



2024 Spring Conference of the  
Association *for* Environmental Archaeology

Faro, Portugal 3-5 May 2024



# BOOK OF ABSTRACTS

Edited by  
Cláudia Costa  
Aroa García-Suárez  
Anna Rufà  
Ceren Kabukcu

Hosted by University of Algarve





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**2024 Spring Conference of the Association for  
Environmental Archaeology**

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Cláudia Costa, Aroa García-Suarez, Anna Rufà, Ceren Kabukcu

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## **Organisation**

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## Welcome

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On behalf of the organizing committee of the 2024 Spring Conference of the Association for Environmental Archaeology and of the University of Algarve, we welcome you to Faro.

The University of Algarve was founded on the 16 of January 1979, when its foundation was voted in the Portuguese Parliament. The University of Algarve results from the union of two preexisting institutions: the University of Algarve and the Polytechnic Institute of Faro, which makes it somewhat different from most universities, given that colleges and schools of both systems normally co-exist. It was also the only Portuguese university created by law.

It is placed in the southernmost region of the Portuguese mainland: the Algarve. The university has its headquarters in Faro, where two of its three campuses are located: Gambelas and Penha *campi*. It has around 10,000 students, 20% of whom are international, from more than 90 nationalities, and around 700 permanent teachers and researchers.

Archaeology has been at the core of the University since its foundation, and it is currently part of the Human and Social Sciences Faculty. Since the creation of ICAREHB (Interdisciplinary Centre for Archaeology and Evolution of Human Behaviour) in 2013, the area strongly supports an interdisciplinary approach in palaeosciences, including archaeobotany, ecology, palaeoclimatology, geoarchaeology, ancient DNA, and bioarchaeology, through the enrolment of researchers in training and teaching activities at the three-level courses in Archaeology.

We are honoured to have the support of the municipalities of Faro and Vila do Bispo. Our gratitude is also extended to Associação Arqueológica do Algarve, Archaeology Hub and to the other generous sponsors.

This conference focuses on the *Environmental Archaeologies of Origins and Transitions in Prehistory*, exploring the complex interplay between human history and ecological dynamics that lie at the heart of our discipline. This collection of abstracts showcases a wide range of environmental approaches that can be applied to examine and interpret the archaeological record, spanning the disciplines of archaeobotany, zooarchaeology and geoarchaeology. The session on the *Environmental Impact of Sustained Human Settlements* addresses the reciprocal relationship between ancient societies and their surroundings, covering a broad geographical range and chronological time periods. Talks on *Agricultural Origins and the Earliest Villages* examine the origins of plant domestication and its impact on the emergence of sedentary societies, providing insights into the foundational stages of human civilisation. The student-led session *Lightning Talks on Environmental Archaeology* provides succinct summaries into a diverse array of topics, showcasing the breadth and depth of research undertaken by young scientists. The session dedicated to *Cross-disciplinary Research in Environmental Archaeology* underscores the collaborative nature of our discipline, where experts from different fields of knowledge often converge to unravel the complexities of past human-animal-environment relations. Finally, oral contributions on *Adaptations to Coastal and Wetland Environments* shed light on the challenges associated with the management and sustainability of these fragile ecosystems.

Together, these sessions invite us to reflect on the urgency of comprehending our collective environmental heritage in order to foster a more sustainable trajectory for future generations.

Enjoy Algarve,

Ceren Kabukcu<sup>1</sup>, Anna Rufà<sup>1,2</sup>, Aroa García-Suárez<sup>3</sup> and Cláudia Costa<sup>1</sup>

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## Schedule Summary

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### **3RD MAY, FRIDAY**

- 10.00 - REGISTRATION: DESK OPEN
- 12.00 - CONFERENCE OPENING
- 12.15 - WELCOME, PRACTICAL INFORMATION & AND KEY AND AIMS OF THE CONFERENCE
- 12.45 - LUNCH
- 14.00 - SESSION 1: ENVIRONMENTAL IMPACT OF SUSTAINED HUMAN SETTLEMENTS
- 15.40 - DISCUSSION
- 15.55 - COFFEE BREAK
- 16.25 - SESSION 2: AGRICULTURAL ORIGINS AND THE EARLIEST VILLAGES
- 17.45 - DISCUSSION
- 19.30-20.30 - WELCOME DRINKS: MUSEU REGIONAL DO ALGARVE

### **4TH MAY, SATURDAY**

- 9.00 - REGISTRATION
- 9.30 - SESSION 3: LIGHTNING TALKS ON ENVIRONMENTAL ARCHAEOLOGY
- 10.05 - DISCUSSION
- 10.20 - COFFEE BREAK
- 10.50 - SESSION 4: CROSS-DISCIPLINARY RESEARCH IN ENVIRONMENTAL ARCHAEOLOGY
- 12.30 - DISCUSSION
- 12.45 - LUNCH
- 14.00 - SESSION 5: ADAPTATIONS TO COASTAL AND WETLAND ENVIRONMENTS
- 15.40 - DISCUSSION
- 15.55 - COFFEE BREAK
- 15.55 - POSTER SESSION
- 16.45 - CLOSING STATEMENTS, ANNOUNCEMENT OF THE STUDENT PRIZE  
GROUP PHOTO
- 19.30-22.00 - CONFERENCE DINNER

### **5TH MAY, SUNDAY**

- 8.00-18.00 - FIELDTRIP TO SAGRES

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## SESSION 1: ENVIRONMENTAL IMPACT OF SUSTAINED HUMAN SETTLEMENTS

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### S1.1: Long-term development of cultural landscapes in Timor-Leste

Simon Connor<sup>1\*</sup>, Frederico dos Santos<sup>2</sup>, Susan Rule<sup>1</sup>, Sarita Camacho<sup>3</sup>, Larissa Schneider<sup>1</sup>, Simon Haberle<sup>1</sup>

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Timor-Leste occupies a key position in the history of human migration and adaptation in South-East Asia, with evidence of cultural continuity, artistic development and maritime connections stretching back tens of thousands of years. Over this time, strong cultural and spiritual links have been forged between people and the rich biodiversity of the Wallacea region, creating distinctive landscapes of high biocultural value. These landscapes are of critical conservation value and rely on particular kinds of human intervention to maintain their cultural and ecological integrity. While Timor-Leste's archaeology is well researched and has yielded valuable information on past interactions between local people, flora and fauna, there is no information about long-term change in the country's landscapes. It is critical to understand these landscapes and safeguard their cultural significance for future generations as Timor-Leste enters an era of rapid development.

