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Early farmers, megalithic builders and the shaping of the cultural landscapes during the Holocene in Northern Iberian mountains. A palaeoenvironmental perspective

Sebastián Pérez-Díaz[a,*], José Antonio López-Sáez[a], Sara Núñez de la Fuente[b], Mónica Ruiz-Alonso[a]

[a] G.I. Arqueobiología, Instituto de Historia (CCHS), C.S.I.C., Albasanz 26-28, 28037 Madrid, Spain
[b] Instituto Internacional de Investigaciones Prehistóricas de Cantabria, Universidad de Cantabria, Avda. de los Castros s/n, 39005 Santander, Spain

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ABSTRACT

The study of anthropogenic activities in prehistoric landscapes has increased greatly in recent decades in the Northern Iberian Peninsula, particularly through pollen records from low altitude areas where settlement was more frequent throughout Prehistory. However, little is known about the evolution of landscapes in highlands, particularly in the Basque-Cantabrian mountains (Northern Iberia). In this paper, we analyze human dynamics in mountain landscapes through the multiproxy analysis of Arbarrain mire from c. 8200 cal BP. Obtained main results show the predominance of deciduous forests in the whole sequence, with presence of pinewoods at a regional scale. The first evidence of anthropization of mountain environments is dated c. 6800 cal BP, in relation with the early Neolithic. During the Mid-late Neolithic evidences of human impact on the landscape increases in parallel to the development of the megalithic structures. The Chalcolithic shows a decrease in the anthropogenic activities in mountains. Finally, during the Bronze Age, Iron Age and Historical Period, from c. 4000 cal BP, mountain ecosystems reflect the expansion of *Fagus*, clearly linked with a further increase in human activity, origin of current landscape configuration.

1. Introduction

Knowledge of palaeoenvironmental evolution during the Middle and Late Holocene, and the impact of human activities and/or climate variability on the landscape has developed in recent years in the Iberian Peninsula, especially through pollen records from both natural (e.g. lakes, peat bogs) and archaeological sites (Riera et al., 2004; López-Sáez et al., 2011; Pérez-Díaz, 2012; Lillios et al., 2016; Revelles, 2016). These studies provide new insights into the adoption and consolidation of the productive economy, which constitutes one of the defining features of Late Prehistory.

In the Iberian Peninsula, the current state of the art indicates that most Late Prehistoric archaeological sites are located at low altitudes, mainly in the bottom of the main valleys and in coastal areas, where the supply of lithic raw materials and food resources were more favourable (Arias, 2007; Díaz-del-Río and Consuegra, 2011; Cortés et al., 2012; Rojo et al., 2012; Strauss and González-Morales, 2012; Bernabeu et al., 2015; Fano et al., 2015; García-Martínez de Lagrán, 2017). Sites in mountain sectors are noticeably scarcer. This phenomenon, i.e. the preferential location of archaeological sites at low altitudes, limits knowledge of the temporal dynamics of high mountain ecosystems and the extent of human impact. In addition, in mountain areas, other kinds of deposits, like peat bogs or lakes, can be used to study palaeoenvironmental evolution at diachronic and spatial scales, and the incidence of anthropogenic activities in those particular ecosystems (Carrión et al., 2010; López-Sáez et al., 2014).

Mountain areas, which have traditionally been viewed as marginal areas, very limited by their severe climate conditions and extreme topography, are now considered cultural landscapes of high socio-ecological value (Galop and Jalut, 1994; Fernández-Mier et al., 2014). Mountains are sensitive and vulnerable to the effects of climate change, and to many other perturbations that may be increased or accelerated by climate change. They are very particular areas because of the harsh living conditions and their marginal position in terms of economic integration (Kohler and Maselli, 2009). Bearing in mind that climatic variability and anthropogenic dynamics are the main factors that have influenced the plant evolution in mountain environments, a historical analysis of these two factors and their interactions will allow us to

* Corresponding author.
E-mail addresses: sebastian.perez@cchs.csic.es (S. Pérez-Díaz), joseantonio.lopez@cchs.csic.es (J.A. López-Sáez), sara.n.delafuente@gmail.com (S. Núñez de la Fuente), monica.ruiz@cchs.csic.es (M. Ruiz-Alonso).

