Mediterranean Archaeology and Archaeometry, Vol. 16 No 3,(2016), pp. 229-243

10.5281/zenodo.163774

LITHIC INDUSTRIES OF THE AEGEAN UPPER MESOLITHIC

A. Sampson[1], J. K. Kozlowski[2], M. Kaczanowska[3]

[1]*University of the Aegean, Laboratory of Environmental Archaeology, Rhodes, Greece*
[2] *Jaggiellonian University, Krakow, Poland*
[3] *The Polish Academy of Arts and Sciences, Krakow, Poland*

Received: 15/07/2016
Accepted: 20/10/2016
Corresponding author: (adsampson@rhodes.aegean.gr)

ABSTRACT

Recent research at Areta in the northern side of Chalki Island (Dodecanese) has revealed an enormous quantity of lithics of the Mesolithic period**.** It is the first time that such an old settlement is located in the area of the Dodecanese, thus extending to the southeast of the Aegean the already known Mesolithic network of sites and creating a sea route from Cyclades to Dodecanese. Apart from the Melian obsidian, there is great abundance of obsidian from Yali of Nissiros used for making tools despite its poor quality. The last few years' surveys of the Aegean University discovered an extensive Mesolithic site at the southern part of Naxos that follows the usual model of Mesolithic occupation with the selection of sites very close to the sea. The types of tools in both sites exhibit a number of analogies with the sites of the Aegean Mesolithic such as Maroulas in Kythnos and Kerame 1 in Ikaria. Dissimilarities between the above-mentioned inventories result first of all from the fact that different raw materials were exploited. Despite of the missing absolute dates, the regularity and increase of geometrical tools, and the presence of other microlithic forms may suggest that the lithic industry of both sites represents a later phase of the Aegean Mesolithic. The lithic industry of the Upper Mesolithic resembles with the lithic repertory of the aceramic level X of Knossos showing an origin from the Aegean and not from the East.

KEYWORDS: Chalki, Areta, Naxos, Roos, Knossos, obsidian, microliths, Melos, Yali

1. INTRODUCTION

The last two decades, Mesolithic sites have been excavated around the Aegean Basin such as Cyclops Cave in the Northern Aegean, Maroulas in Kythnos (Cyclades) and Kerame 1 in Ikaria resulting a flourishing Aegean Mesolithic culture. Moreover, a network of sites was located in Kythnos, Ikaria and eastern Peloponnese (Runnels 1996, 2001, 2009) showing a dense occupation mainly on coastal areas.

The common stone industry of Ikaria and Kythnos, as well as the transportation of the obsidian from Melos and Yali to different parts of the Aegean lead to the assumption that sea routes had existed at least since the 9th mill. BC. Smaller sea routes could have existed among the islands of the central and southern Aegean serving for the distribution of Melos and Yali obsidian to the Mesolithic centers. The new Mesolithic site in Chalki Island was responsible for the transfer of Melian obsidian to the Dodecanese while Naxos stands in the course of the voyage from Ikaria to Melos.

Until now, the choice of inhabitation in small islands is related to the interest in key positions belonging to a network of sea routes and suitable for fishing. The large settlement in the island of Chalki (Sampson 2010) constitutes a stop in the SW Aegean suggesting routes to Crete and Cyprus (Sampson 2014, 2015). The advantages of this location are the safe mooring bay and the proximity to the cave. The island would have offered several food sources meaning vegetables or animals. The high density of surface findings is greater than those of Kerame 1 in Ikaria and Roos in Naxos while it suggests intense activities for quite a while.

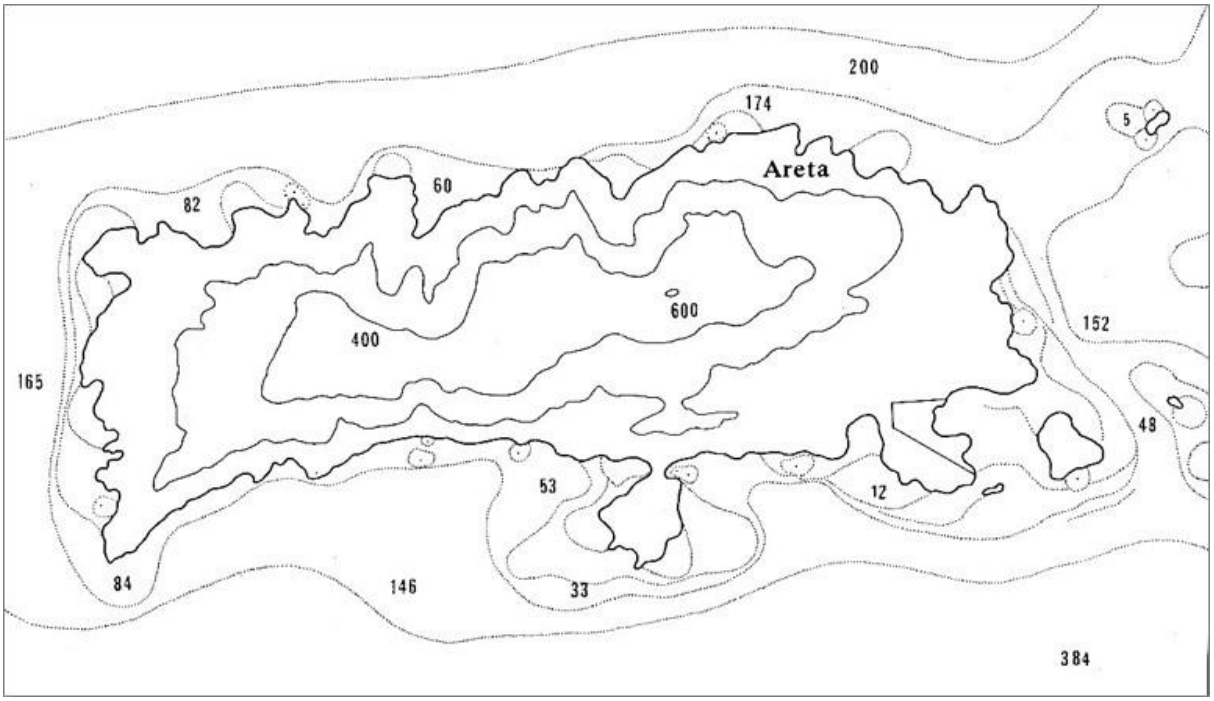

Figure 1. Map of Chalki Island

2. THE MESOLITHIC SITE OF ARETA, CHALKI

Chalki is a small island of the Dodecanese region, 35 nautical miles west of the city of Rhodes (Fig. 1). The island is rocky and mountainous covering an area of 32 sq. km and consisting almost exclusively of limestone. The length of the island is 4 km from west to east. It has been estimated (Vernicos 1986) that on the island there are four types of land cover and land use: 1) plains containing «Older Fill» (10%), 2) slopes of mountains with soil (35%), 3) rocky slopes with little soil (45%) and 4) rocky peaks, inaccessible even to pasture goats (10%). A few caves have been found mainly in the northern part of the island as well as a few dolines. Few valleys and some natural basins contain more than 6m backfill (Older Fill, Bintliff 1977), derived from erosion of the Pleistocene. A natural cut by erosion on the beach of Pontamos shows several phases of sedimentation of an Older Fill with an iron oxide composition and different sized materials. Within this there is a layer of aeolianite, a soft sandstone from the cementation of dunes (Rachham & Vernicos 1991).

Figure 2. Areta in Chalki. Topographical map (--- boundaries of scattered artifacts).

An episode of great erosion in historical times, called the Younger Fill (Bintliff 1977), was observed in several parts of the island such as the saddles under the village of Kastro and Antramassos. In the latter material, pottery of historical times was found coming from the eroded terraces that existed on the slopes above it. The soils of the Younger Fill are composed of tenuous *rendzinas.* The rainfall is much less than that of Rhodes (400-450mm per year), probably because the mountains of the island are not so high as to pull the rainfall and the orientation from west to east is a further handicap.

