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Understanding the impact of socio-economic activities on archaeological charcoal assemblages in temperate areas: A comparative analysis of firewood management in two Neolithic societies in Western Europe (Belgium, France)

Salavert Aurélie *, Dufraisse Alexa

UMR 7209 (CNRS, MNHN), Archéozoologie, Archéobotanique, sociétés, pratiques et environnements, France

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ABSTRACT

This paper presents archaeological charcoal assemblages from two clusters of Neolithic sites in temperate Europe, which reveal differences in the choice of firewood acquisition areas. We advance and test the hypothesis that there is a link between firewood gathering areas and daily travelled itineraries, using two comparable, but temporally and spatially distinct, case studies. The first of these is the Hesbaye in central Belgium where the Early Neolithic occupation is made up of two settlement phases from between 5200 and 5000 BC (Linearbankeramik culture). The second is the Late Neolithic occupation of the French Jura pile-dwellings in eastern France. In Hesbaye, the firewood supply area is restricted, favouring the rapid development of light-demanding species, while this area appears to be more extensive in the Jura where there is no clear development of light-demanding taxa. We postulate that there is a close spatial convergence between firewood gathering areas and potential cultivated land in Hesbaye and the French Jura. This case study therefore addresses the potential links between firewood management and the socio-economic context and demonstrates that the concept of daily itineraries enhances our understanding of charcoal assemblages and their palaeoecological interpretations.

Introduction

Archaeological charcoal remains from domestic firewood are widely used to reconstruct the composition of local woodlands and to interpret the transformation of these environments as the result of climatic change or human impact. Indeed, past firewood resources are mainly conditioned by biomass, species diversity and the availability of standing or dead woods. However, the choice of species for cooking or lighting and the selection of building timber can be interdependent, as previously demonstrated for Neolithic periods (*e.g.* Asouti and Austin, 2005; Asouti, 2012; Dufraisse, 2008, 2012; Out, 2010). Moreover, wood diameter is at least as important a criterion for firewood selection as the choice of the species for effectively managing a fire with regard to specific fireplace use (Chabal, 1994; Dufraisse and Garcia-Martinez, 2011). In this respect, human practices involving domestic firewood gathering for heating, defense, light, cooking, and the production of goods also depend on economic activities, like the location and the range of the territories covered for pastoral and agricultural activities, as well as the socio-cultural context (Asouti and Austin, 2005; Dufraisse and Pétrequin, 2007; Picornell-Gelabert et al., 2011; Zapata et al., 2003). The development of a more coherent framework including the complex ecological and cultural processes affecting species availability and firewood management is required. The new challenge for current charcoal analysis consists in modelling wood acquisition strategies based on human behavioural ecology (Marston, 2009; Shackleton and Prins, 1992). In this paper, we propose to test the concept of "the carrying capacity of terrestrial space time" proposed by Carlstein (1980) for pre-industrial societies. This can be defined as "the limited ability of a given area to accommodate space-demanding people, organisms, artefacts, materials and the activities associated with them" (Carlstein, 1980, p. 19–20). More specifically, the notions of "daily itineraries" and "life paths" (Carlstein, 1980) could serve as a descriptive framework for understanding interactions between past societies and the environments where resources, including firewood, are not concentrated in one place but are scattered and often mobile across the surface of the catchment area. In order to

* Corresponding author. Address: Muséum National d'Histoire Naturelle, CP 56, 55 rue Buffon, 75005 Paris, France.
E-mail address: salavert@mnhn.fr (S. Aurélie).

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test and use the concept of "daily itineraries" or "life paths" to analyse charcoal assemblages and thus, to advance hypotheses about past firewood acquisition strategies, solid datasets based on well-understood archaeological contexts are required. This paper is based on two summaries of research carried out as part of a PhD thesis on two geographically distant Neolithic communities: early Neolithic groups (5200–5000 BC) on the Hesbaye plateau, in Belgium, and late Neolithic groups (3200–2700 BC) at Chalain Lake, in the French Jura (Dufraisse, 2005; Salavert, 2010).

The two regions studied here concern comparable sedentary human communities from both a technical and economic point of view (Table 1). Firstly, the Neolithic groups of Hesbaye and the Jura are farming communities practising livestock herding but also, to a lesser extent, hunting and gathering. Secondly, in Hesbaye, the LBK people seem to have settled in areas previously unexploited by late Mesolithic groups (Vanmonfort, 2008). Likewise, the settlement pattern could be of pioneer type in the Jura, as implied by the scarcity of archaeological evidence of human occupation prior to the late Neolithic period around Lake Chalain (Pétrequin, 2005). In most cases, the Neolithic villages were built on the lakeshore and the rest of the valley was only slightly affected by temporary clearances (Richard, 1997). Therefore, even if the Neolithic sites of the two regions are temporally distinct, the occupation process is comparable, that is to say, pioneer Neolithic groups settling in woodland that has been subjected to very low human impact. Furthermore, in both regions, the datasets may yield reliable information on exploited forest formations throughout time. The charcoal fragments studied in the two regions come from domestic deposits accumulated throughout time that correspond to different episodes of combustion and are therefore, suitable for palaeoenvironmental interpretation (Chabal, 1994, 1997). Moreover, the two regions present a similar potential of temperate wood species (Table 1).

