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The Early and Middle Pleistocene archaeological record of Greece : current status and future prospects

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5 – Pleistocene deposits and the absence of stratified Lower Palaeolithic evidence: two case-studies

5.1 INTRODUCTION

Excluding the investigations at Petralona and Apidima caves, all of the material that has thus far been reported as of (possibly) Middle Pleistocene age has been collected during survey projects (*e.g.* Cherry and Parkinson 2003). The preceding examination showed that many of the finds reported as probably belonging to the Lower Palaeolithic, were either not associated with any stratigraphic context at all, or their inferential attribution to a geological context is more or less problematic. Should this overall lack of stratigraphic control be attributed to the inability of researchers to assess provenance data? Does it stem from insufficient apprehension of the importance of this contextual control for collection strategies? Or is it that, even if every survey project accounts for this need, not every project is able to fulfill it, due to project-inherent reasons? Although positive answers to one or all of the above questions may be given with regard to specific examples, in most of the cases none of the above seem to be primary reasons: more often than not, researchers reporting Palaeolithic finds are fully aware of the significance of provenience investigations, they do engage serious efforts in that direction, and they are almost always assisted by at least a few specialists in geological disciplines.

The shortage and/or total lack of stratigraphic control appears to be first and foremost a result of geomorphic processes and not research-specific biases. To support this argument, I will briefly discuss in this chapter preliminary results from two survey projects in which I participated. Considering them in a historical context, both can be regarded as relatively representative of two main types of survey investigations, which have so far provided the frameworks for the collection of data on the Palaeolithic of Greece (*cf.* Cherry and Parkinson 2003). Although

even more target-specific than its predecessors, the Aliakmon Project followed the lines of the pioneering works of Higgs and Vita-Finzi (and, later, G. Bailey) in having an explicit focus on the Palaeolithic period. In contrast, the still-ongoing Zakynthos Archaeology Project (ZAP) aims to relate the diachronic and spatial distribution of finds to landscape dynamics, and in that respect, it is in line with other previous research with a diachronic dimension (*e.g.* the Nikopolis Project in Epirus). The survey of the deposits of the Aliakmon river did yield artefacts that would fit perfectly in any known Lower Palaeolithic context, but it failed to tie the finds to the local stratigraphy. The ZAP is still in progress, but, likewise, it has so far been unable to relate the Palaeolithic implements (which in this case come in thousands) to a geological setting; one notable exception (see below) is regarded as only confirming the rule. The case of the ZAP is important in one more respect: here, the bulk of the material is of Middle and -to a lesser degree- Upper Palaeolithic morphology, a picture emphasizing the fact that, wherever landscapes are much disturbed, the lack of stratigraphic control is a problem for almost any kind of finds from the Quaternary. If goals are not at issue and technical constraints not always a good excuse, it is most likely the available geological opportunities that prevent us from realizing what the Latin verb *contexere* originally means, namely ‘to weave together’ artefacts with a four-dimensional spatio-temporal matrix.

5.2 ALIAKMON SURVEY PROJECT

The Aliakmon survey project was a three-year project (2004-2006) of investigations in the basin of the Aliakmon river, Western Macedonia, North Greece (Fig. 5.1). The results from the first two years of the project have been published elsewhere (Panagopou-

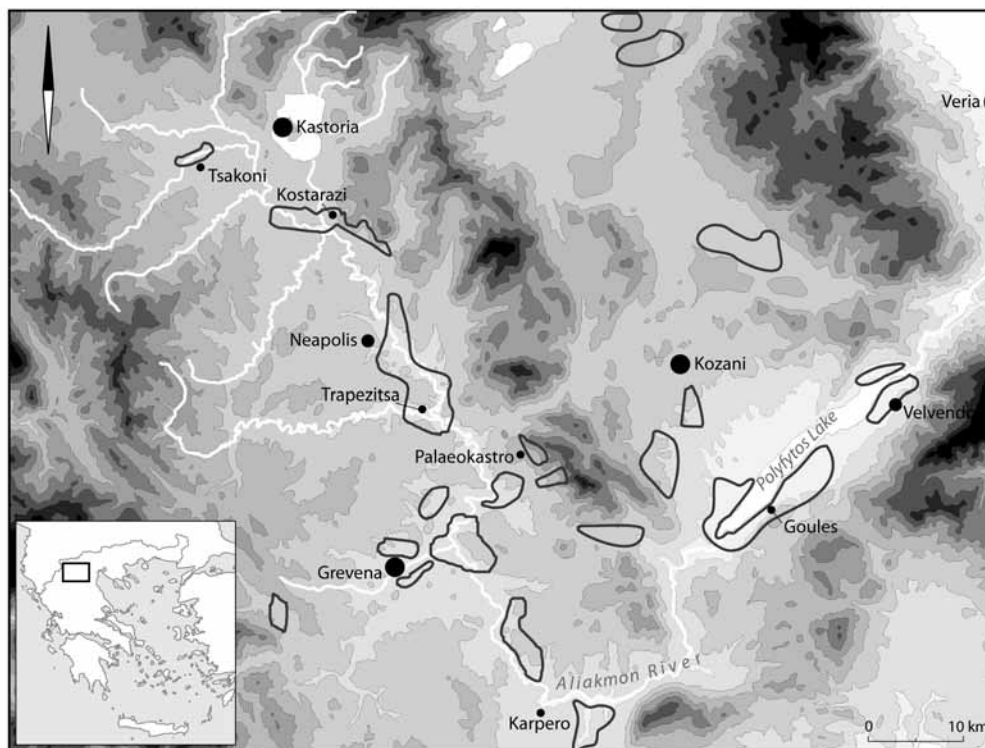


Fig. 5.1 Aliakmon Project: map of the survey area. Modified after Harvati *et al.* 2008: fig. 2.1

