already dated and few of the ideas are new in 1996 or they have been overtaken by much more sophisticated models of crustal evolution.

Some of the information on weather and climate, the continental ice cover in the surroundings of the Schirmacher Oasis, and satellite sea-ice observations is highly descriptive, but the reports on continental ice cover in Chapter 6 include stable isotope data, which will be useful to increase data for climate-change studies. As a layperson, I enjoyed reading the sections on morphological minor forms of the snow and ice surface and the studies on moraines as indicators of Late Quaternary regional glacial history. The satellite observations are of particular value to understand sea-ice behaviour in the Southern Ocean and will be important for future predictions and long-term logistical planning.

The hydrology and biology of Antarctic oases are extremely important for the study of the adaptation of life forms to extreme conditions. More information may ultimately lead to a better understanding of the origin of life. Although I cannot judge the contribution on hydrology as a specialist in the field, I found the report interesting and believe that its importance for the biology and surface physiographic processes of the area probably makes this one of the most significant contributions to this book.

Annexes in the form of black-and-white and colour photographs, hydrographic maps, and biological distribution dot maps are included as a separate volume. These are worthwhile additions to the scientific contributions and especially the hydrographic–morphological maps will be of great value to future researchers. The book is bound in good-quality cloth, and it is therefore a pity that plastic holders were used to enclose the Annexes in the second volume. Mine were torn when I received it, and clearly not of good enough quality for mailing.

The use of language and grammar in *The Schirmacher Oasis* is reasonable. Literal translations do occur in places, but never to the extent that it detracts from the book. Editing has been good, although the occasional typographical error has slipped through.

The Schirmacher Oasis is an attempt to ensure that a record exists of the work that was done in the area and to make this available to a wide audience. It is inevitable that the research has had to be summarized and generalized, but the strength of the book lies in the fact that a large community of scientists has been informed about previously little-known scientific literature about the area, and some of this is referenced in the book. However, there are two major weaknesses, which cannot be overlooked. The first is one that affects all scientific literature seeking to reach a multi-disciplinary audience: in attempting to make a book accessible to a wide audience, the layperson should be able to read outside his own field, but in doing so, the scientific content is diluted for the specialist. *The Schirmacher Oasis* does attempt to overcome the problem by giving general introductions to individual chapters, but I am not convinced that it succeeds entirely. A more serious problem lies with the decision to present only older data, although I do have sympathy with and understand the rationale behind this approach, considering the problems of collating the work. Notwithstanding these comments, it is important for the Antarctic scientific community to take cognizance of the work completed in the Schirmacher Oasis and environs, and the main target audience should therefore be institute and university libraries. (Johan Krynauw, Department of Geology, University of Natal, Private Bag X10, Dalbridge 4014, South Africa.)

MOVING LOADS ON ICE PLATES. Vernon A. Squire, Roger J. Hosking, Arnold D. Kerr, and Patricia J. Langhorne. 1996. Dordrecht, Boston, and London: Kluwer Academic Publishers (Soil Mechanics and its Applications 45). xii + 230 p, illustrated, hard cover. ISBN 0-7923-3953-3. £88.00; $US129.00; Dfl 195.00.

This is a welcome treatment of a topic that has not yet been covered systematically in a book, but that is of great practical importance in Arctic engineering and of considerable scientific interest. The authors are a distinguished group of research workers with considerable experience of field and theoretical studies in this area.

The authors state that 'the goal of this book is to present a modern technical account of our state of knowledge of vehicles and aircraft operating on floating ice,' and, indeed, they have limited themselves strictly to this goal, no doubt due to space limitations in the monograph format. This makes for a tight, systematic, and very well organised treatment that covers the topic in a clear manner. However, it also makes for a shortage of connecting material in which the question of understanding the response of a floating ice sheet to moving loads could be set within a historical context and within the wider context of related scientific problems, such as wave generation in floating ice sheets by wind.

The first chapter of the book, or 'preamble,' does contain a fascinating, but limited, account of historical efforts. The reader is presented with photographs of the Chinese emperor being drawn along a frozen river on a sledge pulled by eight men, and of a railway laid across a frozen river in Manchuria by the Japanese during World War II. However, the serious and sometimes fatal nature of the moving load problem is not fully brought out. For instance, in 1974, when I was in the Canadian Arctic, a Lockheed Orion four-engined turboprop airliner landed on a sea-ice runway at Melville Island delivering a change of crews to a drilling camp. The landing was successful, but, as the aircraft slowed through a critical speed, the wave created by its initial landing caught up with it, the ice cracked around it and the plane went through into the water with the loss of 34 lives. Such tragedies are by no means rare, and demonstrate the importance of understanding the phenomena of wave creation in an ice sheet by a moving load.

Chapter 2 is a useful review of the structure and properties of ice plates in so far as they are relevant to the book's topic. This includes formation mechanisms of sea, river, and lake ice; the development of the brine cell

system in sea ice; and the rheology of ice. Chapter 3 introduces the equations of continuum mechanics, which are vital for understanding the remainder of the book. Linear elastic and viscoelastic equations are given for the response of thin and thick plates on a fluid foundation.

