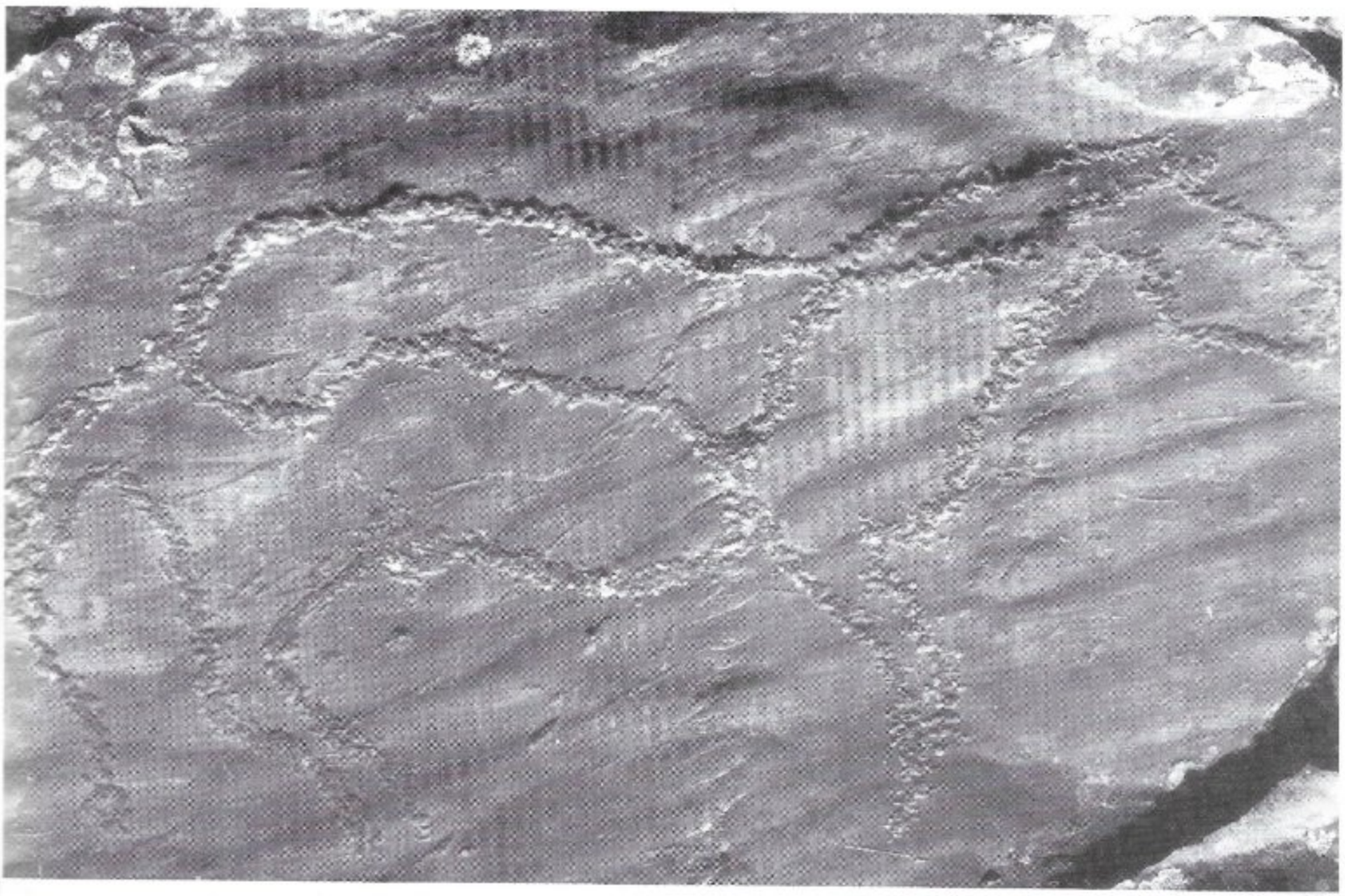
Australia Post — Print Post Publication No. PP329113/00038

ISSN 0813-0426

Australian Rock Art Research Association (AURA)
and International Federation of Rock Art Organizations (IFRAO)

ROCK ART RESEARCH

Volume 14, Number 1 MAY 1997



Horse-shaped petroglyph at Siega Verde, western Spain, thought by archaeologists to be Palaeolithic: 'The villagers from Castillejo de Martin Viejo . . . had always believed the art to have been made by shepherds whiling away the time and they had had a good laugh when archaeologists told them that the art was Palaeolithic'.
(See article by Bjarne Stig Hansen, pages 52-53.)

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.

Contributions should be consistent with these general goals. Notes for contributors appear on the inside of the journal's back cover. All major articles submitted will be refereed. While final responsibility for the acceptance or rejection rests with the editor, responsibility for opinions expressed or data introduced is always the author's.

Selected manuscripts will be sent to commentators and their reviews may be published in order to promote scholarly debate, in which case the author will be invited to respond to these comments. In addition to articles reporting original research of significance, the submission of brief reports, conference reports, reviews and bibliographical entries is also invited.

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Annual subscription for Subscribing Members of the Australian Rock Art Research Association (two issues, surface mail paid to anywhere) is $A20.00

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ROCK ART RESEARCH

The Journal of the Australian Rock Art Research Association (AURA)
and of the International Federation of Rock Art Organizations (IFRAO)

ISSN 0813-0426

Volume 14, Number 1

Melbourne, Australia

May 1997

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.

Archaeological Publications, Melbourne

Volume 14, Number 1, May 1997

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The contents of this journal are listed in the *International Current Awareness Services* and in the *International Bibliography of Social Science*.
Major papers are abstracted by international abstracting services.

KEYWORDS: ***Petroglyph - Cupule - Distribution pattern - Dating - Western Europe***

THE DISTRIBUTION OF CUP-AND-RING MOTIFS ALONG THE ATLANTIC SEABOARD OF EUROPE

Maarten van Hoek

Abstract. The siting of petroglyphs is the outcome of a complex set of factors. Availability of suitable stone surfaces is one such factor. This paper investigates mobility, accessibility and avoidance as important factors determining the siting and distribution of cup-and-ring petroglyphs along the Atlantic seaboard of Europe. The siting, especially in Ireland and Britain, strongly suggests initial small-scale colonisation by new farming communities. Dating evidence seems to place cup-and-ring art well at the beginning of the Atlantic Neolithic. Consequently the origin of cup-and-ring petroglyphs must predate the Irish passage tomb art.

Characteristics of cup-and-ring art

Cup-and-ring art comprises a specific group of petroglyphs, commonly found at open-air sites such as outcrops and natural boulders. The motifs are highly schematic or abstract, a characteristic sometimes argued to be associated with agricultural societies (Anati 1983: 44). In reality schematised or 'abstract' motifs are common in numerous pre-agricultural traditions. Typical motifs of the art considered here comprise cupules (cup-marks), grooves and cup-and-ring symbols (Figure 1).

There may be distinguished simple motifs (comprising cupules or single cups, cups with up to two rings and simple random grooves) and complex motifs (cups with three rings or more and all clearly patterned grooves). The more motifs occur on a rock or the more complex motifs are, the more important the site may have been or the longer it may have been used. Most decorated rocks only feature cupules. I will argue here that complex art developed almost exclusively on through-routes and in topographical key-areas.

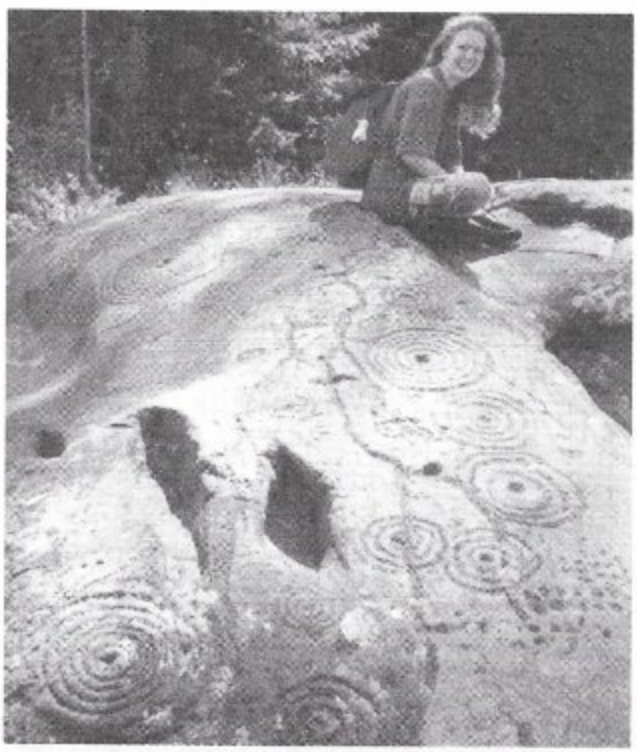

Figure 1. *Typical cup-and-ring petroglyphs at Carschenna II, Switzerland, looking east.*

Figure 2. *Neolithic cup-and-nine-rings and possible Iron Age zoomorphic figure at Carschenna II, Switzerland, looking south-east.*

The size of the motifs has also been claimed to be important (Bradley 1991: 82), but although large diameter rings could easily have been executed they are very rare. On the contrary, major sites more often comprise motifs with rings closely packed, sometimes featuring exceptionally small diameters. It requires more skill and effort to execute closely spaced rings without a failure. In this respect the nine-ring figure of Carschenna, Switzerland, is a masterpiece of its kind (Figure 2).

Although no implement used to execute the glyphs has ever been found on or near a cup-and-ring stone in the British Isles, there is evidence that most glyphs have been pecked out, using the stone chisel - mallet method as suggested by Shee-Twohig (1981: 116). This method yields very few failures and allows motifs to be executed delicately, simultaneously saving stone tools. According to Schwegler (1992: 47), only cups and grooves of about one centimetre depth could be produced in this way. He suggests that deeper cups were made by hammering the rock with a blunt stone tool. Indeed, many cupules do not show the typical pecking of the chisel - mallet method.

Petroglyphs executed by the same hand at the same time in the same cultural context will look the same. Changing conceptions produced differences in style and techniques and existing engravings were consequently altered or even removed. Possibly the first symbols were crude single cupules, which were hammered out in a rather primitive way. Later motifs were chiselled out in a more sophisticated manner.

There is no preference for any size of rock, nor for horizontal or vertical surfaces. An 'exclusive appearance of complex designs on horizontal outcrop' as stated by Hadingham (1974: 51) does not exist. One of the most extensive cup-and-ring groups in Europe, Ballochmyle, Scotland, appears on a vertical east-facing cliff.

Motifs are always placed randomly, although Jackson speaks of *intentional* randomness (1991: 26). The motifs show no preference for any orientation, neither in terms of slope-direction, nor in orientation of the motifs themselves (but see Steinbring and Lanteigne 1991: 18; Van Hoek 1995a: 13). Only groups of decorated rocks, especially when linearly arranged, or major concentrations of motifs seem to show a preference for an easterly orientation.

We have no reliable information about the true meaning of cup-and-ring symbols. A symbol may be defined as a physical phenomenon that has a meaning bestowed upon it by those who use it. Its value must either be told to the observer or it must be revealed by observing the behaviour of the group towards the symbol in its cultural context. Cup-and-ring art may have been of a highly magical character; by magic I refer to the performance of rites believed to produce specific supernatural results. This may be done by imitative magic or by magical actions. Among the many forms of contemporary magic is the act of knocking on an object to turn away evil forces, still practised in many forms in many different cultures. Even today the practice of 'knocking on wood' still exists in modern European societies.

The first symbols of the migrating Neolithic groups were simple cupules which were hammered into the rock. Although this is highly speculative, these first cupules could be interpreted as the result of 'knocking on Mother Earth' in order to turn away disaster and to propitiate the gods.

Certainly, cup-and-ring art, like most of the pre-Historic art forms, must have been deeply rooted in the socio-religious world of Neolithic societies. Religion usually centres on the uncertainties of life, and religious ceremonies and rituals assume that those uncertainties can be resolved. Also, the practice of executing cup-and-rings may have had a strong ritual character. It may represent a deeply felt religious way of communication between the people involved, the landscape they lived in and their supernatural world. The open character of cup-and-ring petroglyphs and the long-lasting nature of its rock-cut motifs may well represent an integral and essential part of its communicative function.

Spatial distribution in Europe

Cup-and-ring symbols occur throughout the world, appear in every inhabited continent and often show a striking similarity in lay-out. This world-wide similarity points to the possibility of parallel development. Mark and Newman (1995: 19) suggest 'a commonality of human thoughts independently creating a striking similar design to which a wide variety of interpretations is attributed'. Despite the world-wide appearance of the cup-and-ring symbol, there are marked differences in distribution. In America it seems to be of rare occurrence and widely scattered (Morris 1988: 23). In Europe, however, large numbers of cup-and-rings are heavily concentrated in limited areas.

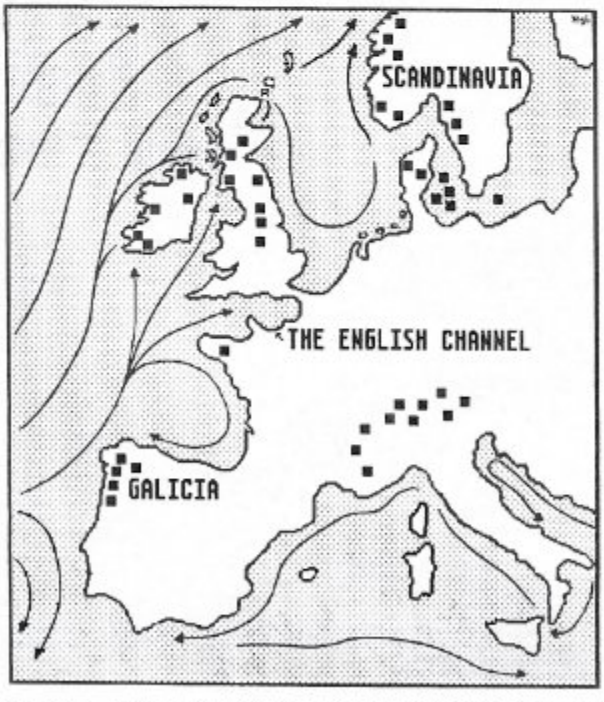

Figure 3. Major cup-and-ring art groups in Europe and the flow-direction of the sea currents.

Cup-marked rocks occur scattered all over Europe, but cup-and-rings are localised in four major concentrations: an Alpine group and three Atlantic groups; Galicia in Spain, the British Isles and Scandinavia (Figure 3). The focus in this paper is on the British Isles as these regions represent the only instance where the art is found not blurred by elements from other periods.

The overall geographical distribution of the art along the Atlantic seaboard suggests strong links between these groups. In this paper it is argued that Neolithic groups slowly migrated in northerly directions simultaneously introducing their symbols to newly occupied areas. Although often criticised in the past, there is evidence which would favour this diffusion theory. More importantly, Anati stated that the direction of this diffusion in Europe was roughly northwards and that the starting date coincided with the beginning of the Neolithic period (1983: 45). Recent work (Bradley 1991; Bradley et al. 1993; Van Hoek 1993b), moreover, associates cup-and-ring art with the movement of people in the cultural landscape.

The distribution of cup-and-ring art implies marine travelling and it is therefore no surprise that the art is mainly a coastal phenomenon. More than often it occurs concentrated around deeply penetrating, rather sheltered, estuaries and it is found too frequently near accessible beaches or bays for this to be mere coincidence. Moreover, it seems that from Galicia to Scandinavia, the siting of petroglyphs can often be associated with the flow-direction of the currents of the Gulfstream (Figure 3).

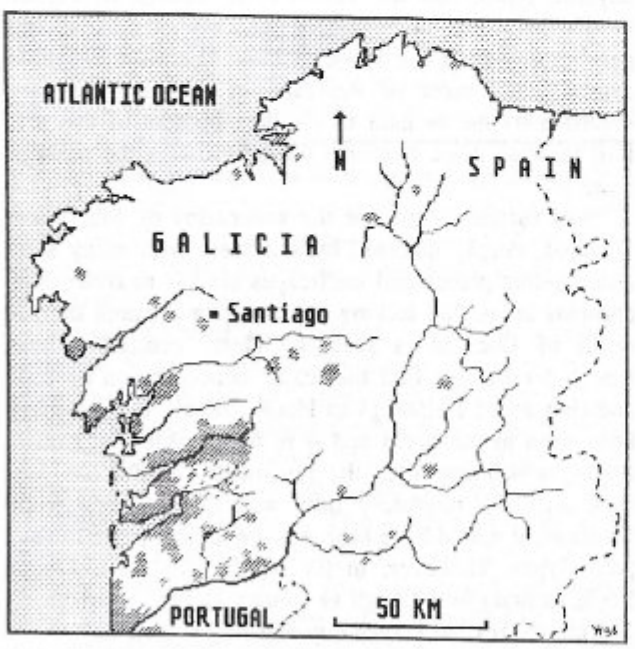

Figure 4. Distribution of petroglyphs in Galicia, Spain (after Costas Goberna and Novoa Alvarez 1993).

Galician sites, for instance, are mainly found on the *west* coast, roughly where the Atlantic currents diverge to the north and to the south. If indeed the migratory flow came from the south, Galicia will have offered a first tranquil and sheltered base for further travel north, using the Gulfstream. A migratory movement from the north, favoured by the east-flowing currents in the Bay of Biscay, could conceivably have resulted in many more engraved stones on the north coast of Spain. But north and east of Santiago cup-and-ring art hardly occurs (Figure 4). The western peninsulas have marked concentrations on both the south and the north shores. But further north an emphasis on the southern shores emerges, again suggesting an approach from the south.

Distribution patterns in Ireland and Britain

South-west Ireland

It is claimed here that from Galicia groups of people travelled northwards either to reach Ireland via Brittany, or to arrive directly on the south-west coast of Ireland (Figure 5). The *south* coast of Cork indeed features a large number of petroglyph sites (Power et al. 1992), the majority well within reach of the sea and more than often near deeply penetrating sea-inlets. Occasionally, river valleys were followed and the odd carved stone occurs some distance inland but generally the interior was avoided.

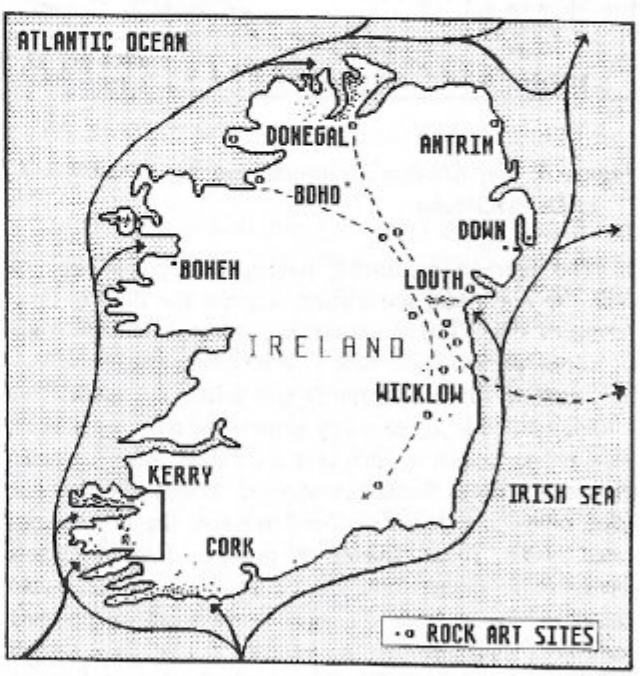

Figure 5. Distribution of petroglyphs in Ireland related to the possible migratory routes. Circles: decorated tombs; dash-line: main axis of the spread of passage tombs to the east. Framed area: Fig. 6.

Further north are the rugged peninsulas of Kerry, separated by deep estuaries, offering many fine sheltered bays and beaches. Important concentrations of rock art are found on the peninsulas of Dingle and Iveragh (Figure 6). These peninsulas are crowned by Ireland's highest mountains and just possibly these might have served as some sort of point of orientation for overseas travelling. Although most petroglyphic stones on the

Dingle peninsula are either removed, destroyed or lost, the great majority is situated south of the east-west running watershed. It is therefore justified to assume that the Dingle peninsula was approached *from the south*, where accessible bays and fine sheltered beaches offered suitable landing places. Often petroglyph sites are found clustered well within reach of those landing places. If the migratory flow would have come from the north, many more sites would be expected to occur on the north coast. However, only three simple sites (none in situ) occur on these shores, offering equally accessible bays and beaches.

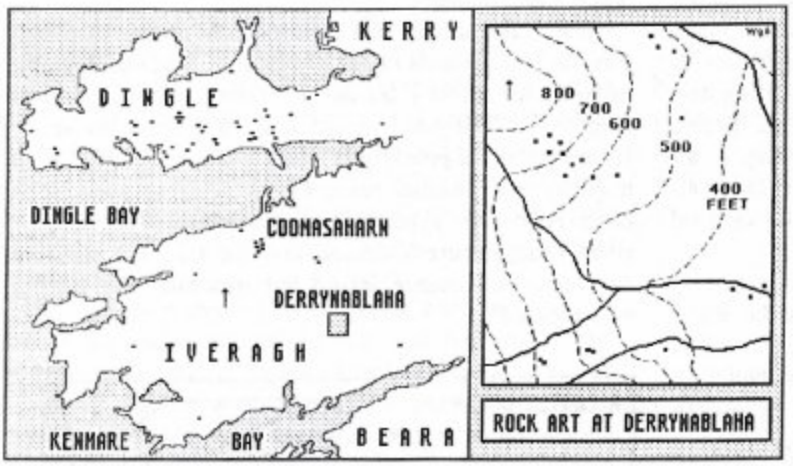

Figure 6. Distribution of cup-and-ring art in Kerry and at Derrynablaha.

The Iveragh peninsula, having petroglyph sites on both the north and south parts, repeats the distinct clustering of sites. The Coomasaharn group is located south of a long neck of land with fine beaches, offering excellent landing places. A rough trip inland for about five kilometres leads to the rocky slopes just north of a small glacial lake which is surrounded on three sides by steep mountain slopes. Some petroglyphic stones overlook the lake, others not. It is very hard to locate the seven decorated stones, some covered by peat, amongst the many usable outcrops and boulders. They are found at a spot certainly not suitable for agriculture. Neither do they indicate a route through the interior. It may have been a ritual location for pre-Historic people for a long time, as the style of decoration on each rock is quite different.

The Derrynablaha group, about ten kilometres inland from Kenmare Bay, is found at the end of a valley, some three kilometres south-east of the Ballaghbeama pass. There are three roughly linearly arranged clusters of petroglyphic stones on the western slopes of the valley, overlooking an arena-like valley to the east. These linear groups run rather steeply uphill, more or less parallel to small 'burns' (Figure 6). Again, the decorated rocks are very hard to find in the scatter of stones.

Often clusters of sites in Kerry are found a short distance inland on a spot which clearly formed a dead end. Deliberately one has chosen spots that were hard to reach and where a steep climb made access even more difficult. The best examples are the Loughadoon group and the Coomasaharn group, located near small glacial lakes and surrounded by steep mountain slopes. Derrynablaha is situated on a steep slope where linear groups run uphill, leading nowhere special; a positive relation with the nearby pass is uncertain.

In Kerry and elsewhere, carved stones are often situated inconspicuously amongst large numbers of undecorated rocks, which renders them quite unsuitable as directional signs. It is clear that they were not marking a route through the interior in these cases. It is more likely that both the carved stones and the path leading to them were part of ritual ceremonies of the community involved. It will not come as a surprise to me when more decorated rocks will be discovered on or near a pre-Historic track to petroglyph sites.

North-west Ireland

Areas with major concentrations of petroglyphs are often situated quite far apart. Between Kerry and Donegal in the far north of Ireland are many areas with estuaries and suitable rock outcrops similar to Galicia and Kerry but there is only *one* cup-and-ring stone. This enigmatic outcrop at Boheh proved to be the second-best decorated rock in Ireland (Van Hoek 1993a). Many keyhole figures on the Boheh stone consist of earlier motifs that were later changed into keyholes by adding parallel grooves (Van Hoek 1995b). Therefore, keyhole symbols and most of the tails of cup-and-rings are regarded by me as later in the development of this art, also because those elements do not exist in the passage tomb art.

Still further north are the mountains of Mayo and Donegal, deeply indented by sea-inlets with many suitable landing places and landscapes similar to other cup-and-ring areas, but lacking cup-and-ring art until the far north of Donegal is reached. Here, centred around Lough Swilly, we find the major concentration of cup-and-ring art of Ireland (Van Hoek 1988a). The estuaries here open to the north and it is remarkable that Lough Foyle, which opens to the north-east, hardly has any rock art. If a migratory flow would have come from Scotland, it would have been a more logical place to find petroglyphs. However, in the whole area from Lough Foyle to Stangford Lough in County Down, a stretch of 180 kilometres, *no* known cup-and-ring site exists.

This is all the stranger when one realises that this specific coastline faces south-west Scotland with its enormous concentrations of petroglyph sites in Argyll and Galloway (Figure 7). It is only 20 kilometres from Antrim to Kintyre in Scotland, the hills of Antrim being well visible for any group coming from Scotland. Moreover, the Antrim coast offers a number of well-sheltered bays. Migration from mainland Scotland should have

generated many more petroglyphs in the coastal areas of Antrim and neighbouring counties, than the two Bronze Age kist-slabs from Drumnakeel and Glenmakeeran, carved with some simple cups (Williams 1985). Distribution patterns in the coastal areas of west Scotland, however, strongly suggest an approach from Ireland and seem to indicate the search for through-routes leading eastwards through the interior.

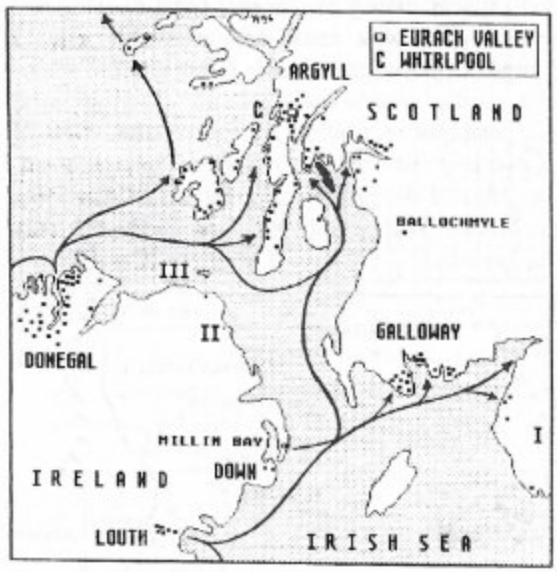

Figure 7. Distribution of cup-and-ring art sites (marked with little squares) related to Neolithic axe factories and suggested migratory routes. The Isle of Bute is marked in black.

Around the north of Scotland

There is evidence of migration from Ireland also to the north of Scotland, using the many islands as stepping stones. A string of simple rock art sites leads north from island to island. Each time an island was approached one looked out for a suitable landing place and executed their mostly simple symbols there, quite often very near the rocky shores. Some glyphs occur even below high water level now.

Having rounded Cape Wrath in the far north of mainland Scotland one travelled east along the rugged coast (with only two decorated rocks near the Tongue estuary) and when reaching the North Sea the hypothesised migratory flow split. One part went on to the north-east and could have ultimately reached Scandinavia via Orkney and Shetland. The other part went south along the east coast of Scotland to arrive in the area around Inverness. Here we find a small and rather scattered group of simple cup-and-ring stones, some incorporated into Neolithic passage tombs. It must be noted that the bulk of mainland Scotland north of Oban and Loch Tay is almost completely devoid of petroglyphs. The main flow seems to have been focused on west Scotland.

West Scotland

Favoured by the currents and the prevailing winds, one could have arrived at the west coast of Scotland. Here patterns of convergence developed, focusing on two major routes through central Scotland: (a) the Forth Valley and (b) the Tay Valley (Figure 8). Marked concentrations occur on *western* coasts, especially at the peninsulas of Kintyre, Cowal and Craignish, and the Isle of Bute, while eastern parts are almost bereft of petroglyphs.

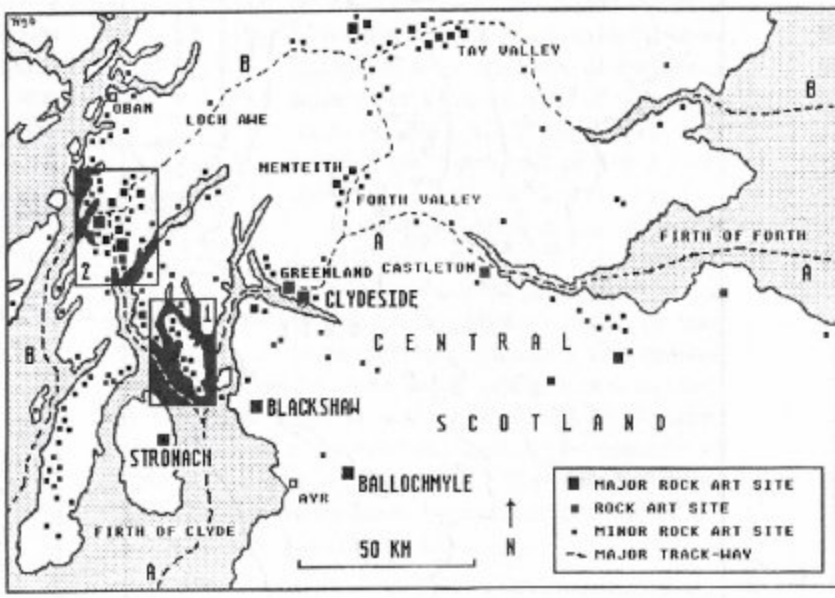

Figure 8. Distribution of cup-and-ring art related to the two major routes through central Scotland.

Bute, an island in the Firth of Clyde (inset 1 on Figure 8), contains more rock art motifs than were previously known (Marshall 1985). The carved rocks are inconspicuously situated and also the motifs are far from spectacular: rocks with only cupules predominate.

Important is that Bute is situated at the point where a major travelling route split. One route went to the north-west, towards the Kilmartin Valley in Argyll, the other continued to the north-east. The great majority of the carved rocks are located at the *western* part of the island (Figure 9). If we accept the main watershed as the division between east and west, only six carved panels exist on the eastern part. The western part contains 71 panels of which the majority are found at the entrance of the western branch of the narrow Kyles of Bute. A lesser concentration exists on the opposite coast of the Cowal peninsula. The pattern that again emerges from this distribution is that of marking entrances and landing places, emphasised by sites found at the probable pre-Historic high water mark.

As the heaviest concentration is found on the west side of the island and especially at the entrance of a deeply penetrating sealoch, it may be safely assumed that the general approach was from the south. Groups of petroglyph sites lead from the west coast into the hills but do not link the west and east coast. Thus no major through-route was established and the style of the motifs remained simple. Also significant is the complete

absence of petroglyph sites at the equally accessible bays on the east side. People travelling up the Clyde must have passed quite close to the east coast of Bute and yet have ignored those fine landing places. Instead, they were focused on east-leading routes.

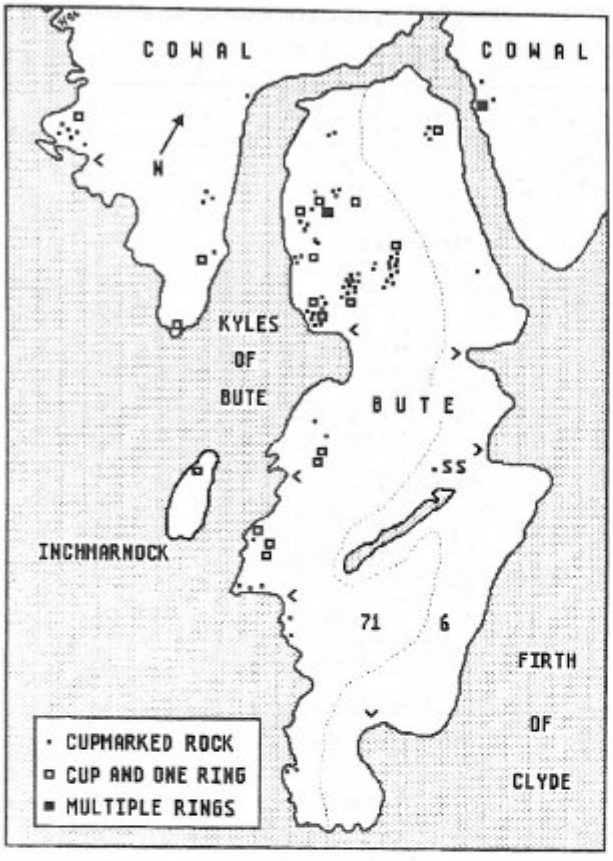

Figure 9. Distribution of petroglyphs on the Isle of Bute (> accessible bays; ss: standing stone).

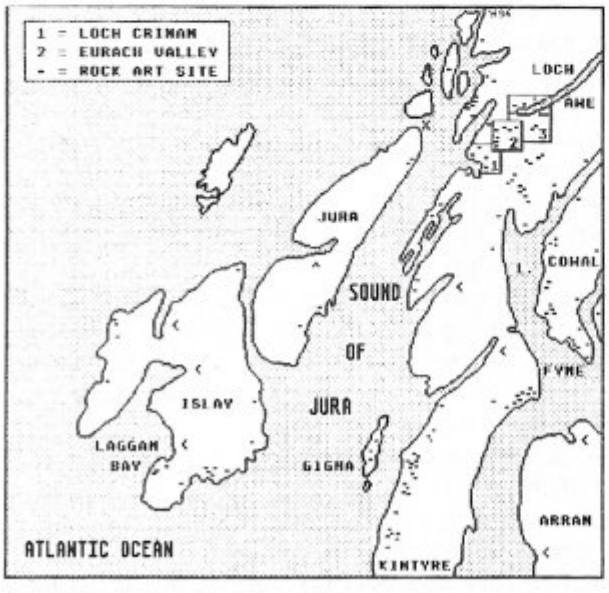

Figure 10. Distribution of petroglyphs around the Sound of Jura, Argyll, west Scotland. Framed areas 1, 2 and 3: Figs 11, 13 and 15 (> accessible bays).

Argyll as gateway to east Scotland

Two major routes developed through Argyll, the east and the west route of the Kilmartin Valley (inset 2 on Figure 8). The west route ran from Loch Crinan to Loch Awe, a lake which formed a major routeway to Loch Tay and the east of Scotland.

The Sound of Jura (Figure 10) acted as a funnel leading to the key area at the Kilmartin Valley. Only simple sites appear mainly at the *east* coast of Islay and especially Jura, its west coast and accessible estuary being ignored. Opposite the roaring Corryvreckan whirlpool, one landed at several accessible places. Minor sites may mark attempts at finding suitable routes. One of these is Cnoc Beg, situated on an ancient (tidal?) island, now at the edge of the large marsh (called Crinan Moss or Moine Mhor). The petroglyphs face inland but only simple cups occur.

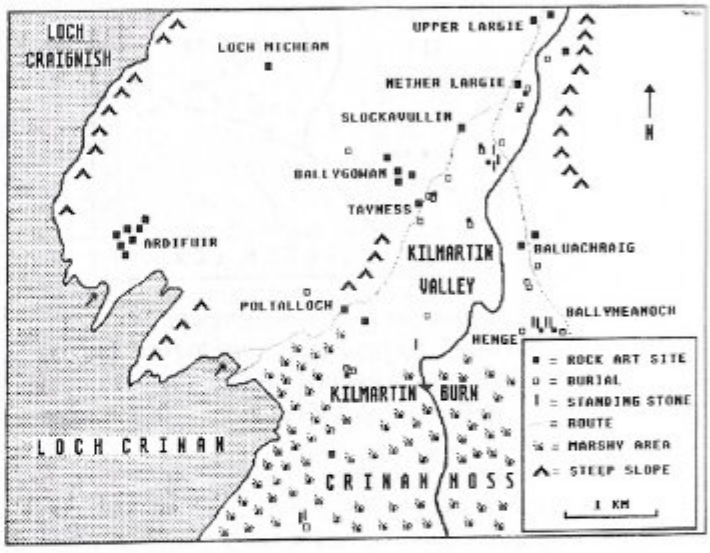

Figure 11. Distribution of petroglyphs in the Kilmartin valley, Argyll, based on the Ordnance Survey, England. Smaller squares: stones in monuments.

Two sites are of major importance: Ormaig on Loch Craignish and Poltalloch on the ancient shores of Loch Crinan. Both sites have numerous petroglyphs and both form the start of routes ultimately leading to Loch Awe. The Poltalloch petroglyphs, north of the big marsh, overlook a raised beach, probably the landing place (compare Garlieston, Galloway). From here, a string of petroglyph sites leads north along ancient river-terraces and the gentle western slopes of the Kilmartin valley (Figure 11). A quantitative graph shows that sites on the west route are found at low altitudes (Figure 12) confirming the travelling on the lower slopes or the valleys. Most cup-and-ring sites are not further away from this route than one kilometre. Many areas are, therefore, completely ignored. Also, steep hill-slopes and marshes have been avoided. This is most evident at the Eurach valley, where specific panel selection demonstrates the determination to mark the route to Loch Awe and not just a suitable rock surface in the area. From Ormaig and Poltalloch one reached the gap in the hills

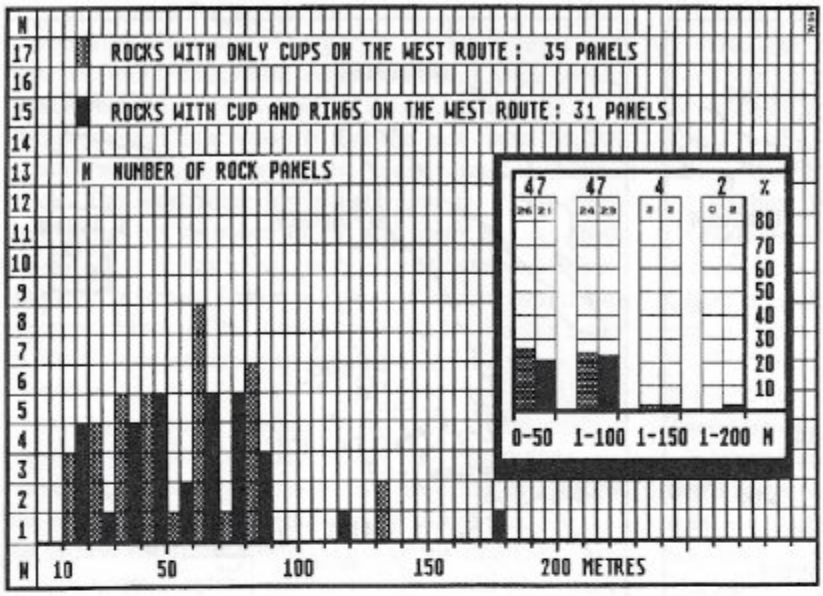

Figure 12. Decorated panels of the west route through the Kilmartin valley related to altitude (range of altitude: 0 to 333 m).

leading to the Eurach valley, which offered easy access to Loch Awe (Figure 13). The valley floor, however, was a bog bordered by steep hills to the east and north. People may have therefore travelled a little further north, where they crossed the Kilmartin Burn without difficulty (Figure 14). One arrived at a flat piece of higher land where a large outcrop, Creagantairbh 1, was decorated with hundreds of cups and some other symbols. East of the site is an inaccessible cliff, more than sixty metres high. South-east of it is a pass, indicated by a cup-marked outcrop.

Beyond the pass is the valley at Eurach. There, a large north-south running *roche moutonnée* blocked the valley, causing another marsh or lake to develop up to Glennan. One crossed the valley, using the rocky ridge, which was decorated. Via the gentle south slopes one travelled to Glennan, where, south of the watershed, again large numbers of simple petroglyphs were executed. The route continued via Ford to Torran on Loch Awe, where one started the journey to Loch Tay (Figure 15).

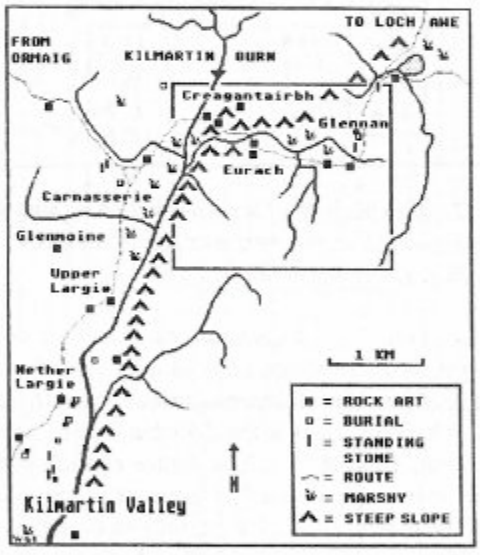

Figure 13. Distribution of petroglyphs around the Eurach valley, Argyll, west Scotland. Based on the Ordnance Survey, England. Framed area: Fig. 14.

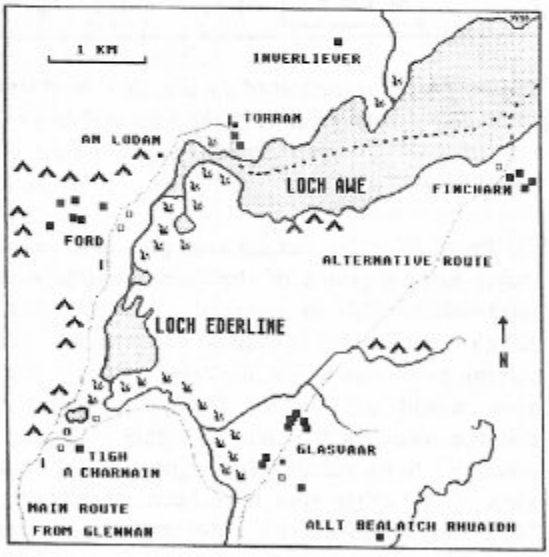

Figure 15. Distribution of petroglyphs around the west end of Loch Awe. Based on the Ordnance Survey, England. The alternative route is the east route mentioned in the text. Legend: see Fig. 13.

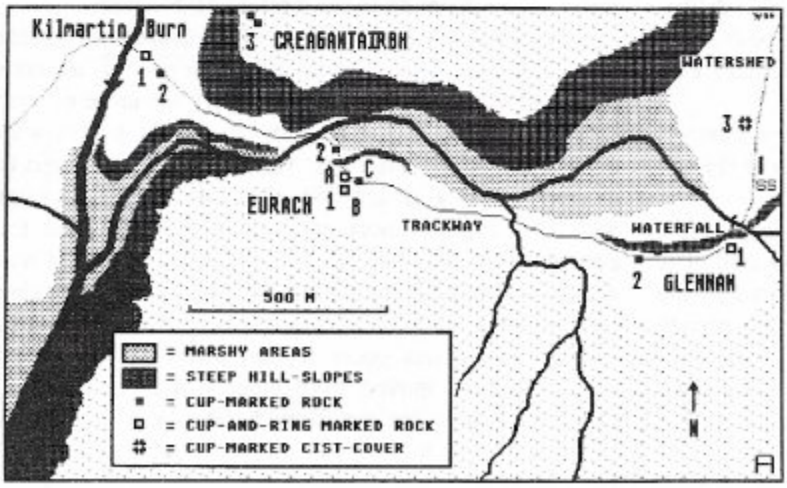

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Figure 14. Location of petroglyphs in the Eurach valley, Argyll, west Scotland. Based on the Ordnance Survey, England.

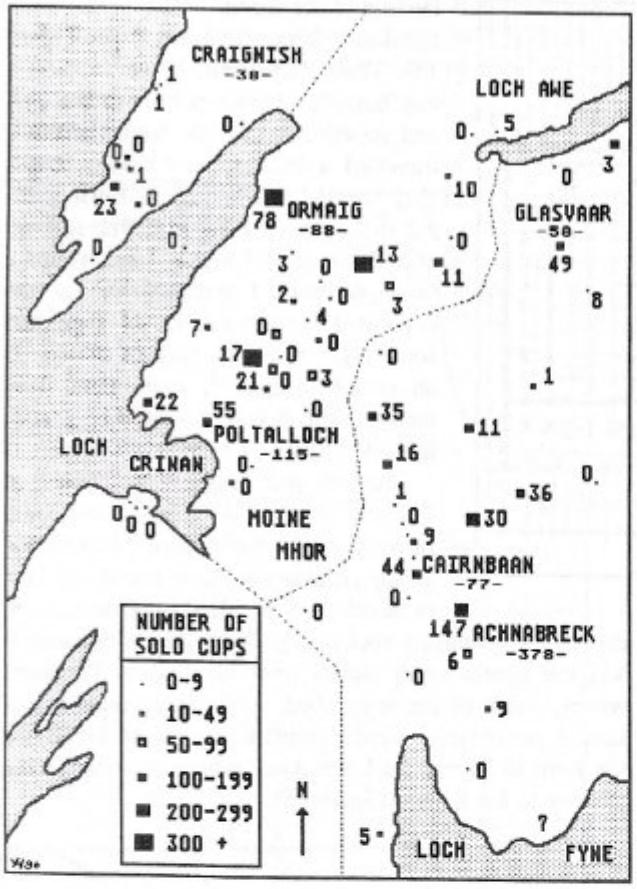

Figure 16. Comparison of the distribution of single cupule and ring marks of the west and east routes through Mid Argyll. Squares may represent clusters of panels.

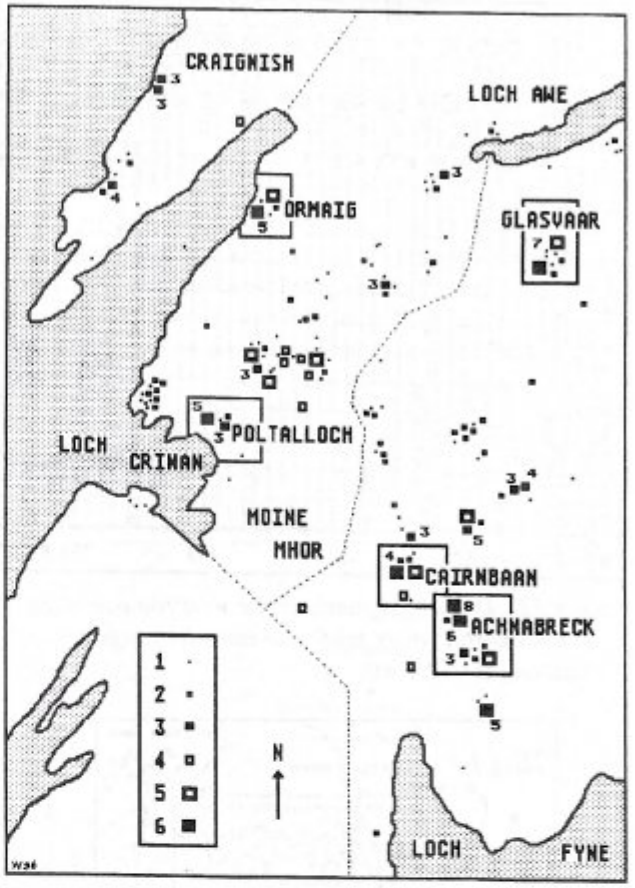

Figure 17. Comparison of the distribution of simple and complex motifs of the west and east routes through Mid Argyll. Legend: see text.

The sites in the Eurach area proved to be located at major turning points of the route, and they are often inter-visible. This is repeated elsewhere in the area: Kilmichael Glassary is even so exactly located on such a turning point that a few metres away from the site the view would not include the petroglyph sites some distance away on the route in either direction. Nearby outcrops, most suitable for engraving but lacking the view of the other sites have been completely ignored. Moreover, when checking the suggested routes in the field, I found more glyphs on the trackways. This deliberate siting of decorated panels resembles the positioning of medieval castles along the coast which were inter-visible by way of fire signals.

Statistical research of the Kilmartin valley shows a greater amount of isolated cups on the west route (Figure 16). The two sites with the greatest number of single cups, Ormaig and Creagantairbh, are strikingly present on the shortest (oldest?) route from Loch Craignish. The east part has more cup-and-ring motifs (indicated by the larger figures; 0 means no cup-and-rings) mainly because of Achnabreck, where altogether 147 cup-and-rings have been reported. The five major sites also show the total number of all concentric rings and with 378 rings, Achnabreck is again the most important site, followed by Poltalloch. In general the west part seems to have relatively more single cupules than ringed cups per site and the east part relatively more ringed cups than cupules. Also illustrated is the distribution of simple and complex sites (Figure 17). The figure at each site indicates the maximum number of concentric rings around one cup. Unnumbered sites have only one or two rings. The east part contains the majority of multiple concentric rings (10 sites against 6). The maximum number of rings is greater again in the eastern part: Achnabreck with a maximum of eight concentric rings and Glasvaar with seven. The maximum in the western part is five.

