Research Article

TOWARDS A CONDITION MONITORING OF ROCK ART SITES: THE CASE OF BNE 1 IN FREE STATE PROVINCE, SOUTH AFRICA

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ABSTRACT

Management of rock art sites entails continuous monitoring of changes in the condition of the site. Monitoring ensures that changes that occur at the site over time are recorded and controlled. Monitoring is a crucial step in any management process because it enables conservators and managers to determine causes and rates of deterioration, derive a prognosis as well as develop appropriate conservation strategies for sites. Monitoring is thus an indispensable tool for rock art managers in their attempts to minimize or mitigate site damage. This paper analyses how condition change was monitored at a particular rock art site (BNE 1) in Clocolan district, Free State Province, South Africa. Photographic analysis using a digital camera and computer software (Adobe Illustrator Creative Suite 2 and ImageJ), was used to monitor condition change. It is suggested that future monitoring of public rock art sites in Free State in particular and in South Africa in general, should be based on a negotiated partnership between interested parties.

Keywords: rock art, condition monitoring, conservation, heritage management, South Africa.

A BRIEF HISTORY OF ROCK ART CONSERVATION AND MONITORING IN SOUTH AFRICA

Southern African rock art researchers have become increasingly concerned about the rapid natural and artificial deterioration of rock art sites in recent decades (Avery 1975; Vinnicombe 1976; Ward 1979; Loubser & Van Aardt 1979; Mazel 1982; Rudner 1989; Pager 1989; Deacon 1994; Pwiti & Mvenge 1996). Researchers have pin-pointed two factors that threaten the condition of rock art sites: natural factors such as rock weathering, biological agents, animal action, normal geological activity, and artificial factors such as lack of public awareness, uncontrolled tourism, acts of vandalism or inadequate conservation strategies that attempt to 'preserve' the site (Avery 1975, 1978; Rudner 1989; Lewis-Williams 1990; Kessey 1995; Deacon 1993, 2006; Walderhaug Sætersdal 2000; Taruvinga & Ndoro 2003).

In the late 19th and early 20th centuries, rock art came to be regarded as a curiosity worth collecting. This aesthetic approach led researchers to believe that effective conservation of rock art could be best achieved by the removal of panels of rock art from sites to museums for safekeeping (Rudner 1989; Loubser 1994; Deacon 1994, 2007; Henry 2007). From as early as 1911 rock art conservation was enforced by legislation that made it illegal to destroy, alter, remove from original site or export rock art without a permit. From the 1930s further protection was enforced by declaring certain sites national monuments (Woodhouse 1988; Rudner 1989; Deacon 1991; Deacon & Pistorius 1996). Although several rock art sites were declared national monuments to safeguard them from destruction, other damage continued, showing the failure of legislation alone to proactively protect rock art sites (Blundell 1996; Ndlovu 2005; Smith 2006).

During the 1980s and 1990s, the conservation paradigm in South Africa began to shift from legislation as the main means of protection to a holistic conservation approach (e.g. Mazel 1982; Pager 1989; Deacon 1994) defined as "all the processes of looking after a place so as to retain its cultural significance, caring not only for the cultural heritage values of the site but also the surrounding environment" (Pearson & Sullivan 1995: 9). These processes entail monitoring signs of deterioration and decay in the condition of rock art sites. Regular monitoring enables an informed assessment of deterioration and identifies cases in which intervention is required (Loubser 2001; Deacon 2006). Monitoring is thus an indispensable tool for rock art managers to minimize or mitigate damage to sites.

The first step towards monitoring of a rock art site is condition assessment: the evaluation, recording and documentation of natural and human impacts on the tangible and intangible condition of a site and its immediate surroundings (Loubser 2001; Ndoro 2006). Condition assessment establishes the state of conservation at any given moment. Since the condition of any rock art site constantly changes, condition documentation enables one to avoid the automatic reaction of presuming that the physical structure of a site is necessarily in decay (Price 1987; Thorn & Dean 1995).

Experiences from the United States of America (e.g. Silver 1989; Thorn & Dean 1995; Dean 1999) and Australia (e.g. Smits 1978; Bednarik 1989; Loubser 1991) have demonstrated that monitoring is a crucial step in any management process because it enables conservators and managers to determine causes and rates of deterioration in order to diagnose and develop appropriate conservation strategies for sites. However, because it is often impossible to reverse the effects of physical deterioration, the best that a well-managed conservation strategy can hope to achieve is to identify the physical processes of deterioration, to measure or estimate their impact on the basis of past experience, and to implement strategies that can slow down a process or arrest it if practicable (Rudner 1989; Deacon 2006).

In South Africa, rock art conservation research has focused on causes of deterioration of sites (e.g. Avery 1978; Rudner 1989; Meiklejohn 1995) and the development of appropriate methods and strategies for effective conservation (e.g. Mazel 1982; Deacon 1994). Important management guidelines for preserving rock art sites have been suggested and many selected sites have been given effective protection (Webb 1980; Deacon 1994, 1997; Blundell 1996). Despite these developments in the conservation of rock art sites, however, issues concerning research on monitoring and the condition monitoring of rock art sites have been largely overlooked and in most cases are still neglected by researchers and heritage practitioners (Deacon

