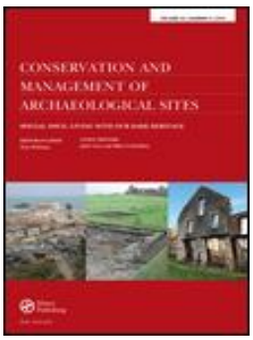

Routledge
Taylor & Francis Group

Conservation and Management of Archaeological Sites

ISSN: 1350-5033 (Print) 1753-5522 (Online) Journal homepage: https://www.tandfonline.com/loi/ycma20

Methodology, consetvation criteria and performance evaluation for archaeological site shelters

Neville Agnew

To cite this article: Neville Agnew (2002) Methodology, consetvation criteria and performance evaluation for archaeological site shelters, Conservation and Management of Archaeological Sites, 5:1-2, 7-18, DOI: 10.1179/cma.2002.5.1-2.7

To link to this article: https://doi.org/10.1179/cma.2002.5.1-2.7

CONSERVATION AND MANAGEMENT OF ARCHAEOLOGICAL SITES (2001) volume 5 pages 7–18

ARTICLE

Methodology, conservation criteria and performance evaluation for archaeological site shelters

NEVILLE AGNEW

ABSTRACT

The many intersecting issues that arise when deciding whether to shelter an archaeological site should be approached using a values-based methodology, one that has demonstrated its validity and practical worth in conservation over recent decades. Nonetheless, pitfalls abound in the decision-making process and in establishing effective conservation criteria which should be based principally on a thorough understanding of the threats to the resource and the specific deterioration mechanisms operating, with the objective of creating a shelter that will preserve the site's identified values. An aspect that has received almost no attention in the past is evaluation of a shelter's performance, both qualitative and quantitative, in preserving the site. It is urged that this receive priority when establishing the conservation criteria during the initial phases of a sheltering project. Issues are illustrated from a range of diverse sites, including a number of published shelters. The paper first looks at the examples of the Laetoli (Tanzania) and Lark Quarry (Australia) trackway sites in the context of decision-making and conservation criteria, and then discusses two examples of evaluation: one quantitative, using an experimental shelter and the other discussing publications on a petroglyph site shelter.

INTRODUCTION

The complexities of the site sheltering process require a high level of conceptual and integrated decision-making and planning. The starting point, as in all conservation work, is a clear and comprehensive statement of the values of the site, a good description and documentation of the physical remains, a thorough understanding of threats and deterioration processes and an assessment of the management context of the site. Without these to the fore in all decision-making, it is easy to make wrong decisions, or to overlook decisions that ought to have been made, with consequences that could seriously impair the site, leading to loss of integrity of fabric and significance.

METHODOLOGY

No formal methodology has been developed for sheltering. Typically, in many places shelters have been built as a one-off, ad hoc venture. Consequently several aspects of the process are at risk. Clearly, when sheltering is being undertaken without the basis of prior experience and without a methodology, the risk is amplified. How can we break out of this essentially unproductive, non-systematic way of working? There is a need to apply a methodology that follows what has become accepted as a standard approach to site conservation planning, intervention and management. This method employs a decision-making process that:

- identifies all the values of the site, and orders them by significance
- documents comprehensively the condition of the resource
- identifies the threats and deterioration mechanisms, ranks them in order of severity and, where possible, quantifies the deterioration (so much

ISSN 1350-5033

damage or loss of this or that kind over that much time)
- assesses the management environment of the site, which includes staffing, infrastructure, funding, as well as input from stakeholders to inform and guide decision-making
- considers also options other than sheltering and what their implications for the site might be.

On the basis of these steps the decision whether or not to shelter the site is made. The assessments and decisions above are the key initial steps in the process. Other steps, some of which can occur in parallel, are:

- consideration of how the decision to shelter will fit with the larger objectives of the site's conservation and management
- interim protective measures, such as temporary reburial or sheltering, while the often long and protracted planning, design, approvals and funding stages for a permanent shelter are occurring
- identification of a team with requisite experience and skills
- a process for shelter design review and revision.

Frequently overlooked in the planning process are three vitally important elements:

- assured resources for long-term maintenance of the structure and the site
- supervision of construction: usually construction of a shelter occurs over unprotected (or minimally protected) remains when the site is particularly vulnerable to damage. For example, covering the site with a combustible material, as a temporary protection during construction, has resulted in fires in two instances reported in the literature
- a monitoring plan to determine whether the resource is being effectively protected. Monitoring should focus on the threats and deterioration processes previously identified.

