ANALYSES OF CÔA VALLEY PETROGLYPHS

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Abstract. This paper presents the results of a recent attempt to extract dating and other information from the petroglyphs at the three major rock art sites in the Côa valley, Portugal. The principal methods used were microerosion analysis and internal analysis. The results show that several traditions have contributed to the corpus, that many motifs were treated or retouched repeatedly, and that weathering and microerosion states offered opportunities for creating a relative chronological framework. Attempts to achieve microerosion dating were hampered by poor suitability of the schistose facies and the lack of reliable calibration, but the oldest anthropic markings detected at the sites examined are being attributed to the mid-Holocene. Most of the figures, however, are significantly more recent, and the motifs exhibiting the most typical Palaeolithic stylistic features are generally less than 3000 years old. This is confirmed by the observation that some of them were made with metal tools.

Introduction

This report focuses on the core elements of my brief research work in the Côa valley of northern Portugal. It relates to an assignment to provide scientific dating information about the petroglyphs in the valley, especially through microerosion analysis (Bednarik 1992a). This method quantifies specific indices of the geometry of fractured or truncated crystals of a modified rock surface. Another purpose was a preliminary application of what is known as 'internal analysis', a method pioneered by Alexander Marshack (e.g. 1972: 147-68, 1986, 1989) and developed by Francesco d'Errico (1985, 1991, 1994) and myself (1984, 1991, 1992b). This form of analysis uses microscopy, experimental replication and empirical observation to examine production aspects of anthropic surface markings, seeking to establish, for instance, the type of tools used and their direction of application.

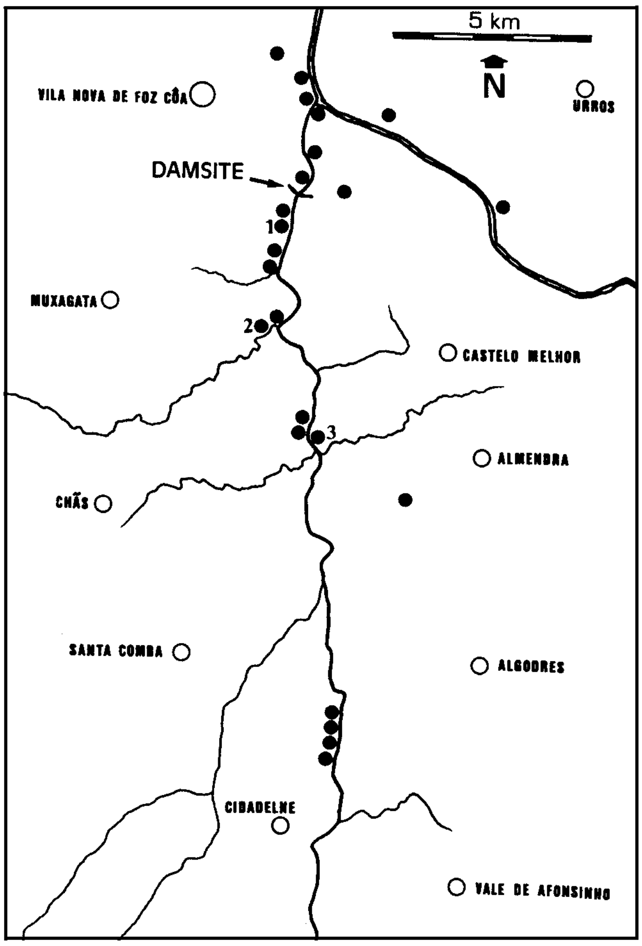

__Figure 1.__ Villages and known rock art sites in the lower Côa region, Portugal. The numbered sites are (1) Canada do Inferno, (2) Ribeira dos Piscos, and (3) Penascosa.

