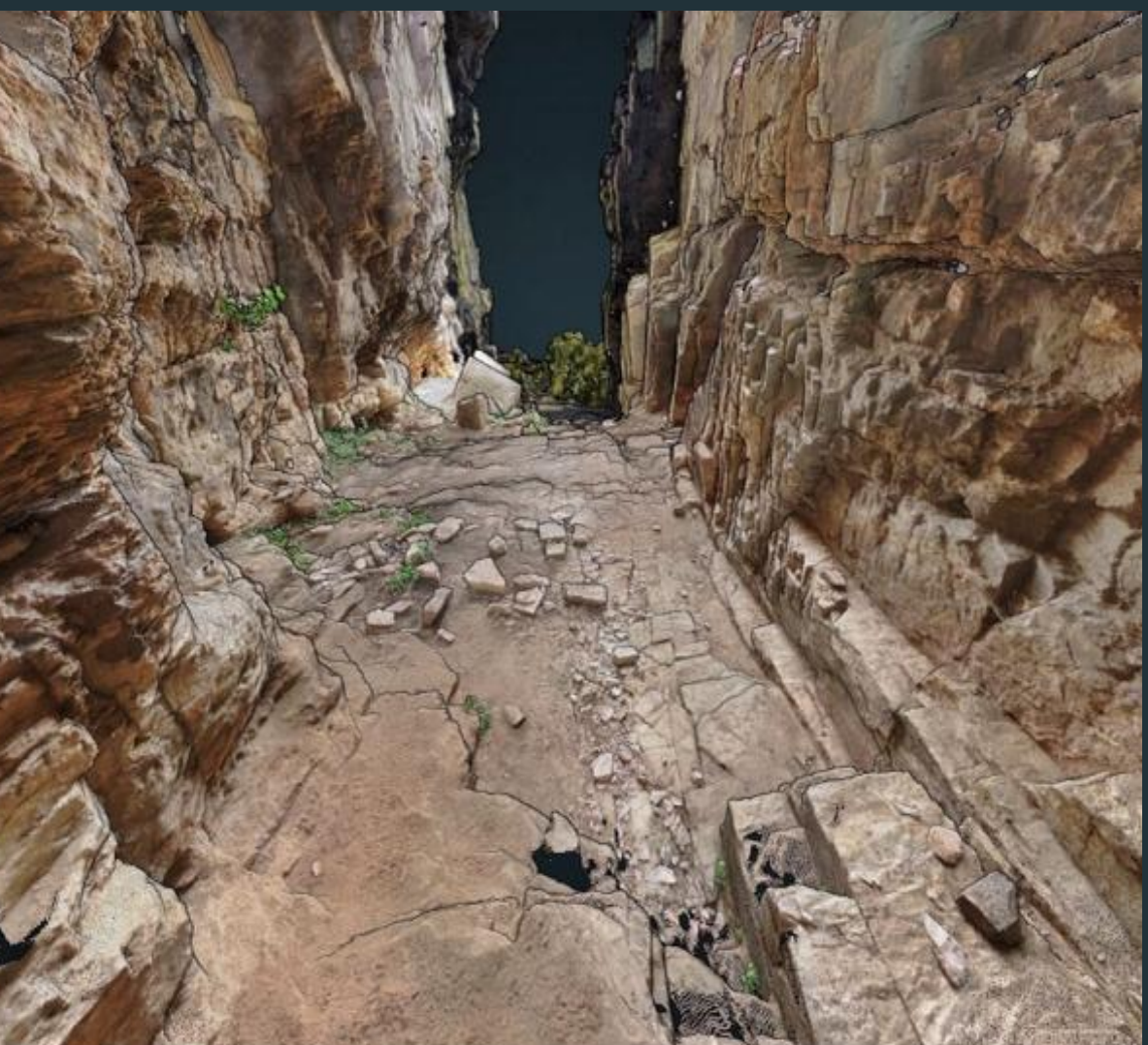
Megaliths and Graphical Markers in Landscapes

New Techniques of Documentation

Edited by
Esther Navajo Samaniego
and Alia Vázquez Martínez



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Cover: Captures produced through 3D models illustrating a view of Buraco da Pala's main room from the entrance of the interior gallery.

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Contributors

Miguel Almeida holds a degree in History with specialisation in Archaeology from the University of Coimbra, a Maîtrise in Ethnology (Prehistory) from Université de Bordeaux I, and a Diplôme d'Études Approfondies in Anthropology (Palethnology) from Université de Paris I – Panthéon/Sorbonne. His multidisciplinary education across European institutions reflects his commitment to diverse perspectives and innovative solutions. Specialising in Archaeology, Prehistory, and Anthropology, his expertise encompasses heritage prospection, geoarchaeology, Palaeolithic studies, lithic technology, built heritage archaeology, military archaeology, and rock art using new technologies. He maintains active involvement in fundamental and applied research, as well as heritage preservation projects. Over two decades, he has developed extensive scientific activity with numerous publications and presentations, collaborating internationally across disciplines to explore new knowledge areas and interdisciplinary approaches.

Fernando Carrera Ramírez holds a degree in Geography and History, specialising in Prehistory (Universidad Complutense de Madrid, 1987), a diploma in Conservation and Restoration, specialising in Archaeology (Escuela Nacional de Conservación y Restauración de Bienes Culturales. Madrid, 1987) and a PhD in History (Universidad Nacional de Educación a Distancia, Madrid, 2005).

Although he has retired, his teaching career has been at the Escuela Superior de Conservación e Restauración de Bens Culturais de Galicia, specifically in conservation of archaeological materials. He has also been part of teaching teams at various universities and currently teaches on the PhD programme in Cultural Heritage Protection at the University of Vigo, among others.

His professional and scientific career has always been linked to the conservation of archaeological sites, particularly those with prehistoric art. Numerous research projects, publications and participation in conferences support this statement. His work on the characterisation and conservation of megalithic art has been particularly intense, but his experience ranges from the Palaeolithic to non-prehistoric rock art. He remains fully active in his research work.

He is a member of the National Scientific Committee on Rock Art of ICOMOS Spain (CCNAR), and of the International Scientific Committee on Rock Art (ISC-CAR). Former president of ACRE (Asociación profesional de Conservadores Restauradores de España), he has been vice-president of that association since January 2025.

Alessandra Caselli completed her studies at the University of Perugia (2015) and obtained a PhD in Near Eastern Archaeology from Sapienza University of Rome. She currently holds a Research Fellowship in Near Eastern Archaeology at the University of Perugia, Italy (since 2020). Since 2013, she has been a member of the Spanish-Italian Archaeological Expedition at Jebel al-Mutawwaq, Jordan, serving as vice-director since 2019. Her research interests focus on the 4th millennium BC in the Southern Levant, specifically Transjordan, and the urbanization dynamics of the Early Bronze Age. This research includes contributions to the PRIN 2022 project "The price of progress. A Multidisciplinary Research on Human-Environment Interactions in the Levant at the Dawn of Urbanism (3500-2000 BC)," supported by the European Union – Next Generation EU (CUP J53D23000150006).

Joana Castro Teixeira is a researcher at the Transdisciplinary Research Center for Culture, Space and Memory (CITCEM), an R&D unit (no. 4059). Holding a Master's degree in Archaeology from the Faculty of Arts and Humanities of the University of Porto (FLUP), she is currently pursuing her PhD at the same institution, focusing on the prehistoric schematic rock art of Serra de Passos/Sta. Comba-Garraia (Mirandela, Portugal).

She has professional experience in archaeological excavation, preventive archaeology, field surveying, rock art studies and recording, and heritage monitoring. She coordinated the Historical and Ethnological Study of the Tua Valley (Portugal), in its Prehistoric component. Her research is mainly centred in the Trás-os-Montes and Alto Douro region of Portugal, focusing on Late Prehistory and Rock Art. She has published several articles on these topics. In 2020 her work was awarded with the Eduardo da Cunha Serrão Archaeology prize (Master's category).

Mónica Corga is currently a funded FCT PhD candidate at Uniarq - Centre for Archaeology, University of Lisbon. Her research focuses on mortuary practices from the 3rd millennium BC, with a special interest in cultural material, multivariate and spatial analysis, and GIS. Specifically, through the study of different archaeological contexts with human remains from the megasite of Porto Torrão (Ferreira do Alentejo, Portugal), she aims to address the phenomena of social complexification of Iberian Chalcolithic communities by analysing the social processing of death and the relations of the living with the dead, while also seeking to develop innovative methods and efficient protocols for preventive archaeology, based on strengthening the multidisciplinary and technological component. These interests stem from her previous academic background and her professional career in Preventive Archaeology, where she coordinated numerous projects in

Portugal and Brazil, with responsibilities including production management, technical and human resources management, and coordination of multidisciplinary Preventive | Rescue Archaeology teams.

Esther Navajo-Samaniego holds a degree in Archaeology from the Complutense University of Madrid (2017) and she has recently obtained her PhD in Prehistory from the University of Alcalá (2025), focusing on megalithic landscapes in the middle basin of the Guadiana River (Southwest Iberia), where she has had the opportunity to employ several methodologies including LiDAR remote sensing. Her research has updated and added new entries to the existing database for the study area. Besides, she has undertaken numerous research stays in Portugal, Ireland, and France, where she has had the opportunity to enhance her training.

Furthermore, she was awarded the JAE Intro fellowship at the Spanish National Research Council, Institute of Archaeology - Mérida (2019), and completed an internship at Gordailua, Heritage Collections Center of Gipuzkoa (2018).

Maria de Jesus Sanches is an Associate Professor at the University of Porto, Portugal, with 42 years of experience in teaching and research in Rock Art and Prehistoric Archaeology, and in management as Coordinating Director of the Master's and Doctoral Programmes in Archaeology (FL-UP). With a PhD in Archaeology and Prehistory (1995) and an Aggregation in Prehistoric Megalithic Art (2006), she has directed various archaeological research projects in rock art, megalithic graves, constructions and settlements. She is the author of more than 160 articles and five books on prehistory and has supervised various Master's and PhD theses. Her recent publications offer overviews of Mesolithic-Neolithic rock art, Bell Beaker and Late Prehistory, demonstrating her research maturity and openness to new methodologies. She has actively promoted public engagement with cultural heritage through in situ museums, tourist routes and Interpretive Centres (Crasto de Palheiros-Murça). Particularly noteworthy are her initiatives related to the rock art heritage of Serra de Passos-Santa Comba-Garraia, begun in 2014, which from 2022 has focused on defending it against a wind farm.

Nuno Ramos holds a degree in Geography and a master's in Risks, Cities and Spatial Planning from the University of Porto, specializing in Risk Prevention and Spatial Planning. During his master's, he developed a low-cost methodology for monitoring potentially unstable coastal cliffs, applied to the coastline of Torres Vedras, Portugal.

He has professional experience in geomatics and 3D digitization, focusing on heritage documentation, structural monitoring, and the integration of multisensorial data. Among the most notable projects are the digital recording of Palaeolithic rock art in the Côa Valley and the structural monitoring of the medieval walls of Leiria Castle.

More recently, he has been working in surveying and technical support for engineering projects, applying precision technologies such as terrestrial laser scanning, GNSS, and photogrammetry for data acquisition, cartographic production, and 3D modelling.

Alia Vázquez-Martínez is a postdoctoral researcher with a Margarita Salas contract at the University of Santiago de Compostela and is currently on a stay at the University of Alcalá. Her research is situated within the field of recent prehistoric rock art, with a primary focus on Galician rock art in Northwestern Iberia. She is a specialist in the application of computational and digital techniques for the documentation, analysis, and interpretation of rock art.

She has developed several of the most comprehensive rock art databases currently available in Galicia (northwestern Iberian Peninsula), thereby making a significant contribution to the systematic study and management of this cultural heritage. In parallel, she has been responsible for multiple research lines focused on the integration of advanced technological tools—such as photogrammetry, Geographic Information Systems (GIS), and statistical methods—into the study of engraved rock art.

Introduction

Esther Navajo-Samaniego, Alia Vázquez-Martínez

This volume constitutes a fundamental contribution to the field of Prehistoric Archaeology, bringing together a collection of innovative works on rock art and megalithic monuments, which are distinguished by the cutting-edge methodologies from which they emerge. This work has its origins in the specialized session, 366, "Megaliths and Graphical Markers in Landscape: New Techniques of Documentation", coordinated by the volume's editors and held within the framework of the 29th EAA Annual Meeting: Weaving Narratives—organized by the European Archaeological Association (EAA)—which took place in Belfast from August 30 to September 2, 2023. During this session, the most recent advances and innovative approaches in the study of these archaeological manifestations were presented, contributing to the renewal of knowledge about prehistoric landscapes.

The contributions gathered in this volume present previously unpublished results derived from recent research, while offering new theoretical and interpretative perspectives that substantially enrich current academic discourse. The body of work is distinguished by its interdisciplinary approach and commitment to methodological innovation, elements that enable a comprehensive examination of the complex relationships between these monuments and their cultural and landscape contexts.

Furthermore, the included studies delve into crucial aspects such as territorial occupation processes, transformations of the prehistoric landscape, and the dynamics of spatial perception, thus providing a more nuanced understanding of these archaeological phenomena. Particularly relevant is the synthesis of emerging documentation and analysis techniques, which not only update existing methodological frameworks but also open new avenues of research for the study of archaeological heritage.

This volume includes pioneering works in the application of new technologies for rock art documentation. Notables are the investigations by María Jesús Sanches, Joana Castro Teixeira, Nuno Ramos, and Miguel Almeida on the rock shelter of Buraco da Pala (Mirandela, Portugal), within the framework of the EscarpArte project. The use of innovative documentation procedures for rock art has provided significant information about the late prehistoric occupation of the Serra de Passos/Santa Comba. This work exemplifies how new technologies generate "new artifacts" that transform both research and the dissemination of archaeological heritage.

Additionally, the research developed by Alia Vázquez-Martínez and Esther Navajo-Samaniego address the dialogues between the north and south of Iberia through the analysis of open-air decorations associated with megalithic builders. This comparative approach enables the identification of patterns of cultural and territorial exchange that transcend traditional geographical boundaries, revealing broader contact networks within the framework of late Prehistory.

The volume incorporates an international perspective through Alessandra Caselli's work on the dolmenic phenomenon in the Southern Levant during the 4th millennium BC, with particular attention to the case study of Jebel al-Mutawwaq (Jordan). This analysis demonstrates the global extension of the megalithic phenomenon and the importance of communal work in the realization of these massive structures linked to ritual and funerary aspects.

Mónica Corga's research introduces a microstratigraphic and transdisciplinary approach to the study of the collective tombs of Horta do João da Moura 1. This work reveals the complexity of mortuary practices, evidencing prolonged and intricate social processes that include discontinuous rhythms, polyphasic depositions, both individual and mass displacements of human remains, as well as scenic exhibitions of relics.

Finally, Fernando Carrera Ramírez addresses the critical issue of prehistoric painting preservation in Northwest Iberia, analysing both paintings in the interior of megalithic chambers and rock paintings in rock shelters. His contribution includes corrective proposals at the territorial scale as well as reflections on the responsibilities of research technicians in heritage preservation.

Collectively, this volume constitutes an indispensable work for specialists in rock art and megalithic monuments, contributing significantly to the knowledge of archaeological heritage studies and its preservation. The volume not only updates the state of the art in these fields of research but also establishes new methodological paradigms that will mark future lines of research in prehistoric archaeology.

The convergence of traditional approaches with emerging technologies, together with the incorporation of international and transdisciplinary perspectives, makes this volume a fundamental reference for the contemporary understanding of megalithic manifestations and rock art, as well as for the development of effective strategies for the conservation and valorisation of archaeological heritage.

This work is supported by project PID2022-141188NB-I00 from the Spain Research National Agency (AEI).

The Buraco da Pala rock-shelter (Passos-Santa Comba Mountain, Mirandela-Portugal). Scrutinizing Neolithic-Chalcolithic site functions and purposes.

Maria de Jesus Sanches [1], Joana Castro Teixeira [2], Miguel Almeida [3], Nuno Ramos [4]

Abstract:

This paper offers a general overview of the ongoing research work in Buraco da Pala (Mirandela, Portugal), where the use of new technologies and procedures of rock-art documentation in the scope of the EscarpArte project has recently added significant information concerning the shelter's and Serra de Passos / Santa Comba Late prehistoric occupation, while also rising new questions and opening horizons for further investigation.

We also put forward the impact of these new technologies and the resulting «new artifacts» for dissemination in the framework of a communication program presenting the visitors with a narrative informed by the complex and ambiguous archaeological reality of Late Prehistory.

Keywords:

Late Prehistory, Northwest Iberia, 3D recordings, prehistoric contexts and paintings

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Foreword

Located in the eastern escarpment of a quartzite inselberg that reaches a maximum altitude of 1,000 meters in the Serra de Passos/Santa Comba-Garraia, the Buraco da Pala rock shelter (Mirandela, northeast of Portugal) (Figure 1) directly faces the winter solstice sunrise (Figure 2-A1). The site was excavated in the 1980s and published in the following decade (Sanches, 1997)[5]. All archaeological layers have been radiocarbon dated. The chronological intervals referred to in this text use calibrated weighted averages of this an extensive C-14 program results.

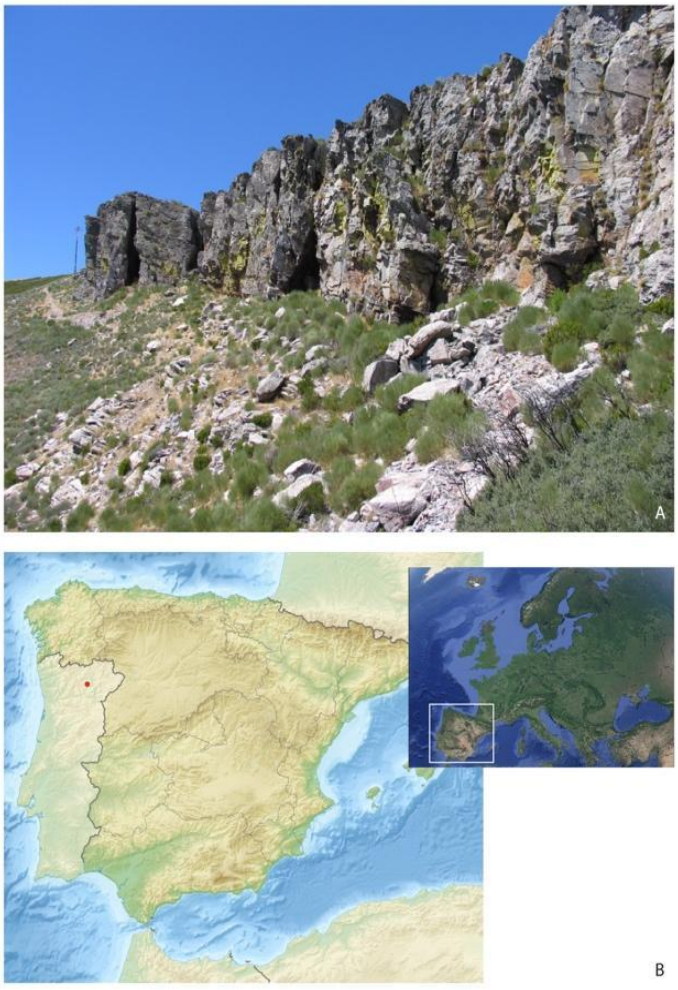

Figure 1. A - View of the Pala's escarpment, showing the Buraco da Pala rock shelter entrance at the left (©RafaelMorais). B - Location of the Buraco da Pala rock shelter and Serra de Passos/Santa Comba - Garraia in the Iberian Peninsula.

[5] The description of the results of the excavation of Buraco da Pala can be found in this publication, so it would be redundant to quote it continuously, particularly in point 3.

The rock shelter's inner space consists of a large, photic room measuring around 80m^2, extending into the interior of the escarpment through a long (27m), yet low and narrow, gallery (Figure 2-A). Both inner spaces have delivered evidence of human occupation, either by its buried archaeological remains and by the graphic manifestations on the shelter's walls. Indeed, several painted rock art panels were also identified along the escarpments adjacent to Buraco da Pala. Outside, further evidence of occupation has been identified in the platform adjacent to the shelter's entrance.

Regional framework and impact

In the 1990s, the first Buraco da Pala excavation's results (Sanches 1996) have surprised the scientific community as preserved stratified layers delivered a sequence of occupations with extensive cultural, ecological, and radiometric data that unprecedentedly proved the occupation of the site dating back to the Early Neolithic — around the 6th to 5th millennium BC transition — a chronology previously unknown for northwest Iberian Neolithic.

The distinctive communal use of that site during the Chalcolithic period should also be noted. Used as a seasonal settlement, during Early Neolithic and Late Neolithic/Chalcolithic period, the site took on a considerable social dimension, becoming a place for ritualistic and scheduled community practices such as the consumption of agriculture products — wheat, barley, broad beans, peas, poppies — and gathering — as acorns (Figure 3). Moreover, wheat, barley, fava beans, and acorns were not just consumed, but also stored in Buraco da Pala, as well as subjected to ritualistic processes, including its destruction by fire. Additionally, other more exceptional practices, such as copper metallurgy, are also documented at the site through the collection of two bellow nozzles— in ceramic and with traces of copper— and a copper axe (Sanches 1997, I: Est XXVII-445) (Figure 4). It is also very likely that gold metallurgy was practiced, of which both the six beads and a small plate found there (layer I) could have remained as archaeological evidence (Cavalheiro and Sanches 1995; Sanches 1997, II: 203-204; I, Est. LXII.2). The emphasis we place on the ritualized practices of consumption and destruction by fire (see below) shows more direct contextual parallels to sites associated with funerary practices (undocumented in the Buraco da Pala rock-shelter) than to habitats.

The schematic painting found on the walls inside the shelter (two panels in the main room and two at the end of the interior gallery) also indicates the existence of spaces organized according to the parameters of performed/ ritualized practices (below discussed in more detail).

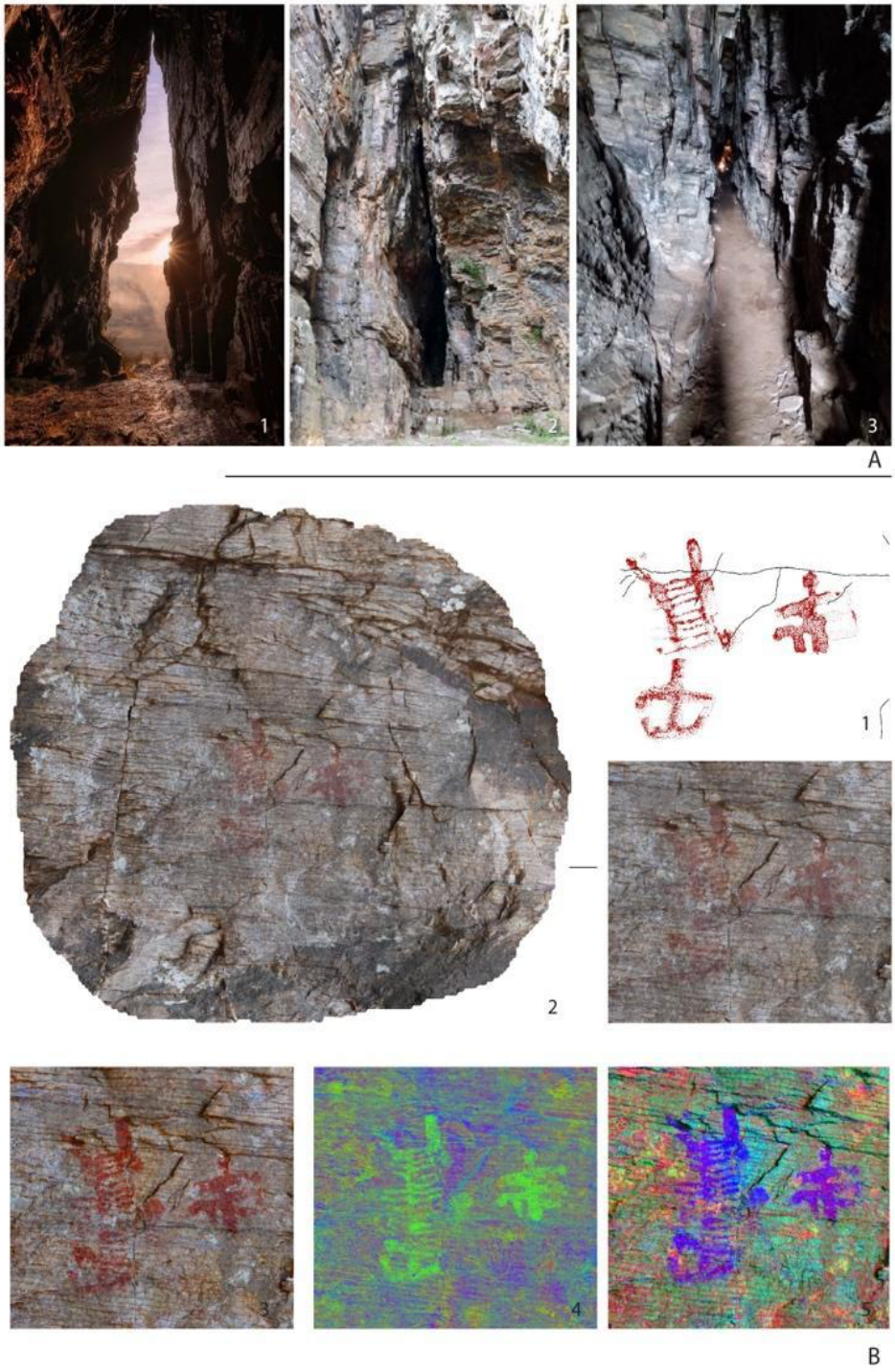

Figure 2. Fig.2: A - Inner views of Buraco da Pala: 1 - Winter solstice seen from the entrance of the rock shelter (©LuísRomba); 2 - Entrance to the interior gallery (photo taken from the main room); 3 - View of the long and narrow interior gallery. B - Buraco da Pala painted panel 1: 1 - Direct tracing of the panel 1 paintings performed in the 90's (Sanches, 1997); 2 – Digital documentation of the panel 1 paintings obtained by SfM-MVS photogrammetry and colour decorrelation.

Within the scope of the EscarpArte project, aiming to open the rock shelter to public visits focused on the site's heritage, a data recovery program using state-of-the-art recording methods and technologies was considered imperative for conservation purposes. Additionally, the resulting 3D digital products should also serve the visit's narrative, enriching the visitors with an informed experience as done in other Iberian sites, such as Penedo Gordo (Comendador Rey *et al.* 2021). Amongst other communication goals, the discourse to be implemented should also underscore good usage and visiting practices consistent with the preservation and respect for this extraordinary, yet unusual, heritage site.

