The Potential of Analysing Prehistoric Human Occupation in the Western Rias of Galicia (Northwest Iberia): Methods and Prospects

Le potentiel de l’analyse des occupations humaines préhistoriques dans les rias occidentales de la Galice : méthodes et perspectives

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Abstract: Located in the north-west of the Iberian Peninsula, Galicia is the region with the longest coastline in Spain. This coast is characterized by the presence of several estuaries (rias), the largest of which are located in the west. A number of islands and islets can be found within or at the mouth of such rias, as is the case in Ría de Vigo, Ría de Pontevedra and Ría de Arousa. Unlike other European Atlantic regions, the occurrence of prehistoric remains in topographically low coastal locations has traditionally been considered rare in the area. However, prehistoric human subsistence strategies in the region largely benefited from the extremely rich coastal and maritime resources, and there is increasing material evidence of sites dating from these periods, as well as of long-distance exchange of materials and ideas between these and other European Atlantic communities. In this paper we will focus on the different survey, fieldwork and dating methods and approaches recently used in these Western rias and will discuss the future prospects for prehistoric coastal research and heritage in the area.

Keywords: Prehistory, coastal archaeology, coastal erosion, Galicia, Iberian Peninsula.

Résumé : Située au nord-ouest de la péninsule Ibérique, la Galice est la région qui, en Espagne, possède le plus long littoral. Cette côte est caractérisée par la présence de plusieurs estuaires (rias), dont les plus grands sont situés à l’ouest. Un certain nombre d’îles et d’îlots se trouvent à l’intérieur ou à l’embouchure de ces rias, c’est le cas de la Ría de Vigo, de la Ría de Pontevedra et de la Ría de Arousa. En Galice, contrairement à d’autres régions atlantiques européennes, la présence de vestiges préhistoriques dans des zones côtières topographiquement basses a traditionnellement été considérée comme rare. Cependant, les stratégies de subsistance développées au cours de la Préhistoire ont largement tiré parti des ressources côtières et maritimes, et il existe de plus en plus d’indices de sites de ces périodes ainsi que d’échanges d’idées et d’objets entre ces communautés et d’autres communautés atlantiques européennes. Dans cet article, nous parlerons des différentes méthodes et approches relatives à la prospection, à l’enregistrement, à la fouille et à la datation des sites de la Préhistoire dans ces rias occidentales et nous discuterons à la fois des perspectives de la recherche et du patrimoine côtier préhistorique dans la région.

Mots-clés : Préhistoire, archéologie littorale, érosion côtière, Galice, péninsule Ibérique.
INTRODUCTION

The archaeological study of prehistory in coastal areas and their associated ecosystems (e.g. estuaries, marshes) has undergone fundamental changes at the international level in recent decades. Driven in part by Anglo-Saxon and Scandinavian research in the 1990s and 2000s, regional programs of an interdisciplinary nature have multiplied (e.g. Ashmore, 1994; Bell and Neumann, 1997; Bailey et al., 2020) and journals specialising in this type of environment have emerged. (e.g. Journal of Island and Coastal Archaeology, Journal of Maritime Archaeology, Journal of Wetland Archaeology). Advances in the field include, on the one hand, aspects of epistemological, theoretical and methodological positioning and, on the other, legal and administrative issues, which have had a notable impact on the data corpus at both qualitative and quantitative levels.

Unlike other Western European regions, specific research on and management of coastal archaeological heritage has not been fully addressed in the Iberian Peninsula until recent years. This is despite the known potential of the coastal areas for providing fresh quantitative and qualitative data on prehistoric societies and despite the fact that, like in neighbouring regions, there are severe threats to coastal cultural heritage from both natural and human factors. In Spain, specialists working in virtually all coastal regions have warned of the effects that climate change and coastal erosion are having on their cultural heritage. The situation is similar in Portugal, but with less regional variability as all the coastal regions face the Atlantic, none being open to the Mediterranean. It is noteworthy, however, that while Portugal is rich in prehistoric coastal sites (e.g. Sousa et al., 2016), only a few of them correspond to submerged or intertidal sites (Bicho et al., 2020).

