

orthodox majority believes that the global climate has altered measurably and significantly over the last hundred years or so, that the reason for this alteration is industrial activity (primarily burning things) by mankind, and that if we do not mend our ways pretty soon, we will wreak great and irreversible harm on our planet. Dissenters from this orthodoxy are sometimes accused of being in the pockets of big business, or at least those parts of big business seen as having a short-term commercial interest in perpetuating this state of affairs, while the dissenters (perhaps it is not too fanciful to use a religious analogy and refer to them as heretics) have been known to accuse the orthodox of scaremongering for a variety of reasons, ranging from anti-capitalism to seeking research grants.

Clearly, anything that brings cool reason into this sometimes overheated arena is to be welcomed. Harvey's book is by no means the first of these, but it is an exceptionally good one. It is written at a level appropriate for advanced undergraduates or graduate students, and the author claims for it, with some justification, that it is 'intended for individuals who want an objective, critical and thorough introduction to the science underlying the global warming issue.' I suspect that a non-technical reader might find it rather hard going — indeed, the subtitle 'the hard science' contains a deliberate ambiguity, implying both the hard science that is distinct from the soft or social sciences, and the science that is not easy. (Readers looking for something less technical might want to turn to John Houghton's book instead.) Thorough the book certainly is. It is divided into three parts. The first of these describes how the global climate system works, the physics of the so-called 'greenhouse effect' (as Harvey points out, and many have done before him, greenhouses don't work like that), the factors that drive the emissions of 'greenhouse gases' into the atmosphere, and the evidence of change provided by a large range of climatic variables, including land- and sea-surface temperatures, atmospheric temperatures measured by balloons and satellites, precipitation, the extent of ice and snow, sea level, atmospheric ozone concentrations, and so on. This is, by any standards, an extensive and detailed piece of work. The second part of the book discusses mathematical modelling of the climate system, and the final part, on the 'science-policy interface', presents a fairly brief but still very detailed discussion of possible future scenarios of climate change, and what Harvey calls 'prospects for surprises' — more or less abrupt variations in the climate system, such as, for example, the sudden die-back of forests.

The book is very well presented and extensively illustrated with diagrams, graphs, and tables. There are remarkably few errors (I did discover an interesting new molecule, CO₄, on page 7), and the style is generally accessible. The author is rather fond of acronyms and abbreviations, so that capital letters tend to proliferate on the page in a manner that can be rather off-putting and sometimes quite close to code, for example, 'V compiled their NH data independently of J.' A more serious criticism could be that the book does not quite live up to the author's

claims of objectivity and criticality. I am insufficiently expert to be sure about this, but it seems to me that, in places, the more respectable arguments advanced by the global-warming heretics are not presented with sufficient detail to qualify as having been considered objectively. For example, I would have liked to have seen fuller discussions of the discrepancies between the land surface (including the so-called 'urban heat island effect'), sea surface, balloon and satellite temperature measurements, the role of variability in the solar luminosity (including the remarkable correlations that have been reported between solar cycle length and global mean temperature), and the relevance of climate dynamics during the onset of ice ages. In places, the rebuttal of heretical ideas has a faint flavour of catechism. But I think these are not important criticisms of the book, merely expressions of my 'wish list' for a book that this is not, and does not really purport to be. As a thorough, up-to-date, and extremely detailed presentation of the orthodox view of global warming, with more than a nod towards some of the alternative viewpoints, I think this book is hard to beat. I expect to use my copy heavily over the next few years. (Gareth Rees, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER.)

SCIENCE AND TECHNOLOGY IN HISTORIC PRESERVATION. Ray A. Williamson and Paul R. Nickens (Editors). 2000. Dordrecht: Kluwer Academic Publishers. xxii + 357 p, hard cover. ISBN 0-306-46212-5. £58.75; US\$85.00; NLG200.

This book is the fourth volume of the 'Advances in archaeological and museum science' series, produced with the stated aim of encouraging interdisciplinary collaboration between archaeologists and scientists to provide overviews of developments in practices in archaeology, preservation of historic sites, and museum conservation. I am a museum conservator, also extensively involved in interdisciplinary research on preservation of historic sites in Antarctica. Thus it was of considerable interest to me to put this book to practical use in my work and in particular to judge if it may be useful for heritage professionals, managers, and those with general interests in the subject.

