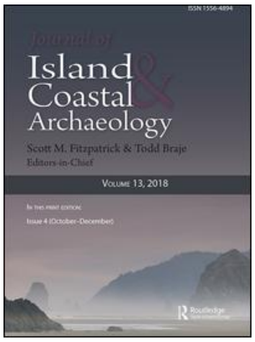

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Before the Neolithic in the Aegean: The Pleistocene and the Early Holocene record of Bozburun - Southwest Turkey

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ABSTRACT

The renewed Mesolithic research in the Greek mainland and the islands has been providing new insights into the lively maritime activity within the region; however, the southwest coast of Turkey has been virtually devoid of related investigations until the commencement of the Bozburun Prehistoric Survey project in 2017. The aim of this paper is to give an overview of the prehistoric sites discovered at the Bozburun Peninsula during the 2017–2019 field seasons. Preliminary results indicate that the area is rich in prehistoric activity. While Middle Paleolithic chipped stone industries were identified at the sites of Kayabaşı Cave, Çakmak, and Sobalak, flake based microlithic chipped stone industries typical of the Aegean Late Pleistocene and Early Holocene were identified at the sites of Sarnıç, Hurma, Sobalak, Zeytinlik, and Çakmak. A variety of artifacts, suggestive of the Neolithic, were also recorded at the sites of Hurma, Zeytinlik, and possibly at Sobalak and Sarnıç. In specific, the presence of carinated end-scrapers, burins and polyhedric cores at Sarnıç, as well as some geometric microliths at Hurma, demonstrates that Bozburun was frequented during the Upper Paleolithic and the Epipaleolithic. The presence of a few geometric microliths made on Melos obsidian at Hurma also demonstrates that the region was connected to the Aegean obsidian network routes at least by the beginning of the Holocene. If our relative dating is correct, this constitutes the earliest known use of Melos obsidian in the Anatolian mainland.

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Introduction

In Aegean prehistory, the transition from foraging to farming (i.e., the Neolithic transformation) is one of the most important periods of cultural change; however, the

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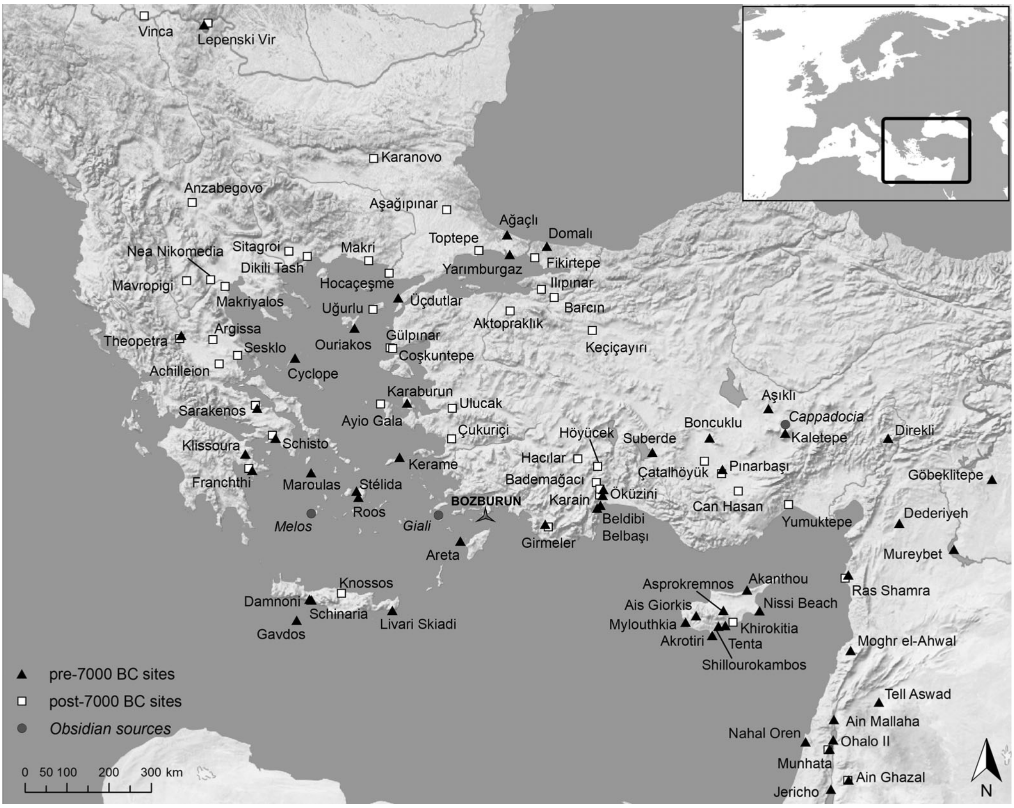

Figure 1. Some of the important sites in the eastern Mediterranean and Balkans around the Pleistocene-Holocene transition (compiled from Arbuckle et al. 2014; Broodbank 2006; Kozłowski 2007; Reingruber 2017, 2018; Shea 2013).

reasons and dynamics behind this transformation are still debated. These debates are often formed with reference to two polarized perspectives: demic diffusion vs. local acculturation. While there are shades of agreement and disagreement with both perspectives, some researchers prefer to see the Aegean Neolithization as a result of the westward human population migrations from the Levant and central Anatolia (Brami 2017; Colledge and Conolly 2007; Horejs et al. 2015; Özdoğan 2014; Perlès 2001); others emphasize local development hypotheses based on the lively presence of Mesolithic communities, interacting with the eastern Mediterranean, Anatolia and the Greek mainland during the Late Pleistocene-Early Holocene time span (Figure 1), preparing the scene for alternative scenarios of Neolithization in the region (Broodbank 1999, 2006; Budja 2013; Kaczanowska and Kozłowski 2014a; Knapp 2010; Papoulia 2016; Reingruber 2011, 2017; Sakellariou and Galanidou 2016; Sampson 2014; Séfériadès 2007; Strasser et al. 2010; Thissen 2005; van Andel 2005; Yakar 2016).

Arguably, there is enough evidence to be skeptical of both propositions. The current evidence indicates that the Neolithic communities, with features of agricultural activity based on domesticates and sedentism, emerged abruptly at both sides of the Aegean and the islands during the first quarter of the seventh millennium BC, as demonstrated at sites such as Argissa, Bademağacı, Çukuriçi, Franchthi, Knossos, Mavropigi, Sesklo, Uğurlu, and Ulucak (Asouti, Ntinou, and Kabukcu 2018; Budja 2013; Çevik and Erdoğu 2020; Douka et al. 2017; Duru 2012; Erdoğu 2017; Horejs et al. 2015; Karamitrou-Mentessidi and Efstratiou 2015; Perlès 2001, Table 5.3; Reingruber 2015; Starnini 2018; Thissen 2005). All of these sites demonstrate fully flourished agriculture of domesticated plants and animals which must have been brought from the heartlands of domestication in Anatolia and Mesopotamia, where progenitors of the domesticated species existed (Arbuckle et al. 2014; Colledge et al. 2018; Erdoğu 2014; Trantalidou 2003, 2010; Vigne et al. 2011; Zeder 2008, 2011). Also, at many of these sites, the so-called "Neolithic Package" elements, such as architecture, pottery, figurines, stamps, bone objects, etc., previously known from the Anatolian and the Near Eastern sites, are also present (Özdoğan 2010; Perlès 2005). This abrupt appearance of both agricultural life and the material culture elements in Greece and the Balkans would appear to be in favor of a demic diffusion via "westward migration" hypothesis. At the same time, the spatial and chronological distribution of the so-called "Neolithic Package" is highly varied from one region to the other, which may be an indication of the influence of the divergent local traditions on the Neolithization process (Arbuckle et al. 2014; Atakuman 2014, 2015; Budja 2013; Milić 2014; Reingruber 2011, 2017, 2018; Sampson 2014, 2019; Thissen 2005; Yakar 2016).

However, stronger arguments, in favor of a continuous interaction and a potential acculturation hypothesis, may be based on the evolution of lithic industries and obsidian distribution patterns throughout the transition from the Late Pleistocene to the Early Holocene. The Aegean Early Holocene lithic traditions are often described by the intensive presence of "flake based micro-industries" (Kaczanowska and Kozłowski 2014a), which are deemed to be different from the mainland Near Eastern traditions, that are typically based on blade/bladelet production with an increasing emphasis on large blades and decreasing microlithization (Rosen 2012; Shea 2013, 274–80). However, some geometric microliths, typical of the last phases of the Near Eastern Late Pleistocene, may also be observed at the Aegean and southwest Anatolian sites during the transition from the Late Pleistocene to the Early Holocene. For example, a few geometric microliths were found at the Early Mesolithic site of Maroulas in the context of the typical flake based Mesolithic industries of the Aegean (Kaczanowska, Kozłowski, and Sampson 2009; Kozłowski 2007). At the Epipaleolithic site of Öküzini in Antalya, indications of Aegean lithic traditions were present in the context of the lithic industries typical of the Levantine Natufian (Kartal 2003, 2011; Reingruber 2011). In fact, it has been argued that the Antalyan and the Aegean Epipaleolithic traditions were linked with the lithic industries of the Younger Dryas (III) occupation of Ouriakos on the island of Lemnos, at least by the eleventh millennium BC, both of which arguably stemmed from the Epigravettian entities of the eastern Mediterannean (Efstratiou, Biagi, and Starnini 2014; Kaczanowska and Kozłowski 2013; Kozłowski 2016; Kozłowski and Kaczanowska 2009; see also Özdoğan and Gatsov 1998).

