scatter of lithics was discovered and collected in 2017 along the dirt road that leads to Site 1, c. 200 m north of the latter (Fig. 3, Site 3). It consists of a few artefacts among which are a single lunate (Fig. 8, n. 4) and a few exhausted cores.

Site 4 (27 m asl): This site is very interesting, although its cultural and chronological attribution are uncertain because the only lithic tool discovered does not find parallels with any other Epipalaeolithic artefact ever recovered from the island. One long, straight perforator obtained by abrupt, deep, direct retouch (Fig. 8, n. 11) was collected from the bottom of a profile opened by natural events in a deposit of concreted sand of dark yellowish-brown colour (10YR4/4) c. 80-cm thick. The site is located c. 70 m east-southeast of Site 1 (Fig. 3, Site 4).

Site 5 (13 m asl): Two different collections were made in 2017 and 2021 in a parking place opened by a bulldozer a few years earlier on a terrace facing the sea (Fig. 3, Site 5) (see supplementary databases 1 and 2). The site was probably buried by a Holocene dune. The artefacts come from small clusters, which were exposed during the construction of the car park. They are represented by cores (Fig. 16, nn. 6 and 9), 1 simple burin (Fig. 16, n. 2), 1 sidescraper, and a few unretouched artefacts.

Site 6 (11 m asl): Is located within the same parking area of Site 5, just a few metres north of it, at the beginning of the pathway that leads to the beach (Fig. 3, Site 6). Many artefacts were collected from the surface in the summer of 2017, among which are different types of cores, 2 end scrapers (Fig. 16, n. 8), crested blades, technical pieces, and unretouched artefacts (Fig. 16, n. 10).

Apart from the sites reported above, a few more isolated knapped stone artefacts of uncertain attribution were recovered from the area of Agia Marina. According to their typological characteristics, they are probably to be attributed to different periods of Palaeolithic frequentation (Fig. 16, nn. 1, 3–5, and 7). Some of the artefacts were collected in 2012 next to a natural profile that opens just to the west of Site 4 at c. 27 m of altitude (39°49′55.80″N-25°20′41.60″E). Two more were found during a brief survey made in 2013 (Fig. 16, nn. 5 and 7).

To sum up, in addition to Site 1, which yielded the most consistent number of finds, the other sites have also yielded important data, which improve our knowledge

