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Lithic economy and territory of Epipaleolithic hunter–gatherers in the Middle Tagus: The case of Pena d'Água (Portugal)

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ABSTRACT

In Central Portugal (westernmost Eurasia) the transition from the traditional Pleistocene hunter–gatherer societies to the complex Mesolithic societies of the Holocene has been debated for decades. While some argue that these differences were a progressive phenomenon that started with the shift from the Pleistocene to the Holocene, others defend that the Late Pleistocene patterns were fairly similar to those of the Epipaleolithic and that the major shift was rapid, dramatic and triggered by the necessary adaptation to the 8.2 ka cal BP (8.09–8.25 ka cal BP) climatic event. The study of lithic raw material provenance might be useful for this discussion, since it has been suggested that the Magdalenian and Epipaleolithic populations from this region were collecting this resources within a close range territory, whereas the Mesolithic populations were acquiring them at longer distances.

In this paper, we present the results from p-XRF, VP-SEM-EDS and μ-XRD analysis done on the Epipaleolithic lithic assemblage from Pena d'Água Rockshelter, and in some geological samples from secondary sources located ~14 km from this site. This layer is of major relevance for this debate since it is dated from 8.19 ka cal BP. If the transition was gradual, it would be expected that this assemblage would show some traits of higher-complexity seen in the Mesolithic, namely of longer distance acquisition. However, our results indicate correspondence between the archaeological chert types and some of the geological sources. The differences seen between the archaeological specimens and geological samples are mostly present in traits that can be related with manufacture, handling and post-depositional phenomena.

The results suggest that, in what concerns to the economy of abiotic resources, the Epipaleolithic populations living at the time of the dramatic 8.2 ka cal BP cold event, were performing a short range acquisition of lithic raw materials which reinforces the idea of continuity from the Late Pleistocene to the 8.2 ka cal BP event and an abrupt and dramatic shift soon after this phenomena.

1. Introduction

In the last decades, several research projects approaching the Early Holocene in Central Portugal have been pointing to a change in the settlement, dietary, economic and tool-kit patterns of the hunter–gatherer societies. This change led to the division of this period in two moments: the Early and Final Mesolithic or the Epipaleolithic and Mesolithic. As noted by these different nomenclatures, despite the fact that the investigators agree in the separation, they disagree in its genesis and nature and, therefore, on the overall weight of each process. On one hand, some argue that the transition from the Final Upper Paleolithic to the Mesolithic was an adaptation to the new conditions brought by the Holocene (Araújo, 1993, 2009, 2012). On the contrary, others assert that the patterns seen in the archaeological record until 8.2 ka cal BP are similar to those seen in the Magdalenian and that the change to the Mesolithic was an abrupt but necessary adaptive change triggered by this climatic event.

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The 8.2 ka cal BP cold event, 8.09 to 8.25 ka cal BP (Bousman and Vierra, 2012), was an abrupt decrease of 1.5–3 C° in the average global atmospheric temperature, that highly affected the Northern Hemisphere. It seems to have been related with an enormous melt-water pulse from the final collapse of the Laurentide ice sheet in North America that suddenly drained into the North Atlantic Ocean (Barber et al., 1999; Alley and Agustsdottir, 2005). Among other things, this resulted in changes in the upwelling regime with consequences in the impoverishment of coastal resources, sea rising, the increase of drier/arid conditions, the maximum expansion of the Holocene forest cover and the maximum Flandrian transgression. Such conditions demanded from these human groups a rapid and dramatic reorganization of their settlement systems from residential to logistic mobility strategies, ultimately leading to more complex societies that included the formation of shell middens as the first monuments in the Atlantic façade of Europe soon after the impact of this climatic event.

Regarding stone-tool economy and production, the assemblages in Portugal pre-dating the 8.2 ka cal BP event show balanced frequencies between multiple raw materials (chert, quartz and quartzite), a strong coarse-grained raw material component (frequently on quartzite and/or greywacke), a large flake component in relation with regular elongate blanks, small and irregular bladelets detached using reduction strategies similar to those of the Upper Paleolithic, a relative larger frequency of awls, splintered pieces and retouched flakes (usually marginally retouched, notches and denticulates) along with small numbers of marginally retouched bladelets (such as Dufour bladelets), backed and/or truncated points (Microgravette, Istres, Sauveterre, or La Malaurie points) and few geometrics (trapeziums and rarely crescents or triangles). Together, these features make these assemblages more similar to those of the Magdalenian (Bicho, 1994; Zilhão, 1997; Araújo, 2003, 2009; Pereira and Carvalho, n.d.) than with those of the Mesolithic.

