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STONE AGE SEAFARING IN THE MEDITERRANEAN

Evidence from the Plakias Region for Lower Palaeolithic and Mesolithic Habitation of Crete

ABSTRACT

A survey in 2008 and 2009 on the southwestern coast of Crete in the region of Plakias documented 28 preceramic lithic sites. Sites were identified with artifacts of Mesolithic type similar to assemblages from the Greek mainland and islands, and some had evidence of Lower Palaeolithic occupation dated by geological context to at least 130,000 years ago. The long period of separation (more than 5,000,000 years) of Crete from any landmass implies that the early inhabitants of Crete reached the island using seacraft capable of open-sea navigation and multiple journeys—a finding that pushes the history of seafaring in the Mediterranean back by more than 100,000 years and has important implications for the dispersal of early humans.

INTRODUCTION

How did early humans (hominins) from Africa reach Europe in the Pleistocene? Were they confined to the Near Eastern land corridor, or did they cross the Mediterranean? When did seafaring in the form of deliberate, direct transpelagic crossings begin? When did early humans first reach Crete, an island for some 5,000,000 years that was until recently thought to have been inhabited for the first time only in the Neolithic period? These are a few of the questions posed by recent discoveries in southwestern Crete, where the Plakias Survey project has conducted two seasons of archaeological reconnaissance, in 2008 and 2009.[1] The area surveyed is located on the

1. The Plakias Survey project was conducted under the auspices of the American School of Classical Studies at Athens and the Greek Ministry of Culture (Ephoreia of Palaeoanthropology and Speleology of Southern Greece and the 25th Ephoreia of Prehistoric and Classical Antiquities). The project was funded by the Institute for Aegean Prehistory, the Loeb Classical Foundation, the National Geographic Society, and Providence College. For help in the field, we thank Natalie Cooper, Chad DiGregorio, Doug Faulmann, Tammie Gerke, Hannah Johnson, and Epaminondas Kapranos. The director of the American School of Classical Studies, Jack Davis, and staff members, in particular Maria Pilali, are to be thanked for their support of our project and their assistance in practical matters. We would also like to thank Nina Kyparissi-Apostolika (director of the Ephoreia of Palaeoanthropology and Speleology of Southern Greece) and Maria Andreadaki-Vlazaki (director of the 25th Ephoreia of Prehistoric and Classical Antiquities) for their support. Finally, we are grateful to the anonymous *Hesperia* reviewers for their helpful suggestions.

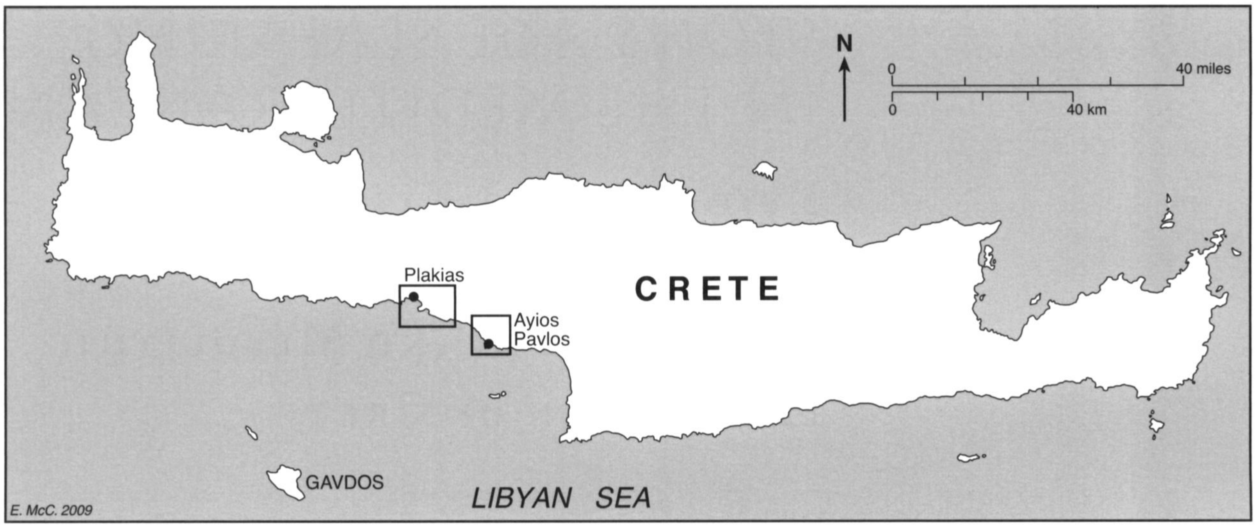


Figure 1. Map of Crete showing areas surveyed by the Plakias Survey project. E. McClennen

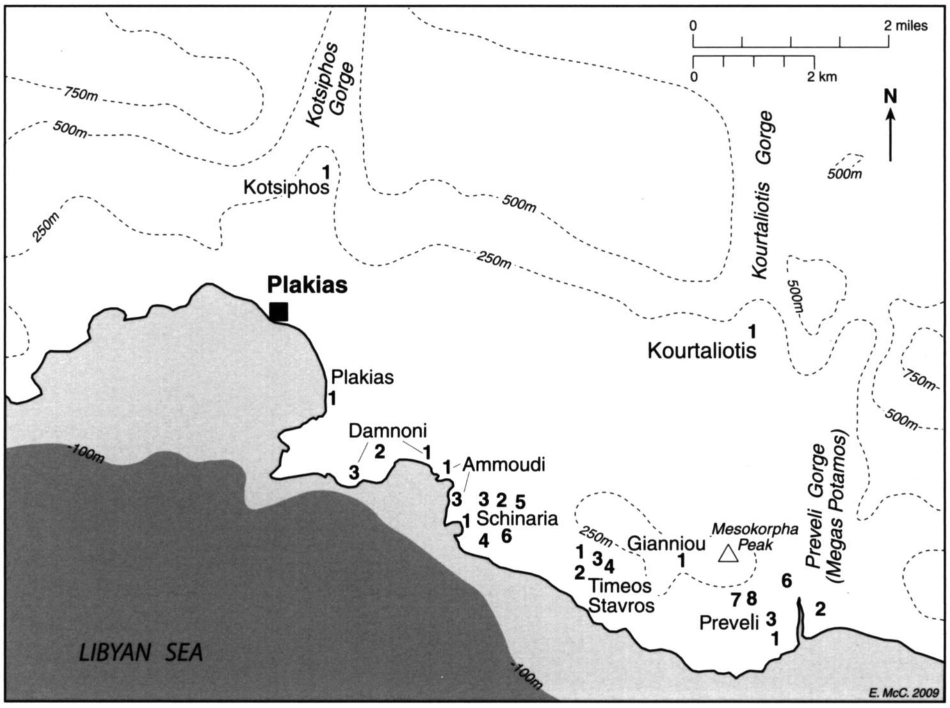
coast in the Rethymnon nomos, and includes the area from Plakias to the Preveli Gorge as well as the area around Ayios Pavlos (Fig. 1).

Although claims for pre-Neolithic habitation on Crete have been made for many decades, the Plakias Survey is the first project to identify pre-Neolithic cultural materials in geological contexts that provide approximate ages for the finds. Our survey identified 28 findspots or sites associated with caves and rockshelters (Fig. 2, Table 1) and collected a sample of just over 2,100 lithic artifacts attributable to at least two early prehistoric industries. One industry consists of microlithic artifacts of Mesolithic type found on 20 sites. The other industry (or industries) is of Palaeolithic type and is found on nine sites. Two findspots (Kourtaliotis 1 and Plakias 1) produced only undiagnostic lithics, but they appear to be pre-Neolithic. Although there was some overlap in the use of sites in the Palaeolithic and the Mesolithic at Preveli 2, Preveli 3, and Preveli 8, the artifacts representing the two periods were for the most part found on different sites.

The discovery of Mesolithic sites was the focus of our original research, and was not unexpected in light of recent discoveries of Mesolithic or Epipalaeolithic sites on other islands, such as Kythnos, Ikaria, Alonnisos, and Cyprus (see below). The existence of Lower Palaeolithic artifacts in association with datable geological contexts, however, was a complete surprise. Given the presence of Mesolithic remains on other islands, it had been assumed that Mesolithic foragers were seafarers, but until now there has been no certain evidence for Lower Palaeolithic seafaring in the Mediterranean.

In the following pages we present the evidence from the Plakias Survey, focusing on the artifact assemblages and the details of their geological context and dating. While there can be no doubt that these discoveries will have profound implications for the questions posed above, at this preliminary stage our research cannot sustain far-reaching speculations. We do not know precisely when Lower Palaeolithic hominins reached Crete, or whether their occupation of the island was widespread, long-lasting, or continuous. Nor can we say what the implications will be of the discovery

Figure 2 ***(opposite)*****. Details of the survey areas shown in Figure 1, with approximate locations of sites mentioned in the text: (a) western area around Plakias; (b) eastern area around Ayios Pavlos. The –100 m isobath marks the approximate extent of the coastal plain at the end of the Pleistocene.** E. McClennen


0
2 miles
0
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N
750m
500m
250m
Kotsiphos Gorge
Kotsiphos
1
Kourtaliotis Gorge
500m
500m
250m
500m
Plakias
Plakias
1
Kourtaliotis
1
750m
500m
Damnoni
2
1
3
1
Ammoudi
-100m
3
3 2 5
1
Schinaria
4 6
250m
Gianniou
1
Mesokorpha Peak
Preveli Gorge (Megas Potamos)
1
3 4
2
Timeos Stavros
7 8
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Preveli
3
1
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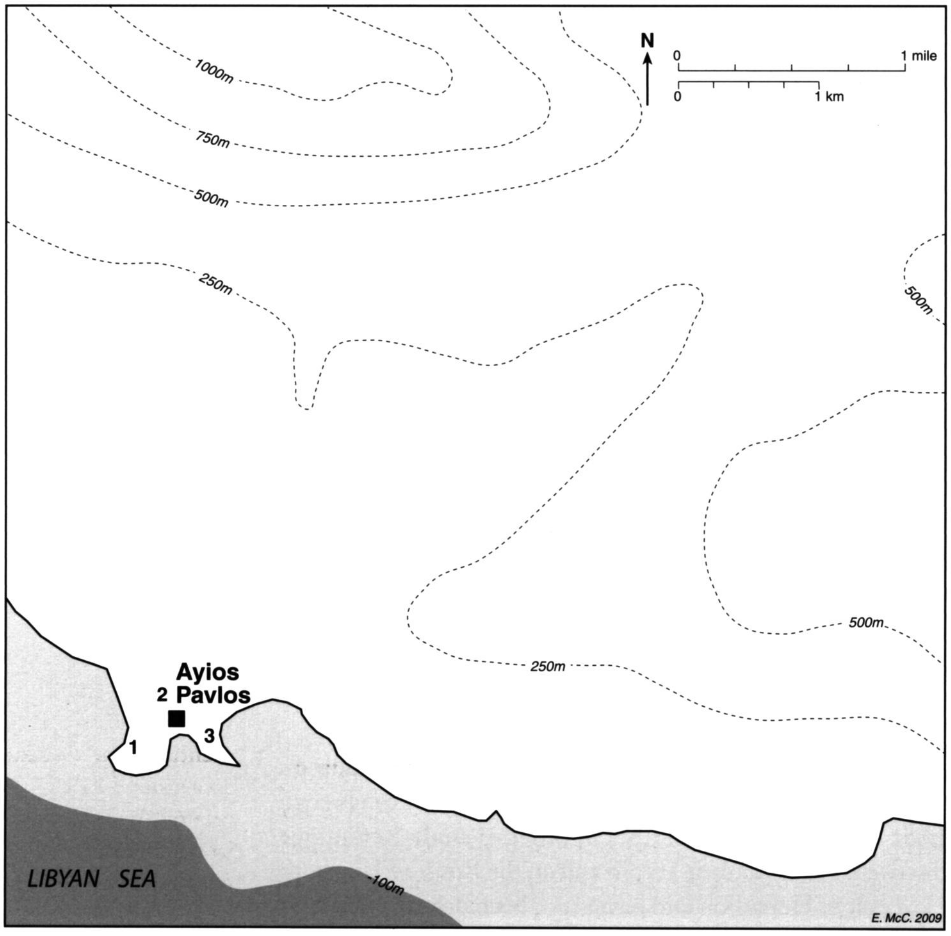
LIBYAN SEA
-100m
E. McC. 2009

a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E. McC. 2009

b

TABLE 1. CHRONOLOGY OF THE SITES

Sites	*Palaeolithic*	*Mesolithic*	*Other*
Damnoni 1	—	×	—
Damnoni 2	—	×	—
Damnoni 3	—	×	—
Ammoudi 1	—	×	—
Ammoudi 3	—	×	—
Ayios Pavlos 1	—	×	—
Ayios Pavlos 2	—	×	×
Ayios Pavlos 3	—	×	—
Schinaria 1	—	×	—
Schinaria 2	—	×	—
Schinaria 3	—	×	—
Schinaria 4	—	×	×
Schinaria 5	×	—	—
Schinaria 6	—	×	—
Preveli 1	—	×	—
Preveli 2	×	×	—
Preveli 3	×	×	—
Preveli 6	—	×	—
Preveli 7	×	—	—
Preveli 8	×	×	—
Kourtaliotis 1	—	—	×
Kotsiphos 1	×	—	—
Plakias 1	—	—	×
Timeos Stavros 1	×	—	—
Timeos Stavros 2	—	×	—
Timeos Stavros 3	—	×	—
Timeos Stavros 4	×	—	×
Gianniou 1	×	—	—

of Mesolithic inhabitants for our understanding of the arrival of Neolithic settlers on Crete or elsewhere in the Aegean. The results we present here are but a first step on the path of research leading to a better understanding of the movements of early prehistoric peoples among the Mediterranean islands and beyond.

PREVIOUS RESEARCH

Previous research concerning the pre-Neolithic periods on Crete has produced few conclusive results. There are several reasons for this, including ambiguous data and the lack of scholarly training of archaeologists to recognize Palaeolithic or Mesolithic remains.[2]

The first scholar to claim evidence for pre-Neolithic occupation on Crete was M. L. Franchet.[3] Sent to Crete and Egypt in 1912 by the French Ministry of Public Education and Fine Art in order to study "céramique primitive," he discovered stone tools at Trypiti and on the Rouses Plain; both sites were ca. 3 km east of Heraklion and have since been destroyed or covered by recent construction.[4] In his surface collections, Franchet identified

2. Hutchinson 1962, p. 45.
3. Franchet 1917, pp. 63–81.
4. Hutchinson 1962, p. 46; Zois 1973a, pp. 59–60.

two industries: one of obsidian, which he assigned to the Neolithic, and the other of limestone. Franchet thought the limestone industry was significant because it was earlier; the large "pics" and perçoirs seemed to him to be characteristic of the "campiniennes" stages in France and Egypt.[5] It is difficult to know exactly what date Franchet assigned to this material; he states only that it is earlier than the Neolithic then known on Crete.

Franchet's research was quickly dismissed by British archaeologists working on Crete.[6] Robert Bosanquet and Arthur Evans, in particular, challenged his research, claiming that he misinterpreted the retouch found regularly on Bronze Age stone tools.[7] Nevertheless, after studying the aceramic Neolithic flaked stone industry from stratum X at Knossos, Zois assigned the unretouched microliths from Trypiti and Rouses to the Mesolithic period, and the larger limestone "tools" to either the Mesolithic or the Palaeolithic.[8]

At Kastellos, an important Neolithic and Bronze Age site in the Lasithi Plain, John Pendlebury tentatively identified a red chert tool found there in the early 20th century as Aurignacian.[9] He based this attribution on a comparison with a similar artifact collected by George Finlay in the 19th century and housed in Manchester, England. The latter tool had been identified originally by Abbé Breuil. Burkitt and Wilfred described the tool in the publication by Pendlebury and colleagues, but insufficient comparative artifacts and the purely Bronze Age context strongly suggest that it is not Aurignacian—and Pendlebury himself doubted such an early date.[10]

In addition to stone tools, some scholars thought that they saw evidence of pre-Neolithic habitation of Crete in the form of worked bone and antler artifacts. In 1969, S. E. Kuss identified two pre-Neolithic cultures in the areas of Kalo Chorafi and Grida-Avlaki, located on the north coast between Rethymnon and Heraklion.[11] He dated the "artifacts" from Kalo Chorafi to the Riss glaciation (120,000–100,000 B.P.) and those from Grida-Avlaki to the Riss-Würm interglacial (100,000–60,000 B.P.). To the earlier period he assigned the label *keratische Kultur* (the Antler Culture), and to the later the label *osteokeratische Kultur* (the Bone and Antler Culture), reflecting the media of the respective artifactual industries. The type-artifact for the *keratische* culture is a deer antler, heavily scratched, and with a worn and zigzag-patterned tip. The *osteokeratische* culture is distinguished by forklike "tools" from deer radii and metatarsals. The radii have forks on both ends, while the metatarsals are forked only on the distal ends. The antlers and bones come from a now-extinct endemic Pleistocene deer, *Cervus cretensis*. Although no worked stone tools were found, Kuss suggested that stone tools had to have been used to create the bone tools, and that the residual striations on the bones supported this conclusion.

