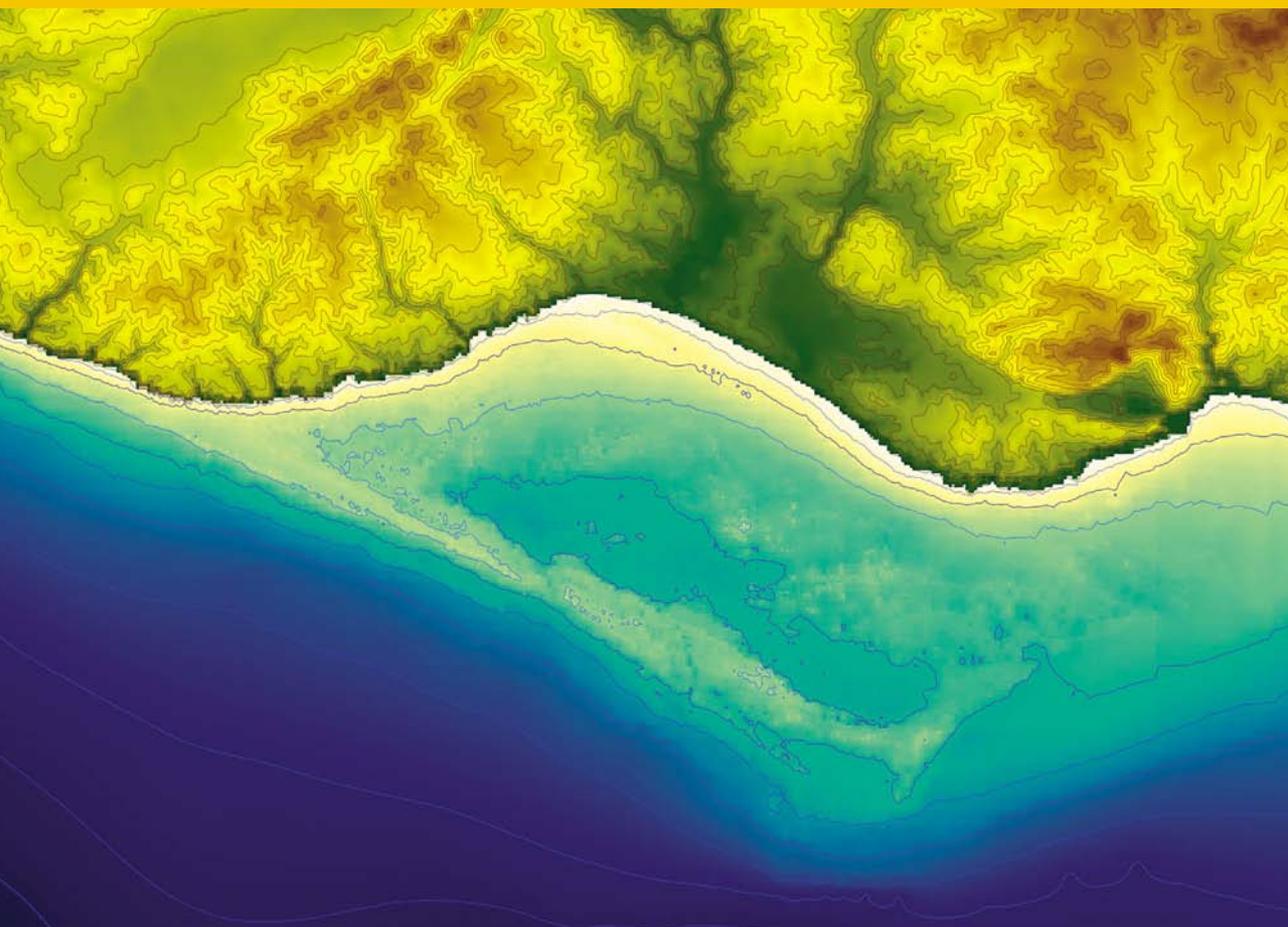


A. CAMPAR ALMEIDA · ANA M. S. BETTENCOURT · D. MOURA
SÉRGIO MONTEIRO-RODRIGUES · MARIA ISABEL CAETANO ALVES



ENVIRONMENTAL CHANGES AND HUMAN

INTERACTION ALONG THE
WESTERN ATLANTIC EDGE

MUDANÇAS AMBIENTAIS E INTERAÇÃO HUMANA

NA FACHADA ATLÂNTICA OCIDENTAL

IMPRINT / FICHA TÉCNICA

Title: ENVIRONMENTAL CHANGES AND HUMAN INTERACTION ALONG THE WESTERN ATLANTIC EDGE
MUDANÇAS AMBIENTAIS E INTERAÇÃO HUMANA NA FACHADA ATLÂNTICA OCIDENTAL

Eds. A. Campar Almeida, Ana M. S. Bettencourt, D. Moura, Sérgio Monteiro-Rodrigues and Maria Isabel Caetano Alves

Editors:

APEQ - Associação Portuguesa para o Estudo do Quaternário
CITCEM - Centro de Investigação Transdisciplinar “Cultura, Espaço e Memória”, financiado por Fundos Nacionais, através da FCT – Fundação para a Ciência e Tecnologia, no âmbito do projeto PEstOE/HIST/UI4059/2011.

CEGOT - Centro de Estudos de Geografia e Ordenamento do Território

CGUP - Centro de Geologia da Universidade do Porto

CCT - Centro de Ciências da Terra da Universidade do Minho

Editorial advisory committee:

António Monge Soares, Fernando da Silva Rebelo, Helena Granja, Isabel Figueiral, João Luís Cardoso, João Pais, Lúcio Cunha, Maria da Conceição Freitas, Nuno Bicho, Pedro Proença e Cunha, Philippa Ascough, Ramon Fábregas Valcarce.

Cover image: Digital terrain model of the Armação de Pêra, Algarve, Portugal (by Leandro Infantini)

Composition, printer and bound by Sersilito-Empresa Gráfica, Lda.

Edition: 500 Exemplares

Legal deposit: 350801/12

ISBN: 978-989-97140-1-4

Coimbra, October 2012



A. Campar Almeida, Ana M. S. Bettencourt,
D. Moura Sérgio Monteiro-Rodrigues, Maria Isabel Caetano Alves (eds.)

Environmental changes and human interaction
along the western atlantic edge

*Mudanças ambientais e interação humana
na fachada atlântica ocidental*

Contents

Índice

7 Foreword

I

Methodology

Metodologia

- 13 Marine reservoir effects: problems and prospects for radiocarbon dating
Philippa L. Ascough
- 27 Radiocarbon dating of aeolianite formation
A. M. Monge Soares, A. Ramos Pereira, J. M. Matos Martins & P. J. Portela
- 43 Diatomáceas como potencial ferramenta para reconstituições paleoecológicas
A. Gomes, T. Boski & D. Moura

