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ROCK ART CONSERVATION IN AUSTRALIA

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Introduction

Australia's corpus of rock art is the largest in any continent (Bednarik, 1992a) and it includes the oldest dated examples of rock art in the world (petroglyphs dated by radiocarbon as being over 43,140 years old; Bednarik, 1992b) as well as the most recent. To appreciate the size of the task facing the Australian rock art conservator it is worth remembering that, in Queensland alone, the second largest Australian state (almost six times the size of Italy), there are estimated (Morwood, 1984) to be around 50,000 rock art sites. There are dense rock art concentrations in the Northern territory, especially in Arnhem Land and in the Victoria River District, and also in the northern half of Western Australia. in the Pilbara, a mountainous region of the latter state, the largest corpus of petroglyphs in the world was discovered during the 1960s (Bednarik, 1973). The northern-most part of Western Australia, the Kimberly, is even more inaccessible, and the major discoveries made there in the last couple of years show that this much neglected body of art is one of the most spectacular: paintings of up 43 m length have been found there (Walsh, 1991a), and many hundreds of new sites have been recorded most recently (Walsh, 1990).

In view of these massive quantities of rock art it should be clear that the Australian rock art conservator is in no position to attend to all sites, or even to a

significant portion of the sites. Yet the rock art conservation programs in Australia are regarded as being most successful, despite the immensity of the task, which should warrant their detailed consideration in other countries (Lanteigne, 1991). Site protection and management strategies are comparatively evolved, and the first post-graduate course for rock art conservation was held in Australia (Pearson, 1988). It is now intended to establish a course for rock art conservation in China, based on that in Australia (Chen Zhao Fu, pers. comm.).

Natural conservation threats

Most rock art is of a considerable age, and to exist today it must have survived many threats. So older the art, so more potential natural threats it must have survived, and so higher the expectation that it will survive longer still (Bednarik, 1990). This is because the older art has attained a condition of near equilibrium with its natural environment, which can be threatened only by major environmental changes, or by human intervention. The oldest art is thus proportionally at a greater risk from human interference (Bednarik,

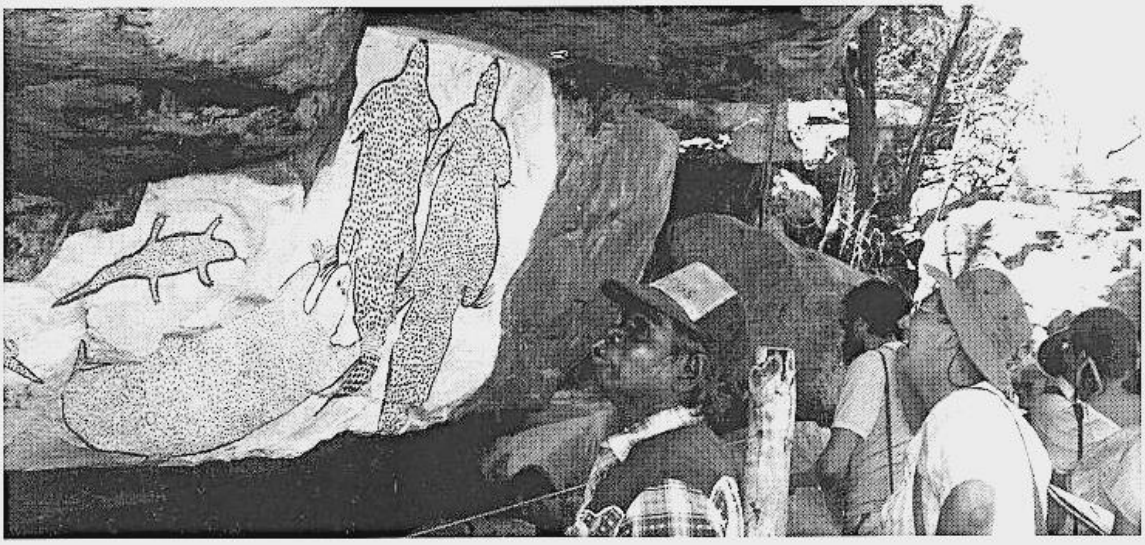

Fig. 90. Australia. Aboriginal site custodian Alex Campbell at Kimberley rock art site. Prof. L.G.A. Smits and Dr. P.G. Bahn are also in the picture.

Fig. 91. Australia. Gibb River: Sacred Wandjina site, Kimberley. Paintings have been recently refreshed.

1992c), and it is often regarded as the most important or the most valuable.