lou *et al.* 2006; Harvati *et al.* 2008) and the following review and discussion is based mainly on those publications as well as on my own observations as a member of the survey team during the last two field-seasons. It should be noted here that results from a pilot dating-study (palaeomagnetism, ESR) of the Aliakmon river terraces are pending.

In view of the overall lack of Lower Palaeolithic sites in South-Eastern Europe in general and in Greece in particular, the aim of the project was to locate early Palaeolithic, palaeoanthropological and palaeontological sites, which could potentially add valuable information to the debate about the earliest peopling of Europe. With its explicit focus on Early and Middle Pleistocene landforms, this research can be regarded as the first systematic survey of Lower Palaeolithic sites in Greece. The targeting of fluvial and fluvio-lacustrine deposits in Western Macedonia was justified on the basis of three main premises: (1) Lower Palaeolithic evidence in European/Mediterranean landscapes is most commonly associated with this kind of sedimentary contexts; (2) the Aliakmon, the longest river in Greece, offers the most extensively

out-cropping fluvial deposits of this period (Late Pliocene to Late Pleistocene) in northern Greece: Epirus contains very restricted drainage basins, whilst Early and Middle Pleistocene river sediments in Thrace are deeply buried under younger alluvia; (3) Macedonia had previously yielded not only (presumably Lower) Palaeolithic artefacts (see 4.3.2)⁴⁰, but also significant Pliocene and Pleistocene faunal material; considering these indications, as well as the physiographic course of the river, it is likely that the Aliakmon fluvial system could have dictated dispersal routes connecting the northern Balkans with the Greek Peninsula and -in extent- Asia Minor and the Near East, as the region of western Macedonia is the

40. That is, the handaxe found by E. Higgs in Palaeokastro (Kozani prefecture), but also another (unpublished) biface made on a green volcanic material, which was found during works of the local archaeological service on the shores of the Polyphytos artificial lake, close to the locality from which we, too, collected artefacts later. Note that another survey project in the area of Grevena has documented the presence of Middle Palaeolithic artefacts on highland plateaus (above 1000 m; Efstratiou *et al.* 2006).

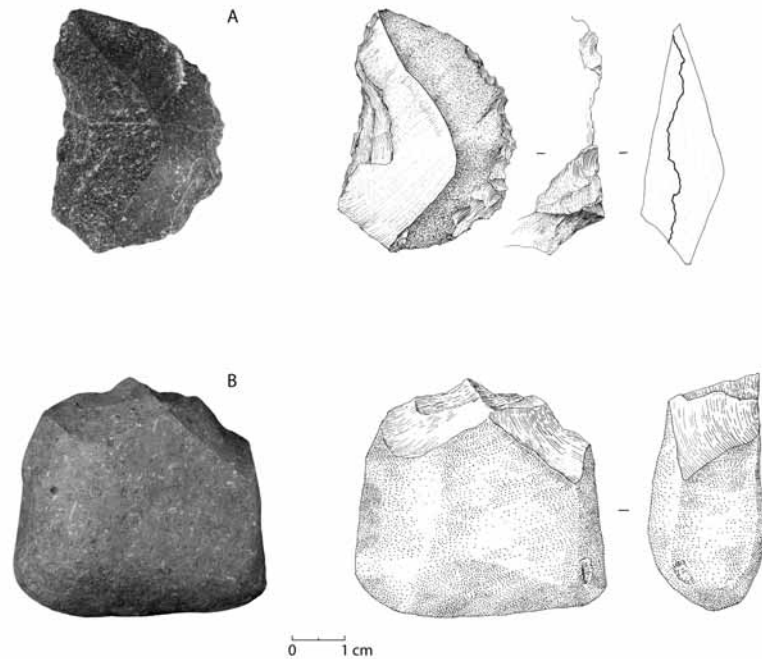


Fig. 5.2 Aliakmon survey project: lithic artefacts from the localities of Polemistra (A) and Karpero (B). Reproduced after Harvati *et al.* 2008: fig. 2.3 and fig. 2.4

main natural passage between north-western and north-eastern Greece.

