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Presence of Neandertals on the Island Agios Efstratios and Probable Networks of Contacts in the Northeastern Aegean during the Middle Palaeolithic

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ABSTRACT

Eight years ago, on a tour at the northern Aegean Sea, I spotted one Paleolithic site with stone industry of Middle Palaeolithic and three Neolithic sites on the small and isolated island of Agios Efstratios. At two subsequent transits on the island, a fairly large material of lithic artifacts, shells and bones was collected. In order to clarify the exact period and type of habitation, Prof. J. K. Kozlowski and M. Kaczanowskavisited the site while later, with the cooperation of the geologist E. Kabouroglou, a surface survey was carried out throughout the island, particularly in the northern part of the island,at the Alonitsi areawhere the Palaeolithic site is. The geological formation and the volcanic activity of the island were studied in relation to the neighboring island of Lemnos, while special consideration was given to the isostatic history of the area, taking into account the position of the island on the Northern Aegean-Anatolian fault. The stratigraphy and stone industry of the site are examined in relation to the Palaeolithic sites that have been found in recent years on the neighboring islands of Lemnos and Imbros, as well as on the Kallipolis peninsula, suggesting a very early communication network.

INTRODUCTION

The Geological History of the Island

The island looks like a rectangular triangle (Fig. 1) with the right angle at Cape Thascoli southeast of Alonitsi and the smallest acute corner at its southern tip in Cape Tripiti. It is located at the western end of the northern branch of the Anatolian fault that crosses across Asian Turkey (Papanikolaou 1986). It is a seismogenic fault of horizontal sliding, with the movement of the northern part to the east and the southern to the west. This fault gives very destructive earthquakes to Turkey because its main branch there is in the continent, while in its western extension to the Aegean is divided in three parts growing in underwater area. Its seismic activities in the Northern Sporades, Agios Efstratios, Lemnos, Lesvos and other regions of Greece are relatively degenerate (Papanikolaou 1986).

Morphologically, the island's relief is intense although it is hilly with the highest hills on its eastern side and narrow valleys mainly in the west, usually along faulting surfaces. Most torrents at the western side are on the faults having a direction E-W. At least 10 of them were counted.

The main geological formation that covers the island about 90% is pyroclastic formations that enclose tephras and irregularly scattered and uncountable pieces of volcanic rocks with a general inclination to west of 10°-15° but locally 20°-25°. Their probable age is Oligocene - lower Miocene (18 - 23 million years, IGME 1985) and belong to the volcanic arc that acted this period north of the Central Aegean including the islands of Lesvos, Chios, Agios Efstratios, Psathoura of Northern Sporades and Euboea (Ktenas 1928, 226; Papastamatiou 1961; Fytikas et al. 1984; Innocenti et al. 2005).

The pyroclastic formations are overlaid by yellow organogenic lime stones in angular unconformity which locally convert to travertine limestones. These formations of Miocene age are marine (shallow marine environment) as evidenced by the fossils they contain (Elasmobranches, Gastropods, Pitchers, etc.). Their appearance is very limited to the south of capeThaskoli at the site of the Osios Efstratios cave. This small cave (about 8m long) is opened in this formation. There is a recent lousy crack in the roof with a 10-20 cm opening across the cave which has created conditions of instability in the roof and the walls. It is probably related with the earthquake of 1968. To the above formations, marls, sandstones, clays and sandstone-conglomerates, mainly of lakes to brackish phases, occupy the northeastern part of the island and cover about 10% of the surface (Fig. 12). The thickness of the formation is estimated to be approximately 120-150 m while their age is most likely Pliocene. The same sediments appear on the smallisl and of Ag. Eleni (Fig. 1), which is just off the Cape Thaskoli, about 800 m to the north, while no pyroclastic rocks are found on it. Obviously the Pliocene sediments extend beneath the sea northwest and northeast of the valley of Alonitsi and reach the islet.

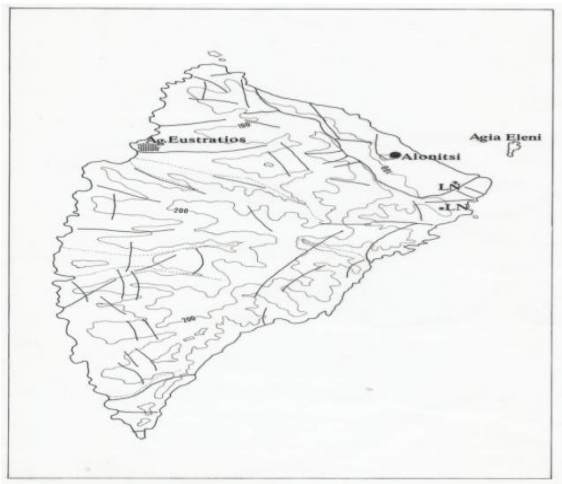

Figure1. *Map of Agios Efstratios with the tectonic faults. LN: Late Neolithic sites in the Alonitsi area.*

Finally, the newer rock formations are alluvial deposits, which occur locally to a small extent along the small valleys and in coastal formations when the terrestrial section is smooth and slightly inclined. Their biggest appearance is in the northeastern part of the island, where a fertile valley is developing along the coastal zone to which the prehistoric site of Alonitsi hill belongs (Fig. 2, 3). Most of this valley is covered by dunes. They are mainly made of non-bonded clay-sand materials, conglomerates, fine sand (when it is of aeolian origin) or compact sandstone-conglomerates when they are beach rocks; their age is Holocene (from 10,000 years to the present).