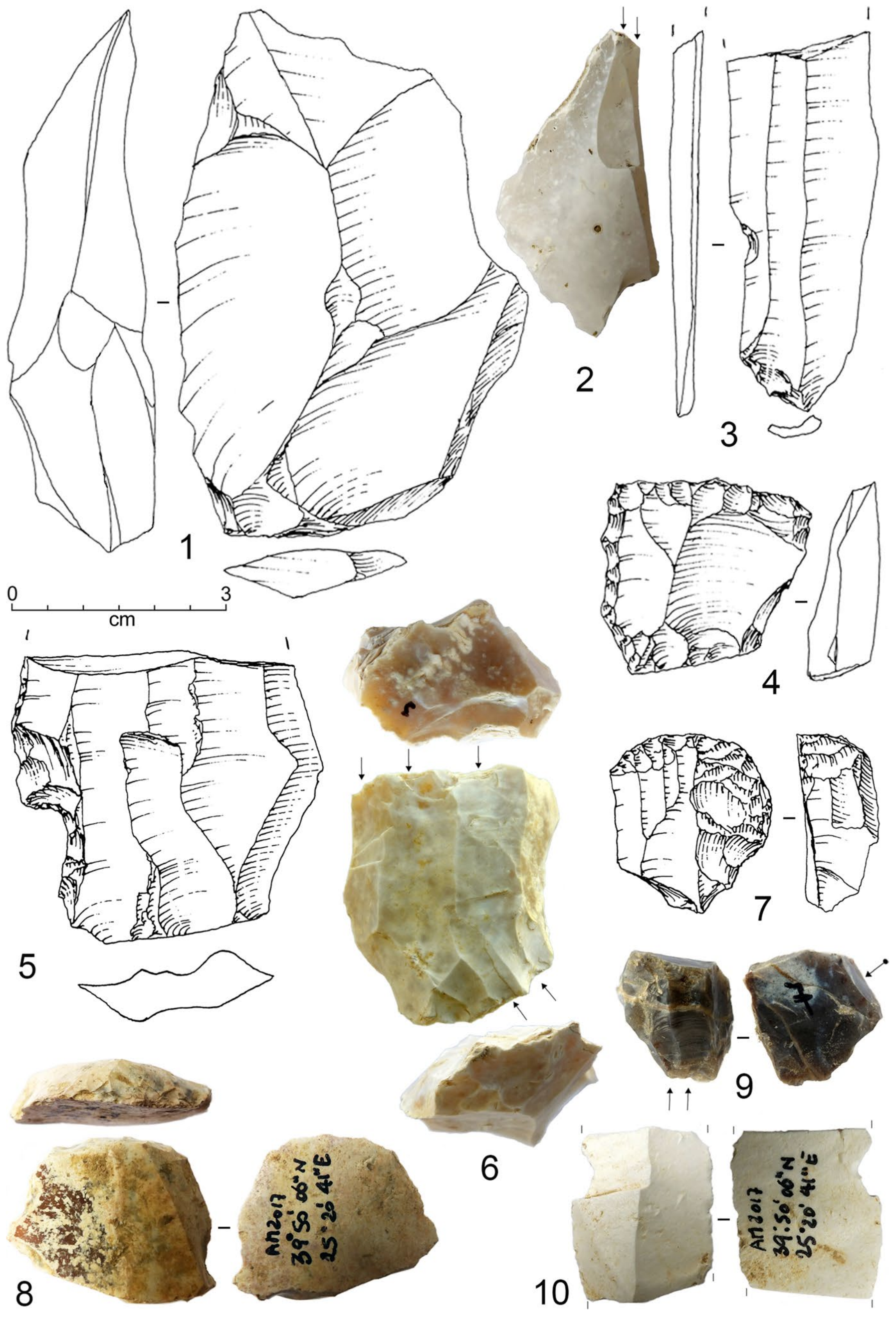

Fig. 16 Agia Marina: Surface collections 2012, 2013, and 2017. Scattered finds: Middle Palaeolithic (?) flake (n. 1), blade fragment (n. 3), latero-transverse scraper (n. 4), notched scraper (n. 5), short end scraper (n. 7). Site 5: Side burin on flakelet (n. 2), prismatic core (n. 6), core fragment (n. 9). Site 6: short end scraper (n. 8), blade fragment (n. 10) (drawings by P. Biagi and G. Almerigogna; photographs by E. Starnini)

of the behaviour of the final Pleistocene hunter-gatherers who settled in the region and help interpret the complexity of their mobility patterns (Kent, 1991). The unique conditions of the island, whose coastal area is still in a reasonably good state of preservation, provide an occasion for recording traces of prehistoric occupations. Apart from cases of land exploitation for present-day and historical agro-pastoral activities, some territories are still little urbanised. However, the new policy of tourism development has favoured the exploitation of some coastal zones, increasing accessibility to beaches, and opening new earth roads and parking areas. Consequently, on the one hand, this policy may have caused the loss of archaeological sites, but on the other, it has favoured the discovery of new sites. In our case, the coastal surveys carried out over the last decade, have shown that groups of Epipalaeolithic hunters repeatedly frequented some localities which were particularly suitable for settlement due to their natural resources.

Peristereònas

The site of Peristereònas was discovered during the summer of 2017, located on a small, heavily weathered promontory that protrudes towards the sea along the north-eastern coast of the island (Fig. 1, n. 3; Fig. 17). At present, the cape is covered with sand and spots of small *Centaurea spinosa* bushes. The area immediately inland is rich in springs and small, seasonal streams.

The only systematic surface collection of knapped stone artefacts was made in the summer of 2018 within a grid of 10×10 m. The finds were recovered from an area of c. 95 sq m, with a collection unit of 2×2 m due to the low visibility of finds (Fig. 17, bottom). A small trial trench, measuring 1×2 m, was opened in 2019 to check for the presence of residual archaeological deposits in situ (Fig. 19, top). Unfortunately, the test pits showed that the site is eroded; the deposit yielded no evidence of archaeological features or charcoal remains, and the bedrock lies c. 20 cm below the land surface. Just four knapped stone artefacts were recovered in the first 10 cm by dry sieving (see supplementary database 3).

The industry from the surface collection made in 2018 consists of 588 artefacts (Table 2). A further twenty-two pieces were collected in 2017 and 2019. The spatial distribution of the artefacts is biased by the bush cover that affects the visibility in many squares (Fig. 17, bottom). The finds seemed to be randomly concentrated in a few squares. Most specimens consist of undiagnostic fragments, blanks, debitage, and debris pieces. Many artefacts are in a fragmentary state (536: 90.54%), a few are burnt (61: 11.38%), or heavily weathered (see supplementary database 3). Forty complete, unretouched artefacts were measured to develop the length/width/thickness scattergram of Fig. 6, top. The results show that 75% of the unretouched pieces are of hypermicrolithic and microlithic dimensions. Despite the low number of artefacts available, the general picture is comparable with that obtained from Agia Marina Site 1 (Fig. 6, bottom: 79%).