The methodology of the research was based on selecting specific areas for surveying, according to a set of geological and geomorphological indicators, which were assessed by cartographic means and geological reconnaissance. After selecting the areas, the survey teams concentrated on the systematic investigation of the longitudinal profiles of the river terraces, as well as on examining alluvial fans and fluvial deposits of tributary streams that are often exposed in ravines. Despite serious efforts, we did not find any artefacts *in situ* in the exposed profiles. In total, seventy-four specimens were collected from the surface. In lack of stratigraphic context, it is not possible to firmly ascribe any of the artefacts to a specific period of the Palaeolithic. Nonetheless, two assemblages have been reported as of probable Lower Palaeolithic age, but only on the basis of the morphological characteristics and technological features of the artefacts (Harvati *et al.* 2008, 18). At the locality of Polemistra, nineteen artefacts, made on a coarse-grained volcanic rock, were collected from the lakeshore of the Polyphytos artificial lake. Nine

artefacts made on the same raw material (probably andesite or basalt) were recovered from the surface of a river terrace at the locality of Karpero. Both assemblages consist of cores, choppers, chopping-tools, large primary flakes and a few bifacially-worked tools (but no typical bifaces, such as handaxes; Fig. 5.2). A somewhat similar picture is drawn with regard to the palaeontological findings, although -in contrast to the lithics- some of them were found in stratigraphic context. Relatively dense accumulations were observed at a number of places along the Livakos stream, a tributary of the Aliakmon, which yielded a fauna dominated by *Equus* and probably dating to the Late Pliocene-Early Pleistocene. At the findspot of Kostarazi, several fossils were collected from within a quarried part of a river terrace, including skeletal parts of a proboscidean, remains of a large ruminant (possibly *Megaloceros*) and equids.

Considering the fact that this project had very focused research objectives and targeted very specific areas for investigations, the archaeological and palaeontological findings were arguably meager in numbers and of rather low informational value. Most

importantly, the question to be addressed is how to explain the conspicuous absence of stratified lithic artefacts and the overall scarcity of *in situ* animal fossils. In all likelihood, the most plausible answer to this question lies in what I consider as one of the major conclusions deduced by the geological work of the project: the fact that the Pleistocene fluvial system of the Aliakmon appears to have been principally erosional, rather than depositional (Panagopoulou *et al.* 2006).

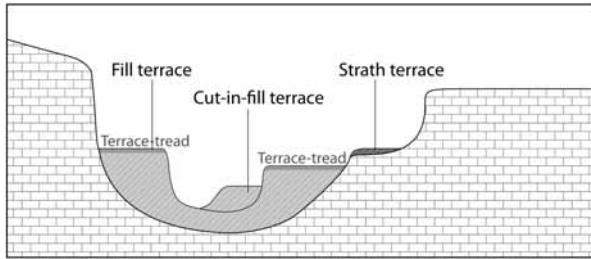


Fig. 5.3 Schematic cross-section of a river valley showing depositional ('fill') and erosional ('cut-in-fill'; strath) river terraces

River terraces are abandoned river channels and floodplains, and are formed when changes in equilibrium conditions force rivers to incise their former valley floors (Fig. 5.3). In the case of *depositional* terraces, sediments were accumulated by either vertical or lateral alluvial accretion, and the surface of the terrace, called tread, represents the uneroded surface of the former level of valley fill; depositional terraces are sometimes called 'fill' or 'aggradational' terraces. *Erosional* terraces are formed when a valley floor becomes truncated by lateral fluvial erosion and subsequently stranded by down-cutting (incision). There are two types of erosional terraces: (1) those that are created when the river cuts down its own, previously deposited alluvium; these are sometimes called 'fill-cut' or 'fill-strath' terraces, but I prefer the use of the term 'cut-in-fill', which is more accurately descriptive; (2) those that are formed when the river erodes the bedrock of the valley; these are called strath terraces. Most of the Aliakmon fluvial terraces are erosional (either of strath or cut-in-fill type), and this reality has important implications not only for the preservation of archaeological material but also its potential emplacement within a regional chronostratigraphic framework.

In most cases, the treads of both erosional and depositional terraces represent palaeo-surfaces that have been in existence since the time of their formation. What does this mean in archaeological terms? Consider that such a tread (palaeo-surface) was formed at, say, 500 ka; artefacts resting today on that surface could have been discarded by hominins at any time between 500 ka and the present. This is the reason why the project focused on the examination of longitudinal profiles, instead of the surfaces of terraces. There is, though, one important point to take into account. In the case of an erosional tread, any artefact scatter lying on the surface will represent an episode of discard much younger than the time-span represented by the underlying deposits (and this is most dramatically exemplified in the case of strath terraces). In contrast, artefacts resting on a depositionally-formed tread *may be* chronologically close to the time-span during which the terrace (and its tread) was formed. For example, if an assemblage that is discovered on the surface of a depositional terrace comprises artefacts of the same raw material and typo-technological characteristics, it can possibly be assumed that the assemblage has been eroded out of the terrace deposits (*e.g.* by deflation) or it has been lying there (undisturbed) since the formation of the terrace. Of course, both of these assumptions need to be cross-checked by various taphonomic and geomorphological indications, and are most convincingly confirmed when similar artefacts are found also stratified in an exposed section of the same terrace; if confirmed, any possible dating of the sediments of the terrace can furnish a chronological estimate for the artefacts lying on it. The point is that no such assumption can be made when artefacts are found on the surface of an erosional terrace: in this case, the artefacts are *de facto* out of context and their provenance can hardly be inferred, let alone demonstrated; needless to stress, the age of the underlying sediments is of no value with respect to the artefacts. This distinction, only sketchily described here, is very important also when assessing the possibility that an artefact-concentration found on the surface may be indicative of more artefacts being buried in the subsurface. In other words, subsurface investigations (*e.g.* with test-trenches) guided by surface artefact clusters are meaningful only in the case of depositional terraces. In the same vein, fossils found on the surfaces of an erosional terrace cannot be corre-



