

Article

An Aurignacian Assemblage from the Island of Lemnos (Greece): Some Aspects of the Beginning of the Upper Paleolithic in the Northeast Aegean

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Abstract: The discovery of an Aurignacian lithic assemblage along the northern coast of the Island of Lemnos in the northeastern Aegean Sea has opened new perspectives on the study of the beginning of the Upper Paleolithic in this region. The site is located some 93 m from the present seashore. It was discovered in the summer of 2020, ca. 2 km west of the Pournias Bay. The lithics were exposed in a well-defined oval concentration, ca. 25 × 10 m wide, buried by a Holocene sand dune. They were uncovered following sand removal by a bulldozer for the construction of a parking lot. The knapped stones are made almost exclusively from hydrothermal siliceous rocks, a raw material available on the island. Raman spectroscopy and optical observations confirmed that this raw material is chalcedony. The surfaces of most artefacts are weathered due to deposition in an environment rich in marine salt, which does not preserve any organic material suitable for radiocarbon dating. The knapped stone assemblage consists of diagnostic artefacts, among which are different types of carinated end scrapers, cores, and a few bladelets. The discovery of an Aurignacian site plays an important role in the study of the Paleolithic peopling of Lemnos and the Northeast Aegean in general, a period that was previously known only through Epipaleolithic sites discovered and excavated mainly along the eastern coast of the island.

Keywords: Lemnos; Aegean Sea; Upper Paleolithic; Aurignacian; Raman spectroscopy; chalcedony

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1. Introduction

Surveys carried out by the Aristotle University of Thessaloniki over the last decades on the island of Lemnos have led to the discovery of a few Epipaleolithic open-air sites, most of which are located along the eastern coast of the island [1]. Moreover, the presence of knappable stone outcrops has yielded evidence of local raw material availability and their exploitation over different periods of prehistory [2].

The island of Lemnos (presently 475.6 km²) is located in the northeastern Aegean Sea, very close to the Anatolian coastline, from which it is separated by a sea stretch, a maximum of 100 m deep and 62 km wide, as the crow flies. The most recent reconstruction of

the Holocene relative sea level (RSL) in this Aegean coastal sector, located within the South Marmara microplate, is consistent with a continuous RSL rise in the last 6.0 ka BP across the whole NE Aegean Sea [3]. This is consistent with the glacio-hydro-isostatic curves available for the area [4–6]. The continuous rise in sea level after the Younger Dryas separated Lemnos from the Anatolian mainland, but during the Last Glacial Period, the island was connected to the western coast of Anatolia [7,8], easy to access for the Upper Paleolithic hunters.

The objective of this paper is to present and discuss an early Upper Paleolithic Aurignacian knapped stone assemblage [9] discovered during the surveys carried out in the summers of 2020 and 2021 along the northern coast of the island, some 2 km west of the Bay of Pournias (Figure 1).

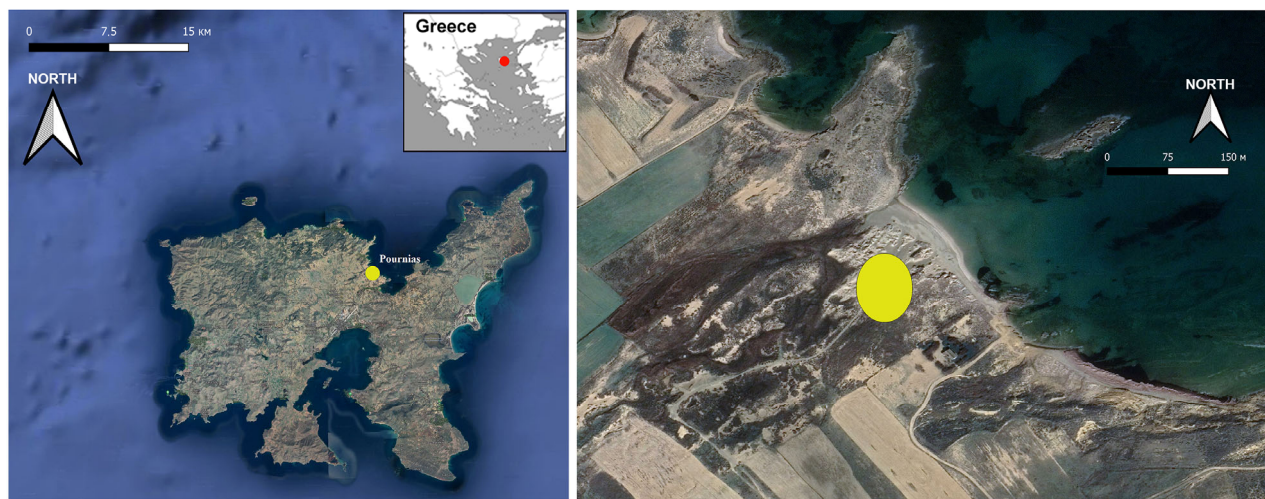


Figure 1. Pournias: The location of the Aurignacian site (yellow dot) along the northern coast of the island of Lemnos (map by Y. Agafonova and E. Starnini).

To date, a few Aegean islands have yielded lithic assemblages attributed to different Paleolithic periods [10], shedding some light on the Pleistocene peopling of the Aegean [11,12]. According to some authors, these finds show that seafaring was practiced during some Paleolithic periods [13,14]. This issue has been widely debated, although the Paleolithic sites are few and mostly undated. In contrast, information regarding sea level changes is detailed, at least for the entire Upper Paleolithic ([6], Figure 4). The discovery of an Aurignacian assemblage in Lemnos is intriguing. This cultural aspect, which is related to the spread of the first modern humans towards Europe [15–19], is poorly known in Anatolia [20,21] and Greece [22,23], as it is in the southern part of the Balkan Peninsula [24]. This is why the site of Pournias plays an important role in the Pleistocene archaeology of the Aegean and southern Europe in general.