II

Palaeoenvironmental Changes and Human Activity

Mudanças Paleoambientais e Actividade Humana

- 51 Reconstructing Holocene evolution in the archaeological site of Campo Lameiro (NW Spain): an interdisciplinary approach to geoarchaeology
Manuela Costa-Casais, Antonio Martínez Cortizas, Joeri Kaal, Maria Isabel Caetano Alves & Felipe Criado-Boado
- 71 Sedimentological analysis of relict slope deposits from Serra da Estrela (Portugal): first results
Alexandre Trindade, G. Vieira & C. Schaefer
- 79 Environmental changes in the westernmost Cantabrian range during the postglacial period: the Pena Velosa (Muniellos, Asturias) pollen record
C. Muñoz Sobrino, F. J. Suárez Pérez, H. S. Nava Fernández, M.A. Fernández Casado, L. Gómez-Orellana, M. A. Rodríguez-Gutián, J. A. Fernández Prieto & P. Ramil-Rego
- 95 Refúgios para árvores temperadas caducifólias na área litoral do Noroeste Ibérico durante o último período glacial
Luis Gómez-Orellana, Pablo Ramil Rego & Castor Muñoz Sobrino
- 107 História do fogo durante o holocénico na serra da Estrela, Portugal: resultados preliminares
João Araújo, Simon E. Connor, Jacqueline F. N. van Leeuwen & Willem O. van der Knaap
- 115 Firewood and timber exploitation during the 3rd and 2nd millennia BC in the Western façade of the Iberian northwest: wooden resources, territories and chaîne opératoire
María Martín-Seijo, Ana M. S. Bettencourt, Emilio Abad-Vidal & Juan C. López García

III

Fauna and Human Activity

Fauna e Actividade Humana

- 139 O povoamento humano do paleo-estuário do Sado (Portugal): problemáticas em torno da ocupação dos concheiros mesolíticos
Mariana Diniz & Pablo Arias
- 159 Preliminary analysis of the spatial relationships between faunal and lithic remains on the Mesolithic shellmidden of Cabeço da Amoreira (Muge, Portugal)
Rita Dupont de Sousa Dias, João Cascalheira, Célia Gonçalves, Cleia Detry & Nuno Bicho
- 165 Burial practices in Muge shell middens (Portugal): state of the art
Olívia Figueiredo
- 171 Acerca da influência ambiental e humana nos moluscos do Monte Molião (Lagos, Portugal)
Cleia Detry & Ana Margarida Arruda

IV

Mining and Environmental Impact

Mineração e Impacto Ambiental

- 187 Impacto ambiental da primeira mineração e da metalurgia especializada no Sudoeste da Península Ibérica
Nuno Inácio, Francisco Nocete, José Miguel Nieto, Moisés R. Bayona, Joaquín Delgado, T. Boski & Daniel Abril
- 203 Modelo de gestão e circulação de sílex há 5000 BP na faixa litoral entre Nazaré e Peniche (Estremadura portuguesa)
Patrícia Jordão & Nuno Pimentel

V

Evolution of Coastal Land

Evolução do Litoral

- 219 Mean sea level and coastline-Late Quaternary
D. Moura, A. Gomes, S. Gabriel & J. Horta
- 227 Utilização de ferramentas SIG para o estudo da morfologia submersa da bacia de Armação de Pêra (Algarve)
Leandro Infantini, D. Moura & Nuno Bicho
- 243 Guidoiro Areoso. Megalithic cemetery and prehistoric settlement in the Ría de Arousa (Galicia, NW Spain)
José Manuel Rey García & Xosé Ignacio Vilaseco Vázquez
- 259 Evolução recente (décadas de 1950-2010) da morfologia dos deltas do Catumbela e Cavaco (Benguela, Angola)
Pedro A. Dinis, Luís S. Silva, João Huvi, Jorge M. Dinis & Pedro P. Cunha
- 265 Land use evolution of the coast Blanc Cap to Cantin Cap (Moroccan Atlantic coast): cartography by aerial photography analysis
Khalid el khalidi, Abdenaim Minoubi, Bendahhou Zourarah & Ahmed Aajjane

GUIDOIRO AREOSO. MEGALITHIC CEMETERY AND PREHISTORIC SETTLEMENT IN THE RÍA DE AROUSA (GALICIA, NW SPAIN)

José Manuel Rey García¹ & Xosé Ignacio Vilaseco Vázquez^{1,2}

*“We could have fancied ourselves the first of men
taking possession of an accursed inheritance”*

Joseph Conrad

Abstract: Guidoiro Areoso, a small islet in the middle of the Ría de Arousa, the bigger of the Galician estuaries, has many signs of occupation during prehistoric times. There are at least five megalithic structures (mounds) from Neolithic, and an Early Bronze Age settlement. Most of these remains are in the intertidal zone, since a dune occupies the inner part of the island. This position on the foreshore suggests that there has been a significant variation in the sea level over the past millennia. In this paper we describe all the structures that have been located by now, and analyze the possibility of the islet forming part, in mid-Holocene times, of a peninsula attached to the continent.

Key-words: Mid-Holocene; Neolithic; Bronze Age; Sea level change.

Resumo: Guidoiro Areoso, um pequeno ilhote no meio da Ría de Arousa, apresenta numerosos indícios duma importante ocupação durante a pré-história. Documentaram-se, pelo menos, cinco estruturas megalíticas (mamoas) do Neolítico e um povoado da Idade do Bronze Inicial. A maior parte das evidências acham-se na área entre marés, já que o interior da ilha está ocupado por uma duna. Esta posição, na beira-mar, permite supor que se produziu uma importante variação no nível do mar nos últimos milénios. Neste trabalho apresentam-se as estruturas arqueológicas descobertas e avalia-se a possibilidade de que o ilhote formasse parte, durante o Holocénico médio, de uma península unida ao continente.

Palavras-chave: Holocénico médio; Neolítico; Idade do Bronze; Variação do nível do mar.

1. GUIDOIRO AREOSO 1988-2011. STORY OF AN EROSION

Guidoiro Areoso (municipality of A Illa de Arousa, Pontevedra province) is a small islet placed in the middle of the Ría de Arousa, being the largest of all that belong to what has been called Ría and Os Guidoiros archipelago. Placed nearly 1.400 m off Illa de Arousa, it is just 600 m long from north to south, less than 200 m at its wider point from east to west and only 9 m over the sea level in its highest spot. It has two different

¹ Servizo de Arqueoloxía. Consellería de Cultura, Educación e Ordenación Universitaria. Xunta de Galicia. San Domingos de Bonaval, s/n. 15703 Santiago de Compostela. Spain. E-mail: jose.manuel.rey@xunta.es

² Grupo de Estudos para a Prehistoria do NW Peninsular. Departamento de Historia I. Universidade de Santiago de Compostela. Praza da Universidade, 1. 15782 Santiago de Compostela. Spain. E-mail: ignacio.vilaseco@usc.es

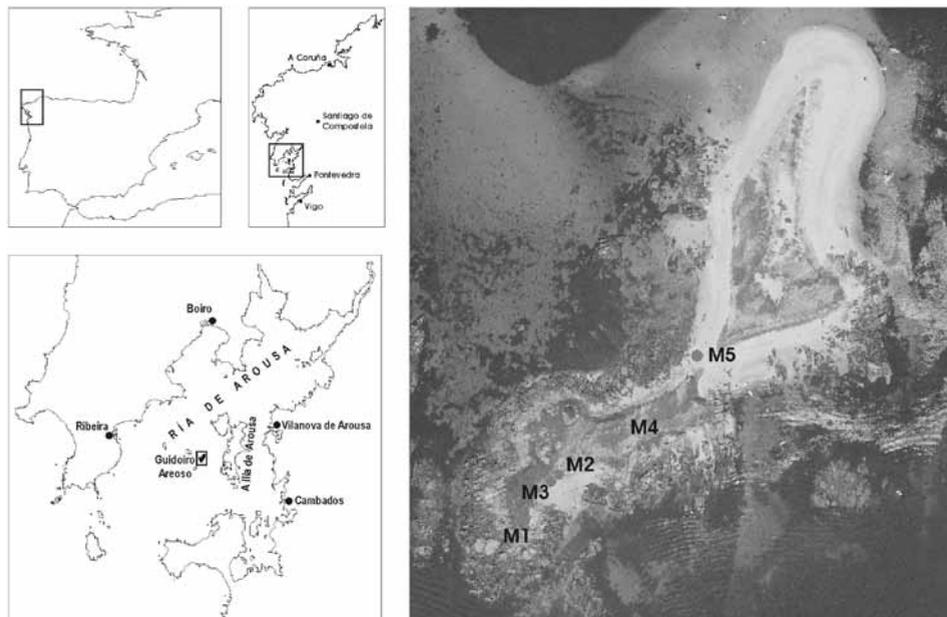


Fig. 1 – Location of the islet of Guidoiro Areoso and position of the mounds which are known in the area.

parts separated by a narrowing of its width: the northern, which is nearly completely covered by an active sand dune, and the southern, in which granite outcrops mixture with a vegetated dune, apparently inactive.