The introduction of this book highlights the public policy issues of heritage and the opportunities inherent in advances in digital technology. This is followed by six chapters covering various analytical techniques used to document the history and materials of heritage sites, two chapters on 'restoration and conservation,' and five chapters covering site management, maintenance, and protection. The scope is unusually broad, which offers considerable benefit to those interested in the management of heritage projects who need one central reference rather than a series of specialist publications. The preface of the book acknowledges the political support given to the project by two US Congressmen and that the publication is a means of 'focussing congressional attention on the technical and administrative issues of preserving America's historic

patrimony' (page xiii). On this basis alone I would recommend its acquisition for parliamentary libraries everywhere. While the book aims to be state of the art, this is difficult for a hard-bound book in the era of web publishing. Technological developments outpace the ability of most researchers to write up their work.

The chapters on 'Discovery, documentation, and analysis' cover the main techniques used to determine the extent, age, and materials characteristics of heritage sites. These include remote sensing and geophysical techniques and established dating techniques for both ancient and more recent eras, as well as standard materials analysis for determining the origin of materials. The content of the book does reflect its American origins, giving considerable coverage of wood, glass, and ceramic materials, with less emphasis on preservation of stone that is of particular relevance in Asia and Europe. Surprisingly, the index contains no references for adobe, mud, earthen construction, or similar terms, yet this form of construction is very important in southwestern Amerindian sites and it surely deserves more attention.

The chapters covering aerial surveys and satellite imaging are useful for those working on polar sites and describes important tools such as geographic information systems (GIS) and global positioning systems. The section on ground penetrating radar (GPR) and other geophysical surveys gives useful examples that illustrate the practical considerations and limitations. It is not mentioned in the book, but GPR offers some significant potential benefits to polar heritage sites because it penetrates ice and clearly distinguishes water, rock, and materials such as wood. Information on dating methods and non-destructive testing (NDT) is clear and well illustrated with examples. The information on 'Barriers to implementation of NDT' (page 115) concerning the processes of NDT development and funding is thought-provoking and not widely available elsewhere.

The chapter on wood preservation by Loferski is particularly clearly explained and gives useful reviews of significant current heritage issues such as fire protection, chemical toxicity, preservatives, and repair techniques.

The chapter by Hamilton on conservation of underwater archaeological sites provides definition of terms such as preservation, conservation, and restoration, and discusses the roles of the various professionals (archaeologists, conservators, etc) involved in heritage management. I believe, however, the information provided in *Conservation of marine archaeological materials* (Pearson 1987) gives more detailed and up-to-date information on treatment techniques. Hamilton acknowledges that more detailed information is available elsewhere, but it is unfortunate that there is no reference to pre-disturbance electrochemical surveys and use of cathodic protection, which is now widely used as a pretreatment for large marine artefacts such as anchors before removal from the sea. Hamilton does justice, however, to the topic of the value of casts of natural moulds left by corroded iron artefacts and cautions

conservators on simply viewing versatile techniques such as electrolytic reduction for 'stripping' away corrosion when it can reveal so much about the environment of the wreck site.

It is always difficult to choose between publishing information for practical application and risking its use in unqualified or inexperienced hands leading to damage to buildings or artefacts. Hamilton has provided some level of detail about electrolytic treatments that are commonly used on large artefacts such as anchors. However, there is neither adequate detail on the measurement of chloride that is crucial for monitoring the progressive elimination of chlorides during treatment, nor precautions about the treatment such as the explosion risk of hydrogen evolved during treatment and the problems of large volumes of caustic chemicals.

In Australia, diving enthusiasts frequently contact museums *after* they have removed an anchor asking for help to treat it, often unaware of legislation prohibiting removal except by government licence. In a publication aimed at an interdisciplinary audience, I believe it is advisable to provide these details to warn of the complexity and cost of the treatment and to encourage treatment by experienced professional conservators. Proposals arise every few years for recovery of large marine artefacts in Antarctic waters, such as the anchor of *Aurora* at Commonwealth Bay without addressing the technical complexity, costs, and potential risks of such projects. Large marine artefacts were removed from underwater sites in the Arctic some decades ago, causing considerable conservation problems (David Grattan, personal communication, 1999), despite the widespread expectation of perfect preservation in cold conditions.

Although Hamilton provides a practical section on conservation of metal artefacts from marine sites, there is little information elsewhere in the book about metal construction materials or artefacts from terrestrial sites. Corrosion problems are prevalent in museum collections and at terrestrial archaeological sites and can cause significant problems in modern buildings with corrosion of crucial elements such as nails. Nor is there much information about more modern composite materials such as plywood, corrugated iron, and other common vernacular materials of the late nineteenth and twentieth centuries. Materials of this era are often difficult for archaeologists and heritage architects to deal with, both in terms of diagnosing the problem and treating its real cause, and this should be an area in which research should be encouraged.

Chapter 10 on GIS is comprehensive and gives excellent examples of the application of this technology for cultural heritage. The use of landscape visualisation and techniques for estimation of potential impacts of development on historic properties in both urban and rural contexts would be useful for many readers, although there are no specific references to polar heritage requirements, which are so different to the range of problems usually encountered in temperate and tropical regions.