As for the obsidian, different source localities have been identified and characterized both chemically and visually in the Cappadocian outcrops of central Anatolia as well as on the Aegean islands of Melos, Giali, and Antiparos (Carter and Contreras 2012; Carter, Contreras, Campeau, et al. 2016; Milić 2014). The Cappadocian sources had been used in Anatolia since the Lower Paleolithic (e.g., at Kaletepe Deresi 3; Slimak et al. 2008), and in the Levant possibly as early as 41–32.000 BP (at Yabroud II; Frahm and Hauck 2017), but more frequently by the Late Pleistocene (e.g., at Ain Mallaha in the Natufian; Khalaily and Valla 2013). A few pieces found at Öküzini's Epipaleolithic levels indicate that it was transported to the southwest Anatolian coast by the end of the Late Pleistocene (Carter et al. 2011), and to Cyprus by the late ninth to eighth millennium BC, as evidenced by the sites of Ais Giorkis, Mylouthkia, Shillourokambos, and Tenta (Moutsiou 2019).

The earliest long-distance use of Melos obsidian has been recorded at Franchthi's "Final Paleolithic" levels dating to the eleventh millennium BC (Carter 2016), at Sarakenos Cave's "Final/Late Paleolithic" levels dating to the thirteenth millennium BC (Sampson et al. 2009), and possibly at Schisto Cave between fourteenth and twelfth millennia BC (Laskaris et al. 2011). Melos remains the sole source of obsidian in almost all of the Aegean islands (with the exceptions of Ayio Gala in Chios and Uğurlu in Imbros) and the Greek mainland throughout the Mesolithic and the Neolithic periods (Carter et al. 2011; Carter, Mihailović, et al. 2016; Carter et al. 2006; Carter et al. 2018; Milić 2014, 2016; Perlès, Takaoğlu, and Gratuze 2011). Many excavated Neolithic sites along the western coast of Anatolia demonstrate that Melos obsidian was preferred in this region after the seventh millennium BC, together with some central Anatolian obsidian (Milić 2014). However, the pre-Neolithic presence of Aegean obsidian cannot be secured anywhere in Anatolia, which may be partially due to the scarcity of related research and excavations in the region, rather than reality.

The prehistoric use of the Giali obsidian is less known, partially due to the lower quality of the material, but again, probably also due to the lack of Early Holocene research along the southwest coast of Anatolia (Carter, Contreras, Campeau, et al. 2016; Georgiadis 2008). Nevertheless, at the excavations of Kerame on Ikaria; both Melos and Giali obsidian were recorded in the presence of flake based Mesolithic industries of the Aegean (Kaczanowska and Kozłowski 2014a; Sampson, Kaczanowska, and Kozłowski 2012).

Further supporting data for the interaction and acculturation hypotheses can arguably be found at the excavations of Maroulas on Kythnos (Kaczanowska and Kozłowski 2018; Kaczanowska, Kozłowski, and Sampson 2009; Kozłowski 2007; Sampson 2014), Cyclope Cave on Youra (Kozłowski 2007; Sampson 2008), and Girmeler on the southwest coast of Anatolia (Takaoğlu et al. 2014). At Maroulas, a number of traits traditionally associated with the pre-pottery Neolithic (PPN) of Anatolia, Levant, and Cyprus seem to have appeared during the Ninth millennium BC (Guilaine et al. 2011; Özbaşaran 2011; Perlès 2001; Vigne et al. 2012). In specific, circular stone dwellings and burials under floors at Maroulas very much resembled that of the late Natufian and PPN of the Near East (Sampson 2014). Similar affinities with the Near Eastern traditions of architecture, plastered floors, and burial were revealed during the excavations of the late Ninth to eighteenth millennium BC occupation of Girmeler (Takaoğlu et al. 2014). Furthermore, the Maroulas community was potentially engaged in the management of pre-domesticated pigs, which may have been brought to the island from elsewhere in the Levant or Anatolia, albeit they relied on fishing and small mammal hunting typical of the Mesolithic Aegean subsistence patterns (Trantalidou 2010). Similarly, it has also been argued that the people of Youra were involved in the herding of pre-domesticated goats, which may also have been brought from the Near East or Anatolia (Trantalidou 2003). The same applies to the transfer of Taurine cattle from the Levant to Cyprus across the open sea at the onset of the Holocene (Zeder 2008). Both at Maroulas and Cyclope Cave, the local cultural entity has been identified by the typical Aegean Mesolithic flake based industries and a preference for Aegean sources of obsidian from Melos (Carter, Mihailović, et al. 2016, Table 4), while the previously mentioned animal management activities, as well as the traditions of architecture and burial arguably speak for cultural links between the east and the west, at least by the beginning of the Holocene.

Indeed, other research at the sites of Areta, Damnoni, Franchthi, Gavdos, Kerame, Klissoura Cave 1, Livari Skiadi, Roos, and Stélida also demonstrate that many raw materials, ideas, goods, and people were already circulating during the Late Pleistocene and Early Holocene (Broodbank 2006; Carter, Contreras, Doyle, et al. 2016; Carter, Mihailović, et al. 2016; Kaczanowska and Kozłowski 2018; Kaczanowska, Kozłowski, and Sobczyk 2010; Kopaka and Matzanas 2009; Perlès 1990, 2003; Reingruber 2011, 2018; Sampson 2016, 2019; Sampson, Kaczanowska, and Kozłowski 2012; Sampson, Kozłowski, and Kaczanowska 2016; Strasser et al. 2015). This lively maritime activity is not surprising since Cyprus was also colonized during the Late Pleistocene-Early Holocene time span (Simmons 2010, 231; Vigne et al. 2012).

While the archaeological evidence indicates complex interactions within and beyond the Aegean, unfortunately, none of the existing archaeological contexts give any reliable evidence of a continuous transition from the Mesolithic to the Neolithic in the region. If there was demic diffusion with the onset of the Neolithic, then what happened to the early settlers of the Aegean? Some recent archaeogenomic evidence seems to emphasize the plausibility of such a demic diffusion from Anatolia and the Levant, driving the Neolithization across western Anatolia and Europe, which is then followed by continuous episodes of mixing of migrant farmers and local hunter-gatherers (Hofmanová et al. 2016; Lazaridis et al. 2016). However, other research hints at the existence of a common gene pool of Anatolia and the Aegean that possibly had formed prior to the Neolithic (Kılınç et al. 2017). The problem with ancient DNA research is that no published DNA evidence pertaining to the Mesolithic and the beginning of the Neolithic in the Aegean so far exists; therefore, we are still at a loss in our attempts to explain if the Mesolithic communities of the Aegean were already in the same common gene pool with Anatolia, prior to the Neolithic. If this were to be the case, then the archaeological question shifts toward understanding why the Aegean communities entered so late into the world of agriculture, despite the fact that they were in some kind of contact with the Near East. Ultimately, we believe that the late and abrupt adoption of the Neolithic lifestyles in the Aegean still requires further investigations that account for variability, before jumping into specific conclusions.

Approaching Bozburun material in the context of the chronological and terminological problems

In an attempt to shed some light into the possible Mesolithic background of the Aegean Neolithic, surveys in the Bozburun Peninsula began in 2017 (Atakuman et al. 2019a,

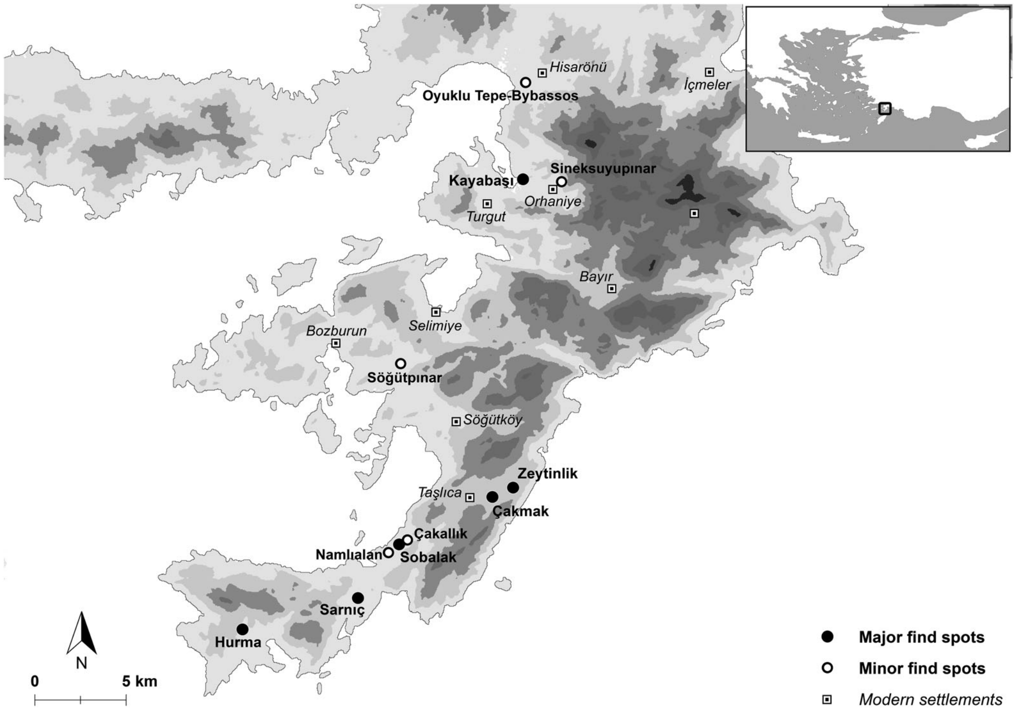

Figure 2. Location of the Bozburun Peninsula and the find spots mentioned in the text.