Several references on oral megalithic chamber and on a few pottery sherds, including bell beaker, have called attention to the archaeological importance of the site. The islet was the aim of a research project conducted between 1988 and 1990 by one of us (Rey 2011). It involved surface and underwater field survey, test pits, and two small open area excavations. Three phases were defined in the occupation of the site: 1) a funerary use in Late Neolithic, with three mounds related to the megalithic local tradition, two of which were investigated. Some pottery sherds found in several places of the islet may be evidences of contemporary inhabitation that could not be valued conclusively; 2) a Bronze Age seasonal occupation, with evolved forms of beaker pottery, metal artefacts and plentiful food waste and 3) a natural sedimentation process without human intervention that masks the structures, and involves the accumulation of bones of rodents and coastal birds. Part of roman amphorae was found on top of the sequence, probably from a nearby flotsam, and marks the end to the sequence.

There is no later evidence of human occupation at Guidoiro Areoso, although the site was frequently visited, as the numerous traces of traditional granite quarrying prove, probably, belonging to recent times, not older than medieval ages.

For the last ten years the islet has been the subject of an important alteration, as its sands are very variable, corresponding to a sand dune environment. Tidal and storm action are changing dramatically the site and as a consequence of this, at least since 2005 the top

of two standing slabs could be seen on the western beach, apparently a new megalithic construction covered by the sand, as we could see ourselves in 2007.

At the beginning of summer 2011 was reported that a full dolmen was visible in a profile of Guidoiro Areoso. This information took us back to the islet, allowing to check the important reduction of the sandy areas, both on the northern sand dune, which had been significantly reduced in height and extension, and on the southern beaches, where more than 40 cm of sand had disappeared only from 2007. The sequence of aerial photographs in figure 2 is clear enough to understand this heavy erosion process.

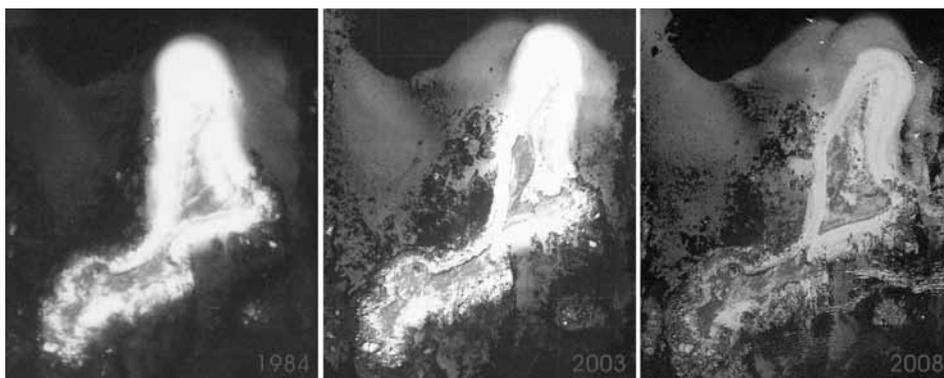


Fig. 2 – Aerial photographs showing the evolution of the degradation of sandy areas in Guidoiro Areoso from 1984 to 2008.

Throughout summer 2011 we could identify in our visits that there are at least five megalithic structures at Guidoiro Areoso, most in a very precarious condition due to the erosion in recent years. Three were previously known, but the one found but not excavated in 1988-1990 project had lost nearly half of the mound, and the megalithic chamber was totally exposed to the action of the sea. The fourth corresponds to the two standing slabs at the beach known from 2005, but as most of the sand had disappeared, now all the structure of the tomb could be seen in the foreshore. The fifth is a totally new structure located virtually next to one of the open area excavations made in the 80's, emerging now in the sand because of the intensive erosion. Moreover, all over the borders of the islet there are small areas of paleosols, under the sand dunes and in the intertidal zone, all with large numbers of prehistoric pottery, bones and shells, evidence of a significant prehistoric occupation of the islet.

No archaeological fieldwork has taken place in 2011 but the documentation of the new structures and finds. Trying to avoid the sea erosion over the megalithic chamber in the profile (mound 4) a stone wall protection was built in September by the Servicio Provincial de Costas de Pontevedra from Ministerio de Agricultura, Alimentación y Medio Ambiente (Gobierno de España), owner of the island, under the surveillance of the Servizo de Arqueoloxía from Xunta de Galicia.

2. THE MEGALITHIC NECROPOLIS

At least the southern area of Guidoiro Areoso was used in prehistoric times with a clear funerary purpose. As mentioned, there are, at least, five different megalithic monuments, or better yet, mounds, all in its southern part, but might be possible that the sand is masking other similar structures. In fact, just as we are finishing this paper it has been reported the presence of a small stone structure that could be a funerary cist (Manuel Gago, pers. inf.). As monuments 1 and 2 are already published (Rey 2011), we are specially focusing on the new architectures.

Mound 1

Located on a small platform in the southeast of the islet, the chamber of mound 1 was perfectly visible on the surface in 1988, as is today. It was investigated in 1989, revealing a small polygonal funerary structure, only 1.10 m wide, formed by six slabs, only three in its original position, and possibly a capstone, that was missing. A small barrow, also very low, surrounded it, made of earth and covered with a layer of embedded stones (cuirass). Sea erosion had made disappeared half of it, even though the monument is relatively far from the intertidal zone. Despite of this, it can be inferred a diameter of only 5,80 m, which is too small for a chamber of that size. No significant finds were found related to it.

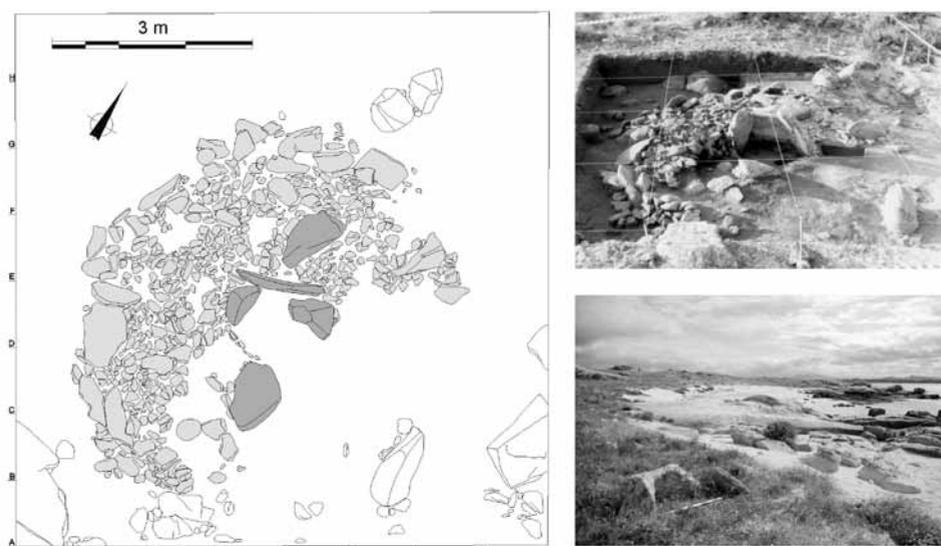


Fig. 3 – Mound 1: plan and photography of the excavation area, and present position, out of the intertidal zone.

