ISSN 0813—0426

THE AUSTRALIAN ROCK ART RESEARCH ASSOCIATION (AURA)

ROCK ART RESEARCH

Volume 1, Number 1 MAY 1984

Digitised image of a petroglyph

The journal *Rock Art Research* is devoted to developing theory and methodology for the systematic and rigorous understanding of this form of human expression. It is supposed that rock art is the major surviving record of the nonmaterial aspect of prehistoric cultures, that which primarily defines any culture. Rock art is believed to be better suited than the study of the material aspects of prehistoric life, for detecting cultural change or continuity.

Although this journal is concerned principally with the Australasian region, the subject served by it is characterised more by its goals and approach than by its geographical bounds. Emphasis is given to communication across the various disciplines related to the study of rock art, and to synthesising related subjects around its focus: the surviving externalisations of prehistoric world views.

Contributions should be consistent with these general goals. Notes for contributors can be found on the inside of the journal's back cover. All articles submitted will be refereed; authors will receive a summary of the referees' comments, plus an editorial view. While final responsibility for the acceptance or rejection of an article rests with the Editor, responsibility for opinions expressed, or data introduced, always rests with the author.

Selected manuscripts will be sent to international or Australian commentators for reviews which may be published in order to promote scholarly debate. Where appropriate, the author may be requested to respond to these comments in the spirit of the involvement and discussion for which AURA stands. In addition to articles reporting original research, the submission of short reports, reviews, abstracts and bibliographical entries is also invited.

Rock Art Research is published twice a year, in May and November. The Australian recommended retail price per issue is $A 12.00

Annual subscription for Subscribing Members of the Australian Rock Art Research Association (2 issues, post paid) is $A 10.00

Full membership with the Australian Rock Art Research Association is **$A 15.00 per annum.** Besides journal subscription and constitutional rights, full membership entitles one to receive the *AURA Newsletter* and to take advantage of reduced prices for the monographs which the Australian Rock Art Research Association may publish from time to time. Please make all cheques payable to Archaeological Publications.

All correspondence, including applications for membership or subscription, should be directed to:

The Editor
Rock Art Research
P.O. Box 216
Caulfield South, Vic. 3162
Australia

Rock Art Research is owned and published by Archaeological Publications, a non-profit company incorporated in May 1983.

ROCK ART RESEARCH

The Journal of the Australian Rock Art Research Association (AURA)

ISSN 0813-0426

Volume 1, Number 1

Melbourne, Australia

May 1984

Founding Editor: Robert G. Bednarik

The principal objectives of the Australian Rock Art Research Association are to provide a forum for the dissemination of research findings; to promote Aboriginal custodianship of sites externalising traditional Australian culture; to co-ordinate studies concerning the significance, distribution and conservation of rock art, both nationally, and with individuals and organisations overseas; and to generally promote awareness and appreciation of Australia's immovable cultural heritage, particularly prehistoric rock art.

Archaeological Publications, Melbourne

CONTENTS

Volume 1, Number 1. May 1984

3 Editorial

5 **Variation in style and distribution of rock engravings in the Pilbara region (Western Australia).**
Howard P. McNickle (New Zealand)

25 **An image digitising and storage system for use in rock art research.**
Jeffrey L. Dickman (California)

35 Rock art summer school

36 **Karlie-ngoinpool Cave: a preliminary report.**
Geoffrey D. Aslin (South Australia) and Robert G. Bednarik (Victoria)

46 **Research needs for physical conservation of rock art.**
G.S. Gibbons (New South Wales)

50 **Reviews and Abstracts**

54 **Orientation**
54 Report of a meeting on rock art conservation
(A. Rosenfeld, J. Golson, W.R. Ambrose and P. Hughes)
60 Report of the XIth ICAES Congress (R.G. Bednarik)
63 Rock art conservation and the Australian Bicentennial (J. Golson)
64 Introducing: the ACASPP
65 Rock art conference in Canada
65 Petroglyphs stolen in Canada
66 Easter Island Congress
66 XIth Congress of the Union Internationale des Sciences Préhistoriques et Protohistoriques
67 Archaeological Tours
68 Second Australian Archaeometry Conference
68 Canadian Journal of Rock Art
68 Letters to the Editor

70 **AURA News**
Terminology - First General Meeting - Logo - 'Registered Members' - Membership and subscriptions - Request

aura

Editorial

This issue marks the appearance of the first Australian periodical devoted to the study of past cultures by means other than the statistical investigation of archaeological sites and their debris. Presenting an alternative to treating the prehistoric human past as an *ecological* response, this journal will emphasise the *intellectual* response of past societies to their physical, social or spiritual environments. By far the most important and comprehensive source of information about the nonmaterial aspects of nonliterate past cultures is their rock art.

Australian rock art research is experiencing a period of rapid development and widening of horizons. Calls for a national facility for rock art research, particularly in conservation oriented studies, are becoming more frequent; archaeologists are beginning to consider the relevance of rock art studies to their own work; and the Joint Academies' Committee on the Protection of Prehistoric Places has recently been formed.

An important development is the realisation that much of Australia's extraordinarily rich rock art may be of Pleistocene age. This is a quite recent discovery, although there have been early conjectures suggesting great antiquity. And while the enormous body of paintings across the north of Australia, from the Kimberleys to Queensland, continues to be of outstanding significance (and may in some cases also predate the Holocene), petroglyphs are receiving much attention lately, particularly those devoid of figurative (iconic) forms. Cave art was almost unknown in Australia just seven years ago, yet the most recent finds suggest that it may have been a widespread phenomenon once, at least along the continent's southern coast. Most of the cave sites currently known provide evidence of an extremely great antiquity for the early art traditions. These developments are destined to change our concepts of Australian rock art, an effect that can only be hastened by the endeavours of several researchers to find new, more promising ways of looking at this ancient form of human expression.

Exciting developments are about to take place, not only in Australian, but also in international rock art research. We hope to chart these developments in this journal and its appearance is therefore perhaps most timely.

•

From my experience with international rock art research I believe that much is to be gained from improved communications among individual researchers. The approach to rock art differs considerably between students of differing interests and backgrounds and a comprehensive interdisciplinary base is needed. Archaeologists, artists, art historians, anthropologists, conservation specialists, rock art recorders, psychologists, sociologists, demographers, linguists, theologists and, perhaps ultimately, philosophers, all have a stake in rock art, not to mention those who possess it as an important part of their traditional culture and spiritual heritage, or those who are concerned with it as a cultural resource, and with the management thereof. The views of all these people differ significantly and I believe liaison and consultation among them have not been adequate. Our primary concern should therefore be to create a common forum for all people interested in the general subject. Whilst this is a reversal of the scientific trend to overspecialisation it should be borne in mind that specialisation is not only enormously conducive to the progress of science, it can also retard it.

Concepts differ not only among disciplines but also, not surprisingly, among different schools of thought. For instance, there is a great gulf between the humanistic outlook and neo-positivism. Both have their strengths and weaknesses: while humanism is of little use in the dating and conservation of rock art, it is futile to tackle such questions as the origin or meaning of rock art, or its articulation with cultural processes, with

positivistic methods alone. In this journal we will try to accomodate humanistic subjectivism, and where possible we will attempt to synthesise it with positivist data. A methodology serving ecological prehistory reasonably well will not necessarily always do the same for the study of rock art.

The most significant heuristic aspect of rock art is not that it can help us in interpreting archaeology; nor is it its ability to express culture, and thus indicate cultural continuity, change, interaction and so forth better than conventional archaeological data ever will. It is the fact that, in common with all graphic and nongraphic art, it externalises and reinforces world views, which are the frames of reference humans used, and still use, to define and comprehend reality. Positivism merely operates within one such frame of reference, and its origin will remain obscure to us unless the study of the earliest art can shed some light upon it.

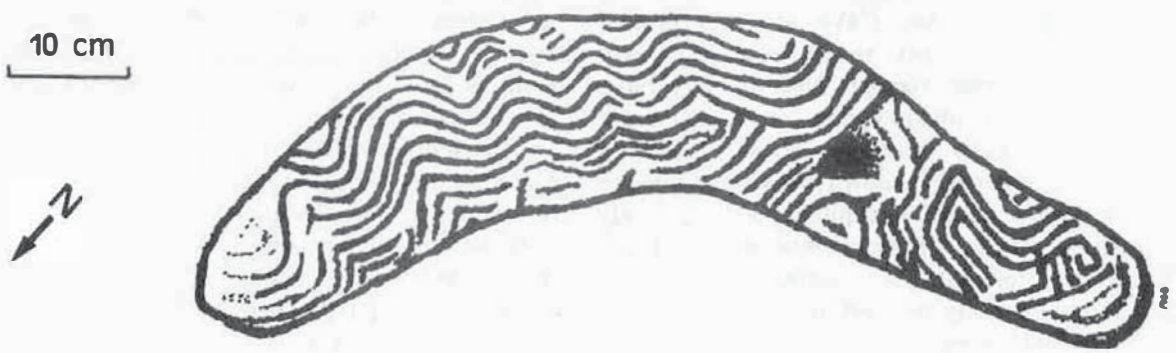
With the burgeoning of new archaeological and anthropological serials in recent years one may well question the need for yet one more new periodical. But other Australian journals generally represent the archaeological model currently dominant in Australia and give little if any regard to alternative, nonpositivistic paradigms. Empiricism is of course very useful in describing phenomena in an anthropocentric way, but it does have a tendency of becoming absorbed by its means. Its limitations are readily illustrated, for example, by its difficulties in coming to terms with the concept of *art*: is rock art, or are particular forms of it, in fact art?

*

If readers have any comments or recommendations concerning the format or content of *Rock Art Research* they are cordially invited to submit them. Constructive criticism will be considered in the production of future volumes. In this inaugural issue we have combined established conventions with a number of innovations. The journal is intended to be a forum, primarily, and this will be manifested in the maximum involvement of AURA members, especially in discussions of fertile topics. We hope that *Rock Art Research* can in this way contribute towards satisfying the first of AURA's principal objectives.

ROBERT G. BEDNARIK

Petroglyph, *pecked and abraded; on a limestone pavement near Port Hedland, northwestern Australia. The intricate pattern resembles the incised decorations often present on Australian wooden implements, such as boomerangs.*



KEYWORDS: **Petroglyphs - Patination - Geology - Western Australia**

VARIATION IN STYLE AND DISTRIBUTION OF ROCK ENGRAVINGS IN THE PILBARA REGION (WESTERN AUSTRALIA)

Howard P. McNickle

Abstract. One of the world's most outstanding concentrations of rock art is to be found in the Pilbara region of Western Australia. This paper offers a broad overview of this area, and considers variations in style, antiquity and purpose of the petroglyphs. It also sheds light on the connection between the distribution of the petroglyphs and the occurrence of certain types of rock.

Although the Pilbara is only renowned for its petroglyphs its rock paintings are also discussed here. The author introduces the hypothesis that the form of graphic art evolving in a region is generally that which is the most suited to the most widely available medium. The style of petroglyphs is adapted to geological conditions; rock paintings occur where suitable rock shelters are available; and where rock art cannot develop, sand designs, stone arrangements or dendroglyphs may evolve.

During the winter of 1982, observations were made of rock art in various parts of the Pilbara in an attempt to obtain an idea as to distribution and variation in style throughout the region. Earlier, but somewhat less detailed, observations had been carried out in 1980 and 1981. I attempted to concentrate on areas in which few observations had previously been made, in order to supplement earlier reports by others (Worms 1954; McCarthy 1961, 1962; Ride, *et al.* 1964; Wright 1968, 1972; Palmer 1975, 1977; Bednarik 1977; Dix 1977; Dix and Virili 1977; Lorblanchet 1977; Virili 1977) of areas already fairly well catalogued. As a result, some patterns appear to have emerged relating to rock types as well as proximity to water supply and food sources.

Areas in which considerable time was spent are the upper Shaw River (refer Fig. 1), including the area to the southeast of Hillside Station homestead and the Spear Hill area which possesses a particularly rich concentration of sites (twenty-six sites, see McNickle, in preparation). Observations were also made in the De Grey River area, at Muccan Station and Nimingarra, the area between Port Hedland and Woodstock Station, the Hamersley Ranges, the Burrup Peninsula and at a few sites in the Chichester Range. Lack of a four-wheel drive vehicle prevented access to many areas including Mt. Edgar Station and much of the Chichester Range. Neither was I able to visit the islands of the Dampier Archipelago apart from the Burrup Peninsula, or Depuch Island, but these have already been surveyed in some detail (McCarthy 1961; Crawford 1964; Virili 1977; Dix and Virili 1977).

The Pilbara is by far the richest petroglyph area in Australia and this form of rock art has obviously prevailed there for many thousands of years. The total number of engraved or pecked figures is certainly in the order of hundreds of thousands, and possibly of millions. Although virtually all parts of the Pilbara possess some rock art the distribution is by no means even. Considerable variations in concentration, style and subject are found from one area to another. These variations appear to be related to several factors, namely location of suitable rock surfaces, proximity to water supplies and food sources, and obviously the motives of the artists themselves. As very little information has been obtained from contemporary Aboriginal communities regarding engravings it appears that the art form is very ancient and may bear little relationship to present day cultures, so that the only source of information as to motive may be the study of the engravings themselves.

In the Pilbara, large areas of exposed rock, especially dolerites and granites, exhibit a very dark brown to black surface or patina which

Original MS received 18 September 1983; final draft 16 January 1984.
Note: Postal addresses of all authors are to be found at the end of each respective contribution.

is mostly due to concentration of iron oxides in the surface layers. When abraded, this patina contrasts strongly with the light, freshly exposed subcutaneous material and it is this colour contrast that forms the image of the engraved subject in the great majority of the Pilbara petroglyphs (see Bednarik 1979: 33, note 1). This type of petroglyph is not so common in other engraving areas of Australia, where figures are visible normally only because of the deep incisions made into the rock and usually exhibit little colour contrast. This is due to repatination over a great length of time (Anati 1963: 189), or because many types of rock show little or no colour contrast when engraved upon. Many of the Pilbara engravings also exhibit no contrast and are visible only due to relief depth. These are presumably much older, especially if they are found upon the same rocks as the high contrast figures, which is often the case. Although the figures displaying the highest contrast are probably amongst the most recent petroglyphs in Australia, there is as yet no reliable method of assigning absolute dates to them. Even the most recent figures have been suggested to be many hundreds or even thousands of years old (J. Clarke, pers. comm.), and any images that have completely repatinated may have been engraved prior to the termination of the last Ice Age some 10 000 to 15 000 years ago.

Considerations of Style and Subject

Changes in style and subject are readily apparent from one part of the Pilbara to another. Along the coastal areas, namely in the Dampier Archipelago, Depuch Island area and at Port Hedland, depictions of marine birds and mammals, fish and reptiles predominate, presumably because these subjects were readily available as sources of food. Considering that during the last glaciation the coastline was over one hundred kilometres away from its present position, it is fairly safe to assume that the great majority of these figures have been engraved during the Holocene. In the Dampier area, a number of stylised human faces have been located and it has been suggested (rock art display, Western Australian Museum) that they may be of great antiquity. But one such face is featured in the 'Climbing Man Panel', a site where dingoes are also depicted. Since the dingo is believed to have arrived in Australia only during the Holocene the rock art at this site must be comparatively recent, unless the dingo figures were added at a much later date. Many anthropomorphic figures are also found in the coastal areas but they are generally outnumbered by those of animals.

In the central and eastern areas of the Pilbara the style of the petroglyphs differs noticeably from that of the coastal areas. This is a particularly interesting region from a geological point of view, featuring a number of varied rock types. Likewise the engravings display considerable variety in style and distribution. The latter does in fact appear to be related to the geology as well as to more obvious factors such as proximity to water. Throughout this area the anthropomorphic figure tends to be the dominant subject although birds, mammals and reptiles are depicted as well. Boomerangs, spears and other weapons are often associated with the human and animal figures but are also depicted by themselves.

Of the many varieties of stylised human figures portrayed the best known are those often referred to as 'Kurangara figures'. This term was first recorded by E.A. Worms to describe figures on Woodstock Station which he believed to be related to the cult known as Kurangara or Gurangara. Although the figures are no longer thought to be related to this cult I have retained the term Kurangara as it has been used by a number of other researchers (e.g. Wright 1968). To avoid confusion perhaps the spelling of 'Gurangara' could be used to describe the cult, and the alternative spelling 'Kurangara' be retained for the petroglyphs [1]). The characteristics of the Kurangara figures are long, flexible limbs usually ending in forked hands and feet, protruding muzzle, usually one or more long antenna-like head decorations, and frequently exaggerated sexual organs. The legs and feet appear to be more frequently oriented in random directions, as if the figures were floating rather than standing on solid ground.

In addition to the Kurangara style (Fig. 2), a great variety of other anthropomorphic figures are depicted throughout the same area, and beyond that in which the Kurangara figures are found. Many of these images display some of the Kurangara characteristics but appear to be of different stylistic traditions. Some of the styles appear to be recurrent, but confined to a restricted area such as two or more sites of a single site complex. An example is a figure depicted at two of the Spear Hill sites (Sites 10 and 17) in which a line joining fingers from each hand loops around the lower part of the image's body. Another example is the occurrence of almost identical inverted 'diving' figures at Spear Hill Site 5, and again at a site on Hillside Station, thirty-five kilometres to the south. Stylistic variations may even be confined to a single site, such as the depiction of several Kurangara figures with bulbous spotted bodies at Gallery Hill, together with other anthropomorphs with heads adorned by vertical or horizontal parallel lines. At Spear Hill Site 14, head decorations come in a seemingly endless variety,

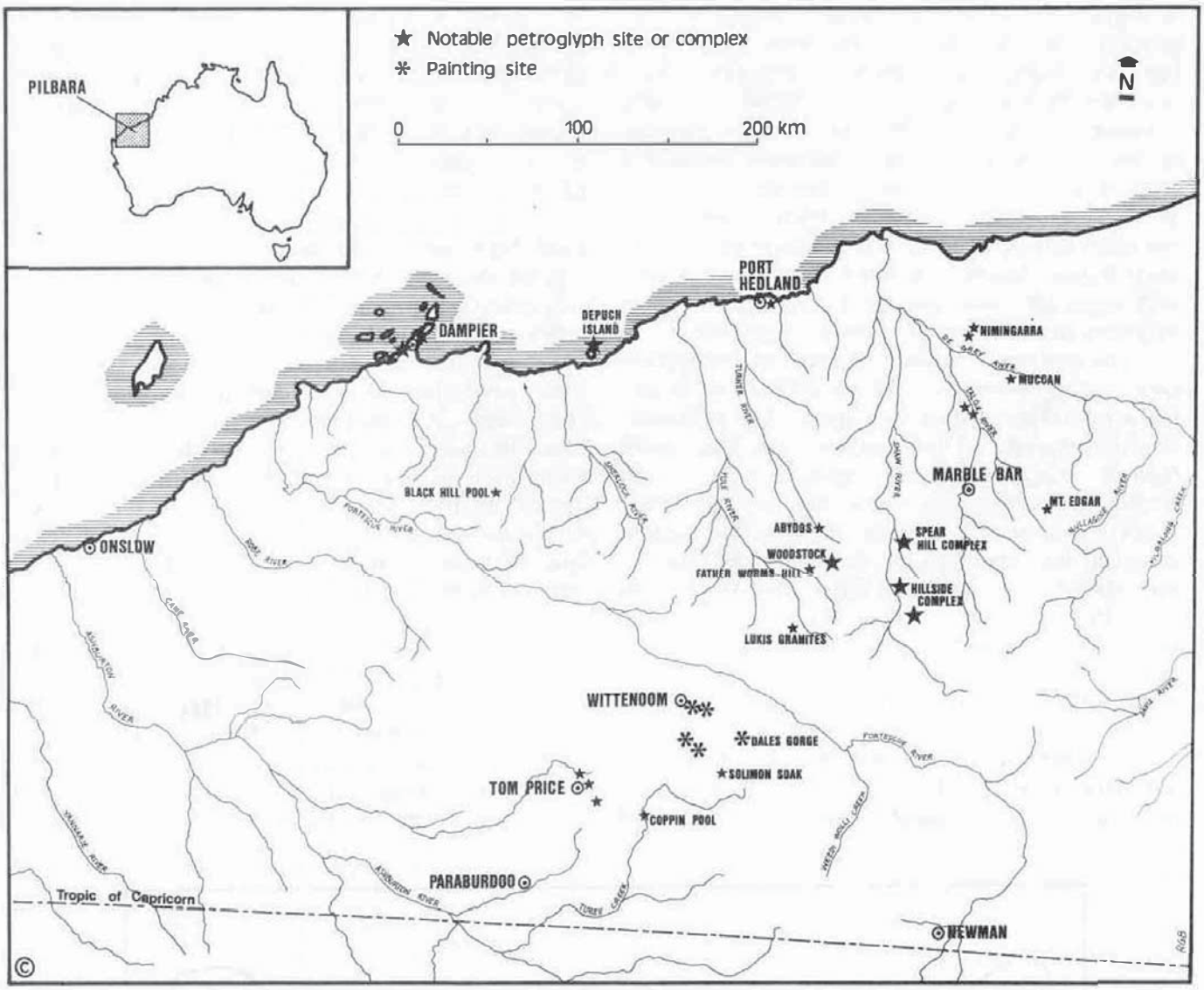


Figure 1. Map of the Pilbara region, showing the principal rock art sites mentioned in this paper.

including radial adornments, herring bone or ladder-like appendages, and head loops (Fig. 3). On some figures the head itself is small and insignificant but it possesses elaborate decorations which may exceed the body in size and length. Even when the head is quite large, very often no attempt has been made to depict facial features and they are then limited normally to the eyes. The size of the stylised human figures varies considerably. Often it is limited by the dimensions of the surface, or the reach of the artist in the case of upright surfaces on boulders. The tallest upright figure I have seen, at Muccan Station near the De Grey River, is about three metres high. However, on flat surfaces or rock pavements where there are no limiting factors on size, human figures in excess of five metres are often encountered.

The true significance of this spectacular display of anthropomorphic images to the artists who engraved them will probably never be known. Even though anthropomorphic figures can probably be regarded as part of the latest phase of rock engravings of the region, there are obviously age differences among the figures. In many cases, superimpositions have occurred and variations

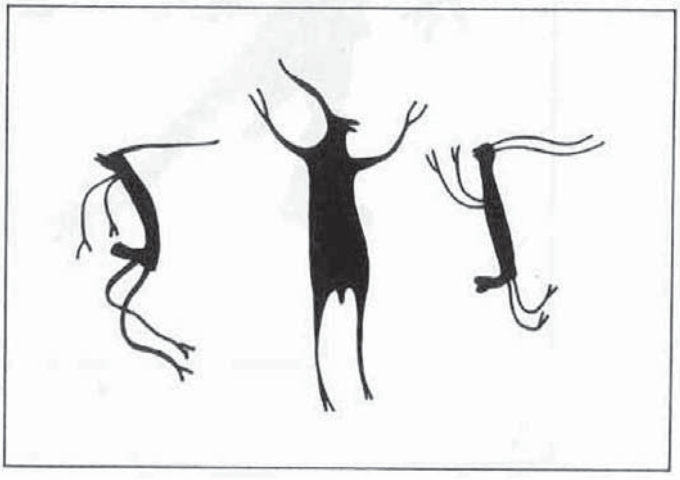


Figure 2. Typical Kurangara figures.

in patina testify to considerable lapses in time between the execution of different images, so even the most recent phase of engraving must have lasted for a period of hundreds, or even thousands of years. From other rock art areas of Australia in which some traditional knowledge of local mythology and rock art has been recorded, stylised human figures have been reported to represent ancestral beings, cult heroes or participants in local myths. A number of engraved figures with spear-like lines passing through their bodies may have been depicted for sorcery purposes.

The protruding muzzle of many of the Kurangara figures resembles that of a kangaroo. Could these mysterious beings be explained as representing a composite of the kangaroo and the human figure? Many of the Kurangara images are in profile, whereas human figures are portrayed almost exclusively face-on in Australian rock art. On the other hand, the macropod images are almost invariably depicted in profile. The fact that so many Kurangara figures appear to be depicted as floating or leaping could be related to the mode of locomotion typical of macropods; when travelling, a kangaroo spends most of its time in the air, seemingly weightless.

As mentioned above, factors usually associated with the location of good petroglyph sites are proximity to water supplies and sources of food and game. However, another important factor appears to be that of availability of suitable rock types. Even if adequate supplies of permanent water are available at a particular location, petroglyphs are much less likely to be found if the surrounding rock is not of a type suited for engraving.

Rock Types and Petroglyph Distribution

Of the many rock types found in the Pilbara, the granites, granophyres and dolerites are the types upon which the most outstanding petroglyph sites are normally found. These are the rock types exhibiting the very dark patina whose contrast with the engraved surface enables very clear images to be depicted. On the other hand, rocks such as banded iron formations and greenstones do not generally display the same type of patina and the contrast between a fresh engraving or pecking, and the original surface, though usually visible, is much less pronounced. Consequently, engraving sites are rare in areas dominated by these latter rock types and even where sites are located, such as around permanent pools, petroglyphs are usually small, or difficult to detect (e.g. Dales Gorge, Glen Herring Gorge). The characteristics of the various rock surfaces, and their responses to atmospheric conditions, are complex and require detailed study, but one

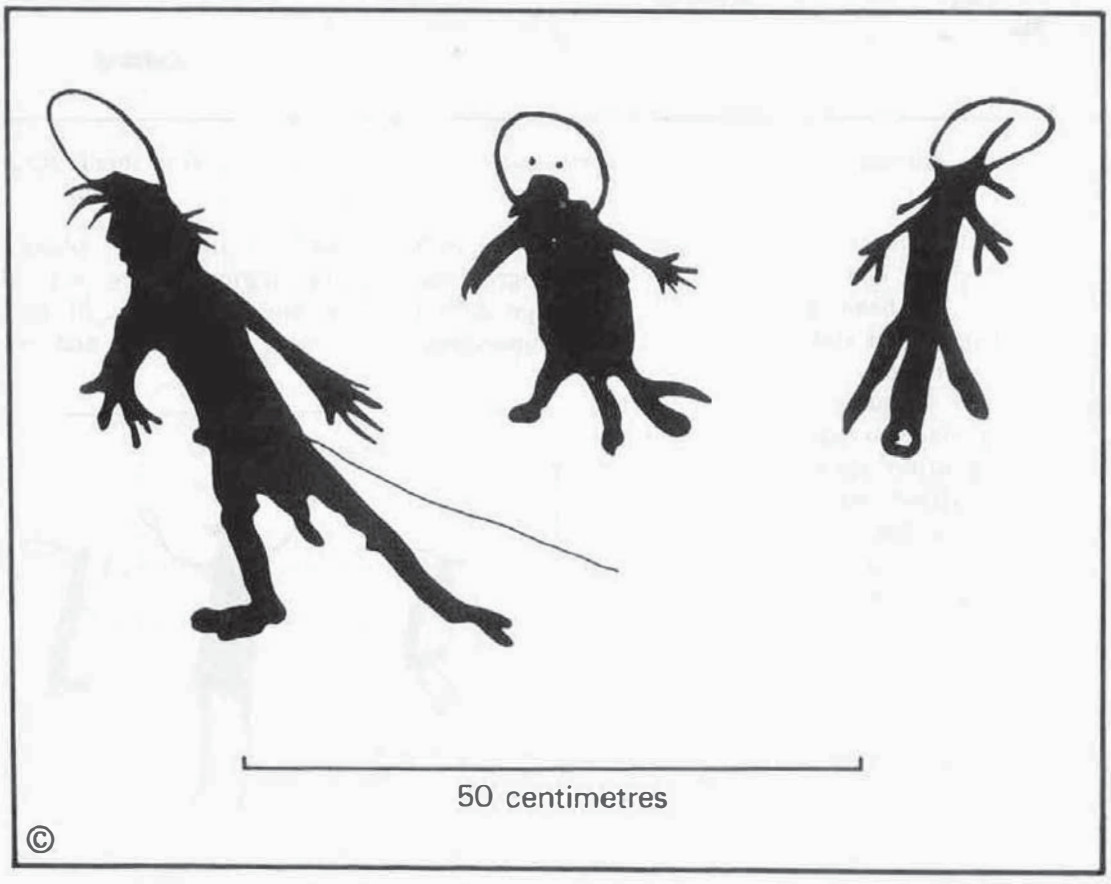


Figure 3. Anthropomorphic figures with head loops. Spear Hill Site 14.

Plate 1.
Kurangara figures executed upon flat upturned surface of a boulder. The figures are oriented at random.

Rami Creek Complex, Hillside Station, northwest of Western Australia.

(All photographs by the author.)

indication is that rocks of an initially high content of iron oxides probably provide a poor surface for engraving. Since the various iron oxides are the main chemicals responsible for the dark patination of all Pilbara rocks (Trendall 1964; Bednarik 1979), shallow petroglyphs carried out on iron-rich rocks some time ago may well have repatinated very rapidly, and hence be invisible today. When looking at the overall distribution of petroglyphs it is most conspicuous that the Wittenoom Gorge, and the nearby other gorges with their large number of deep permanent pools within the banded iron deposits, is extremely poor in petroglyph sites. This contrasts with the southern areas of the Hamersley Ranges, such as the Tom Price region, where outcrops of dolerite appear. Here, a number of good sites are found where the dolerite occurs adjacent to pools, even semi-permanent ones, although these pools are far less extensive than those in the Wittenoom area.

It is not merely coincidence that the most prolific engraving areas, such as the upper Yule and upper Shaw River districts and the central De Grey River, also display the most highly suitable rock types. Granite and dolerite outcrops are the most conspicuous rocks there. The dolerite occurs along intrusive dykes and manifests itself as linear ridges of various size and length, from small but spectacular 'natural walls' sometimes only a metre or so in height, to the impressive black-topped ridges of one hundred and fifty metres height and many kilometres length. Examples are the Black Range through which the Shaw River has cut at Hillside Station, and which itself bisects the Shaw River basin; and several similar lengthy ridges at the central De Grey River. As a medium for engraving or pecking, the dolerite appears to be fairly equally suited throughout the above mentioned area. Petroglyphs contrast well with the dark patina, and proximity to water is again important. Where a stream bed has cut through a dyke the rocks on each side of the creek are likely to be decorated. But this is by no means an infallible rule because a number of dyke breaches, though associated with seemingly permanent pools, were observed to be conspicuously devoid of rock art, whereas quite a number of figures have been placed at the summits of the high ridges, often at considerable distances from water.

On geological maps of the Pilbara, large areas are classified as granite. However, of these areas, only a small percentage of the surface is exposed hard rock, most is comprised of flat, sandy, spinifex (*Triodia basedowii*)-covered plains from which the granite outcrops rise like islands, sometimes in isolation, more commonly in groups and sometimes in large complex structures. The granite is 2600 to 3100 million years old, making it one of the oldest formations in Australia, and the present structures are the result of an exceedingly long period of weathering. The sandy plains result from the slow erosion of the hard granite, but at only a relatively shallow depth beneath the sand stratum lies a hard base of granite. Because granite is impervious to water, rain water run off cannot seep to any great depth and hence is retained fairly close to the surface. Consequently, even though the general appearance of the landscape is barren and dry, water is usually obtainable at a relatively shallow depth. The stream beds, although rarely maintaining a surface flow, very often carry permanent pools and even

when water is not visible at the surface it can usually be reached by digging into the sand. With such reliable supplies of water, the granite plains were obviously able to support considerable numbers of game animals and consequently the Aboriginal hunters who followed them.

The distribution of engravings on the granite outcrops is rather complex. The Pilbara granites are not uniform, they vary in colour, surface texture and geological classification, and this variation appears to be an important factor determining suitability as a petroglyph medium. As well, the various outcrops vary considerably in size, height and general physical structure, and all these factors affect the likelihood of rock art occurring on a particular outcrop. The 1:250 000 geological map (Marble Bar Sheet, SF 50-8, 1978) lists several classifications of granite and I have listed below types amongst which I have searched for petroglyphs. I list them here with their geological description, in order of their diminishing suitability as engraving surfaces, as ascertained from my observations:

AGL - Fine to medium grained biotite adamellite representing remobilised older granitic rocks. Well foliated.

AGM- Fine to coarse, even grained biotite adamellite, biotite granodiosite and less commonly, biotite tonalite. Well foliated, often gneissic and migmatitic.

AGP- Medium to coarse grained posphyritic biotite adamellite and porphyritic granodiosite. Generally well foliated.