2. The Pournias Site

The Paleolithic open-air site of Pournias is located ca. 93 m from the present shoreline. It lies in an area of Holocene sand dunes ([25], XII Figure 1), which are partially fixed

The site was exposed during the construction of a parking lot and an earthen road that leads from the interior to the beach. On this occasion, the topmost part of the sand dune was partially removed with a bulldozer, revealing the presence of a reddish-brown paleosol with a cluster of knapped stone artefacts (see Figure 2), which were discovered during the June 2020 surveys. The coordinates of the central point of the concentration of

artefacts, which extends in a southwest–northeast direction over a surface area of ca. 25 m × 10 m, are 39°57′31.40″ N, 25°16′11.97″ E; the altitude is 6 m a.s.l.



Figure 2. Pournias: The Aurignacian site in the center of the picture taken from the south (a) and knapped stone artefacts on the surface of the sandy paleosol (b,c) (photographs by P. Biagi, 2022).

Two seasons of surface collection were carried out in 2020 and 2021 (Figure 3). Each artefact was precisely positioned with the aid of a GPS and numbered in sequence (see Supplementary Materials, Table S1). Data were then incorporated into QGIS 3.22 software for spatial analysis. It was thus possible to build high resolution distribution maps (Figures 4 and 5), which suggest the presence of a dense lithic cluster and a potential site [26,27].

Most lithics were recovered lying flat on the exposed east–west inclined surface of the sandy soil (Figure 2a,b). The distribution maps show the concentration of all knapped stones collected in the two fieldwork seasons (Figure 5b). Unfortunately, no other artefacts, such as bone tools, or organic materials, like faunal remains, mollusks, or charcoal, have been found in association with lithics. Some artefacts were likely slightly moved when the surface of the dune was removed. However, it seems that they have only recently been exposed due to the rain-induced erosion of the soil covering them. To date, the site has never been test-trenched or excavated. Besides the concentration of lithic artefacts, one isolated end scraper (KOT000) was collected during a visit in September 2022, a few meters north of the site. Its coordinates were taken with a GPS device produced by Garmin Ltd., Olathe, USA (39°57′33.5″ N–25°16′14.0″ E: Supplementary Materials, Table

S1). This find shows that the site likely originally extended beyond the present exposed surface and part of it may still be buried beneath the sand dunes. Considering the scarcity of information regarding the Upper Paleolithic peopling of this part of the Aegean, we believe that it is important to report the discovery of this assemblage to the scientific community.

The collected artefacts were later stored and studied at the Myrina Archaeological Museum.



Figure 3. Pournias: The team from the Aristotle University of Thessaloniki, during the 2020 field-work season, recording the lithic artefacts on the exposed reddish-brown paleosol, from the north (photograph by N. Efstratiou, 2020).