The assemblage includes 11 exhausted cores (1 subpyramidal, 2 subconical, 3 prismatic, 4 on pebble: Fig. 18, nn. 10 and 11) from which microbladelet blanks with a thick triangular cross-section were obtained for the production of lunate

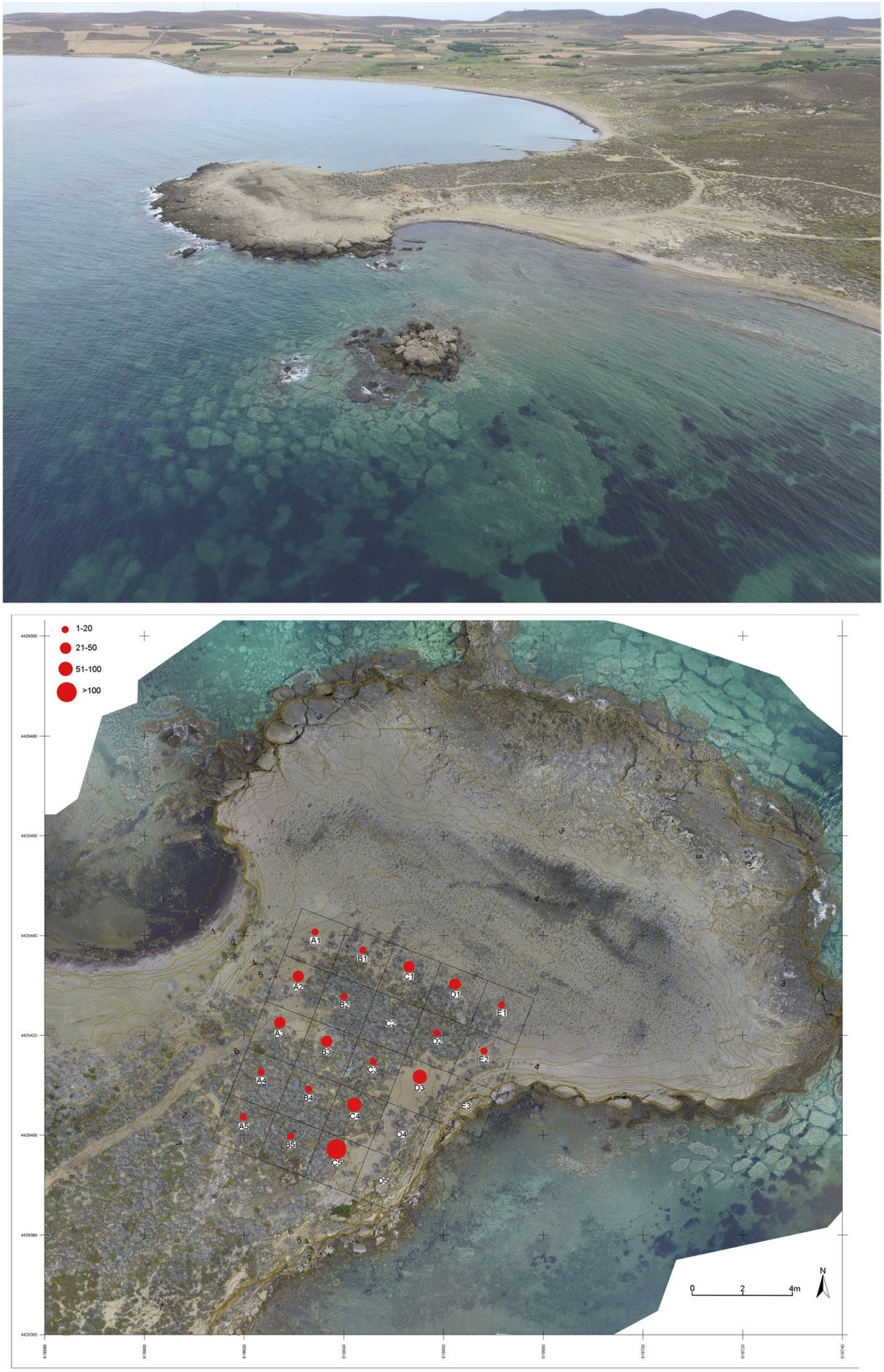

Fig. 17 Peristereònas: The headland on which the site is located from the west (top), and from the air, with the grid into which the site's surface has been subdivided (bottom). The red dots represent the artefacts distribution number (drone photographs by N. Efstratiou)