Mound 2

One of the test pits made in 1988 exposed a stone structure two meters deep under a thick sandy sediment, so there was no evidence of it on the surface.

Subsequent open area excavation revealed that it was part of another tiny funerary monument, with only 7 m in diameter, and not known parallels in NW Iberia. Over twenty small granite slabs, between 20 cm and 50 cm in size, and disposed lying down, formed the small chamber, slightly oblong in plan (1.73 m x 1.50 m). The structure seems unable to bear a big stone cover, as usual, so it is possible that there was no cover, or, as it has been proposed for some megaliths in central Spain, that it was made of perishable materials.

A small barrow, covered by a dense cuirass of embedded stones, with bigger ones on the periphery, surrounded this strange chamber. Although the structure itself was empty, the monument was related to several pottery vessels, some of them with an incised decoration that is well known in the local Late Neolithic (or Chalcolithic), clearly of a pre-beaker period, and dating more or less to the first half of the III millennium cal BC (*Penha* ware). It seems as if the chamber was looted in prehistoric times, and the offerings were thrown in the periphery of the monument.

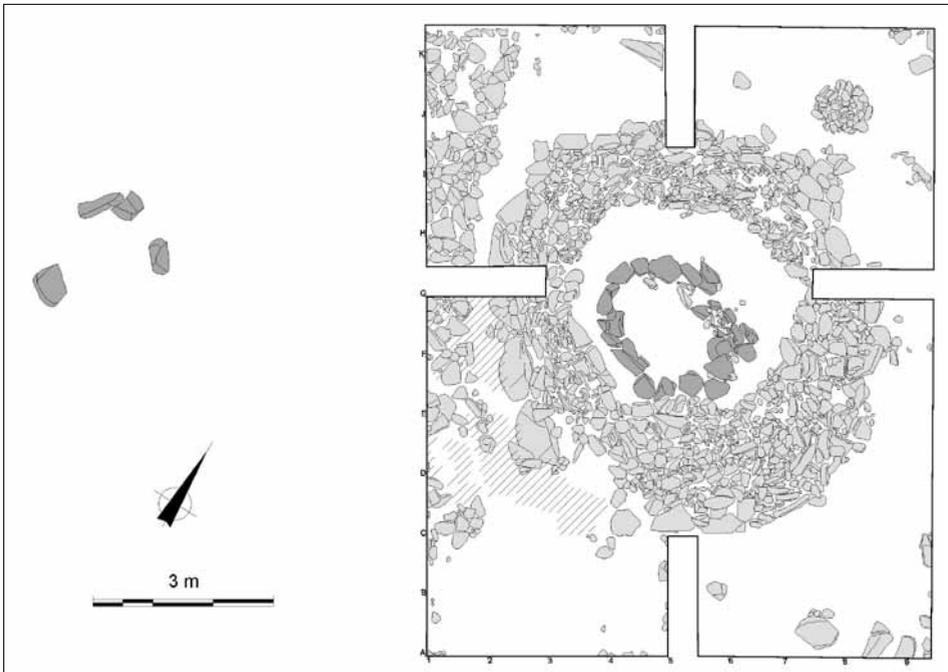


Fig. 4 – Plan of the excavation of mound 2 (right), with the relative position of the chamber of mound 3 (left).

Mound 3

Because of the loss of sand occurred in recent years in the beach where mound 2 was located, at least from summer 2011 a new megalithic chamber is visible. Four slabs emerge about 40 cm over the sand, arranged in a sub circular disposition of more than 1 m in diameter; the one on the NW is probably the backstone of the chamber. But the most remarkable issue is that one of the slabs is slanted on the contrary as it must be,

in a similar way as they appear in NW Iberian mounds when they have been moved by looting. And this despite the fact that the chamber was until recent years under 1 m of sand. East of the slabs, where the sea continues to erode the beach, there were many pebbles spread in the surface, probably part of the stone cuirass of its mound.

The new structure is just next to the previously known monument, as parts of the plastic that covered the bottom of the area at the end of the excavation were also perfectly visible at that moment. The border of the digging area is in fact less than 4.50 m from the nearest slab of the new chamber. In fact, it is possible that a stone structure that appeared in the excavation, west of mound 2, and without contact with it, is really the edge of the new mound, although evidence is not clear as no slope was detected on the disposition of the boulders. Even if this is not true, we have again a small monument, less than 10 m in diameter.

In our first visits to the islet the chamber was surrounded by vegetated sand, and the spring tide did not reach it. But erosion has been increasing and in January 2012 the chamber was well into the foreshore, and apparently the top of a fifth slab could be seen in the sand.

Mound 4

What we call now mound 4 was first detected in 1988, by cleaning a profile on the west of the islet. Although not investigated later, its presence was perfectly clear, as it



Fig. 5 – Detail of the chamber of mound 4, and, in the inset, the barrow in 1988.

was identified the stone cuirass of the structure (Rey 1991). In recent years the sea has been eroding the monument so nearly half of it has disappeared, and now one of the sides of the central funerary structure is perfectly visible in the profile.

It consists surely of an elongated, nearly rectangular, chamber, with 2,60 m long, a width unknown as part of the structure is still covered by the barrow, and 1,50 m in high. Three slabs in one of the longest side, the only one that is completely exposed, compose it. To the right there is another one, only its edge visible, in perpendicular disposition to the rest, the backstone, as it is in the NW, disposed with an important inclination so that the other slabs rest on it. On the left, the edge top of another big slab is visible, probably the one that worked as door when the tomb was sealed. Some small slabs lay on the sand near the structure, and were probably used to seal the interstices between the orthostats.

Over the standing stones comes out the capstone of the chamber. It is 1.80 m long, and only lies over the lateral slabs, not over the capstone or the door. It seems that has completely fallen inside the chamber, breaking at least in two pieces, because of the weight of the sand dune over it. Although the chamber has been partially emptied by the sea action, as spring tides reached it, there is no evidence of desecration at all, so it seems undisturbed since its original sealing in prehistoric times.

To the right of the chamber, the profile shows a precise section of the mound, made of black earth. The cuirass can be distinguished as a line of stones starting at mid-height of the backstone and descending to the ground as it recedes from it. Apparently, it seems no bigger than 10 m in diameter, and 1.20 m high, so the backstone projects over it in 80 cm. Over the mound, there had been some sedimentation before the establishing of the dune.

Mound 5

At least from 2005 two slabs standing at a right angle were visible in the western beach, virtually in the isthmus that joins the two parts of the islet. In summer 2011 more than 40 cm of sand were missing, and all the preserved structure of the mound was visible in the intertidal zone. The megalithic chamber was formed at least by six granite orthostats, although only two stand in its original position. The tallest is 1.25 m

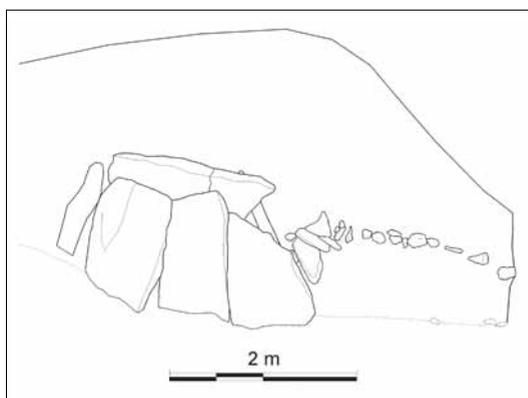


Fig. 6 – Section of mound 4 as seen in the profile of the islet in summer 2011.