Although Chalki today is one of the most naked islands in the Aegean preserving a variety of vegetation of plants or trees in very small numbers but representative of the Aegean. Pine remnants and dense vegetation of shrubs exist on the eastern and northern side of the island (Pefkias, Kania). Information from old residents speak of significant vegetation in the past by conifers and fruit trees. The maquis vegetation is represented by lentisks (*Pistacia lentiscus*) and cedars on the northeastern side of Chalki. In Pampakies there is also a dense vegetation of "fides", a kind of cedar (Juniperus phoenicea). Cypresses, pines and other trees were used in the past to build ships and houses, so apparently there was an exploitation of woodlands.

Vernikos and Racham (1991) believe that the naked environment of Chalki is not due to human intervention and grazing of animals but to natural factors that were active during the Pleistocene. The environment of the island may have never been very different in ancient times than today.

Figure 3.Areta, Chalki. View from the north

Areta is a very remote area located in the northern part of the island, at a point where a deep fjord-like bay is opened that ends in a small sandy beach (Fig. 2, 3). Near the beach, a well collects fresh water from the deep gorge. In a flat area to the west, a large wall was built in the past near the rocky beach in order to keep the soil for crops. However, the erosion today is huge caused by the rain and the action of the waves leaving little soil between the rocks. Terraces for

crops and two threshing floors show the capacity of agricultural production in this area.

At higher levels many terraces have preserved the minimum soil between the rocks. These are very limited places where the locals till the first half of 20th century could have planted barley and legumes. In all those terraces in an extensive area measuring 25000 sq. m., enormous quantities of obsidian artifacts have been collected. The probability of the existence of Mesolithic architectural remains is small because the last centuries, major interventions have taken place in the whole area due to intense cultivation activity. A cave divided in three partitions is located in the gorge above the small beach. Today it's no longer used as a pen, but in 2010 there were accumulated into this huge amounts of sheep wool. Obviously, this cave should have been used by the Mesolithic occupants of the area, however the thick layer of manure prevents the surface survey.

2.1 The Lithic Artifacts

The inventory numbered 769 artifacts that are fairly homogeneous in respect of raw materials and techno-morphological features.

Raw materials

Among raw materials obsidian predomina-tes, of which most artifacts were made (Fig. 4). The inventory contained dark obsidian with white inclusions originating from the island of Yali (of which 41.8% of artifacts were made) and dark-grey transparent obsidian from the

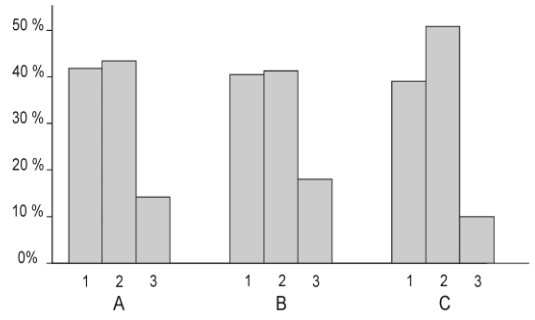

Figure 4. Areta. Raw materials structure: A – general, B – only flakes, C – chips. 1 – obsidian from Yali, 2 – Melian obsidian, 3 – siliceous rocks.

island of Melos, represented by 43.4% of artifacts. The presence of Melian obsidian was confirmed at numerous Mesolithic sites of the Aegean Sea (e.g. at Kythnos – Sampson *et al.* 2010; Youra – Kaczanowska, Kozłowski 2008; Ikaria – Sampson *et al.* 2012) as well as on its western coast (e.g. at Franchthi – Renfrew, Aspinall 1990) and eastern coast (e.g. Cukurici Höyük – Horejs 2012). The presence of both obsidian from Melos and from Yali at Chalki confirms the functioning of a network of contacts and seafaring skills of the inhabitants of this site. The distance from Chalki to Yali is about 70 km in a straight line while to Melos about 200 km. Seafaring in the Aegean Sea was easy due to the existence of chains of islands stretching along Anatolian coast and, latitudinal, across the Aegean Sea (Sampson 2015). Obsidian was arriving Chalki in the form either of concretions or of initial cores. Apart from obsidian, small pebbles of two types of siliceous rocks were exploited, namely: brown-reddish opaque flint (10.1%) and grey transluscent flint (4.1%). Moreover, one core from radiolarite and two artifacts from other siliceous rocks were discovered.

Inventory structure

The inventory structure is provided on Fig. 5. When compared with other Mesolithic sites in the Aegean (e.g. Maroulas), the site at Chalki shows a distinctly lower index of flakes – even when chips are added to this group. Both at Maroulas and at Kerame 1 in Ikaria flakes (together with chips) constituted more than a half of the inventory, whereas at Chalki the proportion of flakes, splinters and chips together is 49%. On the other hand, the tool index at Chalki is higher (17.9), while at Maroulas or Kerame 1, it is about 10%. It seems, that Chalki was a short-term camp set up by a group that arrived with its own store of raw materials (which is evidenced by the high proportion of cores – 10%), while the on-site working of raw materials played a minor role. Possibly, some retouched tools were also brought to the site.

MORPHOMETRICS

The inventory from Chalki can be defined as microlithic. The size of cores, blanks and tools reaches up to 34 mm at most, while it should be added that only two artifacts reach the maximum size. The length of flaking faces of cores is between 13 and 27 mm. These specimens are well-exhausted thus in the initial stage they could have been somewhat larger. The most numerous group includes cores with the flaking surfaces between 14 to 19 mm; flake dimensions are similar (Fig. 6). Nearly the half of all tools were made from blanks between 14 and 19 mm long (Fig. 6). It should be emphasized that flakes longer than 19 mm are more numerous (31%) than tools of similar size (26%). This fact corroborates a hypothesis that some slightly larger cores also existed in the initial stage of reduction, or that some worked pieces were brought to the site from elsewhere. Blanks from Chalki are smaller than the flakes from Maroulas, the length of

which is in the interval of 9 to 81 mm, or from the site of Kerame 1 in Ikaria where blank size reaches as much as 59 mm. At the two latter sites the larger specimens were made from local raw materials – quartzites and quartz at Maroulas and quartz at Kerame 1. When artifacts from extralocal obsidians are compared no difference in size between the sites is observed.

CORES

The inventory provided 77 cores and fragments. Almost half of the specimens were made of obsidian from the island of Yali (43 specimens). Relatively high was the proportion of cores from brownish flint (12 specimens). The cores represented all the stages of reduction. Initial cores were fairly numerous (13 spec.– 16.8%), and included hyper-microlithic cores measuring 14-16x14-18x8-16 mm. Reduction of initial cores was restricted to only one or two removals. In this group only one specimen was made of Melian obsidian, three specimens of obsidian from Yali, three from brown flint, and one from radiolarite. Among initial cores, there were as well slightly larger specimens as well, flaking surfaces of which were between 22 and 17 mm long, produced from larger flakes mainly of obsidian from Yali. No preliminary preparation was registered in the group of initial cores, except from the platform.

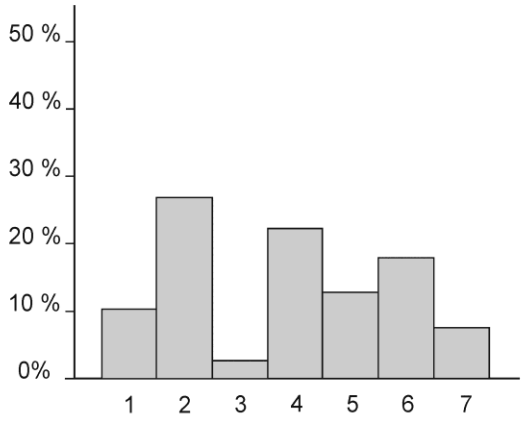

Figure 5. Areta. Inventory structure: 1 – cores, 2 – flakes with splinters, 3 – blades, 4 – chips, 5 – splintered pieces, 6 – tools, 7 – undetermined fragments.

