Proceedings of the Fourth International Meeting of Anthracology

Brussels, 8–13 September 2008
Royal Belgian Institute of Natural Sciences

Edited by

Freddy Damblon

BAR International Series 2486
2013

Published by

Archaeopress
Publishers of British Archaeological Reports
Gordon House
276 Banbury Road
Oxford OX2 7ED
England
bar@archaeopress.com
www.archaeopress.com

BAR S2486

Proceedings of the Fourth International Meeting of Anthracology: Brussels, 8–13 September 2008, Royal Belgian Institute of Natural Sciences

ISBN 978 1 4073 1100 5

Cover image: *Hunters in Snow* (1565) Pieter Bruegel the Elder © Kunsthistorisches Museum Wien (Austria)

Printed in England by Information Press, Oxford

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NEW DATA ABOUT WOOD USE IN THE NORTHWEST OF THE IBERIAN PENINSULA

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Abstract: *This paper presents new data about wood use in archaeological contexts in the Northwest of the Iberian Peninsula. The sites analysed and presented in this paper are: Montenegro (Neolithic), Os Remedios (Chalcolithic), Castro de Montealegre, Castro de Punta do Muiño, Castro de Navás, Castrolandín, Castro de O Neixón Grande, Castro de Zoñán, Corona del Cerco de Borrenes, El Castrelín de San Juan de Paluezas, Pedreiras del Lago, Chaos de Mourán, Castro Orellán, Cerro Pendón (Iron Age-roman period), Mourela (medieval-postmedieval period).*

Charcoal and wood samples were analysed from these different sites, most of which were settlements dating from prehistoric to historical times. The results were recorded in a specific archaeobotany database, which was used in combination with a GIS program to analyse the different spatial contexts of the samples on both a microscale and intrasite level, and within a broader geographical context. The results show the different uses of wood within the settlements and the differences and continuities between geographical areas and chronological periods.

Key-words: *Wood use. Charcoal Analysis. Neolithic. Iron Age. Roman Period. Medieval-Postmedieval Period. Northwest of the Iberian Peninsula*

INTRODUCTION

The application of charcoal analyses (or anthracology) in the Northwest of the Iberian Peninsula has not been uniform. While in North Portugal anthracology have been systematically applied since 1980 (Figueiral 1993, 1994, 1996, Figueiral, Sanches 1998-9), in Galicia and the Northwest of Leon its application has been sporadic (Carballo 1989, Aira, Uzquiano 1996), with results remaining unpublished in many cases (Piqué unpublished, Uzquiano unpublished). However, in recent years archaeological interventions have begun to systematically incorporate archaeobotanical research, with reference to data on forest management and the uses of wood in the past (firewood, construction, and wood-working), as well as completing the palaeoenvironmental data by carrying out pollen and pedological analyses (Carrión 2003, Martin, 2005, 2006, 2007, 2008a).

This paper summarises the data obtained from the analysis of charcoal and wood samples from various sites in the Northwest Iberian Peninsula. The sites date from recent prehistory to the postmedieval period, with the majority belonging to the 1st millennium BC (Iron Age and roman period). The palaeoecological and palaeoeconomical significance of this data is also discussed. In most cases the remains of carbonised wood are the residues generated during the consumption of firewood, and represent the material remains of activities linked to various spheres of production. However, some of these remains are related to episodes of collapse and the destruction by fire of structural elements and furniture. Finally, although less common, some of the remains were found in a mineralized state inside metallic objects. The study of these charcoal and wood samples allows for an analysis of woodland management and provides insight into the species consumed, the areas of exploitation, the anatomical parts used and the characteristics of utilised wood. It also provides information on the immediate vegetational landscape, as species used for firewood were often collected in the immediate vicinity of a settlement.

SITES

The samples examined represent 15 archaeological sites (Figure 1) from the Northwest of the Iberian Peninsula (Galicia and Northwestern León), and from two biogeographical regions (Atlantic and Mediterranean). In the Atlantic area, with its oceanic climate, the sites of Montenegro 1 y 2 (Moaña, Pontevedra), Os Remedios (Moaña, Pontevedra), Montealegre (Moaña, Pontevedra), Punta do Muiño (Vigo, Pontevedra), Navás (Nigrán, Pontevedra), Neixón Grande (Boiro, A Coruña) and Castrolandín (Cuntis, Pontevedra) are situated on hills, while the sites of Mourela 1 y 2 (As Pontes, A Coruña) and Zoñán (Mondoñedo, Lugo) are located at higher altitudes on mountains. In the Mediterranean region various sites are grouped in mesomediterranean

