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The State of the Art: issues concerning ownership, management and conservation of Australian Aboriginal rock images, with special reference to painted images in the Townsville region, North Queensland.

Thesis submitted by

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in August 1992

in partial fulfilment of the requirements for the Graduate Diploma of Arts (Archaeology) in the Department of Anthropology and Archaeology of James Cook University of North Queensland.

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M.M. Scott

21 August 1992

ABSTRACT

Cultural, scientific and political issues associated with the conservation of Australian Aboriginal rock images are discussed. The process of significance assessment and its essential role in the development of a management plan is outlined.

Emphasis is placed on the need for full recognition of Aboriginal ownership of Aboriginal cultural property, and the right of Aboriginal people to decide management and preservation policies for rock images is stressed.

The major causes of deterioration of painted images are summarised and some recommended treatment methods are reviewed. A project involving the removal of graffitti from a Townsville site is described. Current methods for painted graffitti removal are assessed and recommendations made. A case study of the conservation requirements of Aboriginal painted images in the Townsville region is included.

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CHAPTER 1

1. INTRODUCTION

Australian Aboriginal rock art has been variously described as:

> ... [an] aspect of a range of things which make up a sense of place (Sullivan 1991:3);
>
> ...the expression of our beliefs (Marika 1978:7);
>
> ...a material culture resource (Edwards 1978:54);
>
> ...the key element in the cognitive archaeology of Australia (Bednarik 1990:67).

It is obvious from these quotes that rock images have quite different and often conflicting meanings and values to different groups of people. The values expressed by non-Aboriginal people often reflect personal and professional biases, or the political climate of the day. Those expressed by Aboriginal people have mostly been consistent. That is not to say they have not been or should not be used to political ends. This divergence of views and opinions may as a result of ongoing debate and political agitation, assist the long term preservation of rock images and their associated traditions. This thesis examines the range of political, social, economic and scientific issues associated with the conservation of Australian Aboriginal rock images. A case study from the Townsville region is included to exemplify some of the practical aspects of their deterioration and conservation.

1.1 SENSE OF PLACE

The strong association Aboriginal people have to their land is well documented (see for example Stanner 1969; Central Land Council and

Northern Land Council 1991) and is succinctly expressed in the official slogan of the Northern Land Council, 'Our Land Is Our Life'. Aboriginal people believe they belong to the land, that the land is an essential part of their identity and that they are responsible for its natural, spiritual, and cultural survival (Central Land Council and Northern Land Council 1991).

All painted and engraved sites are tangible evidence of Aboriginal occupation of Australia. To non-Aborigines this occupation is now believed to have been for at least 40000 years, but many Aboriginal groups believe their ancestors have always inhabited their territory. The demonstrable link between Aborigines and certain sites could add weight and credence to land rights claims. For example, in August 1983, Aborigines in the Mootwingee area of New South Wales organised a campaign of political activism to highlight their dissatisfaction with inadequate land rights legislation, as well as their discontent at not being involved in management decisions regarding the nearby archaeological sites (Sullivan 1984a).

Galarrwuy Yunupingu (1989:14) makes the following strong statement:

> ...we paint to show the rest of the world that
> we own this country, and that the land owns us.
> Our painting is a political act.

1.2 EXPRESSION OF BELIEFS

When Aboriginal people describe rock images as an expression of their beliefs, they are not only referring to religious beliefs, as might be presumed and defined by non-Aboriginal people. Rather, they are describing the important inter-relationship their paintings and engravings have with all facets of their lives, and within their world view. There is no word in Aboriginal languages for 'art' and it is not seen as separate from other aspects of their lives (Marika 1978). As such, it is just as important to Aboriginal people to preserve the source of their inspirations: the songs, dances, ceremonies, sacred sites, and their associations with their land, as it is the paintings on the walls (Marika 1978). In many cases, it is the site and its surroundings which is more important than the actual images. A witness before the House of Representatives Standing Committee on Aboriginal Affairs (Hope 1974:169) expressed this view in the following way:

> ...you can scrub all the drawings off, but that will not hurt these people. It will only hurt the white fellows who are interested in the drawings.

This point of view would not be universal amongst Aboriginal people. There are occasions where Aboriginal people have requested assistance from white conservators (eg Byrne 1989). However, it does highlight the different perceptions Aborigines and non-Aborigines have of rock images. Many detribalised and urban Aborigines, some of whom have had little or no contact with traditional lifestyles and beliefs, view painted and engraved rock images as vital links with their cultural and spiritual heritage. These sites have become powerful symbols of the rich lifeways of their predecessors. The Aboriginal Arts Board, an all-Aboriginal body of The Australia Council, believes that exposure to rock images is a valuable means of re-establishing and fostering pride and renewed interest in cultural traditions and beliefs (Roughsey 1978).

Aboriginal people who have spiritual links with the land and with their mythology can rightly claim ownership and curatorial responsibility for sites. Maintenance, including the retouching or repainting of images and removal of undesirable vegetation has in some places been continuous, ensuring preservation of the cultural integrity of the sites.

1.3 MATERIAL CULTURE RESOURCE

Non-Aboriginal people are developing a greater appreciation of the richness of Aboriginal culture. Their desire to learn more is evidenced by the healthy market for contemporary Aboriginal art, high visitor numbers to special exhibitions at museums and art galleries and increased enrolments in adult education courses on Aboriginal art and culture offered by Universities and private institutions.

Governments are recognising painted and engraved sites (especially the more visually impressive) as valuable tourist attractions and are keen to develop these for their educational importance and their revenue potential. More importantly, improved heritage legislation and associated increases in funding have facilitated better assessment and conservation of some cultural sites.

1.4 ARCHAEOLOGICAL IMPORTANCE

Archaeologists anticipate that much information about the prehistory of this continent, and of the lives of the people who lived here for at least 40,000 years before the Anglo-celtic invasion, will be gained from the study of rock images and associated living floors.

Australia is the one continent which has an unbroken tradition of rock art, yet its full research potential is still unknown. It may however prove to be one of the greatest untapped sources of archaeological information we have. As an 'artefact' it has the important advantage of still being present in the exact location it was originally placed. We are fortunate to be able to talk with people who have knowledge of some of the customs, beliefs and principles associated with its production and use. There are indications that it may provide a great deal of information about Aboriginal myths and customs. Much of the current research, using semiotics, is focusing on the way rock art can help us to recognise and understand cultural diversity. It can also provide evidence of changes in climate, vegetation and animal species (e.g. Murray and Chaloupka 1984). These important contributions have not been provided to the same extent by other components of the archaeological record.

It is important to acknowledge however that archaeologists' emphasis on research value does not meet with complete accord amongst Aborigines, for whom the sites have other values as described above. Further, research at Aboriginal sites has often been carried out without their consent. Indeed, until very recently Aborigines were not allowed input into the research nor given the opportunity to challenge the findings. It should go without saying that this situation is unacceptable and every attempt should be made to ensure it does not continue.

2.0 PHYSICAL CONDITION

The physical condition of Australia's rock images varies from excellent to very poor, and the rate of deterioration varies between and often within locations. In general the condition of engravings is better than that of paintings. Many people working in the field can cite cases where they have witnessed the deterioration of paintings over relatively short periods. There are other instances where the condition of some paintings does not appear to have altered over several decades and longer. Mountford (1965) notes that paintings he located in a shallow cave near Uluru (then 'Ayers Rock') in the dry centre of Australia, were clear and fresh looking when first recorded in 1935, but by 1958 had almost disappeared. However, Trezise and Wright (1966) compared the appearance of some paintings on Dunk Island in the North Queensland wet tropics, with 60 year old records and concluded that no apparent deterioration had occurred.

These two examples, while making a clear illustration, are interesting for another reason. That is, they seem to contradict what one might expect. It is generally agreed that dry conditions, such as found for much of the year at Uluru are better for preservation than conditions of high rainfall and humidity as found on Dunk Island. Obviously, from these two examples alone, it can be seen that generalisations are sometimes useless and that each site should be considered individually.

2.1 CAUSES OF DETERIORATION

Most of the literature dealing with the causes of deterioration of rock paintings is in agreement that these can be divided into two broad categories:

(1) Physical or natural causes, such as water, salts, surface exfoliation, lichen growth etc;

(2) Human or animal causes such as vandalism, urban or industrial development, abrasion, bird and insect nests etc.

Edwards (1978:55) states that water erosion accounts for approximately 70% of all damage. While probably intended only as an estimate, that figure or any other percentage cannot stand alone. Rather it requires an explanation of the parameters within which it is intended to be compared. It could equally be argued that urban development and road construction account for a similar or even greater percentage of the damage which has and which continues to be caused to rock images.

Godden and Malnic (1982), however, make the very important point that the deterioration of rock images by natural forces has been assisted by the political forces of the last 200 years which have allowed and at times actively encouraged the cultural devastation of Aboriginal societies and led, throughout much of Australia, to the cessation of continual repainting and maintenance of sites. The Anglo-celtic invasion and subsequent colonisation of Australia has had three important effects on Aboriginal cultural material:

(1) It has been subsumed into the national cultural heritage and in some cases world heritage;

(2) Aboriginal people have been denied the rights and responsibilities of its management;

(3) As a direct result of this dispossesion, interventionalist conservation measures, generally carried out by people who do not have cultural links with the images, are now seen as a necessity (Godden and Malnic 1982).

Whatever one considers the primary cause of deterioration, the reality we are faced with is that many of Australia's rock images will be lost in the next few decades. The challenge is to decide what is to be done about this and who should make the decisions. These issues are discussed in more detail in later chapters.

3.0 ETHICAL CONSIDERATIONS

Fundamental to any discussion of rock art studies in Australia is the issue of the validity of white people researching and as a consequence judging the significance of Aboriginal material. As Langford (1983:2) states:

> [archaeology] ...is value laden and its values come from a culture which is not the culture being researched.

We can no longer assume an inherent right to what should be deemed a privilege. Recognition of Aboriginal ownership, not only of their cultural material but of the associated intellectual property, must be total (Bowdler 1984; see also Dix 1978). This not unreasonable code of behaviour has not in the past, or even more shamefully, always in the present, been adhered to. Ongoing heated debate about the return of Aboriginal skeletal material is testament to the fact that white scientists maintain a position of privilege and power over Aboriginal people and are prepared to assert this position if it is expedient to do so.

This debate has close parallels with the repainting of sites. A now famous incident of repainting by Aboriginal custodians occurred in the Kimberley region of Western Australia in 1987 (see Mowaljarlai et al. 1988; Bowdler 1988; Mowaljarlai and Watchman 1989). This is not the only known incident of repainting or retouching of rock images by Aboriginal custodians, but it became famous because of the widespread furore which erupted in bureaucracy, the mainstream media and within the archaeological community. Part-funding for the project through the Community Employment Scheme, was withdrawn with the knowledge and support of the Australian Heritage Commission, apparently as a result of a letter from a white farmer claiming 'desecration' of part of the 'cultural heritage of all mankind [sic]'. The media ran with the story both in Australia and overseas with headlines claiming that ancient rock art was being defaced. Archaeologists expressed outrage at the loss of research potential and also, rather surprisingly, that the work had not been well executed. It should be emphasised that this very heated and public argument occurred initially in 1987, reached a peak at the First International AURA Congress at Darwin in 1988, and still continues (see Mulvaney 1991), even though governments have repeatedly expressed policies of self-determination and self-management for Aboriginal people. Here was a project instigated by Aboriginal elders to preserve their own cultural traditions and to educate young Aborigines in traditional ways (Mowaljarlai and Peck 1987), but which was stopped by white bureaucrats protecting white interests and with no regard for the wishes of the Aboriginal people involved.

We need also to question our motives for and methods of studying Aboriginal history, as well as our desire to preserve its material evidence. When considered in the light of the points made by Godden and Malnic (1982) and described above, one must question the validity of using artificial measures to conserve Aboriginal sites, when their true place in Aboriginal society has been so severely disrupted. While many defend such actions on the grounds of scientific merit, world heritage value, and responsibility to future generations of Aborigines and non-Aborigines, we should not ignore the social and political climate within which these decisions are made. That is, one in which the basic needs and rights of Aborigines are inadequately addressed. The majority of Aborigines in Australia experience poor living standards, high infant mortality rates and shorter than average life expectancy. There continues to be proportional over-representation of Aborigines in juvenile detention centres and gaols, and Aboriginal people do not have equal representation on governmental bodies which formulate policy directly impacting on their lives and their culture.

4.0 TERMINOLOGY

There is on-going debate within rock art studies about terminology, not the least of which centres around the title of the discipline. Some researchers do not use the words 'rock art' at all, preferring for example 'prehistoric pictures' (Clegg 1987), on the grounds that it is not necessarily 'art' and it is not always on rock (e.g. carvings on antler or bone). Others (e.g. Wright 1986) reject the term 'prehistoric' on the grounds that it is Eurocentric and chauvinistic. Many Aborigines are offended at their culture being described as 'prehistoric' denoting as it does a lack of history. In defending the use of 'prehistoric' most writers assume the definition to be 'preliterate' or 'non-literate'. Yet, given the amount of research aimed at trying to decipher the meaning of rock art motifs, it could be argued that rock art is in fact a form of pictographic language, as the symbols appear to convey messages. Recently, an Aboriginal informant advised this writer and others that a motif resembling a 'boomerang' actually meant that a water hole was nearby, and he took us to it just a short distance away. This motif was clearly a signifier and one whose meaning is understood and accepted by a group of people. It therefore conforms to the basic requirements of writing, hence the term 'prehistoric' is for this reason alone not applicable. The term also discounts the fact that 'rock art' is still being produced in Australia.

A number of other terms have also been put forward, including petroforms, ideograms, pictograms, petroglyphs (engravings), pictographs (paintings) and rock images. These terms have been offered as an alternative to the word 'art', which it is argued cannot be specifically defined. Clegg's use of 'picture' as described above was an attempt to move away from the notions of representation, iconicity or meaning. However, he found it had the opposite effect, and instead carried a stonger connotation suggestive of representation than the term 'art' itself (Clegg 1991).

More relevant to this thesis is the association with the European fine art tradition which use of the term 'art' suggests. In that tradition the artist is revered and the art object studied and judged within well defined parameters. The aesthetic and monetary value depend, among other things, on the art object's age and its condition. Paintings which have been 'touched up' or restored are often not as valuable as those in mint condition.

David Mowaljarlai (Mowaljarlai et al 1988:691) has made the opinion of his people very clear:

> We have never thought of our rock-paintings
> as ART. To us they are IMAGES. [Original emphasis retained]

In keeping with the wishes of Aboriginal people and with the philosophy of Aboriginal self-determination, the term rock image is used in this thesis when referring to Aboriginal painted and engraved images. When referring to the world corpus of images or the discipline which studies these, the term "rock art", as defined in Flood's (1987) glossary is used, recognising that the discipline has an international following, however ethnocentric that might be.

5.0 SUMMARY

The task of preserving rock images is a challenging one. The detrimental effects of weathering processes are evident at many sites. Less obvious perhaps are the range of political, cultural and economic factors which contribute to the deterioration of the images. This thesis supports the right of Aboriginal people to decide management and preservation policies for rock images and to decide who should carry out these practices.

This thesis also supports the views expressed by Godden and Malnic (1982) and others, that the real cause of the deterioration of rock images has been the destruction of Aboriginal societies which traditionally created, preserved and maintained the sites.

If the long-term preservation of remaining painted and engraved images is to be ensured all of these factors must be addressed. The following chapters examine many of the issues associated with the conservation of painted rock images. Some options for how this may be achieved are presented.

CHAPTER 2

REVIEW OF ARCHAEOLOGICAL AND PERCEIVED CULTURAL SIGNIFICANCE OF ROCK ART

1. ARCHAEOLOGICAL SIGNIFICANCE

There has been much discussion in the literature during the last decade regarding the archaeological importance of rock art and the correct analytical approach to rock art studies. The many views expressed reflect the inherent difficulties in attempting to assign meaning and value to a large corpus of symbols, much of which was produced long before Europeans arrived on this continent, and long before we recognised the need to ask Aboriginal people about the role these symbols play in Aboriginal society. Whether or not hypotheses about the meaning of rock art are testable has been called a "major conundrum" in modern archaeology (Tangri 1989:83).

The debate continues with opinions being expressed which range from ideological (e.g. Odak 1991) to paternalistic supremism (e.g. Halverson 1987) and much in between. Odak claims that rock art studies (RAS) should be a completely separate discipline, and proposes the tentative title of 'pefology'. He argues that archaeology is a subjective and parochial field, and that archaeologists, through their lack of understanding of the meaning of rock art, have underestimated its research potential and hindered its development as a scientific discipline (Odak 1991:7). Halverson's (1987) amazing assertion that rock art was produced by people who had not attained cognitive thought, happily seems to have more opponents (e.g. Davis 1987; Palmer 1991) than proponents. Indeed arguments on the ways in which to recognise the beginnings of human language and abstract cognitive thought have been based partly on the premise that the oldest known rock art in the world indicates the time and place of these beginnings (see e.g. Ford and Watchman 1990; Bednarik 1991).

