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THE DISCRIMINATION OF ROCK MARKINGS

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Abstract. In an effort to illustrate the difficulties of reliably discriminating between petroglyphs and a variety of other types of rock markings which may resemble them, a range of such rock markings are considered. Their characteristics, occurrence and identification are discussed, and a dozen basic types of rock markings are defined, most of which have been described as rock art on occasion. Misidentification of rock paintings, too, is briefly considered. The author attempts to identify the reasons for such misidentifications by considering the basis of ambiguity in perception, and the inadequate resolution of such matters by empiricism.

Introduction

Rock art students have so far neglected to define how rock art is discriminated from other, often very similar markings on rock surfaces, and this has prompted numerous misidentifications: archaeologists have interpreted rock art and other palaeoart as natural markings, while natural or utilitarian markings have been described as rock art or portable art in even more instances. This problem has dogged the discipline since its beginnings, and so far no remedy has been offered for it. The present paper is one of a series of five articles addressing the general subject. The first dealt with natural markings in limestone caves (Bednarik 1991a), the second with linear surface markings on Palaeolithic ivory, bone and ostrich eggshell objects (Bednarik 1992a), and the third with the widespread wall markings of the cave bear of Europe (Bednarik 1993a). The final paper in this series will address the most controversial aspect, the discrimination of surface markings on portable objects of the Pleistocene.

Intentional non-utilitarian anthropic marks (rock art) account for less than one millionth of all rock markings on this planet (as we shall see), and yet they are apparently the only ones considered by researchers. Thousands of scholarly books and tens of thousands of scientific articles deal with them, while other rock markings have never been scientifically examined in any comprehensive form, in any language; we have almost no scientific literature on them. This state of affairs offers an example to illustrate that what we so carelessly call science is an anthropocentric pursuit, totally self-centred and thus scientifically almost irrelevant. If science were the balanced approach to the natural phenomena it purports to be we should have countless publications on non-anthropic rock markings. That we possess almost none shows that our 'science' is no more than a caricature of what it professes to be.

A scientific definition of rock art is that it consists of rock markings which are detectable by 'normal' human sensory faculties, i.e. vision and touch, which were produced intentionally by members of the genus *Homo*, and which are concept-mediated externalisations of a conscious awareness of some form of perceived reality. This means, among other things, that rock markings not usually detectable by humans (for instance, arrangements of crystals of anisotropically discrete properties, or any configurations of magnetic, chemical or petrographic properties) would not be rock art (even though they may well be perceptible to an interstellar visitor who might use totally different sensory faculties). Similarly, the types of scratch marks cave bears produced to communicate with other cave bears (Bednarik 1988, 1993a), although readily detectable by humans and apparently even possessing semiotic properties, are not rock art — even if they may resemble it very closely. This definition negates all humanistically derived definitions of rock art, which involve culture, intentionality, communication, intellect, picture making, and similarly *sapiens*-centric notions, which are neither the preserves of humans, nor are they very helpful in analysing the subjects addressed with them.

That petroglyphs are detectable by our tactile sense seems incidental, and rock art is clearly aimed at the visual sense. Hence it is particularly relevant to consider what renders rock art visible. For primates, visibility derives from contrast through colour difference, or from contrast through relief. In the second case, visibility is attributable to a combination of depth perception and colour variations due to shadow. The detection of selectively reflected wavelengths of light ('colour vision') is attributable to the rod cells and cone cells of the eye's retina. The rod cells contain light-sensitive rhodopsin (retinal and the protein opsin, whose reaction to light generates an impulse in the optic nerve) and are arranged in discs at right angles to the light entering through the lens. They are mainly responsible for detecting low intensity light, and in humans there are three types that respond to specific spectra of wavelengths. This means that all react to white, which is composed of all wavelengths. The cone cells are more sensitive to details of an image, and they contain pigments that make each cell sensitive to one of the basic three colours.

Visual properties of rock art are, however, shared by a great variety of other phenomena. Many types of rock markings are readily detectable by the human eye, and some resemble rock art closely. To discriminate between those markings which the rock art student wishes to consider and those that are very similar to them can be difficult. It is the purpose of this paper to address these difficulties,

and this is attempted by describing and defining all types of humanly perceivable rock markings that could possibly resemble rock art. But before addressing the discrimination of rock markings it is advisable to consider what might render their misidentification possible.