Tectonics

The morphology of the island is influenced by the old and recent tectonic action on it (Taxidis 2003). The northeastern coastal zone is directly affected by north-west-southeast directed faults almost parallel to the current coastline (Fig. 1). Its western side is affected by breaks almost perpendicular to the present coastline, which act as guides to the direction of the watercourses directed towards the sea.

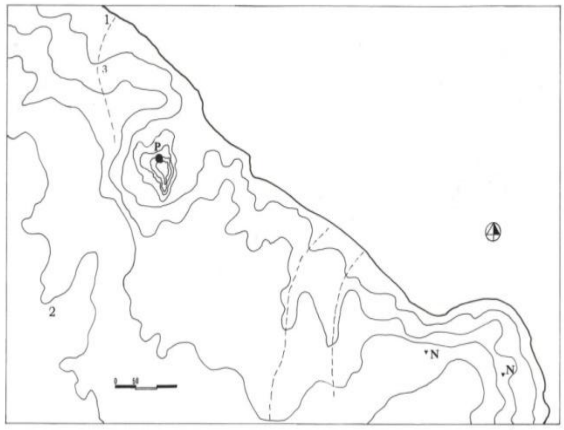

Figure2. *The Palaeolithic site at Alonitsi. N: The Neolithic sites 2 and 3.*

Figure3. *General view of Alonitsi hill. In the background, the rocky island Ag. Eleni or Velia.*

Along those faults, short elongated valleys are formed. Among the two cracks in its western part is formed the largest valley in which the modern settlement of the island is built (Giannou 1983). The most disturbed area is in the northeastern part of the island (Fig. 3, 14) where the above-mentioned Pliocene-Pleistocene sediments appear (Pavlides et al. 1993). The area is dominated by NW - SE normal or left - handed faults that are associated with quadrilateral landslides of the Quaternary. They start south from Agios Athanasios at the northern end of the island and end up at the northeastern end where the Cape Thaskoli is. Due to these fissures, the northeastern part (dominated by the Pliocene sediments) is sinking in relation to the rest part of the island. In the same area right-side lateral sliding faults with a direction NE - SW appear (Pavlides et al. 1990; Pavlides & Tranos 1991).

The Alonitsi Area

It is a lowland area that flows through small torrents and has an extensive sandy beach in front of it (Fig. 2, 3). In the past, it was intensively cultivated with vines and grain, hence the name Alonitsi (*"aloni"* in Greek means threshold).

It is located in the northeastern part of the coastal zone of the island, which is bounded by the NW-SW normal faults mentioned above (Fig. 1, 14).In the middle of the area, there is a hilly ridge (hilltop coordinates in the EGSA 87 is: X: 589652 E, Ψ: 4376346 N) in which Palaeolithic stone tools and bivalve seashells were found. The morphological top surface of the ridge is almost flat with a slope of about 20° and a bend direction while close to the top the slope is reduced to 10°. The lithostratigraphic column of the hill (Fig. 4) near the top of the southeastern slope is presented as follows:

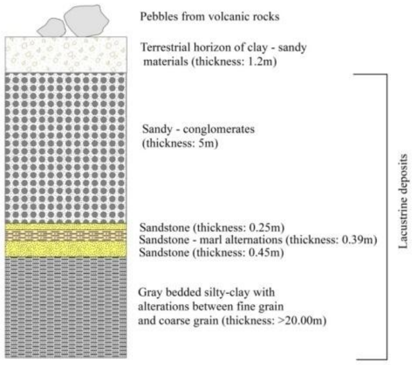

Figure4. *Stratigraphic section of the SE side of Alonitsi hill*

Figure5. *Rounded volcanic rocks on the upper surface of Alonitsi Hill*

- Terrestrial horizon of varying thickness (maximum 1, 20m) of clay-sandy materials into which were found the Palaeolithic artifacts, seashells, cobles ≤ 5cm of varied lithological composition resulting from erosion of the immediately underlying formation. To the northeast, it is destabilized and the underlying sandstone- conglomerate horizon appears.
- Stones and boulders from the earlier volcanic rocks of mainly andesite composition (Fig. 5) are found on it locally. Because there are no corresponding volcanic rocks in the immediate vicinity (they appear only 1,000 meters west of the site at an altitude of ≥ 155m above sea level), their placement is attributed to scrolling by landslide phenomena due to seismic action of the past. Besides, the area as mentioned above is the most disturbed in the island with the most landslides in the Quaternary. In some locations, the boulders are deposited directly on the sandstone due to the absence of the soil horizon (layer 1, fig. 5).
- Lacustrine sandstone and conglomerate pebbles of varying lithological composition ≤ 3cm, though there are even larger ones (Fig. 4, 6). Cobbles of volcanic origin are overflowing but there are also carbonate rocks. The maximum thickness of the layer 2 reaches up to 5 meters near the top. The adhesive is carbonate ($CaCO3$) and aluminate with shells and fragments of sandstone-marls material.
- Lacustrine deposits (Fig. 4, 7).