2019b). Located in the ancient Caria region, facing toward the Dodecanese Islands, Bozburun Peninsula is a logical location to explore the connectivity between the east and west sides of the Aegean (Figure 2). The islands of Giali and Melos, which are the closest sources of obsidian, lie approximately 90 (Giali) and 330 (Melos) km to the west of the peninsula; while with the current sea-levels, the closest islands are Symi and Rhodes, within ca. 7 and 17 km of voyaging distance respectively. Toward the end of the Last Glacial Maximum, the low sea levels in the Aegean meant that Bozburun was united with the Datça Peninsula to the northwest to create a much larger peninsula, in which the current western shores of the Bozburun Peninsula would have been an inland area (Lykousis 2009).

The geology of the peninsula is made up mainly of calcareous formations of Mesozoic age, which were shaped by tectonic movements (Bilgin et al. 1997; Darkot and Tuncel 1978). Balaban Mountains, standing between 400 and 800 m, were formed as a result of these movements; the highest area of the peninsula is found at Mount Eren, in the northern part of the peninsula, with an elevation of 842 m above sea level. Plains, while generally inhibited by the mountains, are concentrated around the modern settlements of Orhaniye, Selimiye, and Turgut. The shoreline is typically quite indented; fault lines have often led to the formation of abruptly rising coasts, which in turn inhibit easy access to the interior (Taşlıgil 2008).

Mediterranean climate with hot-dry summers and mild-wet winters dominates the Bozburun Peninsula. Average annual precipitation is around 750 mm, almost all of which takes place in winter. The region is not rich in its freshwater resources: most of the freshwater runs through temporary/seasonal streams. Ergos/Ergus stream and River

Mesir, flowing to the Bay of Hisarönü, provide the most water-rich areas in the peninsula (Doğaner 1999; Taşlıgil 2008). Alternatively, the inhabitants today resort to groundwater wells, many of which can be found around the settlements of Hisarönü, Orhaniye, Turgut, Taşlıca, Selimiye, and Bozburun. The region is mainly covered with red-brown *terra rossa*, red-yellow podzolic soils, and colluvium. Vegetation is dominated by shrubs, pines (*Pinus brutia*), and various cypress species; higher elevations see the presence of oak and maple. Numerous endemic plant species are also present. Mammals of the peninsula include porcupine, fox, wild boar, roe deer, and jackal as well as many avian and reptile species, whereas the rich sea life supports an advanced fishing economy in the region.

At the end of the third field season in 2019, we have been able to record 45 find spots, some of which produced substantial amounts of chipped stone artifacts, some highly weathered and typologically unidentifiable pottery sherds, and a few small finds (Plates 1–5; S5–6). Before delving into the details of the particular sites and evidence, it has to be highlighted that despite all efforts to synthesize the previously published work on the subject, so far a reliable chrono-typological frame has not been constructed for the Late Pleistocene-Early Holocene Aegean lithic industries. Arguably, there are a few underlying reasons for this situation, some of which are related to the ongoing terminological problems while most of which is based on the difficulties of relative chronologies in the relative absence of well dated material and excavations.

To start with the terminological problems; the term Epipaleolithic is often used with reference to the climatic periods between Older and Younger Dryas, while the term Mesolithic is used with reference to the Early Holocene stages of Preboreal, Boreal, and Early Atlantic. However, in reality, the terms such as Epipaleolithic, Mesolithic, and Neolithic are defined on the basis of an assemblage of material cultural traits, some of which can crosscut these climatic/geologic time intervals. For example, the Aegean "Mesolithic" is sometimes described by the intensive presence of "flake based micro-industries," although it is known that artifacts typical of the Epipaleolithic, or in general the last phases of the Late Pleistocene, may continue to appear throughout the Mesolithic (Kaczanowska and Kozłowski 2014a); similarly, some "Mesolithic" traits can continue into the Neolithic. Therefore, it remains difficult to identify a clear-cut cultural and chronological separation between the Epipaleolithic, Mesolithic, and the early Neolithic industries in the region merely based on relative dating methods. This problem presents itself more acutely during surveys, i.e., neither an isolated presence of a specific tool assemblage can be successfully related to a specific chronological period, nor the presence of "Epipaleolithic" and "Mesolithic" industries together can be reliably interpreted as belonging to two distinct time periods. For the purposes of this study, an outline of the chronological terminologies used, in association with some of the key sites mentioned in the text, can be found in the online supplement (S1).

Nevertheless, if we were to go through the published material with patience, it is possible to see that there are actually very little diagnostic artifacts of the lithic traditions of the Aegean Mesolithic. To start with, it is well established that backed bladelets, specific types of geometric microliths, and end-scrapers are typical of the Late Upper Paleolithic/Epipaleolithic assemblages, such as those at the "Final Paleolithic" levels of Franchthi (Perlès 2003), sequence B of Klissoura Cave 1 (Kaczanowska, Kozłowski, and

Sobczyk 2010), and the Epipaleolithic of Öküzini (Kartal 2003, 2011; Yalçınkaya et al. 2002). Whereas the oldest stages of Öküzini (ca. 18,000–17,000 BC) saw the use of a non-geometric microlith assemblage (with backed bladelets, retouched bladelets, micro-gravette points, and scalene triangles), between ca. 17–15.000 BC geometric microliths started to appear, and by later stages (ca. 14,000–12,000 BC) had gained popularity, with an abundance of lunates, triangles, and trapezes (together with micro-points and backed bladelets); presence of microburin technique is also known from this later stage (Kartal 2003, 50; Otte et al. 2003). Based on the typology of very few atypical end-scrapers and burins, and lunates and backed bladelets at the Epipaleolithic site of Ouriakos (Efstratiou, Biagi, and Starnini 2014), some researchers argued that the emergence of the Mesolithic Aegean tradition is linked to the "Epigravettian" entities of the eastern Mediterannean, such as Antalyan (Kaczanowska and Kozłowski 2013; Kozłowski 2016; Kozłowski and Kaczanowska 2009). This Early Holocene Aegean lithic tradition was defined as "percussion-flake-dominated assemblages, whose modified tools include denticulates, notched pieces, 'pseudo trapezes', scrapers, backed pieces and minority blade/bladelet components" (Carter, Contreras, Doyle, et al. 2016, 279). However, other researchers would argue that the Epipaleolithic assemblage of Ouriakos cannot be linked to the early Mesolithic traditions of the Aegean (Efstratiou, Biagi, and Starnini 2014).

While the continuity between the Epipaleolithic and the early Mesolithic of the site cannot be successfully demonstrated, at the "Lower Mesolithic" levels of Franchthi (Phase VII, ca. ninth millennium BC), geometric microliths and backed bladelets definitely decreased in proportion, and flake based micro industries, typified by denticulated, notched, truncated, and splintered tools, proliferated (Carter, Mihailović, et al. 2016; Perlès 2003, 80–84). Similarly, during the excavations at the early Mesolithic site of Klissoura Cave 1, backed blades, as well as geometric microliths such as rectangles and obtuse triangles with Epigravettian features were found together with the typical Aegean Mesolithic flake based industries (Kozłowski 2016).

Within the comparable time span of the early Mesolithic, the excavations at the site of Kerame show that the assemblage is dominated by flake based micro industries composed of truncations, perforators, scrapers, and notched and denticulated pieces, which were accompanied by only very few geometric microliths, e.g., trapezes (Sampson, Kaczanowska, and Kozłowski 2012). At the early Mesolithic site of Maroulas, the excavations revealed a small amount of geometric microliths, together with a dominantly flake based chipped stone industry typical of the Aegean Mesolithic (Kaczanowska, Kozłowski, and Sampson 2009; Kozłowski 2007). At the briefly excavated cave of Girmeler, the assemblage was composed of some bladelets, multi-directional cores, end-scrapers, rounded scrapers, and perforators, in the absence of geometric microliths (Takaoğlu et al. 2014). Similar assemblages were also discovered at the excavations of the Nissi Beach in Cyprus where the assemblage was formed by the strong presence of arched backed, notched, denticulated, splintered pieces, side-scrapers, and truncations, without an indication of geometric microliths (Kaczanowska and Kozłowski 2014b).

During the "Upper Mesolithic" of Franchthi (Phase VIII) (Perlès 2003), some geometric microliths, e.g., trapezes with lateral retouch that resemble lunates, were observed to increase in frequency. Based on this observation, the surface collections from Roos on Naxos were thought to belong to a similarly later phase of the Mesolithic (Sampson 2016). At the Cretan

Mesolithic sites of Damnoni and Schinaria 1, geometric microliths and backed pieces were present along with a flake based assemblage, represented by notches, denticulates, scrapers, borers, and burins (Carter et al. 2018; Strasser et al. 2010). However, at Franchthi's "Final Mesolithic" (Phase IX), these geometrics disappeared again (Perlès 2003).

The surface collections at the site of Areta on Chalki demonstrate that very few examples of backed pieces and geometric inserts, specifically trapezes and rectangles, are present within a predominantly flake based micro industry, which led the researchers to argue for a later Mesolithic date (Sampson, Kozłowski, and Kaczanowska 2016). The excavated site of Cyclope Cave has multiple strata of occupation extending from the early Mesolithic to the late Neolithic (Sampson 2008; Sampson, Kozłowski, and Kaczanowska 2003); here, few lunates and trapezes were recorded in both Mesolithic and Neolithic layers, with a significant increase of these particular types in the latter period. Otherwise, the Mesolithic assemblage is generally represented by end-scrapers, splintered pieces, and retouched flakes, as well as backed blades, very few burins, denticulates, and notches (Kaczanowska and Kozłowski 2008; Sampson, Kozłowski, and Kaczanowska 2003), most of which seem to be typologically atypical.