Six categories have been used to distinguish simple from complex sites (Figure 17). Category 1 includes panels with only cupules: the west part has more of such sites (43 against 27). Category 2 includes panels with cups with one or two rings: there are more of these at the east part (24 against 19). Category 3 includes cups with three rings or more but lacking special motifs: the east route has five such sites, the west route four. Category 4 are rock panels with only special motifs, lacking cups or rings: the west part has more of these (5 against 3) but these stones occur in man-made structures and may have been moved from other places in the area. Category 5 includes panels with cups and up to two concentric rings and special motifs: numbers are equal

but again examples at the west route could have been moved from elsewhere. Category 6 are rock panels with three or more concentric rings combined with special motifs: the east part has more of these (5 against 2).

The overall conclusion is that the east route displays a more sophisticated art style, culminating at Achnabreck. The west route has simpler motifs. The carving style seems to be more crude and rings are set more widely apart. It has a remarkably large number of single cups and a much lower number of special motifs on outcrops. Many of the stones with special designs occur in burials and ceremonial structures and may represent secondary use.

A hypothetical sequence of the elements of cup-and-ring motifs, developed by Steinbring and Lanteigne (1991: Fig. 12) suggests historical priority for the cupule. They also argue that the large numbers and the diffuse occurrence of cupules 'satisfy one basic tenet of diffusionism — that the most widespread phenomena are the oldest'. The west route, therefore, may be earlier, and Ormaig may, for the same reason, predate Poltalloch.

Central Scotland

The journey which started in Argyll continued to Loch Tay in the centre of Scotland. Further east patterns of divergence emerge: there are fewer sites, they are found widely scattered, are simpler of character and rarely occur in coastal positions.

Scotland has only two major inland concentrations. One occurs at Menteith (Figure 8), where a linear grouping possibly indicates the route from the Firth of Clyde to Loch Awe, avoiding the marshes and dense oak woods of the Forth Valley (Van Hoek 1992: 59).

The Tay valley is the largest inland concentration and is the subject of a special study (Bradley et al. in prep.). Therefore only a summary is given here.

Around the Tay valley petroglyphs only occur within two kilometres from the lake or the river valley. Most sites are distinctly clustered and often those clusters are not inter-visible. In many cases petroglyph sites are located near streams. Often linear groups run uphill along the rather steep slopes, ending at considerable heights. Only a slight preference for more complex motifs at higher levels is noticed (Figures 18, 19).

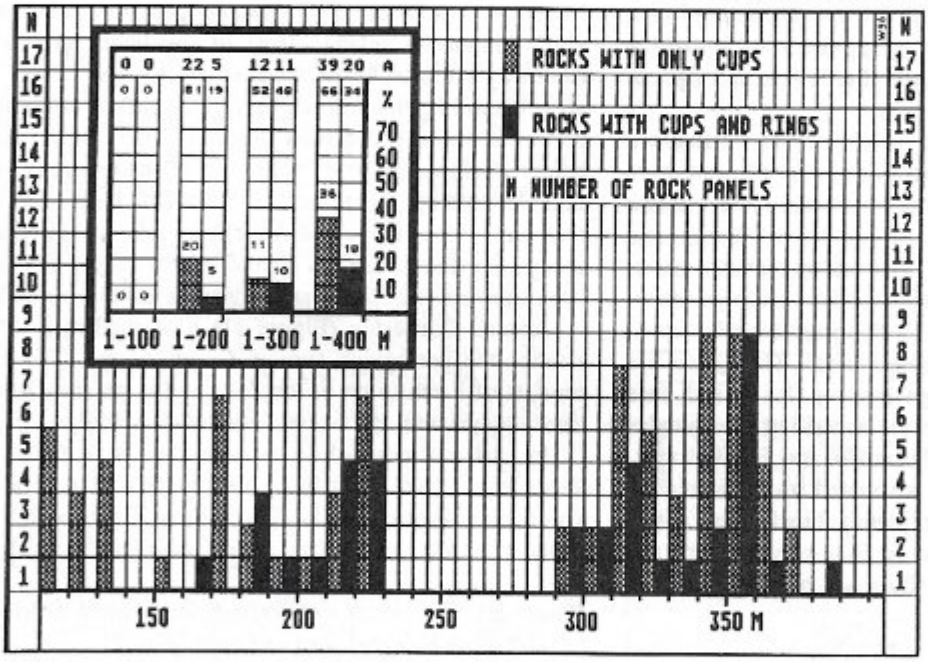

Figure 18. Rock art panels of the Tay valley between Acharn and Ballinluig related to altitude (range of altitude: 100 to 665 m). A = absolute numbers.

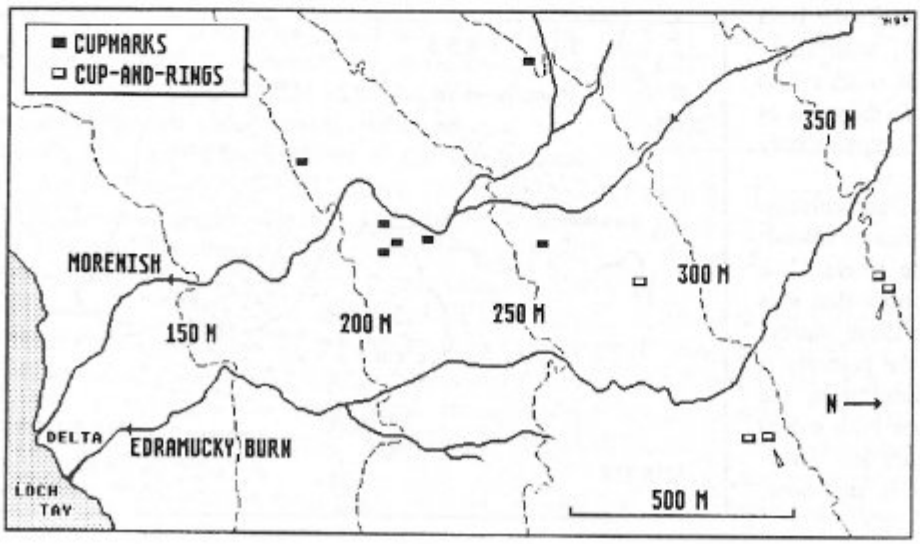

Figure 19. Distribution of petroglyphs at Edramucky, Loch Tay, central Scotland. Based on the Ordnance Survey, England.

Edramucky is a good example of this typical distribution (resembling Derrynablaha, Ireland). A small delta in the lake provides a landing place and a string of sites leads uphill. The glyphs are mostly simple: only two cups with three rings occur (indicated by pointers, Figure 19). East and west of this belt no petroglyphs have been recorded. Evidently, major movement did not take place along the contours. At Acharn, at another delta, and many other places further east, this pattern is repeated.

The Irish Sea

There is a marked scarcity of petroglyph sites in south-east Ireland until one arrives at the Wicklow mountains, where a few mainly simple sites encircle the mountains.

Further north, in the gently undulating landscape of Louth, we find the only important group of cup-and-ring stones of eastern Ireland. The most striking feature is that all petroglyphic stones (remarkably there are *no* panels with cupules only) are roughly linearly arranged. A band of sites runs straight inland from the coast for about eleven kilometres and has a major concentration at the end of the line. This linear group does not follow the valley of the unnavigable river Fane, but a ridge of higher ground to its north.

Further north-east we find the estuary of Carlingford with most of the Mourne mountains north of it, but there are no petroglyphs. Still further north-east there are two cup-and-ring sites in landscape similar to Louth and Galloway. One outcrop site, Ballyculter, Down, some 2.5 kilometres inland, is special for its two big concentric ring systems, one even with ten rings around a small cup, the greatest number in these islands. The glyphs are found at the base of a large outcrop knoll and face inland. They are identical in style and siting to examples found in Galloway, such as Torrs 4A and Big Balcraig. The second site, Ballystokes, is situated seven kilometres inland. Its sea views are completely blocked by a low hill, a feature also often found in Galloway. A third site in Down, Millin Bay, will be discussed below.

Galloway

East of Louth and Down, across the Irish Sea, is Galloway (Figure 20), with more than 400 decorated panels on its south coast; the densest concentration of these isles (remarkably, again, rocks with cupules only are relatively scarce here).

Only four cup-and-ring sites and thirteen cupule sites in Galloway are located inland, in and near the valleys of the rivers Cree and Dee. This is so low a number that it is impossible to firmly establish these valleys as *major* migration routes. If the petroglyph manufacturers would have come from the Pennines, the valley of the river Nith would have been a better choice (Figure 20). However, there are no petroglyphs in that area, although it offers accessible bays and many areas with outcrops, similar to the engraved ones further west. Moreover, in the lower reaches of the rivers Cree and Dee, both emptying in the estuaries that abound in petroglyphs, there are many areas with suitable outcrops but no petroglyphs. The sands of the tidal flats seem to have been avoided as well. Evidently, inland penetration was limited to a small coastal area and did not focus on the rivers.

During the Mesolithic period, however, several riverine routes seem to have existed in south-west Scotland. But the distribution of those lithic finds and their routeways (Edwards et al. 1983: Fig. 1) does not correspond with the spread of the petroglyphs. Moreover, most inland sites are concentrated rather isolated east of the main Mesolithic route. The linear groups of Galloway are too much separated from those early migration routes to be connected with riverine migration. They fit better into the idea of being coastal ceremonial centres for overseas interaction. Bound for east England, one landed at accessible bays, from where distinct linear groups of often inter-visible petroglyph sites developed. Never do these linear arrangements penetrate more than seven kilometres inland. Most of the linear groups in Galloway seem to be focused on the highest hill of the area, encircling that hill and having a marked concentration or a major site behind that hill. There exist rather abrupt endings of those 'belts'. In all cases areas with suitable outcrops continue for miles but they lack any rock art. Also, the areas on either side of the linear groups are almost always devoid of art: only a few isolated sites occur in landscape otherwise equally suitable.

Around Garlieston (Figure 21) it seemed difficult to arrange the petroglyph sites in linear groups. The area consists of a confusion of low hills and large stretches of low-lying ground, the whole dotted with outcrops.

In earlier times, when the land was at a relatively lower level, there must have been quite a marshy area. The higher level of the land nowadays is caused by the isostatic uplift, which has taken place in the north of

Figure 20. *Distribution of petroglyphs in south Scotland and north England. Framed area: Fig. 21.*

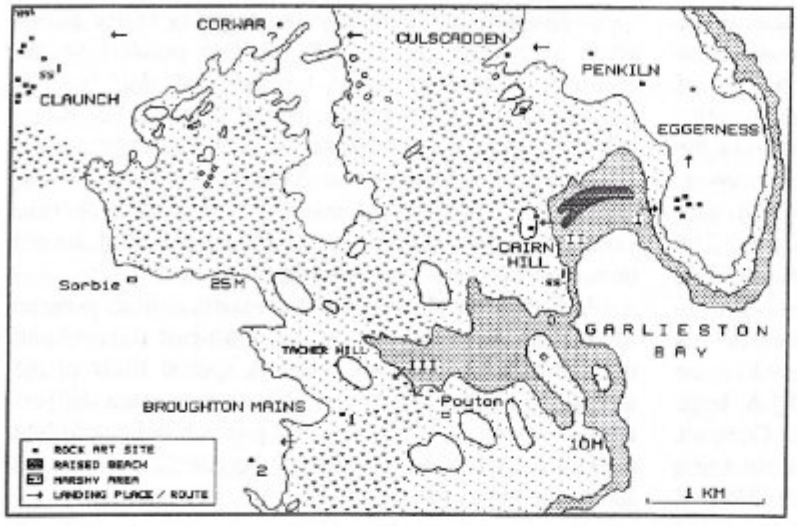

Figure 21. Distribution of petroglyphs near Garlieston, Galloway, south Scotland. Based on the Ordnance Survey, England. SS: standing stone.

Britain as a result of the loss of weight due to the melting of the ice sheet of the last Ice Age. Therefore the sea must have penetrated further inland in pre-Historic times. This is evident at Garlieston Bay, where a raised beach (at about 12 m) runs parallel to the present-day coastline, 300 m north of the high water mark. The petroglyphs of Eggerness and Penkiln are clustered opposite either end of the raised beach, both facing the raised beach (compare Poltalloch, Argyll).

Explanations of local place-names (Brooke 1991) confirm the ideas postulated above. Two names are particularly clarifying. The village of Sorbie derives its name from the Scandinavian *saurr-byr* which means 'swamp farm'. The second name involves the name of Pouton, a farm, now 1.5 kilometres inland, of which the Old English form *pol-tun* means 'village with tidal stream'. This most probably applied to Pouton Burn and this may indicate that the sea reached as far as Pouton farm in earlier days.

A map (Figure 21) with only the 10 metres and 25 metres contours of the area and the present-day coastline may be helpful. The 10-metre contour has been chosen because the raised beach is slightly above that height and therefore the ancient coast-line would have been approximately at that level. The lowest site in Galloway is at 15 metres, which confirms that at least that height was above sea level when those carvings were executed.

Finally, the approximate extent of the boggy areas was added. Thus the natural ridges, avoiding the swamps, became more evident. Two rather distinct linear arrangements emerged. The major group starts at Eggerness (with a wealth of spirals) and runs via the Penkiln sites and the fine site at Culscadden up to the cluster at Claunch. The as yet unlocated site at Corwar (position estimated) neatly fits into this suggested route. Moreover, Culscadden was found when checking the route in the field (compare similar situations in Argyll and elsewhere in Galloway).

The second group starts from Cairn Hill. The motifs at Cairn Hill, however, comprise two simple spirals, nothing else. Possibly, Cairn Hill formed a sort of an island in those days (compare with Cnoc Beg, Argyll). It is therefore more likely that a third landing place existed near the east base of Tacher Hill, north-east of Broughton Mains 1. It might be important that this site has spirals as well.

England

The situation in England is totally different to Scotland. If we take the Pennine range as dividing line between west and east England, the scarcity of petroglyphs in west England is quite evident (Figure 20). Only a few sites encircle the Cumbrian mountains (compare the Wicklow mountains) and a minor concentration is found in the Eden valley.

There are several ancient routes through the Pennines. The Tyne Gap (marked *I*, Figure 20) and the Stainmore Gap (*II*) were the most important. Having used these passes, further travelling continued along the higher parts of the landscape. East of the watershed, entering new areas, major concentrations of cup-and-ring art emerge almost immediately, suggesting approach from the west. Therefore all major petroglyph groups, except for the Yorkshire Moors, are found relatively far inland.

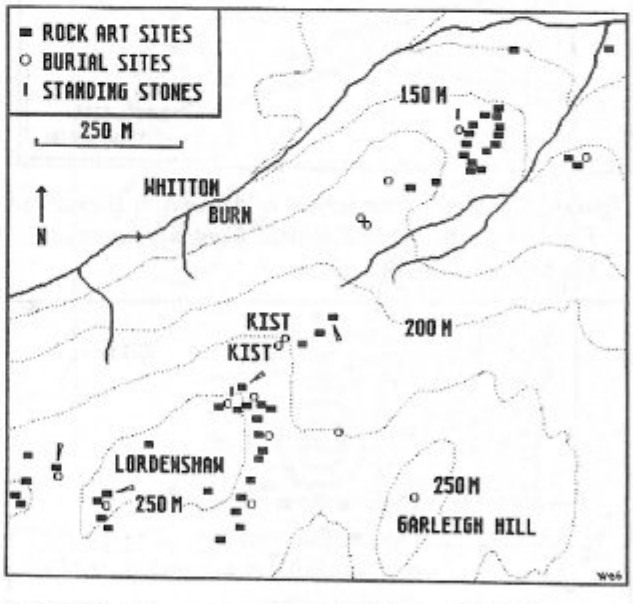

Figure 22. Linear arrangement of petroglyph sites at Lordenshaw, north England. Based on the Ordnance Survey, England.

Although the valleys of the Tyne, Tees and Wharfe will have been used for travelling, the majority of the petroglyphs is found at rather high altitudes, following sandstone ridges in Northumberland and, in Durham and Yorkshire, the higher contours of the hills. Thus also in England linear arrangements developed quite frequently. In Northumberland, linear groups are either found on the

tops of the hills or as arrangements running against the gradient. An example is the Lordenshaw group, which is roughly aligned SW-NE, but not exactly on the top of the hill. Sites continue a little beyond the top (similar situations occur in Galicia, e.g. at Paredes). Most of the 89 panels at Lordenshaw bear simple cups and grooves. Only four panels bear complex motifs (indicated with pointers on Figure 22) all found at higher levels. The absence of petroglyphs on neighbouring Garleigh Hill, with equally suitable outcrops, is remarkable.

At Chirnells, on the slopes opposite Lordenshaw, a linear cluster of outcrop sites is similarly aligned on the dilapidated Football Cairn on top of a hill. A large outcrop near the cairn bears worn symbols. Complex motifs (indicated with pointers on Figure 23) are again found on higher levels. When checking this SW-NE alignment in the field, I found a complex glyph on the alignment. It is situated, however, on the other side of the hill and out of sight of the others. Later, more simple sites were discovered on the alignment.

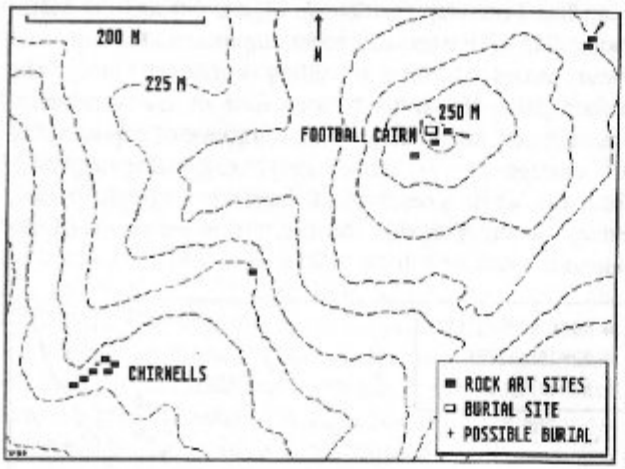

Figure 23. Linear arrangement of petroglyph sites at the Football Cairn, north England. Contours based on the Ordnance Survey, England.

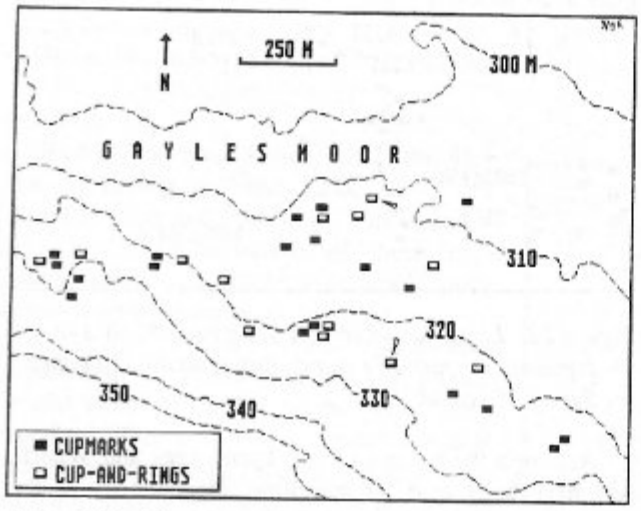

Figure 24. Linear arrangement of petroglyph sites at Gayles Moor, north England. Contours based on the Ordnance Survey, England. Map updated with kind assistance of Paul Brown, England.

In Durham and Yorkshire the majority of the petroglyph sites are aligned more or less parallel to the contours, often high up on terraces and platforms. A good example of this pattern is found at Gayles Moor, North Yorkshire, where rather inconspicuous stones cluster roughly between the 310 and 330 m contours, north of an escarpment, avoiding the central plateau. Complex glyphs (see pointers, Figure 24) and simple ones are distributed at random in this area.

At Rombalds Moor, West Yorkshire, similar patterns occur. Sites are clustered on the north-east terraces and the platforms on the south side. A special study of the area suggests that the central plateau was again deliberately avoided because this central position did not fit into the culturally-defined function of the site (Steinbring and Lanteigne 1991: 15).

Dating

It is notoriously difficult to date decorated outcrops or natural boulders because there usually is no archaeological context. Although non-archaeological means of dating petroglyphs have been available for some years, the requisite expertise has not been developed in Europe (Bednarik 1996).

Fortunately, a number of carved rocks in Europe are found incorporated in all sorts of structures, thus providing some context and occasionally a good *terminus ante quem*. Most of these examples concern secondary use: carved stones have just been used as building material. Farmwalls and fieldwalls, souterrains and forts from the Iron Age, field clearance cairns from all periods, but also pre-Historic burials have yielded cup-and-ring stones. Simply and solely because also a number of cup-and-ring slabs occur in Bronze Age kists (or cists), it has become a durable myth that the cup-and-ring art of western Europe was a Bronze Age phenomenon.

However, a number of facts contradict Bronze Age origin. Firstly, there is a lack of correspondence between the distribution of cup-and-ring art and Bronze Age *but also* Neolithic monuments. Secondly, decorated kist-slabs from the Bronze Age are clearly reused and motifs are often broken off or damaged. The decoration therefore must be older. Thirdly, only a small fraction of the Bronze Age kists incorporates decorated slabs. Of the more than one hundred kists reported in Donegal (Lacey et al. 1983: 64), the area with the biggest concentration of cup-and-ring art in Ireland, *none* bears any decoration. In the petroglyph regions of Scotland and England, only very few kists are decorated (Morris 1981; Beckensall 1983). Galloway, the area with the densest concentration of cup-and-ring sites, has *not a single kist* with cup-and-ring decoration (Van Hoek 1995a). In the Kilmartin valley, Argyll, there are some kists with cup-marked slabs (*none* with cup-and-rings), and three kist-slabs with typical Bronze Age axe heads, one clearly reusing a cup-marked slab (Morris 1977). All the stranger it is that there is *not a single* decorated outcrop or natural boulder in the British Isles which bears true Bronze Age motifs (but see Van Hoek 1988b),

not even in the Kilmartin valley, where Bronze Age people practised some kind of carving tradition.

In the past several researchers have pointed to the congruency of cup-and-rings with metal ore sites (Morris 1981: 176: 1990: 85) and used that as an argument to claim a Bronze Age origin. The art was said to have been intended to induce metal prospecting. There are, however, too many areas with petroglyphs where no metal ores occur, like the Isle of Bute and Yorkshire, or areas with metal ores but no open air rock art, like Connemara, Ireland, and the province of Huelva in Spain.

Especially Neolitihic monuments offer proof for an *early* Neolithic dating of cup-and-ring art. A cup-marked stone from Dalladies long barrow, eastern Scotland, could be dated at 5200 BP. Excavation of the Temple Wood stone circle, Argyll, by Jack Scott yielded a date of 5300 BP for the construction of the orthostats (Scott 1989). Three of these stones were decorated on the outer faces and the carvings on two stones were consequently hidden by a Neolithic bank of cobblestones. One, a cup-marked interval slab, clearly showed its broken-off nature, which points to reuse in the Neolithic.

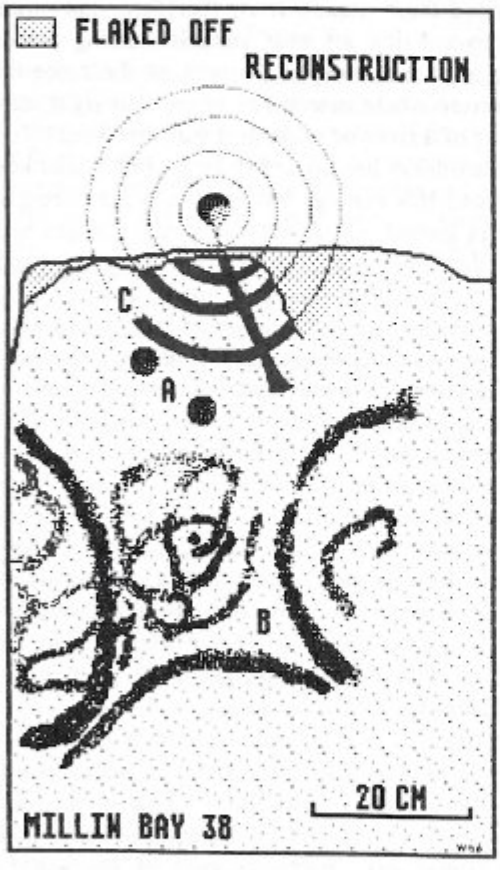

Figure 25. Attempt at reconstruction of stone 38, Millin Bay, County Down, Northern Ireland (based on: Collins and Waterman 1955: Fig. 10.).

At Millin Bay, County Down (Figure 7), we find a Neolithic cairn on top of a raised beach, overlooking one of the very few accessible bays on this coast. Excavation in 1951 yielded 54 decorated stones, all quarried from outcrops in the immediate neighbourhood (Collins and Waterman 1955). Orthostat 44 has three cups, one clearly broken-off at the edge. Stone 47 bears two cups, one of which was damaged. Most important is stone 38 (Figure 25) showing two cups (*A*), the typical Millin Bay decoration (*B*), but also a clearly broken-off cup-and-ring motif with radial groove (*C*, see attempt at reconstruction). The stone has clearly been broken from a larger decorated rock, quite possibly from the nearby outcrops, and was later reused in the cairn. The excavators confirmed its secondary nature but did not establish an *earlier* date for engraving *C*. As the decorated stones were completely covered by cairn material it is impossible that the cup-and-ring figure is a later addition. It proves that the builders of the cairn regarded the existing cup-and-ring figure not suitable for their purposes. Instead, they executed a completely different range of motifs.

Figure 26. Cup-and-ring slab in the south chamber of Cairn H, Loughcrew, Ireland.

Many Irish passage tombs yield similar dating evidence, especially because recent research has established that the passage graves of the west coast are considerably older than those of eastern Ireland. They probably date around 6200 BP (Burenhult 1980). None of these western tombs have decorated megaliths, except for the possible passage tomb at Beltany, Donegal, which has cup-marked kerbstones. The practice of building passage tombs probably spread from the north-west to the east of Ireland (Figure 5).

Halfway into the interior are the tombs of Knockmany and Sess Kilgreen, both with fine examples of cup-and-ring motifs, one, at Sess Kilgreen, possibly broken off (Brennan 1983: 88). Still further south, the extensive cemetery of the Loughcrew passage tombs (roughly dated around 5900 BP) features numerous decorated stones, including some typical cup-and-ring stones, for example at cairn *V* and at cairn *H* (Figure 26). Also a large number of cups and cup-and-ring motifs occur in combination with passage tomb art.

Near the east coast we find the complex of the Boyne with the famous passage tombs of Dowth, Knowth (dated around 5700 BP) and Newgrange (5300 BP). True cup-and-ring art is very scarce in these tombs. Possibly a completely different range of symbols gradually replaced the earlier cups and cup-and-ring symbols. This replacement is also shown by the 'hidden art': decoration of mainly simpler motifs, including cup-and-rings, on the backs of large boulders and *covered* by cairn material, representing earlier work perhaps regarded by the builders as 'out of date'.

Knowth and Newgrange are above average in size, of peculiar construction and function and seem to represent a dead end in development. The decoration of these passage tombs represents possibly also a dead end in development. This, and the presence of typical cup-and-ring stones in older tombs and 'hidden' art in later tombs, indicates that the origin of cup-and-ring art is earlier.

Added to this is the view that Neolithic people started building tombs some centuries *after* their arrival (Weir 1981: 4). This leads to the assumption that, around 7000 BP, Neolithic groups arrived at the British Isles and introduced their cup-and-ring symbols, found in belts of sites that encircle Ireland, go round the north of Scotland and traverse Britain at the narrowest points. The preference to travel this way may be explained by the fact that around 7000 BP, the isthmus between France and England (as suggested in Figure 3) broke open. Heavy surges and currents rushed through the Channel, forcing people travelling by sea to take another route.

There is another remarkable fact. If indeed the art is Neolithic, then it is strange that there occurs hardly any cup-and-ring site near the important Neolithic stone axe mines of the British Isles. Near the Great Langdale axe factories in Cumbria, England (Figure 7: I), there are no petroglyph sites. The distribution of stone axe factory products was almost entirely riverine. It would seem that almost every river, tributary, coastal area and island was embraced in this ubiquitous trade (Stone and Wallis 1951: 118). However, only three decorated rocks occur near the coast, in remarkable contrast with the more than 400, sometimes lavishly decorated rock panels on the coast of Galloway, opposite Cumbria, and especially in Galloway, the spread of cup-and-ring art is certainly not riverine. Also the axe factories of Tievebulliagh (II) and Rathlin Island (III) in Ireland are found in an area completely lacking cup-and-ring art.

If cup-and-ring art indeed is one of the earliest Neolithic expressions of land use it is quite logical to accept that the axe factories were not known at that time. An explanation is that the axe quarries developed later in the Neolithic (see Sheridan 1986: 25), when the tradition of cup-and-ring art was already firmly established in other parts of the Isles. This may also explain the incongruence with other Neolithic monuments.

Summary

Although the distribution of petroglyph sites in general looks completely haphazard to untrained modern eyes, Steinbring and Lanteigne (1991: 15) argue that the selection of the panels to be carved did not occur at random, but in relation to other panels and the surrounding landscape. Bradley (1991) mentions the significance of paths and viewpoints as essential features of the territorial organisation of mobile peoples. This paper confirms their hypotheses to a certain extent.

Notably several instances in this survey suggest that cup-and-ring art represents a complex body of magical and socio-religious rituals of migrating peoples in the early Neolithic. Especially when arriving at areas completely new to them, certain members of the group performed their rituals. It is, therefore, not strange to find cup-and-ring art near suitable landing places and entrances of estuaries, or at spots on the route through the interior where new views come into sight, or when crossing of a river or watershed was involved.

Accessibility has proved to be an ambiguous keyword throughout this survey. Indeed, the cup-and-ring manufacturers looked out for suitable landing places and easy routes through the interior. But on the other hand they often preferred to decorate rock panels at rather hard-to-reach places. It is claimed in this paper that the latter instances represent sacred places, situated some distance from the routes and secular settlements of the community, where groups communicated with their supernatural world. The basic elements of Neolithic cup-and-ring art of Atlantic Europe seem to have been executed during uncertain times (travelling, exploring) and are found widespread. Later, in more settled periods, complex elements were added, especially in key areas or when a site was located on a through route, either spiritual or secular. Major sites became lavishly decorated with designs executed with great effort and skill, emphasising their importance. The very stable period required to build the major Irish tombs generated a special range of different symbols which were relatively short-lived. Cup-and-ring art, however, survived for a much longer time. As Steinbring and Lanteigne argue (1991: 24), 'many societies of the world, after becoming sedentary, perpetuate symbolism of their less stable historical past'.

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Final MS received 4 July 1996.

Résumé. *L'emplacement des gravures sur roche est le résultat d'un ensemble complexe de facteurs. Un de ces facteurs est la disponibilité de surfaces de roche adéquates. Cet article examine la mobilité, l'accessibilité et l'évitement comme des facteurs importants déterminant l'emplacement et la distribution des gravures coupe-et-cercle le long de la côte atlantique de l'Europe. L'emplacement, particulièrement en Irlande et en Grande-Bretagne, suggère fortement une colonisation initiale sur une petite échelle par de nouvelles communautés agricoles. L'évidence de la datation semblerait placer l'art coupe-et-cercle tout au début du néolithique atlantique. L'origine des gravures coupe-et-cercle doit donc précéder celle de l'art irlandais des tombes à passage.*

Zusammenfassung. *Die Lageorte von Petroglyphen sind das Ergebnis komplizierter Faktoren. Die Anwesenheit brauchbarer Felsflächen ist ein solcher Faktor. Dieser Artikel untersucht Mobilität, Zugänglichkeit und Vermeidung als wichtige Faktoren für die Fundorte und das Vorkommen der cup-and-ring Petroglyphen entlang der atlantischen Küste Europas. Besondes in Irland und Großbritannien deuten die Lageorte auf eine ursprünglich geringe Kolonisation durch neue Agrar-Gruppen. Datierungsanhaltspunkte scheinen die cup-and-ring Kunst ganz an den Anfang des Atlantischen Neolithikums zu stellen. Daher muß der Ursprung der cup-and-ring Petroglyphen der irländischen Gang-Gräber Kunst voranzustellen sein.*

Resumen. *La ubicación de petroglifos es el resultado de una compleja serie de factores. Disponibilidad de superficies pétreas apropiadas es uno de tales factores. Este artículo investiga la movilidad, accesibilidad y evasión como factores importantes al escoger la ubicación y distribución de cúpulas y circunferencias grabadas a lo largo de la costa Atlántica de Europa. La ubicación, especialmente en Irlanda y Gran Bretaña, fuertemente sugiere colonizaciones iniciales en pequeña escala por nuevas comunidades de agricultores. La evidencia de datación parece ubicar las cúpulas y circunferencias bien al principio del Neolítico Atlántico. En consecuencia, el origen de los petroglifos consistentes en cúpulas y circunferencias debe ser anterior al arte del acceso a las tumbas Irlandesas.*

REFERENCES

ANATI, E. et. al. 1983. *Preservation and presentation of rock art.* Centro Camuno di Studi Preistorici, Capo di Ponte.

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

BECKENSALL, S. 1983. *Northumberland's prehistoric rock carvings.* Rothbury.

BRADLEY, R. 1991. Rock art and the perception of landscape. *Cambridge Archaeological Journal* 1: 77-101.

BRADLEY, R., J. HARDING and M. MATHEWS 1993. The siting of prehistoric rock art in Galloway, south-west Scotland. *Proceedings of the Prehistoric Society* 59: 269-83.

BRENNAN, M. 1983. *The stars and stones: ancient art and astronomy in Ireland.* Thames and Hudson, London.

BROOKE, D. 1991. The Northumbrian settlements in Galloway and Carrick: an historical assessment. *Proceedings of the Society of Antiquaries, Scotland* 59: 269-283.

BURENHULT, G. 1980. *The archaeological excavation at Carrowmore.* North European Archaeology 9, Stockholm.

COLLINS, A. E . P. and D. M. WATERMAN 1955. *Millin Bay, a later Neolithic cairn in Co. Down.* Archaeological Research Publication (Northern Ireland) 4, Her Majesty's Stationery Office, Belfast.

COSTAS GOBERNA, F. J. and P. NOVOA ALVAREZ 1993. *Los grabados rupestres de Galicia.* Monografias 6, Edicions do Museu Arqueoloxio e Historico Concello de A. Coruña, La Coruña.

EDWARDS, K. J., M. ANSELL and B. A. CARTER 1983. New Mesolithic sites in south-west Scotland and their importance as indicators of inland penetration. *Transactions of the Dumfriesshire and Galloway Natural History and Antiquarian Society* 63: 9-15

HADINGHAM, E. 1974. *Ancient carvings in Britain: a mystery.* Garnstone Press, London.

JACKSON, P. 1991. Comment on Steinbring and Lanteigne. *Rock Art Research* 8: 24-6.

LACEY, B., E. CODY, C. COTTER, J. JUPPAGE, N. DUNNE, V. HURLEY, C. O'RAHILLY, P. WALSH and S. O'NULLÁIN 1983. *Archaeological Survey of County Donegal.* Donegal County Council, Lifford.

MARK, R. and E. NEWMAN 1995. Cup and ring petroglyphs in northern California and beyond. In J. Steinbring (ed.), *Rock art studies in the Americas*, pp. 31-21. Oxbow Monograph 45, Oxford.

MARSHALL, D. N. 1985. The enigmatic cup mark carvings on Bute. *Transactions of the Buteshire Natural History Society* 22: 7-20.

MORRIS, R. W. B. 1977. *The prehistoric rock art of Argyll.* Dolphin Press, Poole.

MORRIS, R. W. B. 1979. *The prehistoric rock art of Galloway and the Isle of Man.* Blandford Press, Poole.

MORRIS, R. W. B. 1981. *The prehistoric rock art of southern Scotland.* BAR British Series 86, Oxford.

MORRIS, R. W. B. 1988. The cup-and-ring motif in the rock art of the British Isles and in America. *The Epigraphics Society* 17: 19-30.

MORRIS, R. W. B. 1991. Cup-and-Ring mark dating. *Glasgow Archaeological Journal* 16: 85-6

POWER, D., E. BYRNE, U. EGAN, S. LANE and M. SLEEMAN 1992. *Archaeological inventory of County Cork. Volume 1: West Cork.* Stationery Office, Dublin.

SCHWEGLER, U. 1992. *Schalen- und Zeichensteine der Schweiz.* Schweizerische Gesellschaft für Ur- und Frühgeschichte, Basel.

SCOTT, J. G. 1989. The stone circles at Temple Wood, Kilmartin, Argyll. *Glasgow Archaeological Journal* 15: 53-124.

SHERIDAN, J. A. 1986. Porcellanite artifacts: a new survey. *Ulster Journal of Archaeology* 49: 19-32.

STEINBRING, J. and M. LANTEIGNE 1991. The petroglyphs of West Yorkshire: explorations in analysis and interpretation. *Rock Art Research.* 8: 13-28.

STONE, J. F. S. and F. S. WALLIS 1951. Third report on the Sub-Committee of the South-Western Group of Museums and Art Galleries on the petrological identification of stone axes. *Proceedings of the Prehistoric Society* 17: 99-158.

SHEE-TWOHIG, E. 1981. *The megalithic art of western Europe.* Clarendon Press, Oxford.

VAN HOEK, M. A. M. 1988a. The prehistoric rock art of County Donegal, Part II. *Ulster Journal of Archaeology* 51: 21-47.

VAN HOEK, M. A. M. 1988b. *Possible 'axehead' carvings at Knock. Transactions of the Dumfriesshire and Galloway Natural History and Antiquarian Society* 63: 89.

VAN HOEK, M. 1992. A survey of the prehistoric rock art of the Port of Menteith Parish, central Scotland. *Forth Naturalist and Historian* 15: 58-75.

VAN HOEK, M. A. M. 1993a. The prehistoric rock art of the Boheh Stone, Co. Mayo. *Journal of the Westport Historical Society* 13: 1-15.

VAN HOEK, M. A. M. 1993b. The spiral in British and Irish cup-and-ring art. *Glasgow Archaeological Journal* 18: 11-32.

VAN HOEK, M. A. M. 1995a. *Morris' prehistoric rock art of Galloway.* Privately published. Oisterwijk.

VAN HOEK, M. A. M. 1995b. The keyhole-pattern in prehistoric rock art of Ireland and Britain. *Journal of Westport Historical Society* 15: 15-25.

WEIR, A. 1981. *Early Ireland, a field guide.* Blackstaff Press, Belfast.

WILLIAMS, B. B. 1985. Excavations at Drumnakeel, County Antrim. *Ulster Journal of Archaeology* 48: 51-60.

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KEYWORDS: *AMS radiocarbon analysis - Accretion - Rock painting - Kimberley - Australia*

AMS RADIOCARBON AGE ESTIMATES FOR EARLY ROCK PAINTINGS IN THE KIMBERLEY, N.W. AUSTRALIA: PRELIMINARY RESULTS

A. L. Watchman, G. L. Walsh, M. J. Morwood and C. Tuniz

Abstract. This paper describes the sample locations, analyses and preliminary radiocarbon age estimates for 'Tassel' and 'Sash' Bradshaw paintings and a large naturalistic animal figure belonging to the 'Irregular Infill Animal' category of rock paintings in the northern Kimberley region of Western Australia. As organic binders were not evident in the paints, carbon in accretions directly associated with paint layers was extracted and dated to provide estimates for when these paintings were made.

Introduction

The rock painting sequence of the Kimberley region, north-western Australia (Figure 1), has unique potential for documenting changes in society, ideology, cultural material and 'outside' contacts (Morwood et al. 1994).

Superimpositions, differential weathering and stylistic developments have previously been used to construct relative chronologies for this sequence, which depicts changes in the natural environment, cultural evolutions and external influences (e.g. Crawford 1977; Walsh 1994). Once chronometric ages are able to anchor major transitions securely in time, changes in representations in rock paintings can be compared with the palaeo-environmental record and evidence from archaeological excavations (e.g. O'Connor 1990). They will also allow the Kimberley rock painting sequence to be systematically compared with that of western Arnhem Land, with which it shares a number of sequential trends (e.g. Chaloupka 1993; Lewis 1984). However, the major problem with research into rock imagery has always been the difficulty in obtaining reliable age estimates.

This paper reports preliminary accelerator mass spectrometry (AMS) ^{14}C age estimates obtained for mineral encrustations associated with paintings of the 'Irregular Infill Animal' and Bradshaw periods — the two earliest rock painting types identified in the region (Walsh 1994). The practical difficulties encountered in AMS ^{14}C dating of early Kimberley rock paintings are also described. In future papers, when data become available, we will report direct AMS ^{14}C age estimates for later Kimberley rock paintings types, including beeswax motifs, Wandjina paintings and Argula paintings (Schulz 1956; Welch 1995). As part of the same Kimberley rock painting dating project, Roberts et al. (e.g. 1996) are using optically stimulated luminescence (OSL) to date the construction of mud-wasp nests overlying and underlying Kimberley rock paintings.

Methods

In July 1994, twenty rock painting sites in the north Kimberley were visited to assess their suitability for our dating program. All had been recorded during previous fieldwork (Walsh 1994). They were selected on the basis of permissions obtained from Aboriginal custodians for the northern Kimberley region, the significance of specific motifs in the relative rock painting chronology for the region, and accessibility.

Preliminary observations about sample suitability were made using a binocular microscope and examining cross-sections and surface features for signs that would justify further detailed investigations. The potential of samples for dating were judged on the basis of thickness of paint and accretionary layers, proximity of the paint to the surface, continuity of paint and accretionary layers across the sample, presence of dark organic-rich laminae, degree of weathering, presence of salts, possible contaminants, surface irregularities and veining or fracture fillings.

Samples were then selected for subsequent detailed geochemical analyses using scanning electron microscope energy dispersive x-ray analysis (SEM/EDXA) and x-ray diffraction (XRD) to identify compositions of the paints and their encapsulating accretionary deposits. A JEOL JSM-840A SEM fitted with a beryllium window on the x-ray detector allowed the detection of carbon and identification of heavier elements using a Tracor Northern energy dispersive x-ray analytical system. Small samples of rock surfaces mounted in plan and section

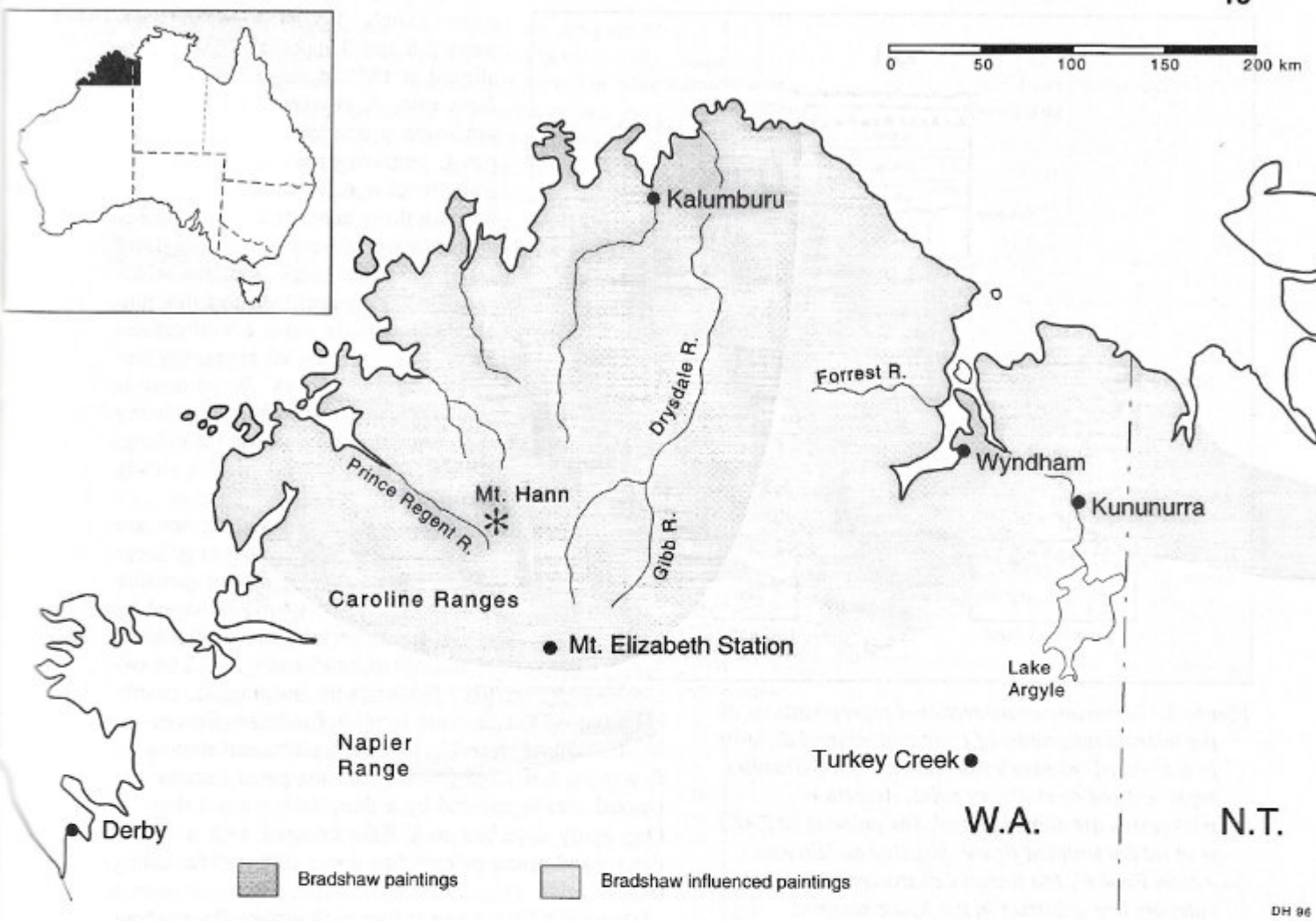

Figure 1. *The distribution of Bradshaw rock paintings (e.g. 'Tassel' and 'Sash') and Bradshaw-influenced rock paintings in north-west Australia. Bradshaw-influenced paintings, such as 'Clothes Peg Figures', are more recent and widespread.*

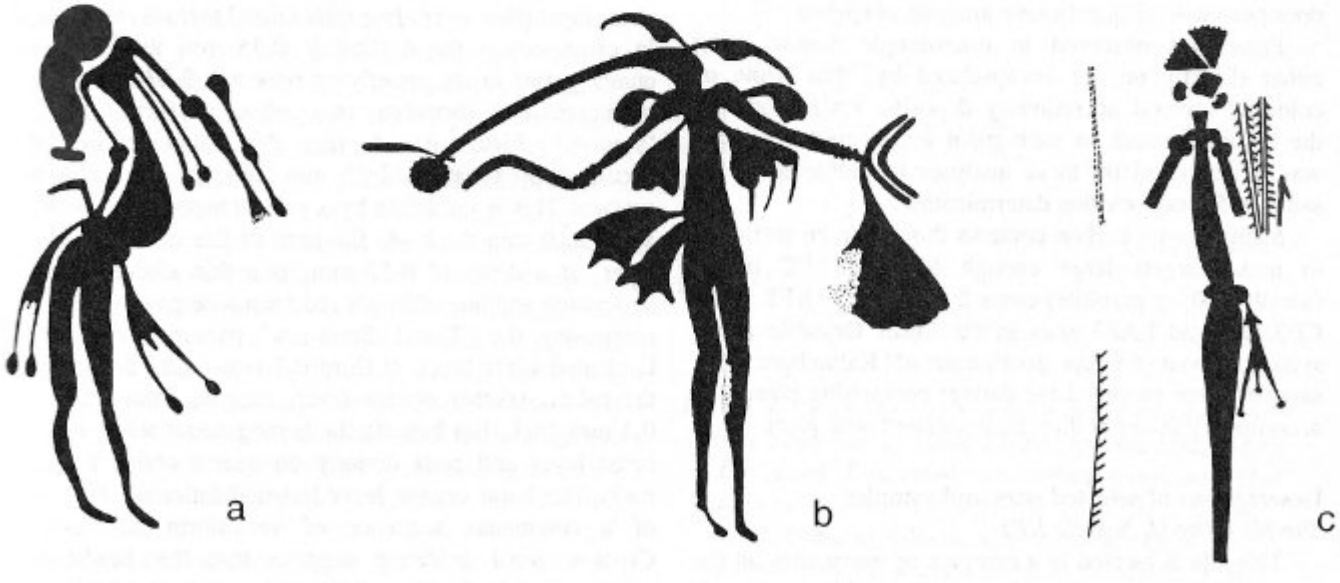

Figure 2. *Typical examples of a 'Tassel Bradshaw' (a), 'Sash Bradshaw' (b) and 'Clothes Peg' figures (c).*

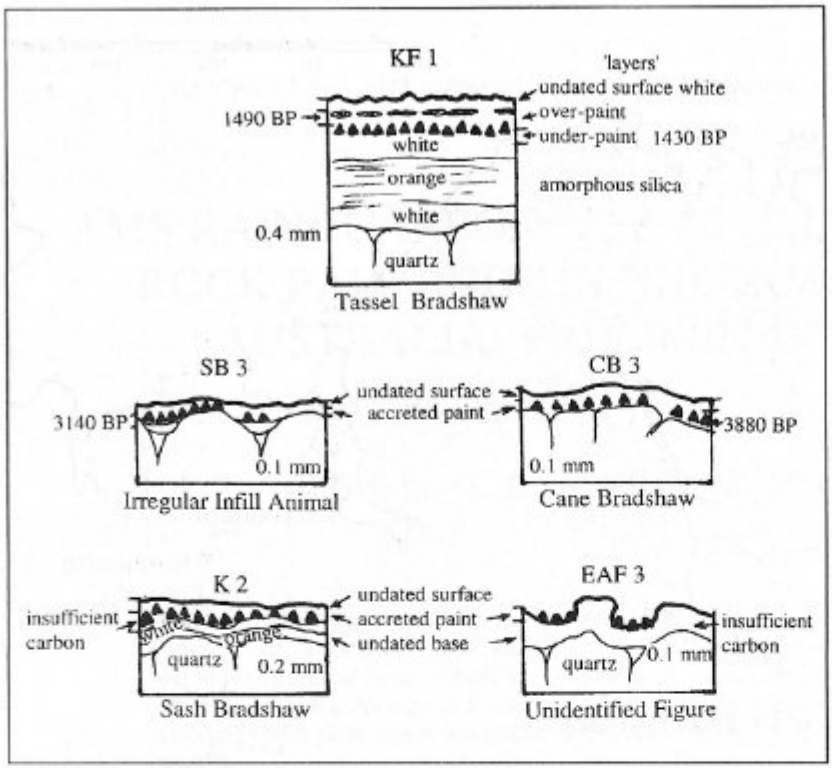

Figure 3. Schematic cross-sectional representations of the micro-stratigraphy of paint and mineral deposits in the 'dated' Kimberley accretions. Solid triangles represent red or mulberry paint. Accretion thicknesses are shown in mm. The painting at EAF3 is of an unidentified figure, possibly an 'Elegant Action Figure', but features characteristic of that category are indistinct in the figure sampled.

orientations were coated with gold-palladium (Au-Pd) to prevent charging. While such a coating has a detrimental effect on measurement of elements with masses between that of phosphorus and potassium (especially chlorine) it does permit semi-quantitative analysis of carbon.