The remaining cores are predominantly single-platform cores in an advanced stage of reduction (24 spec.). The flaking surfaces of these cores are located in the narrower face of a concretion (Pl. I 1, 2); preparation usually extends onto sides (Pl. I 3). Reduction was carried out until a core was totally exhausted, and in the final stage became flat (Pl. I 4, 5). Sometimes, attempts were made to detach blanks from flat cores using splintered technique (Pl. I 5). Cores with a rounded flaking surface were relatively rare (Pl. I, 1). These cores had oblique platforms that gave an

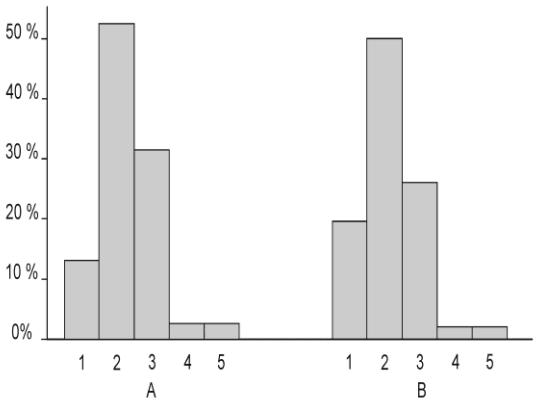

Figure 6. Areta. Length of: A – flakes, B – tools. 1 - <13mm, 2 – 14-19mm, 3 – 20-25mm, 4 – 26-32mm, 5 >32mm

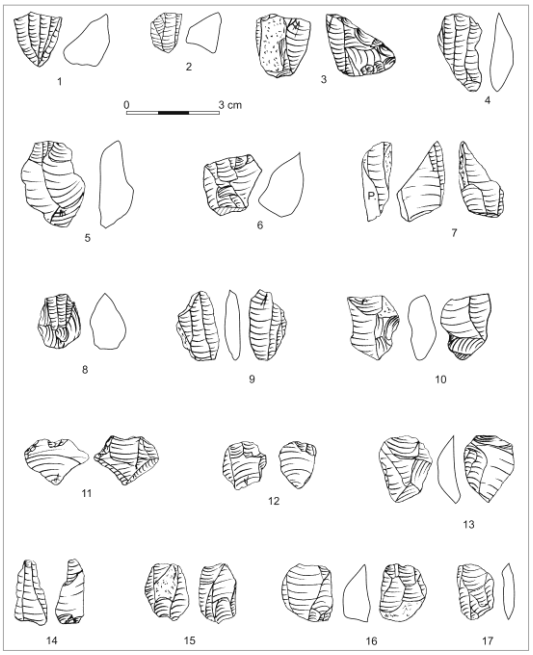

Plate I. Areta: 1-10 - cores, 11-1– splintered pieces

acute angle making blank removals easier. The operations of platform rejuvenation and retrimming were also used.

Except for single-platform cores, double-platform specimens were also found (6 spec.). These were not classical double platform cores with a common flaking surface and alternate reduction from two platforms, but – rather – cores with the orientation changed to the opposite (Pl. I 6). Just as in the group of single-platform cores specimens made on flakes were also present (Pl. I 7).

In the final stage of reduction of polihedral cores the location of platform was changed several times in order to better exploit a raw material nodule. The result was a kind of multiplatform specimen with random reduction (5 spec.)

As far as one third of all cores is concerned, they have been preserved as fragments in a degree that made their attribution impossible (26 spec.). Although in the material collected from the site surface flakes are predominant, yet the flaking surfaces of a number of cores show blade scars (Pl. I 1, 3, 4, 7-9) or blade-flake scars (Pl. I 5, 10). These cores were made from both: good quality Melian obsidian and obsidian from Yali with poor cleavage from which blade removal was difficult, or from siliceous rocks. The blade scars appear on small specimens.

SPLINTERED PIECES

Ninety eight splintered pieces and fragments account for 12.7% of the inventory. Thus, the component of splintered technique is higher than at the site of Maroulas where splintered pieces are 8.5%, and nearly twice as high as at Kerame 1 where the proportion of splintered pieces is only 5.6%. A high component of splintered technique is typical of sites where difficulties occur in raw materials procurement. The most numerous group includes splintered pieces of obsidian from Yali (52 spec.). They are between 11 to 22 mm long and between 7 and 18 mm broad. Splintered pieces from Melian obsidian are fewer (33 spec.); they are between 13 and 25 mm long, and between 6 and 22 mm broad. The dimensions of splintered pieces from brown flint (10 spec.) and grey-brown siliceous rock (3 spec.) are similar. Frequently, flakes (Pl. I 11, 12, 13), sporadically also blades (Pl. I 14), were worked using splintered technique. Moreover, splintered pieces were made from residual cores or small, flat concretions (Pl. I 15, 16). Some bipolar, two-sided specimens are entirely covered with splinter scars (Pl. I 17). Some splintered pieces were modified by retouch into tools, as a rule into denticulated-notched tools, occasionally into backed pieces. Less often, splinters were also retouched into tools (4 specimens).

FLAKES

Flakes together with splinters constitute the most numerous group of artifacts, although their proportion is lower at Chalki than at other Mesolithic sites of the Aegean. Most specimens have been preserved as fragments. The raw materials structure is provided in Fig. 4. Flake length is between 12 and 32 mm, width between 10 and 25 mm, and thickness between 2 and 10 mm. Comparison of flake size from the two types of obsidian (from Melos and Yali) shows that flakes from Melian obsidian are slightly larger (the most numerous group includes flakes about 20 mm). Sporadically dorsal cortex is present. Majority of flakes show dorsal pattern, usually unidirectional. Almost one third of flakes from Melian obsidian shows scars perpendicular to the flake axis which – in this case – is related to change of orientation rather than to core preparation. Probably the knapper wished to fully exploit a nodule of raw material with good cleavage.

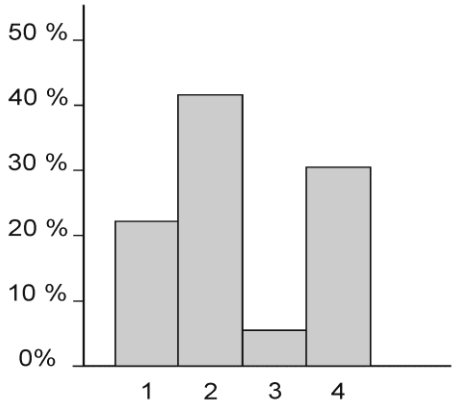

Figure 7. Areta. Butt types of flakes: 1 – unprepared butts, 2 – formed by single blos, 3 – faceted butts, 4 – linear and punctiform butts

As already mentioned, core preparation is modest. This is confirmed by the analysis of flake butts which are predominantly unprepared or formed by a single blow, while specimens with a facetted butt are few (Fig. 7). Because the series of flakes with preserved butts is too small, the methods of blank detachment from the cores made on various raw materials cannot be reconstructed.

Chips

The group of chips, i.e. flakes that are less than 14 mm long in the inventory, is fairly large (171 spec.). However, in view of the fact that the artifacts from Chalki are small in size, many of the chips could have been used as blanks, or as unretouched tool inserts. In the group of chips Melian obsidian has a conspicuous ascendancy (Fig. 4). Three chips from this obsidian come, beyond doubt, from retouch. This means that tool-reutilization – although to a small extent – must have taken place at the site.

Blades

Blades (20 spec.) are merely 2.6% of the inventory. Most are broken specimens; only four blades were complete. Blade width is between 9 and 15 mm, and the maximum length could have been slightly more than 30 mm. Blades are predominantly from Melian obsidian; as many as 16 blades out of 20 were made from this raw material. Some blades show micro-retouch on the edges; this does not attest their function as tools but could have been the effect of post-depositional processes. It is also likely, that

some, more regular specimens could imply a younger (Neolithic) intrusion.