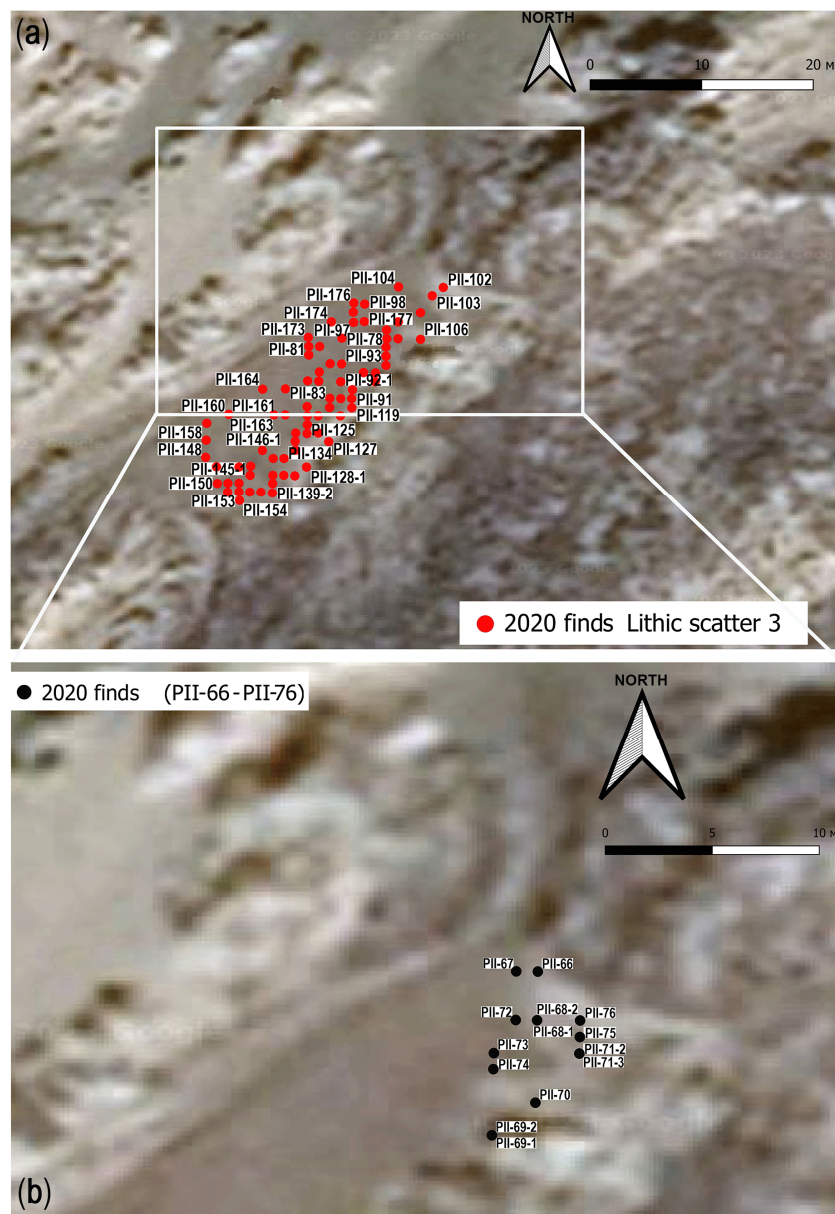


Figure 4. Pournias: The distribution maps (a,b) of the knapped stone artefacts recovered during the 2020 survey (maps by Y. Agafonova and E. Starnini).

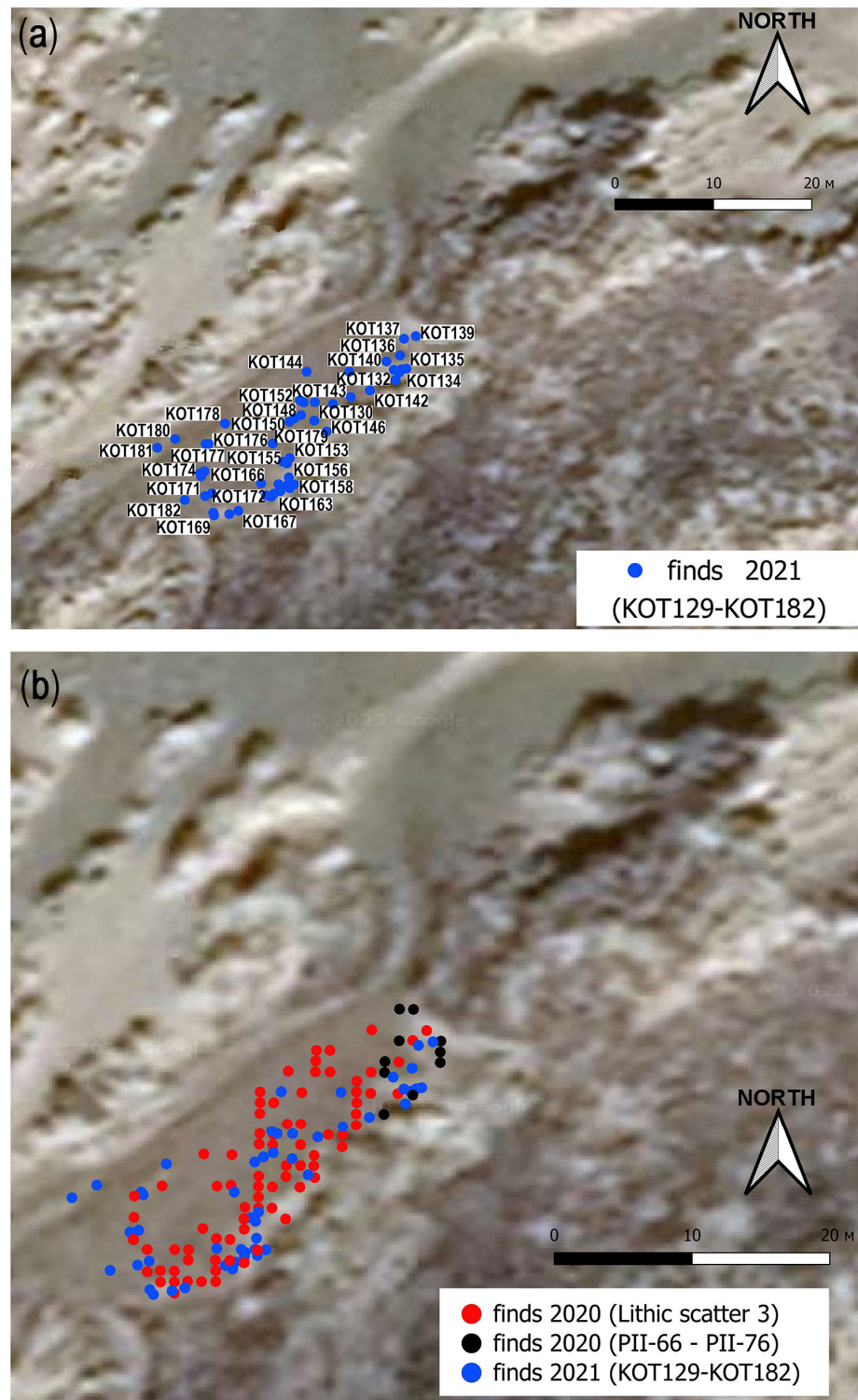


Figure 5. Pournias: The distribution map of the knapped stone artefacts recovered during the 2021 survey (a) and all artefacts together (b) (maps by Y. Agafonova and E. Starnini).

3. Materials and Methods

During the different fieldwork years, the lithic finds were labeled with the prefixes PII (i.e., Pournias II, site 3, 2020 season) and KOT (i.e., Kotsinas, 2021 season). The PII

collection covers artefacts from #65 to #177, and the KOT collection covers artefacts from #129 to #182, for a total of 185 pieces weighing 825.27 gr.

