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The Côa petroglyphs: an obituary to the stylistic dating of Palaeolithic rock-art

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The Côa petroglyphs, seen in the established framework of rock-art studies, belong in the corpus of west European parietal art of late Pleistocene age, as found in scores of caves and some open-air locations. One of the four researchers who this summer studied the age of the figures using 'modern rock-art science' summarizes the group's conclusions, and states how they kill off the stylistic dating of Palaeolithic rock-art.

Introduction

The difficulty archaeologists may have with new scientific methodology is that archaeology has always been conducted as a basically unfalsifiable framework of knowledge-claims (Tangri 1989) based on inductive uniformitarianism (Cameron 1993), but one in which extensive use was made of falsifiable knowledge-claims imported from various other disciplines. This culture of knowledge in archaeology has facilitated the preservation of many false models, ardently defended by protagonists who rely on the perceived lack of refutability of such models (Bednarik 1986; 1995a): 'Archaeology is what the most powerful practitioners, usually professors, say it is' (Lewis-Williams 1993: 49). Whenever a new scientific method becomes available to test some of these models, it threatens to discredit sections of the archaeological community and their entrenched positions. This was the case in 1953 when the Piltdown hoax was examined by new methods. The similar process seen at the present time in Portugal has very major implications elsewhere.

The introduction of scientific dating of rock-art has been a somewhat painful process for archaeology in various parts of the world. In France and Spain, direct dating methodology remained ignored for a decade after it had been introduced elsewhere, until it was suddenly and enthusiastically accepted by a few senior scholars in France in 1990, leading to a flurry of dating activity. In Portugal, direct dating has just been introduced.

Dating the Côa valley petroglyphs

During the 'discovery' of the Côa valley petroglyphs and the subsequent controversy over their proposed flooding (Bahn 1995a; 1995b; Bednarik 1994a; 1995b; 1995c), most of the rock-art has been attributed to the Upper Palaeolithic period on the basis of its style. This initial pronouncement has been unanimously supported by all specialists of European Pleistocene art (e.g. Bahn 1995a; 1995b; 1995c; Clottes 1995a; and numerous media commentaries), except the present author (Bednarik 1994a; 1995b). The consensus opinion is that

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the rock-art is of the Solutrean, and roughly about 20,000 years old.

This estimate derives from stylistic or iconographic beliefs: animal figures were identified as depicting aurochs, horse, ibex and deer, and their styles judged wholly Palaeolithic. Until May 1995, not one of the known open-air Palaeolithic art sites across the Iberian peninsula and to the French Pyrenees, including Mazouco, Siega Verde, Domingo García, Santa Maria La Real de Nieva, Bernardos, Ortigosa, Carbonera Mayor, Piedras Blancas, Fornols-Haut and now the Côa complex, had been subject to scientific dating or any other credible analytic work. Some motifs have been disfigured or vandalized by the archaeologists 'recording' them which may prejudice their dating potential.

Since modern rock-art science accepts neither dating by style (Bednarik 1990/91; Lorblanchet & Bahn 1993), nor the belief of archaeologists in their ability to identify objects depicted in rock-art (Bednarik 1991), the archaeological dating of all these sites must be questioned (Bednarik 1995b). In response to a recommendation by Unesco to conduct scientific research in the Côa valley, the Portuguese government instructed the site manager, Electricidade de Portugal, to arrange a series of blind tests to establish the antiquity of the rock-art. After consulting Dr Jean Clottes, Unesco's principal adviser on rock-art, the Portuguese authorities asked three rock-art dating scientists to participate in this unique experiment: Professor Ron Dorn (USA), Dr Alan Watchman (Canada) and the author (Australia). Dorn subsequently suggested that a colleague, Dr Fred Phillips (USA), also be involved. Each participant was asked to refrain from communicating with his colleagues as well as with the media for the duration of the experiment, to ensure that none of the dating scientists could in any way influence the findings of the others. In this way it seemed possible not only to acquire independent assessments, but also to test the various methods used by the participants. No rock-art dating project has ever been conducted under such rigorous guidelines; indeed, archaeological dating of Palaeolithic rock-art is traditionally arrived at by informal consensus among influential practitioners.

