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Evidence of bee products processing: A functional definition of a specialized type of macro-lithic tool

Mireia Ache[a], Selina Delgado-Raack[a,*], Elena Molina[a,b], Roberto Risch[a], Antoni Rosell-Melé[b,c]

[a] ASOME (Grup de Recerca de Arqueoecologia Social Mediterrània), Department of Prehistory, Edifici B, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain
[b] Institute of Environmental Science & Technology, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain
[c] Institució Catalana de Recerca i Estudis Avançats (ICREA), 08010 Barcelona, Catalonia, Spain

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ABSTRACT

The present study deals with a specific type of cylindrical pestle identified among several thousands of macro-lithic tools studied so far for the Argaric Bronze Age (2200–1550 cal BCE) in the southeast of the Iberian Peninsula. The combination of petrographic, technological, use-wear and residue analyses has allowed us to show that these tools were used to process beeswax and animal fatty products, probably for subsistence purposes. Apart from providing an easily recognizable archaeological tracer of apiculture, these results also complete our understanding of the economic organization of El Argar. Diachronic and spatial data reveal honey and meat productions as important energy alternatives in times of nutritional scarcity within a subsistence strategy based primarily on barley monoculture. Additionally, we show that there was socially differentiated access to both, honey and meat.

1. Introduction

Macro-lithic tools (Delgado-Raack et al., 2009; Delgado-Raack and Risch, 2009, 2012) are stone artefacts that tend to be larger and heavier than most flaked tools and in general were designed for heavy duty tasks such as percussion, abrasion, polishing, grinding, pounding and chopping of a large variety of materials and substances. Ethnographic, experimental and archaeological sources inform about the variety of activities carried out such as working skin, bone, wood and fiber, flint knapping, pottery production, metallurgy, stone trimming and wood chopping as well as food processing. Often, these artefacts are the only material evidence in the archaeological record documenting such activities. In addition to the type of activities performed, macro-lithic tools convey information about the intensity of given tasks, their technical constraints and the volume of production in a much more direct way than is usually possible with other archaeological materials. Finally, their spatial distribution in settlements as well as in funerary contexts provides information concerning the social and economic organization prevailing in a community. In sum, their heuristic potential turns them into crucial archaeological evidence for the analysis of the economic organization of past societies.

The systematic study of several thousands of macro-lithic artefacts from 3rd and 2nd millennium sites from Southeast Iberia, has us led to recognize a specific group of tools with distinctive abrasive use-wear traces (Delgado-Raack, 2008; Risch, 1995; Risch, 2002). These artefacts are also known from other parts of Europe (e.g., Perini, 1987: pp. 118–120, pl. XXVI-XXVII) and they have occasionally been interpreted as digging sticks or even fire pokers (e.g., Ayala, 1991: pp. 73; Maicas and Román, 2001). The present study aims primarily towards a better characterization of this tool type through a combination of morpho-technical and functional analyses, including the identification of use-wear traces and chemical residues. We will then delve into the archaeological contexts where these macro-lithic artefacts appear in Southeast Iberia and conclude with a brief discussion of their role in the economy of El Argar (Fig. 1).

2. Research context and archaeological materials

Between 2200 and 1550 cal BCE the El Argar archaeological complex gradually expanded over an area of c. 35.000 km^2 through a network of hilltop settlements, in which agricultural production of the lowlands was centralized and redistributed. Investigation of monumental architecture, specialized workshops, storage spaces and burials that appear socially stratified suggest that El Argar developed into the first State society of the western Mediterranean during the Early Bronze Age (Lull et al., 2011, 2013, 2014).

A multicomponent analysis of a collection of 608 macro-lithic artefacts combining metrical, morphological and geological variables

* Corresponding author.
E-mail addresses: Mireia.Ache@uab.cat (M. Ache), selina.delgado@uab.cat (S. Delgado-Raack), Robert.Risch@uab.cat (R. Risch), antoni.rosell@uab.cat (A. Rosell-Melé).

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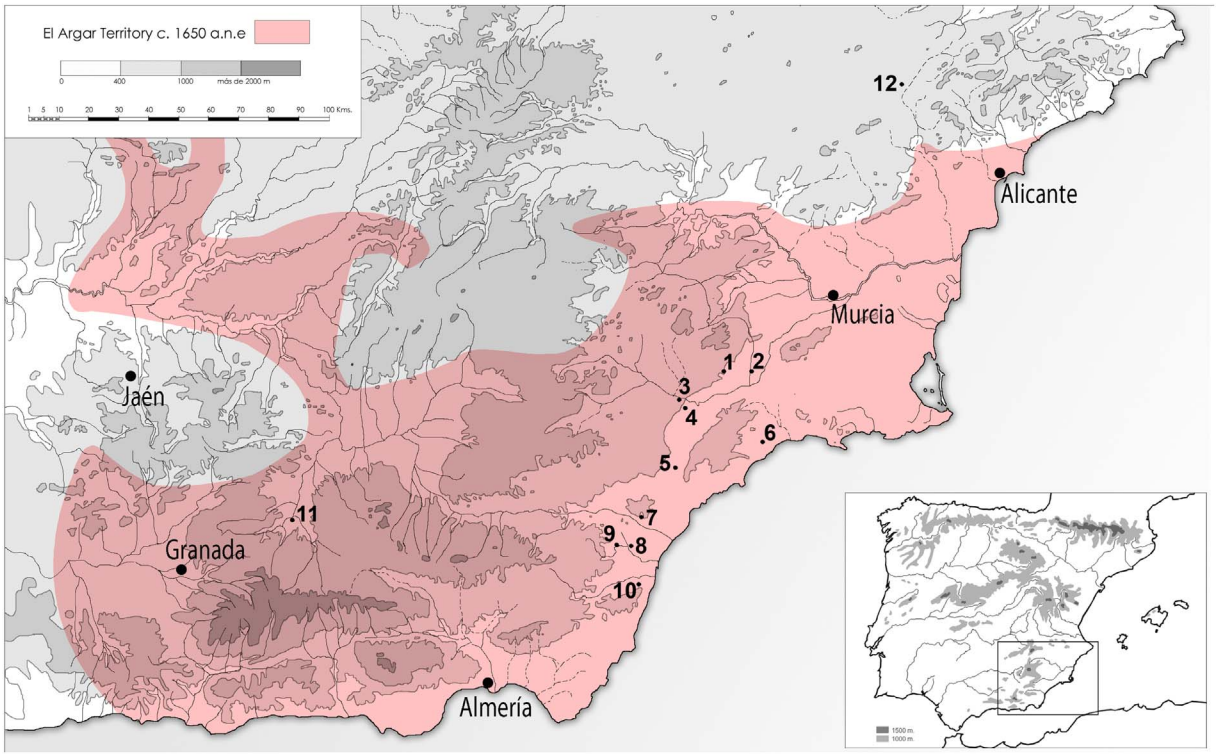