A preliminary analysis of the knapped stone artefacts suggests that Pournias is a homogeneous complex. The artefacts were classified according to the typological lists available for the European Upper Paleolithic [28–30].

The maximum length, width, and thickness of all the artefacts were measured with a caliper and the measurements of the complete end scrapers were plotted for the dimensional analysis.

The raw material employed for making the artefacts consists mainly of chalcedony. One geological sample was collected from a secondary deposit on the island for micro-Raman analysis to verify the accuracy of the visual identification.

4. Results

The assemblage consists of 185 artefacts which, in quantitative descending order, are made of chalcedony, a hydrothermal siliceous rock (175: 94.6%), radiolarite (6: 3.3%), radiolarian chert (2: 1.1%), chert (1: 0.5%), and limestone (1: 0.5%) (Supplementary Materials, Table S1).

All these raw materials are available within a radius of ca. 15 km from the site [1]. Chalcedony, which represents the most employed raw material for making artefacts in this complex, can be found in the volcanic formations on the island, while radiolarites and radiolarian chert pebbles are common in the coarser sedimentary formations, among which are the Ifestia Unit Conglomerates [1,31].

The occurrence of chalcedony was confirmed by combining optical observations at the stereomicroscope and Raman spectroscopy (see Supplementary Materials File S1 and Figures S1 and S2).

At present, hydrothermal alteration areas in Lemnos are located in the western part of the island, the Fakos Peninsula, Sardes, Roussopouli, and Paradeisi Hill [32]. In the latter locality, the outcropping raw material is clearly visible at the top of the small valley upstream from Havouli beach. It was employed for the manufacture of threshing sledge inserts by local farmers until the 1960s ([1], Figure 2; [2], Figure 10).

Only 47 (25.40%) artefacts are complete; 138 (74.60%) are heavily weathered, damaged, or fragmented (Table 1). As reported above, most of the surface weathering is due to the salty environment. In some cases, salt needle crystals form on the artefact surface after collection (see KOT163).

Table 1. Pournias: The composition of the knapped stone assemblage.

Artefact type	Complete	Fragment	Total
Core	2	6	8 (4.32%)
Core rejuvenation	1	0	1 (0.54%)
Carinated end scraper	13	20	33 (17.83%)
Semicircular end scraper	3	1	4 (2.16%)
Long end scraper	0	1	1 (0.54%)
Short end scraper	4	6	10 (5.40%)
Side/transversal scraper	3	3	6 (3.24%)
Backed bladelet	1	0	1 (0.54%)
Bladelet	2	4	6 (3.24%)
Microbladelet	0	2	2 (1.08%)
Flakelet	5	31	36 (19.45%)
Microflakelet	10	61	71 (38.37%)

<i>Tablette/Cornice</i>	3	0	3 (1.62%)
Cortex beach pebble	0	1	1 (0.54%)
Chunk	0	2	2 (1.08%)
Totals	47 (25.40%)	138 (74.60%)	185 (100%)

The retouched pieces are represented by 48 (25.94%) end scrapers (1 long, 10 short, 4 semicircular, and 33 carinated, one of which is nosed and two of which are on tablets: Figures 6–9), five side or transversal scrapers and one bilateral backed bladelet (or point) obtained with abrupt, deep, direct, continuous retouch on both sides (PII-165-1; Figure 6), and one retouched bladelet with straight sides and a trapezoidal cross-section (PII-136-1; Figure 6). Dufour bladelets are not represented in the studied assemblage.

