The use of quartz during the Late Upper Palaeolithic of Central Portugal

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1 - Introduction

Quartz has traditionally been regarded as a raw material of poor knapping quality. Indeed, the structure of this mineral determines the presence of cleavage planes which generate fractures and influence débitage [9,10]. However, he fact that quartz is naturally available in regions where there is no flint or silcrete resulted in its frequent exploitation by the Palaeolithic human communities that inhabited the Portuguese territory. An outstanding example is the preferential use of this raw material for the production of marginally backed bladelets during the Protosolutrean of Estremadura. During this period, archaeological sites situated less than 5km from good quality flint sources feature quartz percentages between 22% and 43% [1,16,17]. Moreover, at sites located in the Hercynian massif (Guadiana, Sabor and Côa river valleys), several different varieties of quartz constitute the most widely used lithic raw materials during the Upper Palaeolithic.

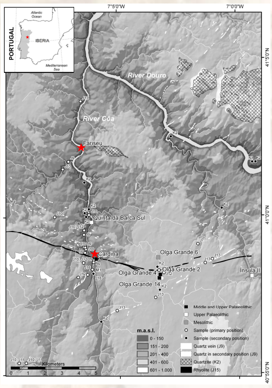

Fig. 1 – Côa Valley: Upper Palaeolithic and Mesolithic sites and local raw materials locations. Adapted from Aubry *et al.*, 2016a.

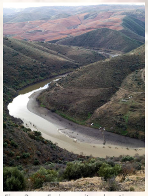
Fig. 2 – Fariseu site: location, overview and landscape. Photo by José Paulo Ruas.

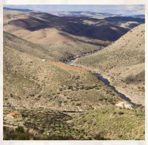
Fig. 3 – Cardina site: location, overview and landscape. Photo by Fundação Côa Parque.

Furthermore, at sites located in the Lusitanian basins (Estremadura and Algarve) and despite the availability of flint, quartz (along with quartzite) is always present in the Upper Palaeolithic lithic assemblages [16]. Considering the recurrent exploitation of quartz in different regions, its study is particularly relevant, enabling an inter-regional comparison that broadens our understanding of the cultural variability of Upper Palaeolithic communities. The present research focuses on comparative data on the use of quartz in the Côa Valley (Fariseu and Cardina) and the Vouga Valley (Vau and Rôdo) sites. We synthesize published data [3] on the Gravettian, Magdalenian and Azilian human occupations of the Côa Valley sites (Olga Grande 4, Olga Grande 14, Cardina, Ínsula II, Quinta da Barca Sul, Fariseu and Olga Grande 6), complemented with unpublished data from Cardina Z/A'-6-8 area. The excavation of this area took place between 2014 and 2018 and site location and stratigraphy were already presented [6].

In 2014, as part of the Ribeiradio-Ermida river dam archaeological mitigation works, the first sites featuring Upper Palaeolithic occupations in the Vouga Valley were identified and excavated: Vau, Rôdo and Bispeira 8 [13]. The study of the assemblages is still in progress, but the diagnostic elements of the lithic industry and radiocarbon dating confirm the human occupation of Vau during Middle Gravettian (SU005) and possibly during Final Magdalenian. Moreover, at Rôdo and Bispeira 8, the assemblages and datings are consistent with Final Magdalenian (SU006) and/or Azilian (SU003) occupations. The Pleistocene assemblage recovered at Bispeira 8 is rather small and only includes three quartz elements (a core and two flakes); thus it was not taken into account in this analysis.

2 - Material and methods

The first level of analysis of a technological approach, focusing on the *chaîne opératoire*, is the study of raw material procurement. The main objective of this type of approach is sourcing local, regional and supra-regional raw materials. During Upper Palaeolithic, in regions where flint was not available, quartz was the main source of siliceous raw material. It is available, in primary or sub-primary positions, in veins and beds embedded in granites and metamorphic rocks, and can be used in the form of angular fragments or crystals (euhedral). It can also be found, in secondary position, in continental detrital formations, in ancient alluvial deposits or in younger fluvial deposits. In this case, it can be exploited in the form of pebbles, just like quartzite [4,5,7].

The work carried out since the identification, in 1995, of the first human occupation contemporaneous with the Côa Valley Palaeolithic engravings resulted in the accumulation of data on raw material procurement and on the production and use of lithic artefacts [2]. As a result of the surveys carried out in this region, a number of different types of quartz could be sourced [3]. The method developed in the Côa Valley to identify local sources of quartz is based on the systematic description and comparison of geological and archaeological samples. The distinction between quartz types and available sources relies, for the time being, on macroscopic observation, but petrographic and geochemical analyses are in progress.