The research and dissemination program, enhanced by digital records

According to an integrated approach stating that scientific dissemination projects must prioritize the material accuracy of "facts" obtained through archaeological procedures, the creation and dissemination of appealing "visual artefacts" must utterly respect the original material objects. Such "visual artefacts" obviously include any produced images or other analytical data, but also their interpretation, where authorial paradigms are inescapable and must always be assumed. They are, therefore, signed and dated.

Because the blind application of technology may create possible "false positives" in terms of rock-art painting interpretation, all laser scanning models (of the entire escarpments or each individual rock shelter / painted panel), are complemented / contrasted by other recording techniques and submitted to direct field-validation. This is the case of the RockartEnhancer and DStretch imaging: while extremely useful in painted rock-art surveying and interpretation, any use of these colour decorrelation algorithms requires a thorough archaeological assessment using comparative documentation protocols concerning the operative chains analysis ("chaînes opératoires" – Leroi-Gourhan 1964; Tixier 1978; 1979; Tixier *et al.* 1980), ink composition, and motive overlapping, among others.

As an example of the issues faced when approaching painted panels' interpretation and its communication to the visitors, especially the non-specialized ones, let's pay attention to Buraco da Pala panel 1. As it can be observed in Figure 2-B, the new techniques of record, analysis and documentation of the panel added some relevant information to the recording produced in the 90s by traditional methods of direct observation and tracing by naked eye observation. This is particularly evident regarding the motif(s) on the left. According to the earlier record there were two separated motifs - a kind of scalariform on top and a schematic anthropomorph positioned below. The application of new technologies allowed us to understand is that these motifs may not be separated. Anyway, we are now facing a new issue: is it one big and complex motif all

together or is it a case of a superimposition? In both cases, the accurate shape and contour of the painting(s) is also difficult to discern. Considering the case of a superimposition, we face now a new doubt - is the bellower motif anthropomorphic, as previously interpreted, or a just a sub rectangular motif with an internal bisection? In fact, what was interpreted as the head of the anthropomorph seems now to be suggested by some differential pigment conservation, but we cannot totally abandon the idea of a dot-like head.

Still considering the hypothesis of a superimposition, an important question to raise is also about what superimposes what? According to the present recordings we cannot accurately discern it and the different colour decorrelation procedures applied may suggest different hypothesis. Besides, there seems to be no difference between the colour tone of the pigments used. Even if this is a case of a superimposition of two motifs, the fact is that, since the moment the second is added to the first one, a reading of a complex whole motif is pertinent. So, once again regarding the superimposition hypothesis, if there are two motifs - or two different moments of painting - what was the vision behind it? To associate two individual motifs or to transform the previous painted one creating a new entity?

In fact, regarding the top of what was interpreted as a scalariform motif, the new recordings seem now to suggest the head of an idoliform with two eyes and two head appendices or «ears». But here there are also interpretation issues and variances suggested by the different filters used - are they real eyes or just two dull dots? The similarities between the two of them suggests that they might be eyes. But this is far from an objective certainty. In fact, our subjective interpretation of what the new recordings are showing us, is of a complex idoliform motif with similarities to some others present in Passos/Santa Comba's iconography but also to some motifs known in dolmen iconography - as it is, for example, the case of the Dolmen de Areita (Gomes *et al.* 1998). However, its complete shape and contouring is in some parts difficult to understand due to conservations issues, surface features, smudge pigment, or even lines that we can't totally understand if its real painting or just some pigment run-offs or even its accumulation in natural fissures of the surface. The colour decorrelation algorithms may sometimes present some variation (possibilities) according to the different colours decorrelated, as mentioned before.

According to this, the main question stands out: how to address these interpretive issues in the visiting discourse? Shall the doubt or subjectivity be part of the message to transmit? These are also some of the questions we are dealing through the implementation of EscarpArte project and why we emphasize that new technologies are indeed powerful tools that amplify our ability to see beyond the naked eye observation, but then the interpretive process must always occur and the final drawing of a motif we produce must always be assumed as a subjective scientific object.

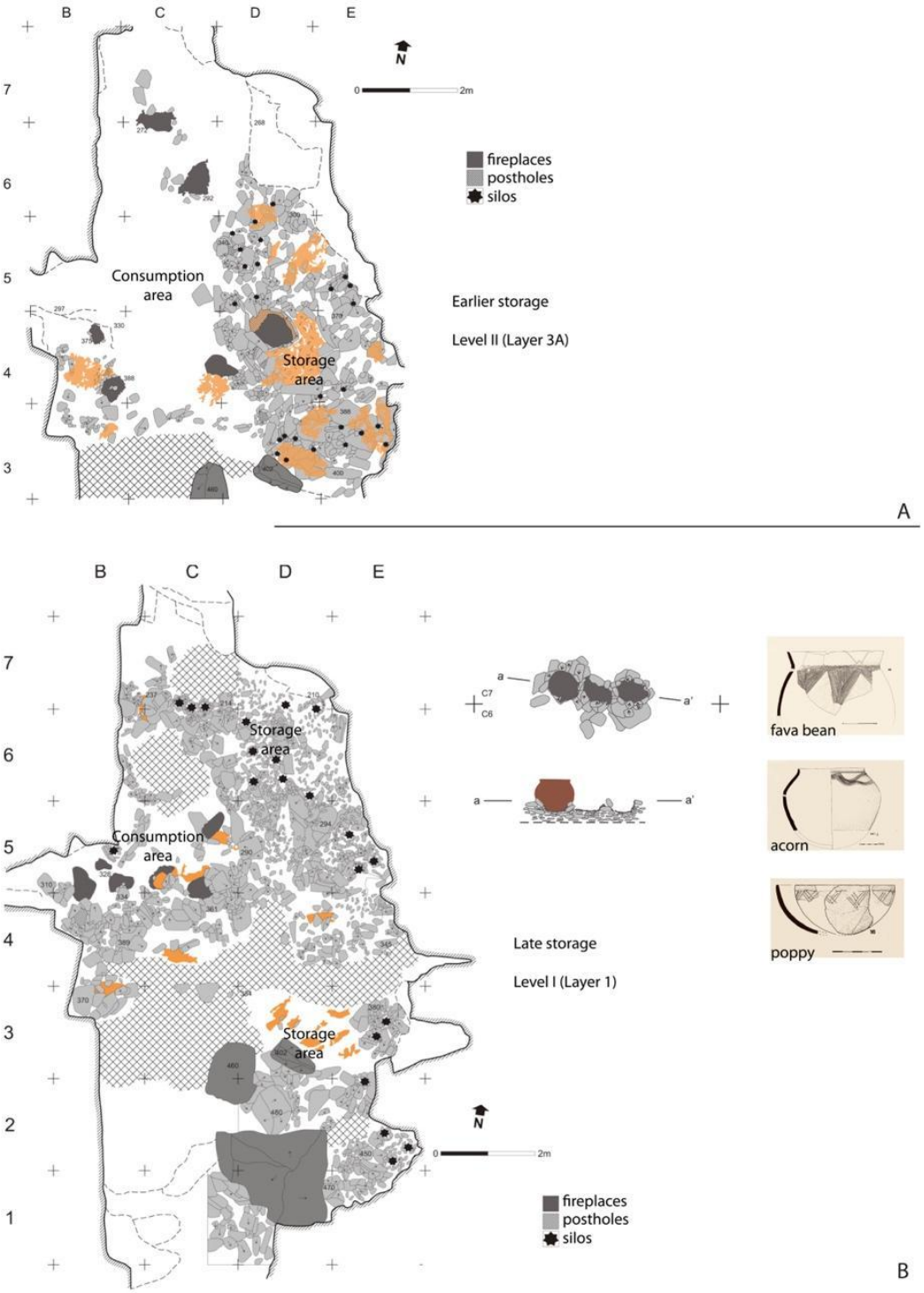

Figure 3. Storage and consumption in Buraco da Pala during the Chalcolithic occupation; A - Plan of the Level II (Layer 3A), referring to the earlier storage level.; B - Plan of the Level I (layer 1), referring to the later storage moment.

Three main objectives were set for Buraco da Pala were settled within the EscarpArte project:

1. Production of an "as-is" realistic 3D digital twin of the rock shelter's interior and exterior areas — entrance, main room, and back gallery — for precise location and spatial analysis of archaeological and rock-art data from previous and recent (limited to the back gallery) excavations and rock-art surveys.

2. Detailed visual inspection of all rock surfaces suitable for painting (within and outside the shelter), followed by photographic documentation and survey using on-the-fly and post-processing decorrelation algorithms, to identify new prehistoric paintings and map "flaked/destroyed" surfaces of the wall (... and present threats, such as recent fires or climbing pitons and spikes).

3. Systematic survey of the surrounding escarpment's suitable rock panels, including the aforementioned recording techniques.

The digital documentation techniques employed are based on 3D survey of the entire shelter, in a multiscale and multisensory approach, ranging from the scale of its surroundings to the panel with rock-art paintings. Inside the shelter, from the back gallery to the entrance, a Terrestrial Laser Scanner (TLS) (FARO Focus S150+) was used for scanning, with a total of 22 stations and an average registration precision of 1.9mm. An aerial photogrammetric survey was conducted outside using a drone (DJI Mini 2) covering an area of interest of approximately 65,000m2. Additionally, a drone flight was performed inside the shelter to capture panels inaccessible with TLS or terrestrial photogrammetry. In total, 1,074 images were used to generate a point cloud, mesh, orthoimage, and digital surface model. The panels were also digitized using terrestrial photogrammetry, employing a Canon EOS 2000D camera. Although these works aren't yet completely finished some preliminary records were already produced (Figure 5).

In this initial iteration, we encountered various challenges in data acquisition with different types of sensors. Nevertheless, we managed to obtain a highly compelling model that showcases the impressive dimensions of this site.

During the data acquisition with TLS, we can acknowledge that the main challenge lies in scanning all the surfaces inside the shelter. The geometry of these rocks is highly complex and irregular making it impossible to achieve complete coverage. This is exacerbated by the shelter's narrow path and vertical development, hindering the laser's reach to all surfaces. The limited lighting in the innermost area of the shelter also hampers the TLS's ability to capture photos effectively. As a result, this area was digitized without colour attributes, extending up to the photic gallery area where the exposure varies significantly between abundant natural light outdoors and low light indoors. To address the lighting issue, it is suggested that in future

surveys, laser scanning should be conducted during cloudy days, with diffuse natural light outdoors. This approach aims to enhance the overall data capture, particularly in challenging lighting conditions within the shelter's interior. Furthermore, a post-acquisition radiometric correction of the survey's photos should be performed (Santos *et al.* 2015).

The image acquisition with the drone for generating the aerial photogrammetric model of the escarpment and subsequent georeferencing of the work resulted in a representative model of the external area. Flying inside the shelter to capture the most inaccessible panels was also achieved, although the results were not optimal due to challenges posed by lighting conditions, the presence of wind within the shelter, and difficulties in stabilizing the drone near the panels due to the lack of GPS signal, thus imposing a flight in ATTI (attitude mode).

On the other hand, terrestrial photogrammetry surveys were conducted under the natural lighting conditions of the shelter at the time, with the assistance of a ladder, which did not always allow for the safe reach of panels and the capture of properly stabilized and coherent photographs. However, this approach enabled us to three-dimensionally document some panels and apply colour decorrelation algorithms to the 3D models, as mentioned.

In certain panels, it becomes possible to observe specific paintings that may gradually become less noticeable over time. Therefore, this digital documentation is crucial to ensure the preservation of these rock paintings.

Scientific support for a public visitation narrative

As stated above, the EscarpArte project/public visiting program is driven by close attention to relevant scientific knowledge, thus demanding a clear definition of the archaeological context of this exceptional archaeological site.

c. 5200-4800 BC

In Early Neolithic times, Buraco da Pala was a seasonal settlement site. Archaeological evidence of this period's settlement was only preserved in a restricted area of the main room, near the entrance (layer 4). However, the entire room must have been occupied, as shown by the discovery of Early Neolithic pottery in its rearmost part. The shelter's dimensions and exposure (including a 25 meters high entrance and a lateral opening facing south), would make Buraco da Pala quite sensible to weather oscillations — particularly wind and rain, thus justifying the presence of several post holes, especially along the side walls, which are the direct traces of huts

made of perishable materials - mainly wood and tree branches, such as oak, cork oak, holm oak, heather, broom and perhaps wild grasses, which would not have been preserved for long but that we admit that were used (Sanches 1997, I, Figure 22, 23).

Figure 4. A - Buraco da Pala metallurgy related artifacts: gold beads, fragment of blowpipe ('alcavariz') and fragment of copper axe; B - Set of green coloured beads (variscite); C: 1 - Poppy seeds; 2 - Fava beans; 3 - Acorn; D - Examples of the most frequent types of pottery found in Buraco da Pala.

Several fireplaces, located at different depths within layer 4, testify the seasonal occupation of the site, set by carpological evidence to have occurred between mid-Spring and mid-Autumn. In fact, until today multiple diaclases of the quartzite continue to channel water from the inner massif, severely dampening the site's ground between November to March. This would probably make the site less attractive to settlements during that season.

Although no pollinic analysis were ever conducted in Passos/Santa Comba - Garraia, pollen data recovered from the neighbouring Madorras I mound (Sabrosa - Vila Real) provided important hints for the reconstruction of the regional prehistoric paleoenvironment. Combining these results with those obtained in the Alto Paiva and Villafáfila regions (López-Sáez *et al.* 2010; 2017) and the anthracological data from Buraco da Pala (Figueiral 1991), we can conclude that, during Early Neolithic, the Serra de Passos/Santa Comba's vegetation would present a dominant mesomediterranean character — attested by the frequency of evergreen Quercus —, but somewhat tempered by a more "Atlantic" character than today's — as shown by the oak forests, arbutus and scrubland of broom. Consequently, at the end of the Atlantic period, the regional climate would show higher humidity levels than today.

The different ecosystems of the mountain and surrounding lowlands help us to get a picture of the multiple activities that have been going on since earlier times and where the creation of small gardens for growing wheat, barley and broad beans — among other wild species that may have been protected to ensure their best production — is more of a social dimension than a strict economic experience. However, as wheat, barley and broad beans are not amongst the endemic flora, their cultivation might be part of social exchanges with neighbouring communities, as are other 'innovations' evidenced in this rock shelter data, including specific ceramic artefacts, mainly small pots.

These first inhabitants were gatherers, hunters, as well as neolithic horticulturists and possibly shepherds, as evidenced cumulatively by the pollen columns from Villafafila (Zamora) (López-Sáez *et al.* 2017). Crops were grown in restricted areas located in higher areas (probably between 750-900 meters) where clearing small areas of forest, using fire, required less effort and could be more ecologically controlled. The rock shelters in the valleys leading to the top were reserved for seasonal occupations more suited to winter grazing. As well as wheat, barley and broad beans grown in small "garden beds" — perhaps to compensate for the scarcity of food, or even for ritual purposes — there was the gathering of acorns, wild grapes and, of course, arbutus, pine nuts and other wild fruits. Although there are no traces of animal consumption, hunting continued to be a strong element, both from an economic and symbolic point of view, as indicated by the hunting tools and the animals (perhaps caprine) depicted on the painted panels of the rock shelters in the lower area. Naturally, these animals could have been domesticated.

3200-2800 BC

Throughout the Early, Middle, and Late Neolithic, evidence is truncated by intertwined anthropic and natural actions. It is in this context of "absences" that a new seasonal residential occupation is recorded at the end of the Neolithic, around 3200-2800 BC (Sanches 1997, Figure 15-21 and 25), in a regional socio-economic context that reveals a greater development of agro-pastoral activities, observed mainly in the pollen columns (López-Sáez *et al.* 2010), but also by the cultivation of a new legume: pea (*Pisum sativum*) (previously undocumented).

However, the Buraco da Pala rock shelter testifies just some of the periods of occupation of Passos/Santa Comba Mountain, which we believe to be continuous from the end of the 6th millennium, as suggested by the various rock shelters with rock paintings and others that were place to specific activities (such as stone knapping, copper metallurgy and, probably, funerary events). It is therefore very likely that, as happens in routine habitats throughout the Neolithic, Buraco da Pala would have been habitually "cleaned" and rearranged so that it could continue to accommodate the human groups that lived there on a seasonal basis, some of whom built funerary megalithic mounds in the lowlands from the beginning of the 4th millennium BC (e.g. Alagoa, Castelo, Arcã and Pedreira).

c. 2800-2600 BC.

Buraco da Pala, in the Chalcolithic period, Buraco da Pala was no longer a rock shelter for everyday life. It was part of the practices of cyclical, calendarized life. Although the social life of these prehistoric communities naturally takes place on a continuum, merging everyday life and non-routine life, the use of Buraco da Pala presents archaeological evidence that clearly points to a place where various types of non-funerary communitarian rituals took place. This can be summarized as follows.

Regarding the stratigraphic sequence, there are three moments of fire, which invaded the entire rock shelter— materialized in layers 3A-B, 2 and 1. It should be noted that layers 3A-B and 2 (level II), display very similar material culture, particularly concerning ceramics' imagery. In layer 1 (level I), both the decoration of the pottery and the storage structures are clearly different from the previous layers. Concerning spatial organization, all three layers have a consumption area —expressed in several fireplaces in the centre / south part of the main room—, and a storage area —, located in the remaining parts, except for the entrance (where archaeological layers were mostly destroyed) (Figure 3, A and B).

By analysing the spatial distribution of data in these areas, we can deduce that (i) the design and location of the two spaces (consumption and storage) were maintained after each fire; (ii) that only the consumption areas were cleaned between different occupations; that (iii) the storage area increased steadily to the detriment of the consumption area, i.e. the latter decreased in proportion to the increase in storage; (iv) that the diversity of consumed products is greater than that of those stored, as it also includes poppy (*Papaver somniferum*), flax (*Linun usitatissimum*) peas (*Pisum sativum*), lentil (*Lens culinaris*) and pine nuts; that (v) the products that were stored in large quantities were barley, wheat, fava beans (*Vicia faba*) and acorn; that (vi) the acorn was only stored on a large scale in level I.

This data is compiled mainly from anthracological and carpological studies (Figueiral 1991; Figueiral and Sanches 1998-99), but the pollen columns prove the development of pastoralism and agriculture in this Late Neolithic and Chalcolithic period (López-Sáez *et al.* 2010; 2017a; 2017b). Confirming this pattern of regional pastoralism and agriculture, there is data from the neighbouring monumental enclosure of Crasto de Palheiros, within the same chronology, where, in addition to the consumption of the same set of domestic agricultural products as Buraco Pala, there is also the continued consumption of domestic animals - sheep and goats and, to a lesser extent, cattle - as well as pigs, probably domestic (Sanches 2016).

The referred layers in Buraco da Pala were archaeologically recorded as fires, with a low proportion of sediment in relation to the amount of charcoal and charred seeds, especially in the storage areas. In the most recent layer (level I) three broken pots with charred seeds inside were exhumed: in one case, fava beans, in another, acorns, in another, poppy (Figure 3-B).

These (and other) archaeological observations lead us to conclude that if that "store" of agricultural goods — barley, fava beans, wheat — and wild ones — acorns —, had burned down three times accidentally (resulting from fumigation practices, for example), the "expected" removal of the charred waste was not carried out. The space continued to be used according to the same sort of activities (except after the third layer fire), and the burnt "remains" are purposely kept as a memory of the total event, being evoked in other activities, scheduled or not, that would take place on the exterior of Buraco da Pala rock shelter, or even beyond this mountain area. In this way, the “store” took on a social significance of its own, transforming its putative removal of the "burnt waste" and other remains (arrowheads, variscite and gold necklace beads, blades, etc.) into an act of iconoclasm.

We can't rule out the idea that the store could have been intentionally burnt down, in a collective attitude that would appeal both to the spectacle of fire and smoke — which would come out of the roof, the main entrance and the side opening — and to the intentional destruction of a

substantial quantity of goods whose production effort would be remarkable. In this context, and in that of other ritual activities— which we can call consecration and reconsecration (where the repetition is fundamental)—, the number of people who could remain inside the rock shelter would be exiguous and restrict, indicating a social ranking through direct participation in the ritual. But those who could take part in this communitarian encounter would certainly go beyond those that the rock shelter could accommodate, from which we emphasize the platform in front of the entrance. Therefore, the whole program of the event (with or without an intentional fire), by involving many actions before, during and after the ritual meeting, could be one of the ways of structuring the group, or social groups, of the communities that would live in and surrounding the mountain range, while simultaneously strengthening inter-community relations.

We would also highlight here the (proven) practice of copper metallurgy, certainly done in secret (not in open view), which once again gives consistency to the power attributed to fire— certainly used with great mastery to clear the fields (for cultivation, pastoralism, recollection, etc.)—, and to the deposition of artefacts and ornaments made from rare raw materials that are difficult to obtain, and which were usually placed in funerary contexts.

On the other hand, artefacts not linked to consumption are rare, which reinforces our interpretation that this was not a place of routine life, even if it was occupied according to a calendar (perhaps in late summer/early autumn).

Among these documented activities related to exceptional practices there were probably the ones related to the painting of the panels and to the represented iconography. We cannot access their intrinsic meaning, but we can frame those practices in articulation to all the other communitarian actions that took place in Buraco da Pala.

Ongoing research

The Buraco da Pala rock-shelter remains a challenge to interpretation, as research is still finding pertinent questions to answer, even regarding the immediate results of the excavation, which ended in 1990. We are planning to carry out several analyses of the artefacts collected, as for example the analysis by chromatography of the ceramic containers from the consumption and storage areas of layer I, but also of the previous layers, to establish comparative frames. Petrographic analysis of the various lithic tools and ornaments will also be of fundamental importance to answer questions about mobility, exchange, and the specific regional aggregation character of Buraco da Pala and Serra de Passos-Santa Comba-Garraia at the beginning of the 3rd millennium BC.

Similarly, with regard to the three panels with red painted motifs, we found it difficult to find the "pristine visual objects" because they simply don't exist any longer; for this reason, we clearly admit that these are incomplete images that our "gaze" and our reading instruments approach tangentially without, however, being able to fixate on them except in an admittedly interpretative way, especially the most complex one, panel 1, as we had detailed before.

Figure 5. Captures produced through the 3D models in execution, to illustrate Buraco da Pala's main room. Top: View to the main room from the entrance of the interior gallery. Bottom: bird's eye view of the main room.

Even so, it was the detailed observation allowed by the orthophotos, along with colour decorrelation tools, that gave solidity to the close relationship between the intention to perform a visual artefact (with its inks and ways of applying them) and the particularities of the "support". Regardless of the choice of surfaces that are more or less suitable in technical terms — for example, with less or more % silica —, or in functional terms — within sight of the whole community, or hidden at the back of the gallery —, which are pertinent factors in intentionality, the analysis of microcracks, pigment dripping and smudge areas, lichens (where we can only observe those of the present), became important elements of research for us.

By recording the petrographic details of each of the panels and monitoring the "behaviour" of the paints throughout the year in relation to the humidity inside and outside the rock, and the development of fungi, etc., we intend to see to what extent this "ecosystem" has enabled preservation for four to five millennia. And, to that extent we can take care of creating the most suitable preservation conditions for the future.

Buraco da Pala has extensive surfaces covered in recent graffiti - painted with various inks, and even engraved, since the rock-shelter was Christianized in 1986 and the affluence to this space has increased. Experimentally, and in the context of the EscarpArte project, and with the contribution of specialists in rock conservation, we have begun the first test interventions on some, very small, damaged surfaces. The aim is to assess which of the products available in the industry will be the most effective to clean the panels from those graffiti, with the principle that the less invasive our intervention is, the better. Ultimately, we may choose to keep such graffiti as part of the history of the rock shelter, while drawing attention to the preservation of Buraco da Pala as an exceptional heritage site that should not be frivolously destroyed.

In fact, as part of the EscarpArte project, Buraco da Pala is the culturally appealing end point of a natural and cultural route through the mountain range, starting in the village of Passos.

Our last intervention on the site, presently underway and to be completed in September 2024 (in parallel with the opening of the cultural route), aims to preserve the rock shelter's "natural" beauty by creating access structures to visitors and paving the interior floor with local sediments. No artificial lighting or other contemporary "artefacts" will be added, either to the main room or the gallery.

An information panel at the entrance will provide general information and QR-Code links to further online information and a downloadable mobile app showing the painted panels in "augmented reality" or "transformed reality", thus enhancing the visitors' experience.

Strict respect to the previously stated assumption will be kept at all times: all provided information derives from ongoing research and our present interpretation of the site.

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Dialogues between North and South Iberia in open-air decorations associated with megalithic builders

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Abstract:

Traditionally, open-air rock art in Northwest Iberia has been studied in relation to elements of the surrounding terrain, such as lithology or the proximity to roads or watercourses, among others. These investigations have not taken in consideration elements produced by past societies which are part of the territory, such as megaliths. However, in Southwest Iberia, an integrating perspective between open-air art and megalithic art have been established, finding associations between them through carving techniques and graphic resources.

This work aims to approach the characteristics of open-air rock art in relation to the natural environment and megalithic art. For this purpose, we will take as a case study two areas far from each other: The International Tagus area (Southwest Iberia) which has already been the subject of this type of work, and Galicia (Northwest Iberia), where there is a lack of research works linking open-air rock art and megaliths.

In both areas, a detailed study of engraved and pictorial motifs is being carried out in field using photogrammetry and geolocation. The combined analysis of different human manifestations in landscape will allow us to make a first approach to the occupation of the territory in both locations, as well as to observe some of the connections based on their symbology.

Keywords:

Rock art, megaliths, GIS, land occupation

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Introduction

In Iberia, several research studies have addressed landscape occupation by prehistoric societies, through the combined analysis of megalithic art and open-air rock art. The integration of different graphic expressions in landscape is the most appropriate strategy to reconstruct the forms of territorial occupation in Southern Europe during Late Prehistory (Bueno Ramírez *et al.* 2004a).

Interaction models of graphic markers in landscapes populated by megalithic builders have been developed in Southwestern Iberia through several fieldwork projects, as is the case of the middle Tagus River basin (Bueno Ramírez *et al.* 2004a; 2006; 2008), in contrast to the absence of models for the middle Guadiana River basin (Figure 1). In this latter area, these models are referred to the development of a methodological proposal that offers a novel line of research. Nevertheless, it still needs further development in field. Aspects related to geographical georeferencing, their positioning in landscape and the creation of archaeological catalogues have been analysed, as well as their symbolic and cultural significance in the settlement dynamics of Neolithic and Chalcolithic societies (Murillo González 2014; Navajo Samaniego and Bueno Ramírez 2022).

Beyond these interaction models, the research conducted in both areas has been focused on the study elements—open-air engravings and rock paintings (Collado *et al.* 1997; Collado and García 2009; Collado and Guerra 2011)-, as unrelated expressions. The increase of new megalithic decorations has promoted survey protocols aimed at documenting paintings and open-air engravings, as part of the strategies developed to mark the territories of those who built these funerary architectures (Bueno Ramírez and Piñón 1985; Bueno Ramírez and Balbín Behrmann 1992; 1997; 2000a and b; 2003; Bueno Ramírez *et al.* 2004b).