CRITERIA FOR PROTECTIVE, AESTHETIC AND INTERPRETIVE FUNCTIONS

Once the decision to shelter has been made, specific conservation criteria are next established in an iterative process by reviewing again the assessments. By conservation criteria are meant those threats, factors or parameters that need to be addressed in a sustainable way in order that the shelter will preserve the values of the site. In this respect the conservation criteria need to go hand-in-hand with the assessments that resulted in the decision to shelter. Conservation criteria must obviously be communicated clearly to the shelter designer or design team and underpin all aspects of the final design.

A good shelter should:

- function effectively to protect the resource, thereby preserving the most important values of the site. Narrowly defined, this protective function should address the specific conservation criteria that follow from the analysis of deteriorative processes affecting the site
- be in harmony with the context of the site and the landscape
- fulfill its interpretive/display function well, but not at the expense of protection
- be capable of being maintained within the resources available, since a shelter cannot, in the end, fulfill its primary function of protection if it is not maintained
- be capable of showing proven protective ability, demonstrated over time by qualitative and quantitative indicators established as components of the conservation criteria.

Protective function

In terms of its protective function the shelter must protect against environmental and biological effects (rain, wind, frost, acid precipitation and invasive flora and fauna). A considerable literature exists on environmental and biological impacts, including human (vandalism), on sheltered sites, so these aspects will not be further developed in detail here [1]. Identified threats should be ranked in order of severity, and potential side effects need to be thoroughly assessed as outlined below. Whether a shelter is an open structure or entirely enclosed, and whether ventilation and environmental controls are active or passive, is dictated principally by the nature of the site and especially the identified threats, as well as resources available for its maintenance.

Aesthetic criteria

Regarding the aesthetics of a shelter there are several points to consider. While the scale of the shelter is dictated by that of the site, both lateral and vertical, the aesthetic impact of the shelter in the context of the site itself and the landscape is important. This is not the same as the architecture of the shelter, considered purely from an architectural perspective, though often the two are not sufficiently distinguished. Admiration for the shelter design may overwhelm the more important consideration, that of the appropriateness of the shelter and its relationship to what it protects and the setting. The harmony of the shelter with the site in the landscape is clearly highly subjective, as witness critiques of Minissi's shelter at Piazza Armerina [2], and a criticism of the Peterborough shelter discussed below. Nonetheless, it is unfortunate when the tail wags the dog and the shelter's architecture takes over. No matter how beautiful the architecture of the shelter is in its own right, inevitably it is an impact on the site, and an alien. Therefore, basic design concepts should be applied to an archaeological site in its landscape. These relate to the aesthetics of proportions, colour, texture of materials and to viewscapes. As part of the process the designer should be briefed to consider these relationships, and also alternative designs.

Interpretive function

Similarly, the interpretive functionality of a shelter, while of great importance in many instances (as has been pointed out, typically shelters are built because the site will be visited), should be subordinate to the protective function. Among criteria to be considered are how the visitor will enter and exit the shelter, the routing of walkways and their capacity, the location of the best viewing points, interpretive panels and materials and how these might affect the flow of visitors, and so forth.

Although unlikely to be universally agreed upon, an hierarchy of priorities when considering sheltering is suggested: Protective effectiveness > display/interpretation functionality > aesthetic of the shelter in context > architectural statement.

THE NEED FOR THOROUGH PROCESS

As stated above, the decision to shelter and conservation criteria are reiterative processes. Not only should these products be the outcome of a thorough methodology, but it is appropriate also to always consider other options besides sheltering. The pressure to shelter can be quite compelling because archaeologists and managing authorities continue to be reluctant to rebury sites. This is a natural consequence of the profession: archaeologists spend time, often years, and money excavating the site and want it revealed, not concealed; authorities have political agendas and pressure from tourism interests to consider. A shelter seems like the answer: it protects and may allow public viewing at the same time. What could be better?

A number of examples, illustrating the need for thorough process and some pitfalls, follow.

Reburial versus sheltering

LAETOLI TRACKWAY

Sheltering is sometimes not the best way to preserve a site, however important and worthy of preservation. For example, at the fragile site of the Laetoli hominid trackway (Fig. 1) in a remote part of Tanzania, various groups had proposed a shelter and public access (as well as other options such as lifting the tracks). The condition and management assessments and conservation criteria for sheltering showed very clearly that a shelter could not fulfill its purpose. The strong recommendation not to shelter was based on considerations such as the rapid weathering of the volcanic tuff, its mechanical weakness, remoteness of the site, lack of infrastructure (water, power, access road), lack of trained personnel, security of the site and inadequate maintenance capability, among other considerations. Consequently, the site was reburied (Fig. 2) and as part of the project an interpretive display was created with a replica of the trackway at the existing Olduvai Museum some distance away [3, 4].