AGC- Medium to coarse, even grained biotite granite and biotite adamellite. Poorly foliated.

Several other types of granite are also listed on the geological map but the above are the most common over the areas which I had the opportunity to survey. The types are sharply delineated on the map but on close observation in the field often appear to grade into one another. The areas covered by my observations comprise only a small part of the total area classified under the above granite types, due to limitations in time and transport. Whereas a high proportion of the AGL outcrops, which are restricted in distribution, were surveyed, only limited investigation of the much more widely distributed remaining types was possible. However, it is believed that the following conclusions can be reasonably inferred relating to the degree of use as an engraving surface, of the various granite types.

The most extensive petroglyph sites covered by my survey are located on AGL or AGM types (Fig. 4). AGM was by far the most commonly observed type, but AGL, though of a restricted range, appeared to have been the favourite choice of the artists. Although occurring at only three locations, Woodstock Station, Hillside Station and the Spear Hill Site Complex, several of the Pilbara's most outstanding petroglyph sites are located on AGL granite. Gallery Hill and Engina Granites on Woodstock Station, and most of the Spear Hill sites are of that type, which is generally surrounded by more extensive areas of AGM type. Several good sites occur on AGM, mainly where no AGL is located in close proximity. Lukis Granites, Father Worms Hill, Abydos Quarry Site and all of the Mount Edgar Station sites are of AGM, but where AGL has been available as well as AGM, the former type appears to have been preferred by the artists. On close inspection, AGL granite outcrops usually display abundant smooth, darkly patinated surfaces with a fine grain which, when engraved upon, would yield a finely detailed high contrast image. AGM granite appears to be more variable, its grain is usually somewhat coarser than AGL and the figures engraved or pecked on it, though clear from a distance, are often less finely detailed than those executed on AGL granite.

The granite types AGC and AGP are also widely distributed over the central Pilbara. Both differ in colour and appearance from AGL and AGM, and AGC granite in particular has a conspicuous, light reddish colour making it readily identifiable from a distance. Because it became apparent at an early stage in the survey that these granite types display few petroglyph sites, only limited observations were made of areas comprising only AGP or AGC granites. One purpose of the survey was to evaluate the distribution of petroglyphs in the areas where they were most prolific.

An extensive formation of AGP granite on Hillside Station, known as 'The Pinnacles', comprises a large number of conical boulder piles, fairly similar in size and shape to the extensively engraved sites of Woodstock and Spear Hill. Because of this it was expected that The Pinnacles would reveal good petroglyph sites, particularly since a stream, Pinnacle Creek, flows between several of the outcrops on the southern margin of the complex. It was found that a few petroglyphs are located at the bases of rocks immediately adjacent to the creek, but the great majority of the numerous outcrops appeared devoid of rock art. This granite extends to the north where its outcrops are quite extensive and complex and the classification changes to AGC. But at about the point where it does, another stream, Long Tin Creek, cuts through the outcrops. On a number of boulders close to this creek, several good petroglyphs were located, but it was also noted that the appearance and colour of this granite differs conspicuously from the

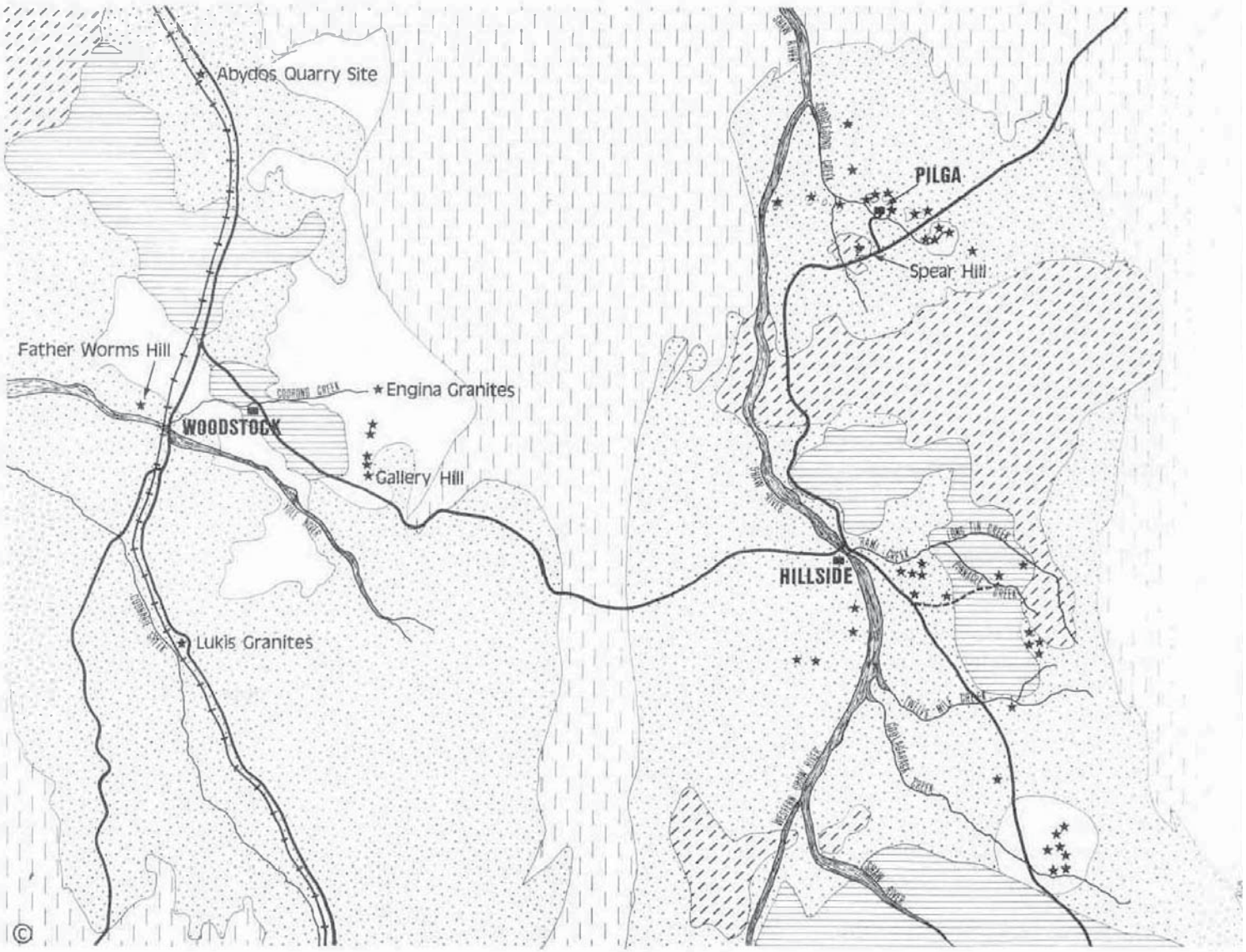


Figure 4. Distribution of granite types and petroglyph sites in the area of Woodstock, Pilga and Hillside Stations. Pilbara Region, Western Australia.

AGP, and is much more similar to AGM - although this is not indicated on the geological map. To the south and west of The Pinnacles the granite is of AGM type. Although the outcrops are far less numerous, nearly all possess some petroglyphs, even when located some considerable distance from water. Between Port Hedland and the Turner River, the Port Hedland - Wittenoom road passes through extensive formations of the reddish AGC granite. No petroglyphs were found upon any of these roadside outcrops, although seed grinding patches were located on granite pavements, indicating former occupation. However, petroglyphs were found upon dolerite ridges where they lay adjacent to the granite exposures.

At only one location have I observed petroglyphs on AGC granite. Spear Hill, between Hillside Station and Marble Bar, is an extensive and complex outcrop measuring one by 1.5 kilometres. Immediately to the north of it lies a line of much smaller hills, arranged east - west, of AGL granite, several of which are among the most prolific

rock art sites in the Pilbara; they comprise several thousand petroglyphs altogether. Only five figures were located on the much larger Spear Hill, being of AGC.

Most of the rock surfaces on outcrops of AGP and AGC appear somewhat rougher, and the patina is not generally as dark as that normally found on the AGL and AGM granites. However, surfaces do vary with each type and the engravings on Spear Hill appear quite distinct and durable, so that the artists were able to find suitable engraving surfaces even on the normally barren AGC. Another difference between types AGL, AGM and AGP, AGC is that the latter two types are often sparsely treed, whereas the former are usually devoid of trees. Perhaps this could be explained by differences in the chemical constitution of the various types of rock.

My conclusion is that the Aboriginal artists did have distinct preferences of certain granite types over others, although their reasons are not entirely clear. Close proximity to water appears to have occasionally induced artists to use a normally neglected rock type for engraving, especially if no preferred rock type is located nearby, but the most suitable types were used extensively even when water may have been located at a considerable distance. Since these conclusions are based mainly upon observations of the more recent phases of rock art, presumably executed when climatic conditions were similar to those prevailing now, the possibility of different hydrographic conditions can probably be disregarded.

The above comments regarding the correlation of granite types and the distribution of petroglyph sites apply to the central Pilbara, i.e. mainly to the upper Yule and upper Shaw River basins, where all these granite types occur along dolerites and rock art is plentiful (Fig. 4). However, it would be somewhat premature to apply similar rules to other areas of the Pilbara, even where the geology is similar. In the central region the styles and subjects depicted obviously bear some degree of uniformity, and it would appear that similar cultural traditions, and motives for engraving, applied over the whole area. However, further afield differences in cultural expression could be assumed to have existed, and other factors may have also influenced petroglyph distribution.

In the De Grey River basin, observations were made in the Muccan Station and Nimingarra areas. The granite here appears to be mainly of AGM type and a number of prominent dolerite dykes are located south of the river. The number and extent of petroglyph sites is lower than at similar locations in the central Pilbara, but where they do occur the style, size and complexity of the figures is quite comparable to that area. Kurangara figures appear to be lacking but other large anthropomorphic beings are depicted. Several large, recently executed snake images were observed, and although a few early animal outlines are present, very few recent animal figures occur. Where Soda Creek cuts through a dolerite dyke, a number of petroglyphs are located at the spur on the northern bank. This same dyke runs north-

Plate 2. Pile of large, densely engraved boulders, consisting of AGM granite. Lukis Granites, south of Woodstock Station.

Plate 3.
This engraved boulder of AGP granite has been subjected to Kernsprung, and to exfoliation of its weathered rind. Long Tin Creek site, near Hillside Station.

east for several kilometres and terminates at Mulgandoonah Hill, a conspicuous dark dome. This hill was examined, but no engravings were located. Near its base are several granite outcrops, but most were also found to be devoid of rock art even though the rock appears to be of a suitable type and a creek lies a short distance to the east.

A particularly good art site was found at the end of a low dolerite dyke close to a water hole, a few kilometres west of Muccan homestead, and only a short distance south of the De Grey River. One of the best dolerite sites I have seen, it features a number of fine figures, including the three metre upright figure mentioned earlier. A short distance north of the De Grey River, and to the east of the road from Marble Bar to Shay Gap, a small granite hill is decorated solely by a beautifully engraved abstract pattern featuring meandering parallel lines and two sun-like symbols, quite unlike anything I have seen elsewhere in the Pilbara. At Nimingarra, halfway between Shay Gap and Goldsworthy, an extensive group of granite outcrops lies to the south of the railway. Although covering several square kilometres in area, only two small concentrations of petroglyphs were located in this formation (one site has been well documented by W. Dix), apart from a few isolated figures, even though the rock surfaces appear well suited.

Certain forms of granite structures appear to have been favoured as petroglyph sites. Symmetrical conical hills consisting of piles of boulders often proved to be prolific art sites. Normally, engravings or peckings would be found on boulders around the base of such hills. Very often, only one half, or a small sector of the circumference of a hill is decorated. Figures are less common high on the slopes, although the summits often display a few petroglyphs, generally on the upward-facing surfaces. Examples of this conical structure are Gallery Hill and several of the most outstanding of the Spear Hill sites.

The reasons why figures are grouped selectively around such outcrops remain open to conjecture. Normally, all parts of the base of these formations would present uniformly suitable engraving surfaces, but in no instance did any of these larger hills present an even distribution of rock art around its circumference. In the case of Gallery Hill, the entire northern half of the circumference has been well utilised, whereas that facing south has been left untouched. Other sites appear to be restricted to the eastward facing sectors of outcrops, such as Father Worms Hill, Spear Hill Sites 19 and 22. Where two or more conical hills are grouped in close proximity, a recurrent pattern is the placing of petroglyphs on the sides of the hills facing toward other members of the group of granite hills. The possibility that centres of special function were located between such adjacent outcrops draws some support from the common occurrence of Kurangara and other recent anthropomorphs at these complexes, but a thorough statistical analysis is required before any firm conclusion can be drawn.

Flat granite pavements, occasionally extending over areas exceeding one square kilometre, are also frequently engraved. As the artists were not restrained on flat surfaces, the largest figures are found on them. Prolific petroglyph sites of this type are Father Worms Hill, several of the Spear Hill sites and other good sites at Hillside Station. Unless the granite pavement rises in a well defined dome, its extent is not always apparent as it may extend below present ground

level. I expect that many sites will produce further engraved pavements upon excavation. These would have the potential of providing minimum dating of the petroglyphs. However, from my own, somewhat limited observations it appears that petroglyphs are more likely to be found on pavements fairly close to boulders which can also be used as engraving surfaces. In fact some of the major rock art concentrations occur where conical hills or boulder piles rise directly from pavements. The Shaw River Complex of the Spear Hill group is a good example of this, as is Engina Granites on Woodstock, the latter being a conical hill surrounded by a sloping granite apron.

Petroglyphs on boulders which stand on rock pavements or aprons are also protected from possible damage by brush fires, which are a hazard to any engraved or pecked surface close to spinifex-covered ground (refer Emery 1944).

The larger granite outcrops may have several summits, and extensive flat or gently sloping areas well above the surrounding plains. The saddles between multiple summits frequently exhibit more spectacular rock art than the boulders around the hill base. Examples of such complexes are Bruce Wright Hill and Flying Bird Hill, Spear Hill group.

Some of the granite plains, such as Corunna Downs, have few or no outcrops. Classified mainly as AGM, the few outcrops present appear most unsuitable for engraving. A few figures of very poor quality were found, justifying the assumption that a suitable surface is required to produce good quality representations. Presumably, this granite was used because it was the only hard surface available in the area. Similarly unsuitable granite surfaces near the highway west of the lower Yule River also carry a few rather poorly executed petroglyphs.

Comments on Relative Antiquity

The most recent phase of the anthropomorphic beings, *fully engraved* bird and animal figures, are generally the dominant petroglyph motifs, and are certainly the most conspicuous because of their clarity and contrast. However, much earlier figures are also present throughout the Pilbara, often at the same sites as the recent images. Because these very early figures are usually engraved in *outline* (McCarthy 1967: 31) and the lines have almost completely repatinated they are far less conspicuous. In areas where time permitted only a superficial search, I quite frequently identified these outline figures only where they were located close to, or in some cases underneath, the clear recent figures. Where a fairly thorough search was conducted, further outlines often became apparent. For this reason it can be expected that more assiduous surveys will succeed in locating large numbers of very early petroglyphs.

The overall distribution of the early figures does not correspond with that of the recent traditions. Although the latter appear to be of greater number, at some sites (for example, at Spear Hill Site 24) the recent figures are outnumbered by the early outlines. The most prolific site of early outline figures I have seen is Solimon Soak, south of the Hamersley Range National Park ranger's residence. At this site, numerous animal and bird figures occur on a gentle slope. 'Boomerang' outlines and concentric circles are also present, as well as some small, fully pecked human figures. With the exception of some solidly pecked and unpatinated human foot tracks, all petroglyphs at this locality appear to be completely repatinated. A gully runs through the centre of the site but no water was seen there during winter visits in three consecutive years.

In the coastal zone, on the Dampier and Depuch Island dolerites and granophyres, and on the Port Hedland limestone pavements, the factors that have given rise to the numerous engravings and peckings are probably quite different to those applying to the inland areas. On the dolerites, in particular, both outlines and fully pecked figures appear to range through various degrees of patination. The subject is complicated by the presumably different patination characteristics among various rock types. A variety of factors may influence rates of patination, and these may have differed in the distant past from those prevailing today. Investigation of patination processes has shown that their products are primarily palaeoclimatic, or other environmental, indicators while their actual dating potential is rather limited (Bednarik 1979). I have observed evidence of differing rates of patination among figures of apparently similar ages, and occasionally different states of patination occur within a single petroglyph. Where the rock grain is very coarse and of a semi-porous arrangement, figures of the more recent styles may display complete repatination.

My general impression is that engravings on the granites, particularly of the AGL type, appear to repatinate at a slower rate than those on dolerites or granophyres. Since a number of figures on AGL granite possess full repatination I feel that some of the earliest outline images of the inland regions may predate any of the coastal rock art, most of which can be assumed to have been executed in the postglacial period.

Superimposition of petroglyphs occurs at most of the prolific sites and appears to have been practised by all of the artistic traditions represented. In the central Pilbara, presumably

recent figures are superimposed over others of apparently similar age, but most superimpositions are over earlier styles. The reasons for superimposing are not clear because lack of available space could account for them only in rare cases. At some of the prolific Dampier sites such as Paterson Valley, the concentration of rock art has become so dense that almost every available boulder is decorated, and fresher images have been pecked over earlier, more faded ones. At Solimon Soak, too, most of the available space appears to have been utilised and many superimpositions occur among the early outlines. However, at the great majority of sites, even most of those displaying large numbers of petroglyphs, there are usually abundant suitable, yet unmarked surfaces. Only a small proportion of the available surfaces have been utilised at any of the granite outcrops in the central Pilbara. In most cases of superimpositions observed, suitable unused surfaces are adjacent to the superimposed images.

Comments on the Purpose of the Pilbara Rock Art

In the rock painting area surrounding Laura, southeast Cape York, Aboriginal informants expressed the belief that a hand stencil placed upon an earlier figure painted for hunting magic or a similar purpose may be an attempt to reactivate the magic for the stencil artist (Trezise 1969). Could this type of purpose be applied to explain some of the Pilbara superimpositions?

Given the obviously lengthy period separating the lifetimes of the artists in the case of most of these superimpositions, the motives of the original artist could only be guessed at by the one executing the superimposition. From the researcher's point of view, the most important function of the superimpositions is to provide information about changes in style over a period of time. Together with patination seriation, this data could be the basis of a complete stylistic sequence, from the very earliest figures to the most recent.

Due to the almost complete lack of traditional information regarding the Pilbara rock art the purpose of it is generally a matter of conjecture. The meaning of the geometric and abstract patterns will probably never be known to us [but see Bednarik 1984, for a different approach]. For 'naturalistic' (refer Pettipas 1982) figures, the range of possible interpretations can be narrowed down somewhat. A lone figure engraved in isolation upon a rock may convey little information other than the fact that it portrays a particular mammal, reptile, bird or anthropomorphic being, but if such a figure is penetrated by what appears to indicate a spear, then further clues

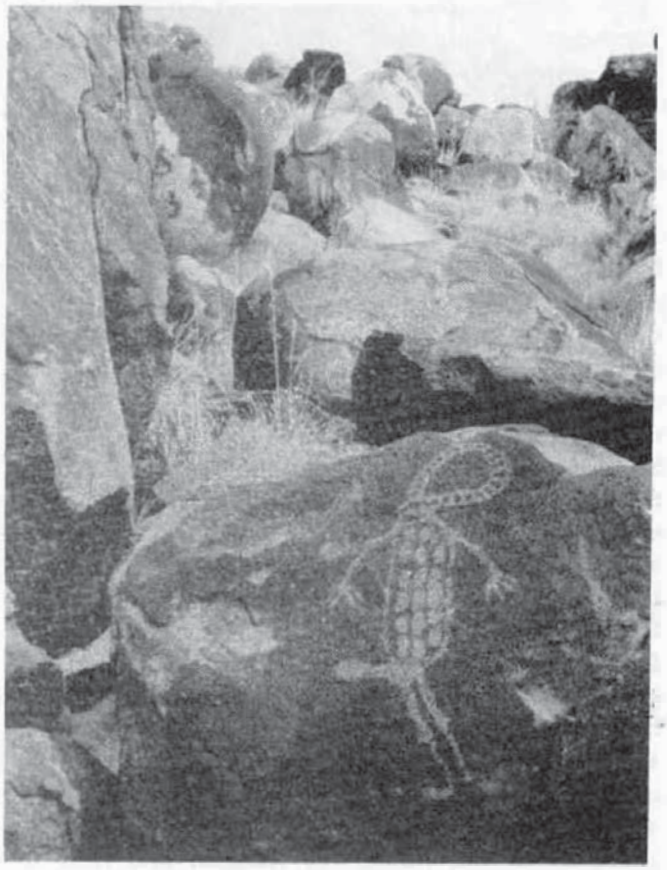


Plate 4. Male Kurangara figure with interior spots and laddered loop head decoration. Gallery Hill, Woodstock Station.

as to its purpose are immediately apparent: hunting magic or sorcery are likely assumptions. It is when a group of two or more figures, which appear to relate to one another in some way, is depicted that the observer may feel an idea is being conveyed. Such compositions vary greatly. Many panels depict large numbers of figures which appear to bear little relationship to each other even though all figures may be of apparent similar age. Panels picturing several upright figures, some penetrated by spears and others not, such as are found at several of the Spear Hill sites, appear to have been intended to illustrate members of a group, but their individual relationship to one another is not clear. Other panels, however, display images strongly related to one another, such as the Kurangara figures engaged in obvious sexual activities at Gallery Hill and other nearby sites. Examples of rows of figures holding hands have been observed at Spear Hill, Nimingarra and on the Burrup Peninsula. They give the subjective impression that ceremony scenes are being portrayed. Compositions in which human figures relate directly to animals appear to be rare, but one example worth mentioning occurs at Site 19 of the Spear Hill Complex. It is believed to illustrate a hunting scene in which a human

figure directs four dingoes that attack three macropods. While one of the dingoes tackles the victim, his tracks encircling it have also been depicted.

Rock Paintings in the Pilbara

While petroglyphs are by far the most abundant and highly developed rock art form to be found in the Pilbara, rock paintings are also present. They are generally quite small and simple in comparison to the elaborate galleries of paintings to be found in the far northern regions of the Australian continent, and in parts of the eastern States. This paucity of paintings can be most likely attributed to the lack of suitable rock types. No extensive outcrops of sandstone or limestone, which weather to large, smooth-walled shelters, exist in the Pilbara. These are the rock types found in the areas of highly developed rock painting, in the Kimberleys, in Arnhem Land and other major Australian rock painting areas. The lack of these rock types in the Pilbara has severely inhibited the formation of rock shelters to provide the adequately protected painting surfaces. In this region, rock shelters are practically restricted to banded iron formations, as in the Hamersley Ranges, and it is in precisely this area that the majority of known painting sites are located. The banded, iron-rich formations form angular slabs of rock that tend to break off the walls and ceilings of these rock shelters, presenting only small and discontinuous surfaces (see Plate 5). Consequently, most of the paintings are small in size, the majority being in the order of ten to twenty centimetres high. In the rare instances where large flat surfaces were available in protected positions the opportunity has been taken to paint larger figures. A yellow outline of a kangaroo nearly two metres high is found in one such shelter in the upper Eastern Gorge. In another nearby gorge, yellow anthropomorphic figures have been painted around the sides of angular slabs, indicating that, had more extensive surfaces been available, these would almost certainly have been utilised by the artists. The locality in which painting sites are most commonly found is the gorge area in the Wittenoom and Mt. Bruce districts and it is perhaps significant that this is the one area of abundant water supplies in which petroglyphs are almost unknown.

Even though Pilbara paintings are generally small and simple, considerable variety in style and subject is shown. Outline 'boomerangs' are common at sites below the northward facing scarp of the Hamersley Ranges and in one case red 'boomerangs' have had long, white anthropomorphic figures superimposed over them. At two fairly widely separated sites, identical figures of bird-like beings with outstretched wings have been depicted. 'Tally marks', vertical parallel lines, are also quite common. Although no more than one colour appears to have been used for any single figure, several different colours have been used throughout the region, including red, orange, yellow and white.

Painting sites are confined largely to the above area of the Pilbara, but during the current survey I located two previously unreported painting sites, one at Spear Hill and one at Engina Granites, Woodstock. These were unexpectedly located in rare shelters beneath granite boulders and the paintings are all executed in a faded, dark-red ochre. Although in fairly well protected situations, all appear to have deteriorated considerably since execution. The Spear Hill paintings are contained in two rock shelters at the summit. In one shelter is a series of hand stencils, only one of which is clearly discernible, and the second shelter features two outline 'boomerangs', one hand stencil, a possible lizard image and a few vague lines. The paintings at Engina Granites have deteriorated even further. A shelter contains simply two faint parallel lines, and what appear

Plate 5. *Painted figures on the ceiling of a rock shelter in banded, iron-rich formations. The small and discontinuous surfaces formed by the erosion of rock slabs are mostly unsuitable for rock art, and the longest figure in this group measures only approximately sixty centimetres. All figures are of white pigment. The rock shelter is located at the base of the northern scarp of the Hamersley Range.*

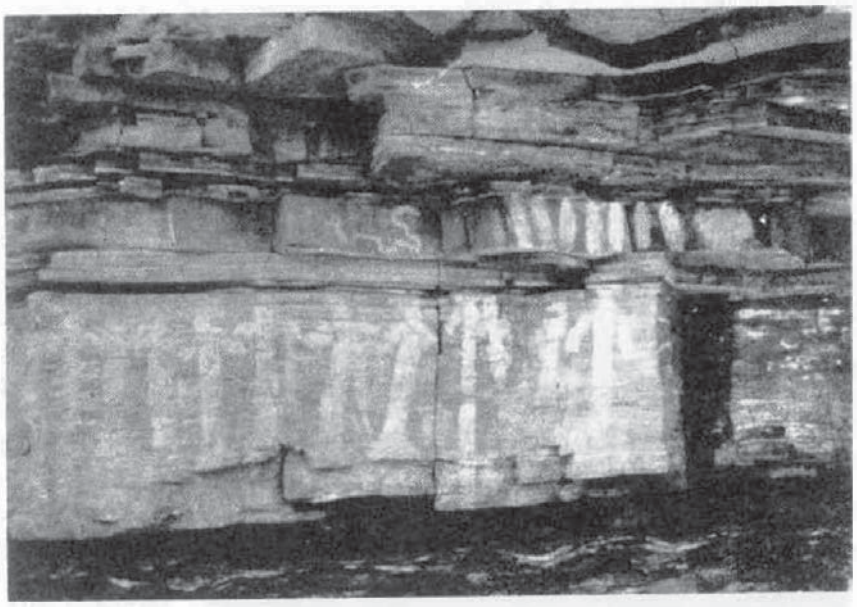


Plate 6.
Painted figures on the vertical face of a rock shelter. The size of surfaces is restricted by horizontal joints in the rock mass. Dales Gorge, near Wittenoom, Hamersley Range.

to be the remnants of a boomerang outline. Two extremely faint images in an exposed position just outside the shelter may have depicted human figures.

Considering the abundance of petroglyphs and occupational evidence at both of these sites it seems possible that any available shelters have been utilised for rock painting. The only available rock, however, was granite and from the observed state of the few paintings it would appear that granite provides a very poor painting surface. As mentioned earlier, granite is impervious to water - a fact rendering the granite belts well suited for human occupation. This property of granite no doubt also helps to protect the exposed surfaces from rapid weathering and hence makes them highly suitable as engraving surfaces. The same property, however, could mean that water-based pigments applied to the surface would achieve little or no penetration, and would merely adhere to the surface like a scum, and hence suffer flaking or rapid deterioration. This theory gained some support when, after this survey, I inspected red paintings in a large granite shelter in the Kimberleys. They were of a similarly advanced state of deterioration. No painted sandstone or limestone surface I have observed ever displayed this type of condition.

Conclusions

The Pilbara is Australia's showplace of petroglyph rock art. Other Australian regions rich in figurative engravings and peckings are the area north of Broken Hill, where a number of substantial, though stylistically less distinctive sites, are located; and the Sydney-Hawkesbury district with its often large outline figures on sandstone pavements. Both these petroglyph regions are far less extensive than the Pilbara, and their stylistic, and probably chronological, ranges are quite restricted by comparison. In both these areas, as in the Pilbara, rock painting is also present, but in a less elaborate form than the petroglyphs.

In the major rock painting zones in northern Australia, namely in the Kimberleys, in Arnhem Land, central Queensland and Cape York, the abundance of suitable sandstone rock shelters has enabled painting to evolve into a complex art form. On the other hand, engravings in these areas are usually rare, and where they do occur they are mostly restricted to non-figurative designs, are often older and found in shelters below or beneath the paintings which completely eclipse them in visual impact. In the Pilbara, it is rock engraving which has developed as the dominant art form while painting has remained simple and restricted in range of motifs. The principal reason for this disparity may have to do with the type of rock available in the Pilbara. Owing to the lack of sandstone and limestone outcrops shelters are restricted to much less suitable rock types, and as a result, rock painting has had little opportunity to develop as a major art form. But the abundance of bare granite and dolerite surfaces covered by a dark patination which, when abraded, leaves a strong colour contrast, has promoted the development of rock engraving to a highly evolved form of art.

Perhaps, if suitable rock shelters had been available in the Pilbara, rock painting would have evolved much more there, and petroglyphs may not have reached the degree of sophistication which they in fact have attained. Throughout much of Australia, the *form of art developed* has generally been that which *is the most suited to the most widely available medium.* This pattern may be widely applicable. Wherever a graphic form of artistic expression has evolved, it is based on the most readily available medium: sand designs and stone arrangements in the central desert regions, dendroglyphs in southeastern

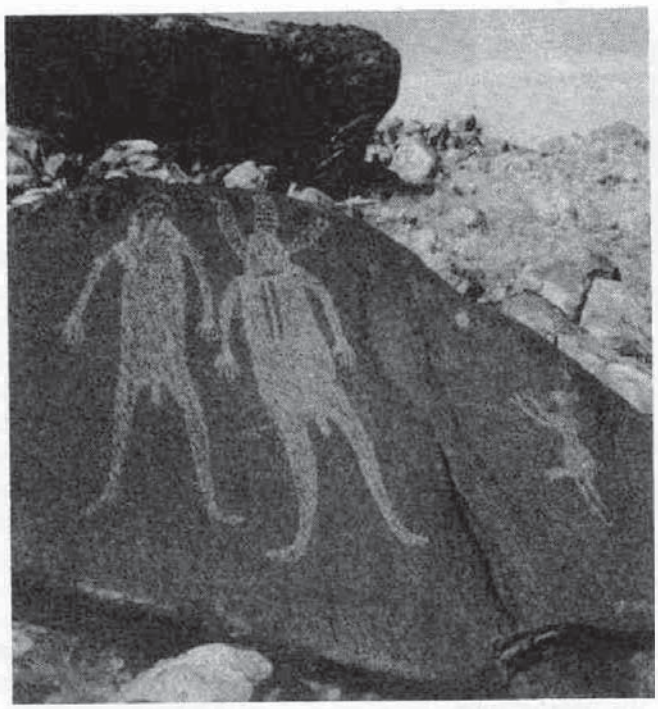


Plate 7. Two large recent anthropomorphic figures, with smaller Kurangara figure in profile on right.
Coolagarrack Creek Complex, southeast of Hillside Station.

Plate 8. Anthropomorphic figures. The figure on the left has been superimposed upon an earlier, repatinated and apparently partially pecked figure.
Rami Creek Complex, near Hillside Station.

Australia, rock paintings in the sandstone regions of advanced erosion states.

The distribution of rock art in the Pilbara is far from uniform. Differences are due to a large extent to variations in rock type. The entire region has been extensively occupied in the prehistoric past, even in areas lacking rock art. Artefact scatters and seed grinding patches are present throughout. Most shelters in the Hamersley Ranges contain stone slabs smoothed by grinding. Even on the types of granite that are seldom used for engraving, smooth grinding patches are found abundantly. Shell middens are common all along the coastline.

The greatest concentrations of petroglyphs appear to occur where several favourable factors coincide. For example, the great abundance and stylistic variety of petroglyphs in the vicinity of Spear Hill and Woodstock occur where outcrops of highly suitable AGL granite coincide with abundant supplies of water. Along the coastal zone, where seafoods and other food sources were readily available, dolerite hills on the mainland and on islands have been engraved upon extensively wherever they occur. No doubt the persistence of petroglyphs over a long period of time helped to bring about the more recent proliferation of styles. While the durability of a particular engraving may have had little significance for the artist in his own lifetime, the continued visibility of a figure over a long period of time must certainly have influenced later generations who may have copied and elaborated such figures to styles of their own, or at least incorporated them into their own mythologies.

