

ADVANCES AND ISSUES IN PREHISTORIC ARCHAEOLOGICAL SITE STABILISATION

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ABSTRACT

Since the mid-1980s, archaeological site stabilisation and preservation has advanced in terms of ethical standards, codes of practice, use of conservation concepts and processes borrowed from other disciplines and in the publication of results. Ecologically appropriate (and therefore cost-effective) methods of stabilisation for earthwork sites have been developed. Issues encompass timing and process of intervention, monitoring, the cost-effectiveness and long-term reliability of conservation technology (especially when compared with the cost of rescue archaeology funded by developers), divergent values of archaeological sites and hence differing management responses, and training.

Key words: ICOMOS, ICAHM, ICCROM, World Heritage Convention, ethics, preservation, monitoring, monuments protection, ecology, restoration, stabilisation, USA, UK, New Zealand, Australia.

The conservation of archaeological sites refers to the practical management of sites aimed at keeping them in the best possible conservation condition. This task is confounded by the complex built and ecological settings in which sites occur and the multiple, sometimes conflicting values, which society places on sites. A number of advances in principles and techniques have been gained internationally in the last decade. The present paper is a consideration of current issues of decision-making (principally when to intervene) for site conservation, monitoring, the cost and long-term reliability of current techniques and finally the need for training and professional development.