LARK QUARRY

A contrasting case to that of Laetoli is the Lark Quarry dinosaur stampede trackway site [5]. At this remote site in Queensland, Australia, the decision to shelter was the wrong one. The site, in fact, should

Figure 1. Re-excavated southern section of the Laetoli hominid trackway, after conservation and documentation in 1995 and prior to reburial (photo: N. Agnew, copyright J. Paul Getty Trust).

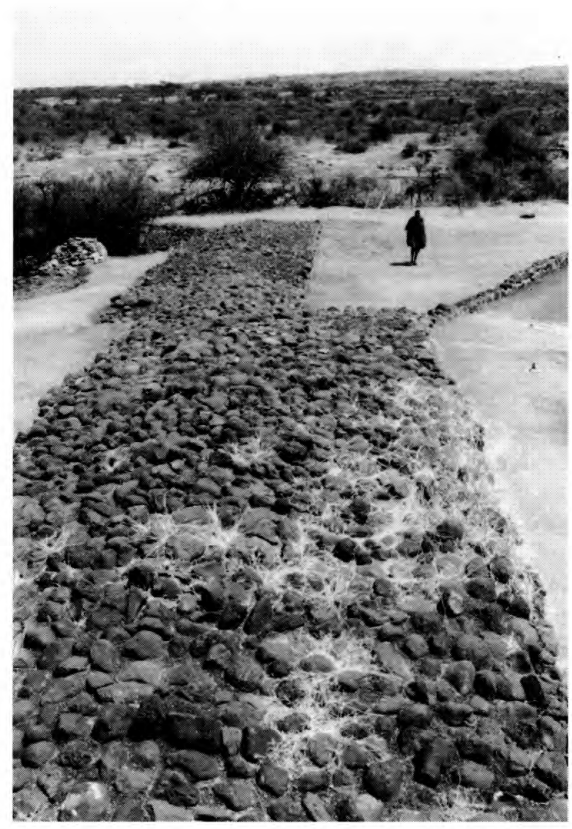

Figure 2. Entire conserved and documented Laetoli trackway after reburial in 1996 (photo: A. Bass, copyright J. Paul Getty Trust).

have been reburied. The scientific values of the site are considerable: the statement of significance reads, in part, 'it represents the largest concentration of running dinosaur footprints thus far known on earth' and 'it holds a large amount of data regarding the gaits, speeds, sizes and behavior of dinosaurs'. The threats to the site were (and are still today) vandalism from the collection of illicit souvenirs, wetting and drying from sheet flooding and direct rain leading to cracking of the soft mudstone, and erosion. The site is not staffed. The decision to open it to visitors was based upon a number of mistaken premises. These were that visitors would come to the site in considerable numbers and that the site could remain unstaffed, being interpreted only through signs and a brochure. In fact, few visitors make their way to the site which is off the beaten track and once there, many are disappointed by their inability to be able to 'read' the trackway's 4,000 footprints, often superimposed upon each other, and, given the dryness of the semi-desert environment, are often obscured by accumulation of dust in the prints.

That being said, the shelter built in 1979 comprised a pentagonal flat roof set on steel posts in concrete footings (Fig. 3). There are a number of cautionary lessons to be learned from both the design and the construction of this shelter. The construction work for the shelter was not supervised and damage occurred where one of the concrete footings destroyed a holotype footprint. The straw and plastic protective covering on the surface was not removed during construction and caught fire during welding. This resulted in darkening and exfoliation of the surface. The shelter roof is open at the sides and does not exclude windblown rain and dust. Today we are all aware that the environments created by shelters also attract un-

Figure 3. Roof at Lark Quarry in 1981, prior to the erection of a perimeter fence to prevent kangaroos sheltering under the roof. Natural lighting is provided by translucent panels and visitors view the tracks from a raised walkway (photo: N. Agnew).

wanted guests; at Lark Quarry these were kangaroos, some of which died on the site during prolonged drought. Additionally, flooding of the site occurred from the hillside above the trackway. Vandalism has repeatedly occurred in the form of taking footprints as souvenirs (Fig. 4).

As a result of these and other problems the scientific, and indeed also the interpretive, values of the site were seriously compromised and much conservation work and retrofitting of the shelter had to be undertaken as early as mid-1983. In fact, it is easy to be critical of a shelter such as Lark Quarry which was undertaken by a competent architect, though someone inexperienced with the conservation needs of a fragile palaeontological site in a remote area. There is apparently now a proposal to completely enclose the site in an environmentally controlled building.

In summary, the assessments of Lark Quarry were not thorough and the shelter failed in its primary function. The shelter was designed and built without conservation input or sheltering ex-

Figure 4. Loss of part of the dinosaur trackway at Lark Quarry. Steel support columns for the roof and walkway, set into and on the trackway, are shown at the top of the image (photo: N. Agnew).