Paint was observed in microscopic studies lying either directly on, or encapsulated by, thin white or coloured mineral accretionary deposits. An estimate of the carbon content in each paint and accretion sample was made based on these analyses to aid selection of samples for radiocarbon determination.

Samples with carbon contents thought to be sufficient to make targets large enough for AMS ^{14}C dating (ideally 100 μg graphite) came from samples KF1, SB3, CB3, K2 and EAF3 sites in the lower Drysdale River system, about 55 km south-east of Kalumburu. Six samples were prepared for dating; comprising powdered accretionary material directly associated with paint.

Descriptions of selected sites and samples

Site No [00685], Sample KF1

This site is located in a complex of many sites on the eastern side of a large mushroom-shaped block of sandstone at the top of the plateau near a narrow rocky stream bed. The paintings are on a vertical rock face, approximately 1.5 m long and between 2.5 and 3 m high. The panel is aligned at 165° to magnetic north and faces east. A six-metre-deep ledge of sandstone protrudes over the painted panel, protecting most of the paintings from direct rain. However, water periodically flows across the painted panel during heavy rain because it runs down the flank of the block from the relatively flat shelter roof. Most of this runoff drops directly down a well-defined water-wash zone on an apparently unpainted portion of rock. When there is a lot of runoff water following heavy rain, some of it seeps along the ceiling-back wall junction and trickles slowly across the paintings.

Five large Bradshaw figures are visible on the panel: one very large 'Tassel Bradshaw', another smaller 'Tassel Bradshaw' (partly obscured by the dark water wash mineral deposits), a 'Sash Bradshaw' and two Bradshaw-like figures with incomplete, partly obscured or lost features (typical Bradshaw figures are illustrated in Figure 2). It is difficult to see more than five individual large paintings on the panel because the painted area is covered by a thin, dark mineral deposit. One partly detached rock flake covered with a brown deposit and near a painted figure was collected for dating (KF1).

Sample KF1 comprises four rock surface flakes about 2 mm thick (during sampling the large, partly exfoliated, flake broke into smaller pieces). Two pieces are 2.2 × 2 cm square, the third is 2 × 1.3 cm and the last measures 1.5 × 1.4 cm. All coated surfaces are similar in texture and composition. They have smooth, pale honey-brown vermiform (thin worm-like mineralised threads) textures. In cross-section the coating is 0.35 mm thick above quartz grains in the underlying rock and 0.37 mm thick in depressions between two adjacent vermiculation 'mounds' (Figure 3). A very thin, dark lamination occurs approximately 0.07 mm beneath the modern surface. This is underlain by a pale orange-brown layer, about 0.05 mm thick. At the base of this orange-brown layer, at a depth of 0.12 mm, is a thin discontinuous lamination and line of bright red haematite paint particles composing the 'Tassel Bradshaw' painting. A finely laminated white layer, 0.18 to 0.2 mm thick, lies under the paint. Another orange layer, ranging from 0.05 to 0.1 mm thick, lies beneath the homogeneous white laminated layer and rests directly on quartz grains in the rock. The basal orange layer has undulations indicative of a continuous sequence of vermiform structures. Cross-sectional evidence suggests that the Bradshaw painting was applied to a white silica skin, and its location marks a change in the composition of silica from translucent-white to pale honey-brown.

The layer of silica immediately beneath the present surface, down to the top of the paint, consists essentially of the following elements; silicon (Si), oxygen (O), aluminium (Al) and phosphorus (P), with minor iron (Fe) and a trace of carbon (C). Gypsum has precipitated in lenses shaped by depressions between small micro-topographic high points above quartz grains. Carbon is slightly more concentrated in these lenses than in the surrounding contemporaneous silica, possibly reflecting micro-organic deposits. The aluminium content is highly variable through this unit, indicating irregular distribution of clay-like minerals through the silica skin.

The paint layer mainly consists of O, Si (combined in the form of amorphous silica) and Fe with small amounts of Al, Ca, Ti and a trace of sulphur and carbon (Figure 4). Significant proportions of iron and small amounts of titanium, calcium and sulphur in the spectrum for this layer indicate an iron oxide pigment containing trace amounts of titanium. The calcium and sulphur are interpreted as gypsum. Amorphous silica and Ca-Mg sulphate appear to have been precipitated directly onto the paint, cementing it to the underlying layer's amorphous silica.

At the base of the paint layer the assemblage of elements is slightly different to that in the bulk of the paint. Phosphorus accompanies O, Si, Al, Ca and Fe. Carbon is also present in trace amounts, but sulphur and titanium are not. The high levels of phosphorus at the base of the paint layer suggest that a vermiform silica surface containing calcium and aluminium phosphate minerals (one has been identified as taranakite ($K_3Al_5H_6(PO_4)_8.18H_2O$)) was present at the time the painting was done. Just beneath the paint O, Si, Al and P are present, accompanied by minor Ca, Fe, Mg and C. As this assemblage of elements is similar to the present surface composition it suggests that alumino-phosphatic silica skins have formed intermittently throughout the history of the rock surface accretion.

Fourier Transform infrared spectroscopy (FTIR) spectra reveal hydrated amorphous silica as the primary mineralogical component in all three 'layers'. A minor absorption peak at 540 cm^{-1} associated with Al-O-Si bonds indicates trace amounts of clay. A small quantity of organic carbon is indicated by absorption at 1509 cm^{-1} in the near-surface layer, but little evidence of organics is seen in the other laminations. Decreasing absorption at 3325 cm^{-1} with depth indicates diminishing volumes of physically and chemically bonded water, presumably through dehydration of the silica skins with age. Once deposited, a silica skin can only lose water through dehydration, it cannot re-hydrate or absorb more water because the original amorphous structure collapses into a more ordered state decreasing the sites for holding water molecules. Modern flows of water containing carbon are therefore most unlikely to contaminate skins already deposited.

Three sub-samples from the same flake were processed for dating at this site. They come from the over-paint, paint and under-paint layers associated with a 'Tassel Bradshaw' figure. It was thought at the time of

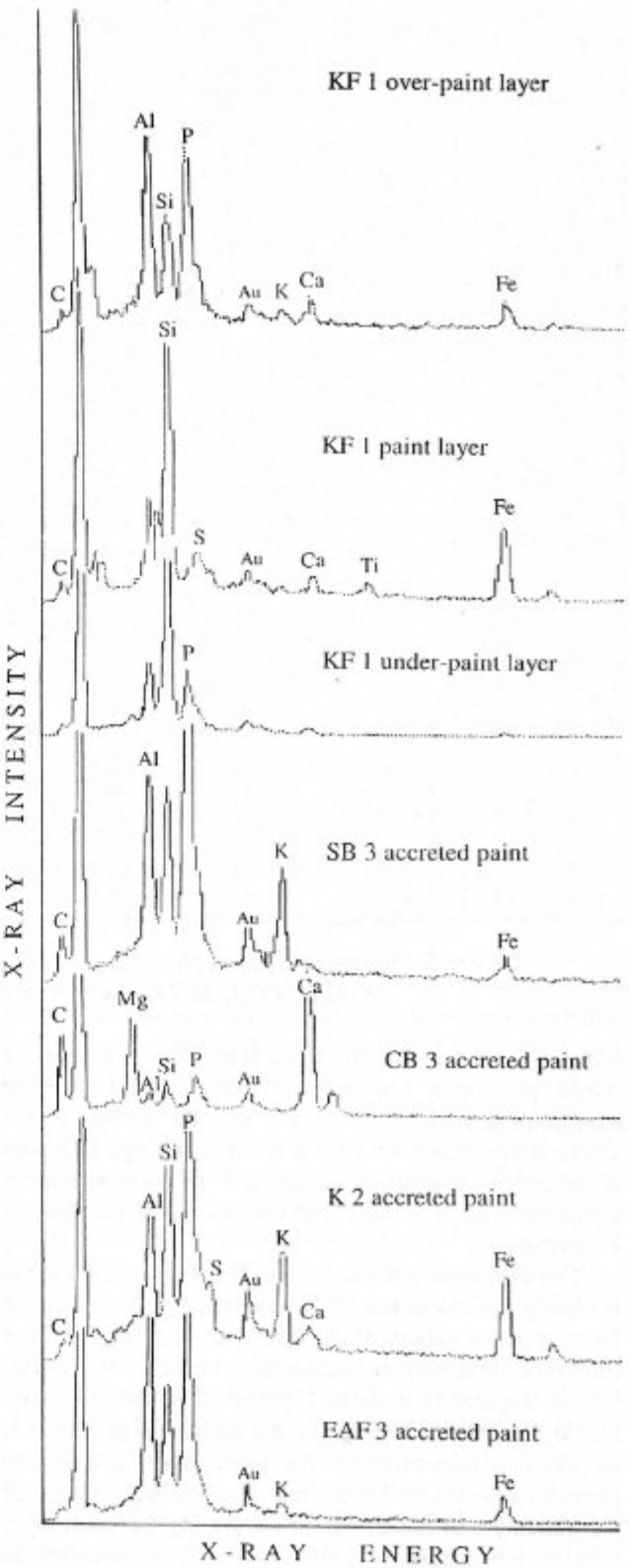

Figure 4. Scanning electron microscope energy dispersive x-ray energy (SEM/EDXA) spectra obtained for the 'dated' Kimberley rock surface accretions. The high peak on the left is from oxygen (O). Element symbols are as follows: C = carbon, Mg = magnesium, Al = aluminium, Si = silicon, P = phosphorus, Au = gold/palladium (from the coating film), S = sulphur, K = potassium, Ti = titanium (probably related to the ochre paint), and Fe = iron.

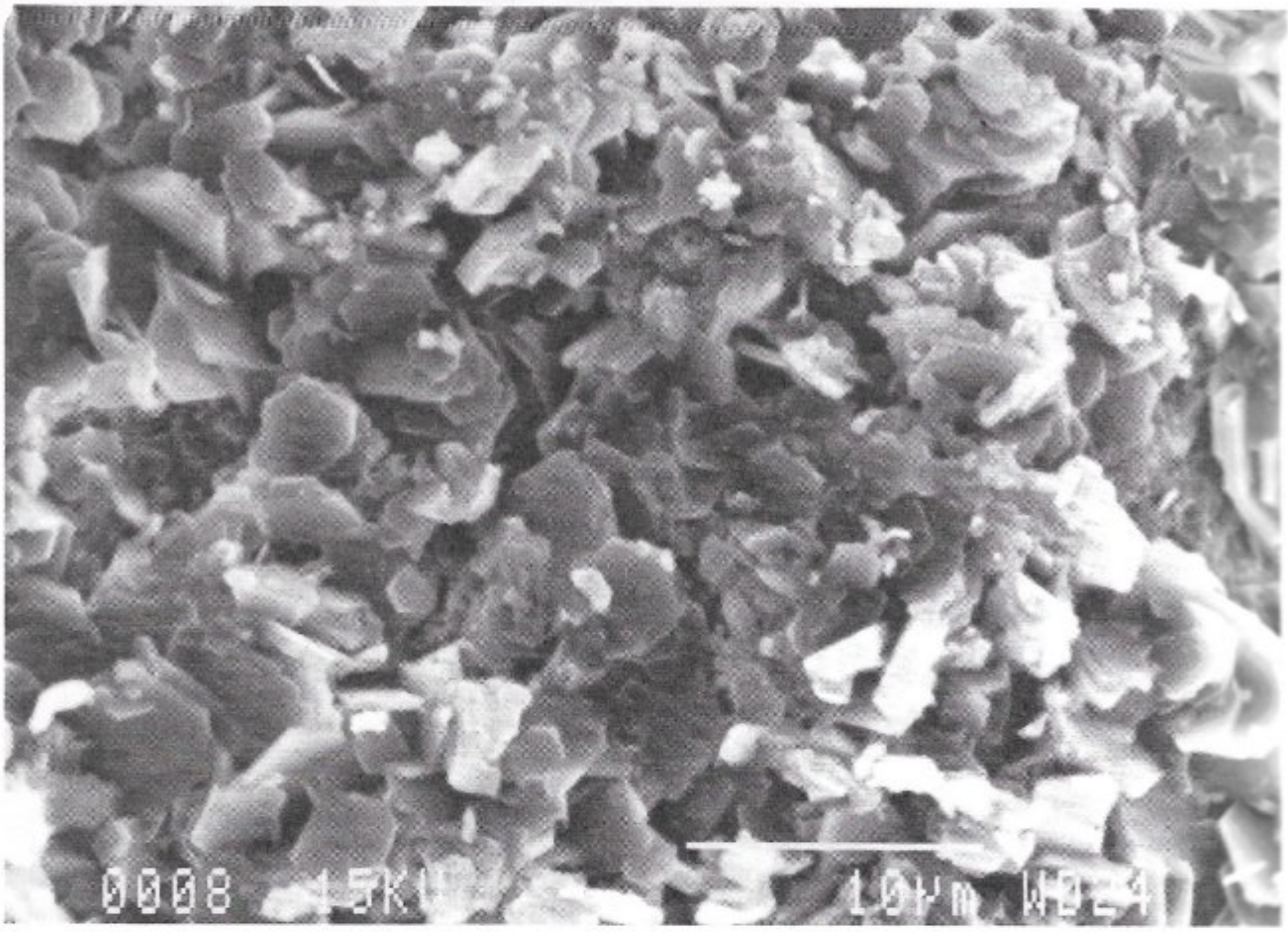

Figure 5. Scanning electron photomicrograph showing the 3 to 5 μm, tabular crystals of taranakite ($K_3Al_5H_6(PO_4)_8.18H_2O$) formed on the surface of SB3 (scale bar is 10 μm).

sample processing that the three layers from one sample would provide a sequence of age estimates showing stratigraphic conformability and that the carbon in the siliceous coatings would yield radiocarbon age estimates representing gradual accumulation of carbon-bearing components incorporated into the coating at the time of its formation.

The dark over-paint layer was chosen because carbon is clearly evident in the EDXA spectrum and because the layer contains relicts of diatoms and other algal matter (observed in rapidly etched sections under SEM) reflecting an organic-rich deposit presumably formed under humid conditions. The age of the carbon in this layer is an absolute minimum for the paint layer, and it also provides an estimate for the rate of silica deposition after the painting was made. Micro-excavating the paint layer with its low carbon content was aimed at providing an absolute date for the painting. Selecting this sample assumed that there was sufficient carbon associated with the paint as a binder, as well as in fossilised micro-organisms presumed to be present in the cementing silica.

Dating the layer of silica under the paint was to provide a maximum age for the 'Tassel Bradshaw'. However, as the FTIR and SEM/EDXA spectra did not reveal large quantities of carbon-bearing substances in the paint and under-paint layers, it was considered unlikely that these two samples would yield enough graphite for AMS ^{14}C dating (subsequent results from samples submitted to the Lawrence Livermore Laboratory, California, indicate only about 0.53 % carbon by weight in the KF1 over-paint layer).

Site No [00687], Sample SB3

This site is situated under a four-metre-wide overhanging ceiling in horizontally bedded sandstones near the crest of the Drysdale River valley. A large block has fallen from the ceiling making a high, but narrow shelter. The back wall of the shelter is covered by an extensive panel of 'Sash' and 'Tassel Bradshaw' figures and numerous animal and other figures (Walsh 1994: 189, Pl. 51).

The painting sampled for dating is from the 'Irregular Infill Animal Period'. It occurs higher up the rock face than a large 'Sash Bradshaw' figure on the eastern side of the shelter. A white coating, approximately 0.2 mm thick, covers the sandstone at this shelter. Some grey quartz grains can be seen where the white coating has exfoliated. Across part of the surface residual red haematite paint occurs in a discontinuous layer encapsulated by the accretion. Elsewhere on the surface red paint occurs in small spots and patches directly on the quartz grains and not covered by accretionary deposits.

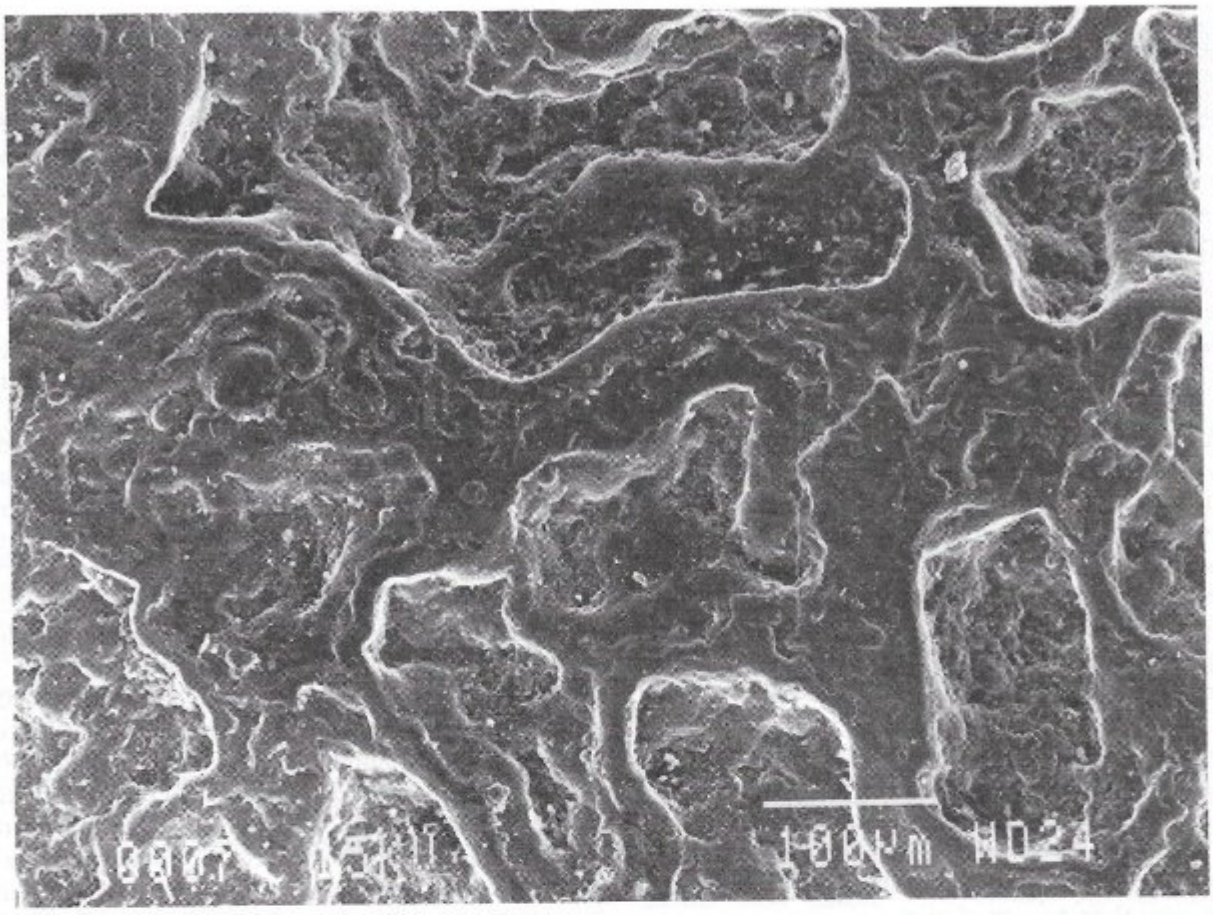

Figure 6. Scanning electron microscope image of the vermiform texture on the surface of EAF3 (scale bar is 100 µm).

In cross-section small concentrations of paint lay in micro-topographic depressions containing white salt and the surface has a thin veneer of amorphous hydrated silica (Figure 3). The depth of red paint, where covered by the thickest surface accretion, is about 0.075 mm beneath the present surface. At other micro-sites the paint is at the surface, indicating that either it was not covered by subsequent salt and silica formation or the surficial deposit has exfoliated.

Analysis of the coating reveals a composition reflecting alumino-phosphate silica, with minor phosphate, iron and carbon. Areas of micro-crystalline taranakite are formed across the surface (Figure 6). SEM/EDXA spectra reveal that the surface consists of P, O, Al, Si, K, a minor amount of Fe and a trace of carbon (Figure 5). The paint layer contains Fe, K, Al, P and O, but carbon is not evident in any of the spectra (Figure 4). Micro-excavation of the paint layer and part of the underlying white salt gave 0.0063 g of powder which was used for dating.

Site No [00705], Sample CB3

This site is located near site [00685]. It is a long shelter (14 m) which is aligned at 80° and faces north. Large slabs of sandstone have fallen from what is now the sloping ceiling. A six-metre overhang juts out 3.5 m above the shelter floor, protecting the stepped back wall from rain. Morning sunlight streams into the shelter and strikes most of the back wall. The ceiling and back wall have paintings of very large 'Tassel' and 'Cane Bradshaw' figures.

The figure sampled for dating is a long 'Cane Bradshaw' painted on the ceiling. A very hard, silicified sandstone lines the ceiling. It and the painting are covered by thin deposits of unidentified pinkish white salts. A large area of natural exfoliation near the painting was enlarged in order to collect a piece of painted rock surface large enough for dating.

A thin white coating covers red paint which lies above an orange-brown layer deposited over sandstone (Figure 3). In some places the white deposit has exfoliated, exposing bright red haematite paint. The total thickness of the surface accretion is approximately 0.15 mm. A white upper layer (0.07 mm thick) overlies red paint about 0.02 to 0.03 mm thick, that was applied as a thin continuous layer across a basal orange-brown amorphous silica (approximately 0.06 to 0.08 mm thick).

The surface layer is composed essentially of Ca, Mg, C and O with small concentrations of Ca, S and O (Figure 4). X-ray diffraction charts indicate the presence of hydrated magnesium and calcium oxalates associated with the paint, with traces of gypsum, but they do not reveal carbonate. Fortunately a small area of the white deposit covering the red paint had exfoliated and so the

red paint and the associated oxalate salts was collected for dating (0.0008 g). The resulting radiocarbon determination for carbon in the oxalate accreted to the paint therefore represents the age of formation of carbon-bearing salt associated directly with the paint.

Site No [00177], Sample K2

This site is situated at the southern end of the earlier mentioned complex in a labyrinth of deeply jointed sandstone adjacent to the lower Drysdale River. The elevated shelter is about 3 m above the base of the sandstone platform in this elevated area. A mass of tangled vines and thick undergrowth make access difficult.

A ledge of sandstone runs for almost 20 m at a height of 2.5 m above base level. A low overhanging ceiling of sandstone that extends outwards for almost 2 m protects the back wall from direct sunlight and rain. The shelter is about 1.0 to 1.5 m high and it was formed by collapse of unsupported horizontally bedded sandstone. The panel of figures includes kangaroos and mulberry and brown 'Striped' and 'Sash Bradshaw' figures.

In several places mulberry Bradshaw figures overlie hard brown wasp nest remnants. The triangular sample, measuring 6 × 5 × 4 cm, is from the waist of a red 'Sash Bradshaw'. The surface of this flake is covered by pale brown, grey and white vermiform mineral deposits. In a few areas the network of micro-ridges and micro-hollows contains traces of mulberry-coloured paint. Other areas show no sign of paint.

A cross-section through the surface reveals a very thin surficial deposit, barely 0.1 mm thick (Figure 3). Mulberry paint mainly rests in micro-depressions on the present surface, not covered by a mineral deposit. SEM/EDXA spectra of the mineral accretion (Figure 4) reveals a composition essentially consisting of three major components: silica, sulphate and phosphate salts. The silica contains Al and P. Sulphate salt is composed of K, Ca, S, O and minor P, with lower amounts of Si and Al, and a trace of carbon (essentially representing polyhalite and gypsum as major minerals). The phosphate salt consists of Fe, K, Al, P and O with minor Si and Al. Both salts are therefore intimately bound by silica (Si, Al, O). Analysis of the paint reveals Fe, O, P, K, Al and Si with minor Ca and S (comprising taranakite, amorphous silica and gypsum), but without detectable carbon.

The paint layer was scraped (0.0064 g), but only 2 μg graphite could be produced and no radiocarbon determination was possible. This therefore means the carbon content in the paint was less than about 0.03 % by weight. As the scraped sample included the bulk of the paint itself the very low quantity of carbon present indicates that no organic binder, such as blood, was present in that painted motif.

Elegant Action Figure Site, Sample EAF3

This rockshelter, in the lower Drysdale River catchment, has formed by collapse of sandstone blocks in the ceiling because of failure along sub-horizontal and vertical joints. Exfoliation of the red-brown surface deposits on the back wall has exposed the underlying, well cemented fine-grained sandstone and this 'clean' surface has been painted. A panel of human figures painted in red infill expresses a range of sitting and walking poses (Walsh 1994: 247, Pl. 80). Unfortunately, as the geochemical analyses below revealed, these elegant figures painted on uncoated sandstone do not contain carbon-bearing substances and they could not be dated.

A sample of coated rock surface associated with an unidentified figure on a panel containing 'Elegant Action Figures' was therefore sampled (Figure 6). As the 'Elegant Action Figures' themselves do not have a covering of amorphous silica, but have been placed on a section of rock surface from which red-brown aluminophosphate silica has exfoliated, they may be younger than Bradshaw figures, or at least late in the Bradshaw sequence.

The surface of the selected specimen has a well-developed vermiform, pale red-brown amorphous silica deposit lying on a well-cemented quartz sandstone. In cross-section an uneven thin mineral veneer, less than 0.1 mm thick, covers the surface (Figure 3), reflecting development of a vermiform texture. This mineral layer consists essentially of Al, P, Si and O (a silica skin, Figure 4), but iron and carbon are not detected in the SEM/EDXA spectra. Pale red-brown paint remnants lie at the base of micro-depressions across the irregular siliceous surface and these accumulations are not covered by mineral or salt accretions, suggesting that the paint may not be old.

Amorphous silica under the paint and remnant surface paint (0.0089 g) were scraped for preparation into graphite targets for dating. It was hoped that trace amounts of organic matter in the amorphous silica and possible remnant organic binder in the paint (undetected by the SEM) would provide enough carbon for dating. Unfortunately only about 2 μg graphite was made from carbon-bearing substances in the silica and paint powder, representing about 0.04 % carbon (by weight) — insufficient for dating. The paint therefore does not contain organic binder, and the silica has encapsulated very little organic matter.

Discussion

Table 1 summarises the results obtained from the first round of dating. These results should be viewed as preliminary because they are the first scientific age estimates for Kimberley rock paintings.

The pigments used for the 'Irregular Infill Animal' and Bradshaw paintings do not appear to contain organic binders and so cannot be directly radiocarbon dated. Instead we must rely on dating carbon-bearing substances lying as close to the paint layers as possible to obtain age estimates for the paintings. For this batch of samples only the encrustations associated directly with paint could be dated and the results therefore provide estimates for the approximate ages of the paintings.

Organic paint components were identified as diatoms

Ref.	Lab. no.	Powder wt., g	Graphite wt., µg	Sample details	Paint style	C14 age, years BP	Calibrated age
KF1	CAMS 16755	0.0104	55	Over-paint	Tassel Bradshaw	1490 ± 50	A.D. 538-623
KF1	OZB124	0.0096	100	Over-paint	Tassel Bradshaw	1490 ± 290	A.D. 240-852
KF1	OZB351	0.0100	N.A.	Under-paint	Tassel Bradshaw	1430 ± 180	A.D. 432-779
SB3	OZB125	0.0063	100	Accr. Paint	Irregular Infill	3140 ± 350	1875-930 B.C.
CB3	OZB126	0.0053	35	Accr. Paint	Cane Bradshaw	3880 ± 110	2559-2149 B.C.
K2	N.S.	0.0064	2	Accr. Paint	Sash Bradshaw	Insufficient carbon for dating	
EAF3	N.S.	0.0089	2	Accr. Paint	Elegant Action	Insufficient carbon for dating	

Table 1. Summary of Kimberley rock painting samples dated by AMS radiocarbon at Lawrence Livermore (CAMS) and Sydney (OZB). (N.S. = not submitted; N.A. = not available; Accr. = accreted; δ ^{13}C is assumed at -25.00 per mil; calibrated ages at 1 σ, Stuiver and Reimer 1993).

and algal remains in the over-paint layer in KF1. The nature of the carbon in the other samples is still under investigation, but calcium and magnesium oxalate salts have been identified in CB3. The extent of weathering of silica, mineral accretions and paint components is also being studied, and we are also looking at the possibility that recent carbon has been introduced into our samples. Even so, we are reasonably confident that the source of carbon dated by the accelerators is authentic, reflecting the probable age of deposition of carbon-bearing substances in the accretions.

The potential problem we face is that the radiocarbon determinations for accretions overlying paint probably underestimate the age of the underlying paintings. In the case of sample SB3, for instance, the depiction of an animal in Irregular Infill Animal style has some pigment covered by silica skin while pigment is exposed at other locations on the same surface. This indicates either that the onset of accretion formation on the same panel can vary by several millennia, overlying mineral skins have on occasion been partly removed down to the paint layer by natural flaking, accreted surfaces may have exfoliated prior to the surface being painted, the accretion is not closed to carbon exchange or paint has flowed along micro-fractures subparallel to the surface. Apparent differences in AMS ^{14}C age estimates for the algae and diatom-rich lamination over the 'Tassel Bradshaw' (KF1, dated at 1490 BP) and for carbon in the accreted paint layer of the stylistically related Bradshaw paintings (CB3, dated at 3910 BP) could provide evidence either of considerable time delays between painting of the rock and its encapsulation in mineral deposits, or very slow or intermittent accumulation rates for different mineral accretions on adjacent surfaces. However, the age estimate for the algal layer (half way to the present surface above the paint layer) suggests that all the silica over the painting accumulated during at least 3000 years. We tentatively conclude that the 'Irregular Infill Animal' and Bradshaw figures may be more closely related in time than previously thought. Further studies of rock surface accretions are under way to investigate these factors.

In conclusion, the AMS ^{14}C age estimates currently available show that early Bradshaw paintings are at least about 4000 years old — but may be much older. By implication, paintings of the 'Irregular Infill Animal Period', which are thought to predate Bradshaw paintings, must also be of mid-Holocene age or older.

Acknowledgments

Permissions for the Kimberley rock paintings dating project were obtained from traditional Aboriginal custodians at Kalumburu and Mowanjum. These included Mary Pandilow (Barton Plains); Tungaal Hector Unghango, Austin Unghango, Robert Unghango, Hector Unghango, Dickie Udmurra Unghango (Drysdale River area); Laurie Utemara, Daisy Utemara, Louis Karedada, Jack Karedada and Sylvester Mangolamara (Mitchell Plateau).

The fieldwork was funded by grants from the Australian Research Council and the Australian Institute of Aboriginal and Torres Strait Islander Studies. It was undertaken with the agreement of the Kalumburu Community Council, under Permit No. 166 from the W.A. Aboriginal Affairs Department, and under Licence No. NE001023 from the Department of Conservation and Land Management.

We wish to thank Dr Ewan Lawson (Australian Nuclear Science and Technology Organisation, Sydney) and Dr John Southon (Center for Accelerator Mass Spectrometry, Lawrence Livermore Laboratories, California) for the preparation and AMS ^{14}C dating of our samples. Dr Michael McGuire assisted with processing arrangements at the Lawrence Livermore Laboratories. Analyses, petrographic studies and sample preparations were carried out at the Centre d'Études Nordiques, Laval Université, Québec. Doug Hobbs drew the map with his usual expertise.

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Résumé. *Cet article décrit les lieux d'échantillonnage, analyses et estimés préliminaires au radiocarbone de l'âge des peintures Bradshaw 'Tassel' et 'Sash' ainsi que pour une grande figure animale naturalistique appartenant à la catégorie d'art rupestre 'Irregular Infill Animal' dans la région Kimberley-nord de l'Australie de l'Ouest. Les composantes organiques n'étant pas évidentes dans les peintures, le carbone accumulé associé directement avec les couches de peinture a été extrait et daté pour donner des estimés de l'âge de la production.*

Zusammenfassung. *Dieser Artikel beschreibt die Probenentnahme-Stellen, Analysen und präliminären Radiokarbonalter Schätzungen für 'Tassel' und 'Sash' Bradshaw Malereien, sowie für eine große naturalistische Tierfigur die zur Kategorie der 'Irregular Infill Animals' von Felsmalereien des nördlichen Kimberley Gebietes von Westaustralien gehört. Da organische Bindemittel nicht in den Farben aufschienen wurde Kohlenstoff von Ablagerungen entnommen, die direkt mit den Farblagen verbunden sind, und wurde zur Schätzung der Herstellungszeit dieser Malereien datiert.*

Resumen. *Este artículo describe los sitios, análisis de muestras y estimaciones preliminares de fechas de radiocarbono para las pinturas Bradshaw de 'Tassel' y 'Sash' y una figura naturalista grande de animal perteneciente a la categoría 'Irregular Infill Animals' de pinturas rupestres en la región septentrional de Kimberley en Australia Occidental. Como aglutinantes orgánicos no eran evidentes en las pinturas, se extrajo carbón de acreciones directamente asociadas con capas de pintura y fechado para proveer estimaciones en cuanto a cuándo fueron hechas estas pinturas.*

REFERENCES

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

CRAWFORD, I. C. 1977. The relationship of Bradshaw and Wandjina paintings in north-west Kimberley. In P. J. Ucko (ed.), *Form in indigenous paintings*, pp. 357-369. Australian Institute of Aboriginal Studies, Canberra.

LEWIS, D. 1984. Mimi to Bradshaw. *Australian Aboriginal Studies* 2: 58-61.

MORWOOD, M. J., G. WALSH and A. WATCHMAN 1994. The dating potential of rock paintings in the Kimberley, N.W. Australia. *Rock Art Research* 11(2): 79-87.

O'CONNOR, S. 1990. 30,000 years in the Kimberley. A prehistory of the islands of the Buccaneer Archipelago and adjacent mainland, west Kimberley, Western Australia. Unpubl. Ph.D. thesis, University of Western Australia.

ROBERTS, R. G., G. L. WALSH, A. MURRAY, J. M. OLLEY, R. JONES, M. MACPHAIL, D. BOWDERY, C. TUNIZ, I. NAUMANN and M. J. MORWOOD 1996. Ancient mud-wasp nests as rock paintings chronometers and palaeoenvironmental archives. *Nature* (submitted).

SCHULZ, A. S. 1956. North-west Australian rock paintings. *National Museum of Victoria Memoirs* 20: 7-57.

STUIVER, M. and REIMER, P. J. 1993. Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration. *Radiocarbon* 35: 215-230.

WALSH, G.L. 1994. *Bradshaws and Ancient Rock Paintings of North-west Australia*. Bradshaw Foundation, Santa Fe.

WELCH, D. 1995. Beeswax rock paintings in the Kimberley, Western Australia. *Rock Art Research* 12(1): 23-28.

RAR 14-406

Professor John Halverson 1928 - 1997

John Halverson died on 28 March 1997, at age 69, after an illness of several months. Born and raised in Iowa, he served in the U.S. Air Force for three years, after which he attended the University of Denver, where he earned a B.A. in humanities; Columbia University for an M.A. in philosophy; and the University of California, Berkeley, for an M.A. and Ph.D. in English language and literature. He taught at Princeton University for four years, and was twice a Fulbright Lecturer in Sri Lanka. In 1966 he accepted a position at UCSC, where he taught until his retirement in 1993. He was part of the original faculty of Adlai E. Stevenson College, co-founding the College's unique core course, among other activities.

Professor Halverson travelled widely and had many friends here and abroad. His scholarly interests were wide-ranging — including ancient Greek, medieval and modern English literature; Buddhism and Christianity; orality and literacy; linguistics, psychology, pre-History and Palaeolithic art — interests that resulted in a number of influential publications, including in *Rock Art Research*. He was a dedicated teacher and an efficient administrator, especially valued in the University community for his common sense and integrity.

A generous person, he contributed to many charitable organisations, supported poor families in Sri Lanka and sponsored the U.S. education of one Sri Lankan youth. He has no immediate heirs, and has left the bulk of his estate to a UCSC scholarship fund for needy students.

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RAR 14-407

KEYWORDS: *Bead - Pendant - Replication - Ostrich eggshell - Pleistocene - Cognition*

THE ROLE OF PLEISTOCENE BEADS IN DOCUMENTING HOMINID COGNITION

Robert G. Bednarik

Abstract. The technological implications of bead and pendant manufacture in the Palaeolithic period are examined in the context of what they can tell us about the cognitive faculties of Pleistocene humans. The author has conducted detailed replicative experiments with ostrich eggshell, a material used in the production of early disc beads. The first find of such beads from the Acheulian is reported, and other forms of very early beads and pendants are considered. The conclusions drawn from the replication work are then applied to the earliest beads known, leading to specific deductions concerning the hominids who made and used these objects. It is shown that the cognitive as well as technological capacities of at least some Lower Palaeolithic people have been grossly underestimated, and that considerable social complexity and the existence of an abstract value system must be postulated for the societies in question.

Introduction

Rock art research represents the major component of our field of inquiry, but our discipline of palaeoart studies also draws on several other types of evidence of the cognitive development of humans. This includes any form of evidence that seems capable of providing information relating to how hominids developed constructs of reality. Our own construct of reality (involving among other things three-dimensional space, linear time continuum, bimodality etc., i.e. the way we individually and collectively experience and intellectually rationalise physical aspects of the world) must be assumed to be derived from these early constructs, in some complex, historically determined way. Thus the ultimate reason for studying palaeoart is that it may be the only corpus of evidence capable of telling us how humans initially constructed a 'conscious' perception of reality.

Broadly speaking this evidence includes all finds from the human past that are thought to be non-utilitarian, although it must be cautioned that there is no sharp distinction between utilitarian and non-utilitarian material evidence. The kind of evidence I would consider to be relevant includes, besides rock art, engravings or notches on bone, stone, ivory; items apparently collected for their exotic properties (e.g. crystal prisms, fossil casts, unusually coloured or shaped pebbles) or apparent iconographic properties; articles possibly used for body adornment (most types of perforated objects, be they artificially or naturally perforated); pigment remains; human interments; certain types of circular or discoid objects; even artefacts that are essentially utilitarian, but show characteristics that are clearly in excess of what technology and function would demand, and thus seem to have aesthetic dimensions. Finally, the relevant evidence should also include technological capabilities that provide an idea of the cultural practices of the people in question (e.g. mining of concealed mineral resources, construction of stone walls) or even just of their technological sophistication (such as wooden artefacts or seafaring capability of the Lower Palaeolithic).

All of this evidence may help us in assessing the cognitive, cultural, intellectual and technological status of hominids. I have considered all these classes of evidence in well over a hundred publications, and have on that basis formed some preliminary ideas of the kind of setting in which hominid cognition needs to be considered. In the present paper I will review one specific class of such evidence which I have found to be particularly illuminating in this quest.

The connection between the cognitive evolution of humans and the topic of the production and use of beads and pendants during the Pleistocene may not be readily apparent, and yet such portable palaeoart objects can be much more pertinent than most other archaeological finds in this respect. To demonstrate this, let us consider the present consensus model of cognitive evolution as held by mainstream archaeology. According to it there was a massive, explosion-like development with the advent of the Upper Palaeolithic, emanating from southwestern Europe, and this is attributed to the appearance of anatomically modern humans in the region. Prior to this significant change, Europe, the dominant model predicts, was populated by primitive humans who probably lacked language, complex social structures and culture,

who had no form of art, hunted inefficiently if at all, and may have even been mere carrion eaters who lacked the use of fire. They may have had no habitation structures and wandered over the landscape rather aimlessly, eking out a most precarious existence for hundreds of millennia in Pleistocene Europe.

It is always useful to exercise a great deal of scepticism in considering the mythologies archaeology creates about the human past. The discipline has a tendency of 'getting it wrong' *most of the time*, but in the case considered here it may have excelled itself in that respect. I propose to look at this dominant model of cognitive development very briefly, in the context of a series of finds from the time interval in question, and then to focus on the specific issue of beads and pendants.

To begin with, the claims relating to the late appearance of symbolism, art and language (e.g. Chase and Dibble 1987; Davidson and Noble 1989; Noble and Davidson 1996) are attributable to ignorance of those advocating these models. Ocean navigation and the ability to colonise new lands by sea clearly postulate the use of complex communication systems, and while this does not necessarily indicate uttered language, that would seem to be the most likely explanation. Adequately informed commentators have known for several decades that ocean crossings by colonising parties seem to have been successful more than 700 000 years ago (Verhoeven 1958; Maringer and Verhoeven 1970: 1977; Bednarik 1995a, in press), which implies that they were by *Homo erectus*. In compiling a list of finds that may indicate the use of palaeoart or complex technology I have listed literally hundreds some years ago (Bednarik 1992a, 1994a, 1995b). Hominids of the Lower Palaeolithic not only created markings on portable objects of various types, they also produced the oldest petroglyphs we have found so far (Bednarik 1993a) and made extensive use of ochre or haematite. There is good evidence that they recognised iconicity (the property of an object to resemble another, which it can then stand for). They certainly used strings and therefore probably knots, they created well-made wooden artefacts and they produced composite weapons (fastening stone to wood). Since there are several cases of stone walls by them that have been interpreted as parts of dwelling structures (Bednarik 1993b) it may be a little hasty to assume that they lacked habitation shelters. They certainly produced artefacts from such materials as bone and ivory, they were capable of drilling or boring, and we assume that we have evidence of their appreciation of exotic finds, such as crystals and fossil casts, which we know they collected on occasion. It is also wrong to say that their lithic industries were unchanging: prismatic blades, borers and burins occur in Acheulian deposits, and in the Amudian of North Africa and the Levant, which developed from the region's Acheulian, blade tools are a major component of the industry many tens of millennia before the advent of the 'Upper Palaeolithic' (Rust 1950; McBurney 1967).

My interest of many years in the origins of beads and pendants has been motivated by the view that they seem to tell us a great deal about both the technology and the culture of their makers and users. Technologically they illustrate not only the ability to drill through brittle or very hard materials, but also they imply the use of cordage (Warner and Bednarik 1996). The very essence of a bead or pendant is to be threaded onto a string, it would simply be pointless to perforate a small object for another purpose but to pass a string though it. However, the use of string also suggests the use of knots, because a string needs to be closed to form a loop to be effective. Although the ends of a string may be joined by means other than a knot, e.g. by the use of adhesive or by plaiting, these alternative means are either impracticable or they are technologically even more complex than the use of knotting.

Without doubt such technological deductions beads permit us are of great interest, but of more importance are perhaps the cultural and cognitive deductions they make possible. Beads can be used in a number of ways or for several purposes: they may be emblemic, for instance, and provide various forms of information about the wearer and his or her status in society. Availability for marriage, political status, state of mourning might be such possible symbolic meanings. One might believe that beads can simply indicate body adornment (White 1993a, 1993b), but this is almost certainly an oversimplification. Even if vanity were the motivation for wearing such items, stating this explains not why such items are perceived as 'decorative'. The concept itself is anthropocentric, we do not assume that other animals perceive the information imparted by the beads as significant. In human culture, however, various forms of meanings may be encoded by such objects, as well as in other kinds of body adornment (tattoos, body painting, cicatrices, anklets, armbands etc.). In ethnography, beads sewn onto apparel or worn on necklaces may signify complex social, economic, ethnic, ideological, religious or emblemic meanings, all of which are only fully accessible to a participant of the culture in question. To name just one example: beads or pendants may function as charms, they may be a means of protection against evil spells or spirits. This would then seem to be a 'utilitarian' use, but it is so only at a very sophisticated cultural level.

Irrespective of their cultural purpose, beads convey complex information about the wearer which it would be impossible to create a context for without the use of a communication system such as language. This needs to be emphasised because it leads to the postulate that the use of beads assumes the availability of a complex communication system. We have many other indicators of possible language use during the Lower and Middle Palaeolithic (e.g. other forms of symbolism, or successful ocean navigation), and the very early use of beads and pendants provides similarly crucial evidence which, collectively, renders the hitherto dominant model of cognitive evolution completely superseded. We can no longer afford to ignore this kind of evidence (Bednarik 1995b).

I will describe Pleistocene beads and pendants, and the production processes some of them involved, in an attempt to illuminate their role in exploring the perception of their makers.

