Konferenzen to summarize past accomplishments, identify priorities and technological needs, and make recommendations for future work. In short, it is a comprehensive review at the state-of-the art level. The book comprises 20 papers written by some of the most respected scientists in the field. There are sixteen background papers on such topics as the dating by physical and chemical seasonal variations and reference horizons (C. U. Hammer), ionic deposits in polar ice cores (H. B. Clausen and C. C. Langway, Jr.), past environmental long-term records from the Arctic (W. Dansgaard and H. Oeschger), long-term environmental records from Antarctic ice cores (C. Lorius and others), and the deposition mechanisms of atmospheric contaminants to snow surfaces (C. I. Davidson). At the workshop the participants were divided to examine the following questions: 1) how do glaciers record environmental processes and preserve information?; 2) what anthropogenic impacts are recorded in glaciers?; 3) how can an ice core chronology be established?; and 4) what does the long-term ice core record tell us about global changes in the environment? Four important review papers with similar titles complete this book.

It is a book to be highly recommended and an essential reference for ice core researchers in the years to come. The price is reasonable for a well-illustrated hard-cover book. (Jefferson Cardia Simões, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER UK.)

ANTARCTIC MICROBIOLOGY

MICROBIAL ECOSYSTEMS OF ANTARCTICA. Vincent, Warwick F. 1988. Cambridge, Cambridge University Press (Studies in Polar Research). 304 p, illustrated, hard cover. ISBN 0-521-32875-6. £37.50.

The 1980s have seen accelerating increases in our knowledge of micro-organisms in the Antarctic. Emerging from a phase of species isolation and description, Antarctic microbiological research is now concerned with processes of community function and with biochemical and physiological adaptations to the singular nature of Antarctic environments. Warwick Vincent has compiled a summary and synthesis of knowledge up to 1988, drawing upon some 500 sources.

The book systematically considers eight major habitat types covering the glacial, marine, freshwater and terrestrial. Each chapter treats environment, microbial communities, microbial processes and trophic structure. Keeping the book to a reasonable size has meant each main ecosystem being limited to about 20 pages (except 'Lakes and Streams', which get a double share), so the information provided is necessarily selective rather than comprehensive. There is emphasis upon studies on continental high longitude Antarctica, understandably from a New Zealand author, and rather less upon those on the Antarctic Peninsula and sub-Antarctic islands with which European scientists are perhaps more familiar. In an informative chapter on microbial strategies, Vincent rightly emphasises the importance of adaptations to diel, seasonal or irregular fluctuations in environmental variables, including a useful discussion on the value of Arrhenius curves in the study of temperature relations. Regrettably the interesting applications of Ratkowsky's equation by Franzmann and others at the University of Tasmania are not mentioned in this context.

The book concludes with a consideration of medical and pollution microbiology in the Antarctic, a huge subject in itself which can only be of increasing significance in future years. A useful glossary and compendium of environmental data are appended. This book is not a critical research review, but serves the probably more valuable function of making its subject accessible to the wider readership of general microbiologists and environmental scientists; it will also find a place in graduate and undergraduate teaching. It is highly enjoyable and readable. (Humphrey G. Smith, Biological Sciences, Coventry Polytechnic, Coventry CV1 5FB UK.)

UNDERSTANDING ICE

LIVING ICE: UNDERSTANDING GLACIERS AND GLACIATION. Sharp, Robert P. 1988. Cambridge, Cambridge University Press. 225p, illustrated, hard cover. ISBN 0-521-33009-2. £15.00, $29.95.

In this book Robert Sharp, Professor Emeritus at the California Institute of Technology, gives the reader the benefit of his 40 years of research and teaching experience in glaciology and glacial geology in a nontechnical style of writing. The purpose of the book is "to touch upon some basic aspects of glaciers, their behavior, and the principal ways they shape the landscape. Information is presented in an informal, conversational manner ...". The author has done the job well. The title *Living ice* is an indication of the manner in which one can associate with the dynamics of glaciers and the work they perform. Indeed, glaciers are hard workers, as evidenced by the products of their toil.

The book is, in some respects, a takeoff from *Glaciers*, an earlier publication of Sharp's published in 1960 by University of Oregon Press. Many of his excellent photographs and illustrations appear in both. *Living ice* is well illustrated with 76 black-and-white and eight colour photographs, most of them taken by Sharp and his colleagues to show examples of glaciers and related features in mainly Alaska, Yukon Territory and Blue Glacier in Washington, USA. A useful aid throughout the text is the boldface type for terms defined later in the glossary, which lists about 360 of them. An annotated list of 13 references is included for supplementary reading.

The book consists of nine chapters, beginning with how a glacier is made (take a lot of snow, as much as possible), followed by chapters on the types of glaciers and how they move. Later chapters are on erosion and its products. Each chapter concludes with a summary. The final chapter deals with the past and the future; that is, the most recent continental ice ages and their proposed causes, and what the future holds.

