Rock Art Deterioration and Conservation in the "Top End" of the Northern Territory

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Part I The setting and causes of rock art deterioration

Introduction

This paper describes causes of damage to rock art in the "Top End" – the northern part of the Northern Territory only, as deterioration of rock art in the centre of Australia is similar to that of the low rainfall areas of New South Wales, South Australia and Western Australia and will be considered by others.

The rock art of the Top End is reasonably well known. It consists, in the main, of rock paintings of naturalistic mode, and their general distribution, styles, frequency of occurrence and aesthetic appeal have been described in a number of monographs and articles. Rock engravings are of a minor occurrence, being generally found to the west and south-west of the Katherine township, and less frequently elsewhere. Another art form found in this region and not previously reported from other parts of the continent are beeswax figures and designs pressed onto the rock surface.

After systematically recording several hundreds of sites in selected areas of this region it is considered that the total number of rock painting sites could be in the thousands. The sites so far recorded vary from that of a slightly protected shelter with a single design, to one three hundred metres long with a reasonable overhang protecting hundreds of individual paintings.

The pigments used in rock paintings are naturally occurring ochres, hematite, manganese oxide and charcoal. As earth originating colours they do not "fade" but weather away and are affected by the same processes of mechanical, chemical and biological weathering as the rock surfaces they have been painted on. Of the pigments used, the red ochres, especially those of hematite base have great staining properties, penetrating the sandstone surface at times to a depth of four millimetres, depending on the rock's composition. Limonite particles and those of white ochres (with the exception of huntite) are larger and less dense, necessitating thicker application and usually no penetration of the paint-rock interface occurs. As there were no binders used, the two most important factors affecting the permanency of a painting are the composition of the rock surface, and the particle size of the pigment used. If the rock surface is a clean, well sorted, medium grained Protozoic sandstone and the pigment used is a fine, well staining hematite, the paintings will last for a long time indeed. However, sandstones even within one formation can vary and many of the sandstone surfaces which were used are softer and more susceptible to weathering. Basically, the hardness of the sandstone depends on the nature of the cementing materials. In the Northern Territory, calcite is a common cementing material. White and extremely hard sandstone is cemented by silica. Brown sandstones are cemented by limonite and red varieties by hematite.

Area

The Setting

The northern part of the Northern Territory forms a self-contained geographical region known as the "Top End" (see Fig. 1). It is that area of land drained by the river systems flowing north into the Timor and Arafura Sea and into the Gulf of Carpentaria. It extends from the tropical coastal belt to the inland limits of the monsoonal penetration – a period marked by heavy rains, high humidity and extensive flooding.

The region is one of marked physiographic, climatic and biotic contrasts. The monsoonal

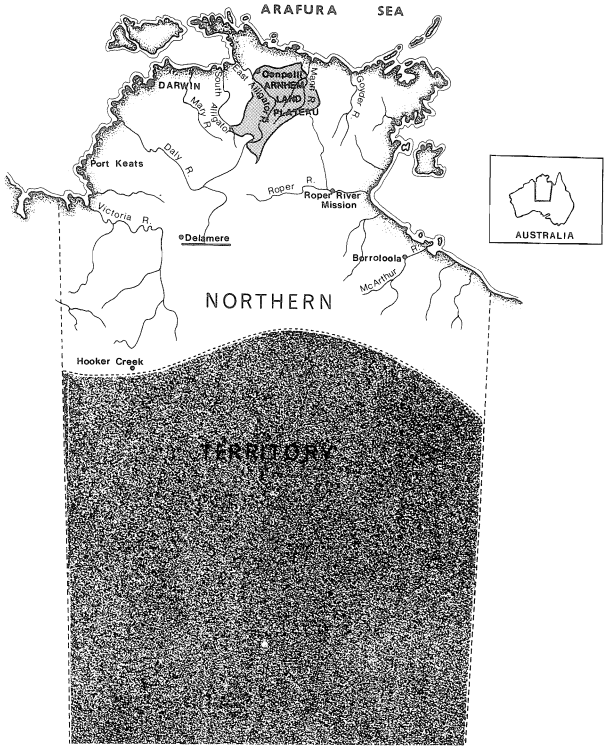

Figure 1: Northern Territory's "Top End" with location of Delamere.

