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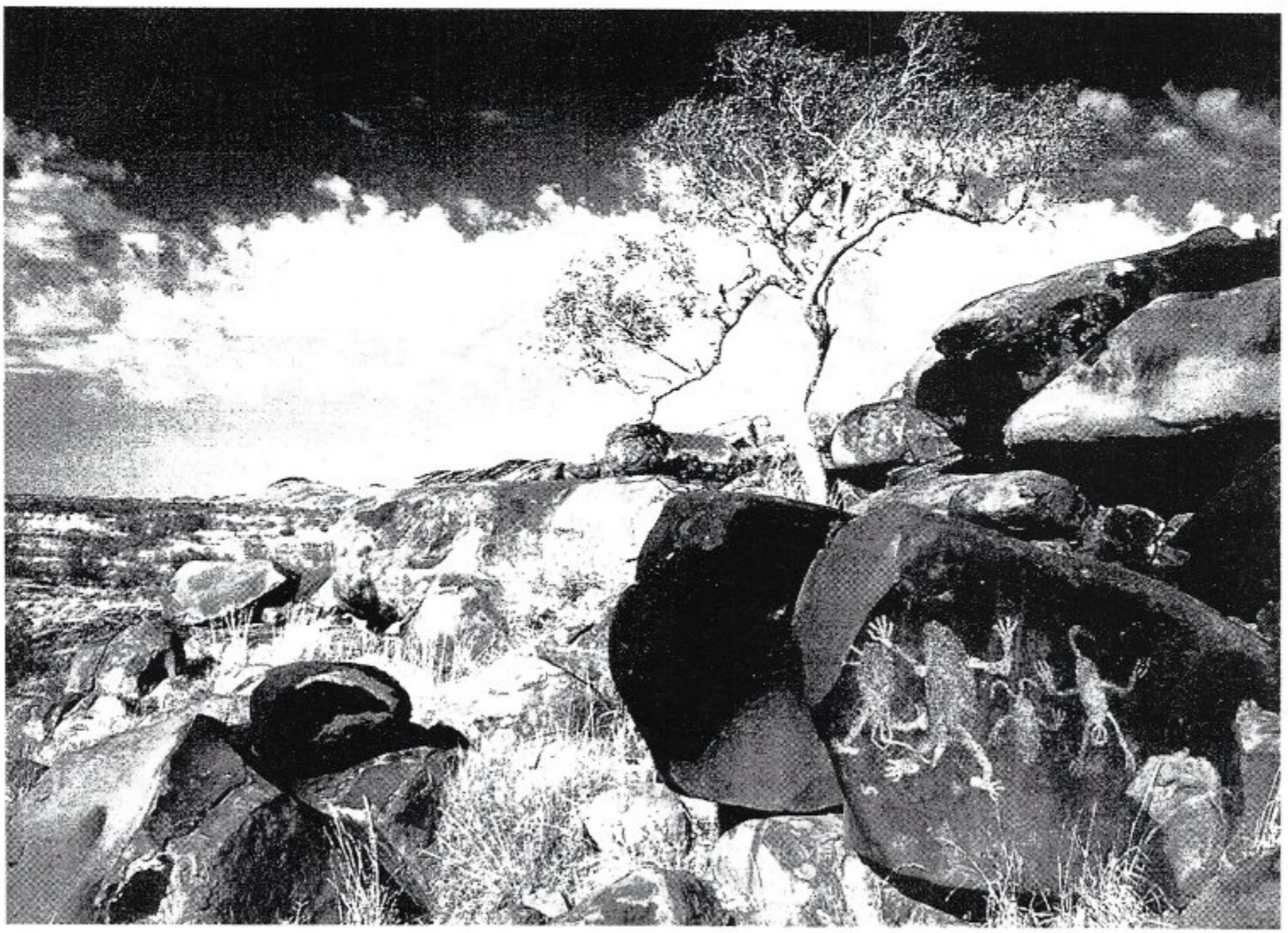

Petroglyphs at Spear Hill, Pilbara, Western Australia. See article on pp. 55-57.
(Photograph by Howard P. McNickle.)

The journal *Rock Art Research* is devoted to developing theory and methodology for the systematic and rigorous understanding of palaeoart and related phenomena. Emphasis is given to communication across the various disciplines related to the study of global rock art, and to synthesising related subjects around the journal's focus: the surviving externalisations of early world views.

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

Telephone and Fax: Melbourne (61-3) 9523 0549
E-mail: *aurarweb@hotmail.com*

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ROCK ART RESEARCH

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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 abroad; and to generally promote awareness and appreciation of Australia's prehistoric cultural heritage.

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KEYWORDS: *Rock painting - Wall painting - Iranian tradition - Ethno-archaeology - Central Asia*

ROCK PAINTINGS — WALL PAINTINGS: NEW LIGHT ON ART TRADITION IN CENTRAL ASIA

Zbigniew Jasiewicz and Andrzej Rozwadowski

Abstract. A rediscovered 19th century photograph sheds new light on the social and semantic contexts of rock paintings of the Zaraut-Kamar Rockshelter, one of the most spectacular central Asian rock art sites, located in southern Uzbekistan. Careful study of the Iranian tradition of painting walls of houses during the New Year festival, recorded in the old photograph, leads to reconsidering chronology and symbolic aspects of central Asian rock painting traditions, as well as the motivations of placing new rock art images in the Zaraut-Kamar site.

Introduction

The value of ethnographic data to ancient pre-Historic rock art has recently been confirmed in a wide range of cultural contexts, for example in Australia, South Africa and North America. In some cases it offered completely new insights into the symbolic and social contexts of forgotten rock art imagery. In central Asia, however, the ethnographic perspective has often been neglected as the overwhelming majority of this rock art is supposed to come from definitively ancient times, for which the ethnographic bridge between the present and past seems to be highly difficult to construct. In this paper we attempt to construct such a path, thus hopefully stimulating further ethno-archaeological approaches to central Asian rock art, revealing its new dimensions.

Figure 1. *Rock painting from Zaraut-Kamar Rockshelter; traced by A. Rozwadowski.*

Figure 2. *Rock paintings on the northern wall of Zaraut-Kamar Rockshelter; in its lower part the oval motif discussed here is visible; photograph by A. Rozwadowski.*

A starting point is an observation made both by an archaeologist and ethnologist about a striking similarity between two paintings. One of them is a rock painting recorded in the rockshelter of Zaraut-Kamar in southern Uzbekistan (Figure 1; cf. Figure 2), so far attributed to

ancient times, ranging from the Stone Age to the Iron Age (Formozov 1969). The other painting, preserved on a house wall, is recorded in a 19th century photograph taken by Leon Barszczewski at an unspecified place in the mountainous area or piedmont in the Bukhara Emirate, in the so-called Upper or Eastern Bukhara (i.e. south-western Uzbekistan or Tajikistan). This area is populated mainly by Tajiks (Figure 3).

Figure 3. A group of villagers, probably Tajiks, against a house; on the wall of the house there is a painting composed of a divided circle and dots; taken by L. Barszczewski, mountain terrain of Bukharan Emirate, precise place unknown, late 19th century.

Recognition of this similarity permits the formulation of two hypotheses. One of them, accepting the hitherto proposed dating of the wall paintings, suggests that the particular motif has been passed down from the Mesolithic or the Iron Age to modern times. The second one, on the other hand, questions the dating of the rock painting, and instead assumes the possibility of approximating the times of origin of the two paintings and even accepting that they either were made at the same time, or in very close times. In addition to chronology, some other important questions arise which concern the message the paintings conveyed and the motivation for placing one of the paintings under consideration in the rockshelter of Zaraut-Kamar.

We find the latter hypothesis, i.e. the one questioning the relation between the painting and the pre-Historic times, more plausible. The data and the ways of reasoning which brought us to accept the latter hypothesis as more feasible will be presented after the description of the paintings and the contexts in which they were found.

Rock paintings in Zaraut-Kamar

The Zaraut-Kamar site, rediscovered in 1939, is located in the Kughitan mountains, which form the south-western part of the Hissar Range, c. 30 km from the nearest town, Sherabad. It is a small rock niche, 3 m high, 5 m wide and 2 m deep, situated in the Zaraut-Saj valley at an altitude of 2000 m. The entrance of the

shelter faces east, and the paintings are concentrated on its northern and western walls. This site is considered one of the most intriguing places with rock paintings in central Asia. This is due, on the one hand, to the fact that in this region, rock paintings are very scarce (in the territory of Uzbekistan there are only two more sites with recorded rock paintings, Sangi-Dzhiumon and Aksakal-Atasay in the Naratau mountains in central Uzbekistan), which makes a sharp contrast to the nearly 140 other sites with petroglyphs found so far in the territory of Uzbekistan as a whole. On the other hand, the uniqueness of this site lies in the fact that the rock paintings in Zaraut-Kamar Rockshelter, along with the rock paintings discovered in Shakhty Cave in Tajikistan, are supposed to belong to the earliest manifestations of the tradition of rock art in central Asia. The majority of rock art in this part of Asia dates back to pre-Historic and early Historic times – the Bronze Age (the turn of the 3rd and 2nd millennia B.C. to the first centuries of the 1st millennium B.C.), the Iron Age or the Early Nomads (8th century B.C. to 5th century A.D.), and the so-called Turkish period and the Middle Ages (6th to 12th centuries A.D.). A large portion of the paintings in Zaraut-Kamar Rockshelter and Shakhty Cave is traditionally dated to the Mesolithic (11th to 7th millennia B.C.; for more information see Sher 1980; Kośko at al. 1997; Rozwadowski and Huzanazarov 1999).

Among the paintings still preserved in Zaraut-Saj Gorge, Formozov (1965, 1969) differentiated three chronological groups. The oldest one comprises presumed representations of human figures, bulls, goats and dogs (see Figures 4 and 5). A few schematic human figures and the oval motif that we are interested in are classified as middle group, and the Arabic inscriptions are considered as the latest (see Figure 2). M. E. Masson estimated the paintings with letters to belong to the 10th to 13th centuries A.D., based on the palaeographic features of the script (Formozov 1969: 66). Since the 'scenes' showing 'bulls' do not contain any elements indicating a farming economy or herding, they have been ascribed to the Stone Age, and in particular Mesolithic times. Due to the fact that the rockshelter with the paintings is located at a height of c. 8 m above the bottom of the valley, a hypothesis was put forward that this spot might have been an ideal place for observing animals entering the gorge.

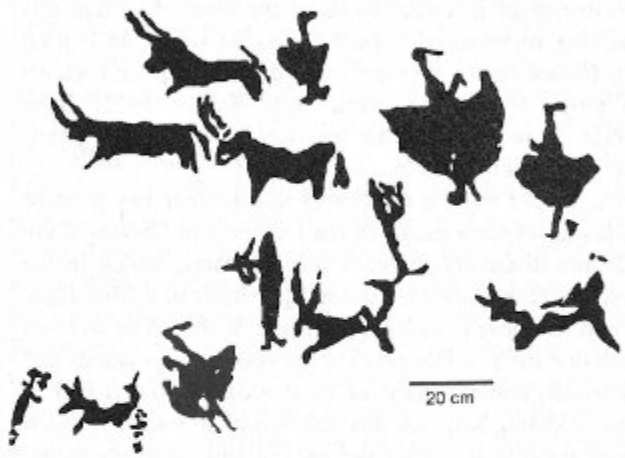

Figure 5. Rock paintings of Zaraut-Kamar, probably some of the oldest, right side of the northern wall.

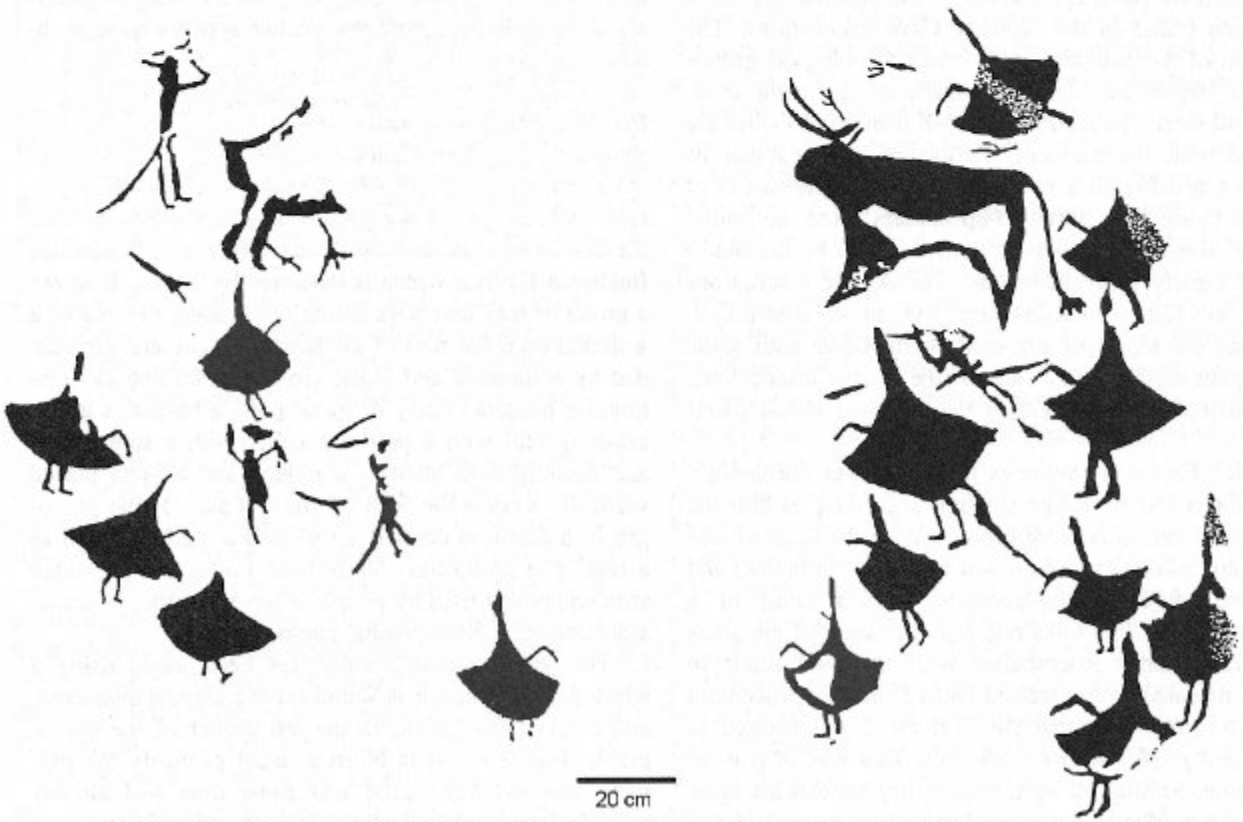

Figure 4. Rock paintings of Zaraut-Kamar, northern wall, supposed to be the oldest art present.

It was further suggested that a triangle-like trunk of human figures resembles a human figure dressed as a bird, and this observation led to the interpretation of these paintings as an expression of hunting magic. The rock paintings were then seen to display figures of dressed hunters who, in this way, were supposed to have acquired a better access to the hunted animals, bulls. Such an interpretation thus seemed to support the Mesolithic origin of the paintings. That such an explanation may be valid might be also supported indirectly by rock paintings in Shakhty Cave in Tajikistan. Besides the picture of a 'bear', they also show human figures, one of which had an unnatural form of trunk (cf. Formozov 1969: Fig. 25). Comparing this human figure with 'similar' African rock paintings, Ranov (1961: 73), the discoverer of this site, came to the conclusion that this painting represented a hunter dressed up as an ostrich (!). Following the then common trend to explain rock art in terms of hunting magic (e.g. Rector 1985; Bahn 1991), Ranov defined the meaning of Asian rock paintings in the same way.

It should also be mentioned that another key premise in favour of such dating of the paintings in Shakhty Cave was the discovery there of flint artefacts, which in the absence of ceramics led to the hypothesis of a Mesolithic origin for these paintings. However, it should be stressed here that the possible relation between rock paintings and excavated material may not be treated as a direct indication of dating and that any relation of this kind is much more reliable if during the excavations elements somehow related to the paintings are found, e.g. pigment grinders, pigment remnants, or objects that might have been used for paint application — which, however, have not been found in the Shakhty Cave excavations. The division of the paintings into three chronological groups is also largely based on the shade of the paint used. Since all motifs painted in Zaraut-Kamar Rockshelter are painted with red pigment, Formozov assumed that its intensity testifies to a relation with time. The motifs of human figures, the 'dressed-up hunters', and the 'bulls' (of the Mesolithic?) — both considered to be the oldest — are clearly paler in colour. The Arabic inscriptions (10th to 13th centuries) are the most contrastive, whereas the shade of the oval motif along with some other paintings is not so clear as the Arabic inscriptions, yet much more distinct than the assumed oldest paintings.

Since Formozov assumes that the upper chronological limit is the Iron Age (though according to him the Mesolithic period is more probable), on the basis of ethnographic analogies (which will be discussed below) and the find of ceramics decorated with a motif of a 'mountain goat' (he links one representation of the goats in Zaraut-Kamar Rockshelter with the oval motif in question) dated to the second half of the 1st millennium B.C., he propounds that the oval motif was created in the Iron Age (Formozov 1969: 78). This way of reasoning is questionable, though, since it implies that the same composition of paints was used to make paintings in different periods. It can be assumed, however, that the shade of red observed today is the result of a few factors (as for example, different compositions of paint and different degrees of deterioration) and hence may not necessarily reflect the chronological sequence suggested by Formozov.

As follows from the above, dating of the paintings in Zaraut-Kamar Rockshelter raises some crucial controversies, including those connected with the theoretical foundations underlying the very construction of the periodisation scheme for central Asian rock art, and in particular those referring to the indication of the oldest rock paintings in the region (Rozwadowski and Huzanazarov 1999). The first aspect of such an inference raising some doubts is a free use of selected thematic and ethnographic analogies whose validity with reference to chronological estimations in rock art studies was undermined a long time ago (e.g. Leroi-Gourhan 1964; Ucko and Rosenfeld 1967: 150-8; Layton 1992). Another weak point of this way of dating is a clearly evolutionist view on rock art. Since both the form of expression, i.e. rock paintings, and the realism of representations recorded on the sites mentioned do not bear any analogies to any successive rock art in central Asia, it has been commonly believed that they preceded many petroglyphs, the earliest of which are associated with the Bronze Age and which, until the Turkish period, 'show', as some researchers claim, a continuous stylistic development (Ranov 1961: 80-84, 1980; Novgorodova 1989; cf. Formozov 1969: 78-81). Due to all these factors the age of the paintings in Zaraut-Kamar Rockshelter, and in particular, of the oval motif, is still controversial, and determination of its antiquity only on the basis of analysis of the paintings from this shelter appears quite problematic.

Painting on a house wall from a photograph by Leon Barszczewski

A photograph by Leon Barszczewski, taken in the late 19th century, is the earliest known sign confirming the habit of painting house walls in the territory of the Bukharan Emirate which is inhabited by Tajiks. It shows a group of men and boys sitting or standing in front of a wall and on a flat roof of the house. People are surrounded by equipment and tools, among which one can distinguish household clay or metal pots, a basket, a grain-crushing mill with a pestle, a roller with a stone base, and farming tools such as a plough and a yoke placed vertically against the wall on the left side of the photograph, a cast-iron coulter, a fork and a spade, as well as a reel. The group has clearly been posed and presented with equipment used by people at work in order to create a documentary ethnographic photograph.

The painting under study has been made using a white pigment, and it is found on the clay, unplastered, and cracked front wall, in the left corner of the photograph (Figure 6). It is blurred; most probably the pigment was not very solid and some time had already passed since it was painted. One can see only an upper

part of the painting, due to the fact that the group of men close to it has crouched down. This portion shows a figure which is most probably an irregular circle or oval divided by a vertical line into two halves filled with irregular large dots. One can notice three dots in the left half of the oval and one in the right. Just above the oval, six other dots are visible, five of which are concentrated near the place in which the vertical line reaches the line of the oval in its upper part. The group of men standing next to the painting enables us to estimate the height of the oval, provided it reaches the bottom of the wall, as about 150 to 170 cm. A cluster of five white dots can also be seen on the right of the oval, close to the window, and it is placed above the heads of the standing men. Therefore we do not know whether it is a part of another motif or whether it is somehow connected with the visible oval. The dots are fairly large with approximate diameters of 8 to 10 cm.

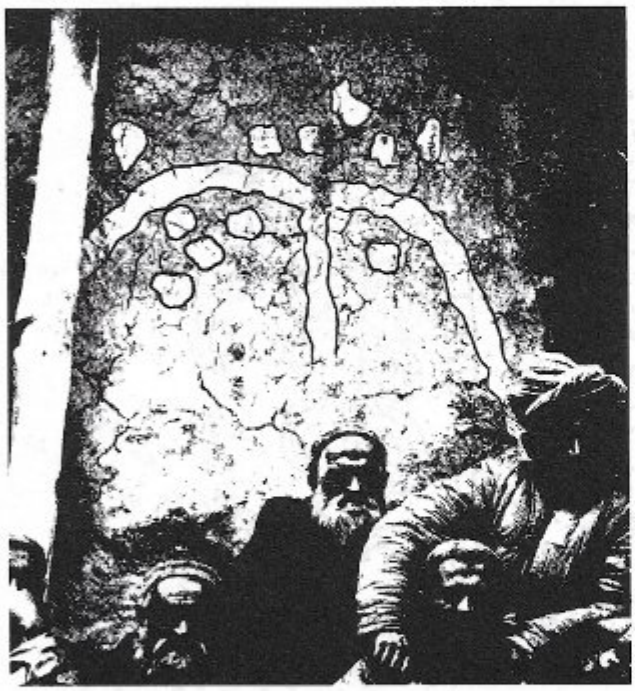

Figure 6. *Detail of a photograph by L. Barszczewski showing a house wall bearing a painting in the shape of a divided circle and dots; the outline of the painting was intentionally marked by the authors.*

Although one can accept the thesis about a deliberate choice of the house by Barszczewski for the photograph and about uncovering the painting so as to record it, it is still surprising that he did not make the effort to document it fully. Hence one can suspect that, first, he was primarily interested in the human group as a whole, i.e. their clothes and tools shown against the house, and second, that he looked at the painting as one of the elements of local culture he did not particularly care about. This can be inferred from the fact that Barszczewski did not leave any notes about the habit of painting the walls and the associated semantics in either his published materials or in manuscript form. It should be remembered, however, that Barszczewski as a traveller and observer, a documenter in the territories of the Samarkand District and Bukharan Emirate, was active in the late 19th century, i.e. at the time when ethnographic studies in central Asia had just started to develop.

Moreover, Barszczewski was self-taught and had a wide range of interests. Either by himself or as a member of research expeditions, he collected materials for many different disciplines of science: in addition to ethnography and archaeology he was also interested in geography, geology, glaciology, botany, zoology, human biology and history. In many of the fields, his photographs were of particular importance. Barszczewski (1849-1910), a Tsarist officer stationed in Samarkand and Pendzhykent and other places of Turkiestan from 1876 to 1896, left an outstanding collection of photographs, including over 100 plates related to ethnography, which allows us to consider him one of the pioneers of scientific photography in Russia and Poland (Bero 1976: 65; 1983: 43). A collection of photographs by Barszczewski ranks as second among the albums dealing with the diversity of central Asia, the first being the so-called Turkiestan Album prepared in the 1870s at the order of the Governor of Russian Turkiestan, General K. P. Kaufman, by photographers from St. Petersburg. Barszczewski's collection, however, additionally contains pictures from the Bukharan Emirate, as well as from distant regions of the Upper or Eastern Bukhara. For this reason it should not be compared to the Turkiestan Album as such but rather treated as complementary to it (Jasiewicz 1994: 363).

There is one difficulty associated with the photograph showing the painting on the wall of the house, namely the lack of information about the name of the place it was taken at. Barszczewski used to place the descriptions of his photographs on small sheets of paper glued to the glass plates. Unfortunately, some of them came off and got lost. Hence it is not possible to locate the exact place in which the house with the painting of interest to us was photographed; neither is it possible to define the place on the basis of ethnographic objects. We can, however, certainly eliminate, as the potential site of the photograph, the high-mountain valley of the River Jagnob and the ethnic group called Jagnobs, who were also studied by Barszczewski, as this territory features a different type of housing. Moreover, Andreev (1970: 174), who studied the Jagnobs in the 1920s, found no decoration on the house walls there. In other territories also examined by Barszczewski, inhabited by other Tajik groups, the custom of painting house walls was widespread. This was confirmed in ethnographic studies conducted, among others, in Karategin and Darvaz (Semenov 1903: 36; Kisljakov and Pisarchik 1970: 65ff.), which were the easternmost territories penetrated by Barszczewski and which bordered on the areas populated by the so-called Pamir Tajiks. In the Lower Karategin, houses decorated with white dots over the whole front wall were encountered (see Figure 7). It cannot be excluded, however, that the photograph displaying the painting on the house

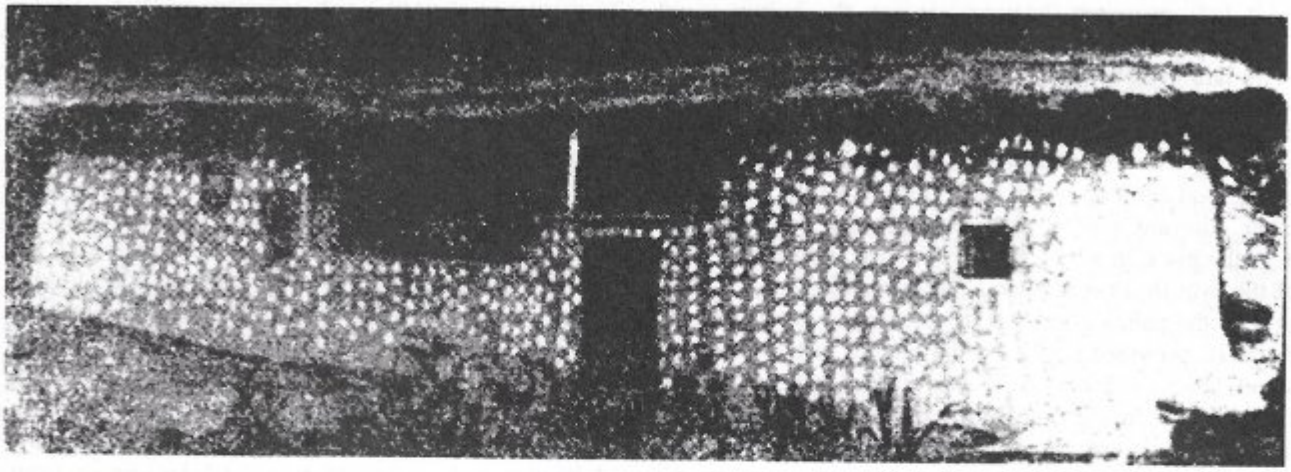

Figure 7. A house in the village Dii-Ta covered with dots over the whole front wall of the house; Lower Darvaz, Tadzhikistan, 1953 (Kisljakov and Pisarchik 1970: 65, Fig. 32).

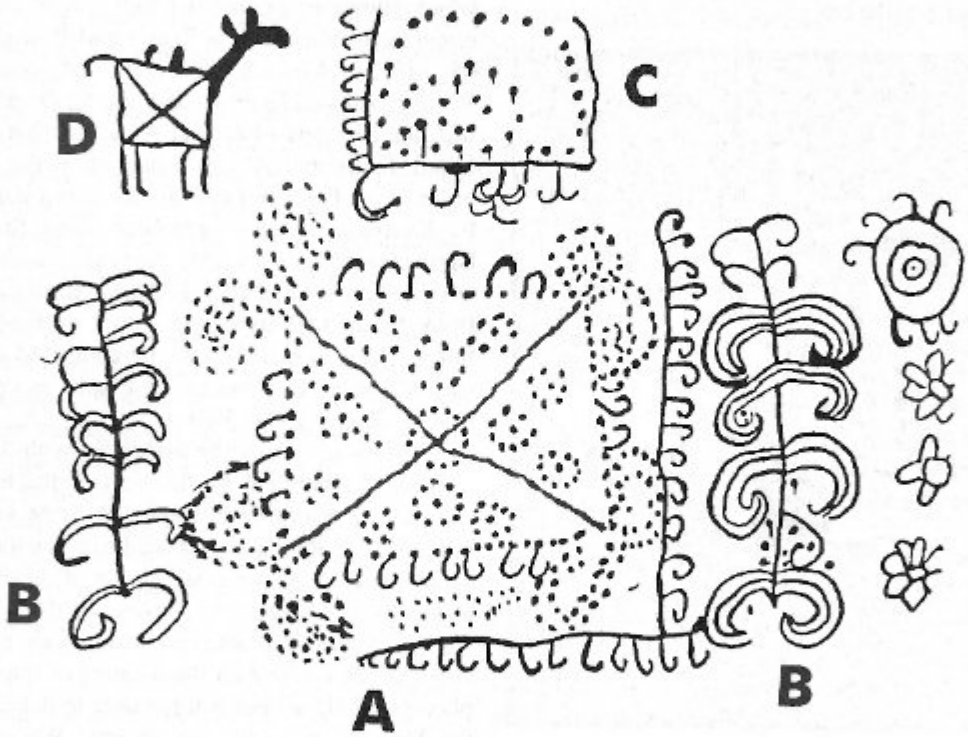

Figure 8. Wall paintings from Shugnan recorded by Andreev (1928: 8), in which rectangular forms filled with dots indicate a pen with rams inside; other motifs, according to Andreev (1928), include: A - orchard, the folding lines coming from the sides of a square represent tree branches; B - trees (cf. Figure 9); C - stockyard filled with sheep; D – camel.

wall was taken by Barszczewski near Sherebad, which is in the area where the rock painting concerned was discovered, and where he stayed three times (1884, 1891 and 1894), conducting very intensive observations (Bero 1976: 101ff.). The period of Barszczewski's research expeditions and in particular the year 1894 define the chronology of the photograph. The photograph was published twice (Bero 1983: 29; Jasiewicz 1994: 367). The photographic glass plate of this picture along with other remaining and preserved plates of Barszczewski's collection are kept in the Reprographic Section of Warsaw University.

Semantics and ritual-religious context of the wall painting

The photograph taken by Barszczewski and his other materials do not answer questions about the meaning and function of the painting preserved on the house wall. The first to publish drawings of closed space — irregular rectangulars filled with dots, placed on a house wall of the so-called Mountain Tajiks of Shugnan — was Andreev (1928: 8-9). This represented a stockyard filled with sheep (Figures 8 and 9). A drawing of a circle with dots inside, alongside a naturalistically rendered shepherd and dog (Figure 10) as a plastic motif put on a

house wall during Nouruz, was published first by Ivanov (1947). This painting was reproduced from memory at Ivanov's request in 1944 in Dushanbe by one of the inhabitants of Shugnan in Pamir. According to the explanations of the creator of the drawing, the circle stood for a cattle pen, while the dots inside it indicated sheep, rams and goats, whereas the line made of dots above the circle indicated a path for sheep and goats. According to the artist's intention the drawing was to foster multiplication of the cattle and secure their safety (Ivanov 1947: 83).

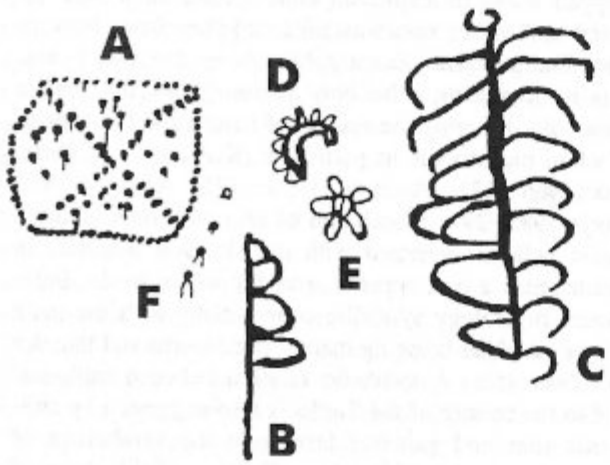

Figure 9. Wall paintings from Shugan recorded by Andreev (1928: 9): A - a pen for sheep; B and C - trees; D - moon; E - sun; F - stars.

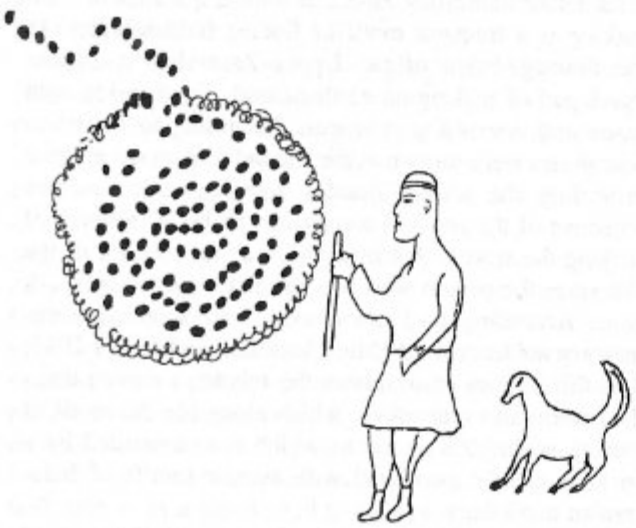

Figure 10. A drawing showing the painting on a house wall, made during Nouruz in Shugnan, Tajikistan (Ivanov 1947: 81, Fig. 1).

In the territories inhabited by Tajiks and Uzbeks, dots in wall paintings appear quite frequently. According to the division proposed by Wallis (1983: 57), if the dots refer to herd animals seen in the mountain terrain from high altitudes, they indicate symbols rather than iconic motifs, and hence it is difficult to decipher their meaning without any information from the people who applied and used them. That sheep and goats, as well as cattle, were treated in central Asia not only as physical objects but also as symbols of wealth and prosperity, has been confirmed not only by Andreev and Ivanov, but also in some other ethnographic papers (see Andreev 1958: 130; Mukhiddinov 1986: 78). Sheep and goats, this time represented as hollows or convexities made of dough, also appeared on bread-pies baked in the New Year and called *kumoch* (Andreev 1958: 130; Mukhiddinov 1986: 78). No data, however, are available on how to interpret the large white dots covering the whole front walls of houses in Lower Karategin (see Figure 7), or the dots surrounding a human figure (Figure 11) on a house wall in a village inhabited by Uzbeks in southern Tajikistan (Kisljakov and Pisarchik 1970: 92; Karmysheva 1985: 14ff.). Dots when multiplied may assume a more general meaning; they may stand for magnitude or affluence, and naturally they do not have to concern stock exclusively. In Shugnan it was believed that the more dots there were on the house wall, the higher the number of sheep in the flock there would be the following year (Andreev 1928: 9).

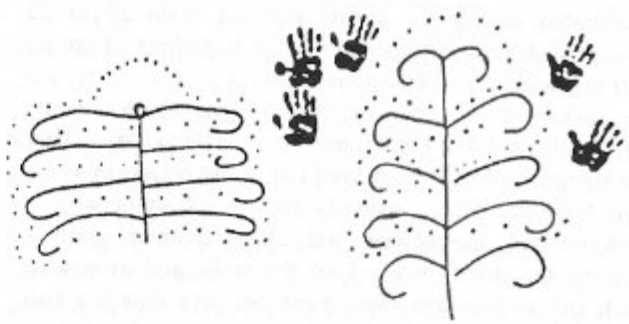

Figure 11. Paintings showing stylised human figures surrounded by dots and human hand prints on a house wall in the Uzbek village Obikiik in southern Tajikistan (Karmysheva 1985: 14, Fig. 5b).

The circle on the picture published by Ivanov was interpreted as a sheep pen; the round bread with sheep marked on it was thought to evoke a protected space. The edges of the bread were called *dasht* (steppe) and they marked off the dangerous space of the pasture, so indispensable for the animals to survive. A circle meant as a closure, and at the same time as protection, appears to be a common symbol.

What differentiates the circle in the studies of Ivanov from the only partially visible circle in Barszczewski's photograph is that the latter is divided by a vertical line. The division of the circle can be observed on two rock paintings presented here (Figures 1 and 12), and though to our knowledge these are the only two representations, one cannot exclude a hypothesis that the representations are not accidental. With reference to some of the observations described above, it seems quite justifiable to suggest an interpretation related to stock farming. It is known that beside the house there were usually two

stone oval pens for animals: one for sheep and goats, and the other for cattle (Andreev 1958: 485). Since people needed two enclosed spaces, they might have divided one pen into two, which would have saved them effort. There is also another difference: the circle published by Ivanov is open at one point and it is here where a line made of dots, interpreted as a path for the herd to follow, starts. Lines originating from the circle, which might indicate paths, also appear on rock paintings. Such a line is not visible on the painting recorded on the photograph, yet beyond the circle some dots appeared there.

The conclusions drawn from the analysis of the elements of the painting in Barszczewski's photograph, which suggest a relationship, inferred on the basis of analogy with the drawing from Ivanov's (1947) paper, between the painting and the magic of animal breeding, become more probable if we support our considerations with materials concerning customs and beliefs of Tajiks. We have already stated that the custom of painting house walls, both inside and outside, was widespread in the territory. What is more, it was noticed by 'almost all researchers' (Rakhimov 1960: 185; Kisljakov and Pisarchik 1966: 159). This custom was commonly related to the rites of the New Year (Nouruz, Nauruz, Shogun), celebrated during the spring equinox from 20 to 22 March inclusive, which marked the beginning of spring farming and agricultural activities.

Making the painting on the walls began on the first day of the holiday known as 'The Cleaning Day', after all equipment had been moved out of the house, interiors had been carefully cleansed, and the cleaning women had washed themselves and changed their clothes. Among the motifs painted on the walls and associated with animal breeding there were not only dots but also drawings of a shepherd, an ibex and other decorations defined as 'ram-tup' or 'horns of ram-tup' (Kisljakov 1934: 187; Rakhimov 1960: 185). The New Year's customs related to breeding magic, or to put it more broadly, to the magic of fertility and the new beginning. For instance, figures of rams and goats were made of dough and baked, as was the bread *kumoch* mentioned above. A special respect was credited to oxen because of their significant role in farming. Oxen were brought into the house and fed on ritual food. Moreover, they were decorated and led in a procession before the ploughing time (Andreev 1958: 128; Kisljakov and Pisarchik 1970: 262; Krasnowolska 1998: 72). The symbolism of an ox as a draught-animal, closely linked to an interesting mythological figure, *Boboi Dehkon*, who was treated as an ancestor and guardian of farmers (Krasnowolska 1998: 121ff.), is probably connected with a still more archaic symbolism not only of strength but also fertility. In the Indo-Iranian tradition, of which Tajik culture is a part, both in the Old Iranian *Avesta* and Old Indian *Vedas*, the link between a bull and fertility was strongly emphasised, with fertility understood in the broader sense of the word, namely from human procreation, through reproduction of plants and animals, to the creation of the Universe (Boyce 1975: 138-50; Lincoln 1975: 126-45, 1981: 49-93; Schwartz 1985: 645-6, 657-9). Let us add that in the Tajik language and in the dialects of Pamir Tajiks, a bull and ox are referred to using one term *barzagov* and *barzagoy* (Rakhimi and Uspenskaja 1954: 47; Rozenfeld 1975: 218).

According to still another interpretation the white dots on the house walls can be associated with rain drops. In Tajik tradition the first spring rain was endowed with a strong positive symbolic potential. Rain was identified with 'the milk of clouds', and its drops were sprinkled on grains in a granary and on freshly stripped milk. In Tajikistan and Uzbekistan it was believed that warm rain was milk dripping from heaven, from Fatima's and Zukhr's breasts — the two being, next to Khadidzhy, the holy patronage of the female household, bringing the revival of nature and the growth of white mushrooms in particular (Kisljakov and Pisarchik 1966: 171; Andreev 1970: 171; Antonova and Chvyr 1983: 29). Association of rain with milk leads to varied beliefs connected with the sky and weather, in which again a bull appears, and for which in the Indo-Iranian mythology symbolic connotations with the male deity of weather bringing mainly rain, storm and thunder are observable. A symbolic relation between milk and rain in the culture of the Tajiks is also suggested by children's rites and games referring to the symbolism of spring thunder, the Thunderer Kambar (Tajik deity of storms) or heavenly bulls which caused storms and thunder when they clashed into one another with their heads. It is worth noting that rites aimed at evoking rain were mainly observed in spring and summer.

Another interesting aspect of some Tajik rites of rainmaking is a frequent motif of freeing hidden water. In the drainage-basin of the Upper Zaravshan a custom developed of making an earth mound, filled inside with water and covered with stones. According to the tradition stones were thrown at the mound to damage the pile protecting the water. Besides freeing water, another objective of the rite was to produce sparks as a result of striking the stones. Actually, this was the essence of the rite since the person who was the first to evoke a spark won. According to Peshchereva, who supplied documentary evidence on the rite (Antonova and Chvyr 1983: 34), this custom encapsulates the relation between thunder, storm and rain water, which alongside the motif of freeing water, the access to which is safeguarded by a rock, is clearly associated with archaic motifs of Indo-Iranian mythology.

In the period of Nouruz the inside wall pictures and paintings were made mainly by women, though some men and children were also permitted to make them. But it was men who made the paintings on external house walls as well as, significantly, on rocks in sacred spots away from home (Kisljakov 1962: 626; Mukhiddinov 1964: 111; Andreev 1970: 174). Men were also reserved the right to paint figures of goats and other animals on walls, while it was in the domain of women to paint vegetable motifs and other ornaments (Andreev 1928: 9). The first to notice the similarity between the draw-

ings on house walls and on rocks was in fact Andreev (1928: 9).

From the point of view of studies on rock paintings, it is very interesting to look at the variety of techniques and materials used for painting. As regards the former, paintings were made using a finger, the whole palm, cloth or a stick wrapped in cloth to mark dots. To make repeated elements of ornaments, templates were applied (Bobrinskij 1908: 74ff.; Ivanov 1947: 82; Mukhiddinov 1964: 111). In the area of Darvaz, an interesting technique of marking dots on the wall was observed: clods of moistened plastic clay were thrown at a wall, leaving round convexities (Mukhiddinov 1964: 112). This technique may be considered mimetic, imitating rain or storm, and as such it may allow for the interpretation associating the white dots on house walls with milky rain drops falling from the sky.

As regards the materials applied to make signs on house walls in the time of Nouruz, the one most often mentioned is flour whose magic properties had been appreciated widely in this part of Asia, as well as by Hindukushu peoples speaking Dardic dialects (Jettmar 1986: 282, 467). Mostly dry flour was used, therefore the most handy was broad bean flour, its consistency improving its adhesion to walls (Mukhiddinov 1986: 77). The materials encompassed also other media such as white, yellow or red clay, crumbled and sieved, then mixed with water; or chalk and lime diluted with water; green pigment extracted from plants, black from crumbled charcoal and soot, mixed with mallow juice; and currant juice (Zarubin 1917: 124; Andreev 1958: 475, 1970: 174; Rakhimov 1960: 185; Mukhiddinov 1964: 111ff.; Karmysheva 1985: 14).

Making paintings on house walls exclusively during Nouruz, i.e. the time of special importance, and treating this as an obligatory rite to perform, leaves little doubt about their magico-religious functions. Can we, however, constrain ourselves and interpret the divided circle filled with dots as a sign referring only to animal breeding, as representing a pen full of sheep and thus magically supporting economic activity? Semantic connotations may be wider. In many cultures a circle or oval symbolises the Universe; a divided circle is interpreted as a way to emphasise its essential elements. We have already indicated two options to interpret the multiple dots as a general symbol, as the sign of abundance, or associating the dots painted on house walls with rain or milk rain — as a sign linked to the sky and further to the acts of creation and the revival of life. The motif, which is the subject of our study, may then just as well express religious ideas exceeding everyday needs and experiences. The puzzling division of the circle into two halves reminds us of the duality so vivid in Iranian beliefs, also present in the pantheon of deities and in the act of the creation of the Universe, in the binary symbolism of gender. It is also found in the division of the calendar into two halves of the year: female (spring, summer) and male (autumn, winter), and of days and seasons into 'happy' and 'unhappy'. The materials we have compiled do not, however, allow us to take our deliberations much further. It was not our objective to reconstruct the 'common' meanings; because many attempts at doing so have led to unjustified and far-fetched interpretations. A painting on a house wall is a magic sign which, in the light of our present knowledge, can be attributed to the magic of spring breeding and protection, as well as to the magic of abundance.

Why can the rock painting be contemporary with the wall painting?

A formal similarity between the oval motif from Zaraut-Kamar Rockshelter and the paintings made by Pamir Tajiks on house walls was noticed by Formozov. He pointed to a very close, as he maintained, similarity between the rock painting and the presentation of a dotted circle published by Ivanov. Having perceived the analogy and having compared the finding to the archaeological find mentioned above from the first half of the first millennium B.C., Formozov (1969: 78) only 'rejuvenated' the painting from Zaraut-Kamar Rockshelter and wrote that

> ...these [archaeological] finds in equal degree to ethnographic parallels allow us to treat the Zaraut-Kamar paintings as objects originating from the Iron Age, and not the Bronze Age...

as it was claimed by G. V. Partfenov, the first researcher of the Zaraut-Kamar paintings. It is interesting to note that in an article published in English four years earlier, the paper being a slightly abridged version of its Russian version published in 1969, Formozov (1965: 81) did not suggest such dating, rather emphasising the similarity between the motif in Zaraut-Kamar Rockshelter and the paintings on Tajik houses, which is in agreement with our conclusions. In his last, more detailed text of 1969, however, he clearly declared the group of paintings under study as dating to the Iron Age.

It should be added that the Zaraut-Kraut paintings were studied in the 1970s by an Uzbek researcher, Kabirov (1976: 77, 79), who identified the motif of a divided circle as a representation of snares. This interpretation was, however, probably subjective because Kabirov did not provide any justification for such a claim.

