THE GATHERING, STOCKING AND KNAPPING OF FLINT DURING THE CHALCOLITHIC AT CASAL BARRIL (PORTUGAL)

Ana Catarina SOUSA and Victor A. GONÇALVES

Abstract
Casal Barril, a Chalcolithic site near Ericeira (Portuguese Estremadura), was discovered in 2006 during the construction of the A21 motorway. All data seem to indicate that Casal Barril was almost contemporaneous with the establishment of the first copper metallurgical communities in the region (Beta-260629: 2860-2490; Beta-260628: 2630-2470 both Cal BC 2 sigma). However, it is impossible to know by radiocarbon dating if its flint sources were exploited in earlier times. Casal Barril belongs to a network of flint exploitations, debitage sites and movement at the regional and even larger scale.

Keywords
Portuguese Chalcolithic. Flint extraction. 3rd Millennium BCE.

1. A PRELIMINARY APPROACH… FROM RANDOM FIND TO FIRST CASE STUDY

The Casal Barril site was discovered in March 2006 during the archaeological supervision of the construction of the A21 motorway (Malveira – Mafra – Ericeira). Archaeological excavations took place between the 4th and 20th May of that same year. ‘Mine-type’ or ‘flint workshop’ sites are often discovered during large infrastructure projects, such as the making of motorways. Indeed, the great majority of Neolithic mines known to date were discovered during such projects. For example, the Casa Montero site in Spain was identified during the construction of the M50 motorway (Consuegra et al., 2004), and the Neolithic mine of Ri in northwestern France was discovered during the course of work on the A88 motorway. On a more regional level, the only primary context known for the extraction of flint, the Campolide site in Lisbon, was identified during the construction of a railway in 1888 (Choffat 1907).

The archaeological work carried out at Casal Barril has supplied a large body of information concerning the extraction, deposition and circulation of flint in the Portuguese Estremadura region during the 3rd millennium. Studies in this area are still ongoing. A preliminary inventory of the materials recovered has been made, and a typological and technological study of the assemblage will take place in the near future. No palaeobotanical nor geoarchaeological study of the site has yet been undertaken. The geological characterisation of the site and of its raw materials (i.e., those used by the inhabitants of contemporaneous settlements) will form one of the basic stages in the characterisation of the strategies used to procure mineral resources at Casal Barril and in the surrounding area. This present presentation is, therefore, of a preliminary nature. An exhaustive monograph is planned for the future.

2. THE DATA UNDER STUDY

2.1. Location of the site

Casal Barril is situated near the town of Ericeira, in Mafra County, in the District of Lisbon (UTM coordinates 29S 464977E 4313948; military geographic coordinates 38°58'13.173"N, 09°24'15.938"W). The site lies in a valley with an absolute altitude of 60m, on the right bank of the Ribeira da Fonte Boa, a small stream that flows into the sea at Praia do Matadouro. The site lies in Cretaceous strata (orbitolinid limestone), a substrate found along the main watercourses of the region (Ribeira da Fonte Boa, Ribeira de Cheleiros to the south, and Ribeira do Cuco to the north). This rocky substrate occurs in association with patches of Cenomanian rocks and the deposition areas of ancient beaches. Pleistocene fluvial terraces are also visible. The
presence of these Pleistocene patches led some researchers (Ferreira 1984) to propose, somewhat indiscriminately, a Palaeolithic chronology for this area.

2.2. Stratigraphic contexts

The stratigraphic interpretation of the site is strongly affected by changes caused by the extraction of soil. Before the building of the motorway, the area was profoundly affected by vine cultivation, although the valley was left relatively intact. During work on the motorway, the valley where the site is located was subjected to the removal of some of its uppermost sediments. Areas of these sediments were selected for excavation work.

Although systematic surface surveying and archaeological supervision of the motorway construction work was carried out over a 50m-wide area, no other evidence of flint exploitation was identified. Nevertheless, other archaeological remains abound in the area, some of which were also investigated during the course of the above construction work. In the valley where the site lies, numerous limestone outcrops of the lapias type were identified, while above, limestone banks abound.

In section, the Casal Barril flint deposit shows continuity beyond the area of the motorway. Thus, it is plausible that the site may extend beyond the valley, a possibility that can only be checked with extensive excavation work; no other surface traces are visible. The archaeological remains of Casal Barril were therefore found in a restricted area. An excavation grid of approximately 20 square meters was set up where the archaeological deposits were found, with efforts concentrated on an area of around 9 square meters. The flint material of the deposit was surrounded by limestone outcrops of the lapias type. Given the nature of the site, the small size of the area and the large amount of materials present, an excavation by artificial units within natural layers was adopted. This involved 12 artificial units and the making of both photographic and graphic records (scale 1:10). All the materials found were registered according to their stratigraphic unit, layer and grid reference.

