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Geological Raw Materials from a Mesolithic Archaeological Site in NW Portugal

Pedro Xavier[1]*, Carlos Alves [2] and José Meireles [1]

[1] LandS/Lab2PT – Laboratório de Paisagens, Património e Território, University of Minho, Portugal
[2] LandS/Lab2PT (FCT-AUR/04509) & Earth Sciences Department/School of Sciences University of Minho, Portugal; casaix@dct.uminho.pt
* Correspondence: pedroxavy@gmail.com;
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Abstract: The present work concerns the study of geological raw materials obtained from an excavation site located in Serra da Cabreira (NW Portugal). The majority of the artefacts are made in quartz varieties (with minor occurrences of flint). Milky quartz is dominant, being similar to diverse occurrences of quartz veins in the immediate neighborhood. There are diverse other quartz varieties, indicating the possibility of locations farther away from the shelter. The study of geological raw materials can be seen as an important source of archaeological information, illustrating the evolution of past relationships between humans and geological resources, and also give relevant information for the present and future, considering namely the extremely low environmental impact of the processing of raw materials.

Keywords: raw materials; pre-history; quartz; chert/flint; Mesolithic; lithic industry; provenance; economy and management.

1. Introduction

The Mesolithic was a cultural and chronological concept, created in the 1866 by Hodder Westroop, in order to conceptualize the very complex process, in its multiple aspects – social, technological, ecological, logistical, among others, – in the period of time covered between the end of the last Ice Age and the establishment of farming economy. Even though is very reductionist to understand all of these shifts as a consequence of climate changes, we should not underestimate the huge influence detained per the advent of Holocene and its consequences in the fauna and flora and, consequently, in the mobility patterns and in the survival strategies of prehistoric communities. According to new paleoclimate data, it is proposed to be around 11.600 cal BP [1-3], the beginning of the current interglacial period.

In the aspect of lithic technology and geological resources, subjects of this paper, the Mesolithic witnessed the affirmation of a new lithic mode, known as Mode 5 [4], with an expressive size reduction of the several components of the lithic industries - the microlithic technology. The microlithic retouched tools geometric (segments, triangles or trapezes) or non-geometric (microlithic points, e.g.) are usually associated with the creation of the composite tools, as well with the dissemination of bow and arrow, proving that hunting activities still played a key role in livelihood strategies of Mesolithic human communities.

In the context of Portuguese Archaeology, quartz, has not been usually referred in provenance and lithic raw material economy and management studies, which have usually focused on the exotic and long distance resources instead of the local ones [5]. Notwithstanding, within the framework of provenance studies, we must mention, inter alia, two of the most recent studies, one in the Sabor valley and the other in Foz Côa region, both located in NE Portugal [6; 7], where some essays of potential sources of different kinds of quartz were exposed.

For decades, the research in Portuguese Mesolithic, famous for the shell middens in Tejo, Sado or Muge estuaries, was concentrated in the interpretation of these structures and with the chronology and functionality/ethnicity value of the lithic industries, especially of some geometrics [8; 9]. However, the thematic of raw material provenance studies is beginning to impose, as the of work of Paixão *et. al*. [10], where some hypothesis concerning the sources of chert - through geochemical analyses of X-ray fluorescence, - proves.

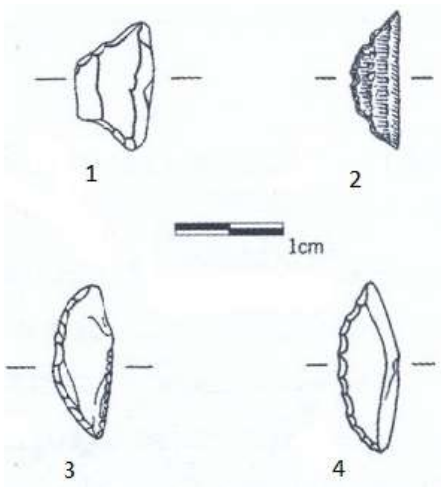
Our ongoing work aims to study the prehistoric lithic industry recovered in the archaeological site of Rock Shelter 1 of Vale de Cerdeira, located in Serra da Cabreira, NW of Portugal. The discovery of this site, in the late 20th century, represented a great improvement to the research, because until then, no prehistoric settlements of Mesolithic chronology were identified in the mountain areas of NW Portugal [11; 12]. Along with the techno-typological analysis, we intend to classify, characterize and try to discuss the relation of different varieties of quartz, exploited and manipulated by the prehistoric communities, to the surrounding geological context.

2. Archaeological Collection

Presently, a whole techno-typological of the archaeological lithic industry study is being conducted. Making assumptions over on ongoing work could be too premature. For that reason, this section of the paper is based on previous works carried out by one of us (11; 12; 13).