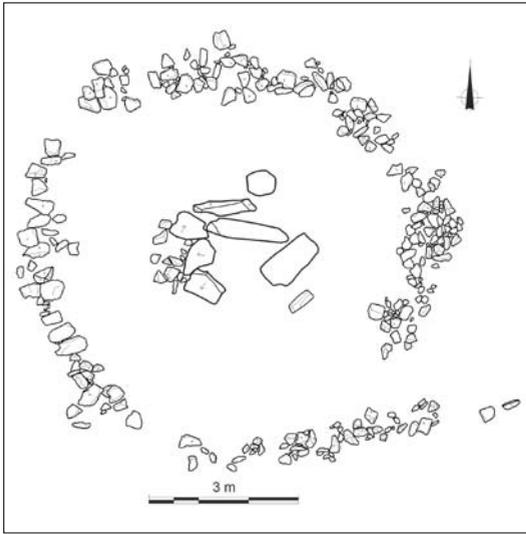


Fig. 7 – Plan of the structures of Mound 5, emerging from the sand of the beach in the summer of 2011.

high from the soil, and appears to be again the backstone. The other four, together with another small slab, lie fallen north of them. As one is 1.50 m high, it is not possible that, at least this was in a vertical position when the mound was first identified. All the slabs are in the centre of a ring of small stones, 30-50 cm in size, which was surely the limit of a mound of only 8.50 m in diameter, as some of them are still arranged with some slope. All the earth had disappeared, apparently not in recent years, as the stones were still partially covered by sand.

Guidoiro Areoso in NW Iberian megalithic context

The features of the mounds located in the islet make them outstanding when compared to what we know about this kind of monuments in the NW (Fábregas & Vilaseco 2006). Some of them, obviously, are common with the rest of the area: the presence of a cemetery of at least five mounds in less than 250 m in a straight line is not strange, as is also nearly a norm the construction of circular mounds, built with earth and small stones. Polygonal (M1) and elongated (M4) chambers are also common.

The first striking characteristic is the small size of all barrows, between 6 and 10 m, as normally they are more diverse and, as far as we know, bigger when holding megalithic chambers similar to mounds 4 and 5, or even mound 1. In two cases (1 and 4) the megalithic structure is not completely covered by the mound, a situation that we only normally have in the biggest passage graves of the area, not in the smallest and without corridor like these. Their limited monumentality is also decreased by their construction very near to granite outcrops. All this makes them have a limited presence in the landscape. Moreover, mound 2 is completely unusual, as no parallels are currently known for this peculiar structure.

The atypical features mentioned make it difficult to establish a hypothetical chronology for the mounds, as scarce finds have been retrieved related to them, and three have not been investigated yet. This is more delicate as barrow construction is in NW Iberia a long-spanning tradition, starting in the second half of the V millennium cal. BC, and extending throughout the next centuries nearly to the end of the Bronze Age, at the end of the II millennium cal. BC (Fábregas & Vilaseco 2006). And, what

is more, in this timespan new monuments are often raised next to the previous ones, setting the present cemeteries.

We have already mentioned that the strange structure of mound 2 was related to pre-beaker Late Neolithic pottery. If the stone structure found west of it is part of mound 3, it is possible that this could have been built later than the former, based on the partial stratigraphic evidence of 1990 excavation. Nevertheless, the chamber seems in fact a more classical structure, even earlier than mound 2. No chronological information was retrieved from the digging of mound 1, and little can be said about mound 5, because of its condition. Chamber of mound 4 seems an ancient monument, belonging to the V or IV millennia, but this cannot be stated with certainty, as we know very few later well-preserved structures.

3. THE PREHISTORIC SETTLEMENT

Although a natural sedimentation covers most of the island, hindering the observation of archaeological remains, it is common to find prehistoric sherds scattered on the beaches of the south of Guidoiro Areoso, as a result of tidal action. The presence of animal bones and shells is also frequent. They are always related to the emergence of paleosols, both under the sand dunes in the foreshore, and in the intertidal zone. It is probable that its presence in the northern part of the islet is masked by the active sand dune.

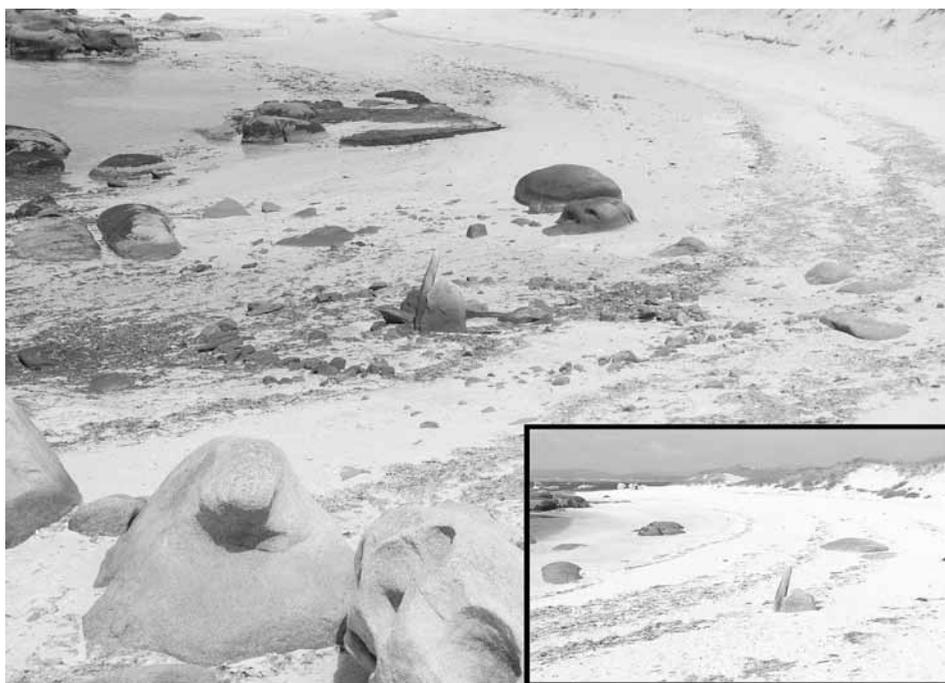


Fig. 8 – Mound 5 from south; the black area in the background is a big fragment of paleosol with prehistoric material. In the inset, the slabs as emerging in the sand in 2007.

The relationship of prehistoric finds to these paleosols was clearly established with the test pits opened in several points of the islet in 1988 investigation, as they were always found in a buried dark-black in colour soil, varying between 5 and 30 cm depth. All of them can be related to Late Prehistory; considering some sherds retrieved in the pits, and one big fragment of an incised decorated vessel found south of barrow 4 in 2011, it is possible that there was a settlement contemporary to mound 2, from the first half of the III millennium cal BC. But occasional or permanent occupation of the site lasted at least to Early Bronze Age.