As mentioned above, the removal of the upper strata at the site by mechanical means has hindered a complete knowledge of its stratigraphy being gained. However, a pit with a very irregular profile (US 7) has been identified with a maximum depth of 1.22m and a width of 2 x 2m at the top. This pit was filled with a sediment of a very dark colour (Munsell, 10YR 5/3, brown) abounding in charcoals (US 4). At the base of the pit a clay sediment of a near orange colour (Munsell 10YR 5/6, yellowish brown) (US 2) was seen. The latter sedimentary deposits differ in terms of the materials they incorporate. In US 4, besides the abundant evidence of lithic industry, a few ceramic shards, a shell (Glycimeris sp.) and the tooth of a mammal were recovered, while in US 2 more boulders of un-worked raw material are seen, as well as a large number of pebbles. Archaeological materials were found exclusively in these two units, both deposited over a marly layer (US 6).

2.3. Material culture and functional specialisation of the site

The classification and study of Casal Barril is ongoing. Although the area excavated was small, an assemblage of some 67,000 lithic pieces was recovered. All were organised in a preliminary fashion and quantified by sample. Area K.6 (see photograph in Figure 11) was selected for detailed study and was found to contain 7,274 items, of which 6,456 were of flint (Figure 1). Besides lithic material, occasional artefacts and ecofacts were registered, although these corresponded to a mere 0.04% of the total. Casal Barril is therefore a highly specialised site, focused on the exploitation, storage and debitage of flint.

2.3.1. Raw materials

The specialisation of the site is clearly demonstrated by the almost dominant presence of flint, corresponding largely to a single type. Only a few examples of exogenous flint have been found. The local flint has a brown colour, and shows a number of inclusions no doubt responsible for the fractures identified. Two types of raw material nodule are found: flint rognons, with a fine cortex layer, and large flint boulders, with a thicker cortex and a number of inclusions.

Quartzite is also present in the form of pebbles. The great majority have not been knapped: of the 310 items recovered only three are flakes, one being the remains of knapping and one a nucleus. Thus, the numerous pebbles found seem to be in their primary context.

Figure 1. Raw materials. Area K.6
2.3.2. Preliminary reconstitution of the flint working process

Since the recovered assemblage was so voluminous, counts was made at the level of working process (Figure 2):

1. Nodules of raw-material composed of unprocessed boulders.

2. Nuclei of different stages, according to different debitage schemes (prismatic and centripetal).

3. Debitage by-products (flakes predominate but some elongated products, blades and bladelets are also present).

4. Tools: retouched blades and scrapers, and denticulated and retouched tools (tools for general use).

5. Residual materials resulting from debitage.

6. Flint fragments showing natural (non-anthropic) fractures (unworked raw material, rejected material).

In absolute terms, flint fragments that might correspond to fractured raw-materials predominate. Residual materials make up the second largest group, followed by the products (mostly flakes). In numerical terms, nodules represent 1.5% of the total, although by relative weight they in fact correspond to just 0.05% (Figure 3). The least numerous group consists of nuclei; these must have been the main product circulated.

With respect to the vertical distribution of the various types of flint materials, two main concentrations were noted, in layers 2 and 10, possibly representing several, short episodes of deposition. The nodules were concentrated at the base of the stratigraphy, especially the larger ones.

<table>
<thead>
<tr>
<th>LAYER</th>
<th>NODULES</th>
<th>NUCLEI</th>
<th>PRODUCTS</th>
<th>TOOLS</th>
<th>DEBRIS</th>
<th>FRAGMENTS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N°</td>
<td>%</td>
<td>N°</td>
<td>%</td>
<td>N°</td>
<td>%</td>
<td>N°</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1%</td>
<td>7</td>
<td>18%</td>
<td>32</td>
<td>7%</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>16%</td>
<td>7</td>
<td>18%</td>
<td>162</td>
<td>38%</td>
<td>13</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>20%</td>
<td>7</td>
<td>18%</td>
<td>83</td>
<td>19%</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>4%</td>
<td>0</td>
<td>0%</td>
<td>27</td>
<td>6%</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>6%</td>
<td>8</td>
<td>21%</td>
<td>59</td>
<td>14%</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>10%</td>
<td>4</td>
<td>11%</td>
<td>32</td>
<td>7%</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0%</td>
<td>3</td>
<td>8%</td>
<td>7</td>
<td>2%</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1%</td>
<td>1</td>
<td>3%</td>
<td>10</td>
<td>2%</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>7%</td>
<td>0</td>
<td>0%</td>
<td>7</td>
<td>2%</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>17</td>
<td>18%</td>
<td>0</td>
<td>0%</td>
<td>6</td>
<td>1%</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
<td>16%</td>
<td>1</td>
<td>3%</td>
<td>5</td>
<td>1%</td>
<td>2</td>
</tr>
<tr>
<td>94</td>
<td>100%</td>
<td>38</td>
<td>100%</td>
<td>430</td>
<td>100%</td>
<td>48</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 3. Flint materials in K.6 – (# 6456)
The distribution of the materials by stratigraphic unit also presents certain peculiarities. US 2 included 4,501 items (73%) and US 4 1,656 (27%). US.4 has a pit that shows intense signs of combustion, and has a larger number of debitage products and tools than US 2. In contrast, US 2 has a larger number of flint cores and nodules (Figure 4).

