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The use of geo-archaeological survey methods in Greece by the Finnish Thesprotia Expedition

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Abstract

The Finnish Thesprotia Expedition carried out archaeological surveys and excavations in the northwest of Greece over seven field seasons from 2004–2010. Greek archaeology has traditionally focused on larger historical sites, such as *poleis* and temples. The focus of our expedition, however, was environmental change, including climate change and changes in subsistence strategies from the Palaeolithic up to modern times. This article revisits the discovered sites with special reference to geo-archaeological methods. A summary of the site catalogue is presented with approximate dates for (pre)historic periods. Geo-chemical methods, namely phosphorus and pH analyses, were utilized in the project, and other data was also gathered with a magnetometer. This part of the research was experimental in character. In retrospect, the results were satisfactory, and geo-archaeological methods are highly recommended as a toolkit for future surveys.

Keywords: soil drilling, phosphorus analysis, soil pH, magnetometer, pollen analysis, Finnish Institute at Athens

24.1 Introduction

Thesprotia is an administrative prefecture in the Greek Province of Epeiros, located nearby the Albanian border. It is the northwestern corner of Greece, where the main branches of the economy are agriculture and tourism. The area is c 1500 km^2 in size and is the home of c 40,000 people today. Topographically, Epirus is on the relatively steep western slope of the Pindos Mountains, where the highest point is as high as 2637 metres a.s.l. In contrast with the more famous areas of Classical or Hellenistic history of Greece, the Epeiros region had not been thoroughly investigated before. Thus, the Finnish Thesprotia Expedition provided a considerable amount of new data.

The survey area was located in the central part of the valley of Kokytos, a 20 km long river that runs from north to south and meets the River Acheron at a distance of c 4 km from the coast of the Ionian Sea. The eastern slope of the Kokytos Valley belongs to the mountain range of Paramythias, which rises to the height of 1300 m a.s.l. or even more.

The project was planned and led by Björn Forsén, Head of the Finnish Institute at Athens (2004–2007 and 2018–), and his team. Mika Lavento, Paula Kouki, and Maria Lahtinen from the University of Helsinki were responsible for the geo-archaeological research. The expedition staff is most grateful for all the effort that students from the universities of Helsinki, Oulu, and Turku made in the field. The Expedition also had Greek participants as well as a few international experts.

The survey was fully scientific in character, and did not deal with any development-led archaeology (i.e. rescue excavations). The collected data is available for further studies. A few results have been published in papers and monographs of the Finnish Institute at Athens (vol. 15, 16, 22, 24) in 2009, 2011, 2016, and 2019. An achievement of major importance associated with the project is the doctoral thesis of Mikko Suha (2021) on Greek fortifications. More research will be published soon by Esko Tikkala and Tommi Turmo.

24.2 Geo-archaeological methods in Greece

The analysis of natural sedimentation and the stratigraphy of human-influenced processes form the basis of any archaeological research below the earth's surface. Geo-archaeological methods are a cost-effective means of taking a step forward after a (tentative) site has been identified but the knowledge about it is still slight. Geo-archaeology likewise proves useful when a location has been determined to have research priority over others. It also belongs to the toolkit of pre-excavation work, and has been used as such in archaeological field research since the 1970s (Gale & Hoare 1991).

In Greece, geo-archaeological methods were introduced relatively late, in a few large-scale field projects by foreign research teams in the Peloponnese in the 1980s and 1990s (Bintliff 1982; Cherry et al. 1991; Alcock et al. 1994). Alongside the study of political history, famous temples, and prestigious ancient burials, there was a growing trend at that time to study the long-term interactions between human groups and their environments. More effort

Figure 1. The cultural layer visible in the cleaning of the profile at the dwelling site PS36. M. Lahtinen preparing the profile map. Photo M. Lavento.

than before was put into questions regarding soil formation, paleoclimates, etc. (Zangger 1993). Björn Forsén, Jeannette Forsén, and Mika Lavento conducted an archaeological survey of the Asea valley in the Peloponnese in 1994–1997 (Forsén et al. 2003). Methodologically speaking, this project took a step forward from previous experience. The research has since become more detailed and provided possibilities to identify remains of earlier and smaller sites, or places where human beings have influenced the soil. As the methodology and the experience in carrying out surveys has developed, all of this has provided opportunities to identify a wider variety of settlement and occupation sites that were used over long periods.