Table 2 Peristereònas: site's surface visibility, number, and characteristics of the artefacts of the 2018 collection

Square	Visibility (%)	Artefact totals	Weight (gr)	Burnt items	Hydrothermal rocks	Cherts	Corticated items	Retouched tools	Crested blades	Cores	Complete blanks
A1	90	11	18	1	9	1	1	1	-	-	1
A2	60	41	36	4	31	6	9	1	-	-	4
A3	60	47	144	9	25	13	4	5	-	3	5
A4	30	4	14	-	3	1	1	-	-	1	1
A5	25	8	6	2	4	2	1	1	-	-	1
B1	80	8	38	1	4	3	1	-	-	-	-
B2	20	15	20	2	10	3	2	-	-	-	1
B3	40	46	48	11	30	5	2	-	-	-	4
B4	5	1	0.50	-	1	-	-	-	-	-	-
B5	15	10	8	2	6	2	3	-	-	-	-
C1	80	23	38	2	17	4	4	-	-	-	1
C2	5	-	-	-	-	-	-	-	-	-	-
C3	5	6	8	1	2	3	1	-	-	-	-
C4	5	61	48	1	48	12	1	1	-	-	-
C5	45	152	197	11	119	22	12	1	-	-	9
D1	60	27	72	-	16	11	5	-	-	2	-
D2	5	4	6	-	4	-	-	-	-	-	-
D3	98	94	133	5	80	9	3	1	1	1	1
E1	95	19	34	2	14	3	3	-	-	-	-
E2	60	11	11	1	9	1	3	-	-	-	-
Total		**588**	**879.50**	**55 (9.3%)**	**432 (73.5%)**	**101 (17.2%)**	**56 (9.5%)**	**11 (1.9%)**	**1 (0.2%)**	**7 (1.2%)**	**28 (4.8%)**

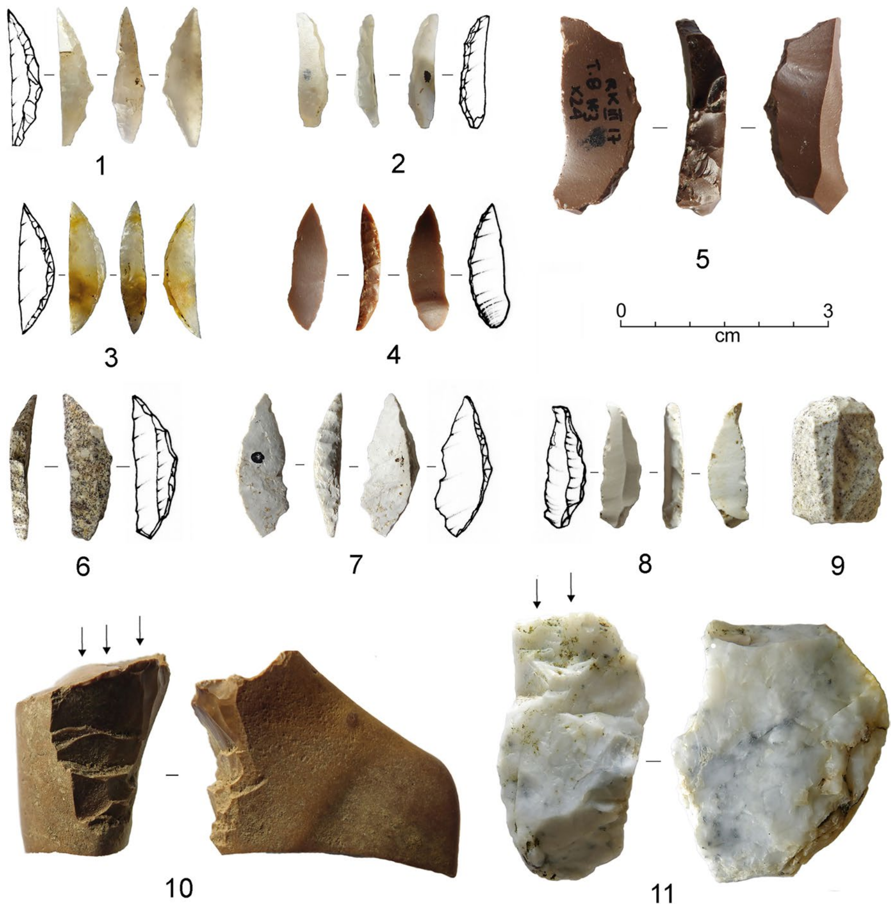

Fig. 18 Knapped stone artefacts from Ouriakos (lunates: nn. 1–5) and Peristereònas (lunates: nn. 6–8, end scraper: n. 9, and cores: nn. 10 and 11) (photographs and drawings by E. Starnini)