➢ Fine-grained yellow quartz sandstone.

➢ Swarms of gray argillic marls with fine sand and gray blue sandstone-marls material. Total formation thickness 27cm.

➢ Quartz sandstone with carbonate adhesive, thickness 45cm.

Gray argil-marls lacustrine deposits. Its thickness in the specific position exceeds 24m (Fig. 8). It is the oldest apparent geological formation on the hill. Because of the looseness of this layer, have been created erosion flap and lateral cone formation from unconnected mainly fine particles in the southern, southeastern and eastern slopes of the hill.

Sandstone-conglomerate rock horizon (as number 2) is observed about 550m northwest of the Alonitsi hill, at the northern edge of the valley and near the beach (Fig. 2, site 1; 9). The slope of the formation is northwest about 10°-15°.

Figure6. *Detail of the layer 2 with fossilized gasteropod and cobble with perforations of lithosphere organisms.*

Figure7. *Alonitsi hill. The contact of the sandstone-conglomerate layer 2 with quarz sandstone layer 3a. Below this swarms of marls with sandstone-marl material (layer 3b).*

Figure8. *Lateral cone from unattached mostly silty clay components at the southeastern side of Alonitsi Hill.*

At the southern and southeastern end of the valley on the western slope of cape Thaskoli (Fig. 12) at an altitude of 108m appear, to a limited extent, sandstone-conglomerate cliffs on marl-sandstone layers corresponding to Layer 2 of Alonitsi hill. In the whole western slope where marls appear, exist high erosion phenomena and lateral cone formation from loose material such as at Alonitsi hill. On the top of this cape Palaeolithic implements of opal of the same type as at Alonitsi as well as Neolithic pottery were found.

A significant part of the valley southeast of Alonitsi hill, where the relief is smooth with a very small slope, is covered by surface dunes (recent and fossilized) which in most part are deposited on the gray-blue clay-marl formations. West-southwest of Alonitsi, there are two ridges at an altitude of 99m and 98m respectively, which are mainly built of yellow marls (Fig. 2, site 2). The slope of the formation is about 10° west-southwest and in both appearances the eastern and southeastern slopes form a corrosion flap and a lateral cone of corrosion materials such as at the Alonitsi hill.

Figure9. *Sandstone – conglomerate horizon 550m northwest from Alonitsi hill (site 1).*

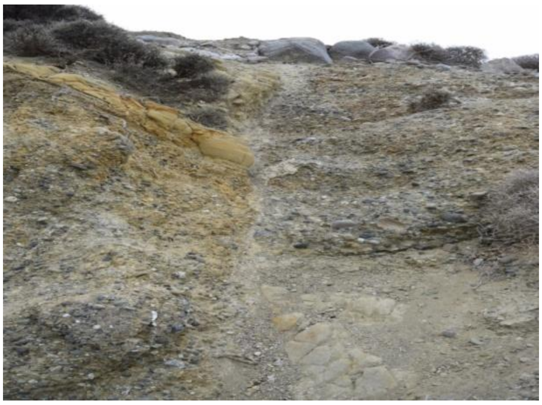

Figure10. *Tectonic fault at the northeastern side of Alonitsi hill. The arrows show the relative movement.*

To the northwest of Alonitsi hill and in a distance of 350m, are two eroded cliffs of gray argil marls, where many small cobbles ≤ 3cm and various bivalve shells have been located (Fig. 2, site 3). The whole morphology of the site suggests the existence of a marine ridge, but there are not all the necessary features to be considered with certainty as a sea platform. The existence of timeless seismicity (old and recent to our days) and the intense erosion have not left clear traces of a sea crest up to 75m altitude. Also, at the southeastern end of the valley near Cape Thaskoli, no evidence was found to justify the existence of a sea bed.

Near the top of Alonitsi hill, there is a vertical rupture that breaks the stratigraphic continuity and has raised the northern part of the hill, compared to the south (Fig. 10). Aerial photos indicate the relative movement of the fault which is parallel to the present coastline. There are also two fault lines of NE direction on the island of Ag. Eleni (Velia), about 800m north of Cape Thaskoli.

Results of the Geological and Archaeological Research

The Pliocene lake - brackish sediments, due to their thickness of ≥120m located at the Alonitsi hill, suggest that in the distant past there was a sizable lake which stretched to the north and east to a great extent. The maximum percentage of these sediments is now submarine between Ag. Efstratios and Lemnos. The limited appearance of carbonate limestones indicates that there are also limestone rocks that are now covered by later sedimentary and volcanic formations. The impossibility of locating sea terraces to be associated with Palaeolithic artifacts is attributed to the old and recent, up to our days, seismic activity on the island.

Although the Middle Palaeolithic stone tools have been extensively dispersed on and around the hill, research has shown that due to the high erosion of layer 1 an excavation in space would not reveal undisturbed layers of this period.