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understand the physiognomy of the present landscapes from a diachronic perspective (Valladares et al., 2004). In this sense, mountains constitute a unique "natural laboratory" to test long-term socio-ecology (Ejarque et al., 2010; Miras et al., 2010; López-Sáez et al., 2014).

The human occupation of mountain areas began at an early date in the Iberian Peninsula, since different archaeological and paleoenvironmental studies have identified their use at least since the beginning of the Holocene in the central and eastern Pyrenees (Galop, 1998; Ejarque et al., 2010; Gassiot et al., 2012; Catalán et al., 2013; Lozny, 2013; Gassiot et al., 2014), and during the Middle Holocene in the Cantabrian range (López-Sáez et al., 2006), the Western Pyrenean region (López-Sáez et al., 2008; Pérez-Díaz et al., 2015), Central System (López-Sáez et al., 2014) and the Betic mountains (Carrión et al., 2007). Unfortunately, large areas of the Iberian Peninsula mountain ranges still have a very limited number of palaeoenvironmental records for the Holocene, and many of them are fragmentary or have insufficient chronological control (Carrión et al., 2010). This is the case of the Basque-Cantabrian mountains, where the available data are currently very scarce and generally of very low resolution (Iriarte, 2009), which makes it difficult to evaluate human-ecosystem interactions at a spatial and diachronic scale.

This region is particularly interesting because it was in the Middle and Late Neolithic the traditional route for cultural transmission from central Europe to the inner Iberian Peninsula, across the Pyrenees to the Ebro valley, as shown by the large number of archaeological remains of different periods (Alday et al., 2006; Peñalver, 2008; Fernández-Eraso et al., 2009, 2015). A very large part of those remains are related to funerary behaviour, which left a remarkable number of megalithic structures in these mountain areas (Arias et al., 2005; Mujika, 2009; Fernández-Eraso et al., 2009). Characterized by different and varied typology, most of megalithic monuments were originated during the Middle and Late Neolithic, and continued in use during the Chalcolithic and even in the Bronze Age (Fernández-Eraso et al., 2010; González-Morales, 2012). The construction and use of those funerary structures on mountains have left different signals on past landscapes, which is an opportunity to understand those particular cultural landscapes. Therefore, the combination of palaeoenvironmental studies and the archaeological record, at different temporal scales in a wide diachrony, is a research strategy still unexplored in this territory, with great potential to understand the rhythm and the extent of anthropic and/or climatic perturbations within the evolution of ecosystems and cultural practices (Galop et al., 2004).

Our main goal is to evaluate anthropogenic evidences in the landscape of the Basque-Cantabrian mountains during Late Prehistory. For that purpose, we shall focus on high-resolution multiproxy analysis (pollens, spores, non-pollen palynomorphs, organic content, magnetic susceptibility, macro-charcoal and wood remains) of Arbarrain mire. The data will be related to i) other high-resolution pollen records from northern mountain areas, and ii) human technocomplexes in this region, in order to contribute to knowledge of human-environment relationships from c. 8200 cal BP.

2. Regional and site setting

The Basque-Cantabrian mountains are a region with gentler relief between the Cantabrian mountain range to the west, and the Pyrenees to the east (Fig. 1). This region is quite rugged, with great climatic and geomorphologic variety. The relief is generally aligned east-west, and therefore the area consists of a series of mountain barriers, parallel to the coastline, which limits the spread of Atlantic flora southwards (Gómez-Piñeiro, 1985; Urrestarazu, 1985). The Basque-Cantabrian mountains form one of the areas of the Iberian Peninsula which, due to a location close to the sea, enjoys a climate that favours the existence of large wooded masses that served as refuge to a varied fauna. Its mountains, forests, lakes and rivers, constitute an amalgam of ecosystems (González and Serrano, 1995; González et al., 1998).