Chapter 11, on 'Use of computers in cultural resource management,' cites interesting applications developed by the US Army Corps of Engineers Construction Engineering Laboratory, which are used to manage the building inventory, condition assessment, and maintenance requirements to enable them to meet their responsibilities under cultural resource laws and regulations. Other computer applications for managing data on archaeological sites, such as the National Archaeological Database containing more than 100,000 records, and various collections management tools are reviewed. The 'ENVIROTEXT' bulletin board system may be of particular interest to some readers of *Polar Record*, as it demonstrates the potential of a system containing full text of all available US federal, state, and local environmental laws and regulations, including those affecting cultural resources. The related DENIX system provides a forum for data exchange and discussion on environmental laws and compliance processes. These systems are said to be progressively being integrated with GIS and some of the information provided may help stimulate application of these or similar systems for Arctic and Antarctic regions, where sites must be managed according to both national and international jurisdictions. Computer technology is a rapidly developing area, and information on these topics will require regular updating.

Chapter 12 discusses the increasing integration of cultural resources into 'a more explicitly ecological land-management framework in the 1990s, as part of ecosystem management' (page 268). This chapter provides much food for thought for Antarctic environmental managers involved with cultural resource issues, stating 'Good management frequently involves the appropriate use of contemporary science and technology to preserve the cultural past often to include the record of past science and technology' (page 270). Knudson cites the corporate cultural change required of the US Department of Defense 'Legacy' programme, which was Congressionally mandated, and one wonders if this programme would have happened otherwise. Increasing pressures to assign economic values to non-renewable resources, such as cultural heritage sites, are discussed in a comprehensive and interesting way, with many useful references to US environmental legislation.

Chapter 13, on 'Technologies against looting and vandalism,' provides a compendium for those responsible for management of cultural heritage sites. The introduction sets the scale of the problem with concise, well-referenced statistics, highlighting the low success rate of convictions against the number of sites damaged. While the chapter does not specifically address sites in the polar regions, the text describes the communications considerations for remote sites.

The concise discussion of legal issues, while intended to cover only the US situation, does provide scope for comparison with other countries. This background information would make it a convenient reference for those responsible for drafting legislation covering cultural

heritage sites, or for parliamentary libraries, to assist in determining the legislative, funding, and staffing needs for adequate protection of cultural heritage. The protection and preservation of historic sites in both polar regions is complicated by the lack of detail in the Antarctic Treaty and the Madrid Protocol and is the subject of detailed consideration by the newly formed ICOMOS International Polar Committee. This committee will help to clarify these issues, and this book may help that committee identify information that must be developed. In addition to the aforementioned lack of protection provisions in the Antarctic Treaty and Madrid Protocol, there is a lack of research on appropriate preservation methods to reduce or rectify deterioration of Antarctic historic sites.

Chapter 14, on technologies for *in situ* and long-term preservation of sites, identifies the need for interdisciplinary cooperation among archaeologists, conservators, and engineers to ensure that sites can be stabilised effectively. The chapter focuses on the needs for further research to improve site-preservation technologies, such as reburial, engineering support of excavated areas, vegetative management, drainage, and chemical and physical protection of exposed rock art. Reading this chapter made me think how little information has been produced to guide heritage professionals and environmental managers on similar issues that are specific to the polar regions.

Indexes are a frequent source of complaint by book reviewers and perfection is rarely attained. The index of this book is reasonable, and the detailed contents list at the front makes it easier to find broad topics, although I encountered several difficulties locating references on particular items. It would be useful to have grouped references for some frequently arising reference questions: for example, 'Acts' (for Acts of Congress) or 'Legislation' would be useful index terms. These could serve as a convenient list enabling one to find relevant legislation rather than needing to know exact titles, because of the number of permutations of the index term. 'International laws, for import and export of artefacts' is indexed, and this is a valuable contribution in the chapter by Reed and Schneider. Overall the index is a minor frustration rather than a significant detraction from its value as a reference text.

This book has a noble aim and makes a valuable contribution in providing an overview of developments in identifying, documenting, conserving, and protecting heritage resources. It would make a useful reference for *Polar Record* readers involved in cultural heritage issues whether in assessment and protection of sites or managing collections taken from these sites to museums, as well as for environmental managers whose responsibilities include heritage sites as a subset of their broader duties. (Janet Hughes, National Gallery of Australia, GPO Box 1150, Canberra, ACT 2601, Australia.)

Reference

Pearson, C. (editor). 1987. *Conservation of marine archaeological objects*. London: Butterworths.