With this highly variable and complex evidence in mind, we tried to establish some criteria for the chronological identification of the Bozburun survey material that are based on the presence or absence of certain typologies, raw materials (such as obsidian), knapping techniques, and the position of the artifacts in the *chaîne opératoire*. If we roughly follow the chronology, from the oldest to the most recent period:

(1) Middle Paleolithic industries are represented by the Levallois method of debitage with Mousterian points and déjété side-scrapers (Shea 2013, 105–14; Sitlivy et al. 2008; Otte et al. 1998, 421–6).

(2) Several periods of the Upper Paleolithic are characterized by carinated end-scrapers and backed blades/points (Kuhn et al. 2009; Özçelik 2011; Shea 2013, 148–57; Starkovich 2017, Table 1).

(3) In generic terms, Late Pleistocene and Early Holocene industries are defined by the presence of backed blades and bladelets (Efstratiou, Biagi, and Starnini 2014; Kartal 2003; Kozłowski 2016; Perlès 2003). Steep retouch is widely used during the Upper Paleolithic and Mesolithic for preparing backed edges functional to hafting, however, the presence of backed pieces can also be an outcome of functional factors, such as its prolific use at hunting camps that may exist throughout the Neolithic. Frequencies of backed pieces decrease through time, specifically as the production of macroblades begin with the Early Neolithic. Nevertheless, it is still possible to detect backed pieces at the earliest levels of the Neolithic sites, such as Uğurlu (Guilbeau et al. 2019).

(4) Otherwise, given the present state of our knowledge, it is very hard to attribute a blade to a given period in Aegean; for the moment, we cannot go beyond the basic distinction between industries with pressure blades and those without this technique. The pressure technique entered the Aegean with the Neolithic (ca. 7000 BC), therefore pressure blades in this region would be characteristic of the Neolithic and the post-Neolithic periods (Gronenborn 2017; Guilbeau et al. 2019; Milić 2018). It should be noted, however, that at the earliest Neolithic

levels of Knossos, Argissa, and Franchthi, some elements of the Aegean Mesolithic chipped stone industries continued to be used alongside the pressure technique (Evans 1964; Milojčić 1962; Perlès 2003, 80–84; Reingruber 2011; Tellenbach 1983; see also Guilbeau et al. 2019). The pressure technique can be detected only in the presence of very characteristic pieces of debitage, in specific the cores. At Bozburun, in many cases the definitive identification was impossible in the absence of these specific artifacts, albeit possible pieces that exhibit very regular and trapezoidal cross-sections are indicated (e.g., Plates 1–4, Table 2; see also Plate 5 for photographs).

(5) Although the frequency of geometric microliths is usually low in the Aegean Mesolithic, different types of lunates, trapezes, and triangles are typical of the Late Pleistocene and Early Holocene industries in the wider region. Trapezes seem to have proliferated at some sites during the later Mesolithic and their use may have continued into the Neolithic, e.g., at Argissa, Cyclope Cave, Franchthi; however, these Mesolithic trapezes are often technologically different from the Neolithic ones (Kaczanowska and Kozłowski 2008; Reingruber 2011; Tellenbach 1983, Tafel 45).

(6) Flake based side-scrapers, denticulates, and notches are typical of the Late Pleistocene and Early Holocene industries, however they can be found from the Middle Paleolithic to the Bronze Age. Therefore their attribution to a specific period needs to be strengthened by the presence of other specific tools. Even though splintered and truncated tools appear more frequently within the flake based industries of the Early Holocene, it is nevertheless difficult to use the absence or presence of isolated typological traits as parameters. For instance, a macroblade of high-quality exotic flint with denticulate retouch on one side might be a Neolithic sickle, while a notched flake or blade fragment of local raw material can be of any period. At the same time, borers made on blades are typical of the Neolithic (Cahen, Caspar, and Otte 1986; Kozłowski and Kozłowski 1987).

(7) The presence of sickle inserts indicates the agricultural practice of crop harvesting which is not earlier than the Neolithic in the Aegean, as far as our knowledge based on the published material is concerned (Mazzucco et al. 2020, 6).

(8) Microblades or bladelets made from Melos obsidian by percussion can be tentatively attributed to a period between the latest Pleistocene through the Early Holocene, since the earliest long-distance uses of this raw material are known to be between fourteenth and eleventh millennia BC (in Franchthi, Sarakenos Cave, and Schisto Cave) (Carter 2016; Laskaris et al. 2011; Sampson et al. 2009).

(9) Giali obsidian is known from the Mesolithic of Kerame and the Neolithic of Knossos, as well as from some Bronze Age contexts both in Greece and Anatolia (Carter, Mihailović, et al. 2016). However, the distribution of Giali obsidian in Anatolia is virtually unknown due to the lack of prehistoric research in the region. Nevertheless, considering that during the Late Pleistocene, Giali was closer (if not connected) to the southwest Anatolian coast due to the lower sea-levels (Papoulia 2016; Sakellariou and Galanidou 2016), it is quite plausible to suggest that the exploitation of this raw material by the Anatolian communities was possible without complex navigation skills.

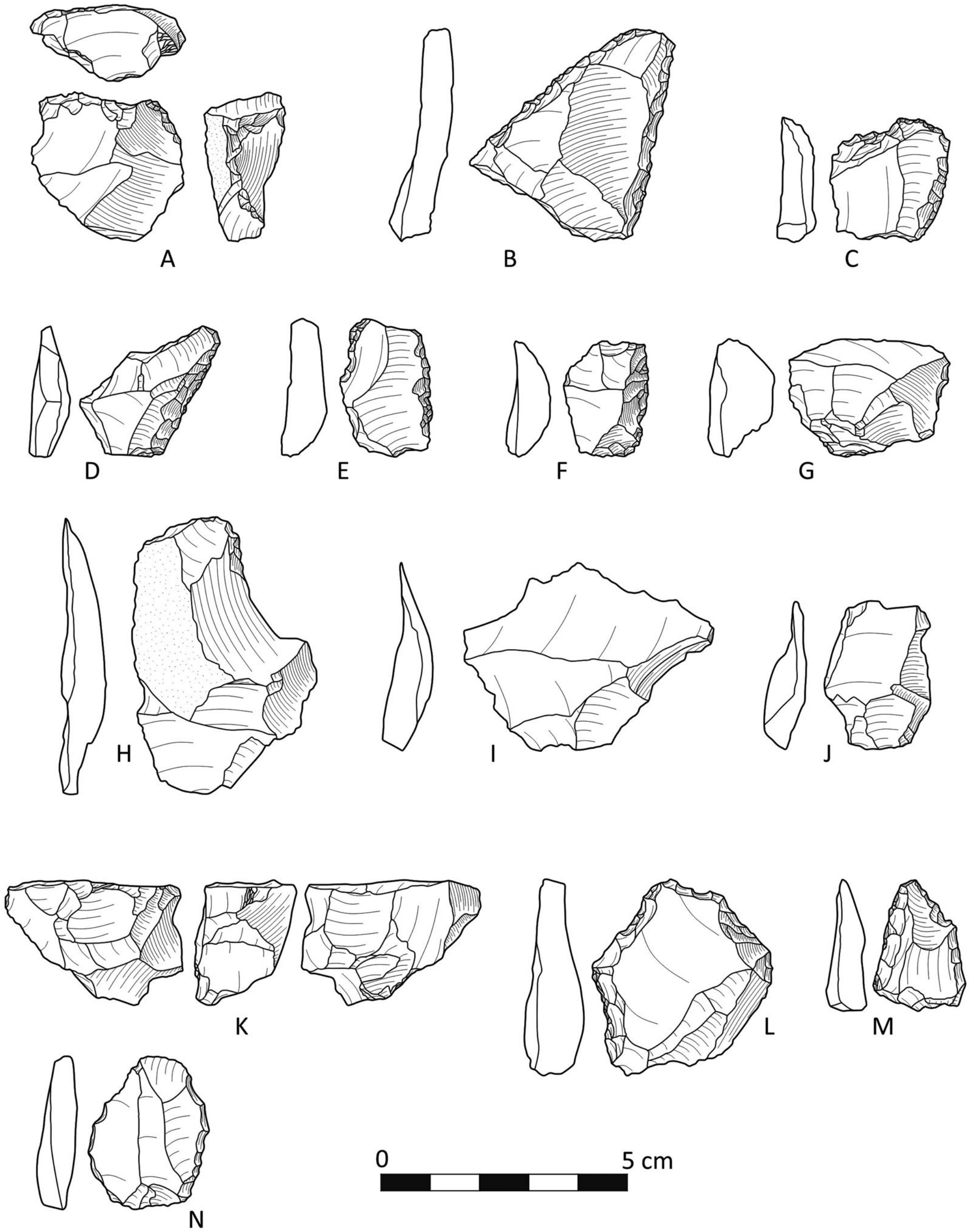

Plate 1. Chipped stones from Kayabaşı and Çakmak. Kayabaşı: (A) Levallois point core; (B–F) side-scrapers; (G–I) Levallois flakes; (J) flake; Çakmak: (K) multiple platform (polyhedric) flake core; (L–M) side-scrapers; (N) retouched flake.