This presentation will highlight new research into Timor-Leste's Holocene vegetation and land use, providing insights into ancient human-environment interactions and the creation of ancient cultural landscapes. The presentation will also highlight approaches to engaging local communities in the scientific research process through animations and storytelling.

*Keywords:* Palaeoecology, Holocene, Timor-Leste

### S1.2: Natural conditions of the Urals during the last ten millennia as triggers for the flourishing and fall of ancient societies

Vlada Batalova<sup>1\*</sup>, Elizaveta Orlova<sup>2</sup>, Mikhail Pereskokov<sup>2</sup>, Pavel Sannikov<sup>3</sup>, Lyudmila Shumilovskikh<sup>1</sup>

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Multicomponent natural environments and the close interdependence of natural components such as climate, water, vegetation, and soils are responsible for ecosystem dynamics over different time periods, as the slightest change in one natural component changes the entire ecosystem. These changes in ecosystems are often considered as the leading triggers of cultural transformations in the pre-industrial era, in addition to socio-economic and political reasons. The transformation of ancient cultures is manifested in the birth, flourishing and fall of a particular culture, as well as in the transformation of one culture into a new one adapted to a new ecosystem.

Issues of cultural transformations in the Ural region of Russia have been a subject of scientific debate for a long time since the Urals have the vivid and complex history of economic development as a meeting point of European and Asian tribes. In addition to the appearance of the first humans in the Urals in the Palaeolithic, there is a great deal of controversy about the cultural changes of societies during the Bronze and Iron Ages, which laid the foundations for the economic, cultural, social, and religious systems characteristic of the region.

To investigate the environmental reasons of cultural transformations in the Urals during the last ~10,000 years, we collected multiple peat cores from regional oligotrophic bogs and analyzed them using traditional paleoecological methods such as AMS radiocarbon dating, loss-on-ignition, macro-charcoal, pollen, and non-pollen palynomorphs analyses. Here we present the Holocene history of changes in climatic regimes, hydrological conditions, landscapes, and



fire dynamics, that supported or, conversely, limited the forces of sociocultural development in the Urals.

*Keywords:* Holocene, palynology, settlement history

### S1.3: Interaction over the Sea and Mountains from the View of Yayoi Pottery Found in Kyushu, Japan

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Archaeological pottery analysis, especially specifying the materials that form earthenware, can approach provenance estimation, production techniques, dating, paleoenvironmental reconstruction, and resource use. By integrating pottery analysis and other archaeological contexts, it can examine past human activities and social-environmental structures associated with pottery. Our current pottery analysis, focusing on interregional interaction during the Yayoi period (ninth Century BC and third Century AD) on Kyushu Island, in the southwestern part of the Japanese archipelago, indicated the pottery movement from northern Kyushu to the Korean peninsula via the islands. Although other previous studies emphasized interaction via the sea, a detailed examination of the pottery reveals that the movement of goods and people to remote areas via mountainous regions was also active, leading to changes in regional society.

This presentation shows the relationship between site location and interregional interaction in Kyushu from our analysis results. On the Iki Island between Kyushu and the Korean peninsula, many potteries with morphological characteristics from diverse regions have been excavated. Based on our analysis, pottery produced on Iki Island has similar material characteristics to pottery produced and moved to the coastal areas in northern Kyushu. These potteries also tended to be excavated from the same site. Collaborating with starch residue analysis, we propose the possibility of deepening our understanding of prehistoric resource use and its relationship with the environment. This presentation shows inner and outer interaction over the sea and mountains in prehistoric East Asia.

*Keywords:* Pottery analysis, inner and outer interaction, site location

### S1.4: Megalithic Landscapes and Microworlds: Preliminary discussion of interdisciplinary paleoenvironmental research as part of the MEG-A Project in North Lebanon

Alison Damick<sup>1\*</sup>, Barbara Woronko<sup>2</sup>, Zuzanna Wynganska<sup>3</sup>

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The MEG-A Project is a joint Polish-Swiss project investigating the enigmatic megalith-building societies that appeared in the 4th-3rd millennium in the Akkar, North Lebanon. The Akkar is a hilly, semi-arid region on the basaltic reliefs west of the Yammouneh fault, which is the northernmost segment of the Dead Sea Fault Zone. This area has been described as a "sub-optimal" region for early human occupations given its steep slopes, shallow soils, and position marginal to prime agricultural areas, but still offering a range of resources for potential exploitation.

An important part of the MEG-A project is to understand what about this particular landscape drew people to inhabit it in this time and to build on it in such a distinct way, profoundly different from what was being done by people living in other areas of Lebanon during this period, and to explore how they interacted with the limitations and opportunities afforded by this unique area. Establishing a clear geoarchaeological and paleoenvironmental chronology is necessary to support archaeological explanations of past human-landscape interaction, and doing so has proven to be one of the greatest challenges for researchers working in the region.

To this end, this paper presents the background and preliminary results of the first two seasons of interdisciplinary paleoenvironmental and geoarchaeological work we are conducting to address this issue.

*Keywords:* Lebanon, geoarchaeology, landscape archaeology

### S1.5: Connecting objects and landscape: basket-making and people-environment engagement during the Iron Age

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In plant craftwork, making objects and structures is sometimes a process of growing and tending trees, shrubs or herbs, and the artisans must work with materials in a process of interrelation and adaptation through skill and senses. In the case of basket-making, control over plants was one of the central tasks of crafting, and a crucial issue to assure the existence of appropriate raw materials.