Antony Sutcliffe subsequently questioned Kuss's conclusions.[12] He observed deer in the wild and found that they frequently gnawed on the bones and antlers of dead deer, perhaps because of a calcium deficiency.[13] Different characteristics could be seen on the gnawed bones and antlers: the bones had forked ends while the antlers displayed zigzag patterns. Sutcliffe also studied bones and antlers collected by the palaeontologist Paul Sondaar—who, like Sutcliffe, was also a faunal analyst—and concluded that they were not artifacts.

5. It should be kept in mind that *The Palace of Minos* I (1921) had not yet been published, so the chronology was undetermined at this point.
6. Zois 1973a, p. 62.
7. Bosanquet 1918; *PM* I, p. 32, n. 3.
8. Zois 1973a, p. 62; see also Cherry 1981, p. 43.
9. Pendlebury, Pendlebury, and Money-Coutts 1937–1938, p. 51.
10. Pendlebury, Pendlebury, and Money-Coutts 1937–1938, p. 51.
11. Kuss 1969.
12. Sutcliffe 1973, 1977.
13. Sutcliffe 1977.

In 1970, Yannis Tzedakis excavated Gerani Cave 3, located 9 km west of Rethymnon.[14] He reported finding worked bone tools associated with horns and skulls of deer that J. F. Cherry, in his 1981 study of the early colonization of Mediterranean islands, presumed were the extinct endemic Pleistocene deer *Megaloceros cretensis.*[15] Tzedakis did not date the tools to the Palaeolithic, but only reported that they were found among now extinct fauna.[16]

Asphendos Cave is located in southwestern Crete near a village of the same name. It was discovered independently by Paul Faure and Christos Papoutzakis, and the data were reviewed by Zois.[17] Inside are petroglyphs of abstract symbols and representations of animals. Despite the primitive character of the petroglyphs, and the interpretation of some of the animal scenes as representing the hunting of wild animals, there are no dates to confirm an early prehistoric age for these images. All archaeological investigations in the cave, including one excavation, have found only Minoan pottery.[18] Moreover, should the scimitar-horned animals depicted in the petroglyphs represent agrimia, Cretan wild goats, they would belong to the Neolithic period or later because agrimia are feral forms of domesticated animals introduced during the earliest stages of the Neolithic.[19]

In the Samaria Gorge, also located in southwestern Crete, members of the Sphakia Survey project discovered a scatter of brown chert initially thought to be Epipalaeolithic or Mesolithic in character.[20] The team excavated two test trenches. Lithic analysts examined the pieces and determined that they were not artifacts but fragments of chert broken by trampling. Similar doubts are connected with the possible Palaeolithic or Mesolithic stone tools associated with now-extinct Pleistocene fauna at Phrangomoura 1 and 2 in eastern Crete reported by Norbert Schlager.[21] He was uncertain whether or not the tools were worked artifacts.

Pleistocene human remains are unknown on Crete, apart from a single reported specimen. Late in the 19th century, Vittorio Simonelli discovered human skeletal remains in a cave near Chania.[22] Facchini and Giusberti report that the remains consisted of a cranium and postcranial fragments heavily cemented in a calcareous breccia.[23] They used the Protactinium/Uranium method to date the breccia to 51,000 ± 12,000 B.P., but there is no stratigraphic context and the bones themselves were not dated.

Recently, Peder Mortensen reported Palaeolithic limestone artifacts from the region of Loutro, 30 km west of Plakias.[24] Members of the Plakias Survey team inspected these objects in the Chania Museum, and determined that the Loutro objects might, despite their suggestive shapes, be geofacts. In light of our discoveries in the vicinity of the Preveli Gorge (see below), however, the area around Loutro should be carefully examined in the future. Finally, in 2006 at the 10th International Cretological Conference, Katerina Kopaka and Christos Matzanas reported that artifacts belonging to all phases of the Palaeolithic were found in a survey on the island of Gavdos, off the southern coast of Crete (Fig. 1), and they recently presented some of these artifacts online.[25] Although the finds from Loutro and Gavdos offer possible corroborative evidence, they await full publication. In sum, none of the research described above yielded secure evidence—in a datable geological context—for Palaeolithic or Mesolithic occupation of Crete.

14. Tzedakis 1970.
15. Cherry 1981, p. 43.
16. Tzedakis 1970, pp. 474–476. Cherry (1981, p. 43), however, reports that Jarman had studied the deer bones and concluded that the deposits were mixed during excavation.
17. Faure 1972, pp. 406–407; Papoutzakis 1972, p. 107; Zois 1973b.
18. Faure 1972, p. 412; Tzedakis 1973, p. 583; Nixon et al. 1990, p. 216.
19. Groves 1989, pp. 50–51.
20. Nixon, Moody, and Rackham 1988, pp. 171, 173; Nixon et al. 1990, pp. 214–215.
21. Schlager 1991, pp. 7–10.
22. Simonelli 1897.
23. Facchini and Giusberti 1992, p. 189.
24. Mortensen 2008.
25. Kopaka and Matzanas 2009; forthcoming.

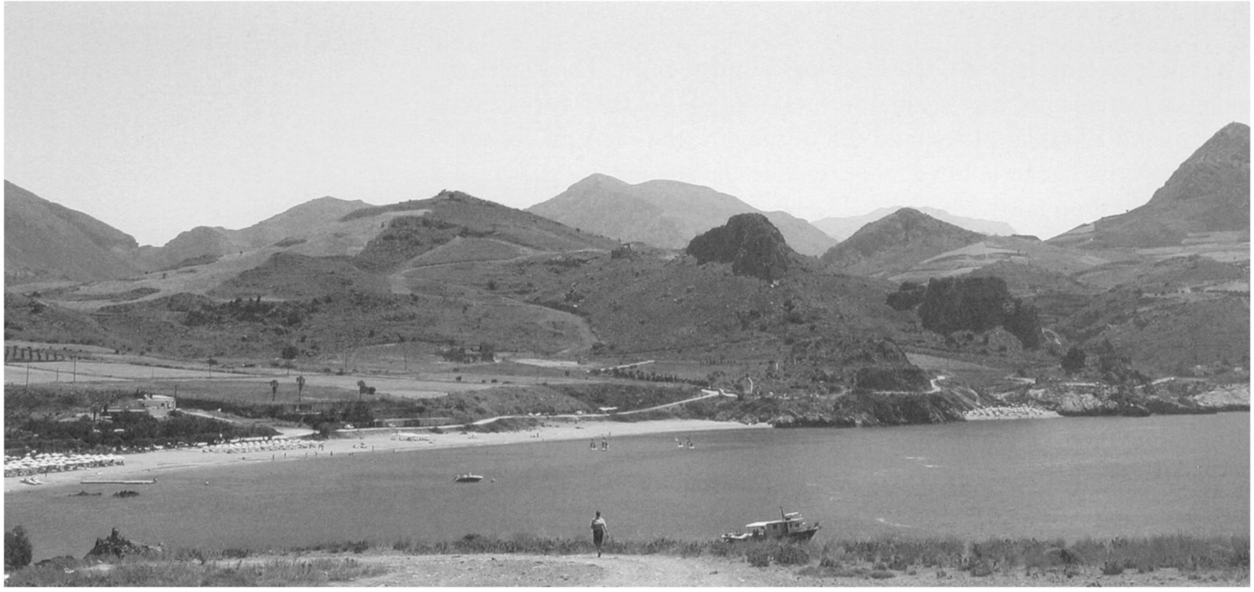


Figure 3. General view of the landscape near Plakias. Photo N. Thompson

THE PLAKIAS SURVEY

Despite the inconclusive evidence for pre-Neolithic habitation of Crete, it seemed likely that evidence for the Mesolithic period would be found on the island because it had previously been discovered on other islands in the Aegean. Discoveries on Alonnisos, Kythnos, and other Aegean islands, as well as on Cyprus, have shown that an early model that argued that occupation of the islands took place first in the Neolithic was incorrect.[26] It was reasoned that if Mesolithic foragers found these islands attractive for subsistence, Crete must also have been a desirable habitat. Crete, however, is a very large island, which raised the problem of where to look for pre-Neolithic remains.

A Mesolithic site-location model developed by researchers working on the Greek mainland and the islands identified areas likely to have early Holocene sites.[27] These areas are habitats that may have been preferred by Mesolithic foragers and that could also preserve their artifacts. We applied this model to Crete. The coastal area around Plakias has characteristic features such as caves, rockshelters, and proximity to coastal wetlands (Fig. 3) that on the Greek mainland were found to fit this Mesolithic site-location model. In addition to using the model for the Plakias Survey, it was possible to involve lithic specialists who were familiar with Mesolithic assemblages from the mainland and who were experienced in identifying artifacts of this period.

26. For the previous view of the earliest habitation of the islands, see Cherry 1981. For a current summary of the evidence, see Broodbank 2006; for early humans in the Aegean, see Chelidonio 2001 and Panagopoulou, Kotjambopoulou, and Karkanas 2001. For Mesolithic Alonnisos, see Panagopoulou, Kotjambopoulou, and Karkanas 2001, pp. 126–135; for Kythnos, see Sampson et al. 2002. For Mesolithic occupation on Cyprus, see Simmons 1999.

27. Runnels et al. 2005.

The Plakias Region

The southwestern coast of Crete is geologically dynamic.[28] The Plakias region is a tectonic mélange created as a result of the collision between the African and Eurasian plates, and the warping of the Hellenic forearc.[29] The coast is backed by uplifted ranges of limestone mountains and crossed more or less from north to south by deeply incising river systems such as the Megas Potamos in the Preveli Gorge (Fig. 4:a, b). Today the region is a complicated mosaic of limestone-flysch thrust sheets (nappes) that record the accretion of sedimentary and volcanic rocks to the Aegean margin during subduction of the African lithosphere; there are younger extensional (normal) faults, and heavily eroded limestone slopes.[30] On the coast are flights (arranged in a steplike fashion) of marine terraces and bedrock erosional planation surfaces (Fig. 4:a) corresponding to intervals of eustatic sea level high stands in the Upper Pleistocene (130,000–10,000 years ago), the preservation of which has been made possible by continual slow local uplift of rock.

The underlying geology of the Plakias region affected our archaeological research in numerous ways. The location and nature of faults, surface water, and cave shelters were factors that we considered likely to determine prehistoric site preference (see below), and the active tectonic and geomorphologic processes that have worked for hundreds of thousands of years have served both to preserve sites in some cases and to destroy them in others. Perhaps the most important of these destructive processes is the ongoing tectonic uplift of the area. This uplift creates steep slopes that can accelerate the deterioration of the caves and rockshelters that were the focus of prehistoric human land use, and the erosion of unconsolidated sediments has affected the preservation of early prehistoric sites everywhere.

Yet other processes, such as the formation of cemented sedimentary beach deposits (i.e., marine terraces) during sea level high stands and their preservation due to subsequent eustatic sea level regression coupled with regional rock uplift, have helped to preserve evidence of prehistoric human activity within them. The strongly cemented and indurated late Pleistocene deposits, especially the sedimentary beach conglomerates observed at Preveli 2 (see below), are associated with lithic artifacts, for example. In other cases, such as Preveli 7 (see below), paleosols (buried and/or fossil soils) contain and preserve artifacts of Palaeolithic type.[31] Finally, the carbonate-rich runoff from cave and rockshelter brows both consolidated and preserved anthropogenic deposits that had been exposed over time by the retreat of the brows, a factor that has helped to preserve evidence of Mesolithic occupation.

28. See Thommeret et al. 1981; Fassoulas and Nikolakakis 2005; Shaw et al. 2008; Wegmann 2008.

29. Fassoulas 2000; Wegmann 2008, pp. 94–139.

30. Rahl, Fassoulas, and Brandon 2004.

31. The alluvial fans in southwestern Crete have been studied extensively (Nemec and Postma 1993; Pope et al. 2008). Mediterranean paleosols form and mature in seasonal wet-dry conditions. The use of paleosols in Palaeolithic archaeology was pioneered in Greece by Tjeerd van Andel and his students, especially Kevin Pope and Eberhard Zangger, and the basic principles are described in numerous publications, including van Andel 1998, Runnels and van Andel 2003, and van Andel and Runnels 2005; see n. 51, below.

a

b

Figure 4. Views of the Preveli Gorge from (a) the west and (b) the south. The marine terraces and level erosional planation surfaces of Preveli 2, located at the middle foreground of (a), resemble a staircase. Photos N. Thompson

Figure 5. View of a cave (Damnoni 3), from the southeast. Photo N. Thompson

Methods

As noted earlier, our approach was based on a targeted survey method successfully employed on the Greek mainland to locate Mesolithic sites.[32] We investigated caves and rockshelters and their immediate environs in coastal zones where early Holocene wetlands (the likely focus of prehistoric activity) once existed. The steep coast of southwestern Crete faces the abyssal depths of the Libyan Sea and is close in a horizontal sense to what we believe was the position of the shoreline in the early Holocene (11,000–9,000 years ago), when local sea levels were ca. 35–70 m lower than today (Fig. 2:a, b).[33] When eustatic sea level rose rapidly in the early Holocene, it would have flooded low-lying land and backed up rivers, creating wetlands with both fresh water and marine resources.

In the Plakias area, the limestone bedrock is pervasively fractured and permeable and is subject to both karstic weathering and tectonic forces. Steeply dipping normal faults in the limestone have relatively soft walls that are attacked by surficial and groundwater flows. These flows create small caves (see Fig. 5), and the runoff carves out long overhangs of rock, the shallower and wider of which are referred to here as rockshelters (Fig. 6). Moreover, during sea level high stands, wave erosion formed level planation surfaces, algal reefs, sea cliffs, notches, and sea caves, the last being enlarged small karstic cavities at sea level. Sea cliffs and associated notches usually have the configuration of rockshelters. Both caves and rockshelters are regularly degraded by brow and ceiling collapse caused by weathering, erosion, and the same tectonic forces and seismic activity responsible for the creation of the fault scarps.

32. See p. 151 and n. 27, above.

33. See the coastal reconstructions for the Aegean in Lambeck 1996 and Lambeck and Purcell 2005, and the application of these data for the reconstruction of early Holocene shorelines in Runnels et al. 2005.

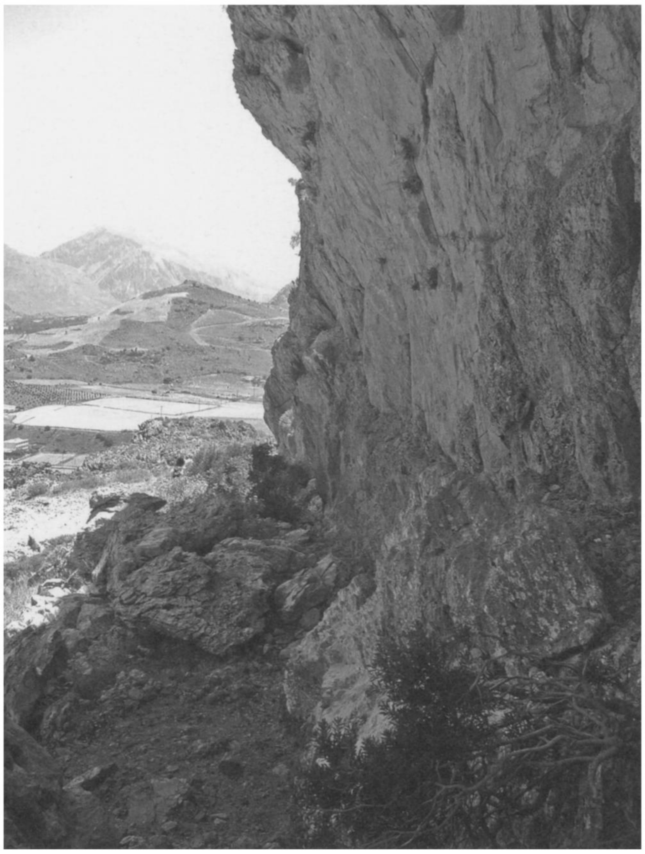


Figure 6. View of a rockshelter (Damnoni 2), from the west, showing the remains of a collapsed brow. Photo N. Thompson

The exact size, shape, and appearance of caves and rockshelters in the Pleistocene and early Holocene cannot be ascertained without excavation and further geomorphological study, but today the caves are rarely more than 10 m deep and typically no more than 2–4 m wide. The largest cave is the cavern at Ayios Pavlos 3, but the evidence of several large karstic windows and the dense rockfall from the collapsed brow (Fig. 7) are testimony that it is too unstable to long endure. Large caverns such as this usually do not remain standing for long. There is evidence in the form of sea notches and holes burrowed by molluscs (*Lithophaga* sp.) that these caves were altered during periods of high sea level and that they were undercut and partially collapsed during periods of lower sea level. Rockshelters differ from caves in that they consist of wide stretches of discontinuous, partly collapsed overhangs of rock (often remnants of former sea cliffs and notches) that protect shallow benches of sediments or deposits.

We examined all caves and rockshelters in the Plakias region found near the mouths of freshwater perennial streams and rivers emptying into the Libyan Sea and within 5 km of the present coast. To locate these features we used a combination of topographic maps at a scale of 1:5,000, Google Earth images, and visual inspection of the countryside. We were able to identify more caves and rockshelters than could be investigated by road or by foot in the time available. Some features were at elevations sufficiently high to be reached only by technical climbing, or in extremely remote and rugged landscape, and these were not investigated.