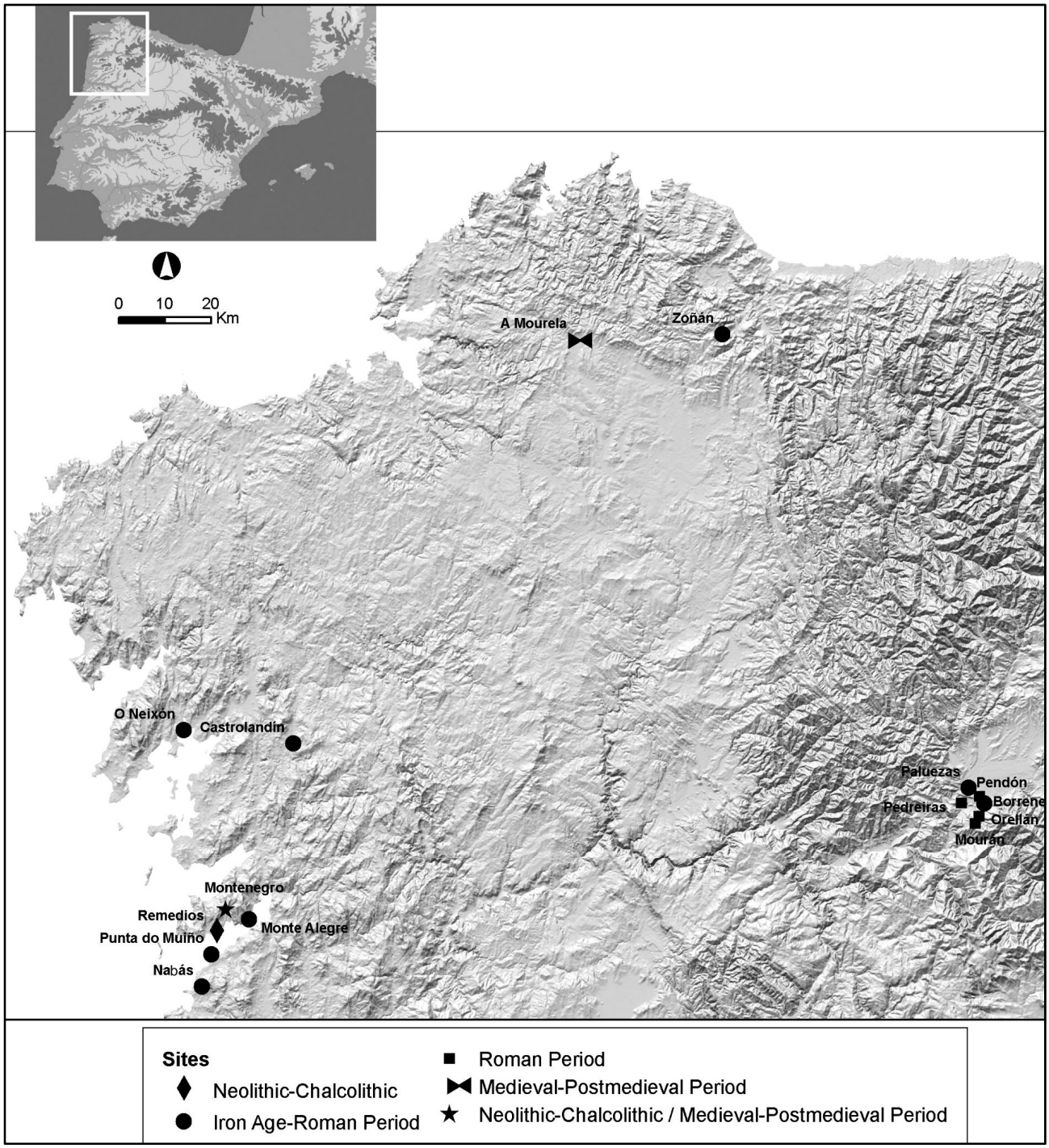

Figure 1. Location of the studied sites in the Northwest of the Iberian Peninsula

thermoclimatic zones: Cerro de Borrenes, Castrelín de San Juan de Paluezas, Cerro Pendón, Pedreiras del Lago, Castro Orellán and Chaos de Mourán (Archaeological Zone of Las Médulas, León).

The majority of the sites are open-air settlements of different characteristics and chronologies. The oldest sites (Remedios and Montenegro) are located in the *ría* (estuary) of Vigo. Remedios is an open-air settlement with a long occupation from the 5th until the 1st millennium BC. A systematic dating of different types of structures and deposits provided the following 2σ calibrated absolute dates: 4720-4530 BC, 4340-4150 BC, 4240-3980 BC, 3810-3705 BC, 3635-3375 BC, 3025-2880 BC, 3125-2195 BC, 2920-2740 BC y 845-767 BC. The settlement was enclosed by a palisade and the internal living area contained habitations made from perishable materials, hearths, pits, etc. (Bonilla y César 2005; Bonilla, César, Fábregas 2006 y 2007). Montenegro 1, an open-air settlement that was occupied in the 3rd millennium BC, contained pits, hearths and buildings made with perishable materials (as represented by postholes, occupation floors, and foundation trenches, *etc.*) and a circular enclosure delimited by two stone rings

(Gianotti, Cancela 2005; Gianotti, Mañana y Criado in press). The radiocarbon dates obtained for this site and calibrated at 2σ are: 2880-2570 BC, 2790-2570 BC y 2470-2130 BC.

All the analysed samples dating to the 1st millennium BC were recovered from *castros* (hillforts/fortified settlements). The chronological sequence of these sites range from the Early Iron Age to the Indigenous-Roman Period, with a variety of spatial locations (coastal, inland) and activities (commercial and mining activities, etc.) represented by these sites. The sites can be grouped according to geographic area and also in relation to the administrative divisions of the roman era. The first group consists of *castros* situated in the coastal and inland regions of *Gallaecia*, while the second group is comprised of settlements near the mining zone of Las Médulas in *Asturia*.

Within the *Gallaecia* group of sites we can differentiate between coastal and inland *castros*. The coastal sub-group includes the sites of Punta do Muiño, Neixón Grande and Montealegre, and also Navás, which is located near the coast. Castrolandín and Zoñán belong to the inland group. The *castro* of Punta do Muiño has a long sequence of occupation from the 7th to the 1st centuries BC, although due to the lack of stratigraphical contextualisation of the samples, it is impossible to know to which occupation period they belong, and as such they are presented as a group (Rey *et al.,* in press). The analysed archaeobotanical remains from the *castro* at Neixón Grande belong to the period between the 4th and 2nd centuries BC. The majority of the studied samples were recovered from different fills of the enclosure ditch and from one of the postholes situated beneath the ditch (Ayán 2008). Various construction phases were also identified at Castrolandín, which was occupied from the 2nd century BC to the 1st century AD (Criado y Ayán 2006). During excavation, dispersed charcoal samples were recovered from the interior and exterior areas. In one of the zones, and dating to the construction phase, remains of carpentry and incompletely carbonised wooden objects were found. The castro of Navás had a short occupation from the 1st century BC to the 1st century AD. In one structure a layer of burning was identified along with the remains of firewood that represented the last fire within the hearth (Martín 2008b). Although the *castro* of Montealegre represents a settlement with a long occupation, the analysed samples correspond to a period from the 2nd century BC to the 1st century AD (Aboal & Castro 2006; González-Ruibal, Rodríguez, Aboal, & Castro 2007). From the dating of samples the chronological range of occupation at the *castro* of Zoñán was found to extend from the 4th century BC to the 4th century AD: 388-204 BC, 357-57 BC, 180-1 BC, 20 BC-128 AD y 129-323 AD (2σ calibrated dates) (Vigo 2007).

All of the sites within *Asturia* are located near the Archaeological Zone of Las Médulas (Sánchez-Palencia 2000). Cerro de Borrenes has an occupation during the Late Iron Age, but was abandoned during the settlement's construction. As the studied samples of this site came from collapse levels few taxa were identified, most of which probably relate to construction material. During the excavation of San Juan de Paluezas, a *castro* that was occupied from the 3rd to the 1st centuries BC, a number of construction phases and a phase of complete abandonment of the site were identified. The *castro* at Orellán, which has a short occupation during the 1st century BC, was a metal-working site with evidence for smelting. Chaos de Mourán is a settlement with an occupation during the roman period and is located in the heart of the mining zone of Las Médulas. The site of Cerro Pendon was also occupied during the roman period. The domus of Pedreiras del Lago was built following the roman architectural model for a local aristocracy who were probably involved in the control and management of the mines.