Figure11. *Pieces of the raw material found in the eastern part of Alonitsi area*

By the surface research has also been identified the raw material of Palaeolithic stone industry; the raw material was found in several places. Small pieces of beige brown opal (silt) of parallelepiped shape show a growth in bands of about 10-12cm thickness (Fig. 11). Also, large angular pieces of opal occur on the shoreline of ≤ 50cm.Correspondingly, angular pieces of opal and its native appearance are observed at the southeastern end of the Alonitsi beach. This material is similar to that of the Palaeolithic artifacts. Pieces of limestone with inclusions of silex of corresponding colors were also found in this area.

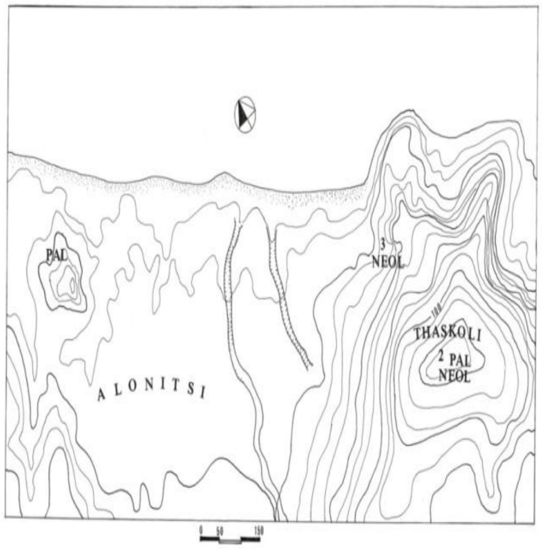

Figure12. *Prehistoric sites at the Thaskoli cape*

A detailed surface survey in Alonitsi area revealed three sites of the Neolithic period (Fig. 2, 12). One of them is at the top of the limestone hill where the small cave of Osios Efstratios is located. The coarse Neolithic potteryfound there does not provide diagnostic data; it probably dates back to the end of the Neolithic period and is the equivalent of ceramics that came from the earliest layer of Poliochni (Bernabo-Brea 1964).

The second Neolithic site was found on the flat peak of Cape Thaskoli, at the same place where the artifacts of Middle Palaeolithic were found (Fig. 12). The third site was presented at the western side of the coastonthe lower slopes of Thaskoli hill, where the opening of a road revealed a prehistoric layer of 0.90 m thickness. The ceramics with typical Late Aegean Neolithic III lugs are similar to those from the cave of Cyclops (Sampson 2008, fig. 2.28: 423, 2.30: 455, 2.33: 512), Ftelia on Mykonos (Sampson 2002, fig. 99, 101, 102) and the

Dodecanese (Sampson 1987, fig. 119, 121). Some Neolithic stone implements were also located at the Alonitsi hill area.

Figure13. *Middle Palaeolithic implements found on Alonitsi hill*

Palaeolithic Stone Industry

About 200 artefacts were collected from the site surface. The analysis of their morphological and technological traits indicates they are Middle and Upper Palaeolithic artefacts, with a small admixture of Neolithic objects.The geological survey revealed that the opal, to which belong the majority of the tools, was found in lenses in limestone (Fig. 11), which forms the background of the island.

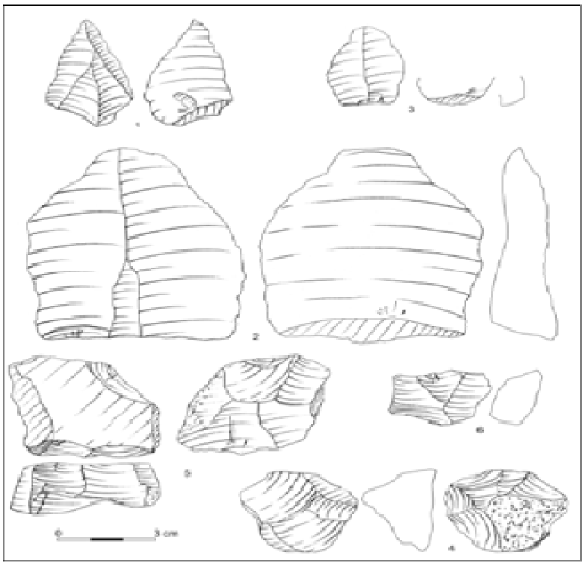

Figure14. *Levallois points (1-3) and different types of cores.*

Middle Palaeolithic materials reveal a relatively small percentage of the Levallo is residual cores no more than 36 mm long, 33 mm wide, and 13 mm thick, pseudo-Levallois points up to 78 mm long (Fig. 14: 1-3) and discoidal core techniques (Fig. 14:4), with the predominance of low flake cores exploited from one or two striking platforms up to 22 m high (Fig. 14: 5,6)

Denticulate-notched forms are clearly predominant among tools: lateral-distal (Fig. 15: 1), bilateral-proximal (Fig. 15: 2), sometimes with lateral obverse and transversal inverse retouch (Fig.15: 3). Lateral (Fig. 15: 4,5) and transversal scrapers (Fig. 15: 6) also occur. Among less common forms one can mention becs formed by notches on blade-like flakes (Fig. 15: 7) or chunks (Fig. 15: 8). Retouched flakes also are relatively well-represented among tools.