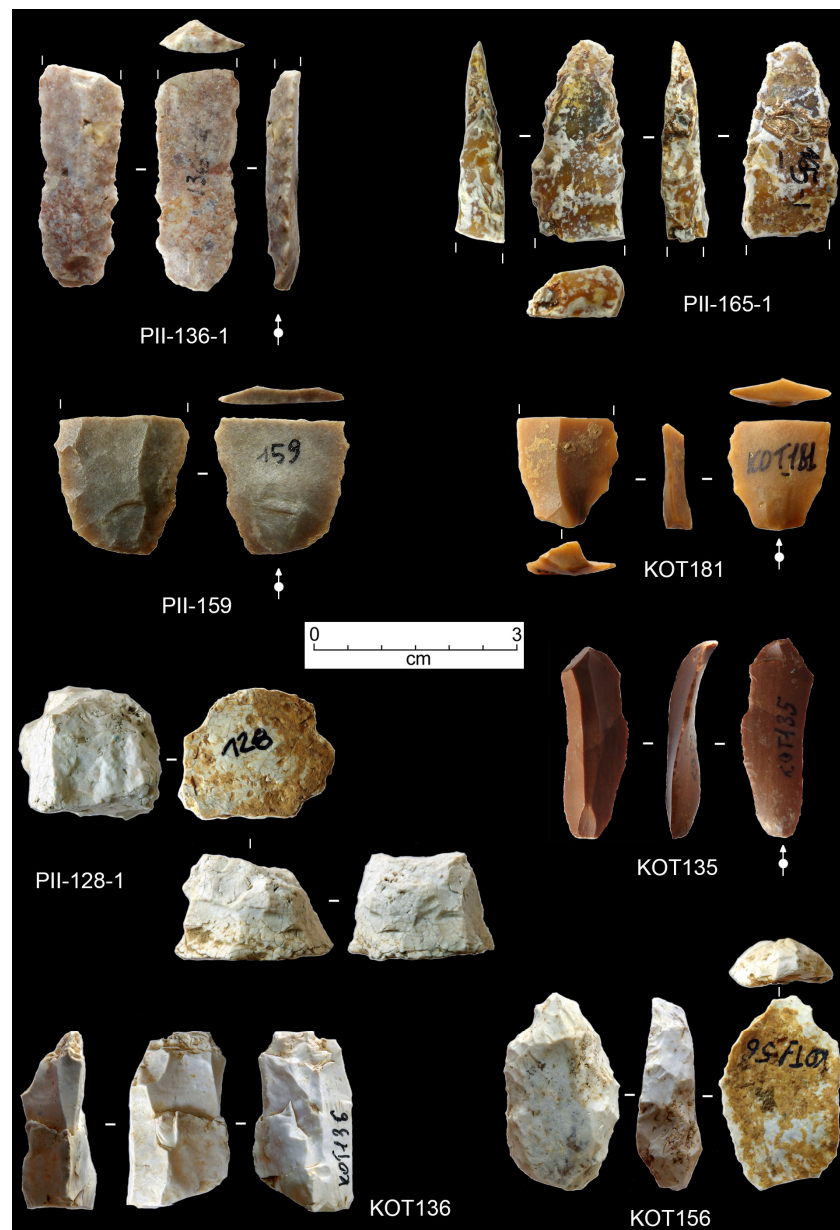


Figure 6. Pournias: Knapped stone artefacts: bladelet [PII-136-1], bilateral backed bladelet [PII-165-1], proximal blade fragments [PII-159 and KOT181], twisted bladelet [KOT135], carinated end

scrapers [PII-128-1 and KOT136], and prismatic core fragment [KOT156]. For details, see Table S1. Dotted arrows show the presence of the percussion bulb, horizontal lines indicate different views of the same artefact (Photographs by E. Starnini).

The length/width–thickness scatterplot of the complete end scrapers shows the high percentage of carinated specimens (Figure 10).

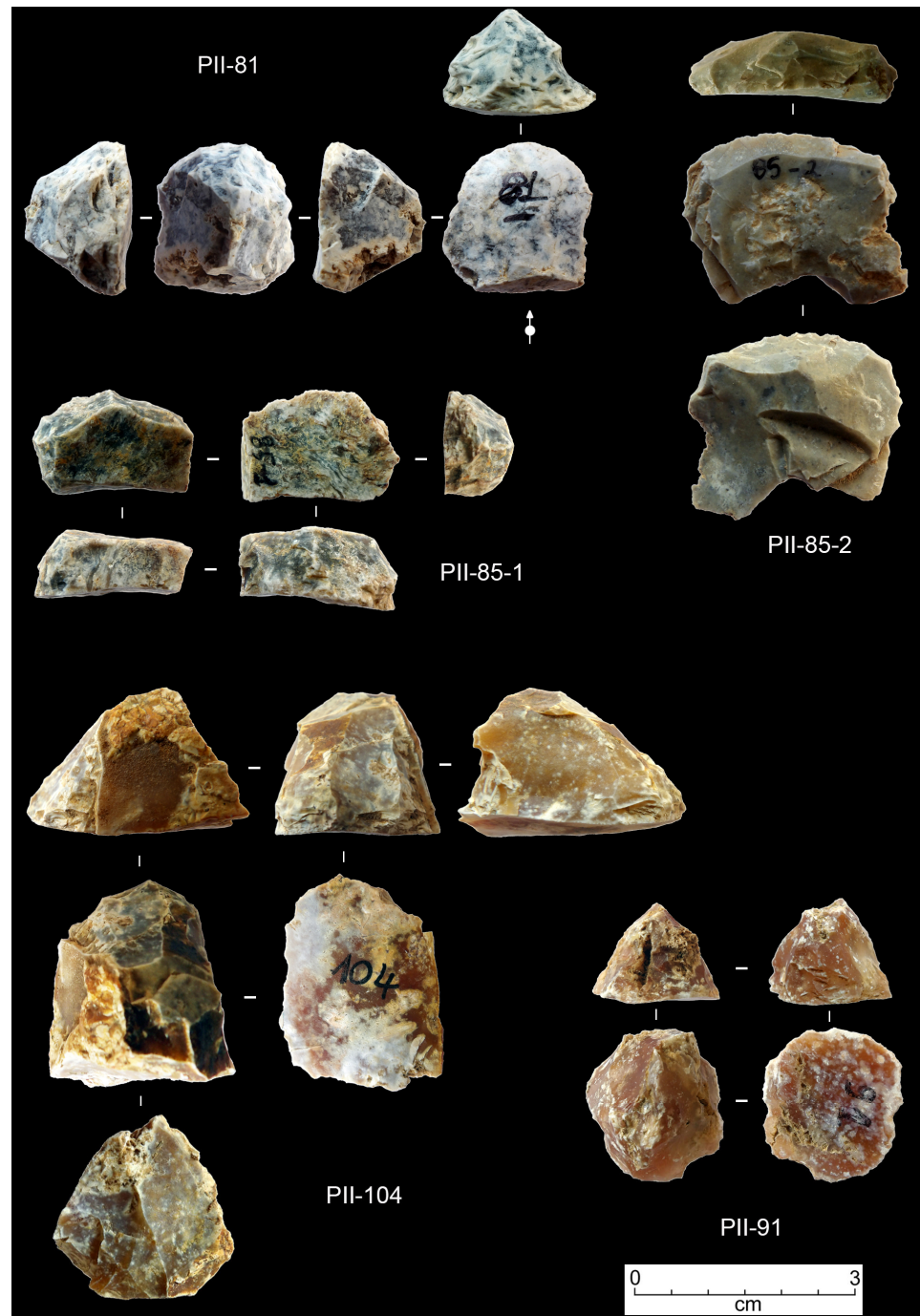


Figure 7. Pournias: Knapped stone artefacts: Different types of carinated end scrapers. For details, see Table S1. Dotted arrows show the presence of the percussion bulb, horizontal lines indicate different views of the same artefact (Photographs by E. Starnini).