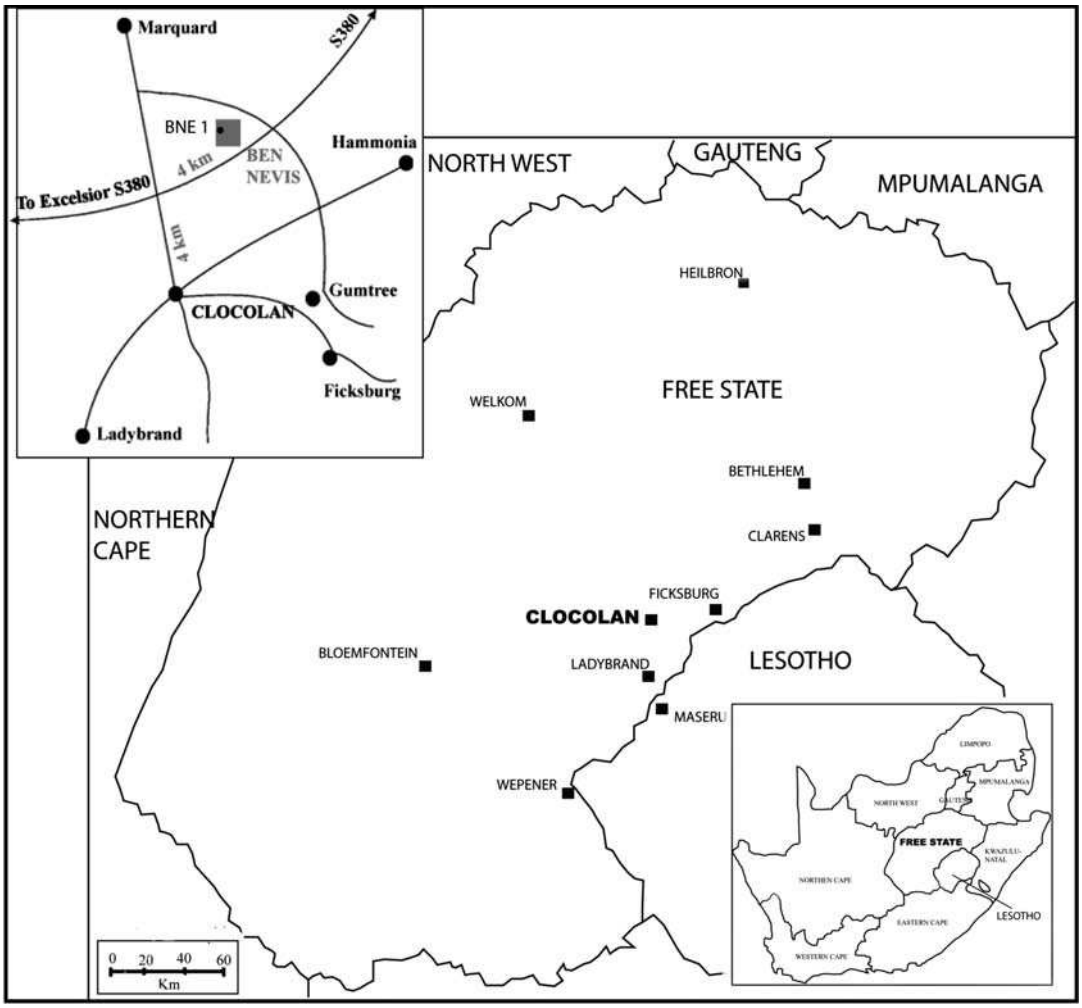

FIG. 1. *Location of BNE 1 near Clocolan, Free State Province.*

2006). This neglect is probably because no monitoring continues after the management plan for the site has been written, as monitoring is usually not included in the budget. In addition, the dearth of expertise at research level to develop and apply rock art conservation measures and subsequent monitoring programmes, contribute towards ineffective management of rock art sites in South Africa (Blundell 1996; Deacon 1994).

There are some noteworthy studies that considered monitoring. Between November 1965 and August 1969, Harald Pager documented rock paintings in 17 shelters in the Ndedema Gorge, uKhahlamba Drakensberg. Subsequent monitoring of the condition of these 17 sites, first by Harald Pager in 1973 and later by Shirley-Ann Pager in 1989, revealed an alarming rate of deterioration of paintings due to exfoliation and 'fading'[1]. The Pagers concluded that the deterioration of paintings was a product of human activities such as increased numbers of visitors camping at shelters with rock art (Pager 1989). However, the fact that the condition assessment took place in 1973 and 1989 (7 years and 15 years in-between) makes it difficult to ascertain the rate of deterioration. In addition, some researchers are known to have sprayed the paintings they were copying or photographing with water so that they could see them better. This practice must surely have contributed to the destruction of the rock art as well.

In 1982 Aron Mazel proposed a monitoring programme for the management of rock art sites in the KwaZulu-Natal Drakensberg area through tracing and photography. Photography was recommended as the primary medium for monitoring sites. Mazel (1982) recommended the compilation of a complete record of colour prints that could be compared with the baseline collection of prints to be housed at the Natal Museum (Mazel 1982). Later on, working in two wilderness areas in Western Cape Province, Janette Deacon (1994) suggested the use of portfolios for each rock art site. These portfolios were to include a copy of the site record form, a photocopy of the relevant section of 1:50 000 maps with the site marked on it, copies of any tracings made of the site and copies of colour prints of rock art panels to be used by the wilderness area staff for monitoring purposes. Despite these suggestions, however, Blundell (1996) argues that the absence of funding and the inefficiency of the erstwhile National Monuments Council meant that, in practice, monitoring of many rock art sites was left to local institutions and was not followed through. The Mapungubwe Cultural Landscape, listed as a World Heritage Site since 2003, is one of the few examples in South Africa of this new trend of rock art management that places special emphasis on monitoring (Deacon 2006).

