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PALAEOLITHIC ARTIFACT TAPHONOMY IN *TERRA ROSSA SITES* AT NORTHWESTERN GREECE REVISITED: TWO NEW CASE STUDIES

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ABSTRACT

One of the great debates in the Palaeolithic research of SE Europe is the taphonomy of stone tools recovered from open-air sites associated with *terra rossa* deposits. Some researchers have claimed that Palaeolithic material can be found *in situ* in these formations, whereas others have excluded any such possibility. During the last fifteen years, excavations have brought to light a large number of lithic artifacts of Middle and Upper Palaeolithic age from the open-air sites of Eleftherochori 7 and Molondra, both located in *terra rossa* deposits in Thesprotia, NW Greece. The study of stratigraphic/spatial context along with the technology, typology, refitting potential, preservation, and surface alteration of these findings leads to clear conclusions about the taphonomy of the artifacts, indicating that at the case of Eleftherochori 7 and Molondra there is no evidence for any in situ recovery of stone tools. Despite this conclusion, we argue that each Palaeolithic open-air site located in *terra rossa* deposits should be considered as a unique case and conclusions drawn about the taphonomy of its findings should be based on the evaluation not only of geological but also of archaeological data.

KEYWORDS: Taphonomy, terra rossa, lithic artifacts, archaeological context, Palaeolithic open-air sites, Northwestern Greece, Upper Palaeolithic, Middle Palaeolithic.

1. INTRODUCTION

Hominin activity in Epirus-NW Greece has been documented since the 1960's through successive surface surveys and isolated excavations, which brought to light numerous Palaeolithic open-air sites. Large quantities of lithic artifacts have been recovered from distinctive, reddish geological formations, known as *terra rossa*, accumulated in karstic depressions of various sizes (Bailey et al. 1993, Runnels and van Andel 2003) and mainly from the thick bedded limestones of the Pantokrator Formation of the Ionian zone (Galanidou et al 2016), by far outnumbering knapped stone assemblages from caves and rockshelters in the area (Fig. 1). From the earliest field research in NW Greece, *terra rossa* deposits were identified as a major landscape feature where Palaeolithic sites could be found and hominin activity could be studied (Dakaris et al. 1964). This observation triggered a systematic effort to investigate the origin, formation processes(s) and chronology/age of the red deposits, which is crucial for the study and interpretation of the lithic material and the archaeological sites. Such 'geoarchaeological cases' (i.e the correlation of specific geological deposits with archaeological findings) are not rare, as it has been shown by the fieldwork experience elsewhere (see for example Sapir et al. 2021).

Figure 1. Terra rossa deposits at Eleftherochori (a), Agia Kyriaki (b) and Megalo Karvounari (c-d), Thesprotia, Epirus.

One of the main objectives in the geological research conducted in open-air sites within red deposits in Epirus was to provide estimations on the age of the archaeological material by dating the geological layers containing it. Yet, in order to incorporate these dates in the archaeological interpretation, first and foremost the stratigraphic association between the Palaeolithic artifacts and the geological layers from which they derived, their taphonomy, needs to be investigated. The term taphonomy is used here in its archaeological sense, i.e. to describe the geological and anthropogenic mechanisms that have had an input in the formation of the archaeological context from the time of the material culture remains deposition until the moment they were recovered by archaeologists (e.g. Dibble et al. 2006).

With the aim to contribute to the ongoing discussion concerning the taphonomy of Palaeolithic artifacts discovered at the Epirus' red deposits, in this paper we review the relative background research and we consider archaeological and geological evidence from two *terra rossa* sites in Thesprotia prefecture - NW Greece: Eleftherochori 7 and Molondra (Fig. 2). By applying a multivariate analysis of the archaeological material available and by studying its stratigraphic distribution we make suggestions about the archaeological context of the two sites, which in this way they function as indicative case studies.

Concerning the terminology used in the present study, it should be noted that according to Runnels and van Andel (2003, 61-62) not all red deposits should be automatically attributed to *terra rossa* (several types of red deposits result from different sedimentation processes and have different ages). To avoid confusion here, where the terms 'red deposits', 'redbeds', or 'red formations' are used instead of 'terra rossa', this is to signify the three distinctive categories of terra rossa-type deposits, as defined by van Andel (1998, 376). In our study the characterization of the archaeological context as primary or secondary follows the classic definitions given by Schiffer (1987).

