Conservation and Restoration of Painting and Engraving Sites in Western Australia

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Introduction

Before attempting any restoration or conservation of a rock art site it is necessary to thoroughly investigate the site so that there is an understanding of the materials which make up the site and the relationship between these materials and the environment. The procedures for accumulating this data are outlined in a previous paper in this publication[1].

It is a sad fact that human vandalism is probably the main cause of rock art deterioration, so that much of the research to date has been aimed at developing procedures to remove the effects of vandalism, rather than "restoring" the art work in a fine art sense. In contrast, site conservation consists of altering the site parameters, either physically or chemically, so that deterioration is halted or slowed; once again there is no attempt made to restore the art work.

Graffiti Removal

For safe and effective removal of graffiti it is necessary to first identify the material used, the rock type and weathering surface, as well as the type of rock art involved. The following descriptions outline the various methods we have used in W.A. to remove various forms of vandalism from rock art sites.

Paint Removal

Where feasible, paint should be removed as soon as possible from rock surfaces as exposure to sunlight and high temperatures can cause polymer crosslinking and other changes which make the paint even more difficult to remove. After trying many of the normally used solvents we have found that two brand name commercial paint removers are more effective and more practical to use. These products "Berger Strip" and "Poly Stripper" consist of a methylene chloride base with xylene and a gelling agent. They can therefore be applied to vertical or overhanging surfaces. They do not evaporate as rapidly as straight liquid solvents. In normal circumstances the paint stripper is applied by brush to the paint only, and allowed to act for 15 minutes. The treated area is then scrubbed with a strong non-ionic detergent solution in water (5 ml. Lissapol "N" in 10l water), until a thick froth is built up on the rock surface. This froth is used to hold the paint particles released by the paint remover and prevent them being spread over the rock surface. The whole area is then washed with clean water. The procedure will often need to be repeated several times to remove all paint. In most cases a paint brush is used for the scrubbing but on hard coarse textured rocks it may be necessary to use a wire brush. This is only done in extreme cases as there is a risk of scratching the rock surface; it is preferable to leave minor traces of paint on the rock then to damage the surface.

We have used the above technique to remove vandals' paint from on top of red pigmented Aboriginal paintings without damage to the paintings. This will depend on the pigment and rock type and is only attempted on siliceous rocks with hematite pigments[1].

There are several precautions to be taken when using this technique. Methylene chloride must be used with caution; protective clothing, gloves and a face mask are necessary and the site must be well ventilated. Both the paint remover and detergent will remove lichen from rock surfaces as well as dust and dirt and this will cause a clean patch in the area treated. In one case we removed a large painted name from the entrance to a rock shelter only to find the name still present as a silhouette of lichen free rock. White rock art pigments are easily disrupted by organic solvents and should be avoided when using this method.

Charcoal, Chalk and Dry Pigments

There are two methods of removing charcoal, chalk and dry pigments and the choice will depend on the site to be cleaned. Small areas of sites which cannot be wetted can be cleaned by using small fibreglass brushes. These brushes are used for jewellery cleaning and consist of a large number of glassfibres bound with string, the largest size (15mm dia x 150mm) are the most suitable. They can be obtained from wholesale watchmakers' supply shops. With the brush it is possible to remove the offending pigment with a scrubbing action (we have even been able to remove charcoal graffiti off the top of Aboriginal paintings without causing any damage). The method works because the glassfibres, while being harder and stiffer than normal brushes, are still softer than most rock forming minerals so there is no scratching of the surface. The method is rather slow if a large area is to be cleaned and a large number of brushes will be required since they wear out quickly. The brushes release numerous small fibres which can cause skin irritation so protective clothes and mask should be used. The main advantage of this method is the high degree of control possible.

The other method is suitable for large areas of vandalism, and sites which can be covered with water. It consists of applying a strong solution of non-ionic detergent (as used for paint removing) with a paint brush to create a thick froth cover over the affected area and then washing it off with clean water. This method is very fast and cheap but should only be used on painting sites on which the pigments are well bonded to the rock.

Wax Crayon, Spirit Inks etc.