Located in the north-west of the Iberian Peninsula, Galicia is the region with the longest coastline in Spain. This coast is characterized by the presence of several estuaries (rias), the biggest of which are located in the west. A number of islands and islets are found within or at the mouths of such rias (Rias Baixas; fig. 1). Despite growing interest in the archaeology of coastal areas in the region, the development of research programs and dedicated lines of research is relatively scarce. The 1980s and 1990s saw an increase in research and publications on coastal prehistory, with, for instance, the discussion of Mesolithic macrolithic industries, Neolithic and Bronze Age remains, rock art, the analysis of Iron Age shell middens and the reconstruction of sea-level fluctuations. (e.g. Aira Rodríguez et al., 1992; Martínez Cortizas and Costa Casás, 1997). Despite these advances, researchers in the early 2000s drew attention to the fact that the development of studies on the use of the sea in the prehistory and antiquity of Galicia were not fully developed (Vázquez Varela and Rodríguez López, 1999-2000). Today, we know that prehistoric human subsistence strategies in Galicia largely benefited from the rich coastal and marine resources, and there is increasing material evidence of coastal and island occupations from these periods, as well as of long-distance exchanges of materials and ideas between these and other European Atlantic communities.

In this paper, mainly focusing on our own work, we will discuss some of the methods and practices being implemented in current prehistoric coastal research in the western rias and the future prospects this research and management may address in the region.

1. THE PREHISTORIC ARCHEOLOGICAL CONTEXT OF THE WESTERN RIAS OF GALICIA

Of all Galician coastal areas, the western rias are probably those that have attracted the most attention. A distinctive aspect of these rias is that they have a number of islands and islets located within them or at their mouths. These rias are fluvial valleys partially flooded by the sea during the Quaternary interglacials, on a coastline undergoing lithospheric uplift (Viveen et al., 2013). Such river valleys were emerged during the last glacial period, being a coastal forest-like continental environment (Vidal-Romani and Grandal-d’Anglade, 2018) with high archaeological potential, as expected for the Portuguese coast (Bicho et al., 2020). After this cold stage ended 20 ky ago (Vidal-Romani et al., 2015), the post-glacial marine transgression started. As the sedimentary record shows, the sea level was then at -100 m below present sea level (bpsl) (Arce-Chamorro et al., 2021), reaching -73 m bpsl around 9 ky ago (Nombela et al., 2005). During this transgression, dune sands were transported from the emerged continental shelf to the present-day coastline (Arce-Chamorro et al., 2021). This is demonstrated by sand layers overlying wood remains from 4.5 ky (cal. BP) in the present intertidal area along the coast of Galicia (Nombela et al., 2005; Vidal-Romani and Grandal-d’Anglade, 2018). Evidence of this can be observed in Galician sites such as Guidoiro Areoso (see below), where dune sand covered several archaeological sites c. 2.5 ky ago. Organic levels 4.5 ky (cal. BP) old were found below the dunes (Blanco-Chao et al., 2017) and in the intertidal area, most likely corresponding to buried wood remains. According to the aeolian accretion model (Arce-Chamorro et al., 2021), the age of the dune overlying the archaeological structures suggests a sea level well below the present one. This would indicate that the sea level raised to present-day levels after 2.5 ky ago(S), and progressively flooded the fluvial valley to form the present ria.

The chronocultural framework of Galician Prehistory has been the object of a wide debate, no less because the bad preservation of organic remains due to the predominance of acidic soils usually hinders the use of radiocarbon dating (see below, 3.2. Numerical dating of sites and sediments). The main available evidence comes from...
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The Neolithic (c. 5000 to c. 2500 BC), the Bronze Age (c. 2500 to c. 800 BC) and the Iron Age (c. 800 BC to c. 1st century AD). The evidence from earlier periods is scarcer, and the identification of several lithic assemblages and remains dating from the Palaeolithic and – especially – the Mesolithic have proved to be controversial (see e.g. Vázquez Varela, 1984). This has resulted in the development of complementary approaches for understanding the human occupation of the region, such as the paleoenvironmental and chemical analysis of soils (Kaal et al., 2011) or the technological and archaeometric analysis of pottery (Prieto Martínez and Lantes Suárez, 2017).