2.2 Retouched tools (Pl. II-IV)

The collection included 138 retouched tools that in respect of raw materials, techno-morphology and measurable attributes represent a homogeneous assemblage. Only two tools could be a younger intrusion, namely: a dihedral burin on a regular blade and a backed piece on a blank split off from a tool with surface retouch. Among the raw materials, obsidian has a decided ascendancy: from Melos – 95 specimens, and from Yali – 34 specimens. Siliceous rocks are represented by 9 specimens from chert or brown flint. Most retouched tools are hypermicrolithic or microlithic (between 5 to 25 mm); specimens up to 35 mm (among perforators) occur sporadically.

End-scrapers (9)

All the end-scrapers are microlithic. They are made on flakes with oblique dorsal pattern (Pl. II 1–3), or on short blades (Pl. II 4), or blade-flakes (Pl. II 5). All the specimens are with weakly rounded fronts shaped by steep retouch. An end-scraper is with bilateral, steep retouch (Pl. II 6); an end-scraper shows damage on one edge, probably post-depositional (Pl. II 4).

Burins

The only burin is a dihedral medial specimen shaped on a regular blade (the preserved fragment is 2.7cm long; the proximal part is broken off), made from Melian obsidian (Pl. II 7). The small size and regular blank indicate that this burin could be a Palaeolithic or Neolithic admixture.

Backed pieces (13)

All the backed pieces are microlithic. The most numerous are angulated backed pieces made on bladelets (Pl. II 8-10), or with a convex or arched back (Pl. II 11–13). Two specimens are hypermicrolithic, one of them has inverse retouch (Pl. II 12). Straight backed pieces on bladelets are represented by two specimens with very steep retouch (Pl. II 14, 15) and two fragments (Pl. II 16, 17). Backed pieces on splintered pieces had partially retouched back (Pl. II 18, 19). A straight backed piece was made on a blank detached from a tool with surface retouch; possibly this is a Neolithic admixture (Pl. II 20).

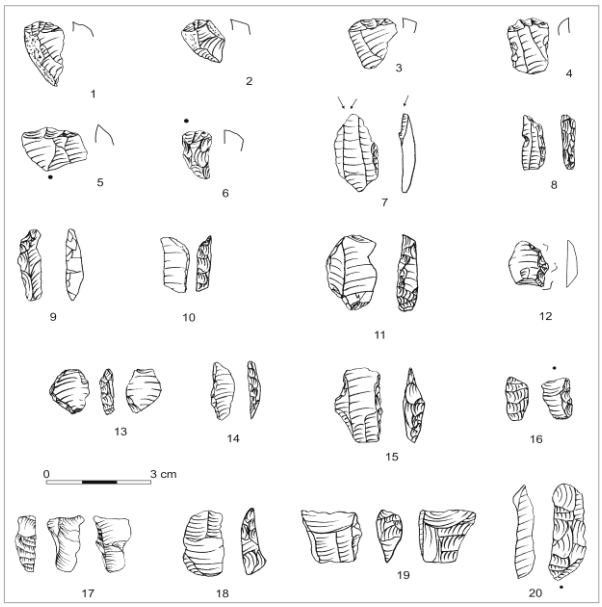

Plate II. Areta. 1-20 – retouched tools

Geometrical inserts (5)

Inserts with double truncations include: rectangles (2 spec.), trapezes (2 spec.), and an irregular rhomb (1 spec.). The items are between 6 and 17 mm long. The rectangles were made on regular bladelets: one has parallel truncations with alternate retouch (Pl. III 1), the other has a thick proximal truncation and a thinner distal truncation, both shaped by obverse retouch (Pl. II 16, 17). One trapeze on a regular bladelet has truncations shaped by alternate retouch: the proximal truncation is thicker, the distal is thinner (Pl. III 3). The other trapeze, made on a sub-crested blade, has truncations shaped by alternate retouch (Pl. III 4). An irregular rhomb was made on a regular bladelet, with truncations shaped by obverse retouch (Pl. III 5).

Truncations (13)

Most frequent are specimens with an oblique distal truncation made on fairly broad bladelets with a preserved proximal part (Pl. III 6,7), possibly very short (Pl. III 8, 9) or even hyper-microlithic (Pl. III 10, 11). Three specimens (Pl. III 6, 7, 9) are with straight truncations. One specimen has a narrow straight truncation and bilateral retouch (Pl. III 13). Also occur a specimen with an oblique truncation and lateral retouch made on a flake (Pl. III 14) and another with straight truncations and lateral retouch (Pl. III 15, 16). The specimens are between 8 and 20 mm long.

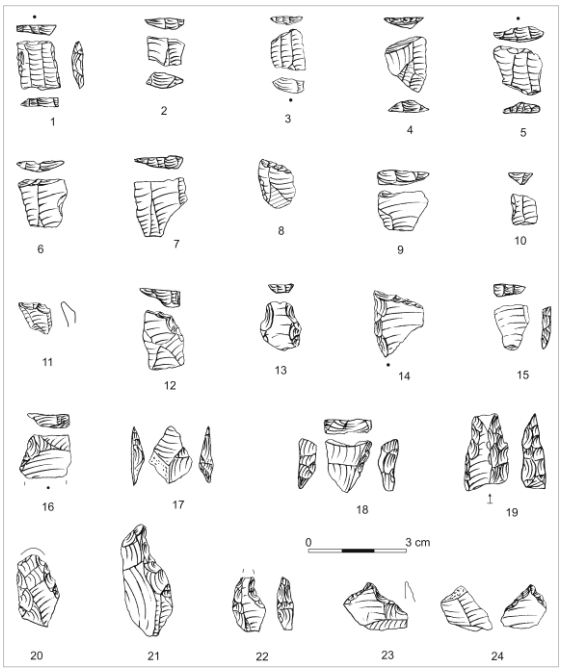

Plate III. Areta. 1-24 – retouched tools

Other microliths (2)

To the other microliths are reported: a point with two convergent blunted backs made on a flake (Pl. III 17), and a triangle on a fragment of a bladelet with two convergent blunted backs and a straight base (Pl. III 18).

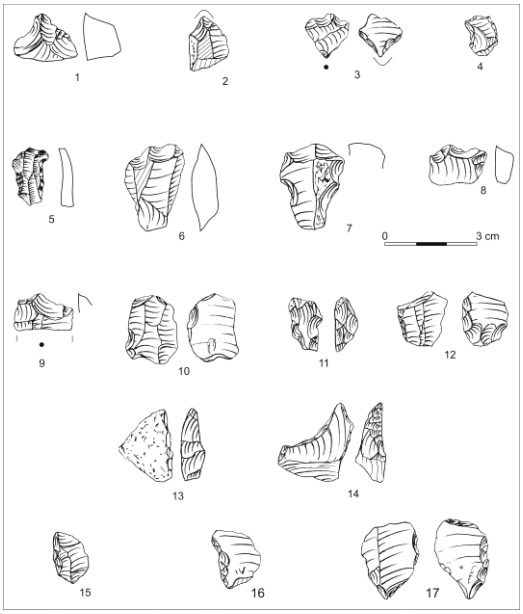

Plate IV. Areta. 1-17 – retouched tools

Perforators and becs

In this group belong 23 perforators and becs (atypical perforators), the length of which is up to 37 mm and 13-17 mm, respectively. The group of typical perforators consists of a specimen with a straight tip shaped on the one edge by bidirectional steep retouch, and on the other by semi-steep obverse retouch (Pl. III 19), two specimens with asymmetrical tips shaped by semi-steep retouch (Pl. III 20, 21), and a microlithic specimen on a bladelet (Pl. III 22).

Atypical perforators are represented by numerous microflake specimens: a) with broad tips shaped by fine obverse retouch (Pl. III 23), b) shaped by inverse retouch (Pl. III 24), c) by Clactonian notches (Pl. IV 1, 2), d) a double specimen on a short flake, with the distal point shaped by Clactonian notches and the proximal end shaped by inverse micro-retouch (this specimen is strongly smoothed by use-wear, Pl. IV 3), e) a specimen on a hypermicrolithic flake with the lateral point shaped by semi-steep retouch (Pl. IV 4), f) a bladelet with bilateral retouch and with a similar lateral point (Pl. IV 5). Some of these specimens have been preserved as fragments.

