whale and talk whale and nothing but whale'. Otto guessed that this was Eskimo psychology, and sometimes they were convinced it had worked for them. Maybe it did."

The author has an unfortunate habit of almost killing a chapter by a clumsy first sentence. "Wrinkled Owhwowin totteringly poised her body over the battered cooking kettle that served the household as a chamber pot" — this must surely be the most bizarre first sentence in any book!

The book is well illustrated and indexed, and the design and the typography are clean and pleasing. But there is no map.

Professional archaeologists and ethnologists wince at the way in which enthusiastic amateurs launch themselves into the field and begin digging and recording. The wheel has come full circle, and many traditional peoples are beginning to resent having their graveyards pillaged, their oral history looted, and their daily routines disturbed by "objective" seekers after knowledge and academic promotion. Otto Geist's very lack of professionalism was what endeared him to the native peoples of Alaska. He lived their life and accepted them as his mentors. They accepted him as a human being first and foremost. This book reveals some dimensions of an extraordinary man who could talk to scientists and live with Eskimos. Such men are rare these days. A definitive biography of this outstanding Alaskan still remains to be written.

Jim Lotz

THE PHYSICS OF GLACIERS. By W. S. B. Paterson. *Oxford: Pergamon Press Limited, 1969. 5 x 7¾ inches, 250 pages, illustrated. Hardcover $5.50. Flexicover $4.00.*

Stan Paterson and Pergamon Press have performed a notable service in producing "The Physics of Glaciers", for which all glaciologists, and especially teachers of that and related subjects, will be most grateful. This inexpensive book covers most of the many facets of glaciology in a direct, and simple fashion, sufficiently rigorously to appeal to mathematically-minded students, but with excellent word descriptions of physical processes that should be readily understood by the reader with very little scientific training.

The book is divided into an Introduction and eleven other chapters, dealing with snow metamorphism, mass and energy balances of glaciers, the measurement and theory of glacier and ice sheet flow, temperature distribution in glaciers and ice sheets, and their response to changes in mass balance and to climate generally. The subject of glacier surges, one of the fascinating "discoveries" of the last decade, but for which no adequate explanation yet exists, occupies a separate chapter. For some of the chapters general references are given under the heading "Further Reading"; and throughout the book, Paterson makes specific references to a well-selected list of original papers that cover developments in the science until early 1968. The whole subject is advancing so quickly that a new edition will be needed in four or five years, but the fundamental material is so well presented that the new edition will involve only an up-dating, and not a rewriting.

Throughout, the level of treatment is appropriate for senior undergraduates and first-year graduate students in physical sciences. The mathematical treatments, necessarily brief, are nevertheless carefully presented so that I judge my geology students will be able to follow without trouble, and will be able to apply the material in their own work. Although no mention is made of till, esker or kame, glacial geologists will find the book a most useful aid in discussing the formation of the features in which they are interested, and the chapter on basal sliding is a good starting point in considerations of erosion processes.

Any reviewer can offer criticisms of any book. I am sorry that Paterson omitted treatments of Thule-type moraines, of the methods of measuring accumulation on ice sheets, of the information on past climates available from the study of long ice cores but, assuming that the length of the book is prescribed, I cannot make corresponding suggestions for the material that should have been excluded. Altogether this is a remarkably good introductory book, and I recommend it wholeheartedly to anyone with even the slightest interest in glaciers. Undoubtedly their interest will be enhanced.

Colin B. B. Bull

POLAR OPERATIONS. By Edwin A. MacDonald. *Annapolis, Maryland: The United States Naval Institute, 1969. 8¾ x 9 inches, 239 pages. $11.00.*

This publication should be required study material for any Master prior to taking command of an icebreaker. However, I do believe that it should have been entitled Polar *Icebreaker* Operations as it deals mainly with this type of operation. Another serious mistake is grouping the Antarctic and Arctic as somewhat similar in ice characteristics,

whereas there are far more differences than similarities, just as the Russian-Alaskan navigational areas are as different from those of mid-Canada as the eastern Arctic is from the latter.