The most significant differences between the two datasets are the time resolution. The main reason for this is that the mode of preservation of archaeological sites may have an influence on absolute dating methodologies. In Hesbaye, due to erosion, only the imprints of houses (postholes) and detritus pits are preserved. The age assessment of the site is based on radiocarbon dating conducted on carbonized macro-remains, seeds and charcoal (Bosquet and Golitko, 2012). The duration of house utilisation is thus not accurately known. In central Belgium, the whole LBK period is estimated at around two centuries (Jadin, 2003). In the French Jura, the littoral sites are preserved in stable anaerobic conditions conducive to excellent wood preservation. Dendrochronology was thus used to accurately date the duration of the village which can be estimated between 12 and 25 years, depending on the period (Viellet, 2007). Another difference lies in the farming system of the two societies. In Hesbaye, the LBK people cultivated permanent plots (Bogaard, 2004), which means that field fertility could have been maintained over a long period of time. In the Jura, settlements are permanent but with a short life span (12–25 years). The Neolithic people may have managed fields in a semi-intensive way (Lundström-Baudais, 1986).

The aim of this paper is thus to compare the charcoal dataset from two areas of pioneer Neolithic occupation in western temperate Europe in order to highlight the processes affecting charcoal assemblage composition. We postulate that firewood acquisition strategies could be linked to socio-economic and cultural contexts in these two Neolithic societies.

Socio-economic settings and charcoal results

Early Neolithic sites from Hesbaye (central Belgium)

The Hesbaye is located in the eastern part of central Belgium. It is a gently hilly plateau region, roughly demarcated by the River Geer to the north, the Meuse to the south and the Méhaigne to the west. The Early Neolithic sites are at about 150 m a.s.l.

Table 1
Comparison of the two Neolithic areas discussed in the text: central Belgium and eastern France.

	HESBAYE (central Belgium)	JURA (eastern France)
Present environment		
Altitude	150 m	500 m
Topography	Mildly hilly	Montainous
Climat	Oceanic, temperate	Semi-continental, temperate
Annual average temperature	10.4 °C	9 °C
Pluviometry (mm/year)	804 mm	1000 à 1500 mm
Main vegetal association	*Quercus-Fraxinus/Quercus* groves	*Fagus/Quercus-Carpinus*
Riparian association	*Salicion-albae/Alno-padion*	*Alno-padion/Alnion glutinosae/Aceri-fraxinetum*
Archaeology		
Dating	5200–5000 BC	3900–2700 BC
Cultures	Early Neolithic (Linearbankeramik)	Recent Neolithic (Horgen, Clairvaux ancien)
Settlement dynamic	Pioneer front of colonisation	Marginal area on lake banks, pioneer front possible
Duration of the cycle of habitat	200 Years, no cultural changes	300 Years, cultural changes
Village localisation	Plateau	Lake banks, plateau
Life of the village	Less than 200 years (low chronological resolution)	10–25 Years (high chronological resolution)
Architecture	Large wooden houses	Large wooden houses
Rubbish management	Floor and pits	Floor, in the water
Economy		
Agriculture	Garden cultivation. Permanent fields. High labour input	Semi-intensive garden cultivation, mobile fields
Crops	*Triticum dicoccum, T. monococcum, Pisum sativum, Linum usitatissimum,* (maybe *Papaver somniferum*)	*Hordeum vulgare, Triticum aestivum, T. dicoccum, Pisum sativum, Linum usitatissimum, Papaver somniferum, Vicia*
Gathering	*Corylus avellana, Malus sylvestris, Prunus spinosa, Rubus idaeus, Sambucus racemosa*	*Rubus fruticosus, Fragaria vesca, Rosa canina, Malus sylvestris, Prunus spinosa,Corylus avellana, Crataegus, Quercus, Physalis alkekengi*
Husbandry	Cattle, sheep/goat, pigs. Herd management unkown	Deer hunting, cattle and pig farming
Anthracology		
Sampling location	Rubbish pits	Occupation floor
Context	Domestic firewood	Domestic firewood
Sites	7	3
Occupations levels	10	7