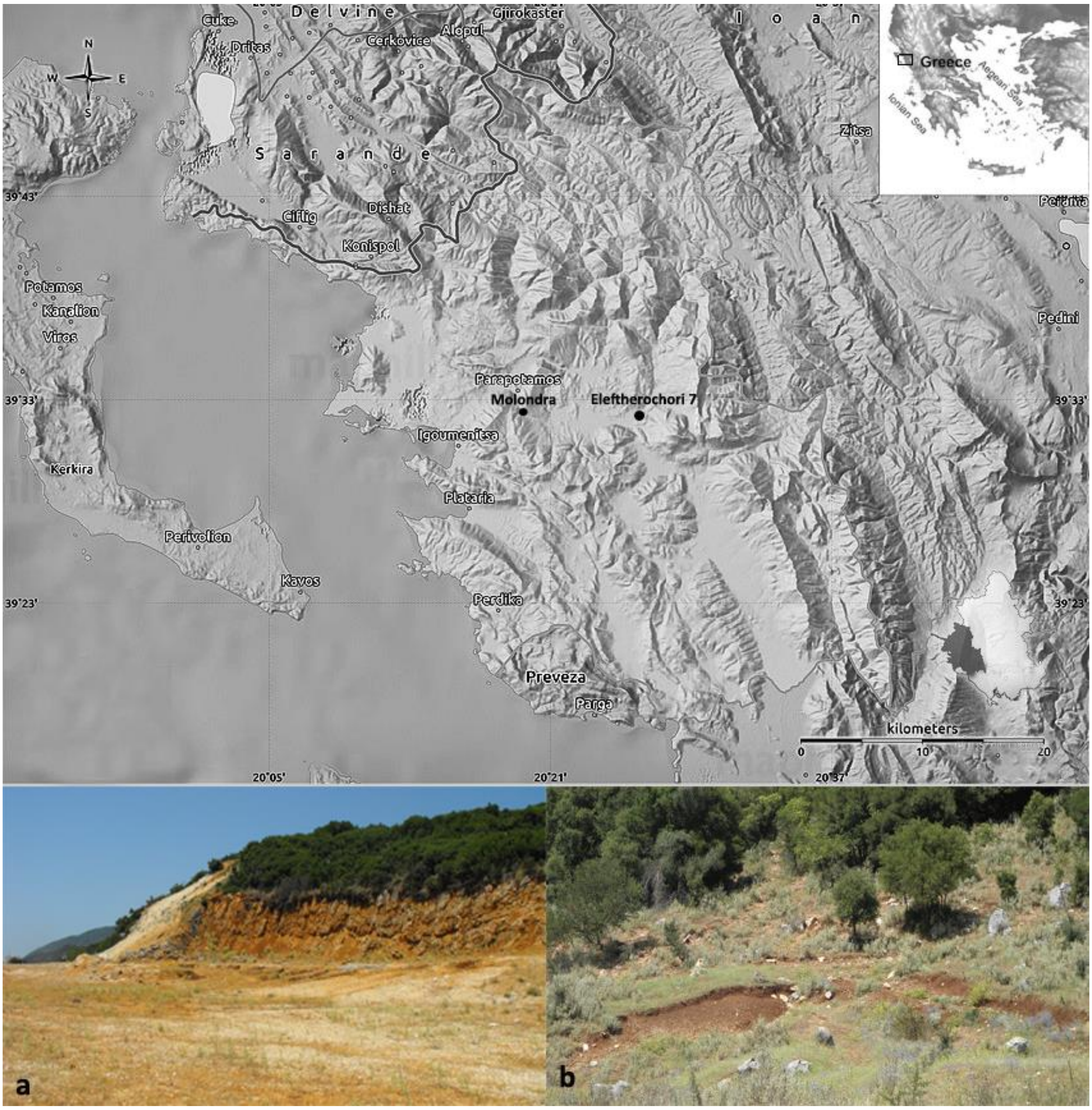

Figure 2. Map showing the location of the study sites at Epirus, Northwestern Greece. a: Elefterochori 7, b: Molondra.

2. BACKGROUND RESEARCH: TWO ALTERNATIVE INTERPRETATIONS

After half century of research, the *in situ* recovery of archaeological material from the Epirus red deposits remains under debate, with two opposing views. The first one argues that Palaeolithic artifacts may have been preserved in primary contexts within *terra rossa* deposits of aeolian, alluvial or colluvial origin (e.g. Dakaris et al. 1964; Higgs and Vita Finzi 1966; van Andel 1998; Runnels and Andel 1993; 2003; Zhou and van Andel 2001; van Andel and Runnels 2005; Tourloukis 2009; 2010; Tourloukis and Karkanas 2012; Tourloukis et al. 2015). This view is based mainly on the suggestion that the formation time of the red deposits coincides, to some extent, with that of the hominin presence. As a result, the remains of Palaeolithic activity, i.e. lithic artifacts, have been successively deposited and then buried within the Pleistocene occupational surfaces. In some cases, such evidence may have remained intact and unaffected by post-depositional processes, such as the erosional action of streams, tectonic activity etc. Lithic finds from the two test trenches in Kokkinopilos open-air site in Preveza, S. Epirus, retrieved by the team of E. Higgs during the survey of Cambridge University at Epirus in the 1960's and considered as *in situ*, were promoted as a primary such example during the early days of research (Dakaris et al. 1964). Until the last few decades, this was the only excavated open-air site in the red deposits of Epirus.

More recently, it has been suggested that in a number of occasions, although archaeological finds may have been recovered from a secondary archaeological context – in the sense that they were moved from their original place of deposition – their stratigraphic association with the geological layer to which they were deposited remains unchanged. In these cases, artifacts are usually regarded as 'geologically in situ', (e.g. Tourloukis 2009; 2010, 73; Tourloukis et al. 2015, 361) or 'in situ in a geological sense' (e.g. Runnels and Van Andel 2003, 96).

Following these lines of evidence and based on absolute dates (e.g. TL, IRsL) for red deposits containing layers with archaeological material considered to be undisturbed, a series of ages have been proposed for either isolated lithic finds or entire stone tool industries. Palaeolithic stone tools from Kokkinopilos, recovered through surface collections, fueled such discussions (e.g. Runnels and van Andel 1993; 2003, Tourloukis and Karkanas 2012; Tourloukis et al. 2015).

Contrary to these interpretations, the second view rules out any possibility to recover *in situ* Palaeolithic material from the Epirus red deposits, arguing that such geological formations are of colluvial origin and that their formation had already been completed during the Middle Pleistocene or earlier, and thus pre-dating the Palaeolithic activity in the wider area (King and Bailey 1985, Bailey et al. 1992; 1993, King et al. 1997). Palaeolithic artifacts are thought to have been deposited on top of already formed *terra rossa* stratigraphic sequences, and then buried in the red deposits due to tectonic activity and erosion that altered the primary environment of the open-air sites. Therefore, *terra rossa* deposits and lithics do not have any stratigraphic association. In this sense, the geological layers are not synchronous with the Palaeolithic remains and therefore the former cannot be used to indirect date the latter. Palaeolithic artifacts from open-air sites, whether recovered by means of surface collection and/or excavation, should not be considered as *in situ* finds, but rather as testimonies of the occurrence of palimpsests of activity, which is impossible to be placed within a specific chronostratigraphic framework.

This view was reinforced by archaeological arguments, with modern reviews on the stone tool industries from Kokkinopilos excavation trenches, suggesting, contrary to the earlier proposals (e.g. Dakaris et al. 1964), that the recovered material was not *in situ*, based on techno-typological features of the lithic finds (e.g. Papaconstantinou and Vasilopoulou 1997; Papagianni 2000).

3. MATERIALS AND METHODS

The purpose of the present study is to contribute new insights into the described long-lasting debate by testing the archaeological and geological context of Palaeolithic artifacts associated with red deposits in Epirus. The material presented here comes from excavations conducted under the auspices of the 8th Ephorate of Antiquities, Greek Ministry of Culture (currently Ephorate of Antiquities of Thesprotia), as part of public construction works (Palli and Papadea 2004). These excavations, although not systematic, and having a rescue character, were the first to be carried out in Epirus '*terra rossa*' open-air sites nearly fourty years after those conducted at Kokkinopilos by the Cambridge team.