Barszczewski's photograph, which we have rediscovered, shows a Tajik wall painting which displays a far greater formal similarity to the motif from Zaraut-Kamar Rockshelter than the image presented by Ivanov. Taking into account the spatial context — it is possible that Zaraut-Kamar Rockshelter is located in the same area where Barszczewski took his photographs — and the striking similarity between the two paintings, we may venture a hypothesis that the painting in Zaraut-Kamar Rockshelter dates back more or less to the period when this region was visited by Barszczewski, i.e. in the late 19th century. This hypothesis seems to be supported by the fact that southern Uzbekistan is a region still today populated by Tajiks. Also very important is the fact that in some other small rockshelters in the Zaraut-Saj valley, Arab inscriptions have been painted, suggesting that paintings were made in this area in Historic times. This

may indicate the significant nature of the locality, i.e. the Zaraut-Saj valley, which might have been a sacred place — a local *mazar*. This hypothesis would also correspond to a gender division, supported by ethnographic literature, as regards making spring paintings. While women were responsible for painting the house walls, the responsibility for making rock paintings and drawings laid with men (Mukhiddinov 1964: 111). It should also be noted here that in 1920, M. Andreev (1929) recorded a few rock art images in the river basin of Kasan (the Fergana Basin) where there were nearby villages inhabited by Tajiks. Among the representations published by Andreev there was one having a form close to the motif of interest to us (Figure 12). It shows a circle divided by a vertical line which extends downwards, thus forming a shape reminiscent of parting roads. In the left part of the split circle there are probably two dots linked with a thin line, and in the right one dot. A formal similarity of this representation to the motif from Barszczewski's photograph is not so close as in the case of the rock painting from Zaraut-Kamar Rockshelter. Also, we do not know whether it was a painting or a petroglyph, since Andreev only published his copy of the drawing and the only information he gave was that it had been made on a rock at the River Kasan. Neither did he offer any interpretation of the rock paintings he published, which does not allow us to take this material properly into our consideration. Similarly, earlier in the early 20th century Bobrinskij (1908: 113) found circles divided into halves by a line on rocks on the upper course of the River Piandzh, yet he also did not supply his findings with any interpretation. His only contribution was confirmation of another occurrence of the motif of divided circle, associated at least geographically with Tajik culture.

At present we do not find support for the hypothesis that the wall painting of interest to us is a recent copy of the rock painting which could be of much greater antiquity then we suggest. Ethnographic data provide no traces to suspect that rock art served as a kind of inspiration for wall paintings. The Tajik cultural context proves that paintings on house walls were endowed with symbolic meanings and their execution was restricted to the sacred time of the Nouruz festival. Thus a choice of motifs to be painted must not be considered accidental. If the artists did not know the meaning of the rock painting, copying it would hardly have been acceptable. The ethnographic data make it clear that the tradition was also applied to rock sites. It should be emphasised also that Zaraut Saj Gorge is the only known location with rock paintings in the southern part of Uzbekistan. Thus their role as the inspiration for making wall paintings, which are of much wider distribution, seems to be unlikely.

Both the ritual-religious context and semantic associations of the motif of a circle from Barszczewski's photograph with the Nouruz rites enable us to put forward a suggestion concerning the reasons why the rock painting of our interest was placed in a rockshelter bearing, if not Mesolithic, still pre-existing, older paintings. Provided we accept that the motif is linked to the Nouruz holiday and dates to around the 19th century, then we may suppose that it expressed a symbolism analogous to the one suggested by the motif from Barszczewski's photograph. In a way it corroborated the uniformity of meaning of artistic representations fulfilling magic-ritual functions for the whole region (Peshchereva 1985: 5). Remembering that one of the motifs of the paintings in Zaraut-Kamar Rockshelter is the image of a 'bull' (Figure 4 and 5), one may hypothesise that the oval motif was deliberately placed in the niche just because of the images of bulls painted there, as they have significant symbolic connotations associated with the Nouruz rites mentioned above.

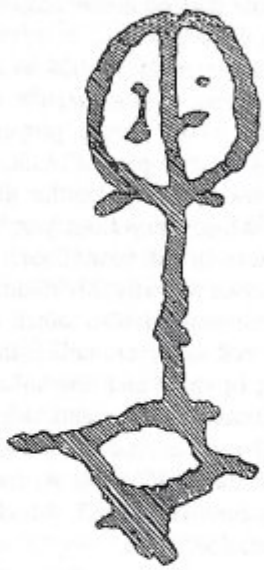

Figure 12. *A rock art image of a divided circle near the River Kasan; Ferghana valley, Uzbekistan, near the town of Hazarat-i-buwzh (Andreev 1928: Table II).*

Conclusions

It was not the immediate goal of this article to give an unambiguous answer to the question about the meaning of the motif we studied. Rather, our objective was to disclose its possible symbolic associations derived from the analysis of the ritual-religious context, and implications resulted from this for the interpretation and age of the Zaraut-Kamar rock paintings. We believe that looking at the rock paintings in the Zaraut-Kamar Rockshelter from the integrated archaeological-ethnographic perspective not only enriches our understanding of the paintings in the Zaraut-Saj valley, and throws a new light on the issue of rock art traditions in central Asia, whose advent has been identified with the spread of Islam. It also adds to our knowledge about Iranian or Indo-Iranian traditions (cf. Rozwadowski 1997, 1999), for a greater understanding of which the Tajik culture seems to be a rich and still inexhaustible source. The analysis presented here tends also to help explain the character of the painting from the Tajik house, photographed by Leon Barszczewski at the end of the 19th

century, as a magic sign associated with spring rituals. Moreover, it corroborated the scientific importance of the collection of Barszczewski's central Asian photographs, which still has not been studied as a whole and duly appreciated as an ethnographic and historic source.

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Professor Zbigniew Jasiewicz
Institute of Ethnology and Cultural Anthropology
Adam Mickiewicz University
Św. Marcin 78
61-809 Poznań
Poland

Dr Andrzej Rozwadowski
Instytut Wschodni (Institute of Eastern Studies)
Adam Mickiewicz University
28 Czerwca 1956, No 198
61-486 Poznań
Poland

Résumé. *La découverte d'une photographie du 19ème siècle éclaire d'un jour nouveau les contextes sociaux et sémantiques de l'abri de Zaraut-Kamar, l'un des sites les plus spectaculaires de l'art rupestre d'Asie centrale, situé dans le sud de l'Ouzbékistan. Une étude approfondie de la coutume traditionnelle iranienne consistant à repeindre les murs des maisons lors des fêtes du Nouvel An, tradition qu'illustre cette photographie, amène à reconsidérer les aspects chronologiques et symboliques des traditions de peintures rupestres d'Asie centrale, ainsi que les raisons pour lesquelles des images rupestres nouvelles ont été réalisées sur le site de Zaraut-Kamar.*

Zusammenfassung. *Ein wiederentdecktes Foto des 19. Jahrhunderts wirft neues Licht auf die gesellschaftlichen und semantischen Kontexte von Felsmalereien im Zaraut-Kamar Abri, einer der spektakulärsten zentralasiatischen Felskunst-Fundorte, gelegen in südlichen Usbekistan. Sorgfältiges Studium der iranischen Tradition des Bemalen von Hausmauern während des Neu Jahr-Festes, in dem alten Foto festgehalten, führt zum Überdenken der Chronologie und symbolischer Aspekte zentralasiatischer Felskunst-Traditionen, sowie der Motivationen zur Anbringung neuer Felskunst-Bilder am Zaraut-Kamar Fundort.*

Resumen. *Una fotografía redescubierta del siglo XIX proporciona nuevas luces sobre los contextos sociales y semánticos de pinturas rupestres del abrigo rocoso de Zaraut-Kamar, uno de los sitios de arte rupestre más espectaculares de Asia central, localizado en el Sur de Uzbekistan. Un estudio cuidadoso de la tradición Iraniana de pintar las paredes de las casas durante el festival de Año Nuevo, registrado en la vieja fotografía, nos conduce a reconsiderar los aspectos cronológicos y simbólicos de las tradiciones de pinturas rupestres en Asia central, así como las motivaciones de plasmar nuevas imágenes de arte rupestre en el sitio Zaraut-Kamar.*

REFERENCES

ANDREEV, M. S. 1928. *Ornament gornykh tadzhikov i kirgizov Pamira*. Obshchestvo dlja izuchenija Tadzhikistana i Iranskikh Narodnostej za Ego Predelami, Tashkent.

ANDREEV, M. S. 1929. Poezdka letom 1928 goda v Kasanskij rajon (Sever Fergany). *Izvestija Obshchestva dlja Izuchenija Tadzhikistana i Iranskikh Narodnostej za Jego Predelami* 1: 109-31.

ANDREEV, M. S. 1958. *Tadzhiki doliny Khuf*, vol. 2. Izdatelstvo Akademi Nauk Tadzhikskoj SSR, Dushanbe.

ANDREEV, M. S. 1970. *Materialy po etnografii Jagnoba*. Donish, Dushanbe.

ANTONOVA, J. V. and L. A. CHVYR 1983. Tadzhikske viesennye igry i obrjady i indo-iranskaja mifologija. In R. S. Lipets (ed.), *Folklor i istoricheskaja etnografija*, pp. 21-44. Nauka, Moskva.

BAHN, P. 1991. Where's the beef? The myth of hunting magic in Palaeolithic art. In A. Rosenfeld and P. Bahn (eds), *Rock art and prehistory*, pp. 1-13. Oxbow Monograph 10, Oxford.

BERO, M. 1976. Wkład Leona Barszczewskiego do poznania kultury ludów Azji Środkowej. Unpublished typescript, Institute of Ethnology and Cultural Anthropology, Adam Mickiewicz University, Poznań.

BERO, M. 1983. Obraz kultury Azji Środkowej w materiałach Leona Barszczewskiego. In: Z. Jasiewicz (ed.), *Kultura i życie społeczne Azji Środkowej*, pp. 23-43. Wydawnictwo Uniwersytetu im. Adama Mickiewicza, Poznań.

BOBRINSKIJ, A. A. 1908. *Gortsy verkhovev Pjandzha. Vakhantsy i ishkashimtsy*. Moskva.

BOYCE, M. 1975. *A history of Zoroastrianism, vol. 1, The early period*. E. J. Brill, Leiden.

FORMOZOV, A. A. 1965. The rock paintings of Zaraut-Kamar, Uzbekistan. *Revisita di Scienze Preistroiche* 20: 63-83.

FORMOZOV, A. A. 1969. *Ocherki po pervobytnomu iskusstvu*. Nauka, Moskva.

IVANOV, S. V. 1947. K voprosu ob izuchenii stennykh rospisej gornykh tadzhikov. *Kratkie Soobshchenija Instituta Etnografii AN SSSR* 2: 80-4.

JASIEWICZ, Z. 1994. Leon Barszczewski's collection of photographs from Russian Turkestan and the Bukharan Emirate as a historical and ethnographical source. In I. Baldauf and M. Friedrich (eds), *Bamberger Centralasienstudien. Konferenzakten WSCAS IV*, pp. 361-368. Klaus Schwarz Verlag, Berlin.

JETTMAR, K. 1986. *Religii Hindukusha*. Nauka, Moskva.

KABIROV, D. 1976. Drevniejshaja naskalnaja zhivopis Zarautsaja. In R. C. Vasilevskij (ed.), *Piervobytnoje Iskusstvo*, pp. 73-82. Nauka, Novosibirsk.

KARMYSHEVA, B. Kh. 1985. Statsionarnoe zhilishche uzbekov-lokaitsev (seredina 1940 – nachalo 1950 godov). In V. A. Litvinskij (ed.), *Etnografija Tadzhikistana*, pp. 11-28. Donish, Dushanbe.

KISLJAKOV, N. A. 1934. Burkh – gornyj kozel. Drevnyj kult v Tadzhikistane. *Sovetskaja Etnografija* 2: 181-9.

KISLJAKOV, N. A. 1962. Tadzhiki. In S. P. Tolstov, T A. Zhdanko, S. M. Abramzon and N. A. Kisljakov (eds), *Narody Srednei Azii*, vol. 1, pp. 528-657. Izdatelstvo Akademii Nauk SSSR, Moskva.

KISLJAKOV, N. A. and A. K. PISARCHIK (eds) 1966. *Tadzhiki karategina i darvaza*, vol. 1. Donish, Dushanbe.

KISLJAKOV, N. A. and A. K. PISARCHIK (eds) 1970. *Tadzhiki karategina i darvaza*, vol. 2. Donish, Dushanbe.

KOŚKO, A., T. SHIRINOV and W. RĄCZKOWSKI (eds) 1997. *Sztuka naskalna Uzbekistanu*. Instytut Historii Uniwersytetu im. Adama Mickiewicza, Poznań.

KRASNOWOLSKA, A. 1998. *Some key figures of Iranian calendar mythology. Winter and spring*. Universitas, Kraków.

LAYTON, R. 1992. Ethnographic analogy and the two archaeological paradigms. In A. S. Goldsmith, S. Garvie, D. Selin and J. Smith (eds), *Ancient images, ancient thought: the archaeology of identity*, pp. 210-231. The Archaeological Association of the University of Calgary, Calgary.

LEROI-GOURHAN, A. 1964. *Les religions de la préhistoire*. Presse Universitaire de France, Paris.

LINCOLN, B. 1975. The Indo-European myth of creation. *History of religions* 15(2): 121-5.

LINCOLN, B. 1981. *Priests, warriors and cattle: a study in the ecology of religions*. University of California Press, Berkeley.

MUKHIDDINOV, I. 1964. Stennye rospisi zhilishch v selenii Jagid (Darvaz) i svjazannyje s nimi poverja i predstavlenja. *Sovetskaja Etnografija* 2: 108-15.

MUKHIDDINOV, I. 1986. Obrjady i obychai pripamirskikh narodnostej svjazannye s tsiklom selskokhoziajstvennykh robot. In V. N. Basilov (ed.), *Drevnye obrjady, verovanija i kulty narodov Srednej Azii*, pp. 70-93. Nauka, Moskva.

NOVGORODOVA, E. A. 1989. *Drevnaja Mongolija*. Nauka, Moskva.

PESHCHEREVA, J. M. 1985. Nekotoryje svedenja o tadzhikskom zhilishche privakhshkikh rajonov. In B. A. Litvinskij (ed.), *Etnografija Tadzhikistana*, pp. 3-10. Donish, Dushanbe.

RAKHIMI, M. V. and V. USPENSKAJA (eds) 1954. *Tadzhikskorusskij slovar*. Gosudarstvennoje Izdatelstvo Inostrannykh i Natsionalnykh Slovarej, Moskva.

RAKHIMOV, M. 1960. Nekotorye obychai i obrjady swjazannye so skotovodstvom u tadzhikov Karatagina i Darvaza. In N. A. Kisljakov and A. K. Pisarchik (eds), *Pamjati M. S. Andreeva. Sbornik Statej*, pp. 181-187. Izdatelstvo Akademii Nauk Tadzhikskoj SSSR, Dushanbe.

RANOV, V. A. 1961. Risunki kamiennogo veka v grote Shakhty. *Sovetskaja Etnografija* 6: 70-81.

RANOV, V. A. 1980. K voprosu o vozraste i interpretatsii petroglifov Srednej Azii (O nekotorykh netochnostjakh v robotakh A. A. Formozova. In B. I. Iskandarov (ed.), *Pamjati Aleksandra Aleksandrovicha Semenova*, pp. 163-176. Donish, Dushanbe.

RECTOR, C. H. 1985. Rock art as hunting magic: anthropological fact or fiction. San Diego Museum Papers 18. *Rock Art Papers* 2: 127-32.

ROZENFELD, A. Z. 1975. Materialy po jazyku i etnografii pripamirskikh tadzhikov. *Strany i Narody Vostoka* 16: 210-21.

ROZWADOWSKI, A. 1997. Sztuka naskalna i Indoirańczycy: interpretacja etniczna petroglifów doliny Sarmišsaj. In A. Kośko, T. Shirinov and W. Rączkowski (eds), *Sztuka naskalna Uzbekistanu*, pp. 205-235. Instytut Historii Uniwersytetu im.Adama Mmickiewicza, Poznań.

ROZWADOWSKI, A. 1999. Znikając w skale: szamanistyczne aspekty tradycji indoirańskiej jako kontekst dla interpretacji petroglifów Azji Środkowej. In: A. Rozwadowski, M. M. Kosko and T. A. Dowson (eds), *Sztuka naskalna i szamanizm Azji Środkowej*, pp. 101-134. Dialog, Warszawa.

ROZWADOWSKI, A. and M. HUZANAZAROV 1999. Some dilemmas with chronological estimations in central Asian rock art studies. In M. Strecker and P. Bahn (eds), *Dating and earliest known rock art*, pp. 79-82. Oxbow Books, Oxford.

SCHWARTZ, M. 1985. The old eastern Iranian world view according to the Avesta. In I. Gershevitch (ed.), *The Cambridge history of Iran*, vol. 2, pp. 640-663. Cambridge University Press, Cambridge.

SEMENOV, A. A. 1903. *Etnograficheskie ocherki zarafshanskikh gor, Karategina i Darvaza*. A. A. Levenson, Moskva.

SHER, J. A. 1980. *Petroglify Srednej i Tsentralnoj Azii*. Nauka, Moskva.

UCKO, P. J. and A. ROSENFELD 1967. *Palaeolithic cave art*. Weidenfeld and Nicolson, London.

WALLIS, M. 1983. *Sztuki i znaki. Pisma semiotyczne*. Państwowe Wydawnictwo Naukowe, Warszawa.

ZARUBIN, I. I. 1917. Materialy i zametki po etnografii gornykh tadzhikov. Dolina Bartanga. *Sbornik Muzeja Antropologii i Etnografii* 5: 97-148.

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KEYWORDS: *Rock art - Pigment - Paint residue - Mineralogy - Northern Australia*

IDENTIFICATION OF MINERALS IN PIGMENTS FROM ABORIGINAL ROCK ART IN THE LAURA AND KIMBERLEY REGIONS, AUSTRALIA

I. Ward, A. Watchman, N. Cole and M. Morwood

Abstract. Mineralogical and geochemical differences in the red, white, yellow and other earth pigments determined from fifty paint samples from numerous Kimberley and Laura rock paintings support the view that different pigments were used for different reasons in paintings. In the Laura area, the rare example of huntite instead of the more typical kaolinite used for a white pigment may indicate a special significance of the respective paintings, and the possible trading of such a rare component. The distinction and use of jarosite in mulberry-coloured paints instead of red haematite is also noted. Similar and complementary analytical studies are required to determine the cultural significance of the selective use of different paints across northern Australia.

Introduction

Northern Australian rockshelters contain numerous brightly coloured paintings representing a variety of styles and meanings, which have been applied to rock surfaces over thousands of years. Selective use of a range of possible inorganic and organic raw materials to manufacture pigments for paints is well established historically and ethnographically (Peterson and Lampert 1985; Smith et al. 1998). In order to help understand why painters chose certain paint ingredients over others, this paper queries what are the mineralogical compositions of the pigments, and whether there is a regional pattern in pigment composition across northern Australia. Here we partially characterise a range of inorganic components from different styles of paintings from the Kimberley and Laura areas in order to examine similarities and differences between pigments with essentially the same colours. It was not the aim of this work to source the pigments, or look at the perspective of material quality to explain the selective use of particular earth pigments.

The samples used in our study were collected as part of two projects carried out during 1994. The first, in the Kimberley region of Western Australia (Figure 1), was aimed at dating paints and rock surface crusts associated with paintings called Wandjina and Gwion Gwion (Bradshaw figures) by the Ngarinyan. One of us (MM) initiated that project in collaboration with Grahame Walsh (Morwood et al. 1994; Walsh 1997; Watchman 1997a). The second project, in the Hann River region of Cape York Peninsula, Queensland (Figure 1), also aimed at dating rock paintings, particularly those paints used as outlines around engraved crescents or boomerangs. That project was planned as an extension of NC's comprehensive research of rock art of the Laura region (Cole 1998; Cole and Watchman 1996). Additional samples were collected from sites near the Kennedy River (west of Laura) and Jowalbinna (south-west of Laura). Previous Australian work on the identification of paint components has been undertaken by Clarke (1976) and Ford et al. (1994) in the Kimberley, and by Henderson (1971), Watchman et al. (1993), and Cole and Watchman (1993, 1996) in the Laura region. No previous studies had been undertaken in the Hann River area.

Methods

Field sampling

Fragments of paint residues, selected primarily for their dating potential, were scraped from paintings using stainless steel dental tools. Small, partly detached flakes of encrusted and painted rock were levered from rock panels, collected in plastic vials and transported to the laboratory. Each site was sketched, notes were taken of each sampling location and photographs taken to help record and identify the painted figures (Watchman 1997b). Red, white and yellow paints were collected in both the Kimberley and Laura regions, blue and brown were collected in the Laura region, and black and a dark mulberry or 'purple' colour in the Kimberley. Inevitably sampling of paintings within these regions was biased because of priorities created by each researcher. In the Kimberley, red paints were scraped from Gwion and Wandjina figures. The biased nature of the red samples is acknowledged as no mulberry-coloured paints have

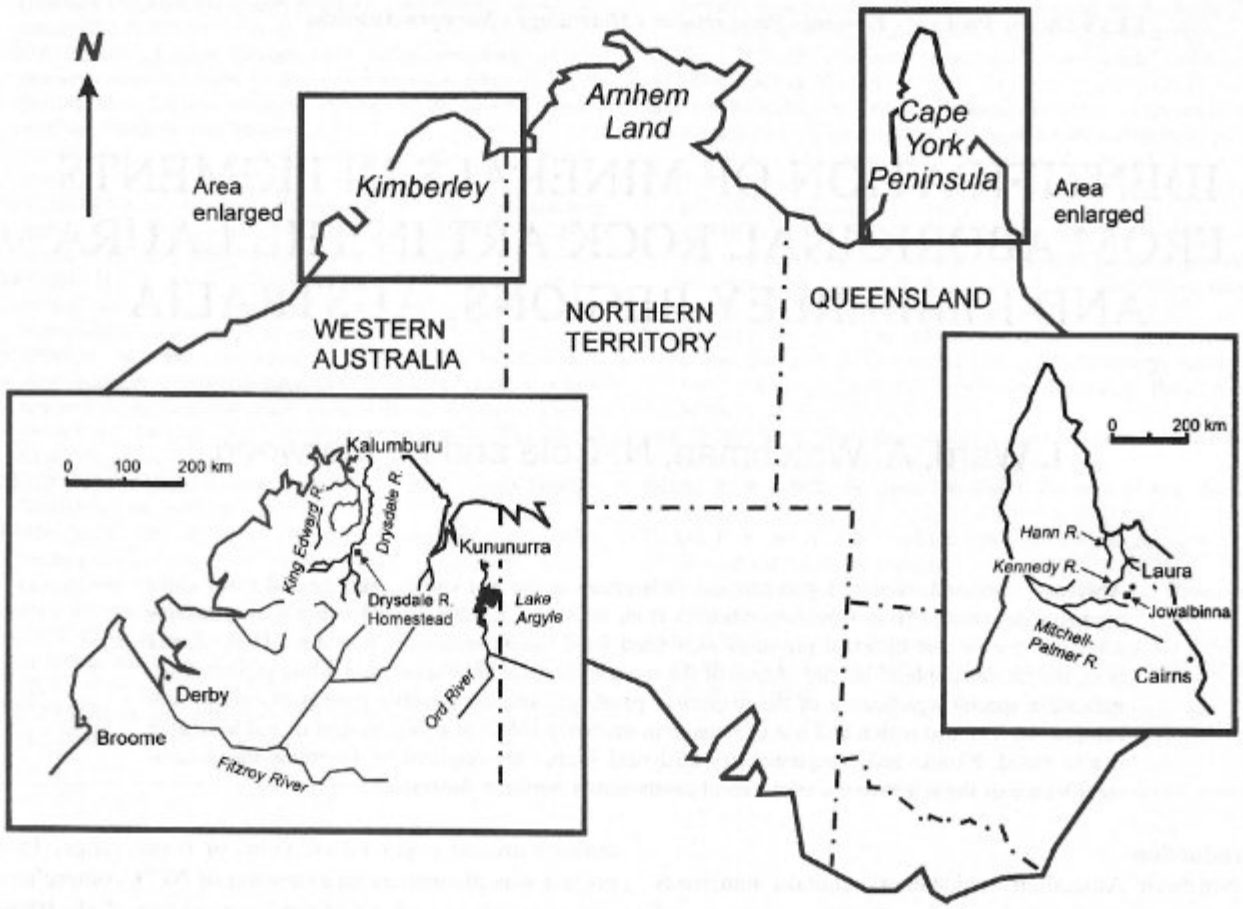

Figure 1. *Location map showing the two major art regions of the Kimberley and Cape York Peninsula from which paint residue samples were obtained.*

been recovered from the Laura region even though these paints are relatively common in red hand stencils. There are also some faded mulberry paintings but the paints are irretrievably bonded to the rock, making sampling impossible (see also Cole and Watchman 1996).

Analytical techniques

Analytical techniques were chosen to identify inorganic and geochemical components from a minimal amount of material, given the advanced analytical equipment available at James Cook University. The identification of inorganic components helps distinguish compound pigments (a mixture of natural minerals) from single natural minerals and synthetic pigments. Geochemical characterisation may help distinguish minerals, which may be present at levels below the detection limit of mineral analyses. It is not always possible to clearly identify inorganic compounds as intended pigments, from others as impurities or additions, but assume well-known coloured minerals are likely to be the mineral pigment. Whilst the techniques chosen do not provide information about binders, amorphous compounds or the paint-making process, some information regarding particle size can be obtained under high-powered magnification.

Initially the paint samples were examined under binocular microscope before being prepared for mineralogical and geochemical analyses. Photographs were taken of each sample and compared against a standard colour chart. Mineralogical analyses of paint samples were obtained from smear samples, run on a Rigaku Denki D2155 x-ray diffractometer (XRD) fitted with a post-diffraction curved graphite crystal monochromator using CuKα radiation, scanning at 0.5°/min. from 1.3° to 60° 2θ. Analyses were run through a trace-match program ('Search') to identify major mineral phases, and characteristic peaks were verified by comparing with standard mineral patterns. The detection limit of XRD is generally less than five weight per cent. Major XRD peaks may comprise typical rock-forming minerals such as quartz, clay minerals or evaporative salts but minute peaks, barely higher than the background, may actually produce the colour of the sample.

Geochemical analyses were obtained to help decipher and confirm mineralogical analyses, using a JOEL JXA-840A electron microscope (SEM) fitted with an energy dispersive x-ray (EDXA) analyser. Samples were prepared for combined SEM and EDXA analysis by mounting individual grains on aluminium stubs with carbon-tape and coating with a thin carbon film. Thus whilst the technique is essentially destructive, samples

can be repeatedly examined. Results of mineralogical and geochemical analyses are presented in Tables 1a to 1d.

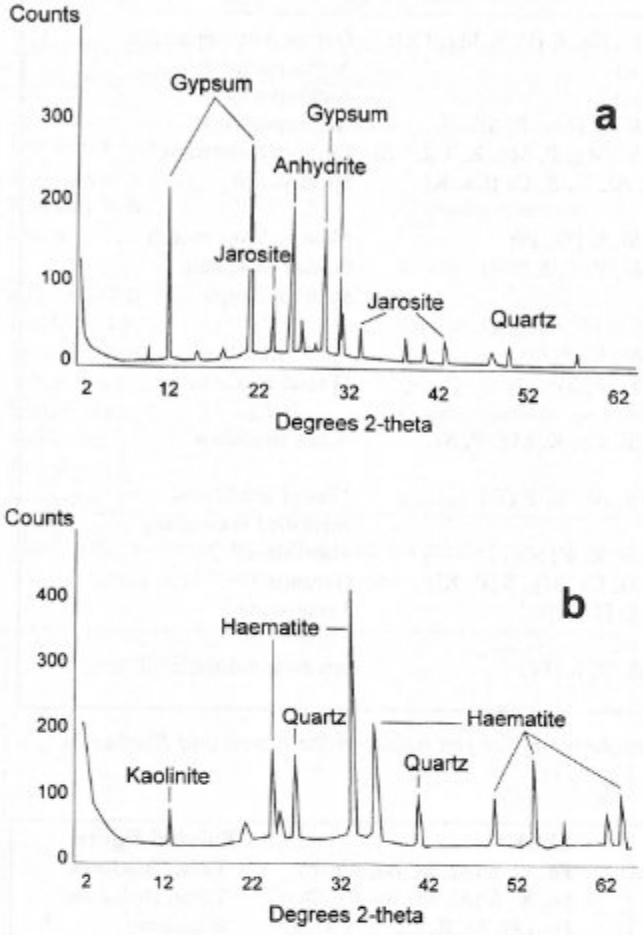

Figure 2. Comparison of characteristic XRD peaks for red paints, (a) jarosite and (b) haematite. Jarosite has characteristic peaks at 28.99, 28.70, 17.42, 14.89° 2θ. and haematite has characteristic peaks at d-spacings of 33.30, 35.77, 54.26, 24.31° 2θ.

Results and discussion

The paint colours sampled from rock paintings in the Laura and Kimberley region comprise red, mulberry-red, white and yellow. Cole and Watchman (1993) have previously documented the more unusual blue paint, and our analyses provide no additional information on this.

Red and mulberry (purple) paints

The few samples analysed in this study indicate that red and mulberry paints are mineralogically and geochemically different. Our mineralogical analyses indicate that the mulberry paint residues have an inorganic component of jarosite-like minerals ($KFe_3(SO_4)_2(OH)_6$) (Figure 2b) and the red paint residues are composed of haematite (Fe_2O_3) (Figure 2a). The term 'jarosite' has been used here to refer to the alunite-jarosite series of sulphate minerals, including natroalunite, natrojarosite, plumbojarosite and schlossmacherite, all of which may occur together and show similar diffraction peaks. It is common to find these jarosite minerals with sulphate salts such as anhydrite and/or gypsum (e.g. BGI1 and BGI2) (see also Figure 2b). Haematite can be distinguished from jarosite through the presence of Fe and absence of K and S in SEM/EDXA analyses. Iron peaks dominate, as expected, in the spectrum of haematite in K8 and LS2.5 (Figure 4a), whereas Fe and K peaks are both dominant in the spectrum of jarosite in BGI1, K1 and LS6 (Figure 4b).

It is unknown why mulberry is a preferred paint colour for the Gwion figures in the Kimberley. According to Morwood et al. (1994) the distinctive mulberry hue used in the painting of many irregular infill animal and Gwion paintings in the Kimberley region has an organic base. According to traditional custodians, tree sap was used (A. Watchman, pers. comm. 2000). The jarosite may be a surviving minor component or contaminant either from the weathering of local iron-rich minerals or from an underlying red paint (Watchman et al. 1993). Analyses of a possible organic component are required for all paint samples.

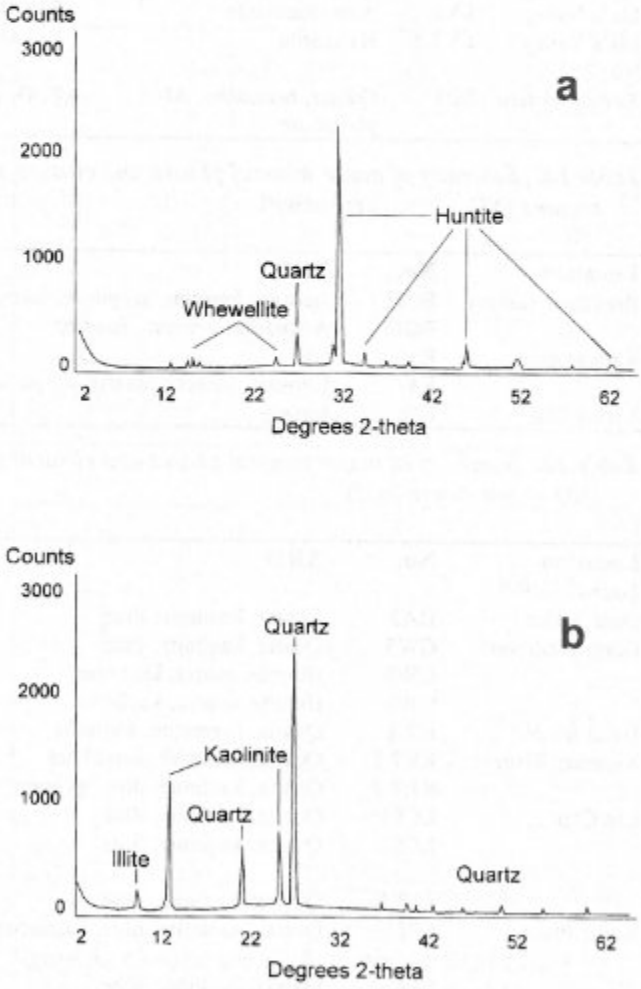

Figure 3. Comparison of characteristic XRD peaks for white paints, (a) huntite and (b) kaolinite. Huntite has characteristic peaks at d-spacings of 31.61, 46.07, 30.94, 15.63° 2θ, and kaolinite has characteristic peaks at 12.35, 22.92° 2θ.

Location	No.	XRD	SEM	Painted figure
Laura				
Deaf Adder	DA1	Quartz, kaolinite	Fe (Al, Si, Ca)	Infilled 'bird track'
Giant Wallaroo	GW2	Quartz, kaolinite, muscovite, jarosite	Fe (Al, Si, K, [S, Ti])	Infilled 'wallaroo'
Hann River	H7.2	Quartz, haematite, illite	Fe (Al, Si, Ca, K [P, S, Mg, Cu])	Outline anthropomorph
	H1.1	Haematite, quartz, kaolinite	Fe (Al, Si)	Anthropomorph
	H1.2	Haematite, quartz, kaolinite	Fe (Al, Si)	Anthropomorph
	H1.3	Quartz, haematite, kaolinite	Fe (Al, Si, K [Mg, P, S])	Anthropomorph
	H1.5	Quartz, haematite	Fe (Al, Si [Mg, P, Mn, K, Ca, Ti])	Outline 'boomerang'
Kennedy River	KR7.2	Quartz, kaolinite, Al-phosphate	Fe (Mg, Al, Si, S, Ca [Ca, K])	Hand stencil
	KR7.4	Quartz, calcite, Al-phosphate	Fe (Al, Si, K [Ti, P])	Male anthropomorph
Snake Place	SP2	Quartz, kaolinite, illite, haematite	Fe (Al, Si, P, S, K [Cl])	Outline of female anthropomorph
Kimberley				
Kangaroo	K2	ND	Fe (Si, Al, K, P, O)	'Sash Bradshaw'
Bradshaw Gallery	BGI3	Anhydrite, gypsum, haematite	Fe (Al, Si, P, S)	'Tassel Bradshaw'
Cane Bradshaw	CB2	Quartz, muscovite, gypsum, haematite	Fe (Al, Si, Ca, K, Mg, P, S)	'Cane Bradshaw'
King Bradshaw	KB2	ND	Ca, S, Fe, Al, Si, P (Ti)	'Tassel Bradshaw'
Living Site	LS5	Quartz, gypsum, haematite	ND	Stencilled boomerang
	LS7	ND	Fe (Al, Si, K, P, S)	Hand stencil
Liz's Valley	LV4	Illite, haematite	Fe (Al, Si, Ca, Mg, S [P, K])	'Goanna'
Liz's Valley No. 2	LV2.5	Haematite	Fe (Al, Si [Ti, P])	Local stone
Sash Bradshaw	SB3	Quartz, haematite, Al-phosphate	P, O, Al, Si, K (Fe)	Irregular animal infill

Table 1a. *Summary of major mineral phases and element geochemistry for red paints in the Laura and Kimberley regions (ND = not determined).*

Location	No.	XRD	SEM	Painted figure
Bradshaw Gallery	BGI1	Jarosite, gypsum, anhydrite, kaolinite	Fe, K, S (Al, Si, Ba, Ca, P)	'Tassel Bradshaw'
	BGI2	Anhydrite, gypsum, jarosite	Fe, K, S (Al, Si, Ba, Ca, P)	'Tassel Bradshaw'
Kangaroo	K1	ND	Fe, (Al, Si, K, Ca, S, P [Ba])	'Bradshaw'
	K4	Gypsum, jarosite, quartz, Al-phosphate	ND	'Striped Bradshaw'
Living Site	LS6	Jarosite	Fe, K (Ca, Mg, Al, Si, P)	Stencilled boomerang

Table 1b. *Summary of major mineral phases and element geochemistry for mulberry paints in the Kimberley region (ND = not determined).*

Location	No.	XRD	SEM	Painted figure
Laura				
Deaf Adder	DA2	Quartz, kaolinite, illite	Fe (Al, Si, Ti, S, K, Mg)	Infilled 'snake'
Giant Wallaroo	GW3	Quartz, kaolinite, illite	Al, Si, K, (S, Ti, Fe)	Infilled eel-tailed 'catfish'
	GW5	Huntite, quartz, kaolinite	Ca, Mg (Al, Si, K, S)	Hand stencil
	GW6	Huntite, quartz, kaolinite	Ca, Mg (Al, Si, K, Ti)	Infilled 'wallaroo'
Hann River	H7.1	Quartz, haematite, kaolinite	Al, Si, S, K, (Fe, Mg)	Infilled anthropomorph
Kennedy River	KR7.1	Quartz, kaolinite, muscovite	Al, Si, K, (Mg, Ti, Fe)	Infilled male anthropomorph
	KR7.3	Quartz, kaolinite, illite, gypsum	Al, Si, (Ca, K, Fe, S)	Male anthropomorph
Lee Chu	LCS1	Quartz, kaolinite, illite	Al, Si, K (Ti, Fe, S)	Horse-like animal
	LCS2	Quartz, kaolinite, illite	Al, Si, K (Ti, Fe, S)	Policeman-like anthropomorph
	LCS3	Quartz, kaolinite, illite	Al, Si, K (Ti, Fe)	ND
Snake Place	SP1	Quartz, kaolinite, illite, haematite	Fe (Al, Si, P, S, K [Cl])	Infilled female anthropomorph
	SP4	Quartz, kaolinite, illite	Al, Si, K (Ti, Fe, P)	Infilled 'snake'
Kimberley				
Access Path	AP1	Quartz, gypsum, Al-phosphate	Si (Al, Ca, S, K [Fe, Zr, P])	Stick anthropomorph
Anne's Complex	AC5	ND	Mg, Al, Si, Fe, P, S, (Ca, Ti)	Stick anthropomorph
Liz's Valley	LV2	Whewellite, halloysite, quartz	Ca, Mg, Al, Si (Fe, Ti, Cl, S)	Wandjina
Wax Creek East	WCE3.4	Kaolinite, gypsum, quartz, Fe-talc	Al, Si, Ca, S, K, P, Mg (Fe)	Wandjina

	WCE4.6	Huntite, kaolinite, quartz	Ca, Mg (Al, Si, S, Cl, Ti)	Wandjina
	WCE4.7	Huntite, kaolinite, quartz, gypsum, illite	Ca, Mg (Al, Si [Cl, K, Fe])	Wandjina
White Spear	WS1	Quartz, Al-phosphate	Al, Si (K [Fe, Ca])	'Spear'

Table 1c. *Summary of major mineral phases and element geochemistry for white paints in the Laura and Kimberley regions (ND = not determined).*

Location	No.	XRD	SEM	Painted figure
Blue paint				
Kennedy River, Laura	KR7.9	Gypsum, unknown	Al, Si, Fe, K, Ca, (S, Cl, Na, Cu)	Graffito
	KR7.10	Quartz, illite, kaolinite, unknown	Al, Si, S, Na, Ca, (P, K, Fe)	Graffito
Brown paint				
Lee Chu, Laura	LCS4	Quartz, kaolinite, illite, haematite	Fe (Al, Si, P, K, Ti [Cu])	Anthropomorph
Yellow paint				
Snake Place, Laura	SP3	Quartz, kaolinite, illite	Al, Si, S, K, Ti, Fe	Indeterminate
Living Site, Kimberley	LV3	Quartz, kaolinite, jarosite, goethite	Fe, K (Al, Si, Ca, Mg, Fe, S [P])	'Goanna'
Black paint				
Kangaroo, Kimberley	K8	Haematite	Fe (Al, Si, K, P)	Unknown figure

Table 1d. *Summary of major mineral phases and element geochemistry for blue, brown, yellow and black paints in the Laura and Kimberley regions.*

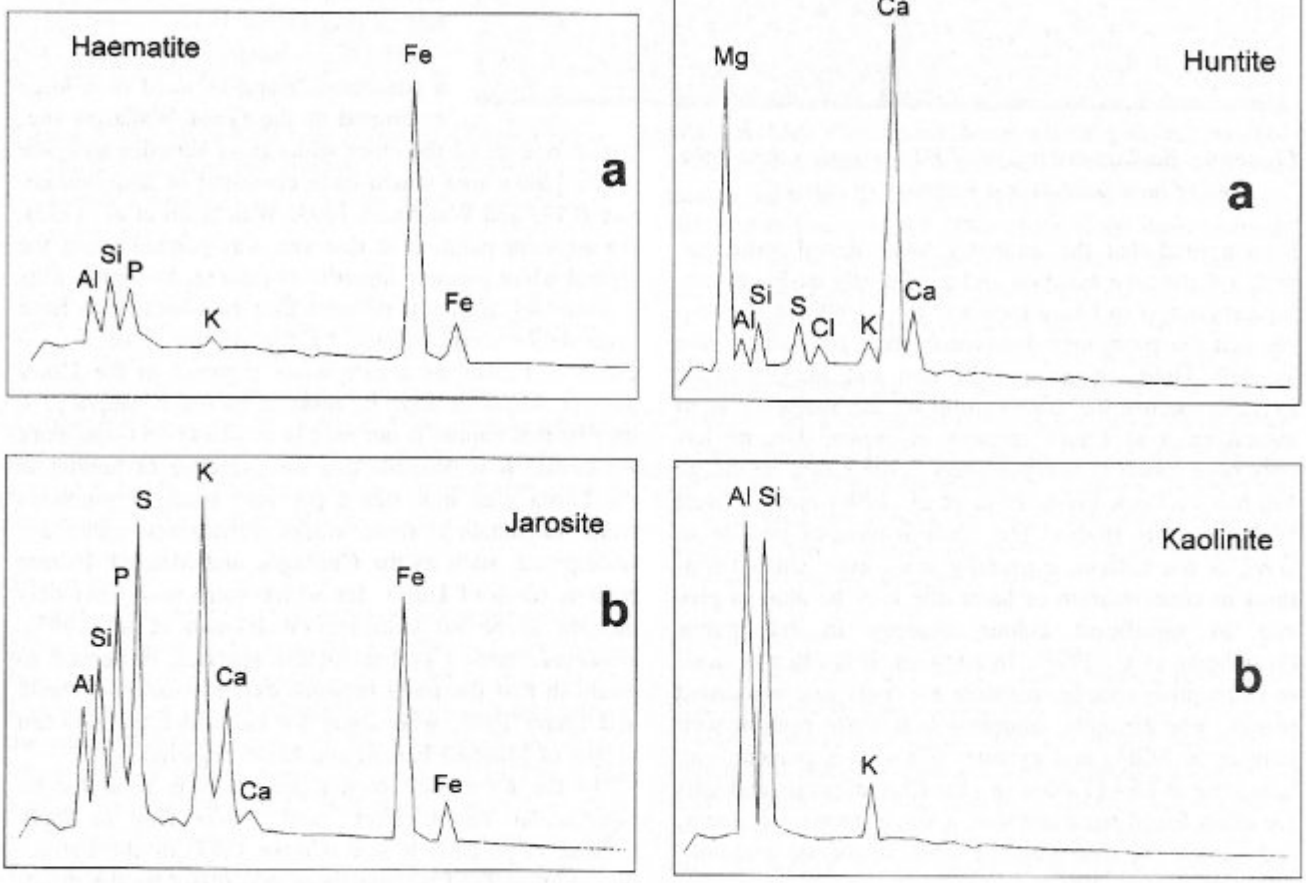

Figure 4. *Comparison of characteristic SEM/EDXA peaks for red paints, (a) haematite and (b) jarosite. Jarosite is distinguished by the presence of K.*

Figure 5. *Comparison of characteristic SEM/EDXA peaks for white paints, (a) huntite and (b) kaolinite. Huntite is distinguished by the presence of Mg, Ca and S, whereas kaolinite is composed of Al, Si and K.*

In the Laura region virtually all the red paint residues sampled are haematite based (Figure 6), whilst mulberry paints survive usually only as stains on the rock with little or no remaining evidence of fresh paint. The Munsell value of the red paint residues is recorded as 10R 3/6 and of the mulberry paint as 5R 2.5/4. As it has

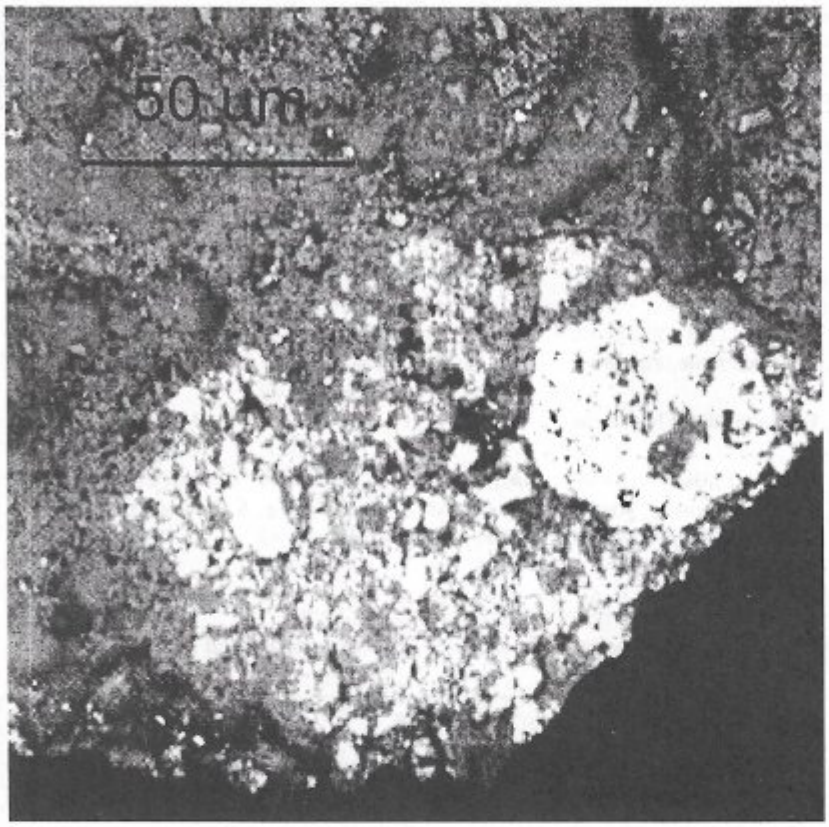

Figure 6. *Backscatter image of H1.4 showing the bright area of haematite over a fragment of clay.*

been argued that the mulberry hand stencil motif has both a distinctive function and a relatively early chronological context in Laura rock art (Cole 1998), it is possible that the paint ingredients may have been distinctive as well. Until successful collection and analysis of an example occurs the composition of the mulberry hand stencil paint at Laura remains unknown. Jarosite has only been found in two paintings in the Laura region, at Mushroom Rock (Watchman et al. 1996) and at Giant Wallaroo (this study). The identification of jarosite in GW2 is not certain, especially since even small variations in concentration of haematite may be able to give rise to significant colour changes in red paints (Watchman et al. 1993). In addition, it is often difficult to distinguish specific pigment elements and associated phases. For example, aluminosilicates are present with jarosite in BGI1, and gypsum ($CaSO_4$) is present with haematite in LS4 (Tables 1a - b). Clay minerals and salts are often found naturally with a single mineral pigment, and cannot be distinguished from deliberate additions (Watchman et al. 1993).