During Iron Age, in Northern Iberia there is a growing number of archaeobotanical and archaeological evidence of baskets and structures made using basketry techniques associated to fences, wattle, and daub buildings. Evidence of basket-making has been preserved, directly, by charring or by mineral replacement and, indirectly, as clay imprints. The evidence recorded up to now indicates the existence of coppicing practices in hazel, and the management of other taxa such as shrubs of the Fabaceae family. The presence of features related to biodeterioration in samples related to wooden fences or other structures built using basketry techniques stresses the relevance of periodically renewing this kind of perishable structures. The information compiled up to now suggests the existence of managed plants oriented specifically to provide adequate raw materials for basket-making creating, in turn, landscapes shaped by crafters.

*Keywords:* Basketry, plant crafts, landscape

## SESSION 2: AGRICULTURAL ORIGINS AND THE EARLIEST VILLAGES

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### S2.1: Adaptation in early sedentary environment-cultural dynamics: Insights from two 9th millennium BCE cult centers in the Middle Euphrates Basin

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At the dawn of sedentary life, early human societies in South-Eastern Türkiye experienced dynamic variations in subsistence and resource exploitation across their distinct local ecological niches. Beyond mere sustenance, the availability of resources also seemed to shape the local cultural characteristics of these early sedentary communities. Within a brief period following the emergence of the earliest sedentary villages in Upper Mesopotamia, particularly in the Middle Euphrates basin, the landscape witnessed the establishment of large-scale cult centers, serving as focal points for inter-communal ritual activities and embodying symbolic significance.

In this study, I aim to provide an overview of zooarchaeological datasets derived from two 9th millennium BCE cult centers, Harvetsuvan Tepe and Sefertepe, shedding light on human responses to the evolving cultural dynamics and sedentary landscapes in the early Neolithic Middle Euphrates region. The dataset indicates an extreme overrepresentation of gazelle, with limited occurrences of sheep, goat, boar, and cattle, suggesting that all animals exploited at these cult centers were obtained through hunting practices. The presence of a diverse range of wild animals prompts inquiries into human adaptation to the new sedentary environment, the

extent of resource exploitation, and their potential implications for animal domestication. It appears that intensive resource exploitation may have subsequently prompted communities to domesticate certain ungulates, such as sheep, cattle, and pigs, or to gradually introduce the domesticated versions of these animals into their subsistence strategies.

**Keywords:** 9th millennium BCE, zooarchaeology, Middle Euphrates

## S2.2: Using plant functional traits to disentangle ecological processes in southwest Asian grasslands and arable fields

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Plant functional ecology has been successfully applied to modern and archaeobotanical weed assemblages to inform about different agroecological aspects of cultivation systems. The commonly applied models focus on crop growing conditions in temperate and semi-arid environments along a productivity axis, primarily reflecting soil fertility and water supply. More recently, models that distinguish grasslands from arable fields using traits related to agricultural disturbance added a tool to further disentangle human management practices in past arable and non-arable habitats. However, our results also show that the application of the productivity model may be misleading when applied to modern grasslands, because the trait specific leaf area (SLA) can indicate habitat productivity or adaptation to shade. We show that in the sampled Levantine grasslands, SLA indicates self-shading of the dense grassland vegetation. This is demonstrated by analysing SLA alongside leaf dry matter content (LDMC), a further trait related to habitat productivity and a plant's resource use strategy. In conjunction with disturbance traits, analysing SLA and LDMC together may therefore represent a further tool to disentangle early Neolithic plant management strategies, as shading in dense stands can be used as a density indicator possibly reflective of forms of disturbance other than soil tillage.

**Keywords:** Wild cereals, grassland ecology, resource management

## S2.3: Agriculture in Northwest Iberia in the 2nd and 1st millennia BC in its cultural and environmental context

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Significant changes in agriculture took place in NW Iberia during the 2nd and 1st millennia BC. These are related to the introduction of new crops but also to transformations in settlement and environment. NW Iberia has a vast carpological record from distinct bioclimatic areas, influenced by Atlantic and Mediterranean climates. This provides an excellent opportunity to examine such changes and integrate them into the environmental, social, and economic dynamics of the Bronze and Iron Ages.

This presentation will provide an overview of the carpological data from NW Iberia in the 2nd and 1st millennia BC and interpret it on an Iberian level. This perspective will highlight the specificities of this region, in which millets (*Panicum miliaceum* and *Setaria italica*) and spelt (*Triticum aestivum* subsp. *spelta*) played a particular role, while the presence of rye (*Secale cereale*), which is exclusive to this region, requires further enquiry. We will interpret agrodiversity as a strategy to build resilience without inhibiting accumulation, showing how, by the end of the 1st millennium BC, communities were able to gather crops in large, fortified storage areas whose management was likely crucial for their social and economic structure.

Furthermore, an analysis of the ample palaeoecological and archaeological records available will allow us to understand the relation between the expansion of agricultural areas, the development of new forms of territorialization and the loss of forested areas. The 2nd and 1st millennia BC were turning points in vegetation history leading to unprecedented deforestation and high-impact erosion events that shaped the region's landscapes. At the same time, settlements became larger and more complex, as a result of demographic growth and socioeconomic changes in which agriculture played an important role."

*Keywords:* Agriculture, environmental trends, socioeconomic changes

#### S2.4: Unveiling Prehistoric Agricultural Practices: Naked Barley Discoveries at a Kiln Site in Ireland

Roisin O'Droma<sup>1\*</sup>

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This presentation delves into the unique findings and implications surrounding the presence of naked barley at a kiln site unearthed in County Dublin, Ireland. The site, exhibiting multiple phases spanning the Middle Bronze Age and the Iron Age, showcases cereal-drying kilns that offer a fascinating glimpse into prehistoric agricultural practices. Of particular interest is the discovery of several thousand well-preserved naked barley grains within a Middle Bronze Age kiln, contrasting starkly with the sparse findings within an Iron Age counterpart, which contained a mere 11 naked barley grains.