SETTING THE SCENE

The eastern Free State Province of South Africa has hundreds of rock paintings located in shelters and overhangs particularly of Clarens or 'Cave' sandstone formation (Loubser & Laurens 1994; Ouzman 1996). BNE 1 rock art site is a 'cave' sandstone overhang with classic monochrome Bushman paintings, located about 600 m uphill in the Clocolan Mountain, at the privately owned Ben Nevis Cherry Cellar & Guest Farm. The site is about 8 km northwest of the eastern Free State town of Clocolan (Fig. 1).

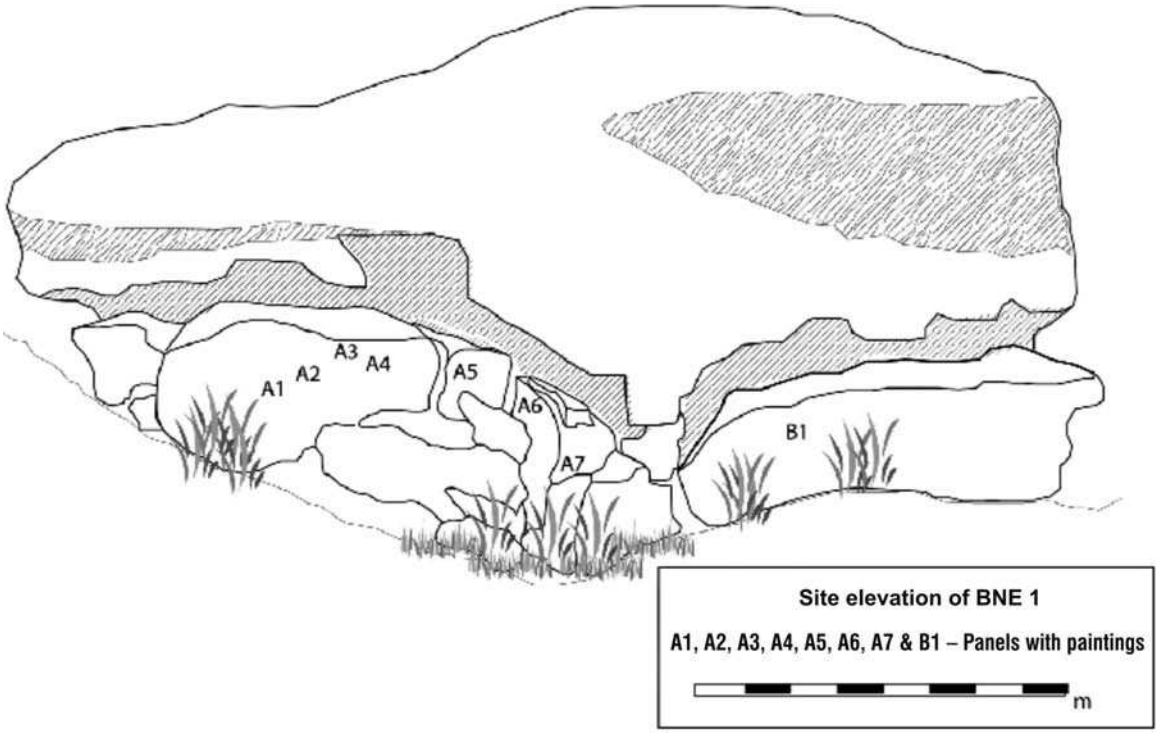

FIG. 2. *Site elevation of BNE 1 rock art site showing the location of the painted panels.*

BNE 1 is open to the public though it is not registered with any Heritage Resources Authority in Free State as a public rock art site. There are however few unauthorized visits to the site as the farmhouse is the main way of getting to the rock art site which has been benefiting from the careful custodianship of the landowners. Since this study aims at analysing the condition of a particular rock art site in order to monitor the changes, BNE 1 was chosen for a detailed case study due to a number of visible physical characteristics (signs) of agents that influence the condition of rock paintings.

The site consists of a large sandstone boulder on the summit of a group of outcrops forming two overhangs facing in different directions. The outcrops underneath the large boulder at the west section of the site (hereafter section A) form a unified "V" wall, where a number of paintings are depicted. The easterly facing overhang (section B) consists of a single outcrop underneath the large boulder that forms an overhang of 4 by 1 m (length and depth), and presents a single assembly of images. The painted areas are identified, within section A, as panels A1, A2, A3, A4, A5, A6 and A7 and within section B as panel B1 (Figs 2 & 3).