The excavation of the area where mound 2 was found revealed that over the structure, once it was looted, derelict, and partially covered by the sand, a prehistoric settlement was placed at this point. Pottery is completely different to the one related to the mound, with a lesser quality except for the Beaker decorated fragments. Textures are little homogeneous, with non-plastic inclusions big in size. Capacity is also different, and several vessels have been exposed to fire, indicating a cooking purpose. Forms are now composed and bigger, including large containers. Decoration is plastic, and, less frequently, there are impressed beakers and some organizations that remember the *Penha* style.

Apart from pottery, some other objects were retrieved, like a small bone awl and lithics, including some polished tools, a small flint blade and several granite stones with one cup-mark in one or two of their sides. There were also two small metallic awls, that brought the site among those with the earliest bronzes in the Iberian Peninsula, together with others known in the NW, like Fixón-A Costa da Seixeira in Galicia, and Sola, Fraga dos Corvos or Bouça da Cova da Moura in Northern Portugal (Comendador *et al.* 2008), all dating to the first half of the II millennium cal BC. A first analysis using Energy Dispersive X-ray Fluorescence (ED-XRF) showed tin percentages higher than 20wt%, but a revision using time-of-flight (TOF) neutron diffraction measurements revealed that in fact they are about 10wt%.

Food waste was also plentiful, which is unusual in NW Iberian contexts, and allowed us to get some information about the diet in the site. Meat came from the main domestic animals –cow, ovicaprines and pig–, which were usually slaughtered as adults. Although bones are badly damaged, butchery marks and evidence of fire have been identified. Bones of two wild species were also identified, a lagomorph and a Mediterranean monk seal, but they are probably intrusions, as no human manipulation was recognized on them. Shellfish formed also part of the diet, mostly two bivalves (*Ostrea edulis* and *Mytilus galloprovincialis*) and one univalve (genus *Patella*), which could be collected in sandy bottoms or rocky areas next to the site.

Pottery finds and metal objects are clearly related to the Early Bronze Age. Unfortunately, only one radiocarbon date was obtained for this settlement, from shells of *Ostrea edulis* (GrN-16108: 4020±40 BP). Considering the problems of dating shells, we have calibrated it using the ΔR value estimated by Rubinos *et al.* (1999) for the I millennium cal BC in another site of the Ría de Arousa, setting the occupation between

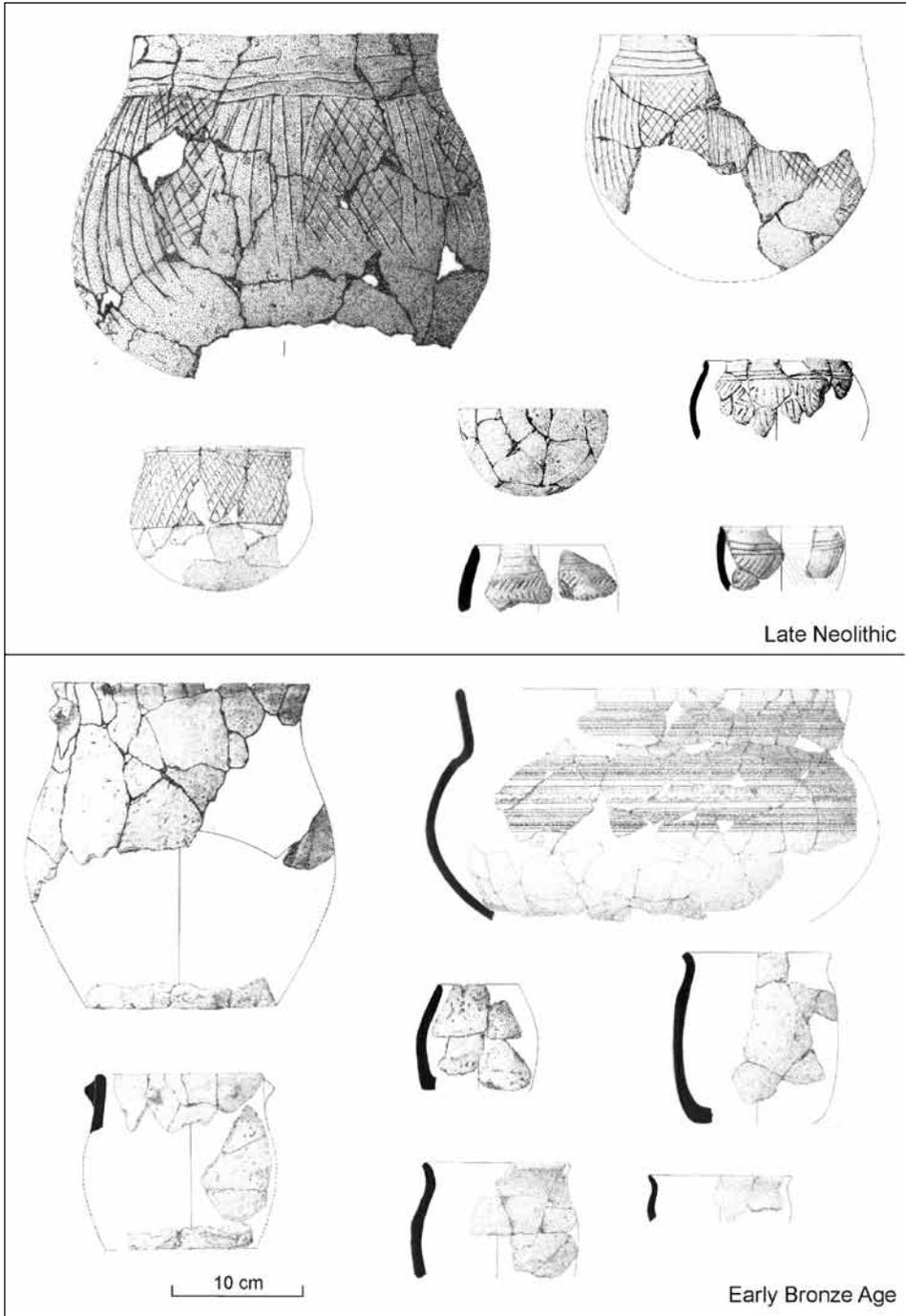


Fig. 9 – Some of the pottery vessels related to Mound 2 (Late Neolithic) and to the Bronze Age occupation.

2225-1950 cal BC (2σ)³. A similar result, with a wider span, was obtained by Antonio Monge Soares using another ΔR value (Comendador & Bettencourt, forthcoming).

As we have mentioned, this is the later stage known of inhabitation in Guidoiro Areoso, although some occasional activities were made by humans in the next millennia, like shellfishing or quarrying.

4. GUIDOIRO AREOSO IN THE CONTEXT OF THE *RÍA DE AROUSA* DURING THE LAST 7000 YEARS

Despite its limited extent, Guidoiro Areoso provides ample evidence of a dense occupation in prehistoric times, and shows itself as a terrific spot to study sea level changes in the last millennia, as most of the evidence is now on the intertidal zone, in a position that obviously was not the original. It is well known that the Galician *rías* (estuaries) are the result of marine flooding of valleys all over the Holocene, because of deglaciation since the last maximum (Pagés 2000). Despite this, there is no agreement about the evolution of this process, when the present mean sea level (MSL) was reached, or even if this has been higher than now (Dias 2004). Archaeologists, meanwhile, have seen the site, since it was first published, as if it were an island also in prehistoric times, forgetting the important changes that must have happened in the coastline from then.