Between these two poles the majority of scholars posit their own particular points of view. Bednarik (1984a; 1985) attempts to summarise the debate saying that different people will approach the study of rock art in different ways according to their background and the school of thought to which they subsribe. As a result, he argues rock art studies require an interdisciplinary basis which incorporates viewpoints ranging from the humanistic to the neo-positivistic, and that the discipline is best served by a synthesis of these two dissimilar approaches. Humanistic approaches could give rise to a range of theories, questions and testable hypothesis, and positivistic methods could provide data and model testing.

2.0 SUMMARY OF THEORETICAL APPROACHES

2.1 POST-PROCESSUAL THEORIES

Post-processual archaeologists are critical of positivism and 'New Archaeology' because of its emphasis on scientific, and supposedly objective, hypothesis testing. They prefer a renewed emphasis on material culture as it reflects social relations (Englestad 1991). Engelstad claims that post-processual archaeologists continue the androcentric bias of the 'New Archaeology' they criticise. However, she points out that criticisms of positivist archaeology, and recent feminist critiques of science share common ground in their criticisms of the notion of 'objectivity'.

In this way the post-processualist s combine the study of social, symbolic, spiritual and functional aspects of societies.

2.2 FEMINIST THEORIES

Feminist archaeology aims to challenge androcentrism in all schools of archaeological interpretation. It does not aim only to make women more visible and more equitably represented throughout prehistory, but like feminist research in all the social sciences, it aims to show how notions of gender have been and still are politically constructed. Feminist critiques have shown that Western archaeologists, who until recently have virtually all written with a white, middle class male bias, have generally projected their own culturally specific beliefs about the roles of women and men onto the groups they study (see Conkey and Spector 1984; Spector 1991). Spector (1991), in describing her work with Native American people, argues that the same factors which promote the invisibility or the stereotyping of women also act to exclude and distort the representation of Native American people. This is just as true in Australia, where the exclusion of Aborigines from the production of academic knowledge about their own culture, perpetuates the racism and sexism so prevalent within the archaeological canon.

By revealing the male bias in 'scientific' methods and theories, feminist theorists challenge the whole concept of 'objectivity'. Others go further to argue that scientific methods, which emphasise testing and proving of hypotheses, have undermined the validity of discussion and deconstruction of the social roles of women (eg Tringham 1991). The work of feminist archaeologists (see also Conkey & Spector 1984; Gero 1989; Wylie 1989; Gero & Conkey 1991) is gradually being recognised, and feminist challenges to androcentrism within archaeology have been credited with helping to develop a more self-critical discipline (Gilchrist 1991; Hodder 1986).

2.3 ICONOGRAPHIC THEORIES

Many writers (e.g. Maynard 1979; Bahn 1986) suggest that we will never be able to subscribe accurate meaning to or correctly interpret rock art, but that it has other important research values. Others (e.g. David and Flood 1991) submit that while similar paintings often have very different meanings, correct interpretation of the paintings relies on the understanding of the narrative traditions of the area and a knowledge of the individual site. Bahn's (1986) paper highlights some of the problems with interpretation using examples of Aurignacian motifs which are almost universally accepted as representing vulvae. Bahn challenges this 'idee fixe' and the consequent notion that the Aurignacians were obsessed by female genitalia, citing the Magdalenian baguette of La Madeleine which has been variously identified as depicting a bear head, phallus and vulva; a bear head, phallus, anus and hindquarters of an animal; and recently a stylised doe's head! Feminist archaeologists, who emphasise the need to scrutinise and challenge all aspects of the discipline, including the descriptions and commonly accepted inferences drawn from data, could make much of this particular debate. One of the contributions which feminist thought has made to the more common androcentric archaeological approaches is the acknowledgement that our interpretations of the past reflect our current world view. Thus these simplistic explanations of a wide variety of motifs tell us more about the assumptions and biases of the people expounding them than about the people being described. Of note here is the (male) gender of the main protagonists (e.g. Breuil, Didon, Leroi-Gourhan, Peyrony, de St Perier).

2.4 TYPOLOGICAL STUDIES

Maynard (1979:86) recommends rock art typology and distribution studies, comparisons with other cultural and environmental manifestations, dating techniques and other forms of analysis to answer a range of questions about the prehistory of Australia. For example, geographical distribution maps may show early patterns of colonisation.

Others (see especially Clegg 1986a) criticise the iconographic approach to rock art, arguing that the subjective nature of interpretation is the fundamental flaw in iconography. Clegg is well known for his system of classification of motifs using a symbol (!) in front of the term used to describe the shape of the motif e.g. !shield (see Clegg 1987). He adopted this method as a means of describing his perceived shape of the motif without necessarily according it his preconceived meaning. In another paper (Clegg 1986b) he argues that pictures can be studied and can provide information about the people who made them without the researcher understanding what the pictures originally 'meant'. He claims that the problems associated with analysing and interpreting rock art are similar to those associated with studies of other archaeological artefacts, and that a specifically archaeological (non-ethnographic) approach should be used. This approach is also used at times by Chaloupka (e.g. 1983).

2.5 SEMIOTICS

Semiotics and structuralist studies in archaeology have followed similar lines (Conkey 1989). In semiotics the relationship between a word and a concept is designated by a sign, which is said to encompass both a signifier and the signified (Smith 1991).

Llamazares (1989) makes a good case for using semiotics in rock art analysis. She states that rock art is too valuable a potential source of information to disregard on the grounds that we may never understand its original meaning. She believes that societies without phonetic writing had other means of communicating and preserving ideas. She goes on to explain that rock images can be considered semiotic because they can be shown to exist within a system which displays internal structural rules and 'linguistic' signs.

Structuralist approaches to the study of rock art have attempted to show how information about societies is encoded in the form, style and spatial arrangements of the images (see Ucko 1977). Smith (1991) shows how the combination of structuralist and semiological approaches to the study of rock art and other artefacts has been used to show cultural diversity. During the last 15 years these approaches have been especially useful in assisting study of the processes of information exchange and how access to this information contributed to social change in past societies (Smith 1991).

Future avenues of rock art research using semiological approaches may focus on how context affects style and the way in which 'artistic systems' not only reflect social change but play an active part in the social process (Smith 1991).

2.6 SUMMARY OF ARCHAEOLOGICAL SIGNIFICANCE

From the various arguments about the role of rock art research within the archaeological profession, a sample of which I have described above, it appears that conflict centres around two main points:

(1) Whether or not we can ever understand the meaning of rock art,

(2) Whether our understanding of its meaning is necessarily important.

So far in this chapter Australian Aboriginal rock images have not been discussed specifically. The opinions of Aborigines on rock images are scantily represented indeed in the mainstream archaeological literature. Yet, it is surely in collaboration with Aboriginal people that future directions of rock art research should be determined. Lilla Watson (1990:88) sums up contemporary Aborignal attitudes to white perspectives and priorities, saying:

> ...we have had enough of being defined and described by whites, of having others determine what is relevant and important in Aboriginality.

In some parts of Australia, Aboriginal rock images retain their important social and religious functions. In many other areas, paintings and engravings are sometimes the main material evidence of a rich lifestyle in harmony with the environment in which it flourished.

While much of the literature highlights the fact that rock images are part of a living tradition, a very large portion of the known sites were executed before the living memory of local Aboriginal people. The Townsville region is one of many in Australia where Aborigines live close to a large number of painted sites but now know little about the production of the images or the meaning of particular motifs. The Anglo-celtic invasion of this area, while not occurring until relatively late in the nineteenth century, was brutal, resulting in rapid and extreme disturbance of Aboriginal culture and decimation of local populations (see Loos 1982; Reynolds 1989).

While having regard for the arguments discussed above, it is not the intention of this thesis to attempt to argue the relative merits of each. Although I believe Specht (1979:60) serves the discipline well when he argues that rock art sites should be regarded as "areas of past human activity and not simply as congregations of symbols."

3.0 PERCEIVED CULTURAL SIGNIFICANCE

Our society places great significance on places or objects which show us something of or contribute to our understanding of the human past. We have a long tradition of interest in and desire to preserve these manifestations of the past. This perceived cultural significance, or heritage value, is based on a number of factors which can include:

(a) Aesthetic value, which is seen as contributing to our quality of life;

(b) Economic value;

(c) Examples of past artistic or creative achievements;

(d) Evidence of different traditions or cultures and of culture change.

It should be stressed at this point that the notion of 'significance' is a human construct. The significance or 'value' of an object or place depends on the perception of the viewer or the society in which it is viewed. As such, the concept is a dynamic one, changing with society's views and between different cultures.

Rock art sites are often seen as possessing all of the above general values and have several other particular values which can make them significant. Most importantly these might include that :

(a) They have social or spiritual value to the people or the descendents of the people who created them;

(b) They have aesthetic and scientific value to the international community.

Australian painted and engraved sites obviously have wide scientific and aesthetic appeal to the international community. For these reasons they have been included in the Australian National Estate and given World Heritage listing. Unfortunately for the people to whom they originally belonged, this has had the effect of removing them from the control of Aboriginal people and of preserving them chiefly for the benefit of white scholars and tourists. While on ethical grounds this is an undesirable situation, the resultant bureaucratic structure within which the conservation and management of rock art sites is currently controlled could and should be used to its best advantage. Legislation exists which in theory protects sites from destruction (e.g. from roadworks, resort development etc). Funds are available for graffitti removal and conservation treatments if required. However, these measures should be carried out only with approval from local Aboriginal groups, something that has not frequently been the case. All conservation treatments should be seen as interim measures until Aborigines have full control over all of their cultural material and heritage.

CHAPTER 3

SIGNIFICANCE ASSESSMENT, SITE MANAGEMENT AND IMAGE RECORDING

1. SIGNIFICANCE ASSESSMENT

In Chapter 2 of this thesis some of the issues relevant to the perceived scientific and cultural significance of rock art sites were outlined. In that discussion I expressed the belief that 'cultural significance' is a complex and dynamic notion which changes with the ever evolving views of different societies. Further, many places have several, often conflicting, values which may require different management strategies. Because of this, careful consideration of the full range of values a particular site may have is essential. This is a process called 'significance assessment' (Sullivan 1992).

Cultural significance is defined by the Burra Charter (ICOMOS Australia1988) as:

> ... aesthetic, historic, scientific (research)
> or social value for past, present or future
> generations.

Aesthetic significance is very subjective and can depend on cultural background and individual preference. Importantly, with rock art sites the aesthetic value as assessed by non-Aboriginal people may be in conflict with that of Aboriginal people. Western society places great value on 'things of the past' and signs of a different way of life. Painted sites fulfil both of these criteria. When they also present a patina of age they are likely to be judged by non-Aborigines as highly significant and possibly of more 'value' than 'newer-looking' images (see Bickford 1981 for a discussion of the "nostalgic" vision of the past). This is evidenced by tourists keen desire to know the antiquity of sites as well as whether they are 'original'. In contrast, traditional owners may view the art as secondary or as having lost its relevance, or they may decide that it requires retouching or repainting (Mowaljarlai and Watchman 1989).

The historic value of a site can also be perceived differently by Aborigines and non-Aborigines. To non-Aboriginal researchers, a site with much superpositioning of motifs may indicate a long period of use and re-use and for this reason it may have historic value. Local Aborigines may consider a site historically important if it represents a particular person, group or time in their history, regardless of whether there is evidence of superpositioning or whether the images are 'old'.

Scientific significance is defined by Schiffer and Gumerman (1977:212) as 'research potential'. Thus it is often difficult to assess, as we need to try to predict future research questions. Rock art sites have already provided us with a great deal of information which we may not have gained from any other source. This is likely to continue and be enhanced by Aboriginal involvement in identifying and addressing research questions.

Painted and engraved sites obviously have strong social significance to Aborigines and to non-Aborigines. When describing cultural significance the Burra Charter (ICOMOS Australia1988) states that:

> Social value embraces the qualities for which a place has become a focus of spiritual, political, national, or other cultural sentiment to a majority or minority group.

Many sites are of sacred importance to Aborigines as well as important evidence of cultural continuity. In other places, the local Aboriginal population may have little or no knowledge of the rock image sites of the area. However, these may become powerful political tools for local Aborigines, *viz.* as evidence of traditional land ownership. In both instances, local Aborigines can claim ownership and custodianship of the sites, though the legal status of such claims depends on local state and territory legislation.

As previously discussed non-Aboriginal people place a range of values on painted and engraved sites, which can often conflict with the values of Aboriginal people. This has relevance to all management decisions. On strong ethical grounds it can be argued that the concerns of Aboriginal groups must be the dominant feature of any management plan.

Until recently, significance assessment has usually been carried out by white employees of government agencies and often without any consultation with Aboriginal people. The recent move toward joint management of National Parks in some states and territories (e.g. Queensland, Victoria and Northern Territory) will go some way to addressing this problem. In most states of Australia it remains to be seen whether Aboriginal ownership of sites will be fully recognised. This would require the acknowledgement of Aboriginal rights to direct and control management decisions regarding the sites. The issue may be decided in the end by further High Court decisions on prior sovereignty, such as the landmark decision on the Eddie Mabo case, which overturned the previously held notion of Terra nullius (Mabo Vs Queensland 1992).

2. SITE MANAGEMENT

Rock art site management involves an interdisciplinary approach which addresses both the physical and the cultural aspects of a site or number of sites. Careful management of rock art sites can make a major contribution to their long-term preservation. It involves the following sequence of steps (Sullivan,1992:3):

(1) Location and documentation of the site;

(2) Significance assessment;

(3) Design of a management policy;

(4) Application of appropriate management practises.

One of the first tasks which should be carried out is a detailed recording of all images and applied marks which can be seen. This record along with a range of other research data will help in determining the significance of the site and thus, how it may best be managed.

Suitably trained site managers may apply or arrange for others to apply already tested conservation treatments to sites, as well as preventive conservation measures such as fencing to prohibit entry to the area by feral and domestic animals.

Appropriate visitor management techniques may reduce the risk of vandalism and unintentional damage to the images, as well as minimising the impact of visitation on the site and the surrounding area (see Gale and Jacobs 1987).

3. IMAGE RECORDING

Recording has always been of fundamental importance in rock art studies. There is a wide and varied range of techniques available for the recording of rock images (see Pearson and Swartz 1991). Most workers in the field agree on the need to combine drawings, photography and written descriptions (Rosenfeld 1977). However, there is much variation in the ways these are carried out. This is probably as much due to the individual workers preference as it is to the aims of the particular recording. That is, the purpose of the recording will often dictate the methods used as well as the level of detail required. The primary academic and governmental purposes of the recording can be summarised under two broad categories:

(1) Cultural heritage management purposes;

(2) Archaeological and anthropological research.

Often a record made for one purpose will not adequately fulfil the requirements of another. For example, a conservator may be interested in the rock composition and the interface between the paint layer and the rock substrate, whereas an archaeologist interested in developing a typology for the area will focus on form and content in the art of the site. Any record therefore must involve some selectivity according to what is required by the researcher.

This notion is not, however, universally accepted. Some claim that the aim of any recording should be a total and accurate representation of all aspects of the site, arguing that we cannot predict what future researchers will require. This, of course, is true, and total recording may even be considered the ideal. However, even if we were able to identify every trait of a particular body of images, which Clarke (1968) and others claim is infinite, no recording, however thoroughly carried out, can be guaranteed to satisfy the vast array of currently unidentified future research requirements. Furthermore, the pragmatic issues of time and money dictate that this level of recording will rarely be possible (Rosenfeld 1977).

Taking these considerations into account there are some general conventions regarding what should be recorded. Separate specialist recordings will always be necessary where particular data is required. It is generally agreed that anything which may be relevant to the art should be recorded (Rosenfeld 1977; Clegg 1983). This may include the following:

(1) Graffitti, as its proximity to the art will be very relevant should subsequent removal be carried out;

(2) Naturally occurring cracks and marks on the rock face.

Often the latter will be difficult to categorise into what is relevant and what is not. However, features such as hollows which affect the design or distribution of images on the rock face, cracks which dissect parts of an image, as well as the physical characteristics of the rock and the image, may all be pertinent (Rosenfeld 1977).

4. RECORDING TECHNIQUES

4.1 PHOTOGRAPHY

Rosenfeld (1977) sees the purpose of photography as 'primarily descriptive'. While many photographic records are obviously made for this end, they have the capacity for much more. The use of artificial lighting, lens filters and certain films can all enhance the visibility of faint images and the results can be used to check drawings. Close-up photographs can be used to monitor paint loss or surface exfoliation. Archival processing and storage of the photographs, transparencies and negatives in unbuffered acid-free paper enclosures or inert plastic storage materials will contribute to their long-term stability and preservation.

Colour transparencies and black and white prints should both be taken. As colour film is not stable in the long-term, black and white photographs are often recommended as being most suitable for archival purposes. Obviously in these cases a record of the colours used in the images is required. Munsell Soil Color Charts or recordings using digital colour meters would be useful. These should be seen as essential parts of field notes. In some instances colour prints may be useful and instant Polaroid photographs may be of immediate assistance in the field and a helpful adjunct to field notes (Rosenfeld 1977).

General views of the site and surrounds should be taken, as well as overall views of the specific rock face and of individual figures. Weaver

(1974) is quite specific about the photographic records which are required and recommends the following series of photographs, which record the site in increasing detail:

(a) the site or region;

(b) the group location within the site;

(c) the specific item within the group;

(d) the detail within the item;

(e) the micro evidence within the detail.