As a province for the study of pre-European Australian culture, the Pilbara presents a unique opportunity to study changes in rock art style, no doubt covering an immense period of time. Combined with other archaeological evidence, this will eventually provide an important key to the understanding of Australia's prehistory.

Howard P. McNickle
P.O. Box 1386
Rotorua
New Zealand

Currently:
c/o Northern Territory Museum
of Arts and Sciences
G.P.O. Box 4646
Darwin 5794
Northern Territory
Australia

Comments

By **JOHN CLEGG**

It is widely recognised that the Pilbara rock engravings are of great importance for both their quality and their quantity. There are perhaps millions of engravings scattered over a wide and often inaccessible area. The study of Pilbara engravings must proceed in the normal sequence, with synthetic review papers interspersed with smaller research papers directed towards individual topics or observations.

It is now sixteen years since Bruce Wright's synthesis, so the time must be nearly ripe for a new review for the present archaeological generation, which will take in the work done since 1968 - some of it EIS and salvage work, as well as the scientific and academic papers. McNickle does not present such a synthesis. Rather he gives us a series of individual ideas and observations, which could have been worked up into individual papers. One of the most interesting of these is the study of the distribution of engravings in relation to rock types. McNickle reports that there are many different types of granite in the area, but that the engravings are confined almost exclusively to two types of granite. The preferred sites for engravings are symmetrical conical hills and flat pavements, close to water. But the figures are grouped selectively in such areas; the distribution of engravings in any one such area is neither even nor random. This distribution should be the subject of research, for it could provide information about the reasons for engraving in particular places other than mere availability of material.

One of McNickle's interesting points derives from his consideration of the painting and drawing which is to be found in the Pilbara region. Even when allowances are made for the fact that paint is much less easily preserved in the Pilbara than are engravings, there remains a marked lack of emphasis on painting. In other parts of Australia, where other materials are available (trees for dendroglyphs, sandstone shelters for paintings, for example) other media are used for the predominant (or most developed) forms of art.

> Through much of Australia, the form of art developed has generally been that which is the most suited to the most widely available medium.

I find the whole idea of one form of art being more developed than another in the one area of great interest and hope that McNickle will expand on it one day. But meanwhile, I am unconvinced that the point is yet demonstrated: in the Sydney area there are plenty of engravings, paintings and a few stone arrangements, as there is a profusion of material suitable for each of these media. But there are also many trees - some of them scarred, and there is plenty of bark. Yet there are no dendroglyphs or bark paintings recorded. Such considerations might reduce McNickle's interesting proposition to a much weaker statement about possibilities rather than determinants: that art is restricted to the media available.

With regard to technique, patination, subject and style, McNickle points out that there is variation in all these things in the Pilbara, and the variation may in some cases be caused by chronology, in other cases be related to space and location, as well as the location of various resources like marine animals. In a synthetic review paper one might hope for a sophisticated discussion of the relations between technique, subject and style, and of the problems of basing archaeological work on interpretation - inferring the subject of a picture from one's guess of what it resembles. McNickle restricts himself to pointing out that the variation does exist and that it should be studied, in relation, for instance, to the complicated questions of patination.

This paper makes on look forward to the time when someone will produce a review of present knowledge about Pilbara rock art; it contains interesting observations about the distribution of petroglyphs in relation to rock types and water resources, together with stimulating ideas about variability in Pilbara engravings and the reasons why different forms of art develop in different places.

On the first page, we are told that the author is preparing some work on twenty-six sites in the Spear Hill area. It is clear that this work, when it becomes available, will be of the greatest interest.

John Clegg
Department of Anthropology, A 14
Sydney University
Sydney, N.S.W. 2006
Australia

By **DAVID R. MOORE**

Presumably the author of this interesting and valuable report is a geologist who has been employed in the mineral industry in northwest Australia. Commendably he has given his spare time to investigating one of the most important rock engraving areas of the continent. He has also studied the available literature on the subject to obtain the essential background.

Having said this, it is unfortunately necessary to criticise several aspects of his attitude to the study. Firstly, a mechanistic approach to Aboriginal rock art can never be wholly satisfactory or even valid. From what we know from Aboriginal informants (e.g. see Moore 1971), artists did not choose sites - sites chose artists, through the enduring myths of the Dreaming. This is the only explanation necessary as to why engravings and paintings appear in places apparently quite unsuitable, and conversely are not found in areas obviously (to us) highly favourable. Admittedly the distribution of engravings is necessarily confined to those areas where there is rock capable of being engraved with stone tools, while cave paintings appear only where rock shelters exist. But within these parameters the sites were dictated solely by the myths concerning them. And only men in the correct totemic relationship to the ancestor connected with the site could engrave or paint that site.

This point brings us to the question of superimpositions. To an Aboriginal man, the only important aspect of rock art is the act of engraving or painting at a particular site, which is the fulfilment of the Dreaming law. Previous art at the site is of little or no significance, except as a marker of the site. The act is a ritual one at a ritual site, and must be carried out regardless, to ensure the continuance of the Aboriginal world.

My third point concerns patination. This is not a satisfactory criterion for estimating age, even relative age. It is likely that rates of patination could vary even from rock to rock under similar climatic conditions. In 1971 I was called in to report on some engravings found near Collins Cove, at the base of North Head, Port Jackson (New South Wales). It was immediately obvious that they were fakes, since they gleamed white and fresh in the drab grey sandstone surface of a large flat rock. They showed an elaborate scene of a tribe surrounding a stranded whale. Included was a group of white men in cocked hats, one of whom had just been speared in the shoulder. The style and technique displayed considerable knowledge of the Aboriginal art of the Sydney region. Subsequently it was learned that the engravings had been done by someone who had spent many years investigating rock art in Sydney. The point of this story is that I returned to the site about a year later, to find to my surprise that there had been considerable weathering of the engravings. But even after such a short time there was marked variation in this weathering. Seeking an explanation, I found that there was a clear correlation between the tree cover and the weathering. Where there was tree protection from rain and partly from sun, the grooves were pristine; on more exposed areas, the grooves were already a drab grey.

It is impossible to estimate rates of patination. Although some attempts have been made to carry out accelerated tests on sandstones and other common engraving materials, nothing conclusive has emerged and it is best at this stage to forget patination as a means of estimating absolute or even relative age.

Superimposition, on the other hand, does provide a useful method for establishing relative age and sequences of styles. But for it to be valid, it requires detailed study and recording of motifs and techniques over a complete style region. Once data of this type has been assembled, the computer can help greatly in establishing trends and probabilities (see Edwards 1971).

While McNickle's article is a useful contribution, I feel that it would have been of far more value if the author had undertaken an analysis of the regional distribution of motifs and superimpositions. It is a great pity that keen and conscientious amateurs cannot be integrated into the State site recording organisations, so that there could be a co-ordinated approach to rock art studies. If this could be brought about it could lead to a mosaic of areal data covering the whole continent. From such a co-ordinated mosaic, with the aid of the computer, it is quite possible that speculation could be replaced with scientific knowledge.

David R. Moore
13 Chester Street
Woollahra, N.S.W. 2025
Australia

By **ROBERT G. BEDNARIK**

The Pilbara region of Western Australia has long been regarded by me as possessing the most outstanding of the world's major petroglyph occurrences. This corpus of rock art is excelled neither in sheer numbers of sites and individual figures, nor in stylistic complexity, artistic sophistication or continuity of tradition. It is the surviving evidence of rich spiritual culture traditions.

The amount of rock art research done in this region is diminutive in comparison to the magnitude of the material available for study. Some effort has been directed at particular sites, or site complexes, such as those near Port Hedland, at the upper Yule River, at Depuch Island and Dampier Archipelago. McNickle has attempted a broad overview of the entire region, comparing a sizeable sample of sites. He not only succeeds in providing a concise, general outline of the region's rock art - including its rarely mentioned rock paintings - he also propounds several hypotheses in the process. His unconventional approach,

unfettered by preconceived models, results in ideas that open up interesting perspectives.

Perhaps most importantly, McNickle examines the correlation between rock art type and physical characteristics of the art medium. His arguments are plausible, and of major consequences if accepted. If, as he reports, the type of rock art prevalent in a region is determined by geomorphological factors, the importance of technique as a cultural index can no longer be accepted. Since style is no doubt affected both by the medium and by the technique used, it is expedient to ask: how much is style influenced by purely technological considerations, such as average size of available rock panels, physical attributes of the medium, type of tools available to the artist, or any other technical limitations?

The role of the medium in effecting variations in rock art has been acknowledged before, but McNickle goes further than that. He argues that the effect of environmental agents on the course of regional rock art evolution is quite fundamental.

Concerning McNickle's pondering of the significance one should attribute to superimpositions in rock art, I note that these are a worldwide phenomenon, though one that is more pronounced in some regions than in others. In my opinion, most rock artists had little conscious regard for the ancient images they covered with their own work. Nevertheless, previous art *did* have an influence on them, principally by prompting their subconscious response to it. There are numerous instances of dense concentrations of rock art throughout the world, where successive generations of artists have used the same locality, often the same rock face, over periods of millennia, ignoring similarly suited nearby rock surfaces. As each component of such a sequence reflects the iconographic contents of the culture represented, so do the 'vandalistic' activities of present-day visitors, the dates, initials, stick men and manifestations of the 'I-was-here syndrome'. I think they are all triggered by the older motifs and not so much by an innate desire to produce rock art.

McNickle's comments on patina formation are particularly pertinent and they demonstrate his keen facility of discriminating the essential detail of his observations. The chemical compositions of patinae require the presence, in the rock, of constituents such as pyroxenes, magnetite or olivine, which are commonly present in some rocks (e.g. dolerite) but not in others (e.g. granite, which would seem to depend on its biotite for patinating agents). Patina is an important key to sequencing the Pilbara rock art, but patina formation is as yet inadequately understood, and should be a priority research subject.

Although I cannot subscribe to Trendall's (1964: 88) view that a weathering skin of five millimetres could have taken well in excess of a million years to form, I do think that patination of Pilbara rock art indicates very great antiquity for the oldest traditions.

The employment of Chaloupka's technique of inferring sea level fluctuations from identifiable animal representations (already propounded by Mountford and Edwards 1962) is very useful in the Pilbara, which is rich in coastal petroglyph sequences. One could go further and consider the palaeoenvironmental significance of such figures as the tortoises and 'thylacines' at Tom Price (Bednarik 1977: 74), and other depicted species that would require ecological systems very different from those found today, in this semi-arid, harsh region.

The enormous wealth of rock art in this region still lacks a comprehensive taxonomy, or a general stylistic analysis. Because of the inaccessibility of the sites, multitude and complexity of data and the general remoteness of the region, the establishment of a dated regional art sequence seems a very remote possibility at the present time.

Robert G. Bednarik
Editor, *Rock Art Research*

Reply

By **H.P. McNICKLE**

The above comments and criticisms regarding my paper are gratefully appreciated. My principal motive at the time of my observations at Pilbara rock art sites had been simply to obtain a satisfactory photographic record of the region. Only during the writing of a paper on the Spear Hill Complex (yet to be published) did it occur to me that a paper detailing my observations in the Pilbara region as a whole may bring to the attention of other researchers a few ideas that could be of value. That the reviewers appear to be unanimous in viewing the work as a worthwhile contribution I find most gratifying.

My observations in the Pilbara were severely limited by the means of transport available to me. I did not have the use of a boat, and had the benefit of a four-wheel drive vehicle on only two occasions. Because of this I was able to observe very little of the rock art in areas such as the Chichester Range and at Mt. Edgar Station, where prolific numbers of sites are known to exist but documented information is negligible. Even with the help of the literature compiled by earlier researchers it was not possible to

treat this vast petroglyph region with an approach that was unbiased by my own observations, which had been concentrated in some areas, while neglecting others. As Clegg states, the paper portrays a series of individual ideas and observations. This is as much as was intended, simply to suggest areas and topics which future researchers, undoubtedly more competent than myself, could analyse further. Even in areas investigated in some detail, such as the Spear Hill group, it was noted that particular types of motifs and styles were confined to, or concentrated at particular sites, but nothing as detailed as a statistical analysis was attempted.

The 'mechanistic approach' criticised by Moore also evolved as a result of the limitations of time and transport. In order to determine the most likely areas of prolific art sites I attempted to relate the sites to purely physical features such as size and structure of rock outcrop, type of rock, proximity to resources, etc. In the absence of informed Aboriginal comment regarding the Pilbara rock art, consideration of these factors was found to frequently give a reasonably accurate guide to the location of good sites - although by no means an infallible one.

This brings us to the point of site location in relation to Aboriginal mythology. Moore's observation, that sites chose artists rather than the reverse, through the enduring myths of the Dreaming, is no doubt relevant to areas such as the Kimberleys and Arnhem Land, where rock art still retains traditional meaning to present day cultures; but can similar rules be applied to all other rock art Australia-wide? For perhaps the same reasons that rock art styles have changed in all major rock art provinces, the spiritual traditions and myths would almost certainly have undergone change as well. In the Kimberleys, the traditional custodians of the Wandjina paintings deny any cultural links with the earlier Bradshaw figures, often found at the same sites and even beneath the paintings of the recent tradition. In the Pilbara, Aboriginals have been unable to give any information of cultural links with even the most recent of the engraved figures, and the same applies to petroglyphs in other parts of Australia. Although I can quite reasonably believe that the most recent phase of Pilbara art may have been sited according to motives similar to those suggested by Moore, I find it equally reasonable that petroglyphs of progressively earlier periods may have been less and less likely to have been executed for these reasons, and that different criteria applied then. As pointed out in my paper, the frequency and location of early motifs and figures is by no means parallel to those of the more recent phase. L. Maynard is of the opinion that much of the Pilbara rock art was executed at a time prior to the establishment of the present, Australia-wide cultural traditions of sacred sites and rigidly enforced separate roles for men and women. My own observations and photographic record clearly indicate that petroglyphs have frequently been partially obliterated by seed grinding patches. I here include not only the earlier petroglyphs but even the supposedly recent Kurangara figures (e.g. Spear Hill Site 2). Although Moore's view may be valid for rock art traditions of the present day, I find it quite plausible that, when one considers the possible changes and evolution of rock art traditions over a lengthy period of time, environmental factors may in the distant past have played an important role in the selection of sites.

Moore himself indicates that an artist may have little or no regard for pre-existing art at a particular site, and the resulting superimpositions demonstrate that noticeable changes in tradition are taking place even in recent times. Bednarik's comments regarding his own observations, of a worldwide tendency of rock artists to superimpose upon the art of earlier cultures, often ignoring equally suitable nearby rock surfaces, are most significant. This indicates that a wide variety of cultures, all different from each other and from recent Aboriginal traditions, separated from them in both space and time, have all been motivated by similar criteria, presumably by something very basic to human nature. This tendency is certainly well established in the superimpositions of the Pilbara, which often reveal three separate phases, when abundant equally suitable rock surfaces in the close vicinity remained undecorated.

All the reviewers agree that the processes of repatination are extremely complicated and variable. The study of repatination rates should be a priority subject for research. In my opinion they may prove to be a more accurate guide to determining the age of petroglyphs than weathering rates of painted surfaces can be for determining the age of paintings. The dating potential of patinae is not significantly impaired by the exceptional effects of certain local conditions which can affect repatination rates undeniably. Moore's account of the faked figures prompts me to relate my observation of a reverse process that may have operated in the Pilbara, at least on some types of rock. The well-known Climbing Man Panel on the Burrup Peninsula, a vertical granophyre face with small figures, receives some protection on one side from a rock projecting and partly overhanging some of the figures. The petroglyphs receiving the greatest degree of protection appear to have experienced more repatination than the less protected figures. The greatest colour contrast, i.e. the least evi-

Plate 9.
Upright anthropomorphic figures. The inverted female figure on the left appears to be in sexual association with the smaller figure above it. The author's height is two metres.
Spear Hill Complex, Site 8.
Pilga Station, Pilbara region.

dence of repatination, is shown by those figures that are completely exposed to the weather. The climate of this area is generally dry, with rainfall normally confined to a brief period of intense tropical storms after which the rock surfaces dry out fairly rapidly. Could it be that the part of the panel that is protected from sun and wind takes longer to dry, and that the longer retained moisture accelerates the repatination process?

My comments concerning the correlation between art and utilised medium are not intended as an infallible, universal rule. Quite obviously local variations of culture also undoubtedly play an important role in these considerations. Areas such as Victoria, poorly endowed with art of any form, are certainly not lacking in suitable media. Some forms of art may have flourished for lengthy periods in the distant past, without leaving any evidence of their former existence. The most ephemeral would be sand designs, followed by paintings on organic materials and by dendroglyphs, then rock paintings, petroglyphs and, probably the most permanent of all, stone arrangements. Where more than one medium was readily available, the artists may have chosen that which cultural convention had selected as the most suitable.

As Clegg points out, paintings and petroglyphs are to be found in the Sydney - Hawkesbury area, but dendroglyphs are lacking despite an abundance of trees. Perhaps the artists were aware of the relative impermanence of trees in comparison to sandstone shelters and pavements. Trees are relatively widespread throughout the Australian continent, even in most arid areas, but their use as a surface for artistic expression is limited to a few selected areas, perhaps where more suitable media are lacking.

My paper appears to have aroused the interest of the above reviewers and if it could stimulate similar interest in other researchers it would have served its purpose: to focus attention upon a major rock art province that has been largely neglected. Because of the current mining and industrial developments, together with continually improved access and the progressive influx of population, the Pilbara should receive a high priority from researchers. Considering the vast amount of rock art, encompassing a wide variety of styles, and spread over an obviously immense period of time, and especially in the absence of informed Aboriginal comment, the interpretation of the Pilbara rock art presents Australian rock art researchers, I believe, with their most formidable challenge.

Acknowledgments

During the period of my research into Pilbara rock art I was given assistance and information by a considerable number of people. The following are those whom I wish to acknowledge as having given particularly valuable assistance.

Mr Bruce J. Wright (former Registrar of Aboriginal Sites, Western Australian Museum)
Mr John Paterson (Western Australian Museum ranger, resident Woodstock Station)
Mr Ian Solimon (Hamersley Range National Park resident ranger)
The owners and families of Hillside, Panorama and Muccan Stations, and the staff of Greenbushes Tin Exploration.

H. P. McNickle

Note:

[1]) At the ANZAAS meeting in Perth, in May 1983, Lesley Maynard proposed that the so-called Kurangara figures should be renamed 'Woodstock figures', for the reasons that are stated by McNickle.

Resume. *Dans la région de Pilbara en Australie Occidentale se trouve une des concentrations de l'art rupestre des plus dominantes du monde. Ce papier offre une vue très vaste de cette région et observe les variations dans le style, les dates et le but des pétroglyphes. Il répand aussi la lumière sur la connection entre la distribution des pétroglyphes et celle de certains types de roches.*

Bien que Pilbara est renommée seulement pour ses pétroglyphes, ses peintures rupestres sont aussi l'objet de discussion ici. L'auteur introduit l'hypothèse que la forme de l'art graphique qui évolue dans une région est généralement celle qui est la plus convenable à la plus grande partie du milieu disponible. Le style des pétroglyphes s'adapte aux conditions géologiques; les peintures rupestres se produisent où des abris rocheux convenables sont disponibles; et où l'art rupestre ne peut se developper et où des dessins de sable, des dispositifs de pierres ou de dendroglyphes évoluent peut-être.

Zusammenfassung. *Eine der hervorragendsten Felskunsttraditionen der Erde ist im Pilbara-Gebiet von Westaustralien zu finden. Der vorliegende Artikel bietet eine breite Übersicht über diesen Raum, und befaszt sich mit Fragen von Stilabweichungen, Alter, und Zweck der Petroglyphen. Weiters wird der Zusammenhang zwischen der Verbreitung der Felskunst, und jener gewisser Felstypen beleuchtet.*

Das Pilbara-Gebiet ist zwar nur für seine Petroglyphen bekannt, doch in dieser Arbeit werden auch seine Felsmalereien besprochen. Dabei entwickelt der Verfasser die Hypothese, dasz die Form der sich in einem gegebenen Gebiet entwickelnden graphischen Kunst im allgemeinen jene ist, für die sich das am meisten verfügbare Ausdrucksmittel am besten eignet. Der Stil von Petroglyphen paszt sich an geologische Gegebenheiten an; Malereien erscheinen, wo geeignete Abris zur Verfügung stehen; und wo Felskunst sich nicht entfalten kann, entwickeln sich vielleicht Sandbilder, Steinanordnungen oder Dendroglyphen (Baumstammdekorationen).

REFERENCES

ANATI, E. 1963. *Palestine before the Hebrews.* London.

BEDNARIK, R.G. 1977. A survey of prehistoric sites in the Tom Price region, north western Australia. *Archaeology and Physical Anthropology in Oceania* 12: 51-76.

BEDNARIK, R.G. 1979. The potential of rock patination analysis in Australian archaeology - part 1. *The Artefact* 4: 14-38.

BEDNARIK, R.G. 1984. Die Bedeutung der paläolithischen Fingerlinientradition. *Anthropologie* 22: 135-42.

CRAWFORD, I.M. 1964. The engravings of Depuch Island. In W.D.L. Ride, I.M. Crawford, G.M. Storr, R.M. Berndt and R.D. Royce, *Report on the Aboriginal Engravings and Flora and Fauna of Depuch Island, Western Australia,* pp. 23-63. Western Australian Museum, Special Publication No. 2. Perth.

DIX, W.C. 1977. Facial representations in Pilbara rock engravings. In P.J. Ucko (ed.), *Form in Indigenous Art,* pp. 277-85. Canberra.

DIX, W.C. and F.L. VIRILI 1977. Prehistoric petroglyphs of the Dampier Archipelago, north western Australia. *Bollettino del Centro Camuno di Studi Preistorici* 16: 87-110.

EDWARDS, R. 1971. Art and Aboriginal Prehistory. In D.J. Mulvaney and J. Golson (eds.), *Aboriginal Man and Environment in Australia,* pp. 356-67. ANU Press, Canberra.

EMERY, K.O. 1944. Brush fires and rock exfollation. *American Journal of Science* 242: 506-8.

LORBLANCHET, M. 1977. Summary report of fieldwork, Dampier, W.A. *Records of the Australian Institute of Aboriginal Studies.*

McCARTHY, F.D. 1961. The rock engravings at Depuch Island, north west Australia. *Australian Museum Records,* N25: 121-48.

McCARTHY, F.D. 1962. The rock engravings at Port Hedland, north western Australia, *Kroeber Anthropological Society Papers,* No. 26.

McCARTHY, F.D. 1967. *Australian Aboriginal Rock Art.* Sydney.

McNICKLE, H.P. in prep. Rock art of the Spear Hill Rock Engraving Complex, northwestern Australia. *Rock Art Research.*

MOORE, D.R. 1971. Australian Aboriginal rock art: its relevance to the European Palaeolithic. *Bollettino del Centro Camuno di Studi Preistorici* 7: 117-36.

MOUNTFORD, C.P. and R. EDWARDS 1962. Aboriginal Rock Engravings of extinct creatures in South Australia. *Man* 62: 97-9.

PALMER, K. 1975. Petroglyphs and associated Aboriginal sites in the north west of Western Australia. *Archaeology and Physical Anthropology in Oceania* 10: 152-60.

PALMER, K. 1977. Aboriginal sites and the Fortescue River, north west of Western Australia. *Archaeology and Physical Anthropology in Oceania* 12: 226-33.

PETTIPAS, L. 1982. Naturalism and stylization in Canadian Shield rock art: a discussion. *CRARA Newsletter* 17: 13-27.

RIDE, W.D.L., I.M. CRAWFORD, G.M. STORR, R.M. BERNDT and R.D. ROYCE 1964. *Report on the Aboriginal Engravings and Flora and Fauna of Depuch Island, Western Australia.* Western Australian Museum, Special Publication No. 2. Perth.

TRENDALL, A.F. 1964. Examination of rocks with Aboriginal engravings. In Ride, *et al.* 1964, *op. cit.*, pp. 83-8.

TREZISE, P.J. 1969. *Quinkan Country.* Reed, Sydney.

VIRILI, F.L. 1977. Aboriginal sites and rock art of the Dampier Archipelago, Western Australia: a preliminary report. In P.J. Ucko (ed.), *Form in Indigenous Art,* pp. 439-51. Canberra.

WORMS, E.A. 1954. Prehistoric petroglyphs of the upper Yule River, north western Australia. *Anthropos* 49: 1067-88.

WRIGHT, B.J. 1968. *Rock art of the Pilbara region, north west Australia.* A.I.A.S. Occasional Paper No. 11. Canberra.

WRIGHT, B.J. 1972. Rock engravings of striped mammals: the Pilbara region, Western Australia. *Archaeology and Physical Anthropology in Oceania* 7: 15-23.

KEYWORDS: Rock art recording - Archival storage - Image enhancement

AN IMAGE DIGITISING AND STORAGE SYSTEM FOR USE IN ROCK ART RESEARCH

Jeffrey L. Dickman

Abstract. A comparatively inexpensive computerised system of recording, storing and image enhancing of rock art is described. It consists of a video camera, micro computer, disc drive, monitor and display unit. By using an optical disc rather than a video tape the system provides highly efficient archival storage. In addition, digitised pictorial information can be modulated, a possibility that is most advantageous in rock art research. Faded images, or figures that are difficult to recognise, may be discerned with the help of image enhancing methods.

The described system could be of benefit to international rock art research, because it would greatly facilitate the exchange of vast amounts of pictorial information. There are also potential possibilities of use in the area of public education.

Growing use of 'high technology' and reduced costs from only a few years previous have allowed a foothold into the research and implementation of inexpensive computer equipment for the processing and enhancement of visual imagery.

The practicality of this technology will require extensive testing of the systems' capabilities, and, more importantly, of how such additions to the science affect the way information is thought of, organised and used. Although research is not solely dependent on the visual record, the more complete the information the better our position in making informed hypotheses and conclusions regarding the images and their relationships to culture.

This paper is concerned with both aspects of information management; what information is to be kept and how it is to be maintained; and, secondly, with defining the possible uses of the data. The former refers to the visual record and the quality or interpretation of the visual record, while the second part involves the functional interpretation, e.g. archival, research, and educational.

Image Processing Facilities

Recording an image accurately is paramount. A poorly defined image poses problems to image description, to the slotting of images in nomenclatures and the final statements of relationship of the image to the culture. When an image is lost, through vandalising or erosion, it cannot be brought back, at least in terms of current technology, and within our notion of an image being 'lost'.

What is clear is that recording attention must remain focussed on defining the extent of an image, simply where the image is and where it is not. Under this premise, image enhancement techniques do address the need of rock art research by working to improve an image's reduced recordability. Rock art is mutable, it's destruction coming from various sources, such as geomorphological processes, defacement or superimposition by human action, and lichen or other vegetation.

Essentially, image processing extends the physical sense of sight, while directing the tactile sense. Image processing involves the seeing and manipulating of light from any prerecorded image or any live-time image. The system can, in some cases, improve (enhance) the quality of the image input (picture, video still frame) into the computer, through the manipulation of light and colour, thus aiding in locating the image and determining its condition.

The technology to be described below has been available for fifteen years, finding uses in government and business applications. Like for many products, new markets are sought for the existing technology. The microcomputer

industry has encouraged development and adaption of existing technology, to be reconfigured to the new 'hardware', extending a computer's capability and hence increasing sales of computers.

There are many companies currently retailing image processing peripherals (subsystems), both hardware and software, and the first half of this paper will deal with this equipment.

All of these peripherals depend on a computer for their operation, they are not 'freestanding', they are not able to operate without a 'mother' or 'host' computer. At the time of writing this paper six companies are marketing similar hardware and software products which were configured to operate within the design of the 'Apple II+' microcomputer. Two of these products will be outlined as to three points which characterise the buying and using of any high-technology product:

1) Function:
   a) Does the subsystem do something for which it is sold? This refers to hardware (the tool), software (the program), documentation (how to operate).
   b) Are the tools, programs and documentation salient to the basic needs?
2) Ability:
   a) How can this system do something in respect to product quality, e.g. line display on a monitor (clarity of picture)?
   b) Is this subsystem capable of meeting my particular needs? Can I program it or change it?
   c) Is this service doing or approximating an industry standard?
3) Product life:
   a) Will the subsystem be upgradable? (Because if it cannot be, by the manufacturer, the product stands an excellent chance of becoming outdated, and will not be receptive to important updates.)
   b) Is the subsystem constructed well? Will it last the time between product updates?

Although not all the considerations one needs to be aware of are listed these points will guide the potential user to making a more informed choice. These guidelines were used in selecting the subsystem I am currently using, and helped in outlining this paper.

Distributed under the names of 'Ditherizer' and 'Digisector', the former from Computer Station Inc., the latter made by The Micro Works Inc., both subsystems perform similarly. Each allows the operator to execute two types of tasks; firstly, to receive into the computer via a video camera a still, real-time picture of some object; secondly, both products allow for processing of the image, the manipulation of that image or picture, involving the addition and subtraction of light, or what the computer actually displays, light points or pixels (Digisector Manual 1979).

Briefly, the type of equipment needed to use this digitising technology is a standard NISC video camera, security or movie type, connected by a cable to the peripheral subsystem, which can be either of the two before-mentioned products. This peripheral is located within the 'Apple II+' microcomputer, literally plugging into the computer, and operates within the computer's 6502 microprocessor allowing it to comprehend the video signal.

Contained on both peripherals, or PCB's (printed circuit boards), are preprogrammed 'chips'. These hold the basic commands of operation and are the heart of each subsystem. The peripheral receives a signal from the video camera and this is translated into information which the microcomputer knows. The signal from the camera, called 'video input', can with each subsystem be viewed in two ways. The computer sends out its own 'output' signal which informs the user of the computer's progress in the program. This, like the second signal, is directed through the subsystem board. A second signal comes through the peripheral subsystem and displays what is termed a 'real-time' or live image, like seeing oneself on a video monitor. This second signal, although not necessary, is practical because it allows the user to, firstly, frame the image to be digitised by the computer, and, secondly, it permits focussing of the image to ensure as clear a picture as possible. Thirdly, it allows the user to determine proper lighting, through an aperture on the camera lens, and by adjusting brightness/contrast values on the peripheral.

The first signal, unlike the second, allows the user to see the digitised image in addition to displaying all modifications made to the image. At the time of writing this article both of the above companies' products can 'see' only black and white, although one, the 'Digisector', can add false colour to the addressable levels of light. The source of the image to be 'digitised' can be either colour or black and white. The image to be digitised and processed needs to exhibit the greatest possible contrast. There are two reasons for this. Firstly, the clearer the subject image, the more distinct will be the final computer image. Secondly, this will reduce the time needed in producing, with the computer, the clearest image. Obviously, the better the image is and the higher the quality of the photograph, the easier will be the processing.

As mentioned previously, some of the processing ability resides on the peripheral board itself.

These subsystems also make use of supplemental programs available on a 'floppy disk', a small record-like magnetic information storage medium. Most makers of this type of product offer this software including the subsystems outlined here. Sold as an option for the peripheral boards, it is recommended that the software be purchased for either subsystem. Although some individuals may choose to write their own tailored programs, the existing software works well and offers an inexpensive beginning for image processing. Writing programs is not the exclusive task of the professional programmer, but unless one has such experience the effort can be very time and money consuming.

Neither subsystem will probably ever make

Figure 1. Super Scan digitising and image processing software flow chart. The arrows indicate the influence of dominant program functions, each part of the program being able to move to all other parts of the program.