climate is one of environmental extremes evident in the landscape shaped by it. Violent wet seasonal thunderstorms and cyclones cause floods that scour watercourses, erode deep gorges and send millions of tons of silt into the sea. Due to moderate to high rainfall the rivers of this region discharge more water than the Darling-Murray system of south-eastern Australia. Despite this, there are a few streams which are permanent throughout the year. Most rivers and creeks are reduced to intermittent waterholes and dry beds. During the wet season, rain and heat produce intense growth which during the following dry season is consumed by equally intense bushfires. It is then that solar radiation dries the flood plains, waterholes and watercourses and breaks up rock.

The topography varies as one moves south from the coastal plains with the meandering tidal reaches of the major rivers flooding widely and deeply during the wet season. In areas where organized drainage is lacking, swamps and lagoons are formed. Further inland are alluvial plains of open woodland, and rounded hills or ridges leading to sandstone plateaus and to extensive inland plains with residual messas and dissected tablelands which form the river system divides. Streams are deeply incised into the plateau and the tablelands forming spectacular gorges and valleys.

Plant and animal distribution increases towards the coast with the quantity and reliability of rainfall. The coast and river flats have mangrove and samphire swamps with wild rice and sedge. Rain-forests, paperbark and bamboo lined rivers move into eucalypt and savannah woodland and beyond into open grassy inland plains with annual and perennial sorghums, ending in spinifex on the relatively poor soils on the south western boundary of this region on Sturt Plateau. The major part of this region was well endowed with food and water resources and with shelters in the geological outcrops.

Geology

Corresponding with the drainage systems of the northward flowing rivers draining the precipitation of the monsoonal intrusion lies a belt of pre-Coinozoic rock surfaces. The Arnhem Land Plateau and the tablelands of the Victoria River Plateau are the two dominant topographic and scenic features of these surfaces made up of shelter forming rocks.

The Arnhem Land Plateau and the related outlying massifs are largely composed of sandstones of the Kombolgie formation. The age of the formation has been determined as Proterozoic (Carpentarian) within the range of 1,400 to 1,800 million years. The entire plateau is broken up, eroded and cut into deep valleys, gorges, fissures and crevices. Residual

rocks remain on the top of this plateau and as the plateau outliers on the bordering plain. Much of the sandstone has metamorphosed into smooth quartzite, almost imperious to weathering. Although massive folding movements have taken place, these pressures were localized and most of the horizontal bedding of the rocks remains as it was originally deposited. Ripples made by the wave action of the original deposits can be seen on exposed slabs or where weathering has created shelters. The table-lands of the Victoria River Plateau, bounded by steep scarps and capped by resistant sandstone are of a similar time-depth.

There are other areas of outcropping sandstone throughout the region. In all instances, erosion is still active. The less resistant rock underlying the sandstone are eroded more rapidly undercutting the sandstone formation which then collapses leaving large fallen blocks at the scree base of scarps. Some sandstone massifs show the result of a much more advanced stage of erosion and consists largely of irregular residuals with numerous caves and over-hangs.

Climate

The climate of this part of Australia is monsoonal, with two distinct seasons. These are the summer wet season, lasting from November to April, and the winter dry season from May to October.

Although the months of November to April are regarded as the wet, there is some rain in the northern district during May to September when the monthly total averages 25 millimetres, while elsewhere the dry season is virtually rainless.

In October the rain averages 70 millimetres. It is then that thunderstorm activity develops, and rainfall occurs with increasing frequency during November and December. In late December or early in January the north-west monsoon brings wide-spread and heavy rains. There are even heavier and more intense rains during the cyclonic disturbances, a number of which occur every wet season. The humidity then is very high, and the average daily maximum temperature is 34°C. The mean annual rainfall ranges from nearly 1500 millimetres near Darwin to 450 millimetres at the southern boundary of this region.

The dry season beginning in May is marked by south-easterly winds. The countryside quickly dries up, and dust haze and smoke from bushfires reduces visibility towards the latter part of the dry.