Notched-denticulated tools (49)

The group of notched-denticulated tools is characterized by relatively small blanks no more than 30 mm long and 17 mm broad. The blanks are made by parallel, convergent, opposite and perpendicular dorsal pattern. Sporadically, partial cortical surfaces occur. Specimens with transversal retouch (Pl. IV 6, 7) and others with transversal and lateral retouch (Pl. IV 8-10) are most frequent. Some specimens present bilateral (Pl. IV 11) or proximal (Pl. IV 12) retouch. Some of the specimens have been preserved as fragments.

Side-scrapers

Four fragments of lateral side-scrapers were found: a fragment on a tile of Yali obsidian (Pl. IV 13), two side-scrapers on flake fragments with centripetal scars (Pl. IV 14), and a side-scraper on a splintered piece. All the specimens are with high, steep retouch.

Retouched flakes (18)

One specimen was shaped by lateral obverse retouch on a small splinter (Pl. IV 15), and another on a splintered piece. Other specimens were shaped on flakes and flake fragments by transversal, lateral retouch, inverse or obverse (Pl. IV 16), and proximal-lateral retouch also inverse (Pl. IV 17).

2.3 THE SIGNIFICANCE OF TOOLS FROM CHALKI WITHIN THE "AEGEAN MESOLITHIC"

The series of retouched tools from Chalki exhibits a number of analogies with the island sites of the Aegean Mesolithic, notably with Maroulas in

Kythnos (Sampson *et al.* 2010) and Kerame 1 in Ikaria (Sampson *et al.* 2012). At Maroulas and Kerame 1 the proportion of retouched tools is about 10%, thus it is lower than at Areta. The dissimilarities between the above-mentioned inventories result first of all from the fact that different raw materials were exploited. At Areta there are no artifacts (also tools) from quartz or quartzite, while tools from siliceous rocks (chert, flint) are only 8.1%. At Maroulas quartz accounts for 43.5% of the inventory, quartzite for 2.4%, and siliceous rocks (white patinated flint) 11.9%. Although at Kerame 1 the proportion of quartz is small (about 3%), siliceous rocks (first of all white patinated flint) constitute nearly a half of the inventory. This was caused by the fact that in Kythnos and Ikaria quartz was locally available like, additionally, in Ikaria siliceous rocks. Despite the various frequencies of tools from obsidian at the sites in question (Areta – more than 90%, Maroulas – nearly 50%, Kerame 1 – 25%), as well as of tools from obsidian from Melos and Yali, the measurable attributes of tools from these raw materials are within the same modes of size.

The frequency of the various tool types too, shows fairly important differences, in spite of techno-morphological similarities of types of blanks and retouch. End-scrapers that at Areta account for 6.5% of the inventory, at Maroulas are 17.9%, and at Kerame 1 16.8%. In respect of morphology the end-scrapers at Areta are short blade and flake specimens; similar end-scrapers were registered at Kerame 1 (Sampson *et al.* 2012, Pl. 5:1, 2, 5, 14) and Maroulas (Sampson *et al.* 2010, Pl. XII 14–16, XIII 14). At Maroulas, hypermicrolithic specimens also occur (Sampson *et al.* 2010, Pl. XIV 11–16) just as at Areta where only one burin was found, the ascription of which is anyway uncertain; burins in the Aegean Mesolithic are relatively rare while their proportion at Maroulas is 1.2% and Kerame 1 only 0.7%.

Backed pieces are a permanent stable component of assemblages of the Aegean Mesolithic. Their average index is about 10 (at Areta – 9.4, at Kerame 1 – 10.8) and only at Maroulas it is low – 3.1%. At the three sites in question, backed pieces are with a straight back (Maroulas – Sampson *et al.* 2010, Pl. XVII 25–29, Kerame 1 – Sampson *et al.* 2012, Pl. 11:1, 3), with an arched back (Maroulas – Sampson *et al.* 2010, Pl. XVIII 3–6, Kerame 1 – Sampson *et al.* 2012, Pl. 11:4–7), or with an angulated back (Maroulas – Sampson *et al.* 2010, Pl. XVII 30–35, Kerame 1 – Sampson 2012 *et al.* Pl. 12:9). There are no major differences between the sites in respect of blanks or type of retouch.

Truncations, too, are a stable element of the Aegean Mesolithic. Their proportion oscillates from 5% at Kerame 1, 8.3% at Maroulas, to 9.4% at Areta. In respect of morphology these are specimens on blade like flakes or on bladelets with straight or oblique truncations (Maroulas – Sampson *et al.* 2010, Pl. XVII 8, 9; Kerame 1 – Sampson *et al.* 2012, Pl. 10:7–11), sometimes hypermicrolithic (op. cit. Pl. 12: 12–17). At the sites of the early Aegean Mesolithic, such as Maroulas, dated at the first half of the 9th millenium BC, double truncations are recorded (Sampson *et al.* 2010, Pl. XVII 12–14, Sampson *et al.* 2012, Pl. 11:1, 2). However, at Areta double truncations are more numerous (3.6%) representing more regular geometrical forms such as rectangles, rhombs and trapezes. Possibly, this suggests that Areta represents a later phase of the Aegean Mesolithic. The presence of other microlithic forms at Areta (Pl. 37, 38) could provide an additional argument in support of this hypothesis.

In all the assemblages discussed here, the component of perforators and atypical perforators (becs) is fairly high (Areta – 16.6%, Maroulas – 15.8%), Kerame 1 – 18.6%). These are typical blade perforators (Maroulas, Sampson *et al.* 2010, Pl. XV 5, Kerame 1 – Sampson *et al.* 2012, Pl. 10: 2, 3) which are less numerous, while more numerous are the atypical flake perforators (becs), sometimes shaped by Clactonian notches; hypermicrolithic atypical specimens also occur as at Maroulas (Sampson *et al.* 2010, Pl. XV 12–16) and Kerame 1 (Sampson *et al.* 2012, Pl. 7:13–19).

As far as denticulated or notched tools are concerned, the differences in the frequency of these tools between the sites under discussion are conspicuous. The proportion of denticulated or notched tools is particularly high at Areta; however this does not seem to reflect functional differences between the sites, but, rather, it is the effect of differing raw materials, first of all a much higher proportion of obsidian at Areta. The edges of obsidian pieces were more easily damaged primarily by post-depositional agents (although some damage could be use-wears). At the sites with a greater presence of quartz, flint or quartzite the edges of artifacts were more resistant to damage.

Standard location of retouch is not registered at Areta either, although transversal and lateral-transversal retouch is predominant. At all the sites of the Aegean Mesolithic side-scrapers are recorded, although their proportion is small (Maroulas – 7.4%, Kerame 1 – 3.7%, Areta – 2.9%). At the three sites in question side-scrapers are relatively the largest tools, made on flakes, possibly on splintered pieces with lateral retouch.

Retouched flakes are numerous at the sites of "Aegean Mesolithic". Their proportions are: Areta – 13%, Maroulas – 16.9%, and Kerame 1 – 22.8%. Comparison of frequencies shows that a higher

proportion of quartz and siliceous rocks correlates with a higher proportion of retouched flakes, which were rarely made from obsidian. Retouched flakes are presented with irregular, usually semi-steep, lateral or lateral-transversal retouch. Sometimes, splintered pieces have marginal retouch.

The inventory from Areta does not contain macrotools or macrochoppers that are present at Maroulas and at Kerame 1. This situation, too, can be accounted for the exploited raw materials: obsidian was unsuited for this type of tools.