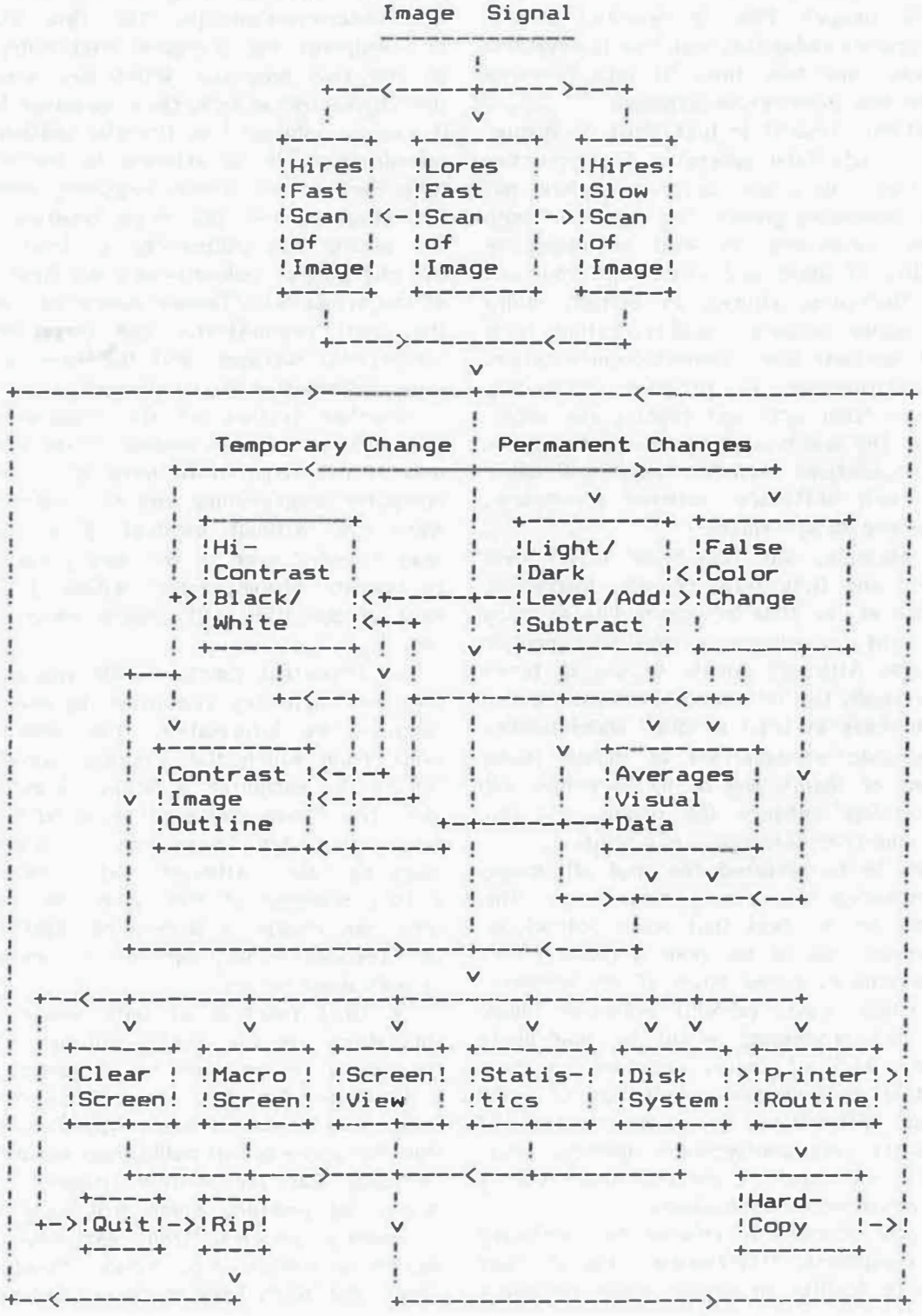


image processing easy or simple, nor will the benefits be immediate. Actually it appears this application in rock art study is unique and there is no manual or guide that applies to it, save the very basic and limited user manuals supplied. Both subsystems require the user to be creative in the production of an image as well as in how the system should and can be expanded to fit the need. Success will come only from exhaustive trial and error.

This does not mean that there is a long uncertain wait before consistent, practical results are achieved. Each system has proved useful in enhancing images. What is required now is interest to explore and define both how the systems are applicable and how they fit into research goals and the new information systems.

An additional benefit is that most companies periodically update their programs. Since purchasing the 'Digisector', one program update has come forth expanding greatly the degree of both false colour processing as well as expanding the capability of black and white high contrast. The only hindrance, alluded to earlier, stems not from either product's quality, rather from the lack of adequate user's manual documentation. Complex relationships of program commands, how each function acts and reacts, are simply not outlined. The user must produce a custom-made manual of operation, outlining major and minor functions, their influence, ordered procedures, the benefits and idiosyncrasies.

As an example, the 'Digisector' offers over one hundred and fifty false colours, thirty-four of which can at one time be assigned to as many levels of light to enhance a particular portion of an image. Although simple to use in terms of the commands, the 'intelligent' decision requires the user to have at least a rough understanding of the possible combinations of colour (there are millions of them), and of which colour will most effectively enhance the image, and too, reproduce clearly to hardcopy, i.e. a printout.

It needs to be restated that not all images can be enhanced to a more clear state. This will be due to the fact that some petroglyphs and pictographs are of too poor a quality, they are 'irrecoverable'. Other kinds of nonsubsystem problems which would prohibit effective image digitising and processing would be inadequate photography, lack of focus, improper contrast, poor lighting or improper developing, to name a few main difficulties. These are problems of image quality and photographic quality. Both, nonetheless, will result in reduced image clarity even with enhancement techniques.

A second concern is related to combining effective equipment. This requires that the user has adequate facility to employ other necessary peripherals, e.g. a high-resolution camera, a reasonable quality lens for the camera, a high-resolution black and white monitor to view the real-time image, as well as a high-resolution colour monitor to accurately display the subtle colours possible, in the case of the 'Digisector'. Of course this assumes that the potential user has access to an Apple microcomputer with 'Applesoft' (Floating Point Basic), one disk drive [2]) and 48k (48 000 character) RAM memory, the space where a computer does the analysis of data. Lastly, the user must have a strong familiarity with the operation of the subsystem and with inter-relationships. The flow chart (Fig. 1) documents the complex relationships of one of the two programs which are available for the 'Digisector' system. Once an image is digitised it can be subjected to literally millions of light combinations, in an attempt to correct visually that part of an image requiring enhancement. The chart outlines the major program functions, the adding and subtracting of levels of light, the changing of colour(s) and the final smoothing of the visual data. Though somewhat complicated, the chart demonstrates the versatility of the subsystem's software and the ease with which visual information can be changed.

Another feature of the subsystem is that the software is completely 'menu-driven'. The user is not required to have any knowledge of computer programming and each company's software runs without incident. Both systems are 'user friendly' even to the novice who can begin to operate either system within a few hours. Skill of operation will require about a week of use.

An important function built into each system are the single key commands to save/store and retrieve the information. The medium is the same from which the programs were taken to run on the computer, a floppy 5¼ inch magnetic disk. This means that once produced to the user's satisfaction, the image can be stored on the magnetic disk. Although each image requires a large amount of disk space for storage the user can create a library of digitised images on additional disks, part of a working archive or permanent record.

A final function of both image processing subsystems are the printer routines which allow the image to be sent to a printer, producing a hardcopy (Fig. 2). Both systems can print an image in a number of sizes, expanding or compressing the image to suit publication needs or reduced hardcopy size for in-field research. There are dozens of printers which will work with both companies' systems, from expensive to lesser expensive models, e.g. 'Epson', 'Anadex', 'Paper Tiger' and 'Nec'. Each of these printers obviously

Figure 2.
The above printout is a rough example of the type of result possible, using the described system. In this example the equipment was programmed to discern different levels of light.

has graphic capabilities.

The anticipated costs to set up the discussed microcomputer image processing system are currently in the order of $ US 3000 to 4000. These prices can drop or increase greatly over short periods of time. Finally, Apple Computer have replaced their 'Apple+' with a new model, the 'Apple IIe'. It is assumed the makers of the peripherals will upgrade their product to run on the new Apple.

Storage and Retrieval of Digitised Images

The second part of this paper deals with the permanent storage of visual information. This includes the previously discussed processed image data and all other types of visual matter, photographs, drawings, sequenced video movie footage and text.

A necessary requirement for producing such large amounts of stored information is a system designed to handle it. Receiving the most interest is the laser disc or optical disc. The optical disc, LP-record sized, became available to the commercial market in 1978 and is moving to supplement other types of active information storage systems. Its predominant role, for the moment, is in home entertainment, but it has not found much favour in the home because it is produced in a permanent format and cannot be recorded onto or changed once produced.

The permanency of this medium is as much an advantage as it is a liability, depending on the circumstances. The laser disc can store vast

amounts of either visual or text information, or any combination. Information from the disc is read by a fine beam of laser light through a system of mirrors and can be displayed on a television or other type of monitor.

A second type of system is produced in a different way and, unlike the optical disc system, retrieves data by means of a 'stylus' which actually touches the disc surface. This second system is called 'CED', Capacitance Electronic Disc, and plays the disc in a continuously advancing format of sequenced pictures. The system is currently marketed for use in home entertainment (Allen 1981: 52; Onosko 1982: 84-5).

Although also designed and being used as a home entertainment machine, the optical disc system offers special functions which have thrust its use into the business of information management. The advantage of the optical disc system for storage and retrieval of information is that it was intended to work with the data, to create interaction between the user and the machine. These are uses which are just beginning to be explored.

An optical disc is produced in such a way that each frame of a still or motion format picture is assigned a discrete place on the actual disc surface, a concentric ring. Each disc, per side, has space for 54 000 of these separate rings. The optical system 'reads' with a fine beam of laser light each ring on the disc, then reproduces an image from information encoded, this being in the form of microscopic 'pits' arranged in a spiral fashion. The length of the pits and the distance between them determines what is seen on a screen. Each ring equals one picture, or frame of information.

The CED system saves data in a less discrete format, each frame of data requiring four rotations of the disc to produce one image. This difference in the way information is stored and accessed is an argument in favour of the optical disc.

The advantages of the optical disc system are probably clear. It allows the user to recall any single frame from the disc and display it for any duration. With frame search, stop, and a wide range of forward and reverse speeds, or frames per second, the user can jump through a 'photo album' of 54 000 images (Onosko 1982: 92). Optical disc systems have only recently developed these special functions to take advantage of this formating type, allowing single frame recall and display.

First generation optical disc players failed, however, to make use of this option, the search and related functions. But second generation optical disc players have done that. All optical disc players marketed by Pioneer Electronic Corp. of America use all possible search functions, except one less expensive model (Onosko 1982: 91-2). The means by which frames of information are recalled is simple enough. Optical players use a button or keypad format, broken into two types, by function and by number. Located externally on the player, this can be operated by a remote control unit on some players (Pioneer Electronic Corp. n.d.). Although there are many models designed about the optical disc method this article will discuss the Pioneer VP-1000, the first widely marketed second generation player.

This player offers two types of frame searching, a frame specific, and a general search or overview. The frame specific functions are the most practical to a potential rock art archive. This allows the user to search in two ways, by frame, or by chapter. In terms of home entertainment philosophy of system use, the frame search function assumes the user wishes to see one particular frame, while the chapter search, also going to 'specific frame', takes the user to a certain significant part of dialogue, action or plot. The frame search function, global in scope, can take the user to any part of the disc. The chapter search function, however, is limited in its search capacity because it is of a prioritorial nature (Onosko 1982: 86). The disc player looks for markers or flags in the information which denote some significant point, break, subject change or data type. The number of these 'flags' and their placement are determined by the person or group for whom the disc is being produced, a special function that reflects a user's need. For example, a chapter flag would be appropriate to allow the user to jump from one part of the disc, e.g. Site A, to the beginning of Site B. Site A can be Chapter 1, Site B can be Chapter 2.

The other four functions are ancillary to the basic search functions but are very useful in terms of browsing through data at a given area on the disc. These secondary functions are: (1) still/step frame; (2) slow frame advance, controlled by a variable rate of frame speed; (3) scan, high speed, nondefinable visual search; (4) fast, nondefinable three times normal speed search. All secondary functions have bidirectional capability. Thus the user can move in an ascending or descending fashion through the consecutive frames.

Those discs which employ all the functions of a player possible are called 'CAV' (Constant Angular Viewing) or Standard Play. There is a second disc type, 'CLV' (Constant Linear Velocity), which, unlike the first type, uses only the chapter function and the scan function. The difference between these discs and the functions possible depends on the amount of data stored on a disc.

The standard play format, like the extended play format, draws from a possible 54 000 rings where data is stored. The ring for each disc type is composed of two parts. In the standard play format the ring holds both the image and also encoded commands needed to use many of the player's functions. In the extended play format the portion of the ring which could contain player commands is sacrificed for an additional frame of information. The standard play format offers only half the images possible on the extended play, the trade off being the loss of search and still functions of the player. The different approaches in data storage have directed the CLV disc with its hour long capacity towards home entertainment, while the CAV is fast moving to the forefront as a primary system of interactive data storage and retrieval, in a real sense revolutionising the business world of information management.

The major drawback to the laser disc is that, once produced, the information on the disc is perdurable. Video tape recorders do have a distinct advantage in this respect. Updates can be effected with little additional costs and the video tape player has many of the functions of the optical disc player. A video recorder tape can, depending on the model, 'still' a single frame, slow search forward or back, and fast scan. Further discussion will make clear, nevertheless, why the laser CAV system is the most accurate and cost effective system for permanent storage of information.

An optical disc, as mentioned, is an immutable medium. The production of a disc is not yet possible in the home, nor is it likely to be so for five years or more. But the majority of steps of getting the data to the final production stage before placing it on an optical disc can be undertaken by the group wanting the disc.

There are three steps involved in the production of a laser disc: obtaining the data, organising it, and placing it onto a disc. Assuming the first step is complete, and pertinent data is decided upon, the information is initially transferred by photography, from the paper or hardcopy medium to a one inch C-format video tape from which the master optical disc is produced. Briefly, the types of data that qualify to be placed onto video tape will be of two types, still pictures, and sequenced footage.

1) Still pictures:
   a) Image photographs, panel photos, photographs of image bearing rock.
   b) Site overviews from, and including, pertinent geographical features.
   c) Photographs of topographical maps and site map drawings.
   d) Computer enhanced images.

2) Sequenced footage:
   a) Driving to site, current access, walk-through of site from critical directions.
   b) Panned footage, footage from points of reference, or across an azimuth, e.g. from 0 to 70 degrees.
   c) Sequenced frames to show distance from one image bearing rock to another.

The framework needed to order such a vast amount of data will require a strong, clear set of goals and priorities. There are a number of reasonable approaches for solving this. The format must, as in any archive, avoid subjective interpretations of what it is keeping. We merely wish to present the data, the research is left for the researcher.

The optical disc should incorporate as much recorded information as possible. If it is structured by 'flags' at county areas and the images are ordered by quadrangle map and finally by site number, a researcher could quickly jump from rock art data of Joshua Tree to that of the Coso Range [southern Californian sites].

The data will probably, to one extent or another, need to be adjusted or supplemented to the desired structure on the disc, in a manner reflecting the anticipated uses by academic, avocational and public groups.

The actual production of the disc from the master video tape requires about six weeks, assuming the data on the tape is organised and chapter/picture flags have been determined beforehand. Costs to produce one disc of rock art are certainly not out of reach. Beginning roughly at $US 2500 for ten discs, one side, the cost per disc drops in relation to the number of discs made. If four hundred discs are required, the cost is only about $US 13 per disc.

There is another type of CAV player offered by Pioneer Corp. It is a more intelligent player offering the same basic search and display functions. Like its discs, it is more expensive than the Pioneer VP-1000 player.

In a recent trade journal (*Information and Records Management*, Vol. 16, No 12) optical discs were divided into five broad categories designated under the CAV disc type: 1) entertainment; 2) education; 3) data storage; 4) document storage; 5) image storage. The article recommends three of the five (2, 4, 5), and it is safe to state that these three use types are the most relevant to the production of an archive. Regardless of the type of use, the cost to produce a disc is constant, whether there were to be ten frames on it, or 54 000. Other costs may also come into effect but these depend on the needs of the user:
1) Charges for chapter or picture search insertions apply beyond ten stops per side (labour $US 150

per hour; January 1983).
2) Colour correction costs ($US 350 per hour; Pioneer Electronic Corp., Program Development Service Price List, January 1983).

Essentially the prices quoted would be the costs incurred, save no additional or special editing. The manufacturer can produce the entire disc, placing the images onto a one inch C-format magnetic tape, organising the data, creating the entire product. This of course will greatly increase the final cost of the disc. But two of the first steps outlined earlier can be performed by the user and this would save money, besides giving the user complete control over the structure of the disc.

Given that the format of the data on tape remains the same when it is finally produced on disc it would be fair to ask: why bother producing a laser disc and not simply use the video tape recorder as the means of keeping the information? Optical disc players are comparable to VCR players in price and share similar repair and maintenance costs. But the cost of the players, even if the optical disc player system was less expensive, does not explain the distinct benefit of disc over tape.

There are three advantages over the video tape medium. Foremost is that the optical disc is permanent. If taken proper care of, kept out of sunlight and relative extremes of heat and cold, the disc will never wear out from use [3]). Video tape eventually will, probably after two to three hundred plays, and it can easily be erased, tangled in the moving parts of the VCR player, or affected by magnetic environments. Video tape can also stretch. These and other problems will reduce the quality of the images stored on it.

An optical disc has no such problems. Also, it offers high speed execution of its inherent functions: a frame search from Frame 1 to Frame 54 000 on the Pioneer VP-1000 requires only twelve to thirteen seconds. A video tape player can require minutes just to rewind.

A third aspect which makes the optical disc so attractive as a storage medium is the clarity, the perfect image reproduction resulting from its digital format. Although produced from an analogue signal, the final digital disc has a sharper reproduction of image while holding a picture frozen on the viewing screen, than the VCR system.

This article does not, however, reject the video tape player. In fact the VCR (Video Cassette Recorder) will play an important role in rock art field documentation as there is no portable optical disc recording system available. In this situation the VCR can also work as temporary storage, maintaining visual and text data until enough are obtained to warrant the production of an additional optical disc.

A last piece of technology which expands the optical system is, like the 'Digisector' board, an interface between two separate machines, in this case the 'Apple II+' microcomputer, and an optical disc player. At least three companies are marketing an interface board which, when slotted into the 'Apple II+' computer, and connected to a laser type player, can control and manipulate all player functions. What this means is that the computer can be programmed to execute repetitive search functions, or interactive questions and answers, e.g. 'Is this a petroglyph?', the response being co-ordinated with the visual information and frame number. Also, the frame numbers of one or more rock art sites can be preselected to display one image at a time, or bring specific images up on the screen that have been determined or classified, based on frame number, as having in common certain diagnostic traits. The diversity of uses for these technologies is only adequately treated here. In the future perhaps some of these concepts will have been tried, their contributions assessed, and guidelines for their use made clear.

Conclusion

The main benefit of this medium is the tremendous amount of visual and text data which can be stored. Implementation of such a system will open up information to a wider group of interested individuals who presently are unable to participate fully. The potential to disseminate information not only with local researchers, but also with other groups around the world, requires that we afford some thought to the comprehensive information exchanges now possible. Certainly, discourse would be enhanced in terms of establishing nomenclatures, recording methods, style analyses and eventual correlations of the multifarious forms of interpreting studies. Public education at most levels could share in the visual record. Public facilities, libraries, schools and museums could, for the cost of a player, disc and television receiver, bring into view the delicate nature of this, and perhaps all cultural resources (Kehrberg and Pollack 1982).

Jeffrey L. Dickman
1732 Partridge Street
Anaheim, Ca. 92806
USA

MS received 24 November 1983.

Comment

by **R.G. BEDNARIK**

The general availability of computer technology may be a comparatively recent development, and yet a report such as this one is already overdue. The relevance of digital recording and processing equipment to rock art research is so obvious that it need not be related in much detail. It is enough to consider the most salient benefits:

1) Pictorial and written information can be stored by means of a single medium, and the system can thus double as a library. (One side of an optical disc would probably suffice to store all Australian publications on rock art - copyright conditions permitting.)

2) In terms of cost effectiveness, digitised images would overtake conventional archival systems already at a fairly low volume, and would be far ahead at the high-volume requirements Australia presents.

3) The limited life of film or photographic records has long been a matter of concern for rock art researchers (see the reprint in *CRARA Newsletter* No. 16, p. 58), but permanence of such records is unlikely to be achievable technically. While digitised records are not yet quite perdurable it appears that they could become so, within a short time.

4) The very nature of computerised records renders them particularly suitable for studies involving cross reference or archival search. They can be readily coupled with other digital programs, they in fact permit methods of investigation that would have been almost impossible before the advent of computers.

Dickman's work relates some not so obvious benefits of the system he describes. One of the many problems rock art researchers often experience is the difficult task of interpreting very faded rock paintings, or of distinguishing ochre patches from adjacent natural rock colours. Often, the unaided eye is unable to succeed in such circumstances, and it is then that the computer can take over. By gradually eliminating all but a narrow range of light or colour from a digitised image its clarity can be markedly improved.

I anticipate another potential application of Dickman's system. Petroglyphs, particularly those that are very old, exposed, or occurring on friable stone, are often so eroded that they are very difficult to record. The necessity of examining every single depression, to decide whether it is natural or artificial, is most time-consuming, and an objective judgement is often impossible. When photographs are taken of such images, from different angles or differently lit, each likeness differs slightly from the others.

Digitised recording, I feel, may provide the answer. A perfectly objective recording could be produced of a petroglyph by mounting the video camera on a tripod, and taking a series of perhaps twenty or thirty frames of the same image, from the same angle, focus and distance. Each time, however, the petroglyph is lit from a different angle and direction (obviously, this involves night recording). The resulting frames would no doubt differ in most details, and they would then be processed by an appropriately programmed computer, producing a single image from the series. This composite frame would initially be almost black, but by slowly eliminating from it pixels on the basis of the number of times they have been exposed the image would gradually emerge. A 'threshold of minimum exposure' could be selected at the level that provides the most realistic likeness of the petroglyph.

The resulting representation will not appear lit from any particular angle or direction. Having converted an essentially three-dimensional image to a perfect two-dimensional, 'flat' copy we would obtain a completely objective recording. I think a more objective method of transcribing petroglyphs for any means of storage is not possible.

Digitised recording has more potential applications still, one being of particular interest in Australia. In this country, much of the more recent rock art is sacred to its traditional owners, and restrictions may apply to its recording and dissemination. Usually, there is a limitation concerning the people permitted to see the images.

Males or females may be barred, or uninitiated persons and, in extreme cases, all people but the custodians themselves. In recent years, these restrictions have been taken seriously, and they are now widely observed in public dissemination.

As in several other countries, the traditional owners and the students of rock art have quite different perceptions of the subject and its significance. Conservation or recording of the images for their own sake, themselves so vital in the view of the researchers, have little value for the Aborigines. Sacredness is embodied in the site, in the motif, in the act of producing the image, but permanency of the art is not sought.

The custodians' main objection against recording of rock art of restricted access is that they would relinquish control over its dissemination. In the past, permission was often granted by curators who did not appreciate the full consequences of their consent. Digitised recording, it seems to me, is the ideal solution. Computer

information can be coded so that it is totally inaccessible to unauthorised persons. If the codes required to gain access to it are only available to people eligible by traditional Aboriginal law the recorded images would be far better protected than the originals in the field. The rock art itself can only be protected by keeping its location secret, or by keeping visitors away from it, and these precautions are often ineffective.

In their digitised form, recordings of rock art can only be 'understood' by the computer. The machine would become the custodian's ally, retrieving an image only for an operator that has presented his or her credentials, in the form of a code number. Such a system would simply be the logical, computerised extension of the traditional system of custodianship. At the same time, it would meet the legitimate requirement of the rock art student. The material is recorded, and although he may not be given access to it by the traditional custodians in some cases, the researcher will be satisfied knowing that it is stored safely, by the most advanced method available, and that it will remain available long after the actual rock art has been obliterated.

Another possible use of computer recordings may be in the area of monitoring deterioration processes at rock art sites, for developing conservation strategies.

It is difficult not to be impressed by the system described by Dickman, and by its potential applications. What drawbacks would it have?

I can see three disadvantages, all of which could be overcome. Firstly, the optical disc is not yet perdurable. It should be technically feasible to achieve unlimited durability, and this would be a decisive factor in its acceptance.

Secondly, the production of a hard copy from the optical disc is still a rather ponderous process at present. Again, this is only a technological aspect that may soon change. Rock art recording is commercially irrelevant, and we shall have to wait until marketing demands and technology match our requirements. My other hesitation concerns the effects on international rock art research. Without doubt, this system would greatly facilitate and enhance international co-operation among students, but its use may at the same time disadvantage the researchers in those countries that cannot afford the necessary hardware and facilities. Scientists in economically depressed countries are already being put at a disadvantage by the explosion-like advances in communication and information technology, and due consideration should be given to these matters. Perhaps ICCROM could play an important role here.

In Australia, digitised recording techniques may hold the key to saving a large proportion of the continent's vast body of prehistoric rock art, before it disappears over the next few decades. To understand the magnitude of the task one must consider that the number of rock art images being lost in Australia, through natural or humanly-caused deterioration, is probably in the order of some tens of thousands each year. Hence for much of our rock art permanent digitised recording may be the only possible 'conservation' measure.

I am hoping that my comments will prompt a discussion on the general subject [4]. I invite all AURA members, particularly those engaged in recording or archival work, to air their views, and to contribute to such a discussion, perhaps in the forthcoming issue of this journal.

R.G. Bednarik,
Editor

Notes:

[1]) This paper was written at the request of Professor Clement W. Meighan and is intended for publishing by the University of California, Los Angeles. At AURA's request, and with the author's concurrence, Professor Meighan generously relinquished his prior claim. We express our gratitude to our members Professor Meighan and Mr Dickman, for their obliging attitude, and for giving their Australian colleagues prior access to this important work.

[2]) The term 'disk' refers to a magnetic computer disk. 'Disc' describes any type of video disc.

[3]) Although at a recent records managers conference in USA the life of an optical disc was estimated at five to ten years, improvements will increase its life expectancy.

[4]) Unfortunately, our production schedule did not permit us to obtain further comments for this issue.

Resume. *Un système d'enregistrement par calculateur électronique (computer), comparativement bon marché, emmagasinant et rehaussant l'image de l'art rupestre, est décrit. Il consiste d'une camera pour vidéo, un micro-computer, un disque pour actionner, un monitor et un rayon d'exposition. En utilisant un disque d'optique au lieu d'une bande vidéo, le système fournit un espace efficace très élevé d'emmagasinage d'archives. En plus de cela, des informations illustrées peuvent être modulées par un doigté, ce qui est une possibilité d'un avantage considérable concernant les recherches sur l'art rupestre. Des images déteintes, ou des figures difficiles à reconnaitre, peuvent être discernées avec l'aide des méthodes d'intensification d'images.*

Le système décrit pourrait être bénéfique aux recherches internationales de l'art rupestre, parce qu'il pourrait grandement faciliter l'échange d'un très grand nombre d'informations illustrées. Il y a aussi des possibilités potentielles d'usage dans le domaine de l'éducation publique.

Zusammenfassung. *Ein verhältnismäszig billiges, computerisiertes System zur Aufnahme, Aufbewahrung und Bildverbesserung von Felskunst wird beschrieben. Es besteht aus Videokamera, Microcomputer, Plattenantrieb, Monitor und Bildwiedergabegerät. Durch die Verwendung der optischen Platte anstelle des herkömmlichen Videobandes ermöglicht das beschriebene System äuszerst raumsparende Archivaufbewahrung. Weiters läszt sich ein elektronisch fixiertes Bild modulieren, eine für Felskunststudien sehr vorteilhafte Möglichkeit. Verblichene Darstellungen, oder schwer zu entziffernde Figuren können mit Hilfe von Bildverbesserungsmethoden erkannt werden.*

Das beschriebene System könnte für internationale Felskunstforschung von Vorteil sein, denn es würde den Austausch von bildlicher Information in enormen Mengen ermöglichen. Weiters hat es Verwendungsmöglichkeiten auf dem Gebiet öffentlicher Bildung.

REFERENCES AND ADDITIONAL READING

ALLEN, D. 1981. Conversation with Nicholas Negroponte. *Videography* 6: 44-56.

BLIZEK, J. 1982. The first national Kidisc. TV becomes a plaything. *Creative Computing* 8: 106-8.

DE CILLA, H.A. 1982. Optical disk technology and integrated media systems. *Information and Records Management* 16: 31-2.

KEHRBERG, T.K. and R.A. POLLACK 1982. Videodiscs in the classroom. An interactive economics course. *Creative Computing* 8: 98-102.

KELLER, C. 1982. V is for Videodisc. *Creative Computing* 8: 104-5.

MICRO WORKS 1979. *Digisector DS-65 Owners Manual.*

ONOSKO, T. 1982. Visions in the future; Videodisc technology: current and future. *Creative Computing* 8: 84-97.

PIONEER ELECTRONIC CORP. 1982. *Price Lists:* Disc Mastering and Replication; Program Development Services.

PIONEER ELECTRONIC CORP. n.d. *Operating Instructions for VP-1000, Laser Disc Player.*

ROBERTSON, D. 1982. *Super Scan 1.2, Owners Manual.* Magna Soft.

VALCAMONICA SUMMER SCHOOL

The Valcamonica Summer School provides professional training in research, documentation and conservation of rock art, and aims at conveying a higher degree of professionalism in the field of rock art research.

LOCATION

The Archaeological Field School is held at the CCSP (Centro Camuno di Studi Preistorici), in Valcamonica, Italy, the location of the major concentration of rock art in Europe, where more than 180 000 prehistoric petroglyphs have been recorded already and many more await to be unearthed. The rock art sites of Valcamonica have been included by UNESCO on the World Heritage List.

ANTECEDENTS

Every (northern) summer the Centro Camuno holds an archaeological field camp which includes participation in archaeological excavations and research in rock art. In the course of years it has become an international field school.

The International Consultation of Specialists on the Study, Documentation and Conservation of Rock Art, organised on behalf of UNESCO with the participation of ICOM, ICOMOS and ICCROM, held in 1981 at this Centro, agreed upon a series of recommendations in which the Centro Camuno is asked to continue and further its co-ordinating role in rock art studies; '*... More scientific energies and resources must be devoted to the systematic study of rock art, which should involve co-operation among the various disciplines ... International seminars for exchange and comparision of information should be held regularly ...*' The Summer School thus represents a fulfilment of such recommendations.

SCHEDULE

The Valcamonica Summer School program includes exploration, field research, laboratory work, projection of documentary films, lectures and debates, for a total of 200 hours in five weeks. Activities are carried on five days a week. Saturdays and Sundays are free. Occasionally, optional activities are organised for the weekends. The cost of the Summer School is $US 445.00.

The session usually starts in mid-July; accepted candidates are notified of the finalised dates. Applications must reach the following address by the 20 May of the year of intended attendance:

Valcamonica Summer School
Centro Camuno di Studi Preistorici
25044 CAPO DI PONTE (BS.)
Italy

KEYWORDS: Early parietal markings - Nonfigurative petroglyphs - South Australia

KARLIE-NGOINPOOL CAVE: A PRELIMINARY REPORT

Geoffrey D. Aslin and Robert G. Bednarik

Abstract. The discovery of another Australian cave with archaic rock art is briefly reported. Consisting of thousands of Pleistocene petroglyphs, this find demonstrates the magnitude of the recently discovered Australian cave art tradition. The site possesses the largest known concentration of non-figurative cave art in the world. This preliminary report describes the find briefly and proposes an appropriate study program for the next few years.

Introduction

The discovery of Karlie-ngoinpool Cave is a fitting climax to the recent amazing string of finds of cave art sites in Australia. The preliminary report on Karake Cave (Aslin and Bednarik 1983), a recently discovered, nearby site of rock art, was only being written when one of us (G.D.A.) investigated a large sinkhole cave between Mount Gambier and Kongorong, southeast South Australia. Since access to the steep floor of this sinkhole is difficult, there was little hope of locating any type of human occupation evidence in the forbidding cave. Yet perseverance was amply rewarded: a series of deeply abraded, large circles and extensive finger flutings were found on the walls of the cave.

A subsequent thorough examination showed that the wall decorations are in fact more extensive than first thought. The cave was found to contain the most substantial gallery of parietal art so far found in Australia, and one of the largest in the world. Thousands of petroglyphs cover the greater part of the accessible rock surfaces, and they are locally of such concentrations that individual designs can only be distinguished with difficulty. Modern graffiti are almost absent in this cave, and much of the rock art is surprisingly well preserved.

It is not our intention to attempt here an adequate description of this overwhelming site, or even an adequate evaluation of its research potential. The purposes of this paper are:

(1) To propose a strategy for the exploration and study of this significant site.