The most recent dates recovered were from the sites of Montenegro 2 and A Mourela. Montenegro 2 was occupied during the medieval period, and contained various structures including a collapsed stone building, some pits and ditches. During the excavation of A Mourela, a *castro* situated on a mountain ridge, two occupation phases were identified (Fábregas y Bonilla 2008). The site had sporadic occupation between the 7th and 11th centuries AD (2σ calibrated dates: 604-778 AD y 772 -1048 AD), which was represented by a hearth and a circular stone-built enclosure that was probably connected with pastoral activities. Later, and in the vicinity of the enclosure, a shepherd's cabin was constructed, occupied and rebuilt over a number of centuries (14th -19th centuries AD) as is shown by the ^{14}C dates obtained (1391-1454 AD, 1393-1522 AD, 1397-1489 AD, 1465-1678 AD, 1483-1683 AD y1877-1917 AD).

MATERIAL AND METHODS

Samples

All the analysed charcoal and wood samples were collected during excavation work. In 80% of the sites the samples were collected by hand, while in the other ones (A Mourela, Navás, Castrolandín) a combination of manual collection and soil-sieving (water sieve and flotation) was employed. A combined collection strategy minimises the fragmentation of large charcoal samples by collecting by hand, and also allows for the identification of a greater variety of taxa through the use of soil-sieving and flotation. In the sites of Northwest Iberia, where the samples were collected by hand, there is an over representation of species such as *Quercus* sp deciduous, as opposed to shrub species (*Fabaceae*, *Corylus avellana*), or soft wood species (*Salix/Populus, Frangula alnus, Alnus* sp). This result bias could be derived from the collection method employed.

It must also be noted that the studied sample size varies between sites, although this does not appear clearly to be the cause of the greater or lesser diversity of the

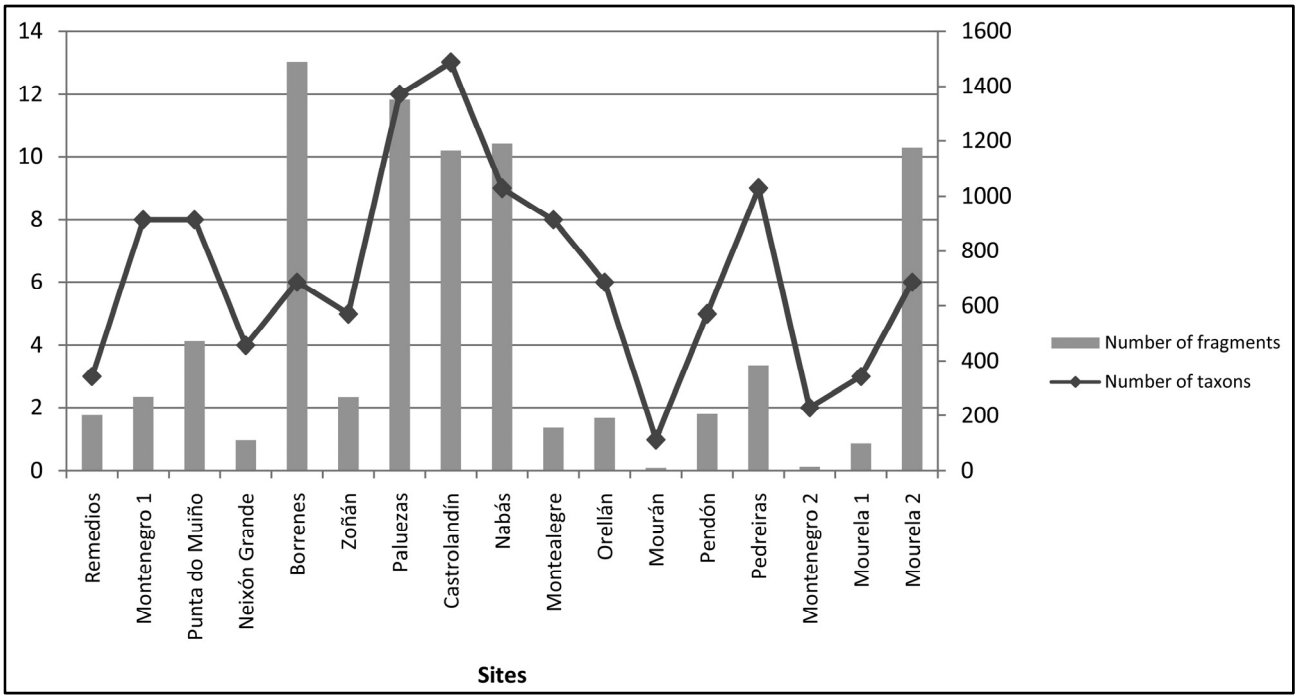

Figure 2. Number of fragments and number of taxons identified in the studied sites

documented taxa. As we can see in Figure 2 the diversity of taxa seems not have a correlation with the number of samples studied. But, if we except Mourela 2 Borrenes and Navas the correlation number of fragments/number of taxons remains possible.

Charcoal/Wood analysis

Each fragment of charcoal that was analysed was first prepared for identification by breaking by hand and observing the transversal, tangential and radial surfaces. In the case of mineralized wood, three anatomical cuts were made using a knife to enable identification. Samples were examined using a reflected/transmitted light microscope, with lenses of 20x to 400x. Atlases of wood anatomy by F.H. Schweingruber (1978, 1990), J.G. Hather (2000), and García *et al.* (2003) were used for comparative purposes, along with a charcoal reference collection.

As well as taxonomic identification, certain dendrological aspects (Marguerie, Hunot 2007) were examined, such as: (1) measuring complete branch diameters to obtain data about the size of firewood and timber used; (2) the presence of vitrification and radial cracks in the tissues, which can be related to the combustion of green wood or combustion in the absence of oxygen, (3) signs of entomofaunal action that can be related to consumption of dead firewood or a xylophagous attack on structural timbers, (4) the presence of scars, (5) compression and tension wood. This paper is concerned with the dendrological data from sites dating to the 1st millennium BC only.