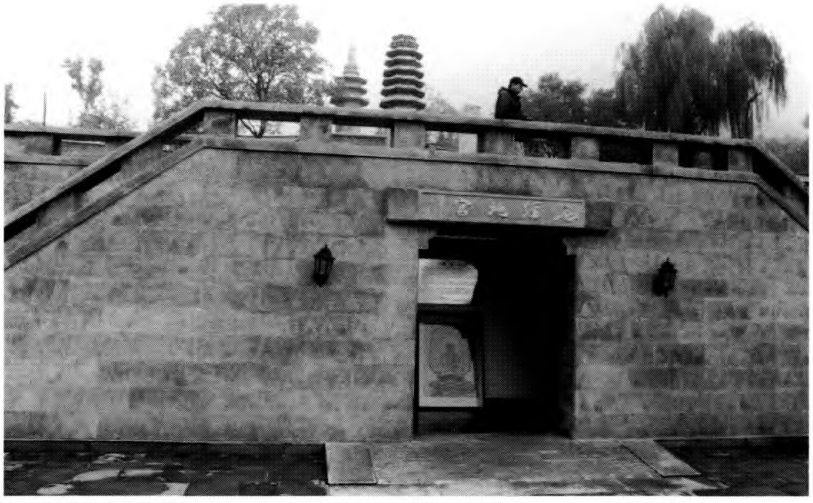

Figure 5. Underground shelter for inscribed stone stele at Yunju Temple near Beijing (photo: N. Agnew, copyright J. Paul Getty Trust).

Figure 6. The underground viewing gallery at Yunju Temple (photo: N. Agnew, copyright J. Paul Getty Trust).

Figure 7. Stacked stele at Yunju Temple. View through the window ports (photo: N. Agnew, copyright J. Paul Getty Trust).

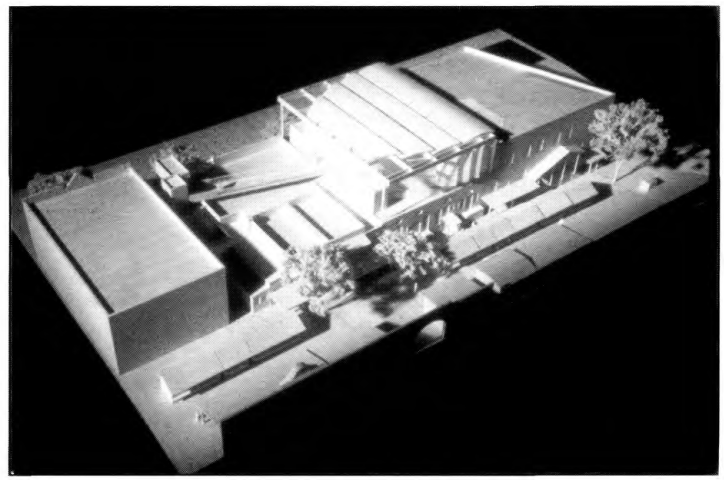

Figure 8. Model of the proposed protective and viewing shelter over the Siqueiros mural, *América Tropical*, Los Angeles (photo: M. Lohmann, copyright J. Paul Getty Trust).

pertise. Thus, many of the issues were overlooked. As each deterioration problem came up, the shelter required retrofitting as remedy. The methodological process was not in place at that time. The lessons to be learned here are that if the wrong decisions are made early on, there is a multiplier effect with adverse consequences over time.

Stakeholder issues

Of signal importance in the sheltering process is the management assessment that would have taken place during the decision-making stage. There are many facets to this, but one of particular relevance is the need for stakeholder involvement. Fortunately, today there seems to be better awareness of the important role of stakeholders in conservation. Two examples follow where this was overlooked.

YUNJU TEMPLE

At Yunju Temple, an ancient Buddhist site near Beijing (not far from the Peking Man fossil site), some 10,000 stone stele inscribed with texts predicting the end of the world, dating from about the 6th century, were excavated and in recent years housed on site in a new underground shelter (Fig. 5). This was done, presumably, to mimic the original deliberate burial of stele. This is an interesting hybrid of sheltering and 'reburial' of which a number of other examples exist, e.g. Tubac in Arizona and Atri [6] in Italy. Visitors view the stele, through glass, in their nitrogen-filled underground gallery. The stele are stacked in rows one behind the other and are inaccessible (Figs 6 and 7). Scholars of the texts have been outraged by being thwarted in their legitimate desire to be able to examine the inscriptions firsthand.