Each of the four participants was taken to the main sites separately, where they worked for durations ranging from three or four days to a few weeks, depending on the requirements of the respective methods. In early July 1995, the results of these studies were submitted to the government of Portugal, and the communication embargo was lifted later that month. The results are briefly summarized.

Results of the studies

Watchman

Watchman sampled and analysed thin mineral accretions formed on some of the petroglyphs, and similar deposits on undecorated rock panels (Watchman 1995a). The radiocarbon content of the carbonaceous matter detected in the samples was determined by accelerator mass spectrometry (AMS). Watchman's primary dates range from over 2000 to almost 7000 years, but dates from engraved marks were greater than those of adjacent unengraved surfaces. Moreover, a date of approximately 6500 years BP was secured from a similar accretion on a 100-year-old railway quarry face near where the Côa flows into the Douro. On investigating the source of the contamination, Watchman detected graphite at the base of the more recent of two distinctive accretionary strata. Graphite occurs as a natural accessory mineral in a very thin weathering rind between an older skin of grey to white amorphous silica, and a younger deposit of silty, brown silica accretions. After the contamination was discounted, the petroglyph dates became younger than those from the deposit truncated by the engraving marks, and they agreed with superimposition sequences. Also, when the thicknesses and corrected estimated ages of the silica deposits are plotted with the known age of the railway quarry face they fit a growth curve obtained from similar Australian silica accretions.

By securing dates from both the older silica skin, which is truncated by the petroglyphs and thus pre-dates them, and from the silty brown skin that covers some petroglyphs, Watchman attempted to secure maximum as well as minimum dates for the rock-art (Watchman 1995b). His analysis of the nanostratigraphy of the accretionary deposits and the dates he secured from deposits older and younger than the rock-art provide reliable age estimates for the petroglyphs. He established that the older deposit pre-dates 1700 b.p., and that petroglyphs considered to be of typical Palaeolithic style seem to be consistently more recent than this

date. His corrected radiocarbon dates suggest that some of the 'Palaeolithic' images may have been engraved only last century. Watchman attributes the change in the silica's composition 1700 years ago to the environmental impact of intensive cultivation on the steep hill slopes above the sites.

In order to test claims that a large alluvial terrace at Penascosa, one of the 15 rock-art sites currently known along the Côa river, is a Pleistocene feature, Watchman conducted luminescence dating of that site's sediment. A preliminary optical date of 4000–6000 BP was obtained from feldspar grains collected 2·5 m below the surface of this deposit, confirming geological opinion that it is a Holocene terrace.

Dorn and Phillips

Dorn also sought to secure AMS radiocarbon dates from the sparse accretionary deposits found on some of the petroglyphs. He sampled five animal figures and reported a total of 10 dates from these, which range from about 2000 years to over 5000 years (*cf.* Appendix 2 of Dorn's report). These agree very well with Watchman's primary results, considering that he did not always sample the same art panels or figures as Watchman. However, Dorn did not, apparently, detect the graphite contamination and thus failed to correct his primary dates. It is believed that Dorn also attempted cation-ratio analysis, but no details are known by the writer.

Phillips sought to establish exposure ages of the rock panels by analysing cosmogenic radiation products, through the concentrations of Chlorine-36. His detailed results have not yet become available, but he has reported that one exposure age is only 3000 years. This confirms Watchman's and the writer's suspicion that the rock exposures themselves are often only a few millennia old.

Bednarik

The writer quantified superimposition sequences relatively through the weathering of accretion-free marks, and used micro-erosion analysis (Bednarik 1992) to estimate the age of the earliest component. In addition, he introduced 'internal analysis' as pioneered by Marshack (e.g. 1986) to study production aspects of selected petroglyphs. The work was conducted under the supervision of, and after consultation with, officers of the Portugûes do Património Arquitectónico e Arqueológico, the state's archaeological authority.