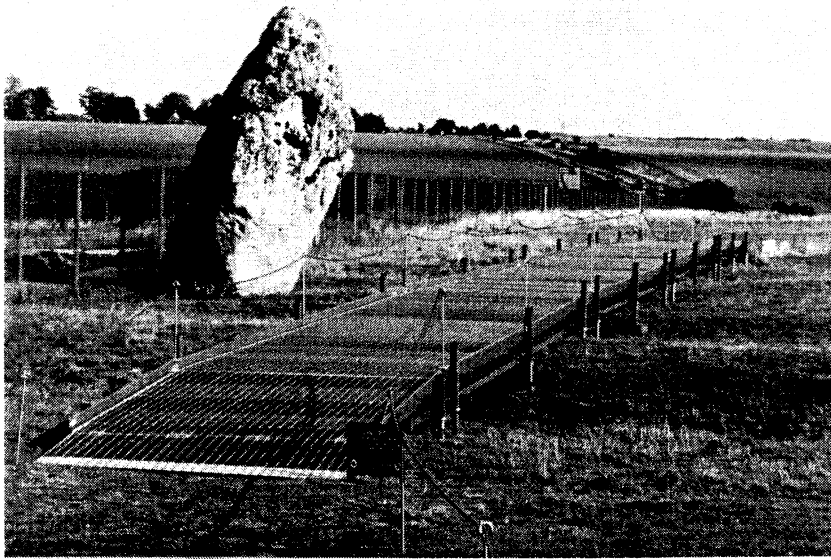
ADVANCES

Development of Principles

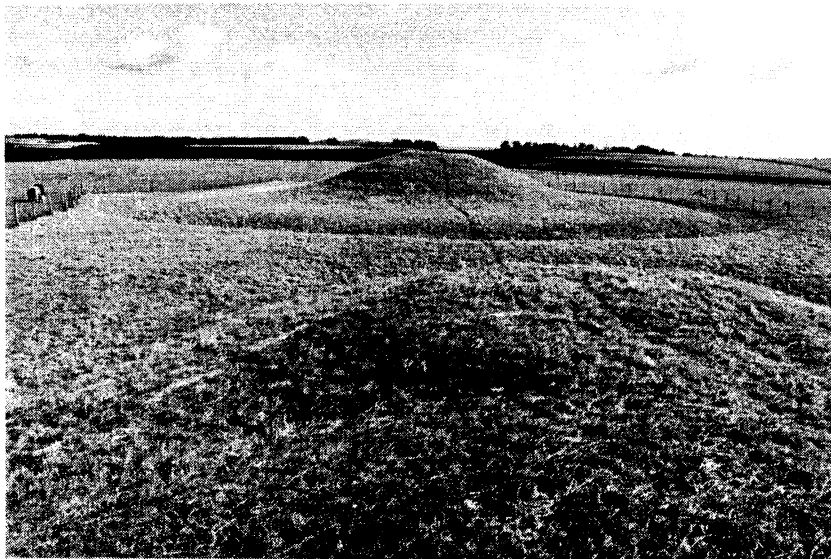
The development of principles has been fostered in three areas. The more notable area includes UNESCO's World Heritage Convention and the charters of ICOMOS (International Council for Monuments and Sites), such as the International Charter for Archaeological Heritage Management (ICAHM 1990) and the draft Charter on Cultural Tourism. The designation of a place as a World Heritage Site is conditional on adequate legal protection and conservation management planning. The relevant clause of the operational guidelines (UNESCO 1999: clause 24 (b) (ii)) has stimulated a number of innovative conservation planning and monitoring measures (e.g., see Wainwright 1993) (Figure 1). The operational guidelines (clauses 35-42) also define the key concepts of cultural landscape, where particular sites may have greater possibilities of survival when they are part of such a protected landscape.

The ICAHM has systematised thinking in a number of areas such as legislative protection and integration of a range of protection policies and objectives. Although it includes a preference for *in situ* protection (Corzo and Hodges 1987), this is balanced with recommendations on rescue excavation.

The ICOMOS (1999) Charter on Cultural Tourism will have more specific value with respect to standing monuments likely to be the focus of tourist attractions. Many archaeological site protection authorities will welcome its clear guidelines on local community interaction and economics, and the protection of historic fabric. The charter will be especially relevant for authorities when they meet with the indiscriminating proponents of the economic benefits of mass tourism, irrespective of its likely effect on heritage fabric.



(a) By the Heel Stone, the cursus ditch is bridged at the point where visitors cross as they walk around the perimeter of the main site.



(b) Some bell-shaped barrows are fenced to protect them from heavy grazing and to establish a historically appropriate, near-natural downland grass and herbaceous cover.

Figure 1. Intensive conservation management at a World Heritage site: Stonehenge and environs.

Recently, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and ICOMOS have sponsored manuals on specific aspects of management of cultural World Heritage sites – these studies have wider applicability to any managed site (Feilden and Jokilehto 1998; Stovel 1998). I have been

involved in the preparation of similar guidelines for monitoring and for archaeological site management.

Techniques, Implementation and Effectiveness

In parallel with the charters, there has been a significant phase of professional thinking about objectives, principles and techniques of site stabilisation. Notable in the United States are the Andropogon Associates report (1989) on Civil War earthworks, work by Thorne (1988, 1990) for the US Army Corps of Engineers and the National Park Service and by Nickens (1993, 2000; Jones 1993). In New Zealand, we have published extensively on the conservation of archaeological sites on farmland and in native and production forests (e.g., Jones and Simpson 1995).

The Andropogon Associates, led by Leslie Sauer, have propounded a number of principles and practical guidelines for ecologically appropriate stabilisation of surface-visible earthworks for three broad reasons: first, local ecological processes are potentially the most cost-effective means to stabilise sites; second, such local processes are likely to be historically correct, provided they are managed to that end; and third, as historic preservationists, we owe at least a moral respect to nature conservation, which may ultimately make it easier for nature and historic conservationists to maintain a dialogue and work together against the forces which threaten to degrade both natural and historic values (Figure 2). This work has been followed up by further management planning and useful experimental studies on the effects of particular management regimes on earthworks in the Petersburg National Battlefield (Aust *et al.* 2003). This work has wide applicability in the management of standing earthwork archaeological sites.

