

The actual problem of the reasons both for the ice ages and the other climatic changes are treated in the third part of the book. No fewer than 50 theories have been advanced; discussions were liveliest during the turn of the last century when half of these were published. The presentation is as clear and instructive here as in the other parts. The author's own opinion on this problem is that the changes in climate have mainly been caused by a combination of changes in solar radiation and continental topography. To the oldest epochs are added both the changes in the earth's axis and continental drift. The latter is mainly applied to the change between the Carboniferous and the Permian periods, when Gondwanaland is said to have existed, covered with ice in different parts.

Finally what can be expected in the future? Is the earth at present in a milder period between the latest glacial period and a future one? Schwarzbach does not say much more about that problem than: *Qui vivra, verra*—provided that we survive the present time.

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AKADEMIYA NAUK KAZAKHSKOY SSR. OTDEL GEOGRAFIH. *Mezhdunarodnyy Geofizicheskiy God. Glyatsiologicheskiye issledovaniya v period MGG: Zailiyskiy i Dzhungarskiy Alatau* [International Geophysical Year. Glaciological research in the period of the I.G.Y.: Zailiyskiy and Dzhungarskiy Alatau]. Vyp. 1. Alma-Ata, Izdatel'stvo Akademii Nauk Kazakhskoy SSR [Publishing House of the Academy of Sciences of the Kazakh S.S.R.], 1961. 234 p.

THE little-known alpine glaciers of the Zailiyskiy and Dzhungarskiy Alatau of the Kazakhskaya S.S.R. were subjects of detailed glaciological study as a part of the I.G.Y. program. Field observations from July 1957 to December 1959 continued studies initiated by the Academy of Sciences of the Kazakhskaya S.S.R. in the Dzhungarskiy Alatau in 1947. Specialists from the Academy of Sciences of the U.S.S.R., from the University of Moscow, and from East Germany collaborated with those of the Academy of the Kazakhskaya S.S.R. to provide the broad coverage of disciplines related to the I.G.Y. glaciological program.

The recently published volume of results comprises 17 papers in Russian that deal largely with those studies centered on the Maloalmatinskiy and Tsentral'nyy Tuyuksuyskiy glaciers of the Zailiyskiy Alatau, along the southeast border of Kazakhstan. These papers cover a wide variety of subjects, such as the environment of the alpine zone as related to its meteorology and insolation and their effects on the alimentation of the glaciers, the conversion and changes in the physical properties of snow during its metamorphism to glacier ice, ablation, thermal gradient within the glaciers, and surficial glacier motion. Of special interest are reports on ice-boring techniques, methods for determining the thickness of glaciers, and the application of an electrical method to the study of recent moraines. Descriptions of older moraines and related river terraces of outwash and of bedrock benches along valley walls indicate glacier fluctuations in the Dzhungarskiy Alatau that are suggested to be possibly correlative with those of European glaciers during the Riss and Würm stages.

The extensive bibliographies of Russian reports that accompany each paper will prove a boon to specialists wishing for further information. Brief English summaries for each paper are helpful in determining their general content, but they range widely in the amount of informative data given. Those not familiar with the Russian language will wish that captions to the

many tables and figures scattered throughout the volume had been translated. The lack of large-scale maps of the glaciers and the adjacent terrain is a serious handicap to the student who desires a clearer concept of the glaciers and the spatial location of the study areas relative to the local terrain. However, this valuable and timely contribution of results obtained in a little-known area is welcomed heartily by those interested in the results of the I.G.Y. program. Not only are specific data made available, but an opportunity is presented for comparison of results with those obtained by other I.G.Y. programs in far separated areas of alpine ice cover.

LOUIS L. RAY

J. CORBEL. *Neiges et glaciers*. Paris, Librairie Armand Colin, 1962. 224 p. (Collection Armand Colin, No. 361.) Fr. 5.70.

IN this midget volume the author has briefly reviewed the more descriptive aspects of the broad subject of snow and glaciers. With the aid of many tables and diagrams a surprising amount of useful information has been compressed into the relatively few small pages. The purely factual information is presented in an interesting manner and illustrative examples have been drawn from the multitude of available sources.

The author's approach to the subject as a whole is certainly logical, describing in turn the physical characteristics of snow and snow cover, the relationship between climate and snowfall, and the physical processes of the glacier. The latter part of the book is devoted to a careful discussion of glaciers of three separate latitudinal species, the erosive processes and morphology of glaciers, and the Quaternary glaciation. It is unfortunate that no serious attempt has been made to include a section on the mathematical theory of glacial movement.

At the end of the book there is an appendix of "statistical tables", which contains useful facts on the Antarctic and the Arctic, snow and glaciers. The selected bibliography is comprehensive, including most of the important papers to be recommended to the intending student of the subject.

This "pocket-size" handbook is well worthy of consideration by anyone seeking an introduction to "snow and ice".

R. J. ADIE

G. O. RAASCH, ed. *Geology of the Arctic: proceedings of the first international symposium on Arctic geology held in Calgary, Alberta, January 11-13, 1960 under the auspices of the Alberta Society of Petroleum Geologists*. 2 vols., map folder. Toronto, University of Toronto Press, 1961. (Distributed in G.B. by Oxford University Press. £10 4s.)

AT last the many fascinating facets of Arctic regional geology have been brought together in one volume of 732 pages and containing 60 papers. The majority of the papers provide detailed information on restricted topics and only one or two present thoroughly complete geological summaries of any one area. The downfall of this volume is the lack of co-ordination of the stratigraphy, etc., from one area to another—this is a symposium volume, not a textbook, and the reader is left to deduce any correlations there may be.

The second volume of 462 pages is in two separate sections; the first contains a selection of 30 papers and abstracts on glaciology, permafrost, climatology, geomorphology, etc., whereas the second has 13 papers on the problems of logistics and exploration.

There is no single theme in the glaciological papers. They cover a wide range and include such diverse topics as seismic refraction sounding in permafrost, thrust fracture patterns in young sea ice and the more routine glaciological studies in Arctic Canada or Greenland.

The two volumes are superbly printed and bound, and all the illustrative maps (including those in the separate folder) are generally of a high standard. The editor is to be congratulated on bringing together so many interesting papers in such an attractive form.

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