24.3 The role of geo-archaeology in the Finnish Thesprotia Expedition

The survey aimed at building an overall understanding of the settlement patterns throughout the prehistory and history of the research area (Forsén 2009). Excavating is a precise method for collecting detailed knowledge about a chosen place, but is often too slow and expensive for the study of areas dozens of hectares in size. Geo-archaeological sampling, in turn, is a relatively fast method and is much less impactful on modern land-use, such as crop cultivation. Thus, we conducted geo-archaeological surveying side-by-side with select excavations.

In an area like Thesprotia where the erosion of mountain slopes is relatively strong and waters run in valleys with thick sediments, it is obvious that many prehistoric sites are located deep below the surface today. The expected depth of anthropogenic material is anything up to dozens of centimetres below the surface, or sometimes even two metres or more. The archaeological survey must thus include analysing the content of the soil sediments.

Thesprotia has been an area of intense farming for hundreds of years. This has affected the topsoil through the repeated formation of ploughing layers.

No	Site	Dating	Site type	mgP/kg	pH
PS1		Mesolithic			
PS2	Xirolophos	Early Modern		84	
PS3	Sevasto	Mesolithic			
PS4	Sternari	Middle and Late Paleolithic, Bronze Age			
PS5–6	Agia Paraskevi	Late Archaic to Early Roman	settlement	339	
PS7	Kyra Panagia	Hellenistic	farmstead	160	
PS8	Keramareion	Early Modern	tile/pottery manufacture	134	
PS9	Louri	Early Modern	farmstead	82	
PS10	Xirolophov	Late Roman	village	83–87	
PS11	Eloa	Early Hellenistic	farmstead	81	
PS12*	Goutsoura	Neolithic, Bronze Age, Early Iron Age	settlement	41–960	
PS13	-	Early Hellenistic	grave?		
PS14	Xirolophov	Late Roman	farmstead/village	118	7.68
PS15	Pano Pigadi of Sevasto	Early Hellenistic	village with graves	252–444	min. 7.62 max. 7.79
PS16	Balakia	Middle and Late Roman	farmstead with graves	136	7.85
PS17		Bronze Age, Early Iron Age, Early Hellenistic	settlement		
PS18	Asphaka	Bronze Age, Early Iron Age, Late Classical, Early Hellenistic	settlement		
PS19		Roman	farmstead		
PS20		Final Neolithic, Middle Bronze Age, Early Iron Age, Late Classical, Early Hellenistic	settlement		
PS21		Bronze Age	settlement		
PS22	Megalo Karvounari	Middle and Late Palaeolithic	temporary camp site		
PS23	Mikro Karvounari	Middle Palaeolithic, Mes-olithic	temporary camp site		
PS24	Koutsiates	Early Modern	fortified village	92	
PS25	Agios Donatos of Zervochori	Early and Late Hellenistic, Early Roman	fortress	35–840	
PS26		Early Modern, Model Vlach	seasonal settlement		
PS27	Paliokklisi of Ze-rcochori	Late Roman	village with a basilica	334	