Concerning the Vouga Valley sites, the types of quartz characterized so far encompass more generic categories and although some surveys have already been conducted in order to identify raw material sources, there are still some doubts regarding the local availability of euhedral quartz [12].

Figure 7 shows the types of quartz, a short description and the codes used in the analysis of the Côa Valley materials; the same types are also referred to on the map in Figure 1. In order to enable comparisons between the two regions and to support a diachronic analysis we have chosen to merge all types into a generic category of quartz.

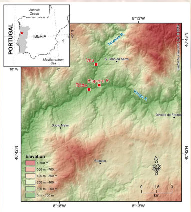

Fig. 4 – Vouga Valley: Upper Palaeolithic sites (Map by L. Dimuccio).


Fig. 5 – Vau site: location, overview and landscape. Photo by Arqueologia & Património.


Fig. 6 – Rôdo site: location, overview and landscape. Photo by Arqueologia & Património.

Code	Côa Valley	Vouga Valley
J8	Euhedral smoky quartz	Smoky quartz
J9	Anhedral milky and grey quartz	Vein and pebble quartz
J10	Anhedral translucent to clear quartz	
J11	Anhedral zoned translucent quartz	
J12	Anhedral grey zoned quartz	Grey quartz
J13	Euhedral translucent to clear quartz	Hyaline quartz
J14	Euhedral milky quartz	
J17	Anhedral smoky quartz	
J18	Anhedral pink quartz	

Fig. 7 – Quartz samples collected during the geological survey of the Côa Valley and their respective codes. For more information on raw material sourcing see Fig 1. For the time being, the quartz types pertaining to the Vouga Valley sites are more generic.

3 - Results

Côa river Valley

Cardina

Area Z/A'-6-8 was excavated between 2014 and 2018, and yielded 20 435 lithic pieces [6]. Throughout SU4 and the first four spits of SU5, most of the lithic materials are made on quartz and the proportion of this raw material ranges from 71% to 87%. A total of 184 retouched tools have been identified and, with the exception of SU4 spit 11, most of them (65%) are made on quartz. The most widely used type of quartz is J9: most of the tools (53) and cores (52) were made on this raw material. Regarding the strategies for the production of supports, until spit 9 of SU4 on-flake and prismatic cores there are the more abundant types (Fig. 10:1,2,3). The production of small flakes or chips through bipolar débitage on anvil is present throughout the whole sequence (Figure 8). A crystal showing one platform prepared by micro-facetage and a 45 degree angle illustrates a prepared but unexploited core (Figure 10:4).

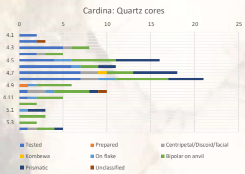

Fig 8 – Quartz cores from Cardina Z/A'-6-8 area according to débitage strategy and stratigraphy.

Fariseu

The lithic assemblage recovered from Fariseu SU4 over the course of three field seasons (1999, 2005 and 2007) totals 6 142 pieces [2,11,12]. Quartz represents 85% of the raw materials, reflecting a mainly local procurement strategy, as only 1.4% of the raw materials are allochthonous flint or other regionally available siliceous materials. Débitage was oriented towards flake and bladelet production. Most of the retouched tools' blanks are flakes (67.5%); bladelet tools represent 17% of the total. The analysis of the quartz cores showed the presence of nine tested and abandoned items (J9), 49 cores were used solely for flake production (mainly J9), seven bladelet cores and 17 cores for small flakes or bladelets. The four hyaline quartz bladelet cores (J8 and J13) feature a crystal as initial volume. In this case, débitage followed the natural facets of the crystal. A particular, unexploited crystal showing opposite percussion platforms prepared by micro-facetage and a 45 degree angle seemingly indicates that this would be the only preparation of these cores (Figure 10:5). Prismatic cores dominate the assemblage, but the use of cores-on-flake and bipolar débitage on anvil are also documented (Figure 10:7).

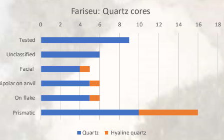

Fig. 9 - Quartz cores from Fariseu SU4 according to débitage strategy.