The first site, Eleftherochori 7, is located 3.5 km northeast of Paramythia town at an altitude of 615 m. a.s.l. (Fig. 2), and it was excavated during the summer of 1998. The geological formation of Eleftherochori 7 is featured by redeposited *terra rossa*, accumulated in a small karstic substrate (doline) of a 25-acre plateau. In total, fifty-five excavation trenches were cut, measuring 3x3 m., from which over 20.000 lithic artifacts came to light. For the purposes of this study, we used data from excavation trenches H2 and Z2, opened next to each other, occupying an area of 18 m2. From these trenches 3615 artifacts were recovered, tentatively dated to the Middle (≈250-40 Kyr B.P.) and the Upper Palaeolithic (≈40-10 Kyr B.P.), based on techno-typological criteria.

In trenches H2 and Z2, the excavation proceeded by removing successively 10 cm-layers down to a mean depth of 1.5 m. The excavated deposits were not sieved. Two distinct stratigraphic units were revealed: layer 1, a pure reddish (5YR 4/4) clay deposit; and layer 2 having the same characteristics as before, but with a grey spots-appearance in places (Fig. 3). These layers, in both trenches, appeared to be undisturbed macroscopically, an observation which along with the absence of major inclinations of the excavation point left open the possibility that the recovered archaeological material may have come from a primary geoarchaeological context.

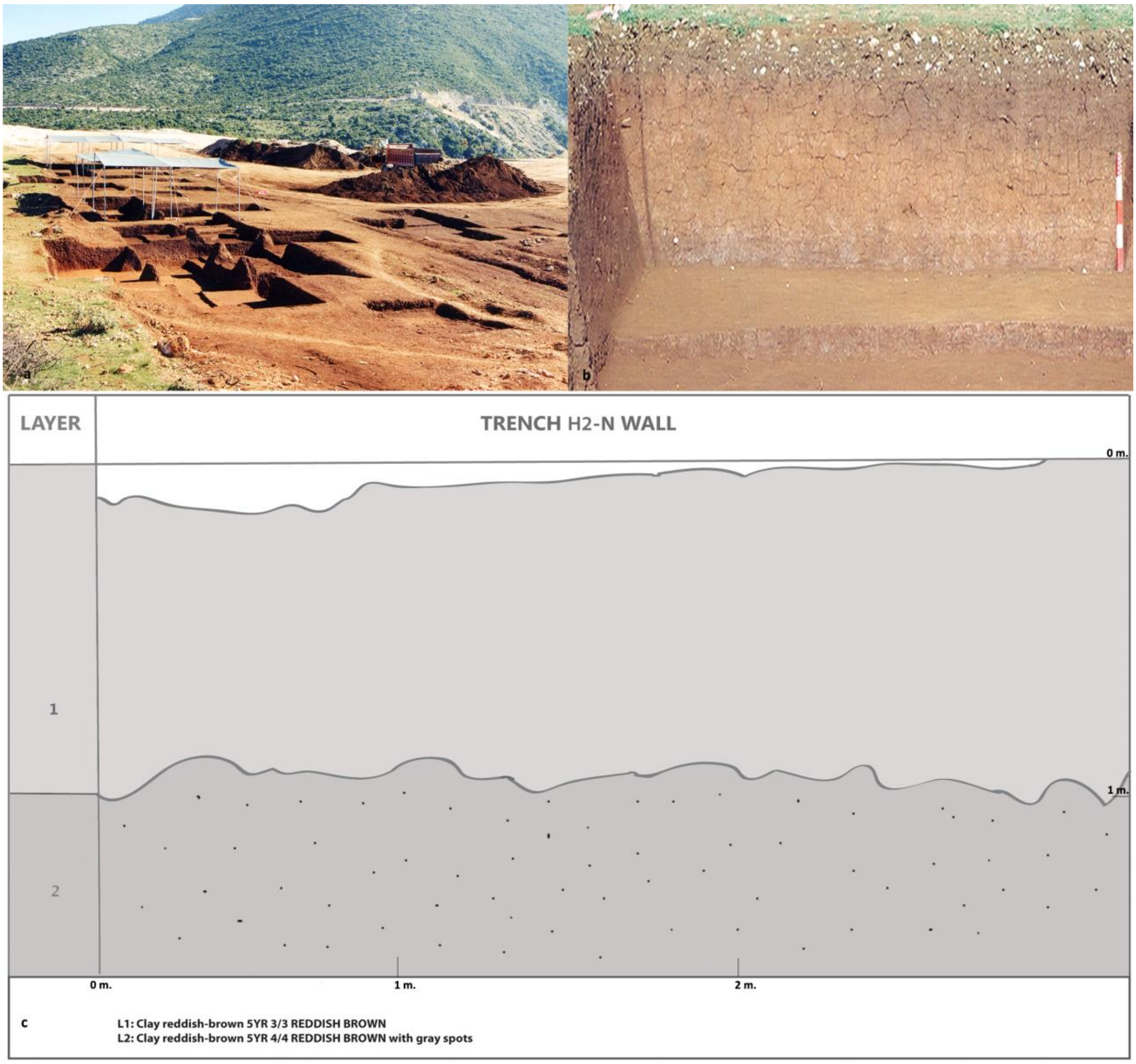

Figure 3. Excavation trenches at Elefterochori 7 (a,b) and H2 trench stratigraphy (c).

Molondra is situated at the 12th km of the old national road connecting Igoumentisa and Ioannina, at an altitude of 215m. a.s.l. (Fig. 2). The site is located on a relatively flat plateau with a total coverage of about 245 acres. The geological formation consists of two different types of redbeds. At the southern part there are colluvial red deposits, while redeposited *terra rossa* is encountered in the northern, less extended, part. Excavations at Molondra, were conducted at the summer of 1999 and were limited at the southern, 'colluvial', part of the site. Six test trenches were opened (D1-D2, A1-A4) and four of them (A1-A4) were located next to each other, covering an area of 36 m2. With the removal of successive 10 cm-layers up to a depth of about 2 meters, 1027 stone artifacts were unearthed. In addition, 105 artifacts were collected from the surroundings of the test trenches. As in the case of Eleftherochori 7, cultural markers assigned the material from Molondra into different chronological phases, with two distinctive components, a Middle and an Upper Palaeolithic.