In section A, the paintings are roughly about 0.40 to 0.80 m

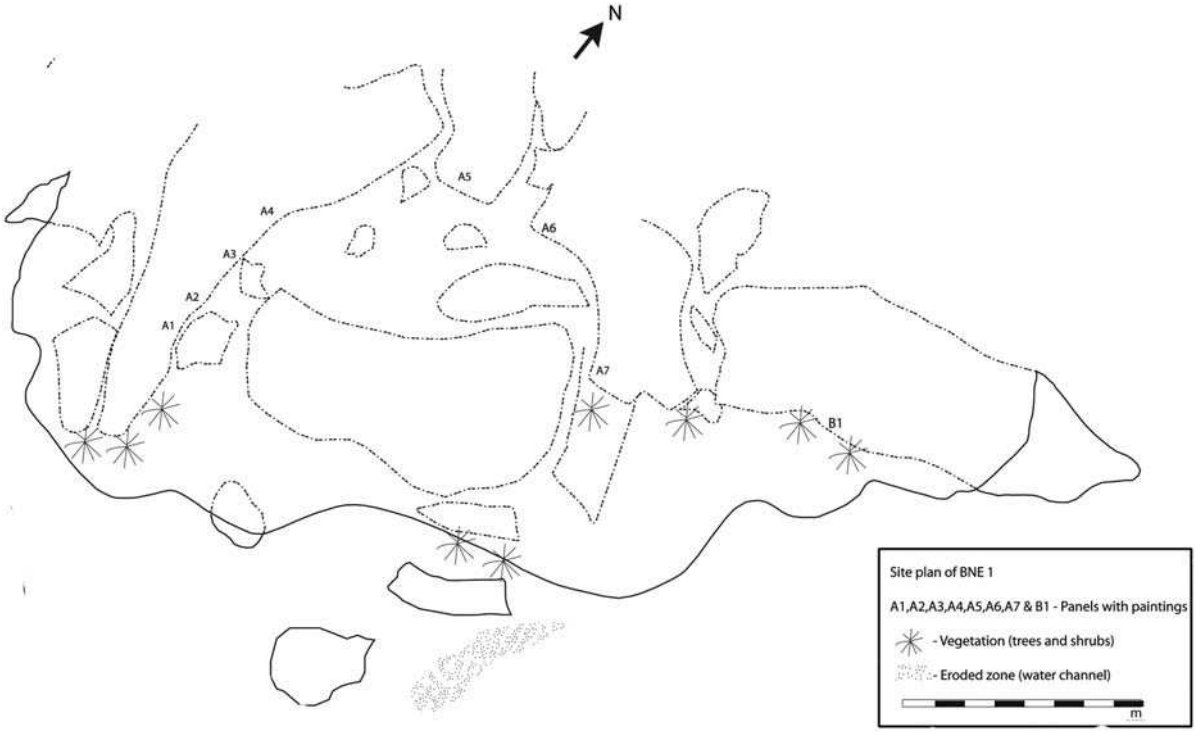

FIG. 3. *Site plan of BNE 1 rock art site showing the location of the painted panels.*

FIG. 4. *Paintings from panel A2 (section A of BNE 1).*

above the present floor level. Significant areas of the panels are covered in white and dark green-brown marks that obscure the images; hence a number of images depicted are not easily discernible. The most notable paintings are clustered in panel A2 (Fig. 4), where the upper part of the panel has a depiction of an animal (an antelope) in maroon pigment. The head of the animal seems to disappear into a natural crack in the rock. Superimposed upon this animal is a human figure that is associated with nine other human figures carrying arrows and bows. These figures appear to be walking towards the crack where the animal head fades into the rock. The single panel of section B consists of five elongated figures appearing to be human and animal combination (therianthropes) with bows and arrows and a number of small human figures (Fig. 5).

METHODS AND TECHNIQUES

Photography was the primary monitoring medium used to assess the changes in the condition of BNE 1. During my fieldwork in April 2007, I photographed the entire site with a digital camera (5.0 mega pixels; ×8 zoom; Nikon Coolpix 5700). Thereafter, I recorded the traces of natural and human interference with the site, such as vegetation, water marks, salts, animal activity and graffiti, on transparent overlays over the colour photographs. I developed a set of annotated symbols to indicate the category and distribution of natural and human features on the rock surface. I devised a system of symbols to illustrate and categorize all signs of deterioration on the photographs (e.g. Mazel 1982; Deacon 1994; Dean 1999).

I photographed the images from approximately the same position as historical photographs of the site in order to compare the changes at specific sections of rock art panels. These historical photographs, taken in the late 1970s by Neil Lee are stored in the Rock Art Research Institute (RARI), accessible on South African Rock Art Digital Archive (SARADA). I also located additional photographs taken in 1992 by workers from the National Museum in Bloemfontein. Unfortunately, the sample of historical photographs from BNE 1 does not cover the entire site. In addition, due to the past practice of wetting rock art panels to enhance photography, some photographs by Lee may not present signs of deterioration such as dust or wash marks that are visible in recent photographss.

I used Adobe Illustrator Creative Suite 2 on Windows XP Professional to digitize all the annotated symbols that I had developed to indicate the category and distribution of deterioration on photographs. In addition to the use of Adobe Illustrator to evaluate changes in the condition of BNE 1, I also used the program to indicate the category and distribution of deterioration signs on each set of photographs, historical and recent. The monitoring of the changes at the site was based upon the use of indicators – all elements that can be used to express the state and the changing integrity of the site. Hence, a number of symptoms or visible effects that might change the condition of the site were used as indicators to assess the change from the historical photographs.

I then employed computer software (Image Processing and Analysis in Java, or ImageJ) to measure the increases in human and natural impacts on surfaces. Initially measured in pixels, I subsequently converted all these values to percentages. I found that ImageJ helped me compare the proportions of change between historical and recent photographs. To facilitate these comparisons I adjusted the scales for historical and recent photographs so that I could standardize the measurement between photographs. These adjustments enabled me to make

FIG. 5. *Paintings from panel B1 (section B of BNE 1).*

accurate comparisons regarding the degree of condition change in the rock art between the different sets of photographs. For example, if I detected the presence of a particular condition in 10 out of 100 units of area in a recent photograph, and none in a historical photograph of the same surface, I could determine that 10% of the area was now affected by that condition.

Notwithstanding the potential of image analysis as a research tool, the absence of specific data relative to field conditions (e.g. relative humidity, rock porosity, temperature variation), the limited number of historical photographs used to assess condition change as well as the gap between the dates of those historical photographs placed limitations on the accurate monitoring of condition change at BNE 1. Although the historical photographs allowed me to identify agents and possible causes, it remains difficult to detect whether these elements are still active or not, and how recently they have been affecting the site.