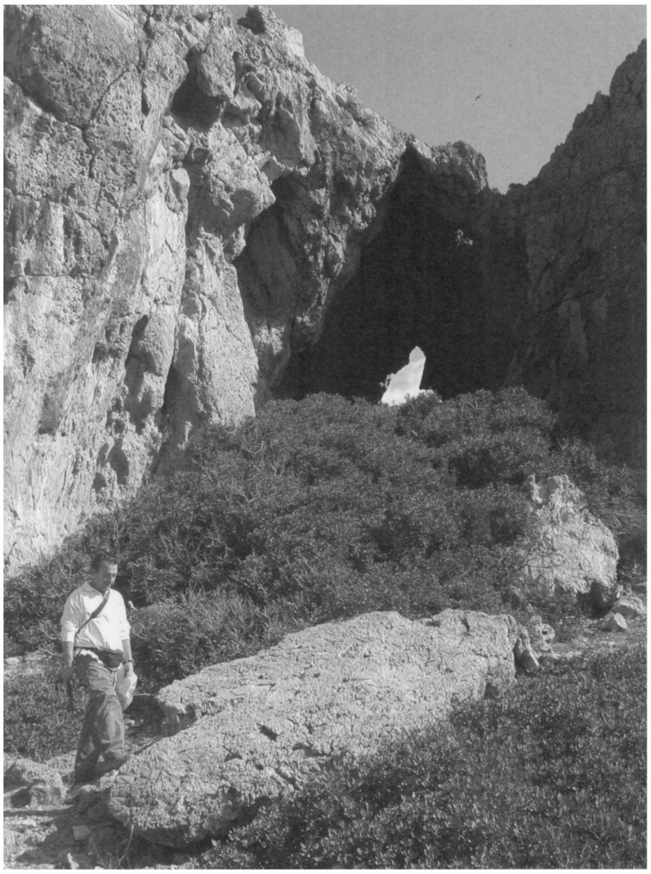


Figure 7. View of the partially collapsed cavern at Ayios Pavlos 3, from the south. Photo N. Thompson

Assuming that most caves and rockshelters have retreated in the last 10,000 years as a result of brow collapse, and that deposits resulting from human occupation are found now outside of the remaining features, we searched in front of each cavity, usually downslope (Fig. 8). Scatters of lithic artifacts were often found around the present-day openings of the caves and rockshelters and on the slopes directly below the openings. We limited the designation of a "site" to findspots where lithics were numerous (i.e., 20 or more) and had similar technological and typological characteristics; these were considered unlikely to have been the result of chance artifact loss resulting from sporadic visitation over long periods of time. The extent of each artifact scatter was estimated by a couple of people walking back and forth across each findspot, and site latitude and longitude were determined with a handheld GPS unit.

When these tasks were completed, we collected a sample of the lithics, including examples of all classes of lithic debitage (i.e., all objects modified by flintknapping). Because the project's goal was limited to the determination of the presence or absence of assemblages of Mesolithic type in the area, we decided that it was sufficient to make relatively small collections of representative lithics from each site. Most sites did not have great numbers of lithics (usually 80–100 artifacts), making it practical to collect all debitage. But some sites were much larger (e.g., Schinaria 1, consisting of thousands of artifacts; see Fig. 9), and we were obliged to be selective in sampling. In order to ensure that the samples in the latter

Figure 8. Searching for Mesolithic artifacts on the talus slope in front of the cave at Damnoni 3; view from the north. Photo N. Thompson

Figure 9. A Mesolithic artifact scatter at Schinaria 1. The artifacts are of white quartz. Photo N. Thompson

cases were small but representative of the basic assemblage composition, the collected material was sorted in the field.

We collected all technical pieces, tools (such as microliths), and flakes and blades if they were complete or nearly complete. Duplicate tested pieces (cores with one or two flakes removed to test the quality), cores, core fragments, small pieces of broken flakes without retouch, and other miscellaneous debitage were not all collected, although some were photographed in the field. Because the collection was supervised by lithic specialists, such nonrandom judgmental grab sampling was deemed sufficient to produce a reasonably accurate representative sample from each assemblage. In several cases, the team returned to sites to collect additional samples in order to ensure that the collections included representative elements from the assemblages sufficient to allow for their identification.

With the exception of a fossilized tooth from Ayios Pavlos 3 and some unmodified seashells from Schinaria 1 and Schinaria 6, only lithic artifacts were collected. The only treatment the lithics received after collection was a brief soaking in water to remove soil before they were sorted and classified. Because the samples were collected from the surface and could contain materials from more than one chronological period or occupational component, statistical treatment of these assemblages was not attempted. The classification of the assemblage was based on the reduction sequence and the identification of retouched tool types in accordance with classification schemes widely used by European prehistorians and which are based on a typological approach popularized by François Bordes in the 1960s.[34]

The artifacts were sorted by class: for example, core/debitage, flake, blade, or retouched tool (see Table 2, below). Each artifact was examined under low magnification to identify retouch or other technological characteristics, and reclassified as necessary. Once the collection from a site had been sorted, the raw materials were described and the objects were measured (typically to determine the length). Diagnostic pieces were drawn and photographed.

GENERAL OBSERVATIONS

Context

The spatial distributions of the lithics were typically small, sometimes no more than 25 or 30 m in extent and rarely more than 100 m from the present openings of caves and rockshelters. The artifacts had been scattered downslope below the cave or rockshelter openings after occupation. The large numbers of artifacts encountered at sites such as Schinaria 1 suggest the in situ weathering of anthropogenic deposits. The following observations support the notion that on the majority of sites the artifacts had not moved far from their original depositional contexts.

All lithic artifacts were examined for evidence of water damage such as smoothing, rounding, and polishing, and for the abrasion of edges and arrises, which is often assumed to reflect postdepositional modification. Such traces could be indications of the transport of artifacts from their original place of deposit after they had been discarded in antiquity, but none of the

34. See Debénath and Dibble 1994.

Figure 10. Patination on a Mesolithic quartz artifact, with the older patinated deliberate retouch cut by a recent unpatinated chip. Photo N. Thompson

artifacts collected show evidence for long-distance high-energy transport. Patination of the artifact surfaces was sometimes observed (see Fig. 10), typically (but not exclusively) on the earlier assemblages, thought to be of Palaeolithic age. Red staining from contact with iron-rich sediments was also present on some of the Palaeolithic material (Fig. 11).

Another feature pointing to the in situ *(sensu lato)* contexts of the sites is the range of size observed among the lithics. The artifacts are angular and of greatly different sizes, ranging from cores of 20 cm or more in their longest dimension down to flakes and fragments less than 1 cm in length. Artifacts of these variable sizes are found on the same sites, confirming

Figure 11. Red soil adhering to a Palaeolithic quartz artifact from Preveli 7, evidence of its former burial in an iron-rich paleosol. Photo N. Thompson

Figure 12. View of a probably Holocene paleosol with Mesolithic artifacts in situ at Preveli 2. Photo N. Thompson

that the specimens had not been sorted into size groups by high-velocity runoff or long-distance transport downslope. Although the rate at which artifacts were brought to the surface is unknown, the locations where they were found are now low-energy domains, although it is fair to assume that these slopes have periodically experienced high-energy erosional processes brought about by torrential rains and sheet erosion. Such episodes may have periodically "cleansed" some sites of at least the smaller artifacts, requiring some time for new material to be brought to the surface by the continuing action of natural erosional processes. The unsorted nature of our lithic scatters, however, suggests that these events have been infrequent, and the deep red color (2.5YR 4/8 red to 10R 3/6 dark red) of the sediments at some sites (e.g., Preveli 2 and Schinaria 1) suggests that the surfaces at these sites, although rather shallow in depth, were sufficiently stable for soils to develop and oxidize (Fig. 12).[35]

Indeed, at some sites lithics may continue to be derived from specific sedimentary deposits by present-day erosion. At Damnoni 2, for example, cave earth deposits are visible among the blocks from the fallen brow, and in situ artifacts were observed within these sediments. Elsewhere, for instance at Preveli 1, Schinaria 1, and Damnoni 3, red sediments can be seen. These occur in outcrops up to 1 m thick or more, below the present cave or rockshelter mouths, and it is probable, but not certain, that some lithics are being eroded from these deposits. At still other sites (Preveli 2, 3, and 7), artifacts were observed in a variety of contexts. At Preveli 2, artifacts were found as clasts within conglomeratic sedimentary beach deposits. At

35. Sediments altered by chemical weathering become soils after thousands of years. See n. 51, below.

Preveli 3, artifacts are eroding from terra rossa soils or alluvial fans on the karstic limestone plateau, while at Preveli 7, they are visible in an exposed outcrop of a paleosol.[36]

Raw Materials

The principal raw materials used for artifact manufacture are milky quartz and, to a lesser extent, quartzite and various types of chert (Fig. 13). Most of the raw materials are seemingly of local origin. Cobbles of various sizes of quartz and chert are visible in streambeds and on beaches throughout the area. Quartz is abundant in the survey area (Fig. 14), more readily available than the rare small outcrops of poor-quality chert, and it was used for the manufacture of the majority of the Mesolithic and Palaeolithic artifacts.

Figure 13. Mesolithic artifacts from Damnoni 1, showing typical raw materials used for manufacture. The white material is quartz, and the dark is chert. Top row, left to right: denticulate, denticulate, truncation, spine, end scraper. Bottom row, left to right: perçoir (borer), retouched flake, truncated flake with a notch, microlith, microlith. Photo N. Thompson

In appearance the quartz ranges from a translucent white with a pearly luster to a rather dull, opaque material with streaks of brown and a blocky structure. It can be flaked as easily as chert or other cryptocrystalline materials. Our experimental flintknapping trials showed that the manufacture of stone tools morphologically similar to the prehistoric artifacts did not require any particular adjustment of flintknapping methods. Given the

36. Mediterranean terra rossa forms on level surfaces as the result of the dissolution of the limestone or other substrates over time by the action of rainwater that leaches calcium carbonate, leaving behind an insoluble residue. Part of the fine silt and clay in terra rossas are of eolian origin and derived from the Sahara Desert (Yaalon 1997, 2009). The formation process of terra rossa is measured in hundreds of thousands of years. Redeposited terra rossa in southwestern Crete is derived from primary terra rossa by sheet erosion, slope wash, and creep through the action of wind, water, and gravity. Once removed from their original places of formation, the sediments may occur in alluvial fans and in depressions without outlets or their uplifted equivalents, where they may be subjected to further weathering, erosion, or deposition. Terra rossas usually have a red or yellowish red color from hematite, goethite, and other minerals present in the insoluble residue of the parent rocks or added with the eolian dust. Redeposited terra rossa collects in tectonic or karstic depressions with low-energy domains. The resulting deposits may be stable enough to allow paleosols to form (see n. 51, below) unless uplift, headward stream erosion, or other types of disturbance breach them and subject them to a high-energy regime of erosion. For a discussion of the association of artifacts with paleosol horizons, and the formation of paleosols in both primary and redeposited terra rossas, see Runnels and van Andel 2003 and van Andel and Runnels 2005.

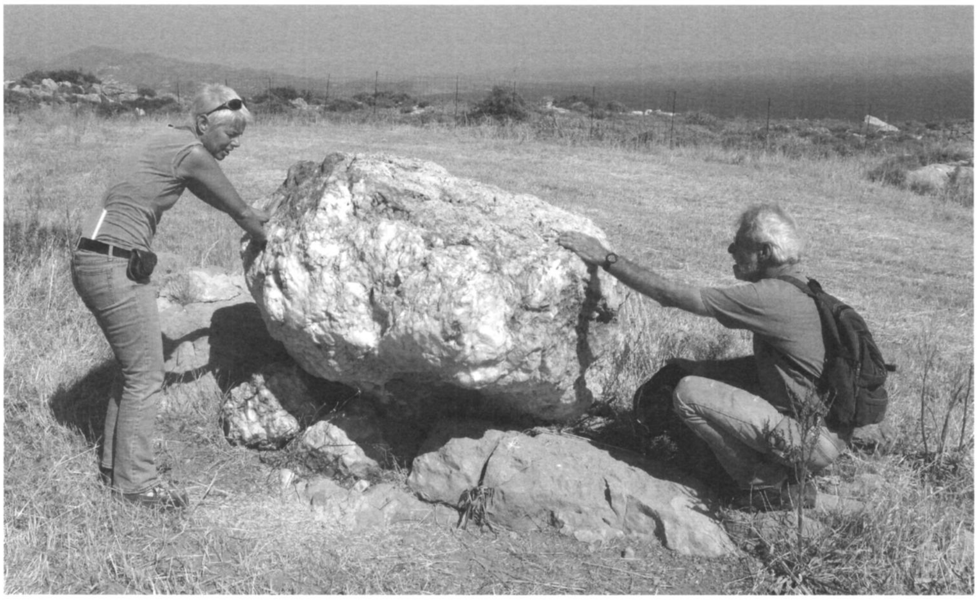


Figure 14. Boulder of unworked quartz near Preveli 3. Photo N. Thompson

blocky structure of the quartz, however, it is difficult at times to recognize conchoidal fractures and the remains of flake removals; in some cases, they were hardly visible, making it necessary to trace them with our fingers under varying conditions of raking light in order to draw them.

Chert does not appear to have been used to manufacture Palaeolithic artifacts, but it does occur in small quantities in the Mesolithic assemblages. It ranges in color from black to green to light reddish brown, and it varies from lustrous to dull in appearance, and from glassy to grainy in quality. The reddish brown tectonized cherts are probably local. Chert may have been brought from elsewhere, and a handful of artifacts of black, white, and green cherts at a few sites (e.g., Damnoni 1) are notably different. We did not find unworked pieces of these kinds of chert in the survey area, nor did we find any cores of these materials on the sites, and these observations suggest a nonlocal origin of the raw material. Other artifacts were manufactured from quartzite or similar hard metamorphic rocks. Heavy-duty tools made from these materials were found on some Mesolithic sites (e.g., Damnoni 2), and quartzite was also used to manufacture artifacts of Palaeolithic type at Preveli 2.

RESULTS OF THE SURVEY

In the following pages, we describe the 28 sites in the Plakias region that we attribute to the Mesolithic and Palaeolithic periods on the basis of their associated lithic assemblages and geological contexts. The composition of the assemblage collected from each site is presented in Table 2. In a few cases, Mesolithic and Palaeolithic artifacts were found at the same site. An early and late horizon could be distinguished at Preveli 2: Mesolithic artifacts were found in a paleosol forming near the summit of the slope and separate from the findspots of the Palaeolithic artifacts. At Preveli 3 and 8, materials from these two periods were mixed by postdepositional processes.

TABLE 2. COMPOSITION OF THE LITHIC ASSEMBLAGES

SITE	*Cores/ Debitage*	*Choppers*	*Bifaces*	*Flakes*	*Blades*	*Microburins*	*Scrapers*	*Notches/ Denticulates*	*Combination Tools*	*Backed Pieces*	*Microliths*	*Retouched Pieces*	*Spines/ Truncations*	*Burins*	*Points*	*Other*	*TOTAL*
Damnoni 1	17	1	—	70	—	—	3	19	4	1	6	9	12	2	—	—	144
Damnoni 2	43	1	—	20	—	—	3	11	—	—	10	4	13	2	—	—	107
Damnoni 3	93	1	—	61	—	—	2	21	—	—	10	15	16	2	—	—	221
Ammoudi 1	8	—	—	3	—	—	1	2	—	—	—	4	2	—	—	—	20
Ammoudi 3	17	1	—	25	—	—	6	11	3	—	2	5	23	—	—	—	93
Ayios Pavlos 1	18	—	—	30	—	—	2	6	1	—	—	1	2	—	—	—	60
Ayios Pavlos 2	13	—	—	10	—	—	1	—	—	—	—	—	4	—	—	1	29
Ayios Pavlos 3	8	1	—	6	—	—	1	—	—	—	3	1	1	1	—	—	22
Schinaria 1	314	1	—	144	—	1	9	35	2	1	15	22	13	4	1	2	564
Schinaria 2	58	—	—	2	—	—	1	6	—	—	—	—	4	—	—	—	71
Schinaria 3	3	—	—	—	—	—	—	—	—	—	2	1	4	—	—	—	10
Schinaria 4	4	—	—	3	—	—	—	3	—	—	1	—	2	—	—	2	15
Schinaria 5	1	—	—	2	—	—	5	—	—	—	—	1	—	—	—	—	9
Schinaria 6	3	—	—	11	—	—	1	—	2	—	2	—	—	—	—	—	19
Preveli 1	12	—	—	26	—	—	1	4	2	1	5	4	8	2	—	—	65
Preveli 2 (early)	29	2	12	13	—	—	10	8	—	—	—	4	2	—	6	3	89
Preveli 2 (late)	3	—	—	—	—	—	2	4	—	—	4	2	3	—	—	6	24
Preveli 3	108	3	3	85	—	—	15	21	—	1	2	15	20	4	7	3	287
Preveli 6	22	—	—	3	1	—	2	6	1	—	2	2	9	—	—	1	49
Preveli 7	12	—	5	—	2	—	18	5	—	—	—	—	4	—	—	1	47
Preveli 8	9	—	1	—	—	—	4	—	—	—	—	2	—	1	—	—	17
Kourtaliotis 1	10	—	—	8	—	—	1	1	—	1	—	—	4	—	—	1	26
Kotsiphos 1	1	—	7	—	—	—	—	1	—	—	—	1	—	—	—	—	10
Plakias 1	19	—	—	8	—	—	1	—	—	—	—	—	—	—	—	—	28
Timeos Stavros 1	12	—	5	6	1	—	5	2	—	—	—	—	—	—	—	—	31
Timeos Stavros 2	2	—	—	1	—	—	—	—	—	—	—	—	3	—	—	—	6
Timeos Stavros 3	5	—	—	—	—	—	—	—	—	—	1	2	3	—	—	—	11
Timeos Stavros 4	4	—	5	5	—	—	6	—	—	—	—	—	1	—	—	—	21
Gianniou 1	9	—	1	8	—	—	4	1	—	—	—	7	13	—	1	—	44

The Mesolithic

Sites

Mesolithic sites are found directly in front of small caves or rockshelters, often dilapidated by the ravages of time. Most sites are small in area and have modest assemblages of lithics, typically fewer than 500 observed in the field, and fewer than 100 collected. These assemblages include elements such as cores, debitage, and a full suite of retouched tool types that suggest that the caves and rockshelters were used as temporary camps. The occupants, even if they were not permanently residing in these places, were there long enough to require the production of fresh blanks from cores and to work and rework their equipment in the form of finished tools.