Fig. 5.4 Palaeontological locality of Kostarazi: one of the few instances where a depositional terrace is extensively preserved. For scale, note the cars in the centre-left of the picture. As evident in the photograph, only a small part of the longitudinal profile is exposed, at a locality that is being quarried for commercial purposes; this outcrop yielded a number of large-mammal fossils, but no artefacts

lated to the time of the formation of this particular terrace, as they may belong to a depositional event that is represented by an older (and higher) terrace, which was subsequently eroded down to a lower level.

The geomorphological examination of the study area showed that the depositional or erosional character of the terraces varies from place to place as a result of the complex history of the fluvial system (Harvati *et al.* 2008, 16). Coupled with an overall lack of dates (ibid), it was hardly possible to make secure correlations between terraces found on different elevations—a task that, especially in tectonically active regions, is bound to be problematic, because relative heights of terraces may vary along different reaches of a river due to, for instance, varying uplift histories. Naturally-exposed profiles in the area are overall scarce and quite often the team's efforts were restricted in examining the few quarries that exist in the area (Fig. 5.4). Depositional terraces are preserved only in the form of spatially-confined patches, a fact that further minimized the chance of them having exposed sections. Thus, in identifying the predominance of erosional terraces and realizing the archaeological consequences of this picture, the methodological strategy of the project had to be adjusted accordingly. At a certain point, it was evident that devoting most efforts to the investigation of the

few available outcrops of depositional terraces was not returning any results in terms of find numbers; on the other hand, the intensive scouting of terrace-treads would most probably increase the collection of archaeological material, but this material would have been mostly of secondary context and hence of a restricted value. In retrospective, I believe that concentrating on the search for stratified occurrences was the correct strategy, notwithstanding the fact that our efforts were unsuccessful in that respect. The project may have failed to provide stratigraphically-supported evidence for a Lower Palaeolithic human presence in Western Macedonia, but it did provide indications for another significant issue: that the absence of evidence should not be uncritically interpreted as evidence of absence, for reasons that are briefly explained below.

On the published accounts, a total of 169 fossils were collected. The faunal material includes proboscideans (*Mammuthus* cf. *meridionalis*, *Elephas antiquus*), equids, bovids, canids, cervids, rhinocerotids, suids and possibly hippopotamids (Harvati *et al.* 2008). Considering that almost the entire faunal collection consists of large-sized mammals (the few specimens from a rodent are also from a large taxon), and particularly species with skeletal parts much larger than that of hominins, it can be argued that the prevailing taphonomic circumstances (during and

after terrace formation) would not have overall favored the preservation of the smaller-sized and more fragile hominin remains.

The absence of stratified lithic artefacts or human remains is largely explained by the fact that depositional events are very fragmentarily preserved in the stratigraphic record of the Early and Middle Pleistocene Aliakmon fluvial system: depositional occurrences are restricted to only a few isolated and spatially confined patches of terraces, thereby minimizing the chances of discovering *in situ* finds. Palaeontological finds were scarce, not only inside the exposed profiles, but also on the surfaces of both depositional and erosional terraces. If we take the total number of fossils and of lithics at face value, considering them as the only ‘signal-at-hand’ for the presence of non-human and human species respectively, the non-human signal is not stronger enough to suggest a real absence of humans as opposed to the presence of other species. Instead, both signals seem to be relatively equally biased by taphonomic factors. On the current evidence, humans were certainly present in Macedonia and all of its surrounding regions during the Late Pleistocene, and were definitely present in the nearby Chalkidiki peninsula even earlier, during the Middle Pleistocene (Petalona Cave). As mentioned earlier, the Aliakmon drainage system connects north-eastern with north-western Greece and the northern Balkans with the southern parts of the Greek Peninsula⁴¹, so that it is difficult to envisage Western Macedonia as a blank area in-between populated regions, *e.g.* during the Middle Palaeolithic. The low and not yet stratigraphically attested Early and Middle Pleistocene human signal in Western Macedonia is essentially an artifact of geological biases; this assessment is supported by the fact that it largely involves also the Late Pleistocene human signal, as far as the results from the Aliakmon project are concerned: none of the possible Middle and Upper Palaeolithic finds that we collected was discovered *in situ* in the terraces.