It follows from this that, as once evaluates the natural conservation threats to a site, one should pay special attention to any possible factors that may appear to be natural deterioration, but are in fact attributable to human agency, however indirectly. For instance, increasing acidity of rainwater is attributable to industrialisation, and the lowering of environmental pH leads to the erosion of protective rock varnish deposits formed over petroglyphs. Or the hydrology may have been charged by human interference, now threatening an art that had managed to survive for a long time. Morphological modifications of a site may have affected its microclimatic regime, resulting in significantly differing environmental conditions which the art has not before experienced, and which pose a serious threat to it.

1. The *microclimate* has been recognized as a major conservator factor in deep cave sites (Bednarik, 1988, 1991) and in some shelter site. At Paroong Cave, a limestone cave with petroglyphs, European settlers had tried to block the entrance and this had altered the speleoclimate. The art was saved by reinstating the conditions that presumably existed before the interference. At shelter sites in Western Australia, site climate has been modified by careful modification of vegetation. Such measures can be very effective because solar radiation affects most rock art pigments and paints, and rock art can often only survive where it is sheltered from abrasion by wind-borne dust and sand.

2. The *hydrology* of a site is often very complex, and yet moisture is a principal agent in the destruction of rock art. It affects rock art sites in various forms: as surface run off, as interstitial and capillary moisture, as splash from rain or from roof drips, in the form of condensation, or in some cases through spray from the sea or a lake. Clearly, each type of moisture damage is different and requires different treatment. Attempts to control capillary moisture failed in Australia project, and studies of condensation have shown that this is best controlled by modifying the climatic regime. By far the most extensive Australian work in the area of moisture control is in diverting surface flow, because it does occur in many shelters and has several damaging effects: it mobilizes the paint itself, it deposits salt and other mineral components on the surface, and it creates conditions suitable for the establishment of micro biota. Laminar flow is controlled by the installation of diverting measures, the most common being the artificial dripline. This is usually of a silicone sealing compound which is applied with a pressure gun (Gillespie, 1983). Other measures of diverting water flow include gutters, small roofs and, in the case of caves with vertical entrances, surface channels or embankments (Walston, 1976; Bednarik, 1988).

3. The *geochemical* and *geomorphological* processes affecting the survival of rock art include the deposition of various mineral skin (silica skins, rock varnish and similar ferromanganese laminae, oxalates, carbonates and others); the deposition of water-soluble salts (as surface efflorescence, interstitially or as a sub-surface layer called subflorescence which effects surface spalling); the removal of soluble salts and subsequent granular or mass exfoliation; temperature or insolation-induced stresses; hydration (for instance of a clay matrix); the solution of limestone by carbon dioxine in the presence of moisture; brush fire spalling; and damage by lightning strike. Most of these processes cannot be realistically arrested, but some remedial action is possible where they are attributable to moisture, by modifying or managing the site hydrology indirectly. Damage from brush and grass fires is avoidable by keeping fuel away from the art panels. Back-burning is practiced. At a number of sites, mass exfoliation has led to programs of consolidating disintegrating panels by grouting. There is no known "safe" method of stabilizing rock art surfaces by concealing or impregnating them, with silicon esters, silicones or silanes, and such methods have been used only experimentally in Australia. the failure of

such treatment has been reported from other regions, such as Siberia (Bednarik & Devlet, 1992). Similarly, the repair of rock varnish (Elvidge & Moore, 1980) has been described as unsatisfactory (Bock & Bock, 1990) and should be avoided.

4. *Geophysical* damage has been identified at many Australian rock art sites. Subsidence that is attributable to underground coal mining in the Woronora Plateau has caused damage to sandstone shelters in the region, many of which contain rock art (Sefton, 1992). Seismic activity can fracture rock art panels, and the same applies to the other factors of tectonic adjustment: gravity, adjustment due to oscillations in a water table (as in cave systems)or removal of a sub-structure. At Mootwingee, a steep rock slope covered by petroglyphs rests on a poorly cemented, softer stratum which disintegrates and provides inadequate support. As a result, the engraved surface layer is breaking up into blocks which slide down the slope. Large stainless steel pins with wooden blocks did slow down deterioration, but new factors were introduced, requiring further remedial action, such as grouting of blocks. This in turn interfered with the site's hydrology, and the site was eventually closed to visitors.