It is clear from Bednarik's study that all the stylistically Palaeolithic figures belong to the dominant, most recent tradition of the petroglyphs. There are older traditions present, including a very small component of significantly older figures. The oldest located on the three main sites (Canada do Inferno, Ribeira dos Piscos, Penascosa) provided a provisional micro-erosion date of about E6500±2000 BP (Bednarik in press a). This age estimate, from an unidentifiable schematic quadruped image at Canada do Inferno, is only tentative as no micro-erosion calibration curves are available for Portugal. At least two calibration curves, for different component minerals, are required for a valid micro-erosion dating result. Due to the low recrystallization state of most of the Côa metamorphic facies, only a minimal number of valid wane-width determinations (14) could be secured. The quartz calibration curve from Lake Onega was used merely to acquire an approximate age estimate, which should not be cited without reference to this experimental context.

The few early figures on the Côa are entirely schematic rather than 'naturalistic', deeply weathered, and they have been pecked, a treatment rarely found in Palaeolithic rock-art. They bear not the slightest resemblance to 'Palaeolithic styles' observed in the cave sites of Europe. More recent figures were pecked (after being outlined in shallow incision) and then abraded, while the most recent, Palaeolithic-style images are often only abraded. Relative micro-erosion indices demonstrate unambiguously that the earliest component of this sequence of art traditions is many times as old as the most recent. The erosion relief in the least weathered, accretion-free figures is only 5–10 μm (microns), while it reaches 600 μm in the most weathered (on identically orientated panels). This micro-erosion relief was found to be a useful variable on schist, a rock providing a comparatively poor medium for micro-wane width determination. The relief is measured between the usually quartz-fortified residual structures on the floor of peck or abrasion marks, and the deepest alveolar erosion pits formed on that floor. This variable corresponded consistently with superimposition sequence, relative degree of weathering and relative thickness of silica accretions where

they occurred on the same motif. Although not providing a reliable indicator of relative age, it does confirm the great range of ages represented by the petroglyph sequence.

Microscopic analysis of shallow incisions has provided information about production details, such as tool type, direction of application and repeated use of the same implement. Some engravings were found to have been made with stone artefacts, others with pointed metal objects. Among the former, two types were distinguished: pointed engraving implements of a material harder than the schist rock, and blunt abrasion tools of similar hardness to the rock. Engraved marks made with metal points lack 'parasitic marks' and maintain a uniform cross-section even around narrow curves and at changes of direction. However, the tool material used in the deeply abraded motifs could not be established satisfactorily, and the use of replicative experiments is recommended to clarify this aspect of petroglyph production (Bednarik in press a).

Comparison of the study results

In view of the diversity of the study methods (endeavouring, respectively, to secure minimum, maximum or actual ages), the consistencies in the principal findings are significant. All reports stressed that the Palaeolithic-style engravings were certainly under 3000 years old. The primary radiocarbon dates of Watchman and Dorn represented the same range, but Watchman had detected the graphite contamination and his corrected results are no doubt more valid than Dorn's higher values. The very different approach of micro-erosion analysis not only confirms these findings, it also poses the greatest challenge to the archaeologists favouring a Palaeolithic age. Since the supposedly Palaeolithic element of this assemblage, the 'naturalistic' animal images (which account for up to 90% of the entire figurative corpus), unequivocally and consistently constitute the most recent component, the question arises: if they were of the Solutrean, as has been suggested, *to what period would we have to attribute the earliest Côa figures* — bearing in mind that they are many times as old?

Opposition to the scientific results

Portuguese archaeologists publicly denounced any dating results that might differ from their stylistic beliefs even before any of the Côa results became known. Yet they have since failed to provide any coherent explanation for why several blind tests, using a variety of methods, all produced identical results: that the rock-art cannot possibly be of the Pleistocene, and that most of it is of the last few millennia.