Along these same lines, Galicia (Northwest Iberia) shows few studies addressing the relationship between megalithic art and open-air rock art. The research developed has dealt separately with each of these art expressions. However, some researchers, such as V. Villoch Vázquez (1995) or R. Penedo Romero and R. Fábregas Valcarce (1997) have attempted to take a closer look at this issue, particularly in those places where the presence of both manifestations has been documented.

For this reason, the present study proposes a dialogue between territories: middle basins of the Tagus and Guadiana River and the Galician region. All of them have references to engraved rocks in open air, painted shelters, and decorated megaliths. Taking as a starting point the work developed in Southern Iberia, a reading of art in the same direction is proposed in Galicia. The main objective is to analyse the possible cultural connection between megalithic art and open-air rock art in Galicia, based on the comparative study of iconographic motifs and geographical

location. The documentation of rock art on both types of support constitutes the most appropriate strategy to reconstruct the forms of organization and territorial appropriation during Late Prehistory.

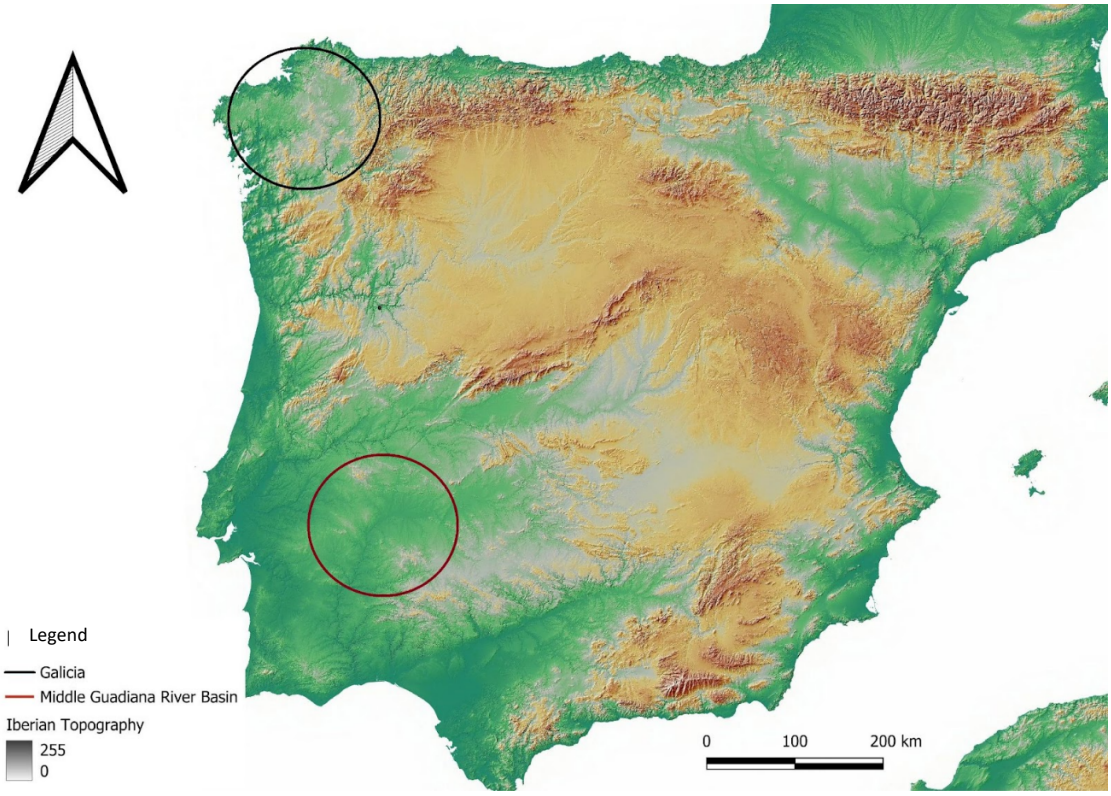

Figure 1. Map of the Iberian Peninsula showing the location of the Guadiana Zone (in red) and Galicia (in black).

Megalithic art, open-air rock art of Galicia and schematic art

Galicia contains one of the greatest concentrations of megalithic and open-air rock art in Western Europe, with a minimum of 3,305 and 3,539 documented records respectively (Carrero Pazos 2019; Fábregas Valcarce *et al.* 2022). However, the proportion between known and excavated dolmens is very unequal, which makes it difficult to access information about the motifs represented or, simply, the presence or absence of engravings on orthostats that are not visible. As for schematic art, only three sites with this type of manifestations have been identified (Alves and Comendador Rey 2017; Rodríguez Rellán *et al.* 2019; Tejerizo-García *et al.* 2020). These monuments were built mainly between the Neolithic and the Bronze Age (late 5th millennium to early 2nd millennium BC).

Rock art of the megaliths of Galicia

The first references to megalithic art date from the late 19th century, with mentions in the press and specialized literature about the existence of traces of red and black paint in passage graves (Moreno López 1875; Fortes 1901). This initial stage is marked by new findings and descriptive works such as the dolmen of Espiñeredo engravings (Negreira, A Coruña) (Murguía 1901, 519) or Dombate dolmen engravings (Pérez Bustamante and Parga Pondal 1924), highlighting the work of G. Leisner (1934) on the dolmen of Pedra Cuberta paintings (Vimianzo, A Coruña).

In the 1950s, F. López Cuevillas (1952) carried out the first synthesis on megalithic art in Northwestern Iberia, in which he highlighted the Northwest as one of the territories known for the development and expansion of this art in Iberia. In subsequent years, especially from the seventies onwards, surveys and excavation projects with new discoveries were intensified. Nonetheless, it was not until the eighties that research gained more strength and several syntheses works on the state of art were published (Rodríguez Casal 1979). E. Shee (1981) published her study on Galician megalithic art in the European context in her work *The Megalithic Art of Western Europe*.

From the 1990s to the present, the appearance of figurative motifs, especially anthropomorphs and anthropomorphic stelae, have complemented the group of megalithic art representations. This expansion of the iconographic repertoire has been accompanied by new studies by researchers such as F. Carrera Ramírez (2005; 2011), who addressed megalithic parietal art in his doctoral thesis, or A. Rodríguez Casal (2002), who analysed, among other issues, the possible apotropaic character of paintings, engravings or sculptures. These researchers, along with others such as R. Fábregas Valcarce or P. Bueno Ramírez, will give great impetus to research.

Based on both technique and theme, megalithic art can be classified into three large groups: engravings, paintings, and sculptures (Rodríguez Casal, 2002). The most frequent engravings consist of vertical or horizontal undulating lines and serpentiform motifs. Another recurring motif documented on several monuments, remains unidentified due to its complex structure and was referred to by E. Shee as "The thing", and more recently identified as a sperm whale (Cassen *et al.* 2019). The repertoire of engraved motifs is further enriched by anthropomorphs, circles, soliform figures and ladders which are typically located within the funerary chamber.

Regarding the paintings, these are executed in red, white and black pigments, and undulating lines arranged in vertical and horizontal lines predominate within them. However, there are also series of triangles and lattices outlined with dots or small triangles, generally found in the chamber. The sculptures correspond to anthropomorphic stelae, slabs, and smooth or incised

pebbles with notches, which are typically located outside the monument (Figure 2) (Bueno Ramírez *et al.* 2007; Fábregas Valcarce *et al.* 2020).

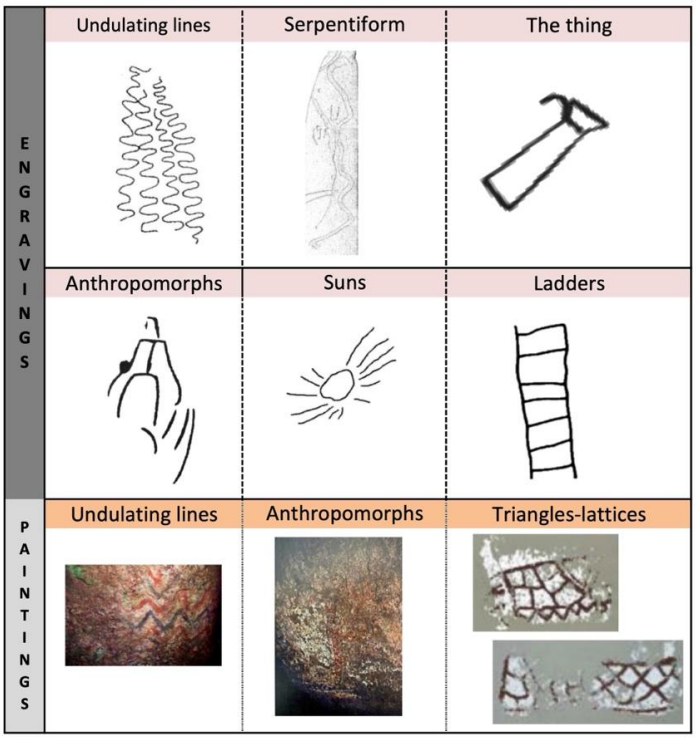

Figure 2. Selected motifs of the megalithic art of Galicia.

Open-air engraved rock art and schematic painting of Galicia

A brief reference to an engraving from the mid-18th century (Sarmiento, 1745) constitutes one of the first testimonies of the open-air rock art of Galicia, known as petroglyphs. However, it was not until the end of the 19th century and the beginning of the 20th that the first interpretations of these manifestations began to develop, marked by the ideological current of Celticism prevailing in those years (Murguía 1908). Nevertheless, some authors disagreed with these ideas, positioning the petroglyphs in the Neolithic period (Martínez Salazar 1898; García de la Riega 1904).

In the 1930s, R. Sobrino Buhigas (1935) produced a synthesis after years of intense fieldwork, which allowed him to characterize this type of manifestation. This work was continued by his son, R. Sobrino Lorenzo-Ruza (1951), contributing new theories about chronology and new classifications.

In the 1990s, the research line of Landscape Archaeology was introduced, which analyses petroglyphs from the perspective of their interaction with the surrounding social and natural environment, understanding petroglyphs as a form of appropriation of space (Bradley *et al.* 1994). In the early 2000s, A. Peña Santos and M. Rey García (2001) published a synthesis that would serve to organize all the theories and information available up to that time.

In the present century, the introduction of three-dimensional reproduction methodologies has represented a great revolution in the documentation of Galician rock art. The use of photogrammetry has allowed a more precise reading of engraved panels, as it is an easy-to-execute method, low-cost and produces more precise and reliable results (Vázquez Martínez *et al.* 2017).

Over the years, several interventions have been carried out to preserve rock art, which has allowed us to learn about its extent in territory, the total quantity, as well as the type of engravings. This has led to the creation of a typological table of rock art that we have already established in other works (Fábregas Valcarce *et al.* 2022) and which follows the line of previous works by A. Peña Santos (1979). The new classification arises from new prospection work that has contributed to increasing the number of findings of certain figures (Vázquez Martínez 2019).

Petroglyphs have been classified into two large categories: engravings from prehistoric times and engravings belonging to later periods. The prehistoric engravings section consists of a wide and varied repertoire of motifs that we can subdivide into three main groups: geometric themes (composed of cupmarks, circles, labyrinths and spirals), naturalistic themes (integrated by animals, humans, weapons and boat-like forms); and "Prehistoric Varia" (formed by those figures whose characteristics do not clearly fit into the previous groups). For its part, the category of historical engravings includes crosses, game boards and a variety of motifs such as phi or alphabetiform (Figure 3).

Regarding schematic painting, the research tradition has been scarcely developed in Galicia due to the late discovery of this type of manifestation, since there were no studies specifically oriented to its identification on the Iberian Atlantic coast (Bueno Ramírez *et al.* 2022). It was not until August 2017 when post-Paleolithic schematic art was documented for the first time in the region, specifically in the cavity known as Cova dos Mouros (Baleira, Lugo) (Rodríguez Rellán *et al.* 2019). A few months later, in October of the same year, the finding of Penedo Gordo (Vilardevós, Ourense) was recorded (Alves and Comendador Rey 2017). Subsequently, new evidence was discovered in Pala de Cabras (Casaio, Ourense) (Tejerizo-García *et al.* 2020).

Initial studies of the motifs represented at these sites have allowed the identification of paintings made in red and ochre-orange tones. The documented graphic repertoire includes semicircular

shapes, anthropomorphic representations, occulated idols, as well as soliform and ramiform motifs (Figure 3).

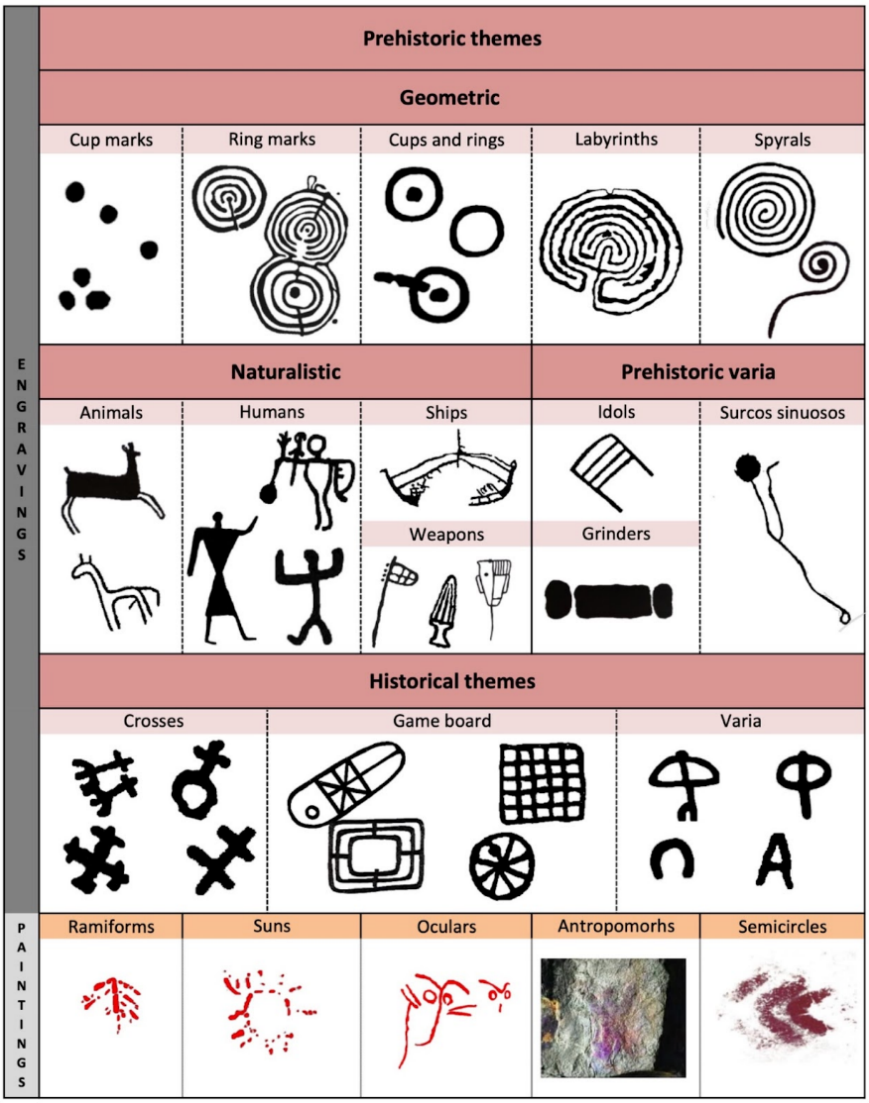

Figure 3. Classification of open-air engraved rock art and paintings of Galicia.

Supports

Schematic painting is found in rock shelters, while engraved art is mostly located on open-air outcrops of granite rock (Vázquez Martínez 2015), with little presence in shelters, such as Pedra Xestosa (Laxe, A Coruña) (Fábregas Valcarce and Rodríguez Rellán 2012). In areas where granite was not predominant, studies indicate that distribution patterns seem to have been modified to take advantage of the scarce existing outcrops in landscape (Fábregas Valcarce and Rodríguez

Rellán 2012). Likewise, rock art has also been documented on schist and slate outcrops, without significant differences being observed in the type of motifs represented according to the lithology of the support.

As for megalithic art, there is also a preference for granite-type materials, with a smaller number of dolmens made of quartzite rocks. Like rock art, there are orthostats made of granite even though this material does not exist in the surroundings, which implies a certain degree of intentional transport (Rodríguez Casal 2005).

Rock art in the middle Guadiana River basin

Rock painting from the Guadiana River has more consolidated research than the engraving one, highlighting pioneering works in Alburquerque at the beginning of the 20th century (Hernández Pacheco and Cabrera 1916; Breuil 1935). It can be seen a significant momentum after the Civil War with various studies developed by researchers such as P. Acosta (1968), M.C. Rivero de la Higuera (1973) or R. Balbín Behrmann *et al.* (1977). Besides, it was believed that these manifestations were absent in western Cáceres, until prospections carried out in the early 2000s, aimed at searching for schematic painting, proved otherwise (Bueno Ramírez *et al.* 2004).

Open-air engraved rock art has been less studied than painted art, highlighting the work carried out by C. Sevillano (1976) and L. Benito and R. Grande (1993).

Regarding megalithic art in the middle Guadiana River basin, studies such as those of Granja de Toniñuelo and Magacela (Bueno Ramírez and Balbín Behrmann 1997; Bueno Ramírez and Piñón Varela 1985) have revealed the decorative richness of these tombs. The intensification of archaeological research has allowed a better understanding of prehistoric settlement, with new catalogues and territorial analyses, as in the Vega del Harnina (Murillo González 2014). The Tagus area has been much more studied, presents a large megalithic occupation and a major nucleus of painted and engraved schematic art has recently been confirmed (Navajo Samaniego and Bueno Ramírez 2022).

Rock art from this study area can be classified into three large categories: engravings, paintings and megalithic art. The latter includes pictorial representations, made mainly in red and black, and engravings. Their motifs are varied, with geometric figures (circular shapes and zigzag), cupmarks, soliform figures, serpentiforms, anthropomorphs, weapons and zoomorphs (Bueno Ramírez and Balbín Behrmann 2003). As for engravings and painting outside the megalithic context, these are located in shelters or on open-air rock outcrops. The represented motifs share

similarities with those of megalithic art, with anthropomorphic figures, zoomorphs, ideoforms, soliform figures and geometric shapes predominating (Figure 4).

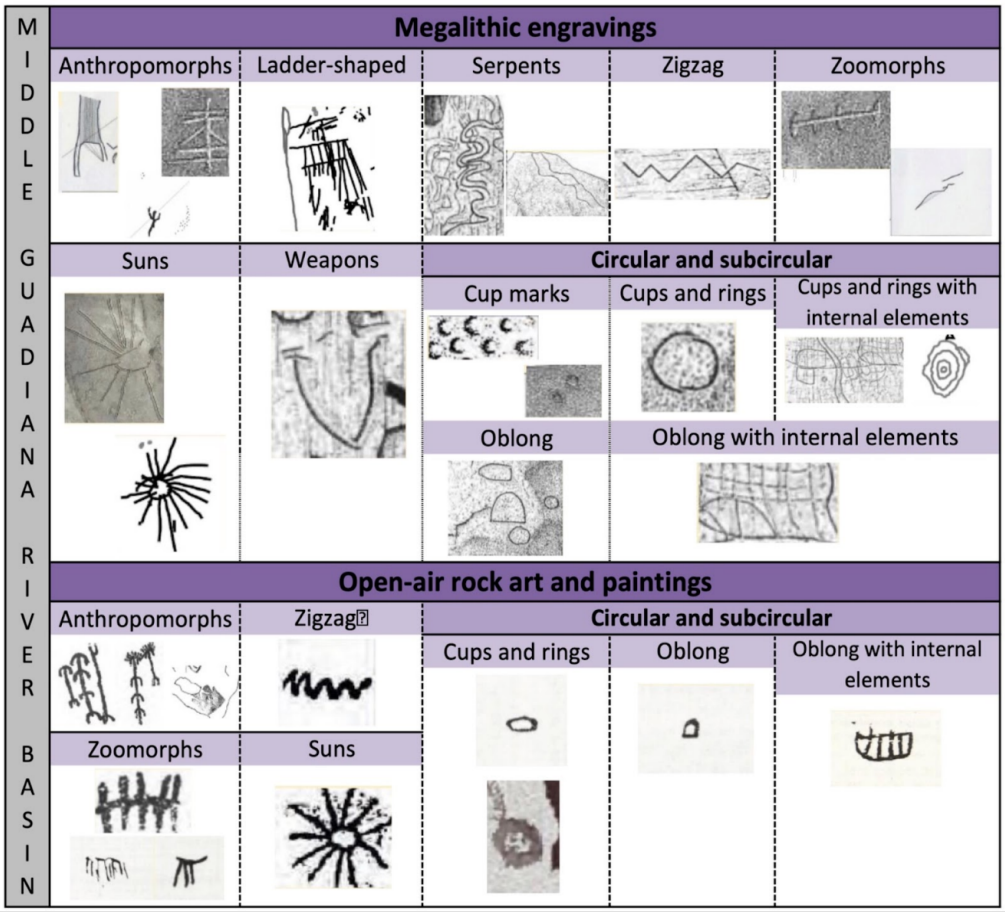

Figure 4. Art classification from the middle Guadiana River basin.

Supports

Engraved and painted schematic art is documented in areas of quartzite lithology, with a smaller number of representations on granite outcrops (Bueno *et al.* 2006, 2010; Navajo Samaniego and Bueno Ramírez 2022). Open-air engravings are associated with schists. In contrast, megalithic structures are mainly located in granite and slate substrate, which indicates a differentiation in spaces and materials selection.

In the case of rock art, these are interventions on natural supports—whether in caves or in open air—which implies a deliberate choice of the physical environment. In contrast, megalithic monuments, as artificial constructions, involve more complex decisions, including the selection of site, materials, architecture and, in certain cases, engraved or painted motifs.

Connectivities

The work developed in the middle Guadiana River basin by E. Navajo Samaniego and P. Bueno Ramírez, among others, has indicated the existence of graphic connections between rock art -both painted and engraved-, and megalithic art, following the model of territorial relationship widely verified in the Tagus zone, between all these versions (Bueno Ramírez *et al.* 2004). Among the most recurring motifs in both contexts are cupmarks and anthropomorphic figures, including their variants: ancoriforms, ramiforms and cruciforms. The wide distribution of these motifs in territory, as well as the spatial proximity between rock and megalithic assemblages, are what provide the greatest cultural connection between both Neolithic and Chalcolithic societies.

In the case of Galicia, cupmarks also constitute the most represented motif in open-air engraved rock art (Rodríguez Rellán *et al.* 2018), and their presence is also documented in megalithic art. The geographical proximity of cupmarks recorded in tumuli, cists and open-air rock outcrops indicate a possible visual connection between the engraved rocks and the physiographic forms associated with megalithic monuments (Villoch Vázquez 1995, 49; Bóveda Fernández *et al.* 1999, 94). Likewise, not only have cupmarks been documented engraved in dolmens, but also on isolated stones located inside them, whose characteristics coincide with those represented in petroglyphs (Fábregas Valcarce 2010, 48).

This connection extends to another motif, considered as the most characteristic element of Atlantic art (Bueno Ramírez *et al.* 2022): concentric circles (Peña Santos and Rey García 1997, 833). These are frequent in Galician petroglyphs and, to a lesser extent, they also appear in megalithic art. However, the motifs recording in Galician dolmens still requires more studies, so it is feasible that more concentric engraved motifs will be identified as research advances (Bueno Ramírez *et al.* 2022). These engraved figures form large and small assemblages on open-air rock surfaces. In megalithic context, they appear in the immediate surroundings of tumuli and, in some cases, on the orthostat that covers the dolmen chamber, as in the dolmen of Leira da Rapada (Lugo).

Other motifs, although less frequent, correspond to reticulated patterns documented in tumuli and cists, as well as in petroglyphs. This type of motif can be observed recorded both in Galicia and in northern Portugal (Penedo Romero and Fábregas Valcarce 1997).

Painted art also maintains a connection with dolmens and engraved rock art. Among the known motifs we can highlight soliform figures, that are present in both paintings and megalithic art. For their part, anthropomorphic representations appear in both painted and engraved art.

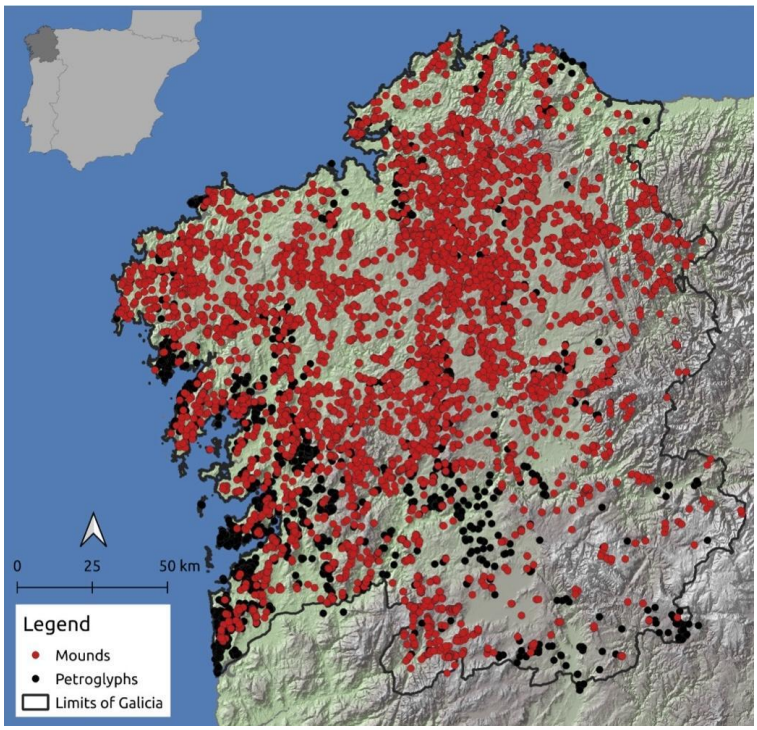

Figure 5. Distribution of megalithic art and open-air rock art in Galicia (Rodríguez Rellán and Fábregas Valcarce 2023).

The spatial distribution of rock art and megaliths throughout Galician territory is similar. However, it is relevant to note that petroglyphs and tumuli tend to occupy different parts in the Galician landscape (Figure 5). Tumuli are generally located on high peaks, while petroglyphs occupy intermediate altitudes (between 100-300 meters). However, in a more specific analysis of distribution, it can be observed that, during the last phases of the Galician megalithic phenomenon, tumuli tend to become smaller—what we call cists—and be located in lower areas, such as hillsides or even valleys, where the distribution of petroglyphs is denser. Precisely, these are the ones that show a connection.