Also in the United States, work led by Thorne has attempted to synthesise frameworks for intervention (Thorne 1988). The process of site stabilisation should follow an evaluation of whether intervention is needed. If intervention is not practicable because of the rapidity of loss, then excavation is indicated. Following evaluation, site stabilisation technologies such as geotextile covers, deliberate re-burial or ecologically appropriate vege-

tation management, may be considered. Any particular technology may be rejected for want of positive proven effects or because it is bad; a chosen technique should be tested and, following successful tests, may be installed and its effectiveness monitored. This broad programme of work in the United States has enlisted a host of relatively low-cost engineering techniques, particularly river bank or strand line protection (e.g., Thorne 1990) - ecologically sound 'soft approaches' using revegetation and deliberate site burial (Stubbs 1984; Thorne 1990; Sotir and Grey 1992). The US Army Corps of Engineers Waterways Experiment Station (1992) publishes a practice notebook on these topics. Others working in this general area have codified the value of interdisciplinary approaches (Matthewson 1989). The long-term goals of site stabilisation and the balance between long-term preservation prospects and mitigation excavations have been particular concerns of Nickens (1993, 2000).

In the United Kingdom, Berry and Brown (1994, 1995) have summarised the principles of the main management agencies and a range of approaches to earthwork archaeological site management. Technical sophistication and many resources have gone into stabilisation of sites in wetlands (Coles 1987) and there are other important developments in management planning led by English Heritage and the National Trust (Lewis and Miles 1985; Gosling 1985; Darvill 1987; Macinnes 1993; Wainwright 1993; Thackray 1994; Thackray *et al.* 1995; Jones 1998; McGlade 2001). The *in situ* preservation of sites in urban areas by using particular engineering techniques such as the installation of post-stressed concrete slabs over sites has also been documented in the UK (Corfield *et al.* 1996).

English Heritage (1991) has sponsored a "Monuments at Risk Survey" (MARS), a programme of broad scope aimed at assessing:

- The scale and rate of physical impact on monuments since 1940 and the reasons and causes for this;
- the present condition and survival of the recorded archaeological resource;
- the effect of measures introduced to improve management of individual monuments, especially the role of designations; and
- an investigation into the implications of monument decay in terms of the information preserved at different stages of survival (Darvill and Wainwright 1995, 1996).



(a) Ground clearance in a 'gallery forest' at Blackbury (an Iron Age defensive earthwork), Devonshire, UK. Following an agreed management plan English Heritage selectively removes ground cover to reveal the earthwork features while still allowing for wildflowers, protective low-level ground cover and the protection of the tree canopy.



(b) Selective removal of destabilising trees from a revetted bank at Te Koru Pa, a Maori fortification some 300 years old, Taranaki, NZ. Elsewhere on the site, trees are planted or allowed to grow to maintain the protective canopy.

Figure 2. Ecologically appropriate management.

The final MARS report:

Contains a number of methodological innovations relating to landscape sampling to establish risk; establishes typical decay curves and area loss factors for field monuments; and concludes on the principal land classes and causes of damage and destruction such as ploughing, urbanisation and development generally, road building, mineral extraction and natural erosion (Darvill and Fulton 1998: 16-29, 174-90).

The MARS study has been able to conclude that scheduled (registered) monuments have fared well over the last few decades, while sites with three different types of adjoining land uses have fared worst of all. In response, English Heritage has produced a strategy for dealing with the problems identified by MARS (1995). Amongst its strategic objectives are the achievement of more appropriate on land-use around monuments, specifically improving controls on destruction resulting from agriculture and forest establishment, and more research into the prevention of natural erosion.

In New Zealand, we have recently published a draft guideline *Caring for Archaeological Sites* (Jones *et al.* 2002), covering principles, practical techniques for dealing with forests, grasslands, farming, forestry and engineering problems along with a number of case studies. Historic Scotland Ancient Monuments Division has also published some innovative studies on burrowing animals (Dunwell and Trout 1999) and bracken as a vegetative cover (Rees and Mills 1999).

