

# FIELDWORK MANUAL



**EcoPLis**

Human Occupations in the Pleistocene Ecotones of River Lis  
Ocupação Humana Plistocénica nos Ecótonos do Rio Lis

**BY**

**TELMO PEREIRA, PATRÍCIA MONTEIRO,  
VÂNIA CARVALHO, TRENTON HOLLIDAY**



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EcoPLis - Human Occupation in the Pleistocene Ecotones of River Lis is a project approved by Direção Geral do Património Cultural, the Heritage Institute of Portugal.

<https://ecoplis.jimdofree.com/>

All team members, whether volunteers or not, must carry this field manual with them at all times during their work.

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# 1. GENERAL GUIDELINES

## Calendar and Schedule

The campaign will take place between the **4th and 30th of September**. Participants should arrive on the morning of September 4th in order to unload, equip and be ready to work after lunch. See “How to Arrive” section.

The archaeological work will take place daily, from Monday to Friday, with the following schedule:

Morning: 8:00-12:00

Lunch: 12:00-13:00

Afternoon: 13:00-16:00

The excavation and laboratory treatment work stops at 16:00. The teams meet at the laboratory to hand in and organize the materials and sediments exhumed during the working day. The work is finished at 17:00.

The teams then leave the laboratory to their accommodation for bathing, change of clothes and rest. We leave the lodging around 19:30 to have dinner at the canteen of the Polytechnic Institute of Leiria.

## How to Arrive

By car: Use GPS. Search for Pavilhão Gimnodesportivo de Santa Eufémia. Coordinates: 39.763780, -8.750445.

By train: Arrival at Leiria train station.

By bus: Arrival at Leiria bus terminal.

## Accommodation

Accommodation will be at the Pavilhão Gimnodesportivo de Santa Eufémia (Sports Pavilion).

This building has a lower area for sleeping and an upper one for cooking, working and socializing.

In the lower area there will be a room for men and a room for women. The rooms are equipped with individual mattresses provided by the Municipality of Leiria. Thus, each person only needs to bring a pillow and sheets or sleeping bag.

The space has two big shower rooms (one for men and another for women) that allow several people to shower at the same time. This allows us to leave on time for dinner. On occasion, only one of the changing rooms may be available, with the other reserved for the local activities in the pavilion. If so, showering will occur in two shifts, one for women and one for men. There will be a sign to indicate which shift is in progress or if the changing room is free.

## **Meals**

Breakfast will take place in the accommodation, prepared individually by each participant, and consisting of bread, butter, cheese, ham, milk, yoghurt, tea, coffee, fruit, cereals. Lunch will be at the camp, to be prepared individually by each participant before leaving for the camp. There will be bread, cheese, cold meats, vegetables and fruit. Lunch normally includes sandwiches, fruit, crisps and juice. The lunch break is from 12:00 to 13:00. Each participant should make sure to bring enough water for the day, but at all locations there are water points for refilling. Dinner takes place at the Polytechnic Institute of Leiria's cafeteria.

## **Personal equipment required**

Accommodation: bed sheets, blanket and/or sleeping bag, pillow, personal hygiene products, towels, and bath slippers.

Excavation: Fresh and comfortable clothing (there is no washing machine, so you should bring enough clothes), comfortable footwear, hat or cap, backpack, sunscreen, insect repellent, handkerchief to protect the nose and mouth from dust, water bottle and ear plugs.

## 2. RESEARCH HISTORY

During the almost two hundred years of research on Prehistoric Portugal, work has been focused mainly on Portugal's interior regions, with special attention to the Lower Tagus basin. More recently, due to the relevance of the study of modern human behavior, some projects have been dedicated to the characterization of coastal areas. However, even if true that these studies have been more balanced between the coast and the interior, little is known about the relationship between these two environments.

It was with this in mind that, in 2015, we began the EcoPLis - Human Occupation in the Pleistocene Ecotones of River Lis project, the objective of which was to understand human exploitation of ecotones connecting the coast to the interior. In this, the Lis River basin is used as a test case, a favored location of exploitation by prehistoric humans. We chose this region for our case study because the Lis River basin contains, in a relatively small and delimited space a great diversity of environments (rocky coast, sandy coast, riverine sandy coasts, rivers with thick Quaternary terraces, karstic canyons, open valleys, plains, plateaus, mountains, vast geological and ecological diversity, as well as open-air archaeological sites (open air, shelter and cave) with links to the adjacent territories. Furthermore, it was already known that this territory had vestiges since the Acheulean and environments permitting excellent preservation of osteological remains (both faunal and human) and vegetal remains (charcoal and pollen), fundamental elements for the defined objectives.