In Galicia, the representation of painted art is scarce and is concentrated mainly in the eastern sector of the territory. Despite this limited presence, it is located in the vicinity of megalithic monuments and engraved rock art assemblages.

Conclusions

This work presents a first approach to the possible relationship between megalithic art, open-air engraved rock art and painting in Galicia, following the work developed in Southwest Iberia.

The research has been developed from a broader scale of analysis, defined by current databases, which has allowed the establishment of an initial framework to understand the landscape.

The geographical framework is broad and general, covering Galicia in connection with studies carried out in the middle Guadiana River basin. Despite the general nature of this approach, the connections between prehistoric art motifs constitute a fundamental aspect for understanding the cultural links of these communities.

Preliminary analysis of the themes present in megaliths and rock art has contributed to reconstructing forms of territorial occupation during Late Prehistory. The manifestations studied—megalithic art, engraved and painted rock art—present a similar spatial distribution, and the iconographic repertoire provides evidence of connection between societies. Motifs that we can also be seen on the Atlantic coast and other points of the Spanish geography, reinforcing the interpretation of the existence of cultural links during Late Prehistory

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The dolmen phenomenon in the Southern Levant during the 4th millennium BC: the case-study of Jebel Al-Mutawwaq, Jordan

Alessandra Caselli[1]

Abstract:

The megalithic phenomenon in the Southern Levant started to be massively attested during the 4th millennium BC. The area is constituted by several sub-regions and the identified megalithic features include standing stones, cairns, dolmens and tower-tombs. Therefore, megaliths were used to build structures linked to rituals or to the funerary aspect, underlining the importance of the community work to realize such massive structure. The paper is focussed on the dolmen phenomenon in the Southern Levant at the end of the 4th millennium BC. In particular, the case-study of Jebel al-Mutawwaq (Jordan) will be presented. Here the Spanish-Italian team is also documenting all the megalithic structures to preserve them.

Keywords:

Dolmens; 4th millennium BC; Southern Levant; Jordan; Jebel al-Mutawwaq.

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Introduction

In the Southern Levant, the dolmen phenomenon spread during the 4th millennium BC and had its peak in the second half of the IV millennium, during the Early Bronze Age I.[2] The slow socio-economic transformations occurred during this period would bring to the creation of proper urban centres which would become cities during Early Bronze Age II.

The funerary rituals and the burial practices are a crucial aspect of the community life, and the analysis of their characteristics can give important data about the social complexity of the group.

The dolmen tradition in the Southern Levant has been studied by several researchers who proposed typological classifications of the structures and several interpretations have been advanced about their use.[3] For example, until recently, dolmens were related to seminomadic communities and only the recent excavations conducted with the modern archaeological methodology have proved that, conversely, the dolmen phenomenon was strictly connected to the development of an urban society.[4]

The Zarqa Valley and the site of Jebel Al-Mutawwaq.

The main difficulties in the investigation of these contexts are due to the high probability to find the burial chamber emptied by robbers because of the visibility of the megalithic structures through the centuries, and to the threat of modern destruction. For example, in Jordan, in the Wadi az-Zarqa valley the dolmen field of Damiye, one of the most investigated in the area, was completely destroyed, some of the structures were rebuilt and are visible today in front of the Jordan Museum in Amman and in Irbid.[5]

[2] For a re-assessment of the available data about the dolmen phenomenon in the Southern Levant during the Early Bronze Age see Fraser 2018; Steimer-Herbet 2011.

[3] For the classification of the typologies of dolmens see Epstein 1985; Steimer-Herbet 2004; Zohar 1992.

[4] Because of the paucity of proper stratigraphic excavations, it was complicated to determine the chronology of the dolmen fields for a long time. Till the recent activities conducted in the last 20 years, all the scholars agreed that the phenomenon was connected to the nomadic groups in the area and, for this reason, some of them thought that the dolmen fields could be dated to EB IV/ Intermediate Bronze, when the crisis of the urban system is attested (see Epstein 1985; Prag 1995; Zohar 1992). Only the new excavations allowed to date the dolmen fields and to understand the community value of these structures as cemeteries for the residents of EB I settlement sites (see Kafafi and Scheltema 2005; Scheltema 2008).

[5] For the site of Damiye see: Stekelis 1961; Dajani 1967; Yassine 1985; de Vreeze 2010.

In the middle Wadi az-Zarqa several surveys have been conducted and allowed to identify dozens of dolmen fields throughout the catchment between the Wadi Jerash and the Wadi el-Ain.[6] Most of them are constituted by small fields of around 20 dolmens each. It is not easy to date these dolmen fields because of the lack of materials on the surface in proximity of the megalithic structures and because of the absence of proper stratigraphic excavations.

Except for Jebel al-Mutawwaq, the main megalithic necropolis of the area, Umm Bteimah and Khirbet Mansub are two interesting dolmen fields which seem to pertain to Early Bronze Age I (Caselli 2023). They are located on the top of a hill, and both presented some architectural remains connected to the necropolis. They could be small stable sites in the region, but unfortunately the modern destruction activities have strongly affected these dolmen fields.

This analysis will focus on Jebel al-Mutawwaq, a key site for the Transjordan Early Bronze Age I (Figure 1).

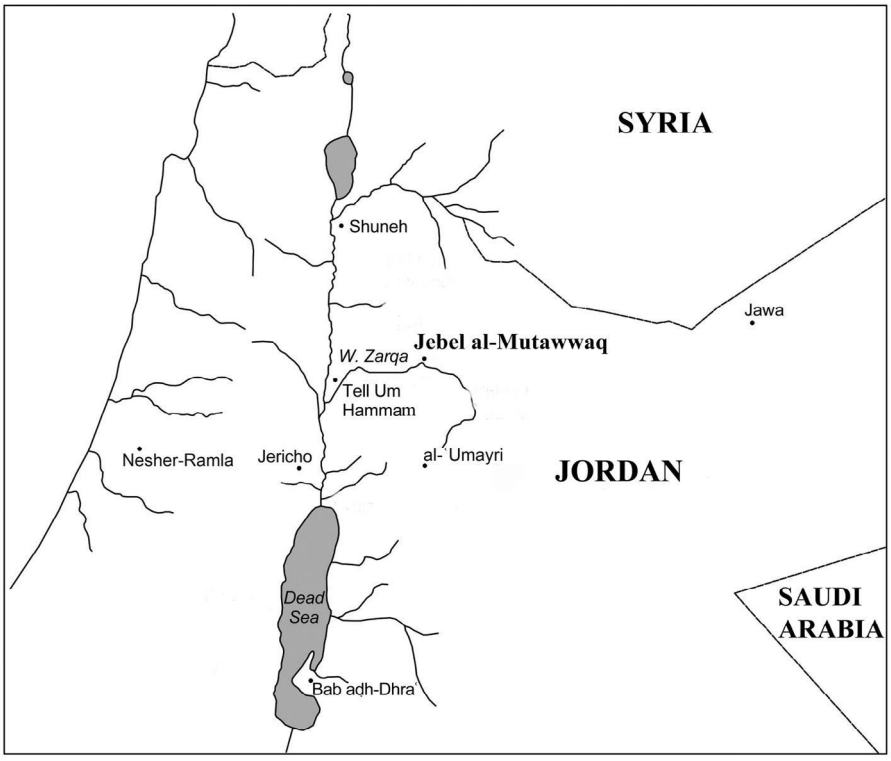

Figure 1. Map of the Southern Levant with the location of the Wadi Zarqa Valley and Jebel al-Mutawwaq.

[6] The main surveys conducted in the region were directed by Nelson Glueck (Glueck 1951); Jack Hanbury-Tenison (Hanbury-Tenison 1987); Gaetano Palumbo (Palumbo *et al.* 1996, Kafafi *et al.* 1997); Lorenzo Nigro (Sala 2008; Nigro *et al.* 2008). For a reassessment of the identified dolmens in the region see Fraser 2018:112-128.

The site, currently under investigation since 2012 by a Spanish-Italian expedition co-directed by Andrea Polcaro (Perugia University) and Juan Muniz (Pontificia Facultad San Esteban de Salamanca), is located on the top of a hill between two springs (of Wadi Hmeid and Wadi el-Ain), and was abandoned at the end of Early Bronze Age I, giving the opportunity to the archaeologists to investigate contexts without massive architectural superimpositions.

The site is constituted by a walled settlement where around 200 domestic buildings together with public production areas and sacred area have been identified and partially investigated.[7] The site had two main occupation phases, in Early Bronze Age IA (3500-3200) and in Early Bronze Age IB (3200-3000), when an increase of the social complexity is attested[8].

Outside the walled settlement, a huge megalithic necropolis spreads toward the entire hill. The necropolis is constituted by trilithon dolmens showing an interesting variety in the architecture among them. Several dolmens disappeared through the years, and it is not possible to understand their exact original number and location. Despite that, thanks to the mapping realized by the Spanish team directed by Juan Antonio Fernandez Tresguerres from 1989 till 2011, the presence of hundreds of dolmens at the end of the 80s (Muniz *et al.* 2014) is attested. Observing the location of the structures it is possible to notice that dolmens are frequently gathered in groups of three-four dolmens showing the same architectural characteristics (Figure 2).

For this reason, one of the aims of the project is constituted by the investigation of different clusters of dolmens to understand the social interactions and relationships between different families belonging to the same community.

[7] For the data collected in the main sacred area, the Temple of the Serpents, see: Fernandez-Tresguerrez Velasco 2005, 2008; for the information about the settlement see: Fernandez- Tresguerres Velasco 2001, Polcaro 2019, Polcaro and Muniz 2020; for information about the EB I domestic architecture see Caselli 2020; for the results coming from the first 6 years of Spanish-Italian excavations see: Polcaro *et al.* (eds) 2024.

[8] The first phase of occupation of the site is dated to Early Bronze Age IA by the 14C analysis performed on some samples collected in the 2019 campaign in the Great Enclosure, Area C East, one of the public areas of the settlement (5470 - 5316 cal BP = 3521 - 3367 cal BC – Beta Analytic 576901); the Early Bronze Age IB phase is attested in the necropolis, in the Temple of the Serpents and in the domestic contexts (From Cave C.1012: 5190 - 5053 cal BP = 3241 - 3104 cal BC – Beta Analytic 561343; from Dolmen 11: 4980 - 4856 cal BP = 3031 - 2907 cal BC – Beta Analytic 576899; from the Temple of the Serpents: 5290–5040 cal BP = 3340–3090 cal BC - Beta Analytic 194526; from House 400: 5064 - 4870 cal BP = 3115 - 2921 cal BC – Beta Analytic 576900).

The necropolis has been divided taking into account the location of the dolmens; the southern necropolis, the southeastern necropolis and the eastern necropolis have been partially investigated since 2012.

Concerning the building technique, all the dolmens are surrounded by a retaining wall covering originally the trilithon. The shape of the retaining wall and the size of the stones pertaining to it are not homogeneous throughout the site and two typologies have been identified (Polcaro *in press*).

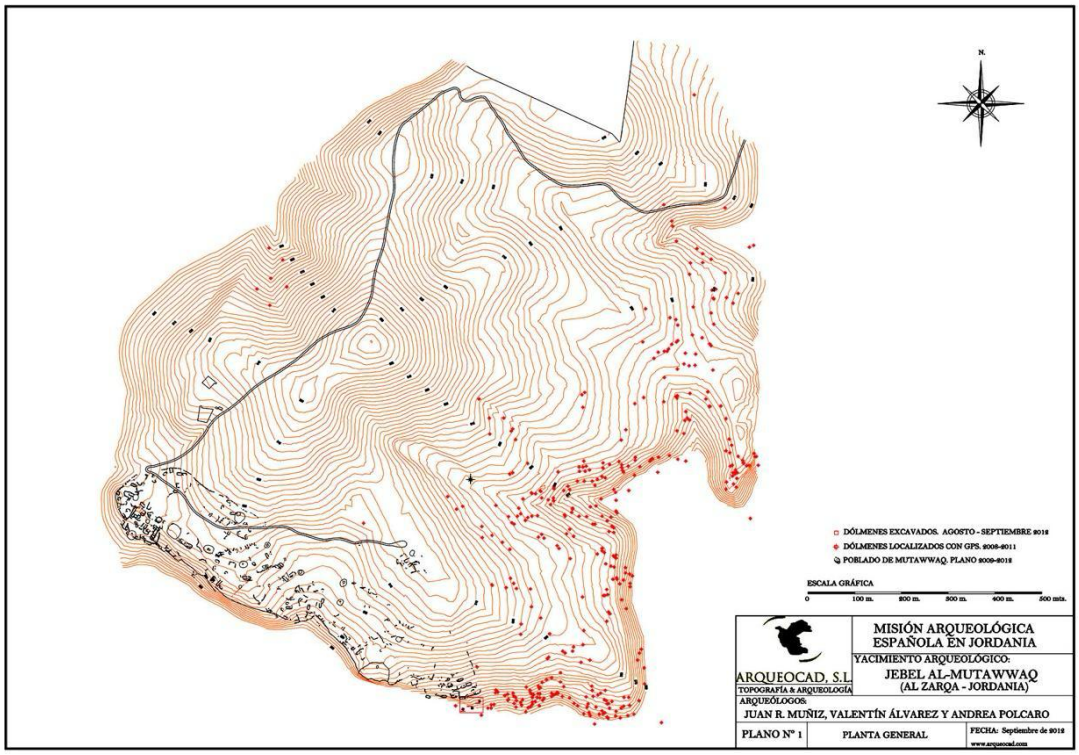

Figure 2. Topographical map of the site of Jebel al-Mutawwaq (This map was realized by the Spanish-Italian Expedition at Jebel al-Mutawwaq in 2012.

The dolmens of "Type A" are characterized by a retaining wall with the core made of small fragmentary stones and compact earth. In most cases the feature has a curvilinear shape, but a more rectangular shape is also attested (Figure 3).

"Type B" dolmens have a "stone box" shape and the covering is not a curvilinear retaining wall, but a proper squared surrounding wall built with large regular stone slabs leaned directly against the lateral and the back slab of the megalithic funerary chamber. The lateral walls can be raised for two or three rows of stones, covering all the trilithon structure including the capstone.

The architectural peculiarities of the dolmens could be observed without an excavation, but it is crucial to analyze the deposition and the grave goods of the dolmens to better understand the social interactions in the community and the burial custom at Jebel al-Mutawwaq,

Since the beginning of the excavations in 2012 the team decided to investigate dolmens including them in large excavation areas in order to examine the context surrounding the tomb and potential rituals performed in the proximity of the burial chamber. This methodology allowed it to collect data pertaining to the use of the dolmen even if the burial chamber had been emptied. Moreover, this choice allowed us to find a sealed cave in front of a dolmen which will be described below.

In the southeastern necropolis, six dolmens have been excavated between 2012 and 2013, only one of them was found sealed: Dolmen 317 (Polcaro *et al.* 2014).

Dolmen 317 pertained to "Type A" shape, and it was found sealed because the entire structure was well preserved and the retaining wall was still covering the dolmen, only the capstone was visible.

Inside the burial chamber, under a flat slab, an intact secondary burial was found, B. 25. The bones were rearranged in a pile of long bones in front of the skull which testified the cause of the death. In fact, on the external side of the left parietal, there was a triangular-shaped hole measuring 8–9mm, which ended in a very small opening only 1mm in size inside the cranium. Due to the absence of cranial bone growth around it, this "wound" could be interpreted as perimortem or postmortem (Polcaro *et al.* 2014, 13).

Usually, dolmens are collective burials and the presence of a single individual inside Dolmen 317 is peculiar. In the back portion of the chamber several scattered bones were collected and the analysis on the bones confirmed that they did not pertain to B. 25 but to other individuals (B. 26), in particular, a minimum of 5 inhumations (3 adults, 1 subadult, 1 juvenile) were recognized. This data suggest that the dolmen was used for a collective burial and that, later, the chamber was emptied to host only B. 25, a 30-40 years old woman who could have a prominent role in the community, taking into account also the peculiar cause of the death[9].

[9] The undergoing analysis, performed by the anthropologists of Bologna University, revealed a second grade of relationship between B. 26 and one of the individuals identified inside Cave 1012, which will be described later. This data could suggest that the family saw an improvement in her social condition, which determined the building of a large dolmen in the Southern necropolis.

Considering the grave goods, they were constituted by two large tabular scrapers, one with an elongated shape and the other one with a fan shape.

The southern necropolis, located on the southern slope of the hill, has a peculiar position facing the Wadi az-Zarqa valley. Dolmens were originally visible from the valley, and they are close to the main gate of the settlement: the southern gate.

Figure 3. On the left Dolmen 317 (Southeastern necropolis) with a "Type A" shape; on the right Dolmen B (Eastern necropolis) with a "Type B" shape.

In this area 3 dolmens were investigated: Dolmen 535 and Dolmen 11 outside the city wall and Dolmen 534, the only one inside the settlement. All the structures pertain to the "Type B", the stone box shape.

The location and the architectural features of these dolmens suggested they could belong to prominent families of the Mutawwaq community and excavations revealed interesting contexts related to these dolmens.

Dolmen 534 was investigated in 2014 campaign and its burial chamber was found emptied because it was violated. Despite that, it was possible to collect some scattered bones in the front portion of the chamber because the structure was robbed from behind. The structure has a peculiar plan. In fact, it has an angular corridor to enter the chamber, rather than the straight stepped corridor attested in the majority of the Mutawwaq dolmens. This peculiar architectural choice depended on the intention to preserve the southern wall of Building 131, which also became the northern wall of Dolmen 534 corridor[10]. Inside the corridor, two jugs together with

[10] Polcaro and Muniz 2018, 2019.

one arrowhead were collected, probably they were part of the grave goods and were not looted because of their location in the corridor and not in the central burial chamber.

Close to Dolmen 534, Dolmen 535 was investigated between 2016 and 2018 (Polcaro and Muniz 2022, 2023). The burial chamber, which was found empty, was large and the engraving on the internal sides of the lateral slabs suggest that the chamber was originally divided into two smaller chambers one upon the other. This feature is attested in some dolmens in the entire necropolis of Jebel al-Mutawwaq.[11].

During the excavations in front of the entrance of the dolmen, a shaft was identified. The shaft was sealed by a beaten earth floor with a small circular installation in it, on the surface a burnished platter and few bowls were collected, probably the evidence of a ritual performed in the occasion of the sealing of the shaft[12].

The shaft was engraved in the bedrock and two large steps were carved to connect the level of the entrance of the chamber and the level of the shaft. Inside the shaft, a cave (2x2m) was identified and investigated (Cave 1012). The cave was sealed by a wall with a bowl wedged in it, testifying the ritual sealing of the cave.

Inside the cave, a collective secondary burial was found. The bones were arranged in three piles with long bones and the skulls against the back wall of the cave (Figure 4). Bologna University, in charge of the analysis on the human remains, identified a minimum of 6 inhumated and, at the moment, is extracting the DNA from the bones to clarify the familiar relationship between the individuals[13].

The good state of preservation of the human remains allowed to perform C14 analysis on the bones, confirming the use of the cave as a burial chamber in EB IB, the second phase of occupation of the site[14].

[11] The inner partition of the burial chamber could create two side by side chambers (for example Dolmen E in the Eastern necropolis) or two chambers one upon the other (as Dolmen 535 and Dolmen 11). This feature is attested also in other sites of the same period in the Levantine area, such as at Tell el-Umeyri in Field K (Dubis and Dabrowski 2002) or Damiye.

[12] At Muraighat, an EB I site in the Madaba region, in several contexts bowls were collected in connection with the dolmens suggesting similar rituals (Andersson 2022).

[13] Interestingly, the first results of the DNA analysis seem to identify a second-grade relationship between an individual recovered inside Dolmen 317 (southeastern necropolis) and an individual identified inside Cave 1012.

[14] 5190 - 5053 cal BP = 3241 - 3104 cal BC – Beta Analytic 561343.

Concerning the grave goods, together with the burials (B. 1020) an assemblage of 11 miniature vessels were collected. The vessels are constituted by 6 cup/bowls and 5 jars, 3 of them showing a peculiar oblong shape not attested in the other contexts of the site (Caselli *in press*).

The third investigated dolmen in the southern necropolis is Dolmen 11 (Polcaro *et al.* 2023, *in press*). The location of this dolmen is very peculiar because the structure is very close to the Southern gate of the settlement and to a water cistern. The dolmen appears to be connected to the main street connecting the valley and the settlement. The relevance of this context is due also to the presence of a standing stone (S. 1200) beside the burial chamber together with a stone bench carved directly on the bedrock and a cupmark. The presence of the stele recalls a cultic pursuit and the bench with the cupmark suggests a productive activity, as confirmed by the several grinding tools collected here, indicating that some kind of funerary ritual was performed there.

Considering the burial chamber of Dolmen 11, it was found emptied but a thin portion of stratigraphy was preserved in correspondence of one of the back corners of the room. Here, a fragment of a human mandible was collected, and it was possible to date it, confirming the use of the structure during EB IB. Internally, the two lateral slabs show the traces of the engravings to divide the inner space in two separated chambers.

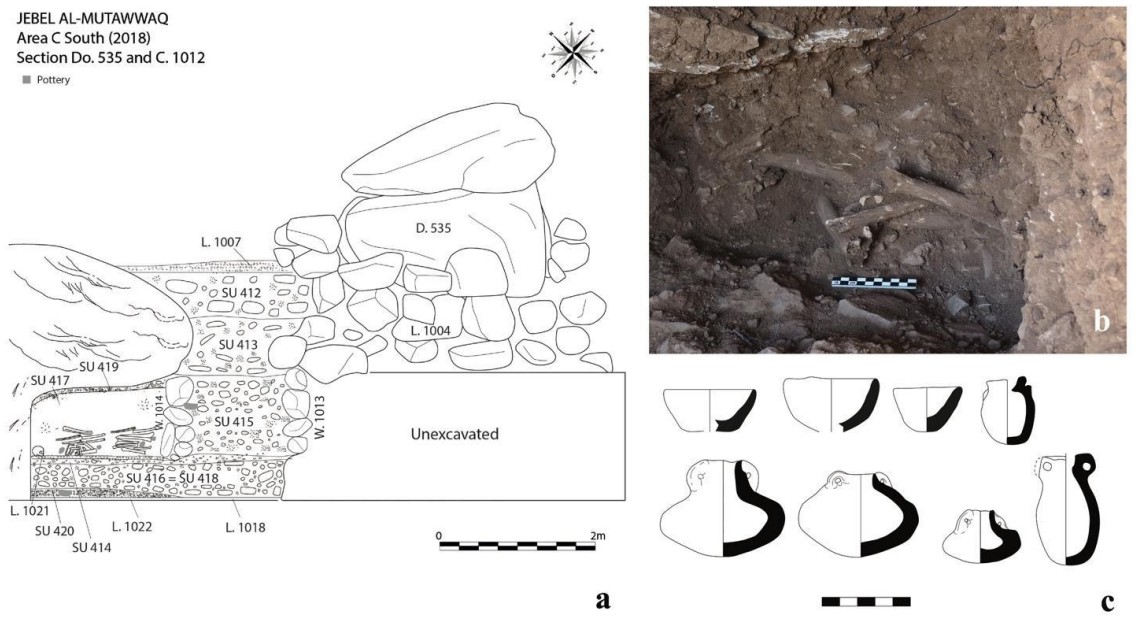

Figure 4. a) North-South Section of Dolmen 535 and Cave C.1012; b) detail of a pile of long bones inside Cave 1012; c) the grave goods collected together with B. 1020: 3 miniature cups and 5 miniature jars.

Significant data from the excavation of Dolmen 11 were obtained from the foundation layer of the structure. Here an assemblage constituted by 5 miniature cups and a miniature jar was collected. Concerning the typology of the vessels, they were similar to those found inside Cave 1012.

The eastern necropolis was partially investigated during the 2022 campaign. This area is located in a private portion of land and, in agreement with the Department of Antiquities, the directors decided to perform a rescue excavation to preserve the threatened dolmens.

Here, five dolmens were investigated (A, B, C, D and E), all of them pertain to the "Type B" shape and one of them, Dolmen E, show a double burial chamber, with two compartments side to side (Polcaro *et al. in press*).

Dolmens A and B were found emptied but the interesting data is that they seem to have been reused in the Middle Bronze Age[15].

Dolmen D was violated, and the burial chamber was found empty. During the excavation of the structure, the team identified the foundation layer of the dolmen, and it was characterized by the presence of several miniature vessels, mainly cups and jars, similar to the vessels collected in the foundation layer of Dolmen 11 and inside Cave 1012.

Dolmen E, with a double burial chamber, was violated but in the back corner there was a small portion of preserved stratigraphy, and it was possible to collect one elongated tabular scraper very similar to the one found inside Dolmen 317 as grave good of B. 25. In this case, Dolmen E and Dolmen 317 pertain to different architectural typologies but show similar grave goods, underlining the variety of the funerary rituals (Caselli *in press*).

Discussion

The excavations performed since 2012 in the necropolis of Jebel al-Mutawwaq testified an interesting variety in the funerary rituals performed by the community.

The first distinction among the dolmens can be detected in the architectural plan and in the building technique which identify two main typologies, Type A and Type B, the first one located on the southeastern slope of the hill, and the second one located on the southern slope and on the eastern slopes of the hill.

[15] Inside both dolmens pottery fragments pertaining to the Middle Bronze Age were collected (for comparisons from the same region: D'Andrea 2014: figures 6-11).

The larger and more articulated dolmens are the ones located in the southern necropolis, the prominent area facing the valley, indicating that the architectural differences between different groups of dolmens could depend on the role in the society of the families buried in there. The fact that Dolmen 11, the closest one to the southern gate, was connected to a standing stone and a stone bench could indicate the prominent role of that family for the entire community, taking into account also the fact that the street descending to the valley was beside the dolmen.

The small dimensions of the dolmens of the southeastern necropolis were interpreted as due to a different chronology, presuming that these dolmens were used in the first phase of occupation of the site (EB IA), or as due to the fact that the 317 builders were not inhabitants of Mutawwaq but of one of the close small sites in the valley. In fact, the extension of the necropolis suggests that the dolmen field was used also by the groups in the surrounding area.

Nevertheless, the extensive excavations performed in the area allowed to identify a street which connected the southeastern gate of the settlement to the dolmens, indicating a clear link between the necropolis and the inhabitants of Jebel al-Mutawwaq. Moreover, the new undergoing analysis on the bones coming from Dolmen 317 indicate that Dolmen 317 and Dolmen 535 pertain to the same period, suggesting that the variability in the necropolis is due to the social inner differentiation of the community.

Considering the burial custom, unfortunately, it is difficult to reconstruct the burial customs and the related rituality in their details because of the bad state of preservation of the original stratigraphy and because of the lack of excavation data from the surrounding dolmen fields which were mainly surveyed. Conversely, it is possible to recognize recurring elements concerning the secondary burial.