The conversational style of writing is especially appealing, enhanced with numerous similes and metaphors

to facilitate easy comparisons of glacial processes for the lay reader. Describing the surge of Variegated Glacier, Alaska, in 1982-3, the "major surge was not a single simple event. Rather, the glacier behaved like an athlete warming up for an event by taking deep breaths, doing calisthenics, and engaging in short sprints to flex muscles and get in trim for the main event". Sharp personalizes glaciers and their actions: "[a] glacier also deepens the valley, not because it needs to, but because it can't help it" (p. 105). He points out the inevitable unknowns and mysteries of glaciology that await solutions by future investigators, such as dislocation creep (p. 66), "not yet fully and satisfactorily understood", and kinematic waves (p. 70), for which "more actual measurements of wave character and behavior are needed". For the future — "If all the world's glaciers were suddenly melted, the results would be catastrophic. Florida would be reduced to a few tiny islands ... [with a] rise in sea level of 70 meters or so". It is also possible that the last Ice Age is not over and we may be living in an interglacial period, to be followed by another period of cold and widespread glaciation. As the author states in the final words of the text, "Could it all happen? Yes, indeed!"

There are a few minor errors to be corrected in future editions; for example the maximum thickness of the Antarctic Ice Sheet appears as 4300 m on p. 24 and more than 5000 meters on p. 174, and there are spelling and printing mistakes. As the dust cover states, this book is a must "for anyone with a passing knowledge of earth science and an interest in the world of living ice"; it is also a genuine bargain for the price. (John Splettstoesser, 1 Jameson Point Road, Rockland, Maine, 04841 USA.)

HIGH ARCTIC VEGETATION

VEGETATION OF THE SOVIET POLAR DESERTS. V. D. Aleksandrova. 1988. Cambridge, Cambridge University Press (Studies in Polar Research). 228 p, illustrated, hard cover. ISBN 0-521-32998-1. £30.00, US$49.50.

Published originally in Russian in 1983, this polar classic has been translated by Doris Löve, who also contributes a foreword. The English edition was encouraged and seen through the press by the late Dr Stanley Greene, who did much to make Soviet arctic studies available in English. The work is based mainly on the Alexandrova's own research in Zemlya Frantsa-Iosifa, one of the world's most northerly island groups, but includes that of many Soviet colleagues in the far north and tundra. As such it is a valuable window on the Eurasian provinces of the Arctic.

The first 30 pages include a brief introductory chapter, followed by two short chapters describing the geographical background, climate, soils and snow regime, and giving detailed treatment of the microclimate in plant-growing conditions at ground level. Virtually all the rest of the book is devoted to the vegetation. Chapter 4, over 120 pages long, is a comprehensive survey of plants and communities on all the Soviet Arctic Ocean islands, in both the Barents and Siberian provinces. Chapter 5, of 40 pages, deals with the flowering plants, with special reference to seasonal development of named species that were the author's special study. The final chapter, called 'Conclusions' can best be described as thoughts on particular communities, on the overal structure of the flora, species composition of flowering plants and the concept of aggressiveness in plant colonization.

This is not an exciting, challenging or speculative book; it sticks tightly to its title, and has little to say about other arctic areas, still less about comparable plants and plant communities in the Antarctic. However, it puts before us in readable English a wealth of well-marshalled fact and natural history observation hitherto available only in Russian. Every polar plant ecologist will need it for reference. (Bernard Stonehouse, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER, UK.)

MUSK OXEN

THE MUSKOXEN OF POLAR BEAR PASS. Gray, D. R. 1987. Markham, Ont., Fitzhenry and Whiteside. 191 p, illustrated, hard cover. ISBN 0-88902-944-X. Can$50.00.

David Gray met his first musk oxen as a member of the Canadian National Museum of Natural Science's first expedition to Bathurst Island in 1968. There followed a five-year doctoral study and later intermittent work, on which this book is based. Gray writes of musk oxen, of the Arctic and its wildlife, and of himself. This is an intensely self-conscious book, with the personal pronoun prominent on every page; some readers may find the author and his feelings unduly intrusive. Nevertheless he gives us plenty of solid information about the community of musk oxen studied, and abundant collateral information on the environment in which they live and plants, birds, mammals and people that share the habitat. The final chapter, 'Summing up', is the least personal and the most thoughtful — an admirable summary of the species, its ecology and behaviour. The book is well illustrated with photographs and maps, and excellent line drawings by P. Geraghty illustrate behaviour. (Bernard Stonehouse, Scott Polar Research Institute, University of Cambridge, Lensfield Road, Cambridge CB2 1ER UK.)

BRIEF REVIEWS

NORTHERN HYDROCARBON DEVELOPMENT IN THE NINETIES: A GLOBAL PERSPECTIVE. Frankling, Freddie. T. 1989. Ottawa, Geotechnical Sciences Laboratories, Carleton University. 257 p, illustrated, soft cover. ISBN 0-7709-0245-6. Can$75.00. Available from GSL, Loeb Building, Carleton University, Ottawa Ont. K1S 5B6.

Proceedings of a conference held in September 1988 in Yellowknife and Calgary, to provide an overview of Canadian oil and gas developments, and examine them in a global setting. Over 40 papers under the following nine headings: Understanding Canada's north; Managing development; Northern hydrocarbon potential: Regulation; Science, technology and the environment; Environ-