Figure 8. Pournias: Knapped stone artefacts: Different types of end scrapers. For details, see Table S1. Dotted arrows show the presence of the percussion bulb, horizontal lines indicate different views of the same artefact (Photographs by E. Starnini).

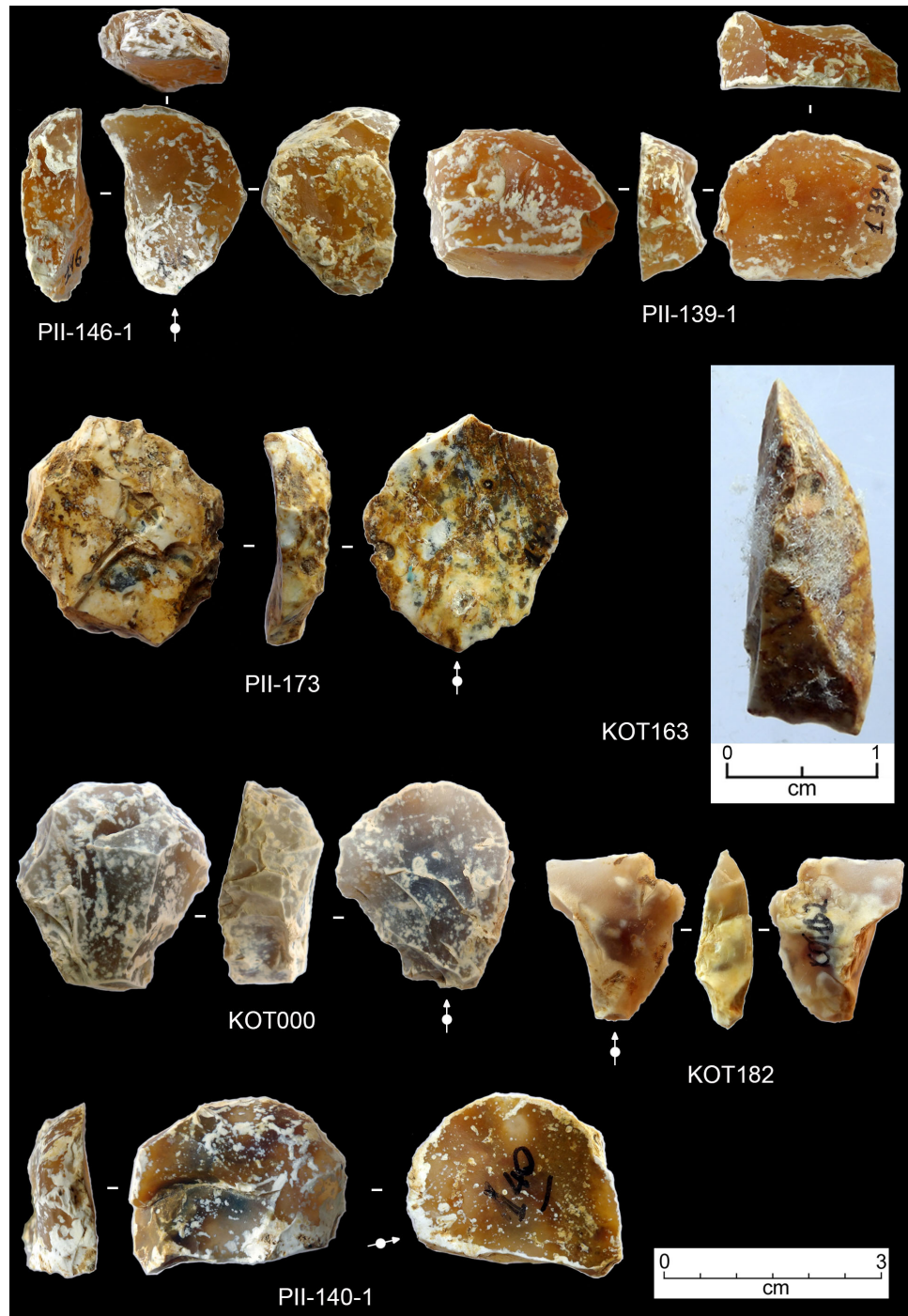


Figure 9. Pournias: Knapped stone artefacts: carinated end scrapers [PII-146-1 and KOT000], carinated end scrapers on *tablette* [PII-139-1 and PII-140-1], *tablette* [PII-173], *cornice* [KOT182], and microflakelet with salt needle crystals [KOT163]. For details, see Table S1. Dotted arrows show the presence of the percussion bulb, horizontal lines indicate different views of the same artefact (Photographs by E. Starnini).