For example, both B. 25 inside Dolmen 317 and B. 1020 inside Cave 1012 were rearranged in piles of long bones in the front portion of the burial chamber and the skulls were on the back portion of it.[16]

Considering the grave goods, they are constituted by two tabular scrapers for Dolmen 317, by two jugs and an arrowhead inside Dolmen 534 and by a group of miniature vessels in Cave 1012.[17]

[16] Concerning the distribution of the bones inside the cave, it is possible to observe as it is similar to the one used in the EBI cemetery of Bab edh-Dhra (Schaub and Rast 1989).

[17] Tabular scraper, both elongated and fan-shaped, are attested in burial contexts since Late Chalcolithic, as displayed at Shiqmim (Levy and Alon 1985: fig. 3). There are also Early Bronze Age I parallels, such as the burial caves in the Nesher-Ramla Quarry (Avrutis 2012, figure 2.8; 2.4). Weapons are rare in Early Bronze Age I contexts and they are mainly constituted by axes and daggers. Comparisons for the arrowhead are not easy to identify because of the

The variability in the grave goods seems to depend on the different role of the family in the society. For instance, the tabular scrapers of dolmen 317 suggest activities related to sheep farming while the arrowhead of Dolmen 534 could indicate a different role.

The grave goods collected together with B. 1020 inside Cave 1012 are constituted exclusively by miniature vessels, which could be more symbolic than functional.

Figure 5. A view of the 3D model of Dolmen 535. The shaft leading to Cave 1012 is visible.

The concept that miniatures were more symbolic than functional is due also to the finding contexts. In fact, miniature vessels are not unusual as grave goods because they can be containers for oils or unguents used during the funerary rituals. Nevertheless, this function can be fulfilled by the small jars but not by the small cups/jars, the presence of which needs another explanation.

irregular shape of the object, but a similar weapon was found in the Early Bronze Age IB cave tomb at Nasher Ramla in association with an Early Bronze Age IB jug (Avrutis 2012: figure 2.2, 5).

Concerning the parallels for miniature vessels as grave goods, there are evidence in some EB IB tombs in Azor, Arad and Tel Esor. (For Azor see Ben-Tor 1975, fig. 7; for Palmahim Quarry see Paz *et al.* 2021, fig. 6, 15; for Tel Esur see Yannai 1996, pl. 7).

Moreover, the finding context has a crucial role in the interpretation. Miniature vessels were not found only in funerary contexts, but also in the foundation layer of Dolmen 11 and Dolmen D and a foundation ritual difficulty imply some sort of unguent.[18]

The available data suggest that the assemblage of miniatures could have the intention to symbolize the vessels in their original size. It was possible to clarify that outside the dolmens some funerary rituals were performed, as attested by the sealing of Cave 1012 with a bowl widget inside the wall and by the sealing of the shaft where containers as platters and bowls were collected. It is not clear if they were periodic rituals or if they were performed on the occasion of the funeral, but it is possible to affirm that those rituals involved some drinking activities.

For this reason, it is possible to hypothesize that the miniature assemblages found inside Cave 1012 and in the foundation layer of Dolmen 11 and Dolmen D had the aim to symbolically represent the ritual performed in the occasion of the deposition of the secondary burial or in occasion of the building of a new dolmen. In this case, the miniature assemblages have not a functional use but only a symbolic one.[19]

Future prospects

Concerning the future investigations in the area, the necropolis is threatened by modern destruction and the team is proposing a project to create an archaeological park on the site in order to better protect it. In fact, the creation of an archaeological park together with the organization of guided tours for the students at the local school could generate awareness about the cultural heritage of Jordan and their protection.

The megalithic necropolis are frequently subject to destruction because they constitute an open air quarry for the presence of several stone slabs already regularly cut. Clear evidence of this process is the fact that, in the Wadi az-Zarqa valley, Nelson Glueck reported the presence of several dolmens at Umm Bteimeh in 1951 (Glueck 1951). Lorenzo Nigro, in the early 2000s did not report any dolmen at Umm Bteimeh, which means that the structures were destroyed in 50 years (Nigro *et al.* 2008).

[18] Parallels from EB I sites in the Southern Levant confirm the presence of miniature vessels in various contexts, such as at Abu Kharaz. It is thus possible that miniatures symbolically reflected the vessels used during the rituals (for Abu Kharaz see Fischer 2008).

[19] For a discussion about the miniatures see Richard 2019.

At Jebel al-Mutawwaq, the private portion of the land is threatened by destruction and through the years several topographical maps have been produced to check the number of the dolmens still in place.

In the meanwhile, the team is creating 3D models of the dolmens under investigation in order to preserve all the information of the structure in the case of future destruction (Figure 5). The realization of the 3D models allows also to create proper scale replicas of the megalithic structures, useful for educational purposes with students in the schools and for exhibitions.

Acknowledgements

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Picking up the pieces: A micro-stratigraphic and trans-disciplinary approach to the collective tombs of Horta do João da Moura 1

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Abstract:

This paper focuses on the mortuary management of two *tholos* type tombs from Horta do João da Moura 1, a site located on the outskirts of the ditched enclosure of Porto Torrão (Ferreira do Alentejo, Portugal). Our results reveal a range of mortuary practices within the same burial site or even inside the same tomb, embedded in prolonged and intricate social processes that encompass discontinuous rhythms, polyphasic depositions, individual or mass displacements of human remains, and scenic displays of relics. In addition, the archaeological record shows the existence of large scale economic and social interaction networks that come into view during funerary performances.

Keywords:

Tholos, collective graves, mortuary practices, 3rd millennium BC, Southwestern Iberian Peninsula

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Introduction

The prehistoric *tholos* type monuments of the Iberian Peninsula have long been a subject of fascination for researchers. Initially, studies were centred on typology, influenced by colonialist theories rooted in Orientalism (Correia 1914, 265). However, over the course of the 20th century, there has been a shift towards more contextual and post-processual approaches, branching out from regional analyses framed by indigenous and processualist perspectives. Although many recent studies express some discomfort with the Oriental terminology (Lago *et al.* 1998; Valera *et al.* 2000, 92; Evangelista 2003; Mataloto and Rocha 2007, 111) still used to describe these tombs, a more suitable alternative has not been proposed as of yet (Boaventura 2009, 211; Sousa 2016, 218).

Towards the end of the 20th century and into the first decades of the 21st century, these theoretical approaches were greatly enhanced by the exponential increase in available data. In the Alentejo region, this was greatly due to extensive Preventive Archaeology commissions framed by large-scale public and private construction projects that led to a surge in the number of sites and excavations. Within these development-driven endeavours, numerous collective tombs of diverse types, including various *tholoi*, were unearthed in proximity to significant archaeological sites such as Perdigões and Porto Torrão (Valera 2019).

In broad terms, the data confirm the distinctive nature of the *tholos* type tombs from southern Iberian Peninsula. These monuments may be found as part of megalithic landscapes in association with other types of megalithic monuments (Los Millares (Aranda Jiménez *et al.* 2020), El Barranquete (Aranda Jiménez *et al.* 2018), and Alcalar (Morán and Parreira 2004)) or funerary structures such as pits or hypogea (La Orden-Seminario (Linares-Catela and Vera-Rodríguez 2021; 2023) and Valencina de la Concepción-Castilleja de Guzmán (Mora Molina *et al.* 2013; Fernández Flores *et al.* 2016), or more exceptionally, physically integrated into older constructions, as in some monuments in Reguengos de Monsaraz (Comenda 2, Farisoa 1, and Olival da Pega 2, Cebolinhos 2 (Gonçalves 2016)) or at Praia das Maçãs (Costeira *et al* 2023). Recently, efforts have aimed to contextualise these monuments within a broader and more structured hierarchical settlement framework than previously acknowledged. This highlights a tendency to position *tholoi* near, if not within, prominent enclosures, which often showcase distinct and concurrent practices regarding the treatment of the dead (Valera *et al.* 2019).

Iberian *tholoi* are consistently semi-buried funerary monuments, featuring circular-shaped chambers built from masonry, orthostats, or slabs lining the negative feature. In some cases, there are signs of a false dome roof, typically made of masonry, or as suggested by some researchers, using a combination of perishable materials or clay, being the structural stability

ensured through the inclusion of internal posts within the chamber, as observed in Montelirio, Praia das Maçãs, Tituaria, Barro, Escoural, Cardim 6, or Perdigões (Boaventura 2009; García Sanjuán *et al.* 2018). The access to the chamber is typically gained from the eastern quadrant, usually through passageways of varying lengths, which may or may not be segmented or preceded by atria. Larger monuments display niches and secondary chambers. Inside these collective tombs, human remains, from both men, women or children are found in primary or secondary depositions, in structured depositions or commingled (Evangelista 2017).

The realisation that a paleoethnological examination of the interplay between the living and the dead requires thorough and dependable contextual information, scrutinised across multiple disciplinary frameworks, has prompted recent field interventions to prioritise an exhaustive exploration of burial practices and the intrinsic social dynamics embedded within these collective mortuary sites.

In general, the current available sets of data for funerary practices during the 3rd millennium BC portray a diversity of architectural styles and rituals, with a clear predominance of the collective burial traditions that had been emerging since the preceding millennium. Such practices tend to have spatial components and leave material evidence in the form of architectures, structured deposits and curated or modified human remains. Detailed analyses of individual mortuary spaces seek to address nuanced inquiries regarding their management, meaning and place within the societal framework of the living.

Stemming from the scientific exploration of the archaeological record of Horta do João da Moura 1 *tholoi* tombs, namely architectures, stratification, grave goods and human remains, this paper delves into site formation processes, grave management, mortuary gestures and syn- or post-depositional processes, through a detailed taphonomic, microspatial and stratigraphic analysis of each tomb from both geoarchaeological and archaeothanatological perspectives. The comprehension of the "chaînes operatoires" in each tomb provides novel insights into the biological and social identity of the dead and on the underlying social fabrics that organised sets of formalised practices around these new – and most likely fluid – ontological entities.

Horta do João da Moura 1: the site and its surroundings

Horta João da Moura 1 (Ferreira do Alentejo, Beja, Portugal) is located on the outskirts of the archaeological complex of Porto Torrão (Figure 1a). It occupies a gently undulating terrain within the interior plains of the Baixo Alentejo region, where the limited availability of water resources underscores the significance of the Vale do Ouro stream, a tributary to the Sado River.

This stream flows just a few meters north of Horta do João da Moura 1 (HJM1) and crosses Porto Torrão, shaping settlement patterns and enriching the region's floral and faunal biodiversity.

Porto Torrão has been the subject of several archaeological investigations since the 1980s. Following pioneering surveys led by José Morais Arnaud (Arnaud 1982; 1984-88; 1993), a series of preventive archaeology projects, conducted both within and beyond the enclosed area, have served to substantiate the narratives regarding the site's exceptional nature and its role as an aggregator, dating back to the late Neolithic and persisting throughout the 3rd millennium BC. Despite the lack of an integrated study and a comprehensive layout of Porto Torrão, these recent investigations have yielded significant findings, such as (1) the presence of two parallel lines of ditches on both banks of the Vale do Ouro stream (Rodrigues 2014); (2) numerous negative features within the delimited area, some interpreted as dwellings, kilns, or refuse pits (Santos *et al.* 2014), and (3) depositions of human remains including multiple, individual or double primary depositions inside pits, and the presence of hundreds of human remains, some still in anatomical alignment, within the fillings of the inner ditch of the left bank, alongside assemblages of pottery shards, faunal remnants, and stones (Rodrigues 2014).

Outside the enclosure, numerous surveys have yielded a plethora of findings dating back to Recent Prehistory, some of which contained human remains (Figure 1b). Such is the case of the pits with primary human depositions from Monte do Vale do Ouro 2, and Monte do Sabino 3 (Rebelo *et al.* 2009, Figueiredo and Granja 2011). This mortuary landscape is also scattered by structured funerary areas, that include pits, rock-cut tombs (Monte do Carrascal 2) and *tholoi* tombs (Monte do Pombal 1, Monte Cardim 6, and Horta do João da Moura 1) (Neves 2019; Corga, 2022; Valera *et al.* 2019).

HJM1 was identified in 2009, during the archaeological monitoring of a residential development and the construction of the Alqueva irrigation project (Rebelo and Santos 2011; Pereiro 2010). After these initial discoveries, subsequent surveys led to the identification and excavation of various negative features with unspecified chronology and a pit burial, possibly dating back to Recent Prehistory, of a pregnant woman. Additionally, five (potentially six) *tholoi* were identified, with two undergoing partial excavation, and the irrigation project was modified to minimise its impact on these prehistoric monuments (Pereiro 2010). Following this, our team resumed work on the two *tholoi*. This phase was characterised by a detailed geoarchaeological contextualisation, micro-stratigraphic analysis, and spatial analysis of the partially excavated tombs. These efforts revealed well-preserved contextual information, diverse mortuary practices, and a wide chronological range which facilitated an enriched discussion surrounding each tomb, mortuary area, or site and facilitated their integration into new regional datasets (Figure 1c).

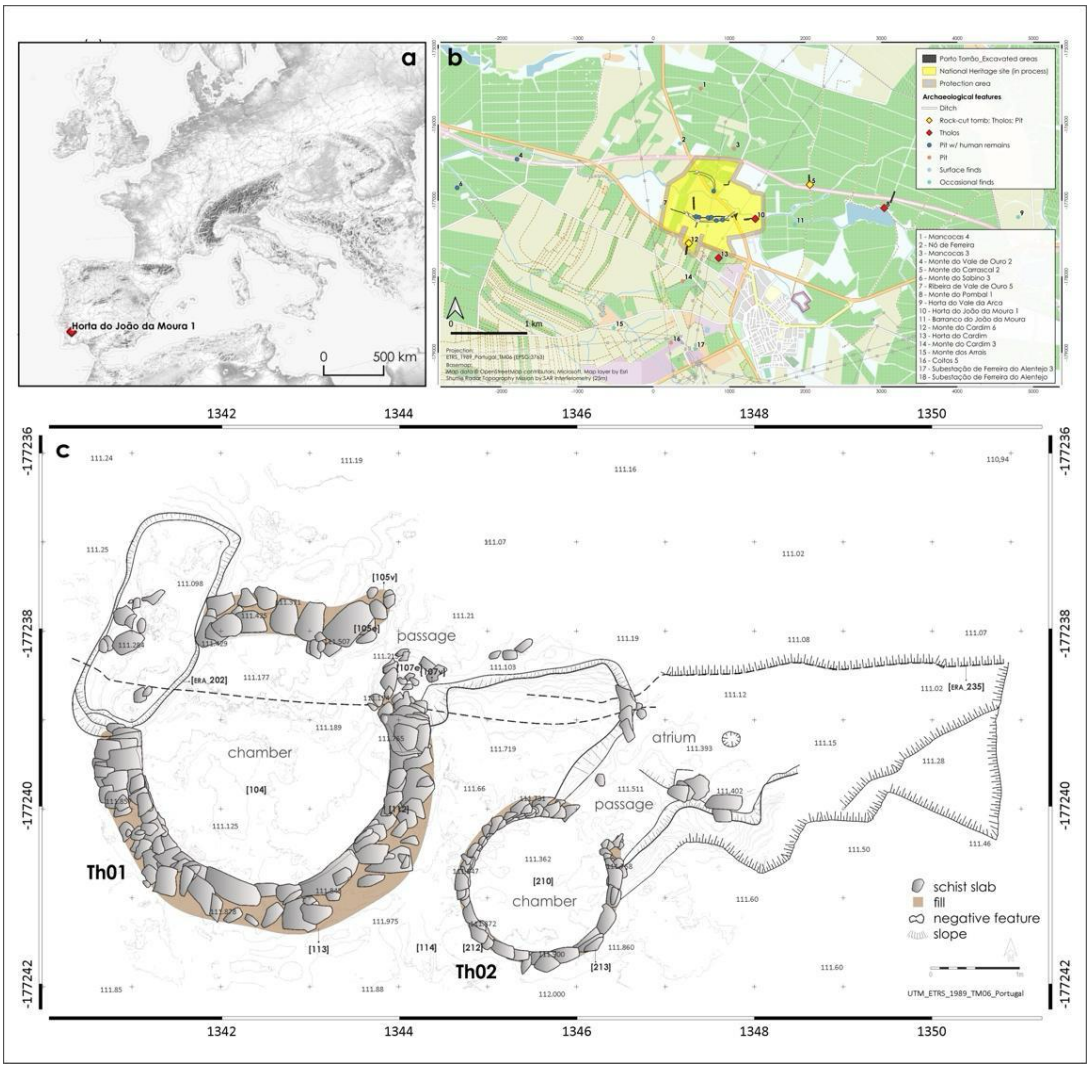


Figure 1. Sites and collective tombs around the enclosure of Porto Torrão: (a) location of Horta do João da Moura 1; (b) study area; (c) Tholoi 1 and 2 of Horta do João da Moura 1.

Material and methods

Through the archaeological data available for each of the categories under analysis (human bones, archaeological artefacts, and architectures) and the application of classical methods from Archaeology, Geoarchaeology (Angelucci 2003), and Archaeothanatology (Duday 2009), our micro-spatial and micro-stratigraphic approach to *tholoi* 1 and 2 of Horta do João da Moura sought a detailed understanding of the mortuary management of the tombs.

Fieldwork emphasised meticulous spatial and contextual analysis, including the georeferencing of all major elements, *in situ* geoarchaeological and archaeothanatological descriptions, and

comprehensive sediment sieving to retrieve small elements pertinent to the discussion. For this multidisciplinary approach involving architectures and stratifications, grave goods, and human bones, we subsequently developed a series of low-level analyses, such as compiling information and verifying data integrity, digitising analogical data, laboratory excavation of ceramic and limestone pots, technological and morpho-typological analysis of artefacts, recording of use-wear, accretions, and general taphonomic status of the archaeological collection. We then proceeded to statistical and spatial, and stratigraphical analysis, using georeferenced databases processed in a GIS environment. This work provided support for the stratigraphic sequencing and interpretation, as well as an approach to the biography of each tomb.

Considering the project's multidisciplinary nature, we aimed to support our observations with results from archaeometric analyses, such as radiocarbon dates, mineralogical data obtained through X-ray fluorescence and diffraction analyses of metals and red pigment.

Architectures and stratigraphic sets

Both tombs follow the traditional layout of the Iberian *tholoi*: simple half-buried monuments featuring a masonry circular chamber and passage and an unstructured hall. While common in Estremadura and Algarve, this architecture is less prevalent in Alentejo, where constructions of the "orthostatic" type, seen as direct successors to dolmenic megaliths, are predominant (Sousa 2016).

The indication of a false dome originating from the base is inferred from the slanted walls and the presence of perforated slabs discovered at the abandonment levels of *Tholos* 1. These slabs likely constituted part of the roofing structure, possibly in conjunction with perishable materials or clay. The structures are built with slabs of schist, which are not naturally occurring on-site, but are available just a few kilometres away.

Both structures exhibit an orientation consistent with most megalithic tombs in the southwestern Iberian Peninsula, generally facing eastward, which has been attributed to astronomical motivations (Boaventura 2009, García and Belmonte 2010).

Tholos 1

Tholos 1 features a chamber with a diameter of 4 meters and traces of a corridor extending roughly 2.70 meters and measuring about 0.80 meters wide. The chamber wall, where best preserved, has a height of around 0.70 meters. The preserved portion of the chamber

corresponds to its buried section, housed within the negative feature that cuts into the calcrete substratum. This nodular-powdery material was used to pave the chamber after the walls were built.

The entryway to the chamber is constricted and marked by two pits filled with schist and gabbro blocks. In each of these pits, a large locally sourced gabbro stone, acting as a jamb, was likely placed vertically, although it has since been displaced. These "doorjambs" precede the construction of the chamber's wall (Figure 2d).

After the construction was finished, a small limestone vase was placed in a small pit excavated on the pavement of the chamber, opposite the entrance with its rim facing downwards. Fragments of ceramic vessels and long bones, without anatomical continuity and originating from at least two adult individuals, were arranged over it. This arrangement was then isolated and marked by a bluish-gray schist slab positioned vertically against the wall of the monument (Figure 2 b, c).

This assemblage is followed by successive depositions of disarticulated human remains and archaeological artefacts. The high fragmentation rates of the material and the presence of a single anatomical continuity suggest a secondary deposition site (Figure 2b). It is possible to isolate some concentrations of clasts, ceramics, and bones, indicating specific structured depositions within the tomb and extending towards the passage (Figure 2e-g).

After the deposition of the last human remains and a sufficient period of time for the formation of a deposit that includes elements resulting from the degradation of the underlying stratigraphic units (ceramic fragments, human and animal bones), the tomb was closed. This sealing event might have been caused by the collapse of the roof structure or by the intentional placement of an overlapping layer of schist slabs (Pereiro, 2010). This layer probably led to the compression degradation phenomena that are observable in the archaeological layers below.

Tholos 2

Tholos 2 consists of an atrium, a small passage, and a circular chamber. The chamber has a maximum diameter of approximately 2 meters and a preserved height of 0.60 meters, corresponding to roughly 9 courses of stone. The corridor, highly deteriorated, is preserved only to a length of about 1.50 meters and a maximum height not exceeding 0.40 meters (Figure 3a).

The chamber is paved with compacted calcrete while the atrium is paved with clayish yellowish material. The entryway is signalled by a deposit of schist, granite, and gabbro blocks.

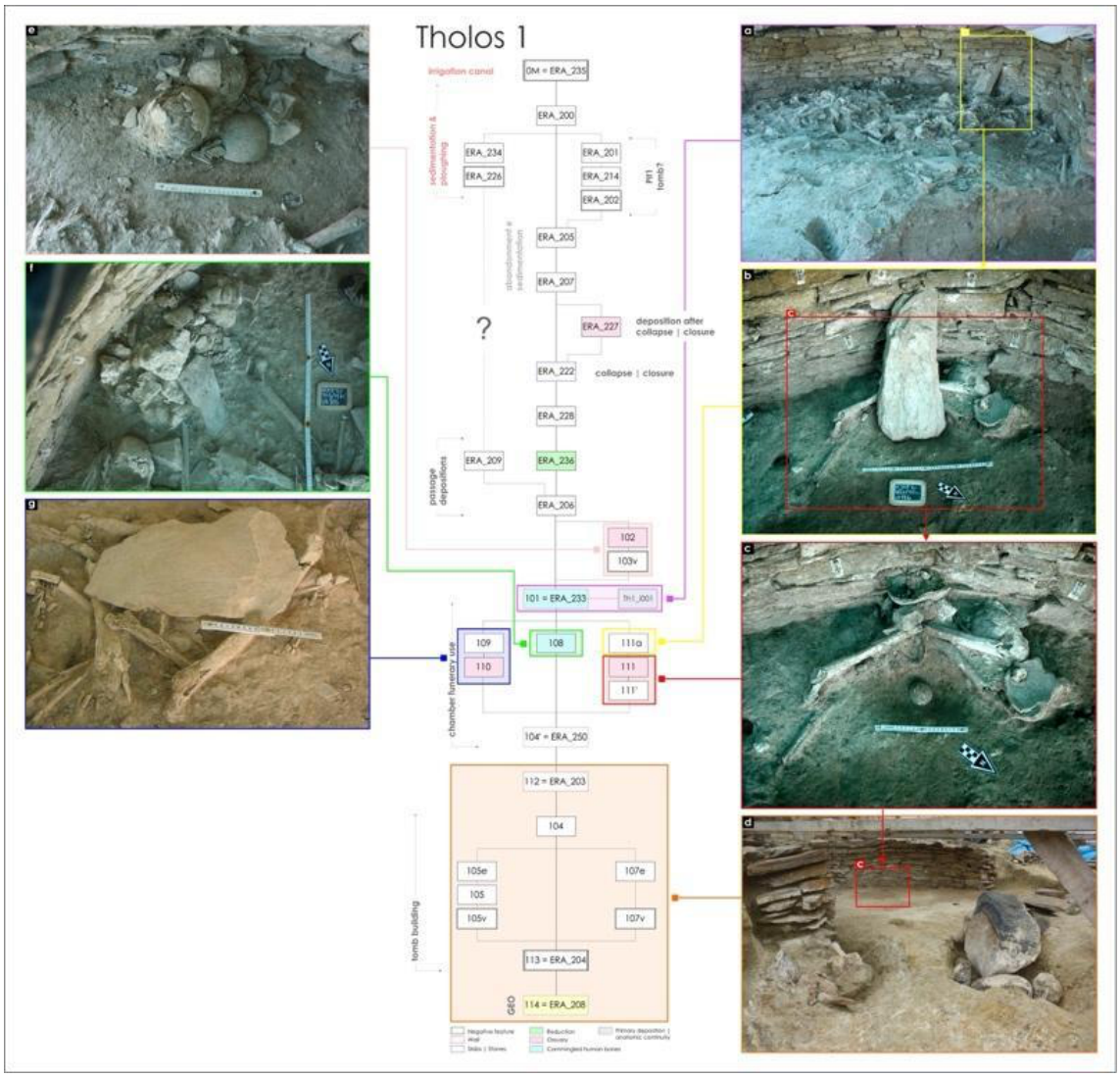


Figure 2. HJM1 – Tholos 1: Harris matrix; (a) Ossuary; (b) Triangular schist slab marking the first deposition inside the chamber after the excavation of the overlying ossuary layer; (c) First deposition inside the chamber, opposite the entrance: sets of clasts, ceramic fragments, and human bones (MNI=2), over a limestone vessel turned upside down; (d) The tomb, after excavation; (e) SU102: deposition of two adult human crania, one pottery vessel and stones against the wall, inside a feature (SU103v) that disturbed the bones from the ossuary; (f) SU108: Structured deposition of human cranial bone fragments (MNI=5) covered by a set of stones; (g) SU110: Structured deposition of 23 fragments of human bones (MNI=2) covered by a triangular slab with two lateral semicircular grooves (SU109).

The tomb is used for the deposition of adult and juvenile individuals accompanied by ceramic vessels. The degradation of this initial burial phase resulted in the vertical and horizontal dispersion of its components, resulting in a layer of disarticulated, fragmented and reworked

bones and archaeological materials. Overlying this layer, other phases of primary depositions have led to the reorganisation of bodies within the tomb and have enhanced the degradation of the pre-existing assemblages (Figure 3c-d). After the degradation of the last depositional phase, the centre of the chamber is used for an individual burial.

Grave goods

The analysis of the grave goods confirms a clear contrast between the two tombs. In *Tholos* 2, apart from a small, weathered fragment, all materials are found intact, while in *Tholos* 1, they are usually fragmented.