The results obtained have confirmed our expectations, namely with the identification of occupations with specific functionalities, such as the Epipaleolithic shell midden and workshop for exporting Solutrean flint pieces in Abrigo do Poço, both linked to times of climatic crisis, as well as the exploration of the Mousterian context of Pedrógão Beach. We also identified Neolithic to Chalcolithic necropolis contexts in the Abrigo da

Buraca da Moira, as well as enriching the map of prehistoric archaeological sites at a regional level. The detailed study and dating of the contexts is ongoing and is rapidly catching up after delay caused, first by multiple institutional changes of much of the team and secondly by the Covid pandemic.

The second phase of the EcoPLis project aims to continue to fill gaps in knowledge of the ecodynamics of prehistoric populations in the Lis River basin – particularly hunter-gatherers, but, given the presence of the necropolis context at Abrigo da Buraca da Moira, also of the region’s first farmers. As before, our team seeks to understand the specific role played by existing resources in the valleys that connect the mountains to the sea, namely during periods of climatic change. In parallel, we seek to refine and extend our knowledge of the regional chronological sequence, on one hand, filling in missing information and, on the other, recognizing regional idiosyncrasies.

Along these lines, research to be carried out between 2021 to 2025 will follow the work carried out between 2015 and 2018, the results of which have been presented to the scientific and general public in meetings and publications, as well as in reports to the supervising and funding entities. The work will be based on four fundamental axes, namely fieldwork, laboratory analyses, advanced training and dissemination, the latter aimed at peers and to the public.

## KEY WORDS

Human Paleoecology; Ecotones; Pleistocene; River Lis

### 3. INSTITUTIONAL INTEGRATION

Universidade Autónoma de Lisboa, Instituto Politécnico de Tomar, Instituto Terra e Memória, CGeo - Centro de Geociências, Uniarq – Centro de Arqueologia da Universidade de Lisboa, CICH - Centro de Investigação em Ciências Históricas, Departamento de Ciências da Terra da Universidade de Coimbra, MARE - Centro do Mar e do Ambiente, CML - Câmara Municipal de Leiria, Tulane University, Junta de Freguesia de Santa Eufémia e Boa Vista.

### 4. RESEARCHERS

**Telmo Pereira:** Assistant Professor at the Universidade Autónoma de Lisboa, Visiting Associate Professor at the Instituto Politécnico de Tomar. PhD in Prehistoric Archaeology from the University of the Algarve. Duties: Scientific direction, lithic industry.

**Vânia Carvalho:** Technical Coordinator of the Museum of Leiria, Centre of Intercultural Dialogue and the Interpretation Centre of the Old Lagar Shelter, integrated in the Division of Museums and Cultural Heritage of the Municipality of Leiria. Master's degree in Human Evolution and Biology from the University of Coimbra. Duties: Scientific co-direction, logistics and history of regional research.

**Trenton W. Holliday:** Professor at the Tulane University. PhD in Anthropology from the University of New Mexico (USA). Duties: scientific co-direction, biological anthropology, revision of texts in English.

**Patrícia Monteiro:** Technician at the Archaeosciences Laboratory (LARC) of the Directorate-General for Cultural Heritage, ICArEHB - Interdisciplinary Centre for Archaeology and the Evolution of Human Behaviour. PhD in Prehistoric Archaeology from the University of Algarve. Duties: Archaeobotany, sediment processing and collection of

archaeobotanical remains for paleoenvironmental reconstruction and economy of prehistoric societies. Co-direction of the excavation work in the Buraca da Moira Shelter.

**Eduardo Paixão:** PhD fellow at MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution. Duties: Functional analysis. Co-direction of excavation works at Buraca da Moira Shelter.

**Sandra Assis:** Researcher at CRIA - Network Centre for Anthropological Research. PhD in Biological Anthropology from the University of Coimbra (Portugal) and Trent University (Canada). Duties: Biological Anthropology. Co-direction of the excavation work at the Buraca da Moira Shelter.

**Marina Évora:** Technician at Arqueohoje, Lda. PhD in Prehistoric Archaeology from the University of the Algarve. Duties: Bone industry. Co-director of the excavation work at the Palha Shelter.

**Ana Abrunhosa:** Post-doctoral Researcher at IPHES - Institut Català de Paleoecologia Humana i Evolució Social through the R2STAIR MSCA-COFUND, Maria de Maeztu Unit of Excellence programme. PhD in Prehistoric Archaeology from the University of the Algarve. Duties: Lithic industry and raw materials.

**João Pedro Cunha-Ribeiro:** Associate Professor at the University of Lisbon. PhD in Archaeology from the University of Lisbon. Duties: Co-direction of work on the Acheulean sites. Lithic industries and geoarchaeology of the Lis.