Archaeobotanical database and GIS

The information for each fragment was inputted in an archaeobotanical database, in order to unify the variables and facilitate the quantification of the results. The results were then expressed spatially using a GIS model. Total fragment counts and a frequency analysis of different taxa were undertaken. A statistical analysis of different aspects of the samples, such as dendrological factors (vitrification, entomofaunal evidence, *etc*.) and palaeoenvironmental conditions (trees and shrubs selection and consumption, *etc*.), was also carried out. The results were analysed on both a microscale and intrasite level, and within a broader geographical context. Three levels of analysis were employed: (1) on a regional scale to observe the data within the area of the Northwest peninsula in general; (2) on an intersite level to compare various sites within a specific geographic area; (3) on a microspatial and intrasite level to observe the distribution and percentages of concentrations within a site in relation to its structures and deposits.

FOREST MANAGEMENT

5th-3rd millennium BC

The data concerning woodland management during the Neolithic and Chalcolithic were recovered from the sites of Remedios and Montenegro (Figure 3). In both sites all of the analysed charcoal samples were recovered from structures, which could be the cause of the limited species variability noted, especially at Remedios. Pollen and pedological analysis indicates that the temperature began to drop at the end of the 4th millennium/beginning of the 3rd millennium BC and continued until 2500 BC. At the end of the 4th millennium BC erosive processes of an anthropogenic origin are detectable, with a decrease in forest coverage and the appearance of charcoal lines in the soil indicative of fires (Fábregas, Martínez-Cortizas,

	Montenegro 1	Remedios
Quercus sp. deciduous	124	199
Fabaceae/cf. Fabaceae	99	1
Corylus avellana	11	–
Rosaceae/Maloideae	3	–
Quercus sp.	2	–
Betula sp.	2	–
cf. *Salix/Populus*	1	–
Laurus nobilis	1	–
Arbutus unedo	1	–
Compositae	–	1
Undetermined	28	–
Total fragments	**269**	**201**

Figure 3. Charcoal analysis from 4th-3rd millennium BC sites

Blanco, R., Chesworth, W. 2003). During the 3rd and 2nd millennia BC there was an increase in anthropogenic pressure on the woodland environment, with settlements becoming more permanent in character and fire being used to clear forests, obtain pastures and to favour the growth of certain species (Martínez-Cortizas, Franco, Fábregas 2000; Fábregas, Martínez-Cortizas, Blanco, R., Chesworth, W. 2003).

Notable in this period is the preferential exploitation of mixed deciduous forests, with the use of the wood of *Quercus* sp deciduous along with that of species indicative of the existence of forest clearings (*Maloideae*, *Corylus avellana*, *Arbutus unedo*) or pioneering species (*Betula* sp). Fuelwood was also collected from the scrubland that formed the forest limits, where the prominent species are the Fabaceae.

1st millennium BC

The significant number of studied sites dating to the first millennium BC enables the observation of how the dynamics of earlier periods continued with some transformations (Figure 4). These changes are related to more permanent occupations of settlements over longer periods, over various centuries, with a greater concentration of population and an intensive exploitation of the environs of the sites, all of which during this period produced a major impact on woodlands.

On a general level it can be considered that from 2700-2500 BP temperature and humidity are increasing (Fábregas, Martínez-Cortizas, Blanco, R., Chesworth, W. 2003) with respect to the previous period. The pollen data from the *Ría* of Vigo allows a reconstruction of t he evolution of the vegetation in this area, which coincides with many of the sites analysed in this study (Desprat, Sánchez-Goñi, Loutre 2003). The earliest dates from this analysis are 975 ± 36 cal BC, a moment in which a faint human impact on the vegetal environment is noted, reflecting small-scale cultivation. From 130 BC – 200 AD, during the galaico-roman period, a more perceptible human impact on the woodland resource is noticeable. This was followed by the appearance of *Juglans* and *Castanea c.* 1 BC and the beginning of the deforestation process, which the authors of the Vigo environmental analysis related to mining activity. The bogs of Penido Vello and Pena da Cadela (Lugo) demonstrate that during this period an atmospheric contamination is increasing caused by lead related to metallurgical activities, a process which had begun during the Late Bronze Age (Martínez-Cortizas *et al.* 1997a; Martínez-Cortizas *et al.* 1997b; Martínez-Cortizas *et al.* 2002). From *c*. 2500 BP until 1800 BP the presence of lead in the atmosphere increased in an almost continuous manner, with the exception of a relative minimum documented around 2100 BP. This process coincided with the beginning of the roman exploitation of the mineral resources of the northwest, which began at the end of the 2nd century BC, increased until the 1st century BC and reached its peak in the high imperial period (Martínez-Cortizas *et al.* 2002).

As well as mining and metallurgical activity, the important impact on woodlands caused by the establishment of *castro* settlements over long periods of time must also be evaluated (fuel requirements, cultivation fields, pastures, *etc*.). The charcoal samples reveal certain continuity in the exploitation of mixed deciduous forests in the sites of the Atlantic area, although from the 5th to 2nd millennia BC there was a significant increase in the exploitation of river-bank woodland species (*Salix/Populus, Alnus sp, Frangula alnus*). In the Atlantic zones with mediterranean influence there was a significant exploitation of *Quercus sp* evergreen, with a sporadic recovery from sites of carbonised fragments of the bark of *Quercus suber* and fragments of *Laurus nobilis*. The exploitation of the wood of wild fruit-bearing trees such as *Corylus avellana* and *Maloideae* is documented, as well as others such as *Castanea sativa* and *Juglans regia*, which were probably cultivated to avail both of the wood and fruit. Scrubland had a great importance, and is represented by the *Fabaceae* and in the zones of greatest degradation of arboreal coverage by *Erica* sp.

