Forest management and territorial practices during the Early Middle Ages in the medium mountain of Mont Lozère (France). A combined approach of charcoal and palynological analyses.

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Summary: *Mont Lozère is located in the Massif Central (France). The area presents a wide diversity of long-term shaped landscapes, which result from complex strategies in natural resources management: farming, agro-pastoralism, forest exploitation, metallurgy… What is the relation between spatial and temporal variability in land-use patterns and the high landscapes diversity? The ongoing project uses a paleo-environmental multi-disciplinary approach (palynology, charcoal analysis, geochemistry, geo-archaeology) combined with landscape, pastoral and mining archaeological evidences in order to find an appropriate answer to these questions. This paper focuses on multi-proxy palaeo-environmental studies (charcoals, pollen, non-pollen palynomorphs). These studies have been undertaken at high spatial and temporal resolution both in natural sequences (peat bogs) and archaeological records (charcoal burning platforms). The results lead to the reconstruction of the vegetation dynamics and, more specifically, to the co-evolution of the vegetation assemblages and the territorial practices. The integration of all data linked together mainly from the High Middle Ages enables to map the forest's distribution.*

Key words: *Charcoal-burning platforms, palynology, landscapes evolution, Massif Central*

INTRODUCTION

Mont Lozère, located in the Massif Central (France), presents a wide diversity of long-term shaped landscapes, which result from complex strategies in natural resources management farming, agro-pastoralism, forest exploitation and metallurgy. In this sense, archaeological surveys have listed nearly 80 lead-ore smelting sites, more than 230 charcoal-burning platforms and 18 agro-pastoral sites (Fig. 1). Most of sites date back from the High and Late Middle Ages.

This paper aims to trace human management and landscape shaping in a middle mountain area during the 11th to 15th centuries. To achieve this, we use a combined approach based on both charcoal burning platforms and palynological data.

MATERIAL AND METHODS

Comparison of charcoal and palynological data allows a further understanding of landscape dynamics. Charcoal-burning platform location let us map the medieval forest distribution (Fig. 1), because of wood exploitation next to the platforms (Davasse, 2000). The charcoal analysis gives local botanical information (determination of the species and the diameter of the burnt wood) (Ludemann, 2010). Besides, the radiocarbon dating of charcoal burning platforms corresponds to a short lapse use (11th-15th centuries).

Otherwise, palynology provides local and regional landscape information in a diachronic way (since the Neolithic period); additionally it informs about the complementarity of human practices, particularly enabling to decipher agropastoral activities (Miras *et al*., 2010). Ten charcoal burning platforms have been analysed in order to determine the taxonomic classification and the diameter estimates. For every charcoal burning platform the surface and depth horizons were systematically studied, so we could evaluate the evolution of the exploited woods. For each layer, nearly 150 charcoals are determined to obtain at least 60 measures of radius curvature. The measurements were realised with AnthracoLoJ application (Paradis-Grenouillet *et al*., 2010).

Palynological analyses have been carried out on two peat bogs: "Countrasts" and "l'Amourous"; dated back from 1960±25 BP and 6930±25 BP respectively. These records have been chosen, following a combined microregional and regional strategy and the location of the charcoal burning platforms and other archaeological elements, in order to obtain a data correlation (Ejarque *et al*., 2010). High resolution pollen analyses have been performed with a sampling resolution narrowed to 2-4 cm. A combination of other biological proxies such as non-pollen palynomorphs,

stomata and pollen clumps furnished more local information.

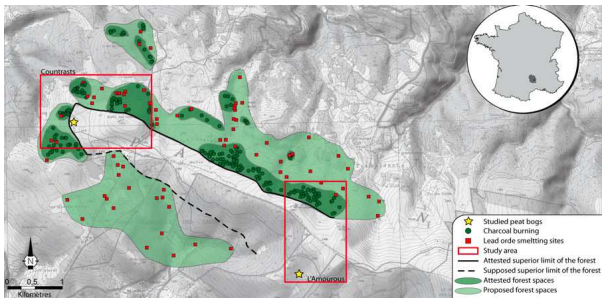

FIGURE 1. Location of archaeological sites and peat bogs studied. Reconstruction of the proposition for the medieval forest.

RESULTS AND DISCUSSION

The charcoal analyses show the exclusive exploitation of beech for the medieval period while palynological data from "Countrast" peat bog confirms the presence of a local beech forest. Examination of the burnt wood diameters show a dominance of small diameters (lower than 10 cm), while the pollen diagram shows a slight increase of beech values (Fig. 2). This could be interpreted as a short lapse coppicing with an accurate managing of the beech forest. During the High Middle Ages, an expansion of pastoral activities is underlined by pastoral pollen indicators and non-pollen palynomorphs. This is concomitant with a decline of annual crops and with the maximum of metallurgical activities. Furthermore, pastoral enclosures, not dated for the moment, have been reported in this area.

All this data suggests a territorial distribution of human activity based on charcoal production and metallurgical activities on the slopes, while agropastoral practices were located on the upper mountain areas.

The end of charcoal production and metallurgical activities (14th-15th centuries), coincides with an increase of arboreal pollen, mainly of beech value, and a decline of anthropogenic pollen indicators. It should be interpreted as a reconquest by the forest following the end of the metallurgical works.

CONCLUSION

The combination of paleo-environmental and archaeo-historical data indicates that the cultural landscape of this area is due to the heterogeneity and complexity of long term human micro-regional and local practices. Such an approach gives us a better knowledge about territorial organization during the medieval period between agro-pastoral and metallurgical activities. Nevertheless the combination of such approaches with other environmental proxies (sedimentary charcoal analyses, geochemistry, isotopic studies, sedimentology) and archaeo-historical data, will allow studying the origin of vegetation dynamics (territorial practices, climatic or environmental events...) since the Neolithic.

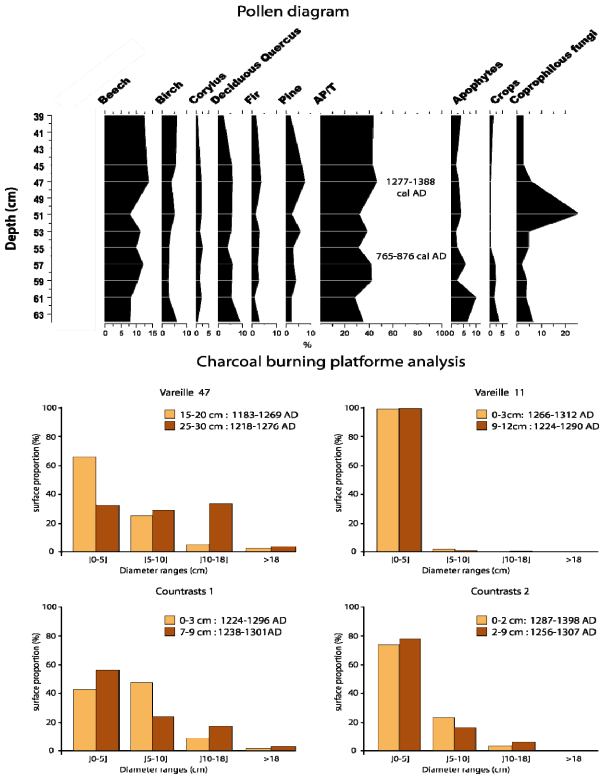

FIGURE 2. Pollen diagram of the Countrasts peat bog (above) and the radius curvature proportion in 4 charcoal burning platforms located in the vicinity of the peat bog (below).

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