RESULTS

CONDITION ASSESSMENT AND DOCUMENTATION AT BNE 1

I carried out a descriptive analysis at the site in order to document the factors that are affecting the painted surfaces at BNE 1.

Figure 6 illustrates the location of panels A1, A2, A3 & A4 in section A. The rock surface is affected by grey wash zones that cover 27% of the rock surface. In some areas of the rock surface there are white patches (covering 3% of the rock surface) that I identify as bird droppings and dark brown-greenish marks (covering 8% of the rock surface), that I identify as dassie (*Procavia capensis*) urine, that run from the top of the outcrop to the bottom. Branches of shrubs at the west side of Figure 6 are located roughly 1.5 m away from the panel A1 and cover 6% of the rock surface. There is scratched graffiti (covering 2% of the rock surface) on the northwest section of panel A1 (roughly 0.8 m away from the paintings) whose content includes an initial and date (H' 8 8 99). Approximately 0.5 m southwest of the scratched graffiti is incised graffiti (a cluster of small incised vertical lines) roughly 0.5 m long and 0.04–0.1 m wide that covers less than 1% of the rock surface.

The exercise shown in Figure 6 was undertaken for each photographed section of BNE 1 so as to document the condition of the entire site (Fig. 7).

The condition documentation of BNE 1 revealed that sections of almost all panels, with the exception of panel B1, are covered by a grey wash mark that partially obscures the images. This grey wash is more evident in some sections of the rock surface (wash zones) than others, and is the result of a mixture of bird droppings and dassie urine washed down by rain run-off. This grey wash obscures 100% of panels A1 & A6, 42% of panel A2, 15% of panel A3, 59% of panel A4, and 82% of panel A5.

Although the grey wash mark appears to be inactive and does not completely obliterate the images, dassie urine and bird droppings are active threats. Dassie excretion (dark brown-greenish marks) covers roughly 22% of panel A1, 13% of panel A4 and 69% of panel A6. Bird droppings (white patches) are more widely distributed on the rock surface, covering 9% of panel A1, 5% of panel A2, 8% of panel A3, 12% of panel A4, and 5% of panel A5. Unlike section A where dassie and bird excretions occur on almost every section of the rock surface, these animal droppings cover less than 2% of the rock surface that is panel B1. Nevertheless, these constitute a potential threat to panel B1 because the amount of excreta may increase in future and wash onto the panel.

Scattered along the length of the ceiling are light orange marks surrounded by white or light patches on the borders that I identify as water seepages. Rainwater flows over the ceiling at a number of spots and drops inside the overhang at places on the ledges on top of painted panels. I suspect that, depending on the intensity of the water during the rainy season, the water that seeps through the cracks in the rock flows onto the ledges of the outcrops, carrying with it dust and animal excreta and washing over portions of panels A3 and A4. Small areas of the ceiling are also colonized by swallows and mud wasps. All the bird nests are largely or partially broken and, with the exception of nests that are almost directly above panels A1 and A7, all the other nests are not placed directly above any panel.

Regarding human impact, there is evidence of deliberate vandalism at the site. There are scratched and incised graffiti markings. Unlike the scratched graffiti, which are a whitish colour, the incised graffiti has less visual impact since it has blended in with the colour of the rock. The graffiti at this site belong to recent times (i.e. less than 60 years old) and cannot be considered historical graffiti. The reason why human impact on the site is minimal may be associated with the fact that since the site is on a privately owned farm there is little unauthorized visitation to the site as the farmhouse is the main access to the site.

CONDITION CHANGES AT BNE 1

I based my assessment of changes in the condition of BNE 1 at the site upon the use of indicators.

Photographs 1A & 1B (Fig. 8) show a section of panel A1 and the entire panel A2. In photograph 1A, taken in the late 1970s, there are remnants of white patches (bird droppings) in the upper section of the photograph covering 2% of panel A2. The white patches (bird droppings) increase up to 5% of coverage in photograph 1B (photos taken in 1992). Also visible in photograph 1B is a grey wash mark that covers 27% of the surface and wash lines of white thin granular deposits that cover 8% of the photograph. Comparison of photographs 1A and 1B with the conditions reflected in photograph 1C (taken in 2007), shows dark brown-greenish marks (dassie urine) that cover roughly 13% of panel A1 and grey wash marks that cover 100% of panel A1 and 43% of panel A2. One can notice that the images are extremely obscured since they can hardly be seen in photograph 1C.

I carried out the same mode of condition documentation for each area of the site where historical photographs were available for comparison. In general, monitoring revealed a significant development of natural agents responsible for the change (deterioration) of the condition of BNE 1. The overall percentage of change in the condition of BNE 1 is attributed to the action of water (manifest as grey wash marks), bird droppings (thin long white patches), dassie urine (dark brown-greenish marks), soluble salts (white crystal granular deposits) and dust. One may assume that these natural processes will continue causing the condition of BNE 1 to change and only an annual monitoring will record the changes and provide more precise information about the rate of decay of the rock imagery.