In *Tholos* 1, out of the 233 ceramic fragments identified, 22 reconstructions were made (only 2 complete recipients), which included 97 ceramic fragments. The state of preservation of the sample and the presence of refitting and conjoinable pieces in proximity suggest a brief taphonomic history and the preservation of the spatial information within the deposits. Some of the items also display signs of use and incorporation into potentially symbolic practices, like exposure to unchecked fire or the use of red pigments, like cinnabar. Their use prior to deposition not only did not exclude these objects from the mortuary rite but also reveals networks of symbolic interaction that may span hundreds of kilometres.

Ceramic objects represent the predominant category of artefacts. They typically demonstrate high-quality craftsmanship, featuring a compact to homogeneous consistency and surfaces that are polished or smoothed. The presence of scattered stains on both surfaces indicates fluctuations in oxygen availability during the firing process. This morphological repertoire is essentially composed of simple forms of small dimensions, such as bowls and cups, globular and spherical.

In *Tholos* 2, the vessels, which appear mostly associated with individuals from the earliest burials, show many similarities with artefacts recovered in other tombs of Baixo Alentejo, such as Monte do Outeiro (Russo 2020), whose chronologies also fit into the first half of the 3rd millennium BC. In *Tholos* 1, there is greater morphological diversity, primarily due to numerical representativeness, integrating vessels with sinuous profiles and flattened bases, as well as a single fragment of a plate (Figure 4).

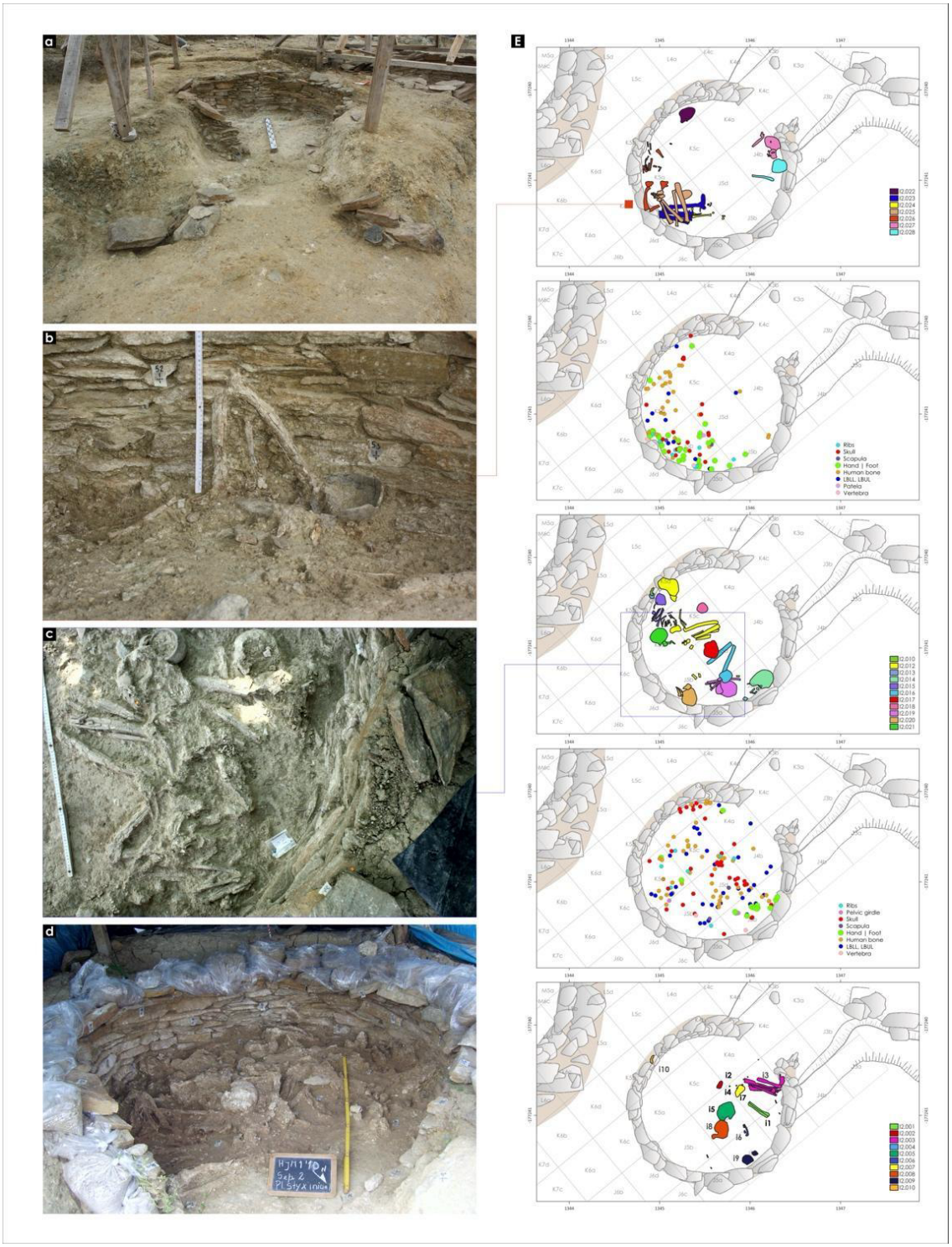


Figure 3. HJM1 – Tholos 2: (a) layout of the tomb after the excavation; (b) Primary burial #26, pushed against the wall of the tomb; (c) overlapping primary depositions; (d) amalgamation of comingled human remains and sediments partially covering primary depositions; (e) plans of the dispersion of the main anatomical regions and comingled human remains for each archaeological level.

Unlike ceramic materials, for which macroscopic analysis performed on the fabrics suggests a local origin, the remaining identified materials attest to supplies in interaction networks at different scales. Among the very few (n=23) lithic objects, there are technological affinities with and raw materials from the Spanish Sub-Baetic system (n=4) and the Portuguese Estremadura (n=5). In the case of the large ossuary of *Tholos* 1, these networks are densified with the presence of one copper awl and other goods considered prestigious or of symbolic significance, associated with chronologies from the second half of the 3rd millennium BC, such as the right valves of marine or estuarine molluscs, the limestone vessel from the first deposition, the use of cinnabar, with a known closer origin in Usagre (Badajoz), or further, Almadén (Ciudad Real) (Rodriguez *et al.* 2020), and the small golden piece, possibly a decorative appliqué for an object or garment, whose mineralogical composition, containing platinum and tungsten, suggests origins in latitudes more compatible with the North and Centre of Portugal or in the northern part of the Spanish Extremadura, where these mineralogical associations are found (Leal 2021).

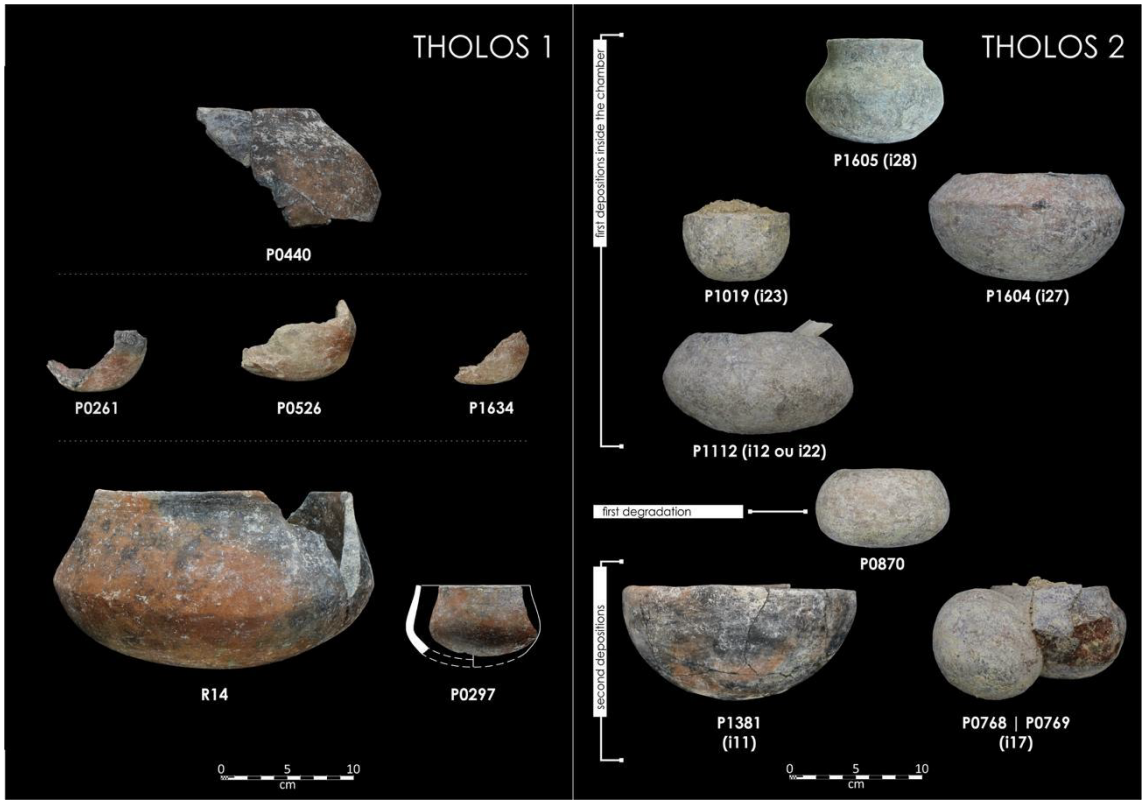


Figure 4. (a) fragments of ceramic vessels from the most recent layers of the ossuary inside the chamber of Tholos 1. Note the presence of sinuous shapes and flat or plano-convex bottoms; (b) ceramic containers identified within the chamber of Tholos 2, accordin to the site's stratigraphic interpretation.

Spatial analysis on human remains

The analysis of available data on human remains unequivocally allows us to speak of collective graves. The highly fragmented state of the bones has limited certain bioanthropological readings, essential for assessing MNI (Minimum Number of Individuals), sex, age at death, stature, ancestry, or pathologies. But, despite the high fragmentation rates, the maintenance of the horizontal continuity of the bone fragments and their spatial and stratigraphic distribution suggests a good contextual preservation of the deposits.

In *Tholos* 1, disarticulated bones are introduced into the tomb from the initial deposition onward. Initially, these bones, mostly long bones, and skulls, are found clustered within structured deposits alongside archaeological materials and stones. Of these deposits, only one occurs after the placement of the main ossuary, which caused a partial rearrangement of the osteological material. All the depositions correspond to a secondary handling of materials and bones after complete skeletonisation (Figure 5).

The large ossuary, which covers almost all the structured deposits, is scattered throughout the tomb chamber, with a particularly dense concentration near the wall opposite the entrance, positioned above the first deposition. From this assemblage, over a thousand osteological pieces were recovered, lacking any discernible organisation, and showing only a single (pathological) anatomical continuity. As far as could be observed in the field, the bones belong to individuals of both sexes and various age groups, and to all parts of the skeleton, although there is a clear overrepresentation of long bones and skulls.

In *Tholos* 2 the presence of anatomical continuities *in situ* and of small bones from the labile articulations of the appendicular skeleton, indicates the use of the tomb for the primary deposition of a natural population of at least 36 men, women, and children. Spatial analysis shows that the use of the tomb starts with the deposition of corpses or anatomical regions in anatomical continuity, associated with complete vessels and/or lithic artefacts, deposited near the skulls. The bodies are disposed in various positions and orientations, though foetal position predominates when observable.

The corpses are placed near the walls of the tomb, preferably, as in *Tholos* 1, next to the wall segment opposite the entrance. The importance of this space in the tomb is revealed by the successive overlap of corpses, even before their skeletonisation, as in the case of individual 26, pushed against the tomb wall to make room for other bodies (Figure 3b).

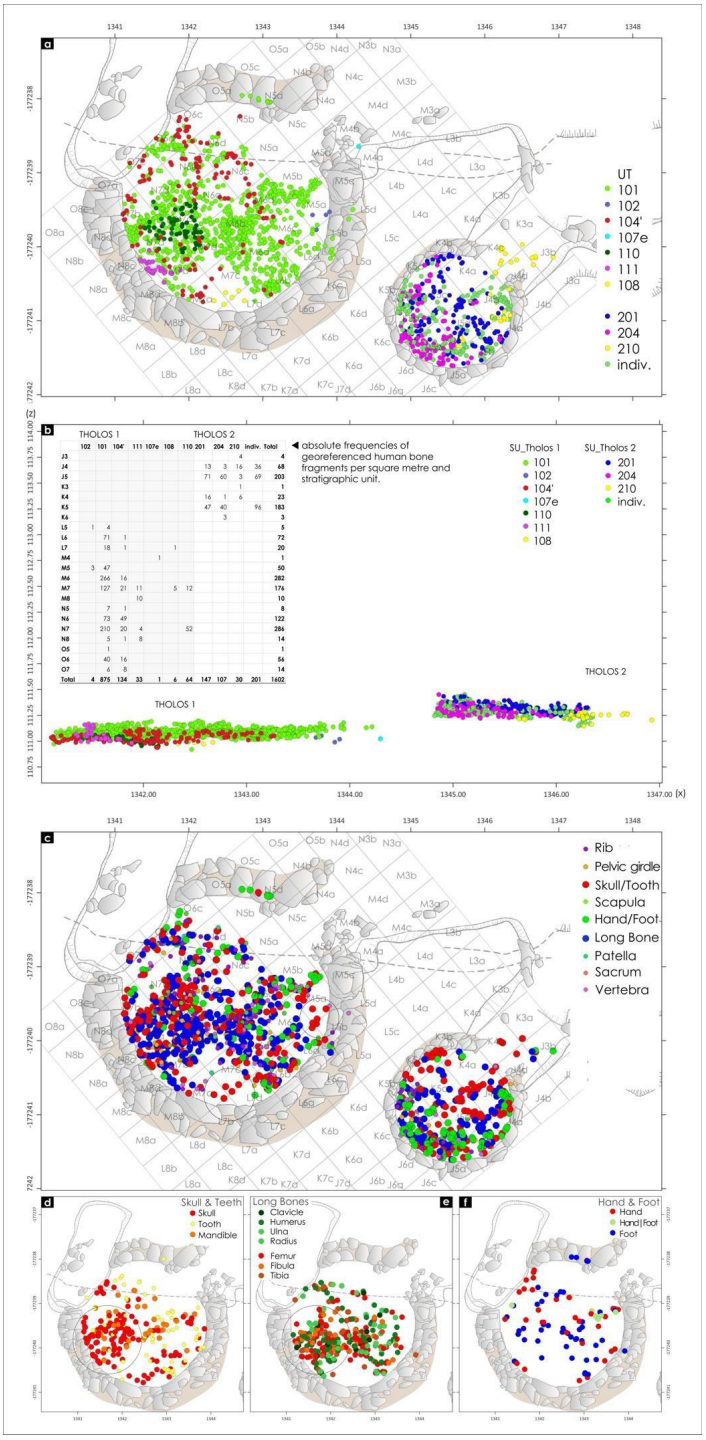


Figure 5. (a) Tholos 1 & 2: horizontal dispersion of human remains inside the chamber, grouped by stratigraphical unit; (b) Tholos 1 & 2: vertical dispersion of human remains inside the chamber, grouped by stratigraphical unit; (c) Tholos 1 & 2: dispersion of the human remains inside the chamber, grouped by main anatomical regions; (d-f) Tholos 1: details of the dispersion of human remains inside the chamber, grouped by main anatomical regions.

These levels of successive primary deposition are interspersed with levels containing sediments and bone fragments without anatomical contiguity. Despite this, the high representation of dental pieces and small osteological pieces from labile articulations is in line with what is expected for primary depositions, suggesting that this deposit results from the combined action of taphonomic factors that caused the degradation of the osteological levels and their dispersal. The filling of the tomb proceeds in stages. Periods of successive corpse deposition are followed by phases of degradation and, subsequently, new depositional phases, without any indications of deliberate anthropic manipulation of the underlying remains (Figure 3e).

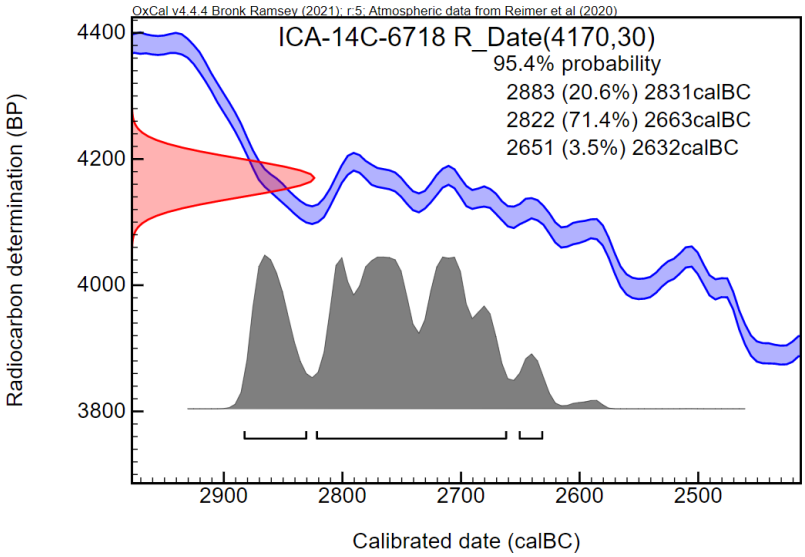
Radiocarbon date

An approach to the biography of collective tombs, likely used over long periods of time, requires thorough and meaningful absolute dating programs. Of the four samples submitted, only one yielded sufficient collagen for a radiocarbon date. This constraint hindered an immediate comparison between the initial, and possibly simultaneous use of both tombs. However, it showed that continuing the dating program will certainly allow for a densification of the chronological resolution for HJM1, in both tombs.

The date was obtained from a dental piece from individual #27, one of the earliest depositions in *Tholos* 2, and places the beginning of its use in the first half of the 3rd millennium BC, providing a broad temporal range between 2883 and 2632 cal. BC. A cautious consideration of the probability of 71.4% narrows the range by almost a hundred years, between 2822 and 2663 cal. BC (Graph 1).

The bayesian analysis on radiocarbon data previously available for the *tholoi* from Alentejo suggested a possible chronological precedence of "orthostatic" constructions over masonry structures that would have emerged following techniques already employed in domestic architecture (Valera *et al.* 2019, 62). Though it is important to stress the low statistical representation of HJM1's date, it enables the discussion of this hypothesis, pushing back the initial use of these masonry monuments from Alentejo to the first half of the 3rd millennium BC, coeval to other mortuary architectures and stylistic variations within the same architectural subgroup.

Conversely, the presence of metal objects and limestone artefacts in *Tholos* 1 suggests an initial use chronology dating back to the second half of the 3rd millennium BC.



Graph 1: Calibrated radiocarbon date of burial #27, from Tholos 1 (OxCal v.4.4.2 Bronk Ramsey, 2020; r:5 IntCal20 atmospheric data from Reimer et al. 2020).

Discussion

In HJM1, the presence of a "specialised" mortuary area and dedicated architectural features, clearly intended for the demarcation of the space of the dead, suggest its removal from social space and ordinary time. The two tombs, located just over a meter apart from each other, almost seem to present themselves as "moments" of successive phases of a long-term funerary rite, which literature generically describes as a "double burial" (Hertz 1907, Duday *et al.* 2014) or "funeral in multiple episodes" (Nilsson Stutz 2003, 206). However, the current lack of numerical chronological data to compare the two tombs and, within each one, to understand the patterns of use, still limits our approach and advises caution against this generalisation.

Nevertheless, we can detail the "chaînes opératoires funeraires" identified within each tomb (Thevenet *et al.* 2014). When applied to the analysis of mortuary practices, the "chaîne opératoire" methodology, embeds technical actions within a process marked by the sequence and dynamic interaction of its components. This approach brings attention back to the actors and encompasses both the material transformation of the corpse and the social transmutation of the deceased (Thevenet *et al.* 2014, Zemour 2016, Zemour *et al.* 2017).

In the case of *Tholos* 2, our analysis confirms that the main practice involves depositing corpses or anatomical regions directly onto the chamber's surface, often accompanied by votive offerings. These bodies are likely placed in the tomb shortly after death, as evidenced by the

preserved anatomical positions of the skulls and mandibles, as well as, when observable, the labile articulations of the hands and feet. Additionally, there is a pattern of successive and overlapping deposition of new corpses at the chamber's bottom, particularly near the wall. This specific location suggests a deliberate choice of a favoured deposition area within the tomb, where disturbing previous burials and overlapping may play a significant role in the burial practice (Nilsson Stutz and Larsson 2016).

Sufficient lapses of time between periods of deposition allow for the decay of bones and tissues, the penetration of sediment, and the formation of a shapeless amalgam of bones. Determining the exact duration between the different depositional phases is impossible, as decomposition and dispersion rates are influenced by various factors not represented in HJM1's archaeological record. Nevertheless, it is probable that several years, rather than days or months, separate the identified depositional moments.

After the tomb is sealed, the last corpse is placed near the centre of the chamber. This act seems to signify both the preservation of the chamber's symbolic significance as it evolves into a long-term memorial monument and the transition to a new symbolic paradigm. In this new paradigm, the individual retains a distinct personality even in death, which may or may not mirror their living identity, but remains uniquely individualised.

In *Tholos* 1, the only item fully intact found inside the tomb is also the first object placed there: a small limestone vase that preceded the initial deposition of human bones. Subsequent secondary depositions are evident and highly formalised, involving skeletal parts moved from a previous context to what would be their final resting place. These depositions occur directly onto the tomb's pavement, leading us to suggest their provenance from another location outside the area delimited by this structure.

These structured depositions of skeletal remains from multiple individuals highlights the depersonalisation of the dead but it simultaneously indicates a sustained symbolic connection to the bones (Blin and Chambon 2013, 67). The disarticulated bones are not discarded and removed from the funerary practice and collective memory; instead, they are managed within a long-term funerary program, which includes the deposition of archaeological materials and, in some cases, the demarcation with stones, slabs, or perishable materials. The selected bones are those of larger size, easier to collect and depending on the burial management of the original space, they allow for the attribution, not to an individual, but at least to a specific referential function. For example, two skulls represent remains of two distinct individuals. The fragmented nature of the ceramic materials identified in these assemblages prompts us to question their ontological positioning within the funerary practice and whether the process of recruitment, as

material and symbolic references, follows the same principles as human bones. To this discussion, we could add reflections on the symbolic status of materials with more complex biographies, seemingly utilitarian (such as loom components), used, or fragmented.

In addition to this process of structured funerary depositions, the interior of the tomb is occupied by a large ossuary, where the fragmented state of the pieces and their disorganisation seem to indicate a simultaneous deposition of disarticulated materials, possibly in the context of emptying another tomb.

The absence of any type of anatomical contiguity (other than the previously mentioned pathology), combined with the lack of excarnation indicators (considering the constraints of observation due to the preservation state of the sample), suggests that the manipulation of the bones occurs after the complete decomposition of the corpses.

These gestures have been interpreted as a natural result of the management processes of collective burial grounds, in which the tomb is assumed to be more relevant than the human remains and where all mortuary acts (funerary or otherwise) converge to the progressive and definitive dehumanisation of the bones. and to prolong the "use-life" of the tombs (Blin and Chambon 2013, 68). In fact, despite the "disorganisation" of the deposit, the bones are once again placed within a dedicated funerary space, tending to concentrate on what our observations have shown to be the most significant part for deposition inside both *tholoi*: the section of wall opposite the monument's entrance. Even after the tomb is rendered unusable and abandoned, its referential function as a mortuary space persists, manifested in new depositions over the closure levels. After their funerary use, the tombs thus become markers of identity, spaces of memory, and negotiation of identities and power.

What we still lack in HJM1 is the primary deposition place of the individuals that legitimise the identity function that *Tholos* 1 seems to assume at a certain point.

The necropolis of HJM1 is not limited to these two tombs. In addition to them, we acknowledge other three, possibly four, very close tombs, the study of which could provide complementary data for reconstructing the mortuary operational chain(s). Besides these, the outskirts of Porto Torrão are defined by other mortuary sites, isolated, or organised in clusters, with diverse typologies that also reflect different mortuary operational sequences (Neves 2019, Valera 2019, Rodrigues 2014). Within the enclosure and its surroundings there is evidence of the manipulation of human remains, even though their integration in a context of funerary traditions is not always clear (Rodrigues 2014, Valera *et al.* 2014, Márquez-Romero and Jiménez-Jáimez 2014). Certainly, the coexistence of mortuary spaces in use, some abandoned, and others in ruins, plays significant roles in the social creation of memory and identity (Bradley 1998, 45).

We are beginning to devise for HJM1 what P. Sellier (2016, 7) defines as a funeral system: a true set of distinct mortuary operational sequences within the same social and symbolic space. In HJM1, the primary deposition of corpses in *Tholos* 2 seems to constitute an end, but *Tholos* 1 demonstrates alternative mortuary practices related to a long liminal time, with various moments of manipulation of the dead that may encompass the emptying of tombs, the deposition of relics, or the creation of ossuaries.

Conclusion

This intra-site and intra-tomb diversity fits into the overall complexity of the 3rd millennium BC. The manipulation and transfer of body parts or bones between tombs and across other structures, seems to challenge a pretended duality between the realm of the living and the realm of the dead. Rather, it reveals a landscape in dynamic construction, where physical, social, and symbolic boundaries are intertwined and blurred.

Moreover, the archaeological record shows the existence of large scale economic and social interaction networks that are purposefully made visible during funerary performances. The exogenous raw material of some of the lithic artefacts, the presence (even if residual) of cinnabar, gold and seashells takes us to long-distance circulation routes of exceptional objects that cover contacts with both the Atlantic coast and the inland of the north, centre and south of Iberia. Thus, testifying for the catalysing role of the great enclosure of Porto Torrão in the context of increasing social complexity and the political management of the surrounding territory and resources during the 3rd millennium BC.

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Losing the colour: Prehistoric painting in Northwestern Iberia

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Abstract:

In the geographical area of the northwest of the Iberian Peninsula (Galicia), a critical analysis is made of the conservation of two types of prehistoric painting: those inside megalithic chambers and rock paintings in rock shelters. In both cases, deterioration and risks are perceived, so that in the second part of the paper proposals for correction are put forward in two areas: on a territorial scale over the whole site, but also reflecting on the responsibilities of the technicians who investigate these sites.

Keywords:

Megalithic art, rock art, conservation, management

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Introduction

In this paper we propose to tackle a subject to which we have devoted reasonable effort and which, unfortunately, continues to be of great concern to us: the preservation of prehistoric painting preserved in megalithic chambers in the northwest of the Iberian Peninsula. Less intensely, ideas will be proposed on another prehistoric expression of recent appearance in Galicia: the shelters with post-Palaeolithic rock art. Other very singular expressions, such as Palaeolithic cave art (Cova Eirós) will not be dealt with here, due to the specificity of their treatment and management. And while we are talking about painting, no reference will be made to the indisputable problems of conservation of an exceptional and seriously endangered heritage: the petroglyphs of the northwest of the Iberian Peninsula. The literature has well described the problems and advanced proposals; all that remains is the will - and not only the political will - for their implementation (e.g. Carrera 1998).