(2) To provide a preliminary description of the cave and its contents.

(3) To acquaint rock art researchers with the thought that extensive cave art is not a phenomenon limited to western Europe. Whilst nearly all of the world's rock art is indeed found in places exposed to daylight, there are now two world regions where Pleistocene parietal art has survived on a large scale. One of these is along the southern coast of the Australian continent where about a dozen deep caves with early rock art are presently known, and more are expected to be found in the course of our continuing research project.

MS received 4 November 1983.

The Cave

The name of the site was chosen by its discoverer, G.D.A. It is derived from *kar-li-e-ngoin-pool,* which means 'many, plenty, numerous', in the tongue of the last indigenous language group that inhabited the southeast of South Australia, the now extinct Buandik (Smith 1880). The name refers to the engraved, pecked and abraded circles, which are indeed numerous in the cave, and it is in keeping with the naming of all other prehistoric art sites in the Mount Gambier district. Malangine, Koongine (Bednarik, in prep. a), Gran Gran, Koorine (Aslin and Bednarik, in prep.), and Karake (Aslin and Bednarik 1983) are all Buandik words (another cave site discovered by the authors is still unnamed). These names are not intended, however, to imply that the petroglyphs were made by the Buandik. It would be quite untenable to suggest that any society could maintain continuity of ethnicity over the immense time span involved.

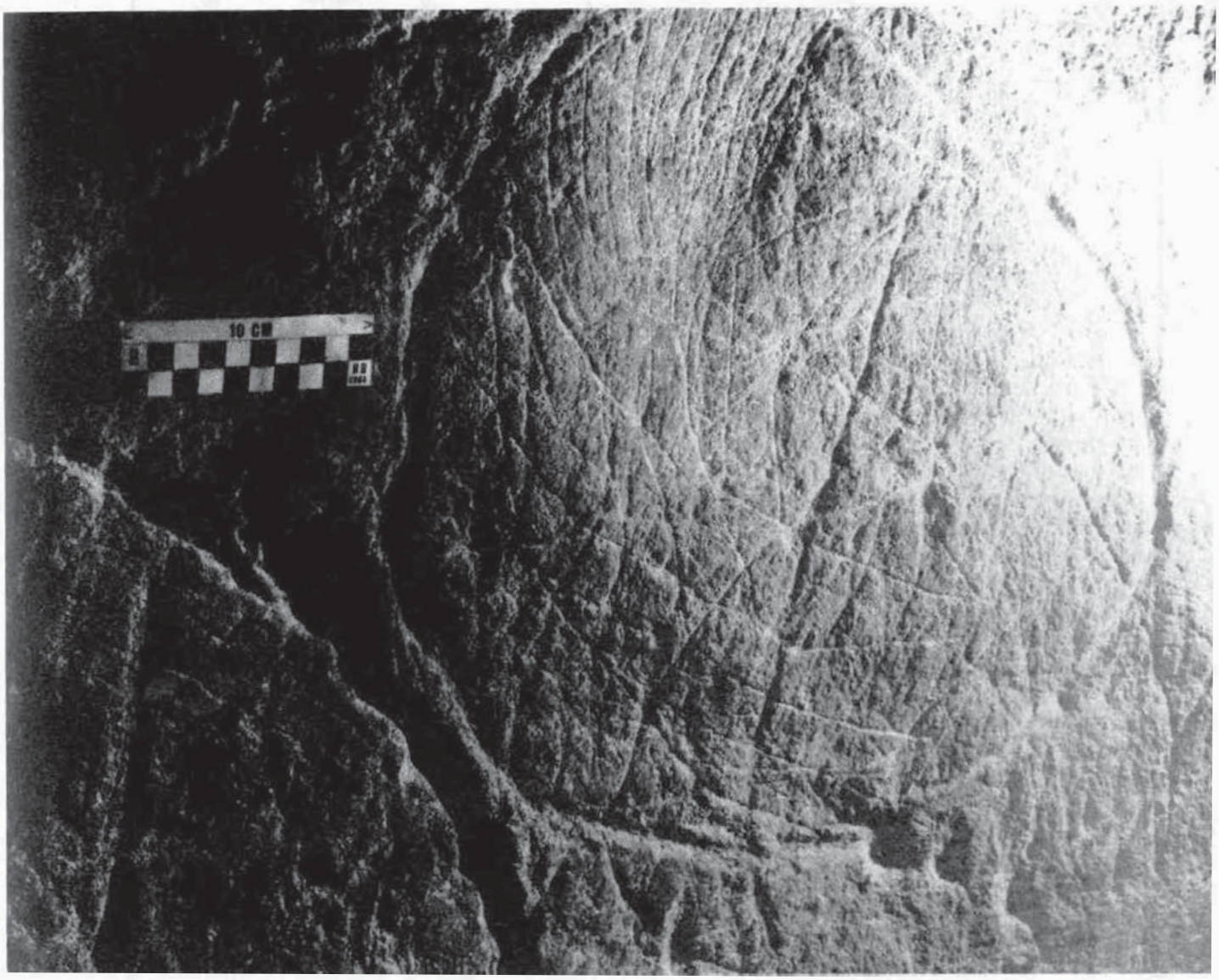


Plate 1. *Densely engraved vertical panel. East wall of the lowest chamber, Karlie-ngoinpool Cave.*

Karlie-ngoinpool Cave consists almost entirely of a steeply descending hall to which access is gained through a vertical sinkhole entrance of about three metres diameter (Fig. 1). Descent is difficult and the use of ropes is advisable. The sloping floor is reached six or seven metres below the ground level. The broad hall declines towards north, at an angle of around forty to forty-five degrees, is roughly twenty metres wide and much of the similarly steeply sloping ceiling is well beyond human reach. At approximately twenty-five vertical metres below ground, the floor levels off and is soon approached by the ceiling. This part of the cave is divided into several chambers by large boulders or low ceilings. It has remained in almost complete darkness even after the floor subsidence further up, which occurred some time after the cave was first entered by human visitors. The extent of the floor level change is demonstrated by the distribution of both petroglyphs and chert mining evidence.

The floor continues gently sloping until, at the lowest accessible point, the cave ends in a small chamber in which almost every square inch of suitable rock surface has been engraved upon in total darkness (Plate 1).

The floor collapse is a particularly interesting, and archaeologically significant, aspect of the cave. The tectonic adjustments the site has experienced since the finger fluting was executed are complex, and there may have been more than one phase of subsidence. The main effects of the structural modifications were the lowering of the floor in the northeastern part of the cave, and presumably a subsidence of the entry shaft floor. These events may be dateable, and they bring to mind the similarly substantial tectonic changes experienced by several other Australian caves with finger lines, which in each case clearly occurred after the oldest petroglyphs were executed. In the Mount Gambier area it is tempting to relate these occurrences to the extensive

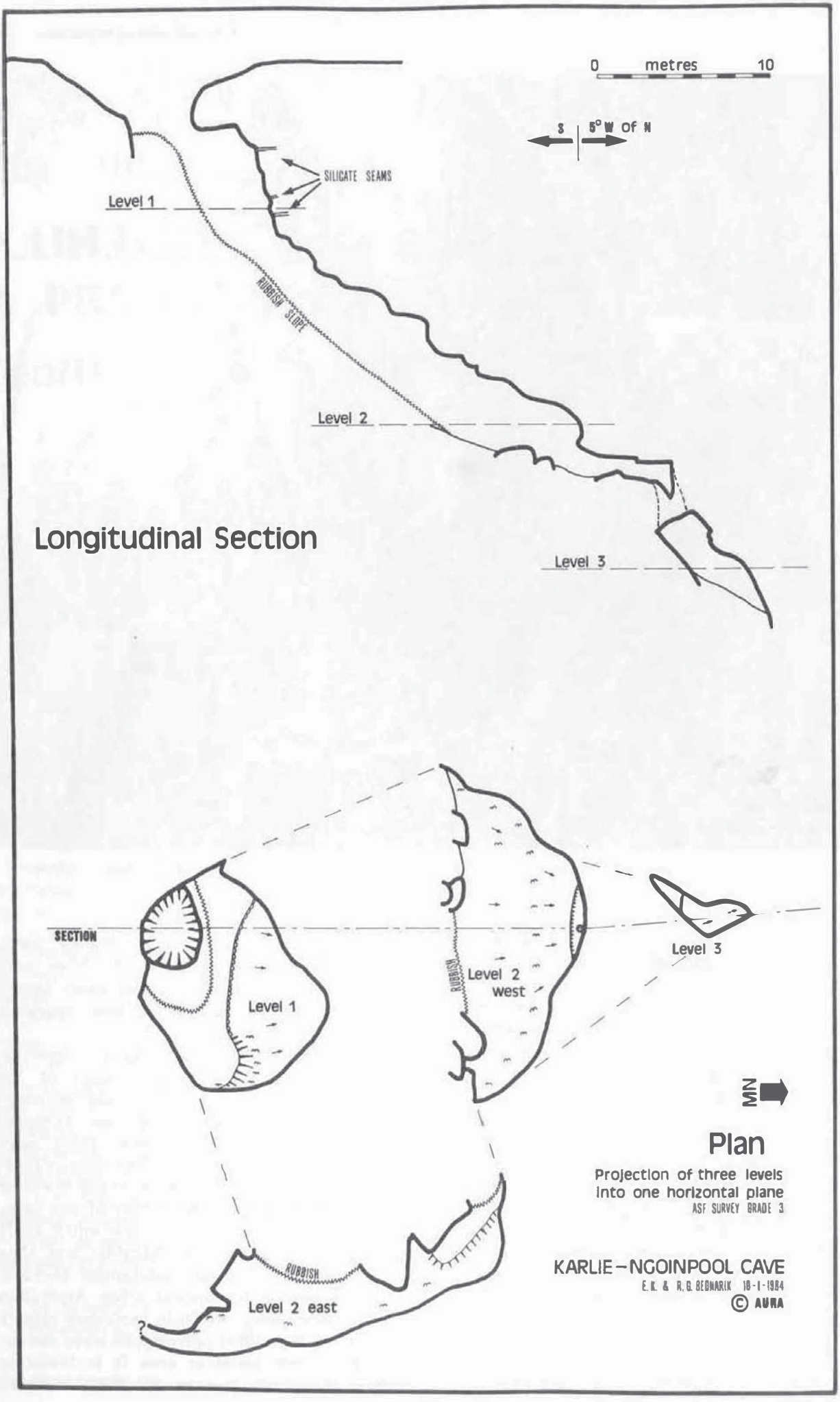

0 metres 10
S 5° W of N
SILICATE SEAMS
Level 1
RUBBISH SLOPE
Level 2
Level 3
Longitudinal Section
SECTION
Level 1
RUBBISH
Level 2 west
Level 3
RUBBISH
Level 2 east
MN
Plan
Projection of three levels into one horizontal plane
ASF SURVEY GRADE 3
KARLIE-NGOINPOOL CAVE
E.K. & R.G. BEDNARIK 18-1-1984
© AURA

Figure 1. Section and plan of Karlie-ngoinpool Cave, South Australia. For symbols, refer ASF Survey and Map Standards 1978. ASF Survey Grade 3 refers.

volcanic disturbances of the Holocene eruptions of Mount Gambier and Mount Schank (about 4830 and 1410 years BP; Blackburn 1966). But the same explanation is not so convenient in the cases of Koonalda Cave (Nullarbor Plain; Gallus 1968, 1971; Wright 1971) and Orchestra Shell Cave (near Perth; Hallam 1971; Bednarik, in prep. b) which have experienced similar adjustments after they were decorated by finger flutings. Whilst volcanic activity could well have caused the ceiling collapse in Koongine Cave, it would be judicious to question the effectiveness of such upheaval in lowering a cave floor if there are no adequate voids beneath it, or if these are filled with water. Perhaps long term climatic variations are more effective in bringing about such tectonic changes. If the water table fell significantly, during a dry period of a stadial epoch (a lowering of the sea level would conceivably have drained the limestone plateau dramatically as it emerged), the structural stability of an extensive subterranean system would suffer through the evacuation of phreatic reservoirs. This explanation could not only account for the floor slump in Karlie-ngoinpool Cave, but also for the subsidence in Orchestra Shell Cave, because both caves can be presumed to be close to major phreatic systems.

As Karlie-ngoinpool Cave descends through the horizontal beds of Miocene limestone it also intersects laminar formations of chert nodules. They are the result of selective replacement of carbonate by silica where the former occurs in layers of higher solubility (Bednarik 1980). Around some of the nodules the limestone matrix has been gouged away, others have been prized from their places. Many bear bulbar scars indicative of impact fractures, which are patinated - an indication of great antiquity in this environment. The extensive evidence of silicate mining is identical to that in the upper part of the northwest passage of Koonalda Cave, and it is relevant to reflect upon the similar chert mining traces that occur in another five of the known finger line caves. It has been noted that these quarried sedimentary silicate deposits are of poor quality (excepting the high quality chalcedony of Koonalda Cave), while all caves concerned are located in regions abounding with easily accessible surface deposits of superb flint and chalcedonic silicates (Bednarik, in press a).

In the western half of the lowest part of the cave, stalactitic formations occur in a narrow passage which possibly leads down to the water table. Numerous *animal scratches* found here suggest that animals sought access to water and then returned by scrambling up rock obstacles in the complete darkness. There are few animal marks in most other parts of the cave, but they appear again in the entrance shaft, which would have been the main obstacle to most species that had either ventured or fallen into the cave. Generally, animal scratches are far less frequent than in many other caves in this region (they have been studied in numerous caves; Bednarik, in prep. c) and it is obvious that this cave did not act as a natural trap for most species.

In the lower part of the cave a well preserved fossilised tooth of a giant white shark (*Procarcharodon angustidens*), measuring sixty-five by sixty-five millimetres, was observed in the ceiling (see Pledge 1980: 4).

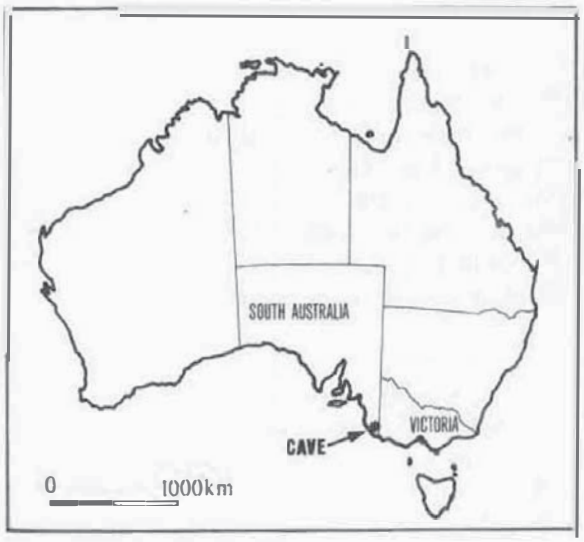


Figure 2; The location of Karlie-ngoinpool Cave on the Australian continent

The Markings

Due to the large sample of petroglyphs available at this site it is comparatively easy to distinguish typical main classes:

(A) *Digital fluting* (Plate 2). This is a particular form of finger lines executed on surfaces of *Montmilch* (a white, soft limestone precipitate; Bednarik, in prep. b) and it is the only form of these archaic externalisations found in Australia. It has been identified in many caves of Europe and Australia by the Parietal Markings Project (Bednarik and Bednarik

Plate 2. Multiple finger lines, fashioned on formerly soft Montmilch, *belonging to two distinct 'generations'. These petroglyphs are located on a wall over five metres above the present cave floor and they are well beyond human reach now. Upper part of Karlie-ngoinpool Cave.*

1982) and where it is found alongside other rock art styles it always precedes them. In those instances where evidence permits some inferences regarding the time span separating the flutings from the subsequent art generation, that time span appears to be quite substantial. For example, the floor modifications at Baume-Latrone (France; Drouot 1953) indicate that the *Montmilch* flutings are significantly older than the earliest Aurignacian paintings (Bednarik, in prep. d), and at Malangine Cave they are separated from the later 'Karake Style' by a period of speleothem precipitation (Bednarik, in prep. a and b).

In Karlie-ngoinpool Cave an area of roughly seventy-five square metres is covered by the finger flutings. Many panels, particularly in the lower half of the cave, have deteriorated to varying degrees, but the best preserved examples known of this archaic art form are to be found at this site. Juvenile markings are common, a peculiarity of many of the world's finger line sites.

Close inspection of well preserved flutings suggests that the surfaces were reworked many times, and it appears that all usable and accessible areas have been 'decorated' in this manner. One panel is almost six metres above the present, collapsed floor.

(B) Some vertical wall surfaces are covered completely and densely by numerous *deep gashes, pits and grooves* (Plate 3). The advanced corrosion state of these enigmatic marks suggests great antiquity. Initial examination indicates no deliberate orientation among them, but their arrangements should be subjected to detailed scrutiny. It remains un-

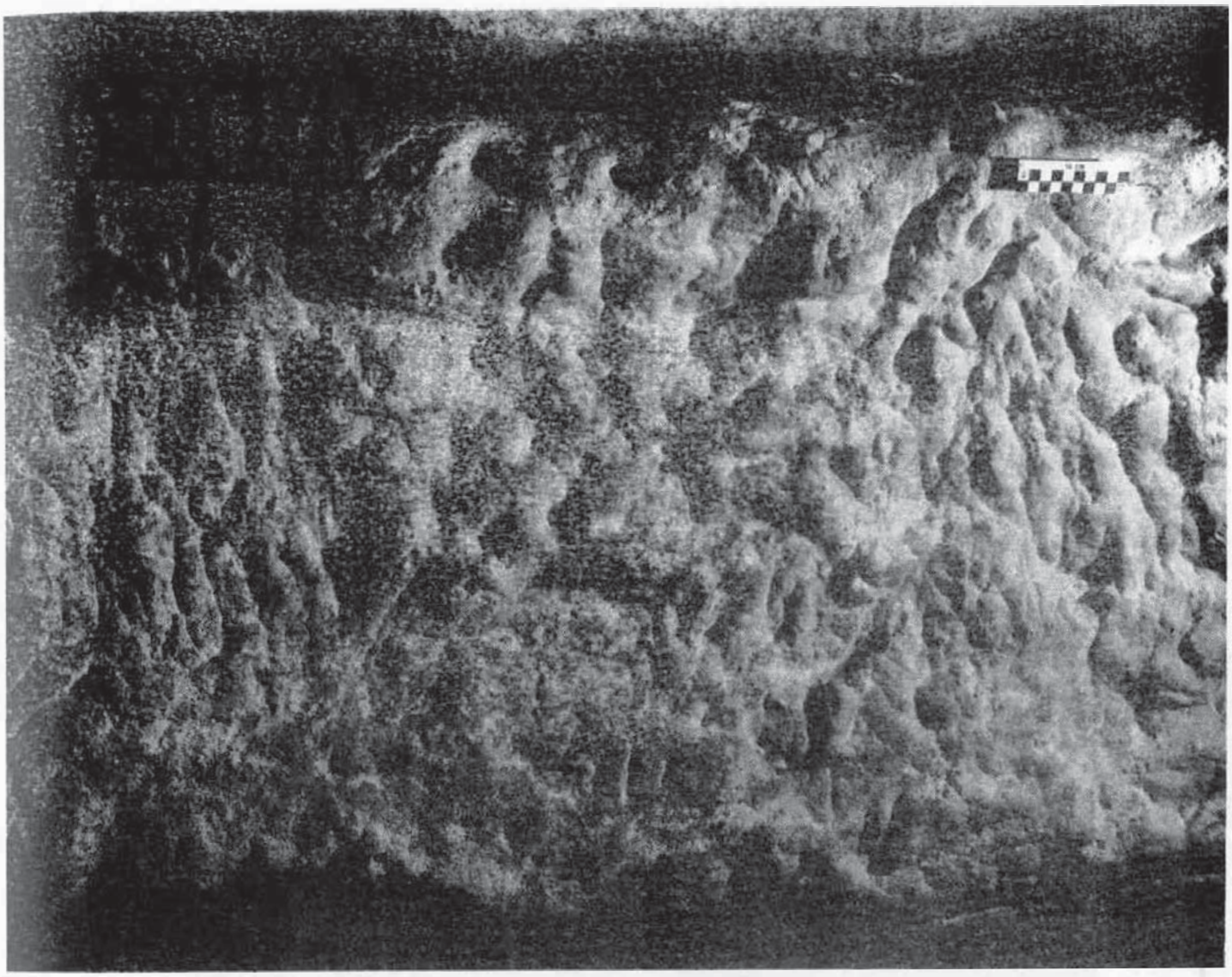


Plate 3. Vertical panel of deep pits and grooves. Lower part of Karlie-ngoinpool Cave.

clear whether they are contemporary with any of the other types of markings.

(C) *Deeply abraded*, occasionally *pounded motifs* of the 'Karake Style' are meticulously executed, with an average groove depth of about ten to fifteen millimetres (Plate 4). They include various circle figures of greatly differing sizes (single circle, concentric circle, dissected circle, pecked circle, circle maze), the dot arrangement, the converging lines motif (sometimes termed 'trident' (Rosenfeld *et al.* 1981: 54); it can in fact be of two to five lines, which need not be fully joined), arrangements of long or short parallel lines, mazes and lattices.
This style must be substantially younger than the finger lines because it is chronologically separated from them by most of the tectonic changes that are now apparent in the cave. For example, there are deeply abraded circles on a rock face that was only exposed when a rock ledge, on which the finger line artists had once stood, broke off. The similarity of the deep engravings to those in Karake Cave, in style, motif range and technique is remarkable and although the circle motifs are absent at Koongine and Malangine Caves, the second-oldest petroglyph generation there (the preliminary minimum dating in Bednarik, in press a, is discussed in Bednarik, in prep. b) is also strikingly similar. Karlie-ngoinpool, Karake, Malangine and Koongine Caves are within a few hours walk of each other. The term 'Karake Style' will be used henceforth to describe this Australian petroglyph tradition. Its relationship with the so-called 'Panaramittee Style' (Maynard 1979: 91), the Tasmanian petroglyphs (Sims 1977), northern Queensland's archaic petroglyphs (Rosenfeld *et al.* 1981) and Flinders Ranges petroglyphs will be discussed in due course.

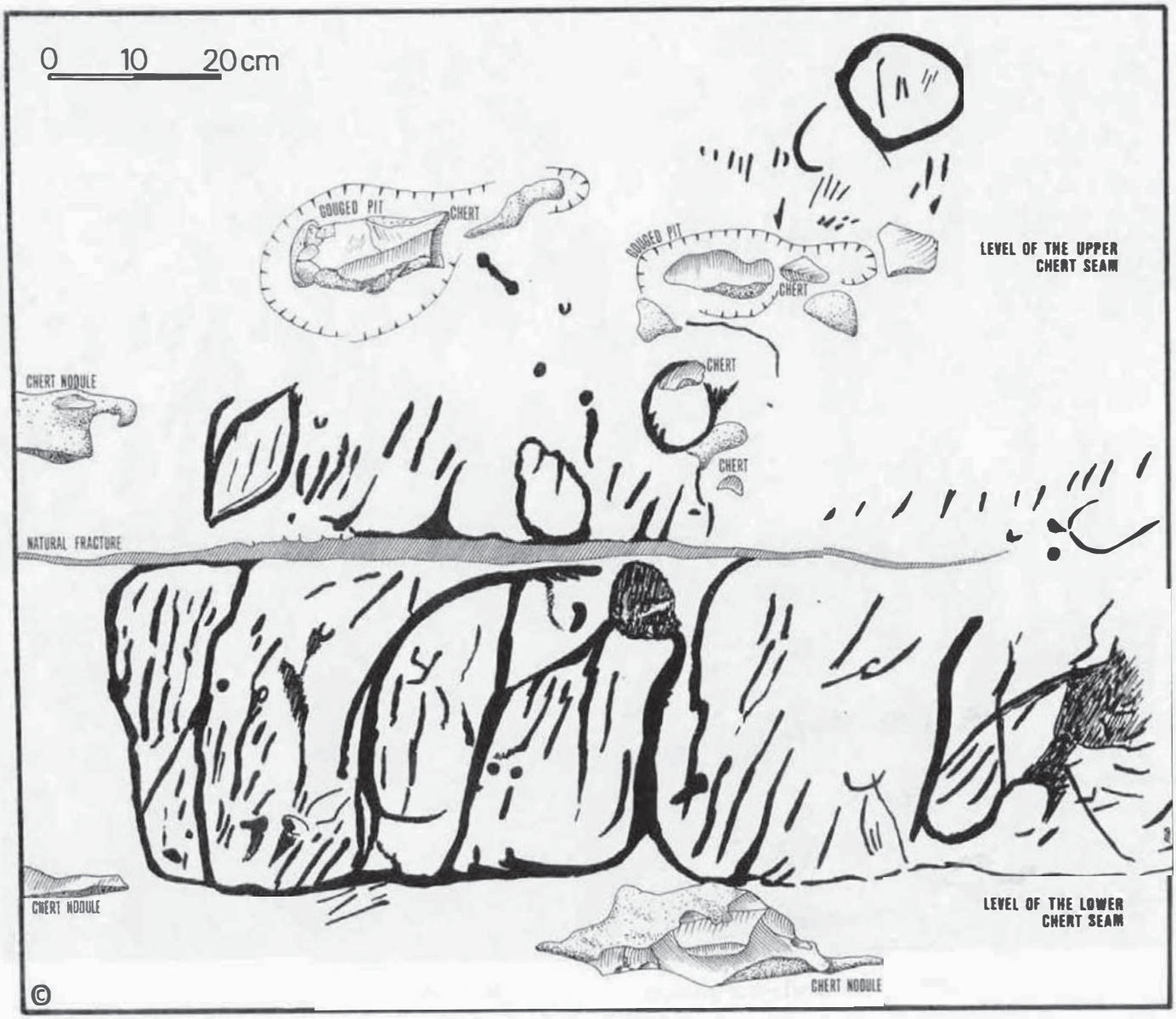


Figure 3. *Arrangement of deeply engraved petroglyphs on a vertical wall in the upper part of Karlie-ngoinpool Cave. The grooves are located among evidence of chert mining, such as nodules with patinated impact fracture surfaces, and gouged pits around nodules of chert. A few circle motifs are present on the illustrated panel but most of the lines form only a loosely constructed maze, the only obvious characteristic of which is that it is generally aligned with the horizontal joints in the rock, and the related seams of sedimentary silicate.*

Recorded by G. D. Aslin on 10 March 1984, using a recording grid of 100mm squares.

(D) *Shallow engravings*, incised with single strokes of a pointed implement, appear surprisingly impulsive and uninhibited and contrast sharply with the preceding rigid, formal figures. They often seem to be a response to earlier designs, and they are certainly superimposed intentionally in some instances, e.g. where a Karake Style circle is filled in with parallel lines. The psychological inferences to be gained from these documented responses are an exciting research possibility which will be pursued (Plate 1).

At Malangine Cave, only a small remnant of the shallow incision tradition has remained recognisable, due to exfoliation. At that site it is separated from the preceding style by a substantial laminated deposit of reprecipitated carbonate which has been dated.

The Future of the Cave

Karlie-ngoinpool Cave has the largest known concentration of noniconic cave art in the world. It has some of the best preserved Australian Pleistocene petroglyphs known, and contains

Plate 4. Deeply engraved maze of the Karake Style. Lowest chamber, Karlie-ngoinpool Cave.

the world's most archaic tradition of artistic externalisation that has survived to the present. It also contains in the order of fifty tons of garbage, fencing wire, machinery and farm animal remains (Fig. 1). The cave has been used as a depository of household and agricultural refuse for more than one hundred years. This is a fortunate circumstance because it has deterred careless investigators from entering. The paucity of modern graffiti and the almost complete lack of modern damage are to be attributed to this impediment. There are only a few recent wall abrasions, caused by rubbish or other debris that have plunged down the steep slope.

Whilst the refuse deposit has been useful in protecting the site (and in fact still covers a ten-metre wide engraved panel) the practice of using sinkholes as rubbish dumps, widespread in the Mount Gambier district, is generally not desirable, and must certainly cease at this particular site. Karlie-ngoinpool Cave is located on privately-owned grazing land, and the owner's attitude is fortunately most co-operative. Descent into the cave is quite dangerous because access is only possible by climbing down the unstable, steep slope of refuse. Entry must certainly not be attempted by persons unaccustomed to negotiating difficult cave terrain and descent must be made with great care, ensuring that no further debris are allowed to fall.

We will subject the cave to a thorough study program over the next few years which will have the following general terms of reference:

(a) Record all manmade markings in the cave.

(b) Analyse and explain stylistic and technological aspects of the petroglyphs.

(c) Develop a plausible chronological model of the rock art sequence.

(d) Consider aspects of resource management, including practical proposals of reclaiming the cave, for ensuring perpetual conservation of its art, and concerning its future use.

Our immediate recommendations are to prevent further deposition of refuse in the cave; to avoid general public dissemination of the find for the time being; and to proceed with a comprehensive study of the site and, more pertinently, of its contents.

Upon completing this research we will present to the Aboriginal Heritage Unit of the South Australian Department of Environment and Planning a report outlining our recommendations, and we will prepare a descriptive and interpretative paper which will be published through the Australian Rock Art Research Association. The emphasis of the scientific work will be on topics relevant to the Parietal Markings Project (Bednarik and Bednarik 1982) which has the principal aim of exploring the correlation between the most archaic forms of rock art, and the apparently rapid development of the modern human intellect at the beginning of the Upper Palaeolithic (Bednarik 1984a, 1984b, in press b).

G. D. Aslin
7 Campbell Street
Millicent, S.A. 5280
Australia

R. G. Bednarik
3 Buxton Street
Elsternwick, Vic. 3185
Australia

The authors express their gratitude to Messrs R.C. Backholer and T. Thompson, for their co-operation in permitting access to the site. Special thanks are due to AURA members Elfriede K. Bednarik and Peter R. Penney, and to Mr M. Aslin, for their involvement with this research.

Resume. *La découverte d'une autre cave australienne avec d'art rupestre archaïque est reportée brièvement. Etant composée de milliers de pétroglyphes, cette découverte démontre l'ampleur de la récente révélation de la tradition australienne de l'art pariétal. Le site possède la plus large concentration connue de l'art pariétal non figurative dans le monde. Ce rapport préliminaire decrit brièvement la découverte et propose un programme d'étude approprié pour les quelques années à venir.*

Zusammenfassung. *Die Entdeckung einer weiteren australischen Höhle mit archaischer Felskunst wird kurz erörtert. Dieser aus tausenden von pleistozänen Petroglyphen bestehende Fund veranschaulicht die Größenordnung der erst kürzlich entdeckten australischen Höhlenkunsttradition. Die Fundstelle besitzt das grösste bekannte Vorkommen nicht-figürlicher Höhlenkunst der Welt. Dieser prälimināre Bericht beschreibt den Fund kurz, und stellt ein entsprechendes Studienprogramm für die nächsten Jahre vor.*

REFERENCES

ASLIN, G.D. and R.G. BEDNARIK 1983. Karake Cave: a preliminary report. *The Artefact* 8.

ASLIN, G.D. and R.G. BEDNARIK in prep. The rock art in Koorine Cave, southeastern South Australia. *Rock Art Research.*

BEDNARIK, R.G. 1980. The potential of rock patination analysis in Australian archaeology - part 2. *The Artefact* 5: 47-77.

BEDNARIK, R.G. 1984 a. Die Bedeutung der paläolithischen Fingerlinientradition. *Anthropologie* 22: 135-42.

BEDNARIK, R.G. 1984 b. The nature of psychograms. *The Artefact* 9 (in press).

BEDNARIK, R.G. in press a. Parietal finger markings in Australia. *Bollettino del Centro Camuno di Studi Preistorici.*

BEDNARIK, R.G. in press b. Engramme und Phosphene. *Zeitschrift für Ethnologie.*

BEDNARIK, R.G. in prep. a. Malangine and Koongine Caves, South Australia. In K.J. Sharpe (ed.), *The Australian Meander Tradition.*

BEDNARIK, R.G. in prep. b. Finger lines, their medium, and their dating. In K.J. Sharpe (ed.), *The Australian Meander Tradition.*

BEDNARIK, R.G. in prep. c. On natural cave markings. In K.J. Sharpe (ed.), *The Australian Meander Tradition.*

BEDNARIK, R.G. in prep. d. The origin of the human capacity to make marks. In K.J. Sharpe (ed.), *The Australian Meander Tradition.*

BEDNARIK, E.K. and R.G. BEDNARIK 1982. The Parietal Markings Project. *Bulletin of the Archaeological and Anthropological Society of Victoria* No. 3, pp. 3-4.