In dealing with icebreaker operations, Captain MacDonald covers every phase with authority and first-hand knowledge but leaves the impression that polar voyages can only be conducted successfully with the aid of icebreaker escort. This is anything but the fact as almost all marine operations in the western Arctic are unescorted and have been for some time. With proper aerial reconnaissance and weather reports any well found ship should be capable of carrying out a successful voyage almost anywhere in ice navigable waters as time is generally not the essence.

The main interest and activities of the author were in the Antarctic and it is too bad that he did not concentrate on the one polar area. For instance: any type of cargo aircraft *can* land on one year ice in the Arctic, even the largest craft (p. 12). While the Arctic polar basin may have moving ice all year, this is certainly not the case in areas used for navigation. The Canadian Arctic Archipelago is composed of almost completely land-fast ice during the winter as is the mainland coast (p. 13). Present icebreakers do not guarantee scheduled service through the Northwest Passage as even icebreakers have been beset or disabled and will continue to be. Small vessels have made the Passage as Captain MacDonald states but did not take "at least a couple of years" due to ice conditions, but because the expeditions had other purposes to accomplish first. Amundsen took 4 and Larsen 3 years; but when it became the prime mission for the latter, he did make the Passage in one year (1944). Prince Regent Inlet is of little consequence in making the southern Passage as it is only used by way of Bellot Strait, as a short cut: Peel Sound is a much better ice-free route (p. 20). Page 128 covers the use of bay ice to unload cargoes. However, while this is true of the Antarctic, there is no bay ice in the summer in the Arctic except in the areas that shipping has not yet reached.

Living off the land is suggested on p. 170. This is a concept far easier to visualize than to effect, as one must assume two circumstances rarely occurring simultaneously in the Arctic: (a) that game is available; (b) that the survivor in an expert hunter. The present concept is to make sure that survival rations are available; a maximum intake of fluids, and rest until rescued. The suggested survival kit on p. 163 could be greatly improved. Methyl hydrate alcohol for starting the primus stove and cleaning picks, a *must*, should be included. An ordinary hand saw is much more efficient for cutting snow blocks than a knife and requires no expertise. Ice chisels would be very much more useful than ice axes.

Two points that Captain MacDonald makes are the most important to me: "Obviously, it would be better never to get into such predicaments" (p. 60, besetment in ice) and "Remember, also, that some ice can never be budged by any icebreaker in the world, and the forces of nature, wind, and current can move more ice in a few hours than an icebreaker can in a lifetime" (p. 67).

In spite of isolated criticisms, I heartily endorse this text of icebreaking operations in the polar areas and am much impressed by the painstaking research involved in producing the only publication of its kind.

Scott E. Alexander

POPULATION ESTIMATES OF BARREN-GROUND CARIBOU, MARCH TO MAY 1967. By Donald C. Thomas. *Canadian Wildlife Service Report Series, Number 9. Ottawa: Department of Indian Affairs and Northern Development, 1969. 8½ x 11 inches, 40 pages, 13 figures, 25 tables. $1.00.*

This is a welcome contribution to knowledge of the improved population status of the barren-ground caribou in Canada after the drastic herd reductions of the 1950's. Donald Thomas, in this short, but very detailed report, has provided information on late winter distribution, spring migration routes and total population numbers of caribou in the Mackenzie District and adjacent portions of Alberta and Saskatchewan. Based almost exclusively on aerial surveys conducted during March and May 1967, the study also provides information on effectiveness of comparative census methods, recruitment rates, human utilization, and predation by wolves.

Thomas estimated that 322,500 caribou existed in the census area and, with other caribou wintering east of 102°W., the total number of barren-ground caribou on the mainland of Canada in 1967 was 387,000. This represents a 7.6 per cent average annual rate of increase from the 200,000 estimated by Kelsall in 1957-58. Recruitment in the survey region was found to be 11.0 per cent, however, when related to mortality statistics the rate of increase in 1966-67 was 2 per cent. Although hunting of caribou is still important to the native people living in the study area, total harvests have decreased