Throughout the year there is consistently high temperature maximum and minimum with small temperature range, although frost can occur in the southern Victoria River District.

Causes of Rock Art Deterioration

In any situations, within every shelter, there are a number of mechanical, chemical and biological agents affecting physical weathering of both rock and painted surfaces. Usually the weathering agents actively co-operate with one another. In the Top End it is the intense and prolonged rainfall with the associated high humidity that is the dominating feature affecting the major weathering processes. The only causes of weathering not directly water-induced are those caused by wind and by temperature changes. The most common causes of rock art deterioration, with suggested corrective action are described below.

Water Damage

Water-wash is the single major cause of damage to rock paintings when it moves over painted surfaces, coming out of seepage points or running over the ledges of a once protective overhang. Water-wash increases with the progression of the wet season, when the rainfall saturates the cracks, crevices and rock faults directly above and beyond a shelter. Under pressure, in the later part of the season, this internal water seeps out and flows over painted surfaces. In most instances it simply washes away pigments which were not previously bonded to the rock surface. If the water carries further contaminants, it can alter the colours of the original pigments or stain the rock surface. Frequently, the water-wash, originally rain water and the carrier of dissolved oxygen and carbon dioxide, acquires various organic acids and achieves solvent properties in its passage through the soils above the shelter. These leaching and corrosive impurities not only affect the painted surface but also weaken and loosen rock surface particles which are washed or eventually fall away.

Further water-induced damage is caused by soluble salts moving through the capillary structure of the rock. The constant movement and swelling due to hygroscopic nature of some of these salts, and their subsequent drying and re-crystallization as solids near the rock surface, is a major factor in the rapid break-up of the underlying rock preceeded by the loss of any pigment. Other mineral salts evaporate over the rock surface and completely cover underlaying paintings. Elsewhere, water-wash carrying soil particles and containing bacteria moves into cracks and fissures of bedding planes, where the bacteria acts on the mineral composition of the rock. Further soil particles may be brought by insects building nests within such openings. The created humus encourages vegetation growth which, in combination with other agents, causes the eventual break-off of horizontally bedded slabs. Ceiling slabs from one to thirty centimetres in thickness have thus collapsed, with their original

painted designs preserved if the roof fall is in an otherwise dry, well protected shelter.

Much of such water-wash caused damage can be prevented by creation of an artificial drip line. By stopping the water-wash from entering the shelter, its erosional and other destructive properties are eliminated, slowing down the rate of decomposition of the surface and reducing the opportunity for further action by the chemical and biological agents. The primary purpose of a drip line then is to divert the water-wash from the painted surfaces. In our experience this can be simply and cheaply achieved by making a drip line of a clear silicone compound at the point where the moving water can be diverted from the paintings. The silicone is applied to the rock surface, previously cleaned of loose particles, with the aid of an applicator gun. The width of the applied line can be varied from one to nine millimetres. It is not aesthetically objectionable, and if necessary it can be easily removed.

Some water damage is caused by actual *flooding* of shelters. When this occurs frequently and the running water is of some velocity only those paintings which were executed in red, and are of some antiquity, remain. There are instances where the upper half of a large multicolour painting remains as a "highest flood mark" while in the area which was washed away earlier designs are revealed. A number of such shelters in Western Arnhem Land are partially or fully submerged by flood waters for at least several days of each year. During the April 1975 flooding of the East Alligator River several shelters with multicolour X-ray designs were submerged for the first time since the most recent designs were executed, causing considerable damage to painted surfaces. As the most recent paintings in the particular shelters date back to the turn of the century, that particular flood was probably the highest one in the past 75 years.

As there is no practical way to prevent such a flooding, the only way the paintings can be preserved is by recording them in detail before they are completely obliterated.

Painted surfaces of some shelters are exposed to *driven rain*, when all of the surface is saturated and eventually subject to a sheet water-wash. This usually occurs in sites with a slight protective overhang, although during cyclonic disturbances high winds may carry rain to back walls of even well-protected shelters.