In the sites of the Mediterranean zone of *Las Médulas* (León) a preference for *Quercus* sp deciduous and *Quercus sp* evergreen was observed, the latter being most common in sites of the roman period. As in the Atlantic zone, there was a continued presence of river-bank woodland species (*Salix/Populus, Fraxinus sp, Alnus sp*). Species related to the existence of clearings in the deciduous forests such as *Prunus sp* and *Pyrus sp* appeared sporadically. In contrast to the Atlantic zone, there was a significant absence in the exploitation of the *Fabaceae*. In this zone scrubland species were rarely documented. *Fabaceae* was only identified at San Juan de Paluezas, a site with continued occupation of approximately two centuries, at the metallurgical site of Orellán, where the appearance of *Pistacia terbinthus* was probably related to the degradation of holm oak forests,

	Punta do Muiño	**Neixón Grande**	**Borrenes**	**Zoñán**	**Paluezas**	**Castrolandín**	**Nabás**	**Montealegre**	**Orellán**	**Mourán**	**Pendón**	**Pedreiras**
Quercus sp. deciduous	229	79	1429	251	634	807	713	44	85	2	192	100
Salix/Populus/cf. *Salix*/*Populus*	41	–	3	11	111	9	13	–	3	–	2	–
Fraxinus sp.	–	–	2	2	45	2	–	–	37	–	4	91
Alnus sp.	26	–	–	–	272	85	1	–	–	–	4	9
Quercus sp. evergreen	40	–	–	–	93	11	170	9	34	–	–	118
Fabaceae/cf. Fabaceae	114	6	–	–	42	114	191	7	–	–	–	–
Rosaceae/Maloideae/cf. Rosaceae/Maloideae	2	10	–	–	–	11	5	12	–	–	–	3
Corylus avellana	4	–	–	–	–	83	85	4	–	–	–	–
Prunus sp.	–	–	–	–	24	–	–	–	6	–	–	2
Taxus baccata	–	–	5	1	14	–	–	–	–	–	–	–
Quercus suber	–	–	–	–	41	–	8	–	–	–	–	11
Quercus sp./cf. *Quercus* sp.	–	2	–	2	–	–	–	14	–	–	–	–
Frangula alnus	–	–	–	–	–	12	4	–	–	–	–	–
Erica sp./ cf. *Erica* sp.	–	–	1	–	–	–	–	16	–	–	–	–
Laurus nobilis	8	–	–	–	–	–	–	9	–	–	–	–
Juglans regia	–	–	–	–	6	5	–	–	–	–	–	–
Arbutus unedo/cf. *A. unedo*	–	–	–	1	7	–	–	–	–	–	–	–
Hedera helix/cf. *Hedera helix*	–	–	–	–	–	1	–	1	–	–	–	–
Castanea sativa	–	15	–	–	–	–	–	–	–	–	–	–
Juniperus sp.	–	–	1	–	–	–	–	–	–	–	–	–
Pinus tp. *sylvestris/nigra*	–	–	–	–	10	–	–	–	–	–	–	–
Ilex aquifolium	–	–	–	–	–	4	–	–	–	–	–	–
Alnus/Corylus	–	–	–	–	–	1	–	–	–	–	–	–
Betula sp.	–	–	–	–	–	1	–	–	–	–	–	–
Pistacia terebinthus	–	–	–	–	–	–	–	–	4	–	–	–
Pyrus sp.	–	–	–	–	–	–	–	–	–	–	2	–
Viburnum sp.	–	–	–	–	–	–	–	–	–	–	–	1
Vitis vinifera	–	–	–	–	–	–	–	–	–	–	–	1
Undetermined	8	1	46	–	53	20	10	40	22	8	1	48
Total fragments	**472**	**113**	**1487**	**268**	**1352**	**1166**	**1200**	**156**	**191**	**10**	**205**	**384**

Figure 4. Charcoal analysis results from Iron Age and Roman Period sites

and at Borrenes, where other species indicative of soil deterioration, *Erica sp* or *Juniperus sp*, were identified.

Charcoal of arboreal and bushy species is well documented on the sites for the first millennium BC. Their extension is related to the adoption of silviculture practices as represented by *Juglans regia, Castanea sativa* and *Vitis vinifera*. *Vitis vinifera* was developed spontaneously in the Iberian peninsula on the banks of the *rías* (estuaries), Based on forestry practices a domestic variation was obtained (Precioso 2004). It is not very common during the first millennium BC, although it has been documented in other sites in the Northwest of the peninsula: Castro das Ermidas, Castro de Penices e Castro de Crastoeiro (Figueiral 1996). Pollen analysis shows that *Castanea sativa* is a species native to this zone, although in this period it extends in relation to silviculture practices (Conedera *et al.* 2004). Its presence has also been documented in the sites of Castelo de Matos, Castro de Penices, Castro de Terroso, San Juliao (Figueiral 1996, Figueiral, Bettencourt 2004). The case of *Juglans regia* is similar to that of *Castanea sativa*: charcoal of this species was identified in Castro das Ermidas y Castro de Penices (Figueiral 1996).

	Montenegro 2	Mourela 1	Mourela 2
Quercus sp. deciduous	–	2	886
Rosaceae/Maloideae/cf. Rosaceae/Maloideae	–	2	20
Betula sp.	–	–	2
Ilex aquifolium	–	–	3
Fabaceae/cf. *Fabaceae*	12	–	21
Erica sp./cf. *Erica* sp.	–	23	216
Castanea sativa	2	–	–
Undetermined	–	74	27
Total fragments	**14**	**101**	**1175**

Figure 5. Charcoal analysis results from Medieval and Postmedieval sites

Medieval and Postmedieval Period

In the sites of the medieval to contemporary period there is a significant reduction in the number of taxa represented (Figure 5). In Montenegro 2 the determination of various fragments of *Castanea sativa* in the interior of one of the medieval ditches stands out. At Mourela 1, charcoal was recovered from a combustion structure. Although the degree of vitrification impeded the taxonomic identification of the majority of fragments, the predominant species was *Erica sp*., which is indicative of soil deterioration. At Mourela 2, mixed deciduous forest species (*Quercus sp* deciduous, *Maloideae, Betula sp* and *Ilex aquifolium*) and scrub species (*Erica sp* and *Fabaceae*) were represented.

WOOD USES

Charcoal analysis and wood studies give us a better understanding of wood use in this area in the past. Fundamentally it provides information relating to fuels, wood for construction and for the elaboration of objects. As the majority of the analysed sites belong to the Iron Age and the roman period, this study puts the accent mostly on the analysis of data from sites of this chronology.