The use of geosynthetic membranes has come into its own in recent years (Getty Conservation Institute n.d.; Hudson and East 1990); their uses include strengthening layers and acting as a permeable membrane separating them. Some forms are designed to prevent root penetration into sensitive layers. Such membranes can be shaped and placed to assist drainage or to provide a surface treatment suitable for encouraging desirable plant covers. Specific types of "geogrids" (injection-moulded interlocking units) may be used for surface treatments to prevent erosion. These media should be in wide use in a range of protection measures for exposed sites – including re-burial and drainage – but a systematic review of their suitability in archaeological site applications has yet to be published.

This body of professional work, reporting thinking and practical endeavours, is as important as the charters. Surprisingly, there is relatively little cross-reference from the ICAHM to practical work, at least as manifested in publications. However, the US Code of Federal Regulations (promulgated under the National Historic Preservation Act and the Archaeological Resources Protection Act) provides a not dissimilar set of precepts to that of the ICAHM and

more general ICOMOS charters (Elia 1993). Both the US regulations and the charters provide good terminology for particular concepts – such as "stabilisation", "repair", "restoration", "conservation" – where clarity and agreement assist professional communication.

ISSUES

Decision-Making about Conservation

There is an issue surrounding the question of how far we can rely on benign neglect and current understandings and technologies to ensure that sites are indeed preserved *in situ*. Conceptualisation of the need for, and timing of, intervention needs to be improved. Thorne's (1988) system for assessing deleterious effects and decisions on the need and timing for intervention is abstract and does not detail the kinds of techniques that are needed to assess rate of effect.

All current work recognises that archaeological sites are part of related complex systems in which partial responses, or responses based on a poor understanding of effects, will not be satisfactory. This may lead to no action or "under-scoped" (Nickens 1993, 2000) mitigation work. However, there have been excellent examples of multidisciplinary investigations of site conservation problems; some have led, correctly, to no intervention. An example is the Great Mound at Cahokia, a World Heritage Site, which began slumping in the 1970s. At that time, a number of intervention methods were considered, most of which were too expensive, too intrusive or not sufficiently reliable to be adopted (Emerson and Woods 1990). The mound has subsequently found an equilibrium, ceased slumping and attained a stable profile.

In yet other cases, the technical issues have been clearly framed so as to assist management decisions – an excellent example is the Jamestown Island Glasshouse, part of Colonial National Park, Virginia (Johnson *et al.* 1991). An excavated and exposed seventeenth-century glass-making site, it had been air-conditioned and housed under a glass roof, leading to severe wicking and efflorescence problems.

In New Zealand, an example with no clear resolution is of stone-revetting (banks reinforced with stone) in a number of archaeological settings – both pre-European (pre-1769) and nineteenth century in age. The pre-European examples are constructed with no interlocking course work; foundations appear to have been undermined by subsequent deepening of terraces, and there was probably poor or non-existent packing of fill behind. There had also been earlier unrecorded reconstruction. The revetted walls are subject to slow deleterious effects from tree growth (Jones and Simpson 1995:104; NZ Department of Conservation 1998). Apart from repeated photo-point monitoring, we have no simple way of monitoring the potential bulging of these

walls so that an intervention would be possible if the bulging were to accelerate. Possible methods include precise measuring between the ends of pins set in the wall and some distance away on the terrace, or stereophotogrammetry, but these methods are fraught with problems.

Revetting is a difficult case, but there are simple ones to which simple methods of monitoring may be applied. In the UK, in Somerset and Cambridgeshire, a range of physical chemistry methods have been adopted to monitor anaerobic conditions of water-logged wood sites (Coles 1987; Coles 1995). This is innovative (for archaeological monitoring), sometimes cheap, simple and effective technology, with relatively clear implications for management. On the Sweet Track in the Somerset Levels, I have observed a system of impermeable barriers around the site, weirs, ditches (leats) and piped water allow for managed control of the water levels (Figure 3). Field drains have been deliberately broken down and impermeable barriers have also been installed at Stonea Camp, Cambridgeshire (Coles 1995:79).

