

Geoarchaeological laboratory analyses in the context of the Iberian Quaternary: Human ability to adapt to climate change in the Iberian Peninsula

Gruta do Escoural

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Introduction to the scientific context

This project will investigate human adaptation during the climate changes in the Iberian Peninsula, specifically, in context with rock art, combining figurative evidence with deposits in caves and outdoors. All of this combining different disciplines and different scientific approaches, through the use of petrographic, geochemical and isotopic analyses. This project aims to improve the understanding of the context and the correlation between human activities, environment, natural resources exploitation and development of technological capacities during periods of climate change. Results will support conceptual models of human evolution in terms of technological development, opportunism and social and economic structure of settlements. One of the main objectives is contribute to increase the knowledge of the communities about the archaeological evidence in the Iberian Peninsula.

Following the aim of this project, the protocols of the multidisciplinary approach will be applied to Portuguese and Spanish sites like Gruta do Cadaval (PT), Gruta do Escoural (PT), Cuevas de los Postes (SP) and Cueva de Maltravieso (SP). In this work we will focus of one of these contexts: -Gruta do Escoural → located about 3 km from the village of Santiago do Escoural and 15 km from the city of Montemor-o-Novo. In this cave the traces of Palaeolithic engravings and cave paintings testify human occupation (Silva, 2008). This cave is part of one important European Interreg Project, called "First Art", in which this Project of Thesis is involved.



Figure 1. Current entrance of the Gruta do Escoural (Photo by First Art Project)

First Art Project

Gruta do Escoural is one of the interesting areas of study of this project. In this area, there is now a documentation campaign of rock art in progress, that is part of a European Interreg project called "First Art" with Professor Hipólito Collado Giraldo as director. The project includes the rock art study of Gruta do Escoural and Cueva de Maltravieso. These two caves show similar evidence. This project has four partners including the Municipality of Mação, Instituto Politécnico de Tomar and Centro de Geociências. They are the scientific partners and are composed of rock art experts of Portugal. The scientific responsible of the Escoural cave is the researcher of Instituto Politécnico de Tomar and Centro de Geociências Sara Garcês. The research campaign consists of a monitoring program of the site environmental conditions, providing a measurement of chemical-physical parameters and will be taking samples to characterise soils and rock compositions, to confirm the datation and to investigate the light isotopes present in this context, DNA analyses on the bones and make a 3D model. The samples for datation U/Th were taken and researchers are analysing them, some samples of pigments will be taken and investigated during this documentation campaign. This context is really interesting because the cave occupation by human beings has covered a long chronological gap of about 30.000 years.

Analytical methodologies

The doctoral project involves different analyses to better investigate and understand the contexts under consideration. The analyses program that will be carried out will be possible thanks to the analytical facilities available at the doctoral centers and thanks to the collaboration with the University of Ferrara. The analyses will be: in situ analysis; analysis of the archaeological context; sedimentological analyses (particle size analyses and Loss on Ignition- LOI); microscope observation of samples; SEM-EDS; micro-Raman and FTIR; XRF; ICP-MS; Isotopic analysis, light isotopes [C, O, H, S, N]; 14C.



Figure 4. Example of human artistic manifestations in the Gruta do Escoural – Rock Art – Painting (Photo by First Art Project)

Gruta do Escoural

The Escoural cave is a natural cavity discovered in 1963, after an explosion due to the extraction of marble. The workers have found a cavity and they have entered inside discovering a natural room in which there were many human bones and ceramic finds. This cave is located about 3 km from the village of Santiago do Escoural and 15 km from the city of Montemor-o-Novo. It is very important in the Iberian panorama for its extension, morphologies and geological structures and the archaeological relevance of the traces of Palaeolithic engravings and cave paintings. These traces testify human occupation dating back to various periods. In the Middle Palaeolithic, it was used as a refuge by Neanderthal hunter-gatherers (Caldeira et al., 2021; García-Díez et al., 2012; Mauran, 2016; Silva, 2008). It is a natural hypogean cavity with a complex underground structure, with an irregular plan and arranged longitudinally on the NO-SE axis. The cave of Escoural is characterized by the presence of many rooms and corridors at different altitudes. It develops in very intricate karst connections, with various external connections (Lopes, 2013; Mauran, 2016; Otte et al., 1996).

The human occupation during the Middle Palaeolithic is proved by palaeolithic art that decorates the walls. In this cave, many paintings and engravings are dating back to the Upper Palaeolithic (35,000-10,000 BP). The paintings and engravings present in the cave are classified into two groups, zoomorphic elements (for which are used mainly black pigments) or abstract (for which are used mainly red pigments). These representations are almost all covered by calcite mineral layers precipitated by the presence of water leaking on the walls of the cave, biological and microbiological alterations (Caldeira et al., 2021; Lopes, 2013).

The hunters of the Palaeolithic used the cave as a symbolic place and left evidence through cave paintings and engravings. During the Neolithic period (5000-3000 B.C.) the cave became a cemetery. The bodies, deposited in the cave, presented funerary equipment. During the Copper age the cave loses this symbolic value because it is the construction of a monument, Tholos of Escoural, where the dead were deposited, fortified about 600 m from the cave (Lopes, 2013; Mauran, 2016).



Figure 2 & 3. Examples of human artistic manifestations in the Gruta do Escoural – Rock Art – Engravings (Photo by First Art Project)

The expected results

The results expected to be obtained from this research include:

- Creation of a database of the realities identified → Paleoclimatic reconstruction;
- Identification of the phases of settlement → Associated with the artist manifestations (Study of rock art);
- Identification of additional reason for the displacement of settlements in some periods in different regions;
- Reconstruction of social and economic relations, movements and exchanges of materials between the populations occupying the Iberian territory → study of archaeological findings;
- Paleo-environmental characterization of the stratigraphic series and dating of the paleontological and anthropological levels of high scientific interest.

Conclusions

The application of complementary methodologies will, in this project, be a strong point to achieve a more complete reading of the obtained results. The application of an interdisciplinary approach, is, to date, a very important element in scientific research. The following is an explanation of how, in this project, the application of complementary analyses and the comparison of their results can lead to an excellent resolution of the research objective. The application of the interdisciplinary approach must always take into consideration the strengths and critical points of the different methodologies and try to solve them through the application of the other methodologies. The expected results will be very useful to investigate Human ability to adapt to climate change in the cave context of the Iberian Peninsula during the Quaternary.

The strength of this research is the application of an interdisciplinary approach. The application of several complementary analyses may lead to a deeper knowledge of the context analysed and to a greater validity of the scientific results.

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