**Pedro M. R. R. Proença e Cunha:** Full Professor at the University of Coimbra. PhD in Geology from the University of Coimbra. Duties: Geomorphology, Lithostratigraphy, Sedimentology and absolute dating.

**Carlos Simões:** Researcher at ICAREHB - Interdisciplinary Centre for Archaeology and Evolution of Human Behaviour (University of Algarve), through the H2020 programme for research and innovation of the European Union. PhD in Prehistoric Archaeology from the Universidad de Cantabria. Duties: Geoarchaeology and micromorphology.

**António Faustino Carvalho:** Assistant Professor at the University of Algarve. Duties: Material culture, economy and funerary rituals in recent Prehistory.

**Rita Peyroteo Stjerna:** Researcher at the Department of Organismal Biology and Human Evolution, Uppsala University. Ph.D. in Archaeology from Uppsala University. Duties: Genetic and isotopic analysis of human remains.

**Cleia Detry:** Researcher at Uniarq - Archaeology Centre of the University of Lisbon. PhD in History-Archaeology from the Universidad de Salamanca and Universidade Autónoma de Lisboa. Duties: Paleoecology and zooarchaeology.

**Maria João Valente:** Assistant Professor at the University of Algarve. PhD in Prehistoric Archaeology from the University of Algarve. Duties: Palaeoecology, zooarchaeology and taphonomy.

**Sara Garcês:** Post-doctoral researcher at the Polytechnic Institute of Tomar and Invited Assistant Professor at the Polytechnic Institute of Tomar. PhD in Quaternary, Materials and Cultures from the University of Trás-os-Montes and Alto Douro. Field research and field recording.

## 5. PROJECT OBJECTIVES

The objectives proposed for the 2021-2025 quadrennium are deeply related to the results obtained in the 2015-2018 quadrennium, which confirmed the hypothesis that the valleys in the Lis basin functioned as refuge areas, mainly during the harshest climatic periods, in which specific and strategic resources were exploited as part of the cultural patterns of these societies. This is clear from the profound differences verified in the Abrigo do Poço. In addition, it was also possible to identify new sites, namely the detection of necropolis caves and remnants of terraces with *in situ* Acheulean remnants. However, during this same four-year period, some work remained unfinished and questions now need to be answered, namely the functionalities throughout the Palaeolithic sequence of the Abrigo da Buraca da Moira. Thus, after taking the pulse of the territory during the first phase of EcoPLis, the objectives of the second phase of the project are:

- To recognise population, ecodynamic and economic patterns, particularly with regard to resources in ecotone areas, to map ecotones of the past which today, due to changes in the landscape, no longer exist, and to identify the functionality of archaeological occupations;

- Refine the regional chronological sequence with the connection between cultural periods, namely with the geomorphological, geoarchaeological, palaeoenvironmental and chronological characterisation of the occupations.

For this second phase of EcoPLis, the team listed specific deposits whose characteristics and traces point with great certainty to the existence of data in large quantity and quality capable of answering the questions posed. Some of these deposits are those into which we did not intervene in the previous quadrennium and where the work was not completed; others are sites that we planned to excavate between 2015 and 2018, but which ultimately was not possible; others are new contexts, identified during or before the beginning of EcoPLis in order to validate their potential or, in those where it is already known, to carry out collection for geoarchaeological characterization and absolute dating. A more detailed overview of the work plan can be found in points 8 to 10.

The prospection, excavation and laboratory methodologies to be recommended will be the same as those implemented during the 2015-2018 four-year period, which were refined throughout the project and which ensured that high-resolution data were obtained. These data helped us to understand human ecological and cultural behaviour during the Pleistocene and early Holocene on the western coast of the Iberian Peninsula.

Comparison of results with available palaeoclimatic data will, as has been the case so far, allow us to infer whether the continuities and changes present in the archaeological record are related to climatic variations, external influences, cognitive abilities or social complexity of these populations. In parallel, the fine sieving and flotation of the sediments, associated with the three-dimensional co-ordination of the finds, the micromorphological and geomorphological studies, associated

with the analysis of the different spoils by specialists in each area (sediments, lithics, fauna, etc.) will provide an understanding of the taphonomic and site formation processes.

With this information and the systematized cross-referencing of data, it will be possible to continue building a framework of coherent, refined and high-resolution knowledge, and identifying, in time and space, intense and discrete variations both in the sedimentary and archaeological record. This approach, which has yielded results in the past, is expected to answer the initial questions that guided EcoPLis, as well as those that, over time, will emerge as a consequence of our research.

Without a direct connection to research, but with an important role in its relationship with society, during the second phase of EcoPLis, emphasis will continue to be given to the dissemination of the project, the sites, our work and results, both through personal and human interaction with the public, and through social networks and media, in close relationship with educational institutions and territorial management institutions.

