

- of Wisconsin, Madison, Wisc., U.S.A.
Geophysical investigations in the Arctic Ocean Basin.
- Poulter, Thomas C., Biological Sonar Laboratory, Stanford Research Institute, Menlo Park, California, U.S.A.
Recording of the underwater signals of seals and sea lions in the Arctic.
- Reeder, William G., The University of Wisconsin, Madison, Wisc., U.S.A.
Study of ecology and behavior of the Arctic Ground Squirrel (*Citellus parryi*).
- Rowett, Charles L., University of Alaska, College, Alaska, U.S.A.
Paleontological study of upper Paleozoic corals from the Alaska Range, Alaska.
- Schell, Irving I., Tufts University, Medford, Mass., U.S.A.
To enlarge upon the work begun on the nature of the relationship of the ice in the oceans.
- Simoni, George, Don Mills, Ontario, Canada.
Study of the relationship of ice flow and physical properties to bedrock topography in a Valley Glacier.
- Sterling, William B., Bloomsburg State College, Bloomsburg, Pa., U.S.A.
Studies in climatology and meteorology at the Icefield Ranges Research Project.
- Smiley, Charles J., College of Mines, University of Idaho, Moscow, U.S.A.
Studies on stratigraphic paleobotany in northern Alaska: the Cape Lisburne area.
- Taylor, Beatrice, McGill University, Montreal, Que., Canada.
Studies in meteorology at the Icefield Ranges Research Project.
- Tinker, Altha H., Lasell Junior College, Auburndale, Mass., U.S.A.
Small mammal ecology study at the Icefield Ranges Research Project.
- Wheeler, E. P., Cornell University, Ithaca, N.Y., U.S.A.
A geologic mapping of anorthosite complex.
- Yoshino, Takeo, The University of Electro-Communications, Japan.
Electro-magnet wave propagation.

Reviews

ANTARCTIC SNOW AND ICE STUDIES. MALCOLM MELLOR, editor. Antarctic Research Series, Vol. 2. American Geophysical Union of the National Academy of Science. Publication No. 1197. 1964. 10½ x 8 inches. x + 267 pages. Text figures, tables, maps. 10 chapters. \$12.00 (U.S.).

The *Antarctic Research Series* is published by the American Geophysical Union with the aid of a grant from the U.S. National Science Foundation. It provides an excellent medium for the prompt publication of the findings of the numerous American research operations in Antarctica.

H. W. Wells, the chairman of the board of editors, says in his foreword that "in a sense the series continues a tradition . . . of the expeditionary volumes which set forth in rich detail everything that was seen and studied . . . The material published is directed not

only to scientists actively engaged in the work but to graduate students and scientists in closely related fields as well."

During 1964 the first three volumes of the series appeared in quick sequence: 1) *Biology of the Antarctic Seas*, 2) *Antarctic Snow and Ice Studies*, and 3) *Polychaeta Errantia of Antarctica*. Volume 4 entitled *Geomagnetism and Aeronomy*, has just been announced.

Volume 2, "Antarctic Snow and Ice Studies", edited by Malcolm Mellor, contains ten independent papers. Presenting, as it does, new data from various glaciological studies, it is a book which must be perused by any practicing glaciologist. In his lucid preface the editor recounts the development of Antarctic research and in so doing explains the variety in topic and in degree of sophistication of the fieldwork and data

evaluation in the papers of this volume. The heterogeneous nature of this collection of papers, which at first surprises the reader, is in fact a true reflection of the present status of our knowledge of snow and ice in Antarctica. At this stage reports on Antarctic research cannot be standardized.

Cameron's paper "Glaciological Studies at Wilkes Station, Budd Coast, Antarctica", is a good example of a classical glaciological study of a selected region encompassing geological background, climate, snow accumulation, ice and firn temperatures, ice movement, regime and the former extent of the ice sheet. Such pioneer studies are still required. Shimizu's "Glaciological Studies in West Antarctica 1960-1962", on the other hand, is more specialised, dealing mainly with snow stratigraphy and the relationship between firn temperatures and climate. His snow pit analysis did not yield the expected results and he states on page 43 that, "Despite many trials, a definitive method was not found for determining annual accumulation using stratigraphy, snow density, and ram hardness profile. Strata from the same pit can be interpreted quite differently by two observers." R. M. Koerner (*Firn Stratigraphy Studies on the Byrd-Whitmore Mountains Traverse, 1962-1963*) applied similar pit techniques and came to somewhat less pessimistic conclusions, but he points out that "little . . . information will be gained from a continuation of traverse glaciology using traditional methods until the validity of these methods is determined by analysis of controlled snow-firn-stratigraphy at one or more stake farms." (p. 230).

