

While this remains a hypothesis, it does offer a very logical explanation: the effective life span of a grinding area depends on how long the case-hardened surface remains hard, and nothing weakens the coherence of the stone's grains as much as prolonged presence of water. On a near-horizontal pavement, moisture is retained far longer than on a sloping site, and if there is a natural hole in the rock which retains water for weeks, it provides an ideal reservoir of the moisture that would have been used in the axe/hatchet reduction grinding. However, the second site requirement was the presence of hardened grinding surfaces: without them the site had no value for the production of ground stone tools. Axe grinding grooves, unfortunately, have a tendency to retain water, and would thus become rapidly unusable unless rain water can drain from them immediately. The area next to the water reservoir therefore needs to be kept dry, and any networks of hammered grooves effecting this are not petroglyphs, but utilitarian rock markings — if they were made with that intention. They indicate to us, once again, that the technology of pre-Historic societies was much more sophisticated than archaeologists are likely to concede, and in particular, that the understanding of such material properties by pre-industrial societies was vastly superior to that understanding and the appreciation of these same materials by empiricist archaeologists.

Archaeological rock markings which are intentional but utilitarian (and consequently are not rock art) occur in many forms in various parts of the world, depending on ecological and geological factors. They are not reviewed here in any detail, and to the best of my knowledge they have rarely presented problems to archaeologists. One example is illustrated in Figure 18, a photograph taken in the 1960s at Site 4, Tom Price region, Western Australia (Bednarik 1977). The hammer marks and the polished surface of the stone slab suggest that it was used for the grinding of seeds, most probably of spinifex (*Triodia* sp.).



Figure 18. Percussion marks on a rock slab found in an occupation shelter. The polished surface suggests use as a grindstone. Site 4, Tom Price, in the Pilbara of Western Australia.

BH2. Non-utilitarian marks

We have thus arrived at the subject of non-utilitarian anthropogenic rock markings, but in defining such markings as art we would do well to consider what art actually is, and to do so outside the concepts of Westerners. Indeed, this question can be properly answered only by taking it outside the conceptual framework of hominids altogether, and by responding in a fashion that would satisfy an extra-terrestrial organism of superior intelligence.

No-one has managed to provide a definition of art that is both philosophically correct and that is acceptable to the majority of practitioners. Therefore I should not hold any false hopes that my own definition could enjoy much support. Nevertheless, I will state it anyway, if only for its novelty value. I have defined art as the medium conveying the artist's awareness of perceived reality to human sensory perception. It therefore serves to externalise human concepts of reality (Bednarik 1991b). In a more esoteric, but philosophically more satisfying definition, I have stated that art is the phenomenon in human experience of which there can be no crucial common denominators for phenomenon categories that are inaccessible to humans; art consists thus of the collective phenomena about which we can argue objectively (Bednarik 1990/91). This definition has the benefits of being mindful of epistemological demands, and of being valid outside an anthropocentric frame of reference. Unfortunately it is difficult to understand, which will prevent it from being widely adopted until this discipline becomes more mature.

However, it would not distinguish, in the case of the graphic arts, between 'graffiti', fine arts, 'utilitarian' art, children's drawings, or the line markings of archaic *Homo sapiens*. Non-utilitarian rock markings are therefore likely to comprise many forms of 'symbolic' expression, including children's art, graffiti and, no doubt, 'establishment art' (e.g. shamanistic art, emblematic art, art embodying cultural, social or political messages). Hence we must expect a great variety of forms, and there is no golden rule to separate rock art from other rock markings, based on simply recognising the former. That discrimination is the principal subject of this paper, and as we have seen it is far from being a simple process. It is true that most rock art is fairly easily recognised, although care is always required even in apparently clear-cut cases. Here we are mostly concerned with that small proportion of rock markings which provide no clear indication of what they are, or which are not what they seem to be. Unfortunately, doubtful cases are not necessarily solvable by summoning up previous cognitive experience, and secure discrimination can involve considerable 'analytical creativity' on the part of the analyst. Moreover, it must be emphasised that I have encountered several instances of rock markings, particularly in caves, that have resisted my own attempts to define their origins. Hence, anyone claiming that the nature of all rock markings can be established securely would be well advised to have acquired considerably more experience and acumen in these matters than I can summon.