Penascosa

Penascosa was the first site I examined in detail, scanning panels 6 and 3 microscopically and examining another three panels superficially. The site is located above a Holocene alluvial terrace on the right bank of the Côa (Figure 1). Petroglyphs occur at elevations from the uppermost level of the river terrace to several metres above it. At the lowest level, fluvial wear of the rock is amply evident, as well as significant differences in kinetic damage on angular boulder edges depending on whether they are on the upstream or downstream end. This is consistent with the high-energy environment of the rapid downcutting of this young valley which was formed during the Quaternary (Daveau 1973; Ferreira 1978; Zilhão et al. 1997). The lower exposures at Penascosa are still subjected to occasional inundation but there is no obvious or macroscopic fluvial wear visible on the lowest petroglyphs. In general, the local rock facies exhibit characteristics of low-grade metamorphosis, with hydrous minerals such as chlorite, micas and amphiboles.

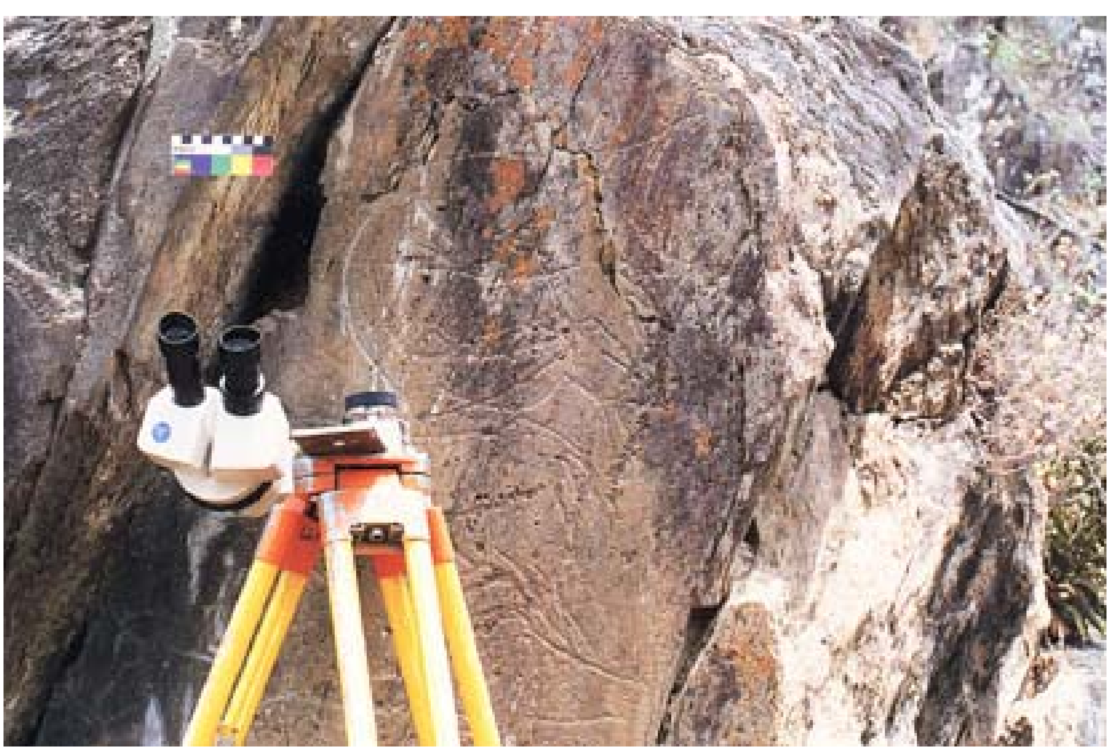

__Figure 2.__ Penascosa, Côa valley, northern Portugal, panel 3. Microerosion analysis in progress.

Panel 3 consists of a vertically arranged array of animal figures which are mostly abraded (Figure 2). The rock exposure has been truncated on the right, where remains of much more weathered pecked figures are found. The level of microerosion observed in the recent engravings and the much older peckings differs greatly. The micro-relief in the accretion-free peckings on the panel's lower right, measured between the quartz-fortified residual structures and the deepest erosion pits, ranges up to about 500 µm. In the abraded marks that are free of accretionary deposits, the micro-relief ranges from 5 to 10 µm in the least altered surfaces, to 30 or 40 µm in the most eroded. There can be no question that the pecked figures on Panel 3, lower part, are several times as old as the abraded figures on the same panel.