Sites which are at present exposed to *direct rainfall* have only designs in red or traces of such designs remaining. Some of the enigmatic symbols still visible were once a part of a multicolour painting of whch only the parts painted in red survive. The only effective way to protect such exposed walls would be by erecting protective canopies. One such canopy was recently suggested for an important site in Western Arnhem Land. It would consist of aluminium extrusions and clear perspex sheets where the aluminium beams are placed against the wall and their upper half covered with overlapping sheets of clear perspex with a space between. This would allow for free air circulation as well as allowing normal light penetration. The beams can be so spaced that existing trees need not be removed.

Cryptogamic Growth

There are a number of biological agents such as algae, fungi, lichens and bacteria which are responsible for the decomposition of the rock and its painted surface. This cryptogamic growth is directly influenced by excessive moisture and the humidity content of a shelter. The ideal condition for such organic activity occurs during the prolonged wet season when the temperature is between 25° – 34°C and relative humidity of 70% or higher.

The main agent of deterioration seems to be bacteria introduced in the original pigment. In most instances where paintings were executed in pipe clay or its inmixtures, the bacteria contained in that pigment which lie dormant during the dry season become active with the increase in the humidity level, grow and expand, lifting the pigment layer off the rock surface so that it falls. An early application of approved fungicide could prevent such damage.

Insect Damage

Moisture and humidity within a shelter are also ideal conditions for the development of insects. The building of nests and passages by insects over painted rock surfaces causes considerable damage in some areas. This damage comes mainly from two families of insects – *Isoptera* (termites) and *Hymanoptera* (ants, wasps and bees).

In one instance, where a large number of ant passages covered a painted surface dieldrin solution was applied at the base of the rock. In the dry part of the shelter this application (five years later) is still preventing further insect activity, while in the area where the solution was leached away by water intrusion re-infestation is taking place. This was a crude attempt to remove the offending insects.

Before any application is made directly to the painted surface, tests must be made to ascertain that the chemicals used will not have a deleterious affect on the rock surface or the pigments. There are now a number of well-documented insecticides available and, as their application is relatively simple, insects should be easily eradicated and deterred.

Vegetative Growth

Considerable damage is caused by shrubs, trees, vines and creepers growing in close proximity to or over the painted designs. The amount of growth is directly related to the amount of available moisture, soil type and how sheltered a site is. Large areas of painted rock surface are covered in creepers in areas where seepage occurs at the base of an escarpment, or where the rock borders permanent wetland. In some instances rootlets completely cover and intrude into the rock surface.

Elsewhere, bushes and trees grow alongside the shelters walls, constantly brushing against the rock surfaces and ultimately obliterating the painted designs.

It is quite simple to remove the offending vegetation and to prevent it from regrowth. Vines, creepers and smaller shrubs can be pulled out, whilst trees can be cut off above ground level and the stump injected with arsenic.

Animal Damage

There are a number of native animals which frequent shelters containing rock art. The most common ones are the walleroos, rock wallabies, rock possums, dingoes, the little northern native cats as well as several species of bats and mud swallows. Damage to rock art caused by these animals, with perhaps the exception of mud swallows, is minimal when compared to that caused by the activities of introduced animals such as the water buffalo, feral pigs, donkeys, horses and cattle.

The distribution of mud swallows within the Northern Territory is limited to the area from the Katherine district west towards the Kimberley. It is especially common in the eastern Kimberley where its habit of building "mud" nests on the painted ceilings of shelters causes considerable damage.

Of the introduced animals most of the damage is caused by the Asiatic water buffalo, a large animal which in a few decades has spread from its initial point of release throughout the sub-coastal districts of the Top End. Its favourite habitat is the flood plains from the Coburg Peninsula down to the Alligator Rivers and westward to Darwin.

It is in the region of the East Alligator River where the flood plains reach the base of the Arnhem Land Plateau that the buffalo does most damage. The open shelters are situated along the plateaus escarpment, in the plateau valleys and around its residual outliers which, as small rocks or large masifs, rise out of the estuarine and alluvial plains.

It is mainly in the wet season, when the buffaloes seek higher ground and protection from the thunderstorms, cyclonic winds and the resulting flooding, that they enter the shelters. They trample and make deep wallows in the occupation deposits, while the painted surfaces are covered with mud or are completely obliterated as they rub their bodies against the rock. In shelters with low painted roofs, these are scored by the animals horns or rubbed off by their backs. Indirect damage results from their constant movement in and out of the shelters wearing out paths which in some instances cause water intrusion into a shelter which otherwise would be dry. This increases potential damage to surfaces even above their reach by deleterious agents acting when humidity within the shelter is increased.