TOWARDS MONITORING OF ROCK ART SITES IN FREE STATE PROVINCE

It is important to acknowledge that monitoring of public rock art sites in South Africa has to deal with obstacles such as:

- the non-existence of prerequisites such as site management plans (according to SAHRA standards) at public rock art sites;
- the absence of responsibility and capacity at local level to manage sites; and

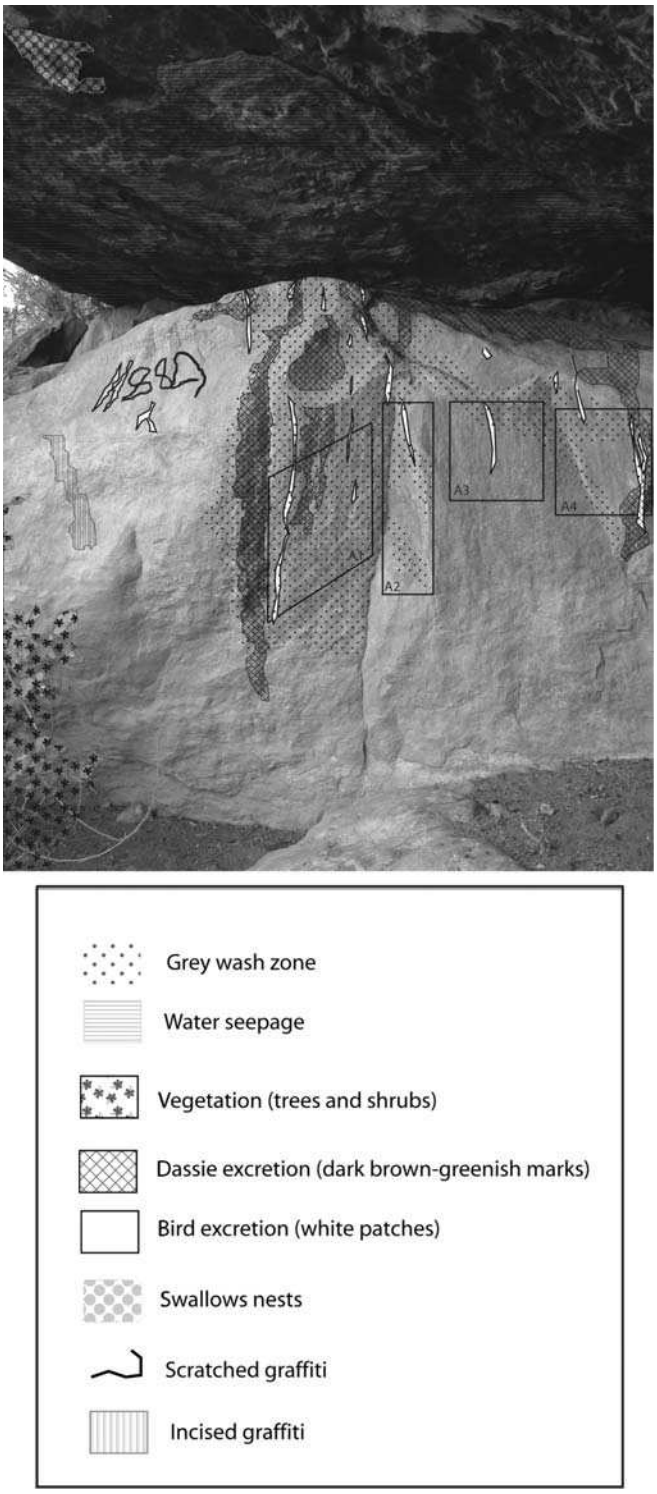

FIG. 6. *Condition documentation of section A of BNE 1.*

- the lack of funding to support monitoring programmes (Deacon 1994; Blundell 1996).

According to the South African Heritage Resources Agency (SAHRA) standards, any rock art site to be opened for public visitation should be comprehensively recorded with a site management plan to sustain the site as a long-term cultural attraction (National Heritage Resources Act No. 25 of 1999, sections 32 & 35). The management plan should ensure, among other things, that regular and continuous condition monitoring is conducted. It is only after these conditions have been fulfilled that a site can be formally registered with the appropriate heritage agency. Unfortunately, the reality is that almost all the