The immediate area of the western rias shows an early Neolithic occupation, as the evidence from A Cunchosa suggests (Suárez Otero, 1997; here: fig. 1, nº5). From the middle of the 5th millennium cal. BC, and up to the beginning of the 2nd millennium, the landscape is dominated by the presence of megalithic monuments, some of which are organised in clusters in the higher areas of the sierras overlooking the sea (Criado Boado and Villoch Vázquez, 1998). Settlements are also abundant, especially compared with what is known for the rest of Galicia, although not many of them have been excavated in detail. Some of them, such as Monte dos Remedios (Fábregas Valcarce et al. 2007; here: fig. 1, nº6), seem to have been occupied intermittently throughout the aforementioned period, while others had more limited occupation (e.g. O Regueiriño and Montenegro: fig. 1, nº8 and nº7; Criado Boado and Cabrejas Domínguez, 2005). All of these settlements were open-air sites with huts made of perishable materials, without clear delimitation of the inhabited space or, at most, with possible palisades.

As the Bell-beaker pottery horizon disappeared, well into the Bronze Age (2nd millennium BC), the number of known settlements decreased. Settlements with elongated huts (e.g. Setepías; Acuña Piñeiro et al., 2011) and large storage pits (e.g. Monte Buxel; Lima Oliveira and Pri-

![Fig. 1 – Map of the western rias of Galicia (Rías Baixas) indicating the main sites cited in the text: 1. Os Pericos; 2. Guidoio Areoso; 3. Punta de Riasón; 4. Monte Lobeira; 5. A Cunchosa; 6. Monte dos Remedios; 7. Montenegro; 8. O Regueiriño.](image-url)
methodology has made the coast a privileged field of study for the analysis of human societies and their interaction with the environment. The often exceptional preservation of organic remains and the access to certain sedimentary archives (dunes, paleosoils) are key to understanding the interest in these areas (e.g. Verdin et al. 2019; López-Romero et al., 2023). Secondly, the reorientation of international archaeometry and of interdisciplinary approaches to archaeology has made the coastline and wetlands to occupy a renewed place in the agendas of various projects. Finally, the vulnerability of these areas to the effects of climate change has recently placed them at the forefront of the discussion about the causes, consequences and solutions to this global issue. (i.e. numerous articles on this subject in the international archaeological journals).

Based on our own experiences and activities, we will discuss three essential aspects that relate to the recent methods and practices of prehistoric coastal archaeology in the western rias of Galicia: the survey of and excavation in coastal areas, the numerical dating of prehistoric sites and sediments, and the heritage dimension of prehistoric coastal sites.

2.1. Archaeological survey and excavation

Archaeological survey of coastal areas requires an understanding of natural and maritime cycles that makes it different from fully continental survey on dry land. Firstly, like in most European Atlantic regions, tidal regimes (two high and two low tides per tidal day) dictate the times and seasons that are more suitable for archaeological surveys. Secondly, differential erosion affects the visibility of the archaeological record; in this sense, several decades can elapse before a site that originally stood just a few meters apart from another is revealed (e.g. Guídoiro Areoso ‘Monument 3’; Rey García and Vilaseco Vázquez, 2012). Thirdly, the rich biodiversity of most coastal areas in Galicia implies that specific planning is necessary, the presence of natural reserves and protected species necessitating additional permits.

Taking into account these factors, pedestrian surveys focus on dune horizons, the intertidal zone and the high water mark. While the survey of locations on continental dry land is obviously also necessary, the former contexts are those with the highest potential, having paradoxically received less attention. In the western rias, a dedicated survey of such targeted areas proved to be essential for the understanding of human occupation of small islands and islets (Ballesteros Arias et al., 2013).

Due to edaphological conditions – shallow granitic soils – and rapid erosion, deposits containing substantial archaeological sequences are rare. This situation implies that repeated surveys of a same area are necessary through the year, something that is not always possible in the absence of long-term funded programmes. Added to this, seasonal deposition of sediments and organic remains such as algae limit both pedestrian and geophysical surveys (fig. 2). On the basis of these facts – erosion, research limitations and visibility of the archaeological record –, make the original density and spatial distribution of prehistoric remains difficult to judge.

