Rock Art Conservation in South Africa

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Introduction

Prior to 1975 investigation of the problems and conditions affecting the preservation of rock art in South Africa was mostly undertaken by enthusiasts concerned at the rapid deterioration of this vast heritage (for background information and references see Avery[1]). In 1975, however, in response to widely expressed concern the National Building Research Institute (N.B.R.I.) of the Council for Scientific and Industrial Research (C.S.I.R.) was commissioned by the National Monuments Council to undertake a scientific investigation into methods of preservation. This paper reports on the aims and achievements. of this research which has been divided into three phases.

1. An initial investigation of selected sites in the field in order to assess the problem and the logistics of a conservation programme.
2. Experimentation with various methods both in the laboratory and in the field.
3. Preservation in the field.

Areas with differing conditions have been investigated and phases one and two have been initiated. Efforts are being concentrated in the cave sandstone area of the Drakensberg in East Griqualand and Natal, where deterioration is considered to be most serious.

Results

Two important factors affect the application of paint to rock surfaces and any attempts at conservation. First and foremost, rock is 'living' and weathering is a constant and natural occurrence under normal conditions. Rock surfaces are therefore naturally unstable. Secondly, paint applied to a surface is drawn into the pores to a varying degree sealing the surface against natural movement of moisture and salts from inside and thereby sometimes aggravates weathering processes.

In situ and laboratory investigations confirmed that there is great variability in the porosity and natural weathering properties of rocks. This was found to be the case not only between rock types such as sandstone, quartzite and granite but also within each type and locality. The cave sandstone shelters of the Drakensberg were considered to have the greatest porosity and to show the most extensive deterioration. Table 1 summarizes the major causes and effects of deterioration of paintings on granite and sandstone surfaces which differ in composition and occur in areas with different climatic conditions.

Water movement was found to be the greatest factor causing deterioration of rock surfaces together with porosity and the condition of painted areas prior to application of paint. This water movement takes the form of surface run off or internal percolation and results in the transportation and precipitation of salts such as calcium carbonate, calcium sulphate, sodium chloride and manganese oxide, and the growth of algae.

By far the most important form of water movement and a major cause of natural weathering is through internal percolation of moisture contained within the rock itself. This moisture contains dissolved salts and evaporates as it reaches the rock or paint surface, causing the salts to concentrate within about one centimetre of the surface. The salts dry out, crystallize and, in so doing, expand. This applies pressure to surrounding areas causing weakening of the surface which disintegrates. This leaching of salts can also have a beneficial effect when dry conditions provide enough stability for salts to protect paintings by binding or covering the surface instead of breaking it up.

Surface runoff is caused by direct exposure to moisture or leakage through cracks and fissures. It washes out pigment particles and binders, thus causing fading. It also contains salts which on

TABLE 1. Summary of main causes and effects in the deterioration of paintings executed on granite (o) and sandstone (x)

EFFECT	CAUSE							
	Sunlight or Rain	Surface Run-off	Rainfall — Low	Covering by precipitated salts and/ or organic growths	Effect of moisture on surface of soluable salts	Moisture dissolving soluable salts	Crystallization of salts and sealing effect of paint	Thermal Extremes
Fading (Bleach and Removal)	o							
Paint Removal (Pigment and Binder)		o x						
Maximal Salt Formation on Paintings			o					
Obliteration of Paintings				x				
Deterioration of Surface and Paint					o			
Weakening of Rock Surface						x		
Spalling							o x	o x

o — Granite — dense rock, dry Climate (South West Africa)
x — Sandstone — porous rock, Subtropical Montane (Drakensberg — S. Africa)

drying may be deposited as opaque washes which obliterate paintings. Recurring surface wash also 'activates' crystalline salts in the surface skin of rocks by dissolving and redepositing them. Upon drying these expand and cause further deterioration.

Temperature extremes causing freeze/thaw conditions result in expansion and movement of moisture contained in the rock surface or sealed behind painted surfaces and consequent break up or spalling.

These problems are compounded by human factors involved in the selection of differentially weathered areas for painting. Within a small area of a shelter it is possible to observe paintings executed on surfaces which ranged from relatively stable new spall scars to highly unstable areas in the process of spalling. This obviously causes differential deterioration of paintings and raises serious problems for conservators.

The solution to the problem of rock art deterioration lies primarily in the elimination of its causes by improvement of conditions within painted sites. Complete elimination is considered to be virtually impossible except perhaps in a very few cases where sites could be isolated from these factors and the very high costs justified. The effects of drying out a rock body are as yet unknown and could in fact further weaken the basic structure of paintings which normally experience damper conditions. With this sobering fact in mind the aim of the N.B.R.I. at present is to consider methods whereby the process may be slowed down. Even this, however, may not be possible where extreme conditions and practical considerations dictate.

A field experiment has been set up in a rock shelter on the farm Beersheba in the Drakensberg. The paintings in a low sandstone shelter, which depict early conflict between white settlers and bushman cattle thieves, are being obliterated by salt deposition caused by surface run-off. The only sure way to stop the serious deterioration of this site was considered to be removal to a museum. This was not possible, however, and the alternative diversion of the runoff has been initiated, the basic assumption in this operation being that by creating drier conditions in the shelter, deterioration must at least be slowed down. After investigation of practicalities such as the introduction of further chemicals in the form of salts and corrosion products, appearance and longevity, epoxy resin was used to embed a stainless steel strip into a groove cut into the roof of the shelter with a carborundum saw. This forms an artificial dripline which it is hoped will reduce runoff and moisture content of the painted area. Long term results are only expected within 5-7 years and the main considerations at the present are the mechanics of establishing means of comparing paintings through time (photographs are not considered a viable proposition), and testing whether conditions have improved and moisture content of the rock been reduced. For the latter it is proposed to sample the moisture content of a sealed borehole filled with grit-composition in the shelter at regular intervals.

The question of preservatives is being very carefully studied and an extremely conservative approach is being adopted. While it is thought likely that present approaches will help to slow down deterioration, removal to a stable environment is considered to be the only permanent solution. It will be extremely difficult to arrive at any solution. Moisture is derived from many sources all of which could be operating in a single site. It is also necessary to bear in mind that the paint layers are thin and their absorbtion into the rock variable. Furthermore, failures are not reversable so that the utmost care is essential. The N.B.R.I. is therefore not using preservatives in the field although laboratory experiments are being undertaken. In this connection it is pertinent to cite an experiment as a warning. A preservative with penetration of over one centimetre was introduced into a rock sample. After introduction of salts through an untreated side and sustained weatherometer tests no detrimental effects were noted and the results were considered to be most encouraging. The sample was then removed and left in the laboratory. After a very short space of time, however, it was noticed that without apparent warning the 'preserved' outer surfaces of the sample had broken away neatly at the point of deepest penetration. It must, therefore, be accepted that success in simulated laboratory experiments may not necessarily indicate results which might be obtained over long periods of time under natural conditions in the field. I end this report, therefore, with a plea that this be borne in mind by scientists constrained by limited funds and time when quick results are sought. I would further suggest that the time factor is of such importance in rock art conservation that funding bodies supporting research programmes in this field make every attempt to allocate sufficient funds for long term investigations in appreciation of the enormity of the problems involved and the responsibility laid on scientists. In this way only will a full and worthwhile contribution be made towards preserving the rock art heritage of the world.

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References

1 Avery, G. (1975). The Preservation of Rock Art with Special Reference to South African Problems and Conditions. *S. Afr. Archaeol. Bull. 30*, 139-142.