Rock paintings

Instances of the misidentification of rock paintings and natural colourations are quite rare in comparison with the surprising frequency of misidentifications of petroglyphs. This subject is mentioned here only briefly, for the sake of completeness. As we have seen, rock paintings lacking clear configuration as recognisable motifs are perceived by

their colour contrast, and to a lesser degree by the fact that only a limited range of colours is normally used. Paint colours such as green, blue, bluish and grey are exceedingly rare in world rock art, red being by far the most common colour (Bednarik 1992f). Misidentification as a painting is only possible where there are natural discolourations on a rock surface that appear to form a motif. These may be due to pigment that has been applied by a non-human agency, they may be natural petrographic colours, caused by weathering, or they may consist of an accretionary deposit of coloured matter.

No coloured rock markings by a non-human mammal are known, but a considerable number of insect species do produce such motifs. Most particularly, a variety of wasps (e.g. in South America and Australia) construct mud structures on sheltered rock surfaces. Where they use a mud that is rich in pigments such as red clay or iron oxides, the pigment may penetrate a sandstone support surface and once the mud nest has weathered away, a distinctive pigment stain may remain. Such wasp nests tend to be divided into a number of small chambers of remarkably regular patterning, which will produce distinctive 'motifs'. In some cases, these may resemble actual rock art motifs. For instance, a wasp of north-eastern Brazil constructs nests of oval form, divided into large chambers with parallel walls. The stain then left on the rock consists of an oval with distinctive internal barring, which is a motif commonly found in various rock arts, including that of the region in question (Bednarik 1989). Other species produce different patterns (e.g. in Australia), but I am not aware of any misidentifications of this phenomenon.

Inherent colouration of rock or coloured patches caused by weathering should not present difficulties of identification. Nevertheless, accretionary deposits are a different matter and can be tricky, as indicated by the following two spectacular instances of such misidentification. At the well-known petroglyph site of Rochester Creek in Utah, a roughly triangular patch of red colour was found below the

surface upon excavation of some sediment, and this patch was identified as a rock painting by some dozens of rock art specialists. An archaeologist then secured a charcoal sample from nearby and, assuming it to be stratigraphically related to the 'painting', obtained a radiocarbon date from it which he tried to relate to the red patch. Knowing that a haematite painting is extremely unlikely to survive below ground level in sediment exposed to the weather, I examined the site closely and found that no pigment deposition was evident. The entire panel was covered by a dark-brown varnish which had become locally discoloured within a small area of roughly triangular shape. Right above it was a scar where a flake had become detached by thermal fracture. I therefore proposed that a fire had once been lit at the foot of the near-vertical panel, altering the rock varnish locally (Figure 19). Most likely this had involved the dehydration of goethite to haematite, which would account for the colour change from brown towards a reddish hue. This may be a fairly unusual case, but it shows that the rock art student must always guard against being misled by the effects of unexpected phenomena.

My second example refers to a very different type of surface deposit. At the site of Laurie Creek, in the Northern Territory of Australia, an AMS radiocarbon date was derived from what was defined as blood residues in a weathered dark red pigment. At the time the 20 000-year date was reported it was the oldest direct date from a rock painting in the world. Nelson (1993), the group's radiocarbon scientist, was sceptical enough to re-sample the deposit, and found that it consisted neither of pigment, nor did it contain human blood as reported, in fact the material dated was not even proteinaceous. The deposit was simply a natural weathering product of iron oxides, and Nelson found that organic material was often present on the site's rock surfaces. The date obtained has therefore no archaeological significance whatsoever.

It is again clear from these examples that rock art identifications by professional archaeologists of many years' experience should not necessarily be relied upon.