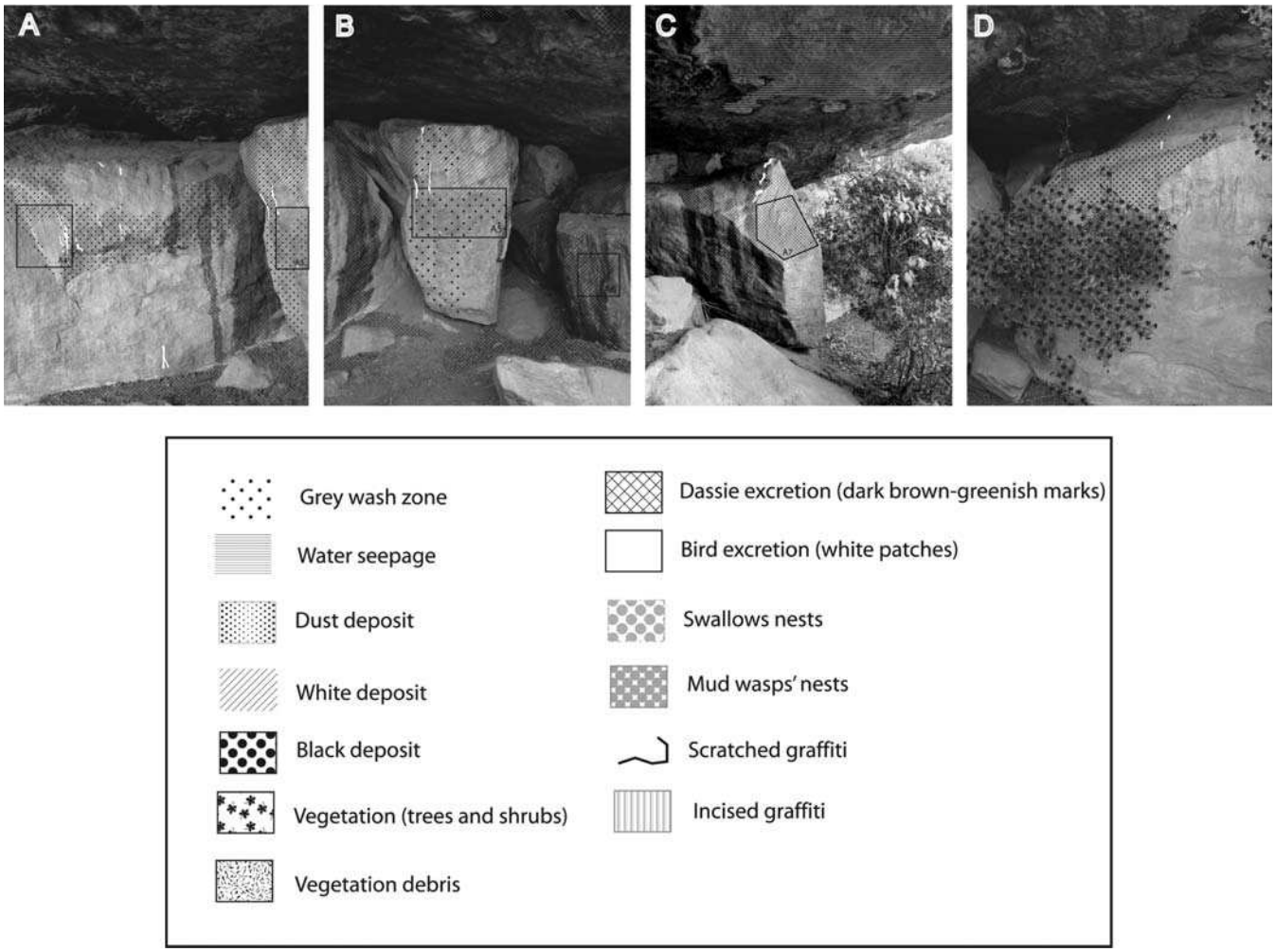

FIG. 7. *Condition documentation of BNE 1.*

rock art sites considered public in the Free State – Tandjesberg, Modderpoort, Schaapplaats and Stowlands (Lewis-Williams & Blundell 1998; Ouzman 1997, 1999, 2000), do not have a management plan or monitoring programme in place.

Considering that not all known sites or even the public sites in Free State could be included in monitoring programmes, the selection of rock art sites to be monitored as well as the frequency of monitoring could be determined by a number of criteria:

- cultural and scientific significance of the sites;
- sites open to the public, either as a formal site museum, official public site, or simply as a place of interest;
- accessibility of a site where there is a path into a general area of the site (path network);
- the distance of the site from the closest urban area or the nature of the terrain;
- general visibility of the site in the landscape or from the closest path in the area;
- level of human inference at the site such as acts of vandalism (graffiti);
- evidence of modern human occupation or knowledge of site; and
- intensity of public visitation and the nature of visitor behaviour (e.g. Mazel 1982: 10; Deacon 1994: 32).

It is thus proposed that monitoring of public rock art sites in the Free State (and South Africa) should be based on a negotiated partnership between interested parties, specifically, landowners, heritage authorities, archaeologists, heritage managers working in museums and universities as well as potential funding institutions (e.g. Ouzman 2001; Smith 2006). I suggest that successful monitoring of public rock art sites in Free State could be achieved if the Free State Heritage Resource Authority (FSHRA) negotiates and agrees with the Rock Art Department of the National Museum in Bloemfontein (RAD-NASMUS), and the landowners or site custodians of the respective public rock art sites to implement a heritage agreement. The heritage agreement should be a binding contract with terms and conditions that suit all the interested parties as stipulated in section 42 of the NHRA (1999). In addition, arrangements (memoranda of understanding) can be made between these parties and academic institutions interested in rock art management, such as the Rock Art Research Institute (RARI), University of the Witwatersrand.

The establishment of partnerships in Free State Province between FSHRA, RAD-NASMUS, site custodians and academic institutions can help overcome some of the constraints that prevent effective management of public rock art sites in the Free State. For example, the Tandjesberg rock art site is currently open to public visitation but has no management plan. RARI developed a management plan for Tandjesberg based on assessments by Archaeology Honours students during a fieldwork module – "Management Plan for Rock Art Sites" held in May 2007. The management plan for Tandjesberg is based on consultations with major interested parties (local community, landowner, FSHRA and RAD-NASMUS). Perhaps, in future, more such applied projects that involve the assessment and monitoring of rock art sites as well as the development of management plans should be included in training of