5. The decay of rock art and its rock support is often attributable to *biological factors* of a great diversity. These range from micro-organisms to large mammals. Nitrogen, sulphur, manganese, and iron bacteria can contribute significantly to the deterioration of rock surfaces, and sometimes rock art paints, while in some cases they may deposit a protective film over petroglyphs. Algae, fungi, lichen and mosses affect rock surfaces in various ways, initiating complex biochemical processes. They can be removed with commercial fungicides or with ammonium hydroxide. However, such chemicals cause contamination of the rock surface and in some cases discoloration, and some cannot be used on rocks or paints with a clay base. If at all possible, such direct intervention should be avoided, as it compromises the research potential of the art. On some sites in the Sydney region, organic deposits have been removed from petroglyph grooves to highlight the art where it is poorly visible. Various species of termites (four in Australia), mud-daubing wasps and other insects (e.g. some bees) are causing extensive damage (Watson & Floor, 1987). It is advisable to destroy all nests within 50 meters of the art, and to return after a year to check whether any structures have been rebuilt. The galleries traversing the art panel should be removed. Nests of mud-daubing insects, however, should be removed (after first wetting them), because it has been found that existing nests attract new ones (Naumann & Watson, 1987). In northern Australia damage by mud-daubing wasps subsides after local eradication of buffaloes: the disappearance of the buffalo wallows corrected an environmental imbalance and it eliminated the supply of mud (Bednarik, 1989). In Australia, feral pigs, water buffalo and domestic cattle damage rock art, and hundreds of sites have been fenced in to keep these animals from rubbing their bodies against the walls of the rockshelters, and from raising dust which settles on the art.

Human damage and site management

Very little human damage in fact deliberate, nearly all is unintentional and can thus be easily eradicated through well-directed public education programs. The behaviour of rock art site visitors has been extensively studied in Australia, particularly through the work of Gale (1985). Children, organized tour groups and local visitors were identified as categories of high-risk visitors at publicly accessible sites, but it was also found that simple measures, such as signs, were most effective in modifying visitor behaviour, especially in the high risk groups (Gale & Jacobs 1986).

Quite a number of measures have been utilized at Australian rock art sites. The most frequent are boardwalks of steel or timber, often with elevated viewing platforms. These keep the visitors away from the art while permitting a close-up view of it, and they prevent damage of the

archaeological floor deposit. The erosion of floor sediments and the development of dust are often controlled by floor covering in rockshelters, such as mats, gravel or wooden floor boards (Walsh, 1991b). Visitors books have been found to be effective, and the Australian experience has shown that the visitors needs to be told what not to do, and is generally most willing to comply with such directions. A large number of unsupervised sites in Australia, especially in the more densely populated south-east of the continent, have been fully enclosed in steel cages. While there is general agreement that these structures are highly obtrusive, it is equally true that they are most effective. A number of considerably less drastic measures have been tasted and in some cases employed in visitor control. These include the placing of "psychological barriers" which may be a low fence, a rock ledge or some strategically placed prickly bushes. Their effectiveness depends on local circumstances, particularly site topography. Bearing in mind that it takes only one visitor with a can of spray paint to ruin a site, these measures cannot prevent blatant vandalism.

Which brings us to the most severe threat from humans. In Australia, a combination of legislative protection prescribing heavy fines, and public education about the significance of the indigenous cultural heritage have widely eliminated the incidence of graffiti at rock art sites. few graffiti removal projects have been conducted (e.g. Thorn, 1991). The removal of existing graffiti may well do more damage to the scientific potential of the site than the graffiti being removed.

One final aspect of Australian rock art conservation is the question of responsibility for rock art conservation and management in Australia, and of the funding sources of the relevant programs. The principal agencies responsible are the Australian National Parks and Wildlife Service, on whose land many of the major rock art concentrations occur; the Australian Institute of Aboriginal and Torres Strait Islander Studies, which dispenses grant money for the purpose; the Australian Heritage Commission, which is also actively engaged in site management and protection, as well as educational projects; the Departments of Environment and Heritage; and the state-funded archaeological or heritage offices, often with the help of federal funding. There is a trend towards Aboriginal control of sites, and in many regions this process is fully complete, with management control entirely in the hand of Aboriginal co-operatives, communities and land councils. Where appropriate, these bodies will employ a trained rock art conservator. In some cases, the land owned by the local Aboriginal group is leased back to the federal government as a National Park, but executive control remains with the indigenous owners (e.g. Kakadu and Uluru national Parks). In other cases, the Aboriginal owners prefer to manage their sites independently (e.g. Laura and Narrabullgin).

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Riassunto:
In Australia è presente, in grande quantità, l'arte rupestre datata più antica del mondo ed anche la più recente. L'Autore mette in evidenza i pericoli ambientali ed antropici che incombono su di essa ed i mezzi per prevenirli.

Summary:
The oldest dated rock art in the world and the most recent is present in Australia in very great numbers. The author discusses the different environmental and human dangers that threaten it and the means to prevent them.

Résumé:
L'art rupestre daté le plus ancien et le plus récent du monde est présent en grand quantité en Australie. L'auteur présente les divers dangers environnementaux et humains qui menacent cet art ainsi que les moyens d'y faire face.