No	Site	Dating	Site type	mgP/kg	pH
PS28		Bronze Age	settlement		
PS29		Late Classical to Early Hellenistic	small village	80	
PS30 & PS48		Classical to Early Hellenistic	small village		
PS31		Early Iron Age, Classical, Archaic and Hellenistic	farmstead, pottery kiln	870–906	
PS32		Middle and Late Roman	small village		
PS33		Hellenistic and Late Roman			
PS34	Koutsiates	Early Hellenistic to Late Roman	fortress		
PS35	Gephyrakia	Late Classical to Early Hellenistic	village		
PS36**	Mavromandilia	Early Iron Age, Hellenistic	village	1–906	min. 6.9 max. 8.14
PS37		Late Classical to Early Hellenistic	fortress	148 (5)	
PS38		Late Roman; some Hellenistic and Early Roman finds	small village	1–113	
PS39		Late Roman	farmstead	1–92	
PS40		Roman	farmstead		
PS41	Mavromandilia	Middle to Late Roman; some Hellenistic and Early Roman finds	farmstead with graves	348 (10)	
PS42		Late Roman	farmstead		
PS43		Middle Palaeolithic, Mesolithic, Early Neolithic	temporary camp site		
PS44	Mavramandilia	Late Classical to Early Hellenistic	farmstead with graves		
PS45		Upper Palaeolithic	temporary camp site		
PS46		Late Classical to Hellenistic; some Bronze Age and Early Iron Age finds	village	829	
PS47		Early Modern	farmstead		
PS49		Late Classical to Early Hellenistic	farmstead	145 (2)	

Table 1. The discovered sites with approximate dates. * Reference: Lavento & Kouki 2016: 149–151; ** Reference: Lavento & Lahtinen 2009: 77–83.

Figure 2. A picture of the Kokytos River valley on the northeastern side of PS12. Photo M. Lavento.

Since archaeologically relevant samples must be taken from layers that are as undisturbed as possible, drilling allows us to observe less disturbed soil stratigraphy. In a few cases, we wished to identify the borders of a particular site. It was important to make sure that each of the sites discovered by our team was defined as a separate unit, and was not the far edge of an already reported archaeological site (see Table 1). Geo-chemical sampling is a suitable method for recognizing differences between sites or loci that are horizontally close to each other.

24.4 The geological environment

The Pindos Mountain range cuts through Greece in an approximately north–south direction, extending towards the Peloponnese. The geological age of these mountains is the same as the Alps: c 65 million years. In Thesprotia, the dominant rock type is limestone, and the sedimentary rock flysch is abundant there. Fossils have provided the key to dating the dolomitic limestone and flysch to the (late) Mesozoic era or somewhat later (Pettijohn 1975: 571–572). However, formation processes have always been, and still are, at an unstable stage here, partly due to continuing tectonic processes (Alpine orogeny) (Talbot & Allen 1996; Runnels & van Andel 2003: 57–68). This makes it challenging to reconstruct the prehistoric landscape and environmental conditions in the area. The bedrock is soft and cracks easily, and the karst formations are especially sensitive to weathering. Erosion has been strong throughout the past millennia, due to the effects of climate conditions (rain, storms), vegetation, farming, and other land exploitation by humans (Wiseman & Zachos 2003; Besonen et al. 2003). Consequently, sedimentation has caused topographical changes in the valleys and forced rivers to take new channels, with the River Kokytos being no exception.

24.5 Searching for ancient sites

The central part of the Kokytos river valley was divided into survey sections according to geological and topographical features. These survey areas thus differed from each other to some extent in terms of sunshine, dominate winds, water, vegetation, and modern land-use. There were a few obvious spots for the survey teams to study. Holocene or even Pleistocene (Palaeolithic) cultural layers would be exposed in places where the abrupt sliding of sediments have caused stratigraphic disturbances. Those could be seen at the base of the mountains or wherever steep slopes meet a relatively flat terrain.

Groundwater is an essential parameter for the formation and continuity of ecosystems in warm climate zones, on both macro- and micro-levels. Erosion of the same kind as seen in Thesprotia has also been taking place over a large part of Peloponnese, where the groundwater table has developed some meters below the ground but the depth is constantly changing as erosion proceeds (Lavento 2003: 158–160). Limestone is a relatively soluble type of rock. As rain and groundwater run into dolines and sinkholes, subterranean water channels are formed. As a result, even if the surface soil is dry the amount of groundwater can be abundant, and there will often be spring water to drink. It was thus reasonable to search for the ancient river bank (Fig. 2) that would deserve special attention in the survey.