The stratigraphy of all six trenches at Molondra did not differ, and consisted of four well-defined geological layers: the surface layer, a brown clay deposit (5 YR 4/4), containing small roots and ridges; layer 1, of brown clay (7 , 5 YR 5/4) to reddish-brown (5 YR 3/3); layer 2, of clear brown-red color (5 YR 4/4); and layer 2A of the same color as layer 2, with limestone cracks in places. This last layer yielded archaeological finds only in trenches A1-A4, with the sole exception of an artifact recovered from the test trench 1 (Fig. 4). As in the case of Eleftherochori 7, the excavated deposits were not sieved.

The chances of recovering in situ archaeological material from colluvial deposits, is by definition very small. Yet, not impossible especially in cases where archaeological remains have been deposited on initial surfaces, which were then covered by the colluvial formations and not transferred with them to the final location of their discovery (for more details see Tourloukis 2010, 180-195).

In the case of Molondra, and according to the excavation reports, the first three layers of the stratigraphic sequence (Surface layer, 1 and 2) were disturbed (existence of modern embankments, and recovery of modern objects). However, the lower layer, 2A in trenches A1-A4 is described as undisturbed and could be promising for preserving a primary archaeological or geological context. From this layer a total of 202 stone artifacts were recovered.

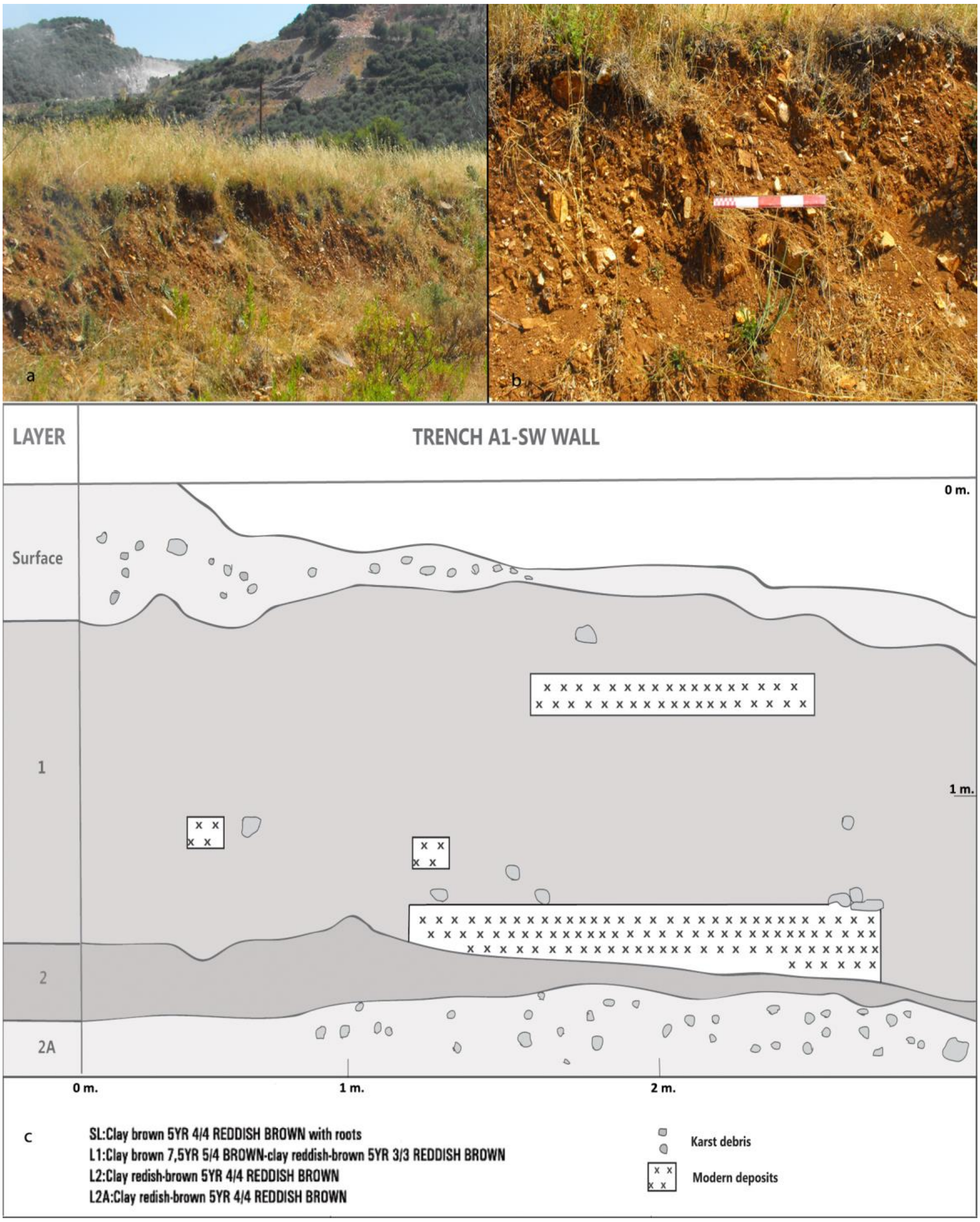

Figure 4. Colluvial deposits at Molondra (a,b) and A1 excavation trench stratigraphy (c).

To get a fuller understanding of the taphonomy of the artifacts included in this study, we relied mainly on the available archaeological data in combination with stratigraphic and general geological observations. Unfortunately, a detailed geological study of the archaeological deposits from the two sites was not possible to be implemented here. Although, in both cases geoarchaeological samples have been collected for further evaluation, these are no longer available (destroyed due to uncontrolled storage conditions).