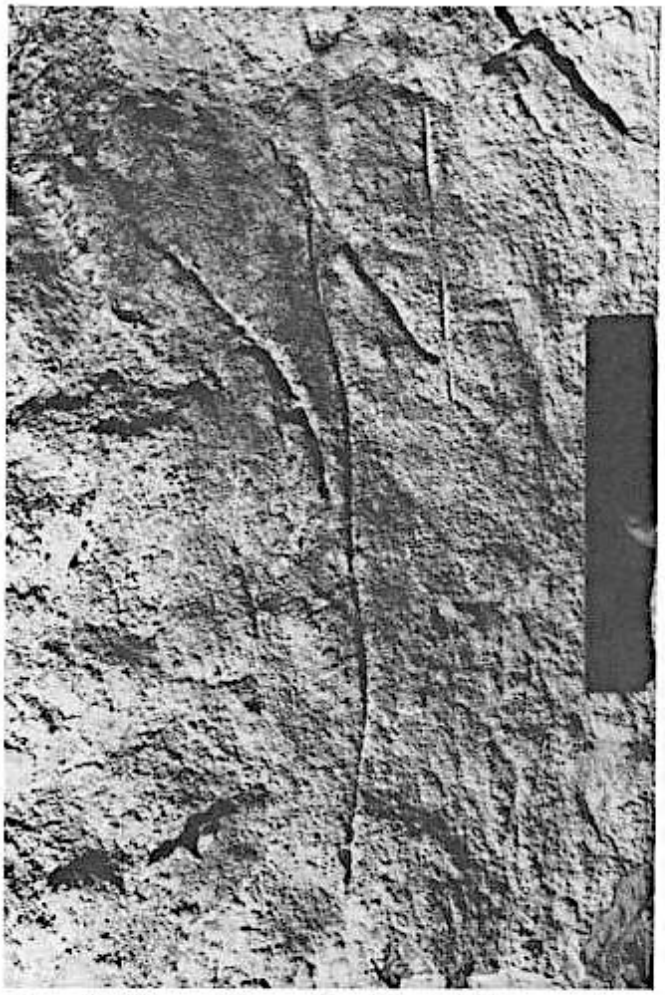

Figure 1. This marking on the ceiling of Robertson Cave, South Australia, measures about 22 cm. Most observers would identify it as an engraving, particularly as it has been said in Australian archaeological literature that animal species do not mark cave ceilings. This marking was in fact produced by an extinct megafaunal species (almost certainly by Thylacoleo carnifex*).*

If a rock marking by one species, such as the cave bear, can be misinterpreted by specialists (e.g. archaeologists) of a second species as belonging to itself, then it must be very similar to what the human observers expect of a human marking (Figure 1). It would be interesting to know whether cave bears would be susceptible to the reverse misidentification. Visual ambiguity is a fascinating, multifaceted subject for rock art students which has been inadequately explored (but cf. Davis 1986). One of the reasons for the example just mentioned (cave bear scratches have often been misinterpreted as Palaeolithic engravings) is that the two species, *Homo sapiens sapiens* and *Ursus spelaeus* Rosenmüller, belong to the same biotic regime (that of the planet Earth; Bednarik 1992b), they are of similar size, and use similar sensory faculties. If one of the two species detected objects not by vision, but by some other sense, their intentional markings might be so different that they could not be confused; indeed, the other species may not even detect them then. Many other types of rock markings were made by non-human animals, or are the result of other factors, and they are simply phenomena which happen to fall within given spectra of properties: this is then entirely fortuitous. By contrast, a rock marking that is, for instance, too small or too large to have been made by humans is not normally misinterpreted as rock art, so we can expect such detectable marks to be a small spectrum of a vastly larger range of natural markings, which is likely to extend in many dimensions outside human detectability.

We can conveniently rationalise from this, using a defensible, non-humanistic anthropocentrism, that there are two types of rock markings which are detectable by *Homo*: those which are within his sensory range because they are meant to be so (including some by other species of similar range, such as the cave bear, but which are not intended to be seen by humans), and those that are within that range purely by accident, and may well extend outside it into various dimensions related to modes of detectability. The purpose of this distinction is not so much taxonomical; rather, I wish to emphasise the difference between humanist anthropocentrism (which is unscientific) and non-humanist anthropocentrism (which is conscious, and thus scientifically permissible). I find it important that this demarcation be understood and observed in our discipline.