White paints

As found previously in the Laura area (Watchman et al. 1993), white paint residues typically comprise quartz plus kaolinite and/or muscovite/illite (e.g. GW3, KR7.1, KR7.3, LCS1 - 3). Munsell colours vary in hue from 2.5 Y8, 5YR 8/1 to 10YR 8/1. Major element contents, as determined by SEM/EDXA, include Si, Al, and K. White pigments with these compositions are probably derived from weathered granites (Watchman et al. 1993) or more rarely micaceous schists (Cole and Watchman 1996).

Huntite ($Mg_3Ca(CO_3)_4$) is also used as a white pigment in both the Laura (GW5 and GW6) and Kimberley areas (e.g. WCE4.6 and WCE4.7). The presence of Ca and Mg peaks in geochemical analyses confirms the x-ray identification of huntite (Figure 5a). Unlike rock paintings in the Kimberley and Arnhem Land regions of northern Australia (Watchman et al. 1993; Ford et al. 1994), carbonate minerals such as huntite and calcite have not been found in any of the Laura paint samples analysed previously (Watchman et al. 1993; Cole and Watchman 1996). Calcite is only found in two samples (e.g. K7 and KR7.4) and it may have formed via the chemical alteration of huntite (Ford et al. 1994).

The use of huntite, as a pigment for a hand stencil and as infill of a large macropod at the Giant Wallaroo site, contrasts with all the other white paint samples analysed in the Laura area which have consisted of illite/muscovite (Cole and Watchman 1993; Watchman et al. 1993). An adjacent painting at that site was painted using the typical white pigment ingredients (quartz, kaolinite, illite /muscovite), thus it is possible that the huntite may have been deliberately selected by the painter. The significance of huntite as a rare white pigment in the Laura area is unknown and, in contrast to the Kimberley, it may be that huntite is not readily available on Cape York Peninsula. It is possible that the presence of huntite in the Laura area indicates a previous trade of pigments from surrounding areas where calcareous rocks are widespread, such as the Chillagoe and Mitchell-Palmer regions south of Laura, for which there was previously thought to be no evidence (Watchman et al. 1993). However, further archaeological research is needed to establish that the trade network existed (see also David and Chant 1995, who argue for cultural links between people of Mitchell-Palmer and Laura regions).

In the Kimberley region, huntite was used for its 'spectacular visual effect', and it was easy to apply because of its particle size (Clarke 1977) or sheet structure (Figure 7). This selectivity was offset by the disadvantage of structural instability under humid conditions leading to exfoliation and loss of brightness. Perhaps it is precisely because of these contrasting physical properties that the pigment was deliberately chosen, although many paintings were re-done, not only when they were flaking off, but also when they became dirty (Clarke 1976). Huntite, whewellite and calcite have been found both in different motifs and in different layers of the same motif

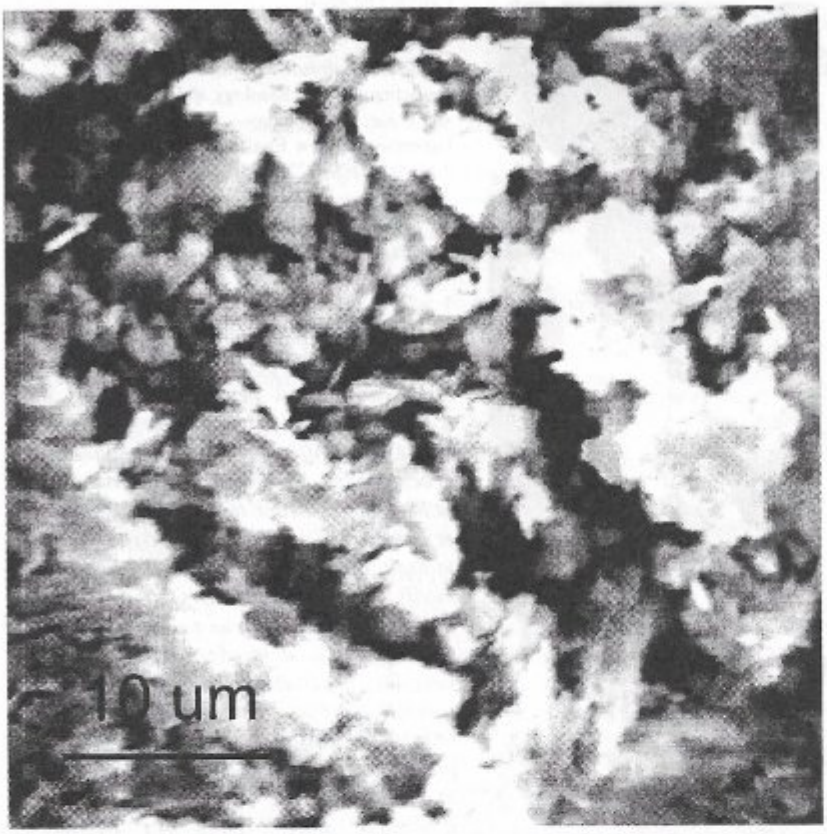

Figure 7. Secondary electron image of a huntite grain GW6, indicating the sheet-like structure which gives huntite a bright lustre. Note the average crystal size is less than 5 μm.

(Ford et al. 1994). Gypsum, aluminium-phosphate, talc and kaolinite-halloysite were also used in the Kimberley. In this study, whewellite was found as a white pigment in a Wandjina, at a site in Liz's Valley. This oxalate salt is probably derived from huntite, following the reaction sequence described by Ford et al. (1994). Degradation of huntite is likely because that white pigment also contains halloysite, a degraded form of kaolinite clay.

Yellow paints

Yellow paints are under-represented in the sample of paintings collected in this study, reflecting a previous bias in selecting particular figures for dating. In the Laura area the yellow paint (10YR 8/4) was taken from an indeterminate painting on the ceiling of the Snake Place site. A yellow image of a goanna or lizard-like animal was sampled in Liz's Valley, Kimberley. Both paint residue samples yield similar elements in their respective geochemical spectrum, but Fe and K are more abundant in the Kimberley paint compared with that from Laura. Calcium and Mg are also present in the Kimberley paint residue, possibly reflecting inclusion of traces of huntite. Quartz and kaolinite are present in both yellow paints but the major difference is the combination of jarosite and goethite in the Kimberley paint. These minerals give depth and brightness to the yellow paint, in contrast to the weak yellow from Laura. A trace of jarosite may be present in the Laura yellow because of the presence of S, K and Fe in the geochemical spectrum, but jarosite and goethite are not evident in the mineralogical pattern. It is possible that pure deposits of iron oxides such as goethite and jarosite were mixed with other materials (such as kaolinite, muscovite/illite, quartz and huntite) to make different colours or modify properties. Most (yellow) pigment sources would not be pure minerals, but mixtures of oxides, hydrated oxides and hydroxides of iron occurring naturally with other weathering products, mainly clay, and colours can range from yellow through various shades of orange, red, purple and black (B. Ford, pers. comm. 2000).

Furthermore, many minerals produce more than one colour depending on the co-ordination of elements in the crystal structure. For example, jarosite may be both yellow (as in LV3, WCE4.7) or red (GW2), and haematite can be both red (e.g. LV2.5, H1.1 - 3) or black (K8). While geochemical analysis may distinguish some minor phases, the co-ordination properties are not easily determined. Minor phases such as rutile (TiO_2) occurs in K7 and barite ($BaSO_4$) is found in K1. Phosphate is another common element in many geochemical analyses, however, its mineral form and element association cannot be determined from the techniques used here. In several samples, including AP1, K4, KB1, KR7.2, KR7.4 and WS1, aluminium-phosphate is a well-defined mineral phase identified by a strong x-ray spike (at 16° 2θ). In other samples from the Kimberley the phosphate-rich minerals cannot be identified by inorganic analyses, despite the strong phosphorus peak in the geochemical analyses, indicating that P is probably present as a poorly defined crystalline species (Ford et al. 1994).

Conclusion

Geochemical and mineralogical analyses have been used to partially characterise red, mulberry, white and yellow paint residues from the Laura and Kimberley regions. Mulberry paints are distinguished by the presence of jarosite, yellow paints by jarosite and goethite, red paints by haematite, and most white paints by kaolinite or huntite. Mulberry paints are a feature of the Gwion paintings of the Kimberley, and of some red hand stencils and paintings in the Laura region. Haematite pigments are found in both regions. Huntite, a white pigment, is a previously unidentified phase in the Laura region, and may indicate the selective use and minimal trade of carbonate pigment ingredients in north Queensland. However, the single occurrence of huntite in the Laura region could be a random event. The separate

Figure 8. Secondary electron image of a kaolinite composite grain KR7.3 showing the fine-grained (c. 10 μm) platelets of kaolinite mixed with individual grains of quartz and salt (gypsum).

occurrence and use of mineral pigments may have been primarily controlled by geological factors, but cultural reasons may have contributed as well. Trace and rare earth element analyses could be used to complement the geochemical and mineralogical analyses presented here to better fingerprint the pigment components for a more advanced sourcing study (David et al. 1993, 1995; Smith and Fankhauser 1996). Similar data are required to determine if these results are significant within a more wide-ranging rock art and geological context.

Acknowledgments

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I. Ward and Dr A. Watchman
School of Anthropology, Archaeology and Sociology
James Cook University
Townsville, Qld 4811
Australia

Dr N. Cole
School of Anthropology, Archaeology and Sociology
James Cook University
Cairns, Qld 4870
Australia

Associate Professor M. Morwood
Department of Archaeology and
Palaeoanthropology
University of New England
Armidale, NSW 2351
Australia

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Résumé. *Les analyses de cinquante échantillons de peintures provenant de nombreux sites à peintures rupestres du Kimberley et de la région de Laura ont révélé des différences minéralogiques et géochimiques entre les pigments minéraux utilisés, de couleurs rouge, blanche, jaune et autres. Ceci autorise à penser que l'on utilisait des pigments différents pour des motifs divers. Dans la région de Laura, l'exemple, rare, d'emploi de huntite comme pigment blanc, à la place de l'habituelle kaolinite, pourrait revêtir une signification spéciale pour les peintures en question, et attester un possible commerce de ce composant peu commun. On note aussi le choix et l'utilisation de jarosite, à la place d'hématite rouge, dans des peintures couleur framboise. Des analyses similaires et complémentaires sont nécessaires pour déterminer la signification culturelle de ces choix volontaires de différents pigments dans les sites du nord de l'Australie.*

Zusammenfassung. *Mineralogische und geochemische Unterschiede in roten, weißen, gelben und anderen Erd-Pigmenten, die von fünfzig Farbproben zahlreicher Kimberley und Laura Malereien bestimmt wurden, unterstützen die Ansicht, daß verschiedene Pigmente für verschiedene Gründe in Bildern benutzt wurden. Im Laura Gebiet, das seltene Beispiel von Huntit statt des typischeren, als weißes Pigment benutzten Kaolinit, zeigt vielleicht eine besondere Bedeutung der jeweiligen Malereien, und das mögliche Tauschen eines so seltenen Bestandteiles. Der Unterschied und die Verwendung von Jarosit in Maulbeer-farbigen Farbtönen anstatt des roten Hämatits wird ebenso erwähnt. Ähnliche und komplementäre analytische Studien sind erforderlich, um die kulturelle Bedeutung der selektiven Verwendung verschiedener Farben im nördlichen Australien zu bestimmen.*

Resumen. *Diferencias mineralógicas y geoquímicas en los pigmentos rojo, blanco, amarillo, y otros pigmentos de tierra, establecidos de cincuenta muestras de pintura procedentes de numerosas pinturas rupestres de Kimberley y Laura sustentan la opinión de que diferentes pigmentos fueron usados por diferentes razones en las pinturas. En el área de Laura, el raro ejemplo de huntita en lugar de la más típica caolinita usada para un pigmento blanco podría indicar un significado especial para las pinturas respectivas, y el posible comercio de un componente tan raro. El discerniminento y uso de jarosita en pinturas de color de mora en lugar de hematita roja es también advertido. Estudios analíticos similares y complementarios son requeridos para determinar el significado cultural del uso selectivo de diferentes pinturas a través del Norte de Australia.*

REFERENCES

CLARKE, J. 1976. Two Aboriginal rock art pigments from Western Australia, their properties, use and durability. *Studies in Conservation* 21: 134-42.

CLARKE, J. 1977. Deterioration analysis of rock art sites. In C. Pearson (ed.), *Conservation of rock art*, pp. 54-63. Proceedings, International Workshop on the Conservation of Rock Art, Perth, September 1977. Institute for the Conservation of Cultural Material, Sydney.

COLE, N. and A. WATCHMAN 1993. Blue paints in prehistory. *Rock Art Research* 10: 58-61.

COLE, N. and A. WATCHMAN 1996. Archaeology of white hand stencils of the Laura region, Cape York Peninsula, north Queensland. *Techne* 3: 82-90.

COLE, N. and A. WATCHMAN 1997. Analysis of Laura paint and crust samples: Stage 2. Abstract, Sixth Australasian Archaeometry Conference, Sydney, Paper 60.

DAVID, B. and D. CHANT 1995. Rock art and regionalisation in northeastern Australian prehistory. *Memoirs of the Queensland Museum* 37(2): 357-528.

DAVID, B., E. CLAYTON and A. WATCHMAN 1993. Initial results of PIXE analyses on northern Australian ochres. *Australian Archaeology* 36: 50-7.

DAVID, B., A. WATCHMAN, R. GOODALL and E. CLAYTON 1995. The Maytown ochre source. *Memoirs of the Queensland Museum* 38(2): 441-5.

FORD, B., I. MACLEOD and P. HAYDOCK 1994. Rock art pigments from Kimberley region of Western Australia: identification of the minerals and conversion mechanisms. *Studies in Conservation* 39: 57-69.

HENDERSON, R. A. 1971. Conservation report on rock paintings, Laura District, Cape York Peninsula. Unpubl. report, Archaeology Branch, Department of Aboriginal and Islander Affairs, Brisbane.

MORWOOD, M. J., G. L. WALSH and A. WATCHMAN 1994. The dating potential of rock art in the Kimberley, N.W. Australia. *Rock Art Research* 11: 79-87.

PETERSON, N. and R. LAMPERT 1995. A central Australian ochre mine. *Records of the Australian Museum* 37(1): 1-9.

SMITH, M. A. and B. FANKHAUSER 1996. An archaeological perspective on the geochemistry of Australian red ochre deposits: Prospects for fingerprinting major sources. Unpubl. report to Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra.

SMITH, M. A., B. FANKHAUSER and M. JERHER 1998. The changing provenance of red ochre at Puritjarra rock shelter, central Australia: Late Pleistocene to present. *Proceedings of the Prehistoric Society* 64: 275-92.

WALSH, G. L. 1997. Wandjinas and recent rock art of the Kimberley. In K. F. Kenneally, M. R. Lewis, M. Donaldson and C. Clement (eds), *Aboriginal rock art of the Kimberley*, pp. 53-64. Kimberley Society Occasional Paper 1, Perth.

WATCHMAN, A. 1990. A summary of occurrences of oxalate-rich crusts in Australia. *Rock Art Research* 7: 44-50.

WATCHMAN, A. 1997a. Dating the Kimberley rock paintings. In K. F. Kenneally, M. R. Lewis, M. Donaldson and C. Clement (eds.), *Aboriginal rock art of the Kimberley*, pp. 39-46. Kimberley Society Occasional Paper 1, Perth.

WATCHMAN, A. 1997b. Kimberley and Hann River paint and accretion compositions. Unpubl. report to the Australian Institute of Aboriginal and Torres Strait Islander Studies, Canberra.

WATCHMAN, A., J. SIROIS and N. COLE 1993. Mineralogical examination of Aboriginal rock-painting pigments near Laura, north Queensland. *Archaeometry, Occasional Papers in Prehistory* 22: 141-50.

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KEYWORDS: ***Hand stencil - Mud-wasp nest - Radiocarbon dating - Blind test - Vanuatu***

DATING THE ROCK ART OF VANUATU:
AMS radiocarbon determinations from abandoned mud-wasp nests and charcoal pigment found in superimposition

Meredith Wilson, Matthew Spriggs and Ewan Lawson

Abstract. This paper reports eleven AMS radiocarbon dates obtained from carbon-bearing substances relating to rock art. Dates were obtained on charcoal paintings/drawings, on pollen present within abandoned mud-wasp nests, and on insects trapped in the core of mud-wasp nests both underlying and overlying hand stencils. Results are discussed in light of previous research which identifies a possible 'Austronesian' rock art tradition for western Melanesia.

Introduction

It is now fairly well established that the initial colonisation of Vanuatu took place some 3000 years ago with the appearance of Lapita settlement and signature dentate stamped pottery. It is also becoming evident that by about 1500 years ago, the relatively cohesive Lapita and post-Lapita settlements marked by similarities in cultural behaviour across the archipelago began to diversify, with more regionalised activities taking place (Bedford et al. 1998; Spriggs 1997; Wahome 1998). For example, regionalised pottery styles emerged in some areas and disappeared from others, and contact with Polynesians (as a result of back-migrations) took place, having various impacts on social systems, in some islands completely transforming social and political structures. From the time when European explorers first set foot on the islands in 1606, many parts of ni-Vanuatu society underwent yet another period of restructuring, this time contending with the incursion of Christianity, sandalwood and other traders, and blackbirders.

Vanuatu is important in Pacific rock art studies as it is one of the few places where each of the major artistic techniques is found, including paintings, stencils and petroglyphs. Sometimes the applications of these techniques occur in superimposition, enabling some degree of chronological resolution. An extensive study of the rock art of Vanuatu is currently being undertaken by one of us (MW) as part of a doctoral thesis. The major aim of this study is to further explore established archaeological models of Vanuatu social dynamics, up to now largely based on pottery analyses. In order to employ the rock art in this way, however, some estimate of its age first needs to be made. While there are various means by which to order the art chronologically, radiocarbon determinations on the rock art itself provide some of the most telling evidence.

This paper is a first step towards a major AMS radiocarbon dating program for Vanuatu's rock art. Here we wish not so much to present a chronology for the art, nor to focus on the age of one motif type or another. Rather, we wish to present an initial series of radiocarbon determinations relating to items of rock art of known absolute or relative antiquity as a check on the technique prior to the full dating program. Our aim is thus mainly methodological, geared to assessing the suitability of AMS for dating different substances associated with rock art. To do this, we have selected a single site in northwest Malakula (northern Vanuatu), and a single motif type – the hand stencil. We obtained a series of AMS dates from the charcoal of the stencils, as well as superimposed and subimposed mud-wasp nests (dating both the pollen and the trapped insects). Samples from two stencils that are known to have been produced between 1996 and 1997 were also dated as an independent check of results.

The eleven AMS dates obtained consist of a series of independent cross-checks for some of the sampled items of rock art. All of the results were obtained as blind tests, in the sense that the radiocarbon dating laboratory was only told by the participant archaeologists (MW and MS) that the samples were expected to date to the last 3000 years; the post-A.D. 1996 creation of two samples was not communicated. The only person to know of the relative superimpositioning of samples, and the recency of two of the charcoal samples, was MW.

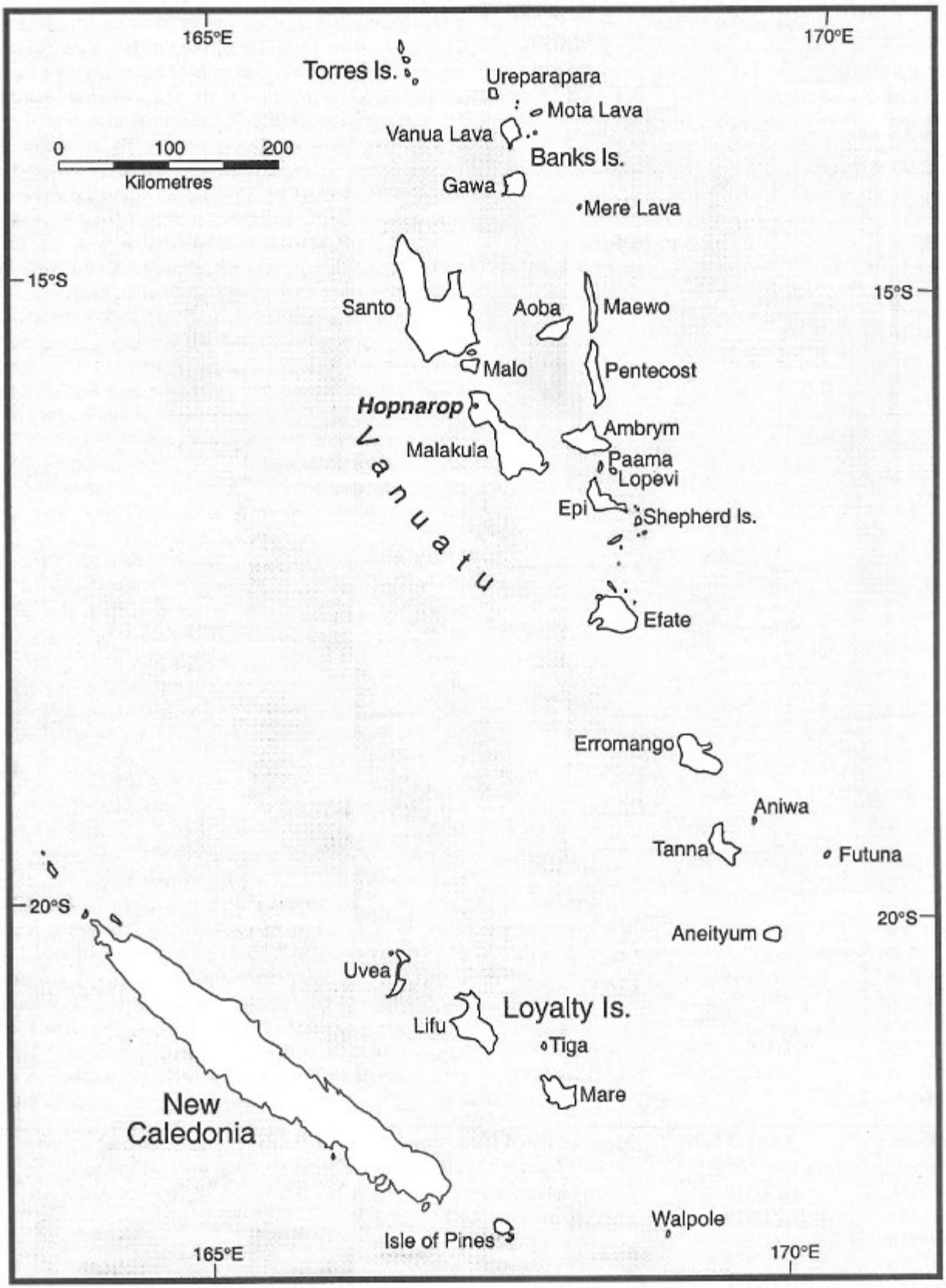


Figure 1. Map of Vanuatu, showing the location of Hopnarop (NW Malakula).

The site

All of the dates reported in this paper come from the limestone cave of Hopnarop (Figure 1). The site is set in the cliff-line of an upraised limestone terrace located some 700 m east of the current coastline, at approximately 40 m ASL. The shelter is likely to be of Holocene

origin, given a known mean rate of uplift of around 3.5 m per 1000 years for the Holocene (Taylor et al. 1980: 5367). When people first arrived in north-west Malakula around 3000 BP (Bedford et al. 1998), Hopnarop would have been situated much closer to the coastline.

Despite late Holocene uplift, much of the rock art at Hopnarop would always have been inaccessibly high. Some of the art can be reached from two ledges that run longitudinally along the northern and southern walls of the cave (about 2.5 m above the ground level), but some occurs on surfaces as high as 3 m to 5 m above the shelter floor. Three black hand stencils were noted on the roof of the shelter, some 7 m above ground level (Figure 2).

Figure 2. Scene looking out of cave towards the coast, photograph taken in 1997. Note hand stencils on the rock surface close to the entrance of the cave.

The rock art of Hopnarop

In 1996, one of us (MW) systematically recorded all of the visible rock art at Hopnarop. This consisted of thirty-three black hand stencils, and thirteen black linear paintings or drawings. A further thirteen images were identified as marks of human origin, but were indistinguishable as either black stencils or paintings/drawings.

In 1997, MW returned to the site, collecting samples from seven hand stencils for radiocarbon dating. Upon arrival, new black hand stencils were discovered on the rock wall (two of these were sampled; the 1997 stencils are clearly absent on the 1996 photographs). The reasons for selecting these particular pictures were three-fold. Firstly, it was agreed in collaboration with the local custodians of the site and with Vanuatu Cultural Centre fieldworker Jimmysan Sanhambath that for this initial dating project we would only collect rock art if it was already partially flaking off the walls, or if the paint residue was sufficiently clumped to ensure that its removal would not expose the underlying rock surface. The hand stencils fulfilled these criteria. Secondly, they also yielded sufficient carbon (charcoal) for AMS dating, increasing the likelihood of a reliable result. And thirdly, the stencils commonly occurred in superimposition with mud-wasp nests, themselves capable of being AMS radiocarbon-dated (Roberts et al. 1997).

Abandoned mud-wasp nests and black paint residue in stratigraphic association were thus collected at Hopnarop in 1997. A total of eighteen nests and seven paint residue samples were collected. A number of the nests were collected away from the rock art with the aim of obtaining examples of the different types of nests present at the site. Of the total sample collection, three nests and five hand stencil samples were subjected to AMS radiocarbon dating.

Sample collection and dating preparation

Mud-wasp nests

The dating of pollen using AMS radiocarbon has been successfully achieved by various researchers (e.g. Gillespie et al. 1991). Pollen is present in mud-wasp nests as a result of wasps visiting flowering plants (Roberts et al. 1997: 698). The nests identified at Hopnarop (belonging to wasp subfamilies Eumeninae and Sceliphron) consist of clusters of mud cells adhered to the side walls and ceilings of the shelter. There are hundreds of nests at the site, ranging from whitish/light-grey mineralised forms (abandoned), to dark-brown fri-

Collection Codes	ANSTO lab. number	Material dated (and where it derived from within the nest)	Dated rock art charcoal samples underlying mud-wasp nests
Hop. 15i	OZD518	pollen (outer portion)	OZD528-529 (Hop. 19 A & 19B)
Hop. 15ii	OZD519	insect (outer portion)	--
Hop. 15iii	OZD520	pollen (inner core)	--
Hop. 15iv	OZD523	insect (inner core)	--
Hop. 3iv	OZD521	pollen (inner core)	OZD525 (Hop. 22)
Hop. 6iv	OZD522	pollen (inner core)	OZD526 (Hop. 24)
			OZD524 (Hop. 20*)
			OZD527 (Hop. 25*)

* *Paint residue samples not in stratigraphic association with mud-wasp nests.*

Table 1. *List of nest samples submitted for dating.*

able nests (still in use). Most of the nests that were within reach, and in stratigraphic association with the rock art, were mid-range with respect to colour and degree of mineralisation.

The nests were collected in such a way as to ensure that minimal damage to the underlying or overlying hand stencils occurred. They were immediately placed in plastic bags, then sealed in plastic containers. The three nests represented by samples OZD518-523 (nest numbers Hop. 3, 6 and 15) (Table 1) were initially prepared for AMS dating by MW. Using sterile razor blades, the nests were divided into inner and outer portions, the logic being that the base of the inner portions of a nest were the first constructed as they were attached to the shelter wall. Any insect remains found within the nests were also collected and labelled according to which portion of the nest they derived from.

Figure 3. *Nest sampled as Hop. 15 and overlying hand stencil. Paint residue from the hand stencil was found overlying the mud-wasp nest.*

The nest sampled as OZD518-520 and 523 (nest number Hop. 15) was specifically selected for testing the integrity of the internal stratigraphy of the nest and superimposed pigment charcoal. This nest was targeted because it had areas of charcoal pigment on the outside of it, and should therefore provide a minimum date for the overlying hand stencil (Figure 3). Pollen and an insect from both the inner and outer portion of Hop. 15 were selected for dating. Nest samples Hop. 3 and Hop. 6 (Figures 4 and 5) overlie hand stencils from where charcoal samples OZD525 and OZD526 (collected as samples Hop. 22 and 24 respectively) derive. The inner portions of Hop. 3 and Hop. 6 were submitted for pollen extraction. The pollen extraction was conducted by Gillian Aitkin at the Department of Archaeology and Natural History, RSPAS, Australian National University.

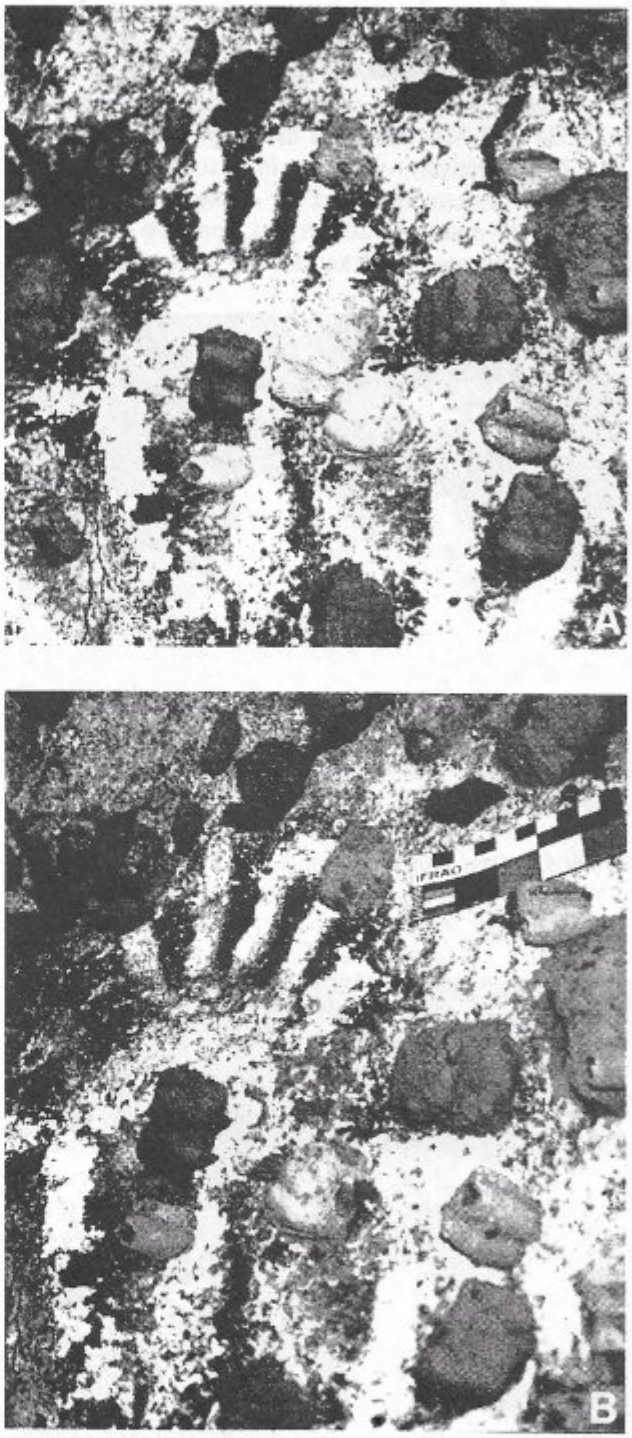


Figure 4. *Hand stencil superimposed by mud-wasp nest reference Hop. 3 (dated as OZD521). A: before nest collection. B: after nest collection.*

Charcoal pigments

Each sample of charcoal was collected using a sterile razor blade and stored in a plastic snap-top sealable phial. Charcoal from five hand stencils was submitted to ANSTO for dating by the ANTARES AMS facility. Three samples derived from the charcoal paint residue of hand stencils that were superimposed by mud-wasp nests (collected as samples Hop. 19, Hop. 22 [OZD525] and Hop. 24 [OZD526]). One of these (Hop. 19) derived

from a hand stencil overlying a mud-wasp nest. It was divided in two and submitted for dating to ANSTO as two separate samples (OZD528-529), acting as an internal check of results. The remaining two samples (OZD524 and 527, collected as samples Hop. 20 and Hop. 25 respectively) were not in stratigraphic association with any nests submitted for dating. Charcoal samples Hop. 19 and Hop. 20 derived from two hand stencils painted between 1996 and 1997 (Figures 6 and 2).

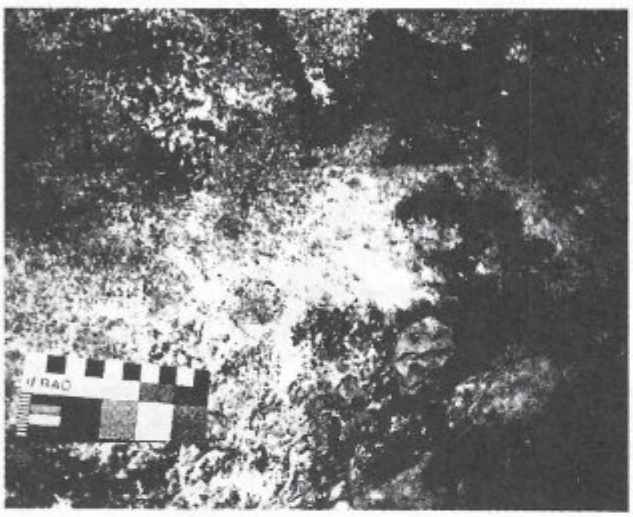


Figure 5. Hand stencil superimposed by mud-wasp nest reference Hop. 6 (dated as OZD522), after nest collection.

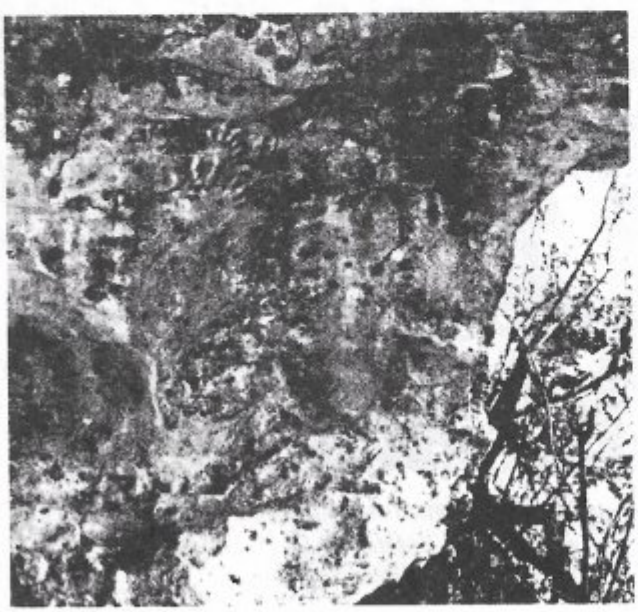


Figure 6. Part of Hopnarop where hand stencils sampled as Hop. 19 and Hop. 20 were later created (see Figure 2). This photograph was taken in 1996 before the stencils were made.

The charcoal and insect samples underwent pretreatment at the ANSTO AMS Centre but pollen extraction was undertaken at the ANU prior to submission. The standard AAA (acid-alkali-acid) pretreatment for the charcoal and insect samples was identical: hot 2M HCl for 30 minutes, 1% solution of NaOH for 1 hour, followed by 2M HCl for 2 hours. This pretreatment removed carbonates, and fulvic and humic acids. Following this all samples, including the pollen, were combusted to CO_2 at 900°C in flowing oxygen and finally reduced at 600°C to graphite using a Fe catalyst (held at 400°C). The graphitisation process was monitored to completion using a pressure transducer, the process typically taking between 6 and 10 hours. Graphite masses were generally in the range of 1.5 to 2.5 mg. At the AMS Centre blanks of varying masses are routinely run to assess the contamination added during the combustion and graphitisation stages. The correction for these contaminations is made in the calculation stages.

The graphite derived from the samples was loaded into cathodes, placed in the 59-position ion source carousel, and measured at the tandem accelerator. The 4+ charge state was selected with the terminal set at 5.2 MV. Fast cycling allowed the quasi-simultaneous measurement of the ^{14}C (in a gas detector) and ^{13}C (in a Faraday cup). Estimates of the machine background (at least 55 000 years) were made to allow the appropriate correction.

Results

The results (Table 2) show that the nests and charcoal pigments are all modern (i.e. dating within the last 200-300 years). The radiocarbon determinations are in all cases in accordance with the relative stratigraphic positioning of samples. They are also consistent with various other expectations as follows:

1. Hop. 19, the charcoal paint residue sampled and submitted in two parts, yielded statistically similar dates. This is a positive indication of the internal consistency of results produced by the ANSTO AMS dating facility.
2. The statistical similarity of the superimposed nest and charcoal pigment dates do not put into question the reliability of either the pollen, insect or charcoal dates. The results are consistent, despite the use of three different carbon-bearing substances.
3. The percentage of modern carbon in two paint residue samples (Hop. 19 and Hop. 20) indicate that the charcoal used to produce the associated hand stencils is unlikely to be older than 1963 (see below). It is known that both of these hand stencils were produced between 1996 and 1997, thus substantiating the post-bomb measurements obtained.
4. The two samples taken from hand stencils known to have been produced before 1996-7 (Hop. 22 and 24) have substantially less modern carbon and were most likely produced within the last 300 years; they show no trace of the bomb pulse, and therefore date to before 1950. As we know that they were produced before Hop. 19 and 20, these results are a further confirmation of the internal consistency of the results.
5. Likewise, the mud-wasp nest and associated insects (Hop. 15) underlying the hand stencil from which

ANSTO Code	Sample ID code	% Modern Carbon pMC and 1σ error		Conventional ^{14}C age yrs BP and 1σ error	
OZD518	Hop. 15i	98.18	±0.59	150	±50
OZD519	Hop. 15ii	116.79	±0.62	post-modern	
OZD520	Hop. 15iii	101.91	±0.53	post-modern	
OZD521	Hop. 3iv	101.07	±0.55	post-modern	
OZD522	Hop. 6iv	100.39	±0.53	post-modern	
OZD523	Hop. 15iv	113.73	±0.56	post-modern	
OZD524	Hop. 20	135.16	±0.65	post-modern	
OZD525	Hop. 22	98.68	±0.56	110	±50
OZD526	Hop. 24	99.13	±0.54	70	±45
OZD527	Hop. 25	no output			
OZD528	Hop. 19 (part A)	127.92	±0.71	post-modern	
OZD529	Hop. 19 (part B)	130.46	±0.67	post-modern	

Table 2. AMS results.

charcoal samples Hop. 19 part A and Hop. 19 part B derive, contained less modern carbon than the charcoal pigment. This is consistent with patterns of superimposition.

6. Concordantly, the charcoal samples from hand stencils Hop. 22 and Hop. 24, which stratigraphically underlie mud-wasp nests Hop. 3 and Hop. 6 respectively, contained less modern carbon than their superimposing nests. Again, there is indication of trend consistency.
7. The radiocarbon dates presented in Table 2 are also similar to an AMS date previously obtained on charcoal from a black hand stencil from the cave site of Velemendi, on the southern Vanuatu island of Erromango: 140 ± 45 BP (calib. 288–0 BP) (OXC 828) (Bedford et al. 1998).

We note that eight of the eleven determinations contain more than 100% modern carbon and therefore belong to the period after A.D. 1950. The other three samples belong to a period shortly before this time. In principle these can be calibrated but they are in a region where one value of the percentage modern carbon (pMC) (or conventional radiocarbon age) gives rise to more than one calendar (calibrated) age. For example, calibration of OZD518/Hop. 15i (pMC = 98.18 ± 0.59) leads to six calendar age (1 sigma) results. Because of this situation, it is an established convention for radiocarbon ages of less than 200 years to be reported as 'modern' (Stuiver and Polach 1977). Our samples OZD518, OZD525 and OZD526 belong to this category. The situation is different where the pMC is greater than 100. Atmospheric testing of nuclear weapons in the late 1950s and early 1960s produced a rapid increase in the ^{14}C concentration (the amount of ^{14}C produced by the two atomic bombs dropped on Japan during World War 2 was relatively small, and no discernible effect has been seen in ^{14}C : ^{12}C ratios). Since the Nuclear Test Ban Treaty in 1963 the concentration has been slowly falling. At the present time (some 35 years after the peak), the atmospheric level is still 10% greater than the 1950 value. We also note that this so-called 'bomb pulse' is markedly different in the Northern and Southern Hemispheres (mainly in peak amplitude). Minor latitude differences also exist in both hemispheres (Hua et al. 1999). In principle, the bomb pulse can be used to calibrate ages between 1950 and 2000, but at present this has to be done manually. We selected an appropriate bomb pulse data set and graphically determined the appropriate calendar age(s) for the measured pMC. The Southern Hemisphere atmospheric data measured in Wellington, New Zealand (Manning and Melhuish 1994), were used. We estimate that in most cases we can determine to about 0.5 year the calendar age associated with the mean value of the measured pMC. The results are shown in Table 3. Note that some samples (with pMC values between 100 and 110) give only one calibrated age; the rest give two ages, one on each edge of the bomb pulse curve.

The calibrated Hopnarop results presented in Table 3 are reassuringly consistent with independent relative (patterns of superimposition) and absolute (known stencilling dates) evidence for the age of the hand stencils. However, we must also recall that the calendar ages, by virtue of the fact that they represent calibrated radiocarbon dates, should be treated within the limits of the statistical probability to which the raw radiocarbon determinations are subject. In addition, there are the 'old wood' and 'old charcoal' problems (David et al. 1999: 109-11), as well as the issue of the timing of carbon assimilation:

> A rock painting made of charcoal cannot be dated by determining the radiocarbon content of the charcoal. What that radiocarbon age-estimate refers to is the probable time when that part of the tree in question ceased assimilating carbon dioxide from the atmosphere. Some time later, the tree died or the branch was removed, some time later again it was carbonized, and the resulting charcoal was used to prepare a paint some time later again. This inevitable chain of events can have taken many millennia, so such a date from charcoal will always be a *maximum* age, a *terminus post quem* (Bednarik 2000: 105).

Thus we are not dating the age of the painting event. The painting event will always be younger than a reliable radiocarbon date.

ANSTO code	Sample ID code	Calibrated (calendar) ages A.D.
OZD518	Hop. 15i	modern
OZD519	Hop. 15ii	1959.5 or 1989.5-1992.5
OZD520	Hop. 15iii	1957
OZD521	Hop. 3iv	1956.5
OZD522	Hop. 6iv	1956
OZD523	Hop. 15iv	1959.5 or 1993.5
OZD524	Hop. 20	1963.5 or 1976.5
OZD525	Hop. 22	modern
OZD526	Hop. 24	modern
OZD528	Hop. 19 (A)	1963 or 1980.5
OZD529	Hop. 19 (B)	1963.5 or 1979

Table 3. Calibration of radiocarbon dates, estimated to nearest 0.5 year.

Discussion

In 1992, Chris Ballard published a locational analysis of the pigment rock art sites of western Melanesia, encompassing the area from Buka and Bougainville Islands in the east to Timor in the west (but excluding sites known from the New Guinea Highlands). The locational variables considered in his analysis included (Ballard 1992: 95):

1. distance of sites from the nearest *current* coastline;
2. topographic contexts of sites;
3. maximum height (in metres) of the location of rock art within sites; and
4. language areas in which sites are located.

Ballard concluded that rock art sites in present-day Austronesian-speaking language areas are predominantly located within one kilometre of the nearest current coastline, are most often coastal cliff sites (including shelters and caves set in coastal cliffs and raised limestone terraces), and include rock art that is for the most part highly visible and situated at least two metres above the ground surface. Ballard proposed a *terminus post quem* of 4000 BP for this so-called 'Austronesian painting tradition', corresponding with the (then) suggested date of movement of Austronesian-speaking people from SE Asia out towards the Bismarck Archipelago. More recent evidence would suggest a date closer to 3500 BP (Bellwood 1998). However, based on evidence for a later colonisation of the southern Papuan coast by Austronesian speakers (where the painting tradition also occurs), and formal similarities between rock art motifs, Bronze Age artefact designs and a local south Papuan pottery style, Ballard favoured a more recent antiquity for the rock painting tradition, one dating to around 2000 BP:

> ... while the date of 4000 BP might provide an upper limit to the appearance of the painted rock art associated with AN-speakers, the few available indirect assessments of the antiquity of the tradition point to a later date of about 2000 BP towards the western and eastern extremities of the sample area. (Ballard 1992: 98)

The site of Hopnarop and its rock art conform to the locational variables defined by Ballard as constitutive of his 'Austronesian' painting tradition. The site is a *coastal cliff site* located in an *Austronesian* language zone, *close to the coast*, and much of the rock art is *inaccessible*. One exception to the general pattern observed by Ballard may be that the rock art is not *highly visible*. Ballard (1992: 97) reported that most of the shelter or cave sites he analysed are cut into cliff faces or upraised terraces and display rock art 'at or near the cave entrance'. Some of the rock art at Hopnarop is situated on surfaces close to the entrance but there is an equally large number of designs towards the centre and rear of the shelter. Another difference between the painted rock art examined by Ballard and the rock art at Hopnarop relates to pigment colour. The Austronesian painting tradition defined by Ballard consists mainly of red painted designs and, indeed, an initial impetus for the locational analysis conducted by Ballard actually derived from observations on correspondences between colour and motif (pers. comm. 1999), with complex red motifs being found not just in rock art assemblages but across a range of media, including pottery and tapa cloth.

In contrast, all of the paintings, drawings and stencils at Hopnarop are black. In fact the majority of pigment rock art thus far recorded in Vanuatu consists of black pigment, and in cases of superimposition, black pigment virtually always overlies red pigment, suggesting black rock art may have been produced more recently than red. That is, black over red is a consistent pattern regionally. The results presented in this paper add further weight to this argument.

However, given that all of Ballard's *primary* locational variables apply to Hopnarop, it is postulated that the rock art at this site may derive from a broader tradition which emerged in western Melanesia and eventually moved eastwards to Vanuatu (with a possible change from red to black through time).

The European contact age of the hand stencils at Hopnarop suggests that the set of locational variables identified as applying to 'Austronesian' rock art by Ballard are also applicable to Vanuatu in modern times. At least some of the rock art found high-up in sites located against cliff faces close to the coast and within an Austronesian language area was produced at a time postdating the arrival of Europeans. It may or may not also have been undertaken during earlier times. Perhaps pigment art underwent relatively few changes over time and through space, to be eventually inherited by the artists or direct ancestors of Hopnarop's artists from their Austronesian neighbours further west. However, a more detailed set of variables may need to be considered to make comparisons between regions and through time more viable. Indeed, Ballard was restricted in his analysis, his data being of limited scope. At the time, Ballard recognised the need to extend his analysis beyond the locational context of the rock art to include the rock art itself, and also to compare the rock art with a range of other media, such as pottery, canoe prows and tapa

cloth.