Three contributions deal with the Ross Ice Shelf—a vast natural laboratory which offers a fine chance to solve some fundamental problems of ice flow. J. H. Zumberge's determinations of "Horizontal Strain and Absolute Movement of the Ross Ice Shelf between Ross Island and Roosevelt Island, Antarctica, 1958-1963" are based on three consecutive surveys of stakes at 20 mile intervals; various theories

regarding the Shelf are discussed in the light of the findings, though the accuracy of the earlier surveys is questioned. The paper by W. Hofmann, E. Dorrer and K. Nottarp, "The Ross Ice Shelf Survey (RISS) 1962-1963" details the new instrumentation and techniques applied in the third survey of the Ross Ice Shelf stakes. The full results of this telurometric survey will only be available in a few years' time after the measurements have been repeated. As a rider to these ice movement studies, some 2000 accumulation measurements were made on the stakes, which are analysed by J. A. Heap and A. S. Rundle in "Snow Accumulation on the Ross Ice Shelf".

The summary account of the accumulation for the entire continent by M. B. Giovinetto, "The Drainage Systems of Antarctica: Accumulation" is, by virtue of its critical approach and by its results, a significant contribution to the Hydrological Decade and such a study should be made of all glacierized areas on the earth.

A comprehensive analysis of snow density data to a depth of 10 m. from the numerous U.S. Antarctic traverses since 1957, is made by K. Kojima in "Densification of Snow in Antarctica". This, by far the longest paper in the volume, is an authoritative monograph on an important topic which has held the attention of some of the best minds since the beginning of modern glaciology; to mention just two—E. Sorge and H. Bader.

"Structural Glaciology of an Ice Layer in a Firn Fold, Antarctica" by J. R. Reid, Jr., is an excellent and detailed investigation of great interest to both glaciologists and geologists. The author questions, however, the feasibility of applying the findings from ice, a monomineralic rock, to more complex rock types. Large portions of this paper, including most of the illustrations and tables, appear in the *Journal of Glaciology*, Vol. 5, No. 38, pp. 191-206.

The last paper in this volume describes the techniques applied and the first results from a study of the "Dis-

tribution of Particulate Matter in a Firn Core from Eights Station, Antarctica" by L. D. Taylor and J. Gliozzi.

It is noted that more than half of this book is written by scientists connected with the Institute of Polar Studies at Ohio State University.

A high standard of scientific writing is maintained throughout and the editing of the text is excellent. Not one typographical error was noted, a fact which gives the reader confidence to use this book with its large amount of numerical material as a reference source. The illustrations, including a large number of fold-in maps and diagrams, are clear and well reproduced. High quality paper and first-class workmanship in the production of the book give it a good appearance. It is sincerely hoped that the good intention of the organizers of the series, *i.e.* to make available the vital information gained in extremely expensive field operations, will not be defeated by the high price of this publication.

Fritz Müller

**EARLY AMERICAN HISTORY:
NORSEMEN BEFORE COLUMBUS.**
By J. KR. TORNÖE. Norway: Norwegian Universities Press, 1964. 5½ x 9 inches. 127 pages, 4 plates, 8 text maps, 1 folding map. N.Kr. 15.00.

In this work M. Tornöe tackles the ever-fascinating riddle that has interested him for thirty years, of where the Norsemen attempted to found settlements in North America. Beginning with the view that the sagas were "mainly fiction" he later accepted them as "based on fact". He has the advantage of much youthful experience with sailing boats in Norse waters and, where others failed, he succeeds in explaining how to "svipt" a sail. He is unlucky in his timing since his book has appeared before Helge Ingstad's report on L'Anse-aux-Meadows but after Gwyn Jones's *The Norse Atlantic Sagas*. The difference between his conclusions and those of Gwyn Jones is striking.

Tornöe believes the sagas "were written about the time of Are Frode (1068-

1148)". Jones more conventionally accepts them as later "workings over of original material" with dates not earlier than 1200 for the *Graenlendinga Saga* and certainly after 1263 for the *Eiriks Saga Rauda*. The two authors also differ in their identification of particular places.

The arguments with which Tornöe supports his conclusions hardly seem convincing. He needs to estimate the distances which Norse seamen covered, and hence their speed of sailing; therefore he cites the *Viking*, a facsimile of the Gokstad ship in which Captain Magnus Andersen sailed from Norway to America in 1893. Andersen tested this vessel against modern sailing ships and "to his great surprise his *Viking* kept pace with most of them", with an average speed of 10 knots per hour. Then Tornöe allows Bjarne Herjolfsson "an average speed of 10 knots" (p. 40) and, by inference, the same for Leif Ericsson (p. 59). But broad and heavy laden merchant ships, like Bjarne's, would not necessarily sail as fast as a light vessel of the Gokstad type; and 10 knots seem improbable. Then as now winds were variable, and a friend, whose merchant voyages under sail total nearer 20 than 10 thousand miles, insists that modern sailing craft could not count on averaging much over 100 miles in 24 hours. Another friend, a yachtsman experienced in New England waters, also questions Tornöe's estimates of average speeds; and any over-estimate of their speeds would exaggerate the length of Norsemen's voyages.

Alternatives must also be eliminated before particular places can be identified from saga descriptions. It can be very difficult to do this, as the *Furdustrandir* show. Forty miles of beach worthy of the name of "Wonderstrands" would seem hard to duplicate. Yet those Tornöe picks on Cape Cod are matched by the beaches in Labrador which Jones prefers. Tornöe's argument that Leiv's sun observation supports the choice of Falmouth, Cape Cod, as the site of his *budir* is insecure too. As the