Rock art is conveniently divided into two major divisions, which happen to be of roughly equal proportions globally. *Petroglyphs* were produced by a reductive method, i.e. some material was removed from the surface. They can be divided technologically (bas-relief, low relief, sgraffito etc.; the latter is in no way related to graffito, conversely) but are usually identified by more subjective terms, determined by presumed method of production (engraving, carving, pecking, pounding, etching etc.), which is consistent with the frequent archaeological subjectivism and humanism in the discipline. The second major division, *rock paintings*, are attributable to an additive process of production: some substance was added to, rather than removed from, the rock surface. These marks have been better taxonomised (stencils, wet applied paints, dry applied drawings, beeswax figures etc.), but in the present context they are of considerably less interest. Not surprisingly, rock paintings are far less prone to misinterpretation: paint or pigment traces are readily identifiable in most cases, and there are few natural products they might resemble. The only other obvious source of misinterpretation is natural discolouration of rock surfaces, and there are few published examples of their misidentification.

It follows that we are dealing here mostly with rock markings that might resemble petroglyphs. This paper offers a comprehensive taxonomy of these, consisting of twelve types which fall into six logical classes, derived from two basic divisions (Table 1). Rather than taking up space in warranting this taxonomy, or in explaining how it was derived, I shall simply list its components and explain the issues involved, always with the help of specific examples.

It is self-evident that this paper and the taxonomy it offers suffer from the distinctive disadvantage of being based largely on the work of one single researcher: there is no preceding work on the collective phenomenon of rock markings, although it is of such massive proportions and of such fundamental significance to the susceptibility of rock art research to scientific methodology. It is therefore essential that practitioners be critical of and responsive to

this paper, as it is the result of over thirty years of research in what can only be defined as a complete research vacuum. The almost complete lack of previous work on the identification of rock markings, and on the discrimination between artificial and natural markings, meant that I had to start from virtual scratch — with scratch markings — and what follows is likely to be centuries behind the rest of much of science.

G. Geological rock markings

GP. Petrographic markings
GP1. Inclusions in igneous rocks
GP2. Naturally enhanced inherent markings

GW. Weathering markings
GW1. Solution marks
GW2. Exfoliation marks

GK. Kinetic markings
GK1. Taphonomic marks
GK2. Clastic movement marks

B. Biological rock markings

BP. Plant markings
BP1. Kinetic plant marks
BP2. Chemical plant marks

BA. Animal markings
BA1. Animal scratches
BA2. Animal polish

BH. Humanly-made markings
BH1. Unintentional or utilitarian anthropic marks
BH2. Non-utilitarian marks

Table 1. *A tentative taxonomy of markings on rock surfaces which are readily perceptible by humans, and which have been, or could conceivably be, identified as petroglyphs.*

We begin this examination by considering three classes of *geological rock markings*: petrographic, weathering and kinetic markings (GP, GW, GK). In each of these classes, I distinguish two types.

GP. **Petrographic markings**

I define as petrographic markings those found on rock surfaces which are attributable to intrinsic structures or inclusions found in rocks, and divide them into two basic types: those which derive their crucial characteristics of visibility from inherent factors of specific areas of rock surface (Type GP1), and those in which this visibility has been enhanced or accentuated by secondary processes, notably selective solution or corrosion (Type GP2). The overriding common characteristic of these markings, and one which they share with no other type of rock marking, is that the structures they are associated with always extend beneath the surface of the rock, over distances ranging from perhaps a millimetre to many centimetres, even metres. In other words, these markings are attributable to forms present in the rock structure which happen to have been truncated by the present surface, and rendered visible by some characteristic or process. Quite obviously, they can be easily distinguished from petroglyphs where they may resemble them by simple sectioning of the rock, to examine whether their formation extends beneath the surface. However, this is neither always readily possible, nor is it desirable to destroy the rock in the process of determining the nature of a marking. Hence it is requisite to possess some understanding of such phenomena. In most cases a careful examination can resolve the matter conclusively and, in any event, only specific rock types seem susceptible to such markings.