Results

Based on the above criteria, we have identified five sites at the Bozburun Peninsula, namely, Çakmak, Sarnıç, Sobalak, Zeytinlik, and Hurma, which yielded chipped stone

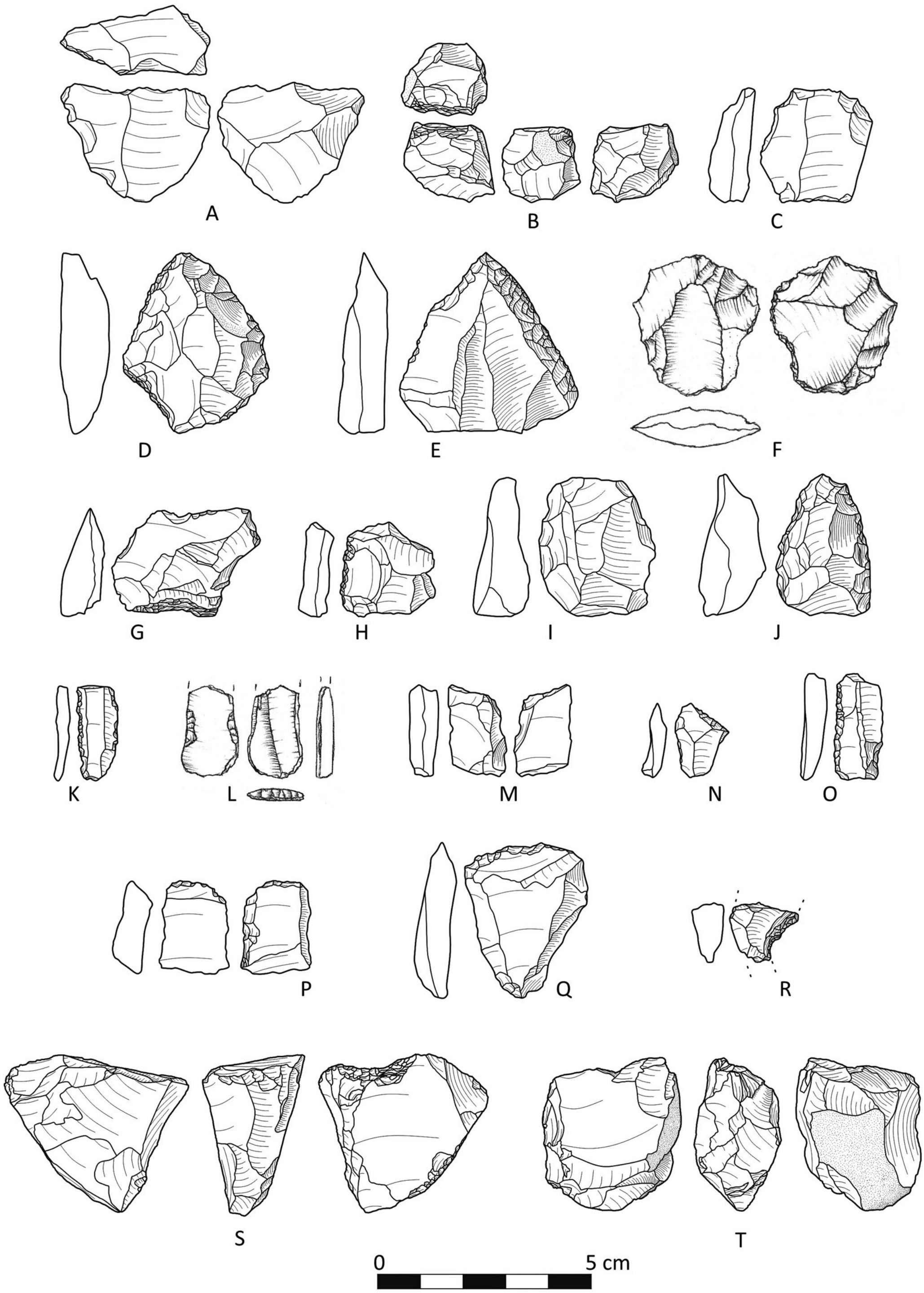

Plate 2. Chipped stones from Sobalak, Söğütpınar, and Çakallık. Sobalak: (A) single platform flake core; (B) multiple platform (polyhedric) flake core; (C) flake; (D–E) Mousterian points; (F) Levallois flake core; (G) Levallois flake; (H–K) side-scrapers (K made on obsidian blade, pressure technique?); (L) obsidian end-scraper (pressure technique?); (M) denticulate; (N) truncation; (O) obsidian retouched backed blade; (P–R) retouched flakes; Söğütpınar: (S) prismatic core; Çakallık: (T) exhausted Levallois core.

Plate 3. Chipped stones from Sarnıç and Zeytinlik. Sarnıç: (A) single platform flake/blade core; (B-C) multiple platform (polyhedric) flake/blade cores; (D) scraper; (E) obsidian side-scraper (pressure technique?); (F) end-scraper; (G) carinated end-scraper; (H) burin; (I) notch; (J–K) truncations (K made on obsidian flake); (L–M) retouched flakes; (N) obsidian retouched bladelet; Zeytinlik: (O) single platform blade core; (P) transversal side-scraper; (Q–R) obsidian side-scrapers; (S) obsidian borer; (T–U) retouched flakes; (V–W) retouched blades (V made of obsidian, W sickle blade? pressure technique?); (X) obsidian bladelet (pressure technique?).

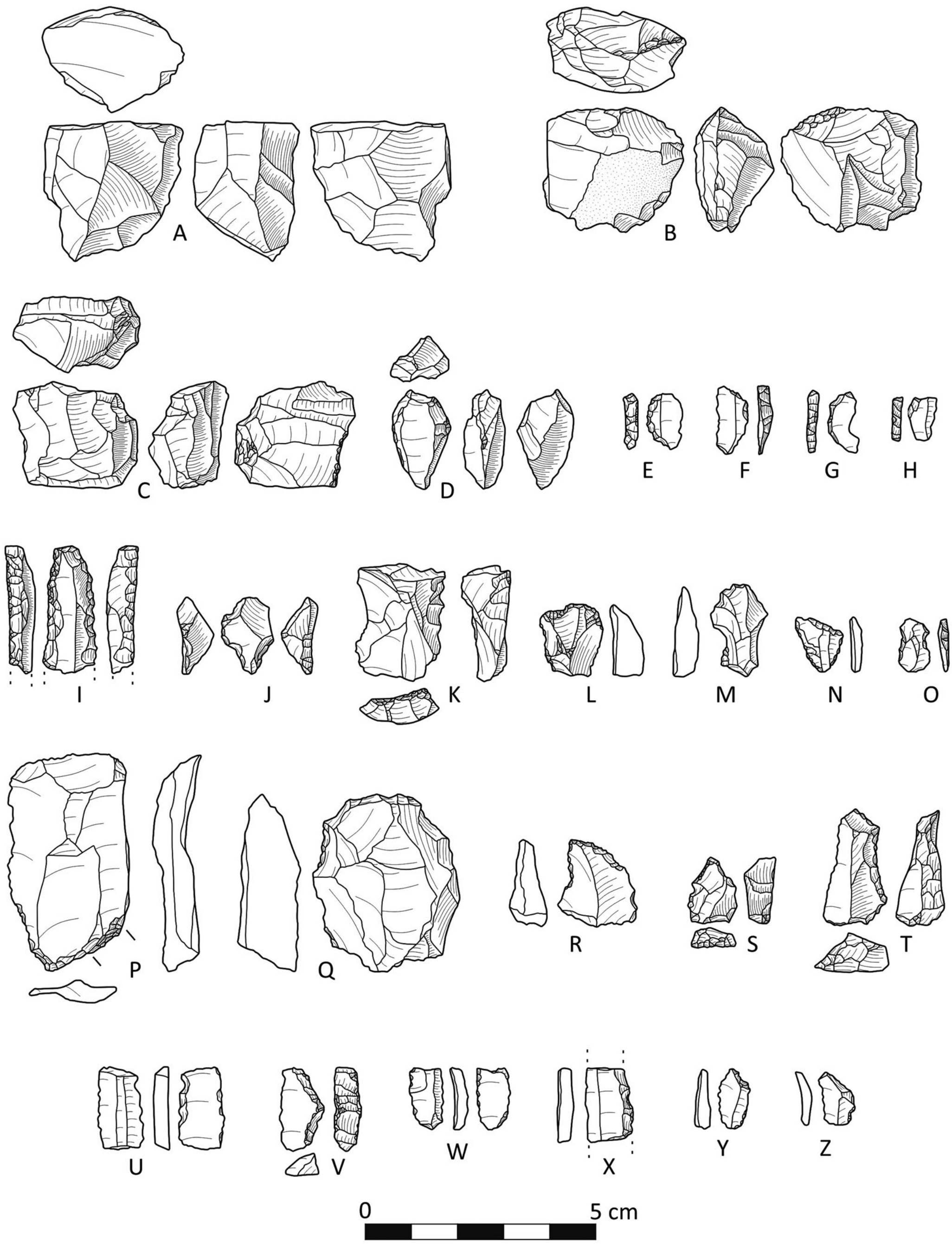

Plate 4. Chipped stones from Hurma. (A–D) single platform flake cores; (E–G) lunates (F–G made of obsidian); (H) obsidian microlith (atypical triangle?); (I–J) borers (I pressure technique?); (K) side-scraper; (L–M) end-scrapers; (N) truncation; (O) obsidian notch; (P–S) retouched flakes (S made of obsidian); (T) retouched flake/blade; (U) obsidian retouched backed blade (pressure technique?); (V) obsidian backed blade; (W–Z) retouched blades/bladelets (X–Z made of obsidian, X pressure technique?).