Given the above limitation, aspects of the following 'archaeological' parameters were co-evaluated in a strict correlation with the stratigraphic distribution of the artifacts derived from every layer in the excavated trenches:

- Chronological markers for the lithics, based on techno-typological criteria. The relative chronology of the artifacts has been estimated using broader cultural frameworks. Yet, only clear, and safe chronological indicators have been considered here (e.g. core reduction sequences, tool types). An *in situ* (archaeological or geological) recovery hypothesis would presuppose a normal vertical 'cultural' distribution of the artifacts within the stratigraphic sequence, with no admixture of objects belonging to different chronological/cultural phases. In this context two broad chronological artifact categories have been created: a 'Middle Palaeolithic' and an 'Upper Palaeolithic' one. A third category refers to indeterminate chronologically artifacts.
- Preservation of artifacts (intact or broken) and rolling indicators (blunt versus 'fresh' edges). Although the preservation criterion is not a clear-cut indicator for the context (not intact objects, i.e. being already broken before their discard, could have been deposited, and thus recovered *in situ*), this parameter was taken into consideration with regards to its uniform -non uniform distribution among the stratigraphic sequence. For example, high rates of intact artifacts within a stratigraphic sequence versus low ones at another one, would be indicative of a potentially different post-depositional history of the objects under study. Regarding the rolling indicator, the presence of both 'rolled' and 'unrolled' artifacts within a stratigraphic unit could be the evidence for a secondary archaeological context.
- Weathering of artifacts by patination. Given that the exact factors and mechanisms which contribute to and affect patination genesis and development remain inconclusive, using such a parameter as a chronological indicator is not safe; still, it can be used as a relevant marker of post-depositional conditions that affect the state of the artifacts (for a more detailed discussion see Purdy and Clark 1987, Burroni et al. 2002, Glauberman and Thorson 2012). Artifacts with the same degree of patination would indicate exposure to similar weathering conditions, for example within an undisturbed stratigraphic unit. Considering uncertainties attached to the patination phenomenon, this parameter was evaluated in relation to the other examined features of the artifacts in this study. Artifacts' patination degree has been measured using four broad categories: 'zero', if patina was completely absent, 'light', if this phenomenon has simply altered the initial color of the artifacts' raw material, 'heavy' if patina has penetrated deep into the artifacts, altering the raw material composition (e.g. artifacts weight). The 'mixed' patina category was used in order to describe artifacts showing different degrees of patination.
- Potential refits. The occurrence of potential refits among the objects of a stratigraphic unit, although rare even in undisturbed stratigraphic horizons of caves and rockshelters, would be a positive indicator of at least a primary geological context.

4. RESULTS

4.1. Eleftherochori 7

Analysis of the features of the lithic artifacts from Elfterochori 7 reveals a uniform stratigraphic distribution pattern as far as relative chronology, preservation and surface alterations are concerned. The general preservation of the lithic assemblage is very poor. Only 19.1% of the assemblage specimens are intact, while many bear clear traces of rolling. These numbers, as mentioned, do not differ significantly between the two layers of the two test trenches, but the rates of intact artifacts are slightly increased in the inferior layers of the excavation trenches.

Considering surface alterations, the vast majority of artifacts are heavily patinated at almost equal percentages within both layers of both excavation trenches. Heavily or slightly patinated artifacts and objects with mixed patina proportions also occur through the entire stratigraphic sequence, although in small numbers. In addition, artifacts bearing clear rolling indicators co-existed with objects in 'fresh' condition within the entire stratigraphy of the site.

As it concerns the relative chronology, artifacts with features attributed to the Middle and Upper Palaeolithic were found mixed in both layers of the excavation trenches, composing a palimpsest, which is impossible to be stratified. Moreover, efforts made to locate lithics belonging in individual reduction sequences (refits) - per layer of each excavation trench, did not produce any results (Figs. 5-6, Tab. 1).

Table 1. Preservation, patination degree and chronology of the Eleftherochori 7 lithic findings by excavation trench and layer.

	Preservation		Patination				Chronology		
	Intact	Broken	Zero	Light	Heavy	Mixed	Upper Palaeolithic	Middle Palaeolithic	Indeterminate
H2 1	345	1622	12	105	1811	12	220	240	1507
Z2 1	171	754	7	23	877	7	82	142	701
H2 2	95	282	3	18	348	3	43	82	252
Z2 2	81	265	2	23	318	2	49	53	244
Total	**692**	**2923**	**24**	**169**	**3354**	**24**	**394**	**517**	**2704**

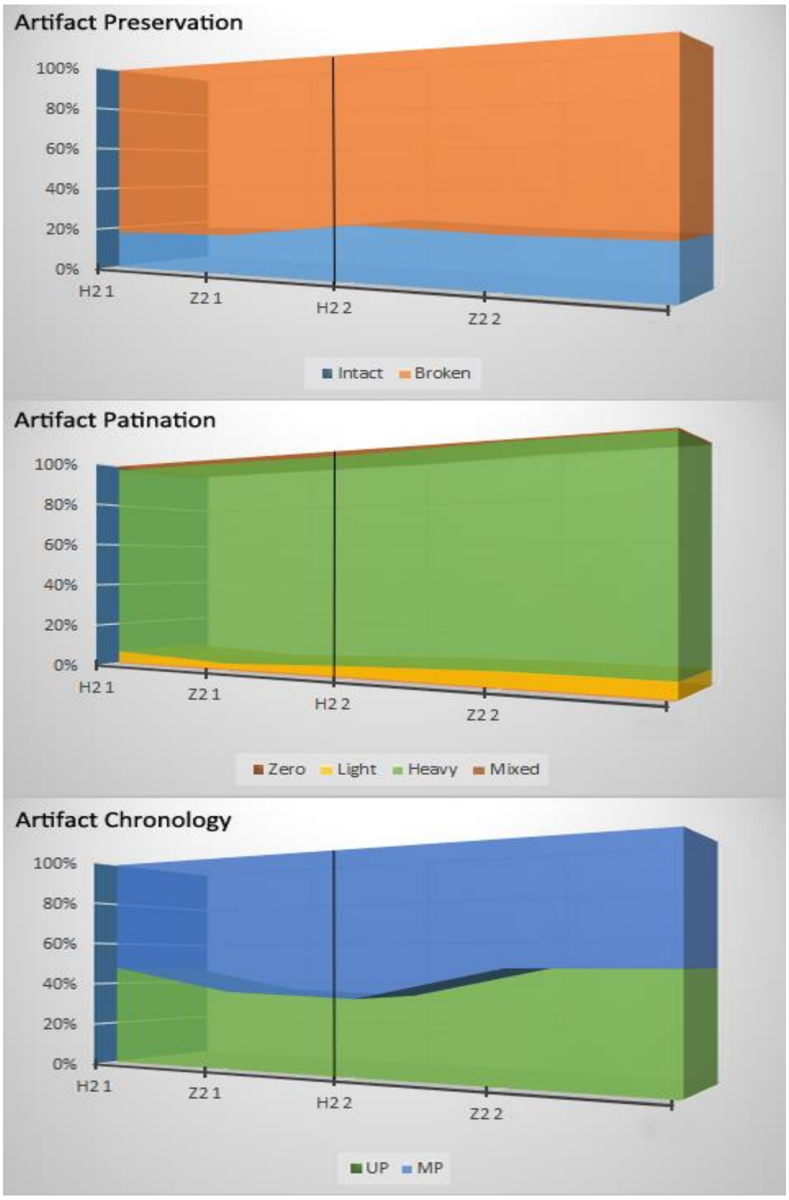

*Figure 5. Graphs with the preservation, patination degree and relative chronology rates of the Elefterochori 7 lithic findings by excavation trench and layer. *Indeterminate artifacts are not included at the artifact chronology graph. **UP=Upper Palaeolithic,; MP=Middle Palaeolithic.***H2 1= Trench H2-Layer 1, etc.*