This type of vandalism must be removed with care as there is a risk of spreading the colouring over the rock surface. The most suitable method is to use a solvent soaked poultice and we have found "sepiolite" to be an ideal poultice, however it can prove expensive on large areas. Cotton wool with a less volatile solvent such as toluene is usually sufficient and much cheaper. On exposed rock surfaces solvents will evaporate very rapidly, often before they have had time to dissolve the offending material. We have used kerosene in such cases combined with a black polythene sheet cover to slow the evaporation rate.

Scratches

Scratches are impossible to remove as they are the result of previous removal of the rock surface. We usually aim to remove the visual effect of the scratch so that words or lines no longer have a visual impact on visitors to the site. This is done by first cleaning all the loose material from the scratch with a fibreglass brush, or detergent and water. This is done to remove the light coloured powdered rock which is the most obvious part of the scratch. The damaged area is then washed with dirty water made from local soil. This is allowed to dry, and the area is then lightly brushed until a suitable colour match is obtained. In some cases where the rock had a dark surface patina we have used natural ochres to colour match the damaged area.

Lichen Removal

Lichens are important agents in rock weathering especially in moist climates[2, 3]. They are symbiotic associations of algae, fungi and bacteria, and destroy rocks both mechanically and chemically and should always be removed if a rock surface is to be preserved. In Western Australia, lichens are not a major problem as most of the State is too arid. However, in many semi-arid regions, sites affected by algae and lichens are common in localised areas with suitable micro-environments.

There are many treatments for removing lichens and the final choice will depend very much on the site in question. We have established a trial area at Bolgart on an exposed granite rock outcrop to test the various procedures. As lichens are relatively slow growing it will be some time before the final results are known; the following summarises the results to date.

Washing

Lichens can be removed by washing the rock with a detergent solution and scrubbing brush, but only non-ionic detergents should be used. The method requires large amounts of manual labour and could cause mechanical damage to friable rock surfaces. Areas cleaned by this method are still lichen free three years later.

Fungicides

Lichens are killed by most fungicides. We have used Pentachlorophenol as a 5% solution in toluene. "Panacide" (a BDH product) as a 50ppm mixture with water, and tributyl tin oxide as a 1% solution in kerosene. All were brushed on and allowed to dry. The difference between a live and dead lichen is not obvious and the treated areas appeared the same three years after treatment. Of the various fungicides the organo-tin group appears to be the safest to use and offers the best chance of producing a residual effect.

Ammonium hydroxide (NH_4OH)

A 10% ammonium hydroxide solution is very effective in removing lichens, especially the more tenacious black "blue-green" algae films. There are several problems with this method. Ammonium hydroxide will dissolve the iron oxides common in many weathered rock surfaces, causing colour changes. It will also have a disasterous effect on

clay minerals, and is therefore only suitable for fresh rock surfaces where immediate removal is required.

Zinc Flurosilicate, $ZnSiF_6$

This compound has had a varied history as a stone preservative[4] and lichen control agent. We used a concentrated solution in water (it is only slightly soluble). It had no visible effect at the time of application but 12 months later the treated area was free of lichen and is still free three years after treatment, however, some workers have reported the formation of opaque films following repeated use of this compound.

Herbicides

We have used a broad spectrum amine based herbicide (Chlorea, an ICI product which is normally used for weed control on open sites and which in addition destroys lichens. A 10% water solution was sprayed onto the rock surface and within two hours the lichens curled up, discoloured and could be brushed off when the rock was dry. The site is still lichen free 12 months after treatment.

Environmental Control

While in most cases environmental control would be the best solution to most site conservation problems, full control is far too expensive and would only be used in exceptional circumstances. However, it is often possible to modify particular micro-environments which are causing problems. Control of moisture is probably the most important and often the easiest to achieve. We have used silicone based caulking compounds to establish artificial drip lines in rock shelters to prevent water reaching painted surfaces. These products, "Rhodorsil Mastic" from Rhone Poulenc, and Sikaflex-la from Sika Ltd., have easy to use cartridge type applicators, are unaffected by sunlight, adhere well to rock surfaces and remain flexible with time.