Lithic Industry

A microlithic industry was found on 20 sites in the survey area (Table 1). The lithics share reduction techniques and morphological types with the Mesolithic industry (*sensu lato,* referring to that of early Holocene hunters, gatherers, and foragers) from excavated Aegean sites such as Sidari (Corfu), Franchthi Cave (Argolid), Klissoura Cave 1 (Argolid), Maroulas (Kythnos), and Theopetra Cave (Thessaly).[37] The small scale of the Plakias artifacts—the average length of cores is ca. 5 cm and that of retouched tools is ca. 1–2 cm—justifies the term microlithic. The flintknappers employed a reduction sequence aimed at removing flakes from small pebble cores by direct percussion. Many flake blanks were retouched, often on multiple edges with retouch that is both small and discontinuous. Retouch is also seen on some cores and technical pieces of different sizes, suggesting a somewhat expedient production of modified edges that took little regard of the original configuration of the blank.

The largest collection was made at Schinaria 1 (Table 2), where 564 artifacts were selected from several thousand pieces on the surface. The assemblage consists almost entirely of quartz artifacts but includes some chert pieces (Fig. 15), and is rich in cores (Fig. 16:m) and retouched tools. The latter include notches and denticulates, retouched pieces, geometric microliths, spines (piercers and borers of various types), combination tools (see below), truncations, and end scrapers (Fig. 16:a–l, n, p, q). Other Mesolithic sites had lower densities of artifacts, and as a consequence the collections were smaller, typically fewer than 100 pieces (Table 2), and confined to pieces with typological or technological features permitting classification. Despite these size differences, the sites yielded similar types of artifacts, although as the size of the site scatter decreased, the number of tool types identified also diminished somewhat, no doubt as a function of sample size.

The Plakias microlithic industry has affinities with both the Lower and Upper Mesolithic at Franchthi Cave (Perlès's lithique phases VII and VIII) (see below), but it would be premature to attribute any of the sites to one specific phase on the basis of surface data. Among the hazards are the similarities of the Plakias Survey site assemblages to one another and the absence of excavated data. Another problem is posed by the short

37. For Sidari, see Sordinas 1970, 2003; for Franchthi, see *Franchthi* III, *Franchthi* V, and Perlès 2001; for Klissoura, see Runnels 1996; for Maroulas, see Sampson et al. 2002; for Theopetra Cave, see Kyparissi-Apostolika 2003.

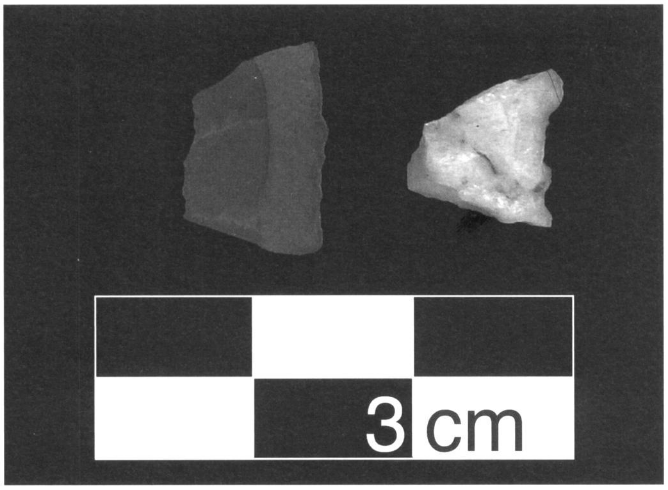
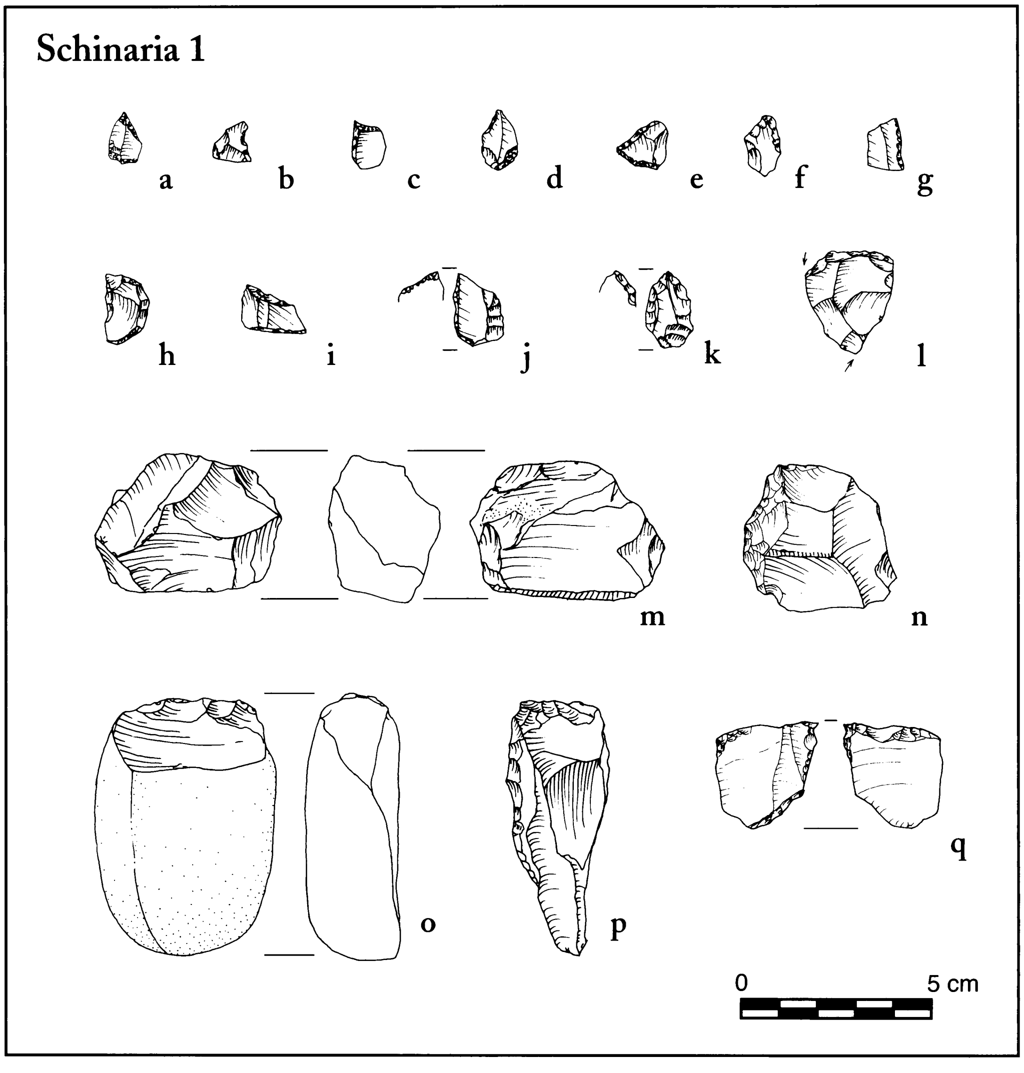
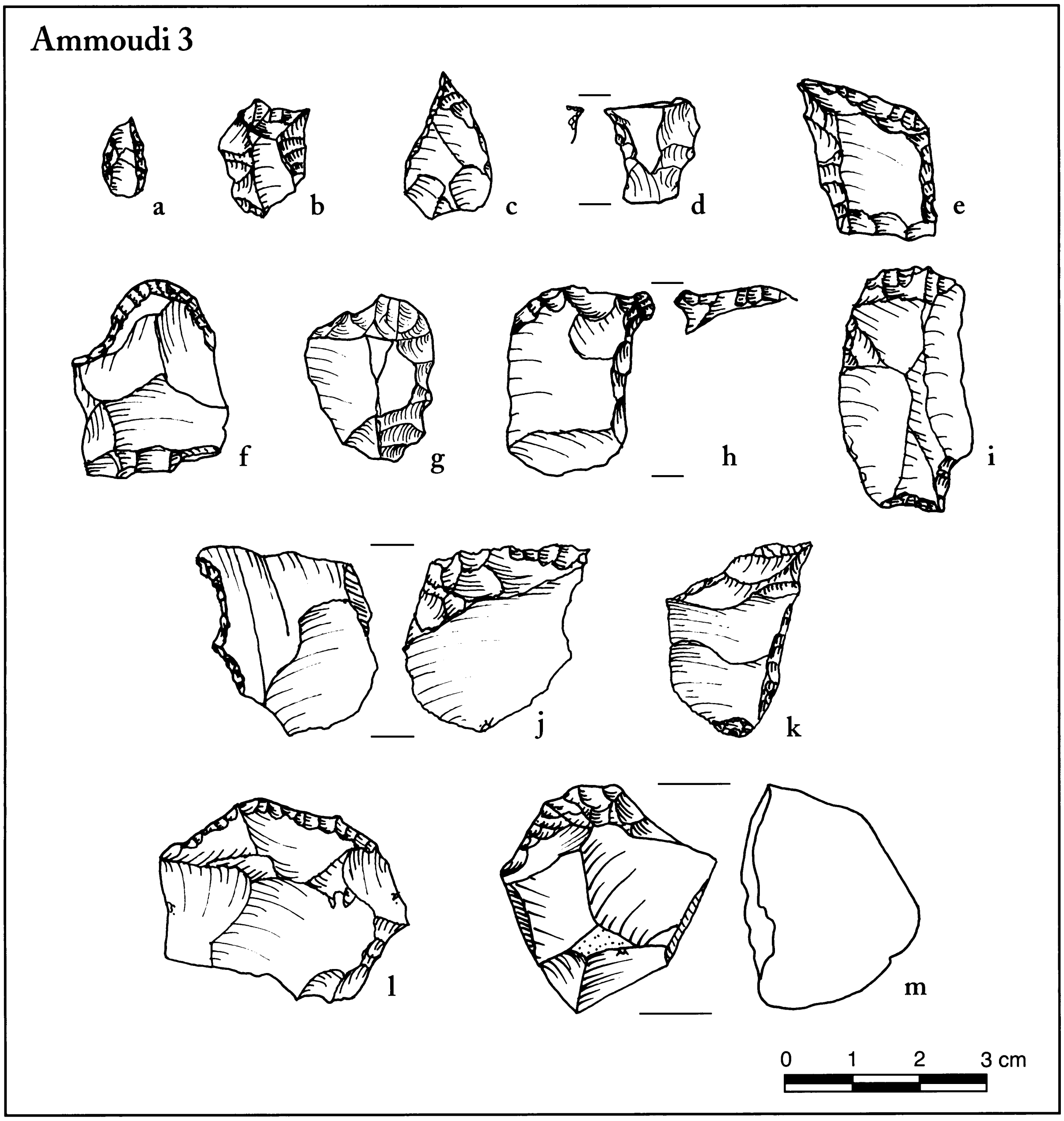


Figure 15 *(right)*. **Mesolithic geometric microliths of chert (left) and quartz (right) from Schinaria 1.**
Photo N. Thompson

Figure 16 *(below)*. **Mesolithic artifacts from Schinaria 1: (a–k) geometric microliths; (l) combination tool with burins and an end scraper; (m) core; (n) denticulated scraper; (o) chopper; (p) retouched blade with an end scraper; (q) oblique spine on a truncated flake. All are quartz except for (g) and (o), which are chert.**
Drawings N. Cooper, C. DiGregorio, P. Murray, and C. Runnels





chronological span of the Mesolithic. The chronological boundaries of the Mediterranean Mesolithic are not fixed, varying from perhaps a millennium to as much as three millennia moving from east to west, but in Greece they probably fall within the range of 9,000 to 11,000 years ago.[38] This limited period of occupation, together with the probability that sites may have been revisited or reused at different times, makes precise dating and phasing very difficult at this stage of analysis.[39]

Notable differences can be observed among the Plakias Survey Mesolithic assemblages (Figs. 15–23) that may not be the result of the collection strategy or the chance preservation of surface remains. At Schinaria 1 and Ammoudi 3, for example, the knappers focused their efforts on the reduction of small pebbles by the removal of flakes by direct hard percussion,

38. For the Mesolithic in the Mediterranean and its dating, see Pluciennik 2008; for Greece specifically, see Galanidou and Perlès 2003.

39. Perlès 2001, pp. 25–30.

Figure 17 *(opposite)*. **Mesolithic artifacts from Ammoudi 3: (a) microlith; (b) oblique spine on a denticulate; (c) spine on a truncated flake; (d) oblique spine on a denticulate; (e) oblique spine on a retouched truncated flake; (f) end scraper with proximal truncation; (g) denticulated scraper; (h) blunted oblique spine on a retouched flake; (i) end scraper on a truncated bladelike flake with a notch; (j, k) combination tools with oblique spine on a truncated flake and on a denticulated flake; (l) denticulated scraper; (m) end scraper on a core. All are quartz, except for (j), which is chert.** Drawings N. Cooper, C. DiGregorio, P. Murray, and C. Runnels

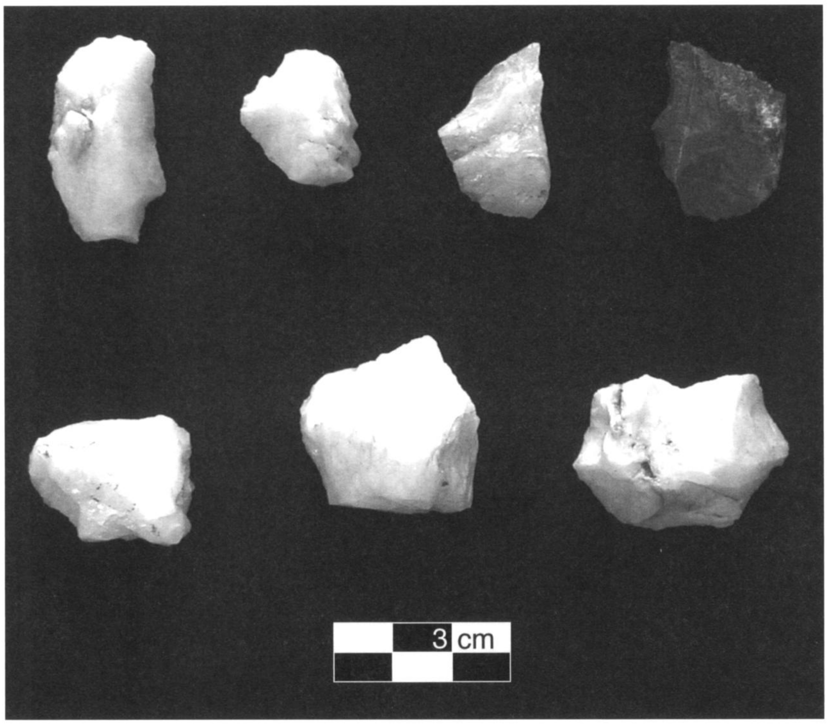


Figure 18. *(right)*. **Mesolithic artifacts from Ammoudi 3. Note that the two artifacts in the upper right are of different raw materials but are the same morphological type as the others. Top row, left to right: end scraper on a truncated bladelike flake with a notch; denticulate; combination tool with an oblique spine on a truncation, denticulated quartz flake; combination tool on a chert flake. Bottom row, left to right: denticulate; denticulate; denticulate with an end scraper.** Photo N. Thompson

often working the cores from multiple directions using many platforms, a process that resulted in exhausted cores that are globular, amorphous, or sometimes flat (Fig. 16:m). At other sites, however, such as Damnoni 1, 2, and 3, the cores were worked by means of bipolar smashing, a technique that resulted in small fragments in the form of long angular splintered pieces (pièces esquillées).

These technical differences are minor, however, and the impression from the comparative study of these assemblages is one of similar techniques and reduction strategies at all sites. The cores, for example, fall within a very narrow range of size as measured by the greatest dimension (usually in the principal axis of flaking), from 2 to 7.8 cm, averaging 4–5 cm (no doubt the size of the original pebble selected for reduction), and all cores were used to produce flakes as blanks for immediate use or for retouching to make tools. Likewise, almost all cores are of quartz, with a few small (i.e., less than 2 cm) chert cores at the Damnoni and Ayios Pavlos sites.