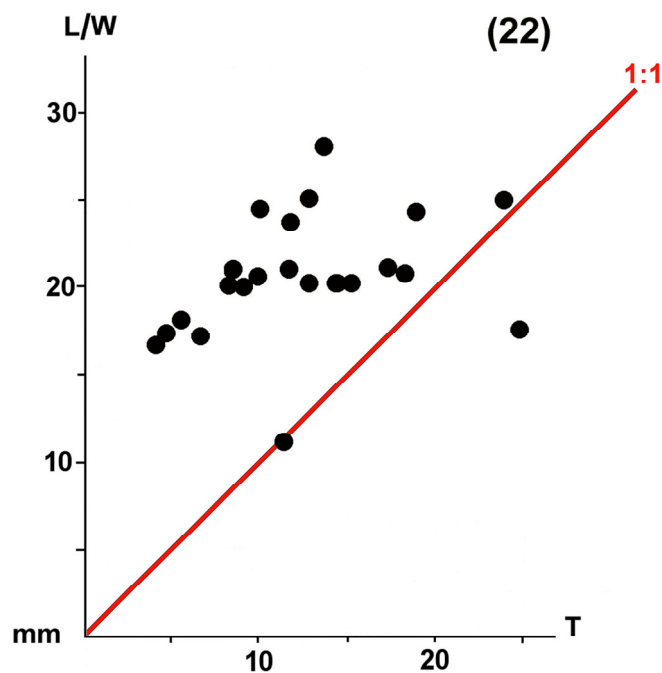


Figure 10. Pournias: The length/width [L/W]–thickness [T] scatterplot of the complete end scrapers (black dots); the red line shows the 1:1 ratio between the 2 values (graphic by P. Biagi).

The technical pieces consist of one core rejuvenation flakelet (PII-135), two tablets (PII-146 and PII-173), two carinated end scrapers on *tablette* (PII-139-1 and PII-140-1), and one *cornice* (KOT182) (Figure 9). There are eight cores (one remnant piece: KOT136) and two raw material chunks (PII-92-2 and PII-137). Three carinated end scrapers were most likely first exploited as cores to detach microbladelets (see [33]). One complete, unretouched red radiolarite bladelet is twisted (KOT135: Figure 6), as is one microflakelet (KOT134), both of which are characteristic of the Aurignacian debitage ([9], p. 14). Most unretouched artefacts are fragmented. They consist of microflakelets (71: 61.73%), flakelets (36: 31.31%), microbladelets (2: 1.74%), and bladelets (6: 5.22%), following the nomenclature proposed by G. Laplace [28]. The presence of cores, one raw material chunk, and technical pieces suggests that the artefacts were manufactured within or very close to the site, exploiting raw material collected from sources available within one day’s walk ([1], pp. 26–27). One of the possible collection areas was most likely the beach, as a few pieces exhibit a neocortical part with characteristic beach pebble scars ([2], Figure 2d). A few artefacts exhibit a flat, inclined butt, a characteristic that fits into the general picture of the early Upper Paleolithic knapping technology [34].

According to the categories proposed by F. Martini [29], the Pournias end scrapers can be classified as hyper-carinated (3: 13.63%), carinated (9: 40.90%), sub-carinated (4: 18.18%), flat (4: 18.18%), and very flat (2: 9.09%). The three classes of more-or-less-carinated specimens (16 out of 22 complete pieces) predominate.

The techno-typological characteristics of the knapped stone artefacts—represented by a high percentage of carinated end scrapers ([35], p. 55), some of which were primarily exploited as cores for the production of microbladelets, a few fragments of twisted bladelet and microbladelets, flat, oblique butts, the employment of the percussion technique, and the homogeneous state of preservation, weathering, and white patina—suggest that they form a coherent cluster. Furthermore, given the impossibility of obtaining

radiocarbon dates, the chronology of the lithic assemblage can only be inferred by comparing its techno-typological characteristics. For example, some carinated end scrapers (PII-81, PII-104, and PII-91: Figure 7) resemble the so-called *nucleus-burin caréné* or *nucleus-grattoir* ([30], Figure 15), which are typical of many European Aurignacian complexes. The characteristic *débitage* bladelet products detached from 2- to 3-centimeter-wide carinated “end scrapers” are not represented in the Pournias assemblage [36]. In contrast, several end scrapers on core *tablette* (KOT178, KOT160, KOT172, and KOT171: Figure 8) reproduce the *semi-tournant* laminar operating scheme of the early Aurignacian ([37], Figure 17). Therefore, based on these common typo-technological characteristics shared with other Aurignacian assemblages in Europe, the site of Pournias can be attributed with good confidence to a period of development of the Aurignacian culture, an aspect that is poorly represented in the Aegean in general [23] and, so far, unknown in the Aegean islands [36].

5. Discussion

The Aurignacian is the first techno-complex related to Anatomically Modern Humans, which “is not a pan-European cultural event with a single point of origin” ([38], (p. 252). Studies show that Aurignacian groups made their appearance around 43–42 kyr cal BP and dispersed rapidly in Europe during the Upper Paleolithic. It is becoming increasingly clear that the events that took place between 45,000 and 35,000 BP are very difficult to interpret due to the scarcity of dated human remains and the complexity of the so-called “transitional period” [9,39]. Recent studies show that Aurignacian techno-complexes made their appearance roughly around 41–40,000 BP in the Balkans [40], and that they dispersed rapidly during the Upper Paleolithic, although the entire process is not yet well understood [18,36]. Conventionally, the Aurignacian is divided into the Proto, Early, Evolved, and Late phases, though the techno-typological and chronological differences between the first two periods are difficult to distinguish and far from being fully understood [18,41,42].

In Greece, Aurignacian and early Upper Paleolithic sites are scarce ([43], p. 60). Some are cave sequences (Franchthi, Klisoura, and Kolominitsa). Open-air sites are known in Epirus at Megalo Karvounari and Spilaion. From the former, Ligkovanlis [44] has reported an Aurignacian component, while the assemblage from the latter is represented by carinated end scrapers and burins, though Dufour bladelets are absent ([27], pp. 138–146). Another open-air surface site is Eleochori, in Achaïa, extending over a surface area of ca. 6–7000 sq meters. The site, disturbed by farming, yielded characteristic Aurignacian artefacts, among which are carinated end scrapers, dihedral burins, and Mousterian Levallois pieces [45].