In opposition, the post-8.2 ka cal BP event assemblages show a predominance of chert, longer, regular and standardized bladelets and blades—probably produced using soft hammer and/or indirect percussion techniques—and of regular geometrics produced through the micro-burin technique, which constitute the larger component of tool-kits (Roche, 1972; Araújo, 1993; Marchand, 2001, 2005; Carvalho, 2008, 2009; Paixão, 2014). This higher frequency of chert implements suggests a higher specialization on a specific raw material that is not ubiquitous in the landscape and that usually needs more complex processes of acquisition, including longer distance procurement to places where it was more abundant (even if in secondary sources) and of better quality, such as the Rio Maior valley (Pereira et al., in press).

One of the ways to evaluate the impact of the 8.2 ka cal BP event over the hunter–gatherer–fishing communities living in Estremadura (central coastal Portugal) is to refine the understanding of their patterns, namely, the range of acquisition of abiotic raw materials; Moreover, this specific study can also provide insights into other aspects such as their territories, pathways and mobility patterns. Thus, the main goals of this study are: (1) to characterize the mineralogical and chemical composition of the chert through non-invasive techniques and (2) to determinate the compositional groups, in order to observe similarities between archaeological and geological samples. Such comparison will allow the authors to infer the provenance of the raw material of the archaeological specimens. In particular, our goal is to understand the provenance of the chert present in the Layer F of the Pena d'Água Rockshelter in order to shade light into the abiotic economy of the Epipaleolithic populations in Central Portugal.

2. The Pena d'Água Rock-shelter

Pena d'Água is located ~100 km NE of Lisbon and ~47 km from the present Atlantic coastline. It is a long (~70 m) and thick (>10 m) sedimentary deposit formed along an escarpment locally known as Arrife that separates the Tagus basin (to the east) from the limestone massifs (to the west), thus forming a marked ecotone between two quite contrasting environments (Fig. 1).

The field seasons were carried out continuously between 1992 and 2000, revealing a stratigraphic sequence with eight layers: Roman and Iron Age (layer B), Early to Late Neolithic (layers Eb-bottom to B) and Epipaleolithic (layer F) (Carvalho, 2012, 1998a, n.d.). Recently, a technological and typological analysis of the artefacts from layer F has been made (Pereira and Carvalho, n.d.). Layer F is the bottom unit of the stratigraphic sequence, lying on the local Miocene bedrock. Sediments are significantly different from those that constitute the upper layers: its matrix is constituted by very dense and compacted coarse sand with a clayish component. It also presents evidence for low energy water flow action (Carvalho, 1998a; Simões, 2012), such as calcium carbonate tuffs, rolled artefacts (sometimes accumulated in shallow pockets), few and poorly preserved faunal remains, both micro- (Póvoas, 1998) and medium- to large mammals (Valente, 1998). However, despite the low number of small chips, the refitting of implements (Pereira, 2010) suggests a fair preservation of the lithic assemblage. This water flow action is related with the presence of seasonal springs near the excavation area, which may have been particularly active when layer F was formed.

A radiocarbon date of 7370 ± 110 BP (Wk-9213), corresponding to 8385–7983 cal BP (95.4% prob.), with a median value of 8.19 ka cal BP, after calibration with the INTCAL13 curve (OxCal program, version 4.2), was taken from a bulk sample of cork oak charcoal (Carvalho, 2008: Table 18). Detailed information and discussion on the relation between the radiocarbon date and the archaeological record can be found elsewhere (Pereira and Carvalho, n.d.).

3. Geological background

The Pena d'Água Rockshelter is located in the western Meso-Cenozoic Basin (MCB) of the Iberia Peninsula, the Lusitanian Basin. It lies on the right margin of the Lower Tagus River, specifically, in the face of an escarpment resulting from a tectonic fault of the Aire Mountain known as Arrife. This normal tectonic fault with ~50 km offset forms a cliff 98 m high, oriented NE–SW, separating the Mesozoic limestone massifs from the Cenozoic terrace deposits of the River Tagus basin, by raising the southern sector of the Aire Mountain in relation to the latter.

The MCB is limited to the north, east and south by Paleozoic formations (Central Iberian Zone) dominated by schist, greywacke, granite and quartzite crests that feed the Tagus terraces with gravels, and on the west by the Atlantic Ocean. The Mesozoic formations are essentially composed by sedimentary rocks of marine and platform origin, usually of carbonated composition (Angelucci, 2004), successively deformed by the orogenic phases of the Alpine cycle (Ribeiro et al., 1979; Manuppella et al., 1985). The regional geomorphology is the product of the deformation occurred during the Cenozoic due to the Alpine orogeny that activated diaclasis with different orientations, caused diapiric phenomena and volcanic activity that lead to slightly deformed and tabular mountains (Angelucci, 2003). After the Cenozoic, a great part of the region was already in continental position (Ribeiro et al., 1979) and, nowadays, it is still subject to regional tectonic raising, neotectonic phenomena and seismic activity (Cabral, 1995). Its geological and structural condition led to rock

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