Although hulled barley became the preferred crop over naked barley throughout Europe in the Bronze Age, large quantities of naked barley have been found at a very small number of sites in Middle and Late Bronze Age Ireland, suggesting that it remained an important crop for a longer period in Ireland. However, this site is also unusual due to the presence of cereal-drying kilns which were a very new technology at this period, with the majority of kilns in Ireland dating from the Iron Age and Early Medieval periods. There were 10 kilns arranged in an unusual formation and are the only Bronze Age kilns with such a large quantity of naked barley. The presence of 'old grains' with this 'new technology' shows that naked barley was still considered an important crop in Ireland.

This presentation will further analyze the significance of these findings within the broader context of prehistoric agriculture in Ireland, shedding light on the complexities of crop preferences, technological advancements, and cultural practices during the transition from the Bronze Age to the Iron Age. This research contributes to our understanding of early agricultural economies and societal dynamics in ancient Ireland.

*Keywords:* Naked Barley, Bronze Age, Ireland

### SESSION 3: LIGHTNING TALKS ON ENVIRONMENTAL ARCHAEOLOGY

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#### S3.1: Tracing the Transition: Plant Exploitation Strategies in Mesolithic and Neolithic Al-Khiday, Sudan (7000 – 4500 cal BC)

Monika Jovanovic<sup>1\*</sup>

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Wild plants have been (and still are) an important element in human subsistence strategies, especially in Africa, where even in modern times various plant acquisition strategies (gathering, cultivation, agriculture) exist simultaneously. Cultural knowledge of local plants is very high, and it is not clear at what point the transition from gathering to farming happened in certain areas. Such a topic, very well traced in other regions of the world (e.g., Southwest Asia), is poorly understood in the north of Africa, where it is well documented that the classical

division of hunter-gatherer Mesolithic and agricultural Neolithic cannot be applied. Furthermore, the understanding of plant exploitation strategies through the study of archaeobotanical material from hunter-gatherer contexts is challenging on its own due to preservation itself, but even more so in Sudan where the lack of systematic recovering of archaeobotanical remains alongside poor stratified sites poses significant problems.

A well-defined cluster of sites at Al-Khiday (in the Western bank of the White Nile) has yielded extensive archaeological material dated to the Mesolithic and the Neolithic, including macrobotanical remains (fruits and seeds) recovered through flotation and stone tools (grinding bases and hand grinders) for the analysis of microbotanical remains (starch grains and phytoliths). The main interest of the archaeobotanical analyses is to understand the plants that the inhabitants of Al-Khiday used/consumed and if they chose to process them. As those two periods are associated with social, economic and environmental changes, it will be possible to see if those changes affected the subsistence strategies of human communities. Apart from the use of local plant species, of special interest is the presence of exogenous plants, which serve as an indication of contacts between wide regions.

*Keywords:* Macrobotanical remains, starch, hunter-gatherers, plants use

### S3.2: Natural limits and opportunities for historical and contemporary land use: case study of Turan-Uyuk Basin, Southern Siberia

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One of the largest mound fields of the Scythian period, known as the Tuvan "Valley of the Kings", is located in the Republic of Tuva in Southern Siberia, Russia. Most of the known mounds here are grouped into several isolated barrow clusters dating from the 9th to 4th centuries BC. It is believed to be one of the oldest in the world and remains poorly understood. The valley's territory features an extremely continental climate with wide temperature range, insufficient water supply, and harsh differentiation of moisture regimes, making it a unique area due to landscape contrast.

Our study aims to identify the limiting and favorable factors for settlement and economic development to reveal relationships between location of anthropogenic objects and natural landscape conditions in the Turan-Uyuk basin. We applied methods of processing and analyzing to a series of satellite images, climatic time series and landscape mapping. The results indicate that the primary group of monuments in the 'Valley of the Kings' is situated at the junction of erosion cones and the main surface. The main surface is located on flat foothill peneplainized plains composed of loess, ancient alluvial loams, and loess-like loams. These plains are under moderately dry fine-sodded steppe on chernozem-meadow soils. The location of mounds is linked to areas that are most conducive to livestock production due to increased grass productivity and a more favorable moisture regime. These areas include erosion cones and floodplains that experience periodic increases in moisture. Current settlement system in general follows the same factors as the ancient one. Residential areas avoid landscapes with strong natural limitations such as soil salinization and stoniness. The location of the most ancient local complex of the Tunnug burial mound in the inaccessible floodplain with long-term inundation may be a variant of adaptation to protect the mound from possible looting.

*Keywords:* Land use, steppe, floodplain



### S3.3: Detecting aboriginal and historical human impact in the Malpaís de la Rasca (Tenerife, Canary Islands): an initial approach through biomolecular and microarchaeological techniques

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The Malpaís de la Rasca Special Nature Reserve is located in Southern Tenerife (Canary Islands) and boasts an exceptional array of distinctive archaeological, ethnographic, and geomorphological features. 112 archaeological sites have been documented, being cabins, huts, sheepfolds and shell middens the most abundant structures. With a climate distinguished by elevated temperatures, minimal rainfall, and a semi-arid halophyte and xerophilous vegetation, the Reserve is characterized by several strombolian eruption centres that have given rise to a scoriaceous lava field (the Malpaís) that extends to the coast along three kilometres. Recently, we have detected a potential sheepfold in the area around the cinder cone of Montaña Pardela (51m a.s.l., ca. 200m from the coastline). A 1m<sup>2</sup> trench was excavated until reaching basaltic bedrock and a 16 cm sedimentary profile was exposed. This sequence is composed of silty clay sediments with visible organised laminations at the top. Among the recovered materials, we found shells of *Patella ulyssiponensis* at the base of the sequence, a well-documented marine resource during aboriginal and historical times in the area.