Recent findings concerning beads and pendants

Ostrich eggshell beads of the Acheulian

The earliest indisputable beads currently known in the world are the three fragments of disc beads from a major Libyan occupation site of the Acheulian (Ziegert 1995). Made from ostrich eggshell, they closely resemble those from other regions and later periods. These first Acheulian ostrich eggshell beads ever reported (Figure 1d-f) come from the El Greifa site complex (Wadi el Adjal, near Ubari). The site is located on what was a peninsula of the huge Fezzan Lake of the Pleistocene, which then occupied a large part of south-western Libya, measuring about 200 000 km^2. Its former extent is indicated by freshwater limestone expanses across the Murzuq Basin, overlying sandstone beds of up to 3000 m thickness (Thiedig 1995) that are still charged with freshwater of between 9000 and 24 000 years age, i.e. deposited during the wetter climate of the late Würm. El Greifa provides ample evidence of Early (Mindelian), Middle and Late Acheulian (Rissian) occupations, followed by Aterian (last Interglacial) deposits. Dating of sediments from 320 000 years to the end of the Pleistocene has been attempted by uranium/thorium analysis at the Niedersächsisches Landesamt für Bodenforschung, Hannover (the same laboratory that processed the samples for the first 'direct dating' of rock art, in 1980), but it is considered to be tentative and experimental. The significantly fluctuating lake levels also provide chronological data; for instance they were about 60 m higher in the Middle Acheulian than in the Lower.

The alkaline and calcareous sediments have provided excellent preservation conditions for insect remains, seeds, bone and ostrich eggshell fragments. The remains of what appears to be a round semi-permanent dwelling structure, about 180 000 years old, have been found on the former lake shore. There is ample evidence of quarrying of quartzite, and substantial ash beds indicate that the reed belt was annually burnt for a period of many millennia. The sites' lithic inventory includes generally 'handaxes', scrapers, borers and burins, but is dominated by large Acheulian types.

The favourable conditions also led to the preservation of three ostrich eggshell beads from the Late Acheulian of El Greifa site E. Dated by the U/Th isotopes of the calcareous sediments they are from, they appear to be in the order of 200 000 years old. The near-perfect rounded circumference and perforation (Figure 1d-f) of the El Greifa ostrich eggshell beads demonstrate that even hominids of the Acheulian possessed a well-developed technology of working this fragile medium with the greatest possible confidence and skill. These perfectly made artefacts also imply the existence of the social structures necessary to provide an ideological context for the production and use of complex body decoration. The three beads are preserved as fragments only (c. 58%, 54% and 28% preserved respectively), but they share a similar perforation diameter of about 1.7 mm, and even their external diameter is very consistent (5.8-6.2 mm). This consistency in size and the near-perfect rounding of all preserved edges, internal and external, suggests the use of a standardised manufacturing process, a characteristic these beads seem to share with the much later beads of the Upper Palaeolithic as well as those of a wide range of Holocene cultural traditions.

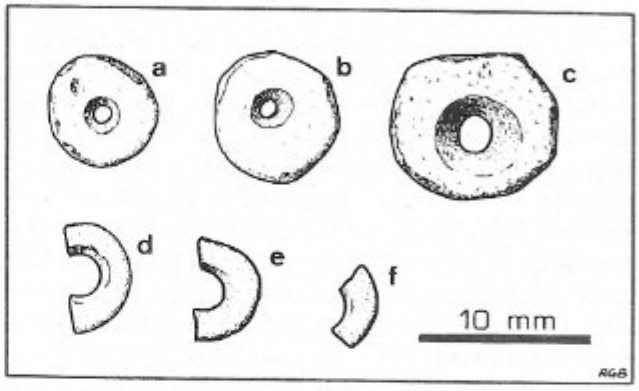


Figure 1. Pleistocene beads made of ostrich eggshell, from India (a-c) and Libya (d-f): a, b - Bhimbetka III A-28, Upper Palaeolithic; c - Patne, Upper Palaeolithic; d, e, f - El Greifa site E, Late Acheulian.

Ostrich eggshell beads in pre-History

To understand the significance of flat disc beads manufactured from this material, and their role in interpreting the cognitive evolution of humans, we need first to consider two factors: the distributions, in both time and space, of such finds, and the taphonomic explanation of both these distributions.

Disc beads such as those made from ostrich eggshell are a form of artefact that is not likely to have been made singly or in very small numbers. To provide such symbolic objects with a social meaning it would have been essential that they were made in quite large numbers, because it is repeated and 'structured' use which confers meaning on symbolic artefacts. The role of beads, as well as pendants, would have always been non-utilitarian, ideological, emblemic or symbolic. Moreover, very small beads such as those made from ivory or ostrich eggshell were probably not worn singly, because to achieve a decorative effect they are generally worn as sets in ethnographic contexts.

This renders it necessary to explain why — wherever ostrich eggshell beads have been found in Pleistocene deposits — only extremely small numbers were recovered. Moreover, why are the few known occurrences so extremely isolated in both time and space? Major intervening time spans have yielded no such artefacts, nor have vast geographic regions in which the ostrich is known to, or can be assumed to, have occurred. Taphonomic logic offers the most realistic explanation for this pattern (Bednarik 1986, 1992b, 1994b). Accordingly we are almost certainly dealing with a phenomenon of a

very long *taphonomic lag time*. The extreme paucity of Pleistocene finds can readily be explained by postulating that they survived from beyond the *taphonomic threshold* of the phenomenon category in question (Bednarik 1994b: Fig. 2).

In India we have only a few specimens from the entire Palaeolithic (Bednarik 1993a, 1993c). Two are from Bhimbetka, south of Bhopal, and three from Patne, Maharashtra. Two of the latter are not perforated, although one is centrally scored. The Bhimbetka specimens were found in the neck region of an Upper Palaeolithic human burial (in shelter No. III A-28), so it has been suggested that they formed part of a necklace made up of beads of perishable materials. While the Patne specimens (Figure 1c) range from 7 mm to about 10 mm diameter and are rather angular, those from Bhimbetka (Figure 1a, b) measure about 6 and 7 mm respectively and are well rounded. In all, some forty-one Indian sites have yielded fragments of Pleistocene ostrich eggshell, and artefacts made of this medium have been reported from seven sites (Kumar et al. 1988). Radiocarbon dates ranging from about 39 000 to 25 000 years BP have been cited as relating to these finds. It must be cautioned, however, that of the 46 'engraved' fragments I have examined, which are all those that have been found in India so far, 45 bear no anthropic decoration. They were marked by a natural process which I have described in detail, involving mycorrhyzal organisms, and which also affects other mineralised, calcium carbonate-dominated substances of animal origin (ivory, limestone, bone; Bednarik 1992c, 1993c).

Other Asian regions producing ostrich eggshell beads are Siberia (Krasnyi Yar, Trans-Baykal), Inner Mongolia (Hutouliang) and the Gobi desert in northern China and Mongolia. In particular, an Epipalaeolithic or perhaps Mesolithic stone tool industry of the Gobi, usually named after the site of Shabarak-usu, has produced many disc beads, made of freshwater shells as well as ostrich eggshell (Narr 1966: 366). This tradition, typically of non-geometric microliths, is not dated but seems to precede the local Neolithic (Bednarik and You 1991). The ostrich (*Struthio camelus* ssp.), now extinct in Asia, seems to have been widely distributed to the end of the Pleistocene and even into the Holocene. Depictions of it have been reported from the rock art of Inner Mongolia but their identification has been questioned (Bednarik and Li 1991; Tang 1993).

Both southern and northern Africa have produced finds of worked ostrich eggshell. The southern African sites yielding such finds date from the Middle Stone Age right up to the proto-Historic period. Decorated specimens from the Howieson's Poort phase in Apollo 11 Cave, Namibia (Wendt 1974), may well be 70 000-80 000 years old, even older. This site has also produced beads made of eggshell from a layer thought to be 22 000 years old. Diepkloof Cave in the south-western Cape, South Africa, has yielded about a dozen supposedly decorated ostrich eggshell fragments of the Middle Stone Age (Beaumont 1992; Bednarik 1993d). Ostrich eggshell beads from Bushman Shelter near Ohrigstad, Transvaal, have been suggested to date from somewhere between 12 000 and 47 000 years ago (see Woodhouse, this issue). Such beads still occur in much more recent periods in southern Africa. For instance they are found in the Smithfield B, a tool complex of the subcontinent's interior regions of the 14th to 17th centuries (Hirschberg 1966). The use of ostrich eggshell for a variety of purposes, including the production of disc beads and as water vessels, continued to be practised by the Bushmen of southern Africa until recent times, and has been described ethnographically (e.g. Forde 1934). As in the Gobi desert and Sahara, ostrich eggshell beads in southern Africa occur together with similar disc beads made from mollusc shells. For details of the production and use of ethnographic specimens in southern Africa see paper by Woodhouse, this issue.

In the far north of Africa, where the ostrich has been extinct for millennia, two pre-Historic periods have provided evidence of the past use of ostrich eggshell: the Acheulian, as we have already seen, and the Capsian. The latter is an Epipalaeolithic blade and burin industry in northern Algeria and Tunisia, dating from the first half of the Holocene. It includes not only numerous figurative and non-figurative engravings on ostrich eggshell fragments (Camps-Fabrer 1966), but also beads of snail shells, teeth and small stones (Camps-Fabrer 1975: 280-2). Almost any excavation of major Capsian deposits produces ostrich eggshell beads, usually well rounded with central perforation. Containers of wholly preserved ostrich eggshells, too, have been recovered from the Capsian. The decoration they bear suggests that the engraved fragments found in the Capsian deposits may well be from such containers. Saharan rock art depictions convincingly resembling the ostrich are known and may well be of the mid-Holocene. Examples are from Wadi Tilizahren (Jelínek 1985a: Figs 4, 6, 31, 34, 55, 56; 1985b: Figs 5, 28), Wadi Buzna (Jelínek 1994: Figs 5, 34, 36) and Wadi Mathendous, Fezzan (Striedter 1984: Fig. 7); Tzeretegem, Niger (Striedter 1984: Fig. 187); Iheren, Tassili-n-Ajjer (Striedter 1984: Fig. 125); and North Thyout, Atlas (Muzzolini 1995: Fig. 200).

Beads and pendants of the Lower and Middle Palaeolithic

In principle, small perforated objects of the Pleistocene may have been beads or pendants, or they could have been quangings, pulling handles or buckles as occasionally reported ethnographically (e.g. Boas 1888: Figs 15, 17, 121d; Nelson 1899: Pl. 17; Kroeber 1900: Fig. 8). However, most of the utilitarian objects of this type are not only of a quite typical shape or design, they exhibit specific wear traces and material properties. To be more specific, small circular objects with central perforation are considered to be beads, especially where they occur repeatedly. Similarly, objects such as animal teeth, perforated near one end (near the root) are not thought to be pulling handles, nor are objects that were too fragile to function as such utilitarian equipment.

Middle and even Lower Palaeolithic finds with artificial perforations have been found throughout the 20th century. Around 200 such objects are reported in the literature, although there is often no reliable evidence that the perforation is anthropic (cf. Klíma 1991). Some materials can be perforated by natural processes. For instance, bones can be chewed through by animal canines or partially digested by stomach acids, while sea shells are commonly perforated by parasitic organisms. It is therefore preferable to rely only on specimens bearing clear evidence of human work.

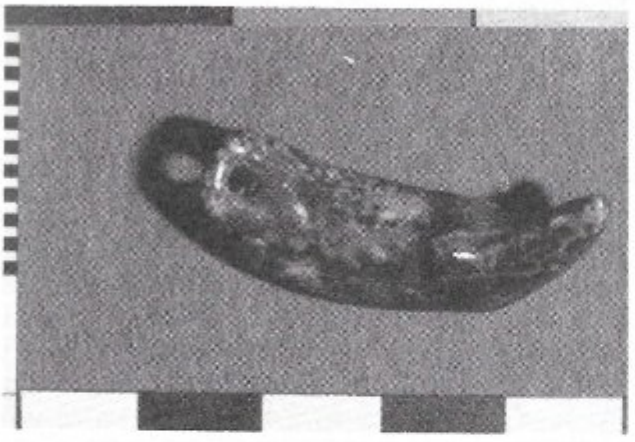


Figure 2. Wolf incisor, perforated near its root. Undetermined late Lower Palaeolithic to early Middle Palaeolithic tradition, Repolusthöhle, Austria. Oldest known object of this type in the world.

Nevertheless, the perhaps earliest perforated objects we know of were clearly fashioned by humans. If the age estimate of the two perforated pendants from the Repolusthöhle in Styria, Austria, is correct, they are close to 300 000 years old. One is a wolf incisor, very expertly drilled near its root (Figure 2). The second is a flaked bone point, roughly triangular and perforated near one corner (Figure 3.). Both objects were first mentioned by Mottl (1951) but have received little attention since then. I first examined them in 1964, and again in 1981 and 1995. They were excavated with a lithic industry variously described as Levalloisian, Tayacian and Clactonian, which is in fact an undifferentiated Lower or Middle Palaeolithic assemblage, but clearly free of Mousterian elements. The occupation deposit was found well below an Aurignacian level, separated from it by substantial clastic deposits of stadial periods. There is no reliable dating evidence available, the age estimate is based on the faunal remains, especially the phylogeny of the bear remains (the chronology of which is well established in central Europe). It is broadly supported by the typology of the accompanying lithics, which is easiest to reconcile with a late Lower Palaeolithic industry.

Apart from the Acheulian ostrich eggshell beads reported below, there are no further reports of bead-like finds from the Lower Palaeolithic. It has long been known, however, that stone tools of that earliest period of human tool use were applied as borers or reamers, especially from micro-wear traces (Keeley 1977). The paucity of drilled objects is therefore probably attributable to a preference for softer materials to work with, especially wood. There can be no doubt that the Acheulian was a tool industry concerned primarily with wood-working (see below).

Figure 3. Flaked bone point, perforated near one corner, excavated with the wolf incisor in Repolusthöhle depicted in Figure 2.

There are numerous perforated objects from the Lower/Middle Palaeolithic transition, however, and at least some of them served no doubt as beads or pendants. The Micoquian has yielded an artificially perforated wolf metapodium as well as a wolf vertebra from the Bocksteinschmiede, Germany (Marshack 1991). The Micoquian of Prolom 2, Crimea, produced no less than 111 perforated animal phalanges, besides four engraved palaeoart objects (Stepanchuk 1993). Although there is no proof that the phalanges were perforated by human hand, the fact that they are all of one species, *Saiga tatarica*, and that no perforated bones of other species were found in the cave, suggests that these may also be anthropic perforations.

The Mousterian of France has yielded a partly-perforated fox canine and a perforated reindeer phalange from La Quina (Martin 1907-10), and another perforated bone fragment from Pech de l'Azé (Bordes 1969). In Spain,

the same technological tradition has left us more perforated phalanges as well as a cranial fragment with a drilled hole at Lezetxiki (Baldeon 1993). The two perforated canines from Bacho Kiro, Bulgaria (Marshack 1991), too, are of the Middle Palaeolithic. As we approach the end of this technological phase, beads and pendants become increasingly common, and materials of stone are now drilled, first appearing in Russia and China. Thirteen such specimens from the lower occupation layer of Kostenki 17, found below a volcanic horizon thought to be about 38 000 years old, include not only polar fox canines and gastropod shells with perforations, but also drilled stone and fossil cast objects (Bednarik 1995c: Fig. 4). From an intermediate Middle to Upper Palaeolithic site in China, Shiyu wenhua, comes a broken stone pendant (Bednarik and You 1991).

With the advent of the Upper Palaeolithic in Eurasia, beads become more numerous and are increasingly manufactured from unwieldy materials, especially ivory. Just three human burials at the Russian site Sungir', from a stone tool technology that is transitional between Middle and Upper Palaeolithic implement types, the Streletsian, contained more beads than have been found in the entire Pleistocene sites of the rest of the world. The three graves yielded 13 113 small ivory beads and over 250 perforated canine teeth of the polar fox. By this time, perhaps 28 000 years ago, the art of bead making had reached an extraordinary level, in which the results of thousands of hours of labour were lavished on three burials.

This synopsis of Pleistocene bead remains might convey the impression that beads were produced infrequently for 200 000 or 300 000 years, and then became much more numerous with the advent of the Upper Palaeolithic. While this is remotely possible it must be cautioned that this pattern of distribution in time provides a rough parabolic curve as demanded by taphonomic logic (Bednarik 1994b: Fig. 2). Accordingly the advent of the Upper Palaeolithic should NOT indicate the advent of frequent bead manufacture, but merely the *taphonomic threshold* of this phenomenon category. This is almost certainly the correct explanation of the evidence available to us in which case that record must be tempered by taphonomic logic before it can be interpreted.

Pleistocene beads and pendants of Australia

Devil's Lair, a cave with Pleistocene occupation evidence in the far south-western corner of the Australian continent, has produced some of the most remarkable archaeological finds in this country. Among them are claimed traces of resin on stone tools, flaked limestone artefacts, three bone beads, a possible bone bodkin or pendant, a flat perforated marl pebble thought to be a pendant, and a series of six incised limestone 'plaques' and pebbles (Dortch and Merrilees 1973; Dortch 1976, 1979a, 1979b, 1980, 1984). In response to critical review, the identifications of several finds from the site were recently revised (Dortch and Dortch 1996: Table 1), and C. E. Dortch, the excavator, has arranged for the marked and some of the perforated objects to be subjected to specialist study (Dortch and Dortch 1996: 30).

In mid-1996 I was requested by the Western Australian Museum to re-examine the collection of controversial 'cultural' objects from Devil's Lair (Bednarik n.d.). Among the objects I was asked to study were three perforated items: the marl object, a tiny sliver of an avian long bone and another stone specimen. No doubts have ever been raised concerning the three finely worked bone beads from the same site, so these were not included in my study. From the published description I expected that at least the two stone objects had not been modified by human hand.

The perforated marl object is thought to be between 12 000 and 19 000 years old, but it has to be remembered that all the radiocarbon analyses of Devil's Lair samples were processed by Sydney University before 1978, when a systematic error in all earlier results was discovered, and these dates have never been corrected (Temple and Barbetti 1981). Across the upper part of the marl object (Figure 4) runs a very fine fracture along a zone of structural weakness which has given rise to the formation of the perforation and other hollows, through natural weathering processes. The 6.5 mm diameter hole bears no trace whatsoever to indicate that it was drilled, enlarged, modified or reamed in any way.

***Figure 4.** Pleistocene marl pendant from Devil's Lair, Western Australia.*

The soft and porous marl the object consists of resembles the material numerous Upper Palaeolithic stone objects of Europe were made from, such as the Willendorf No. 1 figurine (which is of somewhat harder stone) and many of the Russian figurines and fragments thereof

(e.g. 24 figurines from the two Avdeevo sites and many more from Kostenki I; cf. Bednarik 1990). There are also numerous Palaeolithic marl pendants known from Russia, especially the 30 from Avdeevo Staraya, 145 from Avdeevo Novaya, and others from Kostenki, as well as many other objects of carved marl. Thus the use of marl for the production of decorative or artistic objects is well known from the late Pleistocene.

Having studied a large number of such items abroad I knew that in examining Pleistocene stone pendants for use traces one focuses on the perforation surface opposite the object's centre of gravity (Bednarik 1990: 134-5). This is where wear traces are usually present if a perforated object was worn as a pendant. The inner surface of the perforation of the Devil's Lair marl piece bears four distinctive wear grooves (Figure 5). They range in size up to 0.75 mm wide and 0.24 mm deep, and one of them provides good evidence that the supporting string was of approximately 0.225 mm diameter.

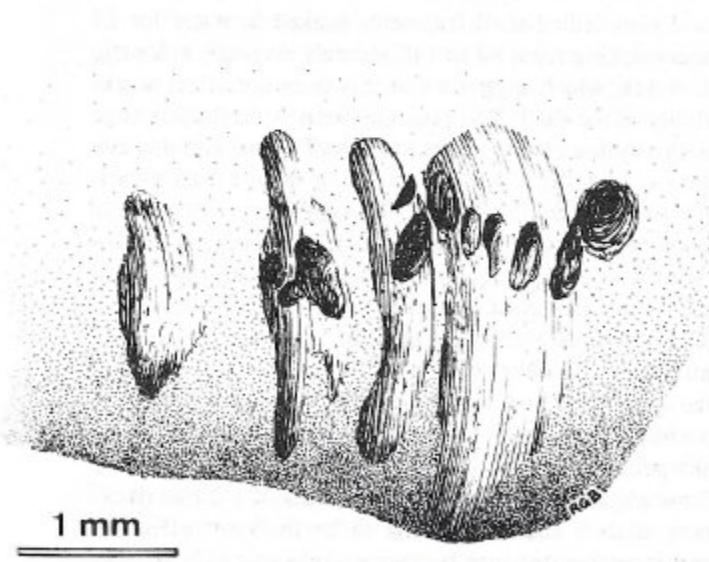
Among the possible uses that of a decorative pendant remains by far the most convincing, confirming Dortch's initial opinion. Such stone pendants have been found at Palaeolithic occupation sites from western Europe to Japan (Bednarik 1994a, 1994c), and although a variety of materials were used (Bednarik 1995c: Figs 4, 5), marl is the most commonly found for this kind of application.

The second perforated stone from Devil's Lair bears no indication of wear, use or modification. The perforation on the small bone fragment, however, is certainly anthropic, it was first punched through from the convex surface, and the resulting hole was then lightly reamed with a stone point. Microscopic splinters of the punching action are still attached to the perforation. If it has been used as either a bodkin or a pendant it should exhibit some wear on the rim of the perforation nearest to the broad end. I could not detect any such evidence of wear, but favour the interpretation that this was intended as a pendant and used only briefly. The bone is much more resistant to wear than the soft limestone, and since the object weighs a mere 0.12 g it would not experience much wear from a supporting string.

The Devil's Lair pendant remains the only Pleistocene example of its kind in Australia (cf. McBryde 1968; Massola 1970). Beads made of organic materials are more common among archaeological finds in this country, even of the Pleistocene and early Holocene. Several hundred specimens besides the four from Devil's Lair (the three bone beads and one perforated avian bone fragment) have been reported (Morse 1993; Feary 1996). Of interest in the present context are the twenty-two perforated marine cone shells deposited in Mandu Mandu Creek Rockshelter, also in Western Australia, about 34 200 years ago. Since this is also a limestone cave, the taphonomic perspective becomes at once relevant: the only Australian beads and pendants of the Pleistocene all come from coastal limestone caves. Unless one proposed that the distribution of body ornamentation was determined by geological variables, which seems absurd, we need to recognise again how profoundly distorted the 'archaeological record' has to be: without proper recourse to taphonomic logic it is for all practical purposes almost meaningless.

Replicative studies of ostrich eggshell beads

The immediate purpose of my experimental replication work with ostrich eggshell between 1990 and 1996 was to determine the technological processes involved in the production of beads of, and engravings on, this material. The results relating to engravings have been reported (e.g. Bednarik 1992c); here I will summarise my findings relating to beads, and their implications in terms of the cultural context of their production.



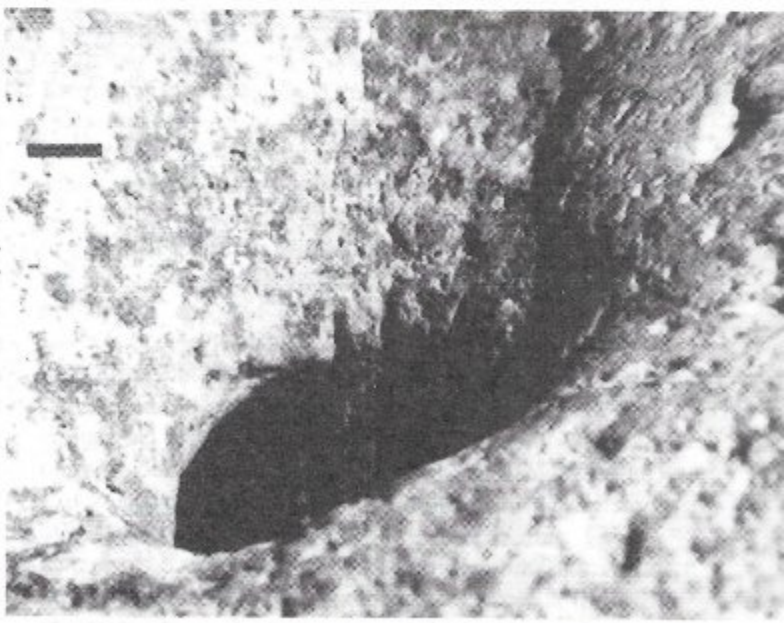


Figure 5. Four wear grooves inside the natural perforation of the marl pendant from Devil's Lair. On the left is a scale drawing of the wear grooves, on the right a microphotograph of them (scale bars 1 mm).

Kumar has conducted experimental replication work with heavily weathered ostrich eggshell fragments collected from Chandresal, which are in the order of 36 000 - 39 000 years old (Kumar et al. 1990: 36). He used Mesolithic stone tools to produce the perforations of two experimental beads, which each took him 10 to 12 minutes to drill through, working from both sides. In my own replication work I have always used fresh ostrich eggshell, because that is what was presumably used in the distant past, and I applied freshly made stone tools of different types and materials to establish relative suitability (Bednarik 1991, 1992c, 1993c). I found it difficult to economically drill through the unweathered shell using thin pointed tools of cryptocrystalline sedimentary silica. The most effective tools for this purpose were found to be rather coarse-grained quartzites and quartz (Bednarik 1991). With them I drilled through the shell of a complete ostrich egg in times ranging from 70 to 90 seconds, i.e. working from just one side.

I have found it easy to reconstruct the production processes for these and other Pleistocene ostrich eggshell beads. The raw material is of unusually consistent properties: the shell thickness is uniform, as is the three-layered morphology of the shell (described in detail by Sahni et al. 1990). The only significant material variable is attributable to the shell's curvature, which is of a much smaller radius at the ends of the egg than it is along the sides. My replication work soon established that the manufacture procedure used followed a specific pattern, as demanded by the morphology and dimensions of the end product, and the nature of the available stone implements. For instance I found that it was difficult and uneconomical to first shape the bead and then drill it, and that it was marginally easier to drill from the concave side than from the convex. Thus experimentation succeeded in establishing the work process quite convincingly, which it seems was as follows for Pleistocene specimens.

Once drained of its contents, an ostrich egg was dried and broken into fragments. These were then reduced further, into polygonal pieces of about 1-2 cm^2 area. This was done by carefully breaking the shell between fingers, probing for already existing fracture lines (Figure 6). The small fragments were then drilled individually, which is a little more difficult than drilling into the complete egg. An experienced operator takes between 70 and 145 seconds (average 121 secs, n = 11) to perforate the dry shell from one side. (I consider that I became an 'experienced operator' after attempting to produce 25 or 30 beads, and quantitative production details reported here refer to subsequent work.) No significant differences in drilling time were noted according to direction (from outside or inside), but the outer veneer (< 0.1 mm; Sahni et al. 1990) is somewhat harder to start from, and is of course of convex surface, so I came to prefer the concave mammilary innermost layer (Sahni et al. 1990: Fig. 2) to start drilling from. Contrary to various opinions stated, I do not believe that ostrich eggshell beads were usually drilled from both directions, as it is very difficult to meet up with the centre of the first indentation. It is much easier to ream out the opening once the boring tool breaks through, using the point of a thin prismatic sliver of chert.

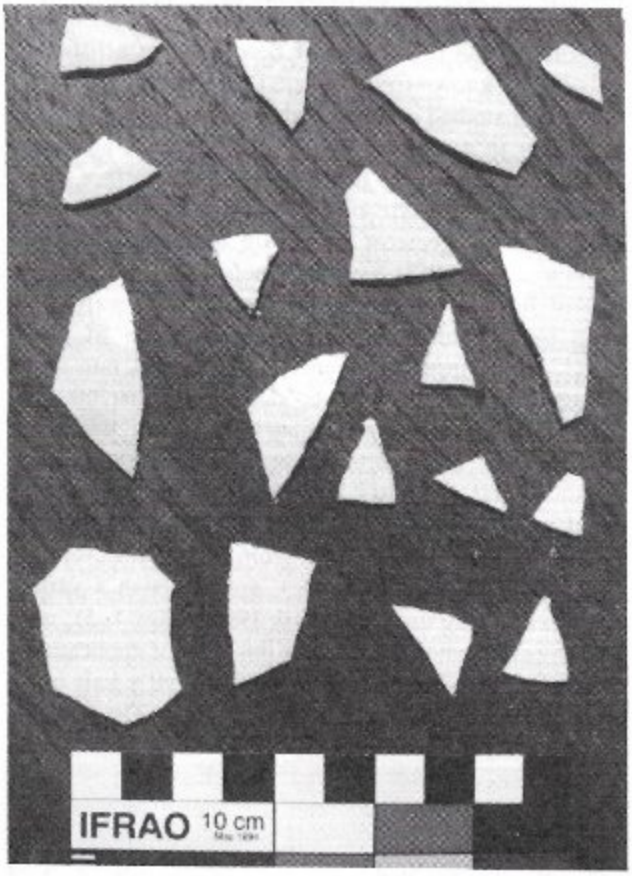


Figure 6. *Fragments of modern ostrich eggshell (of* Struthio camelus*), broken for replicative bead production and ready for drilling.*

I also drilled shell fragments soaked in water for 24 hours, taking from 80 to 140 seconds (average 118 secs, n = 11), which suggests that this does not affect workability of the shell. The principal variable in drilling time is clearly the quality of the stone tool point, and this can vary considerably. In my replicative work I used a variety of stone tool materials, including cryptocrystalline flint, microcrystalline cherts of various types, chalcedony, coarse and fine quartzites, and quartz crystal. I also tried out a variety of tool morphologies, finding that thin points became blunt very quickly, as did finely-grained materials. Nevertheless, all materials I used necessitated the application of two or more points to produce a single perforation economically, so the time of making or resharpening borers has to be added to production time. Stout angular points on flakes or blades of 1-2 mm thickness at their end were found to be the most effective, and excessive pressure is counterproductive as it accelerates the wear of the tool point exponentially.

Once the perforation is complete it is reamed out from the other (convex or outer) side, using slender bladelets or prismatic points, which may be quite fragile.

The duration of this process depends on the desired hole diameter, but in about one minute an even diameter of around 2 mm, eliminating much of the drilling cone, can be attained (Figure 7). It is clear from my work that the three perforated beads of the Indian Upper Palaeolithic were reamed out by alternating rotation of the borer: this usually results in a slightly oblong perforation, as already noted by Semenov (1964: 78) in drilling through other materials with stone tools.

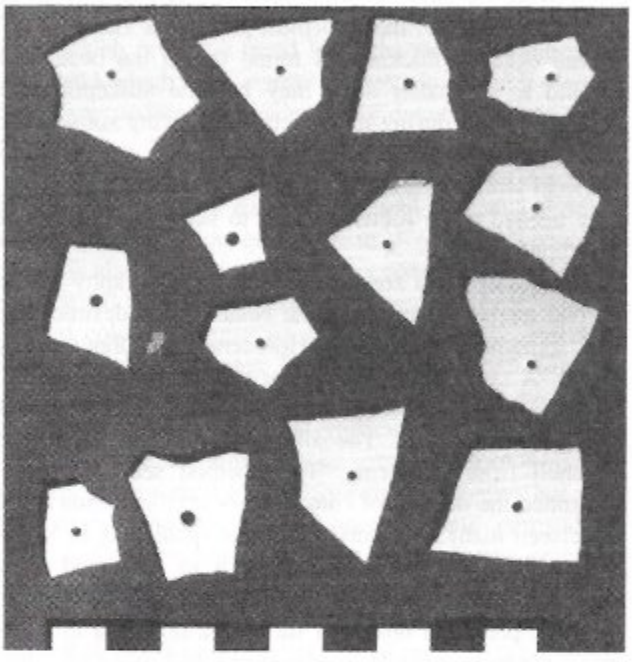


Figure 7. Drilled replicative bead roughs, before trimming.

Before commencing the abrading of the still angular fragment, the excess area is trimmed off by gripping the piece firmly between two fingers in the area that is to form the final bead, and pressing its convex side against a stone surface. Alternatively, one's teeth can be used as a vice in this, as has been ethnographically observed among the Bushmen of southern Africa (see Woodhouse, this issue). This process of snapping off small angular fragments until the actual bead blank is obtained (Figure 8) requires skill and judgment: if the bead is incorrectly held or handled, it can easily crack through the perforation. The average time of the trimming process is 34 seconds.

Grinding the excess material from the fragment's edge is easy, although very demanding on the operator's finger tips. I found it convenient to divide this process into two steps, first grinding the bead blank into a roughly circular shape of under 10 mm, resembling the Patne specimen in Figure 3. This requires between 65 and 270 seconds (mean 217 secs, n = 12), the duration being related directly to the amount of excess material to be removed. Siliceous sandstone, silcrete or quartzite provide excellent grinding surfaces, and an experienced craftsman should not break any pieces in this process (Figure 9).

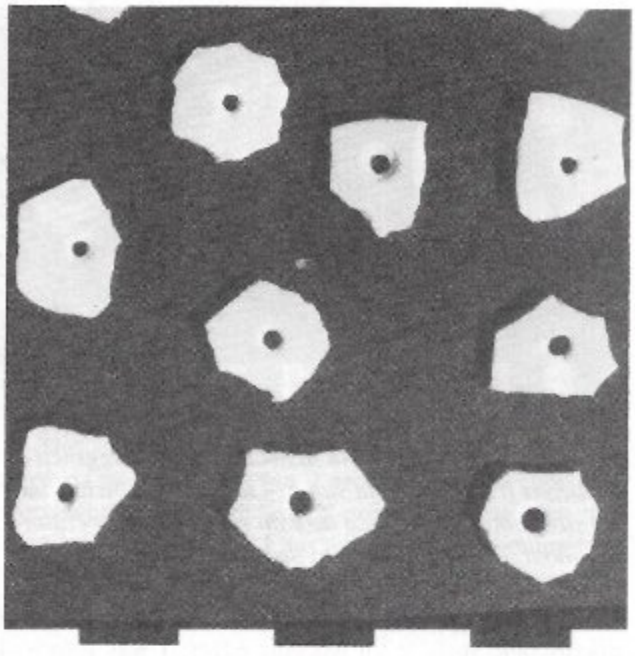


Figure 8. Bead roughs after trimming.

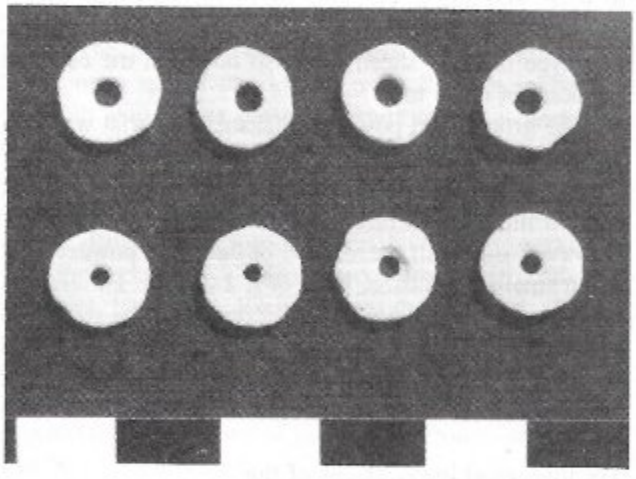


Figure 9. Finished replicative ostrich eggshell beads of just under 10 mm diameter, matching those found archaeologically.

In attempting to replicate the Acheulian specimens from El Greifa, I found that I had to further refine the product of the last step. It takes between 580 and 645 seconds to reduce the < 10 mm beads to almost perfectly round specimens of about 6 mm diameter (mean 618 secs, n = 12). On this basis we can estimate that the time it took to produce one of the El Greifa ostrich eggshell beads, assuming that the maker was a skilled craftsman, was in the order of 17 minutes, or about 25 minutes if we include the time of preparing and resharpening stone points (Figure 10).

Both the beads and the stone tools used in their manufacture were examined under a stereoscopic optical microscope at low to medium magnifications. The information so gained is not only useful in the microscopic study of pre-Historic bead specimens and stone borers, it also explained the surprisingly rapid blunting I experi-

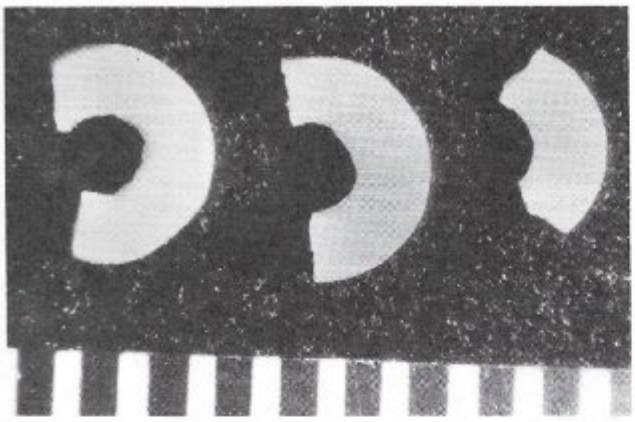


Figure 10. Replicas of the Acheulian ostrich eggshell beads from El Greifa site E, Libya. Using Acheulian stone tool types, these take an experienced operator about 25 minutes each to produce. Scale in mm.

enced with the stone tools. Expecting to find significant microscopic spalling on working edges, I was surprised to see that the 'blunting' of borers was not so much due to wear, but due to clogging up of recesses with highly compacted calcium carbonate. Nevertheless, a characteristic type of wear sheen was also noted on the edges at the point of many tools.

The ground and powdered eggshell material was also examined carefully, and was found to contain surprisingly large chips of eggshell layer, commonly measuring 0.1-0.5 mm, but in rare cases of up to 1.8 mm length. However, over half the volume of the white powder is of much smaller grainsize, most of it 2-20 μm. Differences in its composition were noted according to the rock type used: a gritty siliceous sandstone and a silcrete produced material of slightly different cumulative grain size distribution curves than a dense central Indian quartzite.

Technological implications of the Lower Palaeolithic beads

The replication of archaeological specimens is part of experimental archaeology, without which interpretation in this discipline is of very limited use. It is through the experimentation with technologies that we gain credible insights into how materials must have been utilised in the past to produce the kind of record the archaeologist encounters today. In this sense experimental archaeology is related to the study of the taphonomy of archaeological remains, and together these two areas of research can bring archaeological interpretation to life. I will try to illustrate this with the presently considered evidence, by discussing first the technological implications of the Lower Palaeolithic beads and pendants, and then their cognitive implications.

During my experiments I found that as the beads are ground to a diameter of 8 or 7 mm it becomes increasingly difficult to hold them while grinding them, and after a time it becomes a rather painful task. The finger tips not only have to maintain a tight grip, they are also subjected to abrasion from the siliceous stone. About 6 mm is the diameter at which it becomes uneconomical to continue reduction further, and this is precisely the size of all three Acheulian bead fragments we have. It would be unrealistic to view this as a coincidence, it should be seen as the result of a deliberate decision to reduce the beads to the smallest realistically possible size. It must be considered also that at sizes of under 6 mm, the beads become increasingly fragile: with a perforation of almost 2 mm, their rim width is then reduced to under 2 mm. Moreover, because of what remains of the bi-conical perforation profile, the innermost part of the rim is never of full eggshell thickness. I found that if the beads are ground to a smaller size, they become susceptible to fracture, either during manufacture or during subsequent use. If beads were worn on the body or subjected to physical stress, as we can reasonably assume they were, they needed to be robust enough to survive some rough handling.

We know from southern African ethnography that a second method of grinding the beads to the desired size was sometimes used in the Holocene (Woodhouse, this issue). A number of beads were threaded onto a sinew, with alternate discs of soft material (leather or bark), and then ground together. The soft discs prevented the brittle eggshell from fracturing. This method seems to have permitted the making of considerably smaller beads and I have seen many excavated Holocene specimens in South Africa that were only about 4 mm in size, and even smaller! The mass production of such minute objects with the precision observed should be regarded as a remarkable technological achievement.

Similarly, another insight provided by the replication of Acheulian ostrich eggshell beads (Figure 10) concerns their technological perfection. It suggests that their makers drew from the experience of a long tradition of manufacturing such products of which we know almost nothing. We do know that perforation of hard objects (e.g. teeth) was probably already practised earlier, and very competently. The perforation bored through the root of the Repolusthöhle tooth (Figure 2) measures barely 1.4 mm, which is about the same distance it is from the proximal end of the tooth. This drilling operation was considerably more delicate than that required to perforate ostrich eggshell, and might have taken around two hours to accomplish. By comparison, the two perforated canines from Bacho Kiro, Bulgaria, were very clumsily made, and yet they are thought to be merely in the order of 42 000 years old. Marshack (1991: Fig. 12) has shown that before they were bored, the Bacho Kiro teeth were repeatedly scored to create a surface from which the boring point would not slip. He has also shown how one of these teeth cracked longitudinally in the process of the hole being bored, presumably because too much pressure was applied. Precisely the same problem applies to two fox canines perforated by Neanderthals, one from La Quina and the other from Arcy-sur-Cure (Marshack 1991: Figs 10, 11). The second of these specimens even bears the remnants of a hole that was drilled too close to the root end of the tooth so that

the end broke off. This seems to have been a common problem with tooth pendants, because many of those found at occupation sites have fractured at the perforation. For instance it applies to eight of those I have seen from Afontova Gora, Siberia.

If the Repolusthöhle specimen is, as suggested, of the Lower Palaeolithic, then we have a case of the older example of a class of artefact being technologically superior to more recent examples we have. This kind of evidence conflicts seriously with the evolutionary models that dominate Eurocentric mythologies about the distant past, which predict a trend from the simple to the complex, and which have always decreed into which pigeonholes any undated or inadequately dated finds are to be placed.

In reality, the issue is probably much more complex. Bearing in mind that most ethnographically known beads are of perishable materials we may reasonably assume that this also applied in the distant past. Naturally perforated small objects may have been used as beads, such as crinoid columnar segments (Goren-Inbar et al. 1991) or the ear-bone of the cave bear (Marshack 1991: Fig. 6). Teeth are surely among the hardest materials ever used as pendants, and the most difficult to drill through, hence it is also reasonable to assume that more workable materials were used long before them. Finally, but perhaps most importantly, taphonomic logic demands a much earlier commencement of the use of beads than can be detected on the fossil record (Bednarik 1994b).

In other words, there are numerous reasons to assume that beads and pendants were used for very much longer than the time from which we have secure and non-perishable finds. How does this assumption compare with other indices of Lower Palaeolithic technology? I would like to emphasise here especially the finds we have of wooden artefacts. Particularly impressive are the seven specimens from Schöningen, Germany (Bednarik 1996a; Thieme 1995), thought to be around 400 000 years old. They include three hunting spears of over 2 m length, carefully designed and crafted with the centre of gravity being one third of the length from the point, and the hardest part of the spruce trunk used at the tip. There is also a throwing stick, pointed at each end like Australian ethnographic specimens, and a long flat artefact found embedded among the bones of butchered animals, interpreted as part of a lance. But most importantly, there were two short wooden objects with deep notches at one end. These are thought to have been hafting handles for stone flakes, and would thus represent the earliest known evidence for hafted tools.

Early wooden artefacts have been recovered at two other German sites: the Lehringen spear was found in 1948 inside a forest elephant skeleton and is only about 120 000 years old. At Bilzingsleben, closer in age to Schöningen (300 000 - 350 000 BP), we have fragments of at least one wooden spear or lance (Mania 1990: 54). The spear tip found in 1911 at Clacton-on-Sea in England is of an age similar to the remarkable Schöningen finds. Of particular importance is the wooden plank fragment from Gesher Benot Ya'aqov, Israel, between 240 000 and 730 000 years old. Made from willow wood, it has been finely polished on one side, being of a workmanship similar to what one finds among recent ethnographic material (Belitzky et al. 1991; Bednarik 1991). In all, more than 190 fragments of wood and bark of over 2 cm have been recovered from this site. Another wooden plank, made from mulberry wood, was found in Japan and is thought to be between 50 000 and 70 000 years old (Bahn 1987). Finally, a series of wooden artefacts has been excavated from the Acheulian at Kalambo Falls, Zaire, while Mousterian wooden implements in the form of shallow wooden dishes come from Abri Romani in Catalonia, Spain.

This collection of pre-Upper Palaeolithic wooden artefacts may be small, but it provides an indication of a wood-working technology of some diversity that has been largely neglected. I am not aware of a comprehensive study of Lower or Middle Palaeolithic wood-working skills and technology, an analysis sorely needed to displace the customary emphasis on stone tools. The period's lithics leave little doubt that one of their principal purposes was the production of wooden implements, which were probably far more numerous than stone tools. The polished plank fragment from Israel or the Schöningen spears provide no more than an inkling of the high skill levels these hominids seem to have possessed, in choosing the right type of wood for specialised applications (e.g. the harder end of the trunk for the tip) or producing a finely polished finish. This level of Lower Palaeolithic workmanship is entirely consistent with the technological capability of producing beads and pendants, but it completely negates the dominant view in the discipline, still based on the already superseded paradigm the New Archaeology has bestowed on us.

Cognitive implications of the Lower Palaeolithic beads

The most useful deductions we can draw from the present replication study concern the three Acheulian beads from Libya, and what we can learn about the circumstances of their manufacture, in terms of illuminating the conceptual world of their makers. The first observation we can make concerns the considerably finer workmanship of these Acheulian specimens in comparison to those few we have of the Upper Palaeolithic (cf. Figure 1). This may be unexpected, but it mirrors an experience we had recently with European rock art: the most sophisticated we have found so far, that of Chauvet Cave in France (Chauvet et al. 1995) turned out to be also the earliest we know of in the European Upper Palaeolithic (Clottes et al. 1995). Hence the idea of evolution towards increased sophistication is a Eurocentric myth in rock art development, and may well be so in other areas of archaeology. It is essentially based on two misconceptions about the taphonomy of art:

1. The idea implicit in archaeological approaches to palaeoart, that surviving corpora of evidence are in some way representative of the traditions that pro-

duced them. This is a complete non-sequitur, and it is so for several reasons.

2. The idea that archaeology leads to an understanding of art 'evolution'. Art changes over time, but it does not 'evolve', there is no inevitable 'upwards' development. Western thought needs to free itself from this absurd Darwinist notion in art development.

The near-perfect roundness of the Acheulian beads can be obtained only by constant checking of the shape during the final abrading process, using not just a developed sense of symmetry, but possessing a very clear concept of a perfect geometric form. This roundness cannot be the result of chance or some 'instinct' driven by a mere desire to reduce the size of the beads. It is the outcome of a very clear abstract construct of form — a concept-mediated, geometrically perfect form. Moreover, it is the result of a determined effort to produce high-quality work. To extract the full potential information offered by these few beads, I find the following points particularly important, and they also demonstrate vividly the enormous benefits of replication studies.

There are two types of technological limits set on the minimum size ostrich eggshell beads can realistically have, in the context of a Lower Palaeolithic technology. One relates to increasing fragility with decreasing size, since a perforation opening of 1.4 mm or so is perhaps the most minimal required for the sinews most probably used. It is also close to the smallest size one can realistically produce with early stone drills. Secondly, the minimum bead size determined structurally is about the same that can be made efficiently with human finger tips, being in the order of 6 mm diameter. The key question then is: what could have motivated the Acheulian makers of the El Greifa beads to push their technology to its practical limits? After all, a larger bead is much easier to see, yet a smaller bead represents a significantly greater effort, as my replication work clearly indicates.

This observation coincides with the mentioned geometric perfection of the form of these beads, which is most certainly deliberate: it could never be achieved accidentally, or without giving due attention to this aspect. I cannot stress enough the importance of this point: the mental template of the circle, the geometrically 'most perfect' of forms in human experience, determined the manufacturing process, its externalisation was the deliberate outcome of the entire process. The physical product is a reification of an abstract ideal.

This leads directly to the next implication. The hominids in question (archaic *H. sapiens*, presumably) were producing objects whose 'crucial' characteristics, i.e. smallness and roundness, had no conceivable utilitarian value. These people must be assumed to have possessed a system of abstract values, and while one may conceivably perceive such a system possible on a purely individual basis (i.e. held by one individual), it is extremely unlikely to have existed in a social vacuum at the time in question. Rather these beads were imbued with meaning, and their laboriously achieved perfection had itself communicable meaning. If that had not been the case, the effort invested in their production would have probably not been justifiable.

What kind of meaning could 'perfection' communicate to the beholder? In all probability it would be part of a system of abstract values, and it would certainly need to be understood by the beholder to be of any use or significance. Whatever the cognitive status of these hominids may have been, it is almost certain that comparatively complex symbolisms were shared by this society. Communication systems, most probably uttered language, were required, also a 'consciously' shared ontological frame of reference.