2.3.3. Equipment carried by knappers

Besides evidence of knapping at the site, other evidence regarding the communities that exploited the flint at Casal Barril has been found. Ceramic shards (three plain rims) and a polished stone axe of sub-rectangular section have been recovered. Except for a polished stone axe and three quartzite pounders, little evidence of the heavy tools used

<table>
<thead>
<tr>
<th>Lab Reference</th>
<th>Sample</th>
<th>Context</th>
<th>$\Delta^{13}$C (0/00)</th>
<th>Radiocarbon date (BP)</th>
<th>Cal BC (1σ)</th>
<th>Cal BC (2σ)</th>
</tr>
</thead>
</table>

Figure 5. Radiocarbon dates – Casal Barril.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Distance (m) Measured from Casal Barril</th>
<th>Early Chalcolithic</th>
<th>Middle Chalcolithic</th>
<th>Late Chalcolithic (Beaker)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinta dos Loureiros</td>
<td>578</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Casal Cordeiro 5</td>
<td>936</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Casal Romeirão</td>
<td>2098</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Mil Regos</td>
<td>1780</td>
<td>●?</td>
<td>●?</td>
<td>○</td>
</tr>
</tbody>
</table>

● present / ○ absent

Figure 6. Settlements around Casal Barril.
in the exploitation of the flint has been found. A few artefacts of exogenous flint, bladelets and retouched flakes have also been found.

Alongside these artefacts, 18 charcoal samples were recovered, although these have not been analysed anthracologically. US 4 shows signs of combustion, including the presence of charcoal, coloured sediment and (sometimes) the presence of thermoclasts. However, there is no sign of any thermal treatment of the local flint material; such evidence has only been found for artefacts made from exogenous flint.

Faunal remains are practically absent, except for a shell of the *Glycimeris sp.* and the tooth of a mammal.

2.4. Absolute chronology

Radiocarbon dating was performed on charcoal from level 2 (Beta-260629) and level 4 (Beta-260628). Since the other 16 samples come from the same levels, their analysis was deemed unnecessary. Figure 5 shows results obtained:

Although differences are seen in terms of the upper date interval, these are not statistically significant, implying rapid sedimentation at the site.

3. FLINT EXTRACTION, KNAPPING AND DISTRIBUTION: PRELIMINARY INTERPRETATIONS

3.1. Casal Barril and local Chalcolithic settlements

Casal Barril is situated in a suburban area where traces of Neolithic and Chalcolithic occupation have only recently been discovered. The area has thick sediments covering the 4th and 3rd millennia BCE, and the type of land use (urban areas alternating with areas of dense vegetation cover) reveals surface surveying difficult. The settlements recently identified in the area correspond entirely to random findings made during the course of motorway construction.

To date, four settlements have been identified in the area surrounding Casal Barril (Figure 6).

An element common to all four is their strategy of implantation; all are open settlements without any type of defence, and all are situated at the top of inter-fluvial areas that lie on Cretaceous limestone substrata. Their chronologies also imply a certain unity. Except for Mil Regos, the material culture allows no clear culture classification to be made, although Beaker ceramics are found at all these sites.

Only Casal Cordeiro 5 has been subjected to archaeological excavation (Sousa 2008), and it can be clearly designated as a permanent Chalcolithic settlement. Its stratigraphy is well preserved and three areas of occupation can be distinguished. Domestic structures with floors and hearths have been identified in two places. The absolute dates for Casal Cordeiro 5 have been obtained exclusively from shell samples; the bone samples analysed contained no collagen. The finding of other organic materials (charcoal and mammalian remains) suggests better radiocarbon analyses could be made in the near future. Leaving aside certain reservations regarding the interpretation of dates, comparisons of data supplied by the material culture place Casal Cordeiro 5 in the same chronological spectrum as Casal Barril.