SIQUEIROS MURAL

Similarly, a proposed shelter for the Siqueiros Mural in Los Angeles ran into trouble some years ago. The Getty Conservation Institute had thought that all the stakeholders had been involved. Protracted review of the design (Fig. 8) by different commissions of the city took place over many months, yet towards the end of the process other claimants, notably the Los Angeles Conservancy and the California State Historic Preservation Office, emerged as critics of some aspects of the design, including its aesthetic appropriateness to the historic architecture of the streetscape. While this shelter was not built for reasons of cost and other considerations, the entry of these two organizations late in the process necessitated additional design modifications after a further series of meetings.

Soluble salts

Buildup of soluble salts under shelters is often not realized as a consequence of sheltering. Any good shelter will have a rainwater disposal system from the roof and this is obviously an essential requirement, yet capillary rise from soil moisture or ground water, together with lateral migration from the unsheltered surroundings which are wetted by rain, brings soil salts to the surface. Ventilation systems in shelters have the potential to exacerbate this phenomenon by accelerating evaporation from the

Figure 9. Accumulation of soluble salts by capillarity from the ground. Sheltered mosaic at Paphos, Cyprus (photo: N. Agnew, copyright J. Paul Getty Trust).

sheltered surface. If a capillary supply of moisture is feeding this evaporation, the problem is made all the worse. Of course, under the shelter, the accumulation of salts is not reduced by rainfall as the surface is not wetted. The consequences of accumulation of salts on a fragile surface naturally are often quite destructive (Fig. 9). This may be an intractable problem, but one which is best addressed by ensuring that site drainage is effective, and capillary rise of moisture is minimized.

Site security

Olduvai Gorge

In poor countries building materials are a valuable commodity. Where sheltered sites are not staffed the shelter itself may become the target, not of vandals but of local people wanting materials. A shelter may literally disappear overnight. This might seem an obvious risk given foresight, yet it happens. The so-called DK site, a two-million-year old hominid site in the Olduvai Gorge, was sheltered by Mary Leakey in the 1960s or 1970s. Within a short while, the valuable galvanized steel roof was stripped. The shelter has never been repaired and today the site is derelict (Fig. 10). Other sites in the region have experienced a similar fate [7].

Dust accumulation

Dust accumulation under a shelter is not usually perceived as anything more than a nuisance, one requiring regular removal. Yet dust has quite serious consequences for fragile surfaces, e.g. petroglyphs etched in soft rock, fossil footprints, a mosaic pavement. All of these will be damaged by regular cleaning, to a greater or lesser degree, no matter how carefully done. Additionally, dust obscures the 'readability' of the site, in the case of glyphs or footprints to the extent that the visitor is frustrated. And, furthermore, a dusty surface conveys a lack of care, even if this is a quite erroneous impression.

Unexpected consequences

The unexpected occurs far too frequently in conservation, and site sheltering is no exception to this. With good conservation criteria established and rigorous review of proposals, the consequences of unpleasant surprises can be avoided. The examples above suffice here to illustrate some adverse side effects resulting from failure to follow through the process. Often there is a naïveté when it comes to designing and constructing shelters which translates into a self-deception that the shelter will function well. Perhaps this arises from a natural enthusiasm for the project, the opportunity to create the shelter, and the lack of perceived need for review and critique. Important too, is the mistaken belief that sheltering is not intervening on fabric. The truth is that there is simply not enough prior critical evaluation from every point of view of shelter proposals, whether for unexpected side effects, the shelter's proposed response to deterioration threats and mechanisms, the aesthetics of the shelter in the context of the site and landscape, long-term monitoring and maintenance, staffing, and so on.

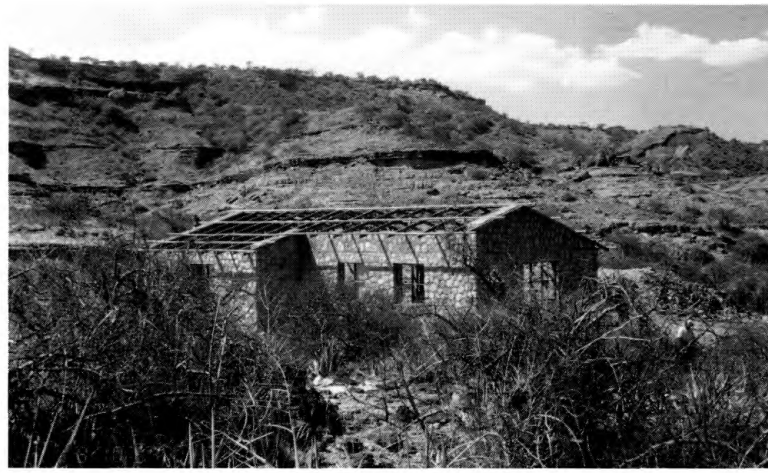

Figure 10. Shelter building over the DK hominid site in Olduvai Gorge, Tanzania (photo: N. Agnew, copyright J. Paul Getty Trust).