The other simple way to improve the site environment is to remove vegetation from the site. Vegetation cover will result in higher humidities at the surface and decrease light intensities; both are factors which will encourage lichen and algae activity and deterioration of rock art. In Western Australia we have the added danger of bushfires which can cause serious mass exfoliation of the rock surface if vegetation is allowed to accumulate.

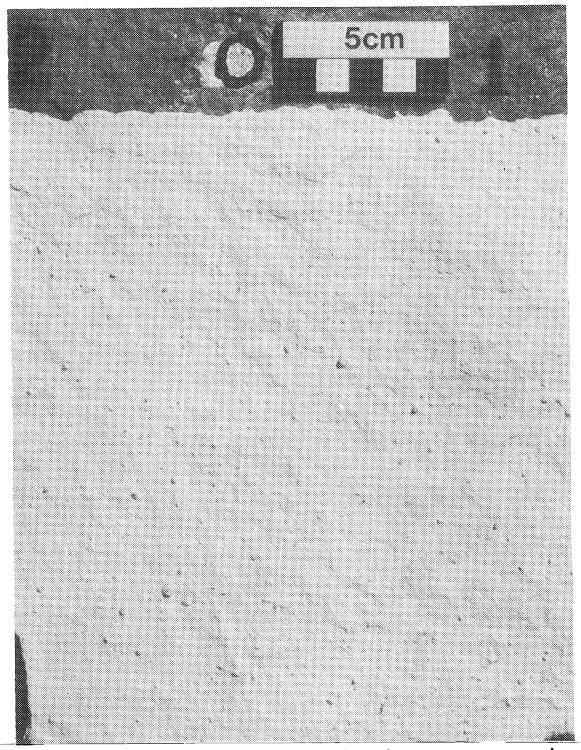
We usually use manual labour to remove the vegetation as regrowth is very slow in the arid environments. In problem areas where there are no environmental constraints on its use we have used the broad spectrum herbicide, Chlorea, to control regrowth.

Stabilisation of Rock Art

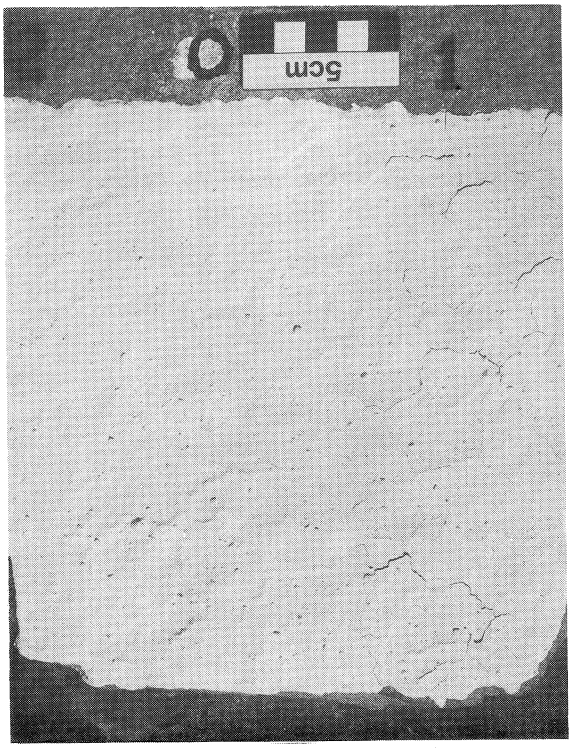
To date we have done very little chemical stabilisation or consolidation of actual rock art sites because of uncertainties about the life of the treatments available and the time necessary to test a proposed method. However, we have recently commenced using a silicone resin to stabilise rock art sites in which porous pigments have been used. As outlined in previous papers[1,5] the main cause of deterioration in the Kimberley "Wandjina" art was capillary action of water passing in or out of the pigment layer. To overcome this we have impregnated the pigment layers with a low concentration of silicone resin. The aim of the treatment is to thinly coat the pigment particles with silicone resin thus preventing capillary action, but allowing vapour to pass freely. The system finally adopted was the result of a test programme using pigments from Aboriginal sources and rock samples from actual sites. These samples were prepared using Aboriginal painting and pigment preparation techniques where possible. They were then treated with various available silicones and silic ester preparations under a range of application techniques. The samples were then weathered artificially in an accelerated weathering apparatus programmed to duplicate temperature, relative humidity and U.V. changes recorded on Kimberley sites. The results were used to further modify the treatment, especially the application techniques, before a number of trial sites were treated in the field. These sites are now being monitored before full scale treatment is undertaken. (Fig. 1 illustrates the results of the weathering test, and Fig. 2 one of the trial sites after treatment).