Thus the most parsimonious explanation for both the size and the form of these objects is that these characteristics reflect a highly developed abstract value system and a considerable social complexity in the society that made and used these beads. Without a cultural impetus placing value and meaning on such perfect forms, and on an utmost standard of craftsmanship that pushes the technology available to it to the utmost limit, it seems almost impossible to account for the empirical characteristics of the evidence. There is certainly no utilitarian explanation to account for the beads, so the motivation of their artisans is to be found in ideology.

Discussion

The strong hypothesis that humans of the Late Acheulian period, about 200 000 years ago, possessed such a probably well-established cultural system is at massive odds with the currently dominant paradigm. Not only does it postulate a value system concerning purely abstract criteria, there must have been a socially shared and communicated meaning regarding the significance of certain characteristics of these symbolic products. There can be no purpose in producing technological perfection if there is no comprehension and appreciation of its ideals.

The excellent rounding of the circumferential edge of the Acheulian beads and the even width of the ring indicate a conscious appreciation of an essentially abstract, geometric form by 200 000 BP at the latest, an appreciation which is amply evident from the later Middle Palaeolithic technological traditions. The latter period has provided such evidence from Hungary (the Tata nummulite; Bednarik 1992a: Fig. 4) to Australia, where we have the extensive geometric rock art of that country's Pleistocene. The Australian Pleistocene technological traditions are for all practical purposes of Middle Palaeolithic characteristics, and one of the most outstanding components of Pleistocene rock art in Australia are the many variations in which circular motifs have been used. Indeed, together with cupules, convergent lines motifs and other linear markings, circles form nearly all graphic markings known from pre-Upper Palaeolithic technologies (the less common are zigzags, multiple arcs and 'mazes').

Mainstream archaeologists may find evidence of such

early sophistication as that reported here extraordinary, but seen in the context of other finds of the general period in question it should be neither unexpected nor controversial (Bednarik 1995b, 1996b). A pertinent question to ask is: why are orthodox archaeologists still speculating whether language was possible prior to 35 000 BP (Davidson and Noble 1989) or 60 000 BP (Noble and Davidson 1996)? Are they unaware that even *H. erectus* must have had language to navigate the sea and colonise new islands (Maringer and Verhoeven 1970, 1977; Bednarik 1995a, in press)? Are they unaware that petroglyphs, too, were produced in the Acheulian, that haematite or other iron compounds were used as pigment up to 800 millennia ago (Bednarik 1994a), that hafted tools with wooden handles, stone-walled dwellings and portable engravings date from the Lower Palaeolithic (Bednarik 1992a, 1995b, 1996c), and that the oldest beads or pendants we know about may be close to 300 millennia old (Bednarik 1992a)? It is unfortunate that the dominant models in archaeology still remain largely determined by scholars who seem as unfamiliar with the relevant evidence as their predecessors were at the time of rejecting the Altamira art a century ago. The most urgent task in archaeology is not to produce more data, but to introduce a systematic study of the limitations of knowledge of its practitioners 'concerning existing data ... how language barriers and other biases limited the flow of information in this field, or how false constructs ... flourished in archaeology' (Bednarik 1995d: 120). This should be done in the context of metamorphology (op. cit.), the scientific version of archaeology. The example illustrated in the present paper confirms this need for reappraisal of major models, but judging by the past and recent history of the discipline it would be unrealistic to expect a positive reaction from mainstream archaeology. The discipline remains dominated by belief systems and dogmas about personal authority and preoccupied with the concept of individual and collective credibility, while efforts to introduce scientific epistemology and method (e.g. falsifiability or blind tests) are resisted vigorously, e.g. as being 'unethical' (Zilhão 1995: 899).

Acknowledgments

My thanks go to Dr Charlie Dortch, Western Australian Museum, who requested my study of the Devil's Lair and other material, arranged the loan of the finds to me, and provided literature and encouragement. I also thank Rudy Frank, La Trobe University, for his generous assistance with microphotography, and Dr David Frankel for his help.

MS received on 29 January 1997.

Résumé. *Les implications technologiques des perles et des pendentifs manufacturés durant la période paléolithique sont examinées dans le contexte de ce que ceux-ci peuvent révéler à propos de la faculté cognitive des humains du pléistocène. L'auteur a fait des expériences de reproduction minutieuses sur des coquilles d'œufs d'autruche, une matière utilisée pour la production de perles discoïdes anciennes. On rapporte la première découverte de ces perles de l'acheuléen, et on considère d'autres genres de perles et de pendentifs très anciens. Les conclusions tirées du travail de reproduction sont ensuite appliquées aux perles les plus anciennes, menant à des déductions précises à propos des hominidés qui avaient manufacturé et utilisé ces objets. On montre que les aptitudes cognitives et technologiques, au moins de certains peuples du paléolithique inférieur, ont été énormément sous-estimées, et qu'une complexité sociale considérable ainsi que l'existence d'un système de valeurs abstraites doivent être postulées pour les sociétés en question.*

Zusammenfassung. *Die technologischen Folgerungen der Perlen- und Anhänger-Herstellung im Paläolithikum werden im Zusammenhang mit dem was sie uns über die kognitiven Fähigkeiten pleistozäner Menschen aussagen erörtert. Der Verfasser hat detaillierte replikative Experimente mit Straußenei-Schalen unternommen, einem Material das in der Produktion früher Scheibchenperlen verwendet wurde. Der erste Fund solcher Perlen aus dem Acheuléen wird berichtet, und andere Formen sehr früher Perlen und Anhänger werden betrachtet. Die sich aus der Replikationsarbeit ergebenden Schlüsse werden dann auf die frühesten bekannten Perlen bezogen, und führen zu spezifischen Deduktionen bezüglich der Hominiden, die diese Objekte gemacht und verwendet haben. Es wird gezeigt, daß die kognitiven ebenso wie technologischen Kapazitäten zumindest mancher unterpaläolithischer Leute ganz erheblich unterschätzt worden sind, und daß beträchtliche soziale Kompliziertheit und die Existenz eines abstrakten Wertsystems für die entsprechenden Gesellschaften vorauszusetzen sei.*

Resumen. *Las implicaciones tecnológicas en la manufactura de cuentas y pendientes en el período Paleolítico son examinados en el contexto de lo que nos pueden decir acerca de las facultades cognoscitivas de los humanos del Pleistoceno. El autor ha llevado a cabo detallados experimentos repetitivos con cáscaras de huevo de avestruz, un material usado en la producción de antiguas cuentas redondas. El primer hallazgo de dichas cuentas del período Acheuliense es descrito, y otras formas de cuentas y pendientes muy tempranas son consideradas. Las conclusiones resultantes del trabajo repetitivo son entonces aplicadas a las más antiguas cuentas conocidas, lo que conduce a deducciones específicas respecto a los homínidos que hicieron y usaron estos objetos. Se demuestra que las capacidades tanto cognoscitivas como tecnológicas de por lo menos algunas personas del Paleolítico Inferior han sido bastante subvaluadas, y que una considerable complejidad social y la existencia de un sistema abstracto de valores debe ser postulado para las sociedades en cuestión.*

REFERENCES

BAHN, P. G. 1987. Excavation of a palaeolithic plank from Japan. *Nature* 329: 110.

BALDEON, A. 1993. El yacimiento de Lezetxiki (Gipuzkoa, País Vasco). Los niveles musterienses. *Munibe* 45: 3-97.

BEAUMONT, P. 1992. The time depth of aesthetic and symbolic behaviour in southern Africa. Paper presented to the Biennial Conference of the Southern African Association of Archaeologists, Johannesburg.

BEDNARIK, R. G. 1986. Parietal finger markings in Europe and Australia. *Rock Art Research* 3: 30-61.

BEDNARIK, R. G. 1990. More to Palaeolithic females than meets the eye. *Rock Art Research* 7: 133-7.

BEDNARIK, R. G. 1991. Comment on F. d'Errico, 'Microscopic and statistical criteria for the identification of prehistoric systems of notation'. *Rock Art Research* 8: 89-91.

BEDNARIK, R. G. 1992a. Palaeoart and archaeological myths. *Cambridge Archaeological Journal* 2: 27-43.

BEDNARIK, R. G. 1992b. The stuff legends in archaeology are made of: a reply to critics. *Cambridge Archaeological Journal* 2: 262-5.
BEDNARIK, R. G. 1992c. Natural line markings on Palaeolithic objects. *Anthropologie* 30: 233-40.
BEDNARIK, R. G. 1993a. Palaeolithic art in India. *Man and Environment* 18(2): 33-40.
BEDNARIK, R. G. 1993b. Stone Age stone walls. *The Artefact* 16: 60.
BEDNARIK, R. G. 1993c. About Palaeolithic ostrich eggshell in India. *Indo-Pacific Prehistory Association Bulletin* 13: 34-43.
BEDNARIK, R. G. 1993d. Early cognitive evidence in Africa. *The Artefact* 16: 61.
BEDNARIK, R. G. 1994a. Art origins. *Anthropos* 89: 169-80.
BEDNARIK, R. G. 1994b. A taphonomy of palaeoart. *Antiquity* 68: 68-74.
BEDNARIK, R. G. 1994c. The Pleistocene art of Asia. *Journal of World Prehistory* 8: 351-75.
BEDNARIK, R. G. 1995a. Seafaring *Homo erectus*. *The Artefact* 18: 91-1.
BEDNARIK, R. G. 1995b. Concept-mediated marking in the Lower Palaeolithic. *Current Anthropology* 36: 605-34.
BEDNARIK, R. G. 1995c. Towards a better understanding of the origins of body decoration. *Anthropologie* 33(3): 1-11.
BEDNARIK, R. G. 1995d. Metamorphology: in lieu of uniformitarianism. *Oxford Journal of Archaeology* 14(2): 117-122.
BEDNARIK, R. G. 1996a. Lower Palaeolithic hafting evidence. *The Artefact* 19: 99.
BEDNARIK, R. G. 1996b. The global evidence of early human symboling behaviour. *Human Evolution*.
BEDNARIK, R. G. 1996c. Crisis in Palaeolithic art studies. *Anthropologie* 34(1-2): 19-26.
BEDNARIK, R. G. in press. The initial peopling of Wallacea and Sahul. *Anthropos*.
BEDNARIK, R. G. n.d. Pleistocene stone pendant from Western Australia. *Australian Archaeology*.
BEDNARIK, R. G. and LI FUSHUN 1991. Rock art dating in China: past and future. *The Artefact* 14: 25-33.
BEDNARIK, R. G. and YOU YUZHU 1991. Palaeolithic art from China. *Rock Art Research* 8: 119-23.
BELITZKY, S., N. GOREN-INBAR and E. WERKER 1991. A Middle Pleistocene wooden plank with man-made polish. *Journal of Human Evolution* 20: 349-53.
BOAS, F. 1888. *The Central Eskimo*, reprinted 1964., University of Nebraska Press, Lincoln.
BORDES, F. 1969. Os percé mousterién et os gravé acheuléen du Pech de l'Azé II. *Quaternaria* 11: 1-5.
CAMPS-FABRER, H. 1966. *Matière et art mobilier dans la préhistoire nord-Africaine et Saharienne*. Mémoires du CRAPE, Paris.
CAMPS-FABRER. H. 1975. *Un gisement Capsien de faciès Sétifien, Mendjez II, El-Eulma (Algérie)*. Éditions du Centre National de la Recherche Scientifique, Paris.
CHASE, P. G. and H. L. DIBBLE 1987. Middle Paleolithic symbolism: a review of current evidence and interpretations. *Journal of Anthropological Archaeology* 6: 263-96.
CHAUVET, J.-M., E. BRUNEL-DESCHAMPS and C. HILLAIRE 1995. *La grotte Chauvet à Vallon-Pont d'Arc*. Le Seuil, Paris.
CLOTTES J., J.-M. CHAUVET, E. BRUNEL-DESCHAMPS, C. HILLAIRE, J.-P. DAUGAS, M. ARNOLD, H. CACHIER, J. EVIN, P. FORTIN, C. OBERLIN, N. TISNERAT and H. VALLADAS 1995. Les peintures paléolithiques de la Grotte Chauvet-Pont d'Arc, à Vallon-Pont-d'Arc (Ardèche, France): datations directes et indirectes par la méthode du radiocarbone. *Comptes Rendus de l'Académie des Sciences de Paris* 50: 1133-40.
DAVIDSON, I. and W. NOBLE 1989. The archaeology of perception: traces of depiction and language. *Current Anthropology* 30: 125-55.
DORTCH, C. E. 1976. Two engraved stone plaques of late Pleistocene age from Devil's Lair, Western Australia. *Archaeology and Physical Anthropology in Oceania* 11: 32-44.
DORTCH, C. E. 1979a. Australia's oldest ornaments. *Antiquity* 53: 39-43.
DORTCH, C. E. 1979b. Devil's Lair, an example of prolonged cave use in south western Australia. *World Archaeology* 10: 258-79.
DORTCH, C. E. 1980. A possible pendant of marl from Devil's Lair, Western Australia. *Records of the Western Australian Museum* 8(3): 401-3.
DORTCH, C. E. 1984. *Devil's Lair, a study in prehistory*. Western Australian Museum, Perth.
DORTCH, C. E. and J. Dortch 1996. Review of Devil's Lair artefact classification and radiocarbon chronology. *Australian Archaeology* 43: 28-32.
DORTCH, C. E. and D. Merrilees 1973. Human occupation of Devil's Lair, Western Australia during the Pleistocene. *Archaeology and Physical Anthropology in Oceania* 8: 89-115.
FEARY, S. 1996 An Aboriginal burial with grave goods near Cooma, New South Wales. *Australian Archaeology* 43: 40-4.
FORDE, C. D. 1934. *Habitat, economy and society*. Methuen. London.
GOREN-INBAR, N., Z. LEWY and M. E. KISLEV 1991. Bead-like fossils from an Acheulian occupation site, Israel. *Rock Art Research* 8: 133-6.
HIRSCHBERG, W. 1966. Späte Jäger- und Sammlerkulturen Süd- und Ostafrikas. In K. J. Narr (ed.), *Handbuch der Urgeschichte, Band 1: Ältere und Mittlere Steinzeit. Jäger- und Sammlerkulturen*, pp. 368-381. Francke Verlag, Bern and München.
JELÍNEK, J. 1985. Tilizahren, the key site of the Fezzanese rock art, part I. *Anthropologie* 23(2): 125-65.
JELÍNEK, J. 1985. Tilizahren, the key site of the Fezzanese rock art, part II. *Anthropologie* 23(3): 223-75.
JELÍNEK, J. 1994. Wadi Buzna rock art gallery in central Sahara. *Anthropologie* 32(2): 129-63.
KEELEY, L. H. 1977. The function of Paleolithic flint tools. *Scientific American* 237(5): 108-26.
KLÍMA, B. 1991. Zur Frage von gelochten Knochen im mährischen Paläolithikum. *Anthropologie* 29(1-2): 73-8.
KROEBER, A. L. 1900. The Eskimo of Smith Sound. *Bulletin of the American Museum of Natural History* 12: 265-327.
KUMAR, G., G. NARVARE and R. K. PANCHOLI 1988. Engraved ostrich eggshell objects: new evidence of Upper Palaeolithic art in India. *Rock Art Research* 5(1): 43-53.
KUMAR, G., A. SAHNI, R. K. PANCHOLI and G. NARVARE 1990. Archaeological discoveries and a study of Late Pleistocene ostrich eggshells and eggshell objects in India. *Man and Environment* 15(1): 29-40.
McBRYDE, I. 1968. Archaeological investigations in the Graman district. *Archaeology and Physical Anthropology in Oceania* 3: 77-93.
McBURNEY, C. B. M. 1967. *The Haua Fteah (Cyrenaica) and the Stone Age of the south-east Mediterranean*. Cambridge University Press, Cambridge.
MANIA, D. 1990. *Der Mensch vor 350 000 Jahren. Ein Bericht aus unserer Vergangenheit*. Landratsamt Artern, Artern.
MARINGER, J. and T. VERHOEVEN 1970. Die Steinartefakte aus der Stegodon-Fossilschicht von Mengeruda auf Flores, Indonesien. *Anthropos* 65: 229-47.
MARINGER, J. and T. VERHOEVEN 1977. Ein paläolithischer Höhlenfundplatz auf der Insel Flores, Indonesien. *Anthropos* 72: 256-73.
MARSHACK, A. 1991. A reply to Davidson on Mania and Mania. *Rock Art Research* 8: 47-58.
MARTIN, H. 1907-10. *Récherches sur l'évolution du Moustérien dans le gisement de la Quina (Charente). Industrie osseuse*, Vol. 1. Schleicher Frères, Paris.
MASSOLA, A. 1970.A note on perforated stone pendants. *Archaeology and Physical Anthropology in Oceania* 5: 80.
MORSE, K. 1993. Shell beads from Mandu Mandu Creek rock-shelter, Cape Range Peninsula, Western Australia, dated before 30,000 b.p. *Antiquity* 67: 877-83.
MOTTL, M. 1951. Die Repolust-Höhle bei Peggau (Steiermark) und ihre eiszeitlichen Bewohner. *Archaeologica Austriaca* 8: 1-78.
MUZZOLINI, A. 1995. *Les images rupestres du Sahara*. Préhistoire du Sahara 1, Toulouse.
NARR, K. J. 1966. Miolithische Kulturen von Westafrika bis Ostasien. In K. J. Narr (ed.), *Handbuch der Urgeschichte, Band 1: Ältere und Mittlere Steinzeit. Jäger- und Sammlerkulturen*, pp. 349-367. Francke Verlag, Bern and München.
NOBLE, W. and I. DAVIDSON 1996. *Human evolution, language and mind. A psychological and archaeological inquiry*. Cambridge

University Press, Cambridge.
NELSON, E. W. 1899. The Eskimo about Bering Strait. In *Eighteenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1896-97*, Part 1, pp. 19-526.
RUST, A. 1950. *Die Höhlenfunde von Jabrud, Syrien*. Karl Wachholtz, Neumünster.
SAHNI, A., G. KUMAR, S. BAJPAI and S. SRINIVASAN 1990. A review of Late Pleistocene ostriches (*Struthio* sp.) in India. *Man and Environment* 15(1): 41-7.
SEMENOV, S. A. 1964. *Prehistoric technology*. Londres, Cory, Adams and Mackay, London.
STEPANCHUK, V. N. 1993. Prolom II, a Middle Palaeolithic cave site in the eastern Crimea with non-utilitarian bone artefacts. *Proceedings of the Prehistoric Society* 59: 17-37.
STRIEDTER, K. H. 1984. *Felsbilder der Sahara*. Prestel-Verlag, Munich.
TANG HUISHENG 1993. Theory and methods in Chinese rock art studies. *Rock Art Research* 10: 83-90.
TEMPLE, R. B. and M. BARBETTI 1981. Revisions to radiocarbon dates from the Sydney University Radiocarbon Laboratory. *Australian Archaeology* 13: 28-9.
THIEDIG, F. 1995. Die Wüste war ein großer See. *Uni hh forschung* 30: 7-9.
THIEME, H. 1995. Die altpaläolithischen Fundschichten Schöningen 12 (Reinsdorf-Interglazial). In H. Thieme und R. Maier (eds), *Archäologische Ausgrabungen im Braunkohlentagebau Schöningen, Landkreis Helmstedt*. Verlag Hahnsche Buchhandlung, Hannover.
VERHOEVEN, T. 1958. Pleistozäne Funde in Flores. *Anthropos* 53: 264-5.
WARNER, C. and R. G. BEDNARIK 1996. Pleistocene knotting. In J. C. Turner and P. van de Griend (eds.), *History and science of knots*, pp. 3-18. World Scientific, Singapore.
WENDT, W. E. 1974. Art mobilier aus der Apollo 11 Grotte in Südwest-Afrika. *Acta Praehistorica et Archaeologica* 5: 1-42.
WHITE, R. 1993a. A social and technological view of Aurignacian and Castelperronian personal ornaments in SW Europe. In V. Cabrera Valdés (ed.), *El origen del hombre moderno en el suroeste de Europa*, pp. 327-357. Ministerio de Educación y Ciencia, Madrid.
WHITE, R. 1993b. Technological and social dimensions of Aurignacian-age body ornaments across Europe. In H. Knecht, A. Pike-Tay and R. White (eds), *Before Lascaux: the complex record of the early Upper Paleolithic*, pp. 277-299. CRC Press, Boca Raton.
ZIEGERT, H. 1995. Das neue Bild des Urmenschen. *Uni hh forschung* 30: 9-15.
ZILHÃO, J. 1995: The age of the Côa valley (Portugal) rock-art: validation of archaeological dating to the Palaeolithic and refutation of 'scientific' dating to historic or proto-historic times. *Antiquity* 69: 883-901.

RAR 14-008

Ostrich eggshell beads in southern Africa

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[This paper was written in 1979, and presented at the Winter School of the Witwatersrand Centre of the South African Archaeological Society, illustrated with relevant colour slides. The paper is published here as an important contribution on the subject of southern African ostrich eggshell beads.]

Introduction

When Professor C. Northcote Parkinson enunciated his famous law that 'Work expands to fill the time available' he was not thinking of pre-Historic communities. But he could have been! The existence of factory sites such as that for 'handaxes' at Wonderboom, Pretoria, provides material evidence of the early preoccupation of some people with time-consuming work. The manufacture of ostrich eggshell beads is another such activity.

Like the ostrich itself, ostrich eggs and ostrich eggshell beads are unmistakable. They are circular, varying in diameter from two to eleven millimetres (Dunn 1931; Mason 1962) and with a thickness of approximately one millimetre. The hole in the centre varies from less than a millimetre to more than two millimetres in diameter. The only similar beads are those made from the shell of the large land snail, *achatina*, which are thinner and more fragile.

Manufacture

There are several eyewitness accounts of how ostrich eggshell beads were and are made in southern Africa, notably by Dorothea Bleek (1928) and, more recently, by George Silberbauer (1965). There is also a comprehensive photographic record in the Fourie Collection in the Africana Museum, Johannesburg (now called Museum Africa), made many years ago in Namibia (Figure 1; see also back cover).

Perhaps the most detailed description is that provided by E. J. Dunn (1931) in his book, *The Bushman* — although it was the Bushwomen who made the beads! First the shell was broken into irregular pieces with a stone; then the pieces were softened in water and a hole was bored through the centre of each. They were roughly trimmed by biting round the edges.

In Dunn's (1931) words,

> there were two ways of finishing the beads, either singly or by 'mass production'. For the former manner, one bead was taken at a time; it was ground on a sandstone slab into a circular disc, finished to gauge in a sandstone groove and was then polished and strung on sinew. For 'mass production', a number of roughly-shaped beads were strung with alternate discs of leather; all were rubbed together on a grooved sandstone slab, and were finished off to gauge in a groove.

In some cases beads were left with unpolished edges. The alternate discs of leather mentioned by Dunn were, and are, sometimes replaced by soft bark (Clark 1959) or by berries (Campbell 1815).

Although the raw material was reasonably plentiful as ostriches lay large clutches of eggs, there must have been considerable waste during manufacture, so it had its value. Evidence of this was provided by the discovery by Jan Gaerdes of a pot full of broken pieces of shell in the Scherz Basin on top of the Brandberg (Jipsen 1963). A similar find consisting of 781 grams of fragments contained in an empty ostrich eggshell was made by H. Roth in another area of the Brandberg (Sandelowsky 1971).

The borers or awls used were originally stone. Agate is specifically mentioned by George Stow (1905). Such borers are a feature of Later Stone Age artefact assemblages. Stow also mentions ivory borers and a splinter from the leg bone of an ostrich. More recently these materials have been replaced by iron awls (Bleek 1928). Some beads were bored from both sides, some from one side only.

Figure 1. Bushwoman engaged in the production of ostrich eggshell beads, from the Fourie Collection. Re-photographed by the author, with permission of the Museum Africa.

The process of manufacture was not complete until the beads had been strung on sinew from the back of a springbok (Dunn 1931), or some similar sinew, in lengths suitable for their ultimate purpose. A single necklace from the Kalahari currently in use by the wife of the author of this paper consists of approximately 500 beads. Dunn recorded one of 700 and another of 2000.

How were the beads worn?

The simple use by both men and women recorded in rock paintings and continuing at present is as necklaces, arm-bands and leg-bands (Lee and Woodhouse 1970). There were and are, however, a number of more sophisticated arrangements. For instance Anderson (1887: 216) writes:

> Several fresh Bushmen and women came to my camp this morning. Some of the young girls were very good looking, and with a profusion of native ornaments upon them made entirely of ostrich eggs. A perfect set comprised a tiara, three inches in width, for the head; a broad necklace, six bracelets on each arm, and eight anklets or bangles to each leg, and finally a rope of beads of sufficient length to go round the loins twice and fastened in front with a piece of rimpey. These constituted the entire dress of one of the girls. She looked like a young African queen, and it had the effect of making her look half pretty.

(Anderson was writing in the 1880s — perhaps he did not dare admit that she was *very* pretty! Rimpey is a rawhide thong.)

Anderson bought two sets for six yards of print each. He estimated that there were not less than 8000 beads in each set and commented on the black and white effect obtained by the disc of leather between each bead. Arbousset and Daumas (1968: 247) mention 'girdles and long aprons which hang from their middle down to their feet'. Stow mentions the wearing of a string of beads from one nostril to the back of the head (1905: 46). The so-called white lady of the Brandberg appears to be wearing beads in the hair and a 'chin strap' made of beads. Fourie photographed Bushwomen with a rather similar ornament hanging down the nose.

Trade

There is currently no evidence to demonstrate trade in beads between one Bushman group and another, but for many years they have been a standard article of barter between Bushmen and their Bantu-speaking neighbours in the Okavango (Schapera 1930). They were also bartered from the Bushmen by the Berg Damara (Kahn et al. 1966). At present they form a much undervalued export from the Kalahari.

Distribution in time and space

Ostrich eggshell beads have been recovered as a result of archaeological activities from sites throughout southern Africa. Most of them are referred to in *The Stone Age archaeology of southern Africa* (Sampson 1974). They have been found at the Magosian site of

Apis Rock, northern Tanzania (Cole 1954) where the deposit was dated to 9500 BP. They were also mentioned as being in current use in that country by Fosbrooke (1956). They have been recovered from several sites on the south Cape coast including Matjes River Shelter where the oldest were in layer D, dated approximately 10 000 years ago. At the time of the report it was confidently submitted that 'These eggshell beads are probably the oldest ever recovered in South Africa' (Louw 1960). Since then we have read the preliminary results of the excavation at Bushman Rock Shelter near Ohrigstad in Northern Province and of the recovery of broken or complete beads from most of the Later Stone Age levels (i.e. down to level 27) and three of the Middle Stone Age levels (i.e. 28, 29 and 35) (Louw 1969). The date for the oldest Later Stone Age level is 12 560 BP. It first seemed likely that the isolated beads in the Middle Stone Age levels got there as the result of being walked down by the Later Stone Age inhabitants as there is a gap of some 35 000 years between the earliest Later Stone Age and the latest Middle Stone Age deposits. But a surprise was in store.

In Namibia, Wendt (1972, 1976) has recorded ostrich eggshell beads over a period from the present back to close on 22 000 BP, together with pendants of the same material in the later levels prior to 6000 BP. The earlier beads appear to have been made during the Middle Stone Age which obviously means that those at Bushman Rock Shelter may be correctly dated somewhere in the large gap between the oldest Later Stone Age date of 12 560 BP and the youngest Middle Stone Age date of 47 500 BP.

The question arises as to how long ostrich eggshell beads could last in our acidic soils. So far as I am aware no experimental work has been done on this interesting question. Distribution in time is therefore 'open-ended' in the present state of knowledge.

The ostrich itself is indigenous to Africa, Syria and Arabia (McLachlan and Liversidge 1940), so the raw material for the beads was available in these geographical areas, but I have not yet found any record of their archaeological presence in north Africa (McBurney 1960). There is, however, a record of their presence in excavated burial sites at Meroe in the Sudan (Shinnie 1967) and the authority on beads, W. G. N. van der Sleen refers to their presence in Sumerian Mesopotamia (Sleen 1967). He also asserts that 'several Bantu tribes still make them' but I have been unable to find a published account of their doing so.

Where ostrich eggshell beads have been recorded at an Early Iron Age site (van Genderen 1974) it seems certain that the Later Stone Age people were living in a close relationship with the Early Iron Age people in very much the same way as groups of Bushmen currently live in a close relationship with Tswana people, acting as their cattle herders. It would seem, therefore, that the manufacture of the beads may be peculiar to the hunter/gatherer people of the Later Stone Age and their modern 'descendants', the Bushmen.

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Acknowledgments

Thanks are recorded to Professor R. Inskeep for permission to photograph ostrich eggshell beads recovered from the Nelson Bay excavation, Robberg, and to Mrs de Wet, the Director of the Africana Museum, Johannesburg, to photograph items from the Fourie Collection and other collections. Special thanks are expressed to Mrs Hilary Bruce, then Professional Officer at the Africana Museum (now Director, Museum Africa) for her work in finding, identifying and assisting with the photography of specimens. Professor Revil Mason was kind enough to draw my attention to certain references. I am grateful to Mrs Yvonne Young for typing this paper.

REFERENCES

ANDERSON, A. A. 1887. *Twenty five years in a waggon*. Chapman and Hall, London.

ARBOUSSET, T. and F. DAUMAS 1852 [reprinted 1968]. *Narrative of an exploratory tour of the north-east of the Cape of Good Hope*. John C. Bishop, London.

BLEEK, D. J. 1928. *The Naron*. Cambridge University Press, Cambridge.

CAMPBELL, J. 1815. *Travels in South Africa*. Black, Parry, London.

CLARK, J. D. 1959. *The prehistory of southern Africa*. Penguin, Harmondsworth.

COLE, S. 1954. *Prehistory of east Africa*. Penguin, Harmondsworth.

DUNN, E. J. 1931. *The Bushman*. Charles Girffin, London.

FOSBROOKE, H. A. 1956. A stone age tribe in Tanganyika. *South African Archaeological Bulletin* 11: 3-8.

GENDEREN, A. M. VAN 1974. Personal adornment in the Early Iron Age of the Transvaal. New discoveries at site 24/73, Broederstroom, Transvaal. *South African Journal of Science* 70(7): 218.

KAHN, C. H. L., K. VEDDER and L. FOURIE 1966. *The native tribes of South West Africa*. Frank Cass, London.

JIPSEN, H. 1963. Prehistoric living sites in the Inner Brandberg. Privately duplicated report.

LEE, D. N. and H. C. WOODHOUSE 1970. *Art on the rocks of southern Africa*. Purnell, Johannesburg.

LOUW, A. W. 1969. Bushman Rock Shelter, Ohrigstad, Eastern Transvaal. *South African Archaeological Bulletin* 24: 39.

LOUW, J. T. 1960. *Prehistory of the Matjes River Rock Shelter*. Memoir No. 1, Bleomfontein Museum.

McBURNEY, C. B. M. 1960. *The stone age of northern Africa*. Penguin, Harmondsworth.

McLACHLAN, G. R. and R. LIVERSIDGE 1940. *Roberts birds of South Africa*. South African Bird Book Fund, Cape Town.

MASON, R. 1962. *Prehistory of the Transvaal*. Witwatersrand University Press, Johannesburg.

SAMPSON, C. G. 1974. *The Stone Age archaeology of southern Africa*. Academic Press, New York.

SANDELOWSKY, B. H. 1971. Ostrich egg-shell caches from South West Africa. *South African Archaeological Bulletin* 26: 153.

SCHAPERA, I. 1930. *The Khoisan peoples of South Africa*. Routledge and Kegan Paul, London.

SHINNIE, P. L. 1967. *Meroe: a civilization of the Sudan*. Thames and Hudson, London.

SILBERBAUER, G. B. 1965. *Bushman survey report*. Bechuanaland Government, Gaberone.

SLEEN, W. G. N. VAN DER 1967. *Handbook on beads*. Musée du Verre, Liège.

STOW, G. W. 1905 (reprinted 1964). *Native races of South Africa*. Struik, Cape Town.

WENDT, W. E. 1972. Preliminary report on archaeological research programme in South West Africa. *Cimbebasia* B2(1): 32-4.

WENDT, W. E. 1976. Art mobilier from the Apollo 11 Cave, South West Africa. *South African Archaeological Bulletin* 31: 5-11.

RAR 14-409

ROCK ART BYTES

KEYWORDS: *Computer - Data storage - Standardisation - North Australia - New Mexico*

THE INTERNATIONAL ROCK ART DATABASE PROJECT

Henry Walt, Bruno David, John Brayer and Chris Musello

Abstract. This paper introduces a new project aiming to develop a computerised database system for the storage and analysis of rock art data. It invites comments from interested readers who may wish to see aspects of the proposed system modified or expanded.

Introduction

Rock art — including paintings, drawings, petroglyphs, prints and stencils — is one of the most visible components of the archaeological record, occurring in all continents of the world barring Antarctica. As such, it has long attracted the attention of archaeologists, historians, social scientists, art historians, visitors and vandals alike. To archaeologists, rock art often represents the most graphic and expressive medium that remains of pre-Historic societies or those without writing. To indigenous people, it is often likewise the most readily visible expression of their culture, past and/or present. For those working with contemporary societies, rock art can also offer a rich archive of symbolic materials.

In these contexts, rock art serves as a valuable source of information about the history and social dynamics of a people, the art itself often having a long and definable antiquity in any given region. Distinct conventions and styles can frequently be identified, testimony to patterns of change and continuity in indigenous societies. Often, the unfolding and emergence of specific conventions and styles can be traced from deep history to the ethnographic present. The nature of this imagery can frequently enable us to investigate social life in so-called non-literate societies, upheavals in their history, patterns of movement and/or spheres of activity, religious and ceremonial elements of their culture, stylistic continuities in their expressive traditions, and even methods of subsistence and elements of their technology.

To date, however, there is no commonly available computerised system to facilitate such investigations. This paper reports the commencement of a new project aimed at producing a database system capable of storing and analysing large amounts of rock art and related data covering various media (e.g. sound, video, photography, text), potentially collected in a variety of different ways (e.g. photography, motif lists, drawings) and following different standards of quality. Such a system will not only enable the storage of rock art imagery for future reference, but also the analysis of data. While we aim to make the database system widely available, we stress from the onset that our objective is to develop a computerised database *system*, not an international database as such. The goals of our project are four-fold:

1. to refine and implement an internationally applicable computerised database system for the storage and analysis of rock art;
2. in developing such a system, three case studies will be used, resulting in the production of databases containing graphics, images, audio ethnography and text of rock art from three internationally significant regions (these databases will remain the property of the appropriate indigenous groups and will not be made publicly available, except where permission is given);
3. to complete the development and implementation of new and technologically current recording procedures; and
4. where appropriate, to provide access to these data and database system in the most complete and convenient way possible.

More broadly, our employment of three samples will permit the project to test and demonstrate: (a) the application of the database system to rock art from widely divergent social, cultural, historical and environmental settings; and (b) the application of the database system both on a post-hoc basis to a pre-existing corpus of research data (the Northern Territory sample), and in a field setting as it guides data collection and the creation

of a new database (the New Mexico sample).

The resulting database system will be widely available through On-line services, CD-ROM, and other portable media. Once established, the system will serve as a means of storing and analysing rock art data, and will be available to academic scholars, indigenous groups and park managers world-wide.

Problems confronting rock art research

Despite its promise, rock art has remained difficult to examine in a comprehensive way. While much petroglyph and rock painting recording today involves extremely detailed and sophisticated documentation it remains largely unanalysed and, we would add, not easily analysable. This remains the case because, except for a few rudimentary computerised databases, documentation in the field is limited to paper forms, hard copy photographs and drawings. The data are usually recorded by hand and must then be painstakingly sorted and analysed by hand. Because sites typically include tens of thousands of images (e.g. c. 20 000 glyphs or pictures at Petroglyph National Monument, New Mexico, USA, and the case study in the Northern Territory, Australia, which has thus far produced c. 40 000 pictures), systematic analysis through any hand-sorting scheme tends, of necessity, to be limited to small portions of an individual region. In many cases the detailed analysis meant to follow the documentation is simply never accomplished. Because the costs of duplicating hard-copy records are substantial, rock art research is also typically restricted to the one locale where the materials are archived. This in itself creates severe access problems and any research devoted to comparative analyses and/or simple cross-referencing has faced enormous financial and logistical obstacles. Complete-site and cross-site research thus remains impossible, incomplete or impressionistic. Clearly, the sheer volume of material to be analysed requires a complex, automated system for data storage and analysis.

Being a product of history, once damaged rock art can never be returned to its original condition. In the face of ever-increasing visitor traffic to archaeological sites, rock art sites are being subjected to unprecedented levels of destruction. There is therefore also a very real and urgent need to systematically record rock art before it is degraded, and to store this information in a medium that will not fade or otherwise disintegrate with time.

Data storage

No readily available database system analogous to the one proposed here now exists. In addition, no single governmental or scholarly organisation has provided any form of broadly usable or widely available database system for rock art, either nationally or internationally. The US National Park Service has a limited archaeological site database, but has included little rock art. Numerous small sites have been placed in databases, but usually for narrowly defined research-oriented purposes. In Australia, some projects have incorporated GIS systems into surveys that include rock art sites. At least three state agencies, the NSW National Parks and Wildlife Service, the Queensland Department of Environment, and the Australian Institute for Aboriginal and Torres Strait Islander Studies, also use a database called 'Minarch' to include rock art data. However, to date the only data entry has concerned 'sites' rather than any form of detailed information on the art. Furthermore, although some conventions have crept into the recording process over the years, many of these methods are now outmoded due to advances in newly available technologies. For instance, rock art continues to be photographed on black and white film, largely for archival purposes. However, colour photographs contain a great deal more information and may be scanned or digitised for preservation purposes. While strict conformity of recording methods is not called for, there is a need for a data storage and analysis system that is capable of handling a broad range of rock art data types — that is, there is a need for a database system capable of handling the various standards of recording employed by rock art recorders around the world.

The database

A successful database system needs to be of a type that will be of major interest to the diverse, international collection of scholars involved in the study of rock art, including academic researchers, managers of state and federal parks and preserves overseeing rock art sites, indigenous groups with access to computer facilities and other interested groups and individuals — for its potential research value, its utility as a tool for preserving and maintaining site inventories, as well as its potential in visitor education through such things as interactive computer displays. Our work with local Native American and Aboriginal communities has provided a clear indication that indigenous groups are also interested in using the database to help record, manage and communicate traditional knowledge.

Project methodology

Rock art, in all its diversity, by definition shares certain basic features of locational permanence and medium. The objective of the planned database system is to take these shared physical and locational characteristics, incorporate the wide range of conventions that rock art exhibits, include associated cultural information, and create a computerised system with the flexibility and inclusiveness required of it.

Three case studies are being used to develop this system. In one case (the Northern Territory sample), the data already exist, having been recorded prior to this project's conception. This is a useful sample as it will enable us to test the system's ability to incorporate data that were not recorded with this project in mind. The other two case studies are being developed as this project is unfolding. The diversity of rock art imagery from these three samples will also test the system's flexibility and capabilities.

The Wardaman sample

The Wardaman are an Australian Aboriginal group whose traditional lands are found near Katherine, Northern Territory. They are one of the few groups in Australia who still retain a detailed knowledge of the creation of rock art on their lands (Flood and David 1994; Merlan 1989). Rock paintings and petroglyphs have been continuously created by the Wardaman and their ancestors for at least 5000 years (as determined archaeologically), continuing well into the 20th century (Flood et al. 1992). Some of the current Wardaman elders either saw their parents or other relatives undertake rock art, or created it themselves earlier this century (Arndt 1962). Therefore, the creation of rock art in Wardaman country occurred within living memory, enabling archaeologists, social anthropologists, linguists and other social scientists to study, in detail, certain relationships between social formations (e.g. clans, language groups, exchange networks) and material behaviour.

The rock art of Wardaman country began to be studied systematically in 1988. In addition to the rock art sites and images themselves, information was also recorded on the social contexts of the art — for example, the clan estates in which the rock art sites were located, the identities of the individuals who held knowledge of the art of each site, the kin affiliations of the individuals who held traditional rights to the various rock art sites, the Dreaming stories associated with each area, site and image, and so forth. Five major field seasons (1988-92) were undertaken to record the rock art of Wardaman country and associated information on social networks. During that time, rock art sites and rock pictures (petroglyphs, paintings, stencils and prints) were recorded from various clan estates (David et al. 1991; David and Flood 1991). The Dreaming stories of most of these sites were recorded, along with the meanings that the rock art had to the members of the Wardaman community. These meanings were recorded under a number of different contexts, including in the presence of single individuals only; groups of people (sometimes of a single gender, sometimes including both men and women); sometimes with elders only and sometimes with both initiated elders and uninitiated youths (David and Flood 1991; Flood and David 1994). The end product has been a detailed body of oral information elicited under various conditions. These oral testimonies have been incorporated into an exhaustive body of rock art data, none of which has yet been incorporated into an adequate computerised database system.

During the course of this project, over 40 000 images from approximately 200 sites have been recorded. These records include detailed and annotated drawings, photographs, descriptions of the imagery, and physical and cultural contextual data.

North Queensland project

Since 1985, one of us (BD) has been systematically recording the rock art from various parts of north Queensland, Australia. Already recorded are large numbers of rock art sites from Chillagoe (in Wagaman Aboriginal country), Ngarrabullgan (Kuku Djungan country) and Bonny Glen and the Mitchell-Palmer limestone zone (both in Kuku Yalanji country). Each of these regions possesses extensive bodies of paintings, with lesser numbers of stencils, prints and petroglyphs (Figure 1). So far, we have recorded c. 1000 rock pictures from each of Wagaman, Kuku Djungan and Kuku Yalanji country. As part of the current project, we are (a) inputting these data onto the computerised database system, and (b) undertaking more fieldwork and recording new sites to test the system's ability to incorporate data collected in different ways from the same region, and additional data from existing sites onto the database. Our first field season towards these aims was held in June-July 1996 by David, Brayer and Walt.

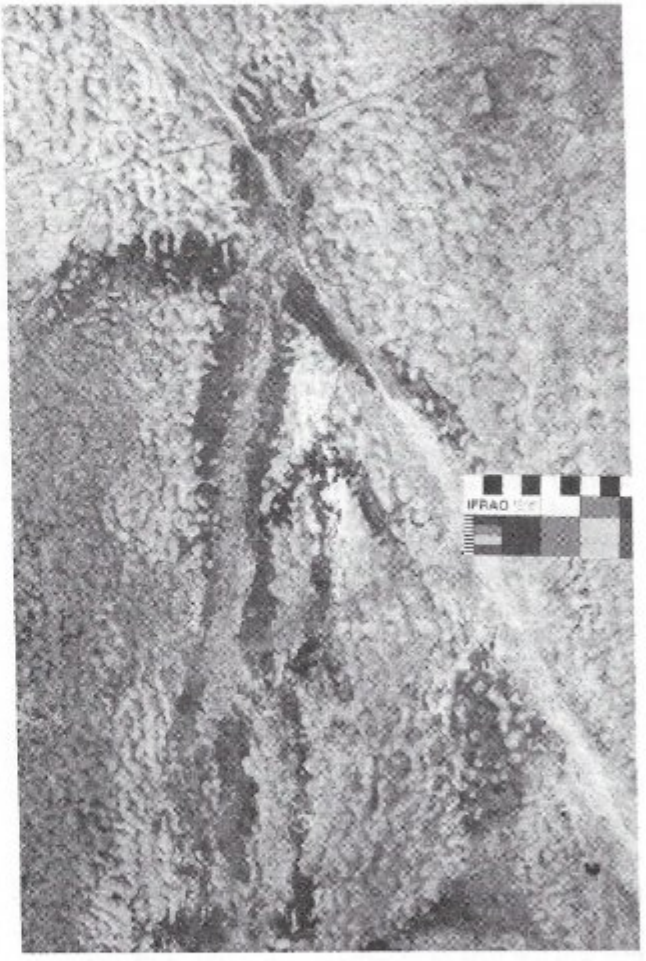

Figure 1. *Anthropomorphs, Pete's Chase (site PM30), Mitchell-Palmer limestone zone, Australia. The black (charcoal) drawing is being AMS carbon-dated.*

Petroglyph National Monument

Petroglyph National Monument, in New Mexico, preserves 7160 acres of petroglyphs and associated archaeological remains. Contained within the 28 km length of the Monument are over 20 000 petroglyphic inscriptions, created for the most part in pre-Historic times by inhabitants of neighbouring Pueblos (Figure 2).

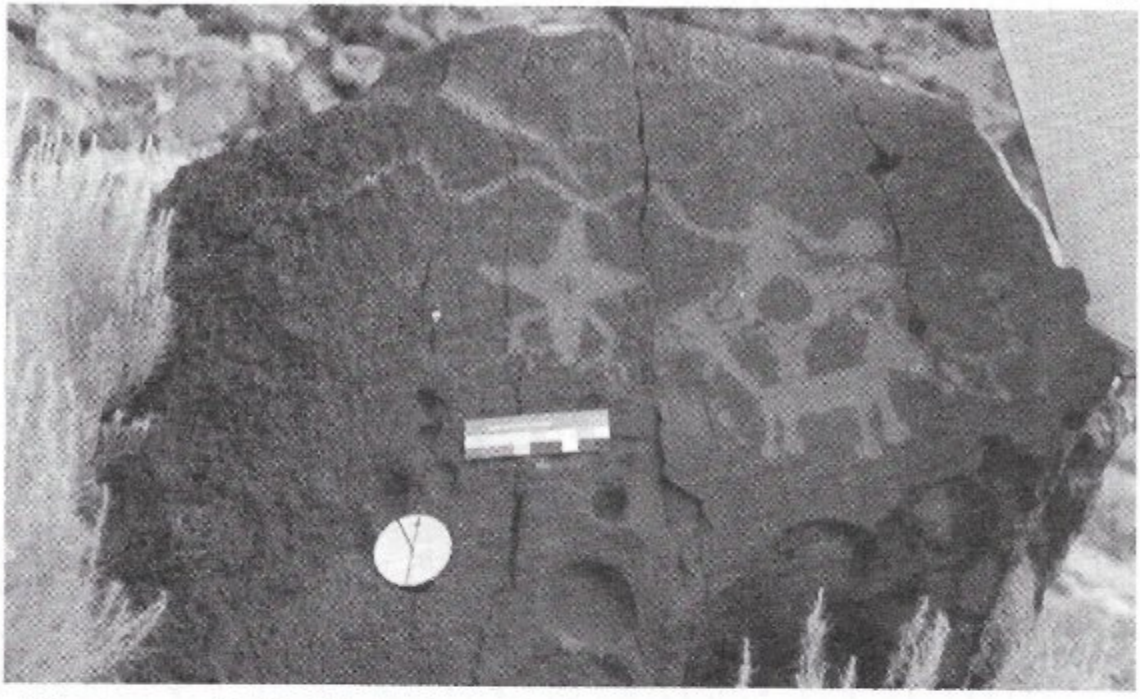

Figure 2. Petroglyphs from Petroglyph National Monument, New Mexico, U.S.A.

Puebloans believed responsible for this site have inhabited this area for at least 1000 years. Their modern descendants reside today in the nearby Tiwa-speaking Pueblos of Sandia and Isleta.

There had, until recently, been no systematic effort to record the rock art of the Monument. The size of the area, which encompasses one of the world's largest collections of rock art, and the difficulty of the terrain have impeded studies of the archaeological materials in Petroglyph National Monument. As a consequence, the rock art of the Monument has been only partially and poorly recorded.

A preliminary assessment of the Monument's glyphs was made by Walt and Brayer in 1994, funded and supported by the National Park Service. The goal of this project was to evaluate previous and current recording protocols and applicable technologies, and to gauge their feasibility for the Monument. This included a review of the current status of rock art recording, the field recording of image and non-image data, and the processing and storage of images and data to include both hardware and database options. This was followed by a field recording project at the Monument in 1995. Assisting Brayer and Walt were members of Sandia Pueblo, descendants of the glyph's creators. Project members documented a geographically-bounded portion of the Monument. Glyphs thus recorded were subsequently entered into a database that served as the initial entries in our present database.

We continue to document glyphs in the Monument, with some modification to our technology and logistics. We believe that by directly entering data and images into the computer we can become more efficient, cost-effective, and improve the quality and correctness of the database. During the northern summer of 1996 we experimented with the use of digital cameras and laptop computers in the field in order to refine these methods.