## 6. CURRENT STATE OF THE ART

Palaeolithic research in Portugal began with the excavations of Nery Delgado (Delgado, 1884). Despite this, knowledge of this period remained incipient until the 1990s and only changed with foreign researchers, and an increase in theses, research and researchers (Zilhão, 2002). In Central Portugal, despite the development of several research and minimisation projects, there are no known remains prior to the Middle Pleistocene.

The work at the source of the Almonda permitted the collection of abundant fauna associated with human fossils up to a date close to 400,000 years old (Daura et al., 2018; Hoffmann et al., 2013). This chronology is consistent with results obtained for the Tagus terraces, where Acheulean contexts appear on the lower and middle third of the T4 terrace, followed by Mousterian contexts on the top of T4, as well as on T5 and T6, while older contexts have not yet been recognised (Cunha et al., 2018;

Pereira et al., 2019). Currently, there are still no published dates for the Acheulean of the Lis River basin.

Until the 1980s, references to the potential of the Lis by Leite de Vasconcelos and Joaquim Fontes, corresponding to discoveries made by Carlos Ribeiro, Cartailhac and Tavares Proença Júnior. Manuel Heleno also identified dozens of sites although he did not recognize any stratigraphic relation during his geological survey, with a record of stratigraphic interest of some and an excavation at Quinta do Cónego (Cunha-Ribeiro, 1999).

Between 1984 and 2000, Cunha-Ribeiro conducted work that led to the production of one of the first doctoral theses, in Portugal, on the Palaeolithic, with strong prospection and excavation components, as well as the study of Quaternary fluvial and colluvial formations; however, these contexts still lack absolute dating (Cunha-Ribeiro, 1999).

As far as the Middle Palaeolithic is concerned, data are particularly lacking, with only Pedrógão Beach (for which dating is pending) (Aubry et al., 2005) and Mira Nascente, which is dated to 40 ka (Haws, et al., 2010). Of particular interest is their location on the coast, with all the implications this has for the exploitation of marine resources by Neanderthals. The difficulty in identifying these contexts may be associated with intense sedimentation and erosion processes, with a high probability that these contexts are preserved in caves.

Regarding the Upper Palaeolithic, despite the findings of Manuel Heleno, research only got a boost with the discovery of the Lagar Velho Shelter (Zilhão & Trinkaus, 2002), which led to the discovery of other contexts in shelters in the Lapedo Valley (Pereira 2010). At the same time, the minimisation and Archaeological Chart work made it possible to record caves and shelters with considerable sedimentary fills and good preservation in the Chitas, Leão, Murtórios, Fagundo valleys and adjacent areas (Carvalho, 2011).

Thus, the work developed before the first phase of EcoPLis (2015-2018) showed that this basin (Figure 1) has good preservation of Palaeolithic and early Holocene contexts, that

these contexts were well distributed in the landscape, confirming great archaeological potential of this region. This information was consistent with its geomorphological and environmental characteristics which provide, even today, a diversity of important resources for hunter-gatherer groups, particularly concentrated in the leafy karst valleys, ecotone ecosystems, which quickly, safely and comfortably, connect the coast to the Lower Tagus Basin and the territory of the Ancient Massif.

Resources include biotic (fauna and flora), abiotic (fresh water, salt, gravel beds with various raw materials and flint outcrops), and living spaces (caves, shelters and protected platforms). In this sense, it was hypothesised that these valleys may have acted as refuges, especially during the harshest climatic periods. As until now, there had not been a project focused on this question, EcoPLis was considered interesting, and received considerable support and financing, with which obtained results allowing the validation of this possibility, despite its early stage of research.

Among other results, in the quadrennium 2015-2018, it was possible to recognize, in Abrigo do Poço, two occupations, each one associated with a period of climatic crisis and a specific activity. Thus, in Solutrean, the site was used to exploit a flint outcrop almost to exhaustion for the production of blanks and foliated tips. The geochemical difference between this source and others in the Chitas Valley would have justified this intense activity. In the Epipaleolithic, the site was used for the consumption of marine resources, probably transported from the coast or the Lis estuary and opened there by heat, which justifies the great quantity of charcoal and shells. In the Chitas Valley there is another similar context, but with a broader chronology (Brás, et al., 2006).