GP1. *Inclusions in igneous rocks*

The phenomena to be considered under this heading have not been significantly affected by weathering processes. The marking on the rock surface is attributable to a distinctive variation in the rock's texture. Such xenoliths formed in igneous rocks when, during solidification of the magma, selective crystallisation occurred locally. Patterns of crystallisation in these rocks are largely determined by cooling rates, which will favour some of the component minerals over others. A variety of visually and often structurally distinctive formations may be the result, and where they become exposed on a rock surface, they may resemble artificial rock markings. The example used here for illustration is from Hinchinbrook Island, off the north-eastern coast of Australia, between Townsville and Cairns. These elongate, ovoid designs might resemble vulvae, and the uniform groove sections are very much like those of petroglyphs (Figure 2). The markings were found by Michele Bird and Allan Plant on granite boulders exposed at the seaward coast of the island.

Figure 2. *Natural petrographic markings on granite boulder, Hinchinbrook Island, Queensland, Australia. (Photograph by Michele Bird.)*

The surface pitting on the lower right of the photograph suggests that the rock has been subjected to a degree of surface corrosion not usually experienced on granites, and it is possible that the 'designs' were also affected by selective erosion processes. However, they are certainly natural features and there is no unambiguous evidence that they were even enhanced or modified by anthropic intervention. They may have been buried under sediment before the sea rose to its present level and subjected the rock surface to a littoral erosion regime. This may have contributed to rendering the markings more visible, because such phenomena seem to be comparatively frequent on coastal exposures. A classical example are the 'whale and fish petroglyphs' at the Canadian littoral site Point no Point (Hill and Hill 1974: 63), which are certainly petrographic marks and have not been enhanced by humans. However, a clear demarcation between my GP1 and GP2 markings is not possible.

Although markings attributable to xenolithic inclusions in igneous rocks may resemble petroglyphs very closely, they are generally easy to identify by close petrographic examination, especially microscopic assessment of crystallisation states, and also by surveying the nearby rock surfaces to establish the full range of rock markings present. As with many other types of natural rock marks, there is often a spectrum of morphology, ranging from those that resemble petroglyphs very closely to markings that certainly do not, by any stretch of the imagination. Once such a range has been identified objectively, it is often easy to see that the 'most convincing' markings must be seen in their full context of surface phenomena existing at the locality in question.

Surface markings that are attributable to inclusions in the rock fabric are of course not restricted to igneous rocks; they can be found in most other types of rock. Among them are bedding strata and other formations in sandstone, fossil casts in a variety of rocks, patches of exotic minerals, products of replacement processes, and many more. However, their nature is usually fairly obvious and serious students of rock art have not experienced any difficulties with them as far as I am aware. They are therefore not considered here in any detail.

Another category of inherent petrographic marks is also omitted from serious consideration here: over the years, a number of people have sent me hundreds of specimens and photographs of markings they perceive on the surfaces of portable clasts. Some even perceive pictures on the fracture faces of pebbles they break in half, and believe these have been placed into the stones by prehistoric people. Sometimes they are dendritic markings, formed by crystallised minerals, but in most cases I have seen they are no more than natural fracture marks or colouration, erosional patterns and the like. I have also examined several reports of maze markings, which may completely cover vast expanses of pavements. For instance, the owner of an actual petroglyph site on Vancouver Island, Canada, is convinced that the barely perceptible, mottled pattern effect on the pavement near her house is also anthropogenic, in addition to the true petroglyphs present there. I omit to consider all these cases here because, to the best of my knowledge, none involved an archaeologist, and there seems no danger of professional misidentification of such phenomena.

GP2. *Naturally enhanced inherent markings*

Mt Loch is a minor peak of Mt Hotham, in the Australian Alps of Victoria. Its summit consists of an extrusive basalt cone, of locally well-developed hexagonal columnar formations. In one small area just 60 m NNE of the summit cairn there occur numerous distinctive surface markings. Most are circles of up to 10 cm in diameter; there are also concentric circles, circles with central pit, and joined circles or ellipses. Circles are often well-shaped, and in many cases the groove widths, depths and sections closely resemble those of archaic Australian petroglyph traditions. Archaeologists have therefore considered the possibility of human manufacture.

Examination of the site showed that the basalt contains inclusions from its igneous phase, which are rounded, often elongate and cigar shaped, but which are petrographically similar to their matrix. Where they are sectioned on the rock surface they form circles. At the contact joints between each inclusion and the matrix occur iron-rich minerals which promote local acceleration of erosional processes, perhaps through the production of corrosive agents, and the result is a distinctive groove following the outline of the truncated inclusion. The joint itself is not visible on the corroded base of the groove, and the markings they form resemble very ancient petroglyphs in every respect, particularly where more recent fractures cross through them (Figure 3). Besides the dominant circular markings, there are also some more complex 'designs' (Figure 4). However, none of them is the work of humans, nor is there any evidence that the grooves might have been emphasised by human intervention. These are clearly natural phenomena, and they are attributable to a combination of diagenetic factors and recent weathering.