Figure 8. Roos, Naxos

Figure 9. Roos beach from the west

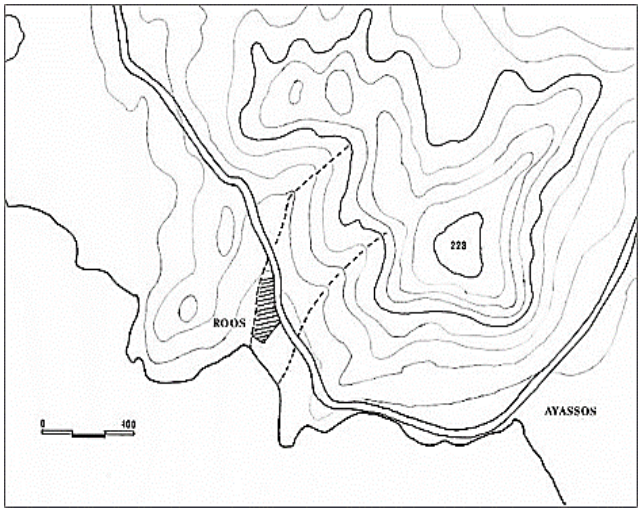

Figure 10. Roos, Naxos. Map of the area

3. THE SITE OF ROOS, NAXOS

The research of the Aegean University in Naxos at the southern side of the island revealed a large quantity of lithics of the Mesolithic period showing an extended installation (Sampson 2010, 85; 2016). The surface findings, plenty of Melian obsidian and white flint, show that the settlement, of more than 20000 sq. meters, lies next to a river with deep watercourse which flows into the sea. The choice of location follows the usual model of occupation of Mesolithic settlements meaning the proximity to the sea (Fig. 8-10). During the survey for the collection of the surface findings, the whole area was divided in five sectors (Fig. 11). Naxos is the largest island of the Cyclades with many dietary sources and other sites of the same period are expected. An additional reason for attracting Mesolithic settlers was the existence of an extensive quarry of white flint at Stelida (Seferiades 1983; Sampson 2006; Carter et al. 2015).

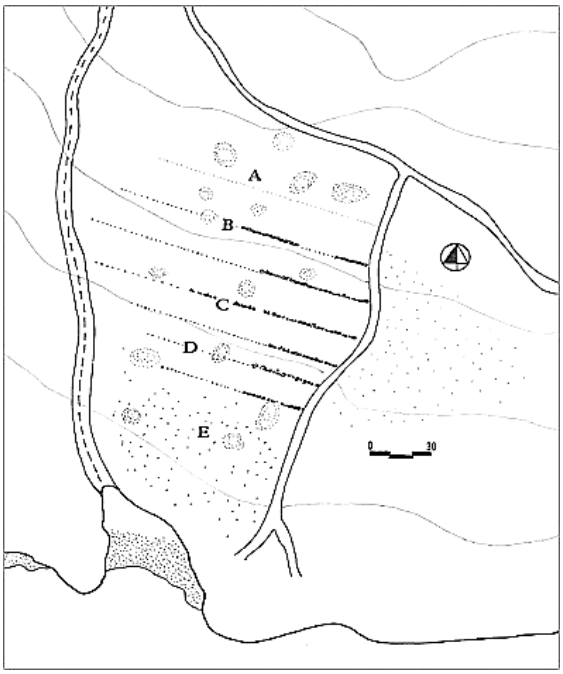

Figure 11. Roos. Topographical map of the site

3.1 The lithic artifacts

The total number of artifacts amounts to 180. The most numerous group are flakes and scaled pieces (71 specimens – 39.4%), followed by tools (29 specimens–16.1%), splintered pieces (26 specimens – 14.4%), and chips (26 – 14.4%). It is worth noticing that only one core (0.5%) was recorded.

Raw materials

The most represented material was obsidian (Table 2), which may have originated from the island of Melos. It is worth noticing that obsidian artifacts at Roos are comprised primarily of blades and

splintered pieces (84.6% of splintered pieces are made from obsidian). These splintered pieces were not used as cores, because scaled pieces were made into tools extremely rarely (1 case only).

The provenance of white patinated flint (Table 2) remains uncertain: in fact, these may be artifacts made from different raw materials which were given a similar look by the white patina, or white variants of chert from the Stelida region in Naxos (Carter et al. 2015). The precise identification of these raw materials would only be possible by means of mineralogical and chemical analysis.

Quartz (Table 2) is a common rock occurring in the tabular form. It is not particularly good knapping material, but due to being common and easily available, quartz was used relatively often.

Cores

A characteristic of the Roos inventory is the lack of cores, except for one small (28x29x9 mm) flat double platform core from obsidian. On its back side, the core has unidirectional scars running transversally to the core's orientation. They suggest that the stage of double platform reduction was preceded by its exploitation as a single platform core with parallel scars (Pl. V 1).

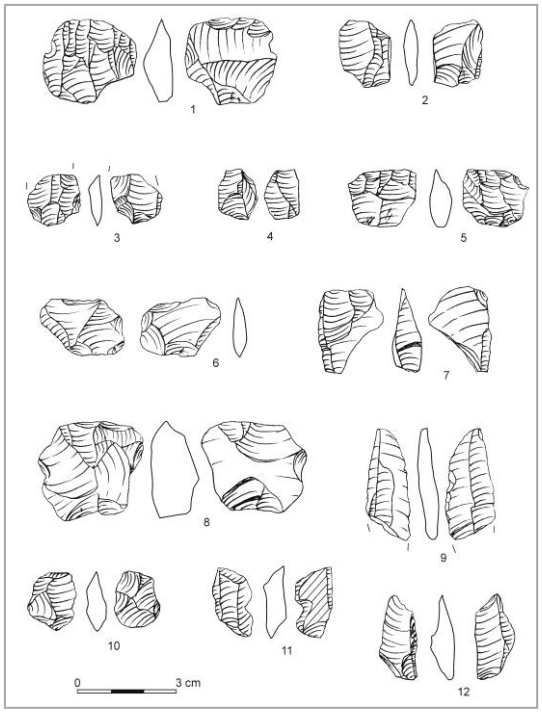

Plate V. Roos. Splintered pieces

Splintered pieces (26 specimens)

Splintered pieces make up 14.4% of the inventory, which indicates that the splinter technique was the predominant method used for the production of microlithic flake and blade blanks. Splintered pieces could also have been used as tools, which resulted in the fragmentation of some of these artifacts (7 fragments among 26 splintered pieces). The vast majority of splintered pieces are made of obsidian; only 3 pieces are made of white patinated flint and 2 of quartz.

Splintered pieces are bipolar and bifacial, and are covered with scars from flake removals (Pl. V, 2-6) so that it is not always possible to determine whether they were made from thermal fragments, tablets, flakes (Pl. V, 7,8), and only exceptionally from a blade (Pl. V,9). There is only one quadripolar splintered piece (Pl. V, 10) in the assemblage. Some of the splintered pieces bear scars from blade removals (Pl. V, 11, 12; VI, 1-3), which suggests they might have been used as bladelet cores. The same function had probably specimens with para-burin scars on the narrower sides (Pl. V, 7; VI, 4).

Only one initial splintered piece was made on the mesial part of a regular mediolithic blade from white patinated flint, with lateral retouch (Pl. VI 5).

Flakes and scaled pieces

There were 71 flakes and scaled pieces, which account for 39.4% of the entire assemblage. Most of them are made from obsidian (45 specimens - 63.4%), 15 flakes are made from white patinated flint, 10 from quartz, and one from a flint covered with a patina of a beige color. Flakes vary in size from 11-42mm in length, 11-30mm in width, and 2-12mm thick. Quartz flakes are the largest, while those made from obsidian are the smallest. There were only 8 scaled pieces identified, which is surprising given the large number of splintered pieces known from the site. On the other hand, the splintered pieces are very small and this may have led to the classification of some of the scaled pieces as chips. Scaled pieces are smaller than flakes, with the length ranging from 11 to 14 mm. Perhaps, two obsidian pieces resembling burin spalls are also the products of splinter technique.

