

The palaeoenvironment of *Homo neanderthalensis* during the Late Pleistocene: preliminary results of the *KalPal* project, the palaeoecological and taphonomical study of the Upper Pleistocene fauna from the Kalamakia cave (Mani Peninsula, Greece)

M. Kolendrianou¹, S. Ligkovanlis¹, M. Tzortzi¹, I. Maniakas^{1,2}, G. Iliopoulos¹

(1) Department of Geology, University of Patras, GR- 26504, Rio, Patras, Greece, kolendrianou@upatras.gr

(2) Department of Geology, Aristotle University of Thessaloniki, GR-54124, Thessaloniki, Greece

Presenting the *KalPal* Project

The *KalPal* Project includes the study of microfaunal and macrofaunal skeletal elements from the Upper Pleistocene deposits of the Kalamakia cave in the Mani Peninsula, in order to extract conclusions on the palaeoenvironment and taphonomical history of the site. The cave was inhabited during the Middle Palaeolithic period by humans and, specifically, by individuals of the species *Homo neanderthalensis*, whose remains were also found during past excavations.

The aim of the project is to identify the palaeo-ecological relationships between the different vertebrate species, including the Neanderthals, living in the area during the time of deposition and, at the same time, the taphonomic processes that affected the samples over time and how they defined the characteristics of the studied fossils. In addition, an attempt will also be made to identify the possible interaction between the people living in the cave with the animals from which the material originated.

Study area

Kalamakia cave is located 2km northwest of Areopolis, in the southern part of Itilo Bay, Mani Peninsula, southern Peloponnese. In this location, the vertical cliff that stands above the coast subsides leaving a small cove and, thus, creating a small plateau by the shore. The cave itself is located above that plateau (that is interpreted as a Tyrrhenean terrace) along with several smaller caves that surround it, either communicating with one another or not. The entrance, which is 7m wide and 8m long, lies at the foothill of a limestone cliffside 2m above sea level, 10m away from the shore, whereas the cave cavity is 20m deep. Excavations in Kalamakia were conducted from 1993 to 2006 by the Ephorate of Paleanthropology and Speleology (Greek Ministry of Culture) in collaboration with the University of Athens and the Muséum National d'Histoire Naturelle (Paris) (Darlas et al., 1998).

Former research

The excavation in Kalamakia is one of the most important palaeontological / paleoanthropological excavations that have been conducted so far in Greece because of the skeletal remains of *Homo neanderthalensis* found in the cave (Darlas et al., 1998, 2004; Harvati et al., 2013). During the excavation, plenty of samples showed that the cave was used during the Middle Palaeolithic period, and more specifically 100-40 kya BP, as a periodic habitat of hunters and gatherers (Harvati et al. 2013).

The identified large mammal fauna of Kalamakia comprises of 17 taxa. Fallow deer dominates the assemblage while ibexes and wild boars follow. Carnivores were also present, although low in numbers, throughout the stratigraphic sequence, with red fox being the most common species. The site also yielded the remains of several smaller vertebrate taxa, including abundant land tortoise remains (mostly *Testudo marginata*) (Darlas et al., 2008; 2016). A previous study of the microvertebrates of Kalamakia, especially rodents, indicated a generally open landscape surrounding the cave with dry and relatively warm climatic conditions (Roger et al., 2008). On the basis of both pollen and faunal data, during at least the first half of the last glacial, the climate in Kalamakia is considered to have been mild. The surrounding landscape was covered with maquis vegetation and some Mediterranean presteppic forest taxa (Lebreton et al. 2008).

Material and Methodology

Different approaches have been selected to decipher the scientific questions of this project and more specifically to provide palaeoecological interpretations, hence each subject of the project (lithic artifacts, microfaunal remains, macrofaunal remains examined taphonomically and animal teeth) follows its own protocol:

- Lithic artifacts: a digital application for the listing of archaeological material was created, in which the parameters were set according to the project's priorities: stratigraphic origin, characteristics of the raw material, data on morphology, technology and typology.
- Microfauna: remains are observed stereoscopically and are identified taxonomically based on literature and the LPS's comparative skeleton collection. Detailed lists for the identified fossils are kept for each specimen reporting the following: stratigraphic origin, type of skeletal element, relative position on the skeleton, taxon identified, preservation state.
- Taphonomic and geochemical analyses of macrofaunal remains: for the evaluation of the site's taphonomical history, the samples are examined macroscopically and microscopically using a stereoscope and scanning electron microscope, while taphonomical indices will also be calculated and analyzed statistically. For the geochemical study, samples are collected and examined under a scanning electron microscope, using nondestructive analytical techniques such as

Raman spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR) and of X-ray fluorescence (XRF) spectroscopy.

- Microwear and mesowear study of ruminant teeth: The procedure for microwear analyses involves upper and lower second molar cleaning with acetone for the removal of dust, and also of any other chemical residues used in the field or during fossil preparation. Dental facets are molded and consequently photomicrographic scans are taken directly on the molds under a stereomicroscope in order to render the surface of the dental wear facets. For mesowear, the procedure has already been done by evaluating the occlusal relief and the cusp shape of the upper and lower molars (M1-M3, m1-m3) through digital photography with the aid of the software tpsDig2 2.17 (Fortelius et al., 2000).

Results and Discussion

So far, 20.500 lithic artifacts have been studied, 14.951 microfaunal specimens have been identified, 54 microfaunal and macrofaunal remains have been examined using X-ray fluorescence (XRF) spectroscopy and 134 samples of maxillary and mandibular specimens (from adult animals) were taken into account for mesowear analyses.

- As far as the type of the cultural material is concerned, stone-knapping from Kalamakia cave seems to have all the components that characterize the lithics in the area of Southeastern Europe during the Middle Paleolithic Age, but it also presents some particularities. What can be said with relative certainty, in relation to human occupation and activity in the cave, is that these were only periodical and that the exploitation of lithic resources was not the attractive factor for human groups (the vast majority of the raw materials are of poor quality and there is occasional use of "circumstantial" lithic backgrounds as tool materials, such as limestone raw material or core leftovers).
- The results concerning the identifications of microvertebrates have revealed the presence of 3 different species of amphibians, 18 different reptile taxa, 3 insectivore species, 2 bat taxa and 6 rodent taxa through the whole sequence. From the taxa identified so far in the assemblage, the majority reflects an open environment. No species, considered typical of colder climates, have been identified yet leading to an estimate that the climate must have been relatively temperate during the depositional periods of the studied material.
- The XRF results obtained so far from the examination of the bones from both small vertebrate and large mammal taxa, suggest that the main elements of the samples are calcium and phosphorus, obviously derive from the biomineral of bone (apatite). Nevertheless the enrichment in Fe, Al, Zn, Sr, Ba, Y and Sn at varying levels, is ascribable to the taphonomic processes that affected the bones post-burially.
- Summary statistics for mesowear data for each taxon and among different strata have revealed a dietary range from browsing to mixed feeding strategy. The vast majority of the samples analyzed, belonged to *Capra* sp. and *Dama* sp. The predominant mesowear pattern over all strata among fossil samples of the two aforementioned taxa is high cusp relief associated with rounded cusp apices. Overall mesowear scores (Fortelius et al., 2000) in *Dama* sp. reflect a slight tendency to browsing but, in terms of average wear signal comparisons of *Capra* sp. and *Dama* sp. among different strata populations, it is rather reasonable to conclude that there were no significant variations through time.

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