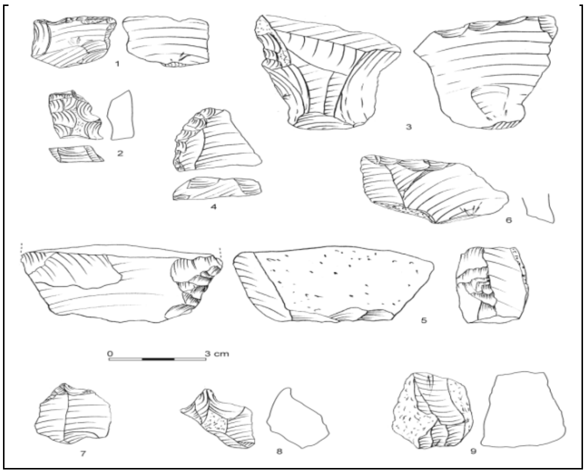

Figure15. *Mousterian denticulates-notched tools and Upper Palaeolithic double platform core (9)*

Thus, we are dealing here with Mousterian with denticulate tools, known from the Aegean Basin. Similar materials, also included into denticulate Mousterian, come from Ucdutlarsite in Kalipolis peninsula (Ösbek, Erdogü 2014).

Upper Palaeolithic artefacts are less numerous in the discussed site than Middle Palaeolithic ones. One can include here first of all double-platform cores, discovered in both the initial (Fig. 15: 9) and more advanced stage of reduction (Fig. 16: 1). Some of them had the orientation changed three times (Fig. 16: 2). A specific trait of this industry is the presence of cores with narrow flaking surface and lateral trimming. A proof for careful trimming can be the presence of a secondary crested blade (Fig. 16: 3). Among the materials recovered from the site there was a distinct group of quite regular, small blades, probably linked with the Upper Palaeolithic. Cultural attribution of the Upper Palaeolithic materials is hampered by the absence of diagnostic forms among the tools, except for a short truncated blade (Fig. 16: 4), and perhaps also a flake fragment with steep lateral retouch (Fig. 16: 5). Splintered pieces (Fig. 16: 6-8) and a flake with splinter retouch on the break (Fig. 16: 9) can also be linked with the Upper Palaeolithic. The absence of end-scrapers and backed pieces makes it impossible to attribute the materials to either Pre- or Epi-Gravettian tradition.

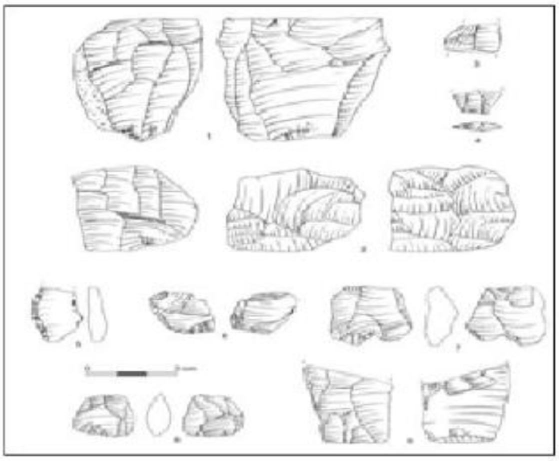

Figure16. *Upper Palaeolithic double platform cores (1, 2), crested blade (3), truncated blade (4), flake with lateral retouch (5), splintered pieces (6-8) and flake with splinter retouch (9)*

A few regular blades with parallel edges and ridges, probably of a Neolithic origin, have also been found on the site surface.

In the same layer, along with the Paleolithic tools, there were many shells (bivalves) which, due to the erosion, appear on the surface (Fig. 17). This species cannot be dated since it has dominated the Aegean Sea for a long period. Into the terrestrial layer 1 except the lithic implements and seashells several ground stone tools were found (Fig. 18).

Figure17. *Seashells from the Palaeolithic layer 1*

Figure18. *Ground stone tool from the layer of Palaeolithic artifacts*

Discussion

So far, numerous Middle Palaeolithic sites, mainly Levallois-Mousterian sites, were registered on the island of Euboea which during the last interglacial (128000-118000 years ago) was connected with mainland (Cherry 1981, 45). During OIS 4 its northern part was connected with the coast of Thessaly and Northern Sporades being a large sub-continent (Sampson 2006) in the form of a long peninsula with a SW-NE orientation, except for a small channel in the strait between Alonessos and Kyra-Panagia and an even smaller one between Kyra-Panagia and Youra(Fig 21). For a second time, the islands remained attached during the Last Glacial Maximum until the early Holocene. The only exception to this, might have been Gramiza Island which Georgiades (2002, 152) suggests that was insular during the LGM.

Middle Palaeolithic sites have been located during a survey on the deserted islands of the NorthernSporades as on Youra, Psathoura and Gramiza. The last one is a precipitous island with a flattened top, where we had collected Middle and Late Palaeolithic artifacts (Sampson 1996, 2008). In Alonessos, a survey (Panagopoulou et al. 2001) revealed several Palaeolithic implements and local sources of flint**,** but not an actual site. In the southern part of Lemnos facing to the northern part of Agios Efstratios, where the Middle Palaeolithic site of Alonitsi is, the site of Ouriakos excavated by N. Efstratiou et al. (2013, 2014) provided a sequence of assemblages with microblade technology based on subdiscoidal, single-platform and double-platform cores. The most characteristic tools are microliths, dominated by segments and bladelets with an angulated back, shaped by steep retouch, often bipolar, but without the use of microburin technique. Other tools are end-scrapers, mostly short and atypical burins (Kaczanowska and Kozlowski 2014**).** The site has been recently dated on burnt bones at the end of Upper Palaeolithic (10 390±45 BP – Efstratiou et al.2014).

