

## REVIEWS

F. MÜLLER and others. *Jacobsen-McGill Arctic Research Expedition to Axel