In reality, the ideas put forward here apply to all archaeological heritage, but today we will focus on post-Palaeolithic painting, which is full of problems and challenges.

With regard to megalithic painting, we are fully convinced that all the megalithic chambers were decorated with painting, and that the current non-existence can be explained by various processes of deterioration. It is therefore possible to associate a series of unique architectural solutions (burial mounds, megaliths) with equally unique artistic forms: painting and engraving. These graphic expressions provide a wealth of information for the knowledge of Neolithic societies, either through direct iconological interpretation or through other data extracted from the study of pictorial materials or artistic techniques (for example: Carrera and Fábregas 2008).

All this not only enriches the scientific potential of the megalithic complex, but also considerably increases its heritage value. In fact, other values that characterise the monument (aesthetic, symbolic) are enhanced by the presence of parietal art: consider, for example, the cases of Pedra Cuberta (Figure 1) or Dombate, perhaps the two most widely known in Galicia. In short, this is a magnificent artistic expression from the prehistoric period, full of information that has yet to be unravelled and with an aesthetic and symbolic potential that is sometimes quite remarkable.

However, if necessary, it should be made clear that the understanding (and conservation) of the painting cannot be separated from the megalithic archaeological ensemble. Consequently, the arguments that will be put forward cover the totality of the sites and their surroundings. Even more ambitiously, we aspire to propose protection solutions for the whole heritage ensemble known as the "tomb phenomenon", and not only for the large megalithic monuments with painting or engraving. We demand the protection and preservation of the whole ensemble, from

the most modest to the most monumental: they are all relevant in writing the history of our ancestors.

In parallel, and in recent times, a reasonable number of rock shelters with prehistoric paintings have been discovered. These are more or less characteristic examples of the group known as "Iberian schematic art" which, until now, was unknown in Galicia (Figure 2). Thus, since the appearance of Cova dos Mouros (Baleira, Lugo) in 2017, the findings of Penedo Gordo (Vilardevós, Ourense) in 2018, Pala de Cabras (Casaio, Ourense) and Penedo do Gato de Lobarzán (Monterrei, Ourense) in 2019 have been added. All these assemblages are being conveniently studied and documented (Rodríguez *et al.* 2019; Tejerizo-García *et al.* 2020; Comendador 2022) and are but the first samples of other sites that will appear in the near future. And, as far as this paper is concerned, they present us with the challenge of ensuring the preservation of this new set of heritage sites, for which we demand a strict protection plan.

To complicate matters further, in both cases - megaliths and rock painting - the safeguarding of the original meaning requires a parallel respect for the traditional landscapes that gave meaning to the specific choice of location, which is even more complex.

In the following paragraphs, therefore, we will take a look at the deterioration of monuments and shelters, and then discuss some ideas on the protection and conservation of this magnificent heritage. The message conveyed here does not have a specific recipient, or rather, it appeals to all those working in the field of archaeological heritage. And it hopes to stimulate initiatives that, from the individual to the institutional level, will allow the management of prehistoric heritage to emerge from the morass and mediocrity in which it finds itself. Despite the depressing perception of what has been lost, and on the contrary, there will always be time for improvement.

The Situation

In a more ambitious work (Carrera 2011a) we analysed the alteration processes affecting megalithic monuments with parietal paintings in the northwestern area of the Iberian Peninsula (Figure 1). The conclusions of the study were devastating: most of the alterations were of anthropic origin, especially in the immediate surroundings and in the architecture, with natural processes degrading the paintings or the rocks used in their construction.

First of all, it is worth mentioning the despoilment that most of the sites have suffered for a long time, a phenomenon that we understand has disappeared nowadays. This destructive trace, a product of other times and other mentalities, has left a megalithic heritage barely intact:

practically all of the monuments studied show more or less serious traces of these "historical" alterations: removal of the archaeological levels of the chamber and corridor, extraction of slabs, razing of the tumuli, etc.

Figure 1. Map of the northwest of the Iberian Peninsula, with location of monuments cited (Table 1).

Due to their topicality, other types of varied anthropic actions observed in monuments and environments could be considered more serious. Without claiming to be statistical but demonstrating this persistence, we will describe the direct observations made between 1997 and 2001 on a limited number of megalithic monuments in Galicia while carrying out sustained fieldwork. These visits revealed a series of aggressions that in some cases would have gone unnoticed were it not for the repeated visits, including, surprisingly, the complete destruction of monuments. It is important to note that these inspections were carried out on a limited number of large monuments; on an unrepresentative selection: open monuments (excavated or heavily despoiled), with monumental architecture and more or less visited by the general public.

As they were carried out on the "select" group of northwestern megalithic monuments, the alterations observed have a strong symbolic meaning.

From what has been recorded (Table 1) it is worth noting that it is related to agricultural activities: the complete ploughing of the burial mounds in the necropolis of Lousada (Roupar, Lugo), or partial ploughing in the burial mound of Pedra da Moura. Reforestation seems to be quite common, requiring the prior ploughing of the burial mounds: eucalyptus at Arca da Piosa and Roza das Modias (Plate 3), pine trees at Chao Mazós. In many cases, unauthorised activities, whether urban (roads, highways) or forestry, were observed in the immediate surroundings of the sites (e.g. Casa dos Mouros). At a different extreme was the uncontrolled felling/rooting around monuments (Casiña da Moura), or the frequency with which monuments are found completely hidden by lush vegetation, of which perhaps the most notorious example is the necropolis of Marco do Camballón. This process of abandonment could sometimes be completed by a forest fire, such as the one observed at Mámoa X Serra das Motas, which caused irreversible damage to painted orthostats.

The newspaper archives show that these types of events are still in full force today, and that we know about them thanks to the public denunciation promoted by heritage protection associations (unified in the Rede do Patrimonio Cultural). The impact of forestry activity and all related work, as well as the fires that have occurred in these reforestation forests, is particularly serious. In fact, although it is beyond the scope of this paper, it would be worthwhile to reflect on the pressing problem of eucalyptus afforestation, which is so serious and has such a varied impact (natural, cultural) that it has merited an interesting report by the Consello da Cultura Galega (2023). From this document, and due to its importance in subsequent reflections, we extract a paragraph:

> "(...) this is the main conclusion of this report, the loss of the material and immaterial presence of the elements that make up the Galician landscape, which implies a transformation of that landscape in which forestry plantations have taken on a decisive role over the woodland, pastures and farmland of the agricultural system, particularly those made with fast-growing forest species, among which the eucalyptus is expanding without hardly any restrictions and which does not seem to be slowing down".

The very serious effect of these dynamics on the conservation of petroglyphs is well known (Rey 2019; Rey, in press) and is leading to the rapid disappearance of hundreds of examples of this millenary heritage. In the case of tombs and megalithic heritage, there is, to our knowledge, no quantification of the destruction accumulated in recent times. In the short period of our observation (5 years), the destruction of two monuments, both with parietal paintings, should

be mentioned: Monte dos Marxos (Plate 4) and Agro da Pena. In both cases, in conscious actions of destruction linked to changes in land use (repopulation) by the owner.

On a less serious level, but representative of an evident lack of appreciation, frequent episodes of vandalism were recorded: graffiti, bonfires, etc., of varying intensity and iconography. In those years, graffiti was observed at Arca da Piosa, Casa dos Mouros, Pedra Cuberta, Axeitos and Dombate. Many of them were made with charcoal, and coincided with the remains of bonfires in the interiors of the monuments. In this group, we could include the burning of a tyre inside a majestic chamber with paintings (Coto dos Mouros). As with petroglyphs, in the cases of monuments with very visible engravings (and perhaps missing paint?), their grooves are filled with chalk and other colouring materials (even lipstick at Roza das Modias). Some stains are particularly serious as they extend directly onto the megalithic painting, as can be seen at Forno dos Mouros (Plate 5).

To conclude with the most delicate aspect, it is clear that megalithic paintings are highly susceptible to degradation, so that all of the above (plundering, removal, vandalism, etc.) expose them to irreversible disappearance. In general, the paintings are poorly bonded and often applied on plaster with a clayey composition, which increases their weakness (Plate 6). The proof of this sensitivity is, as we have already mentioned, the degradation of the paint on monuments that have been exposed to the open air for a long time: little or nothing is preserved on them.

And although not recorded in table 1, we could discuss the objective appearance (cared for versus neglected) of the monuments that receive the most visits. This aspect has a significant influence on the public's perception of the importance of the monument to those who are responsible for its protection. Accordingly, the impression received is negative because all, with very few exceptions, show a substantial aspect of neglect: vegetation, litter, etc.

As we said, if the observations noted above are observed as a whole, it is clear that there is a clear disparity in the number of alterations and the dominant agents: 11% of the damage corresponds to internal alteration agents (derived from the characteristics of the materials themselves), 29% to natural agents and 60% to anthropic agents. In relation to the latter, table 2 summarises in more detail the anthropic participation in the alterations observed. From the interpretation of these data, it can be concluded that the alterations are explained by the following processes:

- Around 50% of the cases are individual destructive initiatives (also vandalism), including the setting of fires. Some of them (removal of slabs, etc.) do not represent a risk for the future, while others are still fully active.
- 28% are represented by individual actions, by companies or communal entities, related to agricultural interests: changes in land use, clearing, reforestation, etc., and even the

abandonment of sites. And to a lesser extent, other initiatives related to works and communication routes.

- An astonishing 17% reach what we understand as erroneous actions (or inaction) of the administrations or technicians: unprotected excavations, incomplete conservation actions, lack of maintenance and abandonment, even authorisation of works in the surroundings of the sites.
- Finally, around 6% are disturbances resulting from tourism activity.

Although individual actions stand out clearly from the rest, the leading role is spread across a wide range of actors and entities, reflecting a wider distribution of responsibilities than initially expected.

And although not comparable from a quantitative point of view, the deterioration resulting from archaeological activity itself certainly has a strong exemplary content and its persistence is unacceptable. And yet, in excavations carried out in recent decades, we have seen paintings that have disappeared because they were exposed to rain after excavation, aggressive cleaning that has eliminated any pictorial remains, or the use of such obsolete and aggressive documentation systems as "bichromatic" for the documentation of engravings. Archaeology must assume its responsibility towards the site it studies (and excavates): as the discoverer and therefore generator of cultural heritage, it is obliged - from an ethical perspective - to promote the conditions that guarantee its preservation.

In relation to the other heritage considered (painting in shelters) and taking into account the very limited group of sites studied (4 sites), it shows a much lower level of deterioration for the moment, in contrast to what is known in other areas of the Iberian Peninsula. And the factors that explain this situation seem obvious: recent and little-visited discoveries, locations in remote places and, as a consequence, a lack of visitors and less economic activity in the surrounding area. Despite the above, anthropic action has had a recent impact, particularly fires in the areas immediately surrounding some of the shelters (Figure 2, Plate 7).

Natural processes are not minor, but as we always point out, they produce slow and fairly predictable alterations. The best example might be the inorganic crusts (in Galicia, generally siliceous) which partially hide the paintings, but also protect them from dissolution (Plate 8). Of all the processes, perhaps the most worrying is the one linked to the geological stability of the -fractured- rock massifs in which the shelters have been formed, and of course the associated seismic risks.

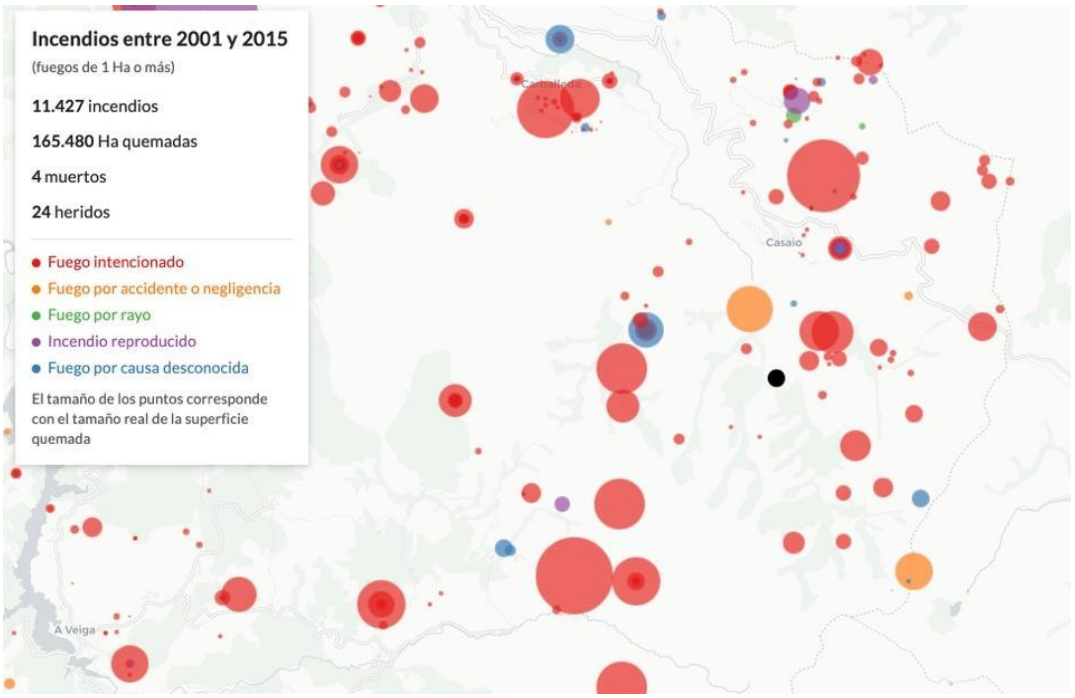

Figure 2. Fires in the area of the Pala de Cabras shelter (black dot), between 2011 and 2015 (taken from https://civio.es/espana-en-llamas/mapa-de-incendios-forestales/). Fires that occurred at the site in 2022 and 2023 are therefore not recorded.

Administrative management of assemblies

What can be glimpsed in the previous chapter is a situation that has barely evolved in recent decades, and which could be summed up as political disinterest, perhaps a sign of a similar indifference on the part of citizens. And it places us before challenges of such magnitude that we can only glimpse a solution by proposing a "reinvention" of cultural heritage management systems. And given the dynamics, for such a revolution to take place, heritage professionals must take a strong leadership role in promoting these changes and, at the very least and initially, accept them as necessary.

Although we have developed this at greater length in other writings (Carrera 2022) and following the proposals of other authors (Agnew *et al.* 2015), we understand that the essential lines of a change of strategy in the protection of prehistoric rock art heritage should include:

- Understand political and public awareness-raising as a priority;
- Demand the formulation of specific management plans for prehistoric heritage;
- Deepening innovative and effective conservation solutions;

- Consider the involvement of communities as essential, perhaps by giving them a greater role in management.

As is easy to understand, these objectives have a myriad of programmatic aspects, and it is precisely this complexity that explains our insistence on the need for planning through management plans (Carrera and Fábregas 2003). These plans must address all aspects of heritage management in an integrated manner: quantification, protection and dissemination. But instead of understanding them as successive, separate and perhaps unconnected actions, they should be seen as phases of a circular process with no beginning and no end; as a continuous series of interrelated actions (Figure 3). In this vision, the ultimate goal would be social appropriation, conditioning and directing all other actions. This could be achieved both through promotional programmes and, above all and as an initial premise, through the direct participation of the different social agents in management actions. The philosophy described above is the one that permeates the very interesting Alicante Charter (ICOMOS 2023), and which constitutes for us an essential element of inspiration.

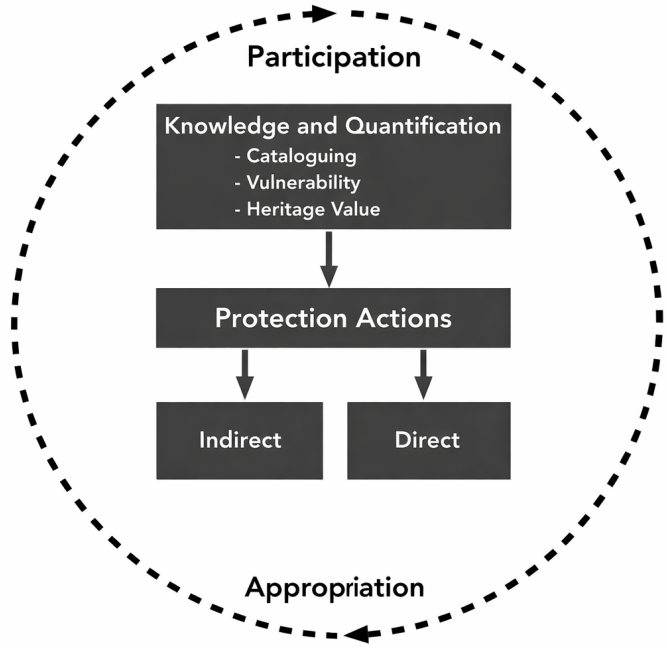

Figure 3. Management scheme for immovable cultural heritage.

In short, heritage management is understood as an integrated (all actions at the same time) and participatory (all actors) process that ultimately aims at the recognition and enjoyment of its heritage by the citizens, so that they actively lead its defence. In pursuit of this ambition, perhaps

the most urgent task is to improve the planning of dissemination, awareness-raising or, if we wish, appropriation, through the participation of the different social actors. It is this ambitious project that we have been proposing as the only possible one for the knowledge, protection and dissemination of the heritages addressed in this document. And although we will use as an argument the observations made about the closed series of shelters and monuments in the northwest of the peninsula with prehistoric art, it should be understood that the programme should cover the whole of the immovable archaeological heritage, which is far beyond the scope and possibilities of this work.

And while for megalithic art (because of its extent, its problems) it seems an unattainable ambition, for prehistoric shelters (because of their limitation and optimal conditions) it is, on the contrary, an extremely simple possibility, which could perhaps serve as an inspiring example for the drafting of management plans.

Cataloguing and vulnerability

The first initiatives in any management process of a heritage complex have to do with its quantification and knowledge: its cataloguing, of course, but also the assessment of its state of conservation. In relation to this task, we consider it a peremptory necessity to introduce two new elements: on the one hand, a minimum quantification of the heritage value and, on the other, a much more detailed estimation of the vulnerability and risk of deterioration. The demands imposed by the new management models propose that, for this task, the participation of various social agents should be encouraged, and of course the socialisation of the catalogue itself, the promotion of its updating, etc.

All this prior information is essential for the design of protection actions. Heritage valuation, to direct investment (musealisation, exhibition) in the most significant elements for the general public. Vulnerability, as a basic tool for the establishment of protection strategies, both direct (on the sites) and indirect (legal, infrastructure, promotion, etc.).

The application of these procedures to the group of monuments with megalithic art in Galicia has made it possible to know the risks faced by the sites studied and, as a consequence, to programme protection and conservation actions. With the above, we are in a position to design and programme actions aimed at the protection of this group, whether through direct protection of the sites (including musealisation) or other actions of a legal and legislative nature. And, in relation to all this, the strategies for the socialisation of knowledge and the social appropriation of heritage, which should be interwoven with the others. In the proposed example (Table 3, based on Carrera 2011a), certain sites present high risks and, as a consequence, conservation and/or

protection actions should have been implemented long ago. The same type of analysis should be carried out for rock shelters (Table 4), and immediate corrective actions should also be proposed.

Indirect protection

The corrective measures that we call indirect protection are essential, because they generally have preventive effects, and act preferably on an anthropic factor that, as we have indicated, explains most of the alterations. In the previous work on megalithic monuments that we have been citing (Carrera 2011a), four types of indirect actions were proposed: changes in the property regime, agreements with entities, dissemination and appropriation and, finally, the design and application of legal tools.

The change in the ownership regime (from private to public) is a simple protective action that has been applied in some monuments (Anta dos Muiños, Pedra Cuberta, Casa dos Mouros), immediately eliminating many of the risks considered. In the event that such a measure is not possible, it would be necessary to propose the establishment of pacts with the property, whether individual or communal, in various areas of negotiation:

- Avoid land-use change on sites located in areas that are still uncultivated and with well-preserved landscapes;
- On the contrary, to suggest a change in such uses in those sites that are heavily impacted (or at risk) by the exploitation of the environment;
- Propose basic maintenance and cleaning actions, e.g. of sites with overgrown vegetation;
- Call for extreme care in any forestry work, renovation and maintenance of roads or works in the environment.

Also considered as indirect protection are general promotion and dissemination initiatives (formal and informal education) and, very characteristically, the various initiatives that we can frame within "heritage legislation". The necessary debate on this matter would merit another forum and more qualified people, so we will make a brief reference to this issue, which is a powerful and negative one: although the regulations are extensive, they do not seem to have been able to eliminate degradation, which suggests insufficiency or even ineffectiveness.

In 2011, the Xunta de Galicia registered 33 megalithic monuments with rock art in the General Inventory of Galicia as Assets of Cultural Interest (BIC), and we know that the processing of BIC files has begun for the four sites with schematic art. Accepting the symbolic value of these measures, we have to recognise that for the dolmens it has meant little in terms of real protection

of the sites and their surroundings, and many of them continue to show unbearable signs of degradation (Plate 9).

Without underestimating the protective effect of these regulations, it seems obvious that they have not been sufficient to stimulate direct protection programmes, feelings of recognition or even pure respect. And in this sense, the need to design not so much new regulations as new strategies is pointed out, which should have as their main objective the organisation of the responsibilities of the different administrations and entities, in a spirit of cooperation and minimising the sanctioning strategy. In fact, more than rules, we believe it is essential to design specific tools for coordination, advice and encouragement. Once again, we return to the principles expressed earlier, in the sense of stimulating the participation of all the agents involved.

All these (indirect) proposals should affect not only the sites but also and at least the protected environments recognised in the legislation, with the intention of protecting the surrounding landscapes as well.

Direct protection

In parallel to the above, and also on the basis of the information obtained in the cataloguing phase, a direct intervention plan should be implemented on the archaeological sites to minimise the identified risks of deterioration. The typology of action is very varied and will not be developed here, although two types of action can be distinguished: curative and preventive. For this purpose, it will be necessary to decide beforehand on the criteria for the exhibition of the sites, since the actions can vary radically.

In this debate, the need to estimate the heritage value of the totality of the sites of the managed complex, as mentioned above, enters strongly into this debate. In our way of working, this is done on the basis of four criteria (Lipe, 1984): scientific, symbolic, aesthetic and economic. According to this analysis, the most "valuable" monuments are Forno dos Mouros, Mota Grande and Coto dos Mouros. The "best" monuments are considered not only because they have a high heritage value, but also because they show a low risk of alteration (high index of heritage efficiency: IEP; Carrera 2011a, 582), and action will be recommended for their public display.

With all of the above (Table 5), we have been able to establish four typologies of action on the group of megalithic sites. The complexity of the proposal increases as the heritage assessment (and the IEP) increases:

- Covering with sediment. This is the type of action on monuments that are not going to be exhibited, either because of their lower heritage value or because of their greater risk of deterioration. This is the simple covering with sediment either of the whole monument or of the most sensitive parts (due to the presence of prehistoric art, Plate 10). In reality, the monuments will always remain partially visible (orthostats, tumulus), so this proposal does not invalidate their participation in simple exhibition actions with broader objectives (cultural routes, etc.). This group includes some monuments of high heritage value that are proposed to be covered due to the relevance of the possible excavation and/or exhibition actions required (Forno dos Mouros[2] , Coto dos Mouros, Anta de Serramo). Also belonging to this group are relevant sites with timid attempts at museumisation (Pedra da Arca), whose very poor state of conservation recommends urgent covering.

- Open air without works. This is the group with the lowest heritage value among those sites that have been identified as worthy of being shown. They are sites in very different states of conservation, from some with treatments in an acceptable state to others that are frankly degraded and have no elements of parietal art or even no tumulus. In all of them, the proposed treatments are of little importance, and the recommended increase in interventions in the most outstanding ones (Arca do Barbanza, Casa dos Mouros, Arca da Piosa) will depend on social and administrative interest. The actions are very diverse, ranging from tree felling (Arca da Piosa) or vegetation clearing (Parxubeira, Casa dos Mouros), road repairs (Parxubeira), simple stabilisation treatments (Fornela dos Mouros) to partial covering of the preserved painting (Arca da Piosa, Casa dos Mouros, Parxubeira). In some cases where ownership is highly diversified (Casa dos Mouros), the purchase of the land by a public administration was strongly recommended, which in fact has already taken place.

- In the open air with works. These are monuments with sufficient heritage significance to recommend their exhibition, although it is necessary to carry out some prior work of varying degrees of importance, depending on each case: stabilisation of the structure (Pedra Cuberta), covering the painting with sediment (Pedra Cuberta[3], Chan de Arquiña), direct action on the parietal art (Roza das Modias, Chan de Arquiña), etc. In addition to the above, in most cases, pacts with local entities are recommended for the care and maintenance of the sites (Axeitos, Meixueiro). It is also very common to recommend better signposting of the sites and, frequently, changes in the ownership regime (Roza das Modias).

[2] This site was partially reburied in 2011 (Aboal-Fernández *et al.* 2012).

[3] This site was partially reburied in 2023 (VV.AA, 2023).

- Reconstruction of the site and/or tumulus, artificial cover. Although with different criteria, the latter degrees are very marked musealisation actions on very remarkable monuments with significant parietal art. The complexity of this type of project requires decisions and planning on the part of the owners (public or community), which are particularly ambitious and beyond the scope of the analysis we are carrying out, which is why no new sites have been added to those currently showing this type of action in Galicia: Dombate and Mámoa do Rey (Chan de Castiñeiras 1).

The strategies to be developed in prehistoric shelters are not easy to propose, given that a diagnosis of the whole complex has not been carried out. In any case, they seem to us to be even more urgent and cautious, due to the very high risks of vandalism that have not existed until now.

The fundamental decisions will have to do with the selection of the shelters to be shown to the public, as opposed to those where the visit will be restricted. And, of course, the design of the conditions for opening to the public, as well as actions related to the management of the visit: adaptation of accesses, signposting, fencing, etc. The debate on the relevance and typologies of enclosure and fencing systems has concentrated much literature (e.g. López *et al.* 2009; 2020). The installation of impassable physical barriers, common in other peninsular regions, is an effective but very impactful action that can have undesirable side effects. Accepting the need to address the debate, we are inclined towards simple, low visual impact protections that delimit the heritage space to be respected.

Direct preventive actions should not be too pronounced, perhaps possible structural stabilisation measures, vegetation management or, in some cases, control of circulating water.

Perhaps the most urgent thing on the whole should be a monitoring strategy linked to the agents that have been identified as the most dangerous, and at least anthropogenic, structural and climatic factors.

And in any case, and it seems important to insist on this, all actions should have strict (but not necessarily complex) periodic maintenance programmes. And this is not limited to the sites with exhibition programmes, but for the whole site. Much of this work will allow the participation of local people and organisations, which will help to achieve other essential objectives. And linked to the above, to develop training (caretakers, guides) and awareness-raising actions on a local scale.