Though lithic industry of the Ouriakos' final Palaeolithic stage was not identified in Alonitsi, in Upper Palaeolithic the communication between the two islands towards the end of the last Glaciation (ca. 18.000-16.000 BC),when the fall of sea level had reached its extreme level, approximately 120 meters lower than the present while others claim 150m (Bird and Fabri 1987), would be not easy since even in LGM, it is estimated that Agios Efstratios was not connected to the continent as Lemnos was (Fig. 18). However, the crossing of this small distance between these two islands would be an easy matter. It is estimated that in the transition from the Palaeolithic to Mesolithic (10,000-9,000 BC), the sea level was 80 meters lower than the present, while temperatures were 2-3 degrees lower (Bintliff - Von Zeist 1982, 289).

In the Middle Palaeolithic the communication between these islands should be more difficult because the sea level had already risen, at a level significantly varying between 35 to 55 meters below the present level. However, the visual contact would make the seafaring easier between Ag. Efstratios, Lemnos, Imbros and the continent. A survey conducted in the northern part of Lemnos by the authors of this paper revealed artifacts of Levallois technique in many sites, while the excavators of Ouriakos have reported a Middle Palaeolithic site at the southeastern part of the island (Efstratiou et al. 2013).

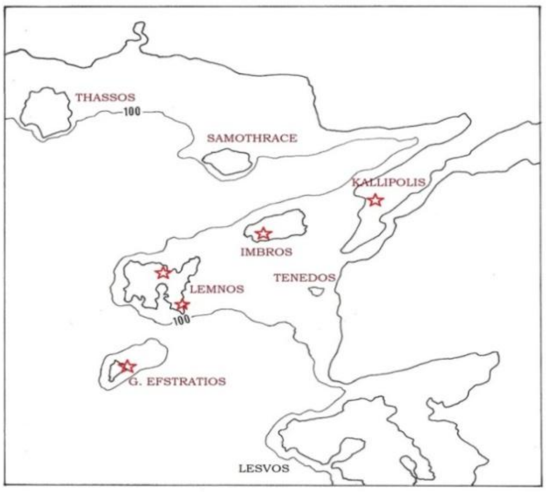

Figure19. *Middle Palaeolithic sites in northeastern Aegean*

The Eskino site in Imbros and the Ucdutlar site in Kallipolis peninsula (Özbek-Erdoĝu 2015) are two other Middle Palaeolithic sites in the northeastern Aegean and it is very likely that along with the aforementioned sites in Lemnos and Ag. Efstratios, should have existed a network of contacts in this early period (Fig. 19).

In the southern Aegean, systematic excavations at the site of Stelida on Naxos yielded artifacts of the same period (Carter *et al.*, 2014). The industry of Stelida is attributed to the denticulate Mousterian with Levallois technology. However, as there are no absolute dates for Stelida, it is not certain whether the island was reached by land or sea route.

The story of the island formation is, of course, a complex and dynamic one. Major advances have taken place in the last ten years ((Lambeck et al. 2004; Lambeck & Purcell 2005; Lambeck et al. 2007; Lykousis 2009; Vacchi et al. 2014) but much work remains to be done regarding questions such as the rates of local tectonic activity on the respective islands. Thus, current knowledge of islands formation at the head of the Aegean Sea is still at the early stage of approximation.We believe that all those changes can be probably attributed to a combination of climatic and tectonic causes, while further intensive investigation is necessary in order to confirm this.

The Alonitsi site possibly documents sea-faring skills of Neanderthals in the Middle Palaeolithic because in OIS 6 and 4, Agios Efstratios was not connected to the mainland (Sampson 2014; Kaczanowska & Kozlowski 2014). The problem is that, as the detailed geological survey in the area has shown the seismicity on the island and the Northern Aegean region in general, is due to the Northern Aegean-Anatolian fault, has created multiple failures (Fig. 1). In terms of eustatic changes, the position of the site - providing no isostatic disturbances occurred during the sea transgression-points to occupation, probably in OIS 5e or possibly OIS 5a or even 5c (Kaczanowska and Kozlowski 2014).

We should consider whether the subsequent seaway linking mainland Greece (Thessaly) to Asia Minor in the Mesolithic and Neolithic existed in Palaeolithic. Although the sea in the northern archipelago between Northern. Sporades and the Chalcidice region is open, often with a very silent undulation, there are many periods of good weather throughout the year, with a calm of one or two weeks in the winter and one week or more in the summer, unlike the Cyclades and the Dodecanese areas where the northern winds are much stronger.

It is self-evident that the Northern Sporades complex forms a continuous chain with northeastern direction. From Psathoura, the northernmost island of the Northern. Sporades, southwards to Euboea there is continuous visual contact between the islands. Although the coast of Chalkidiki, especially Mount Athos, is very often visible from Youra or Psathoura, the great distance of 80 nautical miles has probably discouraged navigation in prehistoric times (Fig. 20). East of Youra, the solitary island of Piperi is very precipitous and inhospitable, and could not have ever favored sailing. Between this point and the closest island of Agios Efstratios, the open sea could have been easily crossed in good weather.