In the Buraca da Moira Shelter, a sequence between Neolithic and Final Gravettian, continuing down to an unknown depth has been identified. The relevance of the continuity of the research in this site is based on two axes. On the one hand the good preservation of the human remains of the necropolis, a

context unknown in the region until now and, on the other hand, due to the identification of Aurignacian in Foz Côa (38.4-34.0 ka cal BP - Aubry, et al., 2020), at Lapa do Picareiro (41.1-38.1 cal BP - Haws et al., 2020) and Pego do Diabo (33.5-34.5 ka cal BP - Zilhão et al, 2010), confirming a possibility previously pointed out by (Zilhão, 1997). This research is particularly relevant given that studies on the extinction of Neanderthals and their replacement by modern humans peg this phenomenon to 41-39 ka cal BP in Europe (Higham et al. 2014) and 34-32 ka cal BP in western Iberia, with the possibility of coexistence (Bicho et al. 2014), given that Gruta da Oliveira, in the mountains, and Mira Nascente, on the coast, were occupied by Neanderthals between 40 and 33 ka (Angelucci, 2009) and ca. 40 ka (Haws, et al, 2010), respectively.

In view of these developments, EcoPLis will continue to help clarify these and other questions about the Pleistocene human occupation of the western Iberian Peninsula, as well as help complete and refine the information currently available.

## 7. TECHNICAL AND SCIENTIFIC DESCRIPTION

The excavation work at sites with already known archaeological contexts and where the intention is to extend the excavation areas will be carried out with the usual tools (trowel, pick, broom and dustpan). More delicate tools (brushes and teques) or heavier ones (pickaxe, lever, sledgehammer or others) can also be used, as necessary, and according to the principles normally established for archaeological fieldwork.

The whole area will follow a 1x1m grid, each 1m<sup>2</sup>, preferably subdivided into four 0.5x0.5 metres. Natural layers will be followed, subdivided into 10 litre buckets within each quadrant whenever archaeological remains are identified, which will be separated according to this subdivision. All sediments will be

sieved with a minimum 3 mm mesh, and whenever possible, sediments will be subject to flotation. In parallel, systematic collections will be made for palaeoparasitology (to be carried out in an external laboratory), geoarchaeology and archaeobotany. All the finds identified in the soil and samples made will be three-dimensionally coordinated and stored in individual bags, labelled to indicate their origin. Each individual artefact will be given a unique sequential number. Finds collected during flotation or screening will be identified with reference to the site, square, quadrant, stratigraphic unit, and bucket.

The aim is to obtain high-resolution data of various kinds – namely, the location of each organic or inorganic specimen, the chronology of occupation, the state of preservation of the sequence and finds, and the characterization of possible structures. The detailed study of the deposits, namely the geoarchaeology of the stratigraphic sequences, the artefacts, faunal and botanical assemblages or their spatial integration, will be carried out within the framework of academic training, with a view to consolidating a team dedicated to the study of the deposits. We will consolidate a team dedicated to the EcoPLis, something done with great success in our first quadrennium.

With regard to the work of cleaning out cuts and drilling, similar means will be used to those used in the 2015-2018 four-year period, although in the case of the Acheulean sites it may be necessary for the initial work to include the use of a digging machine.

As far as prospection is concerned, the team will travel in light vehicles, parking them in safe places. From there, we move on foot, in a single group or in sub-groups, adapting to the conditions of the landscape and the terrain, always maintaining the safety conditions for our members, as well as for others and existing property. In situations of dense vegetation, the team will use light gardening equipment (shears, saws and thinning blades) to clear the way and expose each site to the degree necessary for its characterization. This characterization will result from the observation of the sedimentary deposits, the

surrounding conditions, their characteristics and geomorphological framework, and the identification of traces on the surface, in cuts or in other circumstances, without affecting the sedimentary packages, although these may need to be cleaned. The identified sites will be described *in situ*, on the Site Sheet made available by the DGPC and in according with the Thesaurus list. The coordinates will be taken with portable GPS, with accuracy ranging from 1 to 5 metres.

The work to be carried out between 2021 and 2024 will be directed towards:

1) Buraca da Moira Shelter: The continuation in depth and in area of the excavation of the Buraca da Moira Shelter with a view to understanding the full extent of its reality. Thus, the work in depth will try to extend and recognize the chronological sequence of the site, whereas the excavation in area will try to make the connection between the excavation area outside and inside, as well as to recognize potential areas where the Neochalcolithic funerary rituals were different from those identified so far.

2) Shelter of Palha: The excavation of the Shelter of Palha, in a row connected to the ditch excavated for the sewerage pipe, the platform in front of the shelter (where, at the time, fireplaces were identified) and the interior of the shelter. This work was planned for the previous four-year period, but we were unable to do it. The excavation of Palha Shelter will allow, together with Poço Shelter, to understand the phenomenon of the stelliferous deposits of the Chitas Valley;

3) Terraces: Cleaning of cuts in the Acheulean contexts of Casal do Azemel, Quinta do Cónego, Areeiro do Aeródromo East and Parque das Merendas do IPL, in order to make an updated geomorphological framing, collect samples for geoarchaeological study, palaeoenvironmental reconstruction and absolute dating. Besides the construction of an absolute chronological and palaeoenvironmental framework for these contexts, this work will also help us understand why it is hard to find Mousterian contexts in the Lis terraces.