Hence, the available geological opportunities for the preservation of stratified archaeological material within fluvial landforms are extremely small in Western Macedonia. The parameters that biased preservation are to be found in the incision history of the Pleistocene Aliakmon. This history is expected to have been influenced mainly by climatic factors and especially the conditions characterizing glacial stages (*cf.* Gibbard and Lewin 2009) and the transitional periods during climatic switches (*cf.* Vandenberghe 2008). The erosional terraces of the Aliakmon could have formed due to and during the fluctuating cold-climate conditions within glacial stages; the few aggradational episodes surviving in the record could relate to the peaks of the glacial spells, whilst the paleosols that we observed intercalated within terrace deposits would correspond to interglacial periods of overall fluvial quiescence and landscape stability (*cf.* Gibbard and Lewin 2009). Uplift was certainly an important agent at work, but the driving forces behind it are most likely of regional character and tectonic origin (*cf.* Goldsworthy and Jackson 2000). For example, probably resulting from the Pleistocene activity of the Rimmio-Servia normal fault system, the Neogene sediments in the hanging-wall of this system have been tilted to the south-east, with several streams flowing down-dip into what is now the man-made Polyfyto Lake. The artefacts of Lower Palaeolithic morphology that we collected from the shores of the lake (‘Polemistra’ locality) probably derive from Early/Middle Pleistocene terrace deposits to the north-west of the lake. It is very likely that these deposits were first eroded by the streams when the tilting occurred as a result of fault activation. At present, what we see is small and thin remains of those depositional terraces that patchily cap the Neogene substratum, close to the findspot of Polemistra. And what we find is Lower-Palaeolithic-looking artefacts for which we can only hypothesize -rather than demonstrate- that they derive from those now-eroded terraces.

5.3 ZAKYNTHOS ARCHAEOLOGY PROJECT

As part of the Ionian Islands, Zakynthos is situated between the Hellenic subduction zone and the zone of continental collision between the Apulian and Greek platforms (Le Pichon and Angelier 1979). Be-

41. The Aliakmon drains the northern part of the Mesohellenic Trough, a molassic basin that would have served as a natural route between mountain ranges since the early Tertiary.

cause of its position, the island has been subjected to a highly active tectonic regime that includes both extensional and compressional movements, manifested by frequent and intense seismic events (*e.g.* Lagios *et al.* 2007). Nonetheless, Zakynthos preserves the most complete sedimentary archive of the Ionian Islands, with rocks ranging in age from Cretaceous to Holocene (Duermeijer *et al.* 1999). In contrast, its archaeological record is extremely poor, compared to the evidence from the other islands and the adjacent mainland (Van Wijngaarden *et al.* 2006). Historical sources testify to the importance of Zakynthos in Mycenaean, Classical and Roman times, but standing architectural remains from these periods are overall lacking (*ibid.*).

The Zakynthos Archaeology Project (ZAP) aims to relate the spatio-temporal distribution of archaeological remains to the landscape dynamics, hence geoarchaeological and geomorphological investigations are central in the project's program (Van Wijngaarden *et al.* 2006; 2007; 2009). Three study areas were selected to be surveyed, because they include all of the main geological formations and represent different landscape categories. Methodologically, the basic survey unit is the 'tract', which is defined by topographic and geomorphologic features; within tracts, field-walkers survey at 5 m intervals and collect all archaeological finds they encounter (Van Wijngaarden *et al.* 2007). Previously, lithic implements that have been collected as surface finds were attributed to the Middle Palaeolithic (Kourtessi-Philippakis 1999) or to the Mesolithic and later periods (notably Bronze Age; Sordinas 1970) practically on the basis of their techno-morphological traits. Thousands of lithic artefacts have been so far collected during the ZAP 2005-2009 field seasons, but with very few exceptions (see below) all of them are surface finds; moreover, most of the material is typologically non-diagnostic, whilst much of it is significantly weathered and/or patinated. In most cases, artefacts of -mostly Middle- Palaeolithic morphology (and usually patinated) are found mixed with typologically Neolithic or Bronze Age (unpatinated) lithics and/or pottery sherds from late prehistoric and historic periods. This 'background noise' associated with the *mélange* character of the collections appears to be a wider phenomenon, as it equally affects lithic and pottery finds. As a general pattern, the majority

of the material from all find classes occurs in a much fragmented and worn condition, it is usually typologically non-diagnostic and is found in rather low densities. Below, I will discuss why Lower Palaeolithic finds seem to be missing from Zakynthos and why Palaeolithic material -in general- is hardly to be found in stratified positions. Note, however, that the discussion here is based only on macroscopic observations assessed during limited geological reconnaissance.