The abraded figures have been attributed to the Upper Palaeolithic on the basis of their style and on the perceived iconographic determination of subject matter. The earliest pecked figures exhibit no stylistic characteristics one could reasonably define as Palaeolithic, they resemble more recent, 'schematic' rock art traditions of western Europe. This renders the stylistic age determinations completely unacceptable. If the abraded designs were of the Upper Palaeolithic, the pecked designs would have to be several times as old.

In the upper part of the left-hand margin of this panel, there is a deep recess in the rock which has been artificially enlarged. This is indicated by about ten curved gouge marks. From the shape and arrangement of these marks it is clear that they involved considerable physical force, and the use of a metal tool, a pointed and elongate instrument. A large quartz vein runs through panel 6, high up the slope, which appears to be a much older exposure (Figure 3). According to its microerosion data it became exposed to either precipitation or vadose water flow around 30,000 years ago.

Figure 3. *Canada do Inferno, panel 1, microerosion analysis of very early stylized quadruped figure.*

Canada do Inferno

At Canada do Inferno, I examined six panels of rock art, as the remaining thirteen were under water at the time. Among them, only Panel 1 was scanned microscopically, plus one of the dated inscriptions on panel 7. The rock at Canada do Inferno is more metamorphosed than that of Penascosa, with recrystallization more advanced in the feldspar (plagioclase, especially albite) and quartz components, and chlorite possibly having been replaced by pyroxenes. There are discrete zones of silica, and nodal muscovite and biotite formations. The local facies is slightly harder and more reflective. Thalli of two lichen species occur in cleavage spaces, which contain also calcite and silica precipitates, as well as cemented quartz grains of 200-300 µm which may be a residue of an early fluvial sedimentation event. What remains of the site is now located just above the water line, but the panels extend to almost 40 m up the side of a steep slope.

Panel 1 consists of an upper concentration of animal figures resembling that on Panel 3 at Penascosa, about 80 cm high (Figure 3). The figures are either pecked and abraded or, especially in the panel's lower part, only pecked. The relief in the floor of the lowest accretion-free peck marks is maximal 500-600 µm. Below is a single pecked animal figure by itself, partly eroded and heavily weathered. The figure was first sketched with a bundle of shallow incisions, mostly 10-20 µm deep but locally deeper and made with the point of a stone tool. This initial outline was then pecked, but the two treatments may well have occurred at about the same time. The micro-topography of the floors of all peck marks seems uniformly eroded, similar to the peck marks above.