The system now used is based on a proprietary brand masonry water repellant called "Goliath" from Raffles Paints Ltd. WA. It consists of a 5% solution of imported silicone resin in toluene or white spirit with 0.05% tributyl tin oxide fungicide. The mixture is sprayed on with a normal spray gun working at very low pressure to limit evaporation. The spray technique is important, the aim being to prevent any build up of resin on the surface as this will cause flaking. A light spray is applied to stabilise the surface then the mixture is flooded on and every precaution taken to limit the evaporation rate such as screening the shelter or wall with polythene sheet. Drying should take many hours.

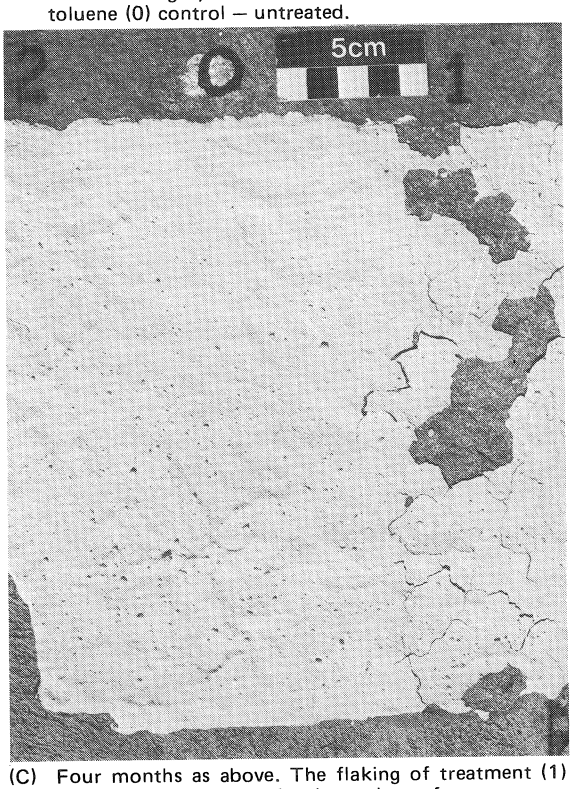
The result when dry is completely invisible, however water is repelled from the surface and there is an improvement in the mechanical strength of the pigment layers. The key to successful treatment is to get enough resin in to the pigment layers to make them water repellent without making them impermeable by completely impregnating the pore space.



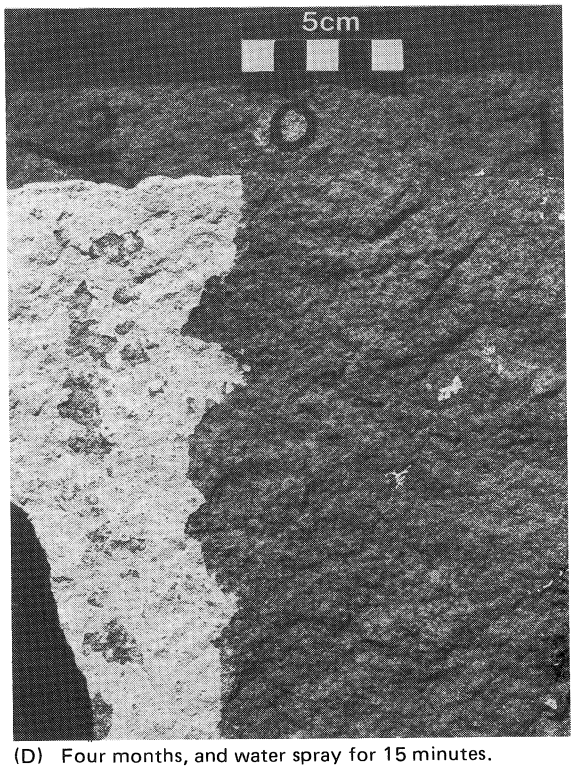
(A) Test sample of a white huntite pigment on quartzite prior to accelerated weathering.
Treatment — (1) combined silicone resin and silicic ester in a highly volatile solvent (2) silicone resin in toluene (0) control — untreated.