Standardisation

The proposed database system needs to be able to cope with a broad range of approaches to rock art recording; we are against the concept of a single, uniform recording form as different researchers may wish to record different types of data to address their purposes. It is stressed here that the nature of the forms used to record site data must *not* be critical to the success of the database system as a usable tool, as many researchers and managers will be, for a variety of perfectly legitimate reasons, reluctant to abandon their own recording practices (including forms).

We describe and include our own field forms as examples in an effort to encourage thorough recording procedures and protocols. Our field recording forms are hierarchically organised, from general to specific (or one may view these the other way round), beginning with a 'Rock Art Site Form' which is an overarching description of the entire site. Below this highest level are four other forms, recording increasingly more specific and smaller portions of the whole, in the following order: 'Rock Art Site Section Form', 'Rock Art Panel Complex Form', 'Rock Art Panel Form', and 'Glyph Form' (Figure 3). In addition, we have developed forms for specific interests and problems, such as conservation and vandalism, ethnographic entries, and larger archaeological site complexes. The more general forms, in particular that for sites, will be more or less common to all recording contexts. The more specific forms, in particular the glyph form, may need to be modified, redesigned or even totally abandoned for each regional study, depending on the approach taken. Examples of the latter option are the Wardaman and north Queensland projects, where glyph forms were not used, all of the art being drawn on graph paper instead. The database system has been organised to make allowances for these case-specific variations.

Recorder _____ Date _____

Rock Art Panel Form

1. Location

Site # _____ Unit # _____

Panel Complex # _____ Panel # _____

Panel Dimensions: (in meters)

Ht._____Width_____

Compass direction of panel _____

Base of image from ground_____

Sub-Surface Art: Yes ☐ No ☐

Inclination (from horizotal) _____

Distance/Angle to Datum _____

Panel Photograph # _____

2. Picture Description

Picture Composition: Yes___No___

Joined ☐ #_____ Wrap-around ☐ #_____

Thematic unity ☐ #_____ Superimposition ☐ #_____

Other ☐ #_____ Describe _____

3. Cultural Context (To Be Defined by Project)

_____

( )_____ ( )_____ ( )_____

Supplemental Forms: Yes _____ No _____ Type _____

GLYPH FORM

Panel # _____ Date _____ Recorder _____ Photographer _____

Glyph #	code #	Glyph #	code #
Glyph #	code #	Glyph #	code #
Glyph #	code #	Glyph #	code #
Glyph #	code #	Glyph #	code #
Glyph #	code #	Glyph #	code #

Element Talley _____

1 SINGLE OR PARALLEL LINES

a) Zigzag	b) Wavy	c) Spiral or scroll
d) Arc	e) Other	

2 BRANCHED OR INTERSECTING LINES

a) Cross or X	b) Rake	c) Ladder	d) Other

3 DOT PATTERNS

a) Line	b) Closed form	c) Other

4 CLOSED GEOMETRIC FORMS

a) Rectangle/square	b) Concentric rectangles	c) Grid	d) Stepped pyramid
e) Triangle	f) Double triangle	g) Joined triangles 'saw'	h) Grouped triangles
i) Diamond	j) Spoked circle	k) Rayed circle	l) Bisected circle
m) Circle	n) Concentric circle	o) Nucleated circle	p) Other

5 HUMAN/ ANTHROPOMORPHIC FIGURES

a) Frontal stick	b) Frontal outline	c) Frontal infilled
d) Profile stick	e) Profile outline	f) Profile infilled
g) Simple mask	h) Intermediate mask	i) Complex mask
j) Partial or torso	k) Therianthrope	l) Other

6 ANIMAL FIGURES

a) Quadruped stick	b) Quadruped outline	c) Quadruped infilled
d) Bird frontal	e) Bird profile	f) Fish
g) Deer/elk	h) Snake	i) Other

7 PRINTS AND TRACKS

a) Human hand	b) Human foot	c) Hoof
d) Bear track	e) Bird track	f) Other

8 CULTURAL SYMBOLS AND PLANT FORMS

a) 'Blanket' design	b) Shield	c) Club or ax
d) Arrow	e) Corn plant	f) Elaborate misc
g) Star figure	h) Star head	i) Star

9 INDETERMINATE

a) Indecipherable/light	b) Scattered dots	c) Smoothed surface

10 HISTORIC IMAGES AND INSCRIPTIONS

a) Christian cross	b) Church	c) Horse
d) Anthropomorph	e) Names/dates	f) Stock brand

11 RECENT GRAFFITI AND VANDALISM

a) Initials/names/dates	b) Message	c) Drawing
d) Defacing	e) Bullet holes	f) Rock removal

Figure 3. Samples of Field Recording Forms. (A full set can be obtained from the authors.)

We have devised this set of nested forms so that we are able to record the relationships between glyphs in a larger structural and site context, a significant attribute of the medium that has too often been overlooked. Hence, the inherent structure of the forms and the database system encourages as much commonality as possible, while allowing flexibility for specific site variations within the context of the standard. Rock art recorders wishing to use their own forms and/or record their own specific information will not be disadvantaged.

Software

The text and image data will be stored in Microsoft Access, a relational database. Access provides the basic functionality we need and is widely available. More importantly, data stored here can later be exported in a standard format to another database, if we make such a decision in the future. As a relational database, Access can store and edit various kinds of multimedia data including text, images, graphics and drawings, audio scripts and video. Access provides standard search capabilities, based on SQL queries or on specially developed user query interfaces. At this stage we do not plan extensive development of specialised interfaces. We recognise that software choices are quickly evolving and we continually monitor these for their applicability to our concerns.

Medium

Our emphasis is on convenience and timeliness for the scholar, manager and indigenous groups. For any given body of rock art, the system needs to be able to present both the raw image data (i.e. digitised rock art and site imagery) and a portable version of the full database in a number of formats, as different groups may have access to different computer hardware and software. The data should be producible on CD-ROM in a DOS directory format and in a Kodak Photo CD format. In some cases, a given database may be partially or totally restricted (i.e. not accessible to other researchers) because of management or cultural reasons, while in other instances complete databases may be accessible to a widespread group of interested researchers. An example of the latter case may be certain European Upper Palaeolithic assemblages. In such cases, the system and the appropriate databases need to be rapidly communicable to a broad audience.

Computer use

In addition to simply entering the recorded data into a standard commercial relational database, there are two primary computer-related goals for this project. First, we want to explore methodologies for computer assistance in the field. There are several important benefits to using a computer on-site while recording.

1. Data entry can take place and be verified in real time at much lower cost than it would by returning later to the field;
2. Computer processing of digital camera images can improve the quality of the recorded imagery and in some projects may help determine when hand drawings are required;
3. Print-outs of recorded imagery can be used to guide the execution of hand drawings.

Second, we want to improve access to the data by:

1. Standardising the user interface to rock art databases from diverse sources;
2. Standardising the *structure* of rock art databases from diverse sources;
3. Where appropriate, increasing the accessibility to data by CD-ROM and the Internet.

Glyph images will be digitised at a resolution of about 15 pixels per centimetre. This leads to a typical image size of about 300 × 300 pixels for a 20 × 20 centimetre glyph. Panel images will be recorded at a resolution of about five pixels per centimetre which leads to a size of about 500 × 500 pixels for a one metre-square panel. Similar calculations for other images lead to a total storage required for the digital imagery of about 5-10 gigabytes.

The coded text data will require much less storage space, less than 100 megabytes. The database system also has the capability of storing and editing audio ethnographic data and video data.

In this project, we plan to directly enter some of the recorded data into a laptop while in the field. This will include survey data which potentially can be directly downloaded from the survey instrument or GPS unit. We will also use a digital camera to record and enter the image data directly into the database, although in practice this option may have to await the commercial availability of cheap high quality digital cameras, which are not yet on the market (predicted to be available within five years). Formatting will be accomplished by recording protocol software set prior to entering the field. Near real-time field verification of the computerised database entries will ensure quality control.

Plans for storage and access

At present we have a WWW home page on the Internet at **http://www.cs.unm.edu/~brayer/rock/sandia.html**. This Internet page contains a brief description of our project with Sandia Pueblo, a few sample images, and links to pages for the Petroglyph National Monument, for Sandia Pueblo, for the American Rock Art Research Association, and finally a link to our report on rock art recording technology.

Conclusion

We believe that a universally standardised database system is possible if developed in an evolutionary and incremental way, incorporating different rock art types and cultural settings. We have already completed two cycles of review between the U.S. and Australia and will conduct further cycles as part of this project. Each iteration consists of alternating periods of field recording, verification or data entry, and periods of discussion and

evaluation of the field forms, the database structure, database search tools and database report generation. After each evaluation, modifications are made to the database and associated methodology before the next recording period. To try to get input from other kinds of projects and other researchers, we plan several strategies. A panel of scholars has been assembled to comment on our project as it develops. But we also require comments from a wider sector of the rock art research community; we therefore invite comments, via *Rock Art Research*, from all who may wish to see certain modifications or additions incorporated within the system.

We are applying for funding from a number of sources, including the National Endowment for the Humanities in the United States, as well as a variety of other potential sources and avenues of research and development. As our project unfolds, we will submit periodic updates to this publication.

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Final MS received 21 February 1997.

Résumé. *Cet article présente un nouveau projet dont le but est de développer un système informatique pour la mise en mémoire et l'analyse de données d'art rupestre. Il invite les commentaires de lecteurs intéressés qui souhaiteraient voir certains aspects de ce système modifiés ou élaborés.*

Zusammenfassung. *Dieser Artikel stellt ein neues Project vor, mit dem Ziel ein computerisiertes Databank-System für die Aufbewahrung und Analyse von Felskunst Unterlagen zu entwickeln. Kommentare sind willkommen von interessierten Lesern, die Gesichtspunkte des geplanten Systems modifiziert oder erweitert sehen wollen.*

Resumen. *Este artículo introduce un nuevo proyecto dirigido a desarrollar un sistema computarizado de banco de datos para el almacenaje y análisis de datos sobre arte rupestre. Invita a comentarios de parte de lectores interesados, que desearan modificar o ampliar aspectos del sistema propuesto.*

REFERENCES

ARNDT, W. 1962. The interpretation of the Delamere lightning painting and rock engravings. *Oceania* 32(3): 163-77.

CLEGG, J. 1971. A 'metaphysical' approach to the study of Aboriginal rock painting. *Mankind* 8(1): 37-41.

DAVID, B. 1989. Prehistoric rock art of southern Cape York Peninsula. *Rock Art Research* 6: 153-5.

DAVID, B., D. CHANT and J. FLOOD 1992. Jalijbang 2 and the distribution of pecked faces in Australia. *Memoirs of the Queensland Museum* 32(1): 61-77.

DAVID, B. and J. FLOOD 1991. On form and meaning in rock art research. *Rock Art Research* 8: 130-1.

DAVID, B., I. McNIVEN, V. ATTENBROW, J. FLOOD and J. COLLINS 1994. Of Lightning Brothers and White Cockatoos: dating the antiquity of signifying systems in the Northern Territory, Australia. *Antiquity* 68: 241-51.

DAVID, B., I. McNIVEN and J. FLOOD 1991. Archaeological excavations at Yiwarlarlay 1: site report. *Memoirs of the Queensland Museum* 30(3): 373-80.

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

FLOOD, J., B. DAVID and R. FROST 1992. Dreaming into art: Aboriginal interpretations of rock engravings - Yingalarri, Northern Territory, Australia. In M. Morwood and D. R. Hobbs (eds), *Rock art and ethnography in Australia*, pp. 33-38. Occasional AURA Publication 5, Australian Rock Art Research Association, Melbourne.

LEWIS-WILLIAMS, J. D. 1981. *Believing and seeing: symbolic meanings in Southern San rock paintings*. Academic Press, New York.

MERLAN, F. 1989. The interpretive framework of Wardaman rock art: a preliminary report. *Australian Aboriginal Studies* 1989 (2): 14-24.

ROSENFELD, A. 1982. Style and meaning in Laura art: a case study in the formal analysis of style in prehistoric art. *Mankind* 13 (3): 199-217.

RAR 14-410

The Alta Conference on Rock Art (ACRA II)

ACRA II will be held from 3 to 6 September 1998. Its emphasis will be on the theory of interpretation of rock art and there will be a session on curation. Altogether 25 papers are to be presented.

Location: Alta, northern Norway.
Organisers: The University of Tromsø, Alta Museum and the Municipality of Finnmark.
Further information: Knut Helskog (Tromsø Museum/ Tromsø University Museum), Fax: (47) 77 64 55 20; or e-mail: knut@imv.uit.no, or Bjørnar Olsen (Institute of Social Science), Fax: (47) 77 64 52 50 or e-mail: bjornaro@isv.uit.no. Address: University of Tromsø, 9037 Tromsø, Norway.

RAR DEBATES

Comment on
papers about the Côa petroglyph dating research
by R. G. BEDNARIK and A. WATCHMAN
In *Rock Art Research* 1995, Vol. 12, No. 2, pp. 86-108.

COMMENT

From Hell to Inferno

By BJARNE STIG HANSEN

To English-speaking visitors Hell may evoke unpleasant associations, but for those familiar with Norway, Hell is just a placename referring to a few houses round a station with no spiritual endowment other than a goods service. It is, after all, easy to be led up the garden path. Various paths, in fact, will lead you to two full-size reindeer images at Hell. Like many other figures in northern Norway, these face the sea, and are justly famous for being the only known Scandinavian rock art which is carved into phyllitic argillite rock. These figures, known at least since 1896, look authentic but then so did the paintings in Zubialde Cave, according to some eminent Spanish experts. The paintings turned out to be recent.

Gutorm Gjessing interpreted figures on Rødøy /roia/, Norway, one of which he found himself, as ski runners (1936). Others, like Hallström (1938), saw in them — and I believe correctly — mere boats. One has to be on the alert when one is faced with the unique. Hell is also an unusual site which was in the headlines long ago, but it never raised as much hell as the recent datings of its counterpart in Portugal, Canada do Inferno, by Robert Bednarik (1995) and Alan Watchman (1996).

Rock art is rarely signed and dated. The lovely female face from A.D. 81 by E. de Dreuzy in the Vallée des Merveilles in the Mont Bégo area of France is an exception. Another good example of modern rock art is a fine sphinx-like figure on a conspicuous rock marred with numerous names and dates north of Miguelanez near Domingo García, though far from some crudely engraved clocks seemingly dating to 1948 at Foz de Piscos in the Côa valley. I would not be surprised if some early clockmakers were responsible for the anthropomorph and two bovids, one bovine consisting of finely incised hatching on slate, with horns invoking Breuil, half a mile away at Ribeira dos Piscos. Here, too, are found two large horses with overlapping heads, a feature almost never seen elsewhere in outdoor rock art. On the spur of the moment I recall only Leiknes, north of the Polar Circle, in Norway.

Some four kilometres upstream from Ribeira dos Piscos, superimposed figures are seen at Penascosa. Here a Roman road descends the mountain to the river which at average water level is forded easily. I was fortunate to see rock art found only two days before my arrival on 9 July 1995 — a maze of intertwining lines on a rock near the river, and animal figures in a nearby gully in a 'style' also seen at Penascosa. Whether the new discoveries included a tiny 'bird' and a 'human' from whose head a 'tree' seemed to be growing, on the steep rocks at Quinta da Barca (Figure 1), is uncertain, at least to me. There seemed to be only these two figures, neither pecked nor carved but finely incised with a sharp stone or metal implement, and if recent certainly made by someone familiar with rock art. Bahn (1995) writes that 'the area also seems to contain quantities of exceedingly fine, small, almost invisible engravings similar to those of Fornols'. I did not find any of these, although I did sight many excellent untouched panels at, among other places, Figuera.

Figure 1. *Incised figures of what I interpret as a 'bird' and 'human with tree on the head'. Quinta da Barca I-II, Côa valley, Portugal.*

The rock art seems to be near the river at places, not surprisingly perhaps, in areas with easy access to the water. I was surprised, however, to have rock art pointed out to me in the

Rua da Cricheira, a road of the village Castelo Melhor, on a stone wall adorned with at least 49 engraved stones, including the image of a fish and various symbols of what I believe to be Iron Age origin.

Robert Bednarik has recently remarked that a few years ago, Steinbring and Lanteigne proposed in *RAR* (1991) that the carved rocks in British megalithic structures may not necessarily have been carved at the time these structures were built, but earlier, perhaps much earlier; and that the wall in the Rua da Gricheira might be an analogous situation (pers. comm.). The petroglyphs are at least older than the wall and may be on stones taken from the remnants of the ruined castle dominating the village. Wherever they are from, they deserve closer scrutiny.

As does the impressive four-metre-high wall at Castro, almost two kilometres long with hundreds of horse figures. This is a kilometre south of the Spanish village of Yecla de Yeltes and about 50 kilometres south-east of Castelo Melhor. No-one knows the exact number, but it seems that some Iron Age Picassos left their work signed only with symbols. Rocks have been left scattered below the wall, some of which are engraved, to prevent real horses from entering the fortress. This has never been excavated, as some of the owners are wary of archaeologists and have so far not allowed any to enter their grounds. Beautiful Roman tombstones in the shape of suns with many rays engraved can, however, be viewed in the excellent little museum found on the village church square. When approaching Castro from the village of Yecla de Yeltes, a further two can be seen on the walls of the last house on the right.

A torch or oblique sunlight clearly highlights most of the images of horses on the Castro walls, some of which are even much fainter than those at Los siete Infantes de Lara, fortunately quite well protected under a protruding, east-facing rock. The horses, and this applies to all of them, are stylistically far from the much larger horse at Mazouco which is best seen late in the morning. However, according to Portuguese researcher Baptista, the Mazouco equine is similar to Iron-Age horses at Vale da Casa in the vicinity and is certainly vandalised, having been scored in continuous lines recently. The figure is well known in the nearby village where I was told it was found by a schoolteacher from Freixo. If true he may have passed on his information to Nelson Rebanda who certainly had a finger in the hot waters of the Côa reservoir.

In rock art research, every decade or two seems to have had a fad: art for art's sake, the menu cards in rock of the magic hunters, sex disguised as animals placed in precise positions which always fell short of fitting the model completely — as if prehistoric man was that Victorian — and lately, a craze about the Palaeolithic whenever finely incised rock art was discovered at open air locations on the Iberian Peninsula.

Among the most important of the 'Palaeolithic style' finds are those of Siega Verde on the river Agueda, Domingo García and Fornols-Haut. The latter two occur at lofty positions far from running water. While some of the animals at Domingo García are complete, Fornols-Haut displays only incomplete animals, 'engravings drawn in all directions' (Bahn 1985). These compare to patterns of panes seen in the Danish Skarpsalling Vessel and in artefacts of the archaeological museums of Valetta and Victoria on the islands of Malta and Gozo. These are naturally from a much later date as was also the graffiti resembling tents which I found on house walls on these islands. I could not help thinking these may have been dated Palaeolithic had they been found on rock. 'Children's stuff', I was told. Jan Jelínek (1989) is certainly correct when writing 'similar ways of human thinking have produced some striking similarities in rock art representations'.

There is reason to wonder, and I wonder whether the correct name should not be *Fournouls*-Haut, or why seemingly no-one has commented on the solid rocks near the engraved block of schist. These have figures, lines apparently resembling nothing, but which are similar in appearance to the Mazouco and some of the Côa lines (Figure 2). Food for thought.

Figure 2. *One of the carved rocks at Fornols-Haut at Campôme, France.*

A kind elderly man told me he had been the guard at Domingo García for two years. He seemed to know each nook and cranny there and whenever I met him he asked me, with a twinkle in his eye, if I thought I had seen it all, and then took me on long walks to the furthest rocks of the ridge. There were always new discoveries to be made, like three heads slightly resembling that of Christ, battle scenes not unlike ones seen in Val Camonica and likely being from the same time as those.

In fact there are many more figures than the 82 mentioned by Bahn (1995), as Domingo García makes a pleasant windy change from the hot farmland plains below, today as well as then. Perhaps it has long attracted humans to its refuge of silence beyond the winds — a description which at least fits the summer. About a dozen of the finely incised figures were pointed out to me, many of which I would have simply overlooked as they are far from the size of the large horse which is hammered out and seen to its advantage at noon as one of the finest images on the hill.

About 60 kilometres south of Mazouco is Siega Verde on the Agueda, like the Côa a southern tributary of the Duero. The number of figures along a 1300-metre stretch on the river's left bank has now risen to 560. I must admit I was dumbfounded upon hearing the high number of images as I had so far only located about 60 of them in seven days. It is obvious that the finely incised figures of which there may be many are hard to see. I was able to find just one of these, an incomplete quadruped with only its hind legs left to see.

I had returned to Siega Verde mainly in order to locate the '*caballo grabado de estilo Paleolitico*' which had been somewhat elusive the previous year. I easily found the figure of the horse about 700 metres upstream from the Siega Verde bridge, certainly a fine if not refined figure, but far from being of 'Palaeolithic style'. The words of villagers from Castillejo de Martin Viejo still rang in my ears: they had always believed the art to have been made by shepherds whiling away the time and

they had had a good laugh when archaeologists told them that the art was Palaeolithic (see front cover of this issue).

With regard to this particular figure I tend to agree with the villagers. It lacks the patina of many of the other figures found along the river on convex or crescent-shaped schist blocks polished by water, the level of which can vary immensely.

Bahn (1995) writes that 'no less than half of the identifiable figures are horses, with bovids and cervids in second place'. Some of the latter, I may add, have enormous antlers which are almost lightning-like, but nevertheless far from awe-inspiring. A fine specimen turning its head — bringing Leiknes and Luine to mind — is seen on a rock, partly in the river, almost under the bridge, its legs ringing bells of Vingen north of Bergen, Norway.

I found no humans apart from a couple apparently dancing. So would I, if the area were turned into an archaeological park. The valley boasts some of the finest rock art in Europe — some of which, alas, like so much elsewhere is being vandalised. This applies to the 'aurochs', about one metre long, below the bridge. Also the large bull in its crescent-shaped cliff which lends no protection, near the bridge. It is a great pity as it is as powerful as the best paintings in Altamira. The rock art was 'discovered' in late 1988 but must long have been known by shepherds and people attracted by the refreshing waters of the river.

I am not following the mainstream and am wary when researchers 'provide an estimated age of more than 30 000 years for the oldest petroglyph sampled' in Olary Province, South Australia (Nobbs and Dorn 1988). Or when rock art is dated to be 31 000 years old, as some of the paintings in the newly discovered Chauvet Cave (Chauvet et al. 1996). Or even to 75 000 years before the present as the Jinmium cupules in the Northern Territory. I shall probably remain a doubting Thomas, recalling the cup marks I found, as sparkling as new-struck coins, in a forest north of Copenhagen. Less than two years later they were hardly recognisable owing to the effects of weathering. One may also bear in mind that the oldest rock art in Val Camonica, believed to be less than 10 000 years old, is for the most part hardly discernible. Thus I find Bednarik's and Watchman's datings of the art in the Côa valley refreshing.

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REFERENCES

BAHN, P. G. 1985. Ice Age drawings on open rock faces in the Pyrenees. *Nature* 313: 530-1.

BAHN, P. G. 1995. Cave art without the caves. *Antiquity* 69: 231-7.

BEDNARIK, R. G. 1995. The age of the Côa petroglyphs in Portugal. *Rock Art Research* 12: 86-109.

CHAUVET, J.-M., E. BRUNEL DESCHAMPS and C. HILLAIRE 1996. *Chauvet Cave*. Thames and Hudson, London.

JELINEK, J. 1989. *The great art of the early Australians*. Moravian Museum, Anthropos Institute, Brno.

GJESSING, G. 1936. *Nordenfjeldske ristninger og malinger av den arktiske gruppe*. Instituttet for sammenlignende kulturforskning, Serie B, 30, Oslo.

HALLSTRÖM, G. 1938. *Monumental art of northern Europe from the Stone Age. I - The Norwegian localities*. Aktiebolaget Thule, Stockholm.

NOBBS, M. F. and R. I. DORN 1988. Age determination for rock varnish formation within petroglyphs: cation-ratio dating of 24 motifs from the Olary region, South Australia. *Rock Art Research* 5: 108-142.

STEINBRING, J. and M. LANTEIGNE 1991. The petroglyphs of West Yorkshire: explorations in analysis and interpretation. *Rock Art Research* 8: 13-28.

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.

RAR 14-411

Comment on
THE PETERBOROUGH PETROGLYPH SITE:
REFLECTIONS ON MASSIVE INTERVENTION
IN ROCK ART
By P. G. Bahn, R. G. Bednarik and J. Steinbring
In *Rock Art Research* 1995, Vol. 12, No. 1, pp. 29-41.

COMMENT

Unfair criticism of Peterborough project

By BRUCE FORD

As a conservator and conservation scientist working with rock art and other forms of cultural heritage, I have found the Peterborough debate within recent issues of *RAR* (12[1], 1995 and 13[1], 1996) intensely interesting. Many of the general issues raised in this discussion about rock art are also central to the evolving ethics of conservation of cultural heritage generally, and continue to be the subject of intense debate in professional forums, for example *Studies in Conservation*. Examples might include the debate over the cleaning of the Sistine Chapel, or new methods being used for the removal of discoloured varnish from oil paintings with particular structural problems.

I thought that the original critique of the Peterborough project was a timely and useful cautionary contribution to the rock art conservation literature, however Bahn, Bednarik and Steinbring's Reply in *RAR* (13[1], 1996) was a disgracefully personal attack on Ian Wainwright in particular.

Taken at face value, Bahn et al.'s interpretation of the evidence and their ethical stance based on a minimalist approach to physical intervention (which I share) sustain a compelling case against the erection of the structure at Peterborough, and their analysis of the available scientific data calls into question the CCI's interpretation of that evidence, upon which the decision to build it was at least partly based.

Faced with the same circumstances in 1996 I would probably not recommend the erection of such a structure for many of the reasons outlined by Bahn and his co-authors. However, I have to say that most of the information I have about the project originates from its detractors and I am acutely conscious, in particular, of the lack of any substantial information in the discussion so far regarding the attitudes and participation of the local Native North Americans.

I could not assume, for example, as do the authors of the Reply, that a 'true elder traditionalist' would automatically be offended by a straight line — some of the longest straight lines in the world were constructed in the Americas, and if that is irrelevant, then so too is their comparison of the project with a building erected in Australia by different people for a different purpose. Their statement about elders puts words into other people's mouths and is about as valid as claiming that Michelangelo would never have approved the cleaning of the

Sistine Chapel. Do the authors really have the right to dictate what a 'true' elder should think, or label an 'Algonkianist', whatever that is, 'peculiar' for approving of angular structures?

Given further evidence I could be yet persuaded that the building was, and still is, a valid response to the situation in which the rock art is now located — fulfilling a protective, educational and ceremonial function at an already well known location and not, as the critics assert, an example of 'wilful destruction' and 'deliberate professional vandalism'.

My problem with their Reply is not so much with their arguments, however, or the decision to publish an analysis of the project in the first place, as with the self-righteous, parochial, and sometimes hypocritical tone that Bahn et al. bring to the discussion. Their Reply in particular is positively paranoid in parts, with its rambling diversions into the evil nature of government bureaucracies, and preoccupation with 'where the blame lies'.

Australian conservation and management practice is held up as the epitome of all that is good in rock art conservation. However, it is not that long ago (since the Peterborough project was completed, from memory) that an Australian rock art conservation publication featured, on the front cover, a park ranger holding a small grinder up to an Aboriginal painting, and it is only a few years since one of the innovative Australian pioneers named removed biological material from within the grooves of an engraved site using just such an instrument in order to make it more visible to the public. As I recall, the site, which was already very well known, had been selected as suitable for public interpretation and the 'cleaning' of the petroglyphs and construction of an elaborate walkway carried out in order to satisfy a need for clear examples for the public to photograph and enjoy in daylight, and hopefully divert attention away from other sites and avoid amateur attempts at highlighting which were occurring. The rationale remains valid, though in the light of recent dating advances would need further thought were it to be contemplated now.

Bednarik himself has erected structures for the protection of rock art sites which I am sure are no less offensively nonlinear than the Peterborough construction, if not on such an ambitious scale. Other practices which are now under question, such as the routine installation of silicone drip lines and the removal of insect and bird nests and attempts to divert water flow were pioneered in Australia and are probably still being carried out here and in other countries from time to time — perhaps appropriately in some cases, in others not.

The Australian 'finely honed national policies' mentioned by the authors are implemented via a cumbersome series of state and federal bureaucracies with no lesser tendencies towards self-promotion and 'reinterpretation' of unsatisfactory results than those elsewhere. Recently one of our bureaucracies attempted to carry out a somewhat hubristically named 'exemplar' conservation project, as if we had arrived at the final glorious state of rock art conservation. Perhaps it is a good thing that for various reasons it did not really get off the ground. What will we think of today's methods and attitudes in a decade's time I wonder? Exemplary? I doubt it.

I mention these examples of Australian conservation not to sling yet more mud, but as a remedy against self-satisfied parochialism and to remind the critics that we do the best we can given our resources and the state of the field at the time. All of the examples above were carried out in good faith, and were properly thought through and justified by the standards of the day. I have never witnessed deliberate vandalism by conservators in any area of conservation — poor judgment, lack of information, misinterpretation of data, changing ethical standards, yes — but not 'wilful destruction'.

If everyone who was judged guilty in retrospect of making questionable decisions were to be 'dismissed from their posts' there would he few experienced conservators and researchers left to carry the field forward, hopefully to better days. It is impossible to be judged as always having done the right thing when circumstances change so rapidly — for example new means of dating overtaking conservation methods in the time it takes to move a project from planning to execution. Even doing nothing, whilst often safe, is not always so.

Personal attacks and emotive language such as that used in the Reply will only serve to suppress reasoned discussion, encourage conservators to avoid peer review and drive experienced people out of the profession. Who in their right mind would (as I have) research, use and advocate the use of the air abrasive technique for removal of graffiti, for example, when phrases like 'sandblasting', 'deliberate professional vandalism' and 'wilful destruction' are indiscriminately bandied around in relation to its use. Highlighting engravings is not the same as removing graffiti, however the authors (presumably Bednarik, since he has access to the unpublished paper referred to) misinform us of two conservators' purported criticism of the technique. 'Purported' because they were, in fact, referring to a wet sand blasting of a site using large-scale commercial equipment by untrained personnel, completely unrelated to the skilled use of the vastly smaller and highly controllable micro air abrasive technique.

Of course every technique has its dangers and every act of hands-on conservation is also an act of interpretation, but the question is one of reasonable risk versus benefit and not of absolutes. Fay Gale's work on graffiti raises stark questions as to whether one should intervene to remove graffiti and risk causing some damage, however minor, in the process, or leave it in place as an encouragement to future graffiti perpetrators.

Those of us in the field should not have to be reminded that rock art conservation and management, particularly where it involves public presentation as it does in this case, is full of such predicaments and contradictions which cannot he wholly resolved by reference to hypothetical repercussions and ethical considerations, as important as such matters must always be in the planning process.

When a decision is made to present a site to the public, intervention in its physical fabric more often than not becomes necessary, and certain values or attributes are inevitably 'sacrificed' to some other end — the question is how to prioritise and minimise those sacrifices in the particular case, not whether they have to be made at all.

If the art site is well known (as I assume the Peterborough site is), do we leave it unprotected and risk people walking on it or highlighting it themselves for photography, do we fence it in and give the public something to read but thereby spoil its natural and (perhaps) spiritual setting, or do we put it in a building and return it to a visible semblance of what it might have looked like when first engraved, albeit in a museum-like setting with some of the scientific information destroyed and nearly all of its natural values drastically altered?

These are largely local and particular decisions and it is ridiculous to claim, as the authors do, that Wainwright 'must advocate the scouring of *all* patinated engravings' irrespective of their physical and social context because he is contemplating it in this case. Hard judgments do have to be made and it is highly unlikely that we all agree on them, and in my view it is unprofessional to mount offensive personal attacks on people because they defend a different balance of priorities based on honestly held differences of opinion.

I fully endorse and encourage the open discussion of conservation projects, particularly where there are questions

regarding their value and where they are likely to be emulated elsewhere because of the publicity given to them, but hysterical calls for the 'dismissal' of conservators 'from their posts', and the constant use of the most emotive language to describe the decision-making processes and the conservation methods used or proposed are inappropriate and lower the standing of the journal.

It seems that Bahn et al. have decided to make an example of Wainwright and the CCI in order to bring others who are thinking of adopting a similar approach to heel. Their aim is defensible, even laudable — great caution is necessary where physical intervention is concerned — and I applaud their passionate commitment to saving rock art from unnecessary interventions, but in this case the means do not justify the ends and I think the authors owe Ian Wainwright and his colleagues at the CCI an apology for attempting to destroy their professional standing as a means of making their point.

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RAR 14-412

REPLY

Hear nothing, see nothing, say nothing?

By PAUL G. BAHN, ROBERT G. BEDNARIK and JACK STEINBRING

We are grateful to Ford for his comments, though we fail to understand how he could view any part of our earlier Reply as either rambling or hysterical — on the contrary, we took great pains to structure and temper our remarks.

Ford makes the point that most of the information he has about the Peterborough project originates from its detractors. This is precisely why our paper needed to be written. The Peterborough building had achieved a wholly undeserved reputation around the world as the epitome of rock art conservation, when in fact very little had ever been published about it other than the CCI's own self-satisfied statements; most of the relevant data still remain unpublished, and in particular not a word had appeared in print, before our paper, about its many negative aspects.

Ford also stresses the 'lack of any substantial information in the discussion so far regarding the attitudes and participation of the local Native North Americans' — but, as we made clear in our response to Margaret Bullen on this very issue, nothing has ever appeared in print about consultation with the local indigenous community. We have subsequently learned (L. Roach, pers. comm.), that a local indigenous leader was in fact a member of the committee set up to decide how best to protect the glyphs, and he approved the building. However, this committee's deliberations have never been made public, and we wholeheartedly share Ford's desire to learn more about the feelings of all the local indigenous people. However, his taking exception to our view that traditional Algonkians might find angular modernistic structural intervention inharmonious with the natural setting did not take into account the basis of the comment. This was not a superficial judgment, but was a reflection based upon more than twenty years of participant-observer, residential field research by one of us among Algonkian hunters in the Precambrian Shield/Boreal Forest Zone — which includes the area of the Peterborough site (Steinbring 1964a, 1964b, 1965, 1966, 1967a, 1967b, 1968, 1971, 1974, 1975a, 1975b, 1977, 1980a, 1980b, 1981, 1982, 1984, 1985, 1990). Algonkian culture is spread through a vast land area occupying the north-east quadrant of the continent, and the Algonkian linguistic phylum virtually extends from coast to coast. The distribution of Algonkian hunters alone may exceed that of any other land-based culture in the world. As for asking what an Algonkianist is, Ford, as a 'conservation scientist', might reasonably be unaware of an immense technical library on these Algonkian hunters, a great deal of it stemming from field work in Ontario. For starters, and narrowing the field to Ontario, we would recommend Hallowell 1955, 1976; Rogers 1962, 1963, 1967, 1969; Dunning 1959a, 1959b; Landes 1966; Bishop 1969, 1970, 1972, 1974, 1975, 1976, 1978; Tanner 1974; Skinner 1912; Skinner and Saterlee 1915; Jenness 1935; and Hickerson 1962, 1967a, 1967b. The list of references in these will suffice to demonstrate that Algonkian studies in Ontario alone constitute a major ethnological speciality, and will satisfy most readers that there is such a thing as an 'Algonkianist'. Ford is also invited to review the 837-page volume 6 (The Subarctic) of the *Smithsonian handbook of North American Indians* (1981). A great deal of it focuses on Algonkians, at a premier level of scholarship.

Much of the rest of Ford's Comment is similarly misdirected. We have not claimed that the Peterborough structure was not erected in good faith, and it is self-evident that everyone makes mistakes, including ourselves. But it was crucial to underline the damage caused. To quote M. Gandhi, 'It is not possible to undo the mistake. But the very admirable doctrine of fair play ... demands that I do not help the mistaken party to fancy that the mistake was no mistake.' Everyone has 20-20 vision in hindsight, although, as we pointed out, some basic precautions in the use of a backhoe and of inflammable materials might well have avoided much of the initial damage at the site. This is not a matter of judging the CCI 'guilty in retrospect' for making questionable decisions, but of condemning the secrecy and concealment of facts which have surrounded this structure ever since its completion.

Our 'attack' on Wainwright is, as Ford correctly observes, restricted to our Reply to him, and it is not evident in any other part of this debate up to that point (in fact we went out of our way to ensure that he was barely mentioned in the original article, despite his pivotal role in the matters discussed, in order to render the paper completely impersonal). Our sharp criticism is clearly related to one issue, and to one issue alone: Wainwright's refusal to take on board a single one of the points we made, and in particular our rejection of his proposal to sandblast the weathering layer on the petroglyphs in the Peterborough building. Our reaction is entirely a result of Wainwright's obstinate response, in which he brushes aside all good advice offered to him, and insists that he will proceed with a course of action that is rejected not only by us but, we are confident, by practically anyone concerned with rock art. If his Reply had contained one iota of regret or of admission that all was not well in the Peterborough structure, if it had shown the slightest willingness to pay heed to the legitimate worries and opinions of others, then our reaction to it would have been very different. Instead of a positive contribution to the discussion we were faced with a wholly negative and dismissive Comment, which caused us extreme disappointment and exasperation. We are painfully aware that our response was exceptionally strong, and if there is any apology to be made, it should be by the party who forced us into taking such drastic action. We believe

there was no other choice available to us to impress upon Wainwright the full gravity of the situation. After all, the further professional vandalism (which we hope to have averted) would have been fully intentional in this case. Indeed, Wainwright has every reason to be grateful to us for preventing perhaps the greatest folly in his professional life.

We intensely dislike having to try to convince a recalcitrant public servant that his or her actions, where they affect rock art, may be subject to peer review, and that where such peer review is offered, it should not be flatly rejected. Ford mentions the debate over the cleaning of the Sistine Chapel; and one might add the current furore over the proposed cleaning of the Giotto frescoes in Padua by an Italian government restoration program which, it is widely feared, may damage them. As James Beck of Columbia University said recently, 'It is essential for the world to have a say in this work. The art world is in the hands of a few people who think that they are the only ones to have influence over art restoration. It is like leaving matters of pollution to be decided by the oil companies.' It would doubtless be superfluous to underline here the analogies to the small world of rock art conservation.

It was never our intention to destroy Wainwright's professional standing. We have merely stated, and only in response to his Comment, that we *would* condemn him if he persisted with his plans *after the consequences had been spelled out* to him in no uncertain terms. We cannot therefore apologise for something that we have not attempted to do. It is not we three who will decide the future of this issue; this is certainly up to Wainwright. How can *we* be made responsible for his future actions and their consequences? Particularly as we have gone to such great lengths to explain the opposition of his peers! If Ford can suggest alternative means of convincing Wainwright to desist, then we would be interested to hear them. We are perfectly willing to consider any alternative measures that will prevent Wainwright from further vandalising the Peterborough rock art.

Ford's interest in this issue is understandable in view of his article entitled 'Portable air abrasive unit for rock art graffiti removal' (Ford 1996). But we are not questioning the use of sandblasting equipment in general, and we were not commenting on its use in graffiti removal at public sites. (Since Ford objects to the term 'sandblasting', we suggest that he may read in its place GBCGAOSBCANADS-blasting, or 'glass-bead-or-crushed-glass-or-aluminium-oxide-or-sodium-bicarbonate-and-compressed-air-or-nitrogen-abrasive-delivery-system'; we find sandblasting perfectly adequate). We were not even commenting on its use in removing only the wax crayon, though we doubt that this could be achieved without mechanical damage to the weathering zone. What we did comment on was its intended use in selectively and systematically removing all weathering zone material from all the petroglyphs in question.

Wainwright's intention (Wainwright and Stone 1990), we repeat, is to remove not only the offending black wax, but also the marble's weathering zone beneath the wax. He even wants to produce different shades of white according to the relative age of each glyph! Yet we do not know even the approximate ages of the figures, so this would be an entirely subjective exercise, imposing a purely speculative chronological model on the whole assemblage! The removal of the weathering zone is not only badly misguided and unnecessary, it would forever prevent any possibility of directly dating the site. Wainwright's reference, in this context, to radiocarbon dating is of particular concern to us: it implies that he is completely out of touch with current trends in petroglyph dating, which underlines the need for peer review of such potentially destructive direct physical intervention.

If Wainwright's assumption that the Peterborough marble retreats at a rate of a quarter of a millimetre per decade were true, the wax should have already flaked off through natural attrition before the building was erected. The simple fact that it remains firmly lodged and shows no inclination to flake off either negates Wainwright's view on surface retreat, or else the wax has very effectively protected the surface from weathering in the many years since it was applied. If Wainwright believes that there is rapid surface retreat he should remove the building and let nature take its course to remove the paint. This may take a long time, but one thing is certain: for as long as the paint stays in place, there would have been no need to protect the glyphs from weathering. To see this, one does not need to be a rock art conservator -- it is a matter of common sense.

We did not hold up Australian practices 'as the epitome of all that is good in rock art conservation', we merely said that Franklin's Comment seems to reflect the considerably better Australian policies: meaningful consultation with interested parties, low-cost minimalist intervention at numerous sites, and so on. For instance, the cost of the two structures at Peterborough equals the entire expenditure of the Australian Institute of Aboriginal and Torres Strait Islander Studies Rock Art Protection Program (Ward 1989) for the six years from 1987 to 1993, during which period it funded something in the order of seventy projects affecting hundreds of sites. This does not imply that no mistakes were ever made, but massive intervention (by which we mean physical intervention that places the rock in a totally different environment) has not occurred in Australia since the sawing off of one motif at Panaramitee North many decades ago. Nor do we think that Ford's dwelling on isolated recent mistakes serves a purpose, when the people concerned have admitted or would admit the inappropriateness of their action and have no intention of rejecting peer review.

He takes one of us to task for having 'erected structures for the protection of rock art sites' (which is incorrect: Bednarik has erected only one entrance grid, in the vertical entrance of Paroong Cave, well away from the art; Bednarik 1991). It is true that there are numerous sites in Australia (and elsewhere) with metal grid protection, particularly sites close to major population centres. But as Gale and Jacobs (1987: 74) observed, no person or agency would have the courage to remove these ugly structures and thus be responsible for the vandalism that would surely occur. These grilles 'are an unfortunate, but effective visitor control mechanism' (Finn and Hall 1996: 71) at public sites. They have no effect on a site's climatic or hydrological regime, but a fully enclosed building does.

One of us has recently added to the debate with an account of a Swedish structure which was recognised as a failure and thus dismantled (Bahn and Hygen 1996). Unlike Ford, we believe that it would be wrong to dwell on past mistakes that have since been corrected, but such experiences do need to be mentioned simply to warn others of the danger of repeating them through having insufficient information available at the time they make their management decisions. Moreover, the Swedes are not travelling to other countries to promote their building as a paragon, nor do the Russians or anyone else who has tried enclosing open-air petroglyphs in a museum. Wainwright, in contrast, continues to extol the 'virtues' of the Peterborough project in his writings and in lectures, for example in a course given in Buenos Aires in 1995. Since very few Argentinians receive *Rock Art Research* or the *International Newsletter on Rock Art*, we fear that most of the people who attended that course still believe that Peterborough is something to be admired and emulated. We find this state of affairs unsatisfactory.

Another recent example is a glowing account of the Peterborough project that has appeared in a new French book on rock art conservation (Brunet et al. 1996: 186), which claims that by 1994 it was clear that the building was entirely beneficial, and constituted the only satisfactory method of arresting the degradation of the site — the source of this information, not surprisingly, is 'I. Wainwright, personal communication'!

Finally, we need to respond to Ford's suggestion that we are 'making an example' of Wainwright. Not only has he nobody but himself to blame for our sharp Reply, but subsequently other professional rock art vandals have already been taken to task by ourselves and colleagues in Europe and elsewhere. We invite Ford to be equally critical of these further efforts to 'bring to heel', as he puts it, publicly funded professional rock art vandals. We agree with him completely that major management decisions concerning rock art sites can be ferociously complex, and that is precisely why those charged with this responsibility need to consult the collective knowledge of the discipline, as well as the feelings of any local indigenous people. Decisions of direct intervention, particularly of massive intervention, must not be made on an individual basis, or on the advice of some paid consultants. Rock art is too precious to become a CRM hostage, and the state does not even have legitimate jurisdiction over it. It merely acts as a curator on behalf of other parties — either its indigenous owners (as in Canada), or humanity as a whole.

In conclusion, we are bemused by Ford's belief that we owe Wainwright and his CCI colleagues 'an apology for attempting to destroy their professional standing'. On the contrary, we would suggest that Wainwright and the CCI owe the entire rock art community an apology for damaging a major site, for concealing unpleasant facts, for presenting a false image of their handiwork to the world, and for advocating further damage.

REFERENCES

BAHN, P. G. and A.-S. HYGEN 1996. More on massive intervention: the Aspeberget structure. *Rock Art Research* 13: 137-8.

BEDNARIK, R. G. 1991. The Paroong Cave preservation project. In C. Pearson and B. K. Swartz (eds), *Rock art and posterity: conserving, managing and recording rock art*, pp. 66-70. Occasional AURA Publication 4, Australian Rock Art Research Association, Melbourne.

BISHOP, C. A. 1969. The Northern Chippewa: an ethnohistorical study. Unpubl. Ph.D. dissertation, Anthropology Department, State University of New York, Buffalo.

BISHOP, C. A. 1970. The emergence of hunting territories among the Northern Ojibwa. *Ethnology* 9(1): 1-15.

BISHOP, C. A. 1972. Demography. Ecology and trade among the Northern Ojibwa and Swampy Cree. (Special Issue: The fur trade in Canada). *Western Canadian Journal of Anthropology* 3(1): 58-71.

BISHOP, C. A. 1974. *The Northern Ojibwa and the fur trade: an historical and ecological study*. Holt, Rinehart and Winston, Toronto.

BISHOP, C. A. 1975: The origin of the speakers of the Severn dialect. In W. Cowan (ed.), *Papers of the Sixth Algonquian Conference. 1974*, pp. 196-208. National Museum of Man Mercury Series, Ethnology Service Paper 23. Ottawa.

BISHOP, C. A. 1976. The emergence of the Northern Ojibwa: social and economic consequences. *American Ethnologist* 3(1): 39-54.

BISHOP, C. A. 1978. Cultural and biological adaptations to deprivation: the Northern Ojibwa case. In C. D. Laughlin, Jr. and I. A. Brady (eds), *Extinction and survival in human populations*, pp. 208-230. Columbia University Press, New York.

BRUNET, J., A. BRUNET, I. DANGAS, E. GUILLAMET and P. VIDAL 1996. Altérations, dégradations, traitements. In J. Brunet and J. Vouvé (eds), *La conservation des grottes ornées*, pp. 171-217. CNRS Editions, Paris.

DUNNING, R. W. 1959a. *Social and economic change among the Northern Ojibwa*. University of Toronto Press, Toronto.

DUNNING, R. W. 1959b. Rules of residence and ecology among the Northern Ojibwa. *American Anthropologist* 61(5): 806-16.

FINN, P. and N. HALL 1996. Removal of iron fastenings and iron stains from sites in the Grampians (Gariwerd). In A. Thorn and J. Brunet (eds), *Preservation of rock art*, pp. 65-71. Occasional AURA Publication 9, Australian Rock Art Research Association, Melbourne.

FORD, B. 1996. Portable air abrasive unit for rock art graffiti removal. In A. Thorn and J. Brunet (eds), *Preservation of rock art*, pp. 72-76. Occasional AURA Publication 9, Australian Rock Art Research Association, Melbourne.

GALE, F. and J. M. JACOBS 1987. *Tourists and the national estate*. Special Australian Heritage Publication Series 6, Australian Government Publishing Service, Canberra.

HALLOWELL, A. I. 1955. *Culture and experience*. University of Pennsylvania Press, Philadelphia.

HALLOWELL, A. I. 1976. *Contributions to anthropology: selected papers of A. Irving Hallowell*. University of Chicago Press, Chicago.