While limited, the data obtained from the analyis of charcoal samples from combustion structures indicate that *Quercus sp* deciduous was the principal fuel source. Occasionally it was used in combination with *Quercus sp* evergreen in certain zones with mediterranean influence, and with fuelwood obtained from bushes like *Fabaceae*. In the Chalcolithic site of Os Remedios the analysis of a combustion structure with a stone grill identified *Quercus* sp deciduous (125 fragments) and *Fabaceae* (1 fragment). At the site of Navás, which has a more recent chronolgy from the 1st century BC to the 1st century AD, similar results were observed for this type of structure, with a predominance of *Quercus* sp deciduous (29 fragments) and the marginal presence of other taxa like *Quercus* sp evergreen (2 fragments) and Fabaceae (8 fragments). The preferential use of oak, in this case for firewood, is not only documented in the study of charcoal related to combustion structures. It is also the most abundant taxa in general in habitation structures, as is the case in the site of Castrolandín. Within the study group of sites oak is the most recurrent species, regardless of chronology or location. In general the data points to a similar pattern throughout the study group in the provisioning of fuel, with a combined use of the wood of *Quercus* sp deciduous and *Fabaceae*, with occasional contributions of other arboreal species, especially bushes: *Alnus sp, Maloideae, Salix/Populus, Corylus avellana* and *Frangula alnus.*

The majority of the dates relating to construction timbers come of sites from the first millennium BC, with samples recovered from levels of burning or from posts carbonised *in situ*. During this period both arboreal and bushy species were used in the construction of habitation structures and for the delimitation of settlements. *Quercus* sp deciduous and *Quercus* sp evergreen were used to make supporting elements (posts or beams) in the enclosing structures of settlements, as was the case of the *castro* at Neixón Grande. Bushy or arboreal species with flexible and large branches were used to construct frameworks or coverings: *Fabacea* was used for coverings, *Corylus avellana* and *Salix/Populus* was used for frameworks. At the *castro* of Punta de Muiño branch impressions in clay were measured. Based on 265 measurements of the most habitual diameters, 43.01% measured between 0.30-0.79 cm, with 26.4% between 0.80 cm and 1.09 cm. These coincide with the measurements of the complete branch diameters of samples of *Corylus avellana* from Punta do Muiño (1 example) and Navás (12 examples), where the diameters of 91.6% of the examples oscillate between 0.60 cm and 1.5 cm. The results are suggestive of the practice of coppicing in species like *Corylus avellana* and probably in others like *Alnus sp* and *Salix sp*, in order to produce large, straight branches with a determined diameter.

A micro-spatial analysis of the data obtained from the *castro* of Navás permits the observation of the association and distribution of different taxa within the interior of a structure (Figure 6). Found beneath a structural stone collapse, charcoal samples from a layer of burning with an important concentration of archaeobotanical remains were manually collected and sieved in water. The fragments, which were concentrated beneath the collapse and close to the walls of the structure, were not abraded and were relatively large, with more than 85% measuring between 1 and 6 cm. Taxonomic identification showed that the charcoal samples that probably correspond to the covering structure consisted principally of *Quercus* sp deciduous and *Quercus* sp evergreen, along with *Fabaceae* and *Corylus avellana*, which are the species that appear associated in the majority of samples from

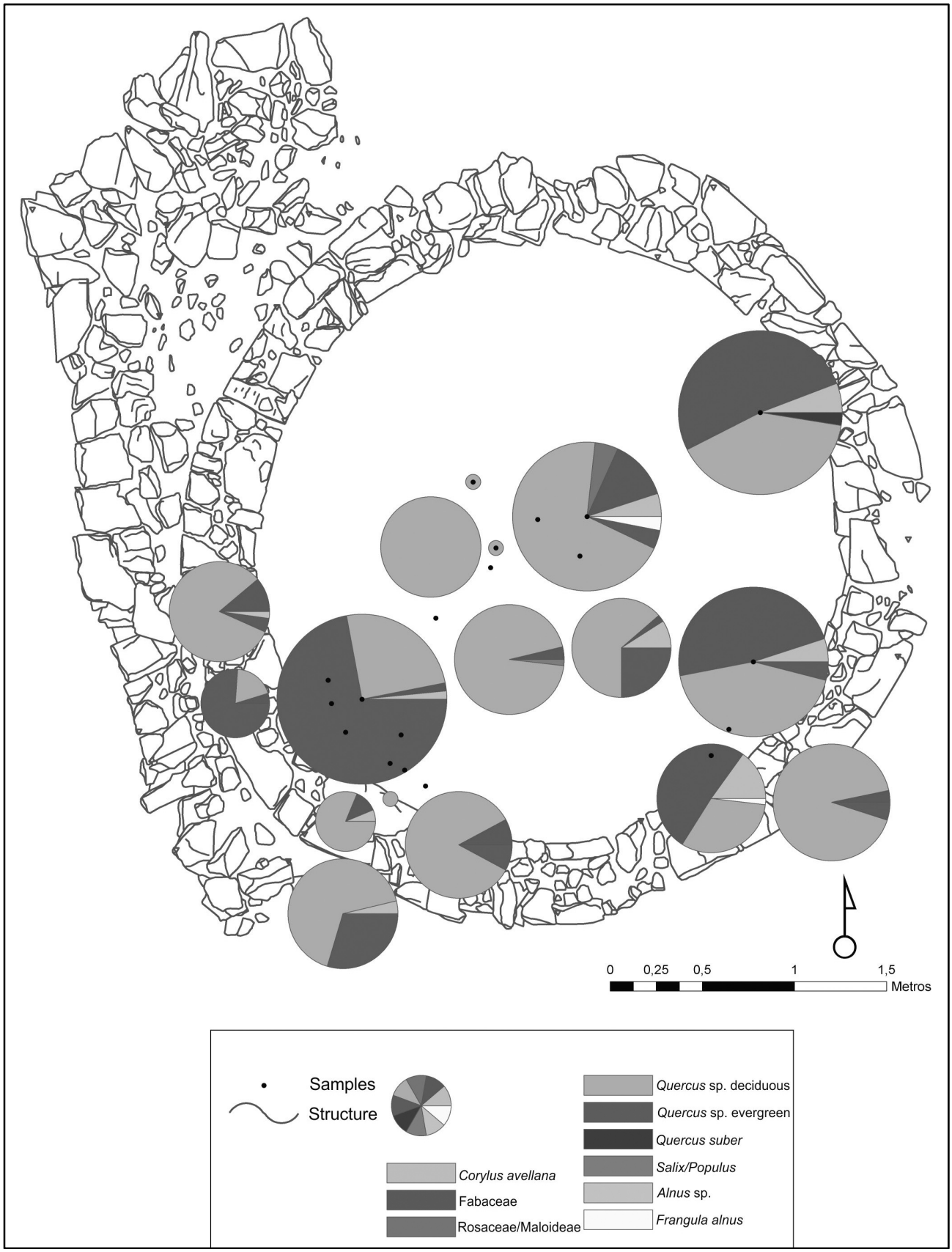

Figure 6. Microscale distribution of taxons inside the construction Castro of Navás

this deposit. *Alnus* sp, *Frangula alnus* and *Maloideae* appeared more sporadically and could correspond to other types of objects or carbonised structures.