During the Pliocene, a westward propagating fold and thrust system resulted in the uplift of the Vrachionas anticline in western Zakynthos, whereas activity of the Ionian Thrust segmented a pre-existing Miocene basin into the sub-basins of Alikanas in the centre of the island and Geraki in the southeast (Fig. 5.5; Zelilidis *et al.* 1998). Thrusting continued throughout the Quaternary, causing the progressive uplift of Pliocene and Early Pleistocene sediments, while from the early Pleistocene onwards rapid basin subsidence affects the landscape (*ibid.*). Thus, an important palaeogeographic change of the (late Miocene) basin slope setting occurs already during the Pliocene, culminating in the continued uplift of western Zakynthos and subsidence of the Zakynthos Channel basin from the early Pleistocene onwards. Sedimentological evidence from south-east Zakynthos points to a tectonic influence (faulting) in the accumulation of sediments already from Late Pliocene and throughout the Quaternary (Zelilidis *et al.* 1998), and palaeomagnetic data record a rapid tectonic event occurring after 0.77 Ma and associated with late Pleistocene uplift in (mainland) Greece (Duermeijer *et al.* 1999). This tecto-sedimentary evolution explains why Pleistocene deposits are today limited to the Geraki basin (Vassilikos Peninsula) in the south-east and to a small area in the east, around Zakynthos town: by the Middle Pleistocene, the loci of sedimentation were largely restricted to the Zakynthos Channel basin and its margins, *i.e.* the Geraki basin. In the western part of the island, the Vrachionas Mountain constituted the major source area for sedimentation; on this mountainous setting, Pleistocene sediments occur only as isolated patches that have been preserved in depressions formed in the karst terrain (*e.g.* *terra rossa* deposits, most probably of late Pleistocene age, in dry, karst valleys). Pleistocene sediments on the centre of the island (*i.e.* the

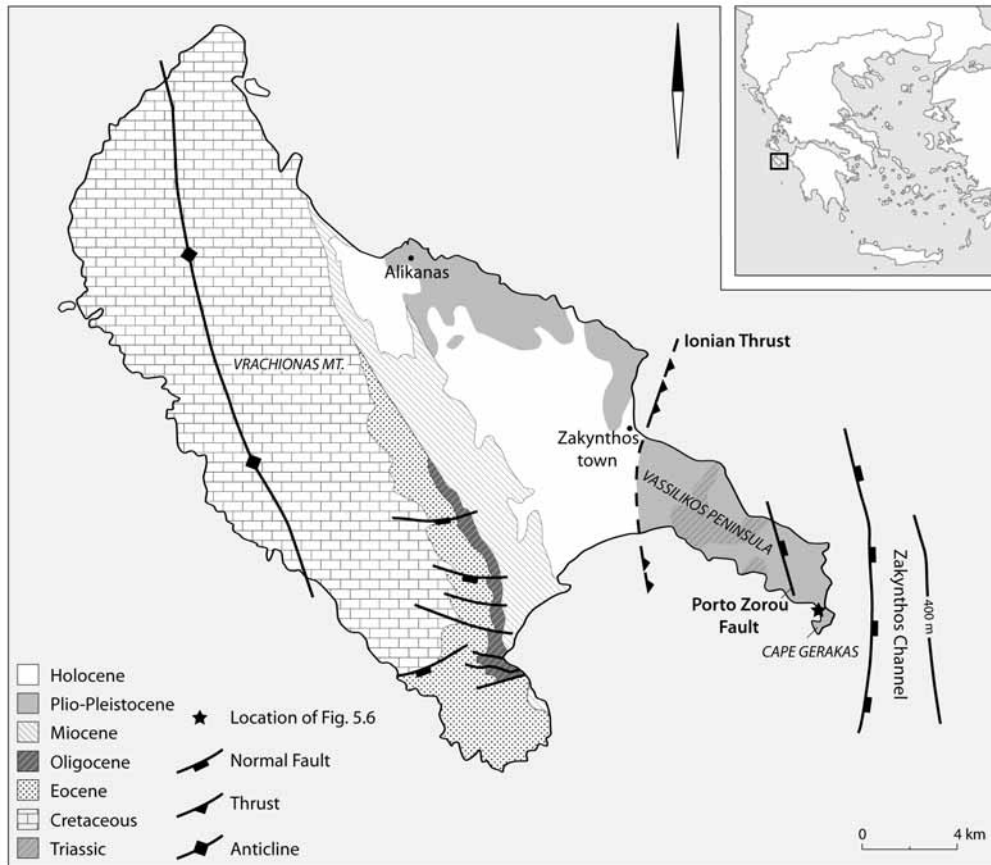


Fig. 5.5 Geological map of Zakynthos. Modified after Zelilidis *et al.* 1998

Alikanas basin) are now buried by Holocene deposits, whilst those that would have been overlying the Miocene deposits directly adjacent to the east of Vrachionas, have been uplifted, tilted and eroded into the Alikanas basin.

In the area between Zakynthos town and Alikanas, the exposures include Pliocene and Early Pleistocene marine sediments (Dermitzakis *et al.* 2000). During a reconnaissance visit of the area together with Prof. R. Caputo (University of Ferrara), we observed red sediments locally overlying the Plio-Pleistocene formations. However, this area is not included in the ZAP study-areas and it was not surveyed; in any case, those uppermost red layers occur only patchily and this is probably why they have not been mapped yet. Most likely, they are terrestrial sediments of late Pleistocene age, and future investigations can check if they contain any artefacts. The peninsula of Vassilikos is the area that has yielded most of the lithic

artefacts collected in the past (Sordinas 1970; Kourtesi-Philippakis 1999) and it also comprises the ZAP study-area with the largest densities in terms of lithic material. Five Formations (Fm), all separated by unconformities, have been defined in the local lithostratigraphic scheme: the Akra Davia Fm is of late Pliocene age, the Gerakas Fm spans the Pliocene-Pleistocene boundary, and the Kalogeras, Porto Roma and Ag. Nikolaos Fm's belong to the middle Pleistocene (Dermitzakis *et al.* 1979; *cf.* Zelilidis *et al.* 1998). Except for the lower part of the Gerakas Fm (which is of Late Pliocene age), all Formations appear to consist of marine deposits, as it is suggested by their sedimentological composition and the presence of marine fossils, and only some locally restricted sedimentary facies of the Porto Roma Fm are recognized as lagoonal sediments (Zelilidis *et al.* 1998). Abrupt transitions from thick mudstones to massive tidal sandstone sequences have been interpreted as the result of eustatic sea-level changes,