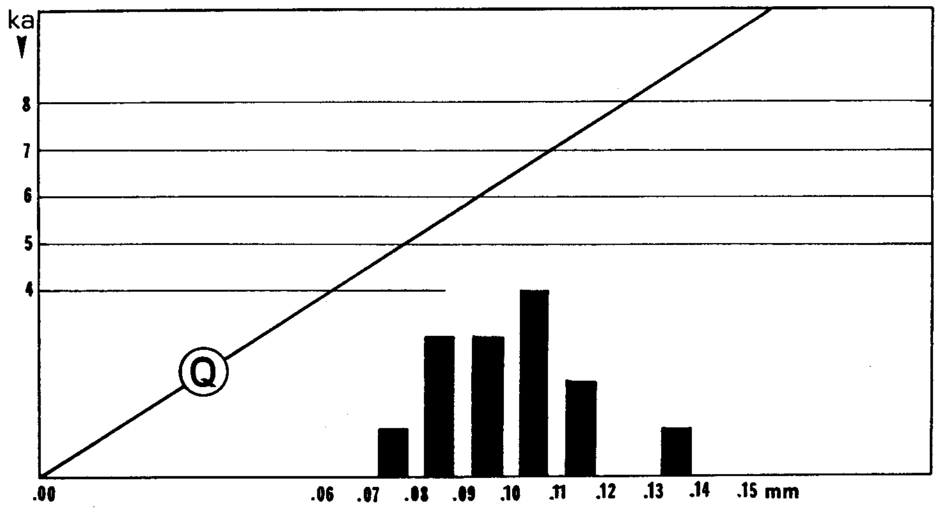

Figure 4. *Canada do Inferno, panel 1, microerosion analysis of very early quadruped figure. In this combination of two graphs, the histogram represents the values of 14 wane widths on quartz. They are experimentally projected onto the Lake Onega calibration curve for quartz.*

Scanning of much of the outline of this figure succeeded in locating three separate, minute bodies of crystalline silica. Fourteen micro-wane width determinations were made on them, summarized here (Figure 4). They are *experimentally* placed into the Lake Onega calibration curve (Bednarik 1993), which does not provide us with a true age of the motif but does offer a fairly reliable indication of magnitude of age for this figure. It has been confirmed, however, by another quartz calibration curve, from a petroglyph site near Grosio, Valtellina, Italy (Bednarik 1999), and in 1998 I secured a quartz calibration curve from two Roman bridges and a Roman inscription at Panóias, just north of Vila Real. This curve was secured from granite surfaces of known ages, and it lays to rest the valid objection that, originally, no calibration curve was available from the region. The Vila Real curve is very similar to that of Grosio, which has also been used in microerosion analyses elsewhere, especially at five sites in Bolivia (Bednarik 2000). It confirms the initial estimates from the Côa valley. Accordingly, this motif is between 4200 and 8200 years old, with the highest probability at about 6200 years BP. This figure is among the oldest I have seen in the three sites examined, and while the age estimate is probably correct, it must not be taken out of its experimental context. For a more secure age estimation, a microerosion calibration curve for at least two minerals would need to be developed for the Côa region. This is possible in view of the numerous ancient and dated structures in the area, and will be undertaken in the future.

Panel 3 at Canada do Inferno consists only of shallow incisions and these were made with stone tools. 'Internal analysis' shows this conclusively, through the occurrence of 'parasitic striations' and the impressions of multiple-point marks, often correlated with micro-topographical features of the surface. Further up the steep slope, perhaps 30 m above the present water level, are panels No. 13, 14 and 15, their main features being two 'bulls' and two 'horses'.

Ribeira dos Piscos

This site is located in a side valley and consists of only two decorated rock panels. Both are just above a shallow alluvial deposit next to the creek bed. The rock is of similar composition and crystallization state as at Canada do Inferno, comparatively hard, but lacks the distinctive mineral zones found there, especially the silica. Muscovite is the dominant mica, often occurring in nodules of randomly orientated crystals, but similar biotite formations are also present. The floor of accretion-free peck marks on panel 1 has only superficial corrosion, with a relief depth of only 10-20 µm. Perpendicularly diffuse pits have a relief of up to 100-120 µm but solution of these features was facilitated by diffuse percussion fractures dating from the pecking treatment which rendered the fabric more solution susceptible. In general, the peck marks of the figure range from 0.9-1.7 mm in depth (Figure 5).

Figure 5. *Ribeiro dos Piscos, panel 1.*

Panel 2 is a recent exposure, very well preserved, mechanically sound and of minimal weathering. The perfectly flat low outcrop bears numerous shallow incisions but no peck marks. A large number of line markings include an anthropomorph, a bovid and a 'horse'. The cross-section of lines is consistently narrow and often distinctly U-shaped and flat-bottomed. Their widths are as low as 150-200 µm. They are entirely free of 'parasitic' markings, of duplication marks and even of changes in cross-section where they negotiate curves. All of this categorically excludes the possibility that they were made with stone tools. Among the metal tools that could have been used, bronze and iron are not very convincing possibilities because of the fairly crystalline rock's relative hardness. It is most likely that all these marks were made with steel implements, and some of them involved the use of a tool point of uniform cross-section.