Although Casal Cordeiro 5 is very close to Casal Barril, very little evidence of lithic industry was found there. Therefore, the knappers seem not to have used Casal Cordeiro 5 for the collection of flint, even though flint was available at this site.

As for the majority of Chalcolithic settlements in the Portuguese region of Estremadura, few remains survive of the early stages of the flint processing operation: nodules, preparation tools and unworked raw materials are in the minority while tools predominate. Macroscopic observations reveal that a diversity of flint types were used, although it is difficult to find any parallels with flint from Casal Barril. Lithographic studies of the various contemporary assemblages at Casal Barril are planned, especially of the fortified settlement of Penedo do Lexim about 12km away.

3.2. Provisioning, knapping and circulation of flint within and beyond the region of Estremadura

Cretaceous and Jurassic formations make up the geological substrate of Estremadura, the region where Casal Barril is located. Veins of flint abound in these formations. The quantity, accessibility, variety and quality of this flint is unparalleled in Portugal (Forenbaher 1999, 31). Estremadura has been long referred to as the main source of flint on a ‘national level’; the abundance of sources of flint contrasts with a notable lack in the surrounding regions (especially the Alentejo region). Extra-regional routes of exchange therefore grew up around Estremaduran flint, which was exchanged for amphibolite from the northern part of the Alentejo region, and for copper from the southwest Iberian pyrite belt.

Although this theoretical model of extra-regional exchange appears in much of the literature referring to the Neolithic and Chalcolithic of Estremadura, the archaeological basis for it is very limited. No systematic geo-archaeological surveying of the areas of procurement has been performed, and excavations are needed to characterise the specialised sites (mines or workshops) along with work to characterise the lithic industries of Estremadura and the Alentejo.

In southern Portugal, the only mine-type of flint exploitation is that seen at Campolide, where galleries for flint extraction were identified at the end of the 19th century (Choffat 1907). The latter, very old publication makes the
Figure 7. 1 and 2: The location and Chalcolithic entourage of Casal Barril, near Ericeira (Mafra, Portugal).
Figure 8. 1: the site when discovered, before excavation; 2: flint nodules; 3: layer 4; 4: the pit and the bedrock after the excavations.
Figure 9. no legend, just Fig. 4, all the text elements are in the figure.
Figure 10. 1: scraper CBR-457; 2, 3: bladelets CBR 301, 417; 4: denticulated CBR-345; 5: flake CBR-435; 6: nucleus CBR-297.
Figure 11. 1: flint nodule CBR-523, probably crushed for quality inspection; 2: nucleus CBR-456; 3: scraper CBR-457.
Figure 12. 1, 2, 3: used polished stone axe CBR-397; 4: ceramic shard CBR-520.
curious statement: ‘pourquoi les hommes néolithiques de Campolide exploitaient-ils le silex par galeries souterraines, ce qui, à cette époque, présentait des difficultés incomparablement plus grands qu’actuellement?’ (Choffat 1907, 341). A clear functional model for the exploitation of these flint mines is yet to be proposed.

The other known contexts are open sites; usually these have been characterised only by surface surveying and collection. Among these, Barotas (Cardoso and Costa 1992) and Monte do Castelo (Cardoso and Norton 1997-1998), in the area of influence of the fortified settlement of Liceia, deserve special mention. The mapping of the surface at Pedreira do Carrascal took place in the 19th century, adjacent to the dolmens of Belas (Ribeiro 1880), while the Santana site in Lisbon was mapped in the early 20th century (Forenbaher 1999). Recently, surface sites have also been identified at Cortegaça (Sousa 1998) and Pedreira do Aires (Andrade and Cardoso 2004).

Of all the flint exploitation sites known in Estremadura, the results of only two excavations have been published: Olival do Passal (Zilhão 1995) and Casas de Baixo (Zilhão 1994; Forenbaher 1999). Both are situated in the area of the Rio Maior, one of the main sources of flint raw material in the northern region of Estremadura, although these sites were discovered during the course of a research project on the Upper Palaeolithic and were initially classified as being of Solutrean chronology. Although the area excavated was restricted (Casas de Baixo – 3.5 square meters, Olival do Passal – 5 trenches), the information retrieved is of importance in understanding the strategies of flint exploitation, knapping and circulation in Estremadura. These sites specialised in the first stages of debitage of leaf-shaped products, widely represented in the lithic industry of the end of the 4th and all of the 3rd millennium BCE. As at Casal Barril, Casas de Baixo is also home to an irregular pit with a depth of 1.14m (Forenbaher 1999, 49).