The only substantive argument mooted against the micro-erosion age estimate has been that an invalid calibration curve had been used. This procedure was clearly and prominently qualified in the initial report. However, since examining the Côa sites, the writer has had the opportunity of determining a quartz calibration curve for Valtellina (northern Italy) which soundly confirms the reliability of the Russian curve. This does not necessarily reinforce the Côa dating attempt, but it implies that environmental variables may not be as effective in the case of quartz micro-erosion as had been implied.

None of the (unpublished) objections raised against the radiometric and other results are worth considering here: they reflect only ignorance about the data or the methods, and particularly about what direct dating of rock-art is. It should be emphasized that these results do not constitute absolute datings of the rock-art in question: they need to be seen in the context of the considerable qualifications that inevitably apply to such data. They must not be interpreted without persistent recourse to these considerations (for recent review see Bednarik in press b). The Côa dating results merely provide refutable dating information, and cannot even collectively amount to an irrefutable dating of the rock-art. They do, however, explain the presence at the Côa sites of petroglyph traditions that are many times as old as the one attributed to the Solutrean.

There should be nothing surprising about the scientific dating findings from the Côa valley. Animal figures of 'naturalistic' appearance occur in many rock-art traditions across Eurasia. They are found in regions excluding the possibility of a Pleistocene age (Scandinavia; e.g. at Böla, Norway), they were made with metal tools (e.g. in Siberia; Bednarik 1995b), and they have been safely dated to the Holocene on portable plaques (Beltran 1992). Even in the Iberian peninsula, this stylistic argument has been rehearsed before, in relation to the Levantine shelter art which was first attributed to the Gravettian/Solutrean, later to the

Mesolithic, and is now regarded as Neolithic (Ripoll 1977; Hernández *et al.* 1988). The known open-air rock-art sites of the peninsula include not one credible depiction of an animal species that was extinct in the Holocene. The Côa sites feature none of the so-called 'signs' that are the most common motifs in Palaeolithic rock-art. The bovids and ovicaprines at the Côa sites resemble breeds of cattle and goats more than Pleistocene species. Even if aurochs, horse and deer *were* depicted, they would be incompatible with the periglacial conditions of the region's Solutrean Glacial Maximum (Straus 1991), which is thought to have resulted in tundra on the planation surfaces surrounding the Côa valley (Bicho 1994). Exposures of the sites' schistose facies with their distinctive laminar structure could not survive periglacial conditions (which extended to the present coast), with the glaciers of the Serra da Estrela barely 30 km away (for the region's geomorphology, palaeoclimate and palaeontology, see Bednarik in press a). Not surprisingly, no Palaeolithic, Epipalaeolithic or even Mesolithic occupation sites are known anywhere in northern Portugal, the nearest such sites being about 175 km from the Côa sites (Póvoas *et al.* 1992). The Côa rock-art is thus totally devoid of any pre-Neolithic archaeological context. The same applies at Mazouco (Jorge *et al.* 1981), a near-by site whose Palaeolithic attribution was rejected by Baptista (1983: 63) even before the Côa art was reported. He had found a horse figure similar to that at Mazouco only a few kilometres from the nearest Côa sites, at the Iron Age site of Vale da Casa. Baptista explicitly invalidated the stylistic dating of Mazouco but it continues to be cited in recent literature. His rejection also applies to the equally similar horse figures on the Côa.

The archaeological, stylistic dating of the Côa petroglyphs (as well as those at Siega Verde, near by in Spain; Balbin *et al.* 1991) is even more absurd in relation to their topographical context. Most are located barely above river level, some are still covered by flood waters regularly. The lowest slopes of the distinctly V-shaped, geologically young Côa valley and the angular boulders on the valley floor bear extensive kinetic damage from fluvial action, yet there is no such wear on the lowest petroglyphs. While the few archaic pecked figures are deeply weathered, the stylistically Palaeolithic motifs bear little or no patination. In the presence of water, their metamorphic rock substrate is highly susceptible to re-equilibration reactions, e.g. reversal of component minerals to hydrous states. All of these factors exclude a great age even before quantifiable dating methods are introduced.