Condition Reporting and Monitoring

Generally, throughout the world, there is currently very little condition reporting and poor short and long-term monitoring. Part of the problem is the scarcity of protocols and established methods for reporting of condition. The problem is widely recognised and there have been a few steps to systematise practice (Jones 2002; see also notes on the ICCROM programme). Precise measures and survey of condition provide clear lessons: first, we may in the future be able to find records of inappropriate interventions that may have been previously carried out, and second, we can follow acceleration in the change of key measurements which may presage failure of a structure and indicate the urgency of intervention. Past records help us to learn from mistakes and may also help to more effectively mitigate the problems they caused. Monitoring also needs to allow for intervention. On-going maintenance should be modified or corrected where it is causing deterioration.

Photographs, properly archived and retained for the long-term, have merits as records of condition. Other simple measures, such as notes on active erosion patches, are easily submerged in subjectivity unless they use precise quantified measures (for example, "2 m of bank undercut by sheep, will shortly collapse") annotated onto detailed large-scale plans of the site.

Possibly the best example of monitoring, albeit for an unusual purpose, is that conducted for the 1960s "experimental earthworks" in the UK. These have been intensively monitored in a wide range of ecological, biological and physico-chemical parameters at geometrically increasing intervals (Ashbee and Jewell 1998). The latest (the 32-year interval) was reported recently (Bell *et al.* 1996) and the



(a) The track line is maintained free of trees and the surface stabilised by grasses and sedges.



(b) Somerset County monitors ground conditions by observing ground water levels and, here, a county archaeologist takes physico-chemical measurements from ground probes.

Figure 3. Conservation management and monitoring: the wooden foundations of Sweet Track, Somerset Levels, UK, are preserved by the anaerobic conditions in peat and silt which have accumulated over four millennia.

earthworks have now been put to sleep – to awake, one hopes, for a generation of archaeologists who will come along when many of us are dead. Being new earthworks, the monitoring has concentrated more on what we would now call taphonomic problems, but in the longer intervals (as indeed at the 8, 16, and 32-year intervals), there are useful lessons for those managing ancient earthworks about monitoring methods and short and long-term processes of degradation and conservation.

The problems identified in a well-prepared condition report wonderfully concentrate the mind on corrective management. In New Zealand, we have found that purpose-flown, large-scale (1:1,000-1:5,000) aerial photographs, preferably in stereo pairs, are good for making plans of sites and for the documentation of condition (Jones 2002). Otherwise, good site plans at appropriate scales (1:250 to 1:1000) are essential to record condition. The condition reports should be accompanied by remedial work prescriptions if the problems are straightforward.

Although we may lament crisis management, monitoring to anticipate failure or critical intervention issues has long been difficult in all branches of environmental studies. The key issues include cost and security of long-term monitoring programmes and determining the priority to be accorded particular issues, systems or sites. The security of monitoring programmes is crucial; an initial investment of enthusiasm and money can easily be wasted by later neglect. The monitoring therefore needs to be technically simple and easily repeated and its results need to be well archived – if necessary separately from the current and often changing administrator of the site or system concerned.

Balance between In Situ Preservation and Mitigation Research

At first glance, the ICAHM article requiring *in situ* preservation is simple, only sites which will inevitably be destroyed should be excavated. On one hand, this has often had the valuable effect that, in the course of Cultural Resource Management (CRM) surveys and mitigation, unanticipated deposits of great research significance have been discovered. On the other hand, there has been much routine data-gathering, conducted in the name of mitigation, that will never be synthesised or properly published. A simple solution is to articulate research questions so that the needed excavations can be carried out on sites that will inevitably be destroyed. A number of national or state authorities have strategies incorporating priority research themes that enable this to be done. In practice, the process is never that simple (Elia 1993:431). Both codes, the ICAHM and that of the Institute of Field Archaeologists (UK), balance *in situ* preservation against the objectives of excavation or research. Arguments against *in situ* preser-

vation include: first, potentially higher costs for installation and ongoing commitment to monitoring, and second, we are not being clever enough at looking at preservation options – there is a “lack of creativity” for identifying management or preservation technologies (Nickens 1993:418).