Fig. 5.6 Terrestrial deposits (Porto Zorou Fm?) unconformably overlying marine bluish-grey clays (Gerakas Fm), as exposed at the NW part of Cape Gerakas. Inset: detail showing a stratified flake projecting out of the terrestrial deposits

which are superimposed on the effects of subsidence along the Porto Zorou (PZ) fault (*ibid*, 402). The latter was probably the dominant fault associated with the subsidence of the Zakynthos Channel basin in the latest Pliocene; the Late Pliocene-Early Pleistocene Gerakas sediments were deposited in the hanging-wall of the PZ fault, which marked the western margin of the Zakynthos Channel (Zelilidis *et al.* 1998). At some point in the middle Pleistocene, a new master fault is formed, defining the present western boundary of the Zakynthos Channel; the area that was previously the locus of (marine) sedimentation as the down-thrown block of the PZ fault becomes now uplifted and back-tilted as part of the footwall of the new master fault; as a result, marine sedimentation is terminated (*ibid*). Then, from the middle Pleistocene onwards, non-deposition and erosion prevailed in the area due to progressive uplift.

The only (Pleistocene) terrestrial sediments in the area are the 7-m thick mudstones of the late Pleistocene Porto Zorou Fm. The latter was defined by Zeli-

lidis *et al.* (1998) and it is not mentioned in the publications of researchers who visited the area previously. In 2006, I examined a profile at the north-western part of the Gerakas Cape and I suggested that these sediments could be correlated with the Porto Zorou Fm (see Van Wijngaarden *et al.* 2007), because it fits the description of Zelilidis and colleagues and it is the only profile in the area of the Cape where terrestrial sediments crop out. These sediments (hereafter referred to as Porto Zorou Fm, even if the suggested correlation is not yet securely verified) rest unconformably over the bluish marls of the Gerakas Fm and the boundary of the two formations is marked by a sandstone layer (an observation that is in accordance with Zelilidis *et al.* 1998). The exposed profile is ca. 6 m thick and consists of clayey silts and sands in the lower part and more sandy layers in the upper, ~1, 5 m-thick part, capped by a thin topsoil; organic remains, manganese concretions and thin gravel lenses are also present in some of the layers (*cf.* Storme 2008 for more detailed descriptions). In 2006, I collected a few, isolated flint

artefacts projecting out of the upper part of the profile; during a revisit in 2007, another flake was found embedded in the lower part of the exposure (Fig. 5.6: inset). In both occasions, it was difficult to conclude whether the artefacts were definitely *in situ* in the deposits, or they have been washed down from higher points and were later covered again because of the ongoing erosion. Patinated artefacts of Middle Palaeolithic morphology and implements diagnostic of the Bronze Age were found in significant numbers on the surfaces of two morphological terraces that are cut on the upper part and on top of the Porto Zorou Fm. Another morphological terrace forms the ‘foot’ of Cape Gerakas in the southernmost part of the area; many flint artefacts, including probable Mousterian pieces, have been collected from the surface of this terrace. So far, it has not been possible to assess if there is any morphogenetic relationship between the red sandy soil covering this latter terrace with any of the layers (notably the uppermost) of the Porto Zorou Fm as it is exposed in the profile discussed above. Further research may test the hypothesis that Middle Palaeolithic artefacts are being eroded out of the sediments of the Porto Zorou Fm, and whether any of the observed terraces could be attributed to any of the sea-level high-stands of MIS 5.

Elsewhere in the Vassilikos peninsula the possibilities of finding stratified lithic artefacts are restricted to paleosol and ‘red-bed’ exposures that are extremely patchily preserved mostly in the centre and north-eastern part of the area. Sordinas (1970) reports the presence of heavily patinated and weathered flint artefacts associated with red-beds, which he identified in a restricted area of three km²; he observed that the redbeds are covered by fossilized dunes, which yielded Bronze Age artefacts. Sordinas does not provide any map and it was not possible to locate the exact area that he describes. Nevertheless, artefacts embedded in red sedimentary facies of terrestrial origin (and most likely of Late Pleistocene age) were identified during my visits in the area, but these are very exceptional and isolated occurrences; due to the severe erosion and deformation of soils and sediments in Zakynthos, they need to be further examined in test trenches, in order to confirm their *in situ* character.