For comparison, and in order to characterise the nature of the deposit, samples were also taken from a natural sedimentary profile (20cm depth) located in an overbank meander 50m south of the potential sheepfold. Here, we report preliminary data obtained from the analysis of microremains and faecal and lipid biomarkers performed in all the collected sediment samples. The combination of these analyses has allowed us to identify human activities and the environmental conditions within this area during the Late Holocene. New radiocarbon dating will provide us with precise age estimates to link the history of human occupation to the socio-ecological evolution of the Malpaís de la Rasca landscape.

**Keywords:** Geoarchaeology, islands, pastoralism

### S3.4: Food and agriculture in Medieval Islamic Iberia: an archaeobotanical approach

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Plants were a significant element of medieval life. They were used for many purposes other than food (crafts, medicines, fodder, rituals, etc.) being central in the everyday life of medieval people. However, despite their important role in subsistence and, in general, in society, the number of Medieval sites where plant remains have been studied in Iberia is very limited. This paper aims to introduce my PhD thesis, which focuses on the role of plants in medieval society, through the analysis of plant remains from archaeological contexts. I am studying several Islamic sites distributed across Iberia, to explore the range of plants that were cultivated by Islamic communities trying to understand the contribution of different productive spaces (cereal fields, forests, home gardens, etc.) to food production. Harvesting wild plants is also considered as a practice that contributed to nutrition. Given that I am in my first PhD year, I will present preliminary results from some of the sites analyzed.

**Keywords:** Medieval islamic, archaeobotany, agriculture

## SESSION 4: CROSS-DISCIPLINARY RESEARCH IN ENVIRONMENTAL ARCHAEOLOGY

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### S4.1: Replicating early human behaviour in bird preparation: A pilot-study focusing on bone surface modification and breakage patterns

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The origin of complex behaviour amongst early humans is a subject of heated debate within the scientific community, and the study of small prey remains has become a significant aspect when examining such modern behaviour. Nonetheless, the consumption of small prey by human populations poses analytical difficulties due to the often negligible, or entirely absent, traces on bone surfaces. To address this difficulty, a pilot experimental study focusing on land-based avifauna has been prepared. The aim is to distinguish potential modifications on bird bone surface modifications and fracture patterns that might facilitate the recognition of human manipulation of avian skeletal remains.

Building upon the challenges encountered in the study of archaeological findings recovered from recent excavations in several Iberian Middle Palaeolithic sites, the experimental protocol was formulated to encompass the processing of two uncooked and three roasted birds. The results showcase distinct patterns of bone surface modifications and breakage. Higher numbers of cut marks and manual disarticulation breaks are found on raw animals, whereas roasted animals show local-specific burning stains and higher bone loss. The findings of this pilot study can correlate with the efficiency of early human food preparation and provide a baseline for future research to further explore the role of avifauna in Neanderthal subsistence and cultural practices.

*Keywords:* Experimental archaeology, taphonomy, avifauna

### S4.2: Human-river systems of the Asian Highlands: interconnectedness from deep time to the present

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The Asian Highlands represent the mountain reaches of the Earth's most expansive river systems. Eight of Asia's major rivers descend from here, their waters supporting forty percent of the globe's human population and twenty percent of its economies. Focusing on two Eastern Himalayan rivers, the Yarlung Tsangpo (upper Brahmaputra) and Driчу (upper Yangtze), this presentation is based on an upcoming cross-disciplinary book that examines the on-going interconnectedness of humans and rivers in the region.

Interconnectedness underscores both planetary and human understandings of these rivers. Mountains, shifting tectonic plates, monsoons, and atmospheric rivers have long engaged in a planetary dance of movements and counter-movements characterized by hazards, such as earthquakes, landslides, floods, and droughts. These movements have also created the present dynamic, through gravitational potential energy, which has enabled the current hydropower dam rush in China and India that carries impacts on human and nonhuman ecologies beyond resettlement and displacement. At the same time, Asian Highlands' communities have developed rich and varied responses to the hydrological, ecological, cultural, and social abundance of the region dating back to the early Holocene. Recent archaeological findings suggest that pre-agropastoral settlement of the Tibetan plateau likely dated 7.4-8.4 thousand years ago along adjacent valleys of major river courses and that responses were

marked by variations in settlement sites, livelihoods selection, plant species, and cultural practices, such as burials.

This presentation traces shifts in Asian Highlands human-riverine contexts from the starting-point of cross-disciplinarity. Ranging from a deep time exploration of the region's creation, through to the establishment of small-scale communities and Tibetan kingdoms in the eastern Himalayas, and finally to the hydropower activities of nation-states, such as China and India, it notes the constancy of interconnectedness through change.

*Keywords:* Asian Highlands, human-river systems, deep time

#### S4.3: From Small to Large Scale: Biomolecular Trends of Guinea Pig Remains to Understand Household and Environmental Dynamics in 1st Millennium CE Nasca, Peru

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Environmental factors impact human societies in both long-term and short-term time scales. Our work often examines wide ranges of time to realize large-scale trends in climatic cycles that influence the way that human societies manage subsistence strategies and intergroup interactions. In this paper, we examine the way that household dynamics at the Late Nasca (500-700CE) site of Cocahuischo were transforming over this period to respond to environmental transformations and sociopolitical changes. An often-overlooked proxy for nuanced changes in human responses to these factors is the life cycle of domesticated guinea pigs (*Cavia porcellus*). Guinea pigs are a commensal species that were and continue to be raised for their meat. They reside and are managed in households, often fed vegetive food scraps, thus recording many of the plant species incorporated into human diet. By examining the way that the zooarchaeological and isotopic profiles of guinea pigs shifts through the Late Nasca period at Cocahuischo provides us with the opportunity to consider how dietary shifts among guinea pigs reflect transforming human subsistence and agricultural strategies to mitigate the impact of climate and interregional complexity emerging with the expanding Wari state from the highlands.