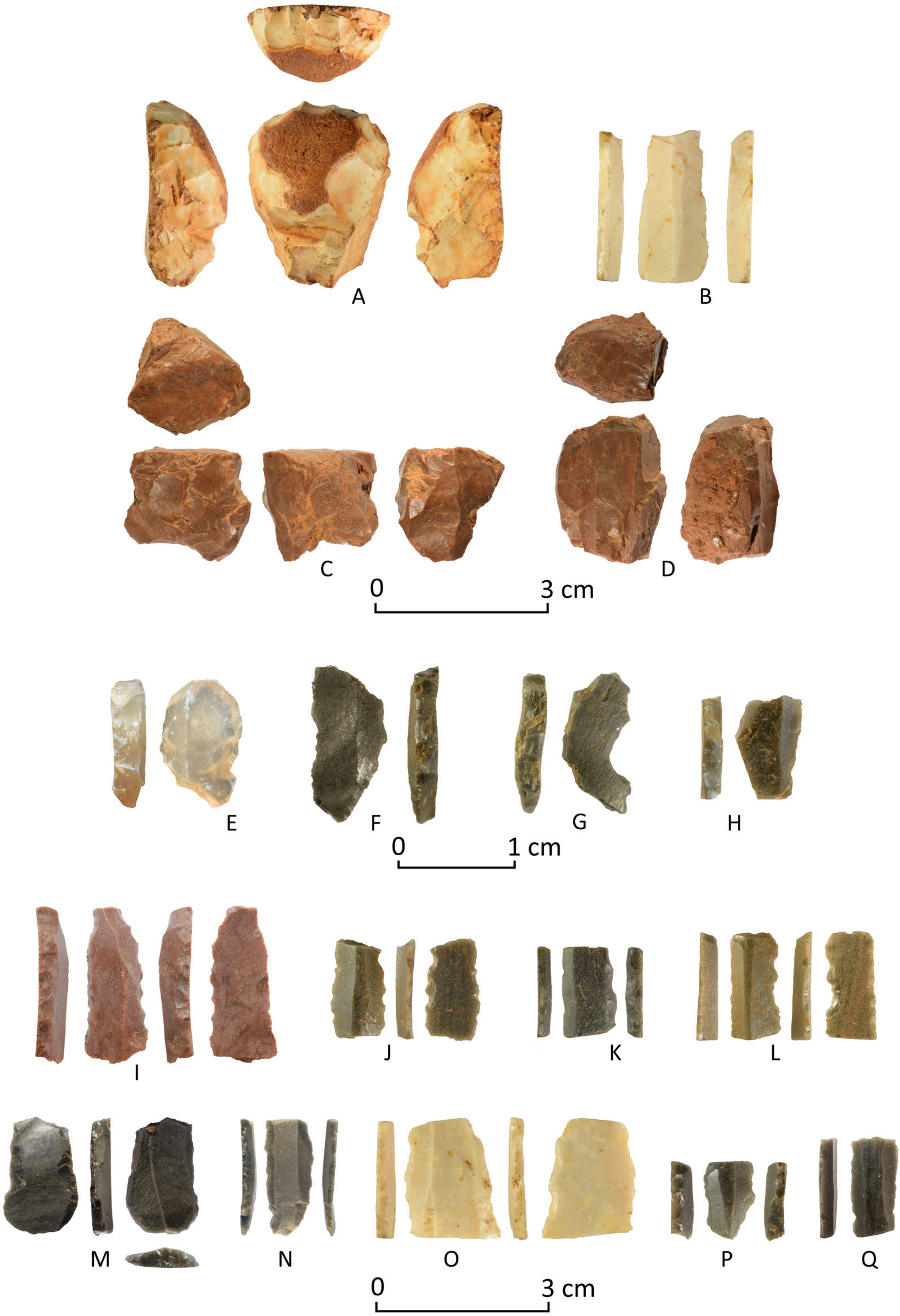

Plate 5. Chipped stones from various sites. Sarnıç: (A) carinated end-scraper; (B) burin; (C–D) multiple platform (polyhedric) flake/blade cores; (L) obsidian side-scraper (pressure technique?); Hurma: (E–G) lunates (F–G made of obsidian); (H) obsidian microlith (atypical triangle?); (I) borer (pressure technique?); (J) obsidian retouched backed blade (pressure technique?); (K) obsidian retouched blade (pressure technique?); Sobalak: (M) obsidian end-scraper (pressure technique?); (N) obsidian side-scraper (pressure technique?); Zeytinlik: (O) retouched blade (sickle blade? pressure technique?); (P) obsidian borer; (Q) obsidian bladelet (pressure technique?).

assemblages indicative of the Late Pleistocene and Early Holocene Aegean; along with these, some artifacts typical of the Middle Paleolithic industries were also identified at three locations (Kayabaşı, Çakmak, and Sobalak). While our analyses on the chemical compositions of the Bozburun obsidian artifacts are ongoing, for the preliminary purposes of this article, we have relied on visually observed macroscopic characteristics (Carter, Contreras, Campeau, et al. 2016, Fig. 13; Milić 2014, Fig. 9), keeping in mind that sometimes this may be misleading, especially considering the fact that it may be difficult to distinguish Melos-Dhemenegaki and Nenezi Dağ obsidian merely on the basis of visual inspection. Nevertheless, tentatively, the obsidian pieces with spherulites were identified as coming from Giali, while the semi-transparent, matte black pieces of obsidian were identified as coming from Melos (Torrence 1986).

Table 1 contains information regarding the chipped stone assemblages of the abovementioned six sites of the Bozburun Prehistoric Survey, while S2 and S4 give an overview of the sites' general features and provide details. On this note, the collections of Bozburun material were not systematic, therefore, statistical analyses and related bar or pie charts could be misleading. Instead, all the typologically significant artifacts from each site are demonstrated through drawings and photographs. Yet, this should not mean that the material presented in plates directly represent a specific chronological period for any given site. As it is the case with all surveys, in the absence of reliable absolute dating methods, such chronology has been inferred with reference to the evidence of comparative assemblages, all of which were critically evaluated previously.

Kayabaşı is a medium-sized cave, carved into the limestone layers of the southern side of a rocky hill formation in Orhaniye area (S7: A). Mouth of the cave is 8 m wide on an east-west direction, and approximately 14 m deep. Presently, the cave overlooks the final stretch of the alluvial plains hosting the settlement of Orhaniye, opening promptly to the Gulf of Hisarönü. The streams that deposited the alluvium flow only seasonally within the modern climate, but there are freshwater springs within a 2 km radius of the cave. The main scatter is inside, but there are also lower density lithic scatters around the cave. Radiolarite seems to have been the main raw material used in the chipped stone assemblage. No obsidian has been encountered. Presence of a Levallois point core and flakes as well as déjété side-scrapers suggest a strong presence of Middle Paleolithic time span (Plate 1). Some heavy retouched tools (such as déjété side-scrapers and Mousterian points) might be related with the Zagros Mousterian assemblages of the Near East (Shea 2013, 112–3). A few non-diagnostic pottery sherds were also found in the cave, but it is not possible to associate them with a time period due to the deteriorated state they were recovered in.

Sobalak is an inland open air site on a low-lying terrace among rocky outcrops, southwest of the contemporary settlement of Taşlıca. Closest seasonal streams are approximately 500 m away and provide a steeply descending route down to the northern shore. Artifacts are distributed on an area of approximately 3 ha, some of which may have been carried from the higher terraces of the surrounding hills. The deposits do not seem to be very substantial. Within this context, five artifacts indicate a Paleolithic presence (Plate 2: C–G). Two Mousterian points, one Levallois flake, and one Levallois flake core suggest a Middle Paleolithic age; an exhausted Levallois core from the close-by find spot of Çakallık also lends itself to such an interpretation (Plate

Table 1. Chipped stone assemblages of the Bozburun Peninsula sites (typology based on Bordes 1961; Hours 1974; Tixier 1963). MP: Middle Paleolithic; UP: Upper Paleolithic.

	Kayabaşı	Çakmak	Sarnıç	Hurma	Sobalak	Zeytinlik	Total
Mousterian point (MP)	–	–	–	–	2	–	2
Side-scraper (MP)	5	2	–	–	–	–	7
Levallois flake (MP)	6	–	–	–	1	–	7
Plain flake (MP)	7	2	–	–	2	–	11
Core (MP)	1	–	–	–	1	–	2
Carinated end-scraper (UP)	–	–	1	–	–	–	1
Burin (UP)	–	–	1	–	–	–	1
Geometric microlith (Late UP/Epipaleo.)	–	–	–	3 lunates, 1 atypical triangle? (3 obsidian)	–	–	4
Backed blade/bladelet	–	–	–	2 (1 retouched) (2 obsidian)	1 retouched (obsidian)	–	3
End-scraper	–	–	1	4 (2 obsidian)	1 (obsidian)	–	6
Side-scraper	–	–	1 (obsidian)	2	9 (2 core s-s) (2 obsidian)	3 (1 transversal s-s) (2 obsidian)	15
Scraper	–	1	2	2 (1 obsidian)	8 (1 rounded scraper; obsidian)	–	13
Splintered piece	–	–	–	–	–	–	–
Truncation	–	–	2 (1 obsidian)	2 (1 obsidian)	1	–	5
Notch	–	–	2	7 (6 obsidian)	3	1 (obsidian)	13
Denticulate	–	–	–	–	1	–	1
Borer	–	–	–	2	–	1 (obsidian)	3
Retouched flake/flakelet	–	9 (1 obsidian)	20	17 (6 obsidian)	17 (3 obsidian)	10 (5 obsidian)	73
Retouched blade/bladelet	–	–	2 (1 obsidian)	11 (6 obsidian)	–	3 (2 obsidian)	16
Retouched, indeterminate	–	–	–	3 (3 obsidian)	2	1 (obsidian)	6
Flake/flakelet	–	31 (4 obsidian)	74 (10 obsidian)	98 (62 obsidian)	107 (11 obsidian)	34 (22 obsidian)	344
Blade/bladelet	–	–	13 (8 obsidian)	45 (33 obsidian)	8 (5 obsidian)	14 (13 obsidian)	80
Radiolarite bladelet by percussion	–	–	2	5	–	–	7
Pressure technique	–	–	1? (1 obsidian)	3? (2 obsidian)	2? (2 obsidian)	2? (1 obsidian)	8?
Sickle insert	–	–	–	–	–	1?	1?
Core rejuvenation pieces	–	–	3 (1 obsidian)	2 (1 obsidian)	13	–	18
Core	–	3	10 (1 obsidian)	10 (2 obsidian)	4	3	30
Presence of obsidian	–	Melos, Giali (debris)	Melos, Giali	Melos, Giali	Melos	Melos, Giali	
Visual source assignment of obsidian artifacts	–	Melos (100%)	Melos (95%), Giali (5%)	Melos (84%), Giali (13%), uncertain (3%)	Melos (100%)	Melos (91%), Giali (2%), uncertain (7%)	

Table 2. Tentative chronology of the Bozburun Peninsula sites.