We thus conclude that all of the rock art dated and presented in this paper was produced within the European contact period. The earliest hand stencils described were produced sometime between the arrival of the first European explorers and 1950, when significant increases in the amount of ^{14}C in the atmosphere (the atmospheric bomb pulse) become detectable by radiocarbon dating. This contact period was a time when Vanuatu underwent major cultural and social transformations. Contacts with neighbouring regions – particularly beyond the archipelago – had long since diminished, and stylistic behaviour had become more regionalised. Customary land ownership was threatened by European settlers, warfare was rife and more intense since the introduction of firearms, people were dislocated from their villages during the sandalwood and blackbirding eras, and Christianity had made inroads into dismantling or transforming former belief structures. It is within these contexts of change that the social production of at least some of Vanuatu's black hand stencils must now be considered.

Further 'direct' dates on the rock art of Vanuatu and elsewhere in Island Melanesia now need to be added to the small corpus of dates currently at hand. David Roe (1992) has obtained a minimum radiocarbon age of around 3000 BP for sub-surface petroglyphs at the site of Vatuluma Posovi (Guadalcanal, Solomon Islands), and Matthew Spriggs has received a recent AMS date (see above) on a charcoal hand stencil from Velemendi, Erromango (southern Vanuatu). Jose Garanger's excavation at Feles Cave (Lelepa, Vanuatu) uncovered a piece of rock wall decorated with engraved cupules and crescent shapes which had fallen and been incorporated into the floor deposit. Garanger obtained a date on charcoal approximately half a metre below the location of the rock wall fragment of 1040 $\pm$ 85 BP (GX-12632). While this provides a maximum date for when the rock wall fell into the deposit, it does not give any clues as to when the rock art itself was produced, which may have been significantly earlier or later (Spriggs and Mumford 1992).

The present paper has aimed to assess our ability to undertake AMS radiocarbon dates on various substances associated with Vanuatu's rock art. Our results in all cases have withstood assessment.

Acknowledgments

We gratefully acknowledge the Australian Institute of Nuclear Science and Engineering, the Australian Museum, and the Australia Research Council for funding various aspects of the Vanuatu Rock art Dating Project. Thanks are also extended to Wallace Ambrose for conducting the SEM analyses of rock art paint residues from Vanuatu, Gillian Aitkin for pollen extraction from the mud-wasp nests, Ian Naumann for identifying the sub-families of mud-wasps present at Hopnarop, Dave Buckle for assistance in the laboratory, and the ANSTO team at Lucas Heights for ^{14}C sample preparation and measurement. Many thanks to Bruno David for assistance with sample selection and for his valuable comments on earlier drafts of this paper. Gary Swinton (Department of Environmental Science, Monash University) and Tam Morris are thanked for assistance preparing Figure 1. Stuart Bedford and Chris Ballard are also thanked for their helpful comments on an earlier draft. Many thanks to the Sanhambath family, especially Jimmysan and Sylvie, for accommodation and logistical help, and to the chiefs of Espiegles Bay for permission to work at Hopnarop. We are especially grateful to Ralph Regenvanu, the Vanuatu Cultural Centre, and the government of the Republic of Vanuatu for supporting this research. Special thanks to Kylie Brass for assistance in the field. Finally, thanks are due to the AURA referees of this paper, which presents research output from the ANU Centre for Archaeological Research.

Meredith Wilson
Department of Archaeology and Natural History
Research School of Pacific and Asian Studies
The Australian National University, ACT 0200
Australia
Meredith.Wilson@anu.edu.au

Professor Matthew Spriggs
Department of Archaeology and Anthropology
A.D. Hope Building
The Australian National University, ACT 0200
Australia
Matthew.Spriggs@anu.edu.au

Dr Ewan Lawson
ANTARES AMS Centre
Physics Division, ANSTO
PMB 1
Menai, NSW 2234
Australia
eml@ansto.gov.au

Final MS received 8 December 2000.

Résumé. *L'article concerne onze datations du radiocarbone à l'AMS pratiquées sur des substances contenant du carbone et ayant une relation avec des figures rupestres. Les dates proviennent de dessins/peintures au charbon de bois, de pollen recueilli dans des nids de guêpes abandonnés, et d'insectes piégés dans le coeur de nids de guêpes qui étaient à la fois sous-jacents à des peintures de mains négatives et en superposition sur d'autres. Les résultats sont discutés à la lumière de recherches antérieures qui mettent en évidence une possible tradition 'Austronésienne' d'art rupestre en Mélanésie occidentale.*

Zusammenfassung. *Diese Arbeit legt elf AMS Radiokarbon Daten vor, die von Kohlenstoff-führenden, auf Felskunst zu beziehenden Substanzen bestimmt wurden. Daten wurden von Holzkohle-Malereien bzw. Zeichnungen erhalten, von in verlassenen Nestern von Schlamm-Wespen anwesenden Pollen, und von Insekten, die im Kern von Schlamm-Wespen Nestern über und unter Handnegativen eingeschlossen waren. Ergebnisse werden angesichts vorausgehender Forschung diskutiert, die eine mögliche 'austronesische' Felskunst-Tradition für West-Melanesien identifiziert.*

Resumen. *Este artículo informa sobre once fechas de radiocarbono AMS obtenidas de substancias conteniendo carbón relacionadas con arte rupestre. Las fechas fueron obtenidas de pinturas/dibujos de carbón de leña, del polen presente dentro de nidos de barro de avispas abandonados, y de insectos atrapados dentro de los nidos de barro de avispas tanto subyacentes como sobre los negativos de manos. Los resultados son discutidos sobre la base de investigaciones previas que identifican una posible tradición de arte rupestre 'Austronesia' para el Oeste de Melanesia.*

REFERENCES

BALLARD, C. 1992. Painted rock art sites in Western Melanesia: locational evidence for an 'Austronesian' tradition. In J. McDonald and I. Haskovec (eds), *State of the art. Regional rock art studies in Australia and Melanesia*, pp. 94-106. Proceedings of Symposium C, Rock art studies in Australia and Oceania. Occasional AURA Publication 6, Australian Rock Art Research Association, Melbourne.

BEDNARIK, R. G. 2000. Some problems with 'direct dating' of rock-pictures. In G. K. Ward and C. Tuniz (eds), *Advances in dating Australian rock-markings*, pp. 104-109. Occasional AURA Publication 10, Australian Rock Art Research Association, Melbourne.

BEDFORD, S., M. SPRIGGS, M. WILSON and R. REGENVANU 1998. The Australian National University-National Museum of Vanuatu Archaeology Project: a preliminary report on the establishment of cultural sequences and rock art research. *Asian Perspectives* 37(2): 165-93.

BELLWOOD, P. 1998. The archaeology of Papuan and Austronesian prehistory in the northern Moluccas, eastern Indonesia. In R. Blench and M. Spriggs (eds), *Archaeology and language II: correlating archaeological and linguistic hypotheses*, pp. 128-140. Routledge, London.

DAVID, B., R. A. ARMITAGE, M. HYMAN, M. W. ROWE and E. LAWSON 1999. How old is north Queensland's rock art? A review of the evidence, with new AMS determinations. *Archaeology in Oceania* 34(3): 103-20.

GILLESPIE, R., J. W. MAGEE, J. G. LULY, E. DLUGOKENCKY, R. J. SPARKS and G. WALLACE 1991. AMS radiocarbon dating in the study of arid environments: examples from Lake Eyre, South Australia. *Palaeogeography, Palaeoclimatology, Palaeoecology* 84: 333-8.

HUA, Q., M. BARBETTI, M. WORBES, J. HEAD, and V. A. LEVCHENKO 1999. Review of radiocarbon data from atmospheric and tree ring samples for the period 1945-1997 AD. *IAWA Journal* 20(3): 261-83.

MANNING, M. R. and W. H. MELHUISH 1994. $^{14}CO_2$ record from Wellington. In T. A. Boden, D. P. Kaiser, R. J. Sepanski and F. W. Stoss (eds), *Trends 93 - A compendium of data on global change*, pp. 173-202 and online updates (Online Trends). Carbon Dioxide Information Analysis Centre, Oak Ridge National Laboratory, Oak Ridge, TN. ORNL/CDIAC-65.

ROBERTS, R., G. WALSH, A. MURRAY, J. OLLEY, R. JONES, M. MORWOOD, C. TUNIZ, E. LAWSON, M. MACPHAIL, D. BOWDERY and I. NAUMANN 1997. Luminescence dating of rock art and past environments using mud-wasp nests in northern Australia. *Nature* 387: 696-9.

ROE, D. 1992. Rock art of north-west Guadalcanal, Solomon Islands. In J. McDonald and I. Haskovec (eds), *State of the art. Regional rock art studies in Australia and Melanesia*, pp. 107-127. Occasional AURA Publication 6, Australian Rock Art Association, Melbourne.

SPRIGGS, M. 1997. *The Island Melanesians*. Blackwell, Oxford.

SPRIGGS, M. and W. MUMFORD 1992. Southern Vanuatu rock art. In J. McDonald and I. Haskovec (eds), *State of the art. Regional rock art studies in Australia and Melanesia*, pp. 128-143. Occasional AURA Publication 6, Australian Rock Art Association, Melbourne.

STUIVER, M. and H. A. POLACH 1977. Reporting of ^{14}C data. *Radiocarbon* 19(3): 355-63.

TAYLOR, F. W., B. L. ISACKS, C. JOUANNIC, A. L. BLOOM and J. DUBOIS 1980. Coseismic and Quaternary vertical tectonic movements, Santo and Malakula, New Hebrides Arc. *Journal of Geophysical Research* 85(B10): 5367-81.

WAHOME, E. 1998. Ceramics and prehistoric exchange in the Admiralty Islands, Papua New Guinea. Unpubl. Ph.D thesis, Australian National University.

RAR 18-559

CARA launched

The Cave Art Research Association (CARA) is now operational and will produce its first newsletter in the course of 2001. This international specialist group will focus on the study, analysis, conservation and management of rock art occurring in limestone caves, and on any other subject closely connected with an understanding of cave art. Membership in CARA is free, but members of CARA are required to join AURA or be current members of AURA. Naturally they receive *Rock Art Research* and the *AURA Newsletter*, in addition to their own journal. CARA invites AURA members to join the association as founding members.

Specialists in cave art research are invited to submit articles for publication. Topics can range widely, including all aspects of cave art, its preservation and management, speleo-climate, weathering of cave interiors, processes of speleothem formation, animal markings in caves, cultural uses of caves, and similar topics. The requirements for manuscripts are essentially the same as for *RAR*, and papers may be submitted to the *RAR* Editor.

Elfriede K. Bednarik
President of CARA

KEYWORDS: *Rock art - Geoglyph - Petroglyph - Interpretation - Metrical analysis*

THE GEOGLYPH OF LA RUEDA DEL INDIO, CHIRGUA, VENEZUELA

Bernardo Urbani and Franco Urbani

Abstract. The La Rueda del Indio geoglyph is located near the town of Chirgua, north-central Venezuela. It is the only geoglyph known from northern South America. A topographic survey of the steep hill where it is located was carried out, and detailed measurements of its shape and the cross-sections of the grooves were taken. Images similar to the geoglyph occur in several petroglyphs of central Venezuela. The geoglyph is embedded in the beliefs and traditions of the region's inhabitants, it is respected and it does not seems to be endangered as long as the prohibition of walking on it is enforced by the landowners.

Introduction

The geoglyphs in the Americas are distributed in two clusters, one in South America —northern Chile and the Nazca region in southern Peru (e.g. Isbell 1978; Grodzicki 1992; Briones and Cachama 1987; Cachama and Briones 1996; Clarkson 1997), with thousands of figures — and a second cluster in North America, in south-western U.S.A. and north-western Mexico (Hayden 1967; Johnson 1986; Whitley 1996; W. B. Murray pers. comm. 2000). The two clusters are separated by a distance of about 7500 km. Between them there is one single geoglyph, and the only one from northern South America (Figure 1), called 'La Rueda del Indio' ('The Indian Wheel'). Located in north-central Venezuela, it is almost unknown in the mainstream archaeological literature, and not mentioned in the recent review *Geoglyphs in the Americas* (Clarkson 1997).

La Rueda del Indio was carved into the soil and weathered rocks of a steep hillside of a region that used to be well forested, with an annual precipitation of 980 mm, even though the specific site of the figure has savanna-type vegetation, probably of anthropogenic origin by continuous burning through time. In contrast other geoglyphs of the Americas are located in arid or semi-arid regions and were made by removing or adding rocks. In all cases there are very few archaeological remains associated with American geoglyphs. The absence of other reported geoglyphs in such a wide region, from southern Peru to northern Mexico, is perhaps more a bias due to the vegetation cover that makes them difficult to find than indicating a real lack of them.

On 25 and 26 October 1947 an expedition of the Sociedad de Ciencias Naturales La Salle of Caracas, headed by the archaeologist José María Cruxent, discovered and studied the geoglyph (Cruxent 1948). On 21 March 1948 the study and survey were continued, and the landowner provided some stone and pottery artefacts he had excavated from the centre of the geoglyph (Cruxent 1949). Further short mentions by Reva (1948), Waisbard and Waisbard (1954), Cruxent (1955), Straka (1975, 1978), López de Ceballos (1974, 1975), Delgado (1977), Sujo Volsky (1975, 1976), Valencia and Sujo Volsky (1987) and García Fernández (1991) provide little additional information, mainly repeating the content of Cruxent (1949). Some authors have suggested that the geoglyph represents an anthropomorphous figure (Cruxent 1949, 1955; Straka 1975; Delgado 1977).

The geoglyph is located on the left margin of the Chirgua River, in the private property of the Cariaprima Ranch, near the town of Chirgua, Carabobo state, Venezuela (Figure 1). The figure was made on a uniform hillside (Figure 2) and the grass vegetation was burnt one month before our fieldwork (Figure 3).

In our work we surveyed the shape and dimensions of the figure, measuring detailed cross-sections of the grooves' shapes that could serve in the future to monitor its possible degradation by erosion.

Methods

An area of 180 m × 170 m containing the geoglyph was surveyed using a plane table at a scale of 1 : 500 with 5 m contours (Figure 2). The procedure used to measure the figure was as follows: (1) a white string was placed along the deepest part of the grooves; (2) a 60-m-long measuring tape was extended along a straight line following the symmetry line of the figure; (3) with reference to the measuring tape and each 2 m down-slope, the perpendicular distances between the tape and the strings were measured, obtaining the X-Y co-ordinates of 77 points used to reconstruct the figure (Figure 4).

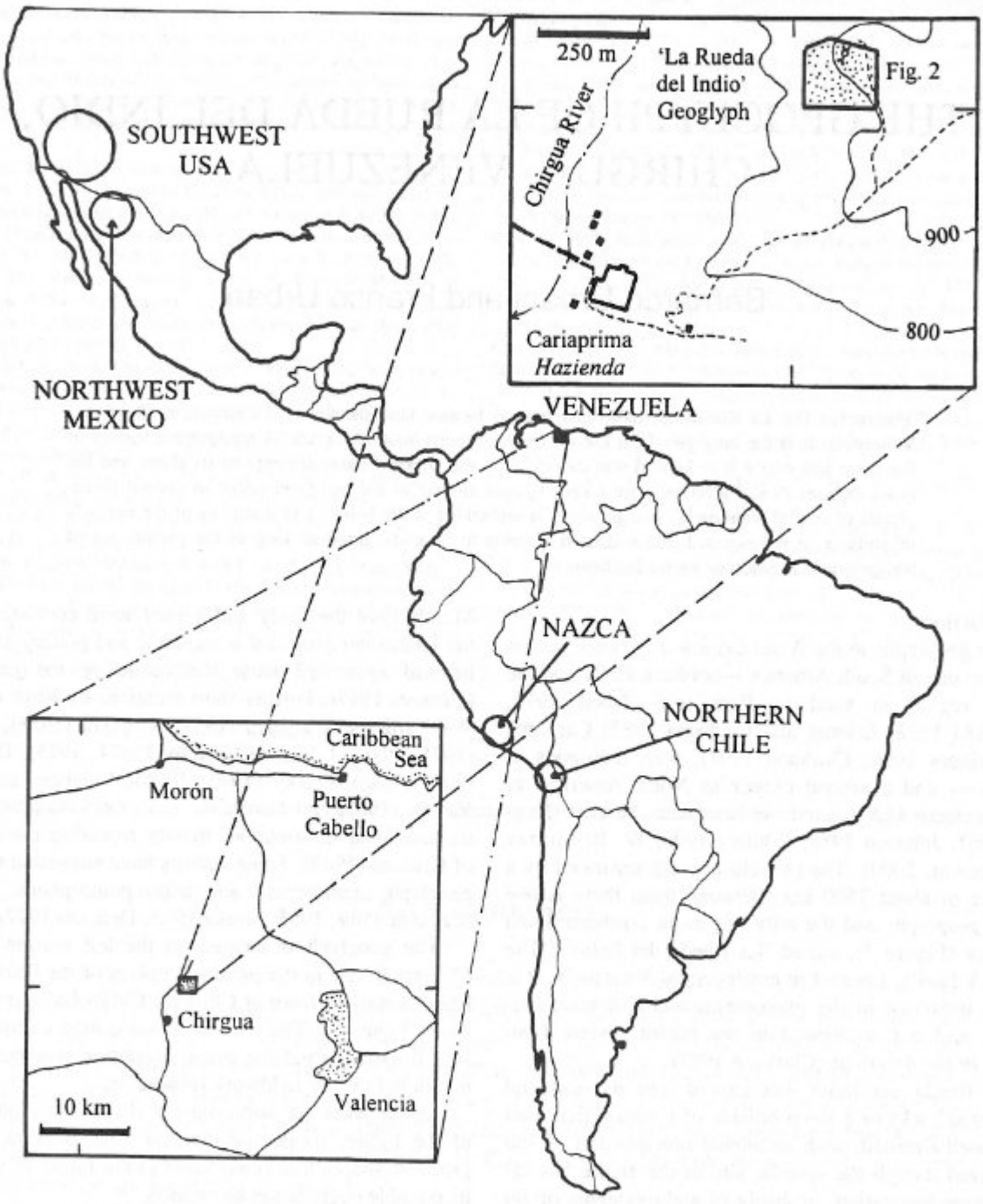
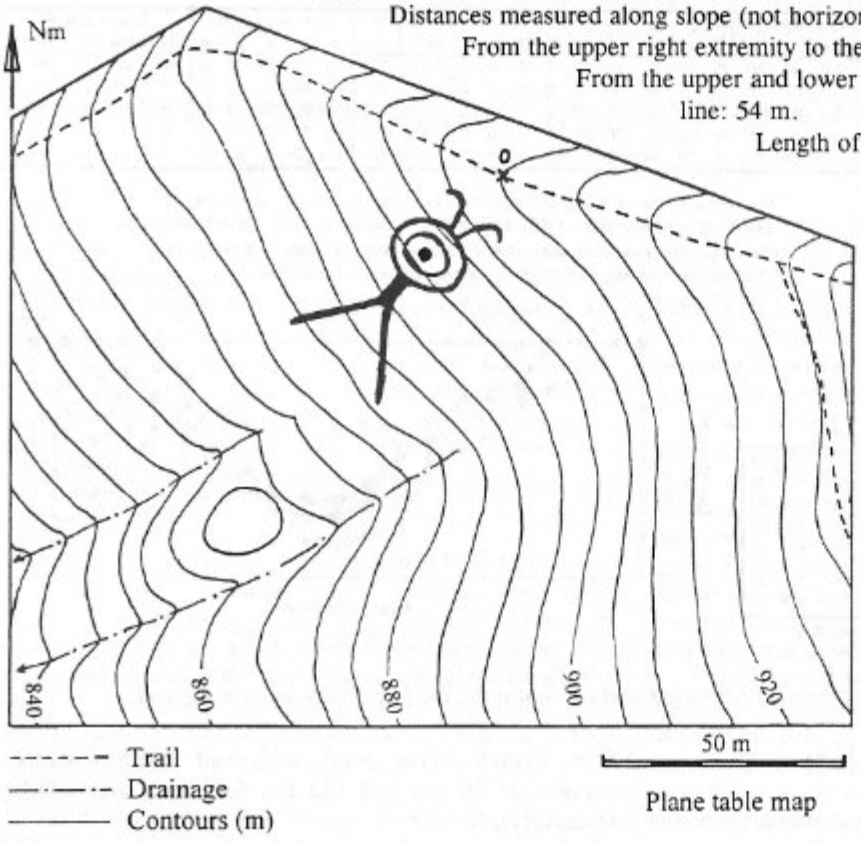


Figure 1. Location maps.

The groove cross-sections were measured as follows: (1) to a 3-m-long topographic staff, a 2-m-long measuring tape was attached with adhesive tape so that the 1 m mark was in the middle of the staff; (2) the staff was placed on the ground perpendicular to the spatial development of the groove, so that its central point (1 m mark) was exactly above its deepest point (string previously placed); (3) direction and inclination of the staff were measured; (4) the depths of the groove were measured each 10 cm, with an average of 13 measurements per section. A total of 42 sections were characterised and parameters such as width and area were computed, and graphs of each section were plotted (Table 1).

Results

The geoglyph has a central part with three concentric circles, and above them two arched and asymmetric extremities. Below the circles there is a wide body, followed by two lower, straight and divergent extremities. Some measurements are:



Symmetry axis: azimuth 211° (magnetic north 1997) and a slope of 39° to the south-west.
Distances measured along slope (not horizontal projections):
From the upper right extremity to the lower left extremity: 57 m.
From the upper and lower extremities projected in the symmetry line: 54 m.
Length of upper left extremity (ULE): 11 m.
Length of upper right extremity (URE): 12.5 m.
Diameter of external circle (EC): 17.5 m.
Diameter of intermediate circle (MC): 10.5 m.
Diameter of inner circle (IC): 3.2 m; this is an approximate dimension due to the fading of the circle and the nearness of the central excavation.
Central hole: approximate 2.3 m diameter, with an escarpment of 1.5 m in the part of higher elevation. Treasure hunters did this hole.
Body: measures 6 m × 3 m and has irregular cross-sections due to erosion.
Length of lower left extremity (LLE): 22 m.

Figure 2. *Plane table map of the hillside with the geoglyph. The co-ordinates of the site are Longitude 68°10'4" W and Latitude 10°16'4" N.*

Figure 3. *Photograph of the geoglyph. The external circle has a diameter of 17.5 m.*

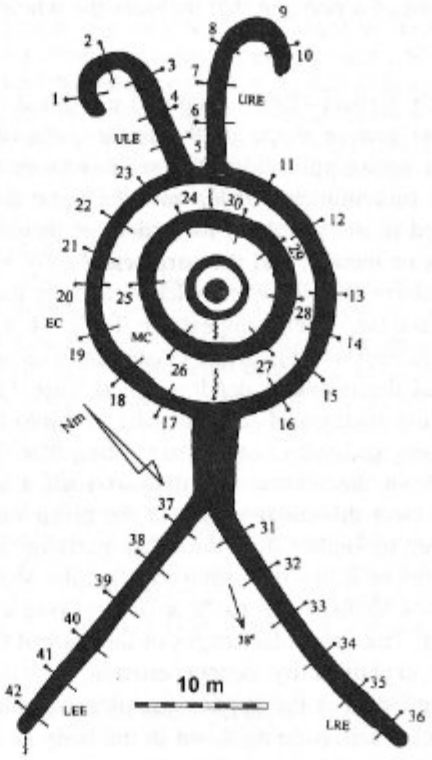
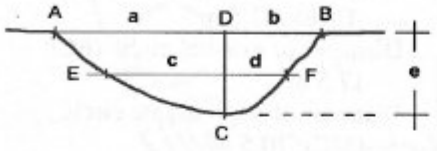


Figure 4. *Image of the geoglyph showing where groove cross-sections were measured. Wavy arrows show directions of drainage. Data of sections 1 to 5 are shown in Table 1.*

Excerpt from Upper Left Extremity (ULE)

Sec.	Azi-	Incli-	<--	Cross-sections depths (dm)																	-->	Area	W.	Groove paramet.					Shape indexes				
#	muth	nation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	(m^2)	(cm)	a	b	c	d	e	SY	SH%	SH^a	VS	FI
1	333	10 S	0	0	0	0	11	18	25	27	32	**37**	36	35	30	26	24	13	7	0	0	0	0,320	125	55	70	40	60	37	86	24	128	86	33
2	183	18 S	0	0	0	10	13	17	23	27	34	**37**	37	36	20	16	9	0	0	0	0	0	0,279	120	60	60	35	30	37	98	30	119	97	40
3	280	16 W	0	0	0	9	11	16	20	25	38	**41**	40	39	34	23	15	13	8	0	0	0	0,332	130	60	70	30	40	41	90	30	117	97	41
4	295	10 W	0	8	11	12	13	14	19	23	36	**41**	41	38	33	30	21	20	15	7	0	0	0,382	160	80	80	25	60	41	85	25	124	103	33
5	185	15 W	0	9	10	14	21	25	28	43	45	**48**	46	38	30	24	19	17	12	7	0	0	0,436	160	80	80	40	40	48	100	30	118	100	40



Representations of groove cross-sections of ULE -->

Groove parameters a, b, c, d and e are shown in diagram at left. W.: width (a+b)
Shape indexes from Urbani (1998): SY: symmetry index, SH%: sharpness index in % units,
SH^a: sharpness index in degrees units, VS: V-shape index, FI: flatness index.
The complete table with 46 cross-sections is available from the authors.

Averages of cross-sections parameters for each sector

S	#	Area	W	a	b	c	d	e	SY	SH%	SH^a	VS	FI
ULE	5	0,350	139	72	67	47	33	41	92	28	121	97	37
URE	5	0,326	142	76	66	50	41	36	92	23	131	93	31
EC	13	0,268	128	67	61	46	39	32	94	22	133	92	30
MC	7	0,286	127	70	57	46	37	34	90	25	128	93	33
LRE	6	0,324	133	73	60	47	34	39	90	27	123	94	37
LLE	6	0,325	134	83	52	50	22	43	79	32	111	105	42

S: segment. #: number of sections measured. Area in m^2

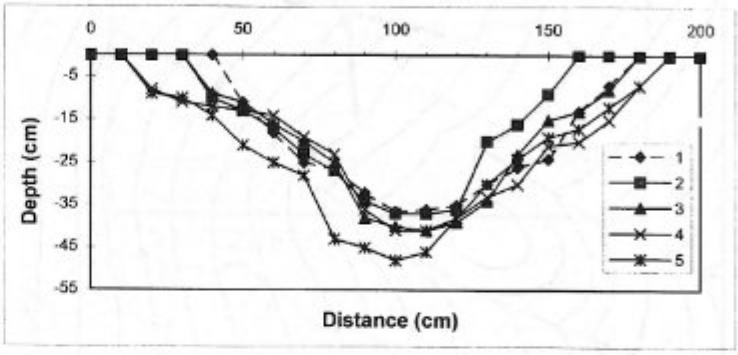


Table 1. *Example of cross-section measurements and calculations, La Rueda del Indio geoglyph.*

Length of lower right extremity (LRE): 23 m.
Angle between lower extremities: 76°.
Elevation of upper right part: 902 m above sea level (asl).
Elevation of lower left part: 878 m asl.
Surface area of a polygon that includes the whole figure: 299 m^2.

Recently Urbani (1998) proposed a method to characterise the groove shape of the linear parts of petroglyphs. In such applications the work was done on a millimetre to centimetre scale, now the same technique was applied to the geoglyph for orders of magnitude of decimetres or metres, and the parameters *a*, *b*, *c*, *d* and *e* and the shape indexes were calculated using the cross-sections data (an excerpt appears in Table 1). Utilising such parameters, a multivariate cluster analysis was performed and the resulting dendrogram (Figure 5) shows that the cross-sections of segment LLE fall into the left-hand clusters and sub-clusters, suggesting that they are different from the others. On analysis such a segment shows the most dissimilar values of the given variables, either lower or higher than the other parts of the geoglyph, therefore it has less symmetry, greater sharpness, is closer to a V-shape and has low flatness (see averages in Table 1). The dissimilar shapes of this part of the geoglyph are explained by deeper erosion by rainwater, which is collected at the upper extremities, reaching the central circles and draining down to the body of the figure. From here almost all the water is channelled through the LLE, eroding more deeply this part of the figure.

Cruxent (1949) mentions groove depths of 20 to 40 cm and widths of 100 to 150 cm, while Waisbard and Waisbard (1954) report that the depth is about 35 cm. These figures agree well with our measurements (averages of 36 cm and 132 cm for depth and width respectively).

The hill has many outcrops of quartz-mica schist ranging to amphibole-bearing rocks, all belonging to the Nirgua Phase of the Mesozoic. The rocks are very weathered but their foliation surfaces are well discernible, forming part of a rather hard sediment almost devoid of A and B-horizons. The grass vegetation is frequently burnt during the dry season as happened in 1997 during fieldwork. In the rainy season any loose fine fraction of the soil is washed down the slope, while the roots of the grass help prevent deeper and faster erosion. Cruxent (1949) mentioned finding small soil pillars of 20 cm height, protected at the top by some rock fragments, showing the degree of erosion. Certainly, since the time of carving the geoglyph a significant thickness of soil must have been eroded, but at any rate its shape is maintained since the water acts preferentially in the deeper parts of the grooves, keeping them well visible and probably deeper and wider than when they were made.

On the same hillside, about 65 m in horizontal distance to the south-west and 30 m below the geoglyph, there is a small rounded hill with a flat top (Figure 2), which according to the oral traditions of the current inhabitants is the place where the Indigenes met for their rituals.

Natural erosion has affected the grooves, acting in some places as water courses, but human action has also degraded the geoglyph, as in the case of the central hole that was excavated decades ago by the grandfather of the current landowner, 'searching for treasures', and there are also some small ditches originating from enlarged trails in its middle section (arrows in Figure 4).

SPECIAL REPORT

Damned dams again: the plight of Portuguese rock art

ANDREA ARCÀ, ROBERT G. BEDNARIK, ANGELO FOSSATI, LUDWIG JAFFE and MILA SIMÕES DE ABREU

Portugal's most important rock art finds of the last three decades all have a rather unfortunate association with dam projects. Considering that there are hydro-electric and holding reservoirs on almost all the major rivers in Portugal, it was almost inevitable that rock art would be affected by some of these projects. The history of this association, which usually proved fatal for the rock art, is reviewed here. It provides a lesson to those trying to preserve rock art. Attention is given to the sociology of state-funded agencies charged with the protection of archaeological resources and rock art.

The Fratel dam on the river Tagus

In the early 1970s, a group of students from Lisbon University, alerted by a local ethnologist, found the Tagus valley rock art area (Serrão et al. 1972). Like all similar finds, the local population knew about the engraved figures before their 'discovery'. Although the group was searching for Palaeolithic sites, they soon knew that they had come across one of the most important rock art areas on the Iberian Peninsula — forty kilometres of river bedrock with tens of thousands of petroglyphs.

The Fratel dam flooded most of the engraved surfaces in 1974. Portugal was still a dictatorship then, so any notion of preventing the impending destruction was out of the question. Sponsored by the *Calouste Gulbenkian Foundation* of Lisbon, Eduardo Cunha Serrão and the students did what they could to record the site. They followed advice from experts of the time, such as Leroi-Gourhan and Emmanuel Anati, and made latex moulds of dozens of surfaces for future studies. These were still in reasonably good condition last time one of us (MSA) saw them in the National Museum of Archaeology in Lisbon.

A complete inventory on this material remains to be done thirty years later, perhaps due to its overwhelming quantity or perhaps because researchers preferred to squabble about chronology instead of providing empirical data. Based almost entirely on style, some writers suggest a long sequence starting in the Epi-Palaeolithic period (Anati 1974; Gomes 1987) while another propounds a shorter one, starting in the Bronze Age (Baptista 1981).

The Pocinho dam on the river Douro

Portugal freed itself from dictatorship in 1974 and blossomed into a full democracy in the 1980s. Even so, environmental impact studies continued to be very superficial and none involved a special archaeology survey. An important piece of news reached the academic world in 1981 — Susana Oliveira Jorge and a group of other archaeologists from Porto University published the 'horse' motif of Mazouco (Jorge et al. 1981). This engraved Palaeolithic-style figure (but see Baptista 1983: 63), located over a dozen metres above the Pocinho dam reservoir, had escaped the inundation.

When engraved rocks were found in Vale da Casa in 1982, the Pocinho dam was practically complete. Baptista's (1983) description does not make it clear how many rocks were flooded by this project.

The river Côa dam

The petroglyphs of Mazouco and Vale da Casa, 50 km apart, should have demonstrated an urgent need for an intensive survey of the area. Francisco Sande Lemos expressed this idea at the end of the 1980s in a preliminary survey of the upper Côa valley (impact studies became compulsory when Portugal joined the European Union). His report noted the existence of four painted rockshelters and some petroglyphs, and recommended further studies in the Côa valley area.

In late November 1994, the world was both surprised and shocked at news emerging about the Côa valley. Written evidence now confirms that some officials of the Portuguese Heritage Institute (IPPAR) and the state-owned electricity corporation (EDP) had already seen some of the engraved rocks in 1992. Knowledge of the rock art was not published or presented in any archaeological forum. The information remained concealed in internal reports of IPPAR while works for the Côa dam went ahead.

Recent history would have repeated itself had it not been for a campaign led by IFRAO members, with the extraordinary support of the international community and a Portuguese movement to oppose the dam (Bednarik 1995). Letters from around the world asked for an international commission to establish the dimension and importance of the finds. That pressure made a difference. Newspapers, magazines and TV disseminated images of the carved animal figures all around the world.

In the first months of 1995, local people led rock art researchers to a series of previously unknown finds, both within and above the intended reservoir area, as well as in the parallel valleys of Vale de Cabrões and Vale de Vermelhosa. By the end of the summer of 1995, fifteen sites with thousands of figures had been examined. It became clear that the Mazouco horse, the figures of Vale da Casa along with those of Siega Verde, a rock art site across the border with Spain, were just the tip of an iceberg.

In November 1995, a newly elected government suspended the Côa dam project and the valley became a park. However, subsequent developments disappointed the world community of rock art researchers. Controversies concerning the management of the park were reflected in reports of severely detrimental management measures (Jaffe 1996) and 'academic xenophobia' (Swartz 1997a; Swartz 1997b). Deposits were churned up haphazardly in a fruitless search for concealed petroglyphs, and engraved surfaces were scrubbed and cleaned with 'wooden tools and river water' (Zilhão 1996), and with chlorides.

Despite all these management shortcomings the Côa rock art area secured UNESCO World Heritage listing in December 1998, after the dam had been formally abandoned in June 1997.

The Laranjeira dam on the river Sabor

When the new Prime Minister, António Guterres, announced the suspension of the Côa dam in November 1995, he pacified dam lobbyists by saying that energy and water policies were not at risk. The Côa project was going to be replaced by the Laranjeira dam on the river Sabor. Already in mid-1995, i.e. well before the general election in October 1995, the construction authority had mentioned this alternative site to one of us (RGB). The Laranjeira project is part of a dam-construction

strategy formulated roughly half-a-century ago, during the time of Portugal's dictatorship. According to government proposals, the project has a budget of around US$210 million to build a wall 130-150 m high. By comparison, the Côa wall would have been 137 m high.

According to the impact study report (Coelho and do Rosário Partidário 1999), several rock art sites are going to be destroyed if the Sabor dam construction proceeds. News of petroglyphs on the Sabor featured in a front-page headline on 28 June 1997 in the *Expresso*, Portugal's most important weekly newspaper. The headline, '*Barragem que substitui Côa também tem gravuras*' ('Dam that substitutes the Côa also has engravings') left no doubt that it is not scientific novelty alone that grabs attention (Jaffe et al. 1997).

Details in the press were contradictory. One article mentioned a single 'Palaeolithic-style' figure but João Zilhão, the President of the Portuguese Archaeological Institute (IPA), told the *Expresso* that 'several engravings' had been discovered, but said nothing about their style and possible chronology. The *Expresso* reported that the petroglyphs are identical to those of the Côa, Mazouco and Siega Verde sites. In the *Público* the same day (28 June 1997), Zilhão said that, for now, the quantity and quality of the engravings cannot be compared to those in the Côa valley.

We have no knowledge of any scientific report about the Sabor rock art having been presented anywhere, not even during one ideal opportunity — the 1998 IFRAO Congress held in Vila Real, Portugal. The few pictures published so far show preliminary but substantial earthworks in the dam construction area. The President of IPA and other officials confirmed that studies are being made in the Sabor valley and everything will be done to protect the petroglyphs. There is even talk of cutting engraved rocks and moving them to a museum in the nearby town of Torre de Moncorvo. This is reminiscent of the statements made by various state officials and politicians during the 1994-95 campaign to save the Côa valley. Yet again the archaeological study by Ricardo Abrantes Teixeira and Miguel Aerosa Rodrigues was made without any rock art specialist taking part. The non-technical report confirms the existence of several archaeological sites classified as being of exceptional cultural value. However, the full report made by *Ecosistema* and *Agripro Ambiente* states that 191 sites were located in the valley, of which 135 will be flooded.

On 7 March 2000, the *Público* reported that the Minister of the Environment is going to approve construction of the Laranjeira dam. According to the plan presented in 1997, construction should have started in 1999 and the reservoir should be full by 2005. The delay provides time to reflect. Environmentalists are opposed to the scheme. A now privatised EDP, the electricity corporation, may yet recognise the viability of alternative forms of energy rather than waste more resources on obsolete dam strategies. Perhaps proper studies can still be made in the Sabor valley, but it is not encouraging that there has been no response to a letter from the IFRAO Convener to the President of IPA (22 March 2000) asking for his assurance that he would safeguard the preservation of the Sabor rock art.

The Alqueva dam on the river Guadiana

A few years ago work on the Alqueva dam, on the southern part of the River Guadiana, began in earnest. No rock art would be submerged by this reservoir, according to António Carlos Silva, co-ordinator of the project's archaeology studies (part of EDIA, Empresa de Desenvolvimento e Infra-estruturas do Alqueva, SA). However, he also admits that there are several previously known or recently discovered engraved rocks in the area. We understand that most of these rocks are decorated with cupules. The dam will be completed in 2001 but archaeological studies and publication are expected to continue until 2003.

The project is partly funded by the European Union (ECU376.7 million, or 53.9% of the total expenditure), the remainder being provided by the national authorities, the private sector and other bodies. Each EU citizen will through taxes contribute about one Euro to the cost of the Alqueva dam — and thus to the destruction of one of Europe's finest concentrations of rock art. Moreover, the dam has been condemned as dangerous and purposeless by all well-informed environmental NGOs (non-governmental organisations). The dam will inundate 250 km^2 in the Alentejo (southern Portugal) and Extremadura (Spain) regions, holding 4150 hectometres of water and irrigating 110 000 ha of land. It will be the largest European artificial lake, 80 km long and 96 m deep. The project was first mooted in 1952, when there was an intent of building a new industrial city. That city has never been built. The second aim of the original project was to intensively irrigate the Alentejo region, yet less than 40% of the irrigation projects already realised in the area are being used. The project's third aim was to produce electricity, yet the dam will contribute only 0.18% of the total Portuguese electricity production, and the system's pumping stations will consume more electricity than it can produce.

With the new availability of European finance the project has been rekindled. All parliamentary political parties of Portugal support construction of the Alqueva dam, pointing either to the great development of infrastructures (680 km of main irrigation channels, 4400 km of secondary irrigation channels, 114 pumping stations, 1100 km^2 irrigated), or looking at the dam as a means of preventing emigration and helping poor farmers. The project has been approved by the European Union on 28 July 1997 (European Regional Development Fund programme N. 97.12.09.001, period covered 1997-99), as a 'specific integrated development program for the Alqueva area (PEDIZA)'. It is listed as Priority 4 ('Strengthening the regional economic base') of the *Community Support Framework for Portugal (1994-1999 period)*. A second stage (ECU199 million) is already foreseen.

In 1997 the project met with fierce opposition from environmental organisations. Martin Hiller, WWF President, described the decision as an ecological catastrophe. He pointed out that the filling of the reservoir depends mainly on Spain, which controls most of the catchment areas, and it is difficult to think that in time of drought Spain would concede its water to fill a Portuguese dam. Despite all oppositions, and despite the fact that even in the European Commission doubts arose about the project, Mme Monika Wulf-Mathies, commissioner of regional policies, approved the European funding, assuring that all the preventative measures will be taken 'to save the environment'. How to save an environment while flooding it is, however, difficult to explain.

Environmental concerns

Strong concerns about the region's fauna and flora have been detailed and documented. Although the ICCRA (the Portuguese ministerial commission retained to manage the financial assistance of the Alentejo region) cites the importance of 'preserving and promoting the natural heritage by saving the natural environment with particular regard to the bio-diversity', the project does not comply with relevant directives. The Guadiana valley comprises four biotopes, of the total of nine recognised by the Habitat Direction of the European Union, that would be destroyed. It is the habitat of many threatened species (otter, white and black stork, Iberian imperial eagle —

the latter two are threatened by extinction). It includes the second-largest western European colony of herons. Wolves, lynxes, turtles and cranes are among the other species whose habitat will be destroyed. The dam will greatly endanger 38 species of birds, 26 species of vertebrates and nine RELAPE ('Rare, endemic, localised, threatened with extinction') vegetal species. The Guadiana valley (corresponding to the border between Spain and Portugal) constitutes one of the most important south-western Iberian endemic Mediterranean forests. More than one million trees will be cut before filling the dam. This massive program of tree felling has already begun.

There will also be great effects on the valley below the dam, including a significant reduction of water flow, pollution by fertilisers and pesticides, and a projected negative impact on fishing and tourism. Concerning the planned irrigation it is important to note that the Alentejo soil is of poor quality and unsuitable for intensive agriculture. Water quality is appalling, and without subsidies profitable cultivation will not be possible — a problem already endemic in Europe's agriculture.

Legal concerns

Strong legal concerns are presented in the on-line site of ADENEX (*http://mastercom.bme.es/adenex*), a Spanish association defending the Extremadura natural environment. There are various irregularities in the evaluation of the environmental impact. It does not present any alternative for the siting of the dam, its technical characteristics and its volume. Of concern is the restricted competition to obtain recommendations regarding the environmental impact which allowed only nine days for submissions after the announcement was made on 25 January 1996, and two months for the study of the environmental impact. Is two months adequate for a project of such magnitude? The European Union directive (85/337/CEE 27.6.1985) states that the main reasons for a particular choice must be specified in the environmental impact study, and if no alternative tender is available the study risks being null and void.

Some irregularities are also evident in the way the study in the Spanish part was presented. Not one of the eleven volumes of the *Integrated study of the environmental impact of the Alqueva project* is specifically devoted to the Spanish section, so the minimal content rules for such a study were not respected.

Three European Directives appear to have been infringed: 79/409/CEE (bird protection), 92/43 (habitat conservation), and 85/337/CEE, which clearly specifies that any decision must be taken only after the impact evaluation, and not before. But a company, the EDIA (constituted by public capital), was specifically created by the Portuguese Government in 1995, based on works begun in 1976 and interrupted in 1978 — well before the presentation of the impact studies. Thus the impact study was purely a means of legitimising an already existing project.

Archaeological concerns

It did, however, result in a funding bonanza for Portuguese archaeology. Five million euros were granted, and a public competition was open at the end of 1996 to appoint collaborators. The deadline to complete the 'minimisation' of the impact on archaeological sites was three years, i.e. at the end of 2000. Each part of the project was conducted under the direction of a Portuguese archaeologist. Some 300 archaeological sites were examined (Silva and Lanca 2001) and the project was divided into sixteen geographical and chronological areas. The intervention plan consisted of surveying, excavating and studying, while the publication of data will commence in 2002. The main archaeological features are Xerez cromlech, which was excavated and transferred, and Lousa castle, a fortified building of the 1st century B.C., absolutely unique in Portugal. This castle will remain where it is.

The disturbing fact is that the public company responsible for the building of the dam also co-ordinates the archaeological work. Concerning the rock art, a new international campaign is gaining momentum, but the situation is far worse than that of the Côa rock art area during 1994-95. During the 4th Prehistoric Art Course, held at the Instituto Politecnico de Tomar in March 2001, the discovery of a very important rock art area at Molino Manzenez (Manzenez mill, Cheles, Badajoz de la Frontera, Spain) with hundreds of engraved rocks was announced. The first impression of many rock art scholars was that the Portuguese side of the project area should also have significant rock art presence. The Spanish complex was studied in the first months of 2001, under the aegis of the EDIA, by a Spanish team of fifteen archaeologists directed by Hipólito Collado Giraldo of the Archaeological Museum of Badajoz. More than 100 engraved rocks have been found. As most surfaces are covered by lichen, many other engraved rocks are probably present. The entire complex shows clear connections with the Tagus valley rock art, submerged as mentioned above by the Fratel dam in the 1970s.

The fate of the Guadiana rock art

At the end of April 2001 the existence of a ten-km-long rock art area on the Portuguese side was disclosed by an environmental NGO, the LPN (Liga para a Protecção da Natureza), after receiving an anonymous tip-off. A Portuguese archaeologist, Manuel Calado from Lisbon University, immediately surveyed the area. Many other complexes are probably present (Tracce 2001).

Just two years before the 1996 formalisation of the Alqueva project, the Côa case was exposed by IFRAO, which not only led to the protection of the valley by a UNESCO declaration and the establishment of the Côa Park, but also caused structural upheaval in Portuguese archaeology. It resulted in the break-up of the agency responsible for the cover-up, IPPAR, and the creation of IPA (Institute of Portuguese Archaeology) led by João Zilhão and of CNART (National Centre of Rock Art) led by Antonio Martinho Baptista. So why did neither IPA nor CNART undertake rock art-related research in the area to be inundated, although such a presence was highly probable, as publicly admitted by Zilhão on 27 April 2001? As the main goal of CNART is to study and to preserve Portuguese rock art, why was no survey undertaken in order to establish the presence or absence of rock art? And why, after the painful experience of the Côa, did the environmental impact study not include the requirement of a rock art survey? Are we to understand that an intensive survey of more than three years by the country's most eminent archaeologists failed entirely to notice the substantial corpus of Guadiana petroglyphs? The IPA claims that there are some 100 people working on the archaeological survey, so it is reasonable to ask why this rock art was found by amateurs of an environmental NGO four months after the deadline of completing the survey, which was begun in the 1980s. Zilhão has volunteered an explanation: perhaps the petroglyphs were covered by river sand (!). It still does not explain why the country's authority for the preservation of rock art never even set foot in the Guadiana valley since the survey work first commenced well over ten years ago. The IPA also claims to have unsuccessfully asked the EDIA three times during 2000, i.e. years after the completion of the impact study, to conduct a rock art survey. Are we to understand that the Portuguese government authority charged with the protection of the country's rock art asked a private construction company to

conduct a rock art survey five years after the impact study?

Once again, Portuguese rock art risks becoming underwater rock art, as did the Tagus rock art and that on the Douro. Once again Portugal's public agencies responsible for the protection and management of the country's rock art heritage have failed in their constitutional duties and it is left to an international NGO, IFRAO, to expose these damning circumstances and to secure the survival of the rock art. IFRAO immediately responded to the report of the Portuguese Guadiana petroglyphs by forming an international commission to evaluate the entire issue and to promote a complete and exhaustive study of the area.