*Keywords:* Andes, zooarchaeology, isotopes

#### S4.3: Pearl millet (*Pennisetum glaucum*): unravelling the history of a novel cereal in Medieval Iberia through a cross-disciplinary approach.

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The MEDAPP project (ERC-AdG-101054883) focusing on Medieval plant remains from Iberia is providing very interesting results coming from the study of different archaeological contexts (both Christian and Islamic). Of particular interest is the first evidence of species such as rice (*Oryza sativa*), citrus fruits (*Citrus* spp.), medlar (*Mespilus germanica*), quince (*Cydonia oblonga*) or hemp (*Cannabis sativa*). Among these novelties, there is also a new cereal, pearl millet (*Pennisetum glaucum*), identified in several sites in Valencia and Andalucía, but absent from the European archaeobotanical record.

Domesticated in the Sahel area between the 4th-3rd mil BC, pearl millet spread eastwards crossing the southern Sahara and arriving into India around 1700 BC. In Mediterranean north Africa, it has been identified at different sites from the 1st millennium BC (Lybia, Egypt), and further south it has also appeared in Sudan and the Egyptian coast of the Red Sea. In Iberia, recent research shows its presence in several sites dated to the 12th-13th centuries AD.

Unravelling the fascinating journey of this crop into Iberia has brought together archaeobotanists, philologists and experts of written sources in a multidisciplinary study that began with an unknown crop in the archaeobotanical record and an unidentified plant name in

the written sources. Our paper shows the potential of cross-disciplinary approaches for better understanding the origin and spread of plant species in the medieval period.

*Keywords:* Medieval, archaeobotany, written sources

#### S4.4: Archaeology and heritage in Environmental Impact assessments in Portugal: definitions, issues, and opportunities for paleoenvironmental reconstructions

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The process of Environmental Impact assessment for Archaeology and Heritage is a legal instrument, regulated by its own national and international legislation. Its goals are, generically, to gather detailed information to assess the environmental consequences of a large infrastructure or development proposal. In Portugal, in particular, transformations at the level of competent bodies for the administration of Cultural Heritage and the legal regime for Environmental Impact Assessment, as well as the advancement of the state of the art in Archaeosciences, led to an update in the legal document regulating these processes. This update led to an increase, both in complexity and variety, of the types of analysis and data requested by environmental assessment committees for paleoenvironmental reconstructions within Archaeology and Heritage. Our aim is to present some case studies and take stock of what has been done so far, and propose a series of recommendations, based on experience, in order to optimize and adapt data collection to the objectives of paleoenvironmental reconstruction, with the output of this reflection being a letter of good practices, with the input of several specialists, from various areas of archaeosciences.

*Keywords:* Environmental Impact; Archaeosciences

## SESSION 5: ADAPTATIONS TO COASTAL AND WETLAND ENVIRONMENTS

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### S5.1: High-resolution climate and seasonality data from shells at Franchthi

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Here we present high-resolution paleoclimatic data retrieved from archaeological mollusc shell records. Our novel method combines laser spectroscopy (Mg/Ca) and oxygen isotope ( $\delta^{18}O$ ) analysis in order to extract high-resolution sea-surface-temperature data from a large number of mollusc shells.

Mollusc shells can significantly contribute to archaeological research regarding several aspects of human behaviour as well as of past environmental change. In this work, we analyse limpet shells (*Patella* spp.) which have been proven to be reliable sclerochronological and sclerochemical archives that are able to provide high-resolution insights into past human subsistence strategies alongside a paleoenvironmental context for other archaeological remains from the same stratigraphic layers.

As a first case study, we targeted the prehistoric site of Franchthi in southern continental Greece, where our cost-effective workflow allowed for a sample size of high-resolution (30  $\mu$ m) climatic records from over 180 shell specimens.

To draw more holistic conclusions on past human activities and the influence of the climate, we further integrate other archaeological archives with our shell-derived data, in order to better

understand the influence of local and short-term expressions of the climate, which would have been perceived by the prehistoric occupants.

*Keywords:* Climate, molluscs, oxygen isotopes

### S5.2: Emergence of Animal Husbandry in the Netherlands: Results of the Dutch Research Council Project EDAN (2020-2024)

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The wetlands along the northern coast of Northwest Europe (from the Rhine-Meuse Valley to southern Scandinavia) were inhabited by hunter-gatherer-fishers during the fifth millennium BCE. These communities kept dogs, used ceramics, and they interacted with farmers who lived further inland in Central Europe. When and how the transition to farming took place in this zone has been subject to debate for more than forty years (if we take Zvelebil and Rowley-Conwy's influential paper from 1984 as a landmark). Prevailing perspectives have been suggesting a gradual, albeit earlier adoption of animal husbandry and cereal cultivation, albeit with limited economic impact. The EDAN project combined traditional zooarchaeology, SIA, aDNA, lipid residue analysis, and Bayesian radiocarbon dating to re-examine legacy animal bone assemblages from prominent sites in the Dutch wetlands. Our findings change the chronology, reveal the complexity of this process, providing novel insights into changes in landscape use, management practices, and the socio-symbolic meanings of animals.

*Keywords:* Neolithic transition in Northwest Europe, biomolecular zooarchaeology, pigs

### S5.2: IPeAAT; Tracing changes in human interactions from Peatland Environments

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Four decades of state and commercially funded archaeological excavations in midland industrial raised bogs in Ireland have generated a unique resource of knowledge on the distribution and character of Irish peatland environmental archaeology on a national scale. These datasets have produced a significant corpus of information regarding patterns and processes of Holocene mire development, human impact and landscape change. There have, however, been few attempts to analyse or integrate these datasets on inter-regional or national scales. Irish Peatland Archaeology Across Time (IPeAAT) is addressing this knowledge gap and is currently collating information from all excavated peatland structures as well as their associated environmental datasets (wood, insects, and plant macro) into a specifically designed ACCESS database.