geometrics. The presence of 1 complete tested block of hydrothermal raw material, chert pebble fragments (4), cores (11), crested blades (3), decortication bladelets (1), plunging blades (1), cortical pieces (64), and debitage flakes suggest that the manufacture of the lithic artefacts took place on the spot. The retouched tools consist of 3 end scrapers, 2 of which are circular, on microflakes, and 1 is long on a bladelet with a trapezoidal cross-section (Fig. 18, n. 9), 1 truncation, 1 probable straight perforator, 1 backed point, 7 lunates, and 1 sidescraper.

From a techno-typological and dimensional point of view, the assemblage can be compared with that from Ouriakos, though most of the Peristereònas lunates are at least 1–2 mm longer than the average size of the Ouriakos specimens (Fig. 18, nn. 1–5; Fig. 20). All the lunates had been obtained without the microburin technique

Fig. 19 Peristereònas: Trial trench opened in 2019 (top) and Ifestia Unit conglomerates that outcrop at the northern edge of the promontory (bottom) (photographs by N. Efstratiou, 2019, and P. Biagi, 2019)

by abrupt, bipolar retouch (Fig. 18, nn. 6–8), except for one complete piece (Fig. 18, n. 6) and one fragment made by abrupt, deep, direct retouch.

The Peristereònas artefacts were produced locally from raw material retrieved from the same local sources exploited by the Agia Marina and Ouriakos

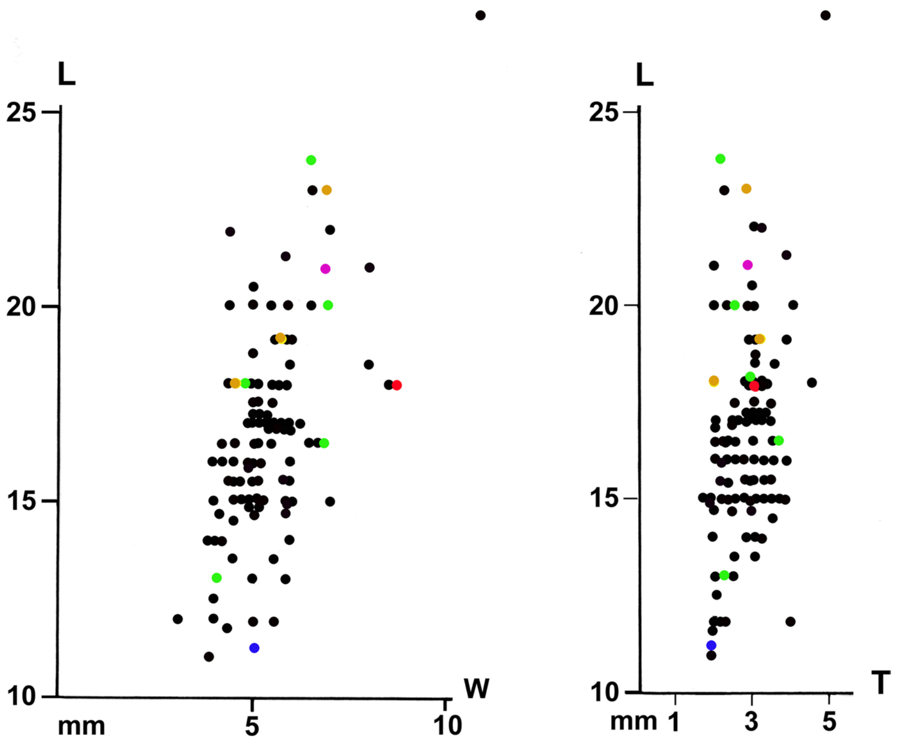

Fig. 20 Length/width (left) and length/thickness (right) scattergrams of the lunates from Ouriakos (black dots), Peristereònas (green dots), Agia Marina (Site 1: brown dot; Site 2: blue dot; Site 3: red dot), and Kocaman, Karaburun Peninsula (violet dot) (drawing by P. Biagi)

inhabitants. The absence of any exotic or imported raw material is significant. It reinforces the suggested chronological and cultural attribution of the assemblage.