4.2 PHOTOGRAMMETRY

Conventional photographic recordings cannot be used to calculate accurate measurements of the images of the site. This is because the rock faces on which they have been executed are rarely flat and distortions result when measurements are taken directly from photographs (Ogleby and Rivett 1985).

Many researchers (e.g. Clouten 1974; Rivett 1978; Ogleby and Rivett 1985) have advocated the use of photogrammetry to overcome this problem. The technique is routinely used in map making and uses stereo-photography to provide a 3-D image. When the stereo-pair of photographs are mounted in a viewer (or 'analogue restitution instrument'), accurate drawings and measurements can be obtained (Ogleby and Rivett 1985). The process seems to have great potential, although there are a number of drawbacks. The equipment is expensive and few cameras currently available accept colour film. While the relatively bulky equipment generally used has been modified to make it more suitable for rock art recording (see Ogleby and Rivett 1985), in areas where the vegetation is dense, where access is difficult, or where parts of the rock morphology limit viewing of the images, use of photogrammetry may not be possible. It has however, been successfully used at a number of sites (e.g. Whale Cave, New South Wales; Quinkin Reserve, North Queensland) where numerous recordings were made, and from which accurate plottings of the images have been obtained (Ogleby and Rivett 1985).

4.3 TRACINGS

Life-size tracings onto transparent polyethylene sheeting are often recommended as the best means of making an accurate recording (e.g. Clegg 1983; Weaver 1974). In this technique, a polyethylene sheet (approximately 2 m X 2 m) is taped to a rock face, and various coloured felt pens are used to trace the lines of the images. The tracing is later reduced to a workable size by photography. The direct nature of this technique lends itself to accuracy, however there is justified concern about the potential damage to the images from abrasion, as well as the possibility of residue from the adhesive tape or 'Bluetack' remaining on the rock face.

A safer method of tracing can be produced by projecting a colour slide of the images to be recorded onto a wall at life-size or larger and directly tracing the images onto polyethylene sheeting. As well as posing no physical risk to the images, this method has the advantage that the slide can be magnified, thus providing a clearer image for tracing.

4.4 DRAWINGS

There are two stages to hand-drawn records of a site. The first stage should be a sketch of all motifs and associated lines and marks. For a large site, this would require dividing the area into smaller, workable parts. This sketch need not be so precise as to involve measurement of motifs, as its purpose is simply to attain a record of images present for checking against subsequent records. It can also be used to develop a hypothesis for testing or analysis at the site. It may be most useful if this sketch is done with coloured pencils approximating the true colours of the images. Clegg (1983) suggests using green for white lines (if the drawings are executed onto white paper) and including a descriptive key.

The second stage drawing should be a detailed, accurate rendering of the images and other features present, drawn to scale on graph paper and using a key to indicate paint colours and to differentiate between naturally occurring and applied features, as far as these can be discerned (Rosenfeld 1977; Clegg 1983). The accuracy of this method depends on the skill and experience of the recorder. Even when this is high, errors can occur as a result of the indirect nature of the technique, in which some level of interpretation, often at an unconscious level, usually occurs. This method has the further disadvantage of being extremely time-consuming at each site.

4.5 DIGITALLY ENHANCED AND STORED IMAGES

Digital image processing is the science of modifying and analysing pictures using computer technology. In this process, image intensities are represented by numerical values. Colour information is converted into numerical data representing the contribution of red, blue and green at thousands of points in the image (see Wainwright 1990 for more detailed information about the technique). The processing and visual enhancement of painted and engraved rock images using computers and digital image processing software is a recent and very promising development for rock art recording and research (e.g. Dickman 1984, 1989; Rip 1089; Consens 1989). Storage of the images on laser or optical disc rather than video or photographic films offers a significant advantage for the archival storage of images (see Bednarik 1984b; Swartz 1991).

Various methods, originally developed for remote sensing applications to locate and analyse earth topography, are currently being considered. Dickman (1984) describes a method of digitising and enhancing images from video film, while Rip's (1989) research involved enhancing images initially recorded on 35 mm colour slide film. Significant advances in technology occurred in the five years between these two papers and is continuing at a rapid rate. In 1984 the available systems could only 'see' black and white images although one system could add false colour. The original source could be either colour or black and white, but for best results it needed maximum contrast and as clear a picture as possible (Dickman 1984).

By 1989 techniques had been developed to 'see' colour and to allow contrast and edge enhancement. The processes allow the manipulation of images by either adding or subtracting light, which the computer stores as 'pixels' or picture elements.

The main benefit of these techniques is the assistance they can lend to the researcher by clarifying superimposed lines and highlighting faded or abraded images. The large number of images which can be stored and rapidly accessed and the permanent record which can result are other important benefits of the technique (Rip 1989).

Video and photographic films can deteriorate over a relatively short timespan. Further, video images can wear out from use, the film can stretch or become entangled in the video cassette recorder (VCR), be affected by magnetic fields or be accidentally erased. Colour photography is well known to be unstable in the long term.

Bednarik (1984b:34) estimates the number of images being lost in Australia, both by human causes and natural deterioration, to be in the order of tens of thousands per year. He suggests that permanent digital recording of images may be the only way we have of 'conserving' our large body of rock art and in fact could be seen as a 'logical, computerised extension of [Aboriginal] custodianship'. While this approach may be very well suited to the purposes of academics, and may even save them the trouble of venturing out of their research institution, it may not serve so well the needs of Aborigines, who have stated repeatedly that permanency of the images, while of some importance is not their main concern (see Chapter 1). Indeed 'computerised custodianship' of painted and engraved images may very well be the ultimate affront to Aboriginal people, although many communities have commenced building databases on other matters relevant to their community.

5. SUMMARY

While I do not agree with the sentiments expressed by Bednarik (1984b), I do accept his point that rock images are being lost at an alarming rate, that it is imperative we record as many of these as possible and that the best possible techniques be used for this recording. Digitised image processing provides an excellent means of storing recorded images and should be used in association with other methods previously described.

It is some peoples belief (e.g. Swartz 1986; Wainwright 1990) that the slow but gradual destruction of rock images is inevitable. Vandalism and development pose potentially greater threats and it is recognised that documentary records may eventually become the only surviving evidence of the images. Unfortunately, this is already the case for many sites.

CHAPTER 4

THE PHYSICAL ENVIRONMENT OF THE TOWNSVILLE REGION

1. INTRODUCTION

In order to attempt to understand the geochemical processes which may lead to the deterioration of painted images it is essential to be familiar with the local physical environment and also to have an understanding of the chemistry of the rock substrate upon which the painting has been applied. Most of the painted images in the Townsville region are on granite boulders or in rock shelters formed by boulder outcrops. A summary of the physical features of the region is presented in the following pages and is followed by a discussion of the chemistry of granite and how this affects the weathering processes it under goes.

2. LOCATION

The Bureau of Mineral Resources explanatory notes, which accompany the 1:250,000 geological map sheet, describe the Townsville region as bounded by longitudes $145^{o}30'$ and $147^{o}0'$E and latitudes 19^{o} and 20^{o} S, basically covering the areas north and south of the city and the hinterland west to the Burdekin River (Wyatt 1968).

3. CLIMATE

Townsville experiences a climate common to most dry tropical regions, with warm, dry winters and hot, wet summers. The relatively flat countryside minimises the severity of the wet season and the surrounding low ranges contribute to a rainshadow effect, producing short wet seasons and relatively long dry seasons.

The rainfall averages 1200 mm per year with most falling between December and March. High intensity rainfall is common and can cause local flooding and erosion through scour run-off (Landplan Studio Pty Ltd n.d.). The wettest month is February (mean 319 mm) and the driest month is September (mean 10 mm). The mean annual temperature is 24.4^{o}C, with seasonal ranges of 20-32^{o}C in summer and 13-27^{o}C in winter. The coolest month is July (mean temperature 19.9^{o}C) and the warmest month is January (mean temperature 27.6^{o}C) (Hornby 1987), with mean maxima temperatures in the range of 30-31.5^{o}C (Brayshaw 1990). The daily range is greater in winter than in summer.

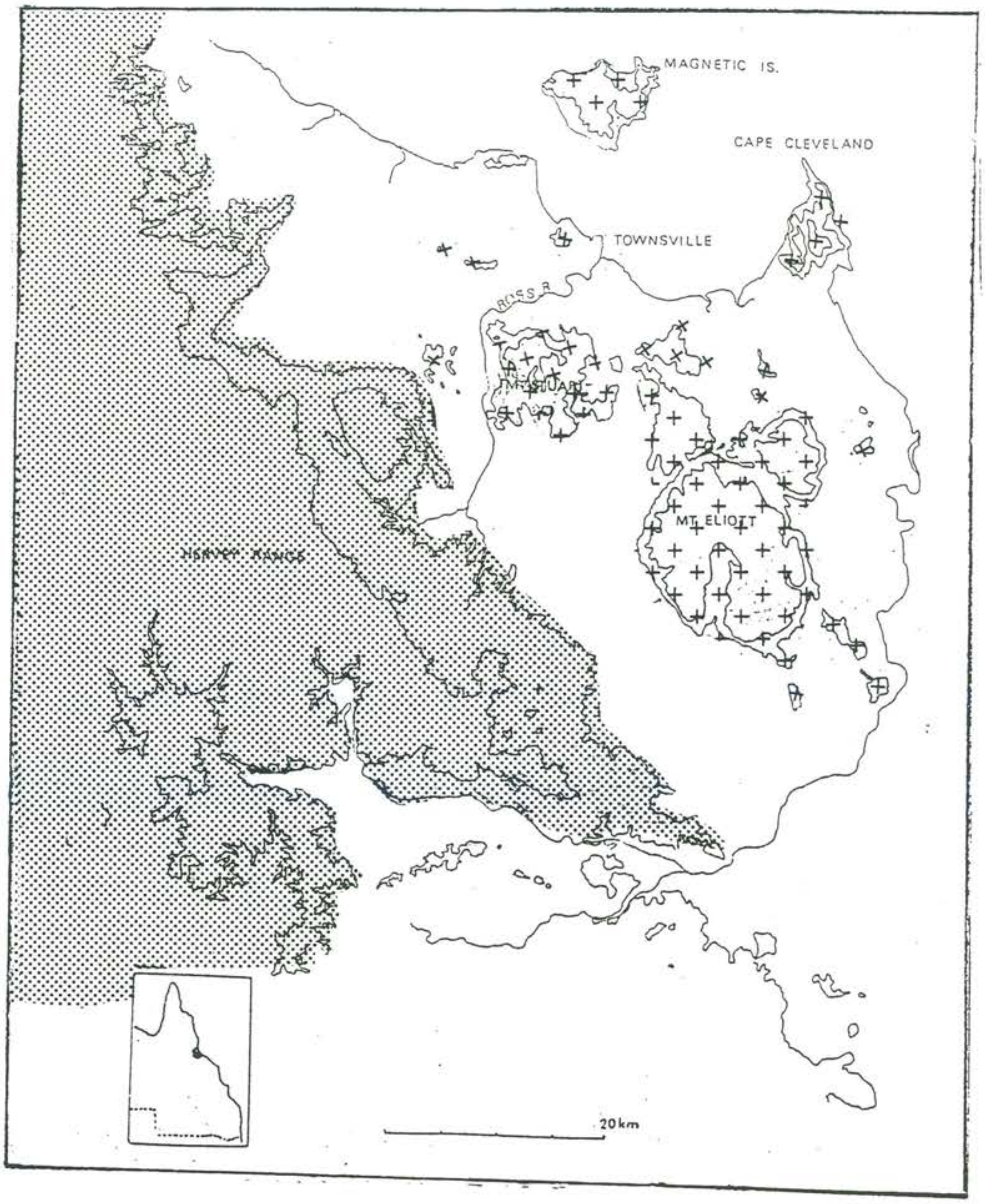
Humidity as a function of rainfall and temperature is relatively high in summer with a significant increase during January to March. April to December is consistently less humid. The region is generally less humid than coastal regions to the north (Landplan Studio Pty Ltd n.d.).

4. TOPOGRAPHY

The landscape of the Townsville area consists of flat coastal plains, isolated mountain outcrops (Castle Hill, Mount Stuart, Mount Elliot) and a border of peaks and ranges forming the Hervey Range escarpment (Trezise and Stephenson 1990).

Wyatt (1968) classifies the region shown in Figure 1 into three main topographic or physiographic types: Coastal Lowlands, Coastal Hills and Mountains, and Inland Uplands.

FIGURE 1 Map of the Townsville region showing major physiographic types. Adapted from Wyatt 1968.



KEY

Coastal lowlands

Coastal hills and mountains

Inland uplands

The Coastal Lowlands extend eastwards from the foot of the Hervey Range, and are composed of alluvial fans near the mountains, merging to outwash plains formed by an old distributary river system. These then merge with the tidal flats and streams of the present coastline (Wyatt 1968; Hopley and Murtha 1975).

The Coastal Hills and Mountains consist mainly of residual volcanic outcrops surrounded by the Coastal Lowlands. Mount Elliot is the highest point in the immediate region (1240 m), but in general the elevation is much less than this.

The Inland Uplands which include the Hervey Range constitute some of the most rugged terrain in the region. The area exhibits much faulting, and it is along these that during the Cainozoic period, upward movement produced the fault scarp still evident in the area (Wyatt 1968).

5. HISTORY AND DESCRIPTION OF THE GEOLOGY

During the Late Carboniferous period (approximately 300 million years ago) heating and melting of rocks within the Earth's crust occurred on a large scale, with widespread volcanic eruptions. Renewed volcanic activity on a large scale again occurred during the early Permian period (286 to 258 million years ago). A large volcanic arc (the Camboon Volcanic Arc) formed along the east side of the Australian continent extending from east of what is now Townsville to Central Queensland (Trezise and Stephenson 1990). There is much evidence of this volcanic activity throughout northeast Queensland. The resultant rock outcrops in the Townsville region are referred to as the Julago Volcanics (i.e. Mount Saint John, Many Peaks Range, Mount Bohle, parts of Mount Stuart and surrounding hills to the south), and while relatively abundant they represent only remnants of the original formations, most of which have been extensively eroded (Trezise and Stephenson 1990).

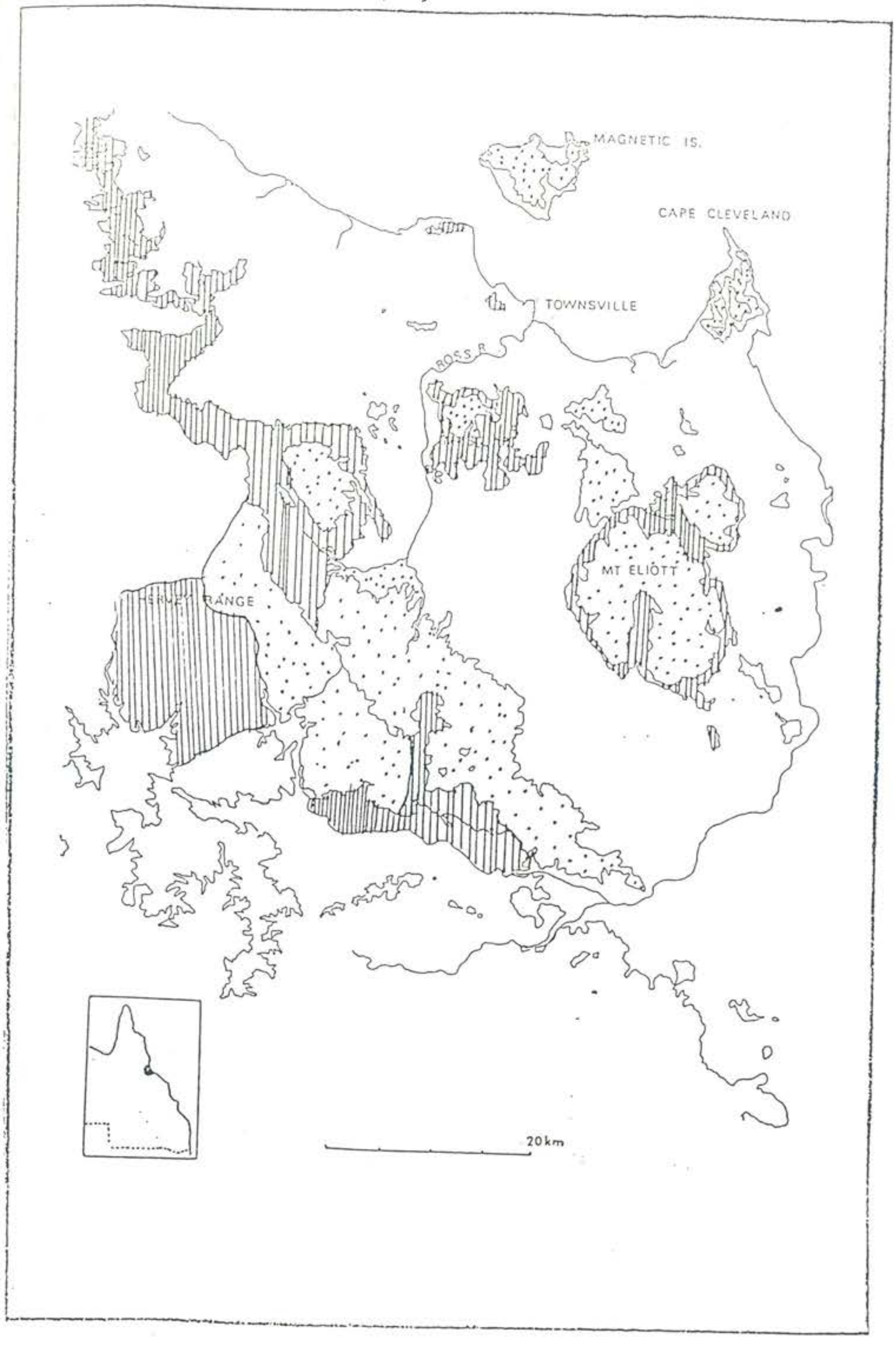
Approximately 270 million years ago, this activity ceased and was followed by the formation of numerous granitic intrusions. Some of the larger intrusions have been individually named, such as Castle Hill Granite, Magnetic Island Granite and Muntalunga Range Granite. Unnamed intrusions are present on Cape Cleveland, Mount Stuart and Mount Elliot (Trezise and Stephenson 1990).