PERFORMANCE EVALUATION

Almost no research or experimental work has been done on sheltering of archaeological sites and cultural resources [1]. This is interesting because it stands in sharp contrast to other types of conservation interventions. Today one would not think of intervening on a monument with, say, a stone consolidant without it having been tested and evaluated beforehand. Why this situation should be so in the case of shelters is difficult to pinpoint exactly, but probably it is due to the fact that shelters are invariably constructed in response to an immediate need as a once-only enterprise. Subsequently no systematic evaluation is undertaken. A further important point is that shelters are not seen as an intervention in the fabric of the site. This view is, of course, erroneous; shelters may have repercussions both good and bad. As a consequence there is a dearth of quantitative information on the actual performance of shelters, despite the huge number of shelters of all kinds (from sheds to vast site museum shelters) around the world. These could afford a valuable archive for the critical evaluation of sheltering and a research topic in its own right for anyone with the time and resources to undertake such a study, though, as discussed below, without valid performance indicators established at the outset, evaluation can at best be only subjective in most cases. The notion that shelters per se are a good thing and provide housing for homeless sites, and that any shelter is better than no shelter, plays a part in this attitude. Yet the complex issues that emerge on closer examination of the question contradict this notion.

Evaluation means different things to different people, and may result in different criteria, usually subjective, being applied. To some the architecture of the shelter is important, to others the crucial aspects are the aesthetic of the shelter and its relationship to the setting and the landscape, yet to others its function as an interpretive center is the significant consideration, and so on. In the absence of documented or quantitative data on the primary function of the shelter, i.e. its effectiveness in preserving the resource and thereby its values, it is not surprising that discord may reign, as demonstrated by the contentious issues raised by one of the cases discussed below.

What is implied by performance evaluation? It means the ability to demonstrate how effective the shelter has been over time in preserving the main values of the site from the main threats. Both quantitative and qualitative criteria are important in evaluation; therefore both objective and subjective factors come into play. Two shelters are described to briefly illustrate these criteria. Both have been published, and fuller detail may be found in the literature.

The Fort Selden experimental hexashelter is an example in which quantitative environmental data were collected with an appropriate monitoring control [8]. The Peterborough shelter is an example of a site where a great deal of good planning and research took place in deciding to shelter and then in its implementation [9], but a qualitative and subjective assessment by others resulted in an extraordinarily contentious situation [10].

Figure 11. Hexashelter at Fort Selden, New Mexico. The roof is an impervious membrane and the side-panels are a knitted, open-weave synthetic textile (photo: N. Agnew, copyright J. Paul Getty Trust).

Hexashelter at Fort Selden, New Mexico

In passing, it should be mentioned that 'hexashelter' is a catchword for the hexagonal 'footprint' of each module. This experimental shelter (Fig. 11) was erected specifically to evaluate its effectiveness (or otherwise) in reducing climatic impact. This was done in two ways: by quantitative monitoring of meteorological parameters under the shelter and outside, and by monitoring adobe walls likewise beneath and outside the shelter (Fig. 12): these were also instrumented. Nearly a year's data were collected before the shelter collapsed from snowload on the membrane roof after an unusually heavy storm. Parameters measured were temperature (air and walls), windspeed, rainfall, and solar radiation. The monitoring walls were photographed regularly. The results were very clear and showed significant reduction in solar radiation, rainfall and windspeed especially. Comparison of the photographic record of the two walls likewise reflected the protective efficacy of the shelter, though no quantitative data were acquired on loss of fabric from the exposed wall.

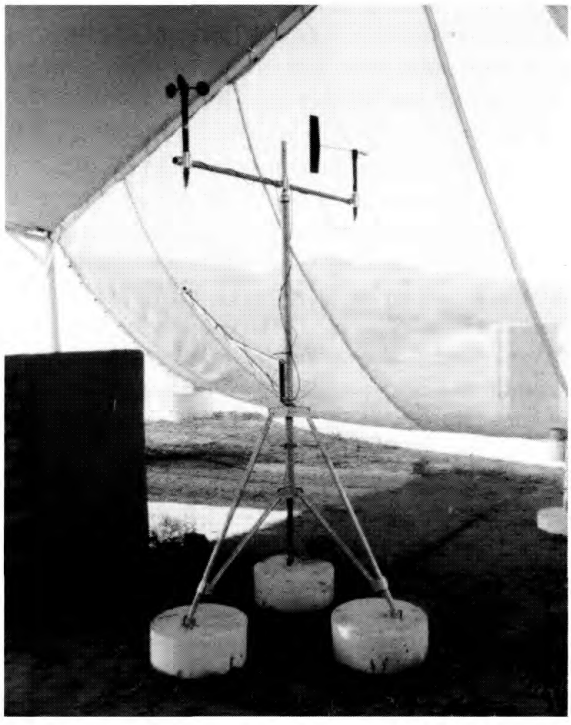

Figure 12. Environmental monitoring of the climate within and outside the hexashelter. The sheltered and unsheltered adobe walls were instrumented, and were photographically monitored to determine comparative weathering (photo: N. Agnew, copyright J. Paul Getty Trust).