A complex relationship exists between the objectives of a development project and the type of mitigation research that can be undertaken. An example is Lake Iloh, North Dakota, an older “New Deal” lake project that is now a National Wildlife Refuge. In recent years, the 1930s period dam had begun to fail. For safety, the lake was drained. The newly exposed bottom silts revealed a dispersed – but nevertheless significant – Paleo-Indian site that had not been known about in the 1930s. Periodic wave action had displaced bottom sediments and deposited blades on the surface. *In situ* stabilisation would have been preferred, but could not be undertaken – for even while *in situ* options were being considered, the objectives of the impoundment had changed. The newly reconstructed dam would now allow for the lake to be drained so that a large part of the flat lake bed could be drained and winter ice or frost would kill “coarse” fish – for example, cat fish. At the same time, on each drainage cycle, the Paleo-Indian sites would be exposed to yet further cycles of freeze-thaw, waves on the varying strand line or where water levels were less than 1 m deep and, when dry, wind erosion. A subsequent possible solution considered was the construction of bunds (banks) to keep water out of selected areas (in summer) and to provide a stable grassed environment. However, this was costly, and determination of the extent of top-priority affected areas was not easy to judge. The solution adopted was simply to excavate areas of the lakebed known to contain significant archaeological deposits and to leave the balance of the deposits to ongoing monitoring and excavation if necessary (Ahler and Karsmizki n.d.). In this case, then, although the worthwhile objective of preservation *in situ* was considered, it was not technically feasible despite some possible innovative methods.

Underlying the *in situ* conservation versus rescue excavation conflict is a deeper issue about professional attitudes. Archaeologists may dismiss unproven technologies and their costs, but are prepared to conduct what Nickens (1993:419) labels “inadequately scoped” investigations. To make proposals commercially feasible, such investigations disguise what should be the true costs of mitigation research and leave unrecognised legacies of unreported or inadequate data and analysis.

Value Conflicts

It is a truism of public policy analysis that policy implementation will not succeed unless it is based on a sound

understanding of the nature and behaviour of the key players affected by the policy (Figure 4). Archaeological site conservation is just such a policy domain, reflected most obviously in the two ICOMOS charters discussed above. So we must ask ourselves – who are the players in archaeological site conservation? What values do they bring to bear? The values are too little analysed, but they will include the following:

- symbolic, places which provide a “defining moment” in history, of grievance or celebration;
- research (excavation);
- education;
- “fine art”, for example, stone carvings in temple ruins; and
- religious, for example, caves in which votive offerings are made.

Archaeologists cannot and should not assume that research will be pre-eminent in the interests of landowners or other local stakeholders, or ethnic minorities with local influence who may claim a role in the management of archaeological sites. Much the same should also be said of site conservation issues. This is an acute issue in conservation policy relating to sites in almost all former colonial societies (Mulvaney 1991; Australia ICOMOS Executive Committee 2001 for the Australian situation).

Training and Professional Development

CRM, as taught or conducted as an adjunct to university courses in archaeology, places an emphasis on legislative programmes and mitigating or rescue excavation. When it is taught in universities, it tends to be accommodated as part of the income-earning arm of the university and may be subject to the pressures of the steadily commercialising university system:

How can a genuinely new archaeology concerned with conservation and stewardship above all else flourish in an educational environment that values ‘publish or perish’? Is archaeology unique as an academic discipline in its urgent need to make conservation and related activities as high a priority as conventional research? Does the Society for American Archaeology need to take a leading role in convincing academic institutions that their reward system is not necessarily appropriate for all academic archaeologists? (Fagan 1998)

Elia (1993:431) is more caustic:

... the CRM field has produced a whole generation of archaeologists who, while paying lip service to the conservation



(a) A conservation planning consultant discusses the provisions of a plan with Maori kaitiaki (local guardians of site values whose ancestors once lived on the site), Te Koru Pa Historic Reserve, Taranaki, NZ.