Approximately 150 million years of geological stability apparently followed, until the early Cretaceous period (144 to 100 million years ago), when the region was uplifted. Subsequent erosion gradually removed much of the volcanic sequences and exposed the granitic intrusions (Trezise and Stephenson 1990). Figure 2 shows some of the major geological features of the region.

6. CHEMISTRY OF GRANITE

Granite is a coarse-grained igneous rock, composed mainly of crystalline grains of felspar, quartz and mica, with minor constituents of horneblende and sometimes tourmaline. The high proportion of silica, present as quartz which is pure silica, and as felspars, has lead to the term silicic rock being commonly used (Stone 1972). The grains of the principal mineral components are roughly equal in size (i.e. equigranular) and are randomly distributed (Rosenfeld 1965).

FIGURE 2 Map of the Townsville region showing major geologic features. Adapted from Hopley 1978.



KEY

Volcanic rocks

Plutonic intrusions, mostly granite

The felspars, present in granite as both orthoclase and plagioclase, form the most abundant minerals. Orthoclase felspars have the chemical formula $KAlSi_3O_8$. The plagioclases form a soda-lime series which ranges from albite $NaAlSi_3O_8$, to anorthite $CaAl_2Si_2O_8$. This series is categorised according to the ratio of anorthite present in the following order:

TABLE 1. SODA-LIME SERIES OF GRANITIC PLAGIOCLASES (after Raguin 1965)

MINERAL	**% ANORTHITE**
Albite	0-10
Oligoclase	10-30
Andesine	30-50
Labradorite	50-70
Bytownite	70-90
Anorthite	90-100

Quartz (SiO_2) is generally the last mineral to crystallise out of the magma and is normally found in irregular shaped grains, which fill the interstices between the other minerals. It forms between 25-40% of the rock bulk, depending on the variety. Of note in granite is the fact that no glassy (i.e. non-crystalline) material is present between the grains (Raguin 1965).

The chemical composition within a given granite mass is relatively constant, although variations may occur near inclusions or border zones. There is, however, wide chemical diversity possible between different rock masses. These chemical variations are mostly due to differing ratios of the orthoclase felspars and the plagioclase felspars (Raguin 1965).

7. WEATHERING OF GRANITE

Granites have a chemical instability near the surface of the earth which is more pronounced than other rock types. The weathering, largely caused by water action, takes the form of granular disintegration, with the rock eventually breaking down to a coarse sand. Microscopic study of the material has shown that the quartz remains unaltered and the felspar is reduced to either kaolin or sericite. Whether kaolinisation or sericitisation occurs depends on the pH value of the solutions responsible for the weathering. It is thought that acidic water favours the formation of kaolin, while more alkaline water tends to produce sericite. Of the two types of felspars, the plagioclase is generally attacked first, although this is not always the case (Raguin 1965).

This is a very simplified description of the breakdown of granite by weathering. In reality the breakdown is not as straight forward as this individual reaction between the rock constituents and the infiltrating water. Few chemical reactions proceed quantitatively to one end product. Generally a number of side reactions occur, and there is often interaction between the newly formed by-product minerals.

As stated at the beginning of this chapter the surrounding physical environment and especially the chemistry associated with the weathering of the rock substrate is very relevant to the understanding of the processes of the deterioration of painted images. As is demonstrated in this thesis, these processes continue to have a significant detrimental impact on the painted images in the Townsville region (see especially Chapters 6 and 7).

CHAPTER 5.

ROCK ART CONSERVATION

1. INTRODUCTION. HISTORY OF CONSERVATION

Modern society has a long tradition of conserving or at least attempting to conserve evidence of our past. By the late Renaissance the craft of painting restoration was well known. Later, with the development of 19th century science came a better understanding of the causes of damage and of the application of new techniques aimed at slowing the deterioration processes. Thomson (1977) cites several early examples of this including a report by Michael Faraday dated 1853 and another by chemists Russell and Abney dated 1888. Faraday expressed concern about damage to artworks as a result of the siting of the National Gallery of London in close proximity to the large chimneys connected to the steam engines which worked the Trafalgar Square fountains. In their report Russell and Abney discussed the suspected causes of the fading of watercolours.

Unfortunately newly developed 'scientific' applications were often detrimental. Thomson (1977) also cites an 1893 record of the Greek Government's official method of acid cleaning bronze statuary, which resulted in their disintegration.

More recent instances of conservation treatments gone wrong are not hard to find. Examples include:

(1) The insertion of steel rods into the columns of the Parthenon in Athens caused further damage as a result of the expansion of the metal rods due to corrosion; the subsequent pressure from the volume

increase of the iron inside the columns was sufficient to fracture the marble;

(2) The widespread use, during the 1960's and 1970's, of soluble nylon as a stone and wood consolidant has caused problems for modern day conservators; the polymer has cross-linked and discoloured, is irreversible and has prevented further treatment of the objects on which it was used (see Sease 1981).

Experiences like this in Australia, combined with the findings of the National Estate Inquiry, the Committee of Inquiry on Museums and National Collections and the Planning Committee on the Gallery of Aboriginal Australia, highlighted the poor condition of Australia's cultural heritage material. This led to the realisation of the need for professional training in sound scientific and ethical approaches to conservation. As a result the only academic based conservation training programme in Australia was established in 1978 (Mulvaney 1977) at the Canberra College of Advanced Education, now the University of Canberra.

A number of years prior to this the Institute for the Conservation of Cultural Materials (ICCM) later to be called the Australian Institute for the Conservation of Cultural Materials (AICCM) had been established and a Code of Ethics was eventually adopted in 1986 (AICCM 1986).

2. ETHICAL STANDARDS IN CONSERVATION

As a result of these relatively recent professional developments, conservation in Australia has become a technically specialised discipline, with rigorous ethical standards. These are clearly stated in the

AICCM Code of Ethics to which the reader is referred if full details are desired (AICCM 1986). In summary, they require that:

(1) All treatments be reversible, but since this is not always technically possible, this ethic is now considered to be fulfilled if the treatment does not prevent subsequent treatments being successfully applied (see Horie 1983 for a discussion of the practicalities of reversibility);

(2) The cultural integrity of the object be maintained;

(3) The highest possible standards of testing, analysis and treatment be adhered to;

(4) The best materials and processes available at the time be implemented.

Conservators are also bound by the principles of the Burra Charter (ICOMOS Australia 1988) and the ethics associated with other professions with whom they are involved, e.g. archaeology. This background has tended to produce a body of professionals who are very aware of the hazards of ill-researched or poorly implemented procedures, and of the need for fully tested, reliable materials. Because of concern over the long-term stability of many products, especially synthetic resins used as adhesives and consolidants, emphasis is often placed on preventive conservation practices. That is, those which do not require direct intervention upon the object, but rather rely on manipulation of external factors which lead to deterioration.

This approach has been quite successful in some instances, such as environmental control within museum buildings and the installation of artificial driplines in rock art shelters. However in other areas, notably building and stone monument conservation, these methods are not appropriate. In situations where the stone fabric is deteriorating, interventionalist methods are implemented. In most cases, the materials used have been tested and found to conform to acceptable standards, however 'acceptable' is the operative word. It is known, for instance, that the resins used will not last indefinitely. However, it is believed that they will not prohibit further work should it be required (R. Taylor 1991 pers.comm). Treatment is carried out now, even with the knowledge that superior methods may become available in the future, because it is believed that to wait would mean committing many of the world's monuments to virtual disintegration.

If we accept the sentiments of Bednarik and others (e.g. see Bednarik 1984b), that rock images are deteriorating at an alarming rate, then the state of the world's rock art can be considered analogous to that of buildings and historical monuments. It may be the case that it is better to treat rapidly deteriorating images now, with the best materials available, accepting the reality that superior materials will likely become available in the future. Rather than hesitate, waiting for the 'ideal' material, which most assuredly means relegating many images to total destruction. This, of course, assumes that it is appropriate that the image(s) be conserved. Some indigenous people may prefer to see the images deteriorate rather than be subjected to artificial conservation measures (see Lewis and Rose 1988).

3. BACKGROUND TO ROCK ART CONSERVATION IN AUSTRALIA

Since the early 1970s, there have been consistent calls by those concerned with rock art for more research into the technical aspects of its conservation (e.g.Crawford 1970; Moore 1975; Pearson 1976; Walston 1975; Mulvaney 1977; Pearson 1978; Hughes et al. 1984; Rosenfeld 1988). The difficulties involved in conserving rock art sites have challenged those charged with their protection for decades.

Due to limited funding there has been a general dearth of longer term, systematic conservation research programmes. Clarke's 5 year research project between 1973 and 1978 (see Clarke 1978a) and the Kakadu National Park Project (Gillespie 1983) are exceptions. Some notably unsuccessful attempts at intervention have been reported (e.g. Lal 1970), however there has been an apparent reluctance to publish critical reviews of earlier treatments.

In 1969 the United States Bureau of Land Management published a Technical Note entitled 'The Care and Repair of Petroglyphs' (United States Department of the Interior 1969). Aimed at non-specialist field workers, the paper recommends a range of treatments which, it claims, are suitable for petroglyphs as well as painted images. These include methods to:

(1) Improve the clarity of photographic recordings, by applying a mixture of aluminium powder and water to the engravings, which could be left in situ and allowed to '... wash off with the next rain.' (United States Department of the Interior 1969:3)

(2) Treat incised graffitti by:

> rubbing or smoothing the area with another stone as hard or harder than the scratched stone (United States Department of the Interior 1969:5).

If, as a result of this treatment a visually disturbing lighter surface resulted, the paper advises that desert varnish can be replicated by:

> ... boiling a mixture of water, soil and sand from near the petroglyph to obtain a liquid rich in manganese and iron. The solution is placed on the area to be covered and baked into place with a blowtorch... (United States Department of the Interior 1969:5).

(3) Consolidate deteriorating rock substrates using a mixture of :

> ... about 1 part Pencapsula to 5 parts mineral spirits sprayed onto the surface to be strengthened, respraying several times if necessary to get the required 1/4 inch [0.5 cm] penetration of the Pencapsula into the sandstone that will do the protection job. Pencapsula is a synthetic resin that encapsulates the grains of sand in the sandstone leaving the natural spaces between them so that the sandstone continues to "breathe" allowing the passage of air and water, thus reducing the tendency of the sandstone to spall (United States Department of the Interior 1969:5).

It is interesting to note that even in 1969 the physical and chemical requirements of a suitable synthetic stone consolidant were well known and understood. Yet the example typifies the sort of inappropriate measures (especially 1 and 2) to which rock images have been subjected in an attempt to ameliorate or halt their deterioration. How widely its recommendations were implemented is difficult to gauge, however as it would have been issued to all Bureau of Land Management (BLM) offices, it may be assumed that several, if not many, well-intentioned officers carried out these treatments at sites within their jurisdiction. Yet, in recent personal discussions with a number of current employees of the BLM, none had knowledge of any reports assessing the long-term results of earlier treatments. However, all were quick to state that such treatments would no longer be advocated!

In a similar Australian example Boustead (1970) advocates the use of 'fascinating new' synthetic materials for consolidating rock paintings. Included amoung these is 'Calaton C.A.' (an ICI trade name) commonly known as soluble nylon (N-hydroxymethyl nylon). As this paper appeared in an apparently popular, or at least frequently cited volume (McCarthy 1970), it is conceivable that its recommendations were followed by some well-intentioned field workers. Yet, I have been unable to locate any published reviews of the efficacy or otherwise of Boustead's recommendations. This is surprising, given the relatively large body of written material on the topic of Australian rock images.

With hindsight and the advantage of recent advances in polymer chemistry, it may be tempting to denounce such pioneering attempts at conservation as unethical or 'unscientific'. Yet, the papers should not be criticised on that basis. One can presume that the chemical properties of 'Pencapsula' and the consolidants included in Boustead's paper were known and that they were considered to be the most suitable materials available at the time. Censure would instead be better directed at the lack of routine follow-up evaluation programmes or the scant publishing of them on the apparently rare occasions when they have occurred.

The works can however be criticised if the treatments were considered experimental. This practise is now directly prohibited by the Burra Charter (ICOMOS Australia 1988). Unfortunately no such guidelines were in place when these treatments were carried out.

Both papers (United States Department of the Interior 1969; Boustead 1970) also exhibit the common but undesirable practice of encouraging unskilled or inexperienced workers to undertake treatments which require expert knowledge. The very serious problem with recommendations of this type is that it allows the possibility of what may be quite sound techniques to be poorly applied. This has been the problem with several attempts at conservation in the past (Lambert 1992 pers.comm.). This view, however, is not to discount the instances where poorly researched or applied conservation measures have amounted to the equivalent of vandalism. In these cases several have resulted in accelerated deterioration of sites (see e.g. Lal 1970; Avery 1978). Miracle cures for the large number of problems affecting rock art sites have so far been elusive. Relatively simple but effective measures (e.g. fencing sites, artificial driplines) which address some problems have been widely implemented in the last twenty years and considerable emphasis has been placed on improving techniques of graffitti removal. Gale and Jacobs (1987) study suggests that the previously high incidence of graffitti vandalism is now on the decrease. Whether this is a result of increased knowledge and respect for Aboriginal culture or fear of prosecution is not clear. Whatever the reasons, it follows that field workers' time and expertise could eventually be directed to other aspects of rock art deterioration. However, it appears to be the current trend among conservators and administrators to focus on more superficial aspects of rock art deterioration which are relatively simple to solve, rather than address more fundamental factors affecting the decay of the rocks and the images upon them (Watchman 1987; J.C. Dean 1992 pers. comm.). Political factors may contribute to this situation. Walkways, fences, visitor books etc. are visible signs of agency presence and the practical and beneficial use of public funds, whereas long-term projects assessing the aging properties of synthetic resins are more difficult to promote and for the public to evaluate their worth.

The need for methods to improve the bond between flaking paint and the rock surface, as well as to consolidate the disintegrating rock substrate, is still pressing. Those not fully aware of the difficulties inherent in these processes still wonder why 'something can't be sprayed on' the rock to solve 'all' the problems. This may eventually be possible and some research is continuing along this line, with a current focus on silicone-based consolidants and water repellents (Ford and Watchman 1990; Haskovec 1991). Polymer chemists, however, generally do not have experience dealing with the type of physical and chemical deterioration factors present at rock art sites. Watchman's research into the processes involved in the natural formation of silica skins and into suitable methods for their artificial replication has held much promise (e.g.Watchman 1985; 1987). Yet institutions and organisations in Australia have been reluctant to fund such research, and his expertise is now unavailable as he has moved to Canada.

4. CONSERVATION STRATEGIES FOR ROCK ART

The European model of art and artists is not applicable to Aboriginal societies, where neither the 'art' nor the person who produced it is revered or valued for its/their own sake (see Chapter 1; also Maynard 1976; Marika 1978; Mowaljarlai and Watchman 1989). Australian Aboriginal rock images must be seen to be part of a living culture. It is inappropriate to treat the images as we would art or other artefacts, which have been accessioned into museums or art galleries. These objects are no longer in their original context. It is therefore correct that they be maintained in the condition they were acquired by the collecting institution. Decisions regarding the maintenance, conservation or restoration of rock images, as previously discussed in Chapter 1, must be made by Aboriginal custodians. It may be the case that conservation intervention by Europeans is inappropriate. Based on extensive research in the Victoria River district of the Northern Territory, Lewis and Rose (1988) report that conservation treatments have the potential to destroy the significance of the images and undermine the authority of the tribal elders. Conservation intervention, other than the regular maintenance of sites by elders, suggest a lack of belief in the regenerative powers of the images and also that the work of the elders is inadequate (Sullivan 1992).

A code of ethical practice more closely reflecting these issues and developed in collaboration with Aboriginal groups, to govern the practices of all rock art researchers in Australia, should be adopted. Indeed, it could be argued that this is an essential requirement if workers in the field are to remain in line with government policies of self-management and self-determination for Aborigines. These are not recently developed policies. Clarke, B.A. (1978:8), for instance, quotes a Department of Aboriginal Affairs Ministerial Directive of 1978/79:

> Aboriginality includes the recognition that Aboriginals have the right to retain, modify or develop their language, culture, customs, traditions and lifestyle in their own way.