The point is not that the hexashelter was especially effective, though it was designed as a 'minimalist' shelter. Many other designs would have served as well or better. Rather, it is to show that it is possible to quantitatively monitor a shelter's performance and the condition of the resource fairly simply, provided that an appropriate control is included, in this case the external wall. Although a sophisticated, solar-powered meteorological station was used which logged data every fifteen minutes, simpler recording devices could serve as well in real situations. More important is a means of monitoring the condition of the cultural resource with an appropriate control. In addition to regular standardized photography, preferably under controlled lighting, other techniques appropriate to a particular site may be employed: an erosion meter, sampling for salt accumulation, monitoring biological infestation, and so on.

Peterborough petroglyph shelter

The case of Peterborough in Canada is illustrative of the passions that a shelter can evoke. Was the criticism by Bahn, Bednarik and Steinbring a fair evaluation of the protective structure or an unwarranted attack sustained in the journal *Rock Art Research* (edited by one of these authors) [10]. The case is included here because it is very specific in the criticisms of the shelter and, as such, qualifies as an evaluation of the functioning of a sheltering structure, though unilaterally undertaken. That the tone of the criticisms is uncompromisingly hostile is unfortunate to say the least. Here is a brief summary of the issues raised.

The shelter was built in 1984 to protect a 1,000–2,000 year old petroglyph site of about 80 m^2. In 1995 Bahn et al. published [10] a long and detailed article relentlessly critical of every aspect of the shelter, from the decision process to the design, implementation and its performance. The paper concluded with recommendations that construction of a shelter (over a rock art site) should be undertaken only if:

- the project manager could guarantee an independent, long-term sophisticated monitoring program over many decades.
- guaranteed high-caliber scientific support would be available, and that identifying the threats precisely was essential.
- all adverse information relating to intervention projects be made available.

In a detailed article published in 1997, one of the most comprehensive in the literature on shelters, Wainwright, Sears and Michalski [9] described the design of the structure at Peterborough and the reasons for the decision to shelter the site. The rationale for the design was discussed, as was the form of the building. The authors mentioned prior consultation with the native community; they described earlier studies and documentation, biological, geochemical and geophysical weathering, the petrology of the site, meteorological data, and concluded that damage by frost far outweighed that from other sources. Vandalism was identified as a major threat. They described, at some length, sheltering options and presented the rationale, the exclusion of water, for a totally enclosed shelter. A completely passive design was chosen for reasons of long-term reliability and elimination of costly energy consumption. Access for disabled visitors was included.

The authors emphasized that they were compelled to conclude that sheltering was the only way whereby the site could be preserved. They stated unequivocally that the site has been stabilized and natural weathering prevented.

Apart from the very bitter debate the Peterborough case generated, in which others joined, an important lesson is the complexity of the sheltering issue, one in which compromises must often be made. Among these are the need for thorough studies, and publication, of the threats and deterioration, for continued monitoring and maintenance and, above all, indisputable evidence for the preservation effectiveness of the shelter. The last seems not to have been quantified definitively at Peterborough, though detailed and various monitoring prior to and after construction has been in place. The team responsible for the decision to shelter, its design, implementation, maintenance and condition monitoring also left themselves open to criticism because comprehensive publication on the site's shelter and process, which might have addressed all or most of the criticisms, was delayed for more than a decade.

CONCLUSIONS

The approach to sheltering requires a holistic, interdisciplinary approach throughout. Shelters are indeed conservation interventions on the cultural resource, and may, in the absence of a thorough approach, do more harm than good. Of particular importance in the sheltering process is a means of demonstrating, sustained over time, that the shelter is doing its job of preventing deterioration. Good baseline documentation of conditions at the outset is obviously essential if this is to be convincing, but it is difficult or impossible to correlate subsequent conditions of the artefact under the shelter with its protective function without a valid control. The simplest way to monitor the efficacy of the shelter is to establish a control outside the shelter. Often this is possible when, for example, non-heritage fabric is adjacent to or near the shelter. Otherwise, indicator samples can be set up within and outside the shelter. These need not necessarily be large or costly. Monitoring of both the artefact and the

control provides direct evidence of the functioning of the shelter. Monitoring can be done photographically and photogrammetrically and/or by other kinds of often simple deterioration markers. Without hard evidence of this kind it is almost impossible to prove that the shelter is performing as it should. This 'hard' assessment is clearly the most important, and convincing, but 'soft' assessment, based on subjective judgments, are also valuable and should not be overlooked because shelters can, and should, also fulfill functions other than purely protective ones. It is suggested that there is a need for the development of a methodology that would permit a more systematic evaluation of qualitative and subjective aspects of shelter performance.