(b) On the chalk banks of the Roman Fortification of Hod Hill, Dorset, UK, various representatives from the National Trust, English Heritage, English Nature, local landowners and environmentalists discuss options for pasture management to achieve nature and archaeological conservation objectives.

Figure 4. Working out value conflicts to ensure cooperation and clear management objectives.

ethic, have grown accustomed to consenting to the destruction of substantial percentages of significant archaeological sites.

We may conclude that not so much emphasis is placed on teaching in the area of *in situ* site conservation as might be expected, given the clear charter in the ICAHM and the implied conservation goals of CRM in general. In the US, site conservation is a major focus of Thorne's programme at the Center for Archaeological Research, University of Mississippi, the University of Pennsylvania (with a strong emphasis on classical archaeology, see Matero *et al.* 1998) and of the contracting programme at the National Center for Preservation Technology and Training at Northwestern State University of Louisiana. In the UK, site conservation features at the University of Leicester and at the Institute of Archaeology, London. ICCROM and the cultural agencies of the EEC (Therond 2001) also play an important role in in-service training for professionals. Much more could be done to expand training in a wider range of tertiary and other vocational institutions, especially in light of the consolidation of professional principles and theory noted in the first part of this paper.

CONCLUSIONS

The key philosophical issue to be resolved in site conservation is whether archaeologists, amongst other groups with an interest in sites, really wish to see sites conserved or whether they are a "selfish generation" who simply wish to have sites available for research in good condition for excavation. It sometimes seems that archaeologists have divided themselves into three factions:

- Supporters of the objective of indigenous cultural revival – who may support: the use of sites as symbolic places, a stop on excavation, and indigenous people's control of almost any form of information about their pasts;
- academic or "pure" researchers who see sites simply as places to excavate in the "here and now"; and
- CRM practitioners who, rather than search for alternative development sites, support the destruction of sites so that funds flow from developers.

Some of these differences are almost schisms, reflected in the composition of international organisations such as the contrasting approaches between UNESCO'S Union of Prehistoric and Protohistoric Sciences on the one side and the World Archaeological Congress on the other. At the professional level, the resolution of the differences requires a determination to listen to other viewpoints and take them into account. However, in the final analysis, it will be the national jurisdictions exercising appropriate legal control over site destruction that will prevail. In this domain the

clear provisions of charters such as the ICAHM and the Cultural Tourism Charter will give some guidance.

In favour of those who wish to excavate in the "here and now" are the following factors:

The scientific values of sites are seldom tested except in the face of development or for research, so that sensible decisions on what priorities should guide *in situ* conservation are not simple, or the data to enable these decisions are not available; and

the long-term successes of practical conservation of sites, whether legislative or stewardship (control of deleterious effects), are not proven.

ICAHM and other international or national guidelines appear to favour *in situ* preservation and it is not necessary to re-state the reasoning of the charter here. However, it is not easy to judge the correct balance between efforts put into mitigation (rescue excavation) and efforts put into site conservation.

We have an increasing number of publications on preservation issues, conservation planning and success stories of site preservation. There is a more concentrated effort on professional reporting in Classical or Mediterranean Archaeology, and in dealing with standing ruins (as opposed to sub-surface sites) both prehistoric and historic. The coverage of most papers is quite specific and technical and the tone is almost always exhortatory, offering in a missionary tone a record of achievement and encouragement for the future.

But how many of these successes will be sustained into the future? To judge by our poor record of monitoring of conditions, inadequate protocols on when to intervene, and more generally in professionalisation of this arena, the future is by no means assured. We may not even be able to judge the success of most current preservation projects for want of long-term physical, chemical and ecological monitoring of the condition of sites.

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