In the western rias, gradiometer surveys were performed on the islet of Guídoiro Areoso (fig. 1, nº2) and on Monte Lobeira, (fig. 1, nº4), a hill near the coast. These surveys (fig. 3) show that, despite the shallow granitic
soils, relevant information can still be obtained through this technique (e.g. site extension). 3D recording of the visible structures also proved to be a cost-effective solution for the survey of areas that are difficult to access with heavy equipment (López-Romero and Mañana-Borrazás, 2013; López-Romero et al., 2015).

In recent years, interventions on coastal sites in the rias included the realization of test pits and open area excavations. For all of these, the collaboration with geomorphologists and geologists, from the Universities of Santiago de Compostela and A Coruña, was essential.

Test-pit excavation at Os Pericos (Ribeira, A Coruña; Vilaseco Vázquez, 2012; here: fig. 1, nº1), together with the geomorphological study of the surroundings (Costa-Casais et al., 2012), made it possible to document that the promontory had a long occupation history. In addition to a Bell-beaker phase, apparently restricted to the lowest sector of the peninsula, a small, fortified settlement from the Late Bronze Age (13th-10th centuries BC) was found in the northern sector and another, from the Second Iron Age, in the eastern sector. The latter was probably a hillfort settled on a dune formed at the beginning of the 1st millennium BC. Today coastal erosion has demolished most of this settlement and the dune where it stood.

Intense coastal erosion also led to the excavation of the Bronze Age cemetery of Punta de Riasón (Illa de Arousa, Pontevedra; Bóveda Fernández, 2017; here: fig. 1, nº3, and fig. 4). Here, three cists were located in the intertidal zone and test pits were opened in the surroundings to study the geomorphological stratigraphy of the area. The cists, rectangular in shape, were in varying degrees of preservation depending on their position in relation to the tides. In the case of one of them, only a slab was preserved in situ. The structure of the second was almost intact, lacking its cover, but having been subjected to the prolonged action of the tide it was empty. The third, also without a cover, was partially buried; the lower archaeological levels of this tomb were apparently intact and two small silver spirals were documented, allowing us to date it to the Bronze Age.

The coastal site that has received the greatest attention is Guidorio Areoso, (fig. 1, nº2), a small islet (c. 8 ha) in the centre of the Arous estuary. An important occupation has been documented here from the Neolithic to the Iron Age. To date, five megalithic monuments are known on the islet, including one that was destroyed by coastal erosion in 2013, and abundant archaeological material is found on its beaches and in the intertidal zone (López-Romero et al., 2015). Excavations on the beach and on ‘Monument 4’, one of the megalithic monuments, took place between 2015 and 2017. Collaboration with geomorphologists was essential to understand and date the stratigraphic sequence, strongly conditioned by the formation of a dune system that ultimately covered the site. The analysis of a Bronze Age shell midden associated with the mound was performed by malacologists.
Fig. 3 – Gradiometer survey of the dune and intertidal zone in Guidoiro Areoso (22/09/2014).

Fig. 3 – Prospection géophysique de la dune et de l’estran de Guidoiro Areoso par gradiométrie (22/09/2014).
from the University of León, being the second of this age found on the islet (Rey García and Vilaseco Vázquez, 2012). This discovery is extremely important, as shell middens pre-dating the Iron Age are very rare in Galicia. 3D scanning and photogrammetry were also essential for the excavation processes, ‘Monument 4’ being a prime example of the integrated use of these techniques (Maña-nab-Borrazás et al., 2020).