Erosion in Zakynthos is vigorous. Due to the highly active tectonic setting, it may have been so already from the Pleistocene, but it has been certainly accelerated lately by anthropogenic causes: the current ever-growing and uncontrolled tourist development has resulted in widespread disturbance of Quaternary landforms. Geomorphological and soil erosion studies carried out in the framework of ZAP (Storme 2008; Gkouma 2009) have confirmed the destructive effects of past and present erosion upon the archaeological record. In contrast to the interior plains and the coastal areas, which are overall highly disturbed by cultivation and building operations, karst plateaus are good examples of relatively stable geomorphological settings, where artefact scatters can be found undisturbed. For instance, quite a large number of Palaeolithic artefacts have been collected from a gently undulating plateau on Mt. Vrachionas. The flat surface of the plateau and the fact that there are not any other adjacent landforms at a higher altitude precludes the possibility that the artefacts come from a derived context; rather, it can be securely concluded that the finds at this site are *sensu lato in situ*, *i.e.* they were originally discarded on the surface of this plateau. Most probably they are not archaeologically *in situ sensu stricto*, in the sense that we do not find them today in exactly the same place where hominins discarded them. However, the minimum-to-zero inclination angles of the surface, and the absence of traces of running water (in the form of gullies or streams) offer good reasons to assert that any movement of artefacts must have been minimal, and this conclusion is also supported by the preservation conditions of the specimens. However, the plateau represents a stable surface in the landscape, an exposed landform on which humans might have been making, using and ultimately discarding their stone-tools during any time within the Palaeolithic period, up to modern times. Accordingly, the lithic assemblage could be (or, *is indeed*) a palimpsest -a mélange composed of material belonging to different periods of the Palaeolithic.

On the current scarce evidence at hand, flint appears to have been the prevailing raw material for the production of stone tools in Zakynthos. As it is attested at least by the material from Vassilikos (Sordinas 1970; Van Wijngaarden *et al.* 2007), natural flint sources that seem to have been widely used are flint

pebbles from river valleys and beach deposits (*cf.* Van Wijngaarden *et al.* 2007). The original pebbles used as blanks are commonly small-sized and this fact poses another difficulty: the size and form of the raw material would not have favored the manufacture of large cutting tools, such as the characteristic handaxes and cleavers of the Acheulean techno-complex. Moreover, possible choppers and chopping-tools of ‘Mode 1’ toolkits cannot be morphologically distinguished from, for instance, the Mesolithic ‘galets aménagés’ (*cf.* Sordinas 1970). Hence, if bifacial products are expected to be scarce in the first place, even the problematic task of identifying Lower Palaeolithic artefacts based on morphological criteria, is further hampered in the case of the Zakynthos material.

To sum up, all formally defined and mapped Early and Middle Pleistocene sediments in Zakynthos are of marine origin; the possibility of finding stratified artefacts in these deposits is minimal. The only Pleistocene terrestrial sediments, *i.e.* the Porto Zorou Fm and patches of red sediments in the area of Vassilikos and to the NE of Zakynthos town, are most probably of Late Pleistocene age and are extremely restricted in both thickness and aerial extent. This explains why Early and Middle Pleistocene archaeological material is overall missing, whereas Late Pleistocene lithic artefacts are so far being collected mainly as surface finds. Moreover, erosion has significantly distorted the archaeological record, largely irrespective of the cultural periods at stake (Van Wijngaarden *et al.* 2006; 2007; 2009). As a result, scatters mixed with artefacts from different periods are the norm, rather than the exception, and in most cases these are erosional palimpsests. Stable areas like the plateaus on the karst terrain of Mt. Vrachionas, or those of the Vassilikos peninsula could potentially offer better insights, but contextual problems are present here as well: in such settings, artefacts may be *sensu lato in*

situ, but the mixing cannot be ruled out, this time in the form of accretional palimpsests. Caves and rock-shelters may, in theory, be devoid of such issues, and they offer themselves as potential targets for future investigations.

In conclusion, Zakynthos exemplifies all aspects of landscape dynamics that disturb the archaeological record and obscure any spatio-temporal distributions of artefacts and sites: a highly active tectonic setting, with thrusting, folding and normal faulting deforming and dislocating landforms; a tectonic and eustatic control promoting marine over terrestrial sedimentation during the Early and Middle Pleistocene; and an intense land use (and misuse) that has disturbed and destroyed most parts of the geological record that may have escaped natural erosion. All in all, the geological opportunities for the preservation of the archaeological archive are so limited that the inability of archaeologists to relate their findings to sedimentary contexts emerges as a wider reality, which largely overprints research-related biases. It should be noted, however, that the methodology of survey projects such as the ZAP (*i.e.* with a diachronic research objective), is not well-equipped for the recovery of Palaeolithic finds and their potential correlation with geological contexts (*cf.* Runnels and van Andel 2003).

Although Zakynthos appears to be an extreme example of conditions disfavoring the preservation of archaeological material, the factors and processes creating this picture apply to most of the landscapes in Greece, albeit in varying degrees. It is to those geomorphic and anthropogenic factors and processes that we shall turn in the following chapter, by broadening the scale of analysis so as to encompass Quaternary landscape evolution and its effects on the Pleistocene archaeological record of Greece.