Technical (and administrative) action on a site

The proposals in the previous chapter refer to integrated management plans for rock site assemblages. In this final part of the paper we would like to address a small reflection on the responsibility of the people in charge of the study and excavation projects of an archaeological site of one of the typologies referred to in this paper and, perhaps, the decisions related to its presentation to the public.

To ensure conservation, at the end of the excavation, archaeologists must face several challenges and, from there, complex decisions. Initially, to establish the vulnerability and heritage value of the site and, based on this and in agreement with the authorities, to decide on future actions for the site. As has been indicated for dolmens, the alternatives may be to exhibit or simply cover the site, although in emergency excavations (public works) the decisions may even contemplate the relocation or even the destruction of the site. Of these, covering with sediments should be the most frequent, because it aims to return the site to conditions similar to those it enjoyed before excavation and which have allowed it to be preserved. On the other hand, displaying the site in the open air always puts its preservation at risk and entails a chain of complex decisions and actions that require multidisciplinary teams and substantial financial resources.

In relation to the shelters and given the impossibility of reburying them, the decisions have to do with the more or less effective concealment of the site or, on the contrary, the implementation of presentation facilities and the organisation of a more or less complex system of visits.

Before any decision can be taken, a number of preliminary work steps should have been completed in a logical and demanding order (Figure 4).

Research, preventive protection and communication

As has already been stated, we believe that archaeological activity must vigorously assume its responsibilities in relation to the protection of the sites it studies. In the case of megalithic sites, the most compromised element will always be the parietal art, but also easily eroded elements (floors, profiles, tumulus, etc.). Consequently, during the excavation process, the technicians in charge of conservation tasks should consider what provisional actions are necessary to prevent the degradation of these elements. As a result, a wide range of conservation tasks may be proposed.

In all cases, the direct action of the most aggressive atmospheric agents (rain, wind, frost, etc.), which could ruin the megalithic parietal art (especially the painting) in the very short term, must

be strictly avoided. Although the actions to be taken may be varied, a temporary cover will generally be sufficient for this control. In the event that there may be a moderate time lapse between excavation and other conservation or display actions, it is advisable to cover the areas with prehistoric art with sediment.

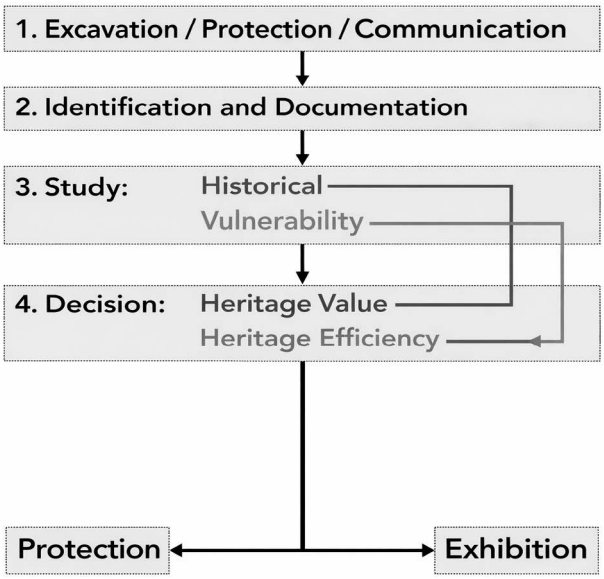

Figure 4. Workflow for the management of an archaeological site.

Related to the above, there may be an urgent need for drainage to prevent waterlogging in the immediate vicinity of the chamber. Excavation areas often become waterlogged areas that concentrate rainwater from the surrounding area, even in the presence of a temporary cover. This should be avoided with a drainage system (perimeter, central, roof drainage, etc.) designed specifically for the site.

In addition, it will often be important to control climatic conditions (humidification and drying), which could lead to severe cracking (in paintings on plaster), crystallisation of salts or other aggressive processes. Conservation specialists will have to establish the best environmental conditions for each site and each type of painting.

Finally, the application of adhesive or consolidating products, always undesirable, may be essential in some cases, which will be left to the discretion of a conservation technician. If possible, these actions should be delayed until the future of the site is decided, at which time they can be carried out with greater precision and linked to the final presentation decisions.

And although this is an issue that transcends research responsibility and enters into aspects related to heritage management, the work of communication with the local population must now begin. Of course, for a defensible task of scientific dissemination but, as far as we are concerned in these pages, to initiate the construction of emotional links between the population and the local heritage, which will be essential for the future protection of the site.

Identification and documentation

In the cataloguing work carried out on megalithic monuments in Galicia (Carrera 1997), painting has been identified in a good number of sites known from ancient times. Leaving aside a relative lack of historiographical attention, all of the above indicates the reasonable complexity that the identification of megalithic parietal art, whether painting or engraving, often involves. In particular, we must recognise the difficulty of identifying painting, either because of the scarcity and weakness of the preserved remains, or because of possible confusion with natural patinas, which requires considerable skill and experience. In shelters with art, the problems (identification, documentation) are also extensive, so these tasks must be detailed and very exhaustive.

To avoid interference with the excavation phase, it is advisable to delay the identification work until after the excavation has been completed, and it is essential to use light sources of sufficient intensity, magnifying magnifiers and a good dose of perseverance. Digital photography, photogrammetry and image processing programmes are proving to be essential for both identification and definitive documentation, and as many techniques as possible should be used to minimise direct intervention on prehistoric art.

When other methods have proved ineffective, direct cleaning becomes essential, although at this stage it should be limited to the use of dry mechanical systems (brushes, wooden punches, etc.), with absolute rejection of the introduction of chemical methods or organic solvents. On the other hand, the level of cleaning necessary for simple identification and documentation is clearly lower than that required for a public exhibition, so a precise objective and limit to this treatment must be established: cleaning is the most irreversible of conservation treatments. In any case, there are no miracle procedures, but rather reasonable risks of elimination if the wrong decisions are made. The first requirement calls for the participation of expert personnel, and more specifically of technical conservation teams in the field, who will be able to identify pigments, carry out cautious cleaning and, of course, make decisions regarding possible direct treatments.

Preliminary studies and vulnerability assessment

The essential function of prehistory is the elaboration of historical narratives that allow the processes of the evolution of humanity, of the slow construction of our societies, to be conveyed to the public. This responsibility starts with the hypotheses prior to the research and is not completed -if it happens at all- until a long time after the fieldwork. However, and as we manage public heritage, the willingness to elaborate and communicate this story must be permanent.

In addition, and with a view to an adequate heritage assessment, a minimum reflection on the scientific and historical relevance of the site under study is urgently needed.

Beyond historical research, there is other essential work to be carried out at this time. Conservation methodology indicates that these interlinked phases are necessary: 1st, to know the object; 2nd) to know the agents that interact with that object; 3rd) to describe the alterations and understand the processes that generate them; 4th) to estimate the risks that will affect the object in the future and 5th) to draw up management programmes for its protection and, if necessary, public presentation. This is in fact the same methodology as for section *Cataloguing and vulnerability* but with a greater scale of detail.

For the first work (characterisation of the object and agents), it is difficult to suggest a generally applicable scheme, given that the level of study depends on the size of the site and its specific problems. Thus, in the case of very important monuments or monuments with a large amount of painting, and of course in the case of public presentation, a very extensive battery of studies will be necessary (for example, Rivas and Carrera 2010). In the case of painted shelters, there are some equally inspiring experiences, which propose very exhaustive methodologies (Caetano in press). Although not intended to be resolved in this paper, a better quantification of the anthropogenic agent (and consequently, of the risks) seems to be an urgent task to be addressed in future heritage management strategies.

The study of the constituent materials is of interest for conservation purposes, but also for pure historical knowledge: composition of pigments and plasters, stone supports, direct dating, etc. Secondly, an estimation of the entity of the main agents of deterioration must be carried out, which is key to their future control. Among the most common are microclimatic, hydrogeological, biodeterioration, structural stability, composition of circulating water, etc. studies. Apart from the data collected in the field, the use of data accessible from various public agencies (climatology, seismicity, etc.) is operational for this task.

With all of the above, we will be in a position to carry out a detailed diagnosis that allows us to understand and quantify the accumulated damage at each of the archaeological sites. In general, this work is carried out on the basis of standardised diagnostic sheets, both for dolmens (Carrera

2018) and shelters (Caetano in press.). However essential it may be, this way of working does not consider processes that have not shown tangible evidence, or events that may occur in the future. For this quantification, the vulnerability report is carried out, which incorporates the calculation of future risk into the diagnosis (Carrera 2022), and which in turn is used in the calculation of patrimonial efficiency.

Decisions and projects

According to the above, decisions regarding the display of sites should not be individual but part of a broader management plan, which goes beyond the project management or local authorities. In fact, it should be the heritage valuation (and heritage efficiency) report that should essentially condition the future of the site, in a decision that should choose between mere preventive conservation or public display. As we saw earlier, in the case of megalithic monuments, we have proposed four alternatives with different ambitions.

Although the exhibition will obviously require a very complex project, the other alternatives also require an action plan, which the technical team will now have to draw up. Depending on this plan, the definitive conservation actions will now be tackled, which, according to what has been outlined, may include works of very different intensity and nature, adapted to the conditions and state of the object. We will not go into a lengthy list of solutions and criteria, which is far beyond the scope of this paper. On the other hand, some ideas can be found in the published bibliography (Carrera 2011a).

In the event that public presentation, in any of its degrees, is proposed, it must be understood that this is a long-term decision and that it is not limited to a set of more or less impactful but punctual actions. To begin with, we understand that the existence of essential starting conditions must be guaranteed:

- Above all, the legal viability of the project; the certainty that a stable management infrastructure is in place. And of course, that the ownership of the land is public.
- The existence of stable and secure sources of funding;
- The absence of irresolvable technical and social factors. Among these, the lack of certain basic infrastructures (access, etc.) or the extreme sensitivity to the alteration of the remains, for example, can be considered negative.

We understand that this is a decision that, as for the management of heritage ensembles, must be translated into a management plan with a very demanding planning, from a series of initial

projects to the planning of a management system that allows for the future sustainability of all the presentation and conservation actions. And also, to guarantee the achievement of a series of unrenounceable objectives (Carrera 2011b, 426):

- Protection. Any intervention on a site must ensure the proper preservation of archaeological remains. Exposure must not compromise conservation, otherwise it is wrong. Moreover, preservation guarantees must be entrenched as a consequence of the plan itself.
- Understanding. The plan makes no sense if it does not encourage the visitor to have a proper understanding of the archaeological elements and their historical and cultural significance. In this sense, the term "musealisation" has been used to indicate the proposals especially aimed at achieving this objective.
- Knowledge. In order to guarantee the above objectives, precise knowledge of the site is necessary: the dissemination of knowledge obviously requires the prior existence of a historical discourse to be transmitted.
- Aesthetics. The aesthetic potential, the monumentality, the capacity to impress of the excavated archaeological remains are significant elements of an exhibition project. The intervention must protect them and even enhance them, so that these types of values form a large part of the experience that the public gains from the visit. Care for this aesthetic component must be extended to the site/environment relationship, and to the artificial elements introduced by the project itself.
- Economy and financial sustainability. Finally, the usual intensity of the proposed actions requires the availability of considerable resources. Consequently, the project must be financially and socially sustainable. This means that financing is available, but also that integration with the socio-economic structures of the surrounding area is considered.

It is now understood that we have indicated that, regardless of the size of the actions, we consider it to be a genuine management plan, in whose design and implementation a large technical team should be involved.

Beyond the initial projects (archaeology, conservation, musealisation), many interventions do not seem to have adequately addressed the aspects related to the future management of the site: responsible entities and funding, promotion, visitor regime, staff training or, of course, the forgotten maintenance programme.

Whether conservation or other actions (musealisation, etc.), everything requires permanent care, which should be addressed by the maintenance (and monitoring) plan. These types of

actions, of lesser intensity but periodic, have increasingly become the key to the long-term protection of sites and should be incorporated into archaeological heritage management.

Conclusions

In the preceding pages we have tried to point out the importance and sensitivity of prehistoric art in rock shelters or inside megalithic monuments. In the case of megalithic art, the persistence of alteration processes as marked as those observed is unacceptable. In rock shelters with rock paintings, the deterioration is still of natural origin, and therefore the planning of protection strategies is even more urgent.

Consequently, the development of specific management plans for all sites is essential. These plans should contain the full range of management strategies, and be guided by participatory criteria, in order to formulate an ambitious set of actions to ensure the protection of the whole site.

In those cases where it is decided to implement actions aimed at public presentation, the conditions and requirements of the intervention projects should be very strict, from the identification and documentation itself to the designs for the display and protection of the various archaeological elements.

All professionals in archaeology and conservation, in any of their various responsibilities, must assume their responsibility of leadership in this task, adapting their methodologies of action according to the demanding requirements of rock and megalithic heritage.

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Plate 2. View of a painted panel from the Pala de Cabras shelter (Casaio, Ourense).

Plate 3. Orthophotos of the area around Roza das Modias (Vilalba, Lugo). Note the progressive change in land use, from agricultural to forestry, right up to the megalithic mound itself.

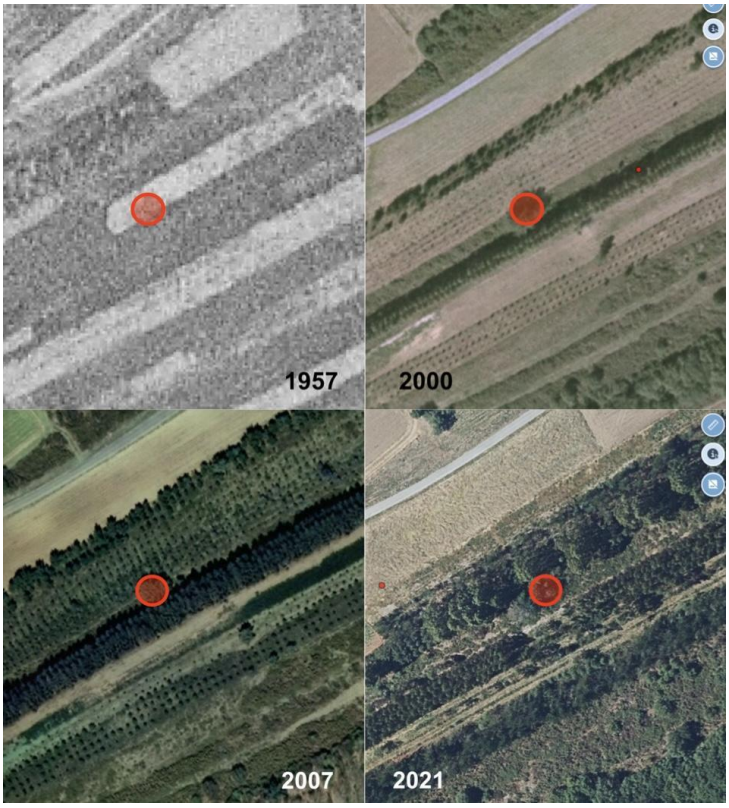

Plate 4. Aerial view (Google Earth) of the area where the monument at Monte dos Marxos (Rodeiro, Pontevedra) was located. Note the disappearance of the tumulus and the repopulation with eucalyptus trees.

Plate 5. Orthostat C1 from Forno dos Mouros. Note the application of an unknown product (permanent) on the paintwork.

Plate 6. Detail of the Pedra Cuberta painting. Note the ochre background (render), the red and black paint.

Plate 7. Pala de Cabras shelter in 2023. Note the effects of the 2022 forest fire.

Plate 8. Photomicrograph (20X) of siliceous crust on red paint, in the Cova dos Mouros shelter (Baleira, Lugo).

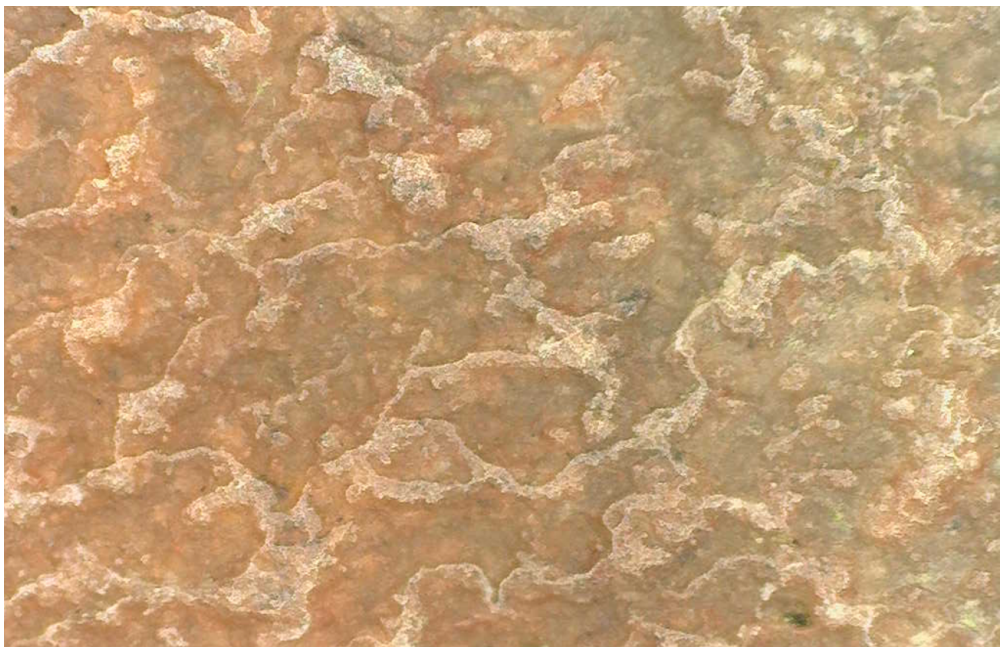

Plate 9. Aerial photograph of the Coto dos Mouros monument (BIC). Note the agricultural works throughout the area, which seriously affect another listed site (Coto dos Mouros 2). All three sites are included in a "protection area" recognised by the legislation for listed sites (or BIC).

Plate 10. View of a reburied monument: Anta dos Muiños (Agolada, Pontevedra). Below, tracing of the preserved prehistoric painting.

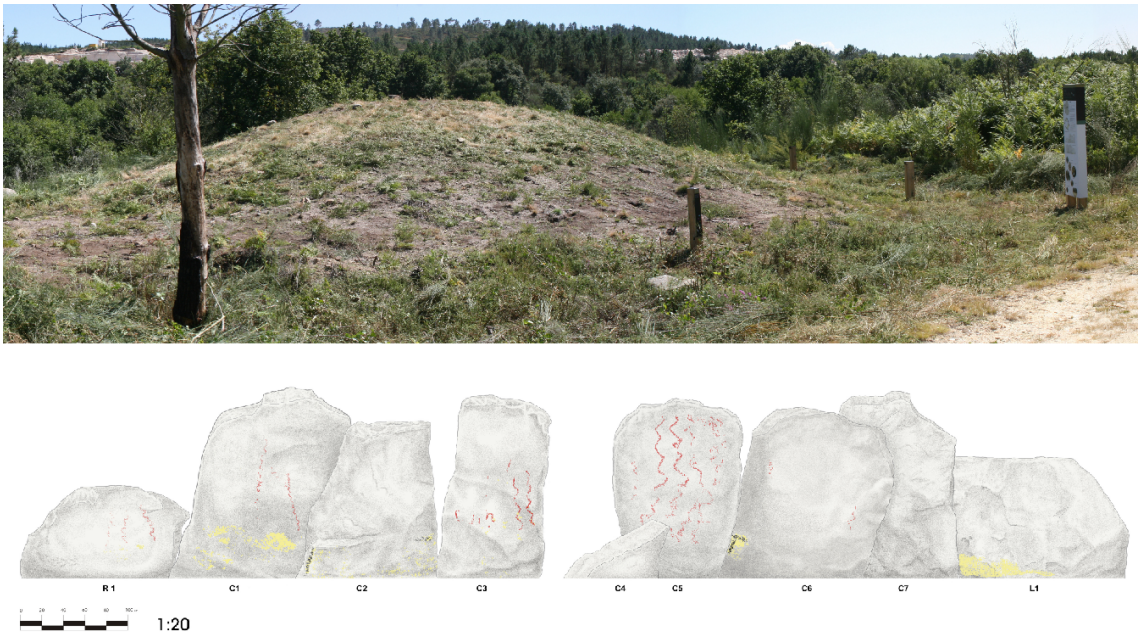

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Table 1. Alterations observed from 1997 to 2001 in the series of monuments visited. The degree of disturbance is measured from 1 to 4 (4, very serious).

Monument	Alteration	Year	Degree
Pedra da Moura	Ploughing in the area closest to the road (SE area)	1997	2
Pedra Cuberta	Orthostat L1 cracking due to pressure from a pine tree	1997	3
Arca da Piosa	Reforestation with eucalyptus on the mound	1997	3
Casota de Berdoias	Chalk and lipstick on engraved grooves	1998	1
Arca da Piosa	Charcoal painted on all orthostats	1998	1
Roza das Modias	Recent reforestation with eucalyptus in SE area	1998	3
Anta de Chao Mazós	Recent reforestation (pine) on burial mound	1998	3
Chan dos Touciños 1	Displaced orthostats	1998	2
Necrópolis de Lousada	Ploughing of 5 megalithic burial mounds	1998	4
Coto dos Mouros	Tyre burning inside the chamber	1998?	3
Fornela dos Mouros	Track near the site, in the upper part	1999	3
Roza das Modias	Painted grooves with chalk and lipstick	1999	1
Casa da Moura	Orthostat C5 in motion	1999	3
Serra das Motas X	Forest fire between 1999-2000	1999	2
Fornela dos Mouros	Headstone displacement?	1999	3
Casota de Berdoias	Widening of the access road, asphalt to 1m	1999	3
Casa dos Mouros	Painted with charcoal in L2, on stone and paint.	1999	2
Forno dos Mouros	Application of foreign substance on paint C1	1999	3

Anta da Parxubeira	Reforestation with eucalyptus trees on the immediate property	2000	1
Arca da Piosa	Track 20 m. from the dolmen, westwards	2000	3
Casiña da Moura	Intense and immediate forestry activity	2000	1
Chan de Castiñeiras 1	Drop of the C1 orthostat on the camera	2000	3
Anta do Meixueiro	Brushcutter cleaning, on paintwork	2000	2
Monte dos Marxos	Total destruction of chamber and tumulus	2000	4
Roza das Modias	Clearing of the western area of the mound	2000	3
Pedra Cuberta	Charcoal painted on R2	2000	2
Casa dos Mouros	Land use changing of the farm located to Southwest of the dolmen	2001	1
Mámoa Agro da Pena	Destruction by bulldozer	2001	4

Table 2. Number of disturbances for each form and agent (anthropogenic)

Process	Individual	Company	Minor Entity	Administration and technicians	TOTAL
Fire	31	-	-	1	32
Upper vegetation	6	-	7	6	19
Preservation actions	-	-	-	7	7
Digs	-	-	-	13	13
Forestry	5	3	18	-	26
Agriculture and livestock	27	1	-	3	31
Abandonment	1	4	1	8	14
Communication routes	1	1	2	9	13

Vandalism	106	-	1	-	107
Turism	17	-	-	-	17
TOTAL	194	9	29	47	279

Table 3. Degree of alteration and risk, priority and intensity of action, for the monuments studied.

Monument	Degree of alteration	Risk	Priority for action	Intensity for action
Cabaleiros	2,1	2,0	1,6	1,4
Pedra Moura	2,4	0,8	1,8	1,3
Pedra da Arca	2,3	1,3	2,0	1,2
Pedra Vixía	2,5	1,2	1,7	1,0
Casa da Moura	2,7	2,8	1,9	2,0
Anta da Lebre	2,8	1,2	1,8	1,7
Arca da Piosa	2,3	2,3	2,3	1,7
Casa dos Mouros	2,5	2,5	2,2	2,1
Paxubeira	1,8	2,1	1,7	1,9
Argalo	2,3	2,4	2,5	1,5
Casota do Páramo	2,8	1,7	2,2	1,7
Arca do Barbanza	2,5	1,4	1,6	1,6
Pedra Cuberta	3,0	2,8	2,5	2,3
Forno dos Mouros	2,3	2,6	2,3	2,1
Roza das Modias	2,4	1,7	2,8	2,3
X Serra das Motas	2,3	2,0	2,6	1,4
Mámoa da Cruz	3,0	1,7	2,8	1,4
Anta de Castiñeiras 1	2,3	2,8	1,8	2,2
Anta de Castiñeiras 2	2,6	1,9	2,0	1,7

Chan da Arquiña	2,0	2,6	2,0	2,0
Casa dos Mouros	2,5	1,8	2,0	1,6
Anta do Meixueiro	2,2	1,5	2,2	1,7
Axeitos	2,8	1,4	2,8	2,0
Dombate	2,3	0,0	2,2	2,0
Mota Grande	3,3	0,6	1,7	1,3
Coto dos Mouros	2,6	1,6	2,8	2,0

Table 4. General risks in the shelter of Pala de Cabras (Casaio, Ourense)

	Risk	Assessment
Total	2,0	High risk
Active processes	2,2	High risk
Risk to the public	2,8	High risk
Risk due to climate change	3,3	Very high risk
Risk of sudden events	3,3	Very high risk

Table 5. Heritage value and proposed action for the monuments studied (VP: Heritage Value; IEP: Heritage Efficiency Index).

Monument	VP	IEP	Type of actuation
Pedra da Moura	1,2	2,0	Reburying
Pedra Vixía	1,3	2,8	Reburying
Argalo	1,5	0,8	Reburying
Pedra da Lebre	1,6	1,6	Reburying
Casa dos Mouros	1,8	1,6	Open (without works)

Pedra da Arca	1,9	3,0	Reburying
Mámoa da Cruz	1,9	1,9	Reburying
X Serra das Motas	2,0	1,0	Reburying
Anta de Castiñeiras 2	2,1	1,9	Reburying
Parxubeira	2,2	0,8	Open (without works)
Pedra Moura	2,2	1,0	Reburying
Casota do Páramo	2,4	1,8	Open (without works)
Arca da Piosa	2,5	0,9	Open (without works)
Casa dos Mouros	2,5	0,9	Open (without works)
Anta do Meixueiro	2,5	1,0	Open (without works)
Chan da Arquiña	2,5	1,5	Open (without works)
Cabaleiros	2,6	1,8	Open (without works)
Arca do Barbanza	2,6	2,0	Open (without works)
Pedra Cuberta	2,7	1,1	Open (without works)
Roza das Modias	2,7	1,4	Open (without works)
Axeitos	2,8	1,9	Open (without works)
Forno dos Mouros	3,0	0,7	Reburying
Mota Grande	3,0	6,7	Reburying
Coto dos Mouros	3,0	3,0	Reburying