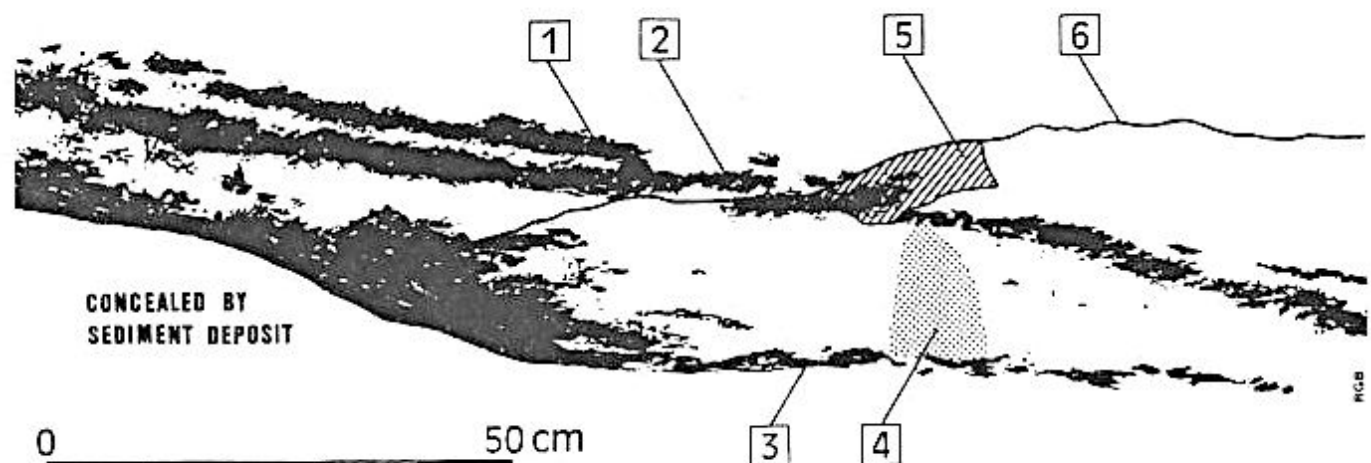


Figure 19. Elevation of the lower part of the main petroglyph panel at the Rochester Creek site, on the confluence of Rochester Creek and Muddy River, Emery, Utah, showing the spatial relationship of features exposed by recent excavation. The uppermost of the three carbonate deposits (shown in black) occurs just below the sediment surface. The features are: 1 - uppermost carbonate deposit, postdating the petroglyphs; 2 - middle carbonate horizon, occurring below all petroglyphs and superimposed over 5; 3 - lower carbonate horizon; 4 - the red patch misidentified as a painting, probably contemporary with features 3 and 5; 5 - thin spall scar, probably a thermal fracture; 6 - natural fracture line, predating features 1 to 5 (Bednarik 1987).

Discussion

It would be easy to be critical of the taxonomic system I have offered here for defining classes of rock markings. Like any taxonomy in our anthropocentric reality, it is at the same time a necessity for, and an impediment to, scientific development. Taxonomies restrict our judgment while also improving it; they are incongruities of reality and yet they are fundamental to human conceptualisations of reality. Being well aware of this, I decided, nevertheless, that in the present context such a taxonomical approach was the most prudent. I realise that most practitioners in rock art studies are not adequately interested in non-cultural rock markings to become seriously involved in the subject, and yet it is clearly essential that they consider the subject in all their work. Thus the most constructive approach was to format the relevant data in a fashion rendering it susceptible to developing it into a simple check-list procedure of analysis. No doubt after the system presented here has been moderated by peer review it will be translated into such a simplified approach, in which a researcher can check off empirical information such as rock type, site type, formal attributes and so forth, to determine what types of rock markings can be considered as possible candidates. In the majority of cases, such a preliminary check-list approach would quite effectively limit the realistic possibilities so much that it should be easy to consider the few remaining alternatives systematically. However, we must not deceive ourselves into believing that such a check-list is all that is needed to discriminate between natural and anthropogenic rock markings. It can provide only a preliminary test. In the final analysis, this is not a task for the inexperienced: discrimination often requires an unusually high level of field experience, an astute open mind and shrewd observational faculties.

Over the decades, I have witnessed almost incredible instances of misidentifications of rock markings, and while they are to be expected from sections of the general public, in far too many cases they were by supposedly trained observers, especially professional archaeologists. It seems that archaeological training induces a tendency to apply what I call taxonomisation: a propensity towards the creation of taxonomies based on inadequate understanding of the phenomenal sensory input involved in observation. As Dubois (1985), who resolved the controversy of the 'written stones' of Quebec, observed: 'While the issue may have been archaeology, the object of attention was rock art and, as such, subject to geomorphological processes'. These rock markings had been misinterpreted as Phoenician writing by an archaeologist from Laval University, who had identified several such 'writings' from the American Atlantic coast.

