

original form relied on the fact that water in very large icebergs was 'packaged' for transport, although, as demonstrated in the first part of this chapter, icebergs are almost certain to breakup in the swell of the Southern Ocean.

The final chapter reviews the role of sea ice in high-latitude ecosystems, in the concentration and transport of pollutants, and in climate. The climate section focuses very much on climate change and associated changes to the sea ice itself, including recent significant changes in the Arctic Ocean.

The book is generally well edited and well presented. There are occasional irritating partial factual errors (katabatic winds are funnelled 'between mountain peaks'; PCBs are a 'type of pesticide'). There are also a few minor typographical errors and some errors in the bibliography (several cited references not in the bibliography, and inconsistencies between the text and bibliography). The bibliography also includes too many references to theses that are not generally accessible. A short section before the bibliography backgrounds other works (mostly monographs) that delve deeper. Note, however, that Jacobs and Weiss (1998) deals predominantly with continental-shelf oceanography and interactions between the ocean and meteoric ice (ice shelves, glacier tongues, and icebergs) — there is little on sea ice.

The book is well illustrated with mostly black-and-white photographs of sea-ice phenomena, although in some cases better examples might have been selected. Curiously, photographs by the author are credited to him, but no others receive any credit: this is somewhat different from the standard 'all photographs by the author unless otherwise credited.'

Does the book achieve its stated aim of providing an introduction to modern knowledge of sea ice and icebergs and the role that they play in the ocean system, largely from a phenomenological approach? In general it does, and it is certainly far more comprehensive and structured than anything else available is. Both the book's strength and some weaknesses derive from Wadhams' unique experience at the centre of many of the advances in sea-ice research over the last three decades. Nearly 10% of the cited references are to publications with Wadhams as principal author, and there are many more on which he is a co-author. With the author's wide personal knowledge, there is a focus on those geographical regions where his work has been undertaken, predominantly the Arctic and the Weddell Sea region in the Antarctic. But there is omission of some of the more recent work in other parts of the Antarctic that are quite different from the Weddell (work by investigators such as Worby, Jeffries, Lytle, Haas, and Ohshima). Certainly the book covers a wide variety of sea-ice processes, but these omissions do detract from it having a complete bi-polar perspective.

Readers with a sound background in applied mathematics will gain most from this book, but there also is much to be learned from it by those who do not. I would

recommend the book as a valuable resource to researchers and postgraduate students of all disciplines involved in work in the polar oceans. (Ian Allison, Australian Antarctic Division and Antarctic CRC, PO Box 252-80, Hobart, Tasmania 7001, Australia.)

### References

- Jacobs, S.S., and R.F. Weiss (editors). 1998. *Ocean ice and atmosphere: interactions at the Antarctic continental margin*. Washington, DC: American Geophysical Union (Antarctic Research Series 75).
- Leppäranta, M. (editor). 1998. *The physics of ice-covered seas*. Helsinki: University of Helsinki Press.
- Untersteiner, N. (editor). 1986. *The geophysics of sea ice*. New York: Plenum Press.

**PERMAFROST: A GUIDE TO FROZEN GROUND IN TRANSITION.** Neil Davis. 2001. Fairbanks: University of Alaska Press. xvi + 351 p, illustrated, hard cover. ISBN 1-889963-19-4. US\$35.95.

This book is written for the scientifically aware layman but contains much of interest to the specialist. The author is a geophysicist whose professional career was in atmospheric physics. However, Neil Davies has spent much of his life in Alaska, and is clearly enthused by the cryogenic phenomena that he encounters as part of his daily life. This enthusiasm is brought to his writing, and he cleverly carries the reader with him through complex explanations of ground freezing phenomena. Following an introductory chapter describing the nature and distribution of permafrost, the book may be divided into three general sections. Chapters 2 and 3 explain the fundamental physics underpinning cryogenic processes, chapter 4 is a review of cryogenic landforms, and chapters 5 and 6 consider applied aspects of permafrost geoscience, including the potential impacts of climate change.

The author begins his explanation of freezing phenomena in chapter 2 by focusing on the material properties and behaviour of water, particularly with respect to phase change. The discussion begins at the molecular scale and covers the fundamental physics of ice formation within soils and rocks. Chapter 3 discusses the processes observed during ground freezing, including water migration, ice segregation, and the formation of vein ice and massive ground ice. The style is easy and explanations are clear, making this a refreshingly accessible account of the physics of frozen ground.

Chapter 4 is concerned with permafrost landforms and sedimentary structures. Emphasis is given to lowland Arctic permafrost phenomena, with almost all examples drawn from Alaska and northwestern Canada. The nature and formation of ice-wedge polygons, pingos and related ground-ice features, mass-movement processes, patterned ground, and thermokarst are discussed, together with a very brief account of weathering in cold climates. Although chapters 2 and 3 generally provide a firm foundation for the process explanations in chapter 4, there are disappointing omissions. For instance, the thaw-consolidation theory is given only a passing mention on page 154, yet it provides

an analytical framework for the strength and stability of thawing soils, and is critical to an understanding of cryogenic slope instability.