In the dry season the buffaloes seek refuge in the shelters from the sun. During this period their movement within the shelters raises fine black-soil dust which settles over rock paintings. When such a shelter is comparatively well ventilated and dry in the wet season, with a reasonably porous sandstone surface which does not "sweat" during periods of maximum humidities, the dust does not adhere to the painted surface and can be brushed off.

Damage similar to that caused by buffaloes is also done by feral pigs. Due to their smaller stature the damage is limited to approximately one metre above shelters ground level. However they cause greater damage by rooting deeply into archaeological deposits. Horses, donkeys and cattle living in more elevated areas cause some damage by frequenting shelters, but are of less immediate concern than buffaloes and pigs.

The best way to protect shelters from such further damage would be the total eradication of the offending buffaloes and pigs. In areas where this cannot be done the threatened shelters should be fenced off.

People Damage

At present rock art sites outside the existing Aboriginal lands are not offered any protection either in *fact* or *de jure.* Much has been said about the existing but seldom used *Northern Territory Native and Historical Objects and Areas Preservation Ordinance 1955–1961*[7], however the fact that in the past 22 years only six sites were declared as protected under this ordinance says something about its inadequacy and implementation. Out of the six sites only one is a rock art site, the others being sacred sites in the vicinity of mining developments and Seale Gorge at Wattis Creek.

Sites which are not protected by inaccessibility or ignorance of their location are exposed to an increasing number of visitors. Some of the famous and important sites such as Obiri and Nourlangie Rock are fully exploited by tourist operators, who bring busloads of people to clamber over and through sites. Hundreds of private vehicles bring many others. There are no site museums and no

rangers to protect the paintings from the visitors enquiring hands. On occasions these like the safari operators, try to improve the look of a site.

There is enough evidence of damage to make us concerned. Initials have been painted on or engraved over rock art, and in one instance diesoline was poured over a series of fish paintings and set alight. There is much unintentional damage caused by visitors camping in the shelters, rubbing against the painted surfaces and building fires from which smoke blackens the designs.

People damage can be prevented by adequate legislation which would provide for an organization whose responsibility it would be to record, protect and conserve all Aboriginal sites of significance and to educate the public about our Aboriginal heritage by establishing site museums in collaboration with local communities and the National Parks and Wildlife Service.

Conclusion

Much of the active deterioration in the Top End of the Nortern Territory can be prevented. The following course of action is suggested. To ascertain and evaluate all possible causes of damage and weathering, site parameters should be established. Such data would include analysis of the rock type and comprehensive date on the physical surrounding of the site. As the regime of a shelter and its surroundings changes with the season, shelters within the monsoonal area should be visited not only in the dry season as is usually the case (because of access difficulty during the wet), but also in the wet season. It is during the periods of intense rainfall that its effects and that of other water induced agents should be observed within the shelter itself and also on rock surfaces above and around it. In the dry season much of this damage, with the exception of the stained and water-washed areas is not easily discernible. By then the stream which may run through a shelter ceases to flow and any evidence of it is covered by animal disturbed soil surface. The seepage also ceases, plant growth withers away and animals which came to seek refuge here during the wet would have moved back to the drying plains.

In areas such as the Top End of the Northern Territory and the Kimberley in Western Australia where it is expected that many more hundreds of rock art sites are to be discovered, the primary aim should be to search for and discover these sites. Only when we know the location and nature of most of the rock art sites will we be able to decide which are the most important ones and concentrate on their preservation.

It can be said that each rock art site is in some way unique and that they all should be preserved, however, the political and economical reality will always be such that only limited funds and resources will be available for site protection and conservation, necessitating the setting up of a list of priorities.

This is not to mean that conservation and preservation practices should not be introduced at once, as we already know that between the hundreds of sites recorded so far, there are many important and unique sites of significance to living Aboriginal people and of scientific and aesthetic value to all Australians.