Raw Material Provenance and Exploitation

The surveys conducted for the identification of the lithic sources have shown that all the raw materials for making artefacts are available on the island within 15–20 km from the sites (see Fig. 1). So far, we have identified two primary sources. One, of sedimentary origin, is the Ifestia Unit (Innocenti et al., 2009), which outcrops in a few well-defined zones of the island. At present, it is exploited as a gravel for road construction. Over the last 20 years, a few gravel quarries have been opened around Moudros Bay from which it is possible to collect hundreds of chert and radiolarian pebbles, which are identical to those retrieved from the archaeological sites for making artefacts (Fig. 1b and Fig. 2b). Another abandoned gravel quarry, opened to exploit the same sedimentary formation rich in chert pebbles, is located on a river terrace along the right side of the Havouli Valley (Fig. 1a and Fig. 2a1).

The second type of source consists of hydrothermal siliceous rocks. They occur as seams in volcanic formations (Fig. 1a and Fig. 2a2), outcropping along the eastern slopes of the Kalogiros Hill, in the uppermost part of the same valley (Efstratiou et al., 2014, Fig. 10). This raw material was exploited until a few decades ago by local farmers to make threshing sledge inserts. The large areas of debris flakes, and the percussion scars still visible on the multicoloured Kalogiros outcrop blocks, testify to this activity (Biagi et al., 2015). Another outcrop of siliceous hydrothermal rocks has been located near the village of Rossoupouli (Fig. 1c and Fig. 2c).

Finally, a secondary source of both chert and hydrothermal rock pebbles is the Agios Ioannis Prodromos Bay (Fig. 1d and Fig. 2d) where the beach is rich in all these raw materials. The chert pebbles collected from the shore of the bay show the same cortical scars caused by wave rolling that have been observed on some archaeological pieces (Fig. 7, n. 10). They demonstrate one of the ways used by prehistoric groups to collect raw materials. Other rocks were also employed, such as quartzite, which is also available from the Ifestia Unit conglomerates that outcrop at the northern edge of the Peristereònas promontory (Fig. 19, bottom).

Discussion

None of the sites discussed in this paper yielded organic material suitable for radiocarbon dating. However, the techno-typological analysis of the knapped stone assemblages can help us establish their relative chronology with some confidence. To give an example, a recent review of the MIS2-Late Upper Palaeolithic assemblages of eastern Central Europe (see Lengyel et al., 2021) has shown that the initial Late Glacial Maximum (LGM) assemblages are characterised by domestic tool dominance and the frequent use of flake tools, while the post-LGM assemblages are correlated with armature dominance and blade and bladelet tools.

At present, Ouriakos is the only radiocarbon-dated Epipalaeolithic site known in Lemnos, attributed to the YD cold event (Mangerud, 2021). During this period, which is still poorly known in the Aegean and surrounding regions (Kaczanowska & Kozłowski, 2013, p. 18, and Fig. 3), the most important caves of the Peloponnesus and Thessaly, Franchthi, Klissoura 1, and Theopetra were not occupied (see Karkanas, 2001, p. 389; Perlès, 2017, p. 177; Starkovich, 2017, Table 1).

A preliminary study of the Ouriakos lithic assemblages has shown the predominance of bipolar-retouched microlithic lunates. They were manufactured without the microburin technique, following a unique technology, which at present has no parallels elsewhere in the Aegean (see Efstratiou et al., 2014, p. 5 and Fig. 14). This observation is important because it is most probably a cultural factor, which challenges its suggested affiliation with the so-called Antalyan, since there are marked differences between the lunates from Ouriakos and those from the Antalya caves (Öküzini in particular), among which are the technology of production, methods of retouch, and dimensions.

The term Antalyan was first introduced by S. K. Kozłowski (1994, p. 145) to frame the Late Epipalaeolithic assemblages found in the Gulf of Antalya caves (Turkey), which according to Kozłowski are characterised by “small backed pieces, segments and isosceles triangles", into the final Pleistocene archaeology of the Levant. However, the term has been employed on very few occasions, mainly to emphasise the importance of lunate microliths in the Öküzini Cave cultural sequence (Kaczanowska & Kozłowski, 2013, p. 18), despite their variable typological characteristics (Kartal, 2003, p. 50).

Although assemblages with different types of microlithic lunates, chronologically attributed to the YD event, are known from a few sites along the entire coast of the southern and western Anatolian Peninsula, from Direkli Cave in the east (Arbuckle & Erek, 2012), to Lemnos and the Karaburun Peninsula in the west (Çilingiroğlu et al., 2020), all the lunate complexes show different techno-typological and dimensional characteristics. Moreover, they are different from those of the same period known in the Levant (Belfer-Cohen & Goring-Morris, 2021, Fig. 2).