Mountains in this sector reach 600–1600 m a.s.l., so, taking into account the context of SW Europe, they should be classified as medium mountain environments, comparing their maximum altitudes with those of the Central Pyrenees, Asturian Massif, Central System and Betic Mountains (Loidi et al., 2011). Those mountains present a clear lithological and morphological contrast between limestone and siliceous areas. The former results in a well-developed karst landscape, with karren and dolines; while the siliceous mountains have a rounded profile with few rock outcrops. The climate is characterized by low temperatures and high precipitation, in which mist, frost and snow are frequent. These climatic and orographic characteristics favour the existence of a landscape dominated by calcareous *Fagus sylvatica* forest in the limestone bedrocks, together with pastures of anthropogenic origin used by cattle grazing. In the siliceous mountains, beech forests also predominate, with presence of *Quercus faginea* in sunny areas (Aseginolaza et al., 1996; Meaza, 1997).

Arbarrain mire (UTM 30T, X: 562.018, Y: 4.749.880, 1004 m a.s.l.) is located on the northern slope of the Arbarrain summit, in the Urkilla range (Basque Country, Western Pyrenean region), very close to the Mediterranean-Cantabrian watershed (Fig. 1). The predominant geological bedrock consists of Lower Cretaceous sedimentary rocks (Middle and Upper Albian–Lower Cenomanian) and sandstones with shales.

The mire is located in the Atlantic climatic area. The nearest weather station (Zegama) recorded in 2015 a precipitation of 1480 mm for a total of 186 rainy days, and a mean annual temperature of 13.4 °C (EUSKALMET, 2011). However, this meteorological station is located at a much lower elevation (520 m a.s.l.) and rainfall is presumably heavier at higher altitudes.

The vegetation in the mire is formed by hygrophilous communities with *Molinia caerulea*, *Narthecium ossifragum*, *Ranunculus flamula*, *Carex echinata*, *Erica ciliaris*, *E. tetralix*, *Viola palustris*, etc. The surroundings of the deposit are dominated by acidophilus beech forests, the most common in this region, with *Fagus sylvatica*, *Ilex aquifolium*, *Vaccinum myrtillus*, *Deschampsia flexuosa*, *Blechnum spicant*, *Oreopteris limbosperma*, etc. At lower altitudes, in sandy soils on the northern slopes of the Urkilla range, forests are dominated by *Quercus pyrenaica* with *Ilex aquifolium*, *Crataegus monogyna*, *Erica arborea*, *Juniperus communis*, *Calluna vulgaris*, *Ulex europaeus*, *Arenaria montana*, *Pteridium aquilinum*, etc. On the southern slopes, in drier conditions with higher insolation, forests are dominated by *Quercus faginea*, *Acer campestre*, *Viburnum lantana*, *Ligustrum vulgare*, *Hedera helix*, *Helleborus viridis*, etc. (Aseginolaza et al., 1996).

3. Materials and methods

3.1.1. Coring, sediments and chronology

The Arbarrain core was taken using a Russian peat sampler (GYK type, 50 cm length; 5 cm in diameter). The coring point was located in the centre of the peat bog, from where a core with a total length of 92 cm was extracted. Sediment is characterized by grey organic silt at the bottom of the core, (92–67 cm depth) with scarce vegetal remains and sands, and black peat with vegetal microrremains in the upper part (66–0 cm depth) (Fig. 2). Contiguous sampling was performed in the whole core, where samples were taken every centimetre. A set of 92 samples were analysed. The chronology is based on six Accelerator Mass Spectrometry (AMS) radiocarbon dates on plant remains and bulk material (Table 1). The dates were calibrated by CALIB 7.1 using the IntCal13 curve (Reimer et al., 2013). An age-depth model was performed by fitting a smooth spline curve (Type = 4; smooth = 0.1) using CLAM 2.2 software (Blaauw, 2010) (Fig. 2). Although we cannot totally rule out a sedimentary discontinuity between 92 and 90 cm dept., with radiocarbon dates separated by c. 1500 years, the sedimentological continuity seems to suggest that there have been no sedimentary interruptions but a slow deposition process.