	Middle Paleolithic	Upper Paleolithic	Epipaleolithic	Mesolithic	Neolithic	Chalcolithic
Kayabaşı	Levallois point core (Plate 1: A) Levallois flakes (Plate 1: G-I) déjété side scrapers (Plate 1: B-C)					
Çakmak	side-scrapers (Plate 1: L-M)			flake-based industry		
Sarıç		carinated end-scraper (Plate 3: G) burin (Plate 3: H)	polyhedric cores (Plate 3: B-C)	flake-based industry	Melos-Giali obsidian present pressure technique? (Plate 3: E) pottery sherds (S6: E)	
Hurma			lunates, atypical triangle? (Plate 4: E-H)	flake-based industry	Melos-Giali obsidian present pressure technique? (Plate 4: I, U, X) borer on blade (Plate 4: I) figurine fragment (S6: H) polished axe (S6: B)	
Sobalak	Mousterian points (Plate 2: D-E) Levallois flake core (Plate 2: F) Levallois flake (Plate 2: G)			flake-based industry	Melos obsidian present pressure technique? (Plate 2: K-L) pottery sherds (S6: F)	
Zeytinlik				flake-based industry	Melos-Giali obsidian present pressure technique? (Plate 3: W-X) sickle insert (Plate 3: W) borer on bladelet (Plate 3: S) polished axe/adze (S6: D)	

2: T; S5: G). Otherwise, there is a strong presence of flake based industries represented by scrapers, notches, and flake cores, in addition to one truncation and one denticulate. There is no evidence of geometric microliths. Radiolarite and chert are the main raw materials that were used in the production of flake based industries (Plate 2). There are a few artifacts of obsidian, while quartz is represented by one scraper. No obsidian cores were found; however, retouched flakes, scrapers, and a retouched backed blade made of Melos obsidian have been recorded. One obsidian end-scraper (Plate 2: L; Plate 5: M) is interesting: the tool has an inverse lateral retouch on both edges, the active part of the end-scraper is made by a direct retouch on the distal end, and it was possibly detached by pressure technique. Another side-scraper also hints at the application of the same technique (Plate 2: K; Plate 5: N)

Besides these, a few ground stone artifacts of indeterminate chronology and a few quite degraded handmade ceramic sherds, possibly of Neolithic-Early Chalcolithic age based on the decoration applied, were observed (S6: F). A serpentinite stamp seal found at a site in close proximity to Sobalak is difficult to date; however, the typology is suggestive of a Neolithic-Early Bronze Age time span (S6: I). Overall, these artifacts indicate a general presence of the Late Pleistocene-Early Holocene communities frequenting the area, possibly on a seasonal basis.

Sarnıç is an inland open air site very close to the Serçe Bay on the southern part of the peninsula. It is situated on a low-lying terrace between the rocky outcrops, and it is approximately 250 m from the closest seasonal stream. Artifacts were distributed on an area of approximately 4 ha, some of which may have been carried down from the surrounding hills. Like Sobalak, the deposits are not substantial. One carinated end-scraper and a burin signal a general Upper Paleolithic presence (Plate 3: G–H; Plate 5: A–B). The carinated end-scraper is very similar to those found at the Karain Cave (B) (Özçelik 2003, 92, Fig. 2.1 and 2.2). Two polyhedric cores on pebble (Plate 3: B–C; Plate 5: C–D) signal a possible Epipaleolithic activity and have parallels in Ouriakos (Efstratiou, Biagi, and Starnini 2014, Fig. 13). Otherwise, a flake based industry involving notches, scrapers, truncations, and numerous retouched pieces indicates a Late Pleistocene-Early Holocene presence, albeit no geometric microliths were encountered. Handmade ceramic sherds in poor condition were observed at the site, some of which may belong to the Neolithic-Early Chalcolithic time spectrum, based on the handle typology (S6: E).

At Sarnıç, radiolarite, chert, and a smaller amount of obsidian were used in the production of flake based industries (Plate 3). Cores of radiolarite and chert have been recovered. Melos appears to be the main source of obsidian used at the site; the tools made from this material include a side-scraper possibly detached by pressure technique (Plate 3: E; Plate 5: L), a truncation, and a retouched bladelet. No cores of Melos obsidian have been recorded, although there is one core rejuvenation flake. Giali obsidian is represented by a multiple platform core (S5: C) and debris; however, no tools have been identified.

Çakmak is also an open air site, surrounded by low-lying hills to the east of Taşlıca. Although the closest seasonal streams flow more than 1 km away, it seems possible on the basis of modern groundwater levels to open up water wells in the area. The artifact scatter at Çakmak is relatively small, covering approximately 1.5 ha on a shallow cultural deposit. Again, the possibility that the lithic concentrations might have been washed down from the nearby hills cannot be ruled out. The industry is produced on the locally available radiolarite, as well as chert and obsidian (Plate 1). Radiolarite and chert were used for flake production; retouched flakes and a few flake cores (Plate 1: K) are present. Obsidian from Giali appears in the form of debris, while Melos obsidian is represented mostly by a few flakes, one of which was retouched; no cores of either type were recorded. A few side-scrapers appear related to the Middle Paleolithic (Plate 1: L–M). Besides these, another scraper and a few retouched flakes (Plate 1: N) are the only tools recovered at Çakmak. A number of pottery sherds that were encountered on the site remain unidentifiable.

Zeytinlik lies 1.5 km northeast from Çakmak, concentrated around a protruding outcrop of limestone, which seems to have served as a rockshelter (S7: B). Freshwater supply is limited in a similar way with Çakmak. Scatter area is around 1.5 ha. Main raw material used in Zeytinlik is obsidian, although radiolarite and chert is also present (Plate 3). The majority of obsidian is from Melos, accompanied by a small amount of Giali obsidian, yet no obsidian cores have been found. There are a number of tools made from Melos obsidian, including retouched pieces, side-scrapers, a borer on bladelet (Plate 3: S; Plate 5: P), and a notched piece. One of the bladelets recovered might have been detached by pressure technique (Plate 3: X; Plate 5: Q). Giali obsidian, on the other hand, is attested in the form of debris and one single crested blade (S5: D), which might have been retouched at its distal end to be used as an end-scraper. Radiolarite and chert are mostly represented by flakes and debris; a few flake cores and a blade core (Plate 3: O) are also present. One possible sickle insert produced by pressure technique is especially significant (Plate 3: W; Plate 5: O). Besides these, a few ground stone artifacts have been recorded, at least one of which is a polished axe/adze fragment (S6: D); and one very small stone bead is noteworthy (S6: J). Few pottery sherds that were recovered are non-diagnostic.

Hurma, close to the southwestern tip of the peninsula, is located on top of a hill stretching out toward the plains below, between two narrow valleys cut to its current shape by seasonal streams (S7: C). The steep topography does not allow for an easy access to these valley bottoms, but this is compensated by a number of active freshwater springs very close to the locality. On the surface of the hilltop, lithics are scattered on a total area of around 1.5 ha, with occasionally dense obsidian patches. These obsidian pieces make up the overwhelming majority of the chipped stone assemblage from the site (Plate 4; S5: A–B, E), accompanied by smaller numbers of radiolarite and chert. Large portion of the obsidian originates from Melos, represented by retouched pieces, geometric microliths (two lunates and a possibly atypical triangle; Plate 4: F–H; Plate 5: F–H), scrapers, notches, backed blades, and a truncation. Giali obsidian is found as flakes and debris without specific tool types. Yet, two obsidian cores from Melos and Giali demonstrate that both sources were used in production (S5: A–B). Meanwhile, one lunate fragment (Plate 4: E; Plate 5: E), a number of retouched pieces, scrapers, borers, a truncation, a notch, as well as a number of flake cores were made from radiolarite and chert.

At Hurma, the possible use of pressure technique (Plate 4: I, U, X; Plate 5: I–K) is significant; one such artifact is a borer on blade (Plate 4: I; Plate 5: I). Also present are a substantial number of polished axe fragments and other ground stone artifacts (S6:

A–B), as well as a fired clay figurine fragment of possibly Neolithic-Early Chalcolithic Age (S6: H). Pottery fragments are found scattered on the site, some of which appear handmade, and might originally have been associated with the figurine and the ground stone implements mentioned.

Discussion

Whereas our purpose for surveying at Bozburun has been to find evidence of Late Pleistocene-Early Holocene activity, we have detected some Middle Paleolithic and Upper Paleolithic chipped stone industries, which are the earliest evidence of human presence identified so far in the survey area (S3).