Dick Roughsey (1978:65) sums up the opinion of the Aboriginal Arts Board in this way:

> ... The Board is confident that now that the accumulated experience and wisdom of the people who know most about Aboriginal art and culture - that is the Aboriginal people themselves - are being brought to bear on the problems, there is ample reason

for optimism.

4.1 CONSERVATION POLICY DEVELOPMENT

Assuming the processes outlined in Chapter 3 regarding significance assessment and site management have been fulfilled, and the decision to conserve a site has been taken, a conservation policy for the site should be developed. Without one, conservation measures may be implemented over a period of time on an ad hoc basis, or as reactive responses to current trends, rather than as a carefully researched, systematic plan of action. A combination of aspects of the AICCM code of ethics (AICCM 1986) and a flexible interpretation of the Guidelines to the Burra Charter, (ICOMOS Australia 1988) both of which reflect European tenets, could provide a useful basis for a plan. To this could be added a number of points relevant to Australian rock images and Aboriginal views, as well as specific to the particular site at which the plan is directed. The type and degree of treatment appropriate will de decided by a number of factors, including available funds and personnel, and will also depend on the previously determined principal cultural significance of the site. There are, therefore, a number of considerations to be addressed in the conservation policy. These may include:

(1) That the proposed use should respect the significance of the place and should not require physical intervention which negatively impacts on that significance;

(2) That treatment should retain or enhance all the elements of cultural significance present;

(3) That the proposed treatment should conform to the financial constraints of the project and be achievable within the technical expertise available;

(4) That full pre- and post-treatment site recording must be part of the process;

(5) That on-going monitoring must be planned for and implemented;

(6) That conservation techniques should be fully researched before application, that is, treatments in the experimental stage should be avoided;

(7) That the least effective intervention possible should be employed;

(8) That there should be recognition of the fact that the site may have significance other than the art, such as its setting or contents (e.g.bones), and these must be respected.

(9) That moving the site is unacceptable.

(Adapted from Sullivan 1992:37-38)

5. SUMMARY

The emphasis on the need for a cohesive approach to the study of rock art deterioration, which had its roots in the early 1970s and expanded in the 1980s, as evidenced by the publication of books by Rosenfeld (1988) and Lambert (1989), seems now to have lost momentum. Even the few long-term projects which have been initiated, have been forced to spend considerable time on individual treatments, often directed at graffitti removal, rather than on pure research (see Clarke, J 1978a; Rosenfeld 1988). Certainly, it is true that all rock art sites require individual assessment and that no treatment can be applicable to all situations. However, fundamental to understanding the causes of deterioration and therefore how these may be retarded is the need for detailed analysis of all factors involved and their implications for the preservation of rock images. In tandem with this research must be the study of the possible effects of treatments both in the short-term and the long-term and on both the micro and the macro level. Current funding attitudes must change to allow professional assessment of preservation treatments. Watchman (1987:164) sums up the situation quite well:

> Now is the time for urgent action by administrators and conservators to do more than build fences. Research must be started [and funded!].

CHAPTER 6
ROCK ART DETERIORATION

1. INTRODUCTION

The physical causes of rock art deterioration have been discussed in numerous publications (e.g. McCarthy 1970; Walston 1975; Pearson and Pretty 1976; Pearson 1978; Gillespie 1983; Hughes and Watchman 1983). However, Rosenfeld (1988) and Lambert (1989) are considered to be two of the most conclusive and up to date texts on the subject. The reader is referred to these texts, which have particular relevance to the Australian situation, for a detailed discussion of most of the factors which affect the permanence and stability of rock images. An overview of these is included in the following pages, to assist a better understanding of the present condition of the rock images of the Townsville region.

As mentioned in Chapter 1 the causes of deterioration are often divided into two broad categories:

(1) Natural causes;

(2) Human or animal causes.

However, painted images can be damaged by any factors which affect the rock substrate upon which they have been executed, or which interfere with the bond between the pigment layer and the rock face. All rocks are part of a dynamic geomorphological cycle of erosion and redeposition. Their surfaces are therefore naturally unstable. Because of this phenomenon an understanding of the physical processes which occur at the substrate/ painting/ atmosphere interfaces is essential to the study of the deterioration and conservation of rock images. In fact, this is a basic tenet of the conservation of any painted surface.

2. NATURAL CAUSES

2.1 MOISTURE

The presence and movement of water are the principal factors affecting the weathering of rock (Walston and Dolanski 1976; Rosenfeld 1988). Most rock-forming minerals chemically react with water and the oxygen and carbon dioxide gases which are dissolved in it. These hydration and oxidation reactions, assisted in some cases by biological activity, lead to the physical break down of the rock. The type of rock and the local climate determine the rate and degree of weathering (Trezise and Stephenson 1990).

Moisture can gain access to rock images either: (a) directly from rainwater and associated surface run-off or (b) indirectly via seepage of groundwater and rainwater through the rock bulk.

Both sources can have damaging effects on rock paintings:

(1) By eroding the paint layer(s) as well as the rock substrate;

(2) By the deposition of salts;

(3) By providing moisture to facilitate cryptogamic growth.

2.1.1 DIRECT WATER DAMAGE

Lambert (1989:4) describes the two most common conditions where direct water damage may occur as:

(1) Where rainfall is heavy but sporadic (these conditions are found in the Townsville region as well as in most tropical or seasonally arid regions);

(2) On boulders or rock faces where the shelter profile is shallow and where no natural dripline is present.

Direct water damage can often be identified by a vertical zone of clean, washed rock. This may transect any images present, and according to Lambert (1989:4) is often associated with a white area of deposit adjacent to a black area. These deposits have been identified as calcium oxylate (Lambert 1989). However, their source has not been confirmed, and in fact it may vary between locations (see also section 2.4 Oxylate Deposits).

Cyclical or repeated episodes where surface wash occurs are most damaging because they lead to hydration of previously 'inactive' salts on or close to the rock surface (Avery 1978; see also section 2.2 Mineral Salt Damage for more details of this process).

2.1.2 INDIRECT WATER DAMAGE

Indirect moisture seepage is more difficult both to assess and treat (Lambert 1989). Internal water movement through the rock can occur in two ways:

(1) By gravity flow through cracks and fissures within the rock fabric;

(2) By capillary action through the interstices between constituent grains.

Presence of water through gravitational forces is generally dependent on local rainfall, which also therefore determines the frequency and intensity of the flow. It has a characteristic localised drainage pattern, and often discharges through a visible crack in the rock (Rosenfeld 1988).

The rate of moisture drawn to the surface by capillary action tends to be governed by the external climatic conditions of temperature and relative humidity (Rosenfeld 1988). Conditions of low relative humidity encourage surface evaporation, resulting in more moisture being drawn toward the rockface. Rosenfeld (1988:19) states that the drainage pattern in this case will reflect the internal rock structure. An homogeneous internal structure will produce an even moisture distribution on the surface. Lambert (1989:7,9), on the other hand, contends that there is generally a localised 'point source' for the seepage zone. Both situations seem possible and are probably dependant on the morphology of the rock face. Percolation or capillary action generally results in moisture concentration at natural high points (Scott 1986a). An uneven surface morphology would therefore tend to produce localised or 'point source' seepage zones.

Identification of active discharge areas may be complicated by the fact that these may not be consistent over long periods of time. Weathering processes are a combination of physical and chemical factors. In certain circumstances these discharge points may become blocked as a result of the swelling of crystallised salts. As moisture is trapped in the rock bulk, hydostatic pressure increases. This can cause mechanical breakdown as well as further dissolution of soluble components of the rock matrix. As the water seeks another avenue for discharge secondary seepage zones are created. As these processes continue, several openings and closures over time may result in a discontinuous and uneven flow of groundwater over the rock face (see e.g. Trudgill 1983; Yatsu 1988 for a detailed explanation of physical and chemical weathering processes).

Whatever its original source, water which reaches the surface from within the rock bulk will have moved through numerous environments. The chemical nature of these environments will effect the pH of the water as well as its mineral content. These minerals, often derived from the rock itself, are then deposited onto the surface as the moisture evaporates. They are often both disfiguring and damaging (Rosenfeld 1988).

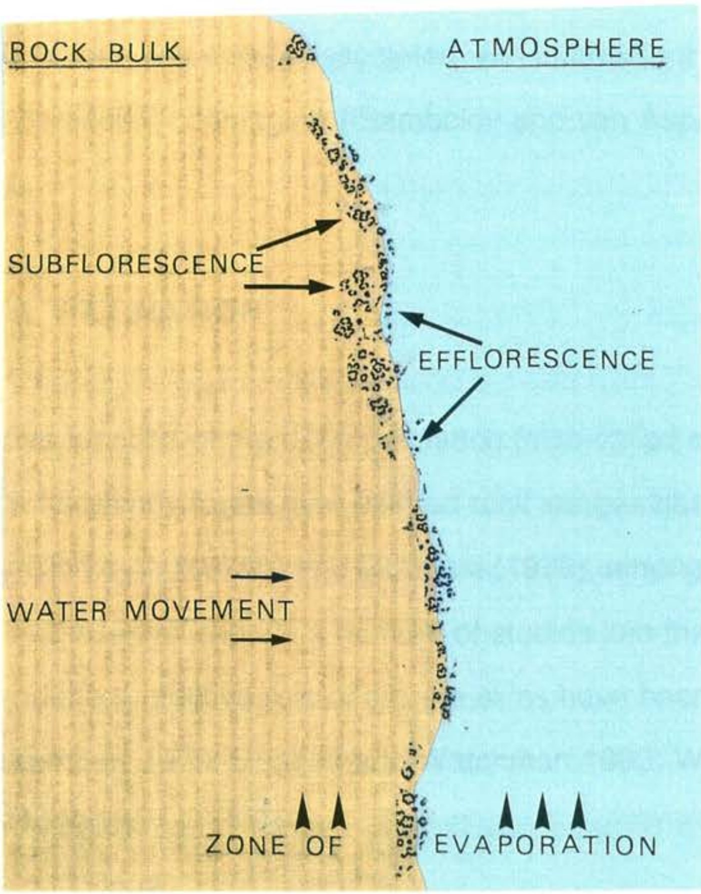
Most researchers agree that water is the major cause of rock weathering. However, there is dispute about which source of water is most damaging to painted rock images. Avery (1978:66) states that the major cause of weathering of rock, and therefore damage to images, is internal percolation of water. Lambert (1989:4), however, claims that damage by water seepage is less common than that caused by direct water erosion. It seems likely that the virtual absence of painted sites on open rock faces is due principally to weathering caused by direct water erosion (see also Chapter 5). However, as all sites require individual assessment, it seems unnecessary to determine which type of moisture damage occurs more frequently. It is important to be aware that both types of damage can occur. Detection of the source(s) of water into a site is, however, important in deciding on a treatment plan. In both cases, Lambert (1989) recommends diversion of water away from images. This treatment has become standard practice in many places, however, it is recognised that the presence of some water can have a beneficial effect on images through the formation of protective silica enriched coatings (see Watchman 1987, 1990c). The complete removal of water from a rock face will interfere with this process and may also cause other problems associated with altered drainage patterns (see also Section 2.3 Silica Patination)

2.2 MINERAL SALT DAMAGE

Salt damage is always associated with the presence of water. Soluble salts present in groundwater, rainwater and the rock itself are transported through the rock body toward the surface, where they crystallise as the water evaporates. The chemistry of rainwater varies and is to a certain extent dependent on the local environment. Proximity to the ocean produces a saline rain while industrial areas cause the rain to be highly acidic. The chemistry of groundwater also changes depending on its volume, rate of flow and the rock type through or over which it has passed (see Probert 1976).

A range of soluble salts have been identified in samples taken from rock surfaces. These commonly include chlorides, sulphates, carbonates, nitrates and oxylates. They are present in combination with calcium, sodium, potassium and other minor elemental products of weathering. As well as obscuring paintings, mineral encrustations can be a major contributing cause of grain by grain attrition, as well as flaking and spalling of the rock (Rosenfeld

FIGURE 3 Schematic diagram of salt efflorescence.



1988). Crystallisation always results in volume expansion. The resultant pressures within the zone of evaporation are sufficient to cause surface exfoliation and eventual breakdown of the rock (Rosenfeld 1988; Winkler 1973). In most cases both surface (efflorescence) and subsurface (subflorescence) crystallisation occurs in microlayers within the same zone (see Figure 3). Repeated episodes, especially associated with intermittent wet-dry cycles, are particularly damaging (Stambolov and van Asperen de Boer 1976).

2.3 SILICA PATINATION

The protective function of the silica patination (also called silcrete skins) which frequently forms over painted rock images has been reported by Clarke, J. (1978b) and Dolanski (1978), amongst others. Since these first reports a number of studies into the formation and the protective role of silcrete skins have been published (Lambert 1979; Hughes and Watchman 1983; Watchman 1985; 1987; 1990c).

It has been thought that silcrete skins are the result of the slow percolation of groundwater causing the dissolution of silica which is eventually deposited on the rock surface (Clarke, J 1978b; Dolanski 1978). Watchman (1985; 1990c) states that the factors governing their formation are not fully understood and will require further research. However, he believes that both groundwater and surface water are involved in their formation and he adds that this should be a matter of concern when deciding on the placement of artificial driplines.

Observations and analyses carried out so far indicate that where paint has been applied before or during the formation of the silcrete skin, the pigments become incorporated into the silica and well bound to the rock substrate. The deposit will usually form a hard, impervious layer which resists further erosion (Rosenfeld 1988). In most cases this layer protects any painted images incorporated within it. The existence of many of Australia's ancient paintings in excellent condition has been attributed to their protection by silcrete skins.

In some instances, however, opaque silcrete skins have formed which obscure paintings, for example at Mt Grenfell in western New South Wales (Dolanski 1978). In other NSW sites, paintings have deteriorated as a result of breakdown of the silica skin caused by expansion and contraction of soluble salts present as inclusions in the silica (Watchman 1990). As a further complication, their impervious nature has in some instances led to surface damage by preventing loss of moisture through the surface, causing a build up of pressure behind the silica and eventually causing flaking (Rosenfeld 1988). Similarly, this phenomenon has led to the failure of some conservation treatments which attempted to consolidate friable rock surfaces and painted images.

2.4 CALCIUM OXYLATE DEPOSITS

Calcium oxylate (also spelt oxalate) deposits, most commonly in the mineral form whewellite, have been reported in a wide range of sites, rock types and climatic regimes throughout Australia and overseas (Hughes and Watchman 1983; Watchman 1990a; 1990b; Clarke and North 1991). Their presence has most often been reported on siliceous rocks.

The proposed mechanisms of oxylate formation on siliceous surfaces have led to considerable debate, particularly in Europe where their presence is believed to contribute to the deterioration of stone monuments (Watchman 1990a; 1990b). Watchman has initiated much of the study of oxylate deposits at Australian sites. He states that more detailed studies are required before a full understanding of their formation processes is reached, and that it is likely that a combination of processes are involved. It has been generally accepted that a biochemical reaction between oxalic acid and calcium occurs, although the source of neither the oxalic acid nor the calcium is fully understood (Rosenfeld 1988; Clarke and North 1991).

Recent research (Watchman 1990a; Clarke and North 1991) has suggested a range of possible mechanisms for their formation, including:

(1) The generation of oxalic acid by lichens and other microflora;

(2) A chemical reaction between organic acids in rainwater and calcium-rich dust particles present on stable siliceous rock surfaces;

(3) Calcium carbonate previously deposited on the rock surface as either paint or a weathering product is attacked by oxalic acid to form oxylate and gypsum;

(4) Oxalic acid from lichens is dissolved by surface water and drawn into the rock where it reacts with calcium ions from the rock minerals to form calcium oxylate.

Damage associated with oxylate formation is similar to that resulting from surface deposition of other salts. Grain by grain attrition is common, as is generalised surface flaking. Lambert (1989:10) cites an example where oxylates have formed in a dry rock shelter, and warns that the installation of artificial driplinès may create conditions conducive to oxylate formation. As such their use needs careful assessment.

Successful treatment of damaging salts is difficult and requires removal of water from the site by diversion. Remedial treatments adapted from those used in building conservation have been attempted. These include poulticing and repeated flushing with water. Assuming the images and the rock face can withstand these measures, removal of some salt crystals will result. However, complete removal is unlikely and if water can still gain access to the site, the problem will recur

These examples highlight the complex inter-relationship of factors which must be considered before any conservation intervention takes place. On the one hand installation of artificial driplines is widely advocated, however the effect this can have on the moisture regime within a rock wall must be fully understood. This is a very real problem facing site managers which has not been adequately addressed.

2.5 VEGETATION

The presence of vegetation growing near sites can be both beneficial and deleterious. Lambert (1989) deals with these in more detail than is possible or necessary in this thesis. In summary he states that beneficial effects can include:

(1) Soil stabilisation and as a result less dust, (when dust is present on rock surfaces, either wind driven or from tourist traffic, it can obscure paintings and play a role in oxylate formation; because of its hygroscopic nature [i.e. moisture attraction capability], it can also retain water on the rock surface);

(2) Reduced wind and rain erosion;

(3) Protection from direct sunlight which can drastically alter ambient temperature within the site as well as the temperature of the rock bulk;

(4) Concealment of sites where public access is undesirable or where the risk of vandalism is high.