Subterranean streams and springs are constantly changing location (Fig. 1) (Lavento & Kouki 2016: 151–154). This has influenced human settlement and plant cultivation throughout prehistory in Epeiros (as well as numerous other mountain areas, both in the vicinity and further away). Geological knowledge of those processes helped us both to locate study sites and to understand the features of the cultural history of the area.

24.6 The sites

The Finnish Thesprotia Expedition discovered 49 archaeological sites ('New sites' in Table 3). Together with the 'known sites' earlier discovered by the Greek Archaeological Service, the current number of archaeological sites in the Kokytos Valley is now 77 (Forsén & Galanidou 2016: 3–4). A catalogue of all the sites has been published by Forsén et al. (2011: 73–122). Table 1 is a site list with (an) approximate date(s) for each site.

At 45% of the 'new' sites (22 cases), soil drilling was carried out in order to study the stratigraphy and take samples. Every site was so different that it had to be decided on a case-by-case basis how to proceed and which methods to use (Fig. 2). The drilling, which was in some cases as deep as over five meters, was often physically difficult. We still found it very cost-effective, however, because this was a way to quickly discover the multi-period character of a few sites. For example, a Neolithic phase of settlement was identified under a few younger layers at three of the sites. Source-criticism was essential both for the interpretation of soil anomalies and in the cases where the auger did not hit any feature of archaeological interest. What did we actually find? How could we construct a picture of all the prehistory and history that was not yet found, but was certainly there (Lavento & Lahtinen 2009: 75–82)?

24.7 Phosphorus analysis and measuring the soil pH

It is a widespread practice for archaeological surveys to measure the values of phosphorus (P) in a grid around a concentration of finds, such as a ruin or other spot of archaeological interest. Combinations of elements and compounds vary in nature from one environment to another. Prior to carrying out the fieldwork, it is thus problematic to assume what is natural and what is an anomaly in a given region. In Thesprotia, our starting hypothesis was that a value of over 100 mg of P per 1.0 kg of soil was anomalous. This would indicate more long-term anthropogenic activity at a site, rather than merely a short occupation at some time in the past or an accidental concentration of fragmentary artefacts (Lavento & Kouki 2016: 49).

The soil samples were analysed in the facilities of the University of Helsinki by Paula Kouki and Maria Lahtinen. As the result, we know that the actual average P value was under 100 mg per one kg of soil, namely 73 mgP/kg. Anomalous concentrations of Phosphorus were observed at 15 sites (Table 2). The highest values were over 900 mgP/kg (Lavento & Lahtinen 2009: 79). The earliest dates for relatively high P anomalies are in Bronze Age sites. Notable P values were also detected for the Early Iron Age and Classical and Hellenistic periods. These observations suggest that Neolithic settlement was still sparse in the Kokytos Valley.

An experiment was made to compare soil acidity (pH) from a few archaeological sites with corresponding values from spots without any known traces of (pre)historic activity whatsoever. In our research area, the average pH of an intact soil is c 7.5–7.7. An increased pH value for a soil layer would indicate human activity at the time when that layer was exposed to contamination. In addition, the electrical conductivity of the soils was measured.

In contrast with the phosphorus analysis, the pH measurements did not show much variation between the sites, or between places of ancient activities and the samples taken from intact soil. The highest (most alkaline) value was 8.14 at the site number PS36 (Fig.1). The site was exceptional, though, because it also yielded the lowest pH value of 6.9 (Lavento & Lahtinen 2009: 77–83).

24.8 Magnetometer

A non-destructive search for magnetic anomalies is a practical method in areas where the natural soil is not too coarse and there are few stones. The Finnish Thesprotia Expedition invited the director of the Crimean Archaeological Institute in St. Petersburg, Tatyana Smekalova, to conduct field research by magnetometer in two seasons, 2008 and 2009. Smekalova is an expert with the equipment and experienced in the reading and interpretation of the data.