The excavated area in the Rock Shelter 1 of Vale de Cerdeira amounts to around 20 m^2 and the sedimentary sequence recorded in the shelter does not reach 1m thick. Three different stratigraphic units were observed: UE-1, UE-2 and UE-3 (base to top). The charcoal samples recovered from two combustion structures in UE- 1provided two ^{14}C dates locating the human occupation of the shelter between the third quarter of the sixth millennium BC (GrN-25614, 6240 ± 50 BP: 5316-5056 cal. BC 2 σ) and the fifth quarter of the fifth millennium (GrN-25613, 6090 ± 40 BP: 5207-4853 cal. BC 2 σ).

The UE-3, disrupted by modern/contemporary occupations of the shelter, mainly associated with shepherding and cattle activities, is rather too uncharacteristic. Consequently, only the first two units will be considered. The most represented category in both stratigraphic units are debris and chips, which proving that knapping activities took place in the shelter, reinforced by the presence of significant number of cores. Therefore, debris and chips category is followed by *debitage* products (flakes, blades and bladelets), cores, fragments or nodules, and finally by retouched tools (illustrated in Figure 1) including the microliths (geometric and non-geometric) and the other tools of more common use (burins, scrappers, notches, denticulates, etc.).



(**a**)

(**b**)

Figure 1. (**a**) Lithic Industry of UE-1: 1 – trapeze; 2-4 -segments; (Adapted [12]); (**b**) Raw Materials from Rock Shelter 1 of Vale de Cerdeira. Above the 5 cm scale, left to right: milky quartz, hyaline quartz, translucent

quartz, grey quartz, rose quartz and smoky quartz; below 5 cm scale, lef to to right: 2 flakes of flint, schist and quartzite

Concerning the lithic raw materials, in both stratigraphic units, we can observe that these come from the exploitation of different varieties of quartz, such as milky quartz, translucent quartz, rose quartz or even hyaline quartz, also known as rock crystal and some very rare occurrences of smoky quartz. Despite of its residual representation we should mention the presence of other lithological resources, of exogenous nature to the local geological context, namely different types of chert. Other resources such as quartzite, despite their presence, its representativeness is practically null. This general panorama experiences some changes in the context of tool production where, although milky quartz continues to dominate, hyaline quartz and flint become more important, pointing an unequivocal management of the available raw material.

In UE-1, more than 13 600 objects were recovered, considering different technological categories. Concerning the retouched tools we should mention the microlithic character of this component since more than 65% were made through blades and microbladelets. Inside the microlithis group, geometrics dominate, more specifically segments, followed by trapezes. In the other class of retouched tools, burins, borers, becs and notches are most representative ones. In a technical perspective, the *chaines operatoires* recognized in industry of UE-1 seeking the attainment of two *debitage* products: flakes of a small module through the exploitation of expedite, bipolar and peripheral cores, and bladelets and micro bladelets from prismatic cores, especially of hyaline quartz, i.e. blanks for manufacture of the microlithic tools. The different raw materials mentioned above, are present in all the technological categories, even in the case of the exogenous resources. That means, for the case of chert, that the raw material have not reach the shelter completely conformed and that the acquisition of these resources was, probably, in the form of small nodules that, therefore, were knapped and shaped in the shelter. Only schist, quartzite and smoky quartz do not fulfill all the categories.

The UE-2 provided another huge set of lithic materials, exceeding 9 500 objects. In terms of abundance, debris are followed, like in the previous unit, by *debitage* products, then cores, fragments and nodules and finally, retouched tools (geometric and of common use). In the scope of application of raw material, the overview is quite identical of the UE-1. However, we must underline a slightly increase of chert, and a short decrease of hyaline quartz. In retouched tools, from UE-1 to UE-2, we can clear observe a greater importance now detained by flint in comparison to hyaline quartz and other types of quartz. The production system observed in this unit is identical to the one referred for the UE-1. The industry reflects a low level of transformation of the *debitage* products. The microlithic component is reinforced by a more representative number of microlithic tools compared with the macrolithic ones. In the case of geometrics, the segments group maintain the preponderance; while in the non-geometrics there is a decrease of points and the total absence of truncated tools. The technological categories are fullfilled with specimens of the different raw materials - milky quartz, translucent quartz, rosy quartz, grey quartz, hyaline quartz and flint. The exceptions are, over again, schist, quartzite and smoky quartz.

Through this brief presentation of the archaeological collection, we can conclude the existence of a strong resemblance between the UE-1 and UE-2 in their production systems and related *chaines operatoires.* Yet, there are some considerable differences in the material cultural domain present in UE-2 that should not be neglected, especially because of some chronological considerations that they can entail. In this regard, it need to be noted the recovery of polished stone tools and the appearance of a small set (about twenty fragments) of manual ceramic production. A first analysis and review of these shreds provide some parallels with Early Neolithic productions, for instance in the archaeological site of Prazo, in Foz Côa region [14].