This Portuguese experience offers valuable lessons, because the nexus of political currents and rock art management has implications around the world. Until 1995, rock art protection in Portugal was administered by the state's authority, IPPAR, which failed severely in its duty. This organisation managed architectural heritage properties as well as archaeological sites, and was dominated by architectural administrators serving the needs of tourism. Rock art was of such low priority that the destruction of countless sites was routinely approved by the state.

Thus the complicity of state-administered heritage management in the destruction of rock art has been endemic in Portugal for several decades. The number of sites that fell victim to this form of 'site management' can only be conjectured, but it is certainly substantial, and at least in the hundreds. As a consequence, a large part of the country's rock art has been allowed to be destroyed by the state-appointed protectors of this irreplaceable heritage. With the recent establishment of IPA and CNART it was thought that the phase of deceptive practices had ended, and that a new and responsible era had replaced it.

Conclusion

Rock art represents an irreplaceable cultural heritage, and the state is not necessarily its most ardent protector. Independent, preferably international peer review is essential. Perhaps it could be argued that international rock art scholars should not concern themselves with what happens to Portuguese rock art. But firstly, the Portuguese public deserves to be independently advised about the performance of its own public servants, particularly in circumstances that may give rise to serious questions; and secondly, the rock art of Portugal is not the property of Portuguese state administrators of rock art management. It is the property of all of humanity — past, present and future. It is to be treated as such, and not as a hostage of an inexperienced, secretive and deceptive technocracy.

Another lesson from the Côa controversy was that 'the political nature of the archaeologists' strategy influenced their scientific discourse' (Gonçalves 1998: 18): to preserve their claim that the rock art is of Palaeolithic age, they tied its preservation to this age claim, and in fact demanded that it must be preserved *because* it is of Palaeolithic age. This was a fundamental error of strategy in several respects. First, the Palaeolithic age was far from demonstrated, consequently it was unwise to base a demand for preservation on it. Second, such an equation would prejudice demands for preserving Holocene rock art elsewhere. Third, the argument that Holocene rock art is somehow less deserving of preservation is emotive rather than rational, and certainly subjective. It is likely to be contradicted by many stake holders in rock art, such as indigenous custodians in other world regions, or researchers specialising in periods other than the Palaeolithic. It follows that the strategy Gonçalves examines was not only politically motivated, it implies inexperience and a lack of consideration of the wider and long-term ramifications. Already the very argument has been mentioned that the Guadiana rock art is not of sufficient value to warrant preservation 'because it is not Palaeolithic'.

There are further fundamental lessons for heritage site management to be gleaned from the circumstances surrounding the saving of the Côa rock art. When a cultural resource management agency with a long history of neglecting its duties was publicly exposed, this led to swift public reaction, but only to cosmetic changes to the offending agency itself. In a healthy democratic system, state technocracies can be subjected to effective criticism, but that does not necessarily entail their ultimate accountability. Indeed, the brazenness of the establishment in the Portuguese example even suggests that such agencies are well aware of their immunity, and what is quaintly defined as 'the will of the people' is of little concern to them. To them, a public controversy on the scale of the Côa issue means little, and as soon as matters have calmed down business returns to the usual format. This is not only disturbing in the political sense, in terms of the cynicism implied, it also indicates that the protection of the CRM estate cannot be expected to be guaranteed by a technocratic system whose ultimate primary concern is its own well-being. We suggest that the Portuguese example shows that it would be a great improvement if such agencies were subjected to monitoring by an independent entity. Such an independent audit would have prevented the excesses documented in Portuguese rock art 'site management'.

REFERENCES

ANATI, E. 1974. Incisioni rupestri nell'alta valle del Fiume Tago, Portogallo. *Bollettino del Centro Camuno di Studi Preistorici* 12: 156-60.

BAPTISTA, A. M. 1981. *A Rocha F-155 e a Origem da Arte do Vale do Tejo*. GEAP, Porto.

BAPTISTA, A. M. 1983. O complexo de gravuras rupestres do Vale da Casa (Vila Nova de Foz Côa). *Arqueologia* 8: 57-69.

BEDNARIK, R. G. 1995. The Hell's Canyon saga continues. *Rock Art Research* 12: 70-72.

COELHO, R. and M. DO ROSÁRIO PARTIDÁRIO 1999. *Estudo de impacte ambiental do aproveitamento hidroeléctrico o Baixo Sabor*. CPPE Companhia Portuguesa de Produção de Electricidade, SA.

GONÇALVES, M. E. 1998. Science, controversy and participation. The case of the Foz Côa rock art engravings. *Journal of Iberian Archaeology* 0: 7-31.

JAFFE, L. 1996. Systematic vandalism and improper conduct in the Côa valley rock art area. *AURA Newsletter* 13(2): 12-13.

JAFFE, L. and M. SIMÕES DE ABREU 1997. Rio Sabor rock art discovery (Trás-os-Montes, Portugal). *Tracce* 9: 28.

JORGE, S. O., V. O. JORGE, C. A. F. DE ALMEIDA, M. J. SANCHES and M. T. SOEIRO 1981. Gravuras rupestres de Mazouco (Freixo de Espada à Cinta). *Arqueologia* 3: 3-12.

GOMES, M. V. 1987. Arte rupestre do Vale do Tejo. *Arqueologia no Vale do Tejo*, pp. 26-43. IPPC, Lisbon.

SERRÃO, E. DA CUNHA, F. SANDE LEMOS, J. PINHO MONTEIRO, M. DE LOS ANGELES QUEROL, S. RODRIGUES LOPES and V. OLIVEIRA JORGE 1972. O Complexo de Arte rupestre do Tejo (Vila Nova de Rodão - Nisa). Noticia preliminar. *Arqueologia e História* 9(4): 349-97.

SILVA, A. C. and M. J. LANCA 2001. *Alqueva, 4 Anos de Investigação Arqueológica, Alqueva*, 3° colóquio de arqueologia, E.D.I.A, Mourão

SWARTZ, B. K. 1997a. An evaluation of rock art conservation practices at Foz Côa, northern Portugal. *Rock Art Research* 14: 73-5.

SWARTZ, B. K. 1997b. An investigation of the Portuguese government policies on the management of the Foz Côa sites. *Rock Art Research* 14: 75-6.

TRACCE 2001. Special issue devoted to the Guadiana rock art, No. 13, April 2001. (*http://rupestre.net/tracce/13*)

ZILHÃO, J. 1996. Letter to the President of IFRAO, 26 August.

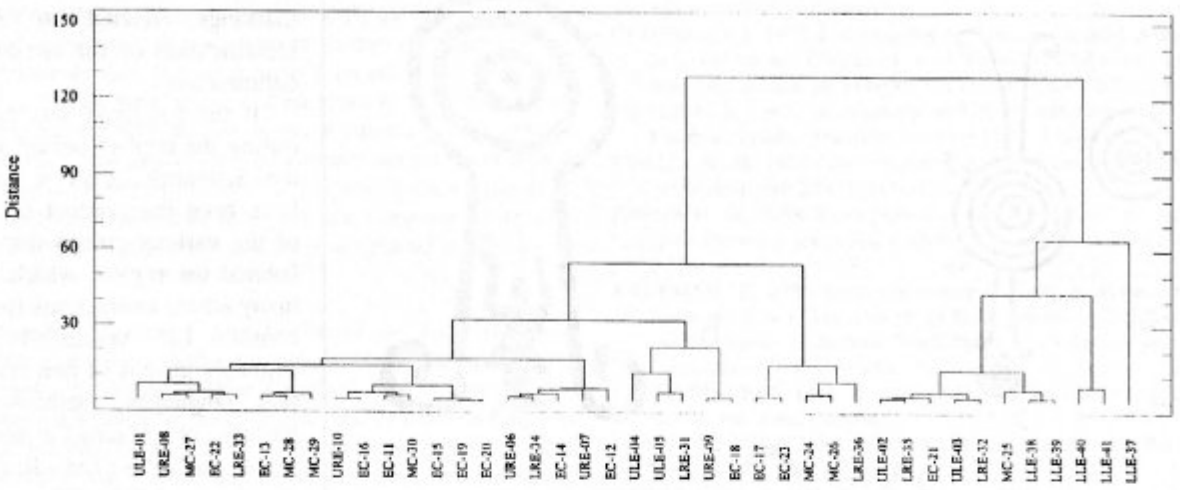


Figure 5. Dendrogram obtained using several parameters of the cross-sections.

Fortunately the same family which appreciates the importance of the geoglyph has privately owned the land for many generations. For example, their cattle branding mark has the shape of the geoglyph. Currently they allow visitors to see the glyph only from a nearby ridge with a good view and they cut down small trees in the geoglyph area whose roots may degrade the grooves, allowing only the growth of grass that helps the soil stabilisation. Besides the prohibition to walk on it, perhaps the only action that would help its future preservation is to promote awareness among the local people, stressing the antiquity of the form and increasing the pride for of their landmark symbol.

During our fieldwork we collected the following oral beliefs:

'During some nights near midnight a small light appears around the figure's centre'.

'The grooves of La Rueda del Indio were most probably made by the Indians using small stone axes'.

'The trails on the ridges above La Rueda del Indio must have been made and used by the Indians who have burnt down the slope since pre-Historic time'.

'The figure represents a shaman'.

Other stories occur in the literature:

Reva (1948) reports that during an interview, archaeologist J. M. Cruxent related that the locals believed that some human bones and artefacts were found in the centre of the figure and therefore it could be a burial site.

Waisbard and Waisbard (1954) inform us that according to some people, the geoglyph must have contained treasures, either from the Indians or the Spaniards.

López de Ceballos (1974) thinks that the Indians used wood and stone instruments to make the figure, while the circles must have been made with the help of a rope.

Straka (1975: 452) says that the figure is called The Indian Wheel because it is believed that the Indian chiefs met within its circles.

López de Ceballos (1975) states that the geoglyph was built in A.D. 1311 by the Indian Chief Cariaprima III. But the author told us in 1997 that such a story has no roots in local traditions and he wholly made it up as a joke.

Within a radius of about 150 km around the geoglyph there are many petroglyphs, some with images similar to the geoglyph, from which it could be inferred that Indigenes of the same ethnic group created them. Cruxent (1949: 30) states that he found a petroglyph similar to the geoglyph near Las Mesas hill, Carabobo. Padilla (1957) presents the drawings of two petroglyphs similar to the geoglyph, one of an unreported locality (Figure 6b) and another from Las Letras hill near Cuara, Yaracuy state (Figure 6a). Straka (1975: 453) mentions similar petroglyphs from Morón creek, Carabobo state. Valencia and Sujo Volski (1987) report a group of petroglyphs from Marbellaco creek, Carabobo state (Figure 6c). Weber (1996) depicts some similar petroglyphs from near Piedra Herrada, Guama del Pao, Cojedes state (Figure 6d, e). Rivas (1999) reports that the geoglyph image is similar to petroglyphs of at least six localities. During our fieldwork we found another such similar petroglyph at Pozo de Emilia, Marbellaco creek, and received information of similar images at La Sayona site near La Mona, Carabobo state.

Discussion and comments

The geoglyph probably had some ritual function for the Indigenous community that created it, since it is located on a high hillside with perfect visibility from at least 5 km in the long valley of Chirgua, and the figure design is repeated in several petroglyphs in the region (Figure 6).

If it is Prehispanic there is the probability that it was made by Indians that came from western Venezuela, including the Andes region, as can be assumed from the archaeological artefacts excavated in the centre of the

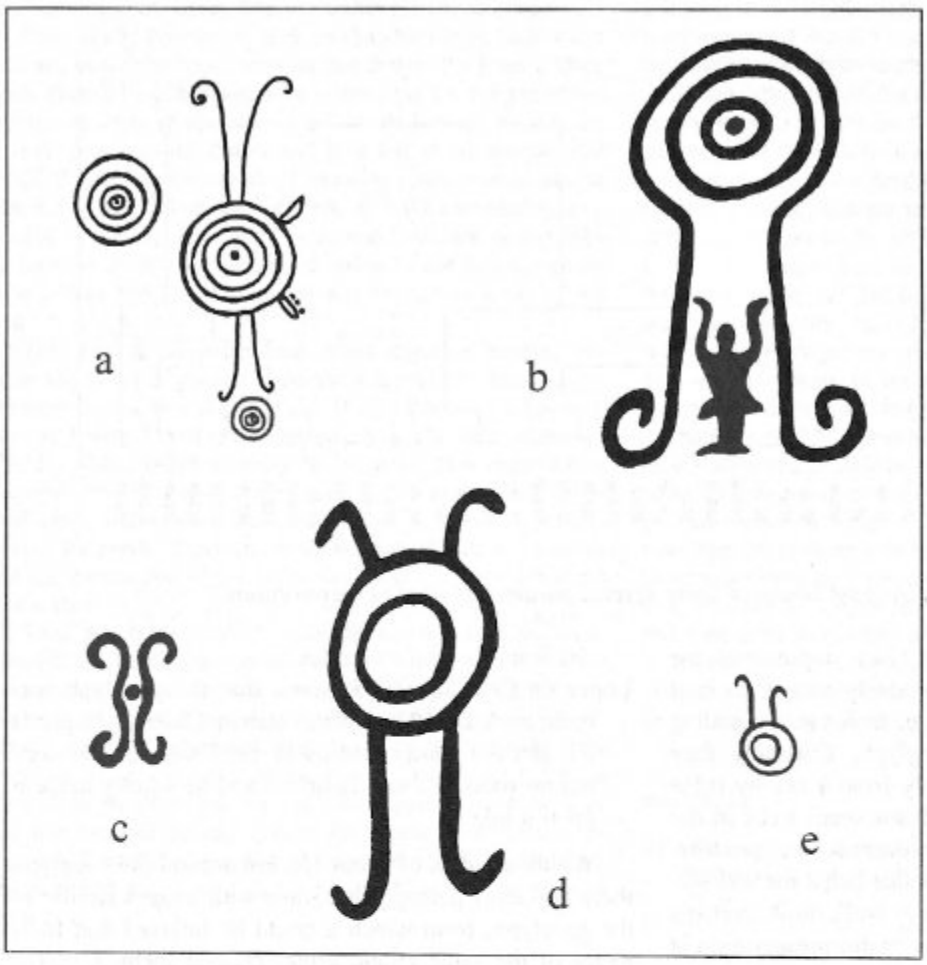


Figure 6. Images of similar petroglyphs: (a) Las Letras hill, Cuara, Yaracuy state (Padilla 1957; Sujo 1975: Fig. 58a). (b) Unknown locality (Padilla 1957; Sujo 1975: Fig. 58b). (c) Marbellaco creek, Chirgua, Carabobo state (Valencia and Sujo 1987: 28). (d, e) Piedra Herrada site, Guama del Pao, Cojedes state (Weber 1996: 44-5). Without scales in the originals.

geoglyph by the landowner and given to Cruxent (1949): a slate pectoral and a seated male figurine. Current knowledge of the nearby Nirgua region suggests that the pottery is related to the Santa Ana style, typically Andean and from periods II to V (A.D. 1050 to 1500) of Venezuelan archaeological chronology (Wagner and Arvelo 1991). Taking into consideration the typology of Cruxent's artefacts, Rivas (1999) reaches a slightly different interpretation, that they are similar to Andean styles, such as Betijoque and Mirinday, extending from periods II to V and IV (A.D. 1150 to 1500) respectively which are contemporaneous with the Santa Ana style, and related to the Tocuyano, Tierra de los Indios and San Pablo styles, from western Venezuela and relatively close to the Chirgua region. Nevertheless, Rivas (1999: 23) suggests an alternative hypothesis, that the geoglyph could be related to Prehispanic groups of Arawakan stock, which implies through ethnographic analogy with present-day Arawakan groups such as the Wayúu or Goajiro that stone designs could well indicate clan markings, related to their identification or for territorial delimitation.

If the geoglyph was made during the contact period with the Spaniards, then it could have been the product of one of the various groups that inhabited the region, which had many ethnic interactions (pers. comm. L. Arvelo 1999). Probably groups of non-classified languages, perhaps of Paezan or Macro-Caribbean stock such as the Jirajara (Kaufman 1990: 39), who probably inhabited the region (Rivas 1989), could also be related with the geoglyph.

The previous interpretations indicate that it is still hypothetical as to which Indigenous group made it. At any rate, today the geoglyph is embedded in the daily life of the inhabitants of the Chirgua valley.

With the detailed data now available, the grooves' cross-sections could be re-measured in the future in order to determine if any significant change occurs due to natural or anthropogenic causes.

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Bernardo Urbani
Universidad Central de Venezuela
Escuela de Antropología y Instituto Venezolano de Investigaciones Científicas
Dept. Antropología
Apartado 47.028.
Caracas 1041-A
Venezuela
E-mail: *urbani@cantv.net*

Franco Urbani
Universidad Central de Venezuela
Facultad Ingeniería
Dept. Geología
Apartado 47.028.
Caracas 1041-A
Venezuela

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Résumé. *Le géoglyphe de La Rueda del Indio se trouve près de la ville de Chirgua, dans le N.-E. du Venezuela. C'est le seul géoglyphe connu dans la partie septentrionale de l'Amérique du Sud. Il a été procédé à un relevé topographique de la colline en forte pente où il est situé, et à des mesures de sections transversales des sillons qui le constituent. Des images ressemblant à ce géoglyphe sont connues sur plusieurs sites à gravures du Venezuela central. Il fait partie des croyances et traditions des habitants de la région, il est respecté, et ne semble pas être en danger tant que les propriétaires du lieu maintiendront l'interdiction d'y marcher.*

Zusammenfassung. *Der La Rueda del Indio Geoglyph befindet sich in der Nähe der Stadt Chirgua, nord-zentrales Venezuela. Es ist der einzige Geoglyph, der vom nördlichen Südamerika bekannt ist. Eine topographische Untersuchung des steilen Hügels, wo er sich befindet, wurde durchgeführt, und ausführliche Maße seiner Form und von Querschnitten seiner Furchen wurden aufgenommen. Dem Geoglyph ähnliche Bilder kommen in mehreren Petroglyphen in zentral-Venezuela vor. Der Geoglyph ist im Glauben und den Traditionen der Bewohner des Gebietes eingebettet, er wird respektiert, und so lange das Verbot der Grundbesitzer besteht, darauf zu gehen, scheint er nicht gefährdet zu sein.*

Resumen. *El geoglifo 'La Rueda del Indio' se localiza cerca del poblado de Chirgua, centro-norte de Venezuela. Es el único geoglifo conocido del norte de América del Sur. Fue realizado el levantamiento topográfico de la colina donde se ubica y se tomaron mediciones detalladas de su forma y de las secciones transversales de los surcos. Algunas imágenes similares al geoglifo existen en varios petroglifos del centro de Venezuela. La presencia del geoglifo esta arraigada en las creencias y tradiciones de los habitantes de la región, siendo por tanto respetado. No parece estar en peligro mientras continúe la medida de no caminar sobre él, tal como es impuesto por los dueños del terreno donde se encuentra.*

REFERENCES

BRIONES, L. and J. CACHAMA 1987. Arte rupestre de Ariquilda. Análisis descriptivo de un sitio con geoglifos y su vinculación con la prehistoria regional. *Chúngura* 18: 15-66.

CACHAMA, J. M. and L. BRIONES 1996. Arte rupestre del Desierto Tarapaqueño, norte de Chile. *Boletín SIARB* 10: 41-51.

CLARKSON, P. B. 1997. Geoglyphs of the Americas. *The Artefact* 20: 3-15.

CRUXENT, J. M. 1948. Reconocimiento arqueológico de la región del valle de Chirgua. *Memoria de la Sociedad de Ciencias Naturales La Salle* 8(22): 109-26.

CRUXENT, J. M. 1949. El geoglifo de la Fila de Olivita. *Memoria de la Sociedad de Ciencias Naturales La Salle* 9(23): 27-30.

CRUXENT, J. M. 1955. Petroglifos venezolanos. *Revista A*, Vol. 2. Caracas.

DELGADO, R. 1977. *Los petroglifos venezolanos*. Editorial Monte Ávila, Caracas.

GARCÍA FERNÁNDEZ, E. 1991. *Petroglifos, huellas en el tiempo*. Ediciones COBO, Caracas.

GRODZICKI, J. 1992. Los geoglifos de Nazca según datos geológicos. In L. Ortlieb and J. Macharé (eds), *Paleo ENSO Records. International Symposium*, pp 119-130. ORSTOM - CONCYTEC, Lima.

HAYDEN, J. 1967. A summary prehistory and history of Sierra Pinacate, Sonora. *American Antiquity* 32(3): 335-44.

ISBELL, W. H. 1978. The prehistoric ground drawings of Peru. *Scientific American* 239(4): 114-21.

JOHNSON, B. 1986. Earth figures of the lower Colorado and Gila river deserts: a functional analysis. *The Arizona Archeologist* 20: 1-179.

KAUFMAN, T. 1990. Language history in South America: what we know and how to know more. In D. Payne (ed.), *Amazonian linguistic. Studies in lowland South American languages*, pp. 13-73. University of Texas, Austin.

LÓPEZ DE CEBALLOS, E. 1974. *Fauna de Venezuela y su conservación*. Ed. Arte, Caracas.

LÓPEZ DE CEBALLOS, E. 1975. La verdad sobre La Rueda del Indio. *Revista Líneas* 217: 20-2.

PADILLA, R. 1957. *De los petroglifos y otras expresiones primitivas de América*. Talleres Gráficos Nacionales, Caracas.

REVA, L. 1948. Un misterio venezolano: el geoglifo de Chirgua. *El Nacional*, Caracas, 13 April, p. 9. [Lumo Reva presumably is the pseudonym of R. Delgado].

RIVAS, P. 1989. Etnohistoria de los grupos indígenas del sistema montañoso de noroccidente de Venezuela: etnohistoria y arqueología del sitio arqueológico Cueva Coy-Coy de Uria, Sierra de San Luis. Unpubl. thesis, Universidad Central de Venezuela, FACES, Escuela de Antropología, Caracas.

RIVAS, P. 1999. Rueda del Indio (geoglifo de Chirgua). In L. Molina, P. Rivas and L. Vierma (eds), *Sitios arqueológicos de Venezuela*. Instituto de Patrimonio Cultural, Caracas, 2: 21-23.

STRAKA, H. 1975. Los petroglifos de Venezuela. *Boletín Sociedad Venezolana Ciencias Naturales* 31(130-131): 447-61.

STRAKA, H. 1978. El dibujo más grande de Venezuela. *Mecánica Nacional*, p. 48. Caracas.

SUJO VOSKY, J. 1975. El estudio del arte rupestre en Venezuela: su literatura, su problemática y una nueva propuesta metodológica. *Montalbán* 4: 709-928.

SUJO VOSKY, J. 1976. Nuevas consideraciones metodológicas para el estudio del arte rupestre en Venezuela. *Actes du XLIIe Congrés International des Americanistes* 9B: 241-258. Paris.

URBANI, F. 1998. A multivariable approach to characterise the groove shape of the linear parts of petroglyphs. *Rock Art Research* 15: 41-5.

VALENCIA, R. de and J. SUJO VOSKY 1987. *El diseño de los petroglifos venezolanos*. Ed. Fundación Pampero, Caracas.

WAGNER, E. and L. ARVELO 1991. La prehistoria y protohistoria del estado Yaracuy y sus áreas de influencia. *Proceedings of the Thirteenth International Congress for Caribbean Archaeology* 9(2): 729-749. Rep. Archaeol.-Anthrop. Inst. Netherlands Antilles, Curaçao.

WAISBARD, R. and S. WAISBARD 1954. *Mon Venezuela*. René Julliard, Coll. Scien. et Voyages, Paris.

WEBER, A. 1996. *Los petroglifos de Cojedes*. Edit. Univ. de Carabobo, Valencia.

WHITLEY, D. S. 1996. *A guide to rock art sites. Southern California and southern Nevada*. Mountain Press Publishing Company, Missoula, Montana.

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KEYWORDS: *Petroglyph - Sandstone quarry - Barkly Tablelands - Northern Territory*

CULTURAL IMAGES: THE PETROGLYPHS OF A SANDSTONE QUARRY, HELEN SPRINGS, NORTHERN TERRITORY, AUSTRALIA

Ken Mulvaney

Abstract. Petroglyphs have been recorded at a site situated in the middle of the Northern Territory, Australia, located in an area not previously recognised as a major rock art province. Known to the Warlmanpa Traditional Owners of the area as Kurutiti, the site is a regionally important sacred and mythological place. In addition, the sandstone outcrops have been quarried for the manufacture of seed milling implements and other objects. The distribution and physical character of the petroglyphs reflects this multi-functional aspect of Kurutiti. Some unique features of the rock art are directly attributable to the grindstone production activities at the site.

Introduction

Near Helen Springs homestead, Northern Territory, a major body of rock art has been recorded in association with a sandstone outcrop utilised for the production of grindstone implements. This is in a region better known economically for its cattle industry and archaeologically for its quartzite blade production and Pleistocene lake deposits (Bowler 1983; Paton 1994; Spencer and Gillen 1904; Smith 1986a). The rock art comprises several thousand images engraved on exposed sandstone bedrock and surfaces created as a product of the extraction and reduction of sandstone blocks (Mulvaney 1997, 1998). For the Australian Aboriginals of northern central Australia the location is known as Kurutiti, a place of major mythological and ceremonial significance. Linked as it is to the exploits of two Snake Sisters, the mythology recounts the structural formation of the sandstone rubble and the creation of the petroglyphs at this location. To the Warlmanpa custodians of the site, their lore and sacred knowledge is encoded in the rock art.

Kurutiti is located within the north-north-west trending Ashburton Range, flanking the semi-arid Tanami Desert to the west, and the slightly better-watered Barkly Tablelands to the east (Figure 1). A region at the southern limits of monsoonal influence, most of what little rain is received (340 mm) falls in the summer months. There are no perennial streams, and the few permanent and semi-permanent waterholes are on the larger creeks flowing from the Ashburton Range. As well, a number of springs occur at a few locations throughout the ranges, these being of both mythological and resource importance. The springs of Renner Springs, 20 km north of Kurutiti, are the most significant of these.

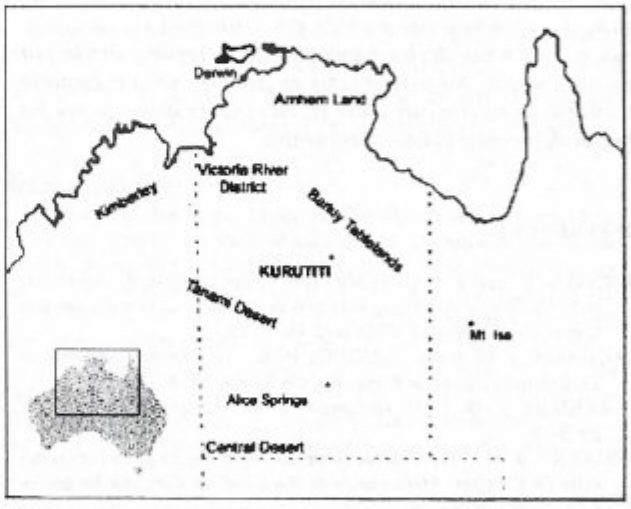

Figure 1. Map of northern Australia showing the location of Kurutiti in relation to major rock art and physiographic regions.

The Ashburton Range and the Whittington Range to the south are composed mainly of resistant silica-cemented sandstones of the folded Tomkinson Creek Beds (Precambrian age), forming strike ridges and plateaus. These remnant hills rise up to 90 metres above the surrounding sandy plains. The less resistant beds are eroded into valleys, and exposed within some of these are Palaeozoic volcanic and sedimentary rocks, along with Lower Cretaceous sediments (Randal and Brown 1969: 5). Folding and faulting of the sandstone beds, subse-

quent volcanic intrusions and further drownings and uplift have produced a diverse and complex array of lithic material. Exploitation of the variable-quality quartzite and chalcedony was important in regional Aboriginal socio-economic spheres (Murgatroyd 1991; Paton 1994). It is the geological particularity of the Kurutiti location that creates the distinctive archaeological imprint, the exploitation of the sandstone and the utilisation of surfaces for rock art production.

The discussion provided here is of a general nature, the intention is to provide a descriptive image of the character of the rock art at Kurutiti and does not pertain to issues regarded as secret-sacred to the Aboriginal custodians of the site.

Site description

Located on the ephemeral Helen Creek, Kurutiti lies in a slight basin surrounded by low hills. Between these hills extend scrub-covered expanses of gravel and sandy soils, and extensive areas of fragmented sandstone bedrock and rubble (Figure 2). The site consists of a large cultural complex, extending over an area of some 84 ha (c. 1200 m by 700 m). Visually dominated by the extensive sandstone rubble associated with the quarry, the site is bisected by the seasonally flowing Helen Creek. The bed and banks of Helen Creek alternate from sand, gravel and pebbles, to sandstone bedrock and detached blocks, boulders and cobbles. It is within and adjacent to the creek that most of the petroglyphs occur, some 80% of the 2249 recorded motifs.

Petroglyphs, associated with low stony rises and small rocky outcrops, are also present at four locations to the south of the main quarry. These are at 300 m and 500 m south-south-east of the main quarry, and 500 m and 530 m to the south-east respectively. The northern limit of the survey area (recorded site complex) is defined by a high stony ridge located some 200 m northward of the main quarry. At the eastern extent of this ridge numerous petroglyphs occur, some of very recent origin. This graffiti consists of names inscribed into the rock faces, most likely to have been made by passing motorists. However, Aboriginal custodians of the site did identify one of the names as that linked to a station worker who was around in the 1960s. Petroglyphs and a few grinding hollows are found between this ridge and the creek on a small exposed sandstone sheet. Petroglyphs abound on the exposed bedrock and loose boulders adjacent to and within the quarry, as well as on material associated with the reduction of sandstone.

The 2249 engraved motifs recorded in the area of Kurutiti are considered to be only a minimum number of those made. Regrettably, there is evidence of the deliberate removal of engraved sandstone slabs and the destruction of some art. In fact, one panel of seven 'bird tracks' was found on a boulder within the quarry subsequent to the initial recording program. Evidence on the boulder indicates that an attempt had been made to split the engraved surface from the main body of the sandstone block, the rock having been abandoned at its present location when this failed. As well, some of the petroglyphs within the quarry were found by turning over rocks while investigating sandstone pieces that retained evidence of the extraction or reduction technology. Given the particular setting of the art, especially within the quarry area where motifs may be on the undersurface of loose blocks, or buried below the surface rubble, it is conceivable that some of the Kurutiti art corpus remains as yet unrecorded.

Figure 3. Photograph of part of the sandstone quarry rubble with two engraved blocks visible, one petroglyph of a pair of 'feet' and on the adjacent block an 'extended bird track'.

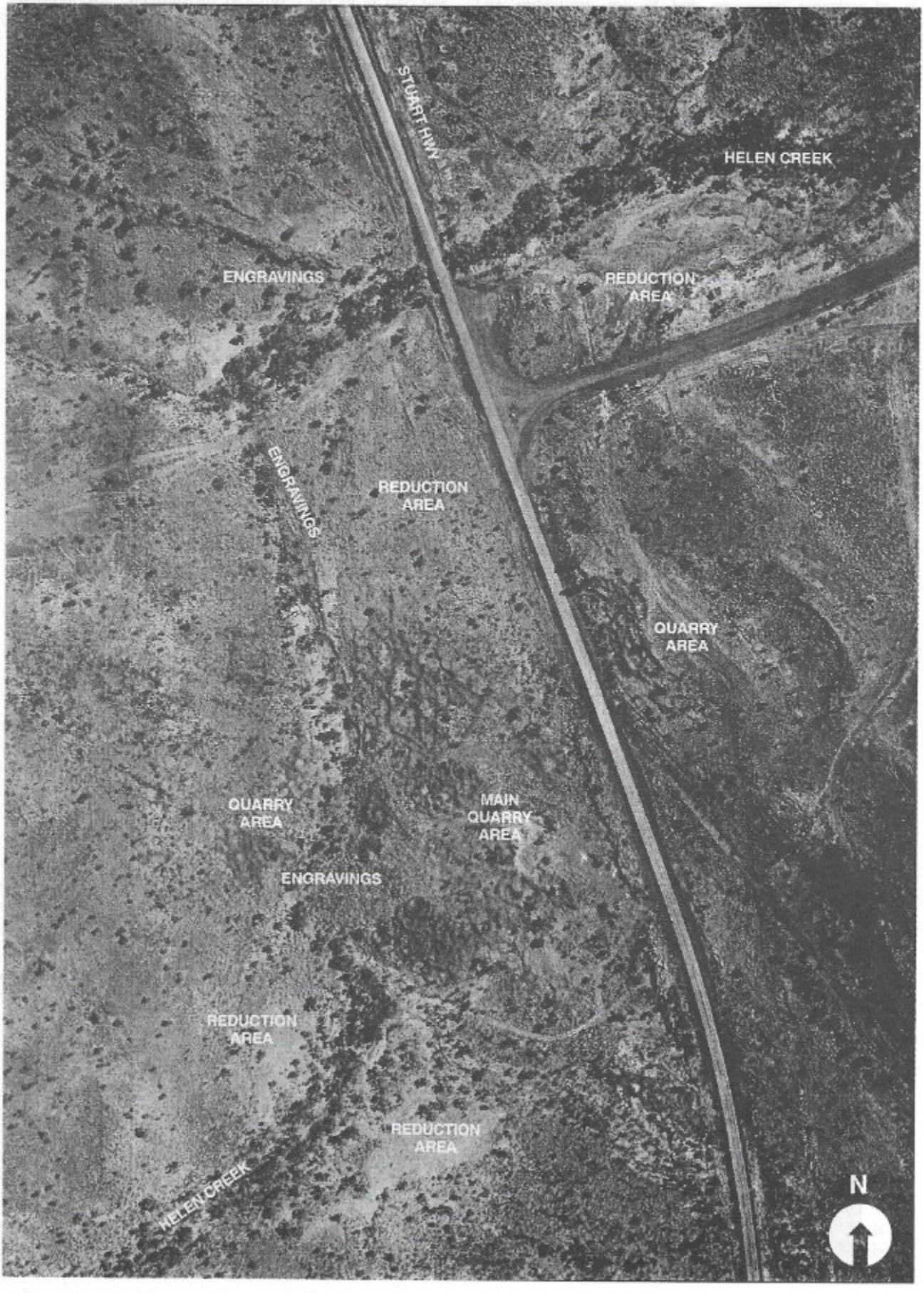

Figure 2. Aerial photograph of a portion of the sacred site Kurutiti with main archaeological areas marked.

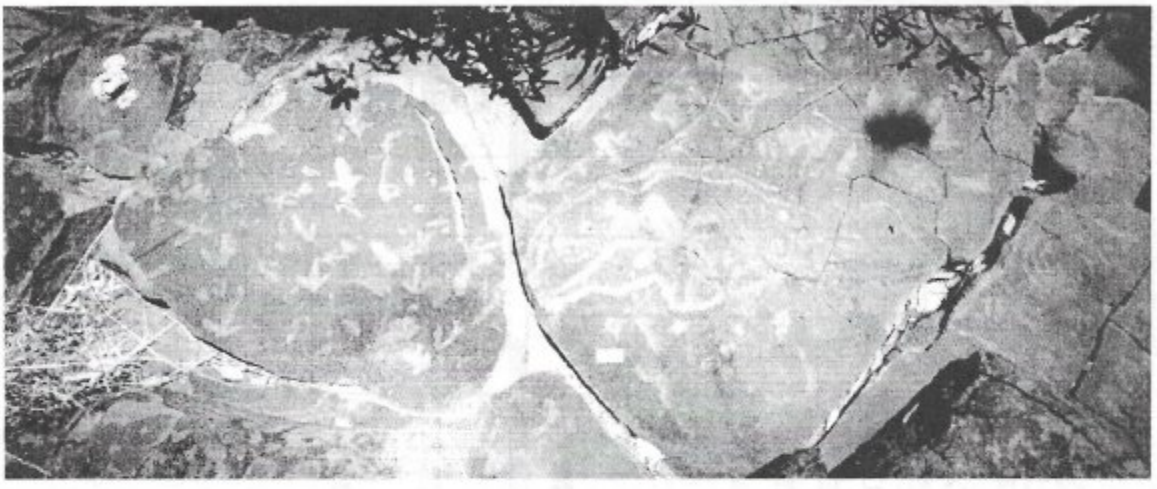

Figure 4. Photograph of a section of the jointed bedrock adjacent to Helen Creek, displaying a relatively dense cluster of petroglyphs, including 'tracks' and the Milywaru Snake Sisters (as illustrated in Figure 9).

Area	Geometric	Track	Figurative	Abstract	Fragment	Total
Bedrock	692	547	19	4	5	1267
Creek	98	57	4	3	2	164
Quarry	106	100	15	3	-	224
Reduction	134	97	10	4	12	257
Outliers	209	115	6	-	7	337
Total	1239	916	54	14	26	2249

Table 1. Broad subject numerical distribution of petroglyphs in relation to cultural and physiographic areas of Kurutiti.

With over two thousand petroglyphs, Kurutiti represents one of the largest concentrations of rock art in the wider region. Most of the petroglyph sites in the local region range from tens of motifs to several hundred, although to date no systematic rock art survey has been undertaken. There is the possibility that other large bodies of rock art exist in the Ashburton Range, although if so, they are unknown to local Aboriginal communities with detailed knowledge of their country. Further afield there is no suitable rock out on the Barkly Tablelands or the Tanami Desert to the west. With the only known art focused in the area of rock-holes, the likelihood of additional major art repositories in the region is minimal.

The site complex can be subdivided into five distinct physiographic units; they also correspond to the nature of the associated archaeology. These are the sandstone rubble of the main quarry, the channel of Helen Creek, the exposed bedrock flanking the creek, the open sandy expanses associated with the reduction areas surrounding the quarry, and the various sandstone outliers which were surveyed (Figures 2-4; Table 1). It is the bedrock adjacent to the creek and along the western side of the main quarried rubble that contains the largest number of petroglyphs, 979 motifs (43.5%) on 210 panels. Opposite this, on the exposed bedrock and jointed blocks along the western flank of the creek, a further 288 motifs (12.8%) occur on 53 panels. Between these bedrock areas within the creek channel a further 57 motifs (2.5%) on 14 panels were recorded. This concentration represents 58.8% of the total recorded corpus of rock art at Kurutiti, comprising 277 engraved bedrock surfaces and faces on sandstone blocks, which represents 42.9% of all panels containing petroglyphs.

The petroglyphs of Kurutiti

Of the 2249 motifs classified during this archaeological investigation, 1239 (55.1%) may be described as geometric (nonfigurative) depictions. The remainder are of non-geometric form. Although certain animal and bird tracks may be geometric in shape, they are usually classified within a separate group. At Kurutiti the 'track' category comprised 916 motifs (40.7%). A further 54 motifs (2.4%) where grouped in the figurative class, with only 14 petroglyphs (0.6%) classed as abstract (or non-classificatory). There are the fragmented remains of a further 26 petroglyphs (1.2%), occurring on broken pieces of sandstone where it is evident that the original motif has been truncated. Most of the fragmentary petroglyphs were classified within the geometric 'motif type' categories, either as 'amorphous geometric' or 'line'.

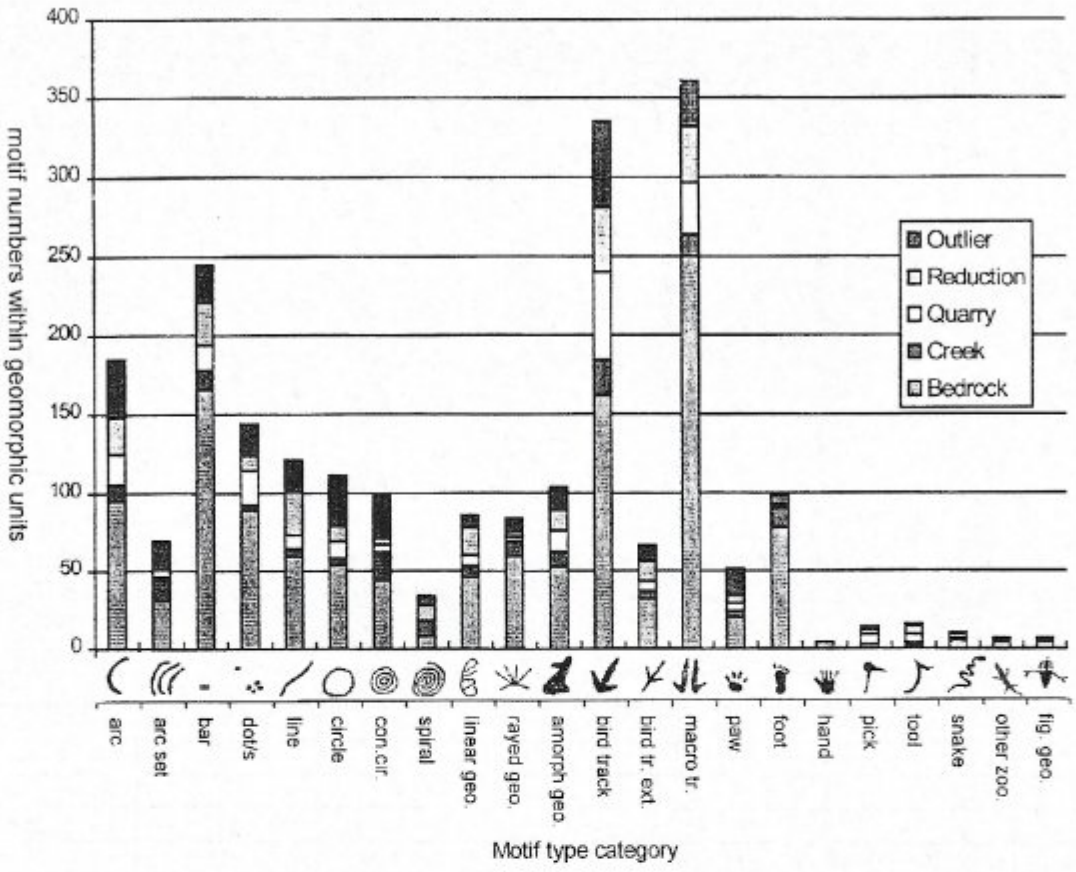

Figure 5. *Graph showing the numerical distribution of petroglyphs recorded at Kurutiti.*

Analysis of the rock art corpus defined 22 broad subject categories, eleven of which can be grouped as being of nonfigurative design (Figure 5). Six categories are ascribed to animal track images, the rest are within the broad gamut of figurative subjects. Within the geometric group there are eleven motif types identified, which include 'dot/s', 'bar', 'line', 'arc' and 'circle' that are simple geometric designs conforming to the mathematical shape. However, the circumstance of how curved a line needs to be to be classed as an arc, or the length/breath ratio to differentiate a dot from a bar, is subjective. Dot motifs occur singly and as clusters (N = 144), a number of these may have their origins in the quarrying of the sandstone blocks, although size and placement on the engraved surface enabled separation between art and functional pitting.

The difference between the classification of 'bar' (N = 245) as opposed to 'line' motif (N = 121) is in the relative length to width ratio. This was not accurately measured, although as a rule where the length/width ratio was 2 : 1 or less this was placed within the 'bar' category. Line motifs include straight or simple linear forms (slight angle variations), hooked or bent forms, and meandering, irregular and wavy forms. 'Arc' (N = 185) and 'arc set' (N = 69) are noticeable components of the total art corpus of Kurutiti. Variation is exhibited with these motifs in the degree of curvature of the arc. Within Australian research studies, the arc form may be interpreted as depictions of boomerangs, the curved wooden throwing stick and musical instrument of the Aboriginals. However, in this study, due to the difficulty of discerning artistic variation in the intended subject representation, most curved linear depictions are classed as 'arc'.

'Circle' (N = 111), 'concentric circles' (N = 121) and 'spiral' (N = 111) make up 19% of the geometric class of motif. These similar types include a range of forms within each motif group. Of the 'circles', 75 instances (67.5% within type) can be said to be regular in shape, forming a geometric circle (constant radius). At the other extreme of this motif type are the seven irregularly formed circle motifs. 'Concentric circles' motifs are depicted with relatively evenly spaced rings, although the gap between each ring in the motif may exhibit some variation. A double ring is the most common form, with an eight-ring 'concentric circles' motif the highest number produced. A feature of both the 'concentric circles' and the single 'circle' is the occurrence of a secondary motif incorporated within the design. The inclusion of a centrally placed dot is the most frequent, although in one case a 'bird track' is at the centre.

'Spiral' motifs are depicted with similar frequency in both directions, with 17 spiralling clockwise and 15 anticlockwise. Two other motifs are engraved with a reversal of spiral direction. Both spiral clockwise on the inner

portion (3 and 2.5 loops), then with an enclosing outer loop (2.5 and 1.5) spiralling the other way. The count of the loops is given from the origin point (inner) for the line to complete an encirclement to be aligned with the initiation point. Three loops within the spiral are the most frequent depiction (N = 13; 38% within type). The range displayed is from 1.5 loops up to eight loops, with the loop finishing either aligned with the origin point, or on the opposite side. In only one case was it recorded that the outer loop did not end at the normal place, continuing a quarter turn past the origin point.

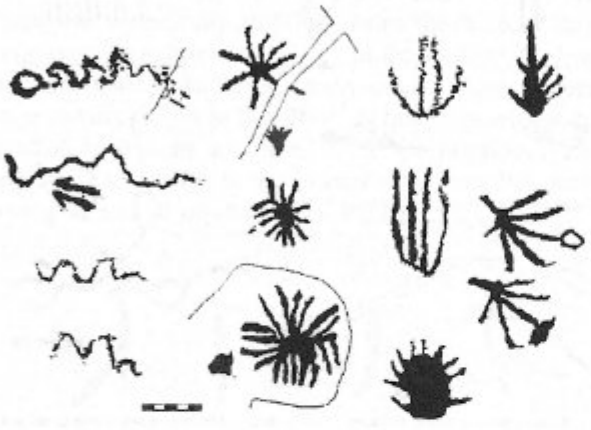

Figure 6. A selection of 'rayed geometric' and 'snake' motifs.

Within the more complex of the geometric forms, the 'rayed geometric' (N = 84) is the easiest to classify (Figure 6). Based on the number of rays (arms) and symmetry of configuration, they are depicted either radiating from a central area or bi-directional (off a common axis). 'Amorphous geometric' by their nature challenges precise classification, although some general observations are possible. Of the 104 motifs recorded within this type-group, 60 are abstract forms defying description. Pecked formless areas (as opposed to scatters of dots) were recorded in 21 examples. These stippled patches do not appear to be associated with the surface preparation in grinding of foods, although they may still have resulted from economic rather than artistic purpose. Seven motifs resemble stylised or abstract representations of the human foot, and one is a possible macropod track.