IPeAAT is a 2-year project, funded by the Irish Research Council COALESCE/INSTAR+ scheme, University College Cork, and involving colleagues from Archaeology and Built Heritage Ltd, University College Dublin, the National Museum of Ireland, Bord na Móna and National Monument Service. The database is a unique source of knowledge which links data from the excavated structures with the environmental data and chronological frameworks. This talk will introduce the IPeAAT database and its initial results and findings in relation to the environmental proxies. The talk will also explore how this data can be queried and used to address the interrelationship between past human activity in prehistoric peatlands, how this changed over time and whether this was related to local environmental conditions or societal needs. The database, when complete, will be made open access and will be very useful for comparative analysis on an international level.

*Keywords:* Peatlands, Database, Environment, Interactions, Ireland



### S5.3: Shell middens and soil terraces as archives of human-littoral interactions during the early settlement of Tenerife, the Canary Islands

Álvaro Castilla-Beltrán<sup>1\*</sup>, Enrique Fernández-Palacios<sup>1,2</sup>, Lea de Nascimento<sup>3</sup>, Carolina Mallol<sup>1,2</sup>, Cristo Hernández Gómez<sup>1</sup>

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Limpet shell middens are common archaeological deposits in the coasts of the Canary Islands. Their study has shed light on indigenous lifeways, but their potential as records of local environmental conditions in coastal areas, where sediment deposits are rare and show poor microfossil preservation, remain to be assessed. Here we use a multi-proxy approach (malacology, pollen, NPPs, phytoliths, microalgae and microcharcoal analyses) in two shell midden and one associated terrace deposit in the coastal area of the Isla Baja (Buenavista del Norte), Tenerife, dated between c. 200-1000 cal yr BP. We document trends of change in mollusc gathering strategies in the first stages of island settlement. We also show that sediments within limpet shells preserve plant microfossils that inform of coastal vegetation shifts, including local decline of thermophilous vegetation with Canarian palm (*Phoenix canariensis*) and the endemic shrub *Justicia hyssopifolia*, configure the present coastal scrub. We discuss the drivers of this landscape change during the early settlement of Tenerife through result integration with archaeological and paleoenvironmental studies, and their implications for the understanding of human-littoral interactions in the Canary Islands.

*Keywords:* Shell-middens, Paleoenvironment, Islands

### S5.4: First Paleoenvironmental and archaeological investigations in the Gulf of Guinea Islands and their potential to reveal land use change and human impacts

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The Gulf of Guinea Islands have been a blind spot in archaeological and paleoenvironmental research. This biologically and culturally diverse island group includes cases that have prehistoric settlements (Bioko) and others that only were settled in modern history (São Tomé, Príncipe, and Annobon), sharing a role as central nodes of early colonial Atlantic empires. This diversity has implications for the type and extent of island landscape transformations that resulted from human action.

This paper presents an overview of published and ongoing research in the Gulf of Guinea islands and reviews some historical sources to create a base for different scenarios of human interactions with island landscapes. We highlight the potential for integrating archaeological and paleoenvironmental (coring-based) analyses and research, fostering local participation through capacity building, expanding botanical reference collections and creating multi-disciplinary collaborations between archaeologists, ecologists, geographers, and others.

*Keywords:* Paleoenvironment, Gulf of Guinea, island archaeology

## POSTERS

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### P1: Inferring the palaeo-environmental dynamics from Late Pleistocene micromammal fossil assemblages at Lapa do Picareiro, Portugal

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The Iberian Peninsula is considered one of the most significant regions in Europe to study the developments of human adaptations and changes in the environment throughout the Late Pleistocene. This region is well known as the location inhabited by Neanderthals before their disappearance. The cause of their disappearance remains debatable. Changes in the environment may have influenced the availability of resources and made conditions unsuitable for their survival. Previous research in this region has employed multi-proxy analyses such as large fauna remains, stable isotopes and botanical remains, to understand the changes in the environmental conditions covering a time range when the Neanderthal population dwindled.

This new research at Lapa do Picareiro will be the first micromammal study at the site which aims to achieve more detailed insights into the palaeo-environmental changes. The micromammal assemblage consists of material from two MIS 3 levels, namely Level GG and Level JJ. Some of the objectives of the study are to identify the taxonomic composition and taphonomic modifications in the assemblage; standardise the methodological techniques used at Iberian contemporaneous sites; introduce advanced techniques to extract data and ensure comparisons between these sites.

The outcome of this research will be used to deduce interpretations from alternative environmental proxies studied at the site from the same levels. This approach will provide a high-resolution, sequenced understanding of the palaeo-environmental and palaeo-ecological background during the Middle to Upper Palaeolithic transition.

*Keywords:* Micromammals, Palaeoenvironment, MIS 3

### P2: Big Data, Big Impact: Human Settlement Strategies in the Iberian Peninsula through GIS

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The aridity of the Mediterranean during the Heinrich Events (HE) appears to have limited settlement refugia to such an extreme extent that communication networks and cultural dynamics broke down and were subsequently reorganized under different socio-cultural conditions. These turnover periods can be explained by the emergence of new techno-complexes. For instance, the replacement of the Mousterian by the Aurignacian during HE4, associated to the final (macro-scale) extinction of Neanderthals and their widespread replacement by Modern Humans. This is recorded across Europe in a diachronous and culturally complex succession of distinct morphologies. Although some of these topics have already been the subject of in-depth studies, very few have focused on analyzing territory settlement patterns.

This project is based on a multidirectional approach in GIS using chronological, geographic, geomorphological, and archaeological data. Therefore, a statistical, descriptive, and univariate methodology, using dependent variables (archaeological sites) and independent variables (lithology, altitude, slope, topographic position index, watercourses) will result in the creation of spatial models. This will allow a better understanding of the adaptive dynamics of the hunter-gatherer populations of the Iberian Peninsula between 40 and 24 thousand years ago.