Ouriakos is a unique site within the general, complex framework of the Aegean and north-eastern Mediterranean Epipalaeolithic. This is due to two main reasons: (1) our knowledge of the Aegean Epipalaeolithic, its origin, and chronological subdivision is very limited (Galanidou, 2011). Moreover, we do not know if, and how, it eventually took part in the formation and development of the Early Holocene Preboreal assemblages of the area, which likewise are almost unknown (Çilingiroğlu et al., 2020, p. 495); (2) Ouriakos is most probably to be interpreted as a complex, repeatedly settled, specialised site, where specific activities were carried out, more precisely weapon production and maintenance (O'Connell et al., 1991, p. 69). It consists of a series of partly overlapping knapping floors, distributed over a large area, resulting from the manufacture of lunate on microbladelet blanks, that are formed in a relatively short time (Efstratiou et al., 2014), whose interpretation is made complex by the "rapid sequencing of events which characterizes the daily lives of living peoples" (Binford, 1981, p. 197). Owing to its uniqueness, extent, ideal sedimentary condition, sealed as it is between two dunes, and the presence of a buried soil (Efstratiou et al., 2013, Fig. 3), Ouriakos represents a unique site to interpret some aspects of the Epipalaeolithic archaeology of the region.

If we compare the Ouriakos assemblages with those collected from Agia Marina and Peristereònas, we notice a few small, but important differences. They concern mainly the typological characteristics of some artefacts, although all the sites are probably to be assigned to the YD event.

Regarding Agia Marina Site 1, the differences are mainly in the absence of bipolar-retouched lunates. In contrast, the site yielded 1 thin lunate obtained by abrupt, direct retouch (Fig. 10, n. 7), and 3 different microlithic abruptly retouched points, only 1 of which is bipolar (Fig. 7, n. 4), and 1 microlithic backed bladelet and truncation (Fig. 7, n. 3). The Peristereònas assemblage is more closely comparable with that of Ouriakos. The size of the lunates from Peristereònas falls into the same dimensional range as those from Ouriakos (Fig. 20). The same can be said of the dimension of the complete blanks (see Fig. 6). Regarding the other Agia Marina sites, their attribution to the YD is based mainly on the presence of bipolar-retouched lunates (Sites 2 and 3) and cores whose technology and shape can be compared with those from Agia Marina Site 1 and Ouriakos (Sites 2, 3, 5, and 6). The only artefact that does not find parallels elsewhere in the region is the straight perforator from Site 4 (Fig. 8, n. 11), whose chrono-cultural attribution remains uncertain.

Conclusions

At present, our knowledge of the Epipalaeolithic period in the Anatolian Peninsula is based mainly on the results obtained from the excavations carried out in the caves of Öküzini (Albrecht et al., 1992; López Bayón et al., 2002), Karain B (Albrecht, 1988), Kızılin (Erbil et al., 2021), and the Beldibi and Beldaşi rock shelters (Bostanci, 1968) in the Gulf of Antalya, Pınarbaşı, in the province of Konya (Baird et al., 2013), Girmeler Cave along the coast west of Antalya (Erdoğu et al., 2021), Esek Deresi Cave in the homonymous valley west of Mersin (Altınbilek-Algül et al., 2021), and Direkli Cave in the province of Kahramanmaraş (Erek, 2010).

All these caves and shelters yielded Epipalaeolithic assemblages characterised by microlithic tools obtained from bladelet blanks detached from subconical and prismatic microcores. They are marked by the presence of abruptly retouched lunates, other types of geometric microliths, and short end scrapers in the case of Girmeler (Erdoğu et al., 2021, Fig. 9). The Direkli Cave horizon with lunates obtained by abrupt, direct retouch, which the authors attribute to the Early Natufian (Baysal & Erek, 2018, p. 523), has been radiocarbon dated to 10,460 ± 179 BP; 12,471–11,712 cal BP (94.9%) (Beta-276742) from a sample of unidentified charcoals (Arbuckle & Erek, 2012, p. 695). A comparable date on bone has been obtained from the Epipalaeolithic layer of the Esek Deresi Cave (10,771–10,361 cal BC (95.4%): Altınbilek-Algül et al., 2021, p. 143). From this cave, the authors report three microlithic lunates obtained by abrupt, direct retouch, microlithic end scrapers and microcores. It is important to note that the two reported radiocarbon results can be compared with that from Ouriakos (GrA-53229). Moreover, they all fall into the time span of the YD cold event. The discoveries and the new radiocarbon dates suggest that the spread of a new type of microlithic assemblage characterised by the presence of lunates and other geometric microliths took place during this period (see Bar-Yosef, 2002, p. 377).