Nevertheless, in recent years a reconstruction of the relative sea curve evolution during the deglaciation for the NW Iberian Peninsula has been published (Alonso & Pagés 2010). This study shows that the rise of sea level was extremely fast until 7500 cal BP, when the MSL stabilized at about 5 to 7 m below present position. Sea level remained stabilized till 4200 cal BP, with a new acceleration until 3100 BP, when there is a period of 500 years of stabilization before the final rise. Similar information has been recorded with different methodology (Fernández-Mosquera *et al.* 2007). We must remember that most of the megalithic constructions in NW Iberia were raised between 6500 and 4000 cal BP (Fábregas & Vilaseco 2006), and that radiocarbon chronology of the Early Bronze Age settlement in Guidoiro is probably 2225-1950 cal BC (4175-3900 cal BP).

Unfortunately, all the cores studied for the reconstruction of the published curve are in the northern coast of NW Iberia, far from the *Rías Baixas*. Despite this objection, all the information we have for this area seems to confirm the proposed curve. In the *Ría de Vigo*, for example, the presence of a lower MSL has been identified for Roman times (Martínez & Costa, 1997), and fossil trunks dating from about 4600 cal BP were found in the foreshore at Praia de Patos (cit. by Costas 2008). Older information was obtained from Lagoa dos Nenos, the coastal barrier-lagoon system in Illas Cíes, in front of *Ría de Vigo* (Costas 2008; Costas *et al.* 2009). The origin of the lagoon has

³ Calibration has been calculated with the OxCal computer programme, v4.1.7 (Bronk Ramsey 2009) with marine data from Reimer *et al.* (2009). A different value that has been previously published (Fábregas & Vilaseco 2003; Rey 2011) was the consequence of a bad use of the calibration process.

been established about 7700 cal BP as a fresh-water pond in an upland depression, without any marine influence. For this to happen it is necessary that the MSL was at least 4 m below present level, which is similar to results in the northern coast. Marine influence is first detected about 3700 cal BP, moment in which the MSL seems to be for the first time in the Holocene over -4 m from present.

The Ría de Arousa also shows strong evidence of the important changes that have happened in the coast all over the last 7.000 years. A Roman site, Praia do Naso, is now placed at the foreshore of the northern coast of Illa de Arousa, been eroded by the tidal action. In Ladeira do Chazo (Boiro) standing tree-trunks were found under the foreshore, associated with prehistoric pottery, including Beaker, and dating from 4000-4500 cal BP (Fábregas & Rodríguez 2012). And in Os Pericos (Ribeira), the outermost point of the northern bank of the estuary, many changes have been detected for the last millennia (Costa-Casais *et al.* 2012). The site is now a rocky point surrounded by

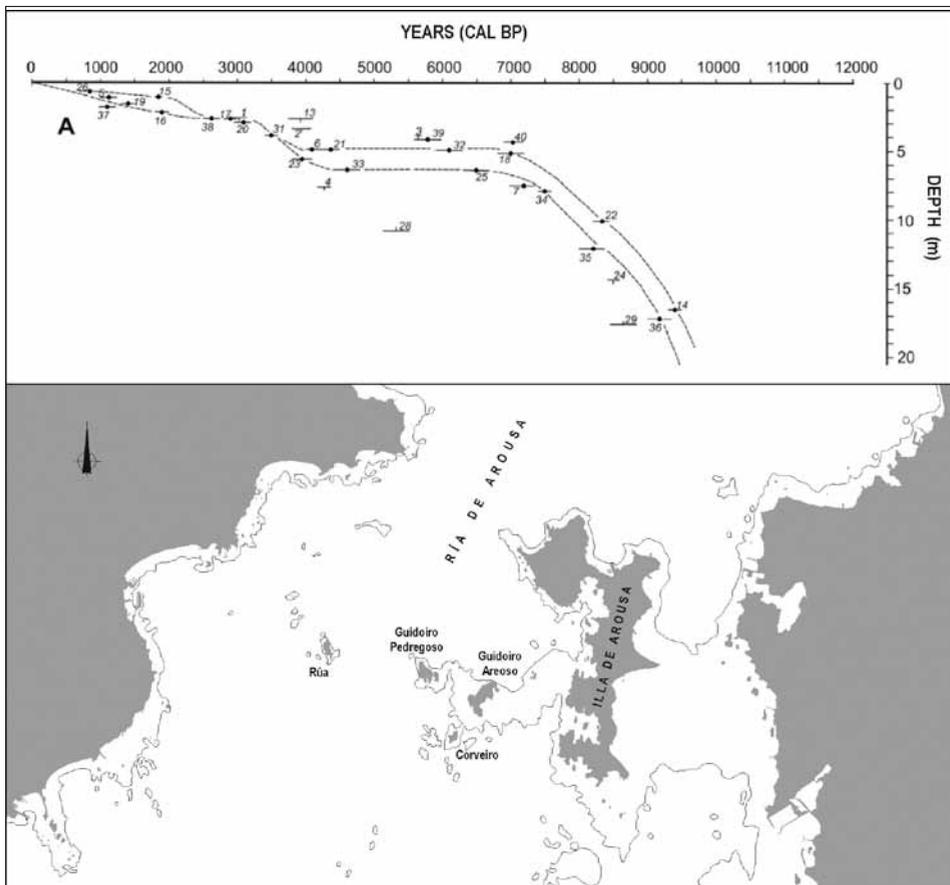


Fig. 10 – *Up*: Recent part of the relative sea curve during the deglaciation in NW Iberia (Alonso & Pagés 2010, fig. 5). *Down*: Plan of the Ría de Arousa in the proximity of Guidoiro Areoso showing the present land surface (grey) and the -5 m depth contour. (Source: Mapa Topográfico Nacional de España. S: 1:25.000).

the sea, but at least two sand dunes existed in the past: the western dune was active at least from about 6800 cal BP to 4000 BP, whereas the eastern one was formed in a short period of time, between 2850 and 2700 cal BP. Nowadays there is nearly no evidence of these two sand-dunes, eroded by the sea action, as it is almost lost the Second Iron Age site (probably a hill fort) that was settled over the second one about 2300 cal BP (Vilaseco 2012).

If we have a look now to the topography of Ría de Arousa in the proximity of Guidoiro Areoso, we can see that the 5 m depth contour under the present main sea level surrounds not only Illa de Arousa, but also our islet and Guidoiro Pedregoso, where also prehistoric pottery has been found, and leaves apart Rúa islet, which is in the other side of the channel of the estuary. Taking this into consideration, it is quite probably that in mid Holocene existed in the middle of Ría de Arousa a big peninsula similar to the one there is nowadays in the other bank (Boiro), and so Guidoiro Areoso was in fact linked to the continent during the construction and use of the megalithic cemetery all over Neolithic and Late Neolithic, probably between 6500-4500 cal BP (4500 and 2500 cal BC).

It is also probable that the site was still accessible by foot in the Early Bronze Age, despite the sea level having risen, and thus it is not strange the presence of the livestock that was consumed in the settlement. Probably it became an islet not far from that moment, at the time that a sand dune covered the archaeological remains, protecting them. In all the historical maps of the area both Guidoiro Areoso and Illa de Arousa are always represented as islands, although a sand bar, known as *Areal do Vao* and still practicable during spring tides until the third quarter of the 20th century, linked the second with the mainland.

But we must mention that Guidoiro Areoso also shows signs suggesting that the MSL has been at some time a bit higher than now. We have mentioned that mounds 3 and 5, despite being under the sand until recent years, seem to have been exposed previously, the first one even with evidence of looting, and the second because of the fallen slabs of the chamber. But the clearest evidence is mound 1, with nearly half of the barrow disappeared because of the sea action although it is actually far from the intertidal zone, even now that the sandy areas had reduced significantly.