3. Geological context

We pretend to attempt here a characterization of the geological features of the region surrounding the excavation, based on analyses of the available geological information and our

fieldwork. Our focus will be on quartz veins and pegmatites as these are the kind of geological bodies that might have quartz occurrences suitable for the archaeological tools found in the excavation.

The excavation is located at the NW corner of the 6-C (Cabeceiras de Basto) sheet of the 1:50 000 Portuguese Geological Map [15]. We will also analyze the information from the sheets immediately at the north [6-A/Montalegre; 16], west [5-D/Braga; 17] and northwest [5-B/Ponte da Barca; 18]. The geological sheets under consideration have dimensions around 20 km (X) and 32 km (Y) and hence the excavation local will be roughly at the centre of an area of 640 km^2 covered by these four sheets.

In the 6-C sheet there is a multitude of quartz veins associated with faults with N-S and NNW-SSE as dominant directions (as summarized in [19]) and some aplite-pegmatites occurrences in the proximity of the excavation local and in the rest of the sheet area. In the NE corner of the sheet (roughly around some 15 km from the excavation local) there is a multitude of aplite-pegmatites on metamorphic terrains of Silurian age (many of which were mined in the past). This same abundance of aplite-pegmatites on metamorphic terrains is also observed in the 6-A sheet where quartz veins are less abundant. In the 5-B sheet there are many occurrences of quartz veins and some aplite-pegmatites while in the 5-D sheet there are more occurrences of aplite-pegmatites than quartz veins (but in the eastern quarter of the sheet these two types occur with similar frequencies).

The report for the 5-B sheet [20] refers the presence of geodes with big crystals of quartz and an occurrence with hyaline, sometimes slightly rose, quartz in an old extraction site. It also mention previous publications that list among the minerals found in the nearby Gerês mountain range the presence of bipyramidal quartz, amethyst and smoky quartz, bluish quartz and rusty-yellow quartz, as well as chalcedony and "petrosilex" ("petroflint"), which might indicate geological samples instead of archaeological ones. Albuquerque [21] also presents a study of a set of quartz samples reportedly from the Gerês mountains (offered to the "Museu e Laboratório Mineralógico e Geológico da Universidade de Coimbra" in Portugal). In this set, smoky quartz was dominant with also some samples of hyaline and milky quartz. This publication also mentions the presence quartz with tourmaline inclusions. The presence of tourmaline associated with quartz has been reported in pegmatites near the excavation place [22; 23].

Another relevant study focused on the quartz (and feldspars) occurrences of mainland Portugal [24] refer the occasional presence in geodes of quartz veins of hyaline crystals (sometimes with a slight amethyst tinge) and the presence in pegmatites of milky, rose, grey and more rarely hyaline quartz.

Our fieldwork has shown that the frequencies of quartz varieties in the geological context is roughly similar to their abundance in the studied archaeological collection, in the sense that there are several occurrences of milky quartz while the other types are rarer or much rarer (as is the case of smoky quartz).

We have not found any onsite occurrence of chert but the presence of this raw material on the coastal beaches of northern Portugal has been reported to us (Prof. C. Leal Gomes, personal communication) and samples have been provided (also by Prof. C. Leal Gomes).

4. Final considerations

The archaeological collection collected in the Vale da Cerdeira 1 shelter is clearly dominated by the quartz variety (milky quartz) that occur in a multitude of locations in the area immediately surrounding the shelter and in many others places nearby, making the establishment of specific pinpoint sources for archaeological artifacts made from this variety of quartz unviable in practice. Nonetheless these observations are compatible with a dominant exploitation of local, nearby, resources. There are other quartz varieties that occur in minor amounts in the archaeological collection and that present scarcer occurrences in the geological context (hence making them potentially useful for assessing provenance discussions).

The occurrence of chert in this archaeological collection could be the most complex situation to tackle in terms of regional sources, given the almost absence of regional geological knowledge in relation to this raw material coupled with the diffuse potential existence of conditions for its genesis and the (so far) scarce findings of onsite occurrences. Given the almost certain exogenous nature of

these resources, their sources may be sought in others geological environments and formations, such as West Portuguese Meso-Cenozoic Border or Iberian Hercinian Massif that according to some works[25, e.g.] constituted the main sources of knappable siliceous rocks of prehistoric archaeological sites of Central and Northeast Portugal. In our case, to comprehend the provenance of these exotic raw material, can represent a major improvement to the work we're carrying on, allowing us theorize about long-distance networks of lithic interchange and social interaction between human groups.

Presently, as we have previously mentioned, we are conducting the complete techno-typological study of the lithic industry of UE-1 and UE-2. This procedure will permit the comprehension of the nature or functionality of the Rock Shelter 1 of Vale de Cerdeira and the process of lithic raw materials economy and management practiced by the prehistoric communities, in a key moment of human past: the transition between the last groups of hunter-gatherers and the first agro-pastoral communities of the Holocene period.

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