Discussion

There is a consistency in the sequence of treatment at all three Côa sites examined. Shallow incisions arranged as bundles of lines were followed by percussion treatment producing distinctive peck marks. The shallow incisions appear to have been made with stone tools, but this is not easy to establish in many cases because they survive only as remnants. The pecking treatment was then followed by abrasion with a stone tool, which in some cases was probably quartz, in others it was a much softer material. Finally, we have shallow incisions that were made with metal tools. Microerosional evidence invariably supports the chronological sequence, and generally adds time depth to this framework by quantifying it relatively.

The majority of figures I have examined in detail, including those clearly made with metal tools, have been attributed to the Upper Palaeolithic period generally, and sometimes to the Solutrean specifically (Bahn 1995a, 1995b, 1995c; Clottes 1995). There are numerous problems with this designation, related to palaeoclimate, topography, geomorphology (Bednarik 1994, 1995a, 1995b), and even to style itself (Baptista 1983). The pattern of repeated treatment as well as the treatment by pecking are both not typical for Palaeolithic art of secure attribution. The so-called signs in Palaeolithic art are lacking completely. Palaeolithic-like, supposedly naturalistic animal outlines made in much more recent periods are by no means uncommon and can be found from Siberia to Norway (Bednarik 1995a, 1995d).

Other objections to a Palaeolithic antiquity of the Côa art include the sites' proximity to the Serra da Estrela glaciers during the Last Glacial Maximum (LGM) and the periglacial conditions that were so widespread in Portugal (Daveau 1973), the location of some of the art close to the level of the river, the lack of patination or weathering, the lack of depictions of species extinct in the late Holocene, the lack of the most common of Palaeolithic motifs (the so-called signs), the dissection of many lichen thalli by engraved grooves, the presence of engraved dates (18th century) and Christian symbols which are often more weathered than the 'Palaeolithic' motifs, the known weathering retreat rates of schist (1-10 mm/1000 years for chlorite schist), the unsuitability of the LGM environment for the species supposedly depicted (Bicho 1994), and the rejection of stylistic dating in modern rock art science generally (Bednarik 1990-91; Lorblanchet and Bahn 1993). Recent developments in France have shown conclusively that most stylistic dating pronouncements in Palaeolithic art have been fundamentally false, and the traditional stylistic sequences of Breuil, Jordá, Laming-Emperaire, Leroi-Gourhan and all other commentators need to be rejected (Bahn and Vertut 1988: 60-67; Lorblanchet 1994; Clottes et al. 1995; Bednarik 1990-91, 1995b, 1995c, 1995d, 1995e).

However, the most decisive objections to the stylistic dating of the Côa rock art are more direct, and they are:

1. The animal figures or compositions that have been regarded as being most typically Palaeolithic are generally among the most recent phase of rock art production. The older phases consist mostly of peckings that have never been re-worked, and that show the most advanced state of erosion. This contradicts stylistic dating totally and irreconcilably.
2. Some of the figures that have been attributed to the Palaeolithic were made with metal tools, presumably steel implements.
3. The attempts to determine the actual age of some figures have not produced results of great precision, they established only an order of magnitude. However, even this is sufficiently decisive to categorically exclude a Pleistocene age: among the figures I have seen, none can be of such age, and it is quite certain that all the specific petroglyphs that were labelled Palaeolithic are in fact under 2000 or 3000 years old.
4. The dating results of Alan Watchman (1995) and Ronald Dorn were acquired without any knowledge of mine, and vice versa. Yet all results are in full agreement concerning the approximate age and sequence of the Côa petroglyphs.

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