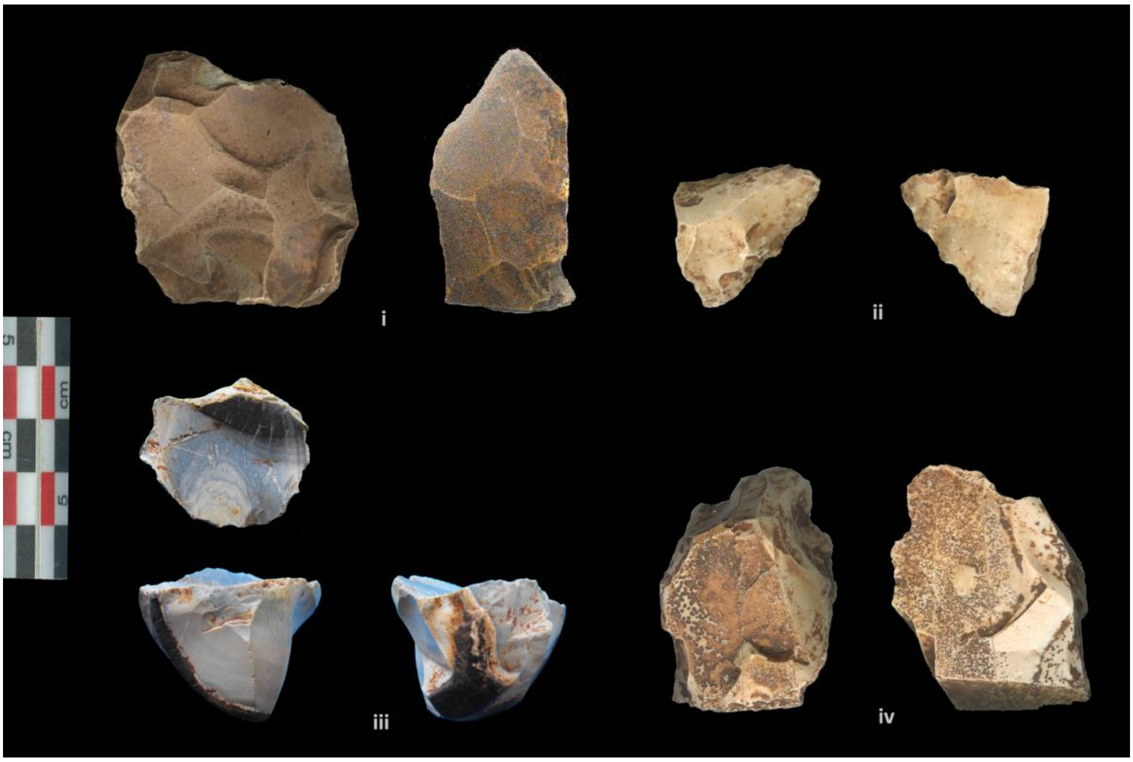

Figure 6. Lithic artifacts from Eleftherochori 7, Trench H2-Layer 2. i: Unifacial discoid core ii: Dejete scraper on pseudolevallois point iii: Laminar, unipolar, tournant core iv: Thick-nosed endscraper.

4.2. Molondra

Results from analysis of the stratigraphic distribution of artifacts' features from Molondra present a more complex picture than the one observed at Elefterochori 7. At Molondra, preservation is relatively better than in Elefterochori 7, but in some cases, it differs significantly between the layers of the excavated trenches. This difference is not necessarily the result of the stratigraphic sequencing, i.e. it does not reflect a 'stratigraphic normality'. In some cases, layers regarded as clearly disturbed (e.g. layers with modern embankments) show a high rate of intact artifacts relative to those considered to be undisturbed (e.g. Layer 2a of trench A3 and A4), whereas in the case of Layer 2A of the trench A1, referred as undisturbed, the rates of intact artifacts are even smaller than those recovered from surface collections at the site.

Regarding artifact patination, again, the relative indices do not show a 'normal' stratigraphic pattern. Slightly patinated objects came from the same layers as heavily patinated ones - in small or greater proportions. This feature characterizes both the referred as disturbed and undisturbed layers of all excavated trenches (Table 2). Moreover, artifacts with edges in mint condition co-existed with objects with fully blunted edges in almost all layers.

Relative chronology for the Molondra artifacts reveals a spatio-temporal pattern observed also in Elefterochori 7. Within all the layers of the excavated trenches, objects with Middle Palaeolithic attributes were recovered alongside with findings, which have clear Upper Palaeolithic features. Despite this fact, the relative frequency of Middle and Upper Palaeolithic artifacts within the stratigraphic sequence show a rather lineal 'normality'. In most cases, at the lower layers Middle Palaeolithic artifacts outnumber Upper Palaeolithic ones, whereas the opposite is observed in the upper layers of the excavation (Figs. 7-8, Tab. 2). Finally, as in the case of Elefterochori no refitted artifacts have been identified in the whole of the lithic industry, regardless of their provenance, excavation trench or layer.