BLACKBURN, G. 1966. Radiocarbon dates relating to soil development, coastline changes and volcanic ash deposition in south-east South Australia. *Australian Journal of Science* 29: 50-2.

DROUOT, E. 1953. L'art paléolithique à La Beume-Latrone. *Cahiers ligures de préhistoire et d'archéologie* 2: 11-46.

GALLUS, A. 1968. Parietal art in Koonalda Cave, Nullarbor Plain, South Australia. *Helictite* 6: 43-9.

GALLUS, A. 1971. Results of the exploration of Koonalda Cave, 1956-1968. In R.V.S. Wright (ed.), *Archaeology of the Gallus Site, Koonalda Cave*, pp. 87-133. A.I.A.S., Canberra.

HALLAM, S.J. 1971. Roof markings in the 'Orchestra Shell' Cave, Wanneroo, near Perth, Western Australia. *Mankind* 8: 90-103.

MAYNARD, L. 1979. The archaeology of Australian Aboriginal art. In S. Mead (ed.), *Exploring the Visual Art of Oceania*, pp. 83-111. University Press of Hawaii.

PLEDGE, N.S. 1980. *Vertebrate Fossils of South Australia.* South Australian Museum, Adelaide.

ROSENFELD, A., D. HORTON and J. WINTER 1981. *Early Man in North Queensland.* Australian National University Press, Canberra.

SIMS, P.C. 1977. Variations in Tasmanian petroglyphs. In P.J. Ucko (ed.), *Form in Indigenous Art*, pp. 429-38. A.I.A.S., Canberra.

SMITH, C. 1880. *Boandik Tribe.* E. Spiller, Adelaide.

WRIGHT, R.V.S. 1971. *Archaeology of the Gallus Site, Koonalda Cave.* A.I.A.S., Canberra.

THE AUSTRALIAN ROCK ART RESEARCH ASSOCIATION

The principal objectives of the Australian Rock Art Research Association (AURA) are as follows: to provide a forum for the dissemination of research findings; to promote Aboriginal custodianship of sites externalising traditional Australian culture; to co-ordinate studies concerning the significance, distribution and conservation of rock art, both nationally, and with individuals and organisations overseas; to institute a code of ethics regarding research in this field and to generally promote awareness and appreciation of Australia's immovable cultural heritage.

Applications for membership or journal subscription are invited from all interested parties, and should be sent to the Editor, *Rock Art Research*, P.O. Box 216, Caulfield South, Vic., 3162, Australia. For membership fees see the inside of the front cover - application form on the back of this page.

KEYWORDS: **Rock art conservation - National approach - Australia**

RESEARCH NEEDS FOR PHYSICAL CONSERVATION OF ROCK ART

G. S. Gibbons

Abstract. Recent developments in Australian rock art research include the more frequent demand for comprehensive national research strategies in the area of rock art conservation. The author considers the problems related to this important issue, and how to deal with them effectively. He advocates co-ordinated experiments at sites, including sites not subject to immediate risk; and the establishment of a national co-ordination centre.

On 25 August 1980, a seminar on 'Conservation of Engraved and Decorated Sandstone' was held at The New South Wales Institute of Technology. The seminar was convened at the request of the Council of Heritage Organisations, and was arranged jointly by The National Trust of Australia (N.S.W.) and the Department of Applied Geology, N.S.W. Institute of Technology. It outlined many of the problems of conserving Aboriginal rock art, with especial reference to the Sydney region; but many of the aspects covered have direct or indirect application to rock art generally. The seminar did not reach any formal conclusions, but there was broad agreement on a number of issues, including areas in which more knowledge is required. This paper represents one participant's impressions of the seminar, and includes personal observations as to how we might develop our understanding of processes of natural deterioration, and ultimately control them.

The Problem of 'Natural' Weathering

It was generally accepted that society should conserve rock art sites to the greatest degree possible, and that current knowledge is inadequate to approach the task with confidence. We need to know more about the fundamental processes of stone fretting and spalling. We must learn how to evaluate the environment of particular sites, to interpret the kinds of deterioration to which they are subject. We must find out more about the long-term effects of various possible 'treatments' for natural deterioration.

One of the major problems in the study of natural deterioration is the great variation in geographical, geological, and microclimatic conditions of the various sites. Another problem is learning to relate short-term factors and long-term effects; e.g. how do we know whether a surface is likely to fail by spalling next year when the surface appears now to be sound and stable?

The Problem of Priorities

Since total conservation of all rock art sites is not practicable, a scale of the relative 'value' of sites is necessary. However, it is not just the less valuable sites which should be made available for experimentation, since long-term experiments must take place on a variety of *types* of site, including 'valuable' ones. Furthermore, our time is limited. Even among the most valuable sites we may be sure that if we do nothing, we will allow many sites to self-destruct; if we experiment, we *will destroy* some sites ourselves, but we will also *save* at least some which would otherwise be lost.

Proper understanding of deterioration is linked in a variety of ways with the categorisation of sites by their relative value and management options. For example:

(a) Understanding of decay rates may lead to a better appreciation of relative ages (and even absolute ages) of the various sites.
(b) Such understanding will not only enable steps to be taken to slow the destructive processes, but will also avoid destruction by inappropriate management or poorly-designed tourist facilities.
(c) The rate of natural deterioration must be

understood to evaluate the *relative degree* of risk through vandalism and urbanisation.

Physical Experimentation cf. Archaeological Excavation

When there is an immediate total threat to an archaeological site, excavation may be the only way of retaining any of the site's potential values. However, this is exceptional. More generally, information will not be ultimately lost if archaeological studies are delayed, whereas delay in experimental work could result in some total losses through lack of timely conservation.

On the other hand, some limited archaeological work may be necessary to assess the relative value and even the broad category or class of site; and to determine which sites are most worthy of urgent conservation measures, and which should be made available for experimentation.

Indeed, the very concept of categorisation of site types presupposes that we know enough (archaeologically and/or historically) to make the necessary comparisons. Nevertheless, selection of sites for archaeological work should be based on quite different criteria from those used in choosing experimental sites for rock art research.

Stone Research Needs

In the course of the August 1980 seminar a number of areas became apparent for which research would be required. Although mainly concerned with sandstone, most of the problems are equally relevant to other stone types.

Areas identified for investigation include the following:

1) Criteria for risk evaluation of sites (including natural deterioration, vandalism, urban or other development). It is noted that the evaluation of *risk* is quite a separate matter from evaluation of current deterioration *rate*, which is in turn a separate matter from the present *degree* of deterioration.
2) Processes of stone deterioration:
   a) basic mechanisms of spalling;
   b) salt accumulation as a primary cause of fretting;
   c) part played by bacteria, algae, etc;
   d) significance of evaporation, especially as compared with wet/dry cycling;
   e) the importance of leaching, especially the leaching of carbonates which act as a cement in many sandstones.
3) Possible enhanced deterioration caused by re-incision of engravings.
4) Assessment of consolidants, surface coatings, moisture barriers, etc.
5) Long-term results of other treatments (e.g. if drip lines prevent surface washing of salts, will accumulation of these salts ultimately cause severe fretting?

In respect of item 1), proper analysis of the physical environment requires an understanding of the geological history of the stone, of the geomorphological history which exposed it, and of current interactions of stone with air, natural waters, and organisms.

Items 3) to 5) clearly involve long-term studies for which sites must be made available as early as possible.

It is item 2) which is most complicated, in the sense that it requires integration of laboratory studies, comparative studies of existing sites, medium-term monitoring in a variety of situations, and long-term field experimentation.

There have frequently been doubts expressed as to whether studies in other areas (e.g. sandstone buildings and gravestones) have relevance to rock art conservation. In fact, such situations are effectively well-controlled experiments which have often been in progress for one hundred and fifty years or more. The materials and conditions are similar, and the fundamental processes identical, to those with which we are here concerned. It is in my view folly to ignore the information available from such long-term experiments when the alternative is a one hundred and fifty-year delay!

Priorities and Time Scales

The assessment of sites needs to take place in at least two steps: a first stage, which will (among other things) identify sites on which experimentation is acceptable; and then, when deterioration is better understood, an assessment which can simultaneously evaluate cultural value, natural physical risk, and risks from vandalism, urbanisation, etc.

Because the time scales for some physical investigations will be long, the second stage of evaluation will be somewhat delayed. It is, therefore, necessary that the first-stage study also identify sites of especially great cultural value which are undergoing rapid natural deterioration. For these sites, hard decisions will be necessary to determine whether they shall be left to disappear naturally, whether steps of uncertain efficacy should be taken in an effort at preservation, or whether in some cases removal to a museum, re-incision, or similar procedures may be appropriate.

Organisation of Research

From the viewpoint of physical conservation, research projects of various kinds are required. In particular, some concentrated laboratory work must be integrated with long-term field

experimentation and widely-based monitoring. If the integration is to be effective, the various fields of study must be co-ordinated, with effective dissemination of information and results as they become available.

Since the problem is largely one of information exchange, and much of the necessary research does not require highly sophisticated equipment, it would be better to attack the problems on a decentralised basis. To attempt a centre-of-excellence approach is inappropriate, although some sort of co-ordination centre seems highly desirable. Such a centre might later become a teaching centre for short and special courses for those involved in site maintenance.

To enable the field and laboratory work to be effectively planned and executed, the *first* step should be the determination of an agreed conservation philosophy and the preparation of an inventory of sites by class and region. This inventory will need to consider cultural value simultaneously with the various types of risk as far as these can currently be evaluated.

Assuming it is agreed that experimentation must take place on some 'good' sites as well as 'poorer' ones, this inventory should be a useful guide as to which sites can be made available for experimental work.

With clear concepts on aims, experimental approach, and the availability of test sites, it should be possible to map out a broadly integrated program involving:

(a) immediate conservation measures;
(b) initiation of long-term monitoring studies;
(c) ancillary research areas worthy of support.

To some degree the proposals for funding will flow from the agreed program. However, if it is accepted that work should be decentralised and diverse, but still broadly co-ordinated, it will probably be appropriate to provide financial support partly as competitive grant funds for research work proposed by applicants, and partly as contract research funds for specified investigations proposed by the co-ordination centre. Funds will also be necessary for publication of results, for regional conferences, and for development of short and special courses to enable dissemination of knowledge.

Conclusions

(1) Sites vary, so 'ideal' conservation measures vary.
(2) Conservation has various aims, so various approaches are needed, even for identical sites. For example, one engraved rock site might be developed for tourism and public education, one might be retained undeveloped for its archaeological significance, and one might be removed to a museum as an archival record.
(3) Currently it is essential that:
    (a) some items be preserved, even if this requires removal from their sites;
    (b) some sites, even particularly valuable ones, must be made available for monitoring and/or experimentation;
    (c) any data-gathering program aimed at assessing cultural/archival value of sites should be so designed as to evaluate past and present rates of physical deterioration, and details of current environment.
(4) Research in physical conservation needs to be carried out on a variety of time scales, and experiment design should be different for different scales. This means we do not set up a single series of experiments and get short-term results in one month and long-term results after twenty years, all from the single experiment design.
(5) Where it becomes clear that a site will shortly be destroyed by urbanisation or other circumstances, funds should be available for archaeological and physical investigations to take place at short notice. There may be a case for *restricting* archaeological work to such situations; but they are of no use for long-term experimentation, so other sites, *not* subject to immediate risk, must be reserved for such experiments.
(6) A co-ordination centre is needed. If this is also to be a research centre, it might be best arranged with a very small core staff supplemented by workers invited from heritage, academic, and National Parks organisations, perhaps on six months or twelve months terms.
(7) The co-ordination of field experiments can be attained mainly by information exchange. Tied funding should be through contract research or supplementary funding. In the current state of knowledge, diversity should be encouraged, and this suggests a relatively high level of untied or competitive grant funding.
(8) The co-ordination centre should be of sufficient size to maintain and integrate descriptive records from a wide variety of sites, since comparative evaluation can be a valuable indication of long-term processes.
(9) It is essential that research and teaching in basic principles be encouraged on a decentralised basis. It will be counter productive in the intermediate to long term if 'top up' funds are taken from current general funding in relevant areas. I believe that it would also be counter productive if new funding were tied by autocratic prescription to a centrally determined, party-line research program.

(10) At a later stage, a tighter degree of central control may be desirable. At present, what is needed is merely enough control to ensure that experimentation is not duplicated, that the minimum number of sites are damaged for data acquisition, that new data is rapidly and widely disseminated as it becomes available, and that there are no significant gaps in the total research effort.

Dr G.S. Gibbons
Head of the Department of Applied Geology
The New South Wales Institute of Technology
P.O. Box 123
Broadway, N.S.W. 2007
Australia

MS received 10 February 1984.

Resume. Les développements recents dans la recherche de l'art rupestre australien englobent la demande la plus fréquente pour des stratégies nationales de recherches étendues dans la région de conservation de l'art rupestre. L'auteur examine les problêmes relatifs à cette importante issue et comment faut-il les régler effectivement. Il recommande des experiences co-ordinées dans les sites mêmes, inclus les sites qui ne sont pas sujet à un risque immediat ainsi que l'établissement d'un centre national de co-ordination.

***Zusammenfassung.** Neuere Entwicklungen in australischen Felskunststudien schlieszen die häufigere Forderung nach einem umfassenden, landesweiten Forschungsprogramm auf dem Gebiet von Felskunsterhaltung ein. Der Autor zieht die mit diesem wichtigen Thema verwandten Probleme in Betracht, und wie sie wirkungsvoll zu behandeln seien. Er vertritt koordinierte Experimente an Fundstellen, einschlieszlich solcher Fundstellen, die nicht ohnedies von Zerstörung bedroht sind, sowie die Einrichtung eines staatlichen Koordinationszentrums.*

*

SPANISH SERIAL ON PREHISTORIC ART

The ARS PRAEHISTORICA series has been conceived in order to offer an account of research carried out on the earliest stages of human artistic productivity in all parts of the world. It will be produced annually. Articles will appear in the main European languages with ample summaries of each written in a different language. The periodical will include the following sections: research and review articles, section of varia devoted to news and problems that arise in the field, and a section dedicated to bibliography, with book reviews and a complete bibliographical index starting from 1980. Specialists in prehistoric art are invited to contribute. The series' Editor is Prof. Eduardo Ripoll-Perelló (Barcelona), assisted by an advisory committee and an editing committee. The first volume, which corresponds to 1982, appeared in June 1983.

The periodical comprises mostly contributions in Spanish. Volume 1, which consists of 250 pages, includes only one brief article of six pages and one book review in English.

Enquiries should be directed to: Editorial Ausa
Apartado 101
SABADELL (Barcelona)
Spain

REVIEWS & ABSTRACTS

Un inventaire des pétroglyphes de Nouvelle-Calédonie by D. FRIMIGACCI and J. MONNIN. *Journal de la Société des Oceanistes*, 1980, Volume 36, pp. 17-59.

The archipelago of New Caledonia is one of the major rock art regions found close to Australian territory. For this study, it was divided into forty-eight zones, and the petroglyphs were categorised into thirty motif groups (including the general category *entailles*). Of the approximately 2200 figures surveyed only about two percent, represented by Categories 18 and 19, could be considered iconic. They are stylised or schematised figures of humans, human feet and zoomorphic outlines. The other motifs appear to be generally noniconic, consisting of spirals, circles, concentric circles, multiple wavy lines, dot arrangements, lattices, radial figures, parallel lines, mazes and combined figures. A distinctive feature of the rock art on these islands is the 'wrap-around' enclosure: motifs are frequently surrounded by a continuous line that tightly envelops them.

The writers do not set out to define different traditions, or to discuss the results of their survey in any depth. However, as a statistical evaluation, the paper is an excellent introduction to the petroglyphs of New Caledonia, and it should be borne in mind that a similar study has not been completed for any one region of Australia.

An experimental critique of Salomon's method of classifying petroglyphs by J. CLEGG. *Canadian Rock Art Research Associates Newsletter*, 1981, Number 16, pp. 45-50.

This paper reports the results of experiments with a method proposed earlier by M. Salomon, which is designed to classify images. Three elements, the numbers of lines, 'vertices' and line-ends, are counted in each image, and then related to each other in accordance with mathematical equations. The results are interpreted as providing insight into 'development' and 'style' of the petroglyph analysed.

It was found that the method works in many areas, but that it may be less valuable when dealing with closed figures, i.e. figures composed of a single line without ends (outline figures). Clegg considers the approach useful as an alternative to qualitative analysis, or where artefacts have been inscrutable to any other taxonomy. He feels that it can be used for cross-cultural and cross-media comparisons.

Are pictographs always painted? by K. MICHELSEN. *Norwegian Archaeological Review*, 1983, Volume 16, pp. 34-8.

The author has closely examined a series of rock art at Trontveit, County of Telemark (Norway), which had been described as rock paintings since 1917. In addition to the 'painted' figures, there are also red patches on the rock surface. They have so far been interpreted as places where the artists had tried out their pigments.

Michelsen found that the red colour of the figures is in all probability attributable to a natural deposit of iron oxides. The images were produced by removing this cutaneous thin surface layer, and a light coloured second lamina beneath it, around each figure. The resulting relief is so low, however, that it is hard to detect.

The writer suspects that the rock art at the other known 'pictograph' sites in the Telemark region was also produced by this method. This has recently been confirmed by him (Michelsen, pers. comm.).

The method Michelsen describes has in fact been used extensively in the rock art of many parts of the world. In Australia, for instance, millions of petroglyphs were produced by the sgraffito technique, as it is called.

L'étude, la dégradation et la protection des peintures rupestres préhistoriques. Exemple du Tassili n'Ajjer (Sahara Algérien) by F. SOLEILHAVOUP. *Caesaraugusta*, 1979, Number 49-50, pp. 115-53.

The study of physical and chemical responses of rock surfaces is perhaps more important to rock art research than the articulation between the latter subject and archaeology. Yet in Australia little attention has been given to the effects of geomorphological processes on rock art, and to their significance for such topics as dating or conservation. The work of Professor Soleilhavoup should therefore be of particular interest to Australian rock art specialists. As a geomorphologist, he concentrates on the processes of rock

surface alterations observed in arid regions. The approximately forty publications this author has to his credit since 1971 illustrate how his scientific interests developed. It was through his extensive geomorphological work in the Algerian Sahara that he became involved in the study of the rich rock art of that area, during the second half of the 1970s.

This paper is concerned with the preservation of paintings in rock shelters. After first discussing the formation of the *abris* themselves, the author turns his attention to the artist's criteria in selecting the surface to be decorated. A system of quantifying the preservation state of rock paintings, involving the use of numerical designations is then introduced.

The paper's highlights are the treatment of the principal causes of pictograph decay, and the proposal of an inventory form for the recording of art in rock shelters.

Les altérations des gravures rupestres et leur intérêt pour l'étude des environnements pré et protohistoriques dans l'Atlas saharien (Algérie) by F. SOLEILHAVOUP. *L'Anthropologie*, 1980, Volume 84, pp. 535-61.

The paper deals with the deterioration of engraved surfaces, and with their relevance to the study of pre- and protohistorical environments in the Atlas Mountains.

A better understanding of the palaeoenvironmental evolution of sites and their engraved or painted rock surfaces can be gained from the collaboration between geomorphologists and art prehistorians. Such a co-operation may be particularly profitable when investigating the relationships that often exist between the chronological sequence of geomorphological processes that affect rock art (or such processes that one can relate to the art), and the relative chronology presently applied to the petroglyphs or paintings. In this study, two examples from the sub-Saharan Atlas Mountains in Algeria are examined. The result is a pioneering study relating petroglyphs to cyclic rock exfoliation, and to the generations of patination associated with it.

Palaeolithic art and natural rock formations by G. de G. SIEVEKING. *Current Anthropology*, 1982, Volume 23, pp. 567-9.

This is a response to articles by T. Rogers who claims to have found the first examples of Palaeolithic cave art discovered in Britain, in the Wye Valley. The site in question is Symonds Yat, a well-known rock shelter and beauty spot. Rogers has excavated there a quantity of stone tools, osteal remains and traces of what is purported to be evidence of Middle and Upper Palaeolithic dwelling structures.

One of the two main 'petroglyphs' has been suggested to depict the outline of a bison, the other has been claimed to represent a deer. The figures consist mostly of natural rock formations and it was indicated that these had been utilised, and improved artificially by some engraved lines. These lines were believed to be filled in with green pigment, consisting of copper sulphate.

Sieveking reports the findings of four specialists who examined the 'rock art'. No evidence of artificial modification was observed. One crucial line has been produced by a natural fracture where a rock fragment became detached from the wall, other grooves are the result of congelifraction. Natural depressions are filled in and accentuated by a growth of green algae which thrives where moisture is draining down the rock face.

The stone industry, first identified as belonging to the Mousterian and the Creswellian cultures respectively, was found to consist of fragments of microlithic blades that could belong to the Creswellian, or to any later British Mesolithic industry. There are some undoubted Pleistocene species represented among the animal remains.

Sieveking's concluding remarks, that the site's investigator had been misled by his hopes and wishes into seeing rather more than is or would be apparent to the unprejudiced observer, are relevant wherever natural markings of rock are seen as rock art, by overenthusiastic investigators.

The oldest works of art? by V.S. WAKANKAR. *Science Today*, 1983, Volume 20, pp. 43-8.

The author has been involved in establishing a chronology for the rock paintings of the Mirzapur district since 1955. Indian pictographs belong to the Upper Palaeolithic, Mesolithic, Chalcolithic and historic periods. Initially, dating was achieved by identifying the Chalcolithic element, a style also found on many pieces of decorated pottery from that period, and by simply assigning the earlier styles to the 'pre-Chalcolithic group'.

Since the discovery of engraved ostrich egg shells, which have been placed beyond 25 000 years B.P. by radiometric dating, it has been suggested that some of the rock art may be as old as 40 000 years. However, no evidence is offered for that claim, and the paper omits to report an important aspect: the style or motif range of the engravings on the egg shells.

The earliest style of rock art consists largely of single line figures executed in green. Copper minerals provided the pigment for this unusual rock art. The motifs found in the Upper Palaeoli-

thic range include animated humans and a variety of animals, all of which are contemporary species of India.

The paper is accompanied by a brief summary of 'Rock Art the World over', written by A. Agarwal. This includes a number of errors and shortcomings, and a synopsis of Australian rock art that illustrates so well how much is known about our rock art overseas that we cannot resist quoting it in full:

> Australia. These paintings are mushroom-shaped and the face of the human figures [*sic*] are enclosed in a broad, horse-shoe shaped band in red or yellow ochre. Only the eyes and nose of a face are depicted. The body is painted in shades of white and filled in with vertical stripes. The arms and legs are well defined, but the hands and feet are rudimentary.

The title question of Wakankar's article remains unanswered, however. Evidence of very ancient paintings (of 8000 or more years) is not restricted to central India, it has also been reported from western Europe, southern Africa, northern Africa, northern Australia and South America, and the claims concerning these regions seem better supported. Petroglyphs of presumably much greater antiquity occur in western Europe and southern Australia, and the first appearance of incised mobiliary objects is a topic still requiring verification. Marshack has suggested that his Meander Tradition could date back well before the Upper Palaeolithic, and Bednarik, without advocating a particular antiquity, has pointed out that the evidence favouring an Aurignacian provenience for the earliest finger flutings of western Europe is no stronger than the case for their interglacial age.

Knowledge and information in Swedish petroglyph documentation by J. NORDBLADH. In C.-A. Moberg (ed.) *Similar Finds? Similar Interpretations?* 1981, 79 pages, 18 figures. Department of Archaeology, University of Gothenburg.

This substantial paper is a presentation about the methodology of transcribing petroglyphs, from the original to the published image. At the same time it outlines the history of rock art recording in Sweden, which may reach back in time further than that of any other country. The oldest petroglyph recording cited by Nordbladh is a wash drawing dating from 1627, and the same panel of peckings has been recorded many times since then. These successive transcriptions illustrate changing styles in reproducing the rock art, and they document a changing emphasis on particular aspects of it.

Nordbladh stresses the importance of studies considering the arrangement of petroglyphs, and of their positioning in the landscape. He sees rock art as representing established sign systems. Having examined some 700 engraved panels he notes that their orientation is easily recognisable. He espouses a number of principles of analysing the glyphs, which he terms the principles of arrangement, orientation, combination, size and centre/periphery. Some of Nordbladh's concepts are well complemented by the article of McNickle, in the present issue of this journal.

As Gravuras rupestres do Tchitundo hulo by J.R. dos SANTOS Jr. *Trabalhos do Instituto de Antropologia 'Dr. Mendes Corrêa'*, 1974, Number 26, 16 pages, 13 plates. University of Porto, Barcelos.

Two petroglyph sites in the Moçâmedes district, southwestern Angola, are described in this brief monograph, one of a series published by the Dr Mendes Corrêa Institute of Anthropology (Portugal). The rock art was found on two granite *inselbergs* that are about one kilometre apart and rise some one hundred metres above the plain. In the local mythology these hills represent a man and a woman. About 2000 images were studied there in 1970 and 1972, and the author interprets the sites as ritual places. He reports a clear dominance of 'geometric or schematic' motifs over figurative ones, the latter being restricted to a few animal outlines, mostly of antelopes. The most common motif is the concentric circle, followed by radiating designs, which are often combined with circular forms.

The petroglyphs are generally shallow and they occur mostly on rock pavements, but some were found on the ceiling of a rock shelter. Their great antiquity is often suggested by repatination, fractures and laminar exfoliation. The granite is heavily patinated, possessing a rind of twenty to thirty millimetres thickness, which is coloured dark red by iron oxides on the shiny, varnish-like surface. Differences in repatination indicate that the rock art covers a considerable time span. An excavation has produced three industries of stone tools: a 'mousteroid Clactonian', a 'Mousterian', and an assemblage with some microliths, resembling the proto-Smithfield industry.

The economic and social context of southern San rock art by J.D. LEWIS-WILLIAMS. *Current Anthropology*, 1982, Volume 23, pp. 429-49. Refer also Volume 24, pp. 237-9.

This paper suggests a new theoretical framework for understanding southern San rock art (South Africa). The traditional explanations have been either innatist or functionalist. To escape the tautology of the former and the restrictions of the latter it is suggested that the articulation between the art and the social relations of produc-

tion be sought. This articulation was expressed in the activities of medicine men, whose symbolic work acted upon the reproduction of the natural order by making rain and controlling animals and then upon the social relations necessary for efficient production and distribution by reducing tensions within the camp. By reports of supposed out-of-body travel the medicine men also reflected the networks of links between camps which facilitated the reproduction of the social formation over extended periods that might include times of extreme strain on local resources. At least some of the medicine men were also artists and painted symbols of trance performance as well as representations of their hallucinatory experiences. The art thus contributed to a pooling of religious experience and imparted a special reality to the cognitive system on which the practice of symbolic work was based.

Australian Aboriginal art: The art of the Alligator Rivers Region, Northern Territory by R. Edwards (1979). 214 pp., colour and black and white plates, maps, references. Australian Institute of Aboriginal Studies, No. 15. Price $A 9.95 (sc), $A 14.95 (hc).

This superb book covers the wealth of Aboriginal rock art to be found in the 'galleries' of the vast Alligator Rivers Region of the Northern Territory. It abounds in rich colour and black and white photographs of the various forms and styles of the region's art and the environments in which it is found. A highly descriptive and easily-readable text includes chapters on rock art regions, the significance of rock paintings, the antiquity of rock art, factors contributing to deterioration of paintings and on cultural tourism. The text, except for the introduction and the omission of appendices, is identical to that published by the same author in 1974 under the title, *The Art of the Alligator Rivers Region*, as part of the Alligator Rivers Region Environmental Fact Finding Study. But this new edition features more colour plates than the original, a revised introduction and has revisions to some picture captions. The book is not only essential for students of art and anthropology but also one which will give information and visual pleasure to general readers.

Prehistoric Indian Rock Art: Issues & Concerns. Edited by JoAnne Van Tilburg and Clement W. Meighan (1981). 66 pp. Institute of Archaeology, University of California, Los Angeles, No. 19. Price $US 6.00.

The proceedings of the UCLA Rock Art Archive's pioneering symposium held in November, 1980. The symposium focused on California rock art as it relates to public policy, public education and scholarly research. Participants included public officials, government planners, scholars, researchers, Native Americans and artists. The papers presented covered vandalism and rock art, the role of rock art in educational activities and suggestions for new directions in rock art study.

Messages from the Past: Studies in California Rock Art. Edited by Clement W. Meighan (1981). 130 pp., illustrated. Institute of Archaeology, University of California, Los Angeles, No. 20. Price $US 10.50.

A collection of six studies on California rock art, including papers by Editor C.W. Meighan, Linda B. King, Gregory Reinhardt, W. Joseph Mundy, Jr., Joan Seavers and Helen Crotty.

This volume includes the following papers presented at a UCLA seminar on California rock art:

Theory and practice in the study of rock art
The incised petroglyph sites at Agua Dulce, Los Angeles County
Pictographs with a historic component: LAn-717, a Los Angeles County rock art site
'Indian caves': an analysis of rock art from SBa-519, Santa Barbara County, California
Two rock art sites in Calaveras County
An analysis of the Chalfant Canyon rock art site, Mono County
Petroglyph Point revisited - a Modoc County site.

Pictographs & Petroglyphs of The Oregon Country, Part 1: Columbia River & Northern Oregon. By J. Malcolm Loring and Louise Loring (1982). 325 pp., 255 drawings, 6 plates. Institute of Archaeology, University of California, Los Angeles, No. 21. Price $US 18.50.

A monumental collection of primary data, this volume describes 50 rock art sites in Washington along the Columbia River and 99 sites in northern Oregon. The Lorings personally recorded each of these sites, investigated all previously published references to them, and prepared drawings of every design they encountered. Many of these sites had never been previously recorded and have since been inundated by dam building along the Columbia River, making this work the only public record of these valuable artistic expressions.

Part 2 of this study, which will include an additional 150 sites in Oregon, is a forthcoming publication.

ORIENTATION

Report of a Meeting on Rock Art Conservation

A. ROSENFELD
J. GOLSON
W. R. AMBROSE
P. HUGHES

Organised by the Joint Academies' Committee on the Protection of Prehistoric Places

A meeting of twenty people closely concerned with questions of rock art deterioration was held on 13-14 June 1981 at the Australian National University to discuss directions and priorities in rock art conservation with a view to generating specific proposals for the attention of the Committee on the Protection of Prehistoric Places established in 1980 by the Joint Consultative Committee of the four Australian Academies. The meeting arose directly out of a symposium held in November 1980 at Sydney University under the auspices of the Joint Academies' Committee (see *Search* 12, 1981, pp. 146-7). At that meeting it had become clear that there was an urgent need to concentrate efforts on rock art conservation in areas of high priority at several levels, from the record and management of rock art sites with a view to assessing their susceptibility to deterioration, to fundamental research into the processes of deterioration and the development of techniques to arrest those processes.

The Canberra discussion proceeded under three major headings:

Problems of recording, chaired by Sharon Sullivan
Problems of management, chaired by Phil Hughes
Problems of conservation, chaired by Wal Ambrose

Each session was left unstructured to allow for as wide a range of assessment of issues as appeared relevant to the participants, and the success of the meeting owes much to the ability of the respective chairpersons to manage the difficult task of allowing free-ranging discussion without losing sight of the objectives of the meeting. A final session to draft the proposals and recommendations of the meeting for the attention of the Joint Academies' Committee was chaired by Jack Golson.

RECORDING

Since the development of any management program depends on gathering information on the condition of rock art sites in a region, the incorporation of such information in site-recording forms is of primary importance. All State Authorities concerned with the management of Aboriginal sites maintain a register and have designed forms for fieldworkers, which are geared to the perceived requirements of the Authorities concerned. The design of these forms varies enormously from State to State, and although all contain provision for statements relating to the state of preservation of sites, the manner in which this information is recorded is particularly variable and often not useful for purposes of taking management decisions.