The most common tool types are end scrapers (Figs. 16:p; 17:f, i, m; 19; 23:i), notches, denticulates (Fig. 22:m), microliths, spines (also known as borers or perforators), truncations, burins (Fig. 16:l), and combination tools that have several differently retouched edges such as a spine and a denticulate or scraper on the same blank (Figs. 22:l, 23:j). Many of these types grade into each other or overlap (e.g., the oblique rectilinear truncations and the spines, and the end scrapers and denticulates), making classification approximate at best (Figs. 17, 18).

The end scrapers are highly variable in morphology but are typically small and convex, often with steep to abrupt retouch (Fig. 19). They are usually on flakes, which may or may not have retouched edges, and they often show signs of heavy use or resharpening.[40] Notches and denticulates

40. Typical examples resemble those in *Franchthi* V, p. 39, nos. 9–16, fig. 7.

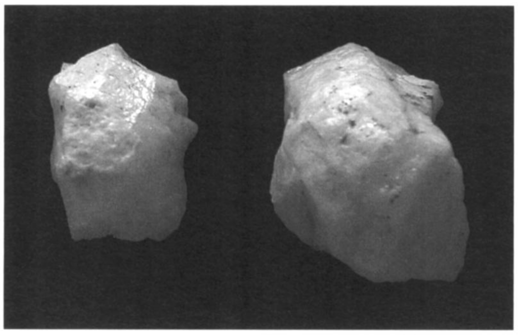


Figure 19. Mesolithic quartz end scrapers from Damnoni 1. Scale 1:1. Photo N. Thompson

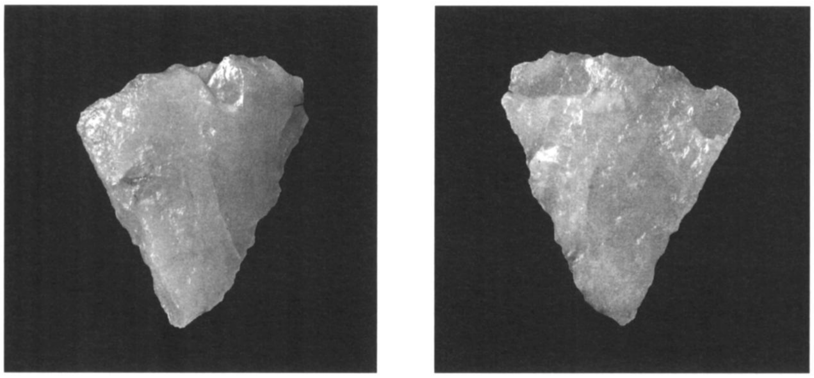


Figure 20. Two views of a Mesolithic quartz geometric microlith from Schinaria 3. Scale 2:1. Photos N. Thompson

Figure 21. Mesolithic geometric microliths from Damnoni 1. The material in most cases is quartz; the microlith on the far left is chert. Scale 1:1. Photo N. Thompson

were manufactured by retouching rather than by the removal of a single notch (Clactonian technique).[41] The presence of notches on artifacts from very old surfaces can result from trampling, but that is not the case here. That the notches are not the result of trampling is evident from the fact that the retouch forming the notches has the same surface appearance as the rest of the flake surface. Flake scars created by trampling are likely to accumulate over time; earlier scars will be more patinated and later ones lighter in color and more light-reflective, making it possible to distinguish recent accidental edge damage from deliberate prehistoric retouch. Recent edge damage is also indicated by a more or less random distribution of the flake scars. Using these criteria as a guide, trampling damage was easily distinguished on the Plakias artifacts, and the notches appear to have been deliberately manufactured in the past by retouch.

The geometric microliths are closely identified with Mesolithic industries (Figs. 20, 21, 22:a–e, 23:a–f). Geometric microliths were also made and used in the Aegean in the final Upper Palaeolithic, and again, in very small

41. For similar notches and denticulates from Franchthi, see *Franchthi* V, p. 38, fig. 6, and p. 39, nos. 1–8, fig. 7.

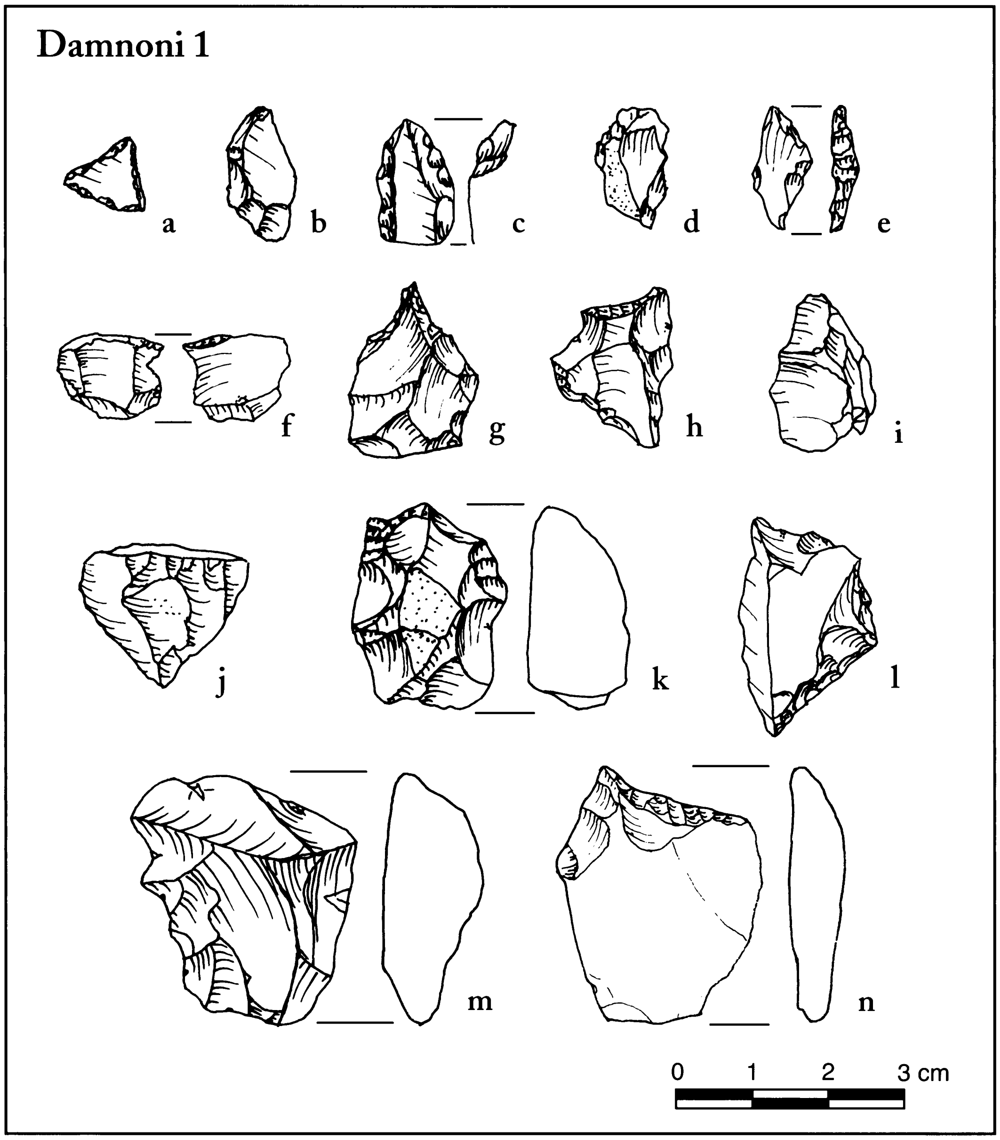


Figure 22. Mesolithic artifacts from Damnoni 1: (a–e) geometric microliths; (f) oblique spine on a truncated flake; (g) perçoir (borer); (h) denticulated trapeze; (i) backed flake or lunate; (j) core; (k) denticulate; (l) truncation and blunt oblique spine on a denticulate (combination tool); (m) denticulate; (n) spine on a truncated flake. All are quartz except for (f), (i), and (j), which are chert.
Drawings N. Cooper, C. DiGregorio, P. Murray, and C. Runnels

numbers, in the Neolithic and Early Bronze Age.[42] The techniques used to manufacture them in these periods, however, differ from those used in the Mesolithic, and the microliths in earlier and later periods are also associated with other classes of artifacts. The microliths found during the present survey are highly variable in shape, but the same technique was employed for their manufacture at all sites. The technique consisted of retouching or blunting one or more edges of small flakes, flake fragments, or irregular pieces of debitage, sometimes in a very opportunistic manner.

As Perlès has also noted for the Mesolithic at Franchthi, the Plakias microliths were manufactured not by the microburin technique of controlled snapping of blades into segments, the method used in the Upper

42. For earlier microliths from Franchthi, see *Franchthi* III, pp. 141–171. For examples of later geometric artifacts, see Hartenberger and Runnels 2001, pp. 258–259, figs. 2, 3; Galanidou 2003.

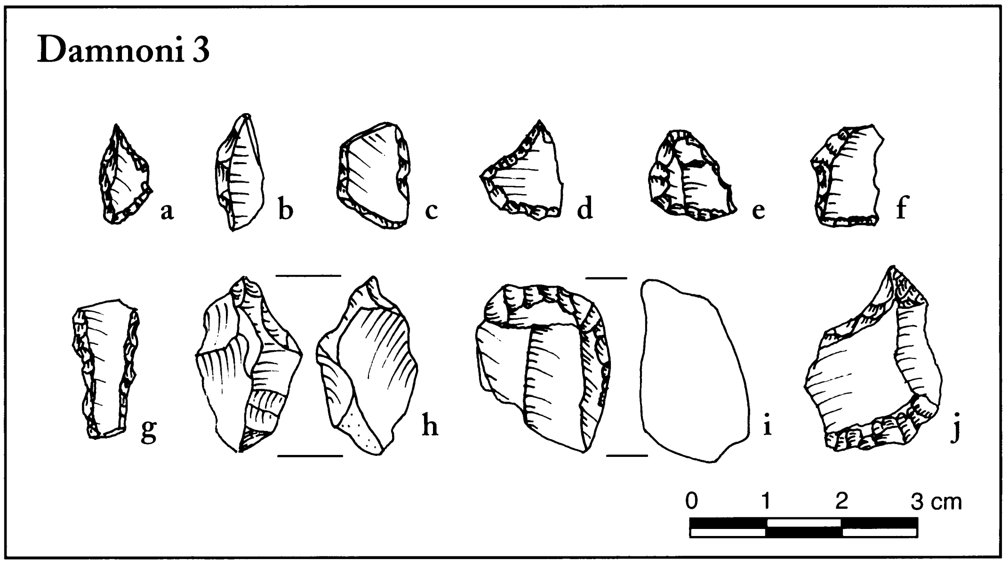


Figure 23. Mesolithic quartz artifacts from Damnoni 3: (a–f) geometric microliths; (g) double-backed flake or bladelet; (h) spine on a denticulate; (i) end scraper; (j) denticulated end scraper and spine on a truncated flake (combination tool). Drawings N. Cooper, C. DiGregorio, P. Murray, and C. Runnels

Palaeolithic, but by minute nibbling retouch of the edges of flakes or small fragments of material.[43] The retouched edges that resulted are often sinuous truncations, sometimes discontinuous, so that the piece does not have a canonical geometric shape. The goal of the retouch was evidently the minimal modification of the smallest number of edges in order to create shapes with multiple backs or truncations, but not necessarily a predetermined outline.[44] This retouch of multiple edges sometimes resulted in true geometric shapes such as trapezes, but often produced irregular forms that defy classification.[45] The geometric shapes include trapezes, triangles, lunates, rectangles, and squares. The microliths are small, many (n = 24) falling between 1 and 1.5 cm in length, and about half that number being somewhat larger, ca. 1.7–2.1 cm in length. Some pieces resemble small projectile points made by minute proximal truncation of the base of a small pointed flake, or alternatively, by an oblique distal truncation to form a point (e.g., Fig. 16:d).[46]

The spines represent another common tool type (e.g., Fig. 22:f, l, n). The technique for making them is characteristic: first a flake or a piece of debitage was distally truncated by direct retouch, after which a notch was created on the truncation by inverse retouch in order to form the spine.[47] The spines are typically found at the distal ends of the pieces, often at oblique angles to the long axes of the flakes. The blanks on which these tools are made are variable in shape and size, ranging from barely 1 cm in length to as much as 3.5 cm.

Among the remaining pieces are many flakes or irregular pieces of debitage; there are also cores with one or more small areas of minute

43. For microliths from Franchthi, see *Franchthi* III, esp. p. 64, fig. 16, and p. 68, fig. 17.

44. Perlès 2001, p. 31.

45. E.g., as summarized in Perlès 2001, pp. 31–37.

46. The point with a retouched base from Schinaria 1 (Fig. 16:d) resembles similar pieces from Upper Mesolithic Franchthi (*Franchthi* V, p. 60, no. 9, fig. 15), and trapezes with truncations (*Franchthi* V, p. 64, nos. 25, 26, fig. 16).

47. Similar but not identical spines are found at Franchthi; see *Franchthi* V, p. 41, no. 12, fig. 8. Some of Perlès's truncated pieces seem similar to our spines, although they lack the inverse notches; see *Franchthi* V, p. 71, nos. 12, 16, fig. 18. Spines similar to those in the Plakias Survey area are found, however, on the mainland, e.g., in Epirus (Runnels and van Andel 2003, p. 120, no. 3, fig. 3:52) and at Kandia (Runnels et al. 2005, p. 276, no. 38, fig. 9).

retouch on an edge (Fig. 22:j). Other pieces may have a notch or two. This retouch, which in some cases may have resulted from use rather than intentional modification, indicates an expedient approach to implement use and discard as circumstances required. The unretouched flakes in these assemblages may be as much as 7.4 cm in length, but the average size is smaller, about 4 cm, suggesting that larger cores were reduced until they were about 4 cm or less before they were exhausted.

Chronology

In the absence of radiometric dates and the excavation of stratified deposits, the age of the Plakias microlithic industry is unknown. There are good arguments, however, for assigning it to the Mesolithic (9,000–11,000 years ago) in the early Holocene. The different site assemblages appear to belong to a single industry on technological and morphological grounds, although some mixing of material from earlier and later subperiods, especially on an artifact-rich site such as Schinaria 1, remains a possibility. Furthermore, as discussed above, the composition of the assemblages in terms of core types and retouched tools most closely resembles the Mesolithic industries from the Aegean.[48] If the industry were Upper Palaeolithic, one would expect to find evidence of prismatic blade reduction in the form of characteristic cores, crested blades, and core tablets, large numbers of backed blades and bladelets (at Upper Palaeolithic Franchthi, these comprise some 40% or more of the assemblage), and other characteristic tool types.[49]

On the other hand, if the industry were mixed with later Neolithic or Bronze Age assemblages, one would expect to find prismatic cores, crested blades, and pressure-struck blades, along with tanged or hollow-based arrowheads, and evidence for the use of obsidian, all of which are absent on these sites.[50] The absence of polished stone axes, ground stone querns, clay or stone spindle whorls, and characteristic ceramic wares of Neolithic or later type strongly argues against a post-Mesolithic age for the Plakias microlithic industry. Finally, characteristic artifacts of Mesolithic type were observed at several sites (e.g., Schinaria 1, Damnoni 3, and Preveli 2 [Fig. 12]) in situ in paleosols that are reddish brown with subangular blocky peds (structure) and thin, but common, clay films, consistent with soil Maturity Stages 2 and 3 with an age of 6,000 to 10,000 years ago.[51]

48. A full description of all the characteristic features of the Aegean Mesolithic is beyond the scope of the present article. We refer readers to the full accounts of the Mesolithic given by Perlès in her publications, especially *Franchthi* V and Perlès 2001.

49. See *Franchthi* III for Upper Palaeolithic Franchthi.

50. For Greek Neolithic industries, see Demoule and Perlès 1993; Perlès 2001, pp. 64–97.

51. Paleosols are fossil soils either buried within sedimentary sequences or, if they are at the surface, no longer actively forming. They are composed of distinct horizons from the top A level down to the Bt horizon (of principal concern here), which is rich in iron, manganese hydroxides, oxides, and clay. Other layers lie below the Bt horizon, down to the C horizon of unaltered rock substrate, which in southwestern Crete is limestone. The formation and maturation (pedogenesis) of a paleosol requires thousands of years, and if the sequence is uninterrupted by erosion, a paleosol will reach a point where further maturation is imperceptible. In the Mediterranean, paleosols mature slowly. The time-dependent characteristics of a paleosol's maturity can be used to estimate its age. The stages of maturity range from Maturity Stage 1, which is reached in ca. 2,000 to 4,000 years, through successive stages until the paleosol reaches maximum maturity in Maturity Stage 6 in ca. 110,000 years. The basis for dating paleosol maturity stages can be found in van Andel 1998, pp. 367–370, table 1; Zhou, van Andel, and Lang 2000; and van Andel and Runnels 2005, p. 378, fig. 10.