Within the category of 'linear geometric' (N = 86), five broad stylistic divisions may be discerned. The more standardised of these are the motifs that resemble a curved capital letter 'E' (N = 5). Similar in form, although with variation and greater number of bars off the base curve, is the motif class that is referred to as a 'rake' or 'pubic tassel' design (Davidson 1952: 97; Forbes 1982). Nine examples were documented, ranging from four bars/lines to seven, the base line either straight or curved. 'Linear sets', arrays of parallel lines and bars, occur 27 times, these ranging from pairs to a suite of 13. Lines with varying attachments account for 31 of the 'linear geometric' motifs. The stylistic form of these is relatively standard, either a line with dots or tassels on the ends, or more complex lines with several linear appendages. An additional variation is exhibited with a more complex configuration of lines and loops enclosing space (N = 10).

Figure 7. A selection of 'human foot' and 'animal paw' petroglyphs.

At Kurutiti 'track' motifs comprise 41% of the art corpus, with six broad categories identified: 'hand' (N = 4), 'foot' (N = 99), 'paw' (N = 51), 'macropod' (N = 361) and two forms of 'bird prints' (N = 399). 'Hand' and 'foot' motifs are those that resemble human palm and footprints (Figure 7). 'Paw' motifs concern those that resemble animal prints such as dogs (dingo) and lizards (goanna) in the main (Figure 7), but can also include other track patterns like those of the echidna, possum and various marsupials and rodents.

Within the 'hand' group, three motifs are of the right hand (or possibly the left as depicted palm up). One of these is paired with the other hand print slightly offset. Of the motifs depicting what look like human feet, only four are as pairs (left and right). Of the remaining 95 'foot' motifs, 33 (34.7%) are right foot depictions, 30 are left foot and 32 are not definite. As with other examples of Australian rock art, the number of toes depicted in the Kurutiti art is variable, ranging from three to nine. Why there should be this overwhelming proportional difference between hand and foot print motifs is unclear, although a number of motifs classed as 'rayed geometric' or 'paw' type motifs may be petroglyphs originally intended by the artist to depict human hands. However, this latter group of motifs is too stylised for such classification in this current analysis.

'Bird track' motifs were subdivided into two stylistic categories; one is the trident form, which is also labelled 'emu track' in many publications (Figure 8). In total, 333 motifs of this category were recorded at the site. The second broad group, labelled 'bird ex', are those tridents with a fourth line opposing the other three. This category occurred less frequently (N = 66, 16.5% of 'bird tracks'). Custodians of Kurutiti, as with Aboriginals elsewhere that have been present during discussions

on rock art motifs, consistently identify all trident forms as bird tracks. In some cases species are associated with particular features. In this regard custodians recognised four types at Kurutiti, emu, pelican, brolga and bush turkey (Figure 9). Their identification is based primarily on the shape and arrangement of the toes. At Kurutiti a single-track depiction is the most frequent motif arrangement, although on some boulders and bedrock surfaces, offset pairs and trails do occur.

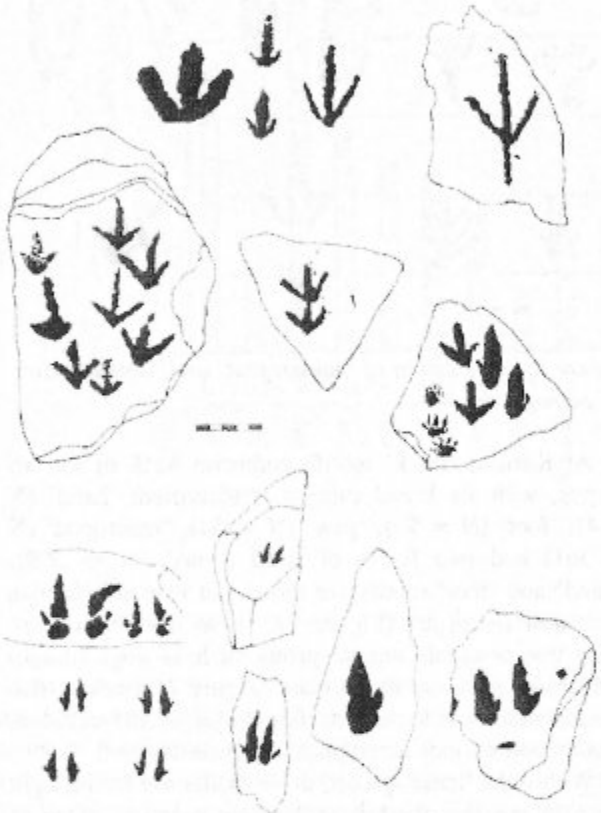

Figure 8. A selection of 'bird track' and 'macropod track' designs.

'Macropod track' motifs account for 38.6% of all track depictions (Figure 8). Of the 361 motifs, pairs are depicted 278 times (77% within macro class), the right track 49 times (13.6%) and the left track in 34 cases. Variability in the style of execution of the motifs is exhibited, with 15 generally distinct forms identifiable. These range from the simple line with side bar to petroglyphs that resemble detailed anatomical features of the toe/track. McDonald (1983) indicated the potential for speciation through her analysis of motifs from the Sturt's Meadows site. In a later paper, McDonald (1993: 114) stated 'that engraved Panaramitee depictions of macropod tracks are naturalistic'. It is possible that the variation exhibited at Kurutiti relates to species representation, although artistic competence and physical character of the rock surface may also be involved. What is constant, however, is that in most cases it is the hopping pads with third and fourth (main side) toe that are depicted. In only two examples does a line extend further than the hopping pads, interpreted as representations of the full macropod, a track left when the animal is stationary. There is also one example with a line between the two foot tracks. Through such a spatial association this is interpreted as a representation of the tail imprint.

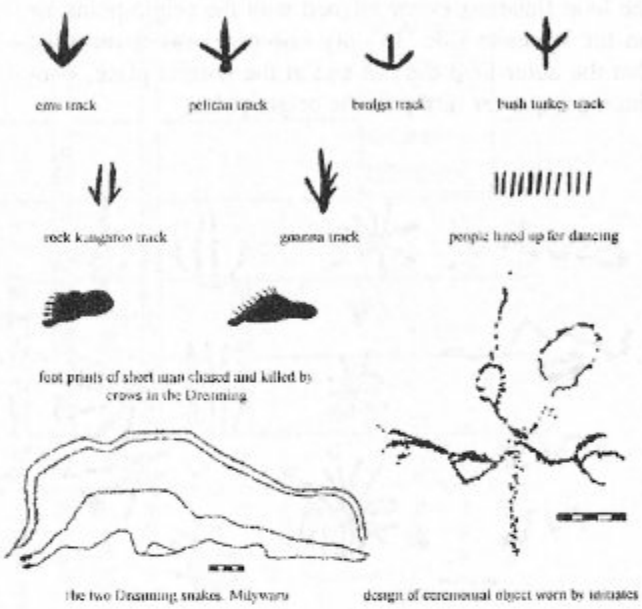

Figure 9. Examples of motifs with specific Walmampa interpretation, including which animal or bird is ascribed to the particular track form.

In addition to the geometric and track motifs, a total of 54 motifs are classified as 'figurative'. Of these non-geometric forms, 14 are classed as 'picks' (see below), a further 16 resemble other 'implements', ten are grouped as 'snake', with another seven classed as 'other zoomorphic'. Additionally, there are motifs which appear to be intended figurative forms although they lack distinguishing attributes which would enable better classification. These have been classed as 'figurative geometric' (N = 7). Identification of the 'snake' motif, although subjective, is based on a number of features that separate them from being classed as 'linear' motifs. The pertinent properties are the form and frequency of wave, inclusion of a head and tapering of the body. However, not all features need to be present (Figures 4, 6 and 9). Supporting this classification is the fact that the Aboriginal custodians of Kurutiti interpreted all these motifs as snakes, and in one case specifically as the two Snake Sisters.

Within the group 'other zoomorphic' (N = 7), two motifs resemble lizards in form, although lacking sufficient detail to positively ascribe such a classification. Two other motifs are more squat and without a defined 'tail'. Depicted in spatial association with 'emu track' motifs is a pair of solid pecked oval shapes. Based on the relationship of these two motifs with the tracks, they are interpreted as representations of emu eggs, and so are

included within the 'other zoomorphic' class. One other figure resembles, to some degree, the form of a long-neck tortoise, although these animals do not occur this far south today. Within the group classed as 'figurative geometric' are a number of forms which do not fit easily within the other categories. Some may be incomplete or weathered zoomorphic motifs; others resemble stylised forms of lizard or anthropomorphous shapes. One petroglyph suggests a bent limb with a four-digit hand/paw.

A distinctive feature of the rock art at Kurutiti is the depiction of a form of hooked line (N = 14) that resembles the profile of stone-bladed fighting picks recorded in the ethnography of the region (Spencer and Gillen 1904). These are stylistically different from the hooked boomerang or spearthrower depicted in the western Arnhem Land art (Chaloupka 1993; Lewis 1988). There is some range exhibited within this class, although generally the 'handle' is straight with the 'blade' perpendicular and tapering (Figure 10). In ten examples the 'spinifex resin hafting' is also incorporated into the depiction.

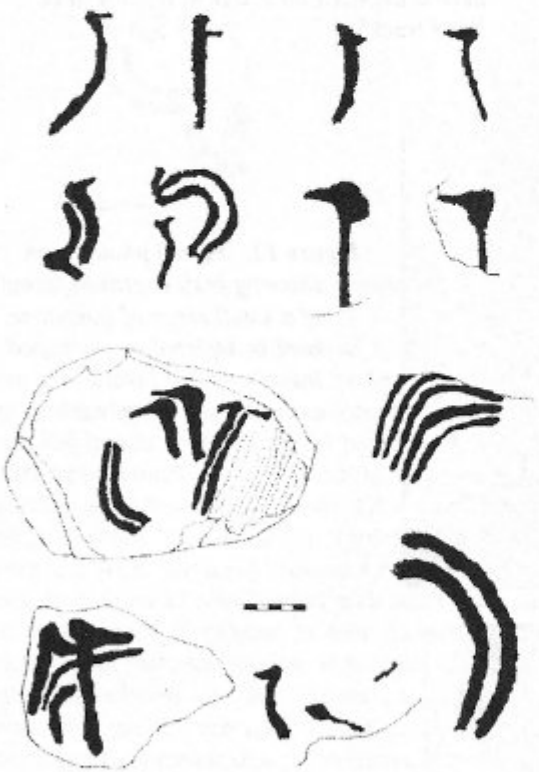

Figure 10. Line drawings of 'pick' and 'boomerang' motifs.

Of the other 'implement' forms (N = 16), two also seem to be stylised picks (both right facing). Hooked sticks or hooked (No. 7 shaped) boomerangs are probable mental templates for eight other motifs within this category (Figure 10). The position and angle of the appendage to the line ('handle') of four other motifs within this class suggests clubs or stone axes. Two other motifs are included within the implement category by spatial association with other implements, although equally they could be placed within the 'arc' category (Figure 10).

Patterns within the Kurutiti petroglyphs

It is evident that the range of motif forms which appear in the Kurutiti rock art is similar to that recorded from other sites containing petroglyphs in the semi-arid and arid parts of inland Australia. Davidson (1952: 92), writing about Western Australian rock art, makes the comment that '[I]n a culture which attaches so much importance to the tracking of humans and animals as the Australian, it should not be considered strange that the footprints are selected for depiction'. The dominance of bird and macropod tracks as compared with other species may be a reflection on the relative economic importance of these animals as food sources. However, it is known from other sites that the dominance of certain types of tracks or the depiction of the animal is linked to the specific Dreaming association of the location. In the case of Kurutiti, this is the Snake Sisters.

Considering that the associated archaeological context of the Kurutiti art is diverse (quarry, reduction areas, camp sites), the form, composition and artistic expression of the petroglyph assemblage is surprisingly uniform. All motifs are produced by the pecking of the rock surface (probably direct percussion); most are formed by interlocking (co-joined or overlapping) pits of 1-3 mm diameter and 1-5 mm deep. Of the 2249 petroglyphs only 35 cases were recorded where the motif is formed by an arrangement of spaced pecks. All but six of these occur in the main rock art area of the exposed bedrock, and adjacent quarry and reduction areas. Most images produced in this style are of geometric form; some designs are complex while others are simple circles and arcs (Figure 10).

As stated previously, there are 2249 motifs recorded on 646 surfaces. In many cases within the reduction scatters, both faces of a sandstone piece are engraved. The extent to which a given panel may have been used as a canvas for the rock art is variable and does not appear to relate to the size of the panel or the relative size of the motifs produced. Many large panels have one or just a few small motifs present, while other panels, whether small or large, are crowded with motifs or a motif fills the available surface space. However, even on the few numerically dominant panels, the rock art of Kurutiti exhibits little superimpositioning. This includes a large bedrock block on the western bank of Helen Creek (270 cm by 200 cm), with 99 identified motifs, and across from this three adjacent jointed bedrock surfaces that exhibit minimal overlap of motifs. In all cases there is what is taken to be the deliberate intention to avoid masking other motifs, or possibly all were done as a composition.

Many of the petroglyphs present on fragments of sandstone are themselves truncated motifs, indicating that they were produced prior to the present-day form of the stone. In a number of cases it is evident that edge erosion and weathering have encroached on the engraved

motif. With others, the sandstone pieces are the fragmented remains of once large engraved panels. As no statistically significant pattern is evident in the class of motifs fractured it is unlikely that specific images were targeted by people for destruction. Some of this breakage may be explained as the result of cattle trampling or, in the creek bed, fluvial action. However, a cultural factor may also be responsible, most likely that engraved bedrock and blocks were subsequently utilised in the production of grindstones. The fragments with petroglyphs are just part of the reduction rubble surrounding the quarry.

There are examples also where petroglyphs have been added subsequent to the breakage of the stone, the central placement of the motif or production on the verso face indicative of this (Figures 11-13). Track motifs are the most frequent occurring of the images so produced, although more elaborate arrangements of geometric motifs are common. In situations where two faces are engraved, the motif subject on both sides may match, such as paired bird tracks. However, in the majority of cases the truncated motifs, predominantly on one face, suggest a period between the production of petroglyphs on each face.

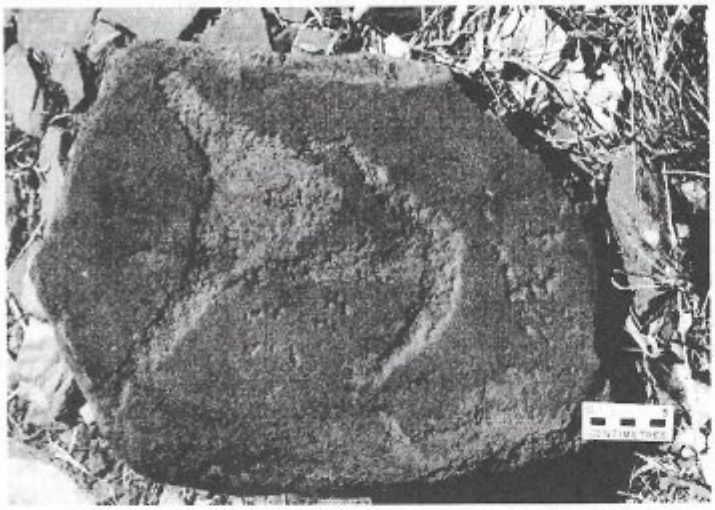

Figure 11. *An example of petroglyphs on a small piece of sandstone derived from the quarry; here is depicted an image of a 'pick' and 'bird track'.*

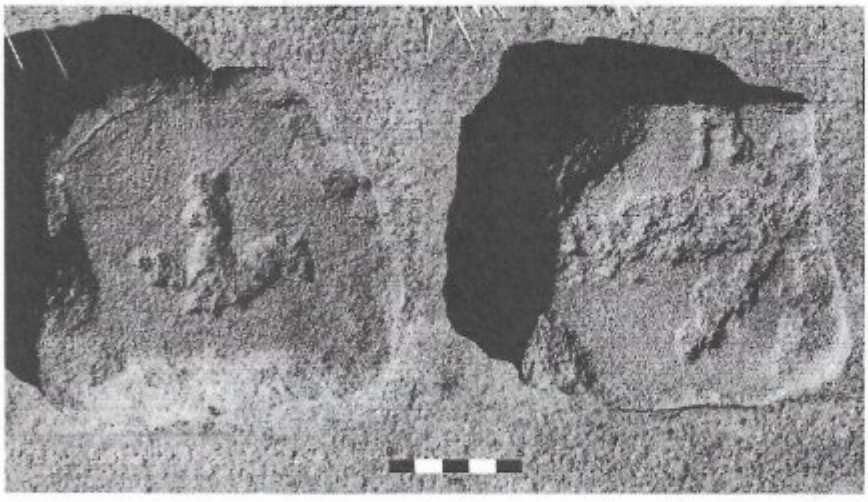

Figure 12. *Paired photograph showing both engraved faces of a small piece of sandstone; here is depicted a 'macropod track' and 'bird track' centrally placed on each surface.*

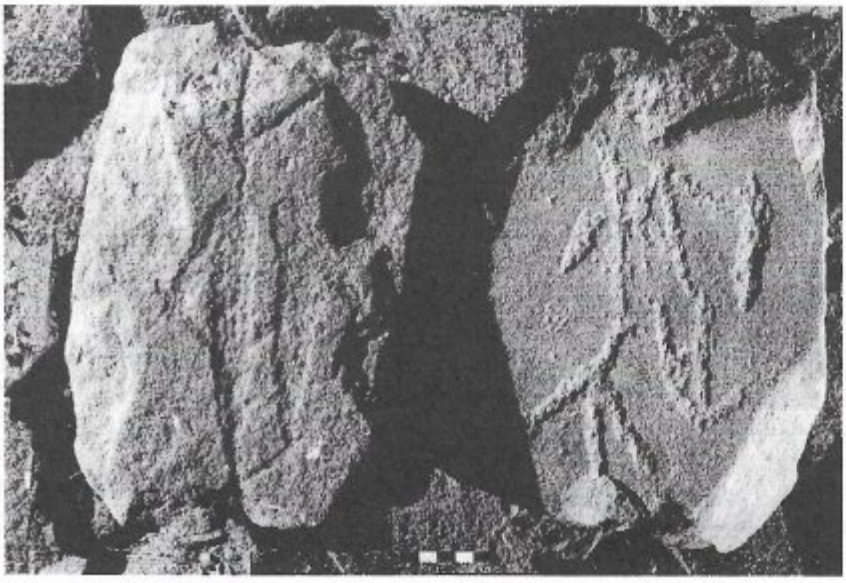

Figure 13. *Paired photograph showing both engraved faces of a small piece of sandstone; here is depicted a pair of 'macropod tracks' and 'bird track' on one face, and set of 'bird tracks' on the obverse face.*

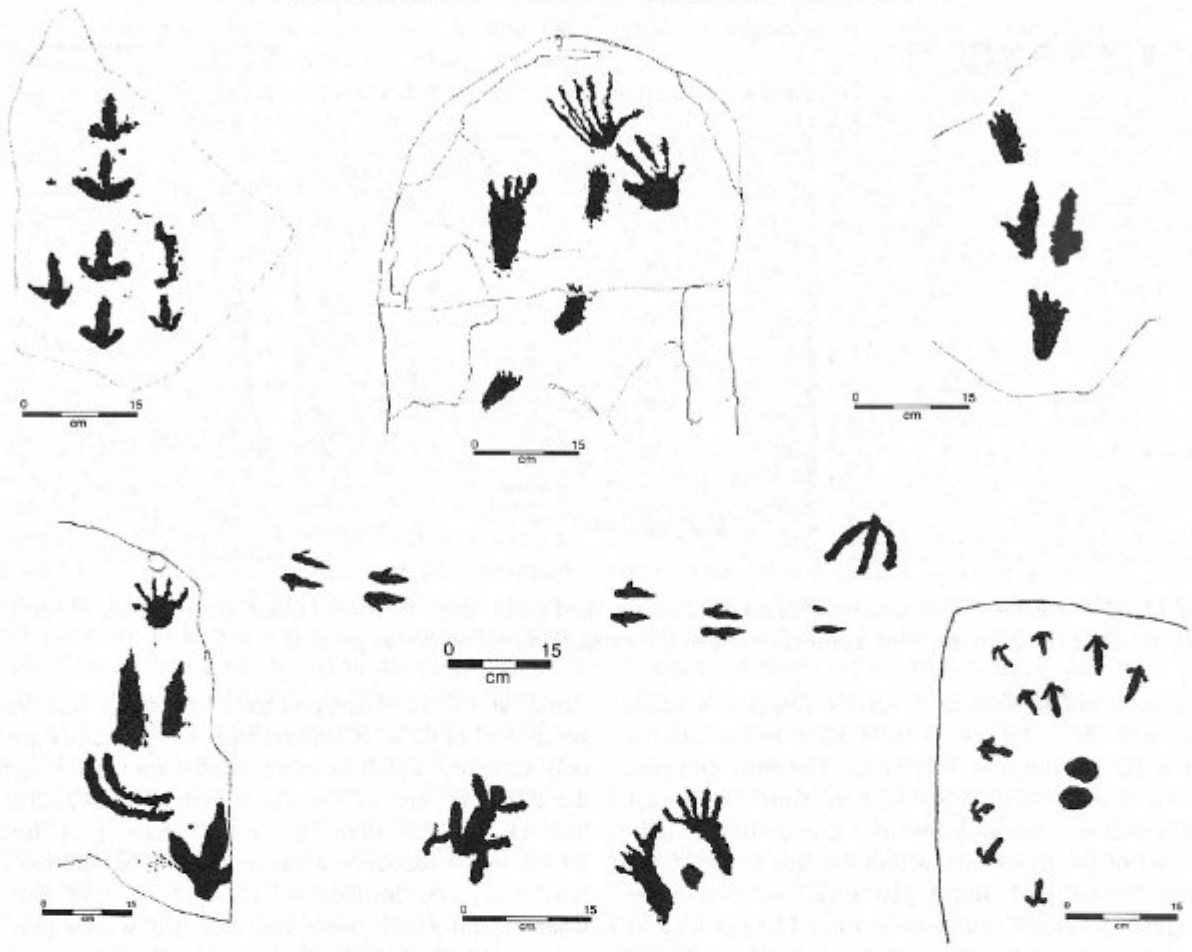

Figure 14. A number of panels comprising trails and compositions; the top left panel is the middle plate in Fig. 15.

Visual compositions at Kurutiti fall into two forms, those that are trails (generally tracks in sequence) and aggregates of motifs in spatial association (Figure 14). In total, 306 motifs produced on 84 panels are identified as occurring in compositions exhibiting spatial association involving at least one other motif. Of these, a large percentage involve 'macropod' or 'bird tracks' in a series across the rock surface. 'Human feet' appear in eight cases, four times in combination with other track motifs. The 'paw' motif is present in four trails, only one of which is not in combination with 'macropod tracks'. Spatial association of 'implements' and 'picks' as a group on a panel were recorded in three cases. While groupings of geometric designs occurred six times, most common are clusters of 'circles' or 'concentric circles'. An additional 13 panels were documented where geometric motifs are linked with other motifs, generally a motif contained within a circle.

Seeming compositions are not limited to arrangements of trails or clustering, structure can be in the singular placement of the motif on the rock surface, or the form and situation of the engraved panel itself. The large, main panel on the western bank of Helen Creek is one such example, where evidently its situation has attracted the production of petroglyphs. A number of other panels are set on angle, especially within the creek channel with a number comprising striking compositions, although fluvial action may have shifted these engraved boulders from their original position. Visual composition in motif placement central to the panel is also a feature of the Kurutiti rock art, especially in regard to the engraved small sandstone pieces found in the reduction areas adjacent to the quarry.

Another feature particular to Kurutiti is the placement of motifs either in spatial association with, or utilising features formed in the process of quarrying (Figure 15). Within the quarry is a sandstone block that retains the isolation pits that aid in splitting the rock (see Mulvaney 1997); here a macropod pair and bird track are executed with toes set to them. Other recorded examples include instances of the motif actually incorporating the isolation pit. To an extent, such cases are a form of isomorphic congruence (see Rosenfeld 1991: 137), the utilisation of an existing feature in the rock, although usually this is a natural mark. In fact, there are only two recorded examples of the incorporation of the natural form or structures within the rock surface. One comprises three pecked lines (not interlocking pecks) positioned between the natural ripple curves on the surface of the sandstone block. The other case is a 'linear geometric' motif formed by a series of curved, spaced, pecked lines, linked at each end. This motif is situated within an area confined by the angle change in the surface of the stone.

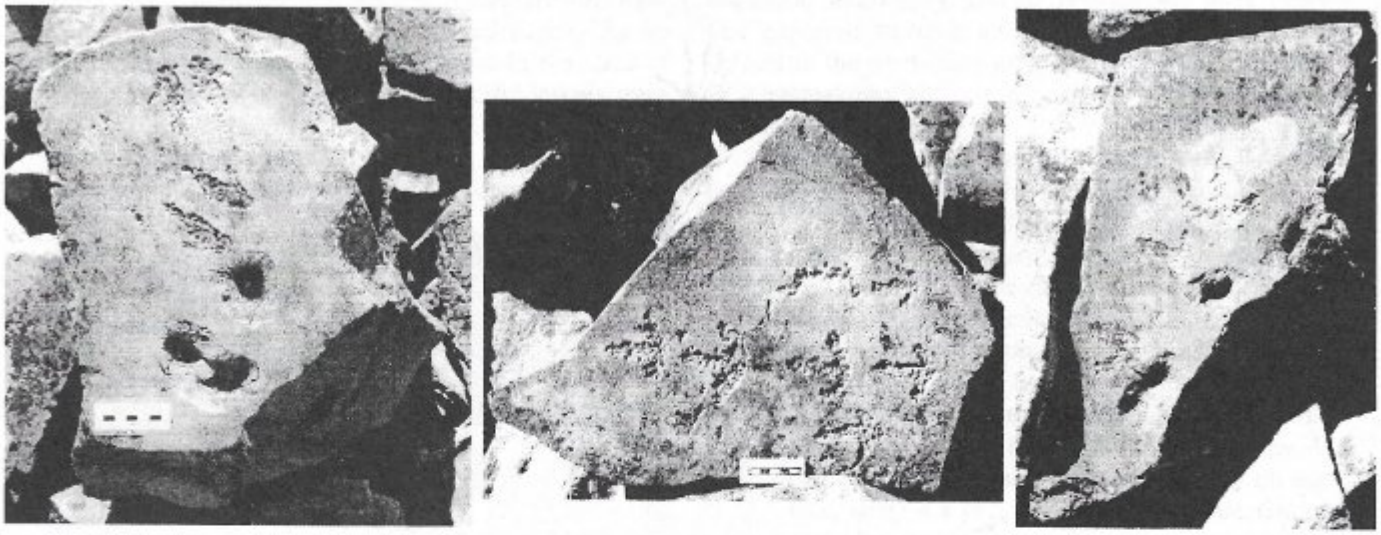

Figure 15. Three examples of sandstone blocks exhibiting 'bird track' and 'macropod track' petroglyphs, either aligned or in combination with features linked to the extraction and reduction process.

The rock art of Kurutiti generally consists of small motifs, with 58% (N = 1178) falling below 10 cm (mean = 12 cm, range = 1-110 cm). The more complex geometric motifs tend to be bigger, with the largest motifs within the 'linear geometric' group. In fact only 33 (1.7%) of the motifs are within the size range of 41-110 cm, 'snake' and 'linear geometric' subjects being the largest. A 'snake' motif measuring 110 cm may at one time have been even longer as on an adjacent panel is what appears to be the tail end of this 'snake' motif, extending 13 cm. Of the motifs in the larger size range, a common form is that of the meandering or irregular line with what appear to be tassels at one or both ends. There are three examples, measuring 107 cm, 92 cm and 60 cm. 'Rayed geometric' design motifs are more frequent in the size range between 44-52 cm. Most of the larger motifs (44-110 cm) occur on the bedrock adjacent to Helen Creek. This feature may be in response to the size of suitable panels on which to produce the art, as there is a general trend to larger panels available on the exposed bedrock at Kurutiti.

Spatial patterning of Kurutiti's petroglyphs

The foremost concentration of rock art at Kurutiti is within the area of exposed bedrock and the adjacent section of Helen Creek, within an area of 1710 m². In this location occur large panels, densely covered by petroglyphs executed on the horizontal or near-horizontal surfaces. To an extent the magnitude and the relative proportions of the motif subjects depicted in this location distinguish this part of the site from other areas containing petroglyphs (N = 1214; 54% of all art). It would normally be expected that if the available sandstone surfaces were merely canvases for the production of engraved images, then the subject distribution across the site should reflect no preference. This is not the case, as some of the motif categories are statistically over-represented in the main area. These are: 'foot' at 78.8%, 'hand' at 100%, 'macropod track' at 69.2% and 'rayed geometric' at 82%. It appears that 'spiral' motifs are the only category which is more evenly spread throughout the different parts of the site complex, with 23.5% on bedrock, 29.4% along the creek channel, a further 29.4% in the reduction areas and 17.7% within the outlying sandstone formations. The only part of Kurutiti where spiral motifs were not recorded was within the quarry rubble area.

Unique to Kurutiti is the presence of petroglyphs within the sandstone quarry and reduction areas on pieces of stone clearly modified in the process of their production for grinding stones. This appears to be directly associated with the rubble produced through the grindstone manufacturing process and not simply reflecting a fortuitous use of available rock surfaces. In total, 223 motifs (9.9% of all art) are located on surfaces within the quarried rubble and 257 motifs (11.4%) occur within the reduction areas adjacent to the quarry.

Within the principal sandstone extraction area are recorded 131 engraved blocks and seven bedrock panels on which 151 petroglyphs are depicted. In addition, 33 panels featuring 58 motifs occur within a confined quarry rubble area situated between Helen Creek and the main quarry. Across Helen Creek from this area and adjacent to the main bedrock panel, a further 15 motifs were recorded within a quarried rubble expanse. It is along the southern portion of the main quarry that most of the petroglyphs are situated (51.7%). Here, also, are the greatest number of 'bird track' motifs found within the quarried rubble (N = 37). Although no other patterns were discernible in the occurrence of petroglyphs amongst the quarried rock a few anomalies exist. In one quarry mining pit, situated near the southern part of the main quarry, occur the only snake-like motifs within the quarry. One pair of macropod tracks also is located within this pit, there being no other such motifs present within the quarry rubble. In an adjacent pit occur six

blocks, each with a single bird track motif. Within the partly disturbed eastern portion of the main quarried rubble deposit are the only two panels that comprise a hooked arc and curved line in combination.

It is possible that the occurrence of petroglyphs on quarried blocks within the extraction areas has more than an aesthetic intention. Such a scenario may relate to the marking of individual ownership, possibly pertaining to the identification of blocks of sandstone for subsequent reduction in the grindstone manufacturing process. Potentially, although less probable, is that these petroglyphs resulted from people doodling while they worked within the quarry.

Not only are there petroglyphs present on boulder surfaces created as part of the quarried rubble, there exist examples where the engraved stone also retains features particular to the grindstone production activities. Some 48 blocks with features linked to the extraction process have petroglyphs, while on the adjacent area of bedrock there are 13 panels which also exhibit quarrying features. Two examples occur within the creek channel and a further eight cases are located within the reduction areas. In addition, twelve examples were recorded within the reduction areas south of the main quarry where petroglyphs actually occur on sandstone implements, not just sandstone reduction material. These fragments include utilised and non-utilised grindstones.

It is within the reduction areas that a high percentage of the petroglyphs occur on small fragments and tabular pieces of sandstone (81% of petroglyphs within these areas). This production of petroglyphs on the small sandstone fragments that occur in spatial association with the reduction working in the production of sandstone artefacts is particular to Kurutiti. At no other site in the region are petroglyphs produced on portable pieces of stone, nor have any been reported from elsewhere in the region. However, other examples have been documented in the Pilbara region of Western Australia and in central Australia (Brown 1983; Brown and Mulvaney 1983; Gunn pers. comm.; Rosenfeld pers. comm.). It is evident that, for whatever reasons, the occurrence of petroglyphs on small sandstone pieces is directly attributable to the abundance of stone present within the reduction areas that are linked to the Kurutiti quarry. Surveys conducted in the surrounding area and wider afield have not located any other petroglyphs on small, portable stones. It appears that motifs were produced in situ, utilising available surfaces and were not transported from the site. It is apparent that the utilisation of both faces of the sandstone pieces also seems particular to the reduction areas. A total of 22 sandstone pieces are so marked, representing 23.4% of all engraved rocks within the reduction areas, almost three quarters of these within one location. In fact, the majority of all engraved stones within the reduction areas are within a relatively small area of 30 m by 15 m on the western side of Helen Creek, south of the main quarry (182 motifs on 63 individual stones in this one area). East of Helen Creek, both south and north of the main quarry, a further 75 motifs are engraved on 31 pieces of sandstone.

Kurutiti in a broader context

Maynard (1979: 84) observed that throughout South and central Australia, ancient petroglyphs have been incorporated into the traditional religious beliefs pertaining to sacred sites and their associated Dreamings. This same situation exists at Kurutiti, where Aboriginal custodians place specific interpretations on certain of the engraved motifs and believe that all the art was created by the two Snake Sisters (Milywaru). Contemporary Aboriginal interpretations and explanations may bear little if any relationship to the original artists' intentions, especially if there is considerable antiquity to the rock engraving episodes. While this does not diminish the current Aboriginal custodians' spiritual relationship to the site, it does provide some insight into the significance of association between past and present. One aspect of this link is that there are clear cultural associations ascribed by the Aboriginal custodians to certain motif forms on the rock surfaces and those used as body decorations during ritual performances.

In the case of Kurutiti it is likely that the use or function of the site does not have great antiquity. The form of the seed milling implements produced at Kurutiti is generally ascribed to the Holocene (Smith 1986b, 1989; however see Field and Fullagar 1998; Gorecki et. al. 1997). Kurutiti's flaked stone assemblage is also indicative of a mid to late Holocene time frame. Development of a blade technology, in particular involving retouched forms (including points), is at most 6000 years old (Bowdler and O'Connor 1991; Clarkson and David 1995; Jones and Johnson 1985; White and O'Connell 1982: 118-20). Blades and points make a more general appearance less than 4000 BP, although in central Australia it may be as recent as 800 years (Attenbrow et al. 1995: 117; Graham and Thorley 1996). The spatial patterning and physical association of the various activities at Kurutiti suggests that the petroglyphs are contemporaneous with the other archaeological aspects of the site. This is supported by the appearance within the motif assemblage of the fighting picks, an implement that incorporated a large blade. This all lends weight to a notion that there may not be such a dislocation of meaning and intention between the current Warlmanpa mythology ascribed to this site and that of the artists who produced the petroglyphs.

Within the general location of Kurutiti, Aboriginal sites with a petroglyph component are known on Muckaty and Helen Springs Pastoral Leases. These sites are all sandstone formations that hold significance within the Milywaru tradition for local Aboriginal people. Nyanya, located in the vicinity of the present Helen Springs homestead, just four kilometres down-stream from Kurutiti, comprises the largest body of known art, apart from Kurutiti. No systematic recording program has been undertaken to date at this site, although it is estimated that between one and two thousand motifs occur. A sample recording set indicates that there is a

higher proportion of arcs and concentric circles/spirals at this site than occurs at Kurutiti. Also some of the 'hand', 'feet' and 'animal track' motifs appear in a more naturalistic style. The interesting feature of the Nyanya site is that on some surfaces less patinated petroglyphs of snake-like forms overlay the earlier art work. As stated, snakes are the principal association of the Milywaru tradition, Nyanya being one of the foremost sacred sites for Warlmanpa linked to this tradition.

A few petroglyphs have been recorded at two other sandstone outcrops between Nyanya and Kurutiti. Both locations contain less than twenty motifs, with subjects comprising arcs, concentric circles, spirals, 'bird' and 'macropod tracks', and extended wavy/meandering lines. One of these sites comprises several hills formed (in part) by outcropping sandstone, which is associated with limited quarrying activities, technologically comparable with that at Kurutiti. To the east of Helen Springs homestead, associated with a sandstone formation, are several 'track' motifs and within a small alcove numerous incised lines are present. This is the only site in the general region at which incised petroglyphs are known to occur. An interesting aspect of this is that the mythological association of the site and even its Warlmanpa name pertain to nose bone ornaments, Marrapinti. Longitudinal grooves are formed when these ornaments were made by grinding to pointed ends on an abrasive rock such as sandstone. A formation of six low sandstone outcrops comprise the sacred site Warlga, located 24 km south-south-east of Kurutiti. Petroglyphs are present on them, although concentrated on the western formation. One hundred motifs are recorded at this site. Within a kilometre east of Warlga is a low formation of siliceous sandstone, containing four rock surfaces that have six engraved 'bird tracks', several concentric circles and two meandering line geometric forms.

From the data available, the pattern indicated at each of these local art sites is that there is a consistency in the subjects and style of depiction. 'Tracks' and circle motifs are dominant, the relative proportion of the two being similar, comprising 40-60% of the total site corpora. However, there also appear to be some motif forms unique to a site, such as the incised lines at Marrapinti. At other locations the relative frequency of depiction of specific motif forms varies between these sites. This is no more apparent than in the extended wavy lines ('snake' motifs) which overlie heavily patinated petroglyphs at Nyanya. All sites within Warlmanpa country so far visited have consistently been associated with sacred sites that pertain to the Dreaming actions of the Milywaru sisters.

Kurutiti in the context of the Panaramitee

Davidson (1952: 90) comments that 'the same narrow range of naturalistic subjects and techniques of execution are among the most striking feature of Australian art, for they demonstrate that the continent shares a basic art tradition'. The subjects depicted in the petroglyphs at Kurutiti may be seen to reflect the world around the artists, with petroglyphs of macropod and bird tracks, and the portrayal of images that match current ceremonial body decorations. It is true that there is an abstract form to much of the art, and that interpretation of the motifs by researchers is subjective, although in part such interpreted meaning is patterned by the Aboriginal custodians' understanding of various motif designs. Considering the basic similarity of many Australian Aboriginal societies, it is not surprising that there appears general conformity within the subjects and style of art across large areas of the continent.

Recording of art sites within the general region of Kurutiti has been confined so far to a few observations made by staff of the Museum and Art Gallery of the Northern Territory (Smith and Cundy 1985), and in records pertaining to documentation of Sacred Sites (Aboriginal Areas Protection Authority). Apart from this current work, no systematic rock art study has been undertaken. This contrasts with central Australia to the south (Edwards 1966, 1968; Forbes 1982, 1983; Gunn 1993, 1994), and the Victoria River region and Arnhem Land to the north (Brandl 1973; Chaloupka 1993; Flood and David 1994; Lewis 1988), where numerous studies have been carried out. Less work has occurred along the western portion of Queensland, although some research has taken place in the Lawn Hill and Mount Isa areas (Dymock 1993; Franklin 1996; Morwood 1985). Paintings as well as petroglyphs occur in all areas, although there may be regional dominance of one art form. Petroglyphs of the Ashburton/Barkly area appear not to fit with the northern painted art traditions, nor do they conform to the central Australian material, which also has a painted art component. Nevertheless, there are similarities with the many pounded petroglyph sites which occur throughout the arid regions of Australia and these invariably contain comparable proportions of motif types (based on subject categories), although each site may contain figures that are specific to that site. This petroglyph component is the distinctive 'style' of the 'Panaramitee' (Maynard 1976, 1979; although see Bednarik 1995).

Despite the particular occurrence of the Kurutiti art in association with quarrying and production of grinding implements, the subject range, pecking technique, form and size of the motifs conforms to the general pattern recorded at sites in the region. These petroglyphs have parallels with the 'Panaramitee' engraved rock art found over much of central and South Australia. These sites, invariably located near water (Edwards 1966; Mountford 1929), are often sites of sacred significance for the local Aboriginal groups. In this respect, Kurutiti with its association to the two Milywaru Snake Sisters conforms to this general pattern. The selection of art subject and style falls within the type range for sites ascribed to the 'Panaramitee' petroglyphs, although Kurutiti is unique in terms of the production of rock art on the quarried stone. Despite this utilisation of small sandstone pieces, the creation of potentially portable art, there is no evidence that the petroglyphs where removed from the site. This

supports the contemporary Aboriginal notion that place, and not simply the art, is the binding link within the culture that produced the art.

One aspect often noted concerning the petroglyphs of 'central Australian (Panaramitee) style' is the relatively small size of the individual motifs, most not exceeding 10 cm in maximum length (Franklin 1991; Maynard 1979). The rock art of Kurutiti would seem to conform to this pattern, with 58% less than 10 cm. It is the snake-like motifs, the primary mythological association of Kurutiti, which are among the largest petroglyphs.

The pattern of the rock art at Kurutiti with the particular response to the character of the location, as formed by the extraction and reduction of sandstone into seed milling implements, suggests that the production of rock art was influenced by the specifics of the site. The link with 'Panaramitee' is likely a stylistic similarity rather than ascribing the art as part of cultural baggage or a tradition, which has generally been held to be the circumstance associated with the engraved rock art of central and South Australia.

There exist a number of divergent motifs to that of the general corpus of 'Panaramitee' art, although it has been noted that at many of the 'Panaramitee' sites there exist unique or site specific designs. Petroglyphs that resemble the stone pick are one such example, in that the distribution of such implements is known to have extended from central Australia into the Top End of Australia (Davidson 1935: 174). However, Kurutiti appears to be the only location at which images of this artefact form have apparently been produced. The inclusion within the central area of a set of concentric rings of an additional motif (generally a track) also features in the Kurutiti rock art.

Conclusion

As Barrett and Kenyon (1952: 10) mused, 'There is a fascination in trying to solve the riddles on these rocks. Have the pictures a deeper significance than has been attributed to them? Have they motives of ritual or of magic; or are they merely due to "play about"?' At Kurutiti, certainly much of the rock art reflects subjects that are readily associated with mundane aspects of Aboriginal life, such as the tracks of the animals that supply much of the meat protein. Some of the subjects, particularly the depictions of fighting picks, are specific to the site but are items of domestic use. However, the concentric circles, spirals and rayed geometric designs are less easily categorised, although in some instances the Aboriginal custodians of the site identified the motifs in symbolism of ritual items or marks.

Kurutiti lies within a region not known for its rock art, yet major and renowned painting and petroglyph sites flank this region. However, in numerical dominance, this site on Helen Creek, with over two thousand images, constitutes one of the largest bodies of petroglyphs in the Northern Territory. It is no coincidence that this location is associated with a regionally important mythological tradition. The links that the Milywaru Snake Sisters have with the sandstone and petroglyphs are both symbolic and physical.

Utilisation of surfaces other than that provided by exposed bedrock and boulders are distinctive features of the Kurutiti rock art. Production of petroglyphs on small tabular pieces of sandstone, often on both sides, is unknown from other sites. This facet of the rock art is directly attributed to the allied activity at Kurutiti of the extraction of sandstone for the production of seed milling implements. The reduction process furnished the source material for this. Also related to the extraction of sandstone is the execution of petroglyphs on sandstone blocks within the quarry. Spatial characteristics indicate that the two activities where concurrent. Some petroglyphs incorporate the extraction marks while in other instances the reduction process truncates petroglyphs.

This site contains an unparalleled amount of cultural material, the flaked stone artefacts and sandstone rubble identify the extent of industrial activity that took place (Mulvaney 1997). Aboriginal associations to the location attest to its religious importance, including meaning to the rock art. The physical appearance and positioning of many of the petroglyphs indicate that much of the rock art had an aesthetic appeal in its production. Spatial relationships between the rock art and other cultural features of the site, where petroglyphs and the sandstone on which they occur are reworked, suggests a more mundane purpose to some of the art or a shift in regard for the images subsequent to their creation.

Kurutiti was a regionally significant sandstone quarry and sacred site that provided items for the ceremonially linked regional exchange system (Mulvaney 1997). That this site was also the focus for rock art production appears more a factor of the mythological significance of the place than pertaining to the grindstone industry. Although, use of the reduction rubble and incorporating marks left by the extraction process are features of the rock art uniquely tied to the quarry. Despite this circumstance, in terms of the motif subject, style and sizes the Kurutiti rock art assemblage fits within the normal pattern of engraved rock art of inland Australia.

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Ken Mulvaney
Aboriginal Areas Protection Authority
P.O. Box 1890
Darwin, N.T. 0801
Australia
E-mail: *ken.mulvaney@nt.gov.au*

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REFERENCES

ATTENBROW, V., B. DAVID and J. FLOOD 1995. Menngе-ya and the origins of points: new insights into the appearance of points in the semi-arid zone of the Northern Territory. *Archaeology in Oceania* 30: 105-20.

BARRETT, C. L. and A. S. KENYON 1952. *Australian Aboriginal art*. National Museum of Victoria, Melbourne.

BEDNARIK, R. G. 1995. Taking the style out of the Panaramitee style. *AURA Newsletter* 12(1): 1-5.

BRANDL, E. 1973. *Australian Aboriginal paintings in western and central Arnhem Land*. Australian Institute of Aboriginal Studies, Canberra.

BOWDLER, S. and S. O'CONNOR 1991. The dating of the Australian Small Tool Tradition, with new evidence from the Kimberley, WA. *Australian Aboriginal Studies* 1991(1): 53-62.

BOWLER, J. M. 1983. 32 +/- 5 ka - northern Australia; hydrological evidence. In J. M. A. Chappell and A. Grindrod (eds), *Proceedings of the first CLIMANZ conference, held at Howman's Gap, Victoria, Australia, February 8-13, 1981*, pp. 4-6. Department of Biogeography and Geomorphology, Research School of Pacific Studies, Australian National University, Canberra.

BROWN, S. 1983. Incised rock engravings and fat-tailed macropod motifs, Pilbara, WA. In M. Smith (ed.) *Archaeology at ANZAAS 1983*, pp. 185-198. Western Australian Museum, Perth.

BROWN, S. and K. J. MULVANEY 1983. A survey for Aboriginal archaeological sites relating to part of, and some associated works on, the Perth-Darwin National Highway. Unpubl. report to the Main Roads Department, Perth.

CLARKSON, C. and B. DAVID 1995. The antiquity of blades and points revisited: investigating the emergence of systematic blade production south-west of Arnhem Land, northern Australia. *The Artefact* 18: 22-44.

CHALOUPKA, G. 1993. *Journey in time*. Reed, Chatswood.

DAVIDSON, D. S. 1935. Archaeological problems of northern Australia. *Journal of the Royal Anthropological Institute* 65(1): 145-83.

DAVIDSON, D. S. 1952. Notes on the pictographs and petroglyphs of Western Australia and a discussion of their affinities with appearances elsewhere on the continent. *Proceedings of the American Philosophical Society* 96(1): 76-117.

DYMOCK, J. 1993. Something deep and rich. Unpubl. report to the Department of Environment and Heritage, Queensland.

EDWARDS, R. 1966. Comparative study of rock engravings in South and central Australia. *Transactions of the Royal Society of South Australia* 90: 33-8.

EDWARDS, R. 1968. Prehistoric engravings at Thomas Reservoir, Cleland Hills, western central Australia. *Records of the South Australian Museum* 15: 647-70.