To understand the propensity of archaeologists to misidentify rock art as natural markings (for examples see Bednarik 1991a) and natural markings as rock art, it is requisite to return to where I began this paper. In human vision, colours and borders are detected with the photo-receptors, which amplify single photons of light through a cascade of chemical interactions, and this information is conveyed, via the ganglion cells, by the optic nerve to the occipital centre of vision, as visual impulses. Here, the information undergoes a process of de-coding, in which visual information is compared with previous experiences, to 'make sense of it'. This process remains poorly understood, but it is at this stage that misidentification occurs, and probably not in the rest of the visual system. It would seem that humans perceive objects by scanning their

memory stores for analogous forms of visual information, but that this process is not necessarily exhaustive. In practice, most visual information is derived from predictable contexts, so a very few characteristics of the perceived object or situation are usually quite adequate for correct interpretation. Paradoxically, ambiguity of perception would have had a measure of survival value during hominid evolution (Bednarik 1986c), so there may not have been a distinct evolutionary bias against it. But at the same time it seems to have provided the cognitive stimulus for recognising resemblances between taxonomically unrelated objects. Davis (1986) has convincingly used this possibility to account for the discovery of iconicity, which is arguably a key factor in the origins of image making.

What an intriguing idea: might one be justified in saying that the dichotomy between art and science has a history as old as humanity itself? Hominids may have begun mapping reality simultaneously by both strategies, the scientific approach (creating and manipulating taxonomies to facilitate 'understanding') and symbolic approach (exploiting ambiguity of perception in creating the possibility of symbolism). Intriguing indeed, but in the present context it is more important to ask how, then, is the misidentification of rock markings possible? Surely it is not due to some retinal deficiency, some inadequate conversion of the rhodopsin of the cone cells or faulty transmission by the optic nerve. It is squarely attributable to cortical processing of the visual input. This renders it possible to propose a tentative profile of misidentification in rock art studies.

To begin with, the process is probably related to the perception of natural features as resembling other objects, or as iconic marks. One may walk on a forest path and, for a fraction of a second, perceive an exposed tree root as being a snake. The ambiguity is immediately resolved by visual focusing on the object in question. It is this visual ambiguity which Davis uses in his theory of imaging origins. But while we quickly realise that there is no snake on the path, and while the hominids experiencing visual ambiguity may eventually have realised that a mark can stand for an object by resembling it (or rather, those aspects of it the hominid probably utilised in its recognition), in the case of the archaeologist who perceives a petroglyph where only a natural marking exists, the misidentification persists even upon closer examination. Hence there must be a conviction present that is stronger than critical reflection. I have often noticed that archaeologically untutored observers with a good understanding of natural processes (foresters, naturalists, peasants etc.) may experience no difficulties in deciding the status of a rock marking as natural or artificial, even when they seem to be faced with this problem for the first time. At the simplest level, then, the difficulties of some specialists seem to be attributable to their 'training', the mental conditioning resulting from scientific (rather than scientific) indoctrination. But it would be a simplistic assessment to then say that the training seems to defeat its purpose, so I would like to complete this paper by attempting a more adequate analysis. It may help us to avoid such misidentifications if in future we are aware of the cognitive expedients we bring to the task of rock mark discrimination.

Scientific training undoubtedly involves mental conditioning; for instance, the concept of 'scientific rigour' certainly looms large. Empiricism derives its confidence from the belief that it can create order in disorder. As I have noted in the case of the pit markings on the tessellated

sandstone pavements of Sydney, the human propensity to perceive patterns imposes order and then interprets it as being intentional. Natural processes are perceived as being random, and thus incapable of producing repeated patterning suggestive of intentionality. When this propensity becomes a scientific predisposition it results in the invention of order that is so typical of scientism. But most variables of the physical world provide in fact only a poor basis for taxonomies: there are no periodic tables of elements in archaeology, no predetermined identifiable species of information units. Archaeology merely creates taxonomies, and then confirms their validity by working within them. In this fashion, one can create styles of objects as perceived by alien commentators, arbitrary cultural periods and even hypothetical societies, not to mention economies, religions and ideologies. It is only when we apply alternative frames such as taphonomic logic (Bednarik 1994c) to these models that we find how little justification there had been for mooting them in the first place. In the specific area of rock art, the indiscriminate creation of taxonomies can lead to particularly absurd results (Bednarik 1990/91), but as long as the models so created are only subjected to archaeological discourse, and not to alternative systems of dialectic, their shortcomings may be hard to see. For instance, elaborate statistics about perceived rock art styles are difficult to challenge as long as the discussion revolves around traditional archaeological empiricist paradigms — self-confirming and essentially non-refutable models of the past.

