Interdisciplinary approach to the landscape and firewood exploitation during the Holocene at La Garrotxa (Girona, NE Iberia)

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ABSTRACT

This paper assesses the landscape and management of firewood resources during the Holocene at La Garrotxa (Girona, NE Iberia), a middle mountain region (400-1600 m a.s.l.) located within a volcanic area in the Pre-Pyrenees. Anthracological and palynological data from archaeological sites and lacustrine and peat deposits in this area have been considered in an interdisciplinary approach to the landscape and use of resources. According to Early Holocene palynological data, the landscape was characterised by the progressive expansion of forests, mainly dominated by conifers (pine and juniper) and deciduous trees (oak and hazel). The Holocene Climatic Optimum led to the culmination of forest expansion, with the dominance of dense oak forests, the landscape that the first farming societies found on arrival in this area. During the Middle to Late Holocene transition (c. 4000 cal BP), the expansion of evergreen sclerophyllous trees and the regression of broadleaf deciduous trees are recorded, in response to both climatic and anthropic causes. Deciduous Quercus and Buxus sempervirens were the most important taxa in all periods and areas, as shown in charcoal data from 26 archaeological levels. However, some other taxa had certain importance in some periods and sites. The variability observed between sites is discussed in terms of the availability of resources and the transformation of landscape evidenced in pollen records. This could explain the appearance of evergreen Quercus and other Mediterranean taxa in the Middle-Late Holocene anthropological record. The characteristics of the sites and socio-historical processes have also been considered in order to understand the use of firewood. In that sense, social necessities would have been the determining factor in planning timber and firewood procurement strategies rather than adapting to the environmental availability.

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1. Introduction

Charcoal recovered at archaeological sites and pollen data are both potentially able to yield insights into human-environment interaction. However, paleoenvironmental studies are often performed with only one palaeoecological proxy (either pollen or charcoal). In fact, charcoal and pollen data are complementary and several studies demonstrate how the combination of both types of data provides a more detailed picture of woodland history, landscapes change and wood resource uses (Nelle et al., 2010; Leroyer and Heinz, 1992; Emery-Barbier and Thiébaut, 2005; Carrón et al., 2010; Newman et al., 2007; Novák et al., 2014; Filipović et al., 2014; Py et al., 2014; Schumacher et al., 2016). Despite this potential, it is not always easy to assess human-environment interactions in a region due to the nature of available data. Both proxies provide different information which responds to the differing nature of the remains studied by these disciplines, natural deposition in the case of pollen and firewood consumption in the case of charcoal. On the one hand, the existence of pollen data limited by an imprecise geochronological control hampers the correlation between human activity and landscape transformation. On the other, charcoal,

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although often well dated, reflects the human selection of firewood, leaving it difficult to discriminate between the climatic and the anthropogenic causes of taxa composition (February, 1992; Shackleton and Prins, 1992; Smart and Hoffman, 1988). Nevertheless, when long sequences are available, charcoal offers the possibility, of discussing changes in firewood uses and their causes (Badal et al., 1994).

The comparison of charcoal and pollen records at a regional level has to address certain problems, with fragmentation of data being one of the major limitations. Sequences cover only short periods in some regions and are often the result of different formation processes (caves, off-site records, open-air settlements). However, this fragmentary evidence can provide significant data on woodland composition and landscape transformation. The aim of this paper is to integrate charcoal data from archaeological sites and pollen data from natural and archaeological deposits in the volcanic region of La Garrotxa (North-east Spain) in order to achieve a better understanding of landscape history and the social management of natural resources. Archaeobotanical data discussed here come from two main valleys: the La Vall d’en Bas-Olot basin and the Llierca valley (Fig. 1). The environmental availability of raw materials and social management of natural resources in these two valleys are discussed according to the available data. Charcoal and pollen data have been compared in order to reconstruct the vegetation history and its correlation with human occupation. In addition, comparison between charcoal and pollen data allows us to follow the history of some single taxa that are relevant because of their economic or environmental value.

2. Study area

2.1. Environmental settings

La Garrotxa is a mountain region located on the southern side of the Eastern Pre-Pyrenees (Spain). Two main areas, both with an extraordinary archaeological record, have been studied in this research: the Llierca valley and La Vall d’en Bas-Olot basin (Fig. 1).

The Llierca valley is located in the northern part of La Garrotxa (Alta Garrotxa). Deep valleys (lowlands at 250–300 m a.s.l) and steep mountainous areas (highest peaks at 1558 m a.s.l) mark the

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Fig. 1. Location of corings and archaeological sites within the study area. Source for vegetation map: Mapa Forestal de España (Zona 10). Climogram: precipitation and temperature data in (a) Sales de Llierca-Sadernes (mean 2005–2011), (b) Olot-mossos (mean 1985–2014) and (c) La Vall d’en Bas-Cooperativa (mean 1981–2010).

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