Flakes most often have butts formed with a single blow (9) or natural (6). Pieces with prepared (4) and dihedral (2) butts are known, too, while flakes with punctiform and linear butts are relatively few (2). Unlike blades, among which no cortex pieces were recorded, the discussed group included both initial flakes (4) and flakes with lateral (1) and distal (2) cortex; however, there was only one obsidian specimen among them, the rest being made from white- or beige-patinated flint (5) or quartz (1).

On their dorsal sides, flakes most often bear scars from removals parallel to the flake's axis. Transversal scars, indicative of the change in core orientation rather than of core trimming, were recorded in 6 cases. In addition, there were 3 flakes with negatives of opposed removals and 3 more

with concentric scars, the latter perhaps connected with core trimming. It cannot be excluded that, analogically to blades, the collection of flakes from Roos include some younger admixtures, but they are extremely difficult to identify.

Chips

There were 26 chips identified, most of which (17 pieces or 65.4%) were made from obsidian. Quartz chips come second, while those made of white patinated flint are the least numerous group. The relatively low percentage of chips made of white patinated flint, lower than the share of this raw material in the entire Roos assemblage, suggests that it may have reached the site in the form of finished products.

Blades

Twenty blades were identified, including 3 complete forms. The percentage of blades in the whole of the Roos assemblage is relatively high and amounts to 11.1%, while in other sites in the Aegean islands it was much lower, reaching only 1.9% in Maroulas, and 1.4% in the Kerame 1 in Ikaria. The share of blades in the layer linked with the initial Neolithic in Knossos was below 10%. This relatively high representation of blades in Roos may stem from:

a) The presence of artifacts of another chronology (probably Neolithic) in the site.

b) The site being occupied by groups representing other Mesolithic traditions, similar for example to the one known from layers 3 and 5 at Klissoura Cave 1 in Argolid (Koumouzelis et al. 2003).

c) The attribution of the Roos materials to other phases of the Mesolithic, probably younger than Maroulas and Kerame 1 dating to the early or mid-9th millennium BC.

Taking into account that the Mesolithic with the "blade tradition" originates from local Late Palaeolithic industries developing in continental Greece rather than in the littoral zone, and that Mesolithic assemblages known thus far from the islands represent the "flake tradition", the first of the above hypotheses seems to be the most likely.

Blades are exclusively made of obsidian. Complete specimens vary from 24 to 26 mm in length and from 10 to 12 mm in width. Most of the fragmentarily preserved blades probably had similar dimensions, as they are typically 10-12 mm wide. Only two blades are distinctly larger (of 18 and 20 mm in width). The blades come from single platform cores in the advanced stage of reduction, as their dorsal surfaces show no traces of cortex. Among the 9 blades in which the butt survived, 4 had the butt formed with a single removal, 2 had facetted butts and 2 other natural butts. One blade has punctiform butt. The blades' edges are parallel or converging, and the scars on their dorsal sides are from blade removals only. Not all the blades are regular as two have twisted profile. It is worth noticing the presence of a proximal fragment of a regular sub-crested blade, probably being a Neolithic admixture.

3.2 Retouched tools (Pl. VI-VII)

End-scrapers

Four specimens are included in this category of tools: distal fragment of blade end-scraper made from obsidian (Pl. VI, 6), short end-scraper made on obsidian blade (Pl. VI, 7), end-scraper on obsidian blade with irregular distal retouch and lateral notches (Pl. VI, 8), fragment of a short end-scraper on flake from white-patinated chert (Pl. VI, 9).

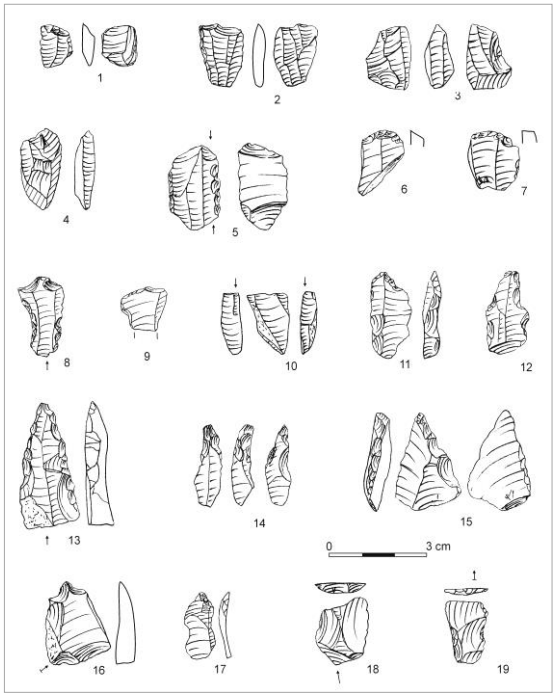

Plate VI. Roos. 1-5 splintered pieces, 6-19 retouched tools

Burin

A double burin on a snap made on the fragment of an obsidian splintered piece was found (Pl. VI, 10).

Perforators/becs

They include one atypical perforator on obsidian blade, retouched in the proximal part (Pl. VI, 11), atypical perforator on obsidian blade with lateral notches (Pl. VI, 12), perforator on macroblade from white patinated chert (Pl. VI, 13), atypical alternate perforator on a thick blade from white patinated chert (Pl. VI, 14), alternate perforator on a flake from white patinated chert (Pl. VI, 15), and atypical bec on the flake from white patinated chert (Pl.VI, 16).

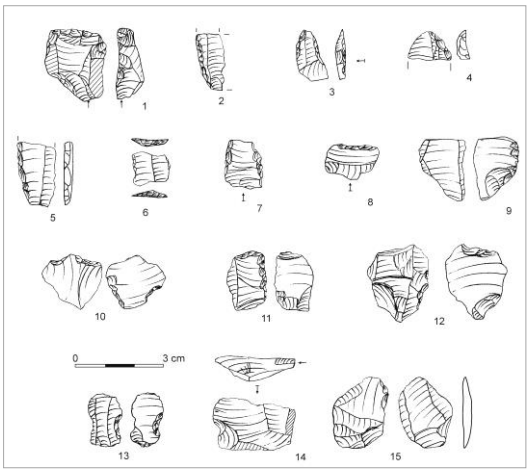

Plate VII. Roos. Retouched tools

Retouched truncations

Four specimens are included in this category of tools: obliquely retouched truncation on the irregular obsidian bladelet (Pl. VI, 17), obliquely retouched truncation on the obsidian flake from core preparation or change of orientation (Pl. VI, 18), transversally retouched truncation of the obsidian flake from the change of orientation on the core (Pl. VI, 19), retouched truncation**+** single blow burin on a thick obsidian blade like flake (Pl. VII 1).

Backed pieces

Four specimens were uncovered: obsidian backed blade, slightly convex (Pl. VII, 2), fragment of the convex backed obsidian blade, transversally broken as a result of the pressure on the lateral edge opposed to the blunted back, with irregular retouch or micro-scars from the use (Pl. VII, 3), distal end of the obsidian backed blade (or segment) (Pl. VII, 4), proximal part of the slightly convex regular backed blade from white patinated chert (Pl. VII, 5).

Trapezes

Two specimens were found: trapeze on the regular obsidian blade with both truncations abruptly retouched (Pl. VII, 6) and atypical trapeze on the obsidian blade-like flake; truncations were formed on lateral edge of the flake (Pl. VII, 7).

Retouched flakes

Four specimens have been uncovered**:** small obsidian flake with distal retouch (Pl. VII, 8), fragment of obsidian blade-like flake with flattish lateral inverse retouch (Pl. VII, 9), flake from the change of core orientation with lateral-distal retouch, made from white patinated chert (Pl. VII, 10), obsidian splinter with obverse lateral/distal retouch and thinning of the proximal part (Pl. VII, 11).

Notched-denticulated tools

Three specimens are included in this category of tools: obsidian flake from the change of core orientation with inverse distal and proximal notches (Pl. VII 12), obsidian bladelet with bilateral alternate notches (Pl. VII 13), fragment of the obsidian flake with transversal Clactonian notch, made from white patinated chert (Pl. VII 14).