In contrast some of the harmful effects of nearby vegetation mentioned by Lambert (1989) include:

(1) Physical abrasion of images;

(2) Splitting of rock substrate by roots etc;

(3) Increase in localised humidity (this is not in itself harmful, however if a change in the natural vegetation cover occurs because of an increase in nutrient or water supply to the area, the subsequent change in the microclimate of the site may encourage cryptogamic growth; further, humidity as a function of temperature may be relevant if it facilitates condensation on the rock face; in

some circumstances this can exacerbate natural weathering processes);

(4) An increase in the risk of fire, (as well as smoke damage, fires are generally associated with a sharp increase in the temperature of the rock bulk which may cause rock fracture and exfoliation).

Removal of vegetation should not be carried out routinely, even if it is thought to be damaging. Aboriginal custodians, who often place importance on the integrity of the whole place, may have objections. Further, the removal of vegetation may have other consequences not fully understood unless a thorough study of the environment as well as the microclimate of the area is carried out.

2.6 CRYPTOGAMIC GROWTH

The damaging effects of cryptogamic growth have been discussed in previous sections. In summary, the growth of mosses, lichen and other microflora can obscure images and can contribute to the growth of mineral salts which consequently lead to surface exfoliation.

Field workers have generally recommended a combination of dry brushing and fungicides to remove microflora. Again, many of the recommendations are based on treatments developed for buildings and stone monuments (Sneyers and Henan 1968; Lal 1970; Lambert 1989). There has been little discussion in the literature regarding the effectiveness of treatments or the risks associated with the removal of microflora from painted surfaces. If it is to be removed, it is important that the microflora is dead and has dried out completely. Live material contains a high percentage of water, and removal in this state can lead to smudged staining, as well as forcing the material into the rock pores, where it is available for recolonisation. If the material will not die back naturally, for example in the dry season, then it will need to be killed. Bleach and a number of fungicides have been used to kill lichen (Florian 1978; Lambert 1989). However, with these there is the possibility that sodium or calcium salts can remain as a surface residue. This can be minimised by thorough washing after application, of course presuming the images can withstand it.

The potential for dating rock images from lichen growth (lichenometry) exists. Although the technique requires further refining before it can be considered reliable, the possibility should be taken in to account when deciding whether lichen is to be removed (Florian 1978).

3. HUMAN AND ANIMAL CAUSES OF DAMAGE

3.1 HUMANS

Humans as a group are responsible for the destruction of innumerable rock art sites. Many hundreds, perhaps even thousands, of sites have been lost through industrial and urban development (Godden and Malnic 1982; Bednarik 1984b). Sullivan, S. (1984b:127) states that development is probably the 'most immediate and irretrievable threat' to sites, and that as such it is important to implement land use planning legislation to prevent destruction of sites.

As visitors to rock art complexes, humans can impact on the site in a number of ways. Much obvious abrasion damage has resulted from either intentional or accidental physical contact with the paint or the rock face. Dust, grease and dirt has been deposited on the images as a result of nearby pedestrian traffic, and graffitti and other forms of vandalism are commonplace.

The installation of walkways at a number of frequently visited sites has successfully reduced dust as well as abrasion. Interpretation panels and visitor books have assisted in the reduction of vandalism. A complete discussion of the issues involved in minimising visitor impact at Aboriginal sites is beyond the scope of this thesis. The topic is specifically addressed in a number of publications (see especially Sullivan, H. 1984; Gale and Jacobs 1987).

The presence of graffitti at a site tends to encourage more graffitti, so it should be removed as soon as possible after it is discovered, or before a site is developed for tourism. Also, it tends to become more difficult to remove the longer it has been in place. In some cases, graffitti has been deemed to be of historical importance. In all cases, therefore, it is important to establish the significance of all aspects of a site before removal is attempted. Thorough pre-treatment documentation is essential.

There are a number of physical factors to be taken into consideration whenever graffitti removal is planned. These concern:

(1) The stability of the rock;

(2) The stability and solubility of the painted image;

(3) The range of methods available to remove the graffitti.

Appropriate methods of graffitti removal depend on the type of graffitti (e.g. engraved or applied) and on what materials have been used (e.g. charcoal, enamel paint etc). There are a number of dry and wet methods available for graffitti removal. It is sound conservation practice to begin with the mildest approach, such as dry brushing and to proceed to more vigourous methods such as wet brushing and the use of chemicals only as required. Lambert (1989) outlines a number of methods for removal of the various types of graffitti. A full description of painted graffitti removal from one site is presented in Chapter 7.

3.2 ANIMALS

Feral, domestic and native animals have all caused damage to paintings by abrasion and in some cases licking painted surfaces (Rosenfeld 1988; Lambert 1989). The damage is permanent and fencing of the site is considered the only practical method of preventing damage. The fence should be situated away from the site so as not to be visually intrusive, must not interfere with any archaeological deposits present and should successfully exclude the animals while not posing physical danger to them. The cruel and unnecessary sight of both dead and struggling goats trapped in a badly designed fence has been observed at a site in western New South Wales (see Lambert 1989).

Mud-nest building birds and insects cause much damage to sites throughout Australia. The nests and bird droppings obscure images and often damage paint layers underneath. It is believed that the animals tend to build nests where other nests are present (Naumann 1983; Watson and Flood 1987), so physical removal is important in breaking the cycle of infestation. Lambert (1989) recommends hand removal of bird nests and if the paintings can tolerate it, washing of the site to remove bird droppings and mud residue. He also advises that mudwasp nests can be cleanly removed from the rock face by knocking them with the blunt handle of a brush, and any remaining mud dry-brushed off the rock. Damage from termite runways across the face of paintings has been described by Watson and Flood (1987). They recommend nest destruction and continued monitoring for reinfestation as the most effective method of preventing further damage. Often this maintenance would have been routinely carried out by the original Aboriginal owners and their descendants. However, because this practice is no longer widely carried out , for this recommendation to be implemented now, frequent and regular access to the site is required. In many parts of Australia this may not be practical because of the distances involved and the difficult terrain often encountered. Interestingly, the removal of existing runways which do not impact on any images is recommended against, as the creation of replacement runways by the termites may extend the area of damage (Watson and Flood 1987; Lambert 1989).

4. PIGMENT INSTABILITY

Previous sections have dealt with factors which affect the rock support or with external aspects which may impact on the images. The permanence of paintings is also affected by the chemical properties of the pigment and by how well bound it is to the rock substrate.

In general it is accepted that red pigments (mainly hematite) are more stable than white and other clay-based pigments (Clarke, J. 1978b; Rosenfeld 1988; Lambert 1989). This is explained by the different physical configuration of the pigments. The very small size of the red pigment particles and their platy shape affords them good penetration and adhesion properties (Clarke, J. 1978b). The white (especially huntite) and other clay based pigments tend to have poor penetration capability and form hygroscopic paint layers. Repeated episodes of swelling and shrinkage associated with absorption and loss of moisture, lead to pigment flaking and loss (Clarke, J. 1978b; Rosenfeld 1988).

It is this factor which has caused some researchers to report that images are 'faded' (e.g. Mountford 1965). Mineral pigments are generally considered resistant to true fading such as is caused by ultraviolet radiation, however in certain circumstances photochemical reactions can produce colour alteration (Gettens and Stout 1966; Hughes and Watchman 1983). In most cases 'fading' is actually the result of loss of pigment particles from the rock face (Rosenfeld 1988; Sullivan 1992).

5. CONSOLIDATION

Much research has focused on methods and materials which will combat the problems of pigment flaking and rock instability. Rosenfeld (1988:58-63) provides an excellent overview of the problems associated with consolidation, as well as a review of the various polymer groups which have been proposed as suitable stone and pigment consolidants (see also Gordon 1984). In summary, a material is required which will impregnate the paint layer, bind it to the rock surface and consolidate the rock fabric. To do this successfully it must also allow moisture to pass through it. Some synthetic materials are available which will achieve this. However, the long-term effects of their use on rock images has not been fully evaluated. A range of moisture repellants and stone consolidants are commercially available. Manufacturers' claims have in many cases not been borne out by on-site or laboratory testing (Walston et al 1987; Lambert 1989). Further testing and artificial aging of a range of synthetic resins is necessary before large scale treatments of sites can be carried out with confidence.

Because of this uncertainty and poor results in the past, consolidation treatments have been generally avoided. However, as a result of continued developments in polymer chemistry, and a better understanding of the physical requirements of consolidants, their use is again being advocated with caution (e.g. Lambert 1989). Schwartzbaum (1985) recommends the use of several products, and Lambert (1989) agrees that their use may be appropriate in instances where it can be demonstrated that images are rapidly deteriorating and that treatment will slow down this process.

The skill and experience of the person applying the consolidant must also be considered. Incorrect surface preparation or excessive application of the material may result in failure of an otherwise suitable treatment.

6. RATE OF DETERIORATION

A knowledge of the rate of deterioration at a particular site is essential if responsible decisions regarding its management are to be made. Lambert (1989) advocates the use of photographic monitoring to determine the rate of pigment loss. However, the long-term instability of photographic film and the reliance on subjective assessment means that other methods may provide more reliable records. In Chapter 3 the use of digitally enhanced image recording methods for this purpose was discussed. These combined with measurements from electronic colour meters could provide accurate, reproducible numeric data which is not subject to deterioration or the vagaries of human perception.

Lambert (1989:58) lists the following 4 reasons for monitoring the rate of deterioration at a site:

(1) To justify the need for conservation;

(2) To justify the need for drastic treatments, such as consolidation;

(3) To observe the effectiveness of previous conservation treatments;

PLATE 1 Painted image on boulder behind Turtle Rock. Photographed June 1977.
(Reproduced courtesy of Associate Professor J.B. Campbell, James Cook University of North Queensland).

PLATE 2 Same image as Plate 1 photographed June 1992

(4) To correlate deterioration with other events such as bushfires.

The importance of careful monitoring is highlighted in the following example from the Townsville area. In June 1977 a red painted image on an open rock face behind the Turtle Rock site was recorded and photographed (see Plate 1). On subsequent visits by a number of people this image was reported as being 'very faint' and 'hardly visible' (J. B. Campbell 1992 pers. comm.). When visited by this writer in June 1992, the image appeared to be in very much similar condition to when photographed in 1977 (cf. Plate 2).

There are several possible explanations for this phenomenon. One commonly expressed explanation is that observers often have enhanced perceptions or memories of images, which when reviewed at a later date do not equate with what is actually present (Lambert 1992 pers.comm.). This theory, however, does not explain incidences of these reports by experienced recorders of painted images. There may be physical explanations which involve the changing colour temperature and colour rendering capabilities of natural daylight. A full discussion of these may be found in texts dealing with the physics of light or in museum and art gallery lighting manuals. Thompson (1986) includes sections dealing with light and colour perception. Other explanations may be associated with changes in the amount of moisture near the surface of the rock and therefore the level of contrast between the rock and the painted image.

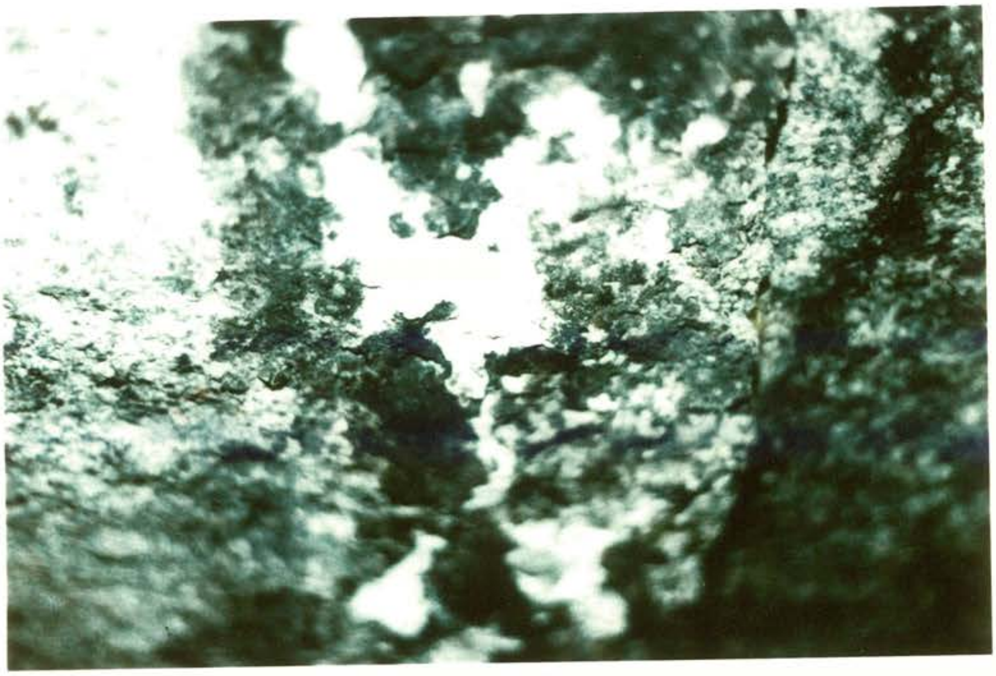


PLATE 3 Detail of damage associated with salt efflorescence. This type of photograph is useful for monitoring the deterioration of painted and engraved images.

The rate of deterioration of images is very relevant to their conservation. It is known that some paintings are deteriorating very quickly, especially relatively recent images which incorporate the white mineral huntite. The structure of this mineral causes it to have poor bonding properties and as a result it tends to flake from the rock face. Consolidation treatment may be appropriate for these images, if they are not going to be repainted in the near future. Many other images are stable and do not require treatment. In the above example from Turtle Rock it is possible that unnecessary conservation intervention could have been approved on the basis of invalid visual assessments. Before any treatment regime is commenced, it is essential that the rate of deterioration be determined. Monitoring should commence with detailed photographs of damage. Plate 3 is an example of a detailed photograph of damage associated with salt efflorescence. Precise location of the position and orientation of the photograph should be accurately recorded, so that subsequent photographs of the same location at the site can be taken.

7. SUMMARY

Many people who do not have direct experience with Aboriginal rock images believe that because the images have lasted for such a long time, they are not in need of any active conservation measures. This is clearly not always the case, as throughout Australia the large corpus of rock images are in varying stages of deterioration and in some places this continues at an alarming rate (Lambert 1989). The preceding chapter has attempted an overview of the many factors which are contributing to the deterioration of the images and an outline of some of the measures which have been implemented to overcome those problems.

CHAPTER 7.

A CASE STUDY ON ROCK IMAGES OF THE TOWNSVILLE REGION: A PILOT PROJECT TO ASSESS THEIR CONDITION AND CONSERVATION REQUIREMENTS

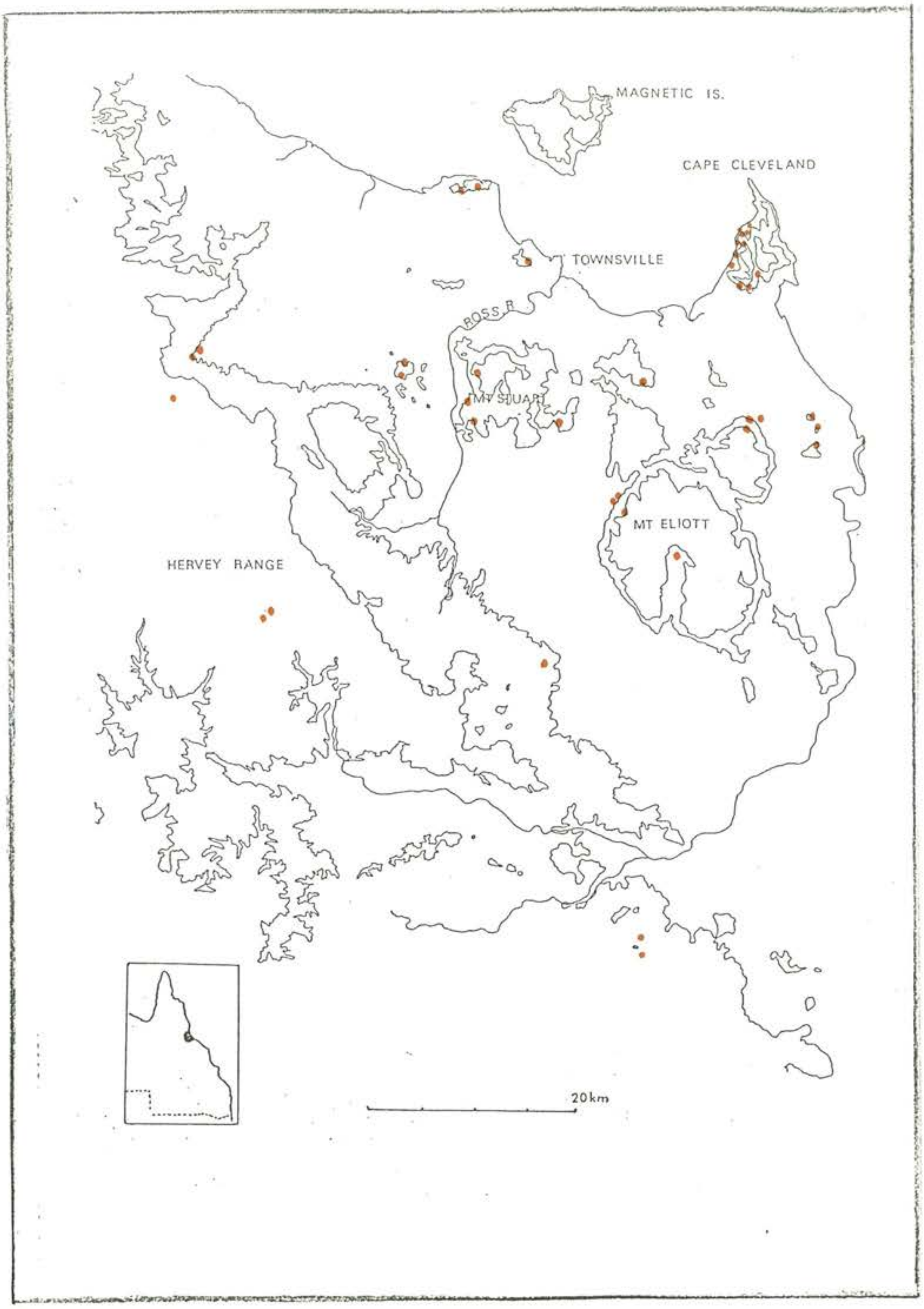
1. INTRODUCTION

The painted images of the Townsville region are susceptible to the range of deteriorating factors described in Chapter 6. In the following pages an assessment of some of the problems affecting several sites is presented in case study form. Much of this work was carried out with the assistance of a grant from The Australian Institute of Aboriginal and Torres Strait Islander Studies, which enabled David Lambert to visit the region and inspect several sites. During this visit Mr Lambert generously shared his knowledge and expertise and much of this is reflected in the following pages. Where views other than Lambert's are presented, they are my own.