Geometric armatures have been recovered from the sequence of the Öküzini Cave, the most important Epipalaeolithic multi-stratified site excavated along the southern coast of Anatolia (Yalçinkaya et al., 2002). Their number increases in the upper sedimentary units (III–IV) where *they are considered a kind of "fossil director"* (Kartal, 2002, p. 239). The YD occupation of this cave is represented by the geological horizons Ia1–Ia2. Two radiocarbon dates obtained from charcoals yielded the following results: 10,150 ± 90 BP, 12,102–11,322 cal BP (94.2%) (OxA-5213) and 10,440 ± 115 BP, 12,687–11,939 cal BP (95.4%) (RT-1441) (López Bayón et al., 2002, Table 1). However, the knapped stone assemblages from the two YD horizons are very different from those known from the Lemnos Island sites, in general, and Ouriakos in particular. The differences consist in the larger size of the artefacts, the presence of many types of geometric microliths (lunates, scalene and isosceles triangles, and double truncations) and short end scrapers, and the use of the ordinary and abrupt microburin technique (Léotard & López Bay, 2002, pp. 176–182).

A similar trend has been noticed in the neighbouring Kızılin Cave, where the undated upper layers of the sequence show the predominance of microlithic lunates (Erbil et al., 2021, p. 162). However, the technological characteristics, and the retouch methods employed for making this type of microlith, have never been described in detail for the Anatolian assemblages, with the exception of those from the Öküzini Cave (Kartal, 2002). In effect, if we compare the data published from the Anatolian caves and rock shelters with those from the Lemnos assemblages, we can see that there are always important differences.

As reported above, the lunates from Ouriakos have been obtained by abrupt, bipolar retouch, without microburin technique. In particular, the bipolar technique can be considered a characteristic element of this assemblage. There is no doubt that this method of retouch has not been conditioned by the quality of the raw material employed for making artefacts because it was systematically employed for retouching microlithic lunates made from both hydrothermal siliceous rock and radiolarian chert. For this reason, we think that their retouch characteristics, and the unusual production technique, are to be considered a cultural trait, which so far does not find parallels in other Epipalaeolithic sites known along the Mediterranean coast of Anatolia and in the Aegean.

The Agia Marina Site 1 displays a few unique types and the use of the abrupt, deep, direct retouch. From these observations, considering the chronology of the Anatolian Epipalaeolithic sequences, and the characteristics of the assemblages, we suggest that the occupation of Agia Marina Site 1 took place slightly earlier than that of Ouriakos, perhaps during the same YD event, though this suggestion cannot be confirmed based on our present data.

To conclude, the discovery of new Epipalaeolithic sites with microlithic lunates in the island of Lemnos and Kocaman, in the Karaburun Peninsula (Fig. 1, blue dot), along the Aegean coast of Anatolia (Çilingiroğlu et al., 2018, Fig. 4), supports the impression of a westward spread of a cultural tradition whose origins are most probably to be sought either in the Levant or northern Mesopotamia (Golovanova et al., 2022; Nishiaki et al., 2011). This observation is reinforced by the discovery of a few new sites along the Mediterranean coast of Anatolia, which are characterised by the presence of microlithic lunates and other types of microlithic geometrics obtained by abrupt retouch. However, the assemblages analysed from the Epipalaeolithic sites discovered on the island of Lemnos partly contradict this suggestion.

Although their characteristics are most probably to be attributed to a Levantine tradition (Bar-Yosef, 2002, p. 377), their unique technological methods of production; the systematic use of the abrupt, bipolar retouch; and also their shape, which is due to the detachment of microbladelet blanks with a scalene, triangular cross-section, distinguish the Lemnos Epipalaeolithic assemblages, which so far find no comparison in the complexes of the same age recovered from the Levantine Mediterranean, Aegean, and Black Sea sites (Bibikov et al., 1994).

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Author Contribution All the authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by Professors Paolo Biagi and Elisabetta Starnini. Fieldwork and artefact collections were made by all the authors. All the authors commented on the previous version of the manuscript. All the authors read and approved the final manuscript.

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Data Availability The dataset generated during and/or analysed during the current study is available from the corresponding author on reasonable request.

Code Availability Not applicable.

Declarations

Competing Interests The authors declare no competing interests.

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