Journal of Archaeological Science: Reports 28 (2019) 102021

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

Multianalytical and multiproxy approach to the characterization of a Paleolithic lamp. An example in Nerja cave (Southern Iberian Peninsula)

Mª Ángeles Medina-Alcaide[a,*], Luisa Mª Cabalín[b], Javier Laserna[b], José L. Sanchidrián[c], Antonio J. Torres[c], Iñaki Intxaurbe[d], Sonia Cosano[c], Antonio Romero[a]

[a] University of the Basque Country UPV/EHU, Geography, Prehistory and Archaeology, C/Tomás y Valiente s/n, 01006 Vitoria-Gasteiz, Spain
[b] University of Malaga UMA, Department of Analytical Chemistry, Faculty of Sciences, Campus de Teatinos s/n, 29071 Malaga, Spain
[c] University of Cordoba UCO, Geography and Territorial Sciences, C/Cardenal Salazar s/n, 14071 Cordoba, Spain
[d] Instituto Internacional de Investigaciones Prehistóricas de Cantabria (IIIPC), Universidad de Cantabria, 39005 Santander, Spain

ARTICLE INFO

Keywords:
Lighting
Paleolithic lamp
Decorated cave
Upper Paleolithic
Iberian Peninsula

ABSTRACT

Understanding the illumination systems used by Paleolithic groups in caves gives us essential information about the Paleo-speleological capabilities of our ancestors and their activities in dark spaces. In this paper, we present a multianalytical and multiproxy approach (wood charcoal and soot) to characterize a Paleolithic lamp. The methodology was employed on an endokarstic clastic block (speleothem) with a natural concavity located in decorated galleries in Nerja cave, Spain. Anthracological analysis has demonstrated that the *Pinus* tp. *sylvestris/nigra* (Scots pine/Black pine) was used as fuel for this illumination system. 14C-AMS dating shows that this light point was lit during the Solutrean period. Paleolithic art from chambers near this fixed lamp present a similar chronology. HD/HG ratio calculus obtain of μ-Raman spectra from pine charcoal shows that burning reached temperatures of more than 700 °C. Thus, wood suffered complete combustion without sudden extinguishing. Furthermore, spherical particles of soot aggregates on the edge of the lamp have been identified, obtained from wood combustion, through TEM-EDX analysis. Finally, 3D modelling of the lamp was carried out. Concerning interpretation, the singular location of the light point suggests that it could have encompassed more functions than just the illumination of the cave.

1. Introduction

Conquest of the subterranean environment was an essential milestone in the history of fire control during prehistory and essential for the spread of rock art in these contexts. The use of fire in the underground domain dates back to the Middle Paleolithic (Jaubert et al., 2016) although this activity is more common in the Upper Paleolithic in relation to caves with Paleolithic art. Knowledge of the illumination systems used to inhabit these spaces, otherwise devoid of any light, gives us information about the Paleo-speleological capabilities of our ancestors. This information is important to understand the activities in which they engaged in caves, their duration, and their symbolic and socioeconomic significance.

With regards to Paleolithic objects suspected of being lamps, their use for this end has only been proven in 28.15% of cases; that is, with evidence of fire found in their active components/part. Only 85 of the 302 artefacts examined by S. de Beaune (1987) have been confirmed as having been put to this use. According to this researcher, the discovery of this evidence in only the active part of the lamp, as well as its suggestive form, allows us to differentiate this instrument from other objects featuring a similar morphology (for example, colour palettes). This evidence of fire may be residue from vegetable fuel (wood charcoal, vegetable fibres), animal fuel (fat) and other alterations, such as rubefaction or soot. Currently, there are very precise tools for the elemental analysis and adequate microscopic observation of the combustion residues present in these elements. Below, we present the multianalytical and multiproxy approach used for the scientific characterization of a Paleolithic fixed lamp located in the inner galleries of a Nerja cave.

The cave of Nerja, located in the district of Maro (Nerja, province of Malaga, Spain), represents one of the largest decorated cave sites in Southern Spain (Iberian Peninsula) (Fig. 1a and b), and is comprised of

* Corresponding author.
E-mail addresses: mangeles.medina@ehu.eus (M.Á. Medina-Alcaide), lmcabalin@uma.es (L.M. Cabalín), laserna@uma.es (J. Laserna), gt1satoj@uco.es (J.L. Sanchidrián), aj.torres47@gmail.com (A.J. Torres), inaki.intxaurbe@unican.es (I. Intxaurbe), scp4294@gmail.com (S. Cosano), antoniojesus.romero@ehu.eus (A. Romero).

https://doi.org/10.1016/j.jasrep.2019.102021
Received 30 May 2019; Received in revised form 3 September 2019; Accepted 30 September 2019