For ships sailing West, the high peaks of Youra are easily distinguished from Agios Efstratios for the greater part of the year, a valuable guide on the route to the SW. On the opposite direction, the low mountains of Agios Efstratios (243 m) and Lemnos (319 m) would not have greatly assisted ships sailing to the NE, as the visibility of these mounts theoretically does not exceed over 35 nautical miles (see *American Practical Navigator, US Navy*, Hydrographic Office 1958). However, under rare circumstances visibility can be significantly greater; Agouridis (1996, 17) notes that in exceptional cases Agios Efstratios, Lemnos, and Lesvos are visible from Skyros.

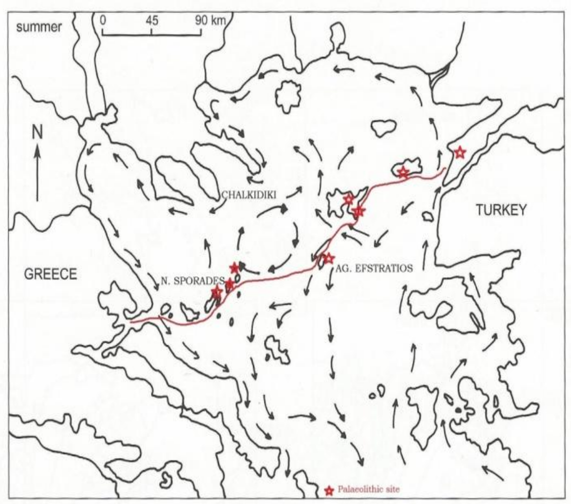

Figure20. *Summer sea currents and probable sea routes in the Northern Aegean (after Papageorgiou 1997)*

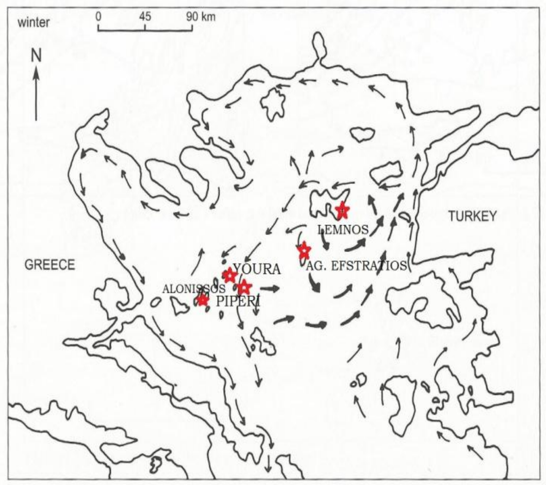

Figure21. *Winter sea currents in the Northern Aegean (after Papageorgiou 1997)*

In addition, sea currents (Fig. 19, 20), which would have been well-known back in prehistoric times (Papageorgiou 1997), played a significant role in seafaring, especially in the Mesolithic and the Neolithic when sails were still not in use. The current of the NE Aegean drifting from Ellispontos to the SW facilitates navigation to N-S directions, especially in the summer season when it is stronger (Fig. 19). Recent studies (Zodiatis 1994) showed that the NE Aegean stream, except for its stable southward course, forms small-scale cyclonic and anti cyclonic flow regions or eddies in the area between Lemnos and the Northern Sporades (Fig. 20), especially in the summer season. These anticyclonic flows facilitate the navigation of small vessels from the Northern Sporades to Lemnos as well as Chalkidiki. In wintertime, anticyclonic flows south of Lemnos would have enabled rowing-boats to follow the current from Skyros to Asia Minor (Fig. 21), and then drift to the NE Aegean assisted by southern winds.

With reference again to the Northern Aegean, the most difficult passage is the one from Lemnos and Agios Efstratios to the Northern Sporades, with strong winds and dangerous currents. Besides this difficult passage, the remainder of the route to the East is fairly easy, as the distance between Lemnos and the coast of Asia Minor is short.

REFERENCES

[1] Agouridis, C. 1997, Sea routes and navigation in the third millennium Aegean, *Oxford Journal of Archaeology* 16, 1-24.

[2] Barakou, A. T, 2000, *Tectonic characteristics of the Northern Greece*, PhD.

[3] Bernabo-Brea, L. 1964, *Poliochni. Cittapreistoricanell' Isola di Lemnos*, Rome.

[4] Cherry, J. F. 1981, Pattern and process in the earliest colonisation of the Mediterranean islands, *Proceedings of the Prehistoric Society* 47, 41–68.

[5] IGME *Geological map of Greece 1:50.000 Agios Efstratios*, Athens 1985.

[6] Efstratiou, N., Biaggi P., Karkanas P., Starnini E. 2013. A late Palaeolithic site at Ouriakos Lemnos (Greece) in the north-eastern Aegean. *Antiquity* [Online] 87.335. Available at: http://antiquity.ac.uk/projgall/efstratiou33.