Fig. 1. The El Argar territory around 1650 cal BCE and the settlements included in this study. 1. La Bastida, 2. Tira del Lienzo, 3. Murviedro, 4. Los Cipreses, 5. Rincón de Almendricos, 6. Ifre, 7. Fuente Álamo, 8. El Argar, 9. Fuente Vermeja, 10. Gatas, 11. Cuesta del Negro, 12. Cabezo Redondo.

allowed for the first time the identification of a special-use pestle, which was named ALS-STA (Risch, 1995: pp. 178–183, 359–370). Its most visible characteristic is a cylindrical shape with an active surface on one or on both of the rounded ends (Fig. 2). These artefacts measure between 77 and 233 mm in length, while their widths and thicknesses tend to fall between 12 and 89 mm and 6–46 mm, respectively. In terms of weight they range between 48 and 775 g, but most are 200–450 g (Fig. 3).

A technological analysis, based on the observation of working traces on the artefact surfaces, confirmed that these tools were not manufactured to shape, but are cylindrical cobbles obtained from fluvial deposits. The geomorphological surveys undertaken in southeast Iberia confirm the availability of cylindrical cobbles in several dry riverbeds next to archaeological sites (Risch, 1995: pp. 298–316; Risch, 2002: pp. 63–72). Another shared feature is their rock type. Petrographic analyses have confirmed that usually metamorphic rocks with a planar or planolinear fabric were selected particularly slate and schist. Muscovite is the exclusive or main mineral component in these rocks. Psammitic rocks, with a higher component in quartz, are much less common (Fig. 4).

3. Methodology

3.1. Use-wear analysis

In order to determine how this specific artefact type was handled and used, a two stage functional analysis was carried out. In the first stage, several hundred artefacts with abrasive use-wear traces were submitted to macro- and meso-scopic analyses (10–100 ×). Shape and morphology of the active or working surface were recorded following a standard procedure designed for the study of macro-lithic artefacts (see Risch, 2002, 35–48; Delgado-Raack, 2013, 187–199). This allowed to identify 115 cylindrical pestles belonging to the ALS-STA type with 122 working surfaces on one or both ends. On artefacts derived from modern excavations with 23 well preserved working surfaces a detailed description of the weft, depth, shape, placement and orientation of use-wear traces was carried out according to the standardized procedure developed for the study of use-wear traces on macrolithic tools (Delgado-Raack, 2008, 181–226; Adams et al., 2009).

After beeswax was identified by gas chromatography (GC) and gas chromatography–mass spectrometry (GC/MS) in some of the El Argar pottery of La Bastida, the possibility arose that these artefacts were used for processing and separating wax from honey (Molina-Muñoz, 2015; Molina-Muñoz et al., 2016). In order to test our hypothesis through an independent approach, the experimental as well as five exceptionally well preserved archaeological tools were selected for organic residue analysis of the carbonized residues on the active surfaces. The residues were collected by scraping with a scalpel less than 1 g of material.

3.2. Lipid extraction

We followed the methodology proposed by Evershed et al. (1990) and modified by Molina-Muñoz (2015). Some 40 µl of tetratriacontane (internal standard) and 10 ml of dicloromethane/methanol (CH2Cl2:MeOH) (2/1 v/v) were added to the charred surface residue in a glass tube. Lipids were extracted in an ultrasonic bath for 15 min twice. The solution was centrifuged (2200 rpm, 10 min) and the supernatants were combined and evaporated to drynes under N_2 and redissolved. An aliquot (100 µl) was derivatised with 50 µl of *N,O*-Bis (trimethylsilyl)trifluoroacetamide (BSTFA) at 60 °C for 60 min. After removing the BSTFA under N_2, the sample was redissolved in 40 µl of isoctane before chromatographic analysis.

3.3. GC and GC/MS analysis

The samples were screened for the presence of lipids in the residue extract using GC with flame ionization detection. Samples which contained lipids were then characterized by GC/MS to confirm the identification of the biomarkers. The GC/MS analyses of contemporary beeswax and archaeological samples were performed on an Agilent 7820A Series GC equipped with an Agilent DB5-MS column of