4) Survey and test pits: Continuation of the survey in the basin in order to identify new sites, but mainly to probe caves with unknown archaeology whose interior appearance suggests they are sites with great potential for deep deposits with good preservation. In the case of the caves, this work will also include clearance and prospection work in order to recognize galleries and any vestiges present in them. See Table 1 for the list of sites to be intervened in the scope of EcoPLis during the 2021-2025 period, and which are reproduced below.

### **Abrigo do Poço**

Chronology: Solutrean, Epipalaeolithic, Neolithic.

Context: Shelter.

Description: Three contexts. The Epipaleolithic context with abundant lithic industry, malacological fauna and charcoal. The Solutrean context with abundant lithic industry and malacofauna. The Neolithic context is recognizable by a pottery sherd in an upper shelter.

Work to be carried out: Completion of work in the area opened between 2015 and 2018, namely in squares E20 and B20.

### **Abrigo da Buraca da Moira:**

Chronology: Terminal Gravettian, Proto-Solutrean, Solutrean, Late Neolithic

Context: Cave

Description: Various prehistoric contexts. The recent prehistoric context corresponds to a necropolis with thousands of human osteological remains. The old prehistoric context corresponds to a Palaeolithic sequence that begins in the Solutrean which goes at least until the Terminal Gravettian, with abundant lithics, fauna and charcoal.

Work to be executed: Continuation of deepening the excavation (to extend its chronological sequence) and widening in area (to guarantee the safety of the excavation at depth) as well as to understand the relationship between the two excavation areas.

# 8. GLOSSARY

**EcoPLis:** Acronym for the project "Pleistocene Human Occupation in the Ecotones of the Lis River."

**Scientific Directors:** Individuals responsible for all fieldwork and have authority over all operations and decisions made.

**Scientific Coordinator:** Individuals designated by the scientific directors to be responsible for specific activities in the fieldwork.

**Experts:** Researchers conducting specific analyses and collections.

**Excavators:** Individuals tasked with excavating, sieving, and coordinating findings.

**Specialized Sample:** Sample collected or indicated for collection by the experts for specific analyses such as paleobotany, sediments, absolute dating, parasites, etc. All samples are marked with a Total Station.

**Excavation Area:** Areas with archaeological scientific intervention underground.

**Stratigraphic Unit (S.U.):** Sedimentary unit that distinguishes itself from others by its composition. They are numbered and sequenced from top to bottom.

**Datum:** Reference points on the ground that allow the precise stationing of the Total Station.

**Total Station (TS):** The instrument used to record the 3D location of findings and S.U.s with an error margin of less than 1mm. The stations are connected to computers for data storage.

**Elevation Tags:** Sequentially numbered tags per square containing the ID given by the TS recording. Each excavator places them in the storage bag with the excavated find, allowing for its identification in the laboratory.

**S.U. Record Sheet:** The sheet where the definitions and characteristics of the stratigraphic units are recorded.

**ID:** Identification number of each finding recorded by the TS.

**Anonymous ID:** Identification number used to outline polygons as stone blocks or elongated findings to gather information about their inclination and direction.

**Stationed Point:** All findings recorded by the TS.

**Square:** Excavation unit measuring 1x1m within a grid organized in an alphanumeric system.

## 9. METHODOLOGY OF THE ARCHEOLOGICAL EXCAVATION

The protocols and methods described below form the basis of the daily work at EcoPLis, including excavation work, prospecting, and laboratory work.

The excavation areas are divided into a horizontal grid organized in 1x1m squares, individually identified in an alphanumeric system (e.g., J20, I20, etc.). The grid and secondary data are set relative to a previously defined main datum with coordinates 100, 100, 100. Thus, all recorded artifacts have an x, y, and z value (latitude, longitude, altitude) relative to the main datum, allowing for their precise location within the excavation area.

Excavation is done through Stratigraphic Units (S.U.s). The S.U.s are horizontally divided to ensure that all findings are recorded within a significantly limited area and volume of sediment. Therefore, the S.U.s are divided horizontally into 1x1m squares, which are further subdivided into quadrants of 0.50x0.50 m (A, B, C, D).

Additionally, the S.U.s are vertically subdivided into 10-liter (10 l) volumes within each quadrant. This volume corresponds to the volume of each bucket.

When necessary, the S.U.s may be further subdivided into sub-S.U.s.