FIELD, J. and R. FULLAGAR 1998. Grinding and pounding stones from Cuddie Springs and Jinmium. In R. Fullagar (ed.), *A closer look: recent Australian studies of stone tools*, pp. 96-108. Sydney University Archaeology Methods Series 6, Sydney.

FLOOD, J. and B. DAVID 1994. Traditional systems of encoding meaning in Wardaman rock art, Northern Territory. *The Artefact* 17: 6-22.

FORBES, S. 1982. Aboriginal rock engravings at N'Dhala Gorge. B. Litt. thesis, Australian National University, Canberra.

FORBES, S. 1983. Aboriginal rock engravings at N'Dhala Gorge, NT. In M. Smith (ed.), *Archaeology at Anzaas 1983*, pp. 199-213. Western Australian Museum, Perth.

FRANKLIN, N. R. 1991. Explorations of the Panaramitee style. In P. Bahn and A. Rosenfeld (eds), *Rock art and prehistory*, pp. 120-135. Oxbow Monograph 10, Oxbow Books, Oxford.

FRANKLIN, N. 1996. An analysis of rock engravings in the Mt. Isa region, northwest Queensland. In P. Veth and P. Hiscock (eds) *Archaeology of Northern Australia: regional perspectives*, pp. 137-149. Tempus 4, Anthropology Museum, University of Queensland, St. Lucia.

GORECKI, P., M. GRANT, S. O'CONNOR and P. VETH 1997. The morphology, function and antiquity of Australia grinding implements. *Archaeology in Oceania* 32: 141-50.

GRAHAM, R. and P. THORLEY 1996. Central Australian Aboriginal stone knives: their cultural significance, manufacture and trade. In S. R. Morton and D. J. Mulvaney (eds), *Exploring central Australia; Society, the environment and the 1894 Horn Expedition*, pp. 74-89. Surrey Beatty & Sons, Canberra.

GUNN, R. G. 1993. The rock art of Therirrerte, central Australia. Report to the AAPA and the AHC, Canberra.

GUNN, R. G. 1994. The rock art of Kwerlpe, James Range, central Australia. Report to the AAPA, Alice Springs, and the AIATSIS and AHC, Canberra.

JONES, R. and I. JOHNSON 1985. Deaf Adder Gorge: Lindner site, Nauwalabila 1. In R. Jones (ed.), *Archaeological research in Kakadu National Park*, pp. 165-228. Australian National Parks and Wildlife Service Publication 13, Australian National University, Canberra.

LEWIS, D. 1988. *The rock paintings of Arnhem Land, Australia*. BAR international series, 415, Oxford.

McDONALD, J. 1983. The identification of species in a Panaramitee style engraving site. In M. Smith (ed.), *Archaeology at ANZAAS 1983*, pp. 236-248. Western Australian Museum, Perth.

McDONALD, J. 1993. The depiction of species in macropod track engravings at an Aboriginal art site in western New South Wales. In J. Specht (ed.), *F. D. McCarthy, commemorative papers (archaeology, anthropology, rock art)*, pp. 105-115. Records of the Australian Museum, Sydney.

MAYNARD, L. 1976. An archaeological approach to the study of Australian rock art. Unpubl. MA thesis, University of Sydney.

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

MORWOOD, M. J. 1985. Facts and figures: notes on rock art in Mt. Isa area, north-western Queensland. *Rock Art Research* 2: 140-5.

MOUNTFORD, C. P. 1929, Aboriginal rock carvings in South Australia. *Report of the nineteenth meeting of the Australasian Association for the Advancement of Science* 192: 337-66.

MULVANEY, K. J. 1997. More than a chip off the old block. MA thesis, Northern Territory University, Darwin, Northern Territory.

MULVANEY, K. J. 1998. The technology and Aboriginal association of a sandstone quarry near Helen Springs, Northern Territory. In R. Fullagar (ed.) *A closer look: recent Australian studies of stone tools*, pp.73-94. Sydney University Archaeology Methods Series 6, Sydney.

MURGATROYD, W. 1991. Djaperi: a prestige item in Aboriginal exchange. Unpubl. B.A. thesis, Northern Territory University, Darwin.

PATON, R. 1994. Speaking through stones: a study from northern Australia. *World Archaeology* 26(2): 172-84.

RANDAL, M. A. and M. C. BROWN 1969. *Explanatory notes on the Helen Springs geological sheet*. Bureau of Mineral Resources of Australia, explanatory notes SE/53-10.

ROSENFELD, A. 1991. Panaramitee: dead or alive. In P. Bahn and A. Rosenfeld (eds), *Rock art and prehistory*, pp. 136-144. Oxbow Monograph 10, Oxbow Books, Oxford.

SMITH, M. A. 1986a. An investigation of possible Pleistocene occupation at Lake Woods, Northern Territory. *Australian Archaeology* 22: 60-74.

SMITH, M. A. 1986b. The antiquity of seed grinding in central Australia. *Archaeology in Oceania* 21: 29-39.

SMITH, M. A. 1989b. Seed gathering in inland Australia: current evidence from seed-grinders on the antiquity of the ethnohistorical pattern of exploitation. In D. R. Harris and G. C. Hillman (eds), *Foraging and farming: the evolution of plant exploitation*, pp. 305-317. Unwin Hyman, London.

SMITH, M. A. and B. J. CUNDY 1985. A report to the N.T. Museum archaeological investigations. Unpubl. report, NT Museum, Darwin.

SPENCER, B. and F. J. GILLEN 1904. *The northern tribes of central Australia*. Macmillan and Co. Ltd., London.

WHITE, J. P. and J. F. O'CONNELL 1982. *A prehistory of Australia, New Guinea and Sahul*. Academic Press, Sydney.

BRIEF REPORTS

Pilbara petroglyphs dated

By ROBERT G. BEDNARIK

Recently I have reported the discovery of Historical petroglyphs in the eastern Pilbara, Western Australia (Bednarik 2000). This find (which has since led to the discovery of an even earlier 18th century inscription in Western Australia) occurred in the course of a systematic search for Historical inscriptions to facilitate the establishment of a calibration curve for microerosion dating of Pilbara Aboriginal petroglyphs. This search began in 1988, when in the company of the late Howard McNickle I found the first dated inscriptions at one of the many Spear Hill sites.

I have been engaged in trying to establish the age of Pilbara rock art since the 1960s, when I discovered the huge petroglyph concentration on Burrup Peninsula as well as many inland petroglyph sites (Bednarik 1973; for a history of rock art research in the Pilbara, see Bednarik 2002). Having anticipated for many years that such scientific dating would succeed via micro-geomorphic methods (Bednarik 1979), and having developed the microerosion method in 1989 (Bednarik 1992), I had decided that the most promising approach would be to secure a series of microerosion calibration readings from Historical inscriptions with dates. Australia unfortunately lacks the multitude of rock surfaces of historically known ages particularly common in Eurasia (monuments, bridges, gravestones, quarries, glacial abrasions etc.). The calibration curve for crystalline quartz in the Pilbara, the first in Australia, has now been completed. It incorporates engraved dates ranging from 1881 to 1997 (the purported 1771 date was unsuitable for analysis as it occurs on dolerite).

In contrast to all other currently used methods of estimating the age of rock art, microerosion analysis addresses the 'target event' of Dunnell and Readhead (1988); it seeks to estimate the actual age of petroglyphs rather than that of a phenomenon associated with them physically. The microerosion method by micro-wane measurement has been used on petroglyphs in six blind tests now, in Russia, Italy and Bolivia (Bednarik 1992, 1995, 1997). Archaeological expectations were matched in all cases except one, where, however, results matched those of other scientific analyses (Bednarik 1995; Watchman 1995, 1996). Calibration curves are now available from Lake Onega (Russia), Vila Real (Portugal), Grosio (Italy), Qinghai (China; Tang 2000) and eastern Pilbara (Australia), and the technique has also been applied in India, South Africa, at several Bolivian sites and on petroglyph-making stone hammers. The method's practical time range on crystalline quartz, from the present to perhaps 50 000 years BP, renders it particularly suitable for rock art, because very little rock art can be expected to be outside that range, and the perhaps most effective range (from around 1000 years to about 10 000 years) coincides with the presumed age range of most surviving petroglyphs.

The precision of the method is probably poor at this early stage in its development, because it depends entirely on the number and precision of calibration points. The principal potential variables in the solution processes responsible for microerosion are temperature, pH and moisture availability. The first two are regarded as unimportant. Variations in mean annual temperatures, even as far back as glacial peaks of the Pleistocene, are not thought to have been of a magnitude that would have affected solution rates appreciably. Variations in pH can be assumed to have taken place through time, but they are just as unlikely to have influenced solution rates. In the case of both amorphous silica and crystalline quartz, there is almost no change in solubility below pH 9, and higher values would certainly not have been experienced in nearly every natural environment. For alumina the effect is negligible in the central region of the pH scale, which coincides with most natural conditions. Precipitation certainly varied in the past, and this is the one variable to be considered further. But significant changes in moisture availability affect component minerals differently, and should thus be detectable by calibration of more than one component mineral. Therefore it is preferable to apply the method to two different component minerals of the same surface, such as quartz and feldspar.

While microerosion analysis is not thought to provide great accuracy, it is probably more reliable than most alternative methods of dating petroglyphs (Bednarik 2001a), and it is certainly cheaper, simpler and more robust than most. It requires no laboratory backing, and results can be determined in the field, which may save considerable effort necessitated by the need to return to a perhaps very remote site to obtain supplementary data. The method provides not single results, but clusters of age-related values that can be converted into various statistical expressions — a luxury not available to all other dating methods currently used. Moreover, it is the only such method offering a means of internal checking — that is, of checking the validity of the result without recourse to another method (although luminescence dating has a limited feature of this type, i.e. the possibility of checking whether the uranium and thorium decay chains are in equilibrium, and multiple targeted AMS ^{14}C analyses of laminated accretions provide good reliability; cf. Campbell 2000; Watchman 2000). Finally, microerosion analysis involves no removal of samples, or even contact with the rock art, being a purely optical method.

Motif	Wanes	Min. A	Max. A	Mean A	Age, years	Tolerance
Female SH7	No measurements taken				**c. E350**	-
Male 65B	10	1	4	2.00	**E425**	+426, -212
Anthropomorph SH9	12	3	5	4.25	**E904**	+160, -266
Female 65B	Micro-wanes range from 10-15 microns				**E2127-3191**	-
Impact scar 65B	20	10	30	17.25	**E3670**	+2713, -1543
Circle 65B	14	75	125	91.07	**E19 376**	+7219, -3419
Circle 65B	14	110	180	125.74	**E26 753**	+11 545, -3349

***Table 1:** Quartz microerosion data from seven petroglyphs, sites 65B and Spear Hill, eastern Pilbara. Micro-wane dimensions in microns.*

Having secured a calibration curve for the Pilbara at the Spear Hill Complex (McNickle 1985) I applied it to several selected petroglyphs in the region, at three granite boulder piles: Woodstock 65B, Spear Hill 7 and Spear Hill 9. Woodstock site 65B is located near the long abandoned Abydos station, on AGM granite, a fine to coarse, even-grained biotite adamellite, biotite granodiosite and, less commonly, biotite tonalite, well foliated and often gneissic. Both Spear Hill sites are of AGL granite, a well foliated, fine to medium-grained biotite adamellite representing remobilised older granitic rocks. Seven motifs were analysed: four anthropomorphs (including three Woodstock figures), two circles, and a 'vandalistic' impact scar spatially related to the younger of the two circles (Table 1; for full details please refer to Bednarik 2002).

Although Pilbara petroglyphs have attracted the interest of Europeans for at least 160 years, and have long been thought to be of great antiquity, until now their age has remained entirely conjectural. Lorblanchet's (1983, 1992) claimed 18 500-year stylistic chronology of a Burrup Holocene site is baseless (it rests on a single doubtful date from a shell found on the surface, unrelated to any rock art). My own quest to determine the age of the region's abundant rock art, commenced in 1967, has now led to the development of a procedure capable of routinely yielding consistently credible age estimates for this corpus. This development was greatly facilitated by three factors. First and foremost was my early appreciation of the need to break out of the archaeological habit of inventing stylistic sequences and then attempting their correlation with perceived lithic traditions, which I replaced with attempts to exploit geochemistry and micro-geomorphology, thereby initiating 'direct dating' of rock art. The second factor was my development of the theory of micro-wane formation in 1989. Thirdly, my discovery of numerous Historical engraved dates made it possible to create the first microerosion calibration curve for any region of Australia.

These three stages have now led to the development of a standardised method for routine age estimation of individual motifs in the Australian Pilbara, particularly in the granite-dominated eastern Pilbara. It is capable of yielding age estimations of about one hundred petroglyphs per week of field work. However, bearing in mind the tendency of archaeologists to misinterpret or over-interpret direct-dating evidence (Bednarik 1994, 1996, 2001a; Watchman 1999), it is important that a number of qualifications and considerations concerning the data presented here are clearly enunciated:

1. These data do not constitute secure and precise datings. Substantial tolerance values are attached to them, reflecting the spread of the primary data. There is no finite guarantee that the true age of a figure must necessarily lie between the tolerance margins, although this is highly probable.
2. The reliability of each result is largely dependent on the number of micro-wane determinations made.
3. The calibration curve the estimates are based on is tentative, and may need to be refined. There is, however, very little prospect for such refinement in Australia, and it may come in the form of comparative data from similar arid regions on other continents.
4. In reliable microerosion analysis the use of two or more parallel calibration curves (from two or more component minerals) is desirable and has already been demonstrated elsewhere. In the present case it is recommended that a calibration curve for feldspar be established to render results more reliable.
5. Crystalline quartz occurs in different forms, and while it is not expected that their presently untested solution characteristics differ sufficiently to affect the rather coarse resolution this method supports, for the sake of rigour it is desirable to test this assumption through analyses targeting surfaces of historically known ages of different quartz types.
6. A large part of Pilbara rock art occurs on plutonic or extrusive igneous rocks such as gabbro, dolerite and basalt, which renders the development of expertise in the microerosion behaviour of such minerals as pyroxene, augite and olivine very useful for an expansion of the dating program now begun. It is planned to attempt this in due course.
7. These preliminary dates provide no basis for archaeological interpretations of traditions, occupation duration, or any of the other types of misleading archaeological constructs often extracted from rock art. Much older dates are expected to be secured from the region in due course, for instance from cupules, and the few present determinations tell us nothing about population densities, artistic trends, 'styles' or any such interpretations.

Nevertheless, there is a realistic possibility that the

adverse climatic conditions introduced by the Last Glacial Maximum around 18 000 years ago effected depopulation of economically marginal regions, such as much of the Pilbara. This does appear to be reflected in the region's rock art, which provides indications of a lengthy period of very little, or even a complete absence of, petroglyph production. This seems to coincide with the final Pleistocene, or the period from the Last Glacial Maximum to the arrival of the coastline near its present level, in the early Holocene. Naturally this hypothesis requires extensive testing, both through excavation and rock art dating. The few age estimates presented here are certainly most inadequate to test such speculations, although they might well support such a scenario. It is most desirable to acquire some few hundred randomly derived dates from the rock art, and with the development of a standardised procedure of securing fairly reliable age estimations routinely there is now no impediment to such a strategy.

One issue clearly addressed by the current work is the presence of Pleistocene rock art in the Pilbara. Indeed, it suggests that petroglyphs of such antiquity occur most commonly in the region, because the type of deeply repatinated, non-iconographic motifs dominated by cupules and certain linear arrangements account for at least twenty per cent of the region's rock art. The ubiquity of Pleistocene rock art had been suspected by me since the 1960s, and other researchers have had similar vibes, but until now these remained purely speculative. Bearing in mind that the number of petroglyph motifs in the region is believed to be over a million, and quite possibly a few millions, it becomes apparent that the Pilbara comprises not only the largest regional concentration of petroglyphs, it apparently also possesses the world's largest surviving corpus of Ice Age art. This body is many times the size of the legendary Pleistocene rock art in the caves of south-western Europe, it is older than any rock art known in the Americas or Africa, and while older rock art does occur in Asia, very little is known there about its extent. In Australia Pleistocene rock art does occur elsewhere, especially in the caves along the southern coast and in various northern and central regions, but numerically these occurrences are not likely to rival those of the Pilbara. At this stage it is realistic to expect that Pilbara rock art will be shown to be the world's largest concentration of Ice Age art. Another definite finding of the project as it currently stands is that the characteristic and highly sacred Woodstock figures are surprisingly recent — certainly more recent than I expected them to be (the two youngest motifs sampled are Woodstock figures). Conversely, rock paintings do occur in the region, but they are rare and none I have seen is likely to be of the Pleistocene.

NOTE: This short report will be followed by two major technical papers about the project, currently in press (Bednarik 2001b, 2002).

Acknowledgments

I thank the most senior traditional custodian of the Woodstock-Abydos region, Gordon Pontroy, for giving me permission to study and record the principal corpus of rock art considered in this paper, and for sharing with me some of his knowledge about the traditional meanings of the petroglyphs at site 65B. I am indebted to Bruce Wright from whose encouragement my Pilbara work has greatly benefited over several decades. Thanks are also due to Julie Drew, Dr Jörg Hansen, Horst Jessen, Wolfgang Lösel, Dr Anthony Manhire and Megan Lewis, for fruitful discussions in the field; and especially to Nicholas Rothwell, for organising a return trip to the region in November 2000 to complete relevant observations.

REFERENCES

BEDNARIK, R. G. 1973. Wohnhöhlen bei Tom Price (Nordwest-Australien). *Die Höhle* 24: 140-5.

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

BEDNARIK, R. G. 1992. A new method to date petroglyphs. *Archaeometry* 34: 279-91.

BEDNARIK, R. G. 1994. Conceptual pitfalls in dating of Palaeolithic rock art. *Préhistoire Anthropologie Méditerranéennes* 3: 95-102.

BEDNARIK, R. G. 1995. The age of the Côa valley petroglyphs in Portugal. *Rock Art Research* 12: 86-103.

BEDNARIK, R. G. 1996. Only time will tell: a review of the methodology of direct rock art dating. *Archaeometry* 38: 1-13.

BEDNARIK, R. G. 1997. Microerosion analysis of petroglyphs in Valtellina, Italy. *Origini* 21: 7-22.

BEDNARIK, R. G. 2000. Earliest known Historical rock art in Australia. *Rock Art Research* 17: 131-3.

BEDNARIK, R. G. 2001a. The dating of rock art: a critique. *Journal of Archaeological Science* (in press).

BEDNARIK, R. G. 2001b. First dating of Pilbara petroglyphs. *Records of the Western Australian Museum* (in press).

BEDNARIK, R. G. 2002. About the age of Pilbara rock art. *Anthropos* 97 (in press).

CAMPBELL, J. B. 2000. The Chillagoe and Laura laser-AMS dating project. In G. K. Ward and C. Tuniz (eds), *Advances in dating Australian rock-markings*, pp. 80-83. Occasional AURA Publication 10, Australian Rock Art Research Association, Inc., Melbourne.

DUNNELL, R. C. and M. L. READHEAD 1988. The relation of dating and chronology: comments on Chatters and Hoover (1986) and Butler and Stein (1988). *Quaternary Research* 30: 232-3.

LORBLANCHET, M. 1983. Chronology of the rock engravings of Gum Tree Valley and Skew Valley near Dampier, W.A. In M. Smith (ed.), *Archaeology at ANZAAS 1983*. Western Australian Museum, Perth.

LORBLANCHET, M. 1992. The rock engravings of Gum Tree Valley and Skew Valley, Dampier, Western Australia: chronology and functions of the sites. In J. McDonald and I. P. Haskovec (eds), *State of the art: regional rock art studies in Australia and Melanesia*, pp. 39-59. Occasional AURA Publication 6, Australian Rock Art Research Association, Inc., Melbourne.

McNICKLE, H. 1985. An introduction to the Spear Hill rock art complex, north-western Australia. *Rock Art Research* 2: 48-64.

TANG HUISHENG 2000. Microerosion dating of Qinghai petroglyphs, China (abstract). In R. G. Bednarik (ed.), *Third AURA Congress, program and congress handbook*, p. 30. Occasional AURA Publication 11, Australian Rock Art Research Association, Inc., Melbourne.

WATCHMAN, A. 1995. Recent petroglyphs, Foz Côa, Portugal. *Rock Art Research* 12: 104-8.

WATCHMAN, A. 1996. A review of the theory and assumptions in the AMS dating of the Foz Côa petroglyphs, Portugal. *Rock Art Research* 13: 21-30.

WATCHMAN, A. 1999. A universal standard for reporting the ages of petroglyphs and rock paintings. In M. Strecker and P. Bahn (eds), *Dating and the earliest known rock art*, pp. 1-3. Oxbow Books, Oxford.

WATCHMAN, A. 2000. Micro-excavation and laser extraction methods for dating carbon in silica skins and oxalate crusts. In G. K. Ward and C. Tuniz (eds), *Advances in dating Australian rock-markings*, pp. 35-39. Occasional AURA Publication 10, Australian Rock Art Research Association, Inc., Melbourne.

Mineralogical and chemical analyses of an ochred rock, Ngarrabullgan Cave (N. Qld, Australia)

By ROSEMARY GOODALL & BRUNO DAVID

Ngarrabullgan is an 18 km long, 6 km wide sandstone-conglomerate mesa, almost entirely surrounded by 200 to 400-m-high cliffs, in north Queensland. It is at the heart of Djungan Aboriginal country, and an important Dreaming place that in the recent past was the home of various dangerous spirits. Because of this, Ngarrabullgan was not commonly camped upon, although this situation seems to pertain only to the last 700 years (cf. David and Wilson 1999).

In order to investigate the nature and dynamics of land use on the mountain through time, we have begun a program of sourcing the various cultural materials found in the excavations. This paper reports on the mineralogy and elemental fingerprint of paint found on a sandstone rock revealed in situ during the 1993 excavations at Ngarrabullgan Cave on the mountain-top. Exposed during collection of OSL samples from the excavation section walls, it was photographed in situ, its position recorded in three dimensions, and charcoal samples collected from around it. This paper reports on the chemistry and mineralogy of the pigment on the rock.

Description

The rock consists of a broken piece of sandstone with flattish surfaces but rounded edges (Figure 1). It is 66 mm in maximum dimension, 57 mm wide and 53 mm high. A yellow pigment that is not a part of the original rock is clearly visible on one surface. It is 0.1-0.2 mm thick, applied mainly towards the centre of the rock surface. The rock has subsequently snapped in half across the painted surface, exposing the yellow pigment in cross-section. The area covered by the pigment measures 41 × 34 mm. The yellow pigment is not flaking, being well bonded to the rock. Its dry Munsell colour is 10YR 7/6 ('yellow'). The pigmented area is amorphous but well defined. Its shape does not resemble any obvious figurative motif, nor any bounded nonfigurative design (the edges of the painted area grade with the surrounding area). The rock is probably a fragment of a palette, although it could alternatively be a painting that has exfoliated from the roof of the cave. We prefer the former option, as individual rocks of this size are rare in the cave wall matrix and do not occur in the vicinity of the excavated squares (where the rock matrix is sandy). The excavated rock is most likely to have been brought in by people from the immediate vicinity.

Ngarrabullgan Cave is decorated with 73 paintings, two boomerang stencils, six hand stencils and 17 indeterminate (faded painted, stencilled or printed) traces of pigment. The single yellow painting consists of an undulating line, located about 5 m away from square L25 where the painted rock was found. It is possible but not certain that the excavated ochred rock reported here was used to create the linear painting on the cave wall. However, no chemical or mineralogical analyses have been undertaken on the painted yellow linear design on the cave wall.

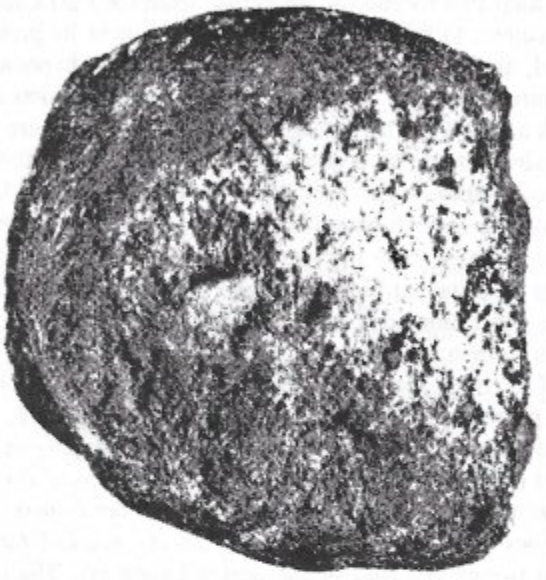

Figure 1. The painted rock. Scale in mm.

Dating

As the rock was exposed in the section after completion of the archaeological excavation, during collection of OSL sediment tubes, it is not associated with an excavation unit (XU). The rock came from square L25, its base located 22 cm below the ground surface (in stratigraphic unit 2). Six charcoal samples surrounding it were individually plotted and collected for radiocarbon dating. David's unpublished field notes recorded the following details:

> All of these charcoal pieces as well as the ochred rock came from near the base of a charcoal-rich unit in square L25. ... This unit cannot easily be related to the section drawing, as it does not occur in the excavation squares, except that it seems to begin 10.5 ± 0.5 cm below ground surface and terminates 28.5 ± 1 cm below the ground surface within SU2, possibly near the boundary with SU3. The ochred piece of rock itself was centred around 20 cm below the ground surface with its base occurring about 22 cm below the ground surface.

Stratigraphic unit 2 has been radiocarbon dated to the mid and late Holocene. A single piece of charcoal lying immediately at the base of the ochred rock (in situ Sample 1) was submitted for AMS radiocarbon analysis. It revealed a radiocarbon date of 3990 ± 70 (OZB090) ($\delta^{13}C$ value = -26.4). This is taken to indicate the time of deposition of the ochred rock.

Chemistry and mineralogy

Experimental

Two techniques have been used to analyse the yellow-coloured material found on the rock, Fourier trans-

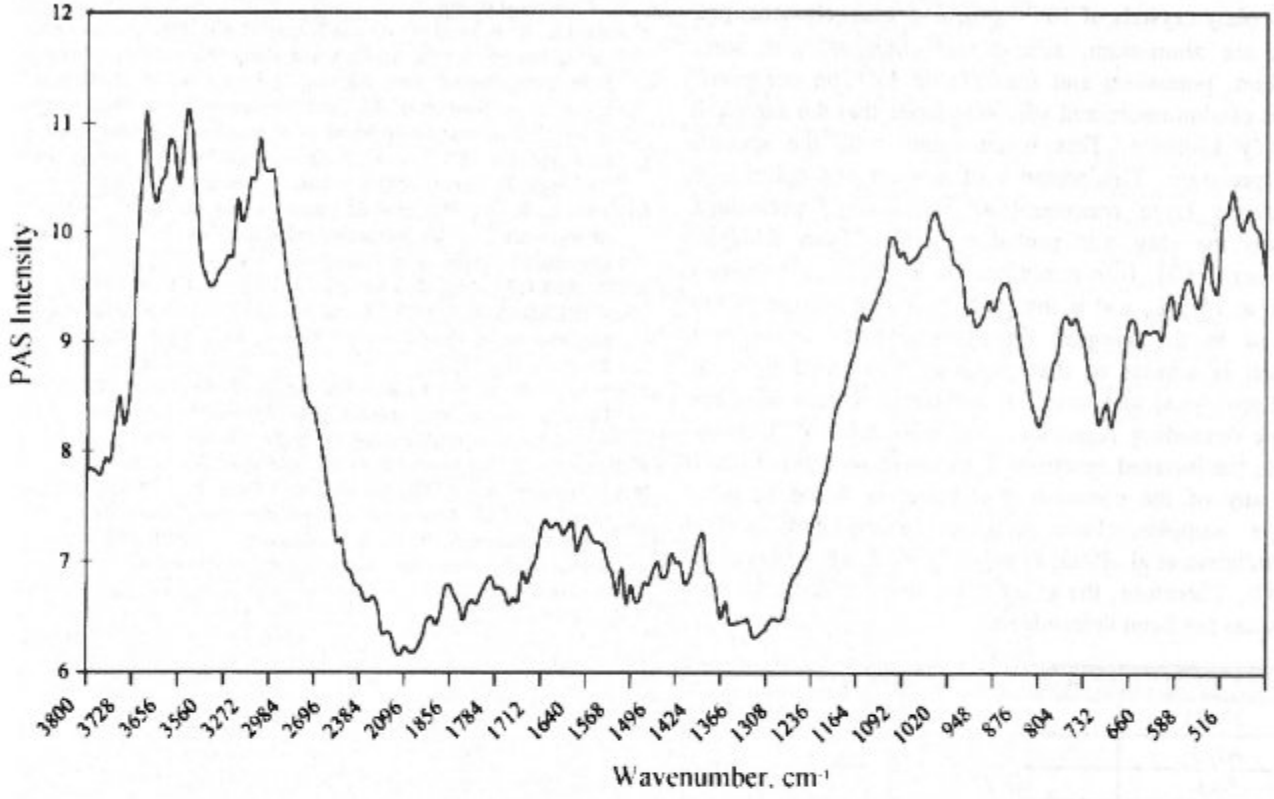

Figure 2. *Infrared spectrum of pigment sample.*

form infrared photoacoustic spectroscopy (FTIR-PAS) and scanning electron microscopy energy dispersive x-ray analysis (SEM-EDXA). These techniques are ideally suited to archaeological samples as both can be applied to small solid specimens. A small flake (< 1 mm) of the yellow material was removed from the rock using the end of a scalpel. The same sample was used for both the infrared and SEM analyses. FTIR-PAS has been used in studies to examine solid samples (Carter and Patuta 1989; Michaelian et al. 1987). Although it requires some treatment to produce the best results, typically samples require no preparation. The spectra produced can be used to determine the mineralogy of archaeological pigments. The sample is not destroyed and can thus be used again for further studies, an important consideration in archaeological applications.

SEM is used to identify the morphological characteristics of the sample and, where it is combined with EDXA, elemental concentrations can be determined. The samples are coated with carbon or gold for best results.

Fourier transform infrared
photoacoustic spectroscopy (FTIR-PAS)

The infrared spectrum was recorded non-destructively using a Perkin Elmer, Series 2000 Fourier transform infrared spectrometer with a MTEC model 200 photoacoustic cell attachment. Photoacoustic infrared is a relatively new technique which enables the spectrum to be recorded for a solid sample (Goodall et al. 1996). The operating conditions were 8 cm^{-1} resolution, 0.1 cm/s optical path difference and co-adding 100 scans. The photoacoustic cell was flushed with UHP helium prior to each analysis. The small flake of coloured material extracted from the rock was placed into the photoacoustic cell with no treatment other than drying (100°C).

Scanning electron microscopy
energy dispersive x-ray analysis (SEM-EDXA)

The SEM analysis was carried out on the same sample flake as the infrared analysis. This sample was mounted on an aluminium disc using double-sided tape and coated with carbon. The analysis was performed on a JEOL JXA-840A electron probe microanalyser. Working conditions were 15 KV and an angle of 40°. The elements measured were silicon (Si), aluminium (Al), chlorine (Cl), potassium (K), sodium (Na) and iron (Fe).

Results

The infrared spectrum shows the bands in the hydroxyl stretching region at 3698, 3667, 3654 and 3620 cm^{-1} (Figure 2). These are typical bands for kaolinite clay (Farmer 1974). The band at 3667 cm^{-1} is only a shoulder band which is indicative of disorder in the kaolinite lattice and is typical of a disordered kaolinite clay. Bands at 939 and 916 cm^{-1} are also consistent with a kaolinite mineral. As these are the dominant bands in the spectrum, it indicates that the sample is predominantly kaolinite with smaller concentrations of other minerals. Strong bands at 804 and 786cm^{-1} indicate that quartz is a minor component.

The SEM examination shows an amorphous surface

with platy crystals of 10-30 μm. The main elements present are aluminium, silicon and chlorine, with some sodium, potassium and iron (Table 1). The concentrations of aluminium and silicon indicate that the sample is mainly kaolinite. This is consistent with the spectral interpretation. The presence of sodium and chlorine in relatively large concentrations, with some potassium, means the clay was probably derived from feldspars (Plimer 1997). Iron concentration as Fe_2O_3 is relatively high at 15.5%, and is the probable source of the yellow colour in the sample. The sample gives a spectrum which is similar to that previously obtained for both archaeological and source ochre samples from SE Cape York (including Ngarrabullgan) (Goodall 1997). However, the infrared spectrum does not show distinct bands for any of the common iron minerals found in other ochre samples, both in this region and beyond (Watchman et al. 1993; Goodall 1997; Lorblanchet et al. 1990). Therefore, the exact mineralogy of the iron species has not been determined.

Oxide	Weight (%)	±2 sigma
Na_2O	14.8	0.55
Al_2O_3	22.6	0.45
SiO_2	32.8	0.52
Cl	12.7	0.23
K_2O	1.38	0.08
Fe_2O_3	15.5	0.54

Table 1. Elemental analysis.

Natural nodules of yellow ochre abound on the mountain, and these analyses are consistent with the composition of local samples analysed previously (Goodall 1997). We conclude that there are no indications that the ochre found on the Ngarrabullgan Cave painted rock is foreign to the general region. The ochre on this 4000-year-old painted rock — probably a paint palette used only once — is likely to have originated in south-east Cape York, and likely at Ngarrabullgan itself.

Rosemary Goodall
Mobil Oil Australia Ltd.
500 Lytton Road
Colmslie, Qld 4170
Australia

Dr Bruno David
Department of Geography and Environmental Science
Monash University
P.O. Box 11A
Clayton, Vic. 3800
Australia
Bruno.David@arts.monash.edu.au

REFERENCES

CARTER, R. O. and M. C. PAPUTA 1989. Photoacoustic detection of rapid-scan Fourier transform infrared spectroscopy from low surface area solid samples. *Applied Spectroscopy* 43: 468.

DAVID, B. and M. WILSON 1999. Re-reading the landscape: place and identity in NE Australia during the late Holocene. *Cambridge Archaeological Journal* 9: 163-88.

FARMER, V. C. 1974. *The infrared spectra of minerals*. Mineralogical Society, London.

GOODALL, R. A., B. DAVID and J. BARTLEY 1996. Non-destructive techniques for the analysis and characterisation of pigments from archaeological sites: the case of Fern Cave. In S. Ulm, I. Lilley and A. Ross (eds), *Australian Archaeology '95: Proceedings of the 1995 Australian Archaeological Association Annual Conference*, pp. 183-187. Tempus 6, Department of Anthropology and Sociology, University of Queensland, Brisbane.

GOODALL, R. A. 1997. Non-destructive techniques for the analysis of pigments from an archaeological site. Unpubl. M.Sc. thesis, Queensland University of Technology, Brisbane.

LORBLANCHET, M., M. LABEAU, J. L. VERNET, P. FITTE, H. VALLADAS, H. CACHIER and M. ARNOLD 1990. Palaeolithic pigments in the Quercy region, France. *Rock Art Research* 7: 4-20.

MICHAELIAN, K. H., K. BUKKA and D. N. S. PERMANN 1987. Photoacoustic infrared spectra (250-10,000cm^{-1}) of partially deuterated kaolinite #9. *Canadian Journal of Chemistry* 65: 1420-3.

PLIMER, I. 1997. *A journey through stone*. Reed Books, Kew.

WATCHMAN, A., J. SIROIS and N. COLE 1993. Mineralogical examination of Aboriginal rock-painting pigments near Laura, north Queensland. In B. I. Fankhauser and J. R. Bird (eds), *Archaeometry: current Australasian research*, pp. 141-50. Research School of Pacific Studies, Australian National University, Canberra.

RAR 18-583

New group of rock art sites in Spain: the petroglyphs of Manzenez Mill (Alconchel, Badajoz)

By HIPÓLITO COLLADO GIRALDO

During the months of January and February 2001 the first of two documentation campaigns has been developed as planned in the environment of the location known as Manzanez Mill, an extensive area with unpublished panels of 'naturalistic' and 'schematic' style that appear on the slate outcrops on the left bank of the river Guadiana. This is located in the municipality of Alconchel to the south-west of the county of Badajoz (Spain) and practically in the border with Portugal.

The intervention was motivated by the next flooding of the area, caused by the construction on Portuguese territory of what will be the largest water storage reservoir in Europe: the dam of Alqueva. Until now one hundred panels in four groups have been documented, a number that without doubt will increase with the second study phase.

The entirety of this rock art corpus was carried out by engraving on slate rocks. The supports used were in more than 95% of the cases flat sub-horizontal surfaces, patinated in grey-blackish or red colour, of very varied dimensions and with different angles of inclination that did not exceed 30° as a general rule. There is also a small proportion of petroglyphs on vertical surfaces. Their distribution is irregular, with areas of greater concentration located in bench marks higher than the other petroglyphs. These areas have been divided into sectors which are separated from each other by spaces with few or no decorated rocks.

Figure 1.
Percussion petroglyphs on slate, Guadiana river.
(Photograph provided by Andrea Arcà, Footsteps of Man)

To represent the diverse motifs two types of petroglyphs were used. The filiform engraving is a type of extremely fine engraving, almost invisible without the use of artificial lighting. Made by this technique, figures are for the most part geometric, using only linear and continuous lines, with multiple lines made by means of several small lines in the same place. The second technique used produced percussion petroglyphs, obtained by impact on the supporting rock, usually outlining the contour of the figure, although on occasion this extends to infilling of interior areas. The percussion petroglyphs represent a great variety of motifs, mainly schematic figures among which should be highlighted repeated graphemes of circular forms (circles with internal crosses, circles, spirals, concentric circles etc.), although there are also anthropomorphs and zoomorphs with different degrees of exfoliation.

As a general rule the petroglyphs documented in the vicinity of the Manzanez Mill do not appear to present narrative scenes, excepting some series of animal figures at site 27. The study of the superimpositions has revealed a long use of this location through perhaps diverse historical stages. Provisionally three diachronic phases have been established:

Phase I. Fine filiform engravings: the thematic content is fundamentally 'schematic' with some possible representations of always incomplete animals.

Phase II. Percussion petroglyphs: the study of the superimpositions indicates its posteriority to the first phase clearly. The figures, with clear parallels in the group of petroglyphs of the Tajo and in the glyphs that decorate the megalithic architectures next to a nearby archaeological context in which occupation sites are located from the Epipalaeolithic to the Bronze Age.

Phase III. This comprises a series of figures superimposed over the percussion petroglyphs of the previous stage. They have been carried out in the technique of the filiform engraving, but their more naturalistic style and the thematic content represented (swords, riders etc.) implies a much later chronology.

The second field campaign will be carried out during the month of October 2001.

Hipólito Collado Giraldo
Archaeological Museum of Badajoz
AP. 702, C.P. 06080 Badajoz
Spain
E-mail: *hipolitocollado@ozu.es*
RAR 18-564

Editorial footnote

The Alqueva dam is located largely on Portuguese territory, roughly east of Lisbon, on the Guadiana river. On 27 April 2001, several years after the commencement of the huge dam project, the Portuguese authorities announced that a massive amount of rock art (extending over ten kilometres) has 'just been discovered' in the valley to be flooded. Preliminary reports indicate that the Guadiana petroglyphs are very similar to those on the lower Côa river in northern Portugal. The IFRAO office of Portugal began its inquiries into this matter, and is taking internationally co-ordinated action to save the rock art as this issue of *RAR* goes to press. The position of IFRAO is presented on page 68.

ORIENTATION

Report on the AURA 2000 Kimberley Tour with David Welch

Following the 2000 AURA Congress in Alice Springs, our group followed the Stuart Highway north to Katherine, and then headed west to the Kimberley. The number of participants swelled and dwindled as some members joined along the way and others left to pursue other activities. In all, about fourteen vehicles and forty people were included in the tour. Two members of the group had their birthdays along the way and we were introduced to American 'somemores' (can I have *some more?),* consisting of marshmallow on a stick, melted over the camp fire, then wrapped in chocolate. We watched the full lunar eclipse as we camped on the banks of Morphett Creek.

There was time to buy Aboriginal artefacts at Ti Tree, just north of Alice, and some members of the group found an excellent petroglyph site further north. This was near an unusual area, about five acres in size, where thousands of loose boulders had been stacked to the sides, forming a number of 'craters' amongst the rocks. The centre of each crater appeared to be a small Aboriginal occupation site, big enough for a single family, as if the boulders were moved to form a protection from the elements.

Once in the Kimberley, we found the ground very boggy in places and this proved a difficulty in reaching some rock art sites. The northern Australian Wet Season generally lasts from about November to April, but the previous Wet had been big and late in the season, and some main roads were still cut only two weeks before we headed out. Normally, one would just wait until later in the year to visit the area. Members of the group quickly learned the importance of not leaving the track when there are boggy conditions. We bogged cars both on and off the track and I have never used my 'snatch strap' so many times in freeing bogged vehicles! Grahame Walsh, who joined us for a day while we were at Mount Elizabeth, also helped, using his vehicle's front winch to pull out the worst-bogged vehicle.

Members of the group, many in hired cars, quickly gained skills in handling their four-wheel drive vehicles, and learned the limitations of the cars. One new vehicle broke the front axle bearing, another miscalculated the angle as a track passed narrowly between trees and grazed one side of the vehicle. Returning from one art site in the evening, we travelled up an extremely steep, eroded, and deeply rutted track and one vehicle fell into the four-foot ditch, having to be pulled out using my 'snatch strap' once again.

One day, as we were driving to a large Wandjina occupation and rock art site, the Mitchell Plateau Aborigines who were showing us the site lit the tall, dry grass along the way. This fire quickly spread around to engulf the track and the cars of those in the group travelling behind, much to some members' amazement, despair and anger! The same fire spread northward to reach our campsite, about 30 km away, a few days later. Such fires are lit regularly by the Aborigines in far northern Australia today and spread over hundreds of kilometres during each Dry Season. They are lit with the purpose of 'clearing the ground' to make walking easier and 'because it's what has always been done'. However, traditionally they were probably more controlled, with a number of people in control and a proper knowledge of the wind changes and use of burning towards gullies and rivers, with the aim of flushing out prey. The fires lit today are generally uncontrolled and there is no attempt to catch game. Those lit earlier in the Dry Season do the least damage because they are retarded by patches of moisture.

Although travelling great distances for much of the time, we managed to see a good cross-section of art. We had local Aborigines with us at sites around Kununurra, at Mount Elizabeth Station and on the Mitchell Plateau. As the members of our group quickly learned, unfortunately much of the Aboriginal knowledge of early Australian rock art has been lost with time. However, with the Aborigines and such an excellent group of rock art researchers and enthusiasts, we were able to extract maximum information from each site. For example, some shelters contain subtle rock markings and rubbings; I had often wondered whether they were natural or made by humans. With the experience of some of the American members I was able to learn that these were, indeed, human markings.

At the end of ten days, the tour split up, each vehicle going its own way. Some visited sites on Theda Station, while others explored more of the Mitchell Plateau. One group journeyed on to meet up with Robert Bednarik's group further down the Western Australian coast, to see the Pilbara. Everyone had gained a new rock art experience and enjoyed the rugged conditions and the effort involved in seeking out Kimberley rock art.

Dr David Welch
1/5 Westralia Street
Stuart Park, N.T. 0820
Australia
RAR 18-565

Re-opening of Tandjesberg San Rock Art National Monument

Tandjesberg is a San rock art site located in the ancient and picturesque eastern Free State/Lesotho landscape. This remarkable site has over 530 well-preserved San or 'Bushman' rock paintings as well as 1000 years of archaeological deposit, indicating that it was an important site for southern Africa's First People.

On 5 September 1998 Tandjesberg — a declared National Monument — suffered from severe veld fire damage. Over the past three years and at a cost of R300 000 the site has been rehabilitated. The rehabilitation is not restricted to only the site, but includes the training of guides, the involvement of local communities and the promotion of the site and the pre-colonial history it represents at local, regional and national levels. To this end, the rehabilitation process has been a partnership between at least seventeen interest groups.

The Tandjesberg rehabilitation has been an outstanding success and the site was reopened for visitation by local and international visitors on 3 March 2001 by Mario Mahongo, a noted San leader and descendant of the First People who painted at Tandjesberg. The reopening was dedicated to the late Angelo Liguori, faithful site custodian for over sixty years.

Centro Camuno di Studi Preistorici, Italy

Course of specialisation in pre-Historic and tribal art

Year 2001/2002

The Centro Camuno di Studi Preistorici directed by Professor Emmanuel Anati announces the forthcoming *Course of specialisation in pre-Historic and tribal art for postgraduate students*. The course is sponsored by the Ministry of Universities and of Scientific and Technological Research.

This project offers the opportunity to develop research activities in an emerging field of the human sciences. There is a growing need for specialists able to take care of the rock art heritage but this need is not being met. It was therefore considered to set up a course for the training of specialists able to handle the methodologies and philosophies of this field of research, which also offers wide perspectives on an international level. A number of scholarships will be offered as specified below. This course will accept a limited number of students, with no territorial or national limitations, with a BA in Human Sciences, Social Sciences or Scientific Sciences. For the year 2001-2002 the attendance is limited to twelve candidates.

Admission is established through a selection of criteria, by a scientific commission elected by the Directorate of the CCSP and chaired by the Director of the CCSP.

Requirements:

a. Bachelor of Arts degree;
b. Good knowledge of at least two of the three following languages: Italian, English and French;
c. A practical knowledge of computer systems (word-processing, page making, images, database).

Preferred:

a. Special consideration will be given to candidates having already acquired practical experience in one or more of the following disciplines: anthropology, art history, archaeology, ethnology, management of the cultural patrimony, pre-History, human geography;
b. Experience acquired in the specific field of pre-Historic and tribal art;
c. Cultural interest and strong motivation for the discipline of the course.

The Course

The course takes place at the Centro Camuno di Studi Preistorici, in Capo di Ponte, northern Italy, in the heart of one of the major areas of world rock art. The course lasts nine months (July 2001 – March 2002) and is structured in three terms.

- Intensive theory (courses, seminars, supported by audiovisuals and text);
- Practical experience (methodology of research, management of research activities, technical training in recording, inventories and thematic studies);
- Apprenticeship (personalised training and tutoring).

At the end of the first term scholarships will be assigned to 30% of the students, which will be those who have obtained the best results. The scholarships are of Euro 4131.66 (c. US$4000) each. This scholarship will be paid in six monthly instalments.

The lectures will be given by top specialists and the theoretical disciplines will include: origins of art, introduction to paleoethnology, psychology of art, aesthetics and semiotics of pre-Historic and tribal art, religion and ideology of pre-Historic and tribal societies, structural analysis of pre-Historic and tribal art, cave art and rock art, statuary and mobile pre-Historic art, techniques and methods of research.