The determination of entomofaunal action on wood was very occasional, with only four sites from the first millennium BC (Figure 7). In some cases the wood with

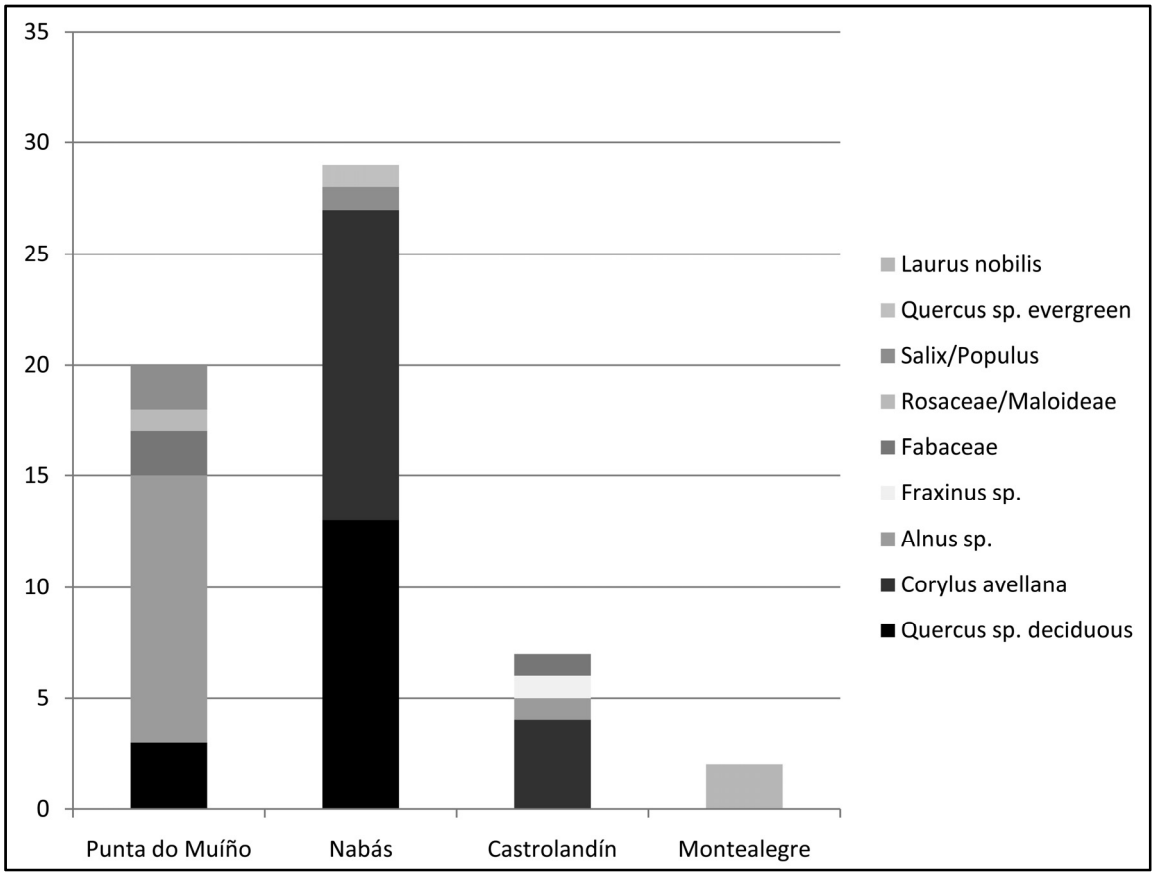

Figure 7. Number of fragments with entomofaunal evidence

evidence of entomofaunal action belongs to *Fraxinus* sp or *Alnus* sp and also records woodworking marks, as is the case in Castrolandín. In most of these samples, these could represent wood used for construction or for fuel wood.

Data about objects made of wood are still very scarce (Castromao, Cameixa, Castrovite, Zoñán, etc.). However, the appearance of fragments of mineralised or carbonised wood in the interior of metallic objects in the *castros* of Neixón Grande and Montealegre, and the identification of wood working marks and semi-elaborated objects of carbonised wood in Castrolandín, provides some insights into wood working and which species were used to make tools, receptacles, vessels *etc*.

In Montealegre a charcoal piece of *Corylus avellana* was recovered from the interior of a small bronze ferrule, while at Neixón a fragment of mineralised wood of *Quercus* sp deciduous was found in the interior of a similar object. However, the most complete data regarding wood working comes from the site of Castrolandín. At this site evidence for felling and cutting was identified (small branches with cutting surfaces/planes), and remains related to carpentry (splinters and small wedge-shaped fragments), objects with evidence of wood working (reductions or cuts to give shape to the pieces) and vessel fragments (rim and body fragments of a wooden vessel) were recovered. Most of these were found in a space between various structures that were probably dedicated to wood working activity.

The wood working evidence at Castrolandín shows that particular species were selected on the basis of the characteristics of the wood and its suitability for the final use of the object. Fragments of receptacles or vessels are smooth (*Alnus* sp), of a light wood, with a fine, soft grain, that is easily worked and polished (López 2002, Abella 2003). Small construction materials such as planks, wedges and joins for the union of pieces were elaborated in ash (*Fraxinus* sp) and oak (*Quercus* sp deciduous). On one fragment, a section of a branch of *Quercus* sp deciduous, two small branches of hazel (*Corylus avellana*) were attached. A small handle for an indeterminate object was also elaborated in *Quercus* sp deciduous. Oak wood is strong and very solid, resistant to rot and easy to polish (López 2002, Abella 2003). It can be used as a structural element and, because of its resistance to compression and flexion, it is used for tool handles. Ash wood, in which a small splint was elaborated, is suitable when elasticity and flexibility is necessary, however once dry it is exceptionally rigid, and as such is not suitable to remain exposed in the open (López 2002, Abella 2003). Various fragements of an indeterminate object in *Ilex aquilofolium* (holly) were also recovered. Holly is a very heavy wood, with a fine and uniform texture. It is hard to work, difficult to dry and in order to prevent torsion it is cut into small pieces and worked in the round (López 2002, Abella 2003).