2. LOCATION

Figure 4 shows a map of the area discussed in this thesis and the location of currently known rock art sites in the region. A comparison of Figure 2 with Figure 4 reveals that most of the recorded rock images of the Townsville area are on granite intrusions. Most sites are in caves, shallow rock shelters or overhangs, however there are examples of discrete images or small groups of images on relatively open rock faces, e.g. behind

FIGURE 4 Map of the Townsville region showing locations of painted rock images. Adapted from Hatte 1992.



Turtle Rock cave, and adjacent to Bruce Highway south of the city. Many researchers have commented on the fact that most painted images located thus far in Australia have been found in shelters or caves, where they have been protected from the effects of direct wind and rain erosion (see especially Godden and Malnic 1982:28). Current theory, as well as the distribution of images of the Townsville region, suggests that this is more a result of preservation factors than an indication of preferred painting sites.

Site CC 1, where the major part of the conservation project was carried out, is situated on the western side of Cape Cleveland, approximately 50 km south of the city of Townsville. The shelter faces west toward Mt Elliot and is adjacent to large salt flats. The presence of old oyster beds at various locations on the Cape, about 1 m higher than present ones, has led some researchers to suggest that previous water levels (before 5,000 years ago) may have been sufficiently high to separate Cape Cleveland from the mainland (Plant 1989). If this were so, Site CC 1 would have been adjacent to a low energy coastline (E. Hatte 1992 pers. comm). The entire area is declared a National Park.

3. CASE STUDY

3.1 PROJECT OUTLINE

With the assistance of a grant from the Rock Art Protection Program of the Australian Institute of Aboriginal and Torres Strait Islander Studies, a project was initiated by Elizabeth Hatte to assist the efforts of the Townsville Aboriginal Community to record and protect the rock images of the region. The major part of the project involved graffitti removal at rockshelter site CC 1 and discussion of conservation problems at this and other sites in the region. This was carried out under the direction of David Lambert of the NSW National Parks and Wildlife Service.

Present with Mr Lambert for the field work which occurred on 5 and 6 May 1992 were:
Ms Elizabeth Hatte, Project Co-ordinator;
Ms Marcelle Scott, Conservator;
Mr Clarence Wyles, Aboriginal trainee sites officer;
Mr Russell Butler, Townsville Aboriginal Community representative;
Mr Steve Sutton, Queensland Government Regional Archaeologist;
Mr Gavin Enover, National Parks Ranger.

3.2 DESCRIPTION OF ROCKSHELTER SITE CC 1

The shelter is a low, shallow one formed from the block collapse of a large section of the parent granite outcrop. It is adjacent to a large expanse of salt flats with scattered mangroves and open schlerophyll vegetation. A 4-wheel-drive access road to locally known fishing spots passes within 100 m of the shelter, however the vegetation tends to obscure direct viewing of the site. It is not known how many people visit the site or are aware of its existence (Hatte and Scott 1992).

The pattern of disruption of the floor deposit after rain suggests that the shelter is impacted upon by run-off down the natural slope of the shelter. The geomorphology of the rock overhang and the presence of vegetation in front of the shelter afford the rock face

FIGURE 5 Scale recording of motifs on eastern wall of rock shelter site CC 1.

protection from direct rainfall. The shelter is, however, affected by indirect water entry, both from rising groundwater sources and from percolation through the overlying soil and rock.

3.2.1 IMAGES

Painted images have been applied to the walls and ceiling of the shelter and several images are faintly visible on the eastern wall outside of the shelter proper.

The motifs include a number of animals and zoomorphs, shield-like figures, and straight, curved and circular lines. Red, orange and white colours are present (see Figure 5).

3.3 RECORDING

Hand drawn scale recordings (1:4) were made of the images and graffitti located on the eastern face of the shelter. A reduced copy of these is reproduced in Figure 5.

Colour transparency, black-and-white and colour print records were made of the site and various details.

Munsell Soil Color charts were used to register the colours present, *viz.*:

RED - 10R/5/8

WHITE -10YR/8/8

ORANGE - 10YR/5/8

3.4 GRAFFITTI

Site CC 1 is the only site so far recorded in the region which has been damaged with graffitti. It is commonly referred to as the "Berry Ford" shelter because the names "E. Berry" and "L.M. Ford" have each been painted twice in black enamel paint on the eastern face of the shelter. Parts of the graffitti obscure some of the red motifs (see Figure 5).

3.5 CONDITION OF IMAGES

The images are in a generally stable condition. Many of the motifs are, however, very faint, indicating that paint loss has occurred over time. Monitoring is necessary to determine if this is ongoing, and if so, what the rate of deterioration might be. Many of the white motifs appear smudged, consistent with previous water damage. No evidence of pigment flaking is present. However, there are numerous areas where both red and white pigment loss has apparently occurred as a result of grain exfoliation of the substrate.

Lambert using visual and magnified inspection only, considered that a protective silcrete skin was present. He then spot tested a small painted area, by gently rubbing the area with a moist white-coloured piece of Japanese tissue. No colour was transferred to the tissue, indicating that the paint was not fugitive in water and was able to withstand some mechanical action. This supported his opinion that a silcrete skin was present. Other researchers, however, have cautioned that silcrete skins are difficult to detect by non-analytical methods (e.g. see Hughes and Watchman 1983;

PLATE 4 Probable calcium oxylate deposit, exhibiting typical black layer in association with white crystallline deposit.

PLATE 5 Example of red paint visible under deposit. Note also evidence of grain exfoliation of rock surface.

Rosenfeld 1988). When Watchman inspected the site in 1990 also using visual observation only, he indicated that no silcrete skin was present (Hatte pers.comm). The problems of silcrete skin identification have been outlined in Chapter 6. This case further highlights these difficulties. Analytical investigation of samples from the site is required if the presence of a protective silica layer is to be confirmed.

The ceiling and parts of the walls of the shelter are covered with a black, well-bound deposit, and in several places a white crystalline deposit is associated with it (see Plate 4). Lambert indicated that a similar deposit has been identified by using SEM and X-ray diffraction analysis, as calcium oxylate and that the white crystals were the hydrated form (see also Lambert 1989:5). Several areas of red paint are visible under this deposit, indicating that periods of painting occurred before the deposit developed to the extent observed today (see Plate 5).

Active cryptogamic growth has been observed in small localised areas of the shelter at various times. This tends to become inactive during the dry season.

In the previous chapter the debate about mechanisms of oxylate formation was outlined. It was stated that the source of neither the oxalic acid nor the calcium, both of which are thought to be necessary for oxylate formation, was understood.

Spot tests carried out by this writer on the white deposit indicate that it is a carbonate salt. A review of the chemistry of granite as

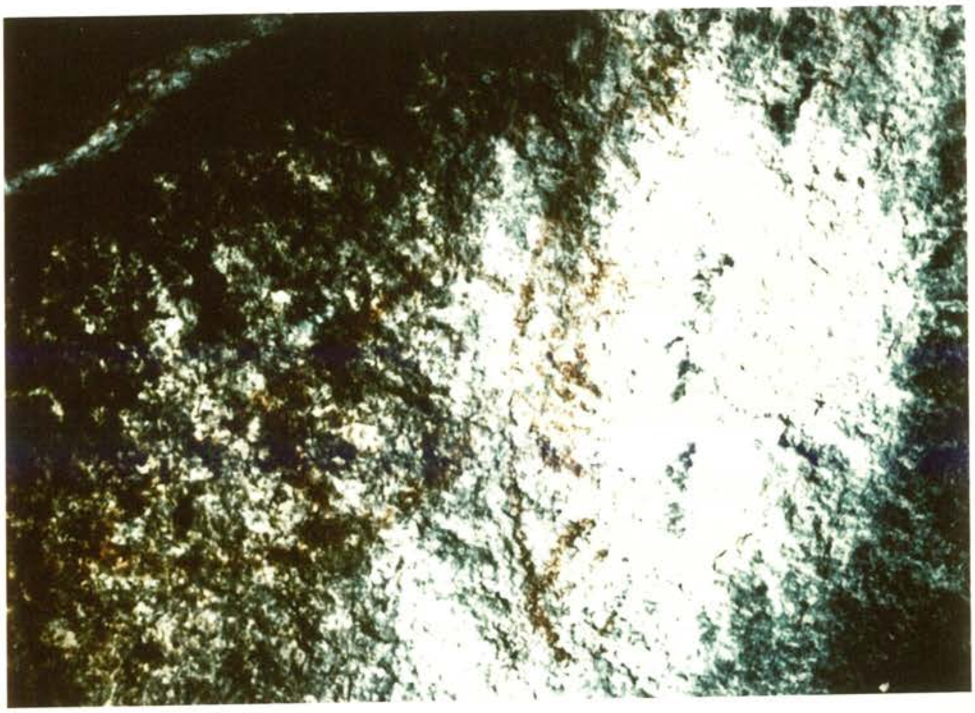


PLATE 6 Carbonate salt deposit obscuring part of red painted shield.

presented in Chapter 4 offers a possible explanation for this result, which may also explain the presence of calcium at this shelter, lending further credence to Lambert's identification of the deposit.

The presence of the feldspar anorthite ($CaAl_2Si_2O8$) in granite has been previously described. From this mineral, lime (CaO) is available for further breakdown. Over time the following series of reactions can occur:

$CaO + H_2O$ -----> $Ca(OH)_2$ (hydrated form of lime)

$Ca(OH)_2 + CO_2$ -----> $CaCO_3$ (calcium carbonate) + H_2O
(CO_2 present both from the atmosphere and dissolved in water)

As active lichen growth has been observed at the shelter, the fourth proposed mechanism of oxylate formation summarised in Chapter 4 seems likely.

Almost exactly half of a red painted shield is obscured by a fine white deposit (see Plate 6). Chemical spot tests indicate this is also a carbonate salt. with sulphates also present as monor constituents. It is difficult to determine the superpositioning in this instance, as it appears that the red paint is dispersed throughout the salt deposit. This may indicate that the motif was intentionally applied over a pre-existing deposit. Conversely, as the deposit emanates from within the rock bulk, it may have become more extensive over time and become incorporated into the paint layer. Further analysis is now necessary for this to be determined.

4. GRAFFITTI REMOVAL METHOD

The decision to remove the graffitti was taken in consultation with the Townsville Aboriginal Community and with the knowledge of the Regional Archaeologist.

The following procedures were used by Lambert to achieve its removal:

(1) Visual inspection of rock, images and graffitti;

(2) Attempted removal of graffitti with dry brushing (which had no effect);

(3) Solubility testing of graffitti in water and selected organic solvents (which also had no effect).

(4) Solubility testing of graffitti in a commercially available paint stipper incorporating dichloromethane as the active ingredient in a CMC (sodium carboxymethyl cellulose) gel, (the water soluble gel retards the evaporation rate of dichloromethane and aids workability of the product, making it suitable for application to vertical surfaces; the graffitti was soluble in the paint stripper, indicating that removal was possible);

(5) The paint stripper was applied to the graffitti, working on small sections at a time, with a bristle brush and left in place until the paint softened (this generally occurred within 2 to 3 minutes of application). Almost immediately after application, the previously clear gel turned a dark greenish colour;

(6) Upon softening, stiff bristle and bronze brushes were used to mechanically remove the paint and gel. The area being treated was then washed fairly thoroughly with water to remove the

PLATE 7 Black painted graffitti at Site CC 1.

PLATE 8 Site CC 1 after graffitti removal. Note close proximity of painted images.

paint and the stripper from the rock. The water was sprayed onto the rock from a 'back-pack' tank with a pump action nozzle, and the rock face was flushed to ground level to reduce contamination by the introduced material.

On drying it was observed that some paint remained and that the green discolouration was still visible. The above treatment was repeated. When inspected again on drying, both paint and gel residue still remained. However, the treatment had significantly reduced the visual impact of the graffitti on the site, and to the uninformed observer it is now hardly noticeable.

A follow-up inspection of the treatment was carried out the next day. A further attempt to remove the green residue was made, using:
(a) mineral turpentine ;
(b) water plus a few drops of a non-ionic detergent.

Thorough washing of the site was done after each application. Neither of these solutions had any effect on the residue. It was decided that the visual appearance was acceptable, and so no further treatment was attempted.

Plates 7 and 8 show the condition of the graffitti before and after removal. It can be seen that the negative visual impact of the graffitti has been significantly reduced. Observers have commented that their appreciation of the images is enhanced now that they are not visually distracted by the previously very obvious graffitti.

5. DISCUSSION OF TREATMENT METHODS

This treatment has become a standard method for the removal of painted graffitti. Lambert (1989) reports success at a number of sites throughout Australia, without any observable damage. The method does, however, require copious quantities of water to be washed down the rock face. In many instances this water must traverse painted images. This in itself is of concern, and thorough testing of the solubility of such images is essential prior to treatment. An added concern is that this water also contains dissolved paint particles and chemicals from the stripper, allowing the potential for staining and residue deposition.

The treatment could be made safer by:

(1) Dry mechanical removal of the bulk of the stripper using swabs and brushes prior to flushing;

(2) Prewetting the rockface below the treated area prior to flushing, as this would:

(i) Saturate the natural porosity of the rock, reducing the risk of the contaminated water being absorbed ;

(ii) Reduce the surface tension of the rock allowing the dirty water to pass over the wetted surface, providing a micro-layer of protection for any images present.

It may be argued by some that these measures are unneccessary on the grounds that no visible damage occurs, particularly where silcrete skins are present. This argument, however, discounts the unknown long-term effect of residues. Their prevention or removal should therefore be as complete as possible.

For the same reason, removal methods for the green residue are worthy of further investigation. According to Lambert this was an unusual reaction which he had not witnessed before. However in previous personal experience with paint strippers similar reactions have been observed, and may be explained by the presence of degraded paint particles being absorbed by the gel and thus altering the Refractive Index (RI) of the gel. An understanding of the action of chemical paint strippers is useful, as it could provide a possible explanation for the colour change in this instance.

The action of a solvent on a polymer such as paint involves several phases. Swelling of the polymer is necessary for dissolution to occur (Ueberreiter 1968). In general, four phases are involved (Horie 1987):

(1) Solvent molecules infiltrate the paint polymer chains by diffusion;

(2) Outer layers of paint polymer react with the solvent and swell;

(3) Swelling allows entry of solvent into the inner layers of the paint polymer;

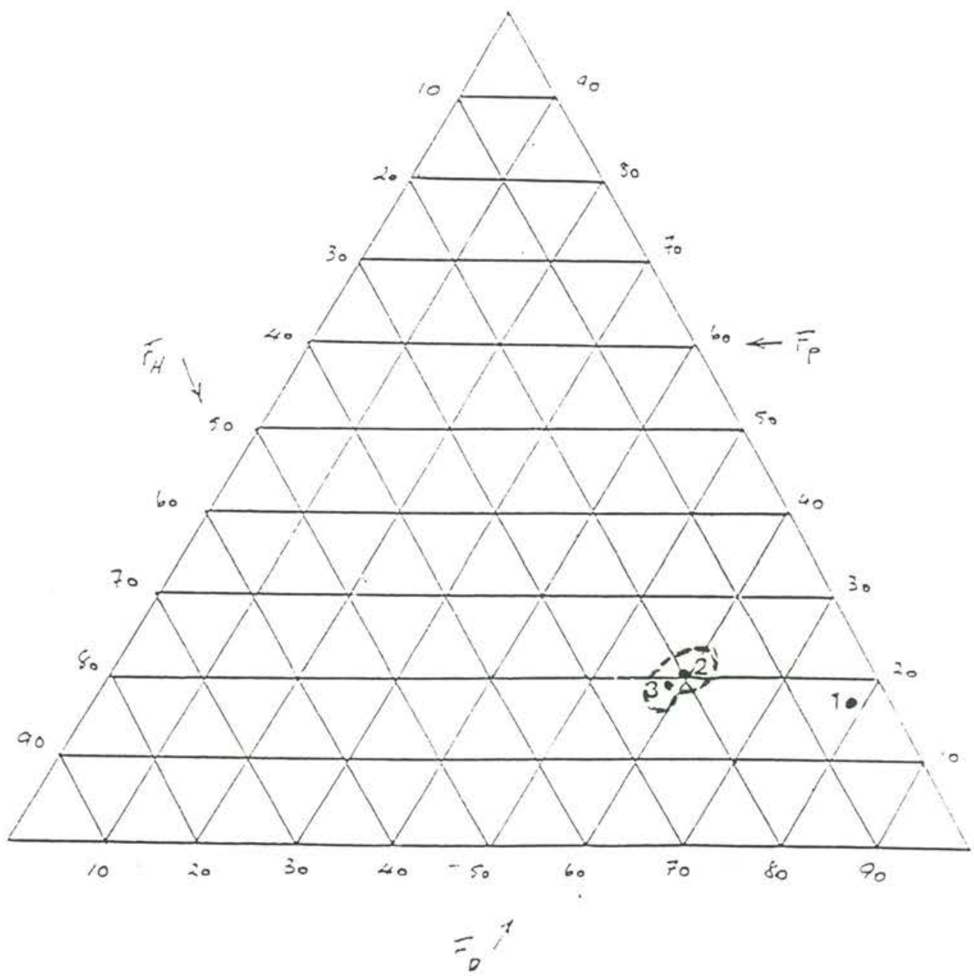
(4) Paint absorbs more solvent leading to paint breakdown.