2.2. Numerical dating of sites and sediments

Due to the acidic nature of most soils, $^{14}$C dating of prehistoric sites in Galicia is most often dependent on the presence of charred remains and on the organic fraction contained in bulk sediments. Fieldwork in the western rias has shown that significant amounts of organic materials, including bone, were preserved here owing to the nature of sediments (calcereous, waterlogged). A human jaw discovered during the 2016 surveys in Guidoiro Areoso was $^{14}$C dated to the Second Iron Age (Olalla Costas, USC, pers. comm.), becoming the first date on human bone for this period in Galicia. A $^{14}$C date on oyster shell had previously been obtained from this same islet (GrN-16108, 4020 ± 40 BP; Rey García and Vilaseco Vázquez, 2012). Other recent $^{14}$C dates on animal bone (Guidoiro Areoso, Beta-495147, 2820 ± 30 BP), plant remains (Punta Riasón, Beta-483265, 180 ± 30 BP showing a post-depositional alteration of the cists; Bóveda Fernández, 2017) and charred wood (Os Pericos, Ua-32504, 2895 ± 45 BP, Vilaseco Vázquez, 2012) confirm the potential of this area to contribute to the chronology of regional prehistory (table 1).

The use of other numerical dating techniques for archaeological purposes is virtually nil. Optically Luminescence Dating (OSL) of sediments has proven useful in coastal contexts, and its potential for the study of prehistoric monuments has been reviewed elsewhere (López-Romero, 2011). In this context, an eroding profile at ‘Monument 4’ in Guidoiro Areoso gave us the opportunity, for the first time, to use OSL to date the building sequence of a Neolithic monument in Galicia. Five OSL samples were taken (fig. 5). The two uppermost of these corresponded to dune sand overlying the excavated structure, while the three lowermost corresponded to organic sediments. The cores were dated at the Luminescence Laboratory of the University of A Coruña. Quartz grains were used for dating using procedures described in W. Viveen and colleagues (2013) and the blue-OSL (BL-OSL) single-aliquot regenerative dose (SAR) protocol (Murray and Wintle, 2000). Radiocarbon dating
was performed on organic matter obtained from samples MG-1, MG-2 and MG-3, by accelerator mass spectrometry (AMS) Beta Analytic laboratory in Florida. The ages were calibrated using the Oxcal 4.1 software package (Bronk Ramsey and Lee, 2013) based on the calibration curve of Reimer et al. (2020).

Gamma spectrometry provided a similar dose rate for all samples (table 2), as observed in coastal dunes of the area (Trindade et al., 2013). The Central Age Model (Galbraith et al., 1999) was used to estimate the ages. The resulting ages (table 2) are stratigraphically consistent and range from 4528 ± 284 to 421 ± 133 BC from the lowermost to the uppermost sample, respectively. Radiocarbon analyses of samples MG-1, MG-2 and MG-3 show ages younger than the OSL ages (table 3). Such 14C ages are not stratigraphically consistent. The organic matter dated probably corresponds to vegetal remains or litter, as the d13C (‰) indicates. Thus, the discrepancy can be explained as a result of plants growing in the soil surrounding the mound. Interestingly, a 14C age of organic sediment at the base of the head slab of this monument provided an age of 3777-3654 BC (Beta-495146; Maña-Borrazá et al., 2020), making it slightly younger than the MG-1 OSL age. Organic sediments of two sedimentary studies of the surroundings (Blanco-Chao et al., 2017; Cajade-Pascual et al., 2019) provided a range of 14C ages from 4449-4336 BC for the oldest to 328-204 BC for the newest. Other 14C ages of organic matter provided in such studies fit our 14C ages for MG-2 and MG-3. This means that the surroundings of the mound corresponded to a continental area with vegetation, and the sediments worked as soils, at least from the moment of construction of the mound until the point when the sand of the dune presently overlying it was deposited. This is shown by OSL ages of samples MG-4 and MG-5 (see fig. 5).