(B) One month accelerated weathering with temperature range 5° to 35°C and R.H. 30 to 90% on a two hour cycle time. Constant ultra violet radiation, at 1.3×10^{-4} watts/cm^2/nm between 257 and 392 nm.



(C) Four months as above. The flaking of treatment (1) was due to a build-up of resin on the surface.



(D) Four months, and water spray for 15 minutes.

Figure 1.

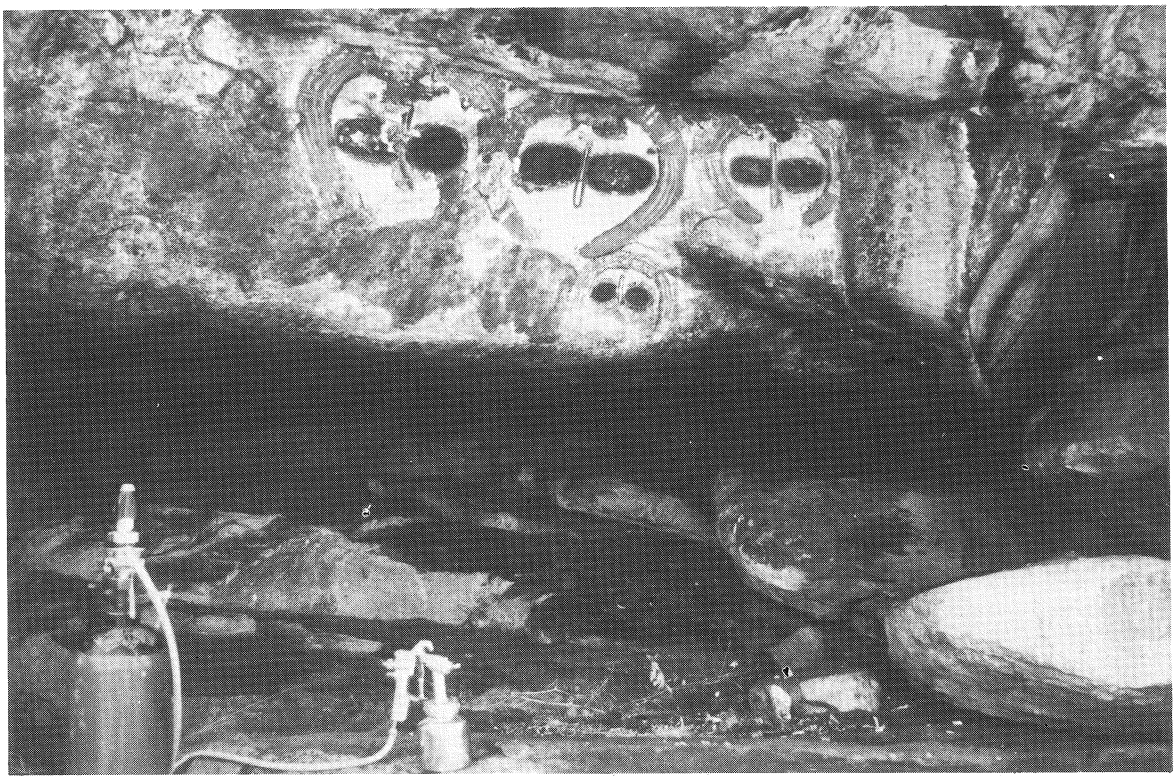


Figure 2. A Wandjina rock art site in northern Kimberley, following treatment with silicone water repellant. Spray equipment in foreground.

Field Example

Following laboratory studies, field trials, and the erection of a security fence, the Aboriginal Sites and Conservation Departments of the W.A. Museum carried out a small conservation and restoration project in August 1975. The site, at Port Hedland, which consists of Aboriginal engravings on a low, coastal limestone ridge was deteriorating rapidly due to industrial pollution and had also been damaged by vandals. (See Clarke[6] for details).