In summary, thorough assessments, diagnosis of threats and deterioration mechanisms and devising conservation criteria to address the threats are key points in the sheltering enterprise. The process is really no different than for any other conservation intervention, but has often been faulty in the past. Without setting the right course at the beginning things will surely go awry.

Neville Agnew received his PhD in chemistry from the University of Natal, South Africa. He headed the conservation section of the Queensland Museum in Brisbane, Australia, before joining the Getty Conservation Institute in 1988. He has undertaken conservation projects in various parts of the world and is now principal project specialist at the Getty Conservation Institute.

Contact address: The Getty Conservation Institute, 1200 Getty Center Drive, Suite 700, Los Angeles, CA 90049-1684 USA. Tel: + 1 310 440 6204. Fax: + 1 310 440 7712. Email: nagnew@getty.edu.

ACKNOWLEDGEMENTS

The author acknowledges with gratitude the contribution of colleagues at the Getty Conservation Institute, particularly Dr Martha Demas, in the preparation of this paper for the January 2001 Shelters Colloquium in Arizona, and in the subsequent revision for publication. Anonymous reviewers' comments were also helpful in the revision.

REFERENCES

1 Demas, M. Annotated bibliography on protective shelters for archaeological sites. *Conservation and Management of Archaeological Sites* **5** (1 & 2) (2001) 91–105.

2 Stanley-Price, N. and Jokilehto, J. The decision to shelter archaeological sites: Three case-studies from Sicily. *Conservation and Management of Archaeological Sites* **5** (1 & 2) (2001) 19–34.

3 Demas, M., Agnew, N., Waane, S., Podany, J., Bass, A. and Kamamba, D. Preservation of the Laetoli Hominid Trackway in Tanzania. In: *IIC Preprints of the Contributions of the Copenhagen Congress, Archaeological Conservation and its Consequences, Copenhagen* (1996) 38–42.

4 Agnew, N. and Demas, M. Preserving the Laetoli Footprints. *Scientific American* **279** (1998) 44–55.

5 Agnew, N., Griffin, H., Wade, M., Tebble, T. and Oxnam, W. Strategies and techniques for the preservation of fossil tracksites: an Australian example. In: Gillette D.D. and Lockley, M.G. (eds) *Dinosaur Tracks and Traces.* Cambridge University Press, Cambridge (1989).

6 Scichilone, G. The site of the cathedral at Atri: a case study of *in situ* conservation of archaeological remains. In: *Preventive Measures During Excavation and Site Protection (Ghent Conference, 6-8 November, 1985).* ICCROM, Rome (1986) 309–14.

7 Waane, S.A.C. Roofs and shelters: The Tanzanian experience. In: *Preventive Measures During Excavation and Site Protection (Ghent Conference, 6-8 November, 1985).* ICCROM, Rome (1986) 245–56.

8 Agnew, N., Maekawa, S., Coffman, R. and Meyer, J. Evaluation of the performance of a lightweight modular site shelter: Quantitative meteorological data and protective indices for the 'hexashelter', *Conservation and Management of Archaeological Sites,* **1** (3) (1996) 139–50.

9 Wainwright, I.N.M., Sears, H. and Michalski, S. Design of a rock art protective structure at Petroglyphs Provincial Park, Ontario, Canada, *Journal of the Canadian Association for Conservation,* **22** (1997) 53–76. See also: Young, G.S. and Wainwright, I.N.M. The control of algal biodeterioration of a marble petroglyph site, *Studies in Conservation,* **40** (2) (May 1995) 82–92; Laver, M.E. and Wainwright, I.N.M. An investigation of the dissolution of a marble petroglyph site by acidic precipitation, *Studies in Conservation,* **40** (4) (November 1995) 265–73; Wainwright, I.N.M. Rock painting and petroglyph recording projects in Canada. *Association for Preservation Technology Bulletin,* **22** (1/2) (1990) 55–84 [Reprinted in *Ontario Rock Art Conservation Association Newsletter,* (Summer-Autumn 1991) 30–59]

10 Bahn, P.G., Bednarik, R.G. and Steinbring, J. The Peterborough petroglyph site: reflections on massive intervention in rock art, *Rock Art Research* **12** (1) (1995) 29–41. See also: *Rock Art Research* **13** (1) (1996) 47–60; **14** (1) (1997) 53–8.