*Keywords:* Iberian Peninsula, geographic information systems (GIS), predictive models

### P3: Analysing the phytolith record from fumier deposits to approach indigenous herding-vegetation interactions in La Palma (Canary Islands)

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The northwest African settlers that arrived to the Canary Islands around the 2nd century CE adapted to isolated insular environments for over 1000 years until the arrival of the European colonizers. During this process of adaptation, the indigenous settlers that colonized the island of La Palma mainly subsisted through herding and a moderate practice of agriculture based on current evidences. Many aspects surrounding their pastoral activities, such as the procurement and use of plant resources, and thus, the exploitation of the insular ecosystems and vegetation communities, remain highly unexplored from a microarchaeological perspective. Phytoliths represent a significant aspect of the recognizable microbotanical findings in the archaeological record, aiding in the recognition and utilization of particular plants.

This poster shows the results of phytolith analyses conducted in two fumier deposits documented at two different cave sites: the Buracas Cave Complex (Northwest of La Palma, 6th – 7th c. CE) and Belmaco Cave (Southeast of La Palma, 9th – 15th c. CE). Initial data suggests that over the centuries, there have been some transitions observed from a predominantly monocot plant-based diet towards one that is richer in dicots among herds. This could possibly imply changes in the use of the landscape and the fodder collection strategies by the indigenous herders. Our archaeological data is supported by phytolith reference material obtained from native and endemic Canary flora.

*Keywords:* Phytoliths, islands, pastoralism

### P4: Short-distance Mobility Patterns in Central European Neolithic Communities: a multi-isotopic approach

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Determining mobility patterns is important for understanding past social dynamics and interactions. This study integrates a multi-isotopic approach to explore the mobility dynamics of the earliest farming communities in Central Europe. Specifically, by combining strontium ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) and oxygen ( $\delta^{18}\text{O}$ ) isotope analysis of human dental enamel, the results of this study have linked these Neolithic communities to different kinds of short-distance movements, likely within local or regional contexts.

This research underscores the significance of employing multi-isotopic analysis to unveil complex mobility patterns among ancient populations. By integrating several isotopic proxies, this approach not only enables the determination of geographical origins but also sheds light on movement within and between communities. Such insights contribute to our understanding of past social dynamics, highlighting the nuanced interactions and mobility strategies employed by ancient communities.

*Keywords:* Mobility patterns, funerary contexts, isotopic analysis, Neolithic, Central Europe

## P5: Mid-Late Holocene climate change in SW Portugal: Ostracod, geochemical and sedimentological preliminary results

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A 1.44m sedimentary core recovered from the continental shelf of Algarve, off Sagres, was analysed according to textural types (sand, silt and clay ratios), organic matter content, and Ostracoda assemblages. The latter are crustaceans with calcite bivalve carapaces and specific ecological requirements (such as water depth and temperature). Dynamics in carapace accumulation reflect marine conditions. Sampling was done every 10cm for the Ostracoda analyses and every 5cm for the remaining proxies. A C14 date at the base supports the core chronology.

The assemblage is largely composed of juveniles, with few articulated carapaces, indicating this is a depositional area from species living close by. The dominating species is the sublittoral *Costa runcinata*; however, phytal, sublittoral-littoral species, such as *Heterocythereis albomaculata*, are also recorded.

Valve accumulation follows the coarser grain size trend. Preliminary results show the lowest sand content occurs at ca. 1650BC, corresponding to the lowest ostracod abundance of well-preserved valves. Increase in fine-grained particle content and ostracod abundance, relatively poorly preserved, between about 900BC and 400BC (Iron Age Cold Epoch) may be related to humid conditions and changes in hydrodynamics. The highest sand content occurred about 70BC (warmer Roman period), simultaneous with high ostracod abundance poorly preserved. More humid conditions after 1300AD (Little Ice Age) favoured fine-grained particles increase, with ostracod valve preservation probably related to lower hydrodynamics.

The record suggests two high-energy events at ~180AD and ~880AD, characterised by an increase in organic matter content, countering the trend from the closest chronological samples.

In accordance with past studies, our paleoenvironmental record confirms the high climatic variability during the Mid-Late Holocene for SW Iberia driven by North Atlantic atmospheric circulation modes that would have affected local human populations reliant on marine resources.

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**Keywords:** Ostracoda, paleoreconstruction, Algarve

## P6: Study of ostracod valve morphology as an indicator of paleoenvironmental changes in Lake Nyalonzwele (Inhambane, Mozambique)

Judite Artur Nhanombe<sup>1</sup>, Ricardo Godinho<sup>1</sup>, Ana Gomes<sup>1</sup>, Maria João Fernandes Martins<sup>1\*</sup>

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Ostracods, aquatic micro-crustaceans with calcitic shells, are biological indicators suitable for reconstituting paleoenvironments given their high abundance in the fossil record and sensitivity to ecological conditions.

Here, we test the hypothesis that valve morphology variation within a lineage of the brackish ostracod *Cyprideis remaneis* reflects paleoenvironmental variation. For this, we analysed valves from part of a well-studied sediment core taken from an interdunal lake spanning a period from ~7000 to ~1500 yrs cal BP. This new approach has the potential to identify disruptive ecological events and provide a better framework when integrating archaeological records.

We developed a workflow of ostracod valve imaging and morphometric analyses. TPSDig2 was used to collect landmark (LM) coordinates (4 conventional LMs and 44 curve sliding semi-LMs). We used the R package Geomorph for standard Geometric Morphometric (GM) analyses, including Generalized Procrustes Analysis (GPA) and Principal Component Analysis (PCA).

However, we still do not have any results from this research, but we hope to identify some morphological variations in ostracods valves, due to the climatic instability that the middle Holocene witnessed in environmental changes and settlement patterns in Africa and around the world.

*Keywords:* Ostracods, paleoenvironments, Holocene, geometric morphometric





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