The meeting, therefore, expressed the strong opinion that all record forms should contain carefully designed questions relating to the physical condition of rock art sites. By and large, experience from previous site records has shown that if the formulation of questions is open-ended, the nature of the information collected tends to reflect the experience and interests of the observer and is rarely of direct relevance to

conservation. On the other hand, a long and detailed questionnaire is counter-productive in that most site recorders are either untrained amateurs such as landowners and bushwalkers or cultural resource managers with some general training in site recording, who, however, because of limited staffing levels and enormous territories to be covered, need a recording system allowing rapid coverage of large numbers of sites. In view of these constraints, the meeting concluded that information relating to the state of preservation of rock art sites would be most effectively obtained by means of a checklist with questions relating only to directly observable factors and not requiring interpretation of likely causes. They should be worded to elicit short, mainly 'yes' or 'no' answers and to add relatively little extra time to basic site-recording procedures. Several people also emphasised the value of dated photographs showing details of special relevance to deterioration conditions as well as general views of a site on which the position of close-up views could be located.

RECOMMENDATION (1)

That data relevant to the state of preservation of rock art sites be asked for on site-record forms and incorporated in State registers and other site register systems along the following lines:

Does lichen etc. occur at the rock surface on or near the art?

Do insects or birds nests occur at the rock surface on or near the art?

Is the site affected by water staining or water flow?

Is the condition of the art good? If not, give details.

Is the condition of the rock good? If not, give details.

Is the site exposed to or sheltered from the elements (rain, sun, wind)?

Is there any evidence of disturbance or damage of the site by humans, animals or vegetation? Give details.

It is also strongly recommended that in addition to general site photographs, site records be accompanied by photographs of details of relevance to the state of preservation, that the location of such details be marked on general views of the site and that the date of observation be recorded.

The application of site-conservation techniques can, of necessity, only be envisaged for a limited number of selected sites. The question of assessing priorities is clearly a managerial issue to which a number of factors including problems of conservation are relevant. Therefore, the meeting emphasised the need, as part of the management procedures for any particular site, for an assessment to be made of its state of preservation, with regard to processes, degree and rate of deterioration. Since the factors affecting site deterioration have complex inter-relationships, many of which may be site-specific, the meeting was of the opinion that such an evaluation should be carried out by a specialist in rock art conservation, who would address two basic questions: the nature of the processes of deterioration and the realistic prospect for conservation.

The meeting acknowledged the fact that at present in Australia there is no one person devoting full-time attention to rock art conservation, in sad, and indeed scandalous, contrast to the provisions made for professional conservation in art galleries and museums. It was therefore considered an urgent need for all State Authorities to have on their staff someone with basic and specialist responsibility for conservation issues, including the recognition of the need for specialist attention for sites high on the priorities list.

RECOMMENDATION (2)

That there should be at least one person on the staff of State Archaeological Authorities with primary and specialist responsibility for rock art conservation matters and adequate funding to support the necessary investigations and remedial measures.

MANAGEMENT

Site-conservation practices were discussed very extensively under three main headings: identifying the problems; assessing appropriate conservation technology; application and management of conservation measures. Many detailed and specialist problems were raised and discussed, focussing especially on the complex effects of moisture, the movement of salts and the effects of micro-organisms and vegetation. It became clear from the discussions that the issues are complex and that, although much valuable research and experimentation have been carried out, too many problems remain unresolved to enable the formulation of guidelines for routine conservation-management procedures.

There was agreement that, at the most general level, the damaging effects on art sites of the close proximity of humans (and their garbage), animals and other organisms should be minimised by controlling their access to the site by appropriate means, like fences and signs. Such measures are already fairly widely practised by State Authorities, but their effective maintenance often suffers from inadequate levels of staffing. How-

ever, the removal of existing superficial damage caused by these agents - graffiti, dust, nests - by simple mechanical means can affect the stability of pigments or rock surfaces, so that it was considered desirable that even apparently simple conservation measures be not undertaken without prior consultation with a conservation specialist.

One protective measure against water flow on rock surfaces which has received fairly wide application is the construction of artificial driplines. Narrow strips of an appropriate silicone compound are placed so as to divert water wash on the rock surface away from paintings. The most frequent use of artificial driplines is along sections of the shelter roof affected by flow. This effectively blocks the flow and causes water to drip down on to the shelter floor, or outside the overhang.

There is ample evidence that the short-term results of artificial dripline applications have generally been encouraging. However, in changing the moisture regime of the shelter walls, it is possible that other factors, such as evaporation and salt deposition from within the rock, may be affected. Splash caused by the downward drip of water on to the deposits may have deleterious effects on the rock wall, the deposits or both. Because of the largely unpredictable long-term effects of changing the moisture regime of a shelter, it is considered imperative that any conservation program which involves the placing of artificial driplines should not be initiated without prior consultation with a conservation specialist and that sites treated in this way should be carefully monitored for the possible secondary effects of the treatment. Maintenance and simple repair of dripline installations can be carried out by cultural resource managers with some initial training in the technique.

In view of the diversity of rock art conservation problems and the divergent and generally problem-specific nature of previous research in the field, the meeting considered there to be a real and immediate need for the co-ordination of existing knowledge. It seems imperative to ascertain the current nature and extent of knowledge of rock art conservation as a basis for future developments and applications in the field. By compiling a corpus of known research and technology for rock art conservation, it will be possible to devise procedural manuals as guidelines on the one hand for the preparation of site-conservation reports by specialist workers, on the other for the application of conservation methods by cultural resource managers.

Polychrome Wandjina rock paintings. Mandangarri Site, Kimberley Ranges, Western Australia.

Photograph by H.P. McNickle

RECOMMENDATION (3)

That funds be sought to commission an appropriate individual to review the present state of knowledge on rock art conservation applicable to Australian conditions, to be published as a series of manuals:

A compilation of the corpus of known research and experimental data;
Guidelines for the preparation of rock art conservation reports;
Guidelines on rock art conservation for cultural resource managers.

It is estimated that a sum in the order of $ 50 000 would be required to support an individual on salary and expenses for twelve months.

CONSERVATION

In view of the fact that many of the specific aspects of conservation had been covered in the discussions of the managerial aspects of conservation, this session focussed on the principles of rock and rock art deterioration and their causes.

There was a consensus of opinion that whatever the overview produced by a compilation of current knowledge, as proposed in an earlier session, there remained an urgent need for fundamental research into the processes of rock and rock art deterioration. It was agreed that the emphasis of such research should be holistic and that the best way to proceed was by the examination of the many and variable facets of deterioration within a small sample of closely comparable sites. Only in this way were we likely to be able to arrive at a thorough understanding of the processes involved and of their inter-relationships.

Research projects of this type require the co-operation of specialists in different fields, mainly in the geological sciences but also appropriate biological specialists. They need to utilise the services of geo-analytical laboratories and are likely to involve the small-scale destructive sampling of rock art sites, including pigments and/or engraved rock. Their results would contribute to the design of appropriate experimental conservation programs and establish an understanding of conservation materials and technologies allowing predictive evaluation of their applicability in other situations.

The execution of such research projects depends on the availability of appropriate research personnel and research facilities, as well as agreement on the designation of 'sacrificial' sites with the appropriate State Agencies and other interested bodies, especially, where relevant, Aboriginal communities. With these criteria in mind, the meeting arrived at two separate proposals for holistic research projects into rock and rock art deterioration, which together should offer valuable comparative and contrasting results. The proposals in question concern rock art sites in the Flinders Ranges, S.A., where the research would be co-ordinated by Alan Spry; and rock shelters at Mangrove Creek, N.S.W., which are already scheduled for destruction by the development of a dam for the Gosford Water Storage Scheme. This particular program would be co-ordinated by George Gibbons.

RECOMMENDATION (4)

That funds be sought to initiate projects of fundamental research into the factors of rock art deterioration and the technologies to control these.

It was noted that a similar long-term project was likely to be generated out of previous research into and current monitoring of rock art sites in Kakadu National Park.

The meeting discussed the desirability of a centralised facility with qualified personnel, supplementing and supporting the work being done in regional centres by undertaking long-term research into and providing consultation services in matters of rock art conservation. It was thought that the proposed National Museum, which is to incorporate laboratories for materials conservation, would be a particularly suitable location.

RECOMMENDATION (5)

That the matter be taken up with appropriate authorities of incorporating facilities for the development of rock art conservation at both research and consultative levels within the proposed National Museum.

FUTURE DEVELOPMENTS

1. The meeting stressed the need for a record of its discussions and developments arising from its recommendations to be communicated to participants, to other interested persons and to agencies such as State Archaeological Services and the National Aboriginal Sites Authorities Committee on which they are represented, the Australian Heritage Commission, the Institute for the Conservation of Cultural Material, the Australian Institute of Aboriginal Studies and the Australian Archaeological Association.

RECOMMENDATION (6)

That the Joint Academies' Committee on

the Preservation of Prehistoric Places, to whom the recommendations of the meeting are in the first instance addressed, consider the preparation of a report on the discussions and recommendations for participants and other interested persons and agencies.

2. The meeting felt that there was need for a small committee to be appointed to maintain liaison with present participants and communication between them, State Agencies and the Joint Academies' Committee. In addition such a committee could act as a clearing house for enquiries about rock art conservation, be the body to whom any person appointed to review the present state of knowledge of rock art conservation, which is the subject of a previous recommendation, might be immediately responsible and be the point of contact for future meetings.

RECOMMENDATION (7)

That the Joint Academies' Committee on the Preservation of Prehistoric Places constitute the organising committee for the present meeting (W. Ambrose, J. Golson, P. Hughes, S. Sullivan) its executive committee in matters of rock art conservation, with the functions set out above.

3. Participants stressed the importance of regular meetings to build on the results of the present one, assess progress and formulate further proposals. Amongst the foreseeable needs was the establishment of a formal course leading to qualifications in rock art conservation and short training courses for management personnel. Colin Pearson suggested that these needs might be catered for within the framework of the Materials Conservation Section at the Canberra College of Advanced Education.

RECOMMENDATION (8)

That the Joint Academies' Committee on the Protection of Prehistoric Places be advised of the need for regular meetings devoted to issues of rock art conservation and that at such a meeting the content of formal courses leading to qualifications in rock art conservation, and the means of implementing them, together with the design of training programs for management personnel, should have high priority for discussion.

4. Further discussion of requirements within the field of rock art conservation emphasised the urgent necessity for raising public awareness of the value of Aboriginal rock art and its susceptibility to deterioration, if the scale of support needed for research into conservation problems and remedial measures was to be achieved. This called for publicity by every possible means and a specific recommendation emerged from the discussion.

RECOMMENDATION (9)

That Bob Edwards, of the International Cultural Corporation of Australia, be approached for his advice about the organisation of an exhibition/exhibitions publicising Aboriginal rock art and stressing the problems of its conservation.

5. As the session continued, an issue that had surfaced in previous sessions began to take shape. This was the matter of a uniform program of monitoring at rock art sites, which had not previously been formalised because questions of how, where, and for what purposes remained unclarified. Discussion about raising the level of public appreciation of rock art indicated how we might proceed. It was pointed out that rock art sites are prominent amongst the places on the Register of the National Estate drawn up by the Heritage Commission. The suggestion was made that a small number of sites of this level of significance in every State/Territory might be made the focus of assessments of the state of their preservation and the agents sooner or later likely to be responsible for their deterioration, with a view to monitoring the processes of deterioration so that appropriate conservation measures could be undertaken before they had gone too far. Such an operation would be valuable in itself as taking positive action in respect of sites which might be classified as national treasures and would provide a striking means of raising public awareness of the value of rock art and of the problems of its conservation.

RECOMMENDATION (10)

That the Joint Academies' Committee on the Protection of Prehistoric Places consider sponsoring a meeting in not much later than six months time, at which:

Each State Archaeological Agency would be asked to nominate up to three or four rock art sites of the highest value;

Recommendations would be made for assessing the state of preservation of the nominated sites and keeping them under surveillance.

TAKING STOCK

If we take an overview of the present situation, we can see that some progress has been made, there are proposals currently being advanced, and there are areas where planning and proposals are still required. There is a hierarchy of issues

that need to be considered: co-ordination of activities, communication of information, investigation of problems, education in procedures and conservation as the ultimate goal.

A. Co-ordination:
The initiative of the Joint Academies' Committee has led to the establishment of a small co-ordinating committee which has acted on two occasions to bring together people who are actively involved in rock art problems. The proposal now is for the creation of a more formal executive committee to act as a liaison group on all succeeding levels of activity.

B. Communication:
The Sydney Workshop in November 1980, attended by a representative group of archaeologists and specialists in rock art conservation, was an occasion when the overall need for identifying priorities was thouroughly discussed. The Canberra meeting has been one of rock art specialists, whose aim has been to discuss and propose specific tasks within a longer-range program of conservation. The most immediate proposal at the level of communication is for the compilation of a 'state of the art' review of research into and application of conservation measures for rock art in Australia. A shorter-term need for further meetings to discuss progress and the further development of conservation measures, is also recognised.

C. Investigation:
The nature and results of investigations into rock art deterioration and conservation that have already been carried out would be set out in the 'state of the art' review that is proposed. The Canberra meeting, in addition, recommends support for two undertakings in basic research, viz: work in the Flinders Ranges co-ordinated by Alan Spry of AMDEL (Australian Mineral Development Laboratories), in association with the Heritage Unit of the South Australian Department of the Environment, and at Mangrove Creek, near Sydney, involving individual consultants, New South Wales National Parks and Wildlife Service and the Australian National University and co-ordinated through the New South Wales Institute of Technology. A major aim of both investigations would be to draw out model or minimum requirements for undertaking practical conservation measures at rock art sites elsewhere.

D. Education:
At the level of education there is at present very little being done in an organised way. Publications from previous rock art conservation conferences in Australia are available but none sets out specifically to provide information for rangers, custodians or others charged with preserving rock art. There have been short courses in New South Wales for teaching graffiti removal to rangers. The Canberra meeting notes the need for the formalisation of instruction for rangers and others and the desirability of courses leading to formal qualifications in rock art conservation, such as might be catered for within the present conservation course at the Canberra College of Advanced Education. In addition, specialised workshops might be held at centres such as the New South Wales Institute of Technology, while the proposed 'state of the art' review should result in the publication of a handbook of recording and preservation procedures.

The meeting is conscious that public education in the value of Aboriginal rock art and its susceptibility to decay is a prerequisite for achieving the moral and financial backing which its specialist recommendations require.

E. Conservation:
Conservation is the goal of the activities discussed above. The Canberra meeting notes the lack of standardised procedures for recording the state of preservation of individual sites and recommends a particular format to meet the need, as well as specialist assessments for particular sites.

The longer-term aim of conservation can be achieved if priorities for attention are identified by State Authorities and there is the possibility of co-ordinated research on the main agencies causing rock art deterioration. An early meeting to highlight these issues in terms of rock art sites of the highest value in each State/Territory is recommended. Such a meeting could be an instrument of public education as well as of specialist planning.

Dr A. Rosenfeld (Rapporteuse)
Department of Prehistory and Anthropology
Faculty of Arts
Australian National University
Canberra

Professor J. Golson and
Mr W.R. Ambrose
Department of Prehistory
Research School of Pacific Studies
Australian National University
Canberra

Dr P. Hughes
ANU Archaeological Consultancies
ANUTECH
Australian National University
Canberra

Report of the XIth ICAES Congress

QUEBEC CITY AND VANCOUVER, AUGUST 1983

The International Congress of Anthropological and Ethnological Sciences is held once every five years (the previous one was held in New Delhi, India), and is sponsored by the International Union of Anthropological and Ethnological Sciences. The IUAES is a worldwide organisation representing the diverse disciplines of archaeology, physical anthropology, social and cultural anthropology, linguistics and folklore. The Union has convened its membership eleven times since its inception in 1934 with the most recent congresses being attended by over 3000 delegates from over 100 different countries.

The XIth Congress was held in Canada in August 1983 and was hosted and organised by the Canadian National Committee of the XIth ICAES. As well as providing for a major and varied scientific program, the Congress also provided the venue for meetings of the members of the Permanent Council and the General Assembly of the International Union of Anthropological and Ethnological Sciences.

The XIth ICAES took place in two phases. The venue for Phase I (14-17 August), which included most of the official functions, was Quebec City. Phase II (20-25 August) was held in Vancouver.

The overall theme of the Congress was 'Anthropology and the Public: The Communication of Scholarly Ideas', reflecting the general concern of anthropologists to communicate the relevance of anthropology to a wide public. Special attention was also focussed on topics of ethical dimensions and the implications of anthropological research. The Phase I aspects of the Congress were dominated by the sub-theme of 'Implications of Anthropology: Ideology, Theory and Practice', creating a context for the discussion of critical concerns of anthropology as it is practised today. The Congress Program for Phase I dealt specifically with topics related to this sub-theme.

Phase II of the Congress gave special emphasis to the overall Congress theme by providing a large-scale public involvement in various aspects of the scientific program as well as providing for activities and events to promote interaction between Congress participants and the public.

The Program Committee of the XIth ICAES had received almost one thousand proposals from anthropologists wishing to organise symposia for the Congress. About four hundred of these were accepted but many symposia had to be cancelled, or consolidated with others, because organisers, discussants or active participants, particularly those from abroad, had been unable to attend. Whilst such cancellations are a feature at any major international convention of this type it has been suggested that their extent in this instance was a reflection of the present world economic trend.

The symposia were sorted into eight major categories on the basis of subject and/or area of interest. These categories were:

1. Anthropological Theory, Epistemology, Applied Anthropology
2. World Archaeology (outside America)
3. Archaeology of the Americas
4. Biological Anthropology
5. Social and Cultural Anthropology; Museums
6. Special Sessions
7. Folklore and Folk Culture
8. Linguistics

Congress days were divided into five sessions of 1½ hours each, and each symposium took up between one session, and several days. In addition, there were special evening sessions, and a program of anthropological films ran continually for the duration of the Congress. This program included the Australian film 'First Contact' which created so much interest that it had to be repeated. Finally, there were various social and cultural events, tours and excursions, an exhibition by commercial publishers, and another of the non-commercial publications of anthropological organisations.

A total of seven symposia had been gazetted for the specific subject of rock art (refer *AURA Newsletter* 1: 8). All of these were planned to take place in Phase II, in Vancouver. Since several organisers and active participants were unable to attend the Congress the number and content of rock art symposia had to be consolidated and only three were eventually held:

Conservation and Recording of Rock Art. Organised by Professor E. Anati (Italy), I.N.M. Wainwright and D. Lundy (both Canada).

American Rock Art. Organised by Dr H. Fuchs (Canada).

International Rock Art Studies. Organised by Dr J. Nordbladh (Sweden).

'Conservation and Recording of Rock Art' was a pre-Congress symposium and commenced already on 15 August, lasting to 19 August. It was sponsored by the Canadian Conservation Institute and the National Museum of Canada.

A comparatively informal meeting, this symposium had no pre-registered papers and consisted largely of discussions and working sessions. A highlight was an excursion to the Nanaimo Petroglyph Park on Vancouver Island. The town Nanaimo, separated from Vancouver by some sixty kilometres of sea, is reached by ferry. Just south of the town, on a rocky hill overlooking housing estates, is a small Provincial Park. It accomodates the best known petroglyph site of British Columbia, with a small assemblage of fairly typical Northwest Coast sandstone engravings. The park is unsupervised and the rock art is protected by no more than a wooden rail and some appealing signs.

This symposium resulted in the formulation of recommendations which were submitted to UNESCO, ICOMOS, ICOM, ICCROM and to the Executive Committee of the International Union of Anthropological and Ethnological Sciences (IUAES). These recommendations provide an excellent compendium of current concerns and priorities in world rock art research, and they are therefore quoted here in unabridged form:

I. INVENTORY AND DOCUMENTATION

I.1 Having considered that rock art provides a unique insight into the human intellectual elementary characters and qualities over at least 30 000 years before the invention of writing; having further evaluated that it is found widely disseminated all over the world, wherever *Homo Sapiens Sapiens* has arrived in all continents, it has emerged that those figures and symbols painted and engraved on rock surfaces constitute a documentation of the utmost relevance for the study and comprehension of the cultural roots of mankind. It should be the concern of every man and woman to assure that this really universal patrimony is preserved, documented, studied and understood, and that it becomes a conscious part of our general culture.

I.2 Rock art is very vulnerable and is fast deteriorating. Inventory and documentation should be given high priority in all countries where it is present. The international organisations should act as authorative channels in stimulating national and regional actions, as leaders in co-ordinating and favouring efforts aimed at assuring the inventory and documentation; in assuring also that the information is published, disseminated, made accessible to all, and preserved for future generations.

I.3 The rapid decay, exfoliation, or other types of deterioration of rock art in many parts of the world make it imperative to rapidly progress with intensive recording, as much as possible and as reliably as possible. National and local governments should be made aware of their responsibilities as keepers of this human heritage and of their role in making the cultural patrimony of their territories accessible to others.

I.4 World co-operation in inventory and documentation of rock art should include the issue of agreement on basic standard requirements that will assure the comparability of data and of documentation. A world survey on the state of knowledge on rock art should be made available to all nations by UNESCO and should further be updated with the constant inclusion of new discoveries and of new information.

I.5 Member states should be stimulated to co-operate and to favour urgent surveys, recording and inventory. A broad campaign should be promoted by the international organisations to explain that any delay, especially in fast-developing regions, may cause the loss of documentation forever.

I.6 Inventory and documentation is seen also as a necessary base for preservation and conservation, which, in many parts of the world, can hardly afford any further delay.

II. PRESERVATION AND CONSERVATION

II.1 Preservation and conservation of rock art is a very delicate matter which should be carried on at highly professional levels. Due to factors of environment, of human intentional or unvoluntary vandalism, as well as of the variety of agents causing deterioration, each case requires specific studies. In order to develop an efficient network of preservation and conservation services, national governments and international bodies should favour exchanges of experts, of information, and of services.

II.2 Rock art is usually surviving in its original context where it was created by humankind. The relationship between the rock art creation and its environment is therefore a vital aspect for its understanding. It is therefore recommended that special attention be devoted to this consideration. The relationship between rock art and its surroundings should be given special consideration in preservation and conservation projects, involving the site as a whole rather than just isolated, damaged or endangered specific figures.

II.3 The understanding of deterioration processes is vital to assure adequate preservation. In-depth structural analyses on the dynamics of deterioration are strongly recommended as sound bases for any eventual action of protection or conservation.

II.4 One of the major problems of conservation which has emerged during this symposium concerns the protection and storage of documentation. Many important collections around the world are fast deteriorating as a result of use of perishable materials or of inadequate storage systems. Colour photography is often altered after a few years; tracings, drawings, recordings, and whatever else has a base of paper which may become altered by time and inadequate storage systems. Documentation which is now disseminated around the world in numerous countries and in different conditions is suffering losses from deterioration every day. Two possibilities have been envisioned to ease this unfortunate condition: A. The implementation of a world data bank where copies of all documentation should be adequately inventoried and preserved; and, B. Substantial efforts be made by governments and by international organisations to assure that documentation is safely preserved, stored and accessible. International organisations are invited to assist and advise on preservation and storage of documentation with special reference to colour transparencies which are known to rapidly deteriorate.

II.5 A world survey on the state of preservation of rock art should be a valuable step for evaluating a situation requiring an international effort. For such purpose, a 'State of Preservation' form should be created and disseminated by the international organisation, filled in and returned by experts and administrators concerned with rock art sites.

II.6 Conservators and restorators around the world should be requested to present short reports, on a standardised questionnaire, on every project or action concerning preservation, conservation or restoration of rock art sites. Such reports should be collated, made available and disseminated by the international organisations.

III. EDUCATION AND INFORMATION

III.1 The majority of those attending this symposium consider that education, information and professional training in rock art studies are presently inadequate. Specialised training courses,

seminars and professional tutoring should be supported by national and international organisations with the purpose of raising the general degree of professionalism in rock art studies.

III.2 Congresses and symposia on rock art studies should be held regularly as a means of assuring regular contacts among specialists, exchange and updating of information, as well as an efficient means of disseminating information.

III.3 Dissemination of information should be implemented also through publications. National governments and international organisations are urged to favour the publication of reports on rock art studies and their adequate distribution.

III.4 Universities should make every effort to include rock art studies in their programs or classes.

III.5 The education of the public at large is considered no less important than the training of specialists. National and local governments should make every effort to disseminate information and stimulate the evaluation and appreciation of the rock art sites existing in their territories.

III.6 A report on all the recording techniques being currently used would be a highly valuable tool for obtaining a world view on a technical aspect which has occupied several sessions of this seminar.

IV. INTERNATIONAL CO-OPERATION

IV.1 Having noted that in several countries the study of rock art appears to be neglected, underestimated or underfinanced, an appeal is made to these states to devote more attention to rock art studies, to stimulate further research and appreciation of rock art and to assure the basic requirements of conservation and preservation of rock art sites.

IV.2 Recording and documentation of rock art should be the duty of those administrations under whose jurisdiction the sites are falling. It is a moral duty of each state to assure that records and documentation of their rock art is accurate, exhaustive, and accessible to all for scientific, cultural and educational uses.

IV.3 The international organisations should provide, when requested, specialists to advise governments how to deal with the study, preservation, conservation, evaluation and public enjoyment of rock art sites.

IV.4 The international organisations and in particular UNESCO, ICOMOS, ICOM and ICCROM are urged to further and develop joint efforts and full co-operation for stimulating international action and for assuming the implementation of these recommendations.

The symposium **'American Rock Art'** was held on 21 August and consisted of the following lectures:

Orientation of South American and Antillean Petroglyphs, by C.N. Dubelaar (Netherlands).

A test study of a small sample of petroglyphs suggests that they are orientated randomly. In this study, orientation refers to the direction in which the engraved rock surface faces. If the image is on a horizontal pavement, orientation is decided by the longitudinal axis of the figure. During discussion, Professor Anati emphasised the utility of 'orientation' as preliminary data.

Petroglyphs in South America, by C.N. Dubelaar (Netherlands).

A comprehensive survey of the literature of South American petroglyphs was attempted and cultural affiliations were considered, of the rock art of various areas, such as the Guyana and Orinoco regions, the left and right tributaries of the Amazon, and of Argentina. A number of 'pilot motifs' were used in this survey. The discussion centred on the admissibility of non-percentage data for statistical treatment.

The Study of Rock Art, Scientists, Dilettants and the Interested Public, by H. Fuchs (Canada).

The lecture discussed mainly American native groups who might consider rock art to be part of their heritage, who might be politically motivated, and under whose supervision rock art research may have to be conducted in the United States. Examples of destruction of rock art by traditional owners were cited, which have been described as 'ethnic suicide'; but it was pointed out during discussion that, in much rock art, it is only the act of producing it that has spiritual significance, while the permanent product itself is often of no importance.

Arte rupestre, ultimos descubrimientos en los Andes Meridionales, Arequipa-Peru, by M.E. Linares (Peru).

A series of six hundred painting and petroglyph sites in Peru were described and illustrated. Four styles occur throughout the region, and they are well dated. In many cases, models of the rock art have been recovered in a datable context. The older styles were dated via paint brushes found in dated graves, the more recent patterns are commonly also found on ceramics and textiles. Generally, the sequence commences around 8000 B.C.

Image Digitising and Computer Storage in Rock Art Research, by J.L. Dickman (U.S.A.).

A comparatively inexpensive computerised system of recording and storing rock art was described. By detecting colour or light levels it may be able to discern faded images. Optical discs are far superior to magnetic tapes and can store huge numbers of images. The described system has numerous benefits and can be expanded in many ways.
(Refer article by J.L. Dickman in this issue.)

The 'Cup and Ring' Carvings of Scotland and North England: some Specific Problems of Analysis, by J.P. Jackson (England).

The 'abstract' motifs in Britain include the 'cup and ring', often with concentric rings; lozen-

ges; multiple waves; multiple arcs; and sets of concentric circles, consisting of up to nine circles. These motifs often occur in maze arrangements which may be very extensive. In contrast to the Spanish tradition, where similar motifs are associated with iconic images such as those of animals and weapons, the British tradition is purely non-iconic.

International Matters of Rock Art Research, by H. Fuchs (Canada).

The lecture concentrated on academic support for the South American colleagues. The speaker advocated the establishment of national associations which are able to apply pressure on local or national governments, and which should strive to establish archives and research centres. The speaker concluded with a motion that the Latin American Congress be revived. The participants present voted unanimously that such efforts be encouraged, but during discussion Professor Ucko questioned whether it would be well advised to be unduly outspoken in the criticism of some countries. A committee was formed to compose formal letters to the governments concerned.

The symposium **'International Rock Art Studies'** was held on 24 August and consisted largely of a discussion session. Dr Nordbladh (Sweden) examined different approaches to rock art research, which he terms syntactic (according to arrangement), pragmatic and linguistic (communicative potential). He is primarily concerned with the 'meaning' of rock art as it may be derived from such aspects as relative position, recurrence of motifs, and the like.

No formal papers were delivered during this symposium, and rather than reporting the course of the discussion I shall just briefly summarise some general impressions:

Spatial aspects of rock art distribution attract far more attention than chronological aspects; the cumulative character of many large rock art concentrations is sometimes not appreciated. The response to the inherent dating problems with rock art is often to treat the subject as a phenomenon devoid of any significant time depth, to be interpreted by ethnographical analogy. Most rock art researchers seem preoccupied with such areas as recording of regional sequences and styles, interpretation attempts and conservation. Very few are concerned with more fundamental issues of rock art research, such as integrating the art into general models of cultural evolution, or with pursuing the line of enquiry pioneered by such scholars as Marshack or Dr Gallus.

Robert G. Bednarik
Editor, *Rock Art Research*

Rock Art Conservation and the Australian Bicentennial

At a meeting held in late July 1983 at the Australian National Library on Conservation and the Bicentennial, Dr Colin Pearson of the Materials Conservation Section of the Canberra College of Advanced Education gave a paper in which he deplored the lack of integrated research in Australia into questions of rock art deterioration and conservation and called for the establishment of a national facility to undertake responsibility for this and for rock art studies in general. As a result he was invited by the Director of the Bicentennial Authority, Mr David Armstrong, to prepare a proposal for consideration for funding by the Authority as a Bicentennial Project.

Through Professor Mulvaney, who had himself been at the meeting, Dr Pearson brought the matter to the notice of the Prehistoric Places Committee, since the invitation offered the opportunity for accomplishing what had emerged as necessary in the rock art field from the two Workshops which it had sponsored. Because the deadline for submissions was 28 September, there was no time for wide consultation, so that initial discussions took place with a small group of people resident in Canberra, Dr Pearson himself, Mr Ambrose, Dr Hughes and Dr Rosenfeld from ANU, Dr Flood from the Australian Heritage Commission, Mr Dix and Dr Ward from the Australian Institute of Aboriginal Studies and Mr Watchman, a consultant geoscientist, besides Professor Mulvaney and myself for the Prehistoric Places Committee. However, the form in which the proposal was submitted to the Joint Academies' Consultative Committee for its sponsorship was much influenced by the recommendations of the Sydney and Canberra Rock Art Workshops, which had drawn on a broad electorate.

At a late stage in this whole operation some doubt was raised within the Bicentennial Authority about the eligibility of the proposal for its consideration, on the grounds that the Authority has, by its nature, a limited life and cannot commit itself or government to long term expenditure, as implied in the proposal. Subsequently, however, we were encouraged (again from within the Authority) to proceed with the submission, but advised to bring the proposal to the attention of the Minister for Aboriginal Affairs, which has been done.

Professor Jack Golson
Chairman of the Joint Academies' Committee on the Protection of Prehistoric Places

INTRODUCING:

One of the principal objectives of the Australian Rock Art Research Association is to 'establish and maintain contacts with organisations, agencies and individuals with similar interests, in Australia and abroad'.

In each issue of this journal, an organisation concerned with rock art studies will be introduced to our readers. The purpose of this column is to familiarise Australian researchers with the many associations and institutions that exist throughout the world, to draw their attention to potential sources of information and literature, and to generally facilitate closer relations among the world community of rock art researchers.

The organisations featured will include both overseas and local ones, and they will generally be those that have established ties with AURA.

THE AMERICAN COMMITTEE TO ADVANCE THE STUDY OF PETROGLYPHS AND PICTOGRAPHS (ACASPP)

Statement of Purpose

In suggesting the formation of ACASPP the intention of the organisers was to further the study, preservation, conservation, and interpretation of a widespread and valuable but vulnerable cultural resource. The initial impetus has been the rapid and often irreversible destruction of these resources by vandals, souvenir hunters, professional antiquities looters, and by exposure to the elements over prolonged time periods. There is no intention to belittle, supersede, or replace the work of such organisations as the American Rock Art Research Association or the Canadian Rock Art Research Associates (ARARA and CRARA), but rather to augment those efforts, and to provide a professional focus for efforts to survey, record, analyse, preserve, conserve, and interpret these resources. Archival support is already available through the Rock Art Archive, Institute of Archaeology, University of California at Los Angeles (UCLA).