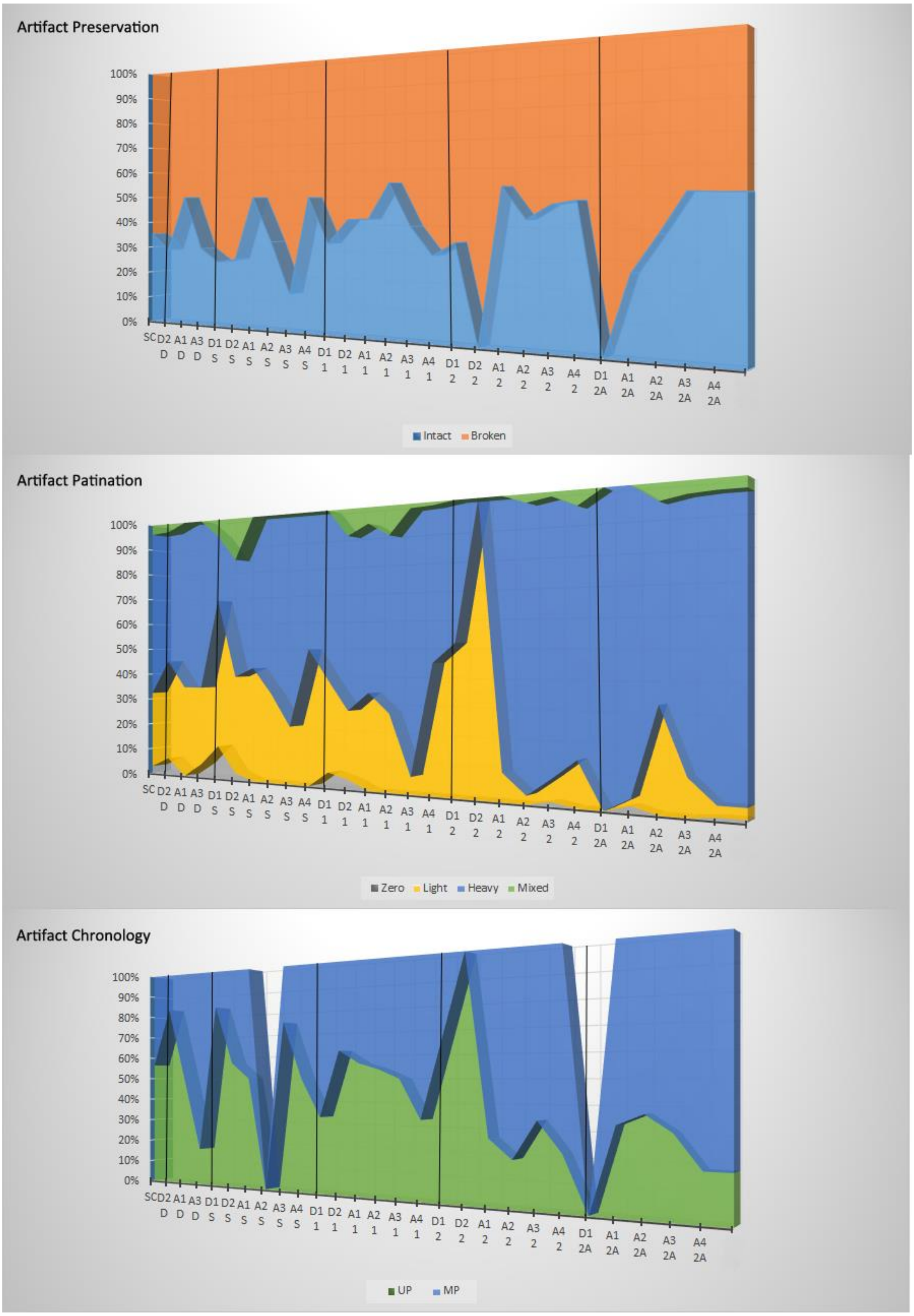

*Figure 7. Graphs with the preservation, patination degree and relative chronology rates of the Elefterochori 7 lithic findings by excavation trench and layer. *Indeterminate artifacts are not included at the artifact chronology graph. **UP=Upper Palaeolithic; MP=Middle Palaeolithic. ***SC= Surface Collection, D2 D= Trench D2-Disturbed deposits…A1 S=Trench A1-Surface Layer…A1 1 =Trench A1-Layer 1 etc.*

Table 2. Preservation, patination degree and chronology of the Eleftherochori 7 lithic findings by excavation trench and layer.

	Preservation		Patination				Chronology		
	Intact	Broken	Zero	Light	Heavy	Mixed	Upper Palaeolithic	Middle Palaeolithic	Indetermi-nate
Surf. Col.*	37	68	3	31	67	4	26	20	59
D2 ME**	9	22	2	12	16	1	10	2	19
A1 ME	10	10	0	7	13	0	3	3	14
A3 ME	6	14	1	6	13	0	1	5	14
D1 Surf.	4	12	2	9	4	1	5	1	10
D2 Surf.	10	28	1	14	17	6	8	6	24
A1 Surf.	7	7	0	6	8	0	3	3	8
A2 Surf.	2	4	0	2	4	0	0	0	6
A3 Surf.	2	12	0	3	11	0	3	1	10
A4 Surf.	3	3	0	3	3	0	1	1	4
D1 1	6	12	1	6	11	0	2	4	12
D2 1	48	66	4	28	71	11	31	19	64
A1 1	22	30	0	18	31	3	13	10	29
A2 1	16	13	0	8	18	3	7	6	16
A3 1	26	39	0	4	60	1	13	13	39
A4 1	26	60	0	39	46	1	11	22	53
D1 2	8	15	0	12	11	0	6	3	14
D2 2	0	1	0	1	0	0	1	0	0
A1 2	22	19	0	4	37	0	7	19	15
A2 2	15	20	0	1	33	1	4	17	14
A3 2	65	71	2	10	122	2	25	48	63
A4 2	29	30	0	9	47	3	8	28	23
D1 2A	0	1	0	0	1	0	0	0	1
A1 2A	12	33	1	1	43	0	0	14	24
A2 2A	7	11	0	6	11	1	3	5	10
A3 2A	13	12	0	3	21	1	5	11	9
A4 2A	59	55	1	4	105	4	12	53	49
Total	**464**	**668**	**18**	**247**	**824**	**43**	**208**	**314**	**603**