Site	Dating
PS13	Early Hellenistic
PS27	Late Roman
E9	Late Hellenistic Early Roman
PS46	Late Classical to Hellenistic
PS37	Late Classical to Early Hellenistic
PS30 & PS48	Classical to Early Hellenistic
PS29	Late Classical to Early Hellenistic

Table 2. The list of sites where a magnetometer was used (Smekalova 2009: 18–20).

The magnetometer was used at seven sites, one of which (E9) had been found before our survey (Table 2). The results were satisfactory: stone structures were discovered before any digging took place. Fireplaces (a kiln, an oven) and slag and metal artefacts were also identified (Smekalova 2009: 18–19). In the following stage of the project, the postulated identification of these anomalies was proven by excavation.

24.9 From pieces of knowledge to an overall picture

The main goal of the Finnish Thesprotia Expedition was fulfilled: the discovered sites shed light on the entire timespan of the region, from prehistory to the historical phases of the river valley. Three paleo-lakes of Pleistocene origin are known in Thesprotia. The formation of the oldest one, Lake Kalodiki, dates to as early as 40,000 BCE (Lelivelt 2011). The Kokytos Valley was inhabited in the Middle Palaeolithic at the latest. Pollen analyses of the samples of the bottom sediments of Lake Kalodiki provide us with some knowledge about climate changes and vegetation in the region. Northwestern Greece, including Thesprotia, was a forest zone with Mediterranean coniferous trees, such as pines, probably as late as the Late Neolithic.

Archaeo-osteological materials from the oldest sites support the assumption that agriculture began as semi-sedentary animal husbandry in the Middle Neolithic, c 6300 BCE. Crop rotation was practiced, and sheep were kept for meat and wool (Kluiving et al. 2011: 50–51; Deckwirth 2016: 280–282). Between c 4500–2400 BCE the environmental conditions favoured field cultivation and encouraged population growth. Certain *Quercus* species are diagnostic for a climate that was suitable for agricultural expansion (Kluiving et al. 2011: 39–40, 52–53). The first period of significant environmental pressure by human dates to the Early Bronze Age, c 3250 BCE (Lelivelt 2011: 68–69). The harvest was rich enough for the keeping of cattle and horses (Deckwirth 2016: 265–277).

Archaeological finds and sites from the Classical, Hellenistic, and Roman phases of the east Mediterranean had already been found in Thesprotia (Forsén et al. 2011) prior to the work by our expedition (see Table 3). We had the opportunity to contribute to this picture by discovering more sites

Period	Previously known sites	New sites	Total number of sites
Modern		1	1
Early Modern		6	6
Medieval	2	0	2
Late Roman	9	12	21
Roman	1	2	3
Middle Roman	4	3	7
Early Roman	1	4	5
Late Hellenistic	1	2	3
Hellenistic	2	7	9
Early Hellenistic	7	7	14
Late Classical	1	6	7
Classical		2	2
Late Archaic		1	1
Archaic		1	1
Early Iron Age		7	7
Late Bronze Age	1		1
Middle Bronze Age		1	1
Bronze Age		6	6
Final Neolithic		1	1
Middle Neolithic		1	1
Early Neolithic		1	1
Mesolithic		5	5
Upper Palaeolithic		1	1
Late Palaeolithic		2	2
Middle Palaeolithic		4	4
All periods (together)	28 (28)	49 (84)	77 (122)

Table 3. The number of known archaeological sites and new survey sites divided according to period.

and opening excavation trenches in some of them. The most recent artefacts of archaeological interest date to the late phase of the Ottoman Empire in the 20th century.

24.10 Final words

Phosphorus analysis was very useful for defining the extent of a site, as well as to locate spots of more intense activity. The magnetometer, in turn, proved to be a very useful tool for choosing excavation areas and expanding the reach of case studies beyond the digging of trenches. Both methods played an essential role in the gathering of field data and placing all of the material within the full story of the area.

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