From this explanation of the process of dissolution of a polymer, it can be predicted that the residue is a mixture of dissolved paint particles and CMC gel which has been absorbed into the pores of the rock. The dichloromethane solvent would have rapidly evaporated and so it is no longer present. CMC is unaffected by organic solvents, such as mineral turpentine (Horie 1987), which explains why this solvent was not successful in removing the residue. As the paint was initially dissolved in dichloromethane and this is known to be compatible with the CMC gel, it is reasonable to assume that this solvent or one in a similar family could affect the gel.

5.1 SOLUBILITY THEORY

The theory of "like dissolves like" is based on the concept that for a solvent to dissolve a material the forces of attraction between the molecules of the solvent must be similar to those between the molecules of the material to be dissolved (Horie 1987). These forces can be measured by calculating the energy required to vaporise a known amount of the liquid. The energy required for vaporisation is known as the Cohesive Energy Density, and its square root has been defined by Hildebrand and Scott (1949) as the Solubility Parameter. Hansen (1967) divided these Solubility Parameters into three different factors (F_H, F_D, F_P) representing the three internal forces of attraction which exist within molecules (see also Scott 1986b). Values of these parameters for most solvents have been calculated and published (see Barton 1983). These can be plotted on a triangular graph known as a TEAS chart. Solvents close together on the chart have similar solvent powers and often belong to the same functional group, while those further apart have different solvent powers. It is not normally possible to assign a single set of parameters to solid materials. A region of solubility can, however, be predicted from the parameters of the range of solvents which attack the material (Scott 1986b). More detailed discussions of the theory of solubility can be found in chemical literature, but excellent summaries of solubilty parameters and

FIGURE 6 TEAS Solubility chart showing the location of mineral turpentine and the predicted region of solubility of CMC gel residue.



KEY

1. Mineral turpentine
2. 100% dichloromethane
3. 90% V/V dichloromethane/5% methanol/5% xylene

Predicted region of solubility of CMC gel residue

TEAS charts are available in specialised conservation publications (e.g. Hedley 1980; Torraca 1984; Horie 1987).

A TEAS chart is useful to assist understanding of why mineral turpentine had no effect on the residue as well as to predict what solvent groups are likely to be more successful. Figure 6 shows a TEAS chart with the location of relevant solvents. From this chart it can be seen that mineral turpentine belongs to an entirely different solvent group to that of dichloromethane. Its solvent properties are therefore different.

Dichloromethane has a very high evaporation rate at room temperature. Its use in combination with other solvents is therefore usually necessary. Previous research (Scott 1986b) has shown that the addition of 5% V/V of xylene and methanol slows down the evaporation rate of the solvent sufficiently to allow manipulation, but it does not significantly alter its solvency action. This is confirmed by plotting the Solubility Parameters of this solution on a TEAS chart (see again Figure 6). It is therefore predicted that the paint stripper residue at Site CC 1 may be removed with this solvent mixture. However, other physical factors may now have to be considered. These concern the fact that as a solvent evaporates from a partially dissolved polymer, the remaining polymer may shrink (Horie 1987). Where this occurs in the case of graffitti removal from rock, the reduced polymer can be further drawn into the rock fabric making complete removal unlikely.

6.0 SUMMARY OF CONDITIONS AT OTHER LOCATIONS IN THE REGION

6.1 SITE CC 2

This site is located approximately 500 m north of Site CC 1. A large granite boulder, part of a rocky outcrop forms the roof of a relatively deep rock shelter, containing a number of red painted images. The granite substrate and the images appear stable. The shelter is not subject to direct rainfall and lichen growth does not seem to be a problem. A number of mudwasp nests were observed in the shelter. These do not currently impact on the images, however since their presence tends to encourage further nesting, regular removal of these is recommended.

6.2 HERVEY RANGE B

This site is situated under a large northeast facing granite boulder at the base of the Hervey Range, approximately 26 km from the coast. Numerous red, orange and white painted images are present, as well as one executed in Reckitt's washing blue.

The condition of the images at this site varies, depending on their location within the shelter. Many images are stable and in good condition. Others exhibit various signs of deterioration. There appears to be rainwater intrusion and associated damage (staining and image loss) to images towards the southern side of the shelter. This area of the shelter may benefit from the installation of artificial driplines.

Grain exfoliation of the granite substrate is occurring as a result subflorescence in several localised areas at the site. Painted images within these zones are consequently being damaged.

Further research is necessary at this site to locate the source of indirect water entry and also to determine if treatment is possible.

6.3 TURTLE ROCK

This site is on the Register of the Australian Heritage Commission. It is situated on private property on plateau land at the top of the Hervey Range and consists of a large shelter formed from granite boulders.

Recent protective measures have been installed at the site under the direction of the Regional Archaeologist. These include:

(1) Fencing to prevent stock entry into the site;

(2) Installation of artificial silicone driplines;

(3) Erosion control measures over previously excavated areas.

A visitors book is soon to be placed on site.

Most of the painted images are thought to be stable at this time. Direct water access should now be eliminated by the installation of the dripline. On-going monitoring of these measures is an integral part of management of the site, and careful inspection should occur during and after the next wet season.

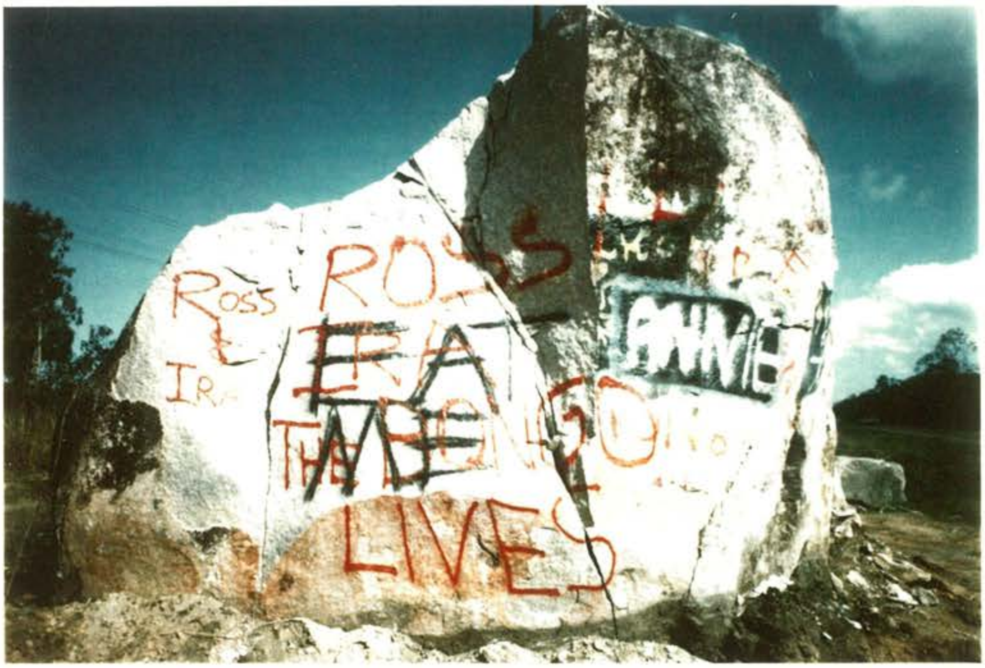


PLATE 9 Granite boulder, Bruce Highway. Photograph taken after initial destruction work.

PLATE 10 Detail of boulder in Plate 9, showing the one remaining intact shield and remnants of another. Some recent graffitti is visible on freshly exposed rock.

6.4 ISOLATED BOULDER

This granite boulder is situated beside the Bruce Highway, approximately 35 km from Townsville. At least seven red painted shield-like motifs have been identified on various faces of the boulder. Much of the boulder is covered with painted graffitti. Toward the end of 1991 the Queensland Department of Transport decided to destroy the boulder by drilling holes into it which were then filled with a composite material designed to expand on setting. This acheived large scale fracturing of the boulder. As a result most of the painted shields were destroyed, one only remaining intact (see Plates 9 and 10).

This work was instigated without consultation with the Townsville Aboriginal Community or the Regional Archaeologist . Much of the damage had already occurred before the activity came to the attention of any of these people. Further destructive work was halted, however since then much fresh graffitti has appeared.

The boulder was visited as part of the grant project. No restorative work was deemed possible. It is likely that destruction of the boulder will be on-going as further stresses build up within the rock fabric. Graffitti application is likely to continue. The future of the site is in grave doubt, highlighting the fact that urban development and associated road construction are some of the major causes of destruction of rock imagery (see also Chapter 5).

Consultation with the local Aboriginal community about this site should now occur. It may be deemed appropriate that it be used for testing consolidation treatment methods, and for graffitti removal exercises in association with the planned Aboriginal Sites Officer training course.

7. SUMMARY.

There are a number of sites in the Townsville region which have been recorded, but which have not been assessed for conservation purposes (see Figure 4). This pilot project confirmed the claims by Pearson (1978) and others that the conservation requirements of rock art sites need individual assessment. Bearing this in mind, however, it can be seen from this and the previous chapter that the main causes of deterioration have been identified. Further research is required to determine how the effects of these are to be minimised.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS

Australian Aborigines have been painting and engraving rock images throughout the continent for tens of thousands of years. Rights to and responsibility for the images traditionally rests with people for whom a particular site has ceremonial or clan relevance. These responsibilities may include maintenance and repainting of the site and have always been an integral part of the rituals and beliefs associated with the images (e.g. see Mowaljarlai and Watchman 1989). However, since the Anglo-celtic invasion, traditional Aboriginal lifeways have been severely disrupted in most parts of Australia. Government and church-run programs have at times actively encouraged the cultural devastation of Aboriginal societies, resulting in the cessation of continual repainting and maintenance of sites throughout much of Australia. As the removal of Aborigines from tribal lands continued and became more widespread, the deterioration and loss of many painted images was inevitable.

During the intervening 200 years, Aboriginal culture and its material manifestations have been widely studied and collected. The vast majority of this research has been done 'on the relatively powerless for the relatively powerful' (Bell 1978:25; see also Langford 1983). This earlier approach encouraged the notion that Aborigines were 'a dying race' (Widders 1974:106) and allowed their material culture to be subsumed into the dominant national cultural heritage. This denies recognition of Aboriginal ownership of cultural material and the rights and responsibilities for its management. The need to change radically this paradigm from one of control to one of Aboriginal empowerment has been recognised and argued by politically active Aborigines. It is yet to receive unqualified support from many non-Aboriginal researchers and bureaucrats who feel they have more to lose than to gain from co-operative interaction with Aboriginal groups.

A basic tenet of this thesis is the recognition of Aboriginal ownership of cultural property and of the right of Aboriginal people to decide management and preservation policies for that property. For these principles to have real meaning it must be realised and accepted that decisions made by Aboriginal people may not always suit European models of cultural heritage management. Two well publicised issues where the views of Aboriginal and non-Aboriginal people have clashed concern the repainting of images by Aboriginal custodians and the return of Aboriginal skeletal material. In both cases the clearly stated wishes of Aboriginal people, as well as their right to decide what constitutes appropriate treatment of their cultural material, have been aggressively challenged and criticised. These issues reflect the oppression of Aboriginal people by dominant academic and bureaucratic bodies. It is important to note that only when practices initiated by Aborigines defy or offend European Australian values is there such vocal national and international outrage. The reverse rarely occurs. Unqualified support for decisions made by Aboriginal people is fundamental to their self-determination and is essential for co-operative integration of the needs of the archaeological profession with those of contemporary Aboriginal societies.

This recognition is only a first step. Bureaucratic processes must be implemented which ensure Aboriginal control. Some steps of this kind have been taken in Victoria for instance since the enactment in 1987 of legislation recognising Aboriginal ownership of Aboriginal culture.

However, in the current situation where thousands of images are in a continual state of decay, the preservation of the vast majority of sites may be the physical responsibility of State and Federal government departments, that have resources to research and implement conservation procedures (Maynard 1976). But the moral decision to preserve or to allow further decay must be Aboriginal (Langford 1983; Mowaljarlai et al 1988; Mowaljarlai and Watchman 1989).

The introduction of such conservation measures could become yet another example of scientific colonialism if technical information and procedures are witheld from Aboriginal custodians (see Fourmile 1988 for a detailed discussion of this issue). In the current political situation, formalisation of conservation policies should be seen as interim until Aboriginal people are empowered to assert their right to manage sites as they wish. Until that time there is an urgent need for Aboriginal Sites Officer training programmes and continued recording of sites. At the same time conservation research must be ongoing, and where appropriate, suitable conservation measures should be applied to sites which are known to be rapidly deteriorating.

Projects seeking to address aspects of the above identified needs have been instituted in the Townsville region. Rock images in the region suffer from the range of physical and socio-political causes of deterioration that are common to sites throughout Australia. Some conservation measures have been applied. However, a detailed study of the condition of the images is yet to be carried out.

The apparent lack of routine on-going evaluation of conservation treatments previously applied to sites around Australia, or the reluctance to publish this information in itself contributes to the deterioration of sites (Sullivan, S. 1984b). Managers do not have access to sufficient information upon which to make sound decisions and possible successful treatments are not being applied because of limited awareness of their existence or their possible benefits.

There have been persistent calls for more research into the causes of deterioration of rock images and methods to slow down these processes. A detailed research strategy was outlined by Sue Walston in 1972 (see Walston 1975) and similar proposals and conference resolutions have been tabled since then (e.g. Pearson 1978). These have largely been ignored. The Rock Art Protection Program administered by the Australian Institute of Aboriginal and Torres Strait Islander Studies is an exception, however salaries for full-time research positions are urgently required.

A thorough understanding of the physical and chemical processes of deterioration is an essential first step in any treatment regime. A cautious approach to the implementation of all proposed interventions is necessary. Manufacturers' claims for the suitability and efficacy of their products are often exaggerated, and there are examples throughout the world where treatment experiments have accelerated the deterioration they were designed to oppose (see Lal 1970; Avery 1978).

Successful conservation treatments to consolidate friable paint and rock surfaces have been elusive, due in part to the inherent difficulties, but also to the lack of adequate and continued funding for research programmes. By informing those responsible for the protection of Aboriginal sites of the facts concerning the deterioration of painted and engraved images, and their requirements for long-term preservation, conservators and other field workers will have fulfilled some of their main ethical and professional obligations (Walston 1974). Responsibility for adopting these recommendations, or the consequences of ignoring them, rests with those who control the necessary resources.

SUMMARY

The issues concerning the deterioration and conservation of rock images are numerous and conflicting. Western society assumes an inherent and moral right to preserve all material deemed, by its own judgement to be sufficiently 'significant' to be saved. In Australia, concern for the study and preservation of Aboriginal material culture is gaining support, while at the same time the emotional, social and political interests of Aboriginal people are still largely ignored. Aborigines have often declared that the preservation of the actual images is not their central concern. Factors related to site management and control, land rights, social policies and their own political empowerment may be more pressing.

Decisions regarding the future of painted and engraved sites must take into account the diversity of attitudes and relationships to rock images. Their scientific and aesthetic values are very important, and in recent years their tourist and revenue potential has been realised. However, their significance to the people who created them and to Aborigines who no longer have direct links to them must receive priority consideration.

Formalisation of strategic management policies, which establish Aboriginal control and recognise Aboriginal rights to self- determination, are urgently required. An essential component of these policies must be adequate funding for conservation research as outlined in the numerous proposals which have been prepared over the last twenty years. On-going evaluation and publication of the results of field trials and conservation treatments must be encouraged and facilitated. The effects of complacency combined with frequent mismanagement of painted and engraved sites are apparent.

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