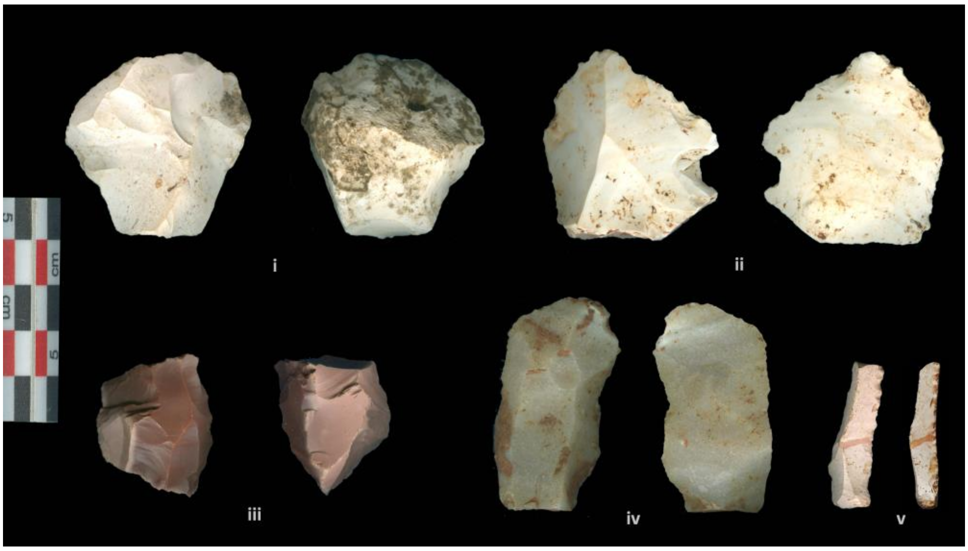

Figure 8. Lithic artifacts from Molondra, Trenches A-Layer 2A. i: Recurrent centripetal Levallois core ii: Notch on Levallois point iii: Laminar, bipolar, semi-tournant core iv: Retouched blade v: Retouched bladelet.

5. DISCUSSION AND CONCLUSION

Examination of the lithics' features presented above, exclude any possibility for undisturbed post-depositional 'environments' for the stone tool industries recovered from the red deposits of Molondra and Eleftherochori 7, suggesting a secondary archaeological and geological context for the objects evaluated here. In both cases a series of observed 'contextual abnormalities' observed are indicative of such an interpretation, even if the rates of the selected attributes under examination (e.g. degree of patination, preservation rates, relative chronology) vary, less or more, between the two sites, revealing most possibly different post-depositional processes. Thus, both at Eleftherochori 7 and Molondra the admixture within every individual stratigraphic sequence of artifacts with different chronological, preservation and weathering features, eliminates the possibility of a primary archaeological context for the examined finds. Such a suggestion would not exclude the possibillity of an undisturbed geological context if we were to deal with a single stratigraphic unit in the two sites. Yet, the 'cultural anomaly' element observed within the vertical stratigraphy in both sites (in every case Middle Palaeolithic artifacts superimpose in some extent Upper Palaeolithic ones) eliminates the chances of the recovered objects coming from what is called as 'primary geological context'.

These results confirm earlier negative assessments (e.g. Bailey et al. 1993, King et al. 1997) about the preservation potential of primary depositional contexts in the Epirus red formations, and consequently on the possibility of getting applicable absolute dates for the archaeological layers. It is worth noticing that the results for some of the artifacts features examined in this study (e.g. patination degree, preservation), do not differ significantly from analogous studies of lithic industries recovered through surface collections in other open-air Palaeolithic sites of Northwestern Greece (Papagianni 2000). This fact in essence emulates the stratified lithic assemblages of the present study with the surface stone industries recovered at the past from the wider area.

Keeping in mind the suggestion made above, still it could not be excluded that *in situ* Palaeolithic material could be recovered from *terra rossa* deposits in the future. A promising such example comes from Mikro Karvounari, an open-air site associated with red formations, where refitted artifacts, though of probable post-Palaeolithic age, occurred from findings that were recovered through surface collection (Papoulia 2011). A future investigation in this or other similar sites could result in the recovery of *in situ* Palaeolithic material.

Figure 9. Wetland of Elos Kalodiki, Thespotia, Epirus.

With regards to the main significance of our work, it becomes clear that sites associated with red deposits should be subjected to thorough, not only geological but also archaeological investigation. The resulted geological and archaeological data should be then cross-checked and co-evaluated within an interdisciplinary framework, to lie a solid background for the study of the material culture evidence (lithics) within its geoarchaeological context. Although such a process seems obvious, and despite more than fifty years of research activity in the Palaeolithic open-air sites of Epirus, detailed geoarchaeological investigation combined with systematic excavation has not yet been fully established as a research practice. The most advanced and well-documented geoarchaeological work in archaeological sites associated with *terra rossa* deposits (e.g. Runnels and van Andel 1993; 2003; Tourloukis 2010; Tourloukis and Karkanas 2012; Tourloukis et al. 2015) has not been complemented by excavations.

The taphonomy, and therefore the indirect dating of lithics recovered from *terra rossa* deposits, seems to monopolise the current discussion. Although this is indeed a major issue, equally important is the body of evidence that can be retrieved through the study of the geological history of the Palaeolithic open-air sites of Epirus, which, as a research field, has a long-lasting contribution to the archaeological interpretation. Despite disagreements over the taphonomic situation – i.e. the chronostratigraphic association between the Palaeolithic findings and the *terra rossa* deposits, it is now commonly accepted (e.g. Bailey et al. 1992; King et al. 1997; Runnels and van Andel 2003; van Andel and Runnels 2005) that these geological formations bordered seasonal or more permanent wetlands in the deep past, which attracted prehistoric hunter-gatherers due to the rich animal and plant resources surrounding them (Fig. 9).

This aspect affects greatly the way we understand and reconstruct palaeolithic hominin survival strategies. Recent, relevant research in the area has significantly enriched our knowledge in this respect (see e.g. Papagianni 2000; Papoulia 2011; Forsen and Galanidou 2016; Galanidou et al. 2016b; 2019; Ligkovanlis 2017).

We suspect that future research in the countryside of Epirus has more to reveal about later Pleistocene hominins, through the recovery and study of the material culture remains, and the better understanding of the ecological parameters (palaeoenvironments and palaeolandscape) involved in the use, discard and deposition of the archaeological material.

AUTHOR CONTRIBUTIONS

Conceptualization, S.L., G.I., O.P.; methodology, S.L., G.I. and O.P.; resources S.L., G.I., O.P. and A.T; data curation, S.L.; writing—original draft preparation, S.L.; S.L., G.I., O.P., A.T. and P.T X.X.; writing—review and editing, S.L., G.I., O.P., A.T. and P.T. All authors have read and agreed to the published version of the manuscript.

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