The only absolute date available for flint production contexts in Estremadura is that obtained for Casas de Baixo. However, it would seem to be too old when compared to the dates attributed to the large leaf-shaped products at Liceia (Soares and Cardoso 1995). Thus, Casas de Baixo cannot be associated with Casal Barril with any certainty, although in typological terms they seem to be contemporaneous. The exploitation strategy followed at the two sites, however, are clearly distinct. While Casas de Baixo is dominated by the early stages of the work process required to make leaf-shaped products, at Casal Barril the initial stages of debitage predominate, with the preparation of cores. The lithic industries of contemporaneous settlements, such as at Casal Cordeiro 5, seem to show the debitage process followed during the 3rd millennium BCE was complex. This process was not entirely undertaken within settlements. Rather, leaf-shape pre-forms, cores and probably blades entered circulation for finishing in other places.

3.3. Mine, workshop or stocking place? The functional characterisation of Casal Barril

The interpretation of Casal Barril is ongoing with geoarchaeological and technological studies of the site still to be performed. The lack of similar sites and the limited number of lithic assemblages in contemporaneous contexts make the interpretation of the data obtained difficult.

In Estremadura, a region that abounds in flints, mines with shafts and galleries for flint extraction are unknown. This unexplained situation finds parallels in other regions, such as at Grand-Pressigny (Villes 2004, 312), where flint knapping and circulation was also important. Further research is required, although the pits identified at Casal Barril and Casas de Baixo may represent forms of systematic exploitation of flint outcrops occurring close to the surface. At least in terms of pit filling, one might interpret Casal Barril in a manner similar to Casa Montero, (Consuegra et al., 2004, 134), where the excavated pit was gradually filled with knapping remains and rejected flint boulders. However, at Casal Barril the concentration of lithic materials is not found at the base of the pit.

Faced with such an abundance of lithic materials, and a location at the bottom of a valley, it might be that the flint extraction site associated with Casal Barril was located in an adjacent area. A similar situation may have existed at the La Venta flint mine, where two areas of exploitation have been identified at a distance of 200m from one another. The slopes of these areas have been designated “workshop areas” (Ramos Millán 1995).

The analysis of the lithic industry of settlements contemporaneous with Casal Barril seems to indicate that several types of flint were in circulation in Estremadura, each originating from distinct supply areas. The data available for the lithic industry of Estremadura in the 3rd millennium BCE suggests the existence of parallel chains of production for leaf-shaped products and elongated products (blades).

Casal Barril belongs, therefore, to a network of exploitation, debitage and circulation of flint, with yet-to-be-identified intensification and diffusion routes transcending the domestic scale of exploitation. Only from a standpoint of stratigraphic contexts, with absolute chronologies in place, and by comparing data with lithic assemblages from domestic and funerary contexts, can further progress be made.

Finally, this work would be incomplete without some words on the absolute chronology of Casal Barril. The dates proposed so far (see Figure 5) confirm one another. Rapid sedimentation at the site might imply an uninterrupted sequence of use, or two successive phases close together in time. The first interpretation is suggested by level 2 (Camada 2), which has more pebbles and nodules of raw-material and rather fewer artefacts. The second is suggested by level 4 (Camada 4), the contents of which fill the pit in
US 7, which has the highest percentage of artefacts, including ceramics. However, in both contexts the same type of flint was used. The absolute chronology of the settlements in the region is important in connecting their activities. For Penedo do Lexim, 12km from Casal Barril, three dates very similar to that obtained for Casal Barril have been suggested: Beta-186854 (2,866-2,482 cal BC 2 sigma), Beta-175775 (2,862-2,489 cal BC 2 sigma), Beta-175774 (2,870-2,498 cal BC 2 sigma) (see Gonçalves and Sousa 2006, 242). Further, one of the dates obtained for Casal Cordeiro 5, located just 936m from Casal Barril, falls into the same period: Sac-2159, 2883-2614 cal BC 2 sigma (Sousa 2008). In fact, all the available data seem to indicate that Casal Barril was almost contemporaneous with the establishment of the first metallurgical communities in the region. It is impossible to know, however, whether its flint was used in earlier times. The present work highlights the complexity of the flint industry in the 3rd millennium BCE in Estremadura and southern Portugal.

Acknowledgements

The authors thank Álvaro de Figueiredo and Adrian Burton for their help with the English version of the manuscript.

References


Ramos-Millán, A. 1997. La Venta. A prehistoric flint mine in a tribal society (Iberian Southeast). In Schild, R.; Sul-