Vouga river Valley

Vau

Flint and silcretes were used to produce most of the pieces (51%) in the lithic assemblage recovered from Vau SU005. Quartz, in the form of pebbles, vein fragments or crystals is represented by 46% of the artefacts; it was used to produce flakes, bladelets and probably small chips. Broadly speaking, quartz pebbles were used for the production of flakes and only one was used for obtaining bladelets. Filonian quartz was mostly used to produce flakes (65% of the cores), but also bladelets and chips. Flake production can be described as expedient, since most cores are considered "Indeterminable" in terms of the type of strategy. The percussion planes are mostly cortical or the cleavage planes typical of this raw material. The analysis of the hyaline quartz industry provided evidence for the production of flakes, and small crystals were used for bladelet débitage. In these cases, only the percussion planes were prepared (at 45 degree angles) and the edges of the crystals were used to guide the extraction of the bladelets. Bipolar débitage on anvil or "splintered piece type" has also been performed on hyaline quartz.

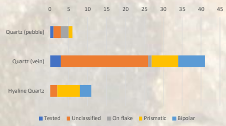

Fig. 11 - Quartz cores from Vau SU005 according to débitage strategy.

Rôdo

Quartz is the most widely used raw material (74% of the total in SU003 and 81% in SU006) in Rôdo. However, less then 25% of the tools were made on this raw material: scrapers, endscrapers and flakes with atypical retouch are the most common types. Most of the quartz used originates from vein fragments and natural dihedral surfaces were often used to start the débitage. This technical choice does not require a preparation of the cores. Some volumes seem to have only been tested and abandoned, probably due to the poor knapping quality of the raw material: diaclases which often originate hinge/step fractures. In addition to a deliberate production of flakes there was also a production of bladelet blanks. The identified bladelet production strategies are: bipolar débitage on anvil, débitage on flake edge and a pyramidal core, which reveals a rotating exploitation of the volume's entire surface. The use of the anvil method may also indicate an intention to produce small flakes. Hyaline quartz has mostly been used for the débitage of bladelet blanks.

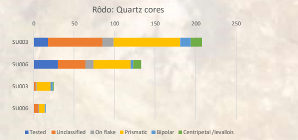

Fig. 12 - Quartz cores from Rôdo SU003 and SU006 according to débitage strategy.

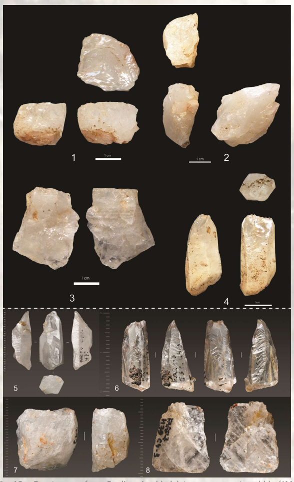

Fig. 10 – Quartz cores from Cardina: 1 – bladelet core on quartz pebble (J11), SU4.6; 2- bladelet core on quartz fragment (J10), frontal exploitation, SU5.4; 3 – bipolar on-anvil quartz core (J14), SU4.5; 4 – euhedral quartz (J13) with 45 degree platform preparation, SU4.3. Photos by C. Gameiro. Quartz cores from Fariseu SU4: 5 - euhedral quartz (J13) with 45 degree platform preparation; 6 – bladelet core on hyaline quartz (J13); 7 – bipolar on-anvil quartz core (J10); 8 – splintered piece on quartz (J11). Photos by J. P. Ruas.

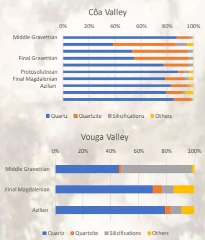

Fig. 14 – Comparing the percentage of use of the different raw materials from Middle Gravettian to Azilian in the Côa Valley and Vouga Valley archaeological sites.

Cultural attribution	Site / Layer (SU / site)	Total (N)	Quartz N	Quartz %	Quartzite N	Quartzite %	Fine grained Silicifications* N	Fine grained Silicifications* %	Others** N	Others** %
Vouga Valley										
Middle Gravettian	SU005 Vau	4 053	1 865	46	64	1	2 051	51	73	2
Final Magdalenian	SU003 Rôdo	21 343	14 970	74	1 459	5	1 765	11	3 144	10
Azilian	SU006 Rôdo	7 864	6 205	81	325	5	625	6	709	8
Côa Valley										
Middle Gravettian	SU3 Olga Grande 4	9 778	8 525	87	971	10	236	2	46	0,5
	SU3 Olga Grande 14	364	141	39	174	48	32	9	17	5
	SU4b Cardina	20 259	10 754	53	8 608	42	839	4	58	0,3
Final Gravettian	SU4.10 Cardina	2 8213	15 381	55	11 875	42	948	3	9	0,0
	SU2 Ínsula	1 267	978	77	242	19	45	4	2	0,2
Protosolutrean	SU2c Olga Grande 14	1 592	1 408	88	71	4	63	4	50	3
Final Magdalenian	SU4.2-4 Cardina	9 534	7 478	78	1 452	15	279	3	325	3
Azilian	SU4.1 Cardina	2 145	1 770	83	284	13	44	2	47	2
	SU3 Quinta da Barca	996	790	79	118	12	77	8	11	1
	SU4 Fariseu	6 142	5 221	85	830	14	84	1,4	7	0,1