HICKERSON, H.1962. *The Southwestern Chippewa: an ethnohistorical study*. Memoirs of the American Anthropological Association 92. Menasha, Wisconsin.

HICKERSON, H. 1967a. Some implications of the Theory of the Particularity, or 'Atomism' of Northern Algonkians. *Current Anthropology* 8(4): 313-43.

HICKERSON, H. 1967b. Land tenure of the Rainy Lake Chippewa at the beginning of the 19th century. *Smithsonian Contributions to Anthropology* 2(4): 41-63.

JENNESS, D. 1935. *The Ojibwa Indians of Parry Island: their social and religious life*. National Museum of Canada Bulletin 78, Anthropological Series 17, Ottawa.

LANDES, R. 1966. The Ojibwa of Canada. In M. Mead (ed.), *Cooperation and competition among primitive peoples*. Beacon Press, Boston.

ROGERS, E. S. 1962. *The Round Lake Ojibwa*. Art and Archaeology Division Occasional Paper 5, Royal Ontario Museum, Toronto.

ROGERS, E. S. 1963. Changing settlement patterns of the Cree-Ojibwa of northern Ontario. *Southwestern Journal of Anthropology* 19(1): 64-88.

ROGERS, E. S. 1967. Subsistence areas of the Cree-Ojibwa of the eastern Subarctic: a preliminary study. *Anthropological Series 70, National Museum of Canada Bulletin* 204: 59-99.

ROGERS, E. S. 1969. Band organization among the Indians of eastern Subarctic Canada. In D. Damas (ed.), *Contributions to anthropology: band societies*, pp. 21-50. Anthropological Series 84, National Museum of Canada Bulletin 228, Ottawa.

SKINNER, A. B. 1912. Notes on the Eastern Cree and Northern Saulteaux. *Anthropological Papers of the American Museum of Natural History* 9(1).

SKINNER, A. B. and J. V. SATERLEE 1915. Folklore of the Menomini Indians. *Anthropological Papers of the American Museum of Natural History* 13(3): 217-546.

STEINBRING, J. 1964a. Recent studies among the Northern Ojibwa. *Manitoba Archaeological Newsletter* 1(4): 9-12.

STEINBRING, J. 1964b. Saulteaux personality, alcohol and nativistic revival. *Mandala* (United College, Literary Publication), pp. 8-11, Winnipeg.

STEINBRING, J. 1965. Culture change among the Northern Ojibwa. *Transactions of the Historical and Scientific Society of Manitoba*, Series III(21): 13-25.

STEINBRING, J. 1966. The manufacture and use of bone defleshing tools. *American Antiquity* 31(4): 575-81.

STEINBRING, J. 1967a. Water-level studies of Ojibwa bands. *Report on the inter-disciplinary study of water resources and water utilization in western Canada*, pp 12-15. University of Manitoba.

STEINBRING, J. 1967b. Ojibwa culture: the modern situation and problems. In *Kenora 1967: resolving conflicts - a cross-cultural approach*, pp. 46-72. University of Manitoba Press, Winnipeg.

STEINBRING, J. 1968. *A bibliography of ethnobotanical usage among cultures of Algonkian type*. University of Winnipeg Press.

STEINBRING, J. 1971. Acculturational phenomena among the Lake

Winnipeg Ojibwa of Canada. *Transactions of the 38th International Congress of Americanists - 1968*, Vol. III, pp. 179-189. Stuttgart, Germany (in English).

STEINBRING, J. 1974. *Preliminary report on the adoption of television by Native communities in the Canadian north*. Canadian Department of Communications, University of Winnipeg Press.

STEINBRING, J. 1975a. Television at the Jackhead (Saulteaux) Reserve 1974-75 (with an addendum on the Fisher River Cree). In *Second report on adoption of television by Native communities in the Canadian north*, by J. Hamer, J. Steinbring, G. Granzberg, E. Monu and E. Dehaney. Part III, pp. 94-113. Canada Department of Indian Affairs, Ottawa.

STEINBRING, J. 1975b. *Second report on the adoption of television by Native communities in the Canadian north: a comparative study* (with J. Hamer, K. Ho, Gary Granzberg, E. Monu and W. deHaney). Canadian Department of Communications, Ottawa.

STEINBRING, J. 1977. New magic for old: T.V. in Cree culture (with G. Granzberg and J. Hamer). *Journal of Communications* 27(4): 154-59.

STEINBRING, J. 1980a. *Alcohol and Native peoples of the north* (with J. Hamer, ed.). University Press of America, Washington, D.C.

STEINBRING, J. 1980b. Television on the Jackhead Indian Reserve: 1969-1980. In G. Granzberg and J. Steinbring (eds), *Television and the Canadian Indian*, pp. 77-182. Canadian Department of Communications, Winnipeg, Manitoba.

STEINBRING, J. 1981. Saulteaux of Lake Winnipeg. In J. Helm (ed.), *The Subarctic*, Vol. 6, *Handbook of North American Indians*, pp. 244-255. Smithsonian Institute, Washington, D.C.

STEINBRING, J. 1982. Shamanistic manipulations and the Algonkian idiom in the archaeoethnology of rock art. *Papers presented at the Seventh and Eighth Annual American Rock Art Research Association Symposia 1980 and 1981*, pp. 212-221. El Toro, California.

STEINBRING, J. 1984. *A review of television impact research in the Canadian Sub-Arctic*. Canadian Commission for U.N.E.S.C.O, Ottawa.

STEINBRING, J. 1985. A search for Cree in the archaeoethnology of the northeastern periphery. In J. Spector and E. Johnson (eds), *Archaeology, ecology and ethnohistory of the prairie-forest border zone of Minnesota and Manitoba*. Reprints in Anthropology, 31: 109-30, Lincoln, Nebraska.

STEINBRING, J. 1990. Post-Archaic rock art in the Western Great Lakes. In G. Gibbon (ed.), *The Woodland Tradition in the Western Great Lakes*, pp. 167-95. University of Minnesota Publications in Anthropology 4, Minneapolis.

TANNER, H. H. 1971. The Chippewa of eastern lower Michigan [1965]. In D. A. Horr (ed.), *Chippewa Indians, V*, pp. 347-377. Garland, New York.

WAINWRIGHT, I. N. M. and T. G. STONE 1990. Experiments to remove wax crayon from petroglyphs in marble. *American Rock Art* 16: 21-33.

WARD, G. K. 1989. The Australian Institute of Aboriginal Studies' Rock Art Protection Program: discussion of the first two years' projects. *Rock Art Research* 6: 126-38.

RAR 14-413

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BRIEF REPORTS

The message stick: an anecdote

MICHAEL PICKERING

A number of rock art studies are characterised by researcher's attempts to ascribe significant meaning to all the motifs encapsulated in an image or object. I offer the following anecdote as a 'cautionary tale'.

In 1990 I was carrying out Ph.D. field research with the Garawa, a language group located in the southern inland region of Australia's Gulf of Carpentaria. One afternoon I was with a party comprising one older man and two women. It was a relaxing afternoon with the two women fishing while the man and I discussed the land-use and settlement activities of past Garawa. During a break after lunch he borrowed my knife, eventually producing a small carved object called a *Dayowurruwurru*, or message stick, an item we had been discussing on and off over several weeks. This object is illustrated in Figure 1. It is 12 centimetres long, 1.5 centimetres in diameter and cylindrical in cross-section. It has several incised lines.

My informant then explained the meaning and use of this item. The message stick was given to a person who was to carry it to its recipients. In addition to delivering the message stick itself, with its text implicit in its inscribed 'symbols', the deliverer was to tell the recipient of the message. The message stick was, therefore, largely a mnemonic device although it also seems to have acted in part as a 'contract' between the sender, the carrier and the recipient.

The example that accompanied the message stick described in Figure 1 is as follows. Two men wish to meet with another two men at a specific location at some time in the future. Two incised lines at one end of the message stick represent the sender and his brother while two incised lines at the other end of the stick represent the recipients. The single pit in the centre represents the location. The deliverer was to tell the recipients of the location and time of the meeting.

This all made perfect sense. I then asked 'what are these marks?', referring to the circumscribing and diagonal symbols. I expected these marks to have a particular set of meanings or to serve as some identifier. My informant looked at me and said, quite straightforwardly, '*Some lines*'.

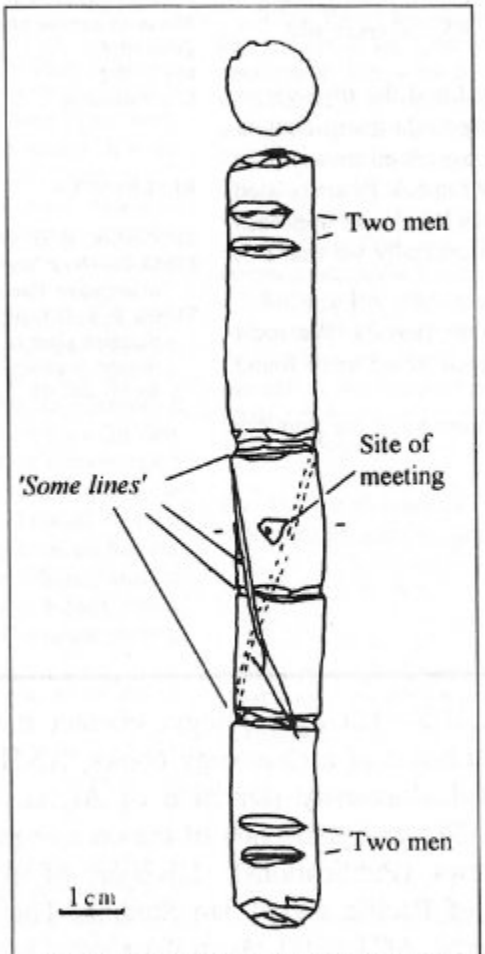

Figure 1. *The message stick described by M. Pickering.*

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RAR 14-414

An unexpected spectacular find

JAN JELÍNEK

Slovenian archaeologists I. Turk, J. Dirjec and B. Kavur recently published a surprising discovery in the 1995 volume of *Razprave SAZU*: a bone flute discovered by the first two of the authors during archaeological excavations in the cave Divje Babe in the Idrijec River valley, western Slovenia (Turk et al. 1995; Bednarik 1996). These excavations were started in 1980, and in 1995 a hollowed cave bear femur bone was found in the fifth Mousterian layer, bearing two complete and two damaged circular holes of the same size, all fairly evenly spaced (Figure 1 on page 60).

The site's sediment layer No. 2, with a typical Aurignacian flat bone point, is radiocarbon dated to 35 300 ± 700 BP (RIDDL 734), layer 6 is dated 43 400 + 1200/ -1400 BP (RIDDL 735) and layer No. 8 (this is the fifth Mousterian layer) is dated 45 100 + 1500/ - 1800 BP (RIDDL 745; dating analyses by Radio-Isotope Direct Detection Laboratory, Simon Frazer University, Barnaby, Canada). The find is also dated archaeologically (through Mousterian stone tools and a fireplace) and

biostratigraphically (90% of animal bones are of cave bear). The circular holes have their circumference finely trimmed as if someone had tried to enlarge originally smaller holes. They are slightly less than 10 millimetres in diameter.

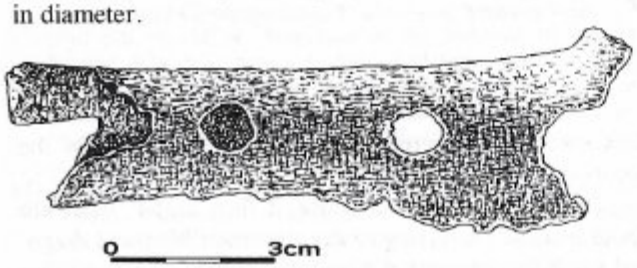

Figure 1. *The perforated cave bear bone from Divje Babe, Slovenia, Mousterian, c. 45 000 years old.*

The find is no doubt well dated and the discoverers will face a spirited reaction relating to its interpretation. Even today one can find the idea expressed in scientific papers that Neanderthals could not speak in articulated language (Lieberman and Crelin 1971). If we approach the unexpected find from Slovenia critically we find two possible interpretations:

1. The holes are traces of carnivore canines. We must add that no other traces of animal biting were found at the site.
2. The holes were produced by a human and the find is a flute.

In the second case we remember that the earliest flutes known so far are of Aurignacian, i.e. Upper Palaeolithic origin: from Isturitz, Istállóskö and Pair-non-Pair. They appear just after the end of the Middle Palaeolithic period. How they were introduced and what their origin was remains an open question. According to our contemporary knowledge we are mostly not prepared for such a spectacular discovery. Let us wait for results of a detailed study, and when considering the whole situation let us try not to be influenced by traditional Eurocentric view that only *Homo sapiens sapiens* was responsible for the origin of our culture.

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REFERENCES

BEDNARIK, R. G. 1996. A Mousterian flute? *The Artefact* 19: 105-6.
LIEBERMAN, P. and E. S. CRELIN 1984. *The biology and evolution of language*. Harvard University Press, Cambridge.
TURK, T, J. DIRJEC and B. KAVUR 1995. Ali so v Sloveniji nasli najstarse glasbilo v Evropi? (The oldest musical instrument in Europe discovered in Slovenia?) *Razprave IV Razreda SAZU* 36(12): 287-93.

RAR 14-415

REVIEWS & ABSTRACTS

La conservation des grottes ornées, edited by JAQUES BRUNET and JEAN VOUVÉ. 1996. CNRS Éditions, Paris. 263 pages, 200 figures (line drawings, half tone and colour photos). Softcover, ISBN 2-271-05286-6.

This French language volume is a comprehensive up-to-date text on the conservation of rock art by the two foremost researchers in this field in France, with contributions by other French scholars and practitioners in the fields of archaeology, monuments conservation and art restoration.

The focus of the book is on problems relating to art in the limestone caves and shelters of France, and most case studies refer to these sites, though with occasional reference to conditions in other parts of the world, including Australia. It is the first synthesis in this field in French, and it constitutes both a valuable introductory text to the subject of cave and shelter art conservation as well as a reference to the important contribution of French researchers to the wider field of rock art conservation in general.

The book is organised in three parts. The first has three short chapters that outline the nature and relevance of cave art, and basic issues relating to its protection and conservation, including a relevant extract of the 1964 Venice Charter. It includes a valuable chapter by Menu and Walter on the sampling and identification of paints in which they demonstrate a relatively complex technology of paint manufacture, with mineral pigments and extenders for the economical use of pigment, and in some cases the use of animal and vegetable oil binders. They conclude that Palaeolithic artists were able to manufacture paints of different viscosities, textures and hues which, together with a range of painting techniques, enabled them to create a wide range of visual effects.

Part 2 consists of more technical chapters in which Brunet, Vouvé and Malaurent present the principles that underlie the problems of rock art deterioration and conservation. A chapter on the nature of the rock support emphasises properties of porosity, permeability and the impact of climate on rock stability. Vouvé and Malaurent's chapter on climate is detailed and exhaustive, with considerations of hydrology in relation to climate and topography; the thermal regime and air flow in caves in relation to surface temperature variation and its relevance to cave humidity, condensation and rock surface stability. An interesting observation made in passing is the suggestion that the Lascaux artists may have been aware of the different stability of rock surfaces, since in unstable, well ventilated passages, details of paintings are emphasised by engraving, whereas this was not done on more stable surfaces where the paint has been better preserved. A third chapter examines the conditions of calcrete formation with particular emphasis on the role of carbon dioxide, and on the impact that surface developments such as agriculture etc. can have on this gas in caves.

Part 3 focuses on methods for the detection of deterioration processes and the development of strategies for management and conservation, with emphasis on actual case studies, mainly in France. The section discusses remote sensing methods, including resistivity and seismic measurement used in conjunction to identify unknown cavities and subsurface zones subject to high water penetration; methods for the stabilisation of cave microclimates, particularly carbon dioxide concentration which can increase dramatically with visitation; and a substantial chapter on natural and anthropogenic sources of deterioration and their treatment, focusing on the actual cave walls. Final chapters briefly explore non-intrusive recording, mainly photogrammetry and the computerisation of images, and ethical problems of heavy visitation in restricted enclosed spaces — concluding with a futuristic imagining of a bus load of tourists, each harnessed in the headpiece and handles of a virtual reality system sharing a trip through a virtual cave ... .

While Part 1 seems easily accessible to the non-specialist, Parts 2 and 3 are written for the interested archaeologist or conservator with some background (or willingness to acquire some) in basic chemistry, geology and hydrology. Both colour and half tone photographs are clear and pertinent, but the many line drawings are of varying drafting quality and (for the non-specialist reader at least) would be enhanced by clearer explanatory captions. There is a short glossary of technical terms used, and the Table of Contents is at the back of the book, as is common practice in French publications.

An appendix refers readers to the Internet site for conservation issues of the French Ministry of Culture which includes data on rock art conservation on http://www.culture.fr/, while the site of the Centre National de la Prehistoire http://dufy.aquarel.fr:8001/cnp.html contains their data base relating to Palaeolithic caves.

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RAR 14-416

Rock art of Kentucky, by FRED E. COY, Jr., THOMAS C. FULLER, LARRY G. MEADOWS and JAMES L. SWAUGER. 1997. The University Press of Kentucky, Lexington, KY. 192 pages, 173 illustrations (drawings and monochrome plates), glossary, bibliography, index. Cloth bound, US$34.95, ISBN 0-8131-1986-3.

This book is the first comprehensive register of the known rock art of the state of Kentucky. Nearly all are of petroglyphs, rock paintings having been found so far at only two localities in this state. Sixty securely identified pre-Historic petroglyph sites are listed, plus another ten sites of Euro-American origin. The numerous half tones provide a representative picture of this corpus: tracks of humans and other animals are frequent, anthropomorphs and zoomorphs somewhat less so. Geometric designs, especially where they are complex, are often quite unique.

Of particular interest, at least from an Australian point of view, are the very frequent design elements and whole panels that could easily have been recorded at an Antipodean site of the archaic linear petroglyph genre, once called the 'Panaramitee style' there. Sites such as Dismal Rock, Big Gimlet, Sparks Indian Rock House, Crow Hollow and Old Landing offer typical examples. The panels of Amburgy Hollow have an uncanny resemblance to Early Man Shelter in north Queensland, the frequent human tracks are like those of the Olary

district. There is also the distinctive ambiguity about 'bird tracks' (might they be chicken tracks, being in Kentucky?), with some specimens resembling series of aligned bird tracks (at Big Sinking Creek Turtle Rock and Brushy Ridge, for example). These seem to form one end of a continuous 'stylistic' spectrum, at the other end of which we find distinctive convergent lines motifs which most certainly bear no resemblance whatsoever to avian tracks of any sort (such as Nada Tunnel 1).

There are, however, also very unique images, and a considerable time range seems to be represented in this corpus. This is amply clear from the many fine photographs, and there can be no doubt that the petroglyphs at Mantle Rock were made with some metal implement of elongate edge. The majority of the petroglyphs seem to occur on sandstone, and the rapid weathering of this rock is well illustrated by an engraved date of 1717 (Fig. 172), which occurs together with several apparently older 'bird tracks'. The authors do address chronology very briefly, stating that the petroglyphs of Kentucky begin with the last millennium B.C. and end with the Historic Period. However, proper dating analysis has not been attempted there or in any nearby state, and the art is best regarded as generally undated.

One message comes through loud and clear from this useful book: the data listed were collected over a period of thirty-three years, and during this time, deterioration of many of the sites has been observed. The book even includes descriptions of nine sites that have been recorded in past years but were since destroyed.

Some of the plates in this book are of historical interest. Figure 1, for instance, shows Dr Klaus Wellmann and his wife Margot in a rockshelter, photographed in 1979. The unpretentious volume is well produced and its contents are well organised. It should serve as a model of how to present the results of comprehensive regional surveys in a format facilitating further research, and of how to present a record of truly permanent value.

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RAR 14-417

Les chamanes de la préhistoire. Transe et magie dans les grottes ornées, by J. CLOTTES and D. LEWIS-WILLIAMS. 1996. Le Seuil, Paris. 119 pages, 114 illustrations, F249.00. ISBN 2-02-028902-4.

Membrane and numb brain: a close look at a recent claim for shamanism in Palaeolithic art

'*Puisque ces mystères nous dépassent, feignons d'en être les organisateurs*'. Jean Cocteau. ['Since these mysteries are beyond us, let's pretend to be their organisers'].

Introduction

Shamanism has been in increasing vogue as an explanation for much pre-Historic rock art during the past couple of decades, thanks to influential papers and books by a handful of specialists. Among the bodies of art to which the hypothesis has been applied is that of the last Ice Age in Europe. This is no innovation. During much of this century, shamanism in some shape or form has been presented as an explanation of selected images in Palaeolithic cave art, by authors as diverse as Joseph Campbell, Andreas Lommel and Karl Narr (e.g. see Lommel 1967; Narr 1983). Many early scholars interpreted the very few therianthropic figures as sorcerers in masks or shamans, basing themselves simply on similarities to ethnographic depictions and accounts. The theory has also persisted in connection with particular images: for example the famous Lascaux shaft 'scene' of the four-fingered bird-headed ithyphallic man with the apparently disembowelled bison and the 'bird-on-a-stick' has often been interpreted, quite subjectively, as a typical shamanistic séance, depicting the shaman, his spirit helper and a sacrificial animal; or as a shamanistic fight, a psychic conflict between two shamans (one in animal form), or between a shaman and a malevolent spirit (Kirchner 1952; Davenport and Jochim 1988). Similarly, the enigmatic 'unicorn' figure in Lascaux, sometimes interpreted as men in a skin, has also been seen as a shaman driving the little horses before him.

Cultures with shamans usually have a zoomorphic view of the world, and things are seen and experienced in animal form. Hence, from this perspective, Palaeolithic images would be 'spirit animals', not copies of the real thing. In a theory of this kind, based on Siberian ethnography, Glory (1968) suggested that many of the figures in Palaeolithic art were 'ongones', spirits which took the form of 'zoomorphs', 'anthropomorphs' and 'polymorphs', and which were asked to help in hunting, matters of health, and so on. In his view, the lines emanating from animals' mouths would be an evil 'illness spirit' being exorcised, while damaged images will have been broken in anger when prayers were not answered.

A closely related view, based on concepts widely held among modern hunting peoples, concerns the 'master-of-animals', usually a dead shaman; this humanoid or composite figure represents a third force mediating between living shamans and animals, and which constitutes the life-force of an animal or which can impart life-force to it. The living shamans derive their own life-force from the animals and then use it in the service of their clients (Smith 1992). According to this scenario, the artists were shamans maintaining links with the animals (with which they closely identified) through the master-of-animals; the power derived from the art came through the act of drawing, not from subsequent viewing. The lines at the mouths and nostrils of animal depictions represented the entrance or exit of life-forces.

Obviously, the shamanistic explanations, like the similar ones based on totemism in other cultures, involve ethnographic parallels; but from what we know about Upper Palaeolithic culture and life (particularly the Magdalenian), it seems quite likely that beliefs of this kind existed and thus played a role in the production of some Palaeolithic art, and that is why I found Smith's speculations, based on what appear to be extremely widespread beliefs among hunter-gatherers, to be interesting and worthwhile (Bahn 1992). However, they will always remain no more than speculations.

The background of the latest manifestation

Problems arise, however, when theories of this kind are presented not as interesting speculations but as being solidly founded and virtually proven. This is the case with the latest attempt to apply such notions to the Ice Age, the book being reviewed here. This book's approach is based entirely on claims about southern African rock art, involving hallucinations, trances and 'phosphene forms'. Two of its chapters (Nos 2 and 3) are excellent, straightforward, factual accounts of the phenomenon of Palaeolithic cave art and the history of its

interpretation, and one can only applaud the conclusion (p. 59) that parietal art simply cannot be subject to a single explanation. The problems — and they are many, profound and varied — lie in the other three chapters.

In the first, the groundwork is laid with a presentation of Lewis-Williams' highly idiosyncratic view of shamanism, entoptics, and their fundamental role in the rock art of southern Africa. Leaving aside the amusing fact that 'eland' has been translated throughout as '*élan*' (elk), this chapter contains an encapsulation of all the speculations, assumptions, assertions and exaggerations that constitute a view of southern African rock art which is attracting ever-increasing criticism as perhaps more objective and balanced opinions, together with testimony from genuine southern Bushman descendants, are brought to bear on this art corpus (see summary of a huge literature on this in Bahn 1997).

In this chapter, all the usual material is brought in — Bushman ethnography, the three stages of trance, vision quests in America, hallucinogenic drugs, altered states of consciousness and so forth. Unfortunately, there are crucial problems with much of this material.

For example, 'altered states of consciousness' — associated with shamanic trance — have come to be seen by a handful of researchers in South Africa and the USA as the origin of virtually all rock art motifs, in numerous periods and cultures. Ethnographic accounts and neuropsychological studies suggest that as shamans enter trance, they experience 'entoptics' (more accurately, phosphene forms) — visual phenomena that include zigzags, chevrons, dots, grids, vortexes etc. This is therefore seen as the explanation for such motifs being present in rock art (although curiously, in the Drakensberg, the richest area of San rock art and heartland of this theory, these motifs are conspicuous by their absence). It is argued that people entering trance or an altered state of consciousness go through three stages. In the first stage they see 'entoptics'. In the second they elaborate these geometric images into objects with which they are familiar, and in the third stage they hallucinate the forms that are most commonly depicted in their rock art.

Since 'phosphene forms' are subconscious images, geometric shapes which seem to be present in the neural system and visual cortex of all human beings, some of the earliest art may indeed be an externalisation of these images (Bednarik 1990). This would explain the similarity between early finger tracings in Europe and Australia — they sprang from a common neural circuitry (see Bahn and Vertut 1997). Moreover, it can certainly be argued that many simple Palaeolithic 'signs' are shapes of this type, although any collection of non-figurative art is likely to include lots of marks which resemble entoptic phenomena, simply because there are very few basic shapes which one can draw, whatever the motivation or source — dots, lines, squiggles and basic geometric forms.

However, there are many problems with this 'entoptic approach' to pre-Historic art. First, a zigzag motif could easily be inspired by lightning, just as circles can be inspired by ripples in water. And it is interesting to note that 'entoptic' motifs are particularly prevalent in art produced by children, and that zigzag patterns, which are difficult to learn, are frequently repeated with enthusiasm by children once they have stumbled on them (Coss 1968: 282). Second, it does not require a shamanic trance to see entoptics — one can just as easily experience them through migraine or pressing on the eyeball, while altered states of consciousness can be induced through prolonged isolation, extreme boredom, nocturnal hallucinations, fervent praying, daydreaming, drowsiness, sleep deprivation and numerous other circumstances — even excessive masturbation (Ludwig 1966: 73)! In fact hallucinogen- or trance-induced phosphenes account for a tiny fraction of such experiences. Hallucinations by older people with failing eyesight are very common and have been well documented since the 18th century. Even more pertinent to the topic of pre-Historic art is that artists are often said to be in an 'artistic trance of creating', in another reality very much like a drug-induced state — for a profoundly creative mind, drugs are unnecessary to have a hyper-reality experience or the feeling of an out-of-body experience. Trance is merely a biological ability at which some people excel — it is a state of focused awareness, when one feels de-focused from the outside world and often experiences a sense of falling, flying or whirling.

Different specialists disagree about how many of the 'entoptic' images derive from the wiring of the human nervous system rather than conscious recalls from things seen in trance. In any case, to seek the source of imagery only in altered states of consciousness and in universal neurophysiology has not produced a cross-cultural 'skeleton key' that unlocks the secrets of pre-Historic art. This is no short-cut to a universal model. In fact, it reveals no more than that the artists were human beings. It may pinpoint the ultimate source of the imagery, but tells one absolutely nothing of its meaning — even if one could be sure the imagery resulted from an altered state of consciousness, one would not know of what kind or in what context.

In South Africa, a large number of cumulative assumptions have been made in order to link ethnographic evidence with rock art, and to link both of them with shamans and trance. It has been declared that, like the art, ethnographic testimony cannot be taken at face value (except where it fits the hypothesis), and needs to be analysed and interpreted. It is claimed, somewhat patronisingly, that most informants were not capable of articulating — or perhaps did not even know — the deeper meanings of their beliefs, but some modern researchers feel themselves to be fully capable of retrieving the metaphors and hidden meanings in this stunted testimony.

Nobody denies that the San/Bushmen sometimes went into trance, usually brought on by prolonged rhythmic dancing, but this was by no means restricted to medicine men; and besides, ritual and dancing among hunter-gatherers do not necessarily involve a trance state. A few paintings may indeed depict people in this state, though most are open to different interpretations; rain-making and transformations may certainly be depicted in some figures. But who painted them?

There is no 19th-century ethnographic evidence of the medicine men or 'rain doctors' being the artists, nor of the artists being in a state of trance before or during the making of pictures. Orpen (see Bahn 1997) obtained many stories from southern San folklore, but no information on the sex, age, or status of the artists. Bleek and Lloyd did not question their informants about the identity or motives of the artists, and make absolutely no mention of trance. They mention 'sorcerers' who, it was believed, could make rain, transform people into animals, and vice versa, perform healing, and so on, but there is nothing whatsoever to indicate that they were more likely to have been painters than were other people. None of the few ethnographic accounts of southern San artists at work refers to them as medicine men or being in any other than a normal state of consciousness. And even if one accepts fully the possibility that the creators of some of the art may have been influenced by hallucinations, that does not prove in any way that they were medicine men — unless one calls everyone who experiences an altered state of consciousness a shaman, in which case we are all shamans, and the word loses all meaning, becoming synonymous with 'human being'!

Yet the proponents of the theory that 'Southern African rock art is *entirely* shamanistic' (Dowson 1996: 469, his

emphasis) base their shaky edifice on this evidence, declaring that medicine men were indeed the painters or engravers, and, using a carefully selected portion of the ethnographic and artistic record, involving a tiny fraction of the hundreds of thousands of figures in the rock art, they insist that none of the art simply reflected daily life or even illustrated myths. Their case relies very heavily on tortuous interpretation of ethnography (much of it derived from the modern Kalahari San who have no knowledge of any painting tradition and who are far removed in space and time from the Drakensberg paintings), and on a reading of the figures in the art as being metaphors of trance. Their inverted pyramid rises ever higher, since, having taken it as read that all the art is shamanistic, they can speculate to their hearts' content about how the making of the art may have been associated with control within social groups, and with hierarchies of power (see below). The edifice has risen so high that many have lost sight of its tiny and very wobbly foundation.

Moreover, even the perfectly reasonable point that the images probably relate to the rock face as much as to each other has been taken to extremes, through the bald assumption that all the rock faces were seen as interfaces between the world of daily life and the spiritual realm, so that any image placed on that interface necessarily had something, no matter how tenuous, to do with beliefs about relationships between the two worlds and with the activities of the shamans who mediated between them. Once again, such absolute, blanket explanations leave no place for discussion. They cannot be tested or falsified, and tentative suggestions that maybe some images might have been placed on a rock which was not seen as an interface but which was simply a handy surface for the purpose, tend to be dismissed as naive, simplistic or outmoded. In any case, such divisions between a real world and the spirit world scarcely existed in Bushman life, and so the supposed boundary is simply a construct of Western scholarship. The basic problem appears to be that, in a wholly laudable effort to escape traditional views of the art of indigenous people as worthless, childlike or 'primitive', the pendulum has been swung to the other, romanticised extreme, where every single mark they made has to be deeply spiritual and complex; in either case, their humanity is diminished.

In short, the material used by Clottes and Lewis-Williams in this opening chapter is of very limited use in any postulation that Palaeolithic art was shamanistic, and in fact we are simply left with the basic supposition that Palaeolithic society, being based on hunting and gathering, probably had religions that were in some way shamanistic (but see Leroi-Gourhan 1977).

Moving into the caves

In Chapter 4, an attempt is made to apply this edifice to Palaeolithic cave art in some detail, and it is therefore necessary to take a close look at the reasoning involved. First it is postulated that hallucinations and altered states must have existed in the period (which, of course, proves nothing more than that these people were human). Second, emphasis is placed on the 'ubiquity' of shamanism among hunter-gatherers (an exaggeration, but no matter). It is then suddenly asserted that caves were spaces in the underworld in which different rituals were performed, some of which involved the making of images, and a few caves are mentioned where bits of bone and other objects have been found stuck into fissures or placed in niches, or where walls and clay have been marked. Inevitably, all of this is assumed to have some ritual purpose, which is probably fair enough (albeit far from certain).

However, this somehow leads to the claim (p. 85) that 'in some instances, it seems as if people were trying to penetrate the surfaces, to reach through the walls' — yet there is not the slightest evidence for this — and that the 'best explanation' for this derives from the tiered shamanic cosmos. Suddenly, then, caves are not merely the underworld, but their walls, ceilings and floors are 'little more than a thin membrane between themselves and the creatures and happenings of the underworld'. Another major assumption has been made, and this 'membrane idea' becomes a springboard for a whole series of speculations about how the walls influenced the artists.

It has long been recognised, for example, that Palaeolithic artists frequently incorporated natural rock- and stalagmite-shapes into animal figures. But the authors, having mentioned a few examples, home in on a handful of faces or heads seen from the front, and assert that they are looking out of the rock wall, 'the rest of the bodies being concealed behind the surface of the rock...these images seem to come from behind the walls' (p. 91). Once again, this is pure speculation, as is the suggestion that the right-hand spotted horse of Pech-Merle is perhaps a 'spirit-horse' (echoes of the Glory theory here, see above) and the belief that those images whose visibility changes with the direction of the light-source 'point to a complex interaction between person and spirit, artist and image, rock and spirit-animal'.

The next leap of faith is even more extreme. Having mentioned the basic facts that many Palaeolithic images seem to 'float' on the rock surface (i.e. no ground-lines are drawn), that no natural surroundings are shown, that there was no regard for relative size, and that the animal species are often unrelated to one another, they blithely assert that 'these four features are characteristic of the projected hallucinations of the third stage of altered consciousness' (p. 92). No matter how exact their anatomical details and postures, 'they are more like visions that were sought in a subterranean spirit realm for their supernatural potency and the help that they could give to shamans'!! Once again, this is pure supposition, but they go on to speak of images being 'conjured out of the rock face', by which the 'artists' (note the new inverted commas) were recreating or 're-dreaming their visions and fixing them on the membrane through which they had materialised. A richly painted cave therefore did not simply contain a number of pictures of animals: it contained many visions made manifest and fixed by painted and engraved lines'. Thus the membrane, originally a bald assertion, has now become a definite.

But they immediately move on to the next supposition:

> sometimes this fixing may have been done during an altered state of consciousness as vision questers reached out to touch the images floating on the walls before them. At other times the fixing may have been done after the altered state had passed; the questers then used painted and engraved lines to bring back and to re-create their visions. Like the Siberian Samoyed shaman described in Chapter One, they may have returned to the cave when they wished to shamanise [*sic*]: there, in the darkness, they recreated their hallucinatory experience.

This is sheer fantasy — yet, ironically, in the first chapter, it has been stressed (p. 19) that 'we are careful to avoid projecting the present uncritically onto the past and so making it seem as if Upper Palaeolithic people were exact replicas of Siberian, American or South African shamans — or, worse, twentieth-century neuropsychologists.'

It is admitted that not all the cave figures can be explained this way, since some large ones were clearly co-operative efforts; but in the next chapter this problem is solved by claiming (p. 110) that the communally produced images were done to prepare the minds of those entering caves in quest of visions!

The authors then tackle the 'signs' and simply assert (p. 93), with no justification whatsoever, that they are 'more probably' fixed, stage-one geometric visions, and that both they and the realistic animal images 'originated in visions'!! Not the least amusing aspect of this is that, fully realising that some 'signs' such as claviforms and tectiforms cannot be explained away as geometric mental percepts, they declare that this is a strength rather than a weakness in the argument 'because it renders invalid the potential criticism that virtually any mark can be interpreted as having been derived from a geometric mental percept.' In other words, this theory simply cannot lose. If it explains all the images, it wins; if it doesn't, it still wins! As Sauvet (1989) aptly wrote of an earlier manifestation of the theory, 'Their hypothesis can explain one thing and its contrary as well. It seems that the model is so adaptable that it cannot be invalidated.'

The authors' attention now turns, inevitably, to therianthropes, one of the key features of Lewis-Williams' South African work, even though they are almost as rare there as they are in Palaeolithic art. In Amis Gorge, Namibia, for instance, only 11 figures out of thousands — 0.2% — are therianthropes. These mixtures of human and animal features are open to a large number of interpretations — for example it is known that some San Bushmen wore animal masks, and these are unambiguously depicted on some figures. When a celebrated informant, an old woman known as M whose father was the last known southern Bushman artist, was shown reproductions of therianthropes in recent years, she said they were hunting disguises, or decorative headdresses worn by medicine men at dances. Other researchers point to the existence of such creatures in mythologies and religions across the globe, and therefore see them as ancestral spirits with the behavioural and visual attributes of animals. They are clearly a mixture of the 'real' and the 'non-real' — in southern Africa a figure with an antelope head and hooves will nevertheless be dressed in a 'real' manner and carry 'real' artefacts. The antelope men have traditionally been interpreted as spirits of the dead or supernaturals of some kind. San folklore repeatedly and frequently mentions gods, spirits, and other mythical creatures, such as in the legend that in the beginning all animals were people.

Yet to Lewis-Williams and his disciples, all such figures are inevitably shamanistic, and so, in cave art, it is decreed that the half-human, half-animal beings, 'though comparatively rare, were clearly highly significant' — this assertion seems to be based entirely on the single example of the Trois Frères 'sorcerer' which is placed above the 'sanctuary', and of course the superficial similarity of this figure to Witsen's well-known (and probably highly inaccurate) early 18th-century drawing of a Siberian shaman is invoked. To the authors, the 'general shamanic context of the art' (note how this has already become a given) suggests that the therianthropes are images of shamans partially transformed into animals.

Yet, of course, there are perfectly good alternative explanations of these few figures, based on solid ethnography. For example, Kehoe (1996), in an interesting extension of his hypothesis that figures in a couple of caves represent the corralling of animals, has shown that in Blackfoot bison drives a decoy runner, dressed in a bison hide, would lure or drive the bison. Why should one deny that some therianthropes might depict such a scene? Why must they all be shamanic?

The authors then turn to hand stencils and prints, and once again disappear into a world of make-believe and fantasy. For them, it was not the stencil that was important, but the act of covering the hand and adjacent surfaces with paint. 'People were sealing their own or others' hands into the walls, causing them to disappear beneath what was probably a spiritually powerful and ritually prepared substance, rather than a "paint" in our sense of the word' (p. 95). We are back in membrane country here, as the hands 'reached into the spiritual realm behind the rock'; it is even asserted that the paint 'acted as a solvent that dissolved the rock'!! Where on earth do these fanciful notions come from? And just when you think things cannot conceivably become more absurd, they turn to the possibly amputated finger joints (and of course it is by no means certain that they were amputated rather than bent over) and suggest that 'the pain thus caused might possibly have contributed to the induction of an altered state of consciousness' (p. 96)!! Words fail me at this point.

But there is more. Children are mentioned next, and for the authors their footprints are evidence that 'confirms the suggestion that children played a role in Upper Palaeolithic shamanism' — note that Upper Palaeolithic shamanism is by now taken as read, though ironically the numerous prints in the Réseau Clastres used as the main evidence are probably not Palaeolithic at all, although pre-Historic. The perfectly valid notion that the presence of children's prints in the caves suggests that nothing sacred was happening (they omit to mention, for example, the prints in Fontanet which seem to be those of a child chasing a fox or puppy) is brushed aside as an 'unwarranted inference' based on Western ideas. The authors' own, equally unwarranted, inference is that 'the handprints and footprints show that Upper Palaeolithic children were part of the shamanic ritual complex' — they may even have sought visions!

The chapter ends with a summary of the evidence — i.e. the markings of various kinds on the cave's surfaces show that this context was clearly meaningful, and 'it was not simply a useful place in which to make pictures' — yet in fact this may very well be the case for many caves and shelters. It is asserted, with no justification whatsoever, that 'the best explanation is that the caves were believed to be passages leading into the lowest tier of the shamanic cosmos'. One's heart, already aghast and amused, plummets when they close by announcing that in the next chapter 'our interpretation becomes more hypothetical' — is that possible?

Unfortunately, it proves all too possible. By page 101, each cave is already 'a complex ensemble of shamanic ritual areas', and they are presenting an 'idealised sequence of ritual areas' in which every type of Palaeolithic art — from open-air rocks, shelters and caves and even portable art — is shamanic in some way, with the sequence seen as 'evidence for changing social complexity'. It is suggested, on the basis of nothing at all, that sometimes images were only made in the open air, at other times only in caves, and sometimes in both. But in any case, this doesn't matter, because inevitably 'both belong to the same general shamanic belief system' (p. 102). They even suggest that at some exterior sites, where numbers of people might have gathered, 'shamanic vision acquisition may have taken place in the midst of the community'; and whether or not this was so, 'ordinary people supported the shamans at these sites ... the various participants would have experienced a range of mental states. Those who were most intensely seeking visions may have used psychotropic drugs to induce deep trance'. Once again, words fail me. One's brain rapidly becomes numb when faced with such a barrage of unfounded speculation.

As for cave chambers, of course, 'it seems likely that these ... were important staging posts on the shamanic journey through the underworld', and the images made there 'probably told of what lay behind the rock'.

The pyramid of speculation rises ever higher: the people who made the images were 'probably an elite ... who tried to enhance and reinforce their own social positions' while some

chambers may have been the ritual centres of social groups or bands, and 'the elaboration of the chambers may have been part of the negotiation of power relations between neighbouring communities' — this all sounds suspiciously like the simple projection of the view of 20th-century post-processualists into the past. There is absolutely no evidence for such aspects of the Upper Palaeolithic.

They go on to say that 'it seems likely' (i.e. 'what we choose to believe is'!) 'that embellished chambers were vestibules that prepared the minds of vision questers for what they would experience in the solitude of the smaller, deeper areas' — they tried to challenge the religious and political status quo, and worked towards the conformity of visions and hence the consolidation of power. These remarkable fantasies make one wonder if the authors have themselves conjured up these visions out of an altered state of consciousness, like latter-day Edgar Cayces.

The membrane makes another appearance on p. 108, where engraved lines in Lascaux's Cabinet des Félins are suggested to be cuts made into the rocky membrane to allow the escape of supernatural power and animals or to achieve some sort of relationship between the maker and the underworld behind the surface. Immediately afterward, these marks have already become 'important evidence for a type of ritual that entailed intimate interaction between people and the spirit world' — so once again we have leaped from a suggestion to a certainty.

'It seems likely', once again, 'that certain small chambers ... were vision quest locations', where sensory deprivation together with drugs led to hallucinations of spirit-animals, appearing out of the rock, which were then 'swiftly sketched' in an attempt to gain control over them. Yet no examples are given, let alone any evidence for drug-use. It is blithely stated that as the horse and bison became increasingly pervasive in people's thinking, they would be increasingly likely to 'feature in hallucinations', and 'people came to believe in spirit-horses and spirit-bison that inhabited the underworld, itself a neurologically generated concept.'

Finally, even portable art is dragged into the picture, with speculations about the power that different images might have had, albeit all linked to what has gone before, and involving spirit-animals.

The book ends with the modest claim that 'we certainly do not claim to have solved all the problems posed by Upper Palaeolithic art ... there are still many loose ends.'

Conclusion: the dangers of blanket explanations

There is a statement near the end of this final chapter that 'we do not propose another monolithic explanation to all forms of Upper Palaeolithic art for the entire period', yet this is precisely the impression given by this large, glossy and beautifully illustrated book. It is certainly the impression which the book's huge media coverage in France has conveyed. The whole thrust of the text is to apply shamanism, and nothing but shamanism, to Palaeolithic art, even though it is admitted that 'different types of shamanism probably existed side by side during a single period ... and that differences developed between different periods.' What underlies the entire edifice is the conviction that in Ice Age Europe, 'people began to use their shared continuum of altered states of consciousness as a resource.' It is claimed that this dual neuropsychological and ethnographic approach brings the Palaeolithic evidence 'into a coherent flexible pattern.'

A declaration is made, in a single paragraph at the very end of the volume (p. 112), to the effect that 'we wish to state clearly that we do not argue that each and every Upper Palaeolithic image, portable or on the walls of caves, was the product of shamanistic practices and beliefs' — although this is somewhat spoiled by immediately adding that despite the art's diversity it has a long-term unity testifying to 'some sort of common framework'. It is claimed that 'no other explanation presently available fits and explains more hard Upper Palaeolithic evidence.' In other words, shamanism may not cover everything, but it supposedly covers far more than any alternative explanation — which is certainly true if one suspends all critical faculties and allows this barrage of unsupported speculations to be applied to the handful of often highly unrepresentative examples that have been carefully selected from a wide array of sites.

Obviously we have no evidence whatsoever to tie Ice Age art to shamanism except as a simple assumption. And even if one readily accepts the possibility of the existence of shamanism in Palaeolithic societies, this in no way proves how it was tied into the art, and leaves many questions unanswered — whether the shamans were artists, whether they were the only artists, what the pictures meant, how they were used, and what percentage of the art could conceivably be interpreted in this way.

For example, were the Palaeolithic artists all shamans? This seems most unlikely, and it would be a most restricting hypothesis to assume so. In the very well documented context of Australian rock art, for example, the painter was not seen as a person with extraordinary gifts, but simply as someone who painted often and with some skill. The artists played a role in increase ceremonies and in educating the young. It is known from first-hand accounts in the Kimberley that in the late Wandjina period male youths were tested for their artistic abilities in order to identify the most skilled, and these were then subjected to specialised training by the artist elders to continue the tradition. In Arnhem Land there were no special classes of creators or 'consumers' of the art. And although religion was all pervasive in Aboriginal culture, and their imagery has highly complex messages encoded in it, reflecting their belief in the interrelationship of all living things and the shape-changing qualities of the ancestral beings, their art nevertheless contains both religious and secular images. If that is so for the Australians, why on earth should one impose a straitjacket on interpretation of any other body of art? Strict adherence to a single theory is a prophylactic against thought. It limits potential explanations and imposes a bogus, reductionist and utterly hypothetical homogeneity on a vast array of different motifs. It suppresses the consideration of any other motivation such as the human urge to create, and what has been called 'the exercise of the normal, undrugged conscious imagination.'

The simple truth, as shown by Australian rock art, is that pre-Historic artists, like those of more recent times, were people like ourselves, and their art can therefore be expected to reflect every facet of life. To cram even a large amount of Palaeolithic art into a single explanation like shamanism is to impose a spurious uniformity on a vast and diverse phenomenon, and to do a grave injustice to the memory and the humanity of these early artists. Just as Leroi-Gourhan's view of Ice Age art as remaining essentially unchanged for 20 000 years has come under increasing fire recently, with the discovery of the very early and remarkably sophisticated figures in the newly discovered Grotte Chauvet hammering the last nail into its coffin, so it should not be assumed blithely that the alleged evidence for shamanism in South Africa can tell us anything about the ideology of the local pre-Historic populations, which is most unlikely to have remained unchanged for many millennia in what has aptly been described as 'an unchanging San present' — for example, the cultures of the southern Bushmen and Bantu-speakers are known to have overlapped in southern

Africa for almost 2000 years. Instead of a theory that stresses uniformity and continuity in ideology and art, with concepts that were structurally unchanged for thousands if not tens of thousands of years — a scenario that is a priori extremely improbable — it should be realised that the art and whatever symbolism may lie behind it represent what has been called a 'complex and dynamic mosaic of beliefs' shaped and changed by contacts with a variety of different cultures.

Unfortunately, in the excitement at finding a possible key to some of the hitherto enigmatic motifs and features of Palaeolithic art, some researchers have predictably gone to extremes — just like those who misused ethnography in the early part of this century — and have not only made major assumptions about motive, content and meaning, but have also extended the hypothesis to ridiculous lengths, claiming, for example, that some of the 'signs' such as claviforms (and the 'butterfly' signs of Chauvet) are toxic mushrooms or hallucinogenic plants, others are magic drums, and handprints represent direct percussion on the cave-wall (Vieira 1996). And despite the authors' above-mentioned sentence denying that theirs is a monolithic or all-encompassing explanation, this is the message that has gone out loud and clear to the media, and I have already heard it said, on British radio, that 'we now know that all cave art was done under the influence of hallucinogenic drugs'.