[7] Efstratiou, N., Biaggi P., Starnini E. 2014. "The Epipaleolithic Site of Ouriakos on the Island of Lemnos and its Place in the Late Pleistocene Peopling of the East Mediterranean Region". *ADALYA* XVII, 1-23.

[8] Fytikas, M., Innocenti, F., Manetti, P., Peccerillo, A., Mazzuoli, R., Villari, L., 1984. Tertiary to Quaternary evolution of volcanism in the Aegean region. *GSL, Special Publications* 17, 687-699.

[9] Innocenti, F., Agostini, S., Di Vincenzo, G., Doglioni, C., Manetti, P., Savaşçin, M.Y.,Tonarini, S., 2005. Neogene and Quaternary volcanism in Western Anatolia: Magma sources and geodynamic evolution. *Mar Geol* 221, 397-421.

[10] Georgiadis, M. 2002, The earliest colonization in the Aegean. The case of Dodecanese, in M. Muskett, A. Kotsida and M. Georgiadis, *Proceedings of the Symposium on Mediterranean Archaeology*, Liverpool 2001, BAR Inter. Series 1040, 150-156.

[11] Giannou, A. I. 1983, *History of the island Agios Efstratios*, Athens.

[12] Kaczanowska M., Kozłowski J.K., 2014. The Aegean Mesolithic: material culture, chronology, and networks of contacts,*Eurasian Prehistory*, 11, 31-62

[13] Ktenas, C. 1928, Sur le volcan de Psathoura, *Proceedings of the Academy of Athens* 3, 226.

[14] Lambeck, K., Antonioli F., Purcell A.,Silenzi S. 2004. Sea-level change along theItalian coast for the past 10,000 yr. *QuaternaryScience Review* 21, 1567–1598.

[15] Lambeck, K., Purcell A. 2005. Sea-level changein the Mediterranean Sea since the LGM: Modelpredictions for tectonically stable areas. *QuaternaryScience Review* 24, 1969–1988.

[16] Lambeck, K., Sivan D., Purcell A. 2007.Timing of the last Mediterranean Sea-Black Seaconnection from isostatic models and regional sealeveldata. In: V. Yanko-Bombach, A.S. Gilbert,N. Panin, P.M. Dolukhanov (eds) *The Black Seaflood question: Changes in coastline, climate, andhuman settlement*. Springer, Dordrecht, 797–808.

[17] Lykousis, V. 2009. Sea-level changes and shelfbreak prograding sequences during the last 400ka in the Aegean margins: Subsidence rates andpalaeogeographicimplications. *Continental ShelfResearch* 29, 2037–2044.

[18] Ösbek O., Erdoĝu B. 2014,Initial occupation of the Gelibolu Peninsulaand the Gökçeada (Imbros) Island in thepre-Neolithic and Early Neolithic *Eurasian Prehistory, 11 (1–2): 97–128.*

[19] Panagopoulou, E., Kotzabopoulou E., Karkanas P. 2001, Geoarchaeological research in Alonessos: New evidence for the Palaeolithic and Mesolithic in the Aegean Basin, in A. Sampson (ed.), *Archaeology in the Northern Sporades*, Munic. Of Alonessos.

[20] Papageorgiou, D. 1997, Currents and winds in the Northern Aegean, in Doumas C. and La Rosa V. (eds), Poliochni e l' Antica eta del Bronzonell' EgeoSettentrionale, Scuola Arch. Italiana di Athena, pp. 424-442.

[21] Papanikolaou, D. 1986, *Geology of Greece*, Athens.

[22] Papastamatiou, I. 1961, The post Alpine volcanoes of Greece, *Archive of Euboean Studies*, 39.

[23] Pavlides, S., TranosN. 1991, Structural characteristics of two strong earthquakes in the northern Aegean: Ierissos (1932) and Agios Efstratios (1968), *Journal of Structural Geology* , vol. 13, 205-214.

[24] Pavlides,S., Mountrakis D., Kilias A., TranosN. 1990, The role of strike–slip movements in the extensional area of Northern Aegean (Greece). A case of transtensiona ltectonics. *Annales Tectonicae*, Special issue, IV,2, 196-211.

[25] Sampson, A. 1987, *The Neolithic period in Dodecanese*, Ministry of Culture, Athens.

[26] Sampson, A. 1996, The Palaeolithic period in Euboea and the Northern Sporades, *Archaeologia* 60, 51-57.

[27] Sampson, A. 2002, *The Neolithic settlement at Ftelia, Mykonos*, University of the Aegean, Athens.

[28] Sampson, A. 2006, *The prehistory of the Aegean: Palaeolithic, Mesolithic, Neolithic*, Atrapos Publishers, Athens.

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

[30] Sampson A., 2014. The Aegean Mesolithic: environment, economy, and voyaging. *Eurasian Prehistory* 11, 63-74.

[31] Taxidis, M. K. 2003, *A study of the historic seismicity of the eastern Aegean islands*, PhD, Athens.

[32] Vacchi,M.,Rovere A., Chatzipetros A., Zouros N., Firpo M. 2014, An updated database of Holocene relative sea level changes in NE Aegean Sea. *Quaternary International*328/329, 301-310.

[33] Zodiatis, G. 1994, Advection of the Black Sea water in the North Aegean Sea, *The Global Atmosphere and Ocean System* 2, 41-60.