The discovery of a concentration of knapped stone artefacts at Pournias contributes to the knowledge of the Aurignacian in Southeast Europe and the Aegean in particular. We know that during the Last Glacial Period (LGP), in the first half of the MIS-3, the sea was ca. –60 m below that of the present level, and it dropped to ca. –80 m during the second half ([46], p. 23), [8,47], which is our period of interest, when the Aurignacian culture developed. The Pournias assemblage is not radiocarbon dated, due to the absence of organic material. However, the techno-typological characteristics of the lithic assemblage suggest that the site was settled roughly during this period, when the island was part of the Anatolian Peninsula, remaining connected with the continent until the Younger Dryas ([48], Figure 3).

According to the available radiocarbon chronology, the Aurignacian period in Greece covers a long time span. This is suggested by the dates available from Klisoura (Klissoura) [22] and Franchthi [23], two caves which open in different regions of Argolis

(Peloponnese). The Early and Middle Aurignacian sequence of Klisoura has been radiocarbon dated to between ca. 33,000 and 31,000 BP [49]. Considering the full picture of the Aurignacian radiocarbon chronology of the two caves, the entire cultural aspect developed roughly between $41,080 \pm 390$ BP (OxA-21070 from marine shells at Franchthi) and $15,490 \pm 410$ BP (Gd-10701 from charcoal at Klisoura), although the latter result seems too recent. Another site is the Kolominitsa Cave, which opens in the Mani Peninsula (south Peloponnese), where a probable Aurignacian occupation has been dated to between $34,150 \pm 280$ BP (Beta-333516) and $33,870 \pm 550$ BP (Beta-193416) from charcoal ([50], Table 7.5).

The situation is quite similar in neighboring Albania, where a few open-air and cave sites have been discovered and partially excavated. Only one radiocarbon date is available from the Blazi Cave (COL1958.1.1: $40,713 \pm 827$ BP: [51], Table 1). The lithic assemblage from the open-air site of Shën Mitri consists of carinated end scrapers and microbladelets, but simple burins and Dufour bladelets are absent. According to the excavators, the knapped stone assemblage from Shën Mitri can be chrono-typologically compared with that recovered from the early Aurignacian horizons of the Klisoura cave ([51], p. 158).

Moving east, our knowledge of the early Upper Paleolithic along the Mediterranean coastline is limited to the Karain cave sequence in the interior of the Gulf of Antalya [21].

6. Conclusions

Lemnos is one of the few North Aegean islands to have yielded an impressive number of prehistoric sites and artefacts covering a wide cultural and chronological spectrum, from the Middle Paleolithic [1] to the end of the Bronze Age [52–54]. At present, only a few Middle Paleolithic knapped stone artefacts have been collected from three different locations on the island, the findings from most of which are still unpublished. However, it has been stated that Neanderthals were present in the Aegean from the last interglacial, MIS-5e ([55], p. 148), and Middle Paleolithic industries have been recorded on the neighboring island of Imbros (Gökçeada) and the North Aegean Anatolian coastline [56,57]. Therefore, the possible presence of Middle Paleolithic artefacts in Lemnos is not surprising.

Thanks to the results of research carried out over the last three decades, the island has also shown considerable potential for the study of the events that took place around the beginning and the end of the LGP and its connections with the Anatolian Peninsula and the Balkans during this period.

Following the techno-typological characteristics of the Pournias assemblage, and its location in southern Europe, we can infer that the site can be attributed either to the Early or Middle Aurignacian, according to the subdivision proposed by J.A. Svoboda for the Danube region [58]. The presence of the concentration of lithics at the Pournias site poses a few important questions to solve, including the following: (1) the itineraries followed by Aurignacian hunters moving northwest, (2) the presence of other Paleolithic sites in this part of the Aegean, and (3) the reason why an early Upper Paleolithic community settled in the present Pournias region. To answer the first question, we must consider that we still know very little about this problem. This is made evident by the scarcity of data, which has only slightly improved over the last decades [59], and the absence of early Upper Paleolithic sites in the entire Anatolian Peninsula [60]. This fact makes the discovery of the Pournias site very important. The waters of this part of the Aegean, where Lemnos is located, are shallow. A wide territory around the island was certainly exposed during the MIS-3. Consequently, we can infer that many Paleolithic sites are now underwater, difficult, though not impossible, to detect [61,62]. Moreover, we still know little about the

presence and circulation of knappable raw material along the western coast of Anatolia [56,63,64]. We can infer that Aurignacian hunters were attracted to the Pournias territory due to the presence of rich hydrothermal siliceous rocks [65,66] and radiolarite outcrops available in its surroundings.

To conclude, the discovery of an Aurignacian assemblage on the island of Lemnos is an important event that may contribute to the improvement of knowledge of the distribution and movement of Aurignacian hunters during the early Upper Paleolithic in southern Europe.

Supplementary Materials: The following supporting information can be downloaded at <https://www.mdpi.com/article/10.3390/heritage8040141/s1>: Table S1: Pournias: A list and description of the lithic artefacts studied; Figure S1: A stereomicroscope view of the chalcedony geological sample; Figure S2: Compared chalcedony and quartz Raman spectra; File S1: Raman measurements.

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Data Availability Statement: Data supporting reported results and datasets generated during the study can be found in the Supplementary Materials.

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