Figure 24. Level erosional planation surface at Preveli 2 below marine terrace at 96 masl. View from the north. Photo N. Thompson

The Palaeolithic

Lithic artifacts of Palaeolithic type were collected from nine sites (Table 1). The assemblages range from a few specimens to 300 or so pieces. Palaeolithic artifacts are distinguishable from the Mesolithic ones by their larger size as well as by technological and typological criteria. In addition, five sites (Preveli 2, 3, 7, Timeos Stavros 1, and Schinaria 5) have geological contexts useful for assigning at least approximate dates.

Sites

One of the most important sites in the Plakias Survey region for dating the Palaeolithic is Preveli 2 (Figs. 4:a, 24, 25). It is located on an uplifted limestone block, the seaward face of which has a flight of marine terraces marked by wave-cut cliffs associated with sedimentary beach deposits, a record of terrace formation that spans Marine Isotope Stages 3 to 5 in the Upper Pleistocene (see below).[52] The inner shoreline angle of the wave-cut cliff face for the oldest raised beach is at an elevation of ca. 96 masl and is thought to belong to Marine Isotope Stage 5. On the slope below this cliff is a thick mantle of sedimentary beach conglomerate with clasts that are compositionally different from the underlying limestone bedrock, and

52. Wegmann 2008, pp. 94–139.

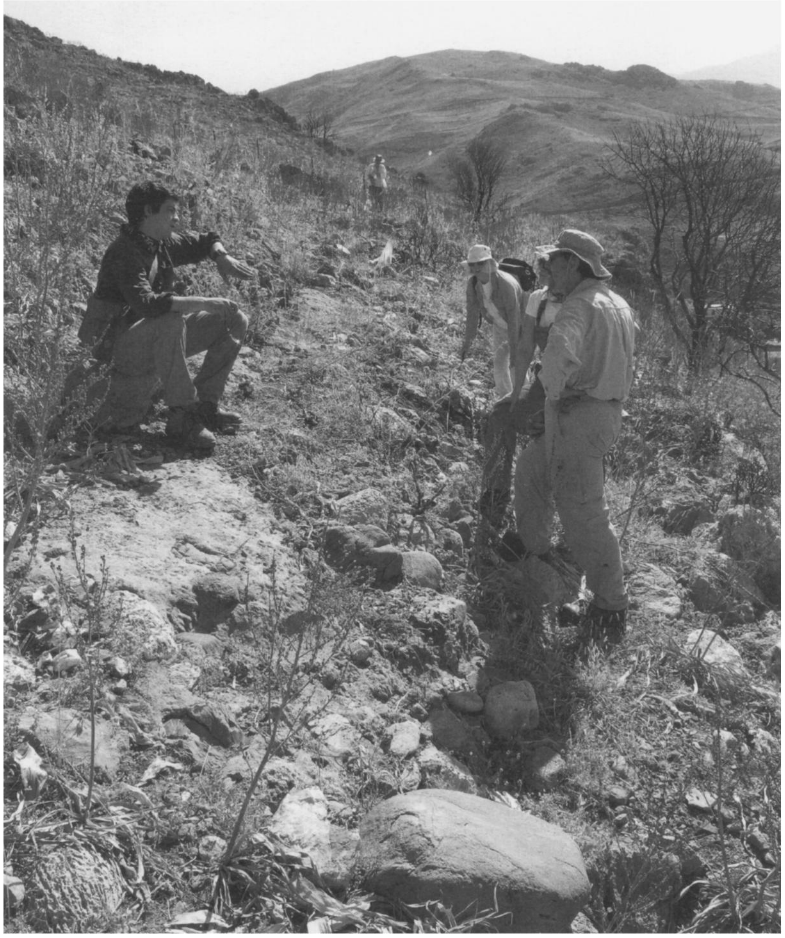


Figure 25. Sedimentary beach deposit (marine terrace, 59 masl) at Preveli 2. The deposit lies between the surveyors. View from the west. Photo N. Thompson

that contains numerous artifacts of both quartz and quartzite. Below that is a nearly level erosional planation surface where artifacts eroded from the beach deposit have been collected (Fig. 24). This surface consists of a dark red (10R 4/6) paleosol of unknown depth, but of considerable age.[53] At a still lower elevation, there is a second wave-cut cliff at ca. 59 masl, below which is a thick layer of breccia that overlies another raised sedimentary beach deposit with incorporated lithic artifacts (Fig. 25). Below this beach, the slope steepens and falls off abruptly toward the sea. At ca. 14 masl, another raised Pleistocene beach, the youngest of the series, was observed.

Palaeolithic artifacts, both large (ca. 30 cm) and small (ca. 2 cm), were found in and on the surface downslope from the wave-cut cliffs and raised beach conglomerates at 59 and 96 masl. The artifacts appear to be derived from these conglomerates (Fig. 26). The gradual erosion of these deposits evidently replenishes the supply of artifacts on the slope, or otherwise the steepness of the slope, particularly below 59 masl, would have contributed to the total loss of these artifacts. The finds are more numerous where they are preserved on the erosional planation surfaces or below the conglomerates, where they were trapped in pockets of sediment among the outcrops of limestone.

53. There were no visible outcrops here and the maturity stages of the paleosols could not be estimated.

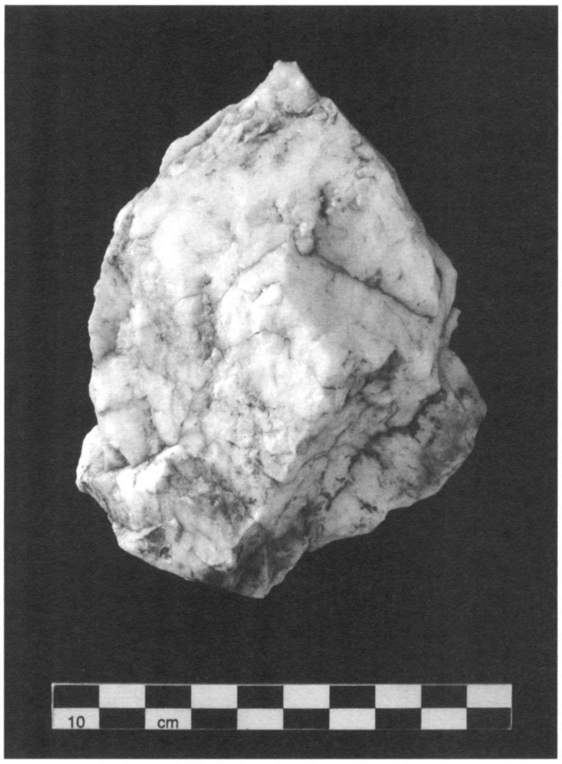


Figure 26. Palaeolithic quartz artifact (flake) from a marine terrace (59 masl) at Preveli 2. Photo N. Thompson

On the west flank of the Preveli Gorge, a second site, Preveli 3, was discovered on a small limestone plateau. On the seaward face of the plateau are wave-cut cliffs and beach deposits at 14 and 25 masl. On the top of the plateau, patches of terra rossa are preserved that are possibly primary or part of a now heavily eroded alluvial fan (Fig. 27). This terra rossa was once more extensively distributed over the plateau, and preserved patches of it can be seen on the narrow interfluves between the deeply incised streams that cut down to the Megas Potamos River and the sea. The terra rossa has been disturbed by the recent construction of roads and a large parking lot that overlooks the mouth of the Preveli Gorge. Outcrops of terra rossa visible at the entrance to the parking lot contain lithic artifacts to a depth of a meter or more from the present surface, and the collection of artifacts from Preveli 3 was carried out on the now-soilless limestone plateau below and to the south of these outcrops. One can surmise that the artifacts were originally part of the terra rossa deposits and are now erosional float (i.e., lag) on the karstic surface where they have been caught between rocks or in cavities.

On the same plateau another site, Preveli 7, is located about 300 m to the northwest at an elevation of ca. 120 masl (Fig. 28). The site is on the edge of a small basin. On the north edge of this basin, a thick (ca. 3 m or more) but narrow (ca. 100 m) remnant of redeposited terra rossa is preserved. A well-preserved paleosol Bt horizon exhibiting the characteristics of a highly mature soil (Maturity Stage 6) with prismatic, platy structure, thick pervasive clay films, and a deep, almost magenta-red color (10R 3/6) crops out in a road cut through the section. Artifacts were found cemented

Figure 27. View of terra rossa above parking lot in the middle ground at Preveli 3. Photo N. Thompson

in the Bt horizon (Fig. 29). Still other artifacts of the same type were found on the surface of the eroding Bt horizon and are clearly derived from it by recent erosion, as can be seen from the red stains and the soil material that sometimes adheres to the artifacts (see Fig. 11, above).

Another deep profile here, ca. 4 m high and exposed by modern building construction, opens a window into the dynamic history of this deposit. There were periods of alternating sedimentation and pedogenesis. At times small debris flows or flood deposits testify to relatively high-energy regimes, while at other times the paleosol formed during long periods of stability. At the northern limit of the basin, about 50 m from the paleosol outcrop just described, and at a higher elevation (ca. 130 masl), is an outcrop of limestone with remnants of small caves. We observed travertines and tufas there that point to the existence of fossil springs that once would have flowed into the basin.

Several sites were found between Preveli and Schinaria to the west (Fig. 2:a). Gianniou 1, ca. 1 km northwest of Preveli 7, yielded a scatter of stone tools, chiefly flakes and scrapers, on the eroded remnants of a narrow saddle west of Mesokorpha Peak. Large quartz boulders were discovered there, some with evidence for the removal of large flakes for stone tool production. Although the site was inspected only briefly, it appears that the lithics are lag or float exposed by the removal of sediments through erosion. It was perhaps originally a flintknapping atelier.

Continuing to the west for about a kilometer at ca. 200 masl, two other Palaeolithic sites were identified on the slopes of the Timeos Stavros hill. Timeos Stavros 1 is in an outcrop of an alluvial fan exposed by modern

Figure 28 ***(opposite, top).*** **View of Preveli 7 basin from the northwest. Paleosol outcrop shown in Figure 29 is to the right of the vehicles in the center.** Photo N. Thompson

Figure 29 ***(opposite, bottom).*** **Paleosol outcrop at Preveli 7. The location of a large Palaeolithic flake embedded in the paleosol is indicated.** Photo N. Thompson

roadwork and soil extraction. The outcrop is up to 2 m thick in some spot (Fig. 30). The same area has limestone fault scarps with caves and springs both fossil and still functioning. The artifacts were collected from the out crop and from the surface of the fan. They show signs of weathering an transport and it is presumed that they have been moving downslope as uplif has continued to steepen the slope on the south face of Timeos Stavros In the same area, Timeos Stavros 4 appears to be a debris flow preserve in a field below a limestone fault scarp. There, in an area of approximatel 40 × 90 m, a large concentration of stone tools was found mingled witl angular pieces of limestone and travertine, suggesting a derivation fron the caves and rockshelters upslope.

Approximately a kilometer west of the Timeos Stavros sites, at Schi naria 5, a modern road cuts through an alluvial fan with outcrops of paleo sols ca. 2 m below the modern surface. The paleosols containing artifact are exposed on the north and south sides of the road in outcrops create by a stream that is incising the fan as it cuts down to Schinaria beacl (Fig. 31). The elevation ranges from ca. 85 to 96 masl. The paleosols ar highly developed with abundant thick clay films and a Bt color of 10R 4/ red to 3/5 dark red, as is the case at Preveli 3, Preveli 7, and Timeos Stavros 1 and it may be of a similar age, Marine Isotope Stage 6.

All but one of the Palaeolithic sites in the survey area was foun between Preveli and Schinaria. The one exception is Kotsiphos 1, wher stone tools are being eroded from a very thick, unconsolidated debris flov fan at the southeastern end of the Kotsiphos Gorge. The stone tools ar

Figure 30 ***(below).*** **View of Timeos Stavros 1 from the west, with an outcrop beside and in the road where Palaeolithic artifacts were found.** Photo N. Thompson

Figure 31. Paleosol outcrop at Schinaria 5, with embedded white quartz Palaeolithic artifacts visible in the foreground. Photo T. F. Strasser

found from the upper slopes to the bottom of the gorge. Although out of context, the artifacts are morphologically similar to those from the Preveli Palaeolithic sites and we surmise that they are being derived from a site that is now destroyed, suggesting that more Palaeolithic sites may yet be found in the area.

Lithic Industries

The lithic artifacts may belong to more than one Palaeolithic industry, including in traditional terms the Lower and Middle Palaeolithic. These industries employed a reduction strategy using direct hard percussion to remove large flakes and, rarely, thick blades, from minimally prepared cores that were often worked bifacially (Figs. 32, 33). Both pebbles and cobbles of quartz were selected for core reduction. The resulting cores range in size from ca. 5 to 20 cm or more in their greatest dimension. The resulting flakes range from ca. 8 to 15 cm in length and have plain or dihedral platforms that are thick and up to 4 cm wide.

Considerable variability can be observed in the morphological tool types, suggesting opportunism in the selection of flake blanks and edges for retouch. Many blanks have only one edge retouched, often partially and discontinuously, and frequently bifacially. It would appear that raw

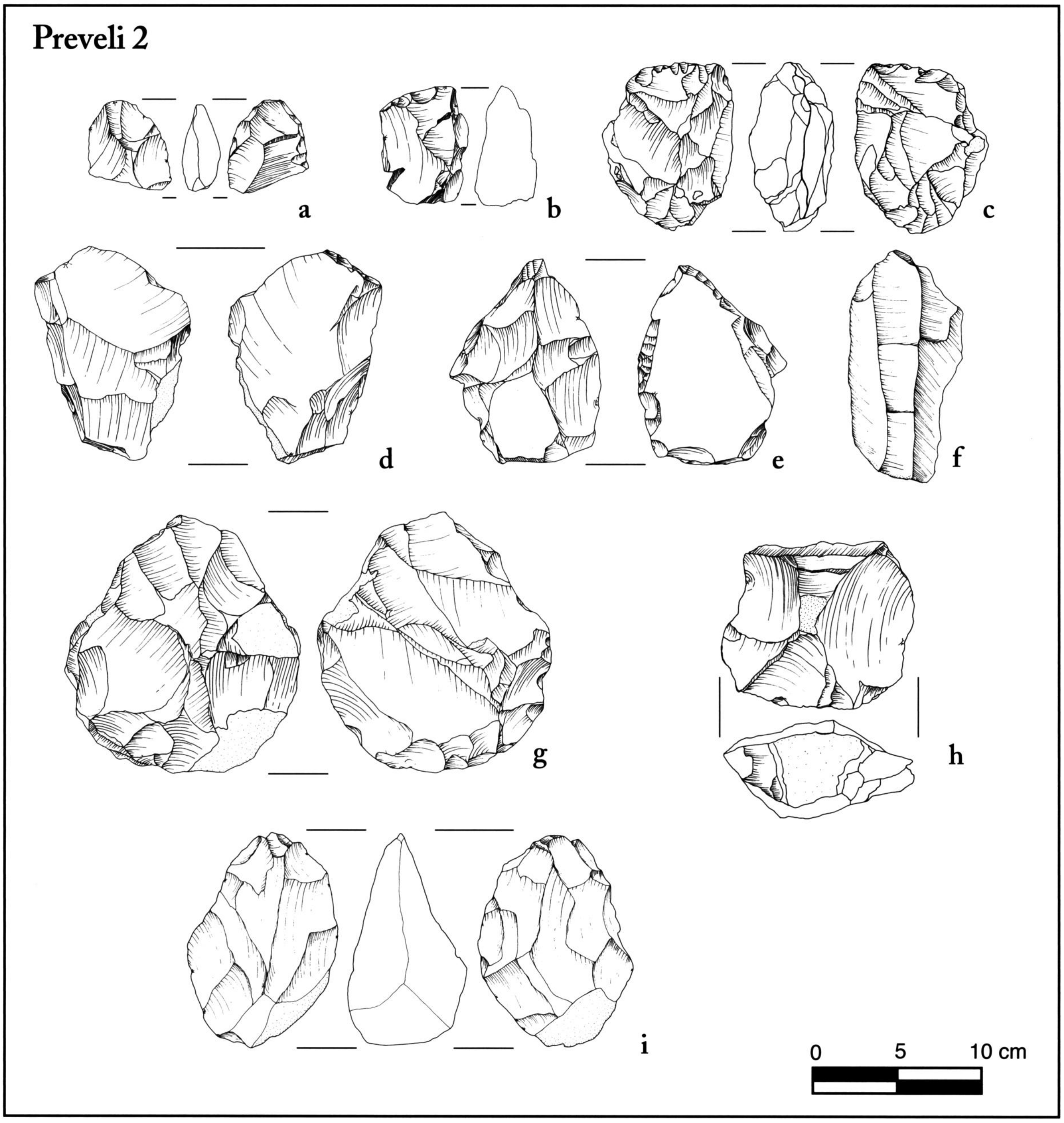


Figure 32. Palaeolithic artifacts from Preveli 2: (a) tip of a biface; (b) biface cleaver; (c) biface cleaver; (d) cleaver; (e) biface; (f) blade core; (g) biface; (h) core; (i) biface. All are quartz except (a), which is quartzite.
Drawings N. Cooper, C. DiGregorio, P. Murray, and C. Runnels

material was plentiful and that there was much expediency in the use of blanks as well as a tendency to discard tools after only short periods of use. As noted above, the chief raw material utilized was quartz, often of poorer quality than the quartz used in Mesolithic times. The material is opaque, dull, and blocky, in contrast to the translucent, lustrous, and fine-grained quartz preferred by the Mesolithic flintknappers. Some artifacts were made on a reddish brown or bluish gray quartzite, and the use of this raw material seems to have been reserved for large heavy-duty tools such as bifaces and cleavers.