Students will be given tests, and towards the end of the course will have to write and discuss a specialisation thesis. This work should be original and demonstrate the scientific and autonomous ability of the candidate. The best work may be selected for publication. Students will be encouraged to develop their own specific areas of interest. Attendance is compulsory. At the end of the course a certificate will indicate the results obtained, title of the thesis, and an evaluation of the candidate.

An application letter including reasons for applying should be accompanied by complete biographic data, *curriculum vitae*, full address, photocopy of passport or identity card, photocopy of high school and degree certificates, two photographs. Letters of reference from professors or employers will be welcome. The application should include the declaration 'The candidate authorises the Centro Camuno di Studi Preistorici to data processing of the above information according to the law 31/12/1996 n.675'.

Registration fees are Euro 465 per term (c. US$450). Upon request the Centro Camuno di Studi Preistorici will provide information concerning board and lodging, which will be the responsibility of the student.

Applications should be addressed to Professor Emmanuel Anati, Director of the Centro Camuno di Studi Preistorici, via Marconi 7, 25044 Capo di Ponte (BS) Italy; Fax 0039 0364 42572; e-mail: *ccspreist@tin.it*

Letters to the Editor

Dear Sir,

I thank you for publishing the review of my book, *The rock art of Arabia – Saudi Arabia, Oman, Qatar, the Emirates and Yemen*, by M. J. Rowland, in your esteemed journal (17: 138ff). I would like to elucidate certain points raised therein, for the benefit of the readers.

Rowland has viewed the book from the point of view and interest of Australian specialists only. Since *RAR* is an international journal with an international readership, a review with a broader international perspective would have been much appreciated. A book on Arabian rock art cannot have direct 'relevance to Australian readership', because conditions and content of rock art are different at these two places. However, it has direct relevance and parallels to the rock art of Africa and other neighbouring countries around Arabia.

The book is meant for those interested in Arabia's rock art, in particular, and other specialists in general, with a broader perspective. It was also intended to bring to light the vast treasures of Arabian rock art of which very little is known. For instance, if you refer to the recent publication *The Cambridge illustrated history of prehistoric art* (1998), by P. G. Bahn (reviewed in *RAR*, 1998, p. 52), you would be surprised to see that Arabia does *not* find a place on the map of rock art sites of the World, nor is there any mention of Arabian rock art in the text. On reading this Cambridge book a reader will think that rock art does not exist at all in the whole of Arabia's seven states. In this context of complete omission in an authoritative work you may well imagine the importance and value of my contribution. On the contrary, on this side of the World the European specialists consider the book as a great contribution towards the advancement of knowledge and literature on rock art that provides immense wealth of information about Arabia, for the first time.

The book has been designed mainly for the archaeologist and general readers of Arabian states. With this objective, general details, such as aims, earlier studies, terminology etc., were briefly mentioned. I have not discussed in depth the terminology and techniques preferred by Australian specialists, as I am sure they are well aware of them and I felt it was redundant to repeat them. Rowland's comments that Australian researchers 'will be greatly disappointed at its depth' (p. 138), is rather surprising as it is not a book exclusively devoted to terminology and techniques in order to discuss these aspects in depth. Just preliminary details were provided as a general introduction for a general reader. Unnecessary digression would have been superfluous.

With reference to the periods and chronology, I may mention that I have briefly discussed the classification and referred to the opinions of about a dozen archaeologists, all those who have worked on Arabia. The chronology was discussed and tabulated by taking into consideration about twenty factors for dating (p. 34). A table of relative chronologies of periods and cultures (p. 35) has been given for the benefit of the readers. In addition, a *tentative* chronological table, along with the salient features in the typological development of rock art (p. 301), has been provided as ready reference. I have stated *tentative*, because the Government Departments of Antiquities and Museums in Saudi Arabia and other states have not carried out any investigation for absolute or scientific dating of rock art taking patination into consideration. Thus, in the absence of any scientific data, one may well imagine the problem I had faced in dating and framing the chronology.

I am at a loss to understand the mind of the reviewer – when the details are brief he expects them to be more elaborate in depth. But when the detailed description of hundreds of petroglyphs was made (pp. 38-288), he considers it as a 'tedious account'. Again, when I have described over 600 petroglyphs in detail, he would consider it as 'not a pleasant or rewarding experience to work through them' (p. 138).

I agree that the photographs are of diverse quality. This is because they were shot under unfavourable and unavoidable environmental situations. Due to the high rise of the outcrops in closer vicinity sun light never appeared on the petroglyphs. Some were too high and steep to be reached. The circumstances were beyond my control. In order to make a comprehensive study and to present various themes, I had to utilise them. Yes, the illustrations are without and with IFRAO scale. In the former case, they were photographed before the introduction of the IFRAO scale. In cases where the petroglyphs were too high and could not be reached, they were taken without scale.

The text is not a translation from Indian. It was written directly in English, not in India, but at my workplace, King Saud University, Riyadh (Saudi Arabia). I accept that some typographical errors have occurred. This might have happened in the process of reducing the original typed script from 1650 pages to the present size. Some may have been overlooked while reading the proofs.

I have not stated that 'Arabia might be the original home of mankind' (p. 139). My argument, on the basis of C. S. Coon and H. McClure is that 'When there is the possibility of tool industry of Tanzania originating from South Arabia, it is quite possible that the oldest people of Tanzania might have also originated from South Arabia. *If this is possibly proved then Arabia becomes the original home of mankind*' (p. 326). It is only a hypothetical consideration, a normal practice in all archaeological studies all over the World.

In Saudi Arabia the ancient religions and mythological topics are considered very sensitive and the law is very strict about their literature. As such, to be safe, I avoided them for 'obvious reasons' and just made a brief study. Scholars of Arabian studies are aware of this aspect.

About the confusion generated by the use of Arabic terms *Wasum* and *Wusum* for the tribal marks, I may mention that the former is singular and the latter plural. Thus, where *Wasum* is mentioned it implied single tribal mark, and *Wusum* implied more than one tribal marks/signs. The only difference is the interplay of second letter 'a' and 'u' in each word. But, this is clear from the caption of the chapter itself; 'signs (*Wusum*)' (p. 343), and the opening line of the chapter 'some sign, symbol, or the *Wasum* ... a mark'. The word has a special significance in the tribal life of Arabia and as such it was adopted in the original form in the text.

The chapters on other smaller Arabian states, Oman, the Emirates, Qatar and the Yemen are shorter, when compared to Saudi Arabia, owing to the limitation of the petroglyphs, which number considerably fewer in these states.

Finally, I crave the indulgence of the learned readers to take into consideration the positive side of the book which provides a wealth of new information, in a broader perspective because, to quote Rowland, 'this is an enormous book' (p. 138).

Dr M. A. Nayeem
RAR 18-566

Editor's reply

I thank Dr Nayeem for clarifying some specific points about his book and its review. I think he is right in some instances, wrong in some others. Yes, the neglect of Arabian (and other) rock art in books that purport to cover the rock art of the World is most regrettable, especially as there are in fact fairly comprehensive works available on Arabia (e.g. by E. Anati, M. Khan) that predate Nayeem's labour of love. And even some of the books that consider global rock art certainly do include sections on Arabia, including one which modesty forbids me to mention.

However, on the whole I agree very much with the tenor of Rowland's review, which I think is a totally fair and very accurate assessment of the book. *RAR* does not publish 'soft' reviews of books, all books considered in this journal are judged rigorously and critically. *RAR* aspires to scientific standards of review and debate, which means that a book describing the vibes of one author about a region's rock art, its meaning and its age (entirely without any basis) can only contribute further to the already excessive volume of unreliable literature we have on world rock art.

It seems to me that Nayeem misunderstood Rowland's contention that the book is of limited relevance to the Australian reader, and it is important for Nayeem's own development as a researcher that he understands what Rowland means. This comment has nothing to do with geography, it refers to epistemology. Australian researchers have at their disposal much better ethnographic information than the rock art students in any other part of the World, and yet they are more averse to addressing questions of meaning and content of rock art than the researchers of any other part of the World. Until the rock art students of the rest of the World understand the Australian reluctance of inventing meanings for rock art, there will remain a communication problem, and works such as Nayeem's book are of little interest to the Australians. Nayeem knows very significantly less about the meaning of Arabian rock art than Rowland knows about the meaning of Australian rock art, and yet Rowland would be very sceptical about the validity of his own information, whereas Nayeem blithely invents meanings and reports them in print. This is the simple truth, and Nayeem needs to appreciate that all he says about the meaning of his rock art, or its age, is without sound basis, and is of no value whatsoever to the serious rock art scientist in Australia or elsewhere.

Seen in this light, Rowland's review was most restrained and positive. This is particularly evident in the light of the accusations of plagiarism levelled against Nayeem by Saad A. Al-Rashid, Deputy Minister of Antiquity and Museums of Saudi Arabia well before the book was reviewed (Ghazanfar 2000).

REFERENCE

GHAZANFAR, A. K. M. 2000. 'Rock art of Arabia' author accused of plagiarism. *The Daily Arab News*, Riyadh, 19 July 2000.

RAR 18-567

Dear Robert,

My membership in AURA continues to be the greatest bargain in a professional membership that is available. Keep up the great work and fine publications. Best regards,

Chuck (Professor Charles Peterson)

*

Forthcoming events

Fourteenth Congress of the International Union of Prehistoric and Protohistoric Sciences. Liège, Belgium, 2-8 September 2001. Contact ABACO, M.A.C. srl, v.le A Gramsci, 47, 47100 Forlì, Italy.

EARARA Workshop on the Recording and Conservation of Tanzanian Rock Art. To be held by the Eastern African Rock Art Research Association, this seven-day international workshop will be held in Arusha, northern Tanzania, from 29 September to 7 October 2001. For full details please see IFRAO Report No. 26 on the following pages. Prospective participants should express their interest to Professor Fidelis Masao, *fitman60@hotmail.com*

International workshop of rock art in Cuba. Havana, Cuba, 15 - 20 October 2001. The foundation 'Anthony Núñez Jiménez' of the Nature and Man invites participation. Registration will be US$100 for professionals and US$70 for students. For details please contact the Foundation 'Antonio Núñez Jiménez' of the Nature and Man, Calle 5 ta, e/ 66 y 70, Playa, Ciudad de La Habana, Cuba, CP 10300. E-mail: *angel@fanj.cult.cu* or *racsofdez@yahoo.com*

Chacmool 2001: An Odyssey of space. Calgary, Canada, 14 - 18 November 2001. Several session topics in this conference, which addresses the concept of space and how it is perceived from the archaeological record, will be of interest to rock art researchers. For details please contact Janet Blakey, *jsblakey@ucalgary.ca* or Christine Cluney, *cjcluney@ucalgary.ca*

Australian Archaeological Association Annual Conference 2001: Barriers, borders, boundaries, 6-8 December 2001. To be hosted by the Aboriginal and Torres Strait Islander Studies Unit and the School of Social Science at the University of Queensland. The conference will be held at Kondari Resort, Hervey Bay, Queensland, with an optional fieldtrip to Fraser Island on Sunday, 9 December. Current session ideas include: DNA, dates and deep History; the archaeology of isolation; boundaries to archaeological thinking; regions and boundaries. For further information please contact: AAA Conference 2001, Aboriginal and Torres Strait Islander Studies Unit, The University of Queensland, Brisbane QLD 4072, Australia. E-mail: *aaa2001@mailbox.uq.edu.au*

La conservation de l'art préhistorique. The 10th SFIIC Study Days (French Group of the International Institute of Conservation), Paris, France, 23 – 24 May 2002, first announcement and call for papers. Topics will include, besides ethics and historic aspects, paintings, rock art, outdoor sites, archaeological objects, environmental and preventive conservation problems, moulding and facsimile problems, as regards both sites and pre-History

museums. The conference will take place over two days (Thursday and Friday). Working languages will be French and English, with simultaneous translation. Papers must have a multidisciplinarity orientation, including scientific, archaeological and conservation aspects. Paper titles and abstracts (about 1500 characters) to be sent by 30 June 2001, to: Secrétariat de la SFIIC, 29 rue de Paris, F-77420 Champs-sur-Marne, France; Tel.: (33) 0160 377797; Fax: (33) 0160 377799. Internet site: *http://www.fnet.fr/sfiic*

Skopje 2002 - International Rock Art Conference of the Macedonian Rock Art Research Association. The IRAC 2002 will be held from 14 to 21 July 2002 at the University of Skopje, Former Yugoslav Republic of Macedonia. Expressions of interest can be directed to Dr Dusko Aleksovski by e-mail: *karpumet@mt.net.mk*

The next *IFRAO Congress* is to be in India in late 2003 or early 2004, and will be chaired by RASI.

Notes

The beeswax art of northern Australia, edited by Erle Nelson, is now available on CD. Professor Nelson and Dr George Chaloupka AO are attempting to set up an Aboriginal scholarship in honour of an Aboriginal colleague who died before the CD-book was complete. It is to be supported from the sales of the CD. Professor Nelson retains copyright for the moment and will ship copies of the CD for $A100.00. This 'book of record', as he calls it, is a comprehensive record of the northern Australian beeswax art, comprising several detailed written contributions, a complete record of the art, and a massive number of high-quality colour images. The data are presented in sufficient detail that they can provide the basis for further scholarly analyses. The CD-book is read with Adobe Acrobat Reader 4 (or later) which is available free on the Internet. It is highly recommended for the serious rock art researcher, and for the time being needs to be ordered directly from Professor D. E. Nelson. Archaeology Department, Simon Fraser University, Burnaby, B.C. V5A 1S6, Canada; e-mail: *Erle_Nelson@sfu.ca*

Rock art of Arabia: Saudi Arabia, Oman, Qatar, Emirates and Yemen, by AURA member Muhammed Abdul Nayeem: a 25% discount applies to AURA members on the price of US$90, and the postage of US$10 is waived, amounting to a total saving of 35%. The book has xxxi + 526 pages, 600 colour photos, 91 b/w photos, 580 line drawings, 23 maps etc., and is hardbound. It can be obtained directly from its Hyderabad publishers, 10-2-5/8/1, A.C. Guards, Hyderabad-50004, India.

Rock Art Research is fortunate to welcome to its Board of Editorial Advisers Mario Consens from Uruguay. Mario is one of the most accomplished scholars in our field, with a distinguished record in research and publishing. As an IFRAO Representative (of CIARU) and a member of the new IFRAO-Brepols Editorial Committee, he is a valuable addition to our team.

All ***back issues*** of *RAR*, beginning with the November 1988 issue, are available from AURA, please order full sets from the Editor.

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The first four books to be published under the new IFRAO-Brepols imprint will be the following volumes:

Rock art science: the scientific study of palaeoart, by Robert G. Bednarik. This is the first comprehensive academic textbook about the application of scientific principles and methods in the study of pre-Historic art. The volume is especially intended for use by researchers, teachers, students, authors, conservators, site managers and administrators concerned with the study, analysis or protection of rock art. It is an essential source for academics in archaeology and several other disciplines concerned with this cultural resource. Rock art research is a rapidly developing field of investigation that has traditionally suffered from idiosyncratic, disjointed and unfocused research efforts. This much-needed standard textbook will provide a point of reference for the discipline.

Glossary of rock art research: a multilingual dictionary, edited by Robert G. Bednarik, Mario Consens, Alfred Muzzolini, Jakov Sher, Dario Seglie and Mila Simões de Abreu. This is the first dictionary compiled specifically for rock art research, in English, French, German, Italian, Spanish, Portuguese and Russian. In a discipline that has hitherto been without an agreed terminology, even communication within a single language has been difficult.

The petroglyphs of El-Hosh (Upper Egypt), by D. Huyge, M. De Dapper, E. Marchi and A. Watchman. A multitude of rock art sites was located in Upper Egypt, comprising several thousand petroglyphs. Dating was achieved by AMS ^{14}C analysis. The monograph describes and illustrates in detail the rock art of El-Hosh and its environmental context. Major emphasis is on the analysis of rock varnishes, dating procedures and adequate reproduction of the rock art. The volume includes numerous black-and-white drawings (direct tracings of panels), about 50-60 black-and-white plates and about ten colour plates.

Rock art and epistemology: courting sophistication, edited by Robert G. Bednarik. This volume introduces a selection of the most innovative papers presented at two major conferences, the 1995 International Rock Art Congress in Turin, Italy, and the Third Congress of the Australian Rock Art Research Association in 2000, held in Alice Springs, Australia.

New AURA members

We have had the pleasure of welcoming the following new members of AURA during the past year:

Dennis Schulz, Marrara, Northern Territory
Camilla Olsson, Grebbestad, Sweden
Blaze V. O'Connor, Dublin, Ireland
Mauro Cinquetti, Pinerolo, Italy
Marco Cinquetti, Pinerolo, Italy
Giancarlo Turco, Pinerolo, Italy
Laura Panero, Pinerolo, Italy
Dr Piero Ricchiardi, Pinerolo, Italy
Davide Ricchiardi, Pinerolo, Italy
Daniel Seglie, Pinerolo, Italy
James Branch Cabell Library, Richmond, VA, U.S.A.
The Pictish Arts Society, Edinburgh, Scotland, U.K.
Siberian Assn of Prehistoric Art Researchers, Kemerovo, Russia
Dierdre Woody, Glen Mills, PA, U.S.A.
Luke Freeman, Yarraville, Victoria
Walter Freeman, San Francisco, CA, U.S.A.
Do Freeman, San Francisco, CA, U.S.A.
Jeanine Warnod, San Francisco, CA, U.S.A.
Masahiro Dantsuji, Brighton, Victoria
Georgio dell'Erba, Pinerolo, Italy
Wendy Rainbird, Farrer, A.C.T.
Paul F. Lawson, Vancouver, WA, U.S.A.
Maria Myers, North Carlton, Victoria
Cecilia J. Myers, North Carlton, Victoria
Professor Ekkehart Malotki, Flagstaff, AZ, U.S.A.
Kazi Jestribek, Nedlands, Western Australia
Polly Schaafsma, Santa Fe, NM, U.S.A.
Curtis Schaafsma, Santa Fe, NM, U.S.A.
Penelope Coleing, Scotts Head, New South Wales
Moira Munro, Mt George, New South Wales
Kakadu National Park, Jabiru, Northern Territory
Peter Blystone, Flagstaff, AZ, U.S.A.
Albie Viegas, Warburton, via Alice Springs, Northern Territory
Ursel Benekendorff, Geesthacht, Germany
Donalda M. Nicolson, Twizel, New Zealand
Marta Irene Arancio, Salta, Argentina
Ian Dunlop, Gordon, New South Wales
Dr Luke Taylor, Canberra, A.C.T.
Helen Bunning, Peppermint Grove, Western Australia
John M. Ware, Mt. Moffatt, Mitchell, Queensland
Sally K. May, Blackwood, South Australia
Professor Terese Vega, Neuquén, Argentina
Dr Peter Thorley, Alice Springs, Northern Territory
Shane Hersey, Alice Springs, Northern Territory
Michael J. Eastham, Fishguard, Pembrokeshire, United Kingdom
Dr Manuel Gutierrez, Nanterre, France
Maria Viegas, Jingili, Northern Territory
Marianne Nolan, Ennis, County Clare, Ireland
Wayne R. Brennan, Katoomba, New South Wales
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Dr Elizabeth Daly E. Orleans, MA, U.S.A.
Gutha Bimbi Budbahra Services Ltd., Farleigh, Queensland
Elena Dolgovessova, Novosibirsk, Russia
Dr Isabel Pereda, Buenos Aires, Argentina
Andrea Arcá, Torino, Italy
Hugh Wallace Smith, Arcadia, Queensland
Dr Ewan M. Lawson, ANSTO, Menai, New South Wales
Johann H. Strauss, Upington, Northern Cape, South Africa
Dr Kalyan K. Chakravarty, Bhopal, India
Chief Johannes Lawrence, Kimberley, South Africa
Tim Gaze, Kent Town, South Australia
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Ludwig Jaffe, Vila Real, Portugal
James Robinson, Richmond, Victoria
Rob Burrett, Harare, Zimbabwe
Charles Robert Bailey, Brooklyn Center, MA, U.S.A.
The Editor, *Sahara*, Segrate, Italy
Professor Fidelis Taliwana Masao, Dar es Salaam, Tanzania
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Jamie Anfossi, Victoria, B.C., Canada
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Dr Ian D. MacLeod, Fremantle, Western Australia
Kaye McPherson, Lia Pootah Community, Lindisfarne, Tasmania
Andrew Harrison, Cairns, Queensland
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Prof. Dr. R. P. Soejono, Jakarta, Indonesia
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Batchelor College, Toowong, Queensland
Glenn R. Woodley, Hill End, New South Wales

IFRAO Report No. 26

Rock art discovery in the Alqueva dam zone of the river Guadiana in Spain and Portugal

The International Federation of Rock Art Organisations applauds the important discovery of petroglyphs by the river Guadiana in Spain and Portugal, in a zone that will be flooded by the Alqueva dam.

A Spanish archaeologist disclosed the petroglyphs in Spain early last April at a course on European pre-Historic art, held at the Polytechnic of Tomar (IPT) in Portugal. His talk was on fieldwork carried out at Cheles during January and February this year (see article on pp. 60-61 in this issue of *RAR*).

IFRAO rock art researchers promptly went to Cheles and confirmed the importance of the discovery. An absence of similar petroglyphs further downstream in Portugal puzzled them. There was not any presentation about petroglyphs like these at last February's archaeology colloquium of the Alqueva Development and Infrastructure Enterprise (EDIA), the agency building the dam that also handles the archaeology and other impact studies.

Then the Liga para a Protecção da Natureza (LPN), a nature protection league founded in 1948, received an anonymous tip-off about petroglyphs just like those of Cheles, except they were spread along ten kilometres of the Guadiana river in Portugal.

In response, members of Movimento Cota 139, a movement aiming to limit the level of the Alqueva dam reservoir level to 139 metres, went to see the petroglyphs on 25 April 2001 and called in Manuel Calado, an archaeologist from the University of Lisbon. An environmental Web site called *Ambiente Online* broke the news of the petroglyphs on 26 April. The following morning, the Portuguese mass media pounced on the scoop.

Position of IFRAO

Although people from the international scientific community are delighted by the discovery, they are also very concerned because the dam is nearly finished and it will be difficult to avoid the destruction of this important rock art area. IFRAO, with thousands of amateurs and specialists in five continents that belong to the Federation's organisations, now calls for the prompt nomination of a genuinely independent international commission to follow the situation and ensure international participation in the exploration and documentation of the rock art area.

The Federation considers the plight of the Guadiana rock art area to be far worse than that of the Côa rock art area, also in Portugal, in 1994-95, for the following reasons:

- Work on the dam is nearing completion.
- It seems that the lesson of the Côa dam was completely forgotten, resulting in an appalling threat to, or loss of, the rock art and a massive burden on citizens and taxpayers that pay the colossal cost of such aborted projects. Today there are bodies that did not exist in 1994: IPA (Instituto Português de Arqueologia), the Portuguese Institute of Archaeology; and CNART (Centro Nacional de Arte Rupestre), the National Centre of Rock Art. These bodies are responsible for keeping an inventory and register of all rock art in the country and advancing the conservation and public awareness of it (Law No. 117/97, 14 May 1997).
- IPA and CNART should have been constantly inspecting what EDIA was doing. The current President of IPA, Prof. Dr João Zilhão, was severely critical of a similar situation during the fight to save the Côa rock art area. IFRAO fails to understand why he does not resign — so showing his total opposition to the destruction of the Guadiana rock art area.
- IFRAO upholds the protection, study and public awareness of rock art in all continents, irrespective of its age or connected traditions. We are therefore once again deeply concerned that an attributed age is once again being used as criterion in determining the importance of rock art and whether or not it is worth protecting.

Rock art areas like the Guadiana, stretching two kilometres in Spain and ten in Portugal, are always of great value and importance. If claims that most of the petroglyphs are Neolithic prove to be true, this corpus would be quite rare because there is very little rock art in Europe attributed to the Neolithic-Chalcolithic period. Rock art of corresponding periods are known in Valcamónica, Italy (UNESCO World Heritage Site), and Mont Bego, France.

IFRAO asks the Prime Minister and Minister of the Culture in Portugal to consider the following points:

- A need for timely action to do everything possible to investigate the petroglyphs with the most appropriate and up-to-date methodology and with adequate time to do so, even if this means delaying or suspending the filling of the reservoir.
- The merit of creating a genuinely independent international commission to assess the importance and value of the rock art. Aside from questions over the competence of IPA, CNART and EDIA, the commission should not fall under these or other state bodies — thus helping to ensure that the integrity of the commission is not compromised.
- State bodies cannot be both players and referees. This was one of the most heavily criticised aspects of the Côa syndrome.
- IFRAO has formed an emergency delegation with specialists from four continents to monitor the situation. It would be extremely beneficial if this delegation were part of an extended commission with representatives of Portuguese universities, archaeology associations and other groups.
- IFRAO can promptly indicate suitable specialists to organise training courses for all the archaeologists and students who will be needed for the tremendous effort a time-sensitive investigation requires.
- We remember the political courage shown by the Prime Minister, António Guterres, in saving the Côa rock art area. To enable constructive dialogue, IFRAO requests an audience with the Prime Minister and his Excellency, the President of Portugal.

Finally, IFRAO wants to tell people in Portugal they can and should be proud of this discovery. When people respect the past, there is hope for the future.

Mila Simões of Abreu
Representative in Portugal of IFRAO
Archaeology Unit
Department of Geology
University of Trás-os-Montes and Alto Douro (UTAD)
Portugal

e-mail: msabreu@utad.pt
ICQ: 8134563
Phone: 254 92 09 21
Phone: 259 35 01 79 (weekdays only)
Cell. Phone: 96 295 56 08 (weekdays only)

Relevant Internet links

http://www.guardian.co.uk/Archive/Article/0,4273,4177255,00.html - Stone Age find will not halt dam, by Eduardo Gonçalves in Outeiro, Portugal and Giles Tremlett in Madrid, *The Guardian*, Saturday, 28 April 2001.

http://www.ambienteonline.pt/AANoticias/portal-noticia.asp?id=330&dia=&mes= - Há gravuras neolíticas no Alqueva. News scoop by João Rabaçã, *Ambiente Online*, Thursday, 26 April 2001.

http://ultimahora.publico.pt/shownews.asp?idCanal=36&id=20647 - Descobertas gravuras rupestres na área do Alqueva. *PÚBLICO Online*, Friday, 27 April 2001.

http://jornal.publico.pt/publico/2001/04/28/Terra/THCAPA01.html - Figuras rupestres descobertas no Vale do Guadiana, by Carlos Dias. *PÚBLICO*, Saturday, 28 April 2001.

http://ultimahora.publico.pt/shownews.asp?id=20913&idCanal=14 - Instituto Português de Arqueologia e Centro Nacional de Arte Rupestre acusados de negligenciar Alqueva. *PÚBLICO Online*, Saturday, 28 April 2001.

http://www.ipa.min-cultura.pt/news/noticias/DecGuad - Descobertas de arte rupestre no Guadiana, Instituto Português de Arqueologia.

http://www.lpn.pt - Liga para a Protecção da Natureza (LPN), a nature protection league.

http://www.rupestre.net/tracce/13/

http://is-it-art.net/guadiana/

http://pwp.netcabo.pt/0167542401/noticias/noticias.htm

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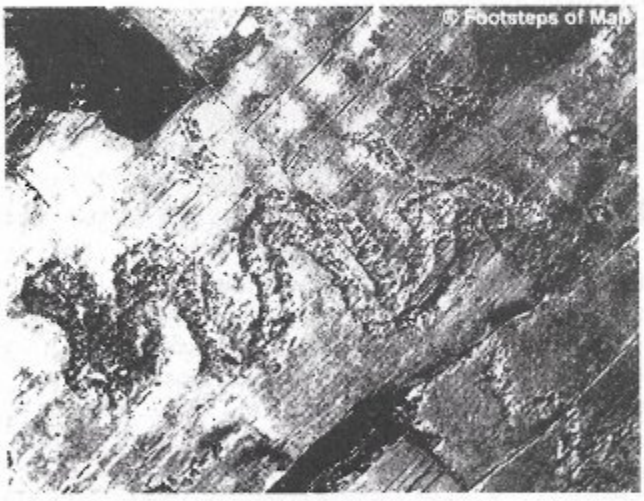

Two petroglyph panels in the Guadiana valley. Images provided by Andrea Arcà, Footsteps of Man, Italy.

IFRAO International Workshop on Conservation and Documentation, Tanzania

The Eastern African Rock Art Research Association has established the dates for the International Workshop on Conservation and Documentation of Rock Art in Tanzania. The dates are from Saturday, 29 September to Sunday, 7 October 2001. The workshop will include two days (30 September and 1 October) of 'brain-storming sessions' led by resource people at the Arusha International Conference Centre (AICC), followed by four days of field work and finally two days of discussions and conclusions. The field work will take place in the famous rock art areas of Kondoa and Singida in central Tanzania. Participants will be accommodated in nearby guest houses.

The organising committee hopes to be able to subsidise participants' accommodation during the field work. It is recommended that participants coming from outside Tanzania try to fly to Kilimanjaro International Airport (KIA) which is less than one hour's drive from Arusha, the venue of the conference. They can also fly to Dar es Salaam and take a domestic connecting flight to KIA. Those who wish to fly to Nairobi can travel by road to Arusha. Arusha is a flourishing tourist city in the northern part of the country. The organising committee is trying to raise money to subsidise hotel accommodation for resource people who we hope will come from Argentina, Australia, Portugal, India, Italy, South Africa, United States of America and Tanzania. The organising committee will be pleased to organise private trips to the famous game parks (Manyara, Ngorongoro, Serengeti etc.) after the workshop, but we have to know such requirements in advance.

Dr Fidelis Masao
Chairman of EARARA
E-mail: *fitman60@hotmail.com*
RAR 18-569

IRAC 2002

The 2002 International Rock Art Congress (IRAC) will take place at the University of Skopje, Faculty of Economy, Former Yugoslav Republic of Macedonia from 14 July to 21 July 2002. The Congress is sponsored by the Macedonian government, Ministry of Culture, and Ministry of Science and Macedonian Telecommunications. The Macedonian Rock Art Research Association (MRARA) is the national host. The event will be a good opportunity to bring together people interested in all aspects of rock art research, education, conservation and protection. Each author or co-author should be prepared to entertain questions or comments directly after the presentation of papers.

The following symposia are currently planned:

1. Rock art in Macedonia: Saska Aleksovska and Dejan Gabriela (Chairs), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*
2. The recording of rock art: Mery Maneva (Chair), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*
3. The archaeo-astronomy of rock art: Leo Dubal (Chair), Laboratory of Archeometry, P.O. 5914, 3001 Berne, Switzerland. E-mail: *rchleo@bluewin.ch*
4. Landscape, place and rock art: Angelo Fossati (Chair), Cooperativa Archeologica 'Le Orme dell'Uomo', Piazzale Donatori di Sangue 1, 25040 Cerveno (BS), Italy. E-mail: *Fossati@numerica.it*
5. Rock art in the world: Jean Clottes and Jean-Loïc Le Quellec (Chairs), 11, rue Fourcat, 09000 Foix, France. E-mail: *j.clottes@wanadoo.fr*
6. Human figures in rock art: Arsen Faradjev (Chair), Ramenki Street 11/1-33, 117607 Moscow, Russia. E-mail: *farajev@hotmail.com*
7. Rock art protection and conservation: Ben Swartz (Chair), College of Science and Humanities, Ball State University, 47306-0435 Muncie, Indiana, U.S.A. E-mail: *01bkswartz@bsuvc.bsu.edu*
8. Cupules — the most numerous petroglyphs: NabuhiroYoshida (Chair), P.O. Box II, Koburamishi Postoffice, 803 Kitakyushu, Japan. E-mail: *jps@qd5.so-net.ne.jp*
9. Semiotics, signs and symbols: Dusko Alksovski (Chair), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*
10. Computer technology as an aid to rock art research: Sasho Manasov, Sasho Aleksovski and Vancho Georgiev (Chairs), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*, *karpumet@mt.net.mk*
11. Rock art education: Dario Seglie (Chair), CeSMAP, Viale Giolitti, 1, 10064 Pinerolo (TO), Italy. E-mail: *CeSMAP@cesmap.it*
12. Dating, pigment analysis and geological applications: Robert G. Bednarik (Chair), AURA, P.O. Box 216, Caulfield South Vic. 3162, Australia. E-mail: *auraweb@hotmail.com*
13. Rock art — basis of cultural, historical, linguistic, ethnographic and religious-philosophical heritage: Aleksandar Apostolov (Chair), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*
14. Classification of rock art according to its geographic position: Bogorodaka Aleksovska and Meri Maneva (Chairs), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*
15. Origin and development of rock art: Dusko Aleksovski (Chair), drustvo za nauka, 91320 Kratovo, FYR Macedonia. E-mail: *rockart@unet.com.mk*

Academic Committee

The Academic Committee of the IRAC 2002 consists of: Robert G. Bednarik, IFRAO Convener, Australian

Rock Art Research Association; Prof. Dr Aleksandar Apostolov, University of Skopje, FYR Macedonia; Dr Jean-Loïc Le Quellec, University of Paris, France; Dr Jean Clottes, Association pour le Rayonnement de l'Art Parietal Européen, France; Mario Consens, Centro de Investigación de Arte Rupestre del Uruguay; María Mercedes Podestá, Comite de Investigación del Arte Rupestre de la Sociedad Argentina de Antropologia; Nabuhiro Yoshida, Japan Petroglyph Society; Prof. Dr Miodrag Hadzi Ristic, University of Skopje, FYR Macedonia; Saso Manasov, Vice Director of Public Enterprise for Urban Planning, Skopje, FYR Macedonia; Prof. Jack Steinbring, Rock Art Association of Manitoba; Dusko Aleksovski, Macedonian Rock Art Research Association; Prof. Dr Vesela Cingova, University of Skopje, FYR Macedonia; Academician Prof. Dr Blaga Aleksova, Macedonian Academy of Science and Art; Academician Prof. Dr Blaze Risteski, Macedonian Academy of Science and Arts; Prof. Dr Dimitar Kornakov, University of Skopje, FYR Macedonia; Dr Angelo Fossati, Cooperativa Archeologica, Cerveno, Italy; Prof. Ben Schwartz, Ball State University, U.S.A.; Florin Stanescu, University of Sibiu, Romania; Dr Friedrich Berger, Germany; Prof. Marcel Otte, University of Liège, Belgium; Laila Kitzler, University of Stockholm, Sweden; Tore Saetersdal, University of Bergen, Norway; Dr Leo Dubal, Laboratory for Archeometry, Berne, Switzerland.

Field trips

The IRAC 2002 field trips offered have been planned and organised by the Macedonian Rock Art Research Centre and the National Tourist Office. Congress participants will pay only US$10 per day including a lunch.

Field trip No. 1

Departure from Central University Place on 16 July at 8:30 a.m., return 11:00 p.m. A bus and walking tour of the Trnovetz rock art site. The Congress participants can see different kinds of petroglyphs and will visit the small town of Kratovo near an ancient volcano. After a brief visit to the town they will view the only rock art 'arcuform' site in Macedonia, named 'Written Rock'. In the evening a concert of folk songs will be organised in a pre-Historic cave at Sopsko Rudare, near Kratovo. The field trip involves long walking.

Field trip No. 2

Kriva Palanka rock art sites on 19 July, depart Central University Place at 8:30 a.m. return at 4:00 p.m. Visit of the town Kriva Palanka and have lunch there. This field trip involves long walking.

Field trip No. 3

Desovo and Gorno Selo rock art sites, near the town Prilep, featuring different kinds of cupules. Depart 24 July at 8:30 a.m., return at 10:00 p.m. There is no long walking involved. Lunch at Prilep. In the evening the delegates will follow the National Festival of Folk Song.

Field trip No. 4

Rock Art of Pena valley near Tetovo, 25 July. Depart at 8:30 a.m., return at 4:00 p.m. A recently discovered rock art site will be viewed. Lunch at Tetovo.

Field trip No. 5

Orizari rock art sites, different kinds of engraved crosses near the town of Kotchani. Depart 26 July at 8:30 a.m., return at 6:00 p.m. Lunch at Kotchani.

Dr Dushko Aleksovski
Chairman of IRAC 2002
RAR 18-570

IFRAO-Brepols

The Editorial Committee of the *IFRAO-Brepols Rock Art Series* comprises the following members:

Professor Paul Bouissac (Canada), *bouissa@attglobal.net*
Dr K. K. Chakravarty (India), *igmsbpl@mp.nic.in*
Dr Jean Clottes (France), *j.clottes@wanadoo.fr*
Dr Mario Consens (Uruguay), *consens@adinet.com.uy*
Professor Tang Huisheng (China), *zy_m@hotmail.com*
Dr Dirk Huyge (Belgium), *Huyge@kmkg-mrah.be*
Dr Jean-Loïc Le Quellec (France), *JLLQ@aol.com*
Dr Alfred Muzzolini (France), no e-mail
Professor Roy Querejazu Lewis (Bolivia), *n.noriega@promesha.umss.edu.bo*
Professor Yakov Sher (Russia), *museum@history.kemsu.ru*
Dr Anne Solomon (South Africa), *asolomon@nmsa.org.za*
Professor Jack Steinbring (USA), *SteinbringJ@Mail.Ripon.EDU*

It is the role of this committee to safeguard the highest academic calibre of the books to be published under the IFRAO-Brepols imprint. The *IFRAO-Brepols Rock Art Series* is to be a major series of books about rock art and related subjects, and the imprint is to be seen as a seal of approval by IFRAO.

The first four books being published under the new IFRAO-Brepols imprint will be the following volumes:

1. ***ROCK ART SCIENCE: the scientific study of palaeoart***, by Robert G. Bednarik.

2. ***GLOSSARY OF ROCK ART RESEARCH: a multilingual dictionary***, edited by Robert G. Bednarik, Mario Consens, Alfred Muzzolini, Jakov Sher, Dario Seglie and Mila Simões de Abreu.

3. ***THE PETROGLYPHS OF EL-HOSH (UPPER EGYPT)***, by D. Huyge, M. De Dapper, E. Marchi and A. Watchman.

4. ***ROCK ART AND EPISTEMOLOGY: courting sophistication***, edited by Robert G. Bednarik

Robert G. Bednarik (Australia)
Editor-in-Chief, IFRAO-Brepols
robertbednarik@hotmail.com

THE EARLY INDIAN PETROGLYPHS PROJECT (EIP)

Rationale for an international commission

During the 1990s, several extraordinary observations were reported from India, suggesting that the earliest known rock art may exist in that country. First, it was noted that two of the eleven petroglyphs in Auditorium Cave, Bhimbetka, were covered by undisturbed upper Acheulian occupation deposits, indicating their Lower Palaeolithic age, and that the remaining cupules in that quartzite cave were of a similar antiquity (Bednarik 1994). Next, a large concentration of cup marks was discovered in Daraki-Chattan (Kumar 1996), and again there were indications of a very great age. Finally, two granite shelters, Bajanabhat 1 and 2, were located and their similar markings seemed to be of comparable age.

These propositions are of the utmost importance to world archaeology, to hominid evolution and to profound questions of the origins of culture, cognition and art-producing human behaviour. Extraordinary claims deserve extraordinary care in their consideration and scientific testing, and it is the purpose of this project to conduct such testing. This project will assemble an international commission to review the claims concerning four central Indian petroglyph sites. The EIP Commission, assembled by the International Federation of Rock Art Organisations and various other scholarly bodies, will investigate these matters thoroughly, using methods such as carbon isotope analysis, optically stimulated luminescence dating, microerosion dating and archaeological excavation. The Commission will report its findings to the international research community and then to the public. It will consist of more than twelve geologists, archaeologists, rock art scientists and archaeometrists, especially from India and Australia. This Commission will conduct research in the four sites concerned, to be followed by laboratory work over several months, before publishing its findings and subsequent recommendations.

Fieldwork is commencing in 2001 and will peak in the early months of 2002. Reports will be presented by late 2002 and in 2003. Over the next few years, this is considered to be one of the most important projects in the World in this field of scientific endeavour.

This Commission operates under the auspices of IFRAO (the International Federation of Rock Art Organisations) and will be directed by Robert G. Bednarik (AURA) and Dr Giriraj Kumar (RASI).

Participating organisations will include:
The Australia-India Council
Rock Art Society of India (RASI)
Australian Rock Art Research Association (AURA)
Indira Gandhi National Museum of Man
Indira Gandhi National Centre for the Arts
Archaeological Survey of India
Physical Research Laboratory, Ahemedabad
Indian Archaeological Society, New Delhi
Dayalbagh Educational Institute, Agra
State Archaeology Department, Government of Madhya Pradesh
State Archaeology Department, Rajasthan
James Cook University, Townsville
University of Melbourne
Australian Nuclear Science and Technology Organisation, Sydney

The Australian members of the EIP Commission are:
Robert G. Bednarik (AURA, Co-Director of project)
Dr Alan Watchman (James Cook University, Department of Anthropology, Archaeology and Sociology)
Dr Ewan M. Lawson (Australian Nuclear Science and Technology Organisation)
Dr R. G. (Bert) Roberts (University of Melbourne, School of Earth Sciences)

They thank the Australia-India Council for underwriting their travel costs.

Robert G. Bednarik
President and Convener of IFRAO

REFERENCES

BEDNARIK, R. G. 1994. The Pleistocene art of Asia. *Journal of World Prehistory* 8: 351-75.

KUMAR, G. 1996. Daraki-Chattan: a Palaeolithic cupule site in India. *Rock Art Research* 13: 38-46.

RAR 18-571

NOTES FOR CONTRIBUTORS

Manuscripts of major research papers should preferably be from 4000 to 8000 words. Longer articles will be considered on the basis of merit. Submissions should comprise the original together with two copies, typed in double-space, with a wide margin on one side of each page. Identify each page by number and author's surname. The preferred method of submission is on an IBM compatible computer diskette, together with three hard copies. The content of the paper should be outlined by four to six keywords (e.g. 'Petroglyph - patination - ethnography - Pilbara') placed above the title. The manuscript must include an abstract of 50 to 100 words, summarising the article.

Spelling and punctuation in this journal follow the *Style manual for authors, editors and printers of Australian government publications* and the *Macquarie dictionary*; where the two disagree the former has precedence. Footnotes should not be used. The bibliography and references in the text should follow the IFRAO style as indicated in this issue. Terminology must comply with the Rock Art Glossary (see *RAR* 17[2]).

If line drawings are included they must be larger than the intended published size (preferably by a factor of 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. Photographs of rock art that were obtained by physical enhancement or other interference will be categorically rejected, except for the purpose of critical discussion. In regions where traditional indigenous rock art custodians exist, their approval must be obtained before submission of any material relating to their culture, and where copyright applies the author must obtain the appropriate consent. 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.

Announcements intended for a specific issue of this journal ought to be available at least two months before the month of intended publication. Text proofs are issued of all articles and must be returned promptly after correction by the author(s). Each author or group of authors receive thirty free copies of their article, additional reprints are available at cost.

All correspondence should be addressed to:

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

Telephone and Fax: Melbourne (61-3) 9523 0549
E-mail: *auraweb@hotmail.com*
robertbednarik@hotmail.com

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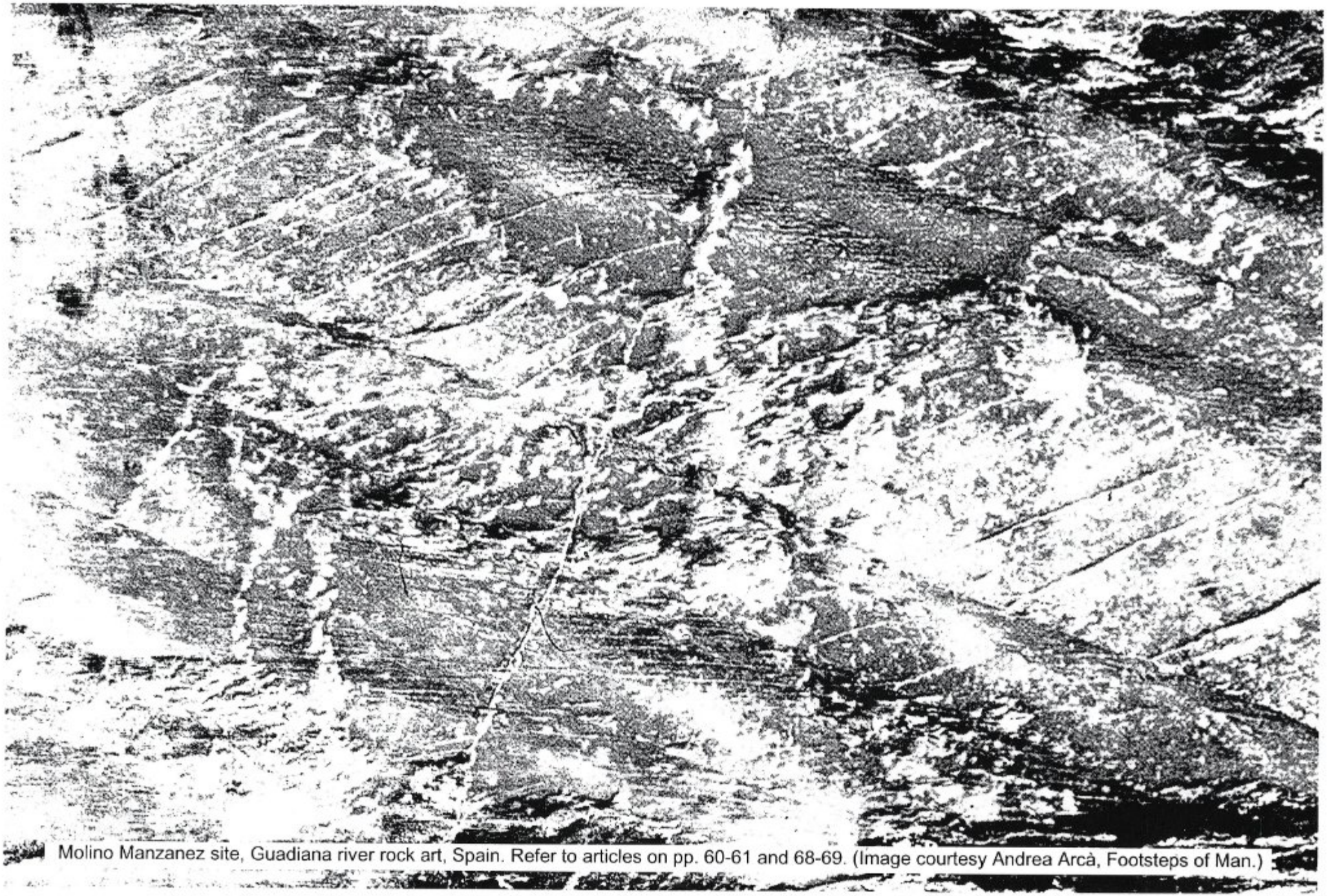

Molino Manzanez site, Guadiana river rock art, Spain. Refer to articles on pp. 60-61 and 68-69. (Image courtesy Andrea Arcà, Footsteps of Man.)