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Facies analysis and Late-Pleistocene fluvial depositional environments in the Cardina-Salto do Boi archaeological site (Côa Valley, Portugal)

Análise de fácies e ambientes deposicionais fluviais do Plistocénico final no sítio arqueológico da Cardina-Salto do Boi (Vale do Côa, Portugal)

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Palavras-chave: Geoarqueologia, micromorfologia, depósitos de vertente e aluviais, transição Paleolítico Médio a Superior

ABSTRACT

In Portugal, climate fluctuations of Late-Pleistocene, more particularly of Marine Isotope Stages (MIS) 5 to 2, are well-known from marine record on the western Iberian continental margin and includes various events of secular abrupt climate changes (Lebreiro et al., 2009; Sanchez Goñi et al., 2010; among others). The pronounced climate instability that characterizes Last Glacial Period (LGP) comprises several distinct cooling (stadial) and warming (interstadial) phases. Continental conditions rapidly oscillated through cold-arid and warm-wet environments in the course of these stadial-interstadial climate jumps. However, although the marine register is well known, in terrestrial archives past environmental conditions have a discontinuous record. Furthermore, these large and rapid climate changes, recorded in a variety of terrestrial archives, have a recognized impact on the bioclimatic zones (e.g., Sanchez Goñi et al., 2010), and possibly on the dynamic, demography and settlement patterns of Middle and Upper Palaeolithic hunter-gatherers of Iberia (e.g., D'Errico and Sánchez Goñi, 2003).

Based on the study of Iberian karst cave/rock-shelter and open-air records, a correlation framework with climate shifts has been proposed to explain the observed discontinuities between sequences containing late Middle and early Upper Palaeolithic occupations (e.g., Aubry et al., 2011, 2014; Mallol et al., 2012). Moreover, a climate driven model has been advanced to explain the later dispersion of Anatomically Modern Human (AMH), the persistence of last Neanderthals and the chronological differences between northern and southern Pyrenean data (e.g., Zilhão, 2006; Carrión et al., 2019).

The discovery of the open-air Palaeolithic rock-art in the Côa Valley region (Douro Basin, north-east of Portugal), by the end of the 20th century, has been a fundamental step in the history of the Iberian archaeology (Zilhão, 1997). In addition, the alluvial and slope deposits preserved in this valley have demonstrated to be a valuable record of information about Late-Pleistocene terrestrial sedimentary processes, depositional environments and hunter-gatherer's behaviour at local/regional scales (Aubry et al., 2010). However, despite all these data, the whole question relating to the Middle-to-Upper Palaeolithic transition has been excessively dependent on the karst archives and should now be investigated in detail in other geomorphological contexts - among which the fluvial and plateau, both present in the Côa Valley region, stands out.

In this sense, the ca. 5-m-thick Cardina-Salto do Boi siliciclastic stratigraphic succession, exposed during systematic archaeological excavations executed between 1995 and 2019 by the archaeologists of the Fundação Côa Parque (FCP), within the aims of the PALÆCOA research project (PTDC/EPH-ARQ/0326/2014 - <http://paleocoa.wixsite.com/paleocoa>), was investigated at a high resolution from a geoarchaeological prospective, and its potential in reconstructing Late-Pleistocene palaeoenvironments was explored.

Due to the presence of a local stratigraphy with recurrent sedimentary features, a classical facies analysis, including detail field strata description (which combines the physical characteristics displayed by a single layer or by a set of layers linked to a well-defined sedimentary process), coupled by grain-size characterization/decomposition, whole-rock/clay mineralogy and micromorphology, were executed in detail. The results of facies analysis, supported by ¹⁴C, TL and OSL dating (Aubry et al., 2019; and references herein), allow the interpretation of the local stratigraphic succession in terms of formation processes and depositional history, also in relation to archaeological evidence previously published for the site and the region, enabling to establish a chronological framework for Neanderthal and AMH evidences in its environmental context.

In terms of site's formation processes, the Cardina-Salto do Boi sedimentary infill started with accumulation in a fluvial environment under low energy diffusive water-flow conditions with settling of suspended fine sediments dominant over bedload deposition, relatively close to the palaeo-channel (overbank sedimentation), which changed to a rapid decrease in water-flow energy (dominated by low-water vertical accretion). The vertical sedimentary accretion continued, relatively more distant from the fluvial channel, being interrupted by environmental stabilization phases with no evident

erosion, and a new phase of overbank sedimentation took place before an important stratigraphic disconformity. The uppermost meter thick sedimentary slope deposition was controlled by gravity-driven processes, where the accumulation, with the concurrent action of water, shows evidences of pedogenesis, anthropogenic inputs/disturbances and redepositions.

Chronological data indicate a stratigraphic succession spanning from MIS 5 to 1 of two sedimentary sequences interpreted, in terms of depositional environment, as follows (from bottom to top): (A) a relatively stable floodplain sequence with some nuisance flooding caused either by overbank floods or by rising groundwater levels, linked to generally continuous and low intense meteoric precipitation initially under more temperate and humid climate (with some seasonality) that evolved to colder conditions; (B) a subsequent period, after the Greenland Interstadial (GI) 3 and during the Holocene, of progressive increase in humid conditions and chemical-weathering attested by the more superficial disturbed slope sequence, driven by gravity processes and shallow surface waters flow.

The results provide context to the archaeological assemblages and reveal a non-depositional unconformity (hiatus, with no evident erosion) at the Middle-to-Upper Palaeolithic transition, dated to 40,5-32 ka interval (during MIS 3 - Aubry et al., 2019), in an alluvial palaeoenvironment. This data supports the persistence of Neanderthal-associated Middle Palaeolithic material culture in Central Iberia after 41 ka and that the arrival of AMH occurred at the end of the Aurignacian.

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