Such age results fit the model of coastal evolution in Galicia over the last 15 ky (Arce-Chamorro et al., 2021), from a lower sea level. Around 6 ky ago, the Ría de Arousa was a fluvial valley above the sea level (between -70 m and -50 m bpsl) that was located more than 3 km further to the west. In such valleys, forests spread over the land (Vidal-Romani and Grandal-d’Anglade, 2018), surrounding the river channels and providing a suitable location for human settlement. With the later sea level rise, aeolian sands were transported from coastal areas upstream in the fluvial valleys, causing dramatic changes in the forest ecosystems. Dunes moved through the inner part of the present rias, as evidenced by the dated dune that overlies the tomb and the surrounding continental soils. Local sedimentary records reveal that the sea level reached a height of -20 m bpsl around ≈2,000 BP

### 2.3. Coastal archaeology and heritage

As has been stated elsewhere (López-Romero et al., 2017), the heritage dimension of Galician prehistoric coastal sites has received little attention. Early research often failed to address questions that are essential to our understanding of past and present uses of the coastal zone

<table>
<thead>
<tr>
<th>Site</th>
<th>Sample</th>
<th>Context</th>
<th>Material</th>
<th>14C Age (BP)</th>
<th>d13C (‰)</th>
<th>(2σ) cal. BC/AD</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidoiro Areoso</td>
<td>GrN-16108</td>
<td>Shell midden</td>
<td>Shell (Ostrea edulis)</td>
<td>4020 ± 40</td>
<td>-</td>
<td>2225-1950 cal. BC (ΔR cal. as cited in the reference)</td>
<td>Rey García and Vilaseco Vázquez, 2012</td>
</tr>
<tr>
<td></td>
<td>Beta-495147</td>
<td>Upper level of the midden that covers the mound</td>
<td>Bone (Bos)</td>
<td>2820 ± 30</td>
<td>-20.9‰</td>
<td>1106-1098 (0.5%) OR 1079-1069 (0.7%) OR 1056-898 (94.2%) cal. BC</td>
<td>This paper (after excavations in 2017 funded by Xunta de Galicia; see Mañana-Borrazá et al., 2020)</td>
</tr>
<tr>
<td>Punta de Riasón</td>
<td>Beta-483265</td>
<td>Base of one of the cists’ slabs (corresponding to a post-depositional alteration)</td>
<td>Plant remains (unidentified species)</td>
<td>180 ± 30</td>
<td>-10.9‰</td>
<td>1655-1698 (19.3%) OR 1722-1814 (50.1%) OR 1836-1883 (7.5%) OR 1910-186 (18.6%) cal. AD</td>
<td>Bóveda Fernández, 2017</td>
</tr>
<tr>
<td>Os Pericos (N terrace)</td>
<td>Ua-32504</td>
<td>Oldest archaeological level</td>
<td>Charcoal (deciduous Quercus)</td>
<td>2895 ± 45</td>
<td>-28.5‰</td>
<td>1219-969 (91.8%) OR 959-932 (3.7%) cal. BC</td>
<td>Vilaseco Vázquez, 2012</td>
</tr>
</tbody>
</table>

Table 1 – Radiocarbon ages on organic remains (excluding organic matter in bulk sediments) from sites in the western rias cited in the text. With the exception of GrN-16108, calibration data are from OxCal v.4.4.4 and the IntCal20 Northern Hemisphere radiocarbon age calibration curve from P. Reimer and colleagues (2020).

Tabl. 1 – Dates radiocarbones effectuées à partir de restes organiques (à l’exception de la matière organique issue de sédiments) de sites des rias occidentales mentionnés dans le texte.
and the sea, such as the way past societies adapted to changes in a highly dynamic environment or what effects these coastal dynamics and the global warming are having on heritage preservation today.

As is the case in neighbouring European regions, there is no specific regulation for coastal or intertidal heritage at risk in Galicia (for a review of the current Heritage Bill regulations see Barreiro and Varela-Pousa, 2017). In spite of this, the management of coastal heritage has benefited from increased collaboration between the regional authority responsible for their safeguard (Dirección Xeral de Patrimonio Cultural), researchers, governmental bodies (e.g. Dirección Xeral de Patrimonio Natural, Parque Nacional Marítimo-Terrestre de las Islas Atlánticas de Galicia) and the wider public. Significantly, citizens and associations have warned of the threats prehistoric coastal sites are being subject to, something that has enabled different actions on specific areas within the rias (Chao Álvarez, 2015; López-Romero et al., 2015; Mañana-Borrazás et al., 2020).