During excavation, when a discontinuity in the sediment pattern is detected (color, texture, resistance, elements - e.g., more or fewer stones), the excavator must:

1. Call a responsible person to verify if a new S.U. has been encountered.

## 2. Follow the instructions of the responsible person.

During the excavation, the volunteer should:

1- Before starting a new Sediment bucket (10 litres), enter a new bucket entry on the Recording Form and log the 3D coordinates of the midpoint in the area to be excavated. The corresponding label should be attached to the bucket. This task must be done under the supervision of a responsible person;

2- As materials appear, do not remove them from their original location until they are documented.

3- Continue excavating around the artifact (not below) to check for possible connections with others.

4- Request dimensioned points following the steps described in the three-dimensional registration protocol.

5- The excavated sediment is removed quadrant by quadrant into the bucket, and altimetric levels are registered when filled (corresponding to 10 liters of sediment);

6- After excavating the sediment corresponding to one bucket (i.e. 10 liters), an altimetric point is given for bucket closure in the middle of the excavated area.

7- Once the excavation in the intervened area is finished, check if all the fields of the Registration Form are filled out and completed, deliver the bags of registered materials to the total station operator or the coordinator and ask the Field Coordinator to indicate a new square to excavate.

Sequence of procedures for documented points (Total Station, TS):

1- Indicate the type of material (Bucket, Lithic, Fauna, Shell, etc.) to be documented and specify how many documented points will be taken for the same find in the case of elongated or large objects.

2- Small or uniform finds receive one documented point; elongated finds receive two documented points; voluminous finds receive points to outline their perimeter.

3- Place the artefact in the bag with the corresponding label.

4-NOTE: Confirm the label number with the operator, case by case.

# 10. METHODOLOGY OF FIELD LABORATORY

The protocols and methods described below are the basic day-to-day work at EcoPLis.

## Flotation

Sediment flotation is the basic methodology for processing excavated sediments in EcoPLis in order to recover plant macro-remains and microfauna. The sediments collected during excavation are placed in a 10-liter bucket, quantified, labelled, and stored in bags in the field. They are later sent to the field laboratory, where the flotation process is carried out. The flotation process follows the Bucket flotation method.

Each group is responsible for recording the following steps for each sediment bag in the laboratory file (Form 1):

- 1 - Sample ID + flotation number, e.g., ABM-J20-UE4-FLOT 31;
- 2 - Quantity of sediment (L);
- 3 - Time from the start of the procedure to the end;
- 4 - Number of repetitions performed;
- 5 - Collection of the "fine fraction" and "coarse fraction";
- 6 - Names of participants and number of buckets used for agitation;
- 7 - Observations.

The groups should have 2 participants – One for recording (labels), assisting in the extraction of fractions, and preparing the drying area, and another for agitating the buckets. If it is not possible and only one person carrying out the flotation process, they must ensure that none of the steps is forgotten. Depending on the amount of sediment, it can be distributed among two or

more buckets, ensuring that no bucket exceeds 1/3 of its capacity.

The sediment flotation follows the following protocol:

Inside the Building:

1- Prepare two temporary labels labeled "fine fraction" and "coarse fraction" that should contain the field label information: sample identification, originating site, stratigraphic layer/unit, and date.

2- Prepare the drying area (spread newspapers);

3- Keep the two labels to accompany the samples during drying.

Outside the Building:

1- Before starting the flotation, place the sediment in a bucket and record the quantity (L);

2- Divide the sediment into two or more buckets;

3- Prepare another bucket on which a 0.25 mm mesh will be placed (fine fraction);

4- Pour water into the sediment bucket without overflowing;

5- Start the timer for the entire process;

6- Stir the sediment manually with water for approximately 3 minutes. This process allows archaeobotanical materials to float;

7- Carefully pour the water from the sediment bucket through the fine mesh; the archaeobotanical materials that were floating in the water will be deposited on it;

8- Repeat the process four times per sample (or more, depending on the quantity) to ensure the collection of all archaeobotanical material;

9- At the end, the material remaining on the fine mesh should be kept, constituting the fine fraction of the flotation.

10- The material that remains at the bottom of the bucket (material that did not float) is the coarse fraction. After storing the fine fraction, the coarse fraction is placed on the fine mesh, washed with water, and then stored as the coarse fraction.

11- Stop the timer;

12- The "fine fraction" and "coarse fraction" are stored inside the school to dry. The coarse fraction is spread over a

newspaper, and the fine fraction is placed on a white paper sheet on top of the newspaper. The labels of both fractions accompany their respective fractions.

- 13- Clean the equipment (buckets and sieves);
- 14- Repeat the process.

### Screening

The "coarse fraction" resulting from flotation is screened in the laboratory. The screening aims to recover and separate all archaeological materials identified in the samples. Fragments of charcoal, lithics, bones, shells, ceramics, etc., should be separated, just like in the sieving process. For this purpose, "Flot. Sheets" (Sheet 2) contain the information that should be recorded during screening.