The realisation that motifs and motives in Palaeolithic art are not easily recognisable has meant that researchers have found it ever harder to move beyond detailed descriptions and well-meant speculations. What it comes down to, basically, is whether one is content to work with the art as a body of markings that cannot be read, or whether one wants to have stories made up about it! Since proof simply does not apply in attempts to explain the meaning of Palaeolithic art, it has been argued forcefully that the use of ethnographic analogy to achieve a 'best fit hypothesis' — as in the case of shamanism, for example — is a viable and valid enterprise. However, in view of the problems outlined above, it would seem that far more caution and rigour are needed to avoid the abuses of ethnography seen earlier this century, as well as the simplistic wholesale transfer of specific interpretations from one body of evidence to the other in what has been called 'ethnographic snap.' The obsession with trance phenomena will in 20 or 30 years time, like hunting magic or structuralism before it, be seen as just another stage in the history of Palaeolithic art studies, but probably not a decisive one (though certainly a simplistic one, since the basic analogy of trance with shamans is utterly rejected by current scholarship on shamanism — see e.g. Atkinson 1992; Hamayon 1995). In all such cases one is left with a few nuggets of useful and sound interpretation, but the rest becomes so much verbiage, of only historical interest.

The fundamental problem with such attempts at interpretation is that what begin as signposts become marked tracks, then tramlines, and finally circular roundabouts that take us nowhere. Certainly it is healthy for all paths to be explored thoroughly, and each one contributes some new piece of the jigsaw, but it is vital to avoid asserting that the jigsaw only has one piece! It is unhelpful to resort to universalistic concepts of supposed primitive mentality: to simply assert, for instance, that shamanism or sympathetic magic or a fear of the underworld must have existed in the Upper Palaeolithic tells us nothing specific about that culture, and to simply claim the existence of such beliefs does not even test the hypothesis (Layton 1987: 211). This is why Leroi-Gourhan rejected the use of simplistic parallels of this kind. One of the supreme difficulties in using ethnographic parallels, however cautiously it is done, and however many 'ifs' and 'buts' are inserted, is that human cultures are enormously diverse, with an inherent tendency to produce unpredictable variations in behaviour.

In short, there is absolutely no reason to suppose that Palaeolithic people drew pictures for the same reasons as very recent Bushmen — on the contrary, the tens of thousands of years and miles separating them render such a belief ridiculous. We have no idea, and no means of telling, how much change there has been in the cognitive structures of non-literate societies over all these millennia.

The new approach cannot even find support in the work of Max Raphael, who would have been highly critical of it: 'Even if some elements of a repertory of signs and configurations are fixed within the human neural circuitry and released by hallucinogenic drugs and during heightened levels of awareness such as in shamanistic trance phenomena, for him each historical moment had its own ideological meaning within a specific culture' (Chesney 1994: 121). Moreover even if one accepts the possibility that some Ice Age images originated in altered states of consciousness, artists could and doubtless did subsequently duplicate them without ever experiencing such a state themselves. This point was made forcefully by Sauvet (1989: 150) in a critique of an earlier article along these lines by Lewis-Williams and Dowson, and he concluded that 'Unless (the authors) are able to state that the human graphic activity was initiated everywhere and at all times by altered states of consciousness, the application of the hypothesis to Palaeolithic art, in the absence of a specific argument that could be used to discriminate between shamanistic and non-shamanistic art, remains in my opinion a gratuitous exercise.' Amen to that.

Many researchers find it irritating that no interpretation of Ice Age art now meets with widespread agreement, and criticise the growing number of specialists who prefer to concentrate on other aspects of its study and abandon any serious attempt at interpretation as a waste of effort. But, as Robert Layton (ibid.) has said quite rightly, 'looking for specific meanings in Palaeolithic motifs is frustrating and relatively unproductive'. The new volume examined in this paper will not, I believe, find widespread support among specialists. Had the authors limited themselves to an in-depth interpretation of one or two sites, or of a specific motif, in the manner of Kehoe (1996), their work might have resulted in an interesting and thought-provoking study. As it is, however, its three problematic chapters almost constitute a work of fiction. Many researchers prefer to leave the art uninterpreted rather than subject it to such pointless speculation. As Toscanini said of the First Movement of Beethoven's *Eroica*, 'To some it is Napoleon, to some it is Alexander the Great, to some it is philosophical struggle, to me it is Allegro con Brio.'

REFERENCES

ATKINSON, J. M. 1992. Shamanisms today. *Annual Review of Anthropology* 21: 307-30.

BAHN, P. G. 1992. Foreword. In N. W. Smith, *An analysis of Ice Age art*, pp. ix-x. Peter Lang, New York.

BAHN, P. G. 1997. *The Cambridge illustrated history of prehistoric art*. Cambridge University Press, Cambridge.

BAHN, P. G. and J. VERTUT 1997. *Journey through the Ice Age*. Weidenfeld and Nicolson, London.

BEDNARIK, R. G. 1990. On neuropsychology and shamanism in rock art. *Current Anthropology* 31: 77-84.

CHESNEY, S. 1994. Max Raphael (1889-1952): a pioneer of the semiotic approach to Palaeolithic art. *Semiotica* 100(2/4): 109-24.

COSS, R. G. 1968. The ethological command in art. *Leonardo* 1: 273-87.

DAVENPORT, D. and M. A. JOCHIM 1988. The scene in the shaft at Lascaux. *Antiquity* 62: 558-62.

DOWSON, T. A. 1996. Review of 'The hunter's vision' by P. Garlake. *Antiquity* 70: 468-9.

HAMAYON, R. N. 1995. Pour en finir avec la 'transe' et l' 'extase' dans l'étude du chamanisme. *Etudes mongoles et sibériennes* 26: 155-90.

KEHOE, T. F. 1996. The case for an ethnographic approach to understanding the European Paleolithic. In I. Campen, J. Hahn and M. Uerpmann (eds), *Spuren der Jagd — Die Jagd nach Spuren. Festschrift für H. Müller-Beck*, pp. 193-202. Tübinger Monographien zur Urgeschichte 11.

KIRCHNER, H. 1952. Ein archäologischer Beitrag zur Urgeschichte des Schamanismus. *Anthropos* 47: 244-86.

LAYTON, R. 1987. The use of ethnographic parallels in interpreting Upper Palaeolithic rock art. In L. Holy (ed.), *Comparative Anthropology*, pp. 210-39. Blackwell, Oxford.

LEROI-GOURHAN, A. 1977. Le préhistorien et le chamane. *Voyages chamaniques, L'Ethnographie* 74-75(2): 19-25.

LOMMEL, A. 1967. *The world of the early hunters. Medicine-men, shamans and artists*. Evelyn, Adams and Mackay, London.

LUDWIG, A. M. 1966. Altered states of consciousness. In R. Prince (ed.), *Trance and possession states. Proceedings of the Second Annual Conference, R. M. Bucke Memorial Society*, pp. 69-95. Montreal.

NARR, K. J. 1983. Felsbild und Weltbild zu Magie und Schamanismus im jungpaläolithischen Jägertum. In H. P. Duerr (ed.), *Sehnsucht nach dem Ursprung. Zu Mircea Eliade*, pp. 118-36. Syndikat, Frankfurt.

SAUVET, G. 1989. Further comment. *Rock Art Research* 6(2): 149-50.

SMITH, N. W. 1992. *An analysis of Ice Age art. Its psychology and belief system*. Peter Lang, New York.

VIEIRA, A. B. 1996. Mythe et magie dans l'art pariétal: la logique de la caverne. *Trabalhos de Antropologia e Etnologia* 36: 169-91.

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RECENT BOOKS OF INTEREST

Rock art of the Dreamtime. Images of ancient Australia, by JOSEPHINE FLOOD. 1997. Angus and Robertson/HarperCollins. 372 pages, profusely illustrated with line drawings, colour and monochrome plates, maps and diagrams; bibliography, substantial glossary, index. Soft cover, RRP $A35.00, ISBN 0 207 18908 0.

***Lhtdytt bcreccdj fpbb - gtnhjukbas* (*Ancient art of Asia - petroglyphs*)**, edited by V. V. BOBROV, D. G. SAVINOV, O. S. SOVETOVA and E. A. MIKLASHEVICH. 1995. Kemerovkii Gosudarstvennyi Universitet, Kemerovo. 115 pages, with 15 contributions, illustrated, English summaries. Soft cover.

RECENT PAPERS OF INTEREST

The oldest art in the world, by ROBERT G. BEDNARIK. *Espacio, Tiempo y Forma* Serie I, 1994, Volume 7, pp. 75-91.

Traces of cultural continuity in Middle and Upper Palaeolithic material evidence, by ROBERT G. BEDNARIK. *Origini*, 1995, Volume 18, pp. 47-67.

Untertag-Bergbau im Pleistozän, by ROBERT G. BEDNARIK. *Quartär*, 1995, Volume 45/46, pp. 161-175.

Logic in direct dating of rock art, by ROBERT G. BEDNARIK. *Sahara*, 1995, Volume 7, pp. 69-78.

Towards a better understanding of the origins of body decoration, by ROBERT G. BEDNARIK. *Anthropologie* (Brno), 1995, Volume 33, Number 3, pp. 201-211.

On the dating of Chinese rock art, by ROBERT G. BEDNARIK. *Purakala*, 1995, Volume 6, Numbers 1-2, pp. 45-51.

Some ideas concerning the roles of the National Museum of Man, by ROBERT G. BEDNARIK. *Pragdhara*, 1995/96, Volume 6, pp. 261-267.

Further back down under, by PAUL G. BAHN. *Nature*, 1996, Volume 383, pp. 577-578.

A thematic approach to the study of rock art in southern Africa, by H. C. WOODHOUSE. *South African Journal of Ethnology*, 1996, Volume 19, Number 4, pp. 135-143.

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

Mehr über die Datierung von Felsbildern, by ROBERT G. BEDNARIK. *Mitteilungen der Anisa*, 1996, Volume 17, Number 1, pp. 5-16.

Übersicht der Methodik direkter Felskunstdatierung, by ROBERT G. BEDNARIK. *Almogaren*, 1996, Volume 27, pp. 257-284.

The Thuiparta rock engravings at Erowalle, Wallace Rock Hole, James Range, Northern Territory, by ANDRÉE ROSENFELD and WINIFRED MUMFORD. 1996. In S. Ulm, I. Lilley and A. Ross (eds), *Australian archaeology '95. Proceedings of the 1995 Australian Archaeological Association Annual Conference*, pp. 247-255. Tempus 6, Anthropology Museum, University of Queensland.

Pleistocene knotting, by CHARLES WARNER and ROBERT G. BEDNARIK. 1996. In J. C. Turner and P. van de Griend (eds), *History and science of knots*, pp. 3-18. Series on Knots and Everything No. 11, World Scientific Publishing, Singapore.

The cupules on Chief's Rock, Auditorium Cave, Bhimbetka, by ROBERT G. BEDNARIK. *The Artefact*, 1996, Volume 19, pp. 63-72.

Prehistoric rock art around Castleton Farm, Airth, central Scotland, by M. A. M. VAN HOEK. *Forth Naturalist and Historian*, 1996, Volume 19, pp. 103-113.

La calibración computarizada a color en las fotografías de arte rupestre, by ROBERT G. BEDNARIK. *SIARB Boletín*, 1996, Volume 10, pp. 24-27.

Recent developments in Australian rock art research, by ROBERT G. BEDNARIK. *International Newsletter on Rock Art*, 1996, Number 15, pp. 26-29.

ORIENTATION

Minutes of the
1997 AURA MEETING
Melbourne, 18 February 1997

The 1997 annual meeting of the Australian Rock Art Research Association was held in the Hercus Theatre, The University of Melbourne. The meeting commenced at 15.00 p.m. and was attended by twenty-one full members and a few visitors. In the absence of the President of AURA, who had to leave the Symposium early due to travel arrangements, the meeting was chaired by the Secretary, Robert Bednarik. It was the concluding event of the 1997 AURA Inter-Congress Symposium, which had been held at the same venue from 15-18 February 1997.

1. WELCOME

2. MEMBERS PRESENT

The following AURA Members were present: Geoffrey Aslin, Elfriede Bednarik, Robert Bednarik, Ross Brown, Margaret Bullen, Bruce Burnell, Hugh Cairns, John Clegg, Anette-Susan Douglas, Julie Drew, Nevin Ellis, James Evans, Josephine Flood, Nicholas Hall, Marvin Rowe, Pamela Russell, Joan Snyder, Graeme Ward, Charles Warner, Alan Watchman, Dominic White, Meredith Wilson.

3. MINUTES OF THE 1995 MEETING

The minutes of the meeting in Turin (see *RAR* 12: 140) were considered to have been read as published, and it was motioned (J. Clegg), seconded (J. Evans) and approved that they be accepted as an accurate record of the meeting.

4. CORRESPONDENCE

The Secretary reported that over 2000 items of correspondence are received by AURA every year, and provided a brief description.

5. TREASURER'S REPORT

As we have recently become an incorporated association we are obliged, among other things, to produce an annual financial report. Our financial year ends on 30 June, so the full report will be published in the first *AURA Newsletter* after the middle of this calendar year. The AURA publishing fund held the sum of $13 299.23 on 30 June of 1996. The main expenditure since then has been the publication of Volume 9 of our Series of Occasional Publications. The production costs for this were in the order of $6000. The current balance of the publishing fund is $11 184.02, and this includes the surplus produced by the present conference. It was motioned (J. Evans) and seconded (J. Flood) that the interim treasurer's report be accepted.

6. CAIRNS DECLARATION

This was briefly discussed but no action was proposed.

7. THIRD AURA CONGRESS

The location of the 2000 AURA Congress was discussed in some detail. With Adelaide and Alice Springs/Uluru being the favourites, logistics were discussed. The meeting recommended that, even though competition among venues was likely to favour Adelaide, it should be investigated whether an Alice Springs venue could realistically compete. It was also suggested that universities be approached, and that R. G. Kimber be consulted. Concerning timing, July emerged as the strongly preferred alternative, after considering the academic year of the Northern Hemisphere and climatic aspects, especially in northern Australia.

8. GENERAL AND NEW BUSINESS

8.a J. Clegg moved that a statement by G. Ward be read out, seconded J. Drew. Subsequent to reading, J. Clegg motioned that it be gazetted (seconded J. Flood, approved).

8.b It was moved and supported that the Secretary write to N. Cole to convey the meeting's best wishes for a speedy recovery.

8.c The work of the Secretary and the Treasurer in organising the 1997 AURA Inter-Congress Symposium was acknowledged by the meeting.

8.d J. Flood reported that the organisers of the next Australasian Archaeometry Conference, in 2000, are interested in synchronised timing with the Third AURA Congress. Although that event is to be held in New Zealand, both events and their participants would benefit from this. This proposal led to further discussion of the timing of the AURA Congress, which led to the general recommendation that a starting date of 10-12 July 2000 would be the most favoured.

9. AURA HOME PAGE

G. Ward moved that C. Ogleby be thanked for setting up the AURA Home Page, and this was generally approved. He then moved that the Secretary investigate possibilities of setting up a second home page which is to be regularly updated by the Secretary. The meeting instructed the Secretary to take appropriate action.

10. AURA AGM 1998

G. Ward proposed that Canberra should be considered as a preferred venue for this meeting. N. Hall and M. Wilson offered to organise this event. J. Flood suggested that there were suitable field trip destinations near Can-

berra. The meeting recommended that the Hall/Wilson proposal be accepted, thanked the two organisers and directed them to collaborate with the Secretary concerning timing and logistics. Announcements about this meeting should be made during the second half of 1997.

11. ADJOURNMENT

The meeting was adjourned at 17.00 p.m.

R. G. Bednarik
AURA Secretary
RAR 14-419

CROSSING FRONTIERS

IRAC 1998 and '98 IFRAO Meeting 6-12 September 1998

The 1998 International Rock Art Congress will be held on the campus of the Universidade de Trás-os-Montes e Alto Douro (UTAD) at Quinta dos Prados in Vila Real (Trás-os-Montes region of north Portugal). Vila Real is a charming town of 13 000 residents and 6000 students. It lies on both sides of an impressive gorge of a river called the Corgo. In Portugal, Vila Real is known as the city of the '*Brasões*'. A *Brasão* is a coat of arms carved on stone that is placed in the facade of a palace or noble home. The town has many beautiful and well preserved examples.

The surrounding area is part of the renowned port wine region, acclaimed as the oldest denominated wine production area in the world, with vineyards on slopes and in valleys near the Douro river. The palace of Mateus (only a few kilometres from UTAD) is a familiar sight to many wine drinkers throughout the world — it is pictured on the wine label of the famous Mateus Rose! September is the *vindimias* period when grapes are harvested. During this time it usually does not rain, nor is it very hot.

During the congress most students will not be on campus because in September there are exams and hardly any classes. Nevertheless, a good number of students are expected to attend. Following the usual policy of UTAD, students, academics and support staff of the university will have free access to the congress proceedings.

The congress symposia, workshops and lectures will take place in the Geo-Sciences Building, which has several lecture theatres seating up to 400. Facilities will include rooms for a book fair, a computer centre and up to 5000 square metres of exhibition space. UTAD will provide most of the support and bear the burden of many of the expenses involved. This includes the provision of conference halls and other rooms related to the event, printing of circulars and programs, mail, phone, fax, computer and Internet facilities (e.g., www page for the congress, information on-line — papers will be kept on-line for at least three years), publication of congress papers on CD-ROM, free accommodation for 40 to 50 participants in student lodging, and the registration fees will be waived for symposium chairs, congress guests and IFRAO Representatives.

Preliminary program

Five days of academic papers (20 symposia anticipated), five round table sessions, five workshops, poster and other exhibitions, slide and video sessions, computer science centre, book fair, artists' gallery, demonstrations of techniques and display of equipment, site visits during congress, excursions before and after congress, and the Annual Meeting of IFRAO with sessions before and after the congress.

The major subject topics of the academic sessions will be:

A. *World tour:* news of finds and work in progress on six continents.
B. *Science:* methodology, analysis, interdisciplinary and multidisciplinary studies, recording, photography, dating.
C. *Future:* heritage management, conservation, preservation, presentation and education.
D. *Ideas:* religion, symbolism, semiotics, cognitive theory.
E. *Cyber-space:* application and use of communications and information technology (imaging, virtual reality, 3D VR, networking, hardware), managing and presenting data, programming, impact of new developments.

Symposia and workshops mooted so far include 'Animals in rock art — biotic representations', chaired by Thomas Wyrwoll (IC, Austria); 'Recording and preventive conservation', chaired by Ben K. Swartz, Jr. (ACASPP, U.S.A.); 'Dating and rock art', chaired by Marvin W. Rowe (Texas A&M University, U.S.A.); 'Rock art and education', chaired by Dario Seglie (CeSMAP, Italy); 'Rock art and geology', chaired by Carlos Coelho Pires and Artur Abreu (UTAD, Portugal); 'Rock art of the Iberian peninsula', chaired by Vitor Oliveira Jorge (University of Porto, Portugal); Management and rock art', chaired by John Clegg (University of Sydney, Australia); 'Aesthetics and rock art' (suggested).

The official languages of the Congress will be English and Portuguese. Presentations in Spanish and French will also be accepted.

Visits and excursions to the following will be free: Geology Museum of UTAD, Archaeology Museum of Vila Real, Sanctuary of Panóias (a pre-Roman monument), Rock of Lamelas (Ribeira de Pena), Rock of Mão do Homem (Vila Real), Nature Park of Alvão.

Pre- and post-congress excursions (not free):

1. Great Tour of Trás-os-Montes — rockshelters of Planalto Mirandês and Serra de Paços, rocks of Assares and Ridevides, the Mazouco horse, rockshelter of Fraga d'Aia, the Côa valley rock art area and archaeological zone of Freixo Numão.
2. Great Tour of Alentejo — Cave of Escoural, the notable menhir and dolmen area of Évora and Reguengos.
3. Douro Valley — Mazouco horse, Côa valley rock art area and archaeological zone of Freixo Numão.
4. Arronches — painted rockshelters of Portalegre and Tagus valley rock art area.

Transport and lodging

The campus is about 20 minutes' walk from the centre of town, public transport and taxis are available. The congress will have a vehicle to help participants get about (maximum of nine persons at a time).

There is modestly priced accommodation near the university campus. Vila Real has several excellent but inexpensive hotels (the best costs about US$40 for a double room) as well as good guest houses. There are also rooms available in various country houses that cost about US$15.

Concerning proposals and further details please contact:

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Other forthcoming events

Second International Congress of Rupestrian Archaeology. 2-5 October 1997, Darfo Boario Terme, Valcamonica, Italy. This event is held by IFRAO member Le Orme dell'Uomo and comprises the following sessions: 'Ethnography and rock art', 'Archaeology and rock art in Europe', Archaeology and rock art in the Alps', Archaeology and rock art in Valcamonica', and 'Rupestrian archaeology: new methods, techniques and terminology'. For registration forms contact the Cooperativa Archeologica 'Le Orme dell'Uomo", Piazzale Donatori di Sangue, 1, I-25040 CERVENO (Bs), Italy.
Tel. ++39-364-433983, Fax. ++39-364-434351.
E-mail: rupestre@10.mb.com
Internet: http://www.10mb.com/ rupestre/

The entangled past. 13-16 November 1997, Calgary, Canada. 30th Annual Chacmool Conference, dealing with integrating history and archaeology. Contact Nancy Saxberg, 1997 Conference Committee, Dept of Archaeology, University of Calgary, 2500 University Drive NW, CALGARY, AB, T2N 1N4, Canada.

Ownership, access, identity. 24-26 November 1997, Sydney, Australia. Contact Karen Perkins, Australian Key Centre for Cultural and Media Policy, Faculty of Humanities, Griffith University, Qld 4111, Australia.

Is human evolution a closed chapter? 1-5 December 1997, Adelaide, South Australia. For details contact Australasian Society on Human Biology, ASHB/5th WACHE, Dept of Anatomy and Histology, University of Adelaide Medical School, ADELAIDE, S.A. 5005, Australia.

Ripon 1999. The IFRAO congress of 1999 will be held at Ripon College, Wisconsin, U.S.A., tentatively 23-30 May of that year. Mid-America, the initiator of this event, expects a very strong participation by indigenous American people, including eleven tribal groups in Wisconsin alone, and many others from various parts of North America. Planning of symposia has commenced, and Professor Jack Steinbring invites proposals: Dept of Anthropology, Ripon College, P.O. Box 248, RIPON, Wisconsin 54971, U.S.A.

AURA 2000. The Third AURA Congress will be held in Australia in mid-2000. Planning has commenced.

Notices

Tracing the past. The Cooperativa Archeologica 'Le Orme dell'Uomo" in northern Italy conducts workshops of rock art research in the Valcamonica this year: 23-28 June and 22-27 September 1997. These courses will involve between five and twelve participants and cost US$600 per person. The cost does not include accommodation. The courses involve lectures, field practice and laboratory activities. Most lessons take place at rock art sites. English, French, Spanish and Italian are spoken. Interested readers are invited to contact the course director, Dr Angelo Fossati, at the address listed above, under 'Forthcoming events'.

Rock art teaching aids required. Tanga tanga, Museo de los Niños (Museum of Children) in Bolivia, would like to receive donations of rock art photographs from all parts of the world as well as postage stamps depicting rock art. Please mail such material to Domingo Izquierdo, Director, Museo de los Niños, Casilla 826, Sucre, Bolivia.

IFRAO Report No. 18

Minutes of the
1997 IFRAO MEETING
Cochabamba, Bolivia

The 1997 IFRAO Meeting was held at the Centro Simón I. Patiño, Cochabamba, on 2 April 1997, as part of the Congreso Internacional de Arte Rupestre held by SIARB. The event was chaired by Roy Querejazu Lewis (President of SIARB).

The following associations were represented by their IFRAO delegates: ARAPE (France), AURA (Australia), CeSMAP (Italy), CIAR-SAA (Argentina), CIARU (Uruguay), ESRARA (USA), SIARB (Bolivia), Sociéte Préh. Ariège (France). The following further member organisations were represented by proxies: ACASPP (USA), AARS (Sahara), ANISA (Austria), AARP (Portugal), Mid-America (USA), MRARS (Macedonia), Orme dell'Uomo (Italy), RASI (India), SARARA (Southern Africa).

The meeting was also attended by the representatives of two prospective member associations, GIPRI of Columbia and a Siberian organisation being established in Kemerovo, who attended as observers. Two further observers were two committee members of SIARB.

The meeting commenced at 8.00 a.m. sharp and closed at the scheduled time, 10.00 a.m., exactly to the minute. All items on the agenda were considered and the meeting was most efficaciously chaired and conducted by SIARB. The following items were considered:

1. Proxies: nine proxies were declared.
2. Confirmation of previous minutes: no minutes had been received prior to the event. Some copies of the Swakopmund minutes were tabled. ARAPE strongly resented the tone and contents of the minutes, deplored the untimely production of the minutes (see Note 1 below), and requested that they be re-written.
3. Matters arising from these minutes: after discussion of the document the meeting decided to reject the Swakopmund minutes, and to regard them as unread.
4. Reports: a series of written reports from members were tabled, others were given verbally. The following reports were provided: Orme dell'Uomo (activities), Mid-America (Ripon congress tentatively in May 1999), CeSMAP, ARAPE (publications, 6000 copies of Unesco brochure), ESRARA (emphasis on indigenous involvement), AURA (became incorporated), SIARB, MRARS.
5. Ongoing business:

5.1 Code of ethics, proposed by SIARB and AURA: to be modelled essentially on SIARB's existing code and relevant parts of the Australian Burra Charter. AURA suggested long and short versions, and flexibility to account for regional differences was discussed. It was decided that a subcommittee of five be formed and be instructed to produce a first draft, and then circulate it for comment. The following delegates were elected to form this sub-committee: Bednarik, Consens, Hedden, Ricchiardi, Strecker.

5.2 Report by IFRAO's Unesco Representative (CeSMAP): no initiatives were reported.

5.3 Strategies for collective international action: Unesco and ICOMOS were first discussed. ARAPE then suggested that the most effective means to gain support are press and Internet. AURA advocated a step-by-step text on dealing in a standardised way with specific local issues. It was emphasised that member organisations have to take initial actions, and the Convener was instructed to then assess whether local possibilities of action have been exhausted, before recommending international action.

5.4 Rock art and education: CeSMAP recommended that the temporary working group formed in Swakopmund be formalised as a permanent committee. AURA requested the inclusion of an Asian and a South American representative on this committee, suggesting Kumar and Strecker, in addition to Bahn, Seglie, Soleilhavoup, Pager and Swartz. The meeting approved this and ratified the permanent status of this committee.

6. New business:

6.1 IFRAO World Wide Web page: IFRAO approved the location of its central Web page at CeSMAP in Pinerolo, Italy, to be administered in collaboration with the Convener.

6.2 Groupe de réflexion sur les méthodes d'étude de l'art pariétal paléolithique: the Groupe has provided a letter stating that the objectives for which it was formed have been met and it has been dissolved.

6.3 Quorum: CeSMAP raised the matter of reducing the quorum at IFRAO meetings, which had been discussed in Swakopmund. The Convener explained the procedure for amending the IFRAO Constitution, and was instructed to conduct a postal ballot to revise the size of the quorum (see Note 2 below).

6.4 1998 meeting: several delegates expressed doubts about the ability of AARP to conduct a large international conference in Portugal. Only vague details were available about this event. (AARP has since produced full details about the conference).

6.5 New members: the Kemerovo group, the Grupo de Investigación de Arte Rupestre Indígena (Columbia) and the Asociación Arqueológica Viguesa (Spain) notified IFRAO of their wish to join the Federation.

6.4 Conservation issues in Portugal: the Côa issue was briefly discussed and one of the reports by Swartz (see following pages) was tabled.

These minutes were compiled by the IFRAO Convener, R. G. Bednarik.

NOTE 1: Jean Clottes, one of the few delegates who read the document, wishes to go on record as strongly resenting the personal attacks contained therein, such as those relating to the Côa issue. He suggests that whenever the action of an IFRAO Representative is criticised, he or she should be advised immediately.

In addition it is to be noted that criticisms of individual IFRAO Representatives should be directed to the respective organisations they represent. Representatives attend IFRAO meetings not as individuals, they represent organisations, and such meetings are not appropriate venues to consider the conduct of individuals. Minutes of such meetings need to reflect this principle, and should not name individuals (except where they are addressed as individuals, e.g. members of committees). In addition, it should be noted that some of the decisions taken in Swakopmund were contrary to the IFRAO Constitution. To avoid such errors at future meetings the Constitution should always be referred to. It should also be noted that IFRAO 'acts as an altruistic focus and cohesive medium for the discipline', its roles do not include the facilitation of endeavours to politicise the discipline.

Subsequent to the IFRAO Meeting in Cochabamba, the current IFRAO President, R. Querejazu Lewis expressed concern about the practice of individuals holding several proxies. He reminds us that the person acting as a proxy, in order to serve the organisation he or she acts for, needs to be fully familiar with the policies and priorities of that organisation. He suggests that in future, proxies will need to be limited to one per delegate.

NOTE 2: The IFRAO President prefers that the quorum at future IFRAO meetings be eighty per cent minimum, unless more than fifty per cent of the total IFRAO membership is represented. A significantly lower quorum would involve the danger that, at a poorly attended meeting, a minority might be capable of making decisions on behalf of the unrepresented majority.

RAR 14-421

An evaluation of rock art conservation practices at Foz Côa, northern Portugal

B. K. SWARTZ, Jr.

The phenomenon of rock art is now of global interest and concern. International organisations now exist that deal with rock art, such as the International Federation of Rock Art Organisations (IFRAO), and the UNESCO-based International Committee on Rock Art (ICOMOS-CAR). It has now become critical that some international consensus be established for a more detailed world-wide convention on proper rock art conservation.

This problem was recently highlighted by the sudden urgent situation caused with the discovery of petroglyphs at Foz Côa, Portugal, that were in imminent danger of destruction by dam backwater inundation. How can resolution of highly vested conflicts be accomplished in a way that allows for the best execution of conservation policy? Portuguese government representatives invited me to Foz Côa to see the area and to consider conservation problems. What I encountered was appalling. This is not to be considered a condemnation of the people of Portugal. In fact they are to be commended for having concerns on conservation. The responsible organisation for managing the Côa archaeological resources has been the Instituto Portugûes do Patrimônio Arquitectónico e Arqueológico (IPPAR). I find that almost anywhere I go, when governments, corporations and even academic colleagues within the discipline become involved with rock art conservation, the results are usually disastrous.

A basic problem with conservation policy is the basic human condition. Humans are primates, that is they must see and touch everything. Their reality is based on sight and touch. If you cannot see it, it does not exist, e.g. foreign sub-molecular particles on engraved rock surfaces. Primates are also curious, they cannot keep their hands off of anything. Also, as lineally-thinking Indo-Europeans we are materialistic. Reality must be concrete; the object itself is important rather than its context. If we follow our instincts we will often unknowingly destroy data. Added to this is the problem of introducing or attracting (often inadvertently) numerous human primates with all these foibles to accessible rock art. The problems are then compounded.

General observations

The fundamental conservation problem at Côa is, of course, obvious — the inundation of the rock art by the reservoir formed by the construction of the dam. Inundation has two effects on the petroglyphs, (1) their rapid destruction and (2) making them inaccessible for appreciation and study. In some ways the existing situation is even less satisfactory, in that intermittent wetting and drying is the worst possible condition for maintaining old rock art surfaces.

During my stay I was amazed to discover a photograph in the March 1995 issue of *Centros Historicos* of an elaborate chalked Côa petroglyph. This is an utter taboo in any long-term rock art management policy. The publication of such an act shows a lack of awareness of basic rock art conservation. Suggestions that have been made of making latex moulds also show this unawareness. A statement by the American Committee to Advance the Study of Petroglyphs and Pictographs (ACASPP) dealing with these matters has been published in various sources and in several languages, including Spanish, French and English. The most widely distributed version is Swartz (1981).

Direct field observations

Evidence of the following practices were observed by the writer in the field:

1. *Excavation at base of panels*. This activity not only disturbs the immediate terrain, but important associated materials may be lost or destroyed, e.g. possible abandoned engraving tools used to make the markings.
2. *Rubbed surfaces*. This activity alters trace element frequencies and removes ageing residues. Indirect

evidence of rubbing is indicated by cleaned surfaces from which recent silt should have adhered from recent inundation. This observation is further corroborated by photographs documenting people touching the panel surfaces.

3. *Rock cutting*. This disfigures the terrain and alters the context of immediate rock configurations.
4. *Widespread disturbance of ground surface*. This also mars the terrain and alters context (disturbance of prior [earlier] natural ground cover).
5. *Labelling of discovered panels with paint*. Two sets of labels were noted, one with yellow paint and another with red. Labels serve as beacons for visitors. Those who manage the area can locate discovered panels from their records and by familiarity with the area. Labelling invites vandalism.
6. *Nearby construction*. These are signs, fences, paths and other construction near and about the petroglyphs. These features can attract unsupervised visitors.
7. *Employment of uniformed guards*. If guards are employed sufficient staff should be maintained to fully monitor the region. Guards should be aware of all human activity in their area of responsibility. If this is not done guards may attract and antagonise high-risk visitors. Guards I encountered felt they had inadequate resources to effectively do their job.

Two unwise social policies noted were (1) the banning of knowledgeable individuals from the area who wished to observe and study the petroglyphs and (2) discouraging the photographing of the panels. Photography is totally non-intrusive. The more something is photographed, the more thoroughly it is documented. Indeed it might be useful to offer guides to locals interested in doing photography.

Recommendations - Nation of Portugal

Conservation recommendations are determined by the policies the managing authority wishes to pursue. 'Conservation' is not comparable to preservation, but is the wise shepherding of natural and cultural resources. The basic Foz Côa management policy alternatives would seem to be:

1. complete construction of the Côa dam inundating the upstream valley where most of the presently known petroglyphs exist;
2. maintaining the status quo, the lower Côa valley being intermittently flooded by the Douro River, or
3. reversion to the condition prior to the Pocinho dam construction.

If a resource itself *cannot be protected* the best conservation policy is 'complete intensive documentation' and long-term archival maintenance of the recovered information, so as to preserve and maintain the database. Complete intensive documentation entails not only traditional means of recording such as textual description and measurements, mapping, photography and sketching, but also newer and more technical approaches that are available and should be employed, such as global positioning, stereophotogrammetry, digital imaging, image capture etc. All recording should be done twice, by two independent teams of two trained individuals each, a recorder and a checker. Recording of the same evidence should be done several times within the daily (and perhaps seasonal) cycles and under varying weather conditions. Conditions of context such as landform configuration, rock/bluff position, ground cover, associated non-rock art archaeological remains should be noted and meticulously recorded. All rock art surfaces to be inundated would be inaccessible and rapidly destroyed by water erosion and, therefore, should undergo complete intensive documentation. Engraved rock surfaces enduring the wetting and drying process caused by intermittent inundation should also undergo complete intensive documentation. This would be the only reasonable conservation procedure to deal with alternatives 1 and 2 management decisions (see above). Such actions as relocation of engraved rocks and protective waterproof-coating of engraved surfaces prior to inundation are not reasonable alternatives. Rock art panels stripped of their contextual setting are much diminished and become, essentially, objects of rock art. Coating or spraying of rock art surfaces alters them and destroys possibilities of trace element analyses. Long-term inundation would still cause extensive general rock deterioration. The proper conservation measure for alternative 3 is obscuring the rock art exposures by natural cover and removing or preventing the introduction of attention-producing features, such as signs, identification labels, paths, fences etc. (see observation 6 above).

Alternative 3 not only offers the only possibility of the preservation of a full-range of rock art for future research, but also interpretation for the public, i.e. the viewing of a full range of unaltered petroglyphs in a natural setting. It is the responsibility of the managers of rock art to make a representational sample accessible to all. The heritage of rock should be available for all humankind. In the case of Foz Côa the general population of the area and the nation has been intimately involved, and a major force in its fate. This is certainly the one case were public interest should be considered. Precedence of policies on public availability to rock art phenomena on a global scale may very well be established by decisions made for Foz Côa. If a viewing area and interpretation centre are established the accessible remains should be initially intensively documented and then be *continuously monitored*. The selection of petroglyphs should be representational, not marginal.

REFERENCE

SWARTZ, B. K. Jr. 1981. Standards for the recording of petroglyphs and pictographs. *Current Anthropology* 22(1): 94-5.

Acknowledgments

Support for travel and field observations of this study, conducted from 26 June to 2 July 1995, was made possible by a grant from the Luso-American Development Foundation. A public lecture on the conclusions of my field work was presented at the Universidade do Porto on 30 June 1995, and at a public conference, Forum do Côa, of

involved officials and scholars, held 1 July 1995 at the University of Lisbon. I was accompanied in the field by Dr Mila Simões de Abreu, Ludwig Jaffe and Dr Paul G. Bahn. Drs Vítor and Susana Oliveira Jorge also co-operated during my stay. It should be stressed that only I am responsible for the conclusions of this investigation.

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[This paper is to be republished in the Turin Congress proceedings.]
RAR 14-422

An investigation of the Portuguese government policies on the management of the Foz Côa sites

B. K. SWARTZ, Jr.
Official IFRAO Consultant, Conservation of Côa Rock Art

On 14 August 1996 an e-mail message was sent to Shirley-Ann Pager, in-coming President of the International Federation of Rock Art Organizations (IFRAO). The print-out of this message, a bill of charges by Ludwig Jaffe on the archaeological activities at Foz Côa by João Zilhão and other archaeologists of the Ministry of Culture of the Portuguese government, was given to this writer. It was agreed that this issue be placed on the agenda of the IFRAO Annual Meeting to be held on 16 August at Swakopmund, Namibia. This message has subsequently been published (Jaffe 1996).

Grave concern of the charges was expressed by the IFRAO Representatives at the meeting, and in partial response to the request by Jaffe that 'an international commission be created' to look into this matter, this writer was designated to be an 'Official IFRAO Consultant for the Conservation of Côa Rock Art'. [It should be noted that in a letter, dated 26 August 1996, Zilhão also suggested that a commission be formed, composed of Paul Bahn, Andrea Arcá, Angelo Fossati and the writer of this report. Arcá and Fossati declined the invitation and Bahn was already willing to let me proceed at the Swakopmund meeting.] The following is the report of my investigations.

Jaffe levels nine specific charges at the Ministry archaeologists. None of the charges are documented by Jaffe, only asserted, and none are specifically denied by Zilhão! This creates a ludicrous situation for an outside investigation. For a comprehensive investigation to be done it is necessary to solicit or subpoena direct face to face testimony in Portugal from the individuals involved. This is beyond my personal means and that of IFRAO. Jaffe's charges 5 and 8 are not pertinent in that the events in question transpired while the resource was being managed the Electricidade de Portugal (EDP), not the Ministry of Culture. This investigator has no further information on the very serious charges 1 and 7 than that made in the statement. Charge 2 is admitted and defended by Zilhão. Fundamentally all the charges listed can be grouped into two basic issues: (1) care of the resource, and (2) accessibility to the resource.

The care of the resource can be further subdivided into two areas: (1) treatment of the surfaces of the rock art panels, and (2) recovery procedures for portable archaeological remains in association with the rock art (or in the district under management by the government), an aspect of charge 6. The following can be inferred from Zilhão's statement in his letter to IFRAO of 26 August 1996:

1. 'Whether lichen should, or should not, be removed from rocks [rock art panels] ... is a matter of scientific debate ... [non-removal] is inadequate and contradictory with the need for adequate study and presentation of the panels to the public'.
2. That Zilhão has, at the minimum, approved the lichen removal: 'I [Zilhão] assume full responsibility for the decision to allow my colleagues doing rock art recording to perform this [lichen] cleaning'.

No mention is made of documentation of lichen growth prior to its removal. If lichen must be removed it is probably best accomplished by killing rather than by mechanical means. There are first-hand eyewitness accounts of the presence of electric generators and the storage of hoses in the area. There are hearsay statements that rock art panel surfaces were washed with pressured water hoses by untrained personnel using chemically treated water. It is now generally accepted worldwide that recording methods requiring direct surface contact are inappropriate (cf. American Committee to Advance the Study of Petroglyphs and Pictographs, Inc. [ACASPP] statement on *Standards for recording of petroglyphs and pictographs*, multiple publication including English, Spanish, French and Italian versions, 1980-). The relation of direct contact procedures with problems of conservation and public interpretation is less clear (see below).

Zilhão refers in his 26 August letter to '... archaeological excavations that we made next to the rock panels.' During the time of EDP management of the Côa valley, in the summer of 1995, I noted extensive disturbance of the soil in rock art areas, especially at the base of various panels (Swartz 1995). I have a first-hand account that this condition still persists under the management of the Ministry. Controlled excavation and careful provenience recording are proper functions of archaeological research. Minimal standards of field excavation, for example those stated by the Society of Professional Archaeologists U.S.A., must be followed if professional field standards are to be maintained. In this dispute no one has mentioned any statement or record of controlled excavation in the area. It is, of course, possible that excavation units have been backfilled, but this is not apparent from observation. I noted no baulks or side walls in abandoned excavation pits.

Zilhão makes it clear in various statements, including his letter of 26 August 1996, that his main concern is the interpretation of the rock art to the public within the Archaeological Park of the Côa valley. The concerns of

public interpretation and conservation of a resource come into conflict. As noted by this investigator (Swartz 1995: 5): 'The heritage of rock art should be available for all humankind. In the case of the Foz Côa the population of the area and the nation has been intimately involved and a major force in its fate.' It is clear the Portuguese people deserved a well-interpreted rock art park. It must also be stressed, however, that the Côa representations may be tens of thousand of years old. If evidence of the past that has survived for a period of time unimaginable to most is snuffed out, the magnitude of such an act or activity must be realised. Therefore it is incumbent on those in positions of responsibility to act as the conservators of the resource. It can never be replaced. Each situation, environmentally and politically, is different and no rules can be universally applied. This investigator believes that considerations of preservation must be paramount in any management policy of rock art. Must visitors be shown every example of rock art in the park? Must the rock art to be viewed be made to look clear or can the original surface suffice? From information I have in hand I am not certain what policy is being followed on these matters by the Ministry archaeologists. These are not easy decisions to make and honourable people can view things differently. From the facts known to me, my view is that the present policy of the Ministry archaeological program pays insufficient attention to the preservation of Côa rock art for posterity.

The second basic issue is access to the resource. As I was personally involved I can attest the validity of charge 9 made by Jaffe (1996). I can also attest to hostility directed at Dr Mila Simões de Abreu (Portugal's IFRAO Representative and independent discoverer and promulgator of the Côa petroglyphs) by local officials in 1995. An event, subsequently labelled 'The Penascosa Incident', transpired on 29 July 1996. In an apparent accidental encounter at the site Abreu requested permission from Helena Moura, an archaeologist employed by Zilhão, to visit 'a site across the river' (Quinta da Barca) which was explicitly denied. There are numerous witnesses to this event (bus travellers, Moura's tour students, a television crew and others). Moura's tour began with the students and television crew entering the fenced off area (of the petroglyph district). Jane Kolber (Chair of the Conservation Committee of the American Rock Art Research Association), a colleague of Abreu, followed the tour. When Kolber was identified Moura requested a guard to escort her from the premises. Another colleague of Abreu, Paul Firnhaber, was informed by Moura 'that she was under orders [to deny permissions]'. This incident has not been denied by the Ministry archaeologists. Zilhão states that the site of Quinta da Barca is still privately owned and the owner has not given the Park authority to provide entry to the public. Zilhão is concerned that Abreu did not communicate to the Park co-ordinator about Kolber's visit. Kolber presented a series of criticisms about Park conservation practices which were released to the general public before Park officials claim they were aware of her presence in Portugal. Kolber states that she made several efforts to contact Zilhão, beginning upon her arrival on 14 August 1996. An article in the newspaper *Expresso*, enumerating Kolber's criticisms, was published on 17 August.

There seems to be a pattern of academic xenophobia in some quarters of the Portuguese government. This investigation has not discovered from whom Moura got 'her orders'. Zilhão has been co-operative with foreign scholars. All persons with a legitimate academic interest in the Côa or any other rock art resource, whether foreign or Portuguese, should have free access to the resource, particularly active researchers who need to refer to and expand their database. Rock art data are unique in that they are not portable, hence physical access is critical. This is an issue of academic freedom. A supportive statement on *Academic freedom and intellectual honesty* in rock art study is presented as an item in the Rock Art Ethical Charter, a solemn declaration of the scholars who met at the International Rock Art Congress NEWS95, Pinerolo, 9 May 1995. There is little precedent on this issue. In the introduction of *Academic freedom, 1940 statement of principles and interpretive comments*, published by the American Association of University Professors it states 'Academic freedom is essential to these purposes [free search for truth and ... free expression] and applies to ... research. Freedom of research is fundamental to the advancement of truth.' In item (a) of the section Academic Freedom in the same document it states 'The teacher [defined by footnote as an investigator who is attached to an academic institution] is entitled to full freedom in research and in the publication of the results ...'.

Recommendations

On the basis of this inquiry I propose two recommendations for approval by IFRAO, to be forwarded to UNESCO:

1. In the management of rock art resources, *primary* consideration must be given to the preservation of the resource for future study and appreciation.
2. Rock art manifestations provide information for databases and such resources on public lands must be made available for study and research by all interested and qualified scholars.

This investigator believes that the most effective way to establish the proper procedures for shepherding rock art resources is to establish a body of precedent derived from the study of rock art phenomena throughout the world, not by arbitrarily issuing dicta and formal regulation. I hope this investigation contributes to such an end.

REFERENCES

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

SWARTZ, B. K., Jr. 1995. Unpublished report to the Luso-American Development Foundation.

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. Underline words to be italicised and identify each page by number and author's surname. The preferred method of submission is on an IBM compatible computer diskette, written either in MS Word or saved as an ASCII or RTF file, together with two 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.

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.

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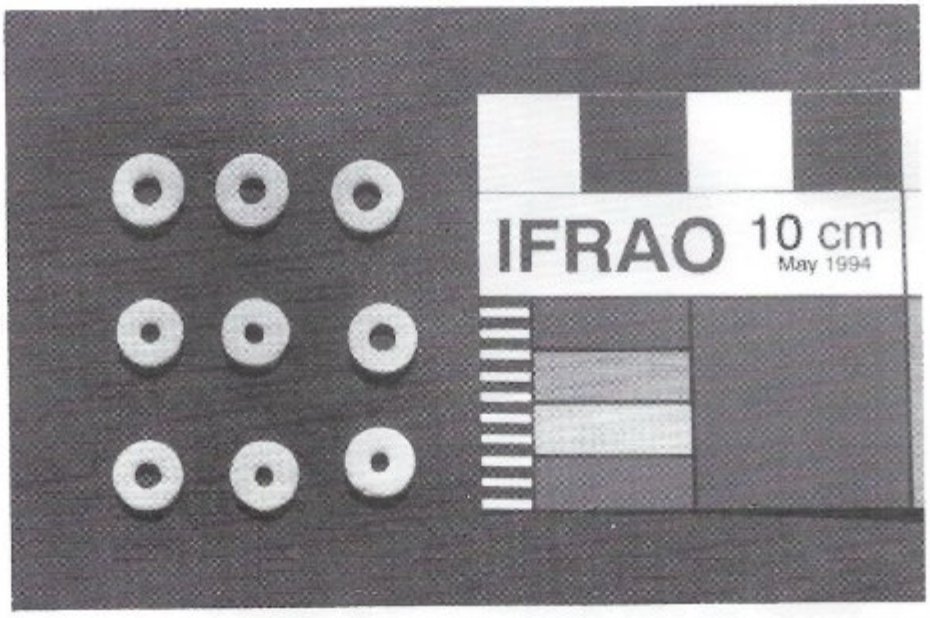
Typesetting and artwork by Robert G. Bednarik, Archaeological Publications, Melbourne
Printing by Currency Productions, Melbourne

Bushwoman engaged in the production of ostrich eggshell beads, from the Fourie Collection.
Re-photographed by H. C. Woodhouse, with permission of the Museum Africa.
(Refer to article by H. C. Woodhouse, pages 41-43.)



Ostrich eggshell beads. (Refer to article by Robert G. Bednarik, pages 27-41.)