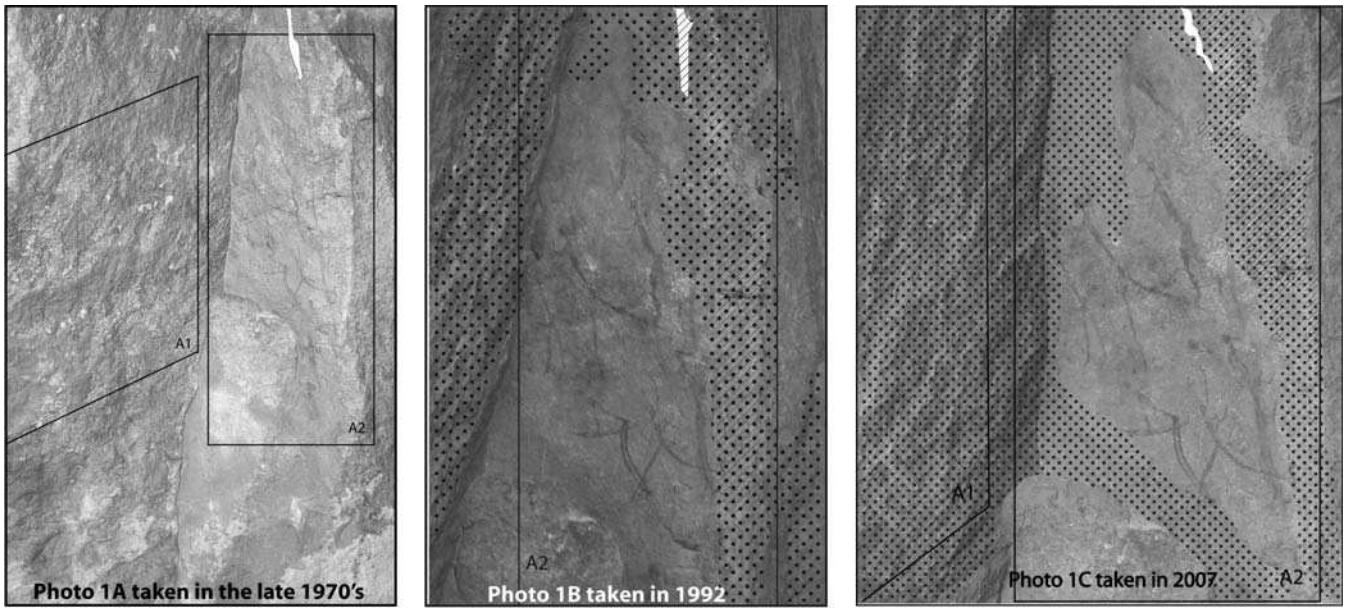

FIG. 8. *Condition analysis: comparative photographs of panels A1 and A2 of BNE 1 from late 1970s (1A), 1992 (1B) and 2007 (1C).*

Archaeology students in universities where capacity exists.

The RAD-NASMUS, in partnership with site custodians, has been involved in the management of 27 public rock art sites throughout South Africa (Tlhapi 2001). From September 1999 to March 2001, RAD-NASMUS successfully pioneered a technique for rehabilitating Tandjesberg rock art site after the wooden in-site boardwalk caught fire and damaged the painted shelter on 5 September 1998 and the site has subsequently been reopened to the public (Ouzman 1997). With this experience it is clear that RAD-NASMUS would be the most suitable institution to manage monitoring of public rock art sites in the Free State. In addition, even considering that the FSHRA is legally the main responsible institution for long-term management of rock art sites in a province, the RAD-NASMUS could also assist in creating a baseline and achieving the monitoring files (a portfolio with photographic images, the condition documentation and condition monitoring forms) for each public rock art site.

Alternatively, landowners of public rock art sites can play an important role in the monitoring process. Apart from the monitoring made by a qualified rock art specialist, another level of monitoring could consist of regular visits to the site by the property owner or site custodian to identify any major change at the site. A portfolio including a basic condition monitoring form and colour photographic prints of rock art panels (with symbols of deterioration signs on transparent overlays covering the photographs), could be provided to site custodians as a monitoring tool. The portfolio would help site custodians accurately identify any significant change such as new graffiti marks. This 'ground' level of monitoring would include routine maintenance such as ensuring that vegetation does not rub against the painted rock surface or the removal of dead wood and leaves so that damage by veld fires can be avoided or limited. Site custodians should be trained to take photographs of any changes in the site. Only after a noticeable major change at the site, should the landowner/site custodian contact RAD-NASMUS. Routine monitoring and maintenance will ensure that natural and human factors that may affect the condition of the site are controlled and RAD-NASMUS is informed expediently.

However, how such a partnership might work in practice in a feasible and sustainable way remains uncertain. In fact, effective monitoring of public rock art sites in Free State would be an additional cost to RAD-NASMUS for transport, accommodation and all other required material, to the landowners (e.g. training of custodians for rock art sites) and other partners involved in monitoring (e.g. rock art departments from universities). It is thus suggested that the heritage agreement between interested parties in monitoring of public rock art sites should include a provision for financial assistance from the heritage authority concerned (e.g. Section 40 of the NHRA 1999). In addition, all the partners involved in monitoring of rock art sites would need to liaise with potential funding institutions. Financial donations can be secured from government and private institutions such as the Free State Tourism Authority, the Department of Sports, Arts, Culture, Science and Technology, the District Municipality, as well as the National Lottery Distribution Fund, since they are usually good supporters of cultural heritage projects.

The establishment of partnerships for monitoring public rock art sites that I propose could also be applied in other provinces of South Africa, such as KwaZulu Natal Province, where adequate institutions exist (e.g. Amafa AkwaZulu Natali and Natal Museum in Pietermaritzburg). However, I acknowledge that due to the absence of adequate institutions (museums or universities with rock art specialists), this model may not be effective in some provinces of South Africa, such as Mpumalanga, the North West and the Eastern Cape.

CONCLUSION

This paper emphasizes two key issues: first, condition monitoring at a particular rock art site (BNE 1); and second, general monitoring of rock art sites in Free State Province. A combined use of different methods and techniques (digital photographic images and computer software) helped record and document the condition of BNE 1. I have also suggested how rock art sites in the Free State Province in particular and, South Africa in general can be effectively monitored. I recommend that monitoring of public rock art sites should be based on negotiated partnerships between interested parties that include landowners (site custodians), heritage authorities, archaeologists and heritage managers (working in museums and universities) on the one hand and potential funding institutions on the other.

NOTE

[1]Researchers have however suggested that paintings do not actually 'fade'. A faded appearance may rather be due to pigment loss or discoloration caused by salt growth, or by the presence of a mineral layer covering or other processes that obscures the paintings (Loubser 1991; Meiklejohn 1995).

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