Aim of Work

The aim of the project was to clear the site of rubbish and vegetation to improve drainage, and then wash the engraved areas to remove soil, iron ore dust and soluble salts which were all causing the engravings to weather at above normal rates. At the same time, restoration work was to be carried out to remove the visual effects of vandalism.

Vegetation Removal

The vegetation was mainly native grasses with some herbs. This was removed with shovels (powered by members of the Aboriginal Site Control Training Scheme). Special care was taken not to chip or mark the limestone surface. Small areas were progressively cleared and resulting trash removed. The vegetation was cleared because it causes soil and pollutants to collect on the limestone surface which in turn supports more vegetation. The soil contains organic acids which attack the limestone and prevent rapid drainage of surface water. Plant roots can disrupt joints and fractures in the limestone. It is worth noting that early photographs of the site by Brockman in 1901[6], show that there was almost no vegetation present on the site.

Rubbish Removal

All the larger pieces of rubbish were collected and taken to the local dump, an old fence was removed and all loose rocks were cleared from the engraved areas. This work was mainly of aesthetic value, however, in many cases iron objects were corroding and staining the surface and the rubbish was assisting soil retention with its associated problems.

Wash Down

The cleaned portion of the site was then carefully washed. This was done by using a large, hired tank truck and a pump unit. The truck carted the water from a nearby industrial area to the site. The water used was "hard" and thus already saturated with calcium carbonate so that no solution weathering of the limestone would occur.

The water was pumped from the truck and flooded onto the site using a 5cm flexible rubber hose with no jet to lessen risk of surface damage.

Sections about 8m long were treated at a time. Work would start at the top of the ridge and the resulting slurry of soil, iron ore dust, rubbish, shells and small rocks was washed to the base of the ridge. Some shoveling was needed to move the thicker deposits towards the base. The remains of a shell midden was left, as much as possible, intact. It would be of no archaeological value but may be suitable display material if the site is developed as a tourist spot.

The tank truck carted 8 loads of 4,000 gal. (18,200 litres) each in the 8 hours available. With this, approximately 1/8th of the total site area was washed, and one half of that area cleaned of rubbish and vegetation.

The washing procedure proved to be a very satisfactory and relatively cheap method of cleaning the site. The main advantages over mechanical methods such as sweeping are that it is more efficient in removing the fine dust particles from the porous rock surface, helps remove soluble salts, lessens the risk of scratching the rock surface, and is much quicker and less labour demanding.

Restoration

The site had been damaged by people scratching and engraving names and figures into the limestone, and painting the surface mainly with pressure-pack type paint.

Two methods were used to treat the scratched and engraved damage. Where the damage was clear of Aboriginal art the name or letters were destroyed by chipping the limestone from nearby and then removing the tool marks with a 10% HC1 solution. The resulting clean surface was washed down to remove any chlorides and then rubbed with soil to give a "natural" surface texture and colour. If the damage was close to or superimposed on the Aboriginal art, the offending section was filled with a mixture of tile grouting cement, ochre and local soil. Where possible the above work was done before the wash down.

The paint proved extremely difficult to remove due to the porous nature of the limestone surface, high solar radiation and the four years the paint had been exposed. Commercial paint removers were only 50% effective and finally a very drastic and unconventional technique involving an axe, wire brush and HC1 was used to remove the painted limestone surface. The newly exposed surface was coloured with a soil and ochre mixture.

Finishing touches

The day after the wash down, when the site was again dry, the odd bits of shell and soil were swept off the surface to prevent damage from it being walked into the surface. This revealed a lot more vandalism that had been hidden by soil or dirt, and this was removed. Several pieces of limestone which had broken away from a large dugong (marine mammal) engraving were cemented back with epoxy resin. The shell midden was picked over to remove rubbish of European origin. A small dust and rain collector was installed to help study the atmospheric input to the site.

Conclusions

We have aimed in this paper to show that there are many things that can be done to protect rock art from both natural and human deterioration and that many of these treatments are neither novel nor sophisticated. Most can be carried out with a minimum of skill and money and yet they will greatly prolong the life of a rock art site. However, they all require the user to be aware of the nature of the rock and art work in a physical and chemical sense and to understand the processes operating on a particular site.

References

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