Explanations and descriptions of landforms and processes are generally clear and extremely well illustrated with photographs. However, the literature on which this account is based generally dates to the 1960s, 1970s, and early 1980s. The lack of up-to-date material may not detract seriously from the book as far as the layman is concerned, although valuable insights are, in consequence, omitted. However, for specialists and for students, this reduces the value of this book. As an example, take the work of Professor J.R. Mackay, surely the leading permafrost scientist of the later twentieth century. The most recent reference to his work in the book is from 1981. Thus, the fascinating and informative observations by Mackay on such topics as pingo formation, thermal contraction cracking, and mass-movement processes are, sadly, not included.

The third section of the book deals with the special problems associated with construction, mineral extraction, and the provision of transport and services in permafrost terrain, and the likely impacts of climate change in the permafrost zone. Again the focus is on the North American continent in general and Alaska in particular, but many excellent photographs, including 24 colour plates, provide superb illustrations of the more dramatic consequences of human activities. Chapter 5 begins with a description of techniques used in gold extraction in Alaska and northern Canada, then describes the engineering solutions adopted to avoid thaw subsidence of buildings and transport links, and finally briefly describes pipeline construction methods. Chapter 6, entitled 'Permafrost in transition,' commences with a useful summary of the geological history of climate change, and this palaeoclimate record is used to place trends in the late twentieth century into perspective. The author then provides a brief explanation of the greenhouse effect, before assessing potential changes in permafrost distribution in Alaska and northwestern Canada. Impacts discussed include increased slope instability, increased methanogenesis in thawed wetlands, and geochemical changes resulting from permafrost degradation. Anecdotal accounts of the effects of permafrost degradation in the Fairbanks area are scattered through this chapter.

Finally, three appendices are provided. Appendix A gives further background on the physics of ground freezing, essentially a more in-depth treatment of selected items from chapters 2 and 3. Appendix B presents soil classification schemes for describing cryogenic soils, and Appendix C lists 'accessible places where permafrost and active-layer features can be seen.' These locations are inevitably all in Alaska or northwestern Canada.

This book is clearly written, with a journalistic style that makes for easy reading. It should prove a fascinating and instructive resource for those who wish to understand the geocryological processes operating in permafrost environments, and the landforms that they generate. The

earlier chapters will prove valuable to many earth scientists working on cryogenic phenomena. The strong North American (Alaskan) bias clearly reflects the experience of the author, and does not necessarily detract from the book for the interested layman. The specialist, however, is likely to be more aware of its limitations in terms of the permafrost environments and the geographical location of the examples given. Notwithstanding this, Neil Davis' book could form the basis for an excellent introductory course in geocryology, although the scientific literature on permafrost landforms would need updating. (Charles Harris, Department of Earth Sciences, Cardiff University, PO Box 914, Cardiff CF10 3YE.)

**ENCYCLOPEDIA OF PREHISTORY. VOLUME 2: ARCTIC AND SUBARCTIC.** Peter N. Peregrine and Melvin Ember (Editors). 2001. Dordrecht: Kluwer Academic Publishers. Illustrated, hard cover. ISBN 0-306-46256-7. £138.00; US\$200.00; Eur210.5.

I love encyclopedias. Between two covers is an up-to-date, accurate, and comprehensive survey of information on whatever the encyclopedia is about: English literature, women in aviation and space, British sport, aging, and Heaven, to name but a few. When I hold an encyclopedia in my hands, I feel the weight of the summarized, alphabetized, and synthesized compendium of knowledge about a given topic. It gives me a feeling of well-being to know that I can peruse the encyclopedia generally over a sandwich at my desk, or delve into it deeply and with intent, the initial step in the serious pursuit of an unfamiliar topic.

Therefore it was with some disappointment that I read the *Encyclopedia of prehistory, volume 2: Arctic and subarctic*, edited by P.N. Peregrine and M. Ember.

My dissatisfaction does not lie with any of the essays written by the 14 non-editorial contributors, each of whom tackled the formidable task of presenting a reasonably detailed overview of an archaeological tradition. These essays are well written and informative, providing a synthesis and a starting point for the non-specialist. Particularly valuable is the detailed bibliographic information. The most informative essays are those in which authors break down the archaeological tradition into sub-traditions and important sites, providing extremely detailed and rigorously referenced information. Many of these contributions will be very useful for teaching university-level prehistory courses.

Rather, my disappointment lies with areas under editorial control: geographical and cultural coverage, quality of maps, organization of the volume, and copy-editing.

To deal with each in turn, I was surprised that an encyclopedic coverage of Arctic and sub-Arctic prehistory does not include those areas of Norway, Sweden, Finland, and northwest Russia that lie north of the Arctic Circle. The prehistoric peoples who inhabited these regions have much in common with those who lived in northernmost North America and north Asia. Because prehistoric