## 11. TASKS

The work to be developed will have the following tasks:

- 1- Fieldwork: excavation, test pits and survey; written and graphic register; sample collecting; laboratory and field school.
- 2- Laboratory analysis: Processing and analysis of samples in the office and laboratory of samples obtained from contexts, deposits, human osteological remains and archaeological remains.
- 3- Presentations at conferences and scientific meetings: Planned time for presentation in scientific events, considering the normal times for these events, notwithstanding preparation and presentation in events outside this season.
- 4- Submission of articles: Final submission of articles based on the data collected in the 2015-2018 and 2021-2025 quadrenniums.
- 5- Reports: Preparation and submission of reports to involved and funding entities.
- 6- Actions with the public: Activities with the general public during the excavation period. Among these include open days and lectures. We also prepare an travelling exhibition, which will

circulate among the entities involved, through local councils and schools. We were unable to execute such an exhibition in the first quadrennium.

7- Web communication: Dynamization of the website, YouTube channel and social media networks.

## 12. ORGANIZATION AND MANAGEMENT

The three members of the project management team have more than twenty years of experience in the region, both in research, prevention and land management, having directed EcoPLis during the four-year period 2015-2018.

Consequently, they know deeply the idiosyncrasies of archaeology in the Lis River basin. They also know the landowners holding the sites to be studied, who have been involved in the activities developed, as well as the local council presidents, businesspeople and other influential people in the area. Finally, they know and have good relationships with bodies that manage the region's heritage, territory, and infrastructures.

The members of direction also have extensive work and post-graduate experience in topics related to human behaviour during the Pleistocene and its landscape and environmental adaptation, having focused two of them (TP and VC), in their post-graduate work, deposits from the region of Leiria.

The project will be managed as follows:

- Telmo Pereira is in charge of the technical-scientific and financial management of the project. This team member will also supervise the team members' graduate and post-graduate studies with the collected data. This team member will share logistical and financial coordination with the team members whenever they can get such support.

- Vânia Carvalho is responsible for supporting the management and coordination, liaising the project with the City Council of Leiria and Câmara Municipal de Leiria and society through dissemination (see below), logistics, management of the collection and of the records deposited in the Municipality of

Leiria. This element will also be responsible, in coordination with the other members, for the logistic and financial means to provide, for the supervision, accompaniment and support to any work that is done by researchers and students in any of the premises of the Municipality of Leiria and also for the dissemination among the general public.

- Trenton Holliday is responsible for supporting the management and coordination management and coordination, editing of all texts in English namely abstracts, articles, lectures, posters and project submissions. This element will also be in charge of coordinating all the elements that will carry out undergraduate and graduate studies in the United States with the data collected.

The members of the board are in constant communication with each other, and decisions are made jointly and in coordination. They are also closely connected to the other members of the team.

All members of the team are responsible for the investigations of a speciality nature to which they are associated, which may also be developed by students of different academic degrees that they are supervising. Some of these team members will also be excavating with co-direction functions at the sites, following the same model applied in the first quadrennium, which worked perfectly.

## **13. RESULTS DISSEMINATION**

The scientific results are disseminated through abstracts, papers, posters and articles submitted to national and international congresses and journals.

With regard to dissemination activities, we do an annual open day, news on regional newspapers, and posts on social media. We highlight the importance of the region in the archaeological research, and raise awareness among the population for the preservation of known deposits and others. The results have

been extremely positive, having secured the volunteerism of citizens in monitoring the sites throughout the year.

## 14. PROTECTION MEASURES

- All open pits that do not result in the identification of archaeological remains are covered to the top with the sediments removed from them.

- All open pits that result in the identification of archaeological remains have the cuts and the surfaces protected with geotextile, and then covered with the sediments removed from them.

- During fieldwork, materials will be taken daily to the facilities of the Municipality of Leiria where they will be organized and stored. At fieldwork's end, they will be temporarily taken to the Universidade Autónoma de Lisboa in order to be studied. Depending on logistical issues, a portion of these studies may also take place at the premises of the Municipality of Leiria City Hall or in the partner institutions, in the laboratories of each of each of the team members. After their study, the collection will be permanently deposited in the City Council of Leiria.

## 15. AVAILABLE RESOURCES

The research centers associated with the project are state-of-the-art, fully equipped and constantly updating their field and laboratory equipment. Likewise, the Archaeology Office of the City Hall of Leiria is singularly equipped both in the laboratory and at the field level. On the other hand, the Department of Anthropology of Tulane University has excellent conditions and is an international reference in research in Archaeology, Linguistics, and Cultural and Biological Anthropology.

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