Guidoiro Areoso has turned thus not only into a splendid archaeological site, but also a great, although unstable, record for the changes occurred in the coast in the last millennia. Unfortunately, if we don't hurry all this information may be hopelessly lost soon, eaten by the force of the sea.

ACKNOWLEDGMENTS: The 1988-1990 investigations on the island were conducted by Jose Manuel Rey García as part of the research program of the Museo de Pontevedra, and funded by Consellería de Cultura of Xunta de Galicia. Metal objects have been studied by Beatriz Comendador Rey, and analyzed, first by ED-FRX in the project *Arqueometalurgia de la Península Ibérica*, and later with TOF in Rutherford Appleton Labs., Didcot (UK). Carlos Fernández Rodríguez studied the macrofauna recovered in excavation, and Carlos M^a. Rodríguez López made the archaeomalacology analysis.

In the 2011 documentation of the new elements we had the invaluable help of Beatriz Comendador Rey, which made most of the field drawings, and María José Bóveda Fernández, with their digitization. We are also grateful to Manuel Gago for his information about the possible new cist he found on January 2012. Andrés Santiago Anaya has revised the English version of the text, but all errors and mistakes are obviously ours.

REFERENCES

- Alonso Millán A. & Pagés Valcarlos J.L.** 2010. Evolución del nivel del mar durante el holoceno en el noroeste de la Península Ibérica. *Revista de la Sociedad Geológica de España* 23 (3-4): 157-167.
- Bronk Ramsey C.** 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51(1): 337-360.
- Comendador B. & Bettencourt A.M.S.** 2011. Nuevos datos sobre la primera metalurgia del Bronce en el Noroeste de la Península Ibérica: la contribución de Bouça da Cova da Moura (Ardegães, Maia, Portugal). *Estudos do Quaternário* 7: 19-31.
- Comendador B., Reboreda S., Kkockelmann W., Macdonald M., Bell T. & Pantos M.** 2008. Early Bronze technology at land's end, North-Western Iberia. In: S.A. Paipetis (ed.) *Science and Technology in Homeric Epics. History of Mechanism and Machine Science* 6. Springer: 113-138.
- Costa-Casais M., Martínez Cortizas A., Pontevedra-Pombal X., Berasategui Vinagre I., Ferro-Vázquez C. & Rodríguez Racedo J.** 2012. Evolución holocena del sector costeiro de punta dos Pericos (Ribeira a Coruña). In: R. Fábregas Valcarce & C. Rodríguez Rellán (eds.) *A arte rupestre no Norte do Barbanza*. Santiago de Compostela: Andavira: 153-174.
- Costas S.** 2008. *Origen y evolución del conjunto playa-duna-lagoon de Cíes: (Parque Nacional marítimo terrestre de las Islas Atlánticas de Galicia)*. Madrid: Organismo Autónomo Parques Nacionales.
- Costas S., Muñoz Sobrino C., Alejo I. & Pérez-Arlucea M.** 2009. Holocene evolution of a rock-bounded barrier-lagoon system, Cíes Islands, Northwest Iberia. *Earth Surface Processes and Landforms* 34: 1575-1586.
- Dias J.M.** 2004. A história da evolução do litoral português nos últimos vinte milénios. In: A.A. Tavares; M.J.F. Tavares & J.L. Cardoso (eds.) *Evolução Geohistórica do Litoral Português e Fenómenos Correlativos: Geologia, História, Arqueologia e Climatologia*. Lisboa: Universidade Aberta: 157-170.
- Fábregas Valcarce R. & Rodríguez Rellán C.** 2012. A Prehistoria Recente do Barbanza. In: R. Fábregas Valcarce & C. Rodríguez Rellán (eds.) *A arte rupestre no Norte do Barbanza*. Santiago de Compostela: Andavira: 35-60.
- Fábregas Valcarce R. & Vilaseco Vázquez X.I.** 2003. El Neolítico y el megalitismo en Galicia: problemas teórico-metodológicos y estado de la cuestión. In: V.S. Gonçalves (ed.) *Muita gente, poucas antas? Origens, espaços e contextos do Megalitismo. Actas do II Colóquio Internacional sobre Megalitismo (Reguengos de Monsaraz, 2000)*. Lisboa: Ministério de Cultura: 281-304.
- Fábregas Valcarce R. & Vilaseco Vázquez X.I.** 2006. En torno al megalitismo gallego. In: R. Fábregas Valcarce & F. Carrera Ramírez (eds.) *Arte Parietal Megalítico en el Noroeste Peninsular. Conocimiento y conservación*. Santiago de Compostela: Tórculo: 11-36.
- Fernández-Mosquera D., Vidal-Romani J.R., Sanjurjo-Sánchez J. & Granja H.** 2007. Cronología por OSL del eólico costero y evolución del nivel del mar en el NW Ibérico durante el Cuaternario superior. In: J. Lario Gómez & P.G. Silva Barroso (eds.) *Contribuciones al Estudio del Periodo Cuaternario. Resúmenes XII Reunión Nacional de Cuaternario*. Ávila: 185-186.
- Martínez Cortizas A. & Costa Casais M.** 1997. Indicios de varaciones del nivel el mar en la ría de Vigo durante los últimos 3000 años. *Gallaecia* 16: 23-47.
- Pagés Valcarlos J.L.** 2000. Origen y evolución geomorfológica de las rías atlánticas de Galicia. *Revista de la Sociedad Geológica de España* 13 (3-4): 393-403.

Reimer P.J., Baillie M.G.L., Bard E., Bayliss A., Beck J.W., Blackwell P.G., Bronk Ramsey C., Buck C.E., Burr G. S., Edwards R. L., Friedrich M., Grootes P.M., Guilderson T.P., Hajdas I., Heaton T.J., Hogg A.G., Hughen K.A., Kaiser K.F., Kromer B., McCormac F.G., Manning S.W., Reimer R.W., Richards D.A., Southon J.R., Talamo S., Turney C.S.M., Van der Plicht J. & Weyhenmeyer C.E. 2009. IntCal09 and Marine09 radiocarbon age calibration curves, 0-50,000 years cal BP. *Radiocarbon* 51 (4): 1111-1150.

Rey García J.M. 1991. Guidoiro Areoso (Vilanova de Arousa, Pontevedra). *Arqueoloxía. Informes 2. Campaña 1988*. Santiago de Compostela: Xunta de Galicia: 29-32.

Rey García J.M. 2011. Guidoiro Areoso (Illa de Arousa, Pontevedra): un pequeno islote con una intensa ocupación entre el Neolítico Final y la Edad del Bronce. In: P. Prieto Martínez & L. Salanova (coord.) *Las comunidades campaniformes en Galicia: cambios sociales en el III y II milenios BC en el NW de la Península Ibérica*. Pontevedra: Deputación de Pontevedra: 201-210.

Rubinos Pérez A., Fábregas Valcarce R., Alonso Mathías F., Concheiro Coello A. 1999. Las fechas C-14 del castro de O Achadizo (Boiro, A Coruña): problemática de la calibración de conchas marinas. *Trabajos de Prehistoria* 56 (1): 91-114.

Vilaseco Vázquez X.I. 2012. Os Pericos (Ribeira, A Coruña). Bronce Final e segunda Idade do Ferro no extremo meridional da península do Barbanza. In R. Fábregas Valcarce & C. Rodríguez Rellán (eds.) *A arte rupestre no Norte do Barbanza*. Santiago de Compostela: Andavira: 137-152.