The tools include bifaces (handaxes) of triangular, subtriangular, cordiform, ovate, and biface à gibbosité form (Figs. 32:i; 33, right; 34), cleavers (Figs. 32:d, 35), scrapers, and other morphological forms (Fig. 36).

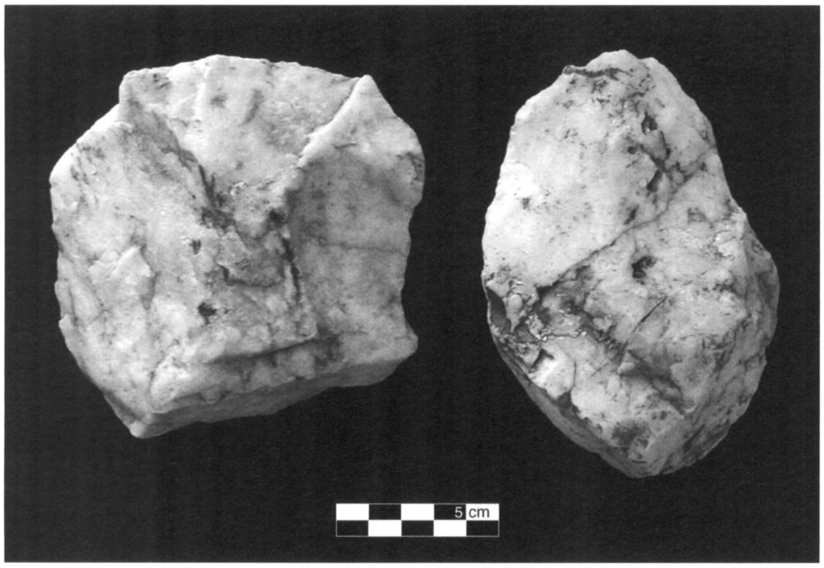
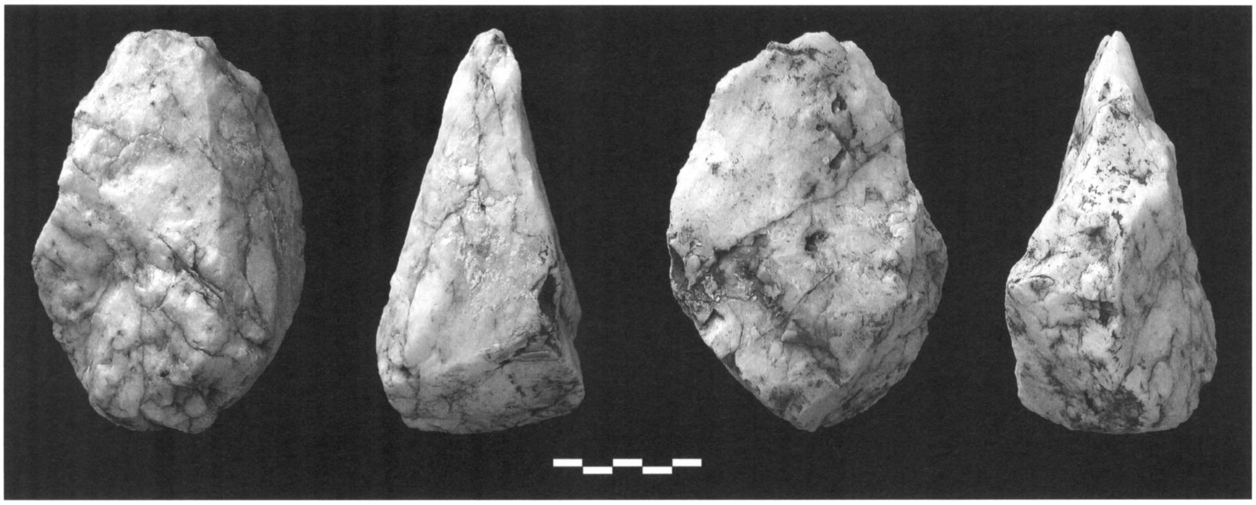


Figure 33 ***(left).*** **Palaeolithic quartz core (left) and biface (right) from Preveli 2, also shown in Figure 32:h, i.** Photo N. Thompson

Figure 34 ***(center).*** **Four views of an ovate Palaeolithic quartz biface (handaxe) from Preveli 2, also shown in Figures 32:i and 33 (right). Found on the terrace at 59 masl.** Photo N. Thompson

Figure 35 ***(bottom).*** **Four views of a Palaeolithic quartz cleaver from Preveli 2, also shown in Figure 32:d. Found on the terrace at 96 masl.** Photo N. Thompson



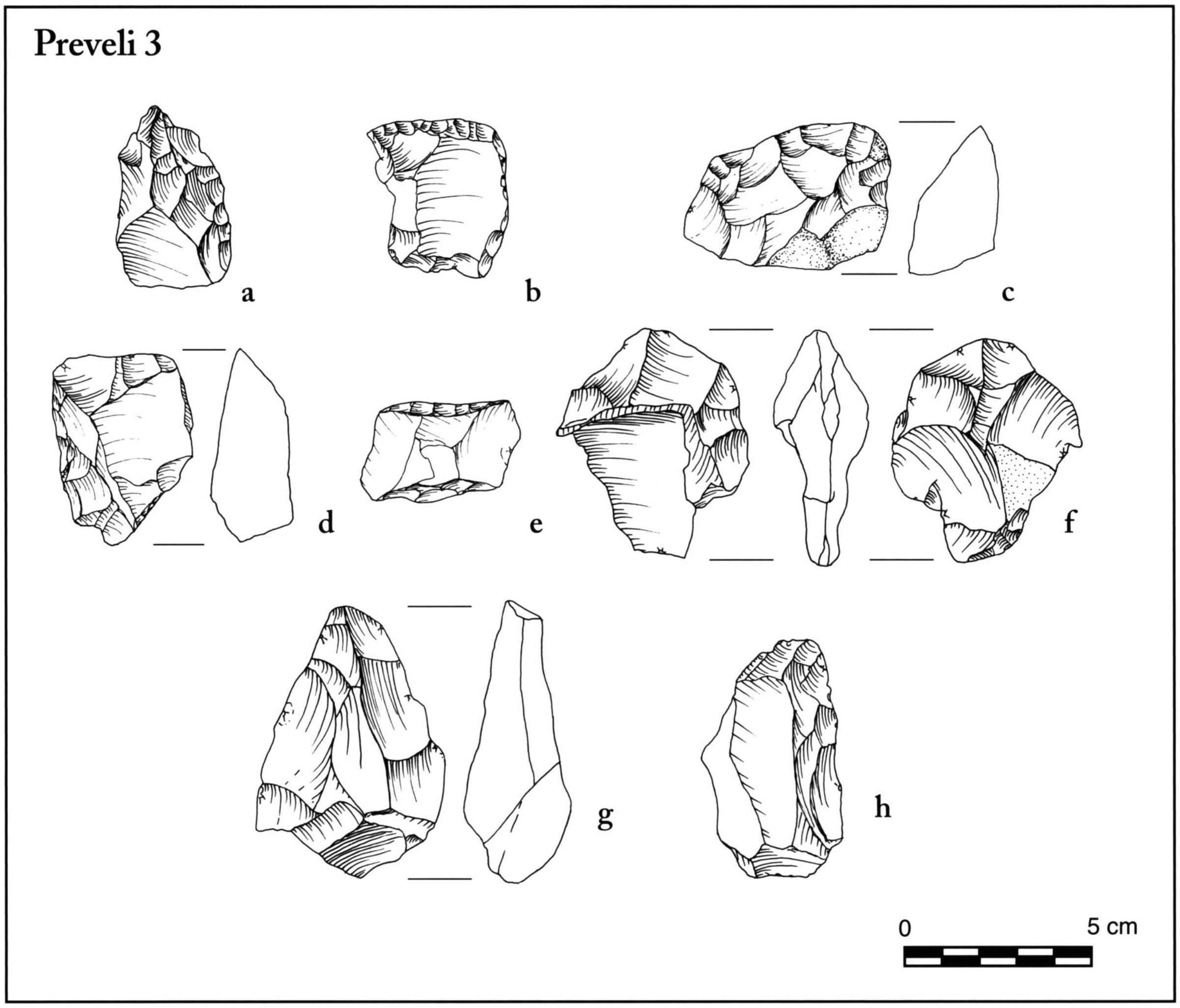


Figure 36. Palaeolithic quartz artifacts from Preveli 3: (a–d, h) scrapers; (e) double truncation; (f) biface tip; (g) double convergent denticulate. Drawings N. Cooper, C. DiGregorio, P. Murray, and C. Runnels

The bifaces average ca. 13 cm in length and they are sometimes difficult to classify by shape. As discussed above, the flintknappers were working with a raw material that had unpredictable flaking qualities, being often blocky and rough in texture. As a consequence, compromises had to be made. The blanks for the bifaces are side-struck or corner-struck flakes with wide, thick, and plain or dihedral platforms. The retouch is invasive, shallow, irregular, discontinuous, and opportunistic. There are usually signs of an attempt to thin the butts by partially removing the bulb of percussion.

Apart from the bifaces, the morphological tool types most commonly found are scrapers (e.g., Figs. 36:c, 37) and retouched pointed flakes. The scrapers include single scrapers, with convex, straight, or transverse forms, and double convergent types. Pointed flakes were numerous at Preveli 2 and Preveli 3. These flakes sometimes have scrapers on an edge, and still others have notches made by the Clactonian technique. Some of these pointed types are double convergent denticulates (such as Tayac points) (Figs. 36:g, 38).

Many tools from the Palaeolithic sites are bifacially flaked, and often—like the handaxes—show attempts to thin the butts by flaking away the

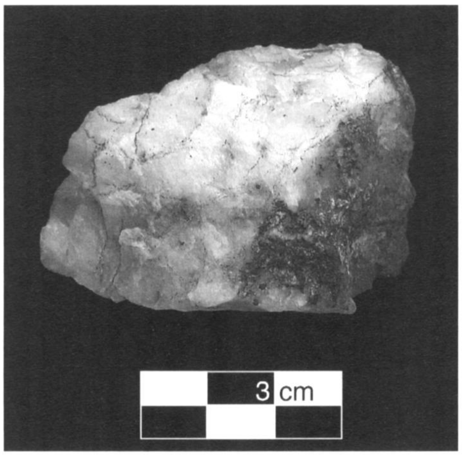
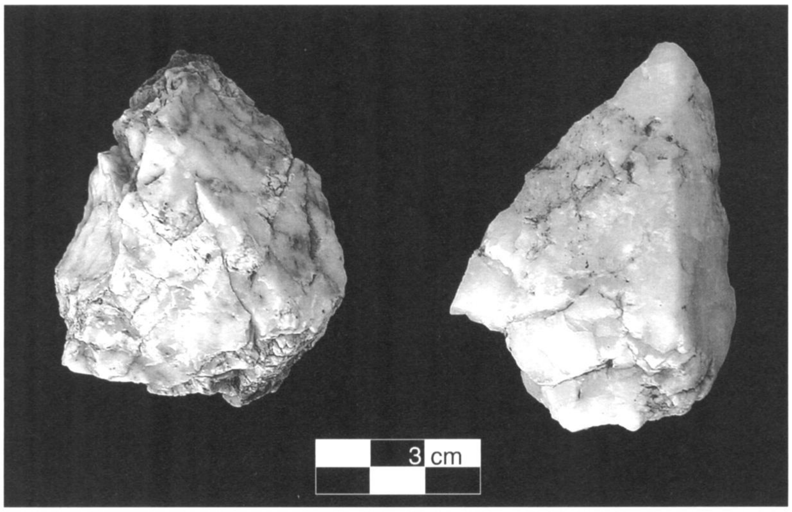
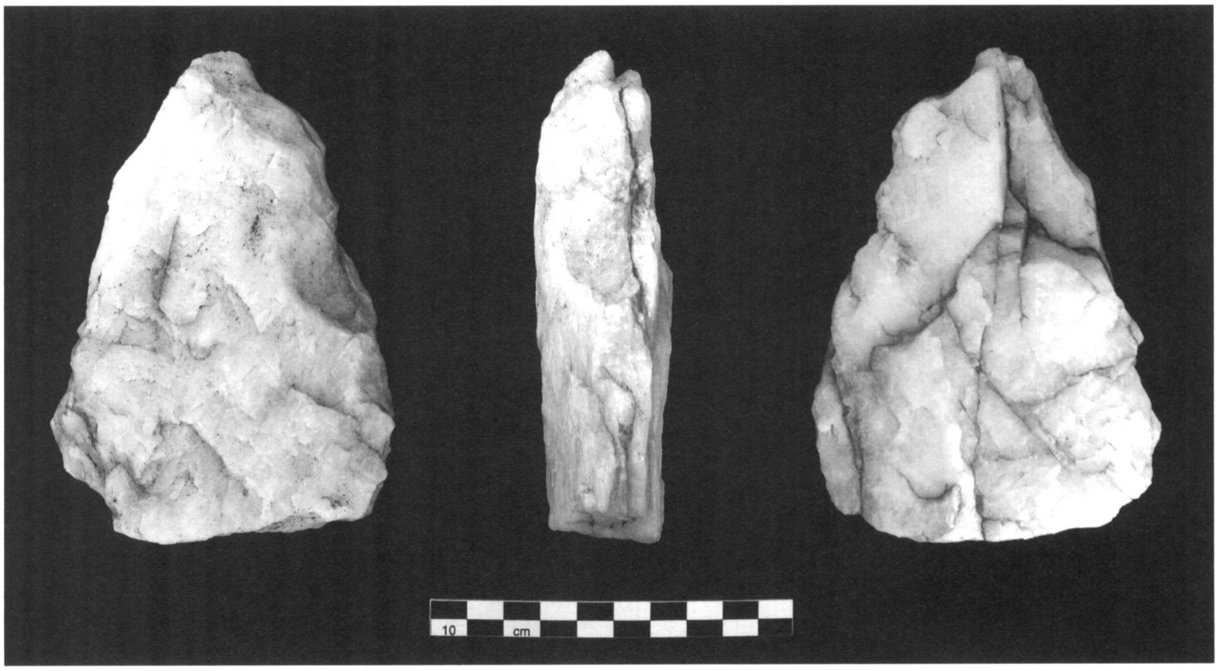


Figure 37 ***(top).*** **Palaeolithic quartz scraper from Preveli 3, also shown in Figure 36:c.** Photo N. Thompson

Figure 38 ***(center).*** **Palaeolithic quartz double convergent denticulates from Preveli 3. The example on the right is also shown in Figure 36:g.** Photo N. Thompson

Figure 39 ***(bottom).*** **Three views of a Palaeolithic quartz biface (handaxe) from Preveli 7, also shown in Figure 40:b.** Photo N. Thompson





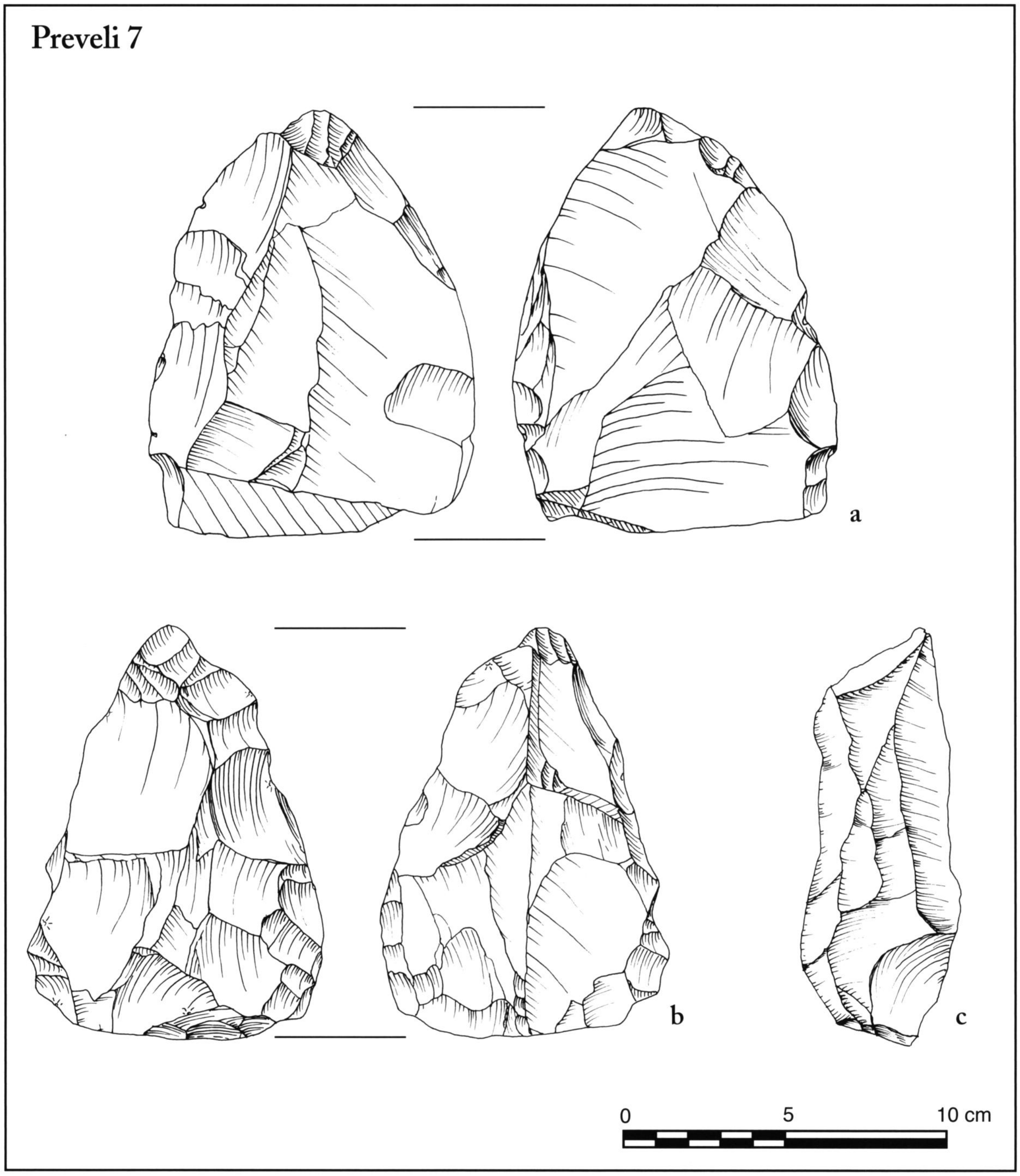


Figure 40. Palaeolithic quartz artifacts from Preveli 7: (a, b) bifaces; (c) blade. Drawings C. DiGregorio, P. Murray, and C. Runnels

platforms and the bulbs of percussion and parts of the surfaces (Figs. 39; 40:a, b; 41:b, c). The forms are somewhat atypical and expedient, as one would expect from the use of the unpredictable quartz as a raw material, but bifacial scrapers with an emphasis on multiple rows of inverse retouch are included. Often only part of an edge was retouched and even quite large blanks were discarded after only minimal retouch and modification.