Other

Fragment of a bifacial tool (or splintered piece) made from white patinated chert (Pl. VII, 15).4.

DISCUSSION

The general tool composition at Areta does not diverge from other sites of the Aegean Mesolithic, such as Maroulas in Kythnos (Sampson et al. ed. 2010) or Kerame 1 in Ikaria (Sampson et al. ed. 2012) (Table 2). Similarities can be demonstrated to the inventory from Roos (also a surface collection), and to some degree also to the aceramic (X) level in Knossos (Kaczanowska, Kozłowski 2011). All the mentioned sites are distinguished by the high percentage of denticulate tools with notches and retouched flakes. The small differences observed may reflect the different functions of the tools at the sites, although one cannot rule out that they may be chronological and cultural markers. The appearance of tools made on regular blades (e.g. trapezes and retouched blades) may point to a later chronological phase.

The most numerous group of tools at Roos includes perforators, which at Maroulas make up 15.5% of the inventory and are completely absent in layer X at Knossos. The second most numerous group at Roos contains retouched flakes and denticulate tools with notches, which are the most frequent tool forms at Maroulas and Kerame 1. At Roos, the frequency of backed and truncated pieces, which in Maroulas and Knossos (layer X) account for 1/5 of all tools, is similar to that of retouched flakes and denticulate tools. Among the very few trapezes at Roos (two pieces), one is made on a very regular blade with symmetrical truncations (Pl. VII 6), which differs from the atypical trapezes (being in fact doubled truncated pieces) known from Maroulas (Sampson et al. 2010, Table 95: 21, 22). The discussed specimen and similar tools from Areta incline us to suppose that the Roos and Areta inventories represent a later phase of the Aegean Mesolithic, during which an expansion of this culture to the southern Aegean and Crete seems to prevail. The location of more sites, in the future, on islands of Southern Aegean could give new perspectives on this hypothesis.

In recent survey at Stelida (Carter et al. 2015), several Mesolithic artifacts have been collected,

mostly belonging to the early phase of the Aegean Mesolithic (denticulates, retouched flakes, end-scrapers, atypical perforators, truncated bladelets and convex backed bladelets).

The implements typical of the late phase of the Mesolithic, mentioned in Stelida, are not illustrated.

Table 1. Major tool categories in Aegean Mesolithic sites

Site	End-scrapers (%)	Burins	Perforators	Microliths (backed pieces, truncations, trapezes)	Retouched flakes	Denticulated - notched tools	Retouched blades	others
Ikaria	16,8	0,7	18,8	16,8	23,5	19,5		3,9
Maroulas	17,9	1,2	15,9	8,3	16,9	25,9		13,9
Knossos	4,2			19,4	44,6		12,7	19,1
Chalki	6,5	0,7	16,6	14,4	13,4	35,5		12,9

Table 2. Raw material in Roos

Raw material	N	%
Obsidian	129	71,6
White patinated flint	31	17,2
Quartz	19	10,5
Beige patinated flint	1	0,5
Total	180	99,8

ACKNOWLEDGMENTS

Thanks are due to the NCN (Polish National Research Centre) –grant no 2015/19/B/HS3/00477- for financial support of this research. We also thank the archaeologists Tonia Tsourouni for the editing of the text and Konstantina Davri for the editing of the illustration, as well as Dr. Vagia Mastrogiannopoulou for her contribution in the surface survey and the location of the Roos site in Naxos.

REFERENCES

Bintliff, J. L. (1977) *Natural environment and human settlement in Prehistoric Greece, based on original fieldwork*, vol. I, II, B. A. R., International Series, Oxford.

Carter, T., Contreras, D., Doyle, S., Mihailovic, D., Moutsiou, T., Skarpelis, N., (2015)The Stelida Naxos Archaeological project: new data on the Middle Palaeolithic and Mesolithic Cyclades, *Antiquity* 341.

Kaczanowska, M., Kozłowski, J.K. (2011) Lithic industry from the aceramic levels at Knossos: an alternative approach, *Eurasian Prehistory*, 8, 1-2, 67-88.

Koumouzelis, M., Kozlowski, J. K., Kaczanowska, M. (2003) Mesolithic finds from Cave 1 in the Klissoura Gorge, Argolid, in N. Galanidou and C. Perlès (eds), *The Greek Mesolithic, Problems and Prespectives,* British School at Athens, Studies 10, 113-122.

Rackham, O. (1982) Land-use and the native vegetation of Greece, in Bell M. and Limbrey S. (eds), *Archaeological Aspects of Woodland Ecology*, B. A. R. International Series 146, 177-197.

Runnels, C. N. (1996) The Palaeolithic and Mesolithic remains from the Berbati-Limnes survey, in B. Wells and C. Runnels (eds), *The Berbati-Limnes Archaeological Survey 1988-1990,*
Stockholm, 23-35.

Runnels, C. N. (2001) The Stone Age of Greece from the Palaeolithic to the advent of the Neolithic, in T. Cullen (ed.), *Aegean Prehistory. A review*, AJA, Supplement 1, 225-255.

Runnels, C. N. (2009) Mesolithic sites and surveys in Greece: A case study from the Southern Argolid, *Journal of Mediterranean Archaeology* 22, 1, 57-73.

Rackham, O. and Vernicos, N. (1991) On the ecological history and future prospects of the island of Chalki, in A.T. Grove, J. Moody and O. Rackham (eds), *Crete and the South Aegean Islands. Effects of changing climate on the environment*. Geography Department, Univ. of Cambridge, 347-361.

Sampson, A. (2006) *Prehistory of the Aegean. Palaeolithic, Mesolithic, Neolithic.* Atrapos ed. Athens.

Sampson, A. (2008) *The Cyclops Cave on the island of Youra, Greece. Mesolithic and Neolithic networks in the Northern Aegean Basin. Intra-site analysis, Local Industries, and Regional Site Distribution,* Vol 1, INSTAP Academic Press, Philadelphia.

Sampson, A., Kaczanowska, M., Kozłowski, J. K. (2010) *The prehistory of the island of Kythnos (Cyclades, Greece) and the Mesolithic settlement at Maroulas*. Kraków, Polish Academy of Arts and Sciences.

Sampson, A. (2010) *Mesolithic Greece. Palaeoenvironment, Palaeoeconomy, Technology*, ed. Ion, Athens.

Sampson, A. (ed. 2011) *The Cyclops Cave on the island of Youra, Greece. Mesolithic and Neolithic networks in the Northern Aegean Basin, vol. II: Dietary resources and Palaeoenvironment.* INSTAP Academic Press, Monograph Series, Philadelphia.

Sampson, A., Kaczanowska, M., Kozłowski, J. K. (2012) *Mesolithic occupations and environments on the island of Ikaria, Aegean, Greece,* Monograph in Folia Quaternaria, Krakow.

Sampson, A. (2014) The Mesolithic of the Aegean Basin, in C. Manen, T. Perrin, J. Guillaine (eds), *The Neolithic transition in the Mediterranean*, Errance, 193-212.

Sampson, A. (2015) The Aegean Mesolithic. Environment, Economy and Seafaring, in A. J. Ammerman and T. Davis (eds), *Island Archaeology and the Origins of Seafaring in the Eastern Mediterranean,* Proceedings of the Wenner Gren Workshop held at Reggio Calabria, 2012 *Eurasian Prehistory*, 11 (1–2): 63–74.

Sampson, A. (2016) An extended Mesolithic site in Naxos, *Mediterranean Archaeology and Archaeometry* vol. 16, No 1, 269-271.

Seferiades, M. (1983) Une centre industriel préhistorique dans les Cyclades: Les ateliers de debitage du silex de Stelida (Naxos), in *Les Cyclades, Materiaux pour une étude de Geographie Historique,* Univ. de Dijon.

Vernicos, N. (1986) Chalki in the Dodecanese, Working Papers for the Seminar On Upgrading Chalki's Natural Environment: Social and Economic, Univ. of the Aegean.