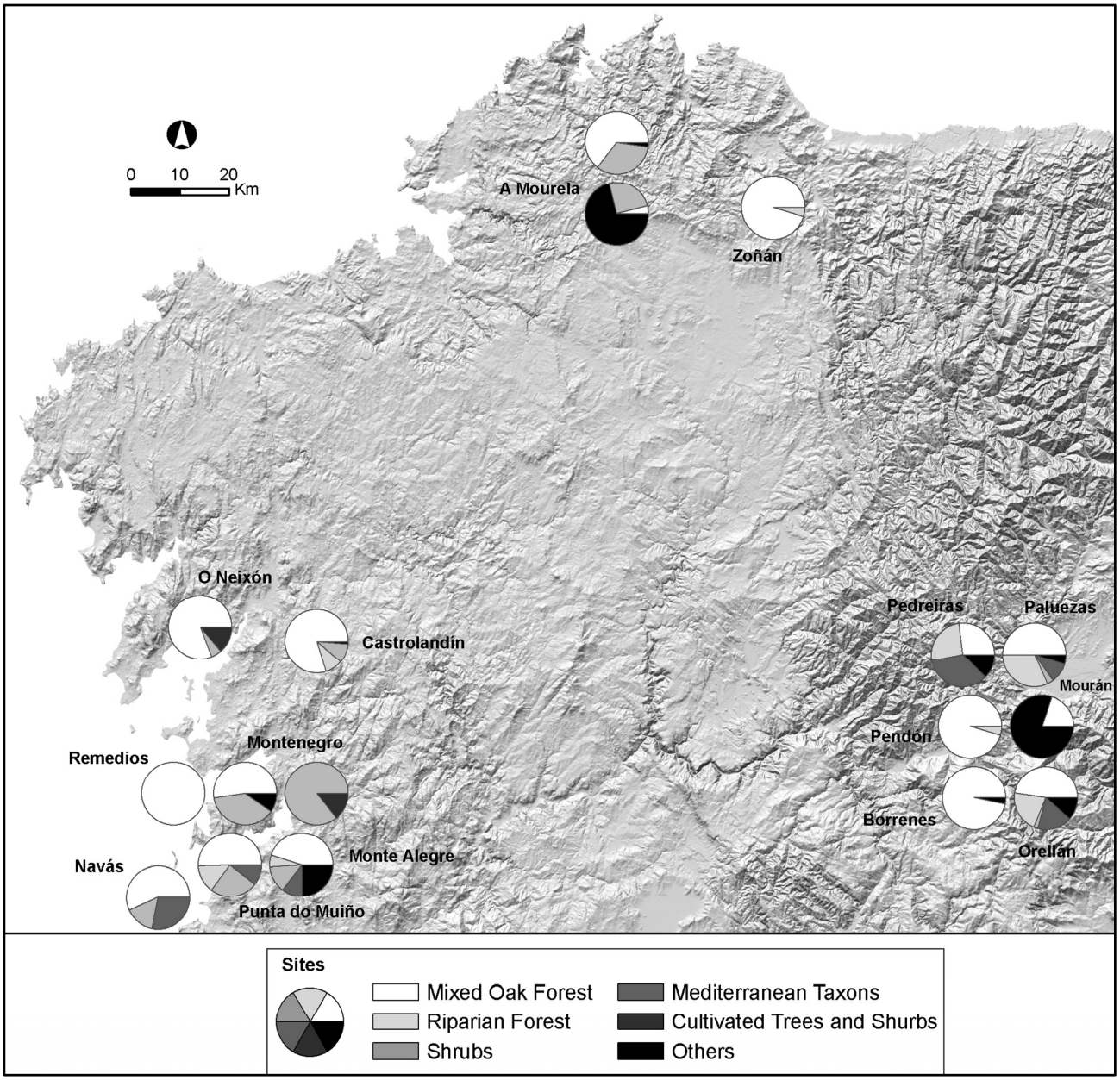

Figure 8. Charcoal analysis results of the studies sites in the Northwest of the Iberian Peninsula

CONCLUSION

The results of this study have enabled an approximation of the palaeoecological and palaeoeconomical background to woodland management and wood use in the Northwest Iberian Peninsula. Since recent prehistory and until the post-medieval period, woodland management was based on the systematic use of deciduous species, especially of *Quercus* sp deciduous as well for fuelwood than for the elaboration of artefacts and structures (Figure 8).

Despite the quantitative limitations of the data set of analysed samples, the information retrieved coincides with the pollen and pedological data which also indicate a retreat of arboreal coverage from the 5th to 3rd millennia BC. Anthracology reveals the presence of mixed deciduous forests related to the existence of clearings (*Maloideae*, *Corylus avellana*, *Arbutus unedo*) and scrub species (*Fabaceae*).

In the first millennium BC the exploitation of mixed deciduous forest resources for timber and firewood continued, but there was also an important representation of riverbank species, especially *Salix/Populus* and *Fraxinus* sp. The exploitation of scrubland species, in particular *Fabaceae*, was also important in the Atlantic area. In sites with very long occupations and significant population concentrations, such as the *castro* of Montealegre, *Erica* sp was also represented. In the Mediterranean area however, scrubland species had a lesser importance and only appeared sporadically in sites with long occupations or in specialised sites with metallurgical activities. Coppicing of species like *Corylus*

avellana and others trees or shrubs related to forestry practices (*Castanea sativa, Juglans regia, Vitis vinifera*) are documented.

The use of wood for construction during this period indicates that *Quercus* sp deciduous and *Quercus* sp evergreen were some of the species utilised for supporting elements (posts, beams, *etc*), while the vegetal framework was constructed using species like *Corylus avellana, Alnus sp* or *Salix/Populus*. With respect to manufacturing objects, selection of species was based on the wood intrinsic characteristics (easy to polish, tenacity, flexibility *etc*.) and its suitability for the different applications intended.

In the medieval and post-medieval periods the importance of scrublands is apparent, although there still exists a preference for mixed forest species for fuelwood, construction material *etc*. During this period it is documented that fire was systematically used to impede the development of woody vegetation, making scrubland widespread, especially from the 15th – 19th centuries AD (Guitián 2001).

Acknowledgements

We would like to thank the directors of the excavations, Roberto Aboal, Xurxo Ayán, Andrés Bonilla, Ramón Fábregas, Camila Gianotti, Carlos Otero, Fco.-Javier Sánchez-Palencia and Abel Vigo, for putting at our disposition both the study material and the archaeological information derived from them. Thanks also to Cliodhna ni Lionan for the translation of the texts and Emilio Abad for the elaboration of the maps for this article.

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