This shortcoming of orthodox Western archaeology also becomes very much apparent in the present context: there is nothing in its approach that could safeguard reliable identification of rock markings, or credible discrimination between natural and artificial, non-utilitarian rock markings. To make these decisions, and make them convincingly, one does not measure groove depths, 'identify' 'motifs', or provide statistical and other limited empirical information of any type. No amount of quantitative or qualitative data about the markings will necessarily extract a believable identification, even though it may help in arriving at one. The problem, very simply, is that, like rock art, other rock markings may also contain more information than may be expressed in an empiricist framework: the phenomenon's entirety does not equal the total sum of its empirical components. Its deconstruction by empiricist determinism does not provide reliable identification of such markings. To see that, one should not have to refer to the countless misidentifications, but they do demonstrate, in a fashion which even empiricists understand, that such deconstruction approaches are not science. If they were, there would have been no need to write this paper.

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My work on natural rock markings has been conducted over a period of more than thirty years; hence it has benefited from the help of many people, particularly by bringing to my attention doubtful rock markings in many parts of the world. It is impossible to thank them all individually. So I express my gratitude to all collectively, and I apologise to the many people whom I have disappointed, having had to inform them that their discoveries were not what they seemed to be. However, there are a few individual researchers who have been particularly helpful in this project. They are Christian Archambeau, Dr Paul G. Bahn, Dr Margaret Bullen, Professor John Campbell, Dr Paul Faulstich, Professor Niède Guidon, R. G. (ben) Gunn, Mary Haginikitas, Professor Sylvia Hallam, Peter Home, Bulu Imam, Dr Giriraj Kumar, Dr John Morison, Kelvin Officer, Grant Pearce, Dr André Rosenfeld, Dr Juri Savvateyev, Franz Schipfer, Peter Scott, Professor Kevin Sharpe, Dr Paul Tacon and Percy Trezise. I thank

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Robert G. Bednarik
P.O. Box 216
Caulfield South, Vic. 3162
Australia

Résumé. En vue d'illustrer les difficultés de distinguer avec confiance les pétroglyphes des autres genres de marques sur roche qui pourraient leur ressembler, on examine un assortiment de telles marques. On discute leurs caractéristiques, leur distribution et leur identification, et douze types élémentaires de marques rupestres sont définis, la plupart de ceux-ci ont été traités de temps à autre comme art rupestre. De plus, on considère brièvement l'identification erronée des peintures sur roche. L'auteur essaye d'établir les causes de ces identifications erronées en examinant la base de l'ambiguïté dans la perception, et la résolution inadéquate de ce problème par l'empirisme.

Zusammenfassung. In einem Versuch, die Schwierigkeiten in der zuverlässigen Unterscheidung von Petroglyphen, und einer Vielfalt anderer Felszeichen die denselben ähnlich sein können, zu illustrieren, wird eine Anzahl solcher Felszeichen erörtert. Ihre Charakteristiken, ihr Vorkommen und ihre Identifikation werden besprochen, und ein Dutzend grundsätzlicher Arten von Felszeichen definiert, von denen die meisten gelegentlich als Felskunst beschrieben worden sind. Missdeutung von Felsmalereien wird ebenfalls kurz berücksichtigt. Der Verfasser versucht, die Ursachen für die falschen Identifikationen zu ergründen, indem er die Rolle von Ambiguität in Wahrnehmung bedenkt, sowie die unzureichende Erklärung dieser Gebiete durch Empirismus.

Resumen. En un esfuerzo por aclarar las dificultades de distinguir, de manera confiable, entre petroglifos y una diversidad de otros tipos de marcaciones en roca que pueden tener semejanza con ellos, una serie de tales marcaciones en la roca son consideradas. Sus características, presencia e identificación son discutidas, y una docena de tipos básicos de marcaciones en roca son definidos, la mayoría de los cuales han sido descritos en ocasiones como arte rupestre. La mala identificación de pinturas rupestres es también brevemente considerada. El autor intenta identificar las razones para tales malas identificaciones al considerar la base de ambigüedad en la percepción, y la inadecuada resolución de tales asuntos por empirismo.

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