<table>
<thead>
<tr>
<th>Sample</th>
<th>Age (a)</th>
<th>Age BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUIDM4_MG-1</td>
<td>30</td>
<td>6545±284</td>
</tr>
<tr>
<td>GUIDM4_MG-2</td>
<td>31</td>
<td>3273±240</td>
</tr>
<tr>
<td>GUIDM4_MG-3</td>
<td>28</td>
<td>4520±157</td>
</tr>
<tr>
<td>GUIDM4_MG-4</td>
<td>12</td>
<td>2489±92</td>
</tr>
<tr>
<td>GUIDM4_MG-5</td>
<td>32</td>
<td>472±92</td>
</tr>
</tbody>
</table>

Table 2 – OSL age results. Activity concentration of radioisotopes, Dr, De and resulting ages.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Uncal (^{14})C Age (y)</th>
<th>Code</th>
<th>(\delta^{13})C (‰)</th>
<th>(2σ) cal. yr BP</th>
<th>(2σ) cal. yr BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUIDM4_MG-1</td>
<td>4260+±30</td>
<td>BETA - 588314</td>
<td>-25.7</td>
<td>4870-4655</td>
<td>2921-2706</td>
</tr>
<tr>
<td>GUIDM4_MG-2</td>
<td>2300+±30</td>
<td>BETA - 588315</td>
<td>-25.3</td>
<td>2357-2160</td>
<td>408-211</td>
</tr>
<tr>
<td>GUIDM4_MG-3</td>
<td>2900+±30</td>
<td>BETA - 588316</td>
<td>-25.9</td>
<td>3159-2953</td>
<td>1210-1004</td>
</tr>
</tbody>
</table>

Table 3 – Radiocarbon ages from sediments of the OSL samples.

Fig. 5 – Megalithic monument of Guidoiro Areoso (Monument M4). Left: Sample location for OSL dating (image Tomos S.L.; 18/07/2017). Right: Comparison of OSL and \(^{14}\)C – bulk organic sediment fraction – dates from these samples (CAD C. Arce).
Rapid intervention is promoted by the regional authorities when works are planned in coastal areas within the rias (Vázquez Collazo, 2005) or when coastal erosion is threatening the destruction of relevant archaeological sites (fig. 6).

A wider perspective involved the application of the ALeRT methodology from western France (Daire et al., 2012) to the coastal archaeological record of the rias. This consisted in the analysis of sites at risk through a dedicated Vulnerability Evaluation Form and a public-science dimension, along with photogrammetry and 3D laser scanning monitoring of some of the most vulnerable sites (López-Romero et al., 2015). While many of the sites analysed through these actions were prehistoric, other archaeological and ethnographic heritage was also considered. Recently, a proposal for the prioritisation of action on a specific type of site – shell middens – has been published (González-Gómez de Agüero et al., 2019), but as far as we know it has not been implemented.

We believe, however, that it is on the holistic approach to coastal heritage that research efforts need to be focused. A no less important aspect of this heritage dimension is the fact that many sites at risk are located in areas protected from an environmental point of view, making it necessary to combine archaeological interventions with preservation of natural spaces. A large portion of the western rias coastline is protected either as part of the Islas Atlánticas de Galicia National Park or within the Natura 2000 Network. As mentioned earlier, one of the consequences of this is that fieldwork is sometimes dependent on wildlife cycles. A paramount example occurred at Guidoiro Areoso ‘Monument 4’, where the archaeological intervention required the dismantling of a dune more than 3 m high that buried the monument. The work was delayed and authorised only under special conditions, including the delay of the fieldwork due to the nesting of the Eurasian oystercatcher (Haematopus ostralegus), a species classified as vulnerable in Galicia.

3. DISCUSSION AND FUTURE PROSPECTS

Dedicated approaches to coastal prehistory in Galicia have emerged in recent decades. Understanding the nature, constraints and opportunities of coastal areas is not always straightforward. Adaptation of the planning and methods to marine ecosystems, to geomorphological conditionings and to natural cycles are a fundamental part of the research process.