The affinities of the Plakias Palaeolithic industry (or industries) are difficult to determine from the limited samples and the few comparisons one can draw from neighboring regions. Bifaces are rare in Palaeolithic

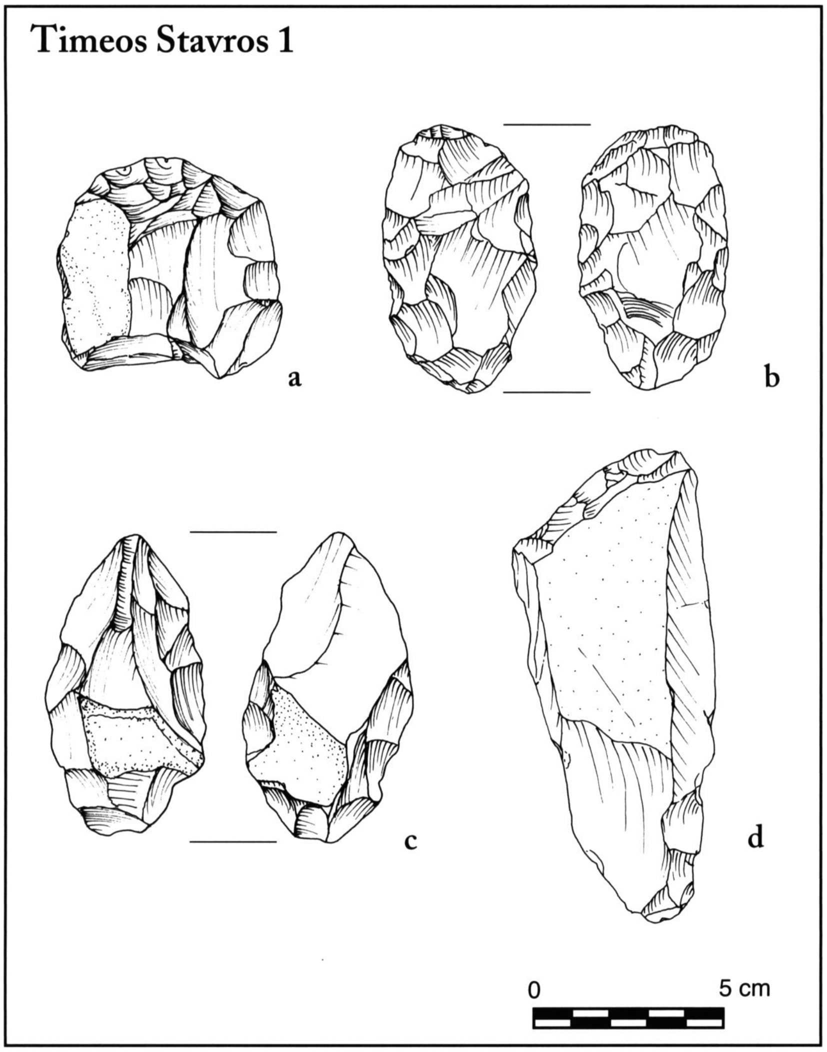


Figure 41. Palaeolithic quartz artifacts from Timeos Stavros 1: (a) scraper; (b, c) bifacial scrapers or small bifaces; (d) blade. Drawings C. DiGregorio, P. Murray, and C. Runnels

assemblages on the Greek mainland, but they do occur in Epirus and on the Aliakmonas sites in western Macedonia, where they are made on reduced cobbles rather than on flake blanks as in the Plakias region.[54]

The Palaeolithic materials resemble the Acheulean *sensu lato* that consists of "large flakes [used] to configure big tools, [with a diversity] of morphotypes of small retouched tools, and [standardized] knapping methods, among which the bifacial centripetal technique [of core reduction] stands out."[55] The Acheulean is described as having a "high frequency of large-sized flakes as blanks for the production of bifaces, the use of side-struck or corner-struck flakes, the presence of techniques involving predetermination ('approximate Levallois patterns'), attempts to thin the bifaces in the area of the bulb of percussion, and a minimal investment in bifacial retouch."[56] These descriptions can also be applied to the artifacts from the Plakias region. Some cores, scrapers, and blades (Figs. 40:c, 41:d, 42), however, resemble Middle Palaeolithic artifacts in terms of preparation technique, form, or retouch. These pieces are few in number, and similar forms are also found in the Lower Palaeolithic, but it is possible that we are dealing with more than one Palaeolithic industry or facies here.

54. For a general overview, see Harvati, Panagopoulou, and Runnels 2009; for Epirus, see Tourloukis 2009; for Thessaly and Epirus, see Runnels and van Andel 2003. For bifaces and bifacial tools in western Macedonia, see Harvati et al. 2008.
55. Carbonell et al. 2008, p. 209.
56. Goren-Inbar and Saragusti 1996, p. 27.

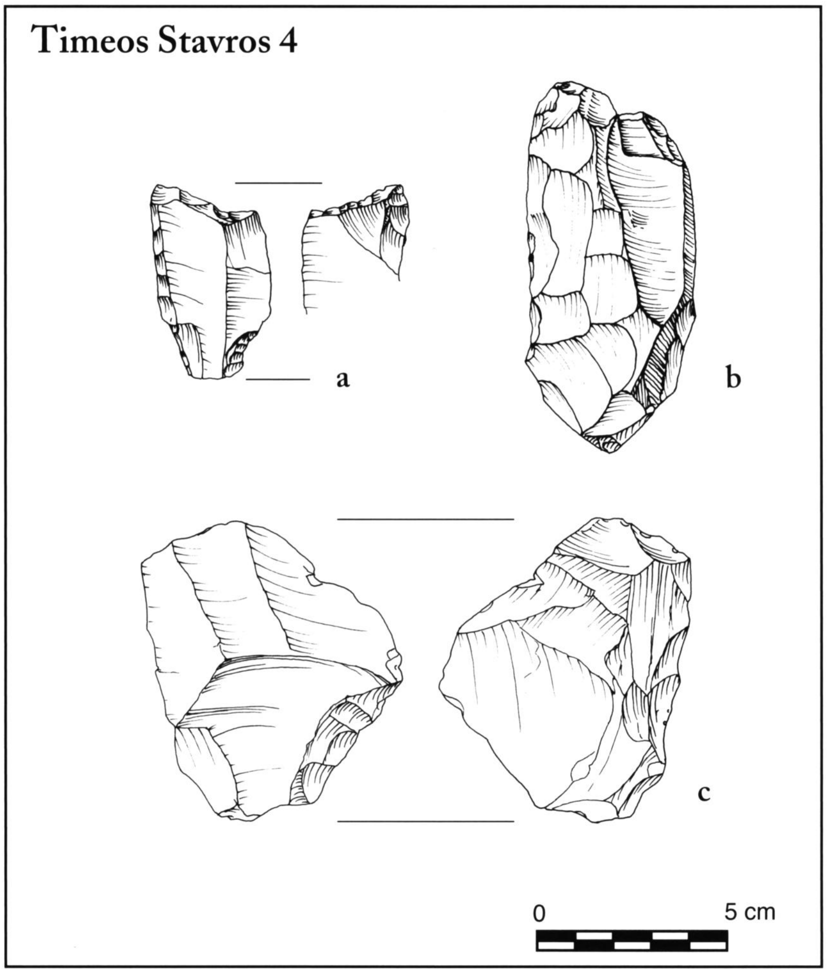


Figure 42. Palaeolithic quartz artifacts from Timeos Stavros 4: (a) truncated retouched blade with a proximal notch; (b) scraper; (c) Levallois core. Drawings C. DiGregorio, P. Murray, and C. Runnels

Chronology

The dating of the Palaeolithic in the Plakias region presents a considerable challenge, not least because of the long period of time that may have elapsed since the occupation of the earliest sites, during which postdepositional natural processes may have obscured the archaeological record. Additionally complicating the issue are the small number of sites, the lack of excavation, and the impact of modern development on the area, which has destroyed many sites.

Several approaches to dating were attempted, and our research on this topic continues. At Preveli 2, east of the Preveli Gorge, Palaeolithic artifacts are associated with a flight of marine terraces resulting from relatively high sea levels in the Pleistocene that were preserved by subsequent rock uplift. The lowest late Pleistocene marine terraces resulting from high stands of the sea at Preveli (14 ± 1 masl) and Schinaria (21 ± 1 masl) have 2-sigma calibrated radiocarbon ages of 45,400 ± 1,600 and 49,120 ± 2,890 years B.P., respectively, and are correlated with Marine Isotope Stages 3.3 and 3.4, both eustatic high stands.[57] The higher terraces, at 59 and 96 masl, are unquestionably older. How much older? Assuming similar rates of rock uplift (1.4 ± 0.1 m/kyr) determined from the age-elevation relationships of the dated terraces at 14 and 21 masl, it is possible to estimate the approximate ages of the

57. Wegmann 2008, p. 123, table 3-3.

terraces associated with artifacts.[58] This correlation provides an approximate age for the lithic artifacts. The higher terrace, at 96 masl, may belong to Marine Isotope Stage 5, possibly early 5e, ca. 110,000 B.P. Artifacts associated with the terrace at 59 masl could correlate with Marine Isotope Stage 5a, ca. 70,000 B.P. It should be stressed that these are rough approximations and these ages are probably *minima* that represent a terminus ante quem. If the uplift rate is changed, the terraces and the artifacts associated with them could be much older.

At Preveli 3, Preveli 7, Timeos Stavros 1, and Schinaria 5, Palaeolithic artifacts were found in outcrops of paleosols that exhibit the characteristics of the oldest maturity stage for such features, that is, Maturity Stage 6, or in geological terms, Marine Isotope Stage 6. Together these observations suggest an age of ca. 190,000–130,000 B.P. and serve as a terminus ante quem for the artifacts embedded within them. The stone tools were incorporated in the paleosols as part of a process described by Runnels and van Andel in Epirus: "the top of the Bt horizon itself would move gradually upward as a result of slow deposition, so engulfing any artifacts laid down on former land surfaces above it."[59] In other words, the Bt horizon, especially as much of the clay comes from eolian sources, will increase in thickness through time, slowly engulfing clasts, such as stone tools, that were formerly in the A horizon.

In sum, the dating of the Palaeolithic sites is based on geological data derived from the study of marine terraces on the southwestern coast of Crete and our identification of paleosols, and these data place the Palaeolithic lithic artifacts firmly in the Pleistocene, ca. 130,000 B.P. or earlier. The chronology can be further refined, however, and a dating program currently in progress may provide data for doing so.

CONCLUSIONS

The purpose of the Plakias Survey was to demonstrate that foragers were exploiting the coastal resources of Crete in the early Holocene, ca. 9,000–11,000 years ago, and this goal has been achieved. The additional discovery of Lower Palaeolithic sites points to an early period of seafaring in the Mediterranean, beginning at least 130,000 years ago, if not considerably earlier, with important implications for the colonizing of Europe by early African hominins.

Based on the available data—and we stress that research is ongoing—the most parsimonious hypothesis is that the exploitation of coastal and estuarine wetland resources of the Plakias region took place in both the Pleistocene and early Holocene, and that two separate human groups left traces of their existence in this region, one in the Middle to Upper Pleistocene (ca. 130,000 B.P. or earlier), and the other in the late Pleistocene–early Holocene (ca. 11,000–9000 B.P.).

A minimum of 20 Mesolithic sites are preserved in the area between Preveli and Damnoni where they are associated with caves and rockshelters. Only traces of Mesolithic activity were found around Ayios Pavlos. The Mesolithic lithic industry is similar in typological and technological terms to Mesolithic industries found elsewhere in Greece. The sites in the survey area are currently unexcavated and undated, and we cannot yet determine whether they were occupied for all or only part of this chronological span.

58. The dating follows Wegmann 2008.

59. Runnels and van Andel 2003, pp. 93–94. For a summary of the early Palaeolithic in the Aegean area, see Runnels 2001 and 2003.

The sites near Plakias are generally small, and their probable function in the landscape may have been as logistical camps or local extraction sites. Schinaria 1 is a candidate for a repeatedly visited site or a residential base because the assemblage is rich in cores and displays a variety of tool types. Given the many other sites of this period in the survey area, it seems likely that we are looking at the exploitation of this region by Mesolithic foragers who utilized a logistical collecting strategy similar to that recognized in the Argolid on the mainland.[60] The concentration of sites around the coastal wetlands is also consistent with the hypothesis that early foragers focused their subsistence efforts on the exploitation of coastal wetlands. But did they investigate, or settle, the higher elevations of the rugged mountainous interior? Were the Mesolithic maritime foragers seasonal visitors or permanent inhabitants? Did they have an impact on endemic flora and fauna? At present, we cannot answer these questions.

The Lower Palaeolithic sites are found between Preveli and Schinaria at elevations between 40 and 200 masl where they are associated with marine terraces, paleosols, and debris flow fans. Although found in the vicinity of caves and rockshelters, none of the known sites remain undisturbed and little can be said about their original contexts. Periods of uplift and marine transgression affected the coast throughout the Upper Pleistocene and may have interfered with the preservation of such materials.

Where did the Plakias Palaeolithic originate? On the present scanty evidence, an African or Near Eastern origin is as likely as an Anatolian or mainland Greek one. Wherever it originated, the Plakias Palaeolithic has implications for our understanding of hominin dispersals. It has long been thought that the Acheulean reached Europe via the Near East, passing through Anatolia, and through the Iberian peninsula directly from Africa, perhaps carried by *Homo erectus* or *Homo heidelbergensis* populations.[61] In this context, Palaeolithic archaeological sites and a newly discovered fossil *Homo erectus* calvaria in Turkey can be cited as support.[62] This view of the peopling of Europe exclusively by land clearly needs to be rethought in light of the Cretan evidence presented here. While early hominins may have reached Anatolia via the Near Eastern corridor, it is apparent that there could have been sea routes crossed and recrossed by long-distance seafarers moving at will throughout the Mediterranean.[63]

Once early hominins reached Crete, was their exploitation of the region continuous or intermittent? Did early hominins find their way into the interior, or did they remain confined to the coast? What effect did they have on the endemic flora and fauna? As with the Mesolithic, these questions must remain for the moment unanswered, and it is evident from the richness of the finds and the limited survey area explored to date that a great deal more research must be done on the island. Many areas rich in wetland resources in the Pleistocene and early Holocene existed on Crete and there are areas where extensive Pleistocene paleosols can be seen, for example, west of Chania. Crete is a large island with rugged relief, and much fieldwork is necessary to understand the extent of the prehistoric record and to gauge properly the impact of early human presence there. The new discoveries presented above compel us to consider the full significance and potential impact of early seafaring on the peopling of the Mediterranean, Europe, and the wider world.

60. Runnels 2009.

61. Runnels and Özdoğan 2001; Roebroeks 2006; Carbonell et al. 2008, pp. 215–216.

62. Bar-Yosef 2006, pp. 484–486; Kappelman et al. 2008. For Palaeolithic research in Turkey, see also Kuhn 2002; Runnels 2003; and Slimak et al. 2008.

63. See Bailey and Flemming 2008.

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