Phenomena of this specific type are comparatively rare and may be restricted to igneous rock, in which such inclusions could form during crystallisation. This is not to suggest that there are no inclusions of other types (for instance, fossil casts or vesicle formations), but it seems that the surface markings they might conceivably cause cannot be mistaken for petroglyphs by a reasonably experienced observer even if there has been an emphasising process at work. Other types of 'naturally enhanced inherent markings' are not restricted to igneous rocks; they have been observed on many types of rock, including sedimentary facies, even limestones. They are still attributable to some inclusion, formation or other feature inherent in the rock fabric. These features include the laminations often found in sedimentary rocks, especially sandstones, thin lamellae of intruded minerals, bedding planes or minute joints, and other structural disconformities. Where they are truncated by the rock surface, their structures may be subjected to differential solution or corrosion, which emphasise visibility of the phenomena. The markings so formed may then be an interplay of the geometries of the geological disconformity, and the relief or topography of the rock surface where the two intersect: for example, a sequence of inclined parallel rock laminations intersected by a concave surface will result in concentric arcs or semicircles, as is the case in my next exhibit (Figure 5). This was found by me in a rockshelter below Signal Peak, Gariwerd (Grampians), Victoria. The set of concentric arcs resembles the archaic petroglyph 'style' of Australia very closely, including the groove section and pitted appearance typical of pounded motifs. Despite its positioning and appearance I attribute the markings to laminae of the sandstone, exposed by weathering processes (granular mass-exfoliation) that formed the curved wall of the recess in which the markings occur.

Figure 3.
Naturally enhanced markings attributable to circular xenolithic inclusions in basalt. Note sectioned xenolith on bottom edge of clast. Mt Loch, Australian Alps.

Figure 4.
Partially preserved markings at the Mt Loch site, one being non-circular, strongly resembling a petroglyph.

Figure 5.
Part of a concentric arrangement of markings attributable to selective weathering of inherent sandstone strata. Gariwerd (Grampians), Victoria.

Figure 6.
Solution grooves along inherent faults in Tertiary limestone, near Koongine Cave, South Australia.

Not far to the west of this find, in the Tertiary limestone karst of the south-east of South Australia, the photograph in Figure 6 was taken, of a limestone pavement with parallel solution grooves attributable to inherent fault lines in the rock.

Horizontal and other tectonic stress lines in limestone caves are often emphasised at the rock surface by solution and other processes resulting in grooves. Sometimes these marks resemble rock art, but in the vast majority of cases their geomorphological nature is quite apparent. Nevertheless, there have been cases of misidentification, including one of the most spectacular cases we have in the literature. In 1981, Rogers reported discovering 'the first examples in Britain of Palaeolithic parietal cave art'. He had found what he thought were engraved pictures of two animals outside a cave in the Wye Valley (Rogers 1981). The grooves were described as possibly being inlaid with malachite, a technique never before reported in Pleistocene art. There were several other aspects of the article which should have suggested that the report was either a hoax or a misidentification, but none of this prevented it from being published in a supposedly prestigious journal, and in fact after it had been examined by several specialists and unanimously rejected by them. The figures were found to be entirely natural markings (one fracture line, possible frost damage, some 'current bedding microstructures' and recent exfoliation), and the 'inlay' in some of the grooves forming them was algae (Sieveking 1982). Indeed, the 'cave' is only a shallow rockshelter and a Pleistocene petroglyph would have been most unlikely to have survived in the British climate.

In the cited case only a few rock markings were present, but fine fissures which were emphasised by natural processes can also occur as dense networks, and where these are observed on prominent rock outcrops they can be easily misidentified as anthropogenic markings. A good example is provided by the natural grooves entirely covering the bedrock outcrop depicted in Figure 7, from the central region of the Republic of Macedonia.

GW. Weathering markings

The rock markings listed under this heading exhibit no readily apparent evidence that they are attributable to some inherent structural disconformities, inclusions or flaws in the rock. Rather, they appear to be the result of weathering processes that are active only at the interface of lithosphere

Figure 7.
Network of naturally enhanced rock markings, Republic of Macedonia. (Photograph by Dusko Aleksovski.)