The Lower Paleolithic chipped stone industries have been detected in western Anatolia at a date as early as 1.1 million years ago (Kaletepe Deresi 3; Slimak et al. 2008) and mainland Greece at 500,000–400,000 BP (Marathousa 1; Tourloukis and Harvati 2018), but no reliable evidence of the Lower Paleolithic has so far been observed at Bozburun. The presence of Lower Paleolithic in the Aegean islands have been argued for on the basis of the evidence from Crete, Gavdos, Lesbos, and Naxos; these continue to remain controversial (Carter et al. 2019; Galanidou et al. 2016; Kopaka and Matzanas 2009; Papoulia 2017; see also Tourloukis and Harvati 2018). Ultimately, it is quite possible that Lower Paleolithic activity may be uncovered at Bozburun in the future.

Instead, the earliest undisputed evidence of human occupation at Bozburun is of Middle Paleolithic age and is represented by the sites of Kayabaşı, Sobalak, and Çakmak (Table 2). Middle Paleolithic in the wider region is known from the Karain Cave (E), with occupations dated to 250,000–200,000 BP, 120,000–110,000 BP, and 70,000–60,000 BP (Otte et al. 1998). The closest comparisons of this industry have been defined with reference to the Zagros Mousterian as well as the Middle Paleolithic of the Balkans and southeastern Europe (Kuhn 2002, 202). Along the eastern Mediterranean coast of Turkey, the caves of Kanal, Merdivenli, Tıkalı, and Üçağızlı II also have rich Mousterian artifacts with closer links to the Levantine traditions; the Mousterian occupation in Üçağızlı II is estimated to have taken place between 60,000 and 50,000 BP (Baykara, Kuhn, and Baykara 2016; Baykara et al. 2015; Kuhn 2002). At Kaletepe Deresi 3 in central Anatolia, there are Middle Paleolithic layers both older and younger than 160,000 BP (Slimak et al. 2008). Middle Paleolithic sites were also detected during the surveys in the region surrounding the Bosphorus (Runnels and Özdogan 2001) and Dardanelles (Özbek and Erdoğu 2014). In mainland Greece, numerous Paleolithic sites are known, mostly concentrated at Epirus, Peloponnese, and Thessaly (Tourloukis and Harvati 2018). Theopetra Cave in Thessaly has Middle Paleolithic layers dating back to an interval of 140,000–110,000 BP (Karkanas et al. 2015). Meanwhile, the oldest dates from the Peloponnese are yielded by Kalamakia Cave, on top of the beach rock dated between an interval of ca. 123,000–96,000 BP (Darlas and Psathi 2016, 97). At Klissoura Cave 1, the earliest Middle Paleolithic occupation is estimated to be from MIS 5 (130,000–70,000 BP), while the uppermost Middle Paleolithic is dated to ca. 57,000–50,000 BP (Sitlivy et al. 2008; Starkovich 2014).

There is an ongoing argument about the presence of Lower and Middle Paleolithic hominins arriving at the region through seafaring, specifically at Agios Efstratios (Sampson et al. 2018), Crete (Broodbank et al. 2014; Leppard 2014; Runnels, DiGregorio, et al. 2014; Runnels, McCoy, et al. 2014; Strasser et al. 2010), Gavdos (Kopaka and Matzanas 2009), Kefalonia (Foss 2002; Tourloukis 2010, 57–8), Melos (Chelidonio 2001), and Zakynthos (Kourtessi-Philippakis 1999; Kourtessi-Philippakis and Sorel 1996; van Wijngaarden, Kourtessi-Philippakis, and Pieters 2013). Since these arguments are based on surface lithic collections with chronological attributions of debatable nature, it is difficult to come to a conclusion. However, the widespread presence of Middle Paleolithic artifacts and other evidence both at Bozburun and the surrounding regions can be evaluated in the context of the emergence of refugia, specifically in the eastern Mediterranean and the Aegean, which may have been occupied both by the Neanderthals and modern humans, as climate cooled in MIS 3 (57,000–27,500 BP) (Stewart and Stringer 2012; Tourloukis and Harvati 2018, 61; see also Carter et al. 2019).

Albeit scarcely, artifacts belonging to the Upper Paleolithic are probably distributed throughout the survey area, e.g., a carinated end-scraper and burin found at Sarnıç (Plate 3: G–H; Plate 5: A–B), as well as a prismatic core found at Söğütpınar (Plate 2: S; S5: F). The Upper Paleolithic record of Anatolia is very sparse, known mainly from a number of sites clustered at three regions: Bosphorus region in northwest, Antalya region in southwest, and Hatay region in the eastern Mediterranean coast (S3) (Özçelik 2011). A number of Upper Paleolithic sites were discovered during the surveys of the Bosphorus region, assigned to the earlier stages of the Upper Paleolithic based on typological comparisons (Runnels and Özdogan 2001). While the Upper Paleolithic levels in the Karain Cave (B) are dated to ca. 31,000–28,000 BP (Yalçınkaya et al. 2007, 547), the earliest evidence comes from the thick deposits of the Üçağızlı and Kanal caves in Hatay, ca. 44,000–34,000 BP (Kuhn 2002, 206; Kuhn et al. 2009). Also in Greece, a series of Upper Paleolithic sites in the Peloponnese (Franchthi, Klissoura Cave 1, Kolominitsa, Lakonis) generally fall between ca. 44,000 and 30,000 BP; however, a decrease in the number of sites in this region between 30,000 and 20,000 BP is reported (Tourloukis and Harvati 2018). In the Aegean, scatters of Upper Paleolithic material are known from the island of Alonnisos, in northern Aegean, and Gavdos, south of Crete (Papoulia 2017). Given the scarcity of Upper Paleolithic artifacts from Bozburun, it is difficult to assign a specific date, although as suggested previously, the carinated end-scraper resembles that of the Karain Cave ca. 31,000–28,000 BP.

Otherwise, with the exception of the Kayabaşı Cave, all the other find spots discovered within the Bozburun Prehistoric Survey area indicate Late Pleistocene-Early Holocene transitional activity (Table 2). The Epipaleolithic tradition at Bozburun Peninsula can be argued for on the basis of two small polyhedric cores at Sarnıç and four geometric microliths (three on Melos obsidian) at Hurma, based on the previously evaluated assemblages of Öküzini, Franchthi, and Ouriakos. The site of Hurma was probably occupied more or less continuously during the very end of the Pleistocene and throughout the Early Holocene, since these geometric microliths were found mixed with other flake and blade/bladelet based industries as well as some indications of pressure technique and few small finds of possibly Neolithic-Early Chalcolithic age. The freshwater springs nearby and the strategic location of the site may explain the thickness of the deposits and occupational continuity in this location. The site of Sarnıç may have also been frequented during the general Late Pleistocene-Early Holocene time period, however, based on the absence of geometric microliths, it can be suggested that the use of the site occurred at different time intervals, perhaps partly overlapping with Hurma, as well as involving earlier occupations during the Upper Paleolithic as mentioned above (Table 2).

At Zeytinlik, there are polished stone axe/adze fragments and a possible sickle insert produced by pressure technique for inferring a plausible Neolithic and/or post-Neolithic presence. At Zeytinlik, as well as Sobalak, Çakmak, Hurma, and Sarnıç, the overwhelming majority of the chipped stones are flake based (S4). At the same time, we have not observed any trapezes or splintered pieces in the survey, while we have encountered only one denticulate, which came from the site of Sobalak. Also, there was no record of retouched blades/bladelets from Sobalak, while at Zeytinlik, there were no artifacts with truncations. Unfortunately, there does not exist well dated comparative series with abundant and typologically well characterized reference material for the area; and as mentioned, it is difficult to use the absence/presence of specific types as chronological criteria, especially if these types are not much diagnostic, like splintered pieces, denticulates, or truncations. Nevertheless, for the trapezes, the observation is intriguing and may mean that a Mesolithic phase with trapezes is absent or the industries of this general period are different at Bozburun compared to other regions.

Among the survey collection, the main raw material seems to be radiolarite and chert of local origin, while Melos appears to be the main source of obsidian used. In specific, the presence of geometric microliths made on Melos obsidian at the site of Hurma indicate the long distance maritime connections, at least by the Early Holocene, if not before. Giali obsidian, on the other hand, is mainly represented by a few cores, flakes, and debris; tools are quite rare, if any. As suggested previously, it is hard to make chronological inferences based on the presence of Giali obsidian alone. However, since Giali was closer (or perhaps connected) to the Anatolian mainland during the Late Pleistocene, its use in such an early period cannot be excluded. All of the above-mentioned Late Pleistocene-Early Holocene sites of Bozburun had a mix of Giali and Melos obsidian except for Sobalak, where no Giali obsidian was identified. Although our analyses are ongoing, such an absence may be a reflection of the access patterns that may have fluctuated through time. To sum up, regarding the implications of obsidian on maritime behavior, it has been previously argued that the distribution of this raw material in the Aegean over a fairly extensive radius results from a direct access to sources by consumers rather than an elaborate system of exchange at least during the Neolithic (Torrence 1986, 223). While the presence of insular obsidian pieces in the Bozburun sites can be interpreted as a proxy of maritime voyages and sea routes, it still remains a possibility that this presence is an outcome of a regional network system (Carter et al. 2018).

Ultimately, we believe that the evidence from Bozburun adds a new dimension to the prehistoric record of the Aegean and we hope that further research and excavations in the area will provide new insights into the development of the Late Pleistocene and

Early Holocene communities as well as to the alternative scenarios surrounding the Aegean Neolithization.

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