More than forty percent of the land surface of the United States is owned by the Federal Government, in contrast to a European nation such as England where the central government holds less than five percent of the land. By law and administrative practice, government agencies are required to seek the services and support of practising professionals in order to survey and document cultural resources, including petroglyphs and pictographs. No comprehensive survey of these resources has as yet been undertaken, nor is there yet any clear agreement among scholars or agencies as to what constitutes an appropriate level of documentation or interpretation. ACASPP is intended to provide a working base to enable present and in-training professionals to co-ordinate their work with each other, government agencies, and other public and private institutions to address these problems. Only by pursuing these goals on an explicitly professional level can research monies be channelled through existing institutional structures to accomplish the necessary work, and provide for publication of results.

Public and private agencies must be furnished an explicit, detailed program of research to accomplish the research goals of those involved, and to meet the needs of government agencies and other responsible bodies. In most cases, work should lead to the completion of academic degree requirements and in all cases to the publication of results. ACASPP can serve as a clearinghouse for information to agencies, public and private institutions, and the general media as to work undertaken and results obtained. Public support and awareness should be obtained by timely release of information to newspapers, magazines, television and radio.

General Information

Professor B.K. Swartz, Jr., the Ad Hoc President of the American Committee to Advance the Study of Petroglyphs and Pictographs, is also AURA's liaison officer with that professional body, and one of our principal contacts with American rock art research in general. Like AURA, ACASPP is keen to maintain international contacts. ACASPP was formed in 1979 and numbered about eighty scholars in 1981. The organisation has been active in such areas as the establishment of minimum standards for the recording of rock art.

Besides publishing a newsletter four times a year, ACASPP produces occasional papers. The organisation's editor is Mr Joseph J. Snyder, who should be contacted via P.O. Box 260, Harpers Ferry, WV 25425, U.S.A.

Volume One, Occasional Papers of the ACASPP, has approximately 160 pages, is illustrated, and contains the following articles:

'The use of Indian gesture language for the interpretation of North American petroglyphs: a trial analysis', by LaVan Martineau, B.K. Swartz, Jr., and C.L. Houck.
'Rock art studies in the eastern United States: the road ahead', by J.L. Swauger.
'A survey of petroglyph and pictograph research as viewed from America', by B.K. Swartz, Jr.
The price of this volume is $ US 10.00 for non-members.

AURA members are encouraged to direct queries, or requests concerning available literature and ACASPP publications, to this body. Professor Swartz can be contacted at the Department of Anthropology, Ball State University, Muncie, Indiana 47306, U.S.A.

Rock Art Conference in Canada

The Sixth National Conference of the Canadian Rock Art Research Associates will be held from 31 August to 2 September 1984 at Trent University, Peterborough, Ontario, Canada. Though originally planned for September 1983, the association's Executive decided to delay this event until 1984, because it would have been too close to the International Congress of Anthropological and Ethnological Sciences, in Vancouver.

The special theme of this meeting will be 'Continuities and Relationships: the Context of Canadian Rock Art'. The conference will be problem-oriented. Papers will deal with the relationships of rock art to other cultural manifestations and will underplay 'reports on recent research'. We are urging papers which attempt to examine rock art in a wider cultural, temporal, and spatial context. Not to be neglected are the possible relationships between the New and Old Worlds.

Examples of hoped-for papers include the following: the relationship of Great Lakes rock art to the Midewiwin bark scrolls; the basis of rock art in religious meanings and rituals; the economic factor in coastal B.C. petroglyphs; an examination of continuities between rock art traditions ('style-areas') within the New World with a view to more precise delineation of shifting 'historic' boundaries (e.g. possible spread of Algonkian rock art after initial contact); an exploration of New World - Old World ties, especially those pertaining to the circumpolar, circumboreal zone. These are merely suggested topics, meant only as illustration, and are by no means yet proposed by anyone. They mean to indicate ways in which this coming conference hopes to explore Canadian rock art in the fullest sense of the word 'context'.

Proposed sessions will include:
(1) Relationships between Canadian Rock Art and Art in other Media.
(2) Canadian Rock Art in Chronological Perspective.
(3) Canadian Rock Art in the Context of World Rock Art.
(4) And, of course, reports of new discoveries will also be scheduled in a special session.

Please direct any enquiries to:
Professor Ron Vastokas
Conference Chairperson
Department of Anthropology
Trent University
Peterborough, Ontario, K9J 7B8
Canada

PETROGLYPHS STOLEN IN CANADA

The following press release by the Heritage Conservation Branch of British Columbia reports the theft of engraved boulders from a site on Canada's west coast:

Three important petroglyphs have been illegally removed from a remote site near Hartley Bay on British Columbia's northern coast. The site, located on Douglas Channel, approximately fifty miles southwest of Kitimat, B.C., has been described by rock art researcher Beth Hill as 'a profusion of petroglyphs, with many birds, some frog-like figures, one 'mermaid' and many faces and eyes and small round pits' [1]). Hill noted thirty-nine petroglyphs on individual boulders when she recorded the site in 1974. This number has now been placed at ninety-seven by Steve Cassidy of the Heritage Conservation Branch, who examined the site in 1983.

The B.C. Provincial Archaeologist, Arthur Charlton, described the removal as shocking. His words were echoed by Dr George MacDonald, Director of the National Museum of Man, who called it a tragic loss. British Columbia is one of the outstanding rock art areas of the world with well over five hundred known sites. Rock art sites are culturally significant to native Indian people, who trace their history to the region. Such sites are important to the heritage record of the province as a whole.

The Heritage Conservation Branch has contacted the R.C.M.P., United States Customs, museums, yacht clubs, marinas and dealers in antiquities in an attempt to track down the culprits. While the Hartley Bay site is protected by the Heritage Conservation Act and the Land Act, Mr Charlton is more interested in seeing the safe return of the petroglyphs rather than pursuing prosecution.

The Heritage Conservation Branch will be working with the Hartley Bay Indian Band to determine ways of better protecting the site. While the petroglyphs could be removed to a safer location, archaeologists are reluctant to do so as the context of the original site is then destroyed, Mr Charlton noted. The Heritage Conservation Branch requests the assistance of the public in ensuring the safe return of these important rock carvings.

Editorial Note:
[1]) This reference is from B. and R. Hill 1974, *Indian Petroglyphs* (Hancock House Publishers Ltd., Saanichton, B.C., Canada), page 184.

Easter Island Congress

This meeting of archaeologists, anthropologists and other scientists who are interested in this area of the Pacific is the first attempt to gather together foreign and national researchers working on studies concerning East Polynesia to exchange information on research in progress and to co-ordinate future research on a regional basis.

Particular focus will be on Easter Island's relationship to other islands of the East Pacific. The subjects under discussion, assessment of current archaeological and anthropological research, should be of interest to people all over the Pacific.

As a part of this Congress, Georgia Lee (UCLA) will be chairing a session on rock art. Depending upon the participants and their special interests, several areas are expected to be covered:

Rock art of the Pacific Islands or peripheral areas;
General recording methodology;
Preservation of sites;
Special techniques for preservation and computerisation of data;
Dating techniques for rock art.

The Congress is from 6 to 12 September 1984. Participants are urged to come early and/or stay over in order to allow time for visiting the numerous and extraordinary archaeological sites on the island. The Congress registration fee is likely to be in the region of $100 for Participants, $80 for Observers, and $50 for Students.

Accomodation on the island varies enormously in price and comforts. You can camp (bring your own gear) for $6 a day at Tahai or stay with a local family for $20 a day (or less), including meals. A lovely residency (Rosita's) can be had for $40 a day with private rooms and baths, and meals. Prices are per person. Hotels are available. The most expensive, Hotel Hangaroa, is $145 a day (for two), including meals. It is the place where the Congress will be held. These prices are current as of January 1984, are in US currency, and may change.

As part of the meetings, field trips will be made to some sites. Cars and motorcycles can be rented, and horses are plentiful. The island is not a barren rock. It is green and lovely and has trees. The Rapa Nui people are friendly, warm and *simpatico*. The rock art is varied and impressive. The other archaeological sites include the world famous quarry, Rano Raraku, where the giant statues were carved; Rano Kau, the crater where the birdman cult was held; and shrines (*ahu*) dot the shores of the island. If you are interested in participating in the Congress, please contact:

Georgia Lee
735 California Blvd.
San Luis Obispo
California 93401
U.S.A.

XIth Congress

UNION INTERNATIONALE DES SCIENCES PRÉHISTORIQUES ET PROTOHISTORIQUES - London and Southampton, 1-7 September 1986

This meeting of archaeologists and others who are interested in the past is to be a truly international one. The working sessions will take place at the University of Southampton and a significant event during the Congress will be the opening of a major new exhibition at the British Museum in London.

The themes of the Congress will be based on pre-circulated papers, so that the five days of meetings in Southampton will be entirely devoted to discussion. The major themes of the Congress will be:

Cultural Attitudes to Animals including Birds, Fish and Insects: categorisation, usage, domestication, art depictions, etc. (of special interest to Commission 9 - Prehistoric Art, and 13(2) - Beginnings of Animal Domestication).
Archaeology and the very Remote Past: archaeology and the origins and dispersal of modern man; man at about 18 000 years ago; the Pleistocene/Holocene boundary (of special interest to Commissions 3 - Palaeoecology of Prehistoric Man, 5 - The Earliest Industries: Pre-Acheulian and Acheulian, 7 - Living Structures of Hunting Peoples, 8 Problems of the Upper Palaeolithic, 10 - Peopling of the American Continent, 11 - Prehistory of the Pacific, 12 - Cultures, Economies and Ecologies of Post-Palaeolithic Hunters).
Archaeological 'Objectivity' in Interpretation: multiculturalism and ethnicity in the archaeological record; individual and group self-expression through material culture (objects of defence and warfare, for status and show, etc.); archaeologists' views of the past (factors influencing choices of interpretations available to the professional

archaeologist, interpretations of sites presented to tourists, interpretations presented in museums, etc.); archaeological time scales and indigenous perceptions of the past.

Interactions between 'Central' and 'Peripheral' Cultures: imperialism, colonialism, centralised and non-centralised societies, states, literacy, etc. (of special interest to Commissions 11 - Prehistory of the Pacific, 12 - Cultures, Economies and Ecologies of Post-Palaeolithic Hunters, 17 - Iron Age Cultures, 19 - Archaeology of the High Middle Ages).

Social and Economic Contexts of the Adoptions of Similar Technological Elements in Different Parts of the World: of special interest to Commissions 10 - Peopling of the American Continent, 11 - Prehistory of the Pacific, 13(1) - Beginnings of Agriculture, 14 - Neolithic of the Old World, 15 - Origins of Metallurgy, 17 - Iron Age Cultures, 18 - Origin of Cities.

The program is designed to allow additional specialist and regional symposia which will include, at least, specialist Commission meetings on: History of Prehistoric and Protohistoric Archaeology (Commission 1), Physical Dating Methods in Prehistory (Commission 2), Data Management and Mathematical Methods in Archaeology (Commission 4), Earliest Hominids (Commission 6), Copper and Bronze Age Cultures (Commission 16) and Archaeology of the High Middle Ages (Commission 19). In addition, the Council for British Archaeology will organise a meeting on Public Archaeology and Cultural Resources Management.

The suggested format of this Congress is different from previous ones. The participation of professional academic archaeologists will continue to be crucial to the success of the Congress but, in addition, the 1986 Major Themes are designed to widen the field of participants to include those from all continents, countries, nations and cultural groups who are in any way involved in studying the past, whether as guides, or as custodians of monuments, or as trainees on excavations, or involved in some other way with archaeological projects.

The National Secretary of the Congress, Professor Ucko, believes that the major aims of the Congress will have succeeded only if in 1986 new and continuing dialogues are established between people from diverse backgrounds with diverse preconceptions, who share a common interest in comprehending the cultural processes which have contributed to past human cultures. It is his intention that out of this Congress there will develop an increased understanding and appreciation of our global heritage and the variety of attitudes we bring to it.

With these unusual aims the 1986 conference can be expected to be a particularly productive event. The registration fee is likely to be in the region of $320. To register your interest in this particularly important meeting write to:

The National Secretary
Professor P.J. Ucko
Department of Archaeology
University of Southampton
Southampton SO9 5NH, England

If you wish to attend with an AURA delegation you are asked to advise the Editor. Some AURA members have already expressed their interest.

Archaeological Tours

Past Times Archaeological Tours provide guided tours of overseas archaeological sites, museums and other places of interest. All of the tours feature pre-trip study materials, lectures on the archaeology and culture of each region, and lectures by notable experts.

For the past four years, *Past Times* has conducted tours to the French Dordogne. Study groups are designed for the traveller who wants a sensitive approach to the fine points of prehistoric art. It is commonly believed that some caves are closed; this is only partly true. The organisers have worked closely with the Department of Antiquities, French archaeologists, and guides who have given them special privileges in the caves and at the museums. With these advantages, these groups see the caves at the best time of day, view caves unknown to the general public (Altamira, Lascaux), and have contact with those people most intimately involved with the cave art. Tours are always limited to a small number of people.

Prehistoric Journey, Part I, 9 June to 1 July 1984: New York - London - Stonehenge - Cambridge - Paris - Lascaux.
21 days, $US 2495 (airfare not included).

Prehistoric Journey, Part II, 9 to 29 July 1984: Altamira Musem - Niaux - Arago - Terra Amata - Valcamonica.
21 days, $US 2495 (airfare not included).

For a descriptive brochure and details contact PAST TIMES ARCHAEOLOGICAL TOURS, 800 Larch Lane, Sacramento, CA 95825, USA.

Second Australian Archaeometry Conference

At the Australian National Gallery, Canberra, Monday 11 - Thursday 14 February 1985

This conference will aim to bring together people working in archaeology, art and the sciences by concentrating on the application of advanced investigative techniques to an understanding of technology, chronology, ageing and preservation processes in cultural materials. Speakers will be encouraged to direct their contributions to questions involving artworks and artefacts, as well as the cultural insights which such analyses may provide. Contributions from the earth sciences in archaeological and environmental research are also invited, particularly where the impact on human groups can be suggested.

The committee would also like to have contributions from researchers who, while not having applied a particular analytical, chronological or investigative system to artefacts or artworks, can nevertheless outline possible applications of their studies in archaeometry.

Preliminary Topics: The final program will depend on the papers offered but the following is an outline for prospective participants.

The time scale of Australian prehistory requires the application of dating systems beyond the range of 30 000 years. In contrast the last thousand years is equally in need of sensitive dating systems, not only for prehistoric studies but also for a broad range of research on museum and gallery collections, for either authentication or stylistic analyses.

As well as the normal physical and chemical analysis of material such as pottery, textiles, metals, painted surfaces, etc. contributions could be in the field of acquired surface changes and the weathering and preservation of materials at sites or in collections. Authentication studies based on materials analyses are also invited.

Studies on the reconstruction of past environments with the emphasis on the relevance of these for human occupation of the study area, are being sought.

If you are interested in further information, write to:

W. Ambrose
Department of Prehistory
Research School of Pacific Studies
Australian National University
P.O. Box 4
Canberra, ACT, 2600
Australia

Canadian Journal of Rock Art

The Canadian Rock Art Research Associates, AURA's equivalent in Canada, are organising papers and other matters for the inaugural issue of the *Canadian Journal of Rock Art*. The CRARA Executive have appointed an Editorial Board, consisting of:

Dr J. Vastokas, Trent University, Peterborough
D. Lundy, British Columbia Provincial Museum, Victoria
Dr J.D. Keyser, U.S. Forest Service, Portland (Oregon, USA)
T. Jones, CRARA Editor.

As one would expect, such an undertaking requires considerable planning for all aspects (format, funding, etc.) and this is well under way. It is hoped the initial issue will be out by the (Canadian) summer.

The *Canadian Journal of Rock Art* will replace the *CRARA Newsletter* which has been CRARA's official organ until May 1982, when it was discontinued. Please direct inquiries to:

Mr Tim Jones
Communications Associate, CRARA
c/o Department of Anthropology and Archaeology
University of Saskatchewan
SASKATOON, Sask. S7N OWO
Canada

Letters to the Editor

To: The National Organisations for the Safeguarding of Monuments and Antiquities

Please find below a copy of a circular letter mailed to the National Commissions of the UNESCO Member States, concerning the support of projects on prehistoric rock art.

It is my hope that the content is of interest to you, and that you may take advantage of the indications provided by UNESCO's Programme and Budget 1984-1985.

Professor Emmanuel Anati

To the Chairpersons of ICOMOS National and International Committees

Dear Sir/Madam,

May I bring to your attention that UNESCO's approved Programme and Budget for 1984-1985 states, in paragraph 11.11.6:

> Activities for the protection of prehistoric rock art will be continued; they will involve the study of documentation methods and the conservation of rock art sites. In addition, advice will be provided to Member States wishing to study and protect their rock art heritage.

This statement is of utmost significance to those who intend to protect their nation's rock art sites, and wish to promote the knowledge and appreciation of this cultural and intellectual heritage.

In November 1979, the International Council on Monuments and Sites (ICOMOS) created the International Committee on Rock Art (CAR) which I have the honour to serve as Chairman. Its organisational and operational center is at the Centro Camuno di Studi Preistorici, Capo di Ponte, Italy. In the event that you wish to undertake projects concerning rock art sites in your country, deserving the attention and the international support of UNESCO, please do not hesitate to contact us immediately. As an international non-governmental organisation of specialists enjoying close relations of collaboration with UNESCO, it is the privilege and duty of ICOMOS to provide whatever professional guidance may be necessary. It is imperative to co-ordinate our efforts in this endeavour to protect rock art sites, further their study and documentation, and open them to public enjoyment.

As Chairman of the ICOMOS International Committee on Rock Art, I wish to assure you of the full support of my committee, in the preparation of well-planned and carefully conceived projects, the search for necessary funding, and the project's final implementation. Through our joined efforts we may achieve truly valid results in protecting and conserving rock art, man's earliest form of self-expression and creativity, as well as in making rock art sites a source of culture, education and scientific research.

Please feel free to contact me for any further clarification. I look forward to hearing from you soon.

Sincerely yours,
Professor Emmanuel Anati
(Chairman, International Committee on Rock Art, ICOMOS; Co-ordinator, World Inventory of Rock Art)

Dear Mr Bednarik,

I have had some additional thoughts about the state of the Australian rock art research and its conservation. The importance of rock art is so great and its preservation so necessary that the task of recording and conservation should be carried out by a well-founded Rock Art Research and Conservation Institute, perhaps an adjunct to the Museum of Australia.

The second issue, of greater importance to the politically more aware, is the fact that the knowledge of sites and their religious associations are the last vestiges of power and control over the land, and their lives, remaining with the people. They fear that if they reveal this knowledge to the European structures they would relinquish their only authority. Under the present Northern Territory Land Rights legislation the people have to prove their spiritual attachment to the land by revealing such sites and ideologies, leaving them open to ridicule by those opposing their land claims, and to threats or even actual destruction of their sites. AURA should seek the views of Aboriginal people, where possible through their organisations, if it is to list traditional custodians of sites and have such sites identified. In Northern Territory, both the Central and the Northern Land Councils keep a register of traditional owners. The traditional owners of Kakadu National Park, where I have recorded some 1500 sites, were named in the Alligator Stage I and II Land Claim Books published by the Northern Land Council. It is possible that the views of individuals and also organisations may vary from State to State and even between communities within the region.

Kind regards,
George Chaloupka
Northern Territory Museum of Arts and Sciences
Darwin

Monsieur,

Le projet de création d'une association Australienne pour l'étude et la conservation de l'Art Rupestre me paraît tout-à-fait intéressant et utile. Je serais heureux et honnoré d'être inclu dans les membres de cette association.

Ayant travaillé une quinzaine d'années dans le Sahara Algérien, ma connaissance de l'Art Rupestre de plein air dans la zone sub-désertique et désertique s'est enrichie d'assez nombreuses observations. C'est principalement en tant que *géomorphologue* que j'étudie l'art rupestre: d'importants renseignements peuvent être tirés des sites, des stations et des parois ornées (peintures et gravures néolithiques); le comportement des roches support à l'interface roche/atmosphère peut être étudié scientifiquement et des résultats peuvent être acquis pour ouvrir la voie à des datations absolues de cet art rupestre. De même une déontologie de la conservation et de l'étude de cet art doit être établie et mise en oeuvre.

Dans le monde, l'art rupestre de plein air de la zone désertique (chaude ou froide) est très abondant: son étude ne fait que débuter; la tâche est immense: l'enthousiasme des chercheurs est également immense, mais trop souvent il manque les structures appropriées, particulièrement pour les chercheurs isolés. La création de l'AURA aura donc, je n'en doute pas un importance primordiale dans la communauté scientifique mondiale.

Comme vous le savez peut-être, je suis membre de l'ICOMOS pour l'art rupestre (Comité International Spécialisé) et à ce titre, je serais heureux d'être un des Correspondants en France de votre Association.

Vous trouverez ci-joint, par coli postal séparé, quelques tirages-à-part de travaux qui pourrent peut-être enrichir votre Centre de Documentation.

Je vous prie de bien vouloir accepter, Monsieur, l'expression de mes sentiments très sincères et dévoués,

F.X. Soleilhavoup
Epinay-sur-Seine
France
[Professor Soleilhavoup is AURA's Liaison Officer and Regional Editor for France.]

Dear Mr Bednarik,

Contrary to some of the comments made in response to your interim newsletter and questionnaire, one would expect that the formation of an Australian rock art research group would be taken for what it is: a very logical, evolutionary step forward. Such research must surely complement the 'traditional' archaeological and anthropological studies and methods. It is a matter of historical record that nearly all basic sciences experienced the same developments in the past. Their offshoots, with a fresh approach and new ideas, have always benefitted the basic discipline, not disparaged it, whether it be ornithology, botany, geology or whatever.

You are to be applauded for taking the initiative in bringing those with a common interest together and providing a medium by which that common interest can be nurtured.

Regards,
P.R. Penney
Mount Gambier

AURA NEWS

TERMINOLOGY

The 1981 International Consultation of Specialists on the Study, Documentation and Conservation of Rock Art produced a blueprint for a world strategy in rock art studies. Its Recommendation No. 2.1 describes as indispensable the adoption of a common terminology in this field. In Australia, the nomenclature used in rock art research is far from uniform, and one of AURA's first priorities should be to promote consistency in this area.

The usual approach to resolve such an issue is to form a committee to which the task of producing a satisfactory system is entrusted. But in practice, the eventual recommendations of such committees are often not adhered to. An example are the recommendations of the Australian Stone Implement Committee of 1967 (Casey, Crawford and Wright 1968) which remain widely ignored, especially in the illustrating of stone implements. In our case it might be more profitable to facilitate a general consensus of Australian rock art researchers. The meaning of a word is not some immutable constant, it reflects the consensus of the group using the language. Similarly, this specialist vocabulary should be the result of accord among the researchers concerned. With only one journal in Australia devoted to rock art it should be possible to resolve the issue efficiently, by calling on the help of AURA's membership.

I believe that a uniform terminology should be co-ordinated with the specialist jargons of other English-speaking countries, particularly those that have well-established research organisations concerned with rock art. In addition, where similar terms exist in other languages their usage ought to be examined. It is not suggested that foreign expressions should be adopted indiscriminately but it would be a regressive course to encourage a narrow, nationalist approach in this matter.

Nevertheless, established Australian practices must be the basis of any discussion of terminology, and they are probably best summarised in F.D. McCarthy (1968) and L. Maynard (1977). Various terms used in the Australian literature on rock art need to be re-examined. In addition to expressions referring to style and technique I believe we should also consider relevant geomorphological terms. For instance, *patination* is a catchword often used, yet it is quite vague by itself (referring to several different phenomena) and it requires further qualification in any context.

I would like to open the discussion by examining some specific examples. In Australia, the term *rock engravings* is often used to refer to all rock art produced by a 'subtractive process' but, as Maynard points out, few of these images were actually fashioned by a process of engraving. Some are abraded but the majority were made by percussion; they are pecked or pounded. (One could be pedantic and point out that not all petroglyphs involve a subtractive process).

Similar considerations apply to the term *rock carving*. 'To carve' is to produce a desired shape by cutting or chiselling, often in the sense of 'sculpturing', and this also seems to be an inappropriate description. One Australian author has used the word *glyph*, which stands for an incised or engraved figure, not necessarily one found on rock. Oddly, the same writer rejects *petroglyph* (i.e. a glyph on rock) as being a 'cumbersome American' term. Yet this designation is not only used in most English-speaking countries, it is used by nearly all scholars from non-English countries when they write in the English language, and the word petroglyph is also in use in other languages. Admittedly, French and Spanish writers sometimes prefer *gravures (gravuras) rupestres* but it must be remembered that the surviving petroglyphs in those two countries were produced almost exclusively by abrading techniques. In contrast, the world's large concentrations of petroglyphs, in America, north Africa, the Near East, northern Europe, Italy and Australia consist mostly of percussion petroglyphs. Abraded petroglyphs are usually restricted to limestone, soft sandstones and slates.

It seems logical to use 'petroglyph', the least specific, as the major term, and retain 'engraving' for *engraved* images, distinguishing these from pecked, abraded, pounded, rubbed, drilled, scratched and finger-shaped petroglyphs.

I hope that these comments will prompt many responses, especially on the initial question of how the terminology issue should be tackled in principle. In particular, our overseas members are asked to enrich the debate that will hopefully develop.

R.G. BEDNARIK

REFERENCES

CASEY, D.A., I.M. CRAWFORD and R.V.S. WRIGHT 1968. The recognition, description, classification and nomenclature of Australian stone implements: the report of the Stone Implement Committee, 1967. In D.J. Mulvaney (ed.), *Australian Archaeology, a Guide to Field Techniques*, pp. 119-30. A.I.A.S., Canberra.

McCARTHY, F.D. 1968. Recording art on rock surfaces. In D.J. Mulvaney (ed.), *Australian Archaeology, a Guide to Field Techniques*, pp. 57-72. A.I.A.S., Canberra.

MAYNARD, L. 1977. Classification and terminology in Australian rock art. In P.J. Ucko (ed.), *Form in Indigenous Art*, pp. 387-402. A.I.A.S., Canberra.

FIRST GENERAL MEETING

With part of 1984 already past it is unlikely that AURA's first general meeting can still be held during the current year. Two venues have so far been considered:

(1) *Carnarvon National Park*, central Queensland. The Oasis Lodge has accomodation buildings, cabins and unique safari tents, a dining room and a library. We have requested further information from the managers.
Benefits: adventurous setting, ample rock art nearby, as well as 'Takarakka', the rock art research centre established by G.L. Walsh.
Drawbacks: quite remote, two hours by air from Brisbane, or 800 kilometres by road.

(2) *Sydney* would offer several benefits. There are numerous sites of sandstone engravings near the city, and Sydney's location is central for members from eastern Australia. Convention facilities can probably be found without undue difficulties.

We are certainly open to alternative suggestions. Ideally, the venue chosen ought to have rock art sites nearby to enable organised or individual excursions; it must provide the facilities needed for a convention of perhaps thirty to sixty participants; it must obviously possess the necessary accomodation; and it should be reasonably accessible for interstate and overseas travellers. I ought to add that most Australian AURA members reside in the eastern States.

Members are requested to submit any proposals to the Editor. It is intended to present in the next *Newsletter* all suggested alternatives for deliberation. Your co-operation is much appreciated.

LOGO

The AURA logo was developed from ideas provided by members G.D. Aslin and S.R. Trezise. We would like to thank them for their help.

The 'trident motif' is perhaps the most ubiquitous found in Australian rock art and yet it remains one of the most enigmatic. It is certainly among the oldest, and while most students of rock art would agree that its more recent forms often resemble bird tracks, Pleistocene examples of tridents are not thought to portray anything figurative at all.

The concentric circles forming the logo's background represent what is possibly the most common motif in the noniconic rock art of the world. The form of the acronym is derived from the style of parietal finger lines, which usually consist of four parallel lines.

'REGISTERED MEMBERS'

Thirteen AURA members are interested in membership with the Centro Camuno (some of them already are members of that organisation). We are currently awaiting the Centro's directions concerning the formation of an Australian chapter of the International Coordination Center for Rock Art Studies. It ought to be noted, however, that the most recent volume of *BCSP* contains even less contributions in English than previous issues did (although this shortcoming is made up for by the merit of the sole English article). Professor Anati's assurance has been received that there will be more non-Italian articles in forthcoming issues. In future, the main languages of *BCSP* will be English and French, and papers in other languages will include summaries in these two languages.

The members who already hold membership with the Centro Camuno di Studi Preistorici, and those who have requested it now, will be AURA's nominees for the Australian chapter of the I.C.C.R.A.S. They are J. Clegg, Dr W.M. Davis, J.L. Dickman, Dr A. Gallus, G.S. Marsh, Dr O. Odak, E.H. Oribin, Dr A. Rosenfeld, Prof. L.G.A. Smits, Prof. B.K. Swartz, J. Turner, S.R. Trezise, R.G. Bednarik. Enquiries from any other members who wish to join this group are most welcome.

The category of Registered Members was created specifically to meet the requirements of the International Coordination Center for Rock Art Studies (refer *AURA Newsletter* 1/2, p. 14), and Registered Members are those who subscribe to the *BCSP* (now the *World Journal of Rock Art Studies*; subscription is $US 40.00). They will be advised individually of further developments.

AURA MEMBERSHIP AND SUBSCRIPTIONS

Membership fees and subscriptions for 1984 are now due. Readers can decide whether they wish to be Full Members of AURA ($A 15.00), or Subscribing Members ($A 10.00 per year, two issues of *Rock Art Research*). Details are to be found on the inside of the front cover.

Overseas subscribers are asked to note that

their country's domestic postal money orders may not be redeemable in Australia. An international money order service is available if preferred to payment by cheque. Receipts will be posted only upon request. Should you change your address we would appreciate your advice of the new forwarding address.

Due to the foreign currency restrictions that exist in some countries our eight members in Tanzania, Kenya and Zimbabwe are exempt from subscriptions.

REQUEST

Members and subscribers are requested to assist in the production of this journal by providing:

(1) Manuscripts of research papers - see *Notes for Contributors* on the inside of the back cover.
(2) Reviews and abstracts of articles and books dealing wholly or partly with rock art or related subjects.
(3) Bibliographical entries that are likely to be of interest to our readers.
(4) Constructive or thought-provoking letters.
(5) Brief reports, research notes, announcements, reports of meetings, lectures, conferences and so forth.

NUMBER 2 OF VOLUME 1

The names of the members constituting the Editorial Board of *Rock Art Research* are expected to be announced in the November 1984 issue. The Board will consist of about eight to ten eminent overseas rock art scholars and several distinguished Australians.

The November 1984 issue will also feature a current list of all AURA members and subscribers, in the order in which their applications were received. AURA's international contacts will be described, and the responses to previous questionnaires will be statistically evaluated. It is further intended to introduce in the November issue a draft constitution for consideration and discussion.

NOTES FOR CONTRIBUTORS

Manuscripts of research papers should preferably be from 2000 to 5000 words. Longer articles will be considered on the basis of merit. Submissions should contain the original, together with one copy, typed in double-space, with a five centimetre margin on one side of each page. Please underline words to be italicised, and identify each page by number and the author's surname. The content of the paper should be outlined by three to five key words (e.g., 'Petroglyphs - patination - style - Pilbara') placed above the title.

Footnotes ought to be avoided where possible. The bibliography and references in the text should follow the conventions established in most Australian archaeological and anthropological journals, following the style indicated in this issue.

If line drawings are included, they must be larger than the intended published size (by a factor of about 1.5 to 2) and line thicknesses, stippling, lettering sizes, etc. must be selected accordingly. Photographs should be black and white gloss prints of high contrast. Captions (on a separate sheet) are required for all illustrative material, together with an indication in the text as to where they, and any tables and schedules, are to be placed.

There are no formal deadlines, but material intended for a particular issue ought to be available about three months before publication. Galley proofs will not be issued. Each author, or group of co-authors, will receive thirty free copies of their article; additional copies are available at cost.

All correspondence should be directed to:

The Editor
Rock Art Research
P.O. Box 216
Caulfield South, Vic. 3162
Australia

Typesetting by Elfriede K. Bednarik, Archaeological Publications
Printed by Complete Print Shop, Melbourne