Chapter 4 deals with historical (that is, before the work of the book's authors) attempts to solve the problem of the disturbances caused by moving point or line loads on floating elastic sheets. It begins with the equations for a freely propagating wave (the flexural-gravity wave), and goes on to consider forcing by different types of loads.

In this chapter the work of a pioneer in the field is unjustly neglected. Sir George Greenhill derived the equations for the dispersion relation of flexural-gravity waves in a floating ice sheet as early as 1887, as is mentioned in the book (in fact, the equations were slightly erroneous in that the effect of Poisson's ratio was left out of the flexural rigidity formula). However, in a later and uncited work, Greenhill took the subject much further and dealt with the topic of moving loads. The paper, which still repays study, was called 'Skating on thin ice' and was published in *Philosophical Magazine* in 1916 (31 (181): 1–22). The paper begins in an apparently jocular vein: 'This title is used metaphorically to describe a method of argument which flies so rapidly over the facts as to be able to dispense with their support, but will not bear to be arrested to examine a detail or difficulty.'

It proceeds more seriously: 'It is derived from the action of a skater, when he is able to go so fast over ice as to ride on the top of a wave, and to change his place so rapidly as not to allow time to break through, although the ice is not thick enough to support his dead weight at rest.'

This is a succinct statement of the moving load problem, and, indeed, before the mechanical age, the majority of fatalities from ice fracture induced by a self-created wave were probably among skaters and dog-sledge drivers. Greenhill correctly draws an analogy between the flexural-gravity wave in ice, in which the dispersion relation contains two branches due to gravity and to the elasticity of the ice, and the dispersion relation of ripples in open water, where gravity and surface tension provide the two branches of the curve. In both cases there is a minimum in the dispersion relation, that is, a minimum phase and group velocity for a wave propagating in this medium. The group velocity minimum represents a critical minimum speed for energy to propagate in the ice sheet, and all the mathematical treatment of the problem really consists of examining the ways in which waves of different patterns are induced by different magnitudes and speeds of forcing by a moving load. In every case, the critical speed has to be exceeded before freely propagating waves can be generated. Thus, when the wind blows over ice, it has to exceed this critical speed before the moving pressure fluctuations will generate a wave spectrum. As Greenhill puts it: 'A skater, then, who can progress up to this minimum value of U and beyond, is able to place himself at will at any point of the ice-wave he forms, say a little beyond the crest, so as to have the advantage of the downhill; and if the ice should crack he will be able to escape.'

Chapter 5 introduces new material based on work by the authors and contemporaries, in which the wave patterns produced by different types of load moving at different steady speeds are properly derived. The treatment is extended to viscoelastic ice to allow for decay of the emitted waves, to ice of finite thickness, to distributed loads, and to vibrating loads. This is the core of the book.

Experiments to measure the effects of moving loads are described in chapter 6. Strainmeters and tiltmeters in various arrays have been used to measure deflections due to train and truck passages and to aircraft landings. Good coincidence between observations and theory is demonstrated. In a final chapter, the effect of varying the ice properties is discussed. Again, it is not a new problem that some of the fundamental properties of ice — such as Young's modulus — are very variable (especially for sea ice, where all properties are a function of the salinity, temperature, and air-bubble content) and are often not known well enough to allow the theory to give good predictions. Greenhill complained that: 'Neither E [Young's modulus] nor W [longitudinal wave velocity in ice] is given numerically in the list of Everett's 'Units and Physical Constants,' or in the 'Smithsonian Tables of Physical Constants' either, although it is curious...that Ice was the first substance of which the Modulus of Elasticity was defined and measured by Bevan and Young [1826].'

The reader who is interested in solving engineering problems of floating ice-sheet response to moving loads will find all that he needs in this excellent book. One very closely related area that the authors might have conveniently dealt with is the question of how waves are generated in floating ice sheets by the wind. It has been found by careful long-term experiments on fast ice that the wind cannot generate waves until the critical speed is exceeded, as in the case of moving loads, but, throughout the Arctic and Antarctic ice covers, there is usually a background spectrum due to the generation and propagation of wind waves. This raises the problem, as yet unsolved, of exactly what pattern of moving pressure fluctuations is associated with a wind field and how this transfers energy to the ice. It is a problem of fundamental interest because the mechanism of wave generation in the open sea by wind is itself not fully understood; in many ways, ice offers a simplified system in which short steep ripples cannot be generated, so there is no 'push' of the wind against inclined water surfaces to produce wave growth, just the vertical pressure fluctuations on a flat surface. (Peter Wadhams, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER.)

WHEN THE WIND WAS A RIVER: ALEUT EVACUATION IN WORLD WAR II. Dean Kohlhoff. 1995. Seattle: University of Washington Press. xvi + 234 p, illustrated, hard cover. ISBN 0-295-97403-6. $US24.95.

The book, written by a historian whose specialty is modern American history, could have been subtitled 'a small case of genocide.'