The integration of Galician coastal prehistory into the current international debates on coastal societies, social complexity and exchange networks, as well as on coastal erosion and heritage management (Kintigh et al., 2014), is becoming increasingly evident. However, a coastal prehistory research agenda should integrate a number of...
aspects that still require implementation or further development. While it is not our intention to formalise such an agenda here, we would nonetheless like to highlight some future prospects that could contribute to the qualitative and quantitative improvement of our knowledge on coastal prehistory in the region. These future prospects can be seen as challenges that regional research has to address.

Firstly, administrative and financial issues should be addressed. Today, the most common types of intervention in the coastal areas of Galicia are punctual surveys or excavations, almost always in the form of rescue actions, without real continuity. There is a need to consolidate medium- to long-term actions and projects, which is something that partly relies on the regional and national R&D strategies. This does not only relate to funding but, more critically, to the need to consolidate research teams in the region. The 2008 economic crisis strongly impacted the commercial archaeology and research sectors in Spain (Parga Dans, 2010), resulting in a reduction in the number of companies, the reconversion of some archaeologists to other professional activities or their migration to other countries. Added to this, the recent impact of the global pandemic (and, ultimately, of the economic impact in Europe of the conflict in Ukraine) still needs to be evaluated.

Secondly, theoretical and methodological discussion should widen the approaches and techniques available for coastal and intertidal research. Acknowledging the importance of the preservation of organic materials and sedimentary archives in these settings is crucial for filling the gaps remaining in regional research. As we have shown, questions of chronology that cannot be addressed in other areas of Galicia can be approached here. The combined use of $^{14}$C and OSL may help unravel some of the traditional issues of regional prehistory, such as the problems posed by bulk sediment dating (e.g. uncertainty about the origin of the organic matter, taphonomic processes resulting in stratigraphical chronological inversion), or the discussion of architectural sequences. Added to this, the preservation of organic remains can foster the analysis of the rich resources available in these coastal areas, as has recently been the case with the excavation of the Bronze Age shell midden associated with the excavation of ‘Monument 4’ in Guidoiro Areoso (Fernández-Rodríguez et al., 2017; Mañana-Borrazás et al, 2017). This will improve our knowledge on their availability to and exploitation by prehistoric societies, contributing to understanding questions of seasonality, biodiversity and ecosystems in the past, as has been the case in recent years in other European Atlantic regions like Brittany (Dupont and Marchand, 2021). Similarly, specific surveys of coastal areas still need to be further developed in Galicia, something to which intensive pedestrian survey, geophysics and airborne sensors (e.g. LiDAR) may largely contribute in the near future.

Thirdly, the heritage dimension of prehistoric coastal sites should be an immediate priority. While coastal erosion and heritage loss are particularly acknowledged at the local and regional scales, we must not forget that this is a global issue (i.e. effects of climate change and of human pressure on coastal areas) and that it therefore requires a global response. It is urgent to combine local and regional actions with wider national and international perspectives. For this, the integration of all layers of society in the diagnosis, research, decision-making and restitution processes should be a priority. Another important aspect concerns the relationship between cultural and natural heritage. While, as we have seen, nature conservation issues may condition archaeological research, the joint consideration of the cultural and natural heritage in coastal areas can result in a win-win situation. Many of the threats are similar to both types of heritage and adapted responses to their vulnerable situation can hence be jointly considered. This is the case for the integration of the public in the survey and monitoring phases, the sustainable exploitation of cultural and natural resources in natural parks, or the study of heritageisation processes (Barbeito, 2013; Sánchez Carretero, 2013).

Finally, all these challenges and gaps should not only be seen as negative. They can also be considered as opportunities to boost the visibility and the future of coastal research and management in the area. There is a real opportunity to situate the region in the international debate of the prehistoric uses of wetlands, estuarine and coastal environments. This can be achieved not only by addressing the aforementioned challenges, but also by proactively integrating the discussion of Galician case studies in European programmes and international working groups. Owing to their characteristics, the western rias and other Galician coasts are also well placed to become a reference for the discussion of the aforementioned natural-cultural heritage dimension. To succeed with this, it is again the multi-scalar perspective from the very local to the global that needs to be emphasised.

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NOTES

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