Table 1 – Inventory by raw material from the main Côa Valley and Vouga Valley Upper Palaeolithic occupations. *Includes flint, silcrete and hydrothermal silicifications
** Includes raw materials classified as amphibolite, micro-gabbro, lydite and rhyolite.

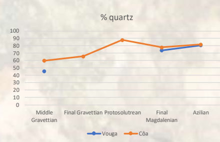

Fig. 15 – Comparing the average percentage of quartz use during the different Upper Palaeolithic phases.

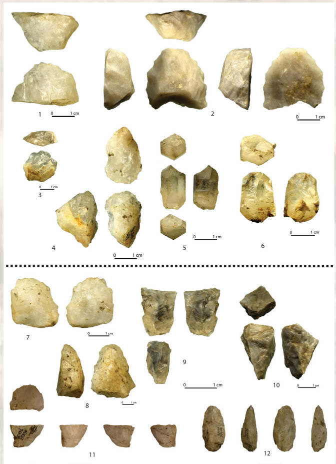

Fig. 13 – Quartz cores from Vau SU005: 1 – core on flake / endscraper; 2 – core on flake / endscraper; 3 – core for small flake production; 4 – core-on-flake for bladelet production / endscraper. Quartz cores from Vau SU003: 5 - euhedral quartz with 45 degree platform preparation; 6 – tested and abandoned euhedral quartz. Quartz cores from Rôdo SU006: 7 - splintered piece on quartz; 8 – core for small flakes. Quartz cores from Rôdo SU003: 9 – bipolar on-anvil core; 10 – core-on-flake for bladelet production, abandoned due to the existence of hinges; 11 – prismatic bladelet core; 12 - prismatic bladelet core. Photos by Carmen Manzano & Rui Oliveira/ Arqueologia & Património.

4 - Discussion and conclusion

Apart from Vau's Middle Gravettian occupations (SU005), where the percentage of quartz does not exceed 46%, and Olga Grande 14 (SU3), where quartz represents 39% of a small lithic assemblage, the remaining Upper Palaeolithic assemblages are mostly composed of various types of quartz, both in the Côa Valley and the Vouga Valley (Table 1). Most of the quartz varieties used at the Côa Valley sites are available in veins or slope deposits in the vicinity of the sites [3]. However, other regionally available raw materials (20-40km) are always used as well, attesting to the knowledge of the regional lithological environment [5]. The available data seem to indicate a decrease in the percentage of flint, silcrete and hydrothermal silicifications from Final Magdalenian/Azilian onwards, in both regions [4].

The lithic assemblages recovered from the Rôdo and Vau (Vouga) and Cardina and Fariseu (Côa) archaeological sites feature both free-hand/not supported and bipolar/supported on-anvil quartz cores. Bipolar débitage on anvil, for the production of small flakes or chips, was used in these two regions since the Gravettian [8,14] and can still be found in Magdalenian and Azilian assemblages [11]. This strategy has been interpreted as an attempt at improving the profitability of raw materials; its use over a long period of time does not allow it to be used as a chronological indicator. The use of hyaline quartz crystals for the production of bladelet blanks, taking advantage of the natural planes of the crystals, has been observed in these two regions. The transformation of blanks, however, is still unclear because the available data only support comparisons between tools on flake, since the quartz armatures recovered at the Vouga sites are quite rare. There is, however, enough information to compare and identify, in these archaeological sites located in two different regions, the same conceptual scheme inherent to the *chaîne opératoire* applied to the different types of quartz.

In the Côa Valley, the use of the same types of flint, silcrete and hydrothermal silicifications available in the Spanish Meseta and Portuguese Estremadura is documented between Gravettian and Tardiglaciar. Most of these raw materials have also been identified at the Palaeolithic sites of the Vouga Valley, a region situated halfway between the Côa Valley and the flint sources of Estremadura [4, 12, 13]. By interpreting the Palaeolithic rock art sites of the Côa Valley as a place of aggregation [15], one can envisage the mobility of human groups between these two regions, more than 150km apart, enabling the exchange of lithic raw materials from various sources and the diffusion of know-how concerning the production of lithic artefacts.

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