Implications for stylistic dating

Stylistic dating of rock-art, on which the 'cultural' attribution of most supposedly Pleistocene rock-art sites of Europe hinges, is based on the beliefs of some practitioners that they possess the ability to detect stylistic characteristics in a corpus of rock-art they are very familiar with. The precise criteria for this ability, why it should exist at all, and how the criteria could be expressed in a testable form remains entirely unclear (*cf.* Conkey & Hastorf 1990). Most of the 300 sites concerned are undated; we have some circumstantial dating evidence from a few, and more solid evidence from fewer still. Credible direct dating involves only a few individual pictures, not whole sites, and has only become available recently. It is therefore not apparent how any perceived stylistic entity — assuming that it could really be identified by archaeologists — could have been given a realistic age tag in past decades.

The various grand stylistic schemes of Palaeolithic art chronology are all contradictory, and none can be reconciled with the evidence as it currently stands. The entire model of Leroi-Gourhan (1971) becomes impossible to maintain as a result of the dating of just one site, Grotte Chauvet. His model of four fundamental styles involves increasing complexity and sophistication with time, culminating in the Middle and Upper Magdalenian. Chauvet, perhaps the artistically and cognitively most complex of all Palaeolithic art sites, was initially assigned a stylistic age of 17,000–21,000 years (Clottes 1995b) rather than a Magdalenian antiquity. With the revelation that this ultrasophisticated art, or at least a good part of it, is well in excess of 30,000 years old (Clottes *et al.* 1995), all existing models of stylistic development in the Palaeolithic period have become entirely redundant (having been contradicted already by dating results at several other sites). Indeed, the impact of this discovery has been that French specialists have begun conceding that elaborate art was probably created long

before the Aurignacian. This had long been obvious to those who had subscribed to a taphonomic model of Pleistocene art. That model (Bednarik 1986; 1994b) rejects the concepts of both an endemic cave-art and of art beginning with the Aurignacian — the two main pillars of conventional archaeological wisdom about art origins.

The dating of the Côa petroglyphs has serious implications beyond the realization that sub-phases or individual art traditions of the Upper Palaeolithic cannot be identified by subjective decision, nor correlated on that basis with the agreed technological taxonomy of that period. The archaeological tendency of forcing the square pegs of cultural traditions into the round holes of technological ones is itself absurd. Surely it ought to be the other way round: cultural traditions should be identified first (through palaeo-art) and the corresponding technological assemblages then organized accordingly. But the Côa data even question the ability of specialists to determine whether a figure or an art body is stylistically Palaeolithic. Without this aura of authority, many archaeological pronouncements about this famous corpus of rock-art become meaningless.

When seen in its proper context of the current revolution in archaeology, there is nothing surprising about the Côa fiasco. The juggernaut of archaeology is now coming to grief in many areas. The staunchly defended division between the Middle and Upper Palaeolithic now appears as meaningless as the definition of the Neolithic. With Neanderthal remains apparently found together with Aurignacian tools, and cultural practices continuing across this all-important division (Bednarik 1995a), another durable myth is collapsing. With *Homo erectus* apparently having used seaworthy watercraft to cross Wallace's barrier 700,000 years ago to reach Flores (Maringer & Verhoeven 1970; Sondaar *et al.* 1994), and subsequently perhaps even Celebes and Timor, the arguments about whether Neanderthals had language become irrelevant. Acheulian people made extensive use of haematite, collected exotic objects and produced petroglyphs hundreds of millennia ago (Bednarik 1994c), and it is becoming increasingly obvious that Europe was of peripheral importance in the cognitive evolution of hominids. This is of course the precise opposite of orthodox archaeological dogma. Most of what the textbooks say on these and other topics is being turned inside out. Through all of these momentous changes, taphonomic logic and metamorphology (Bednarik 1994b; 1995d) are looming on the distant horizon, promising us a science instead of an archaeology.

Notes. The full technical reports about the Côa dating work by A. Watchman and R.G. Bednarik will appear in *Rock Art Research* 12(2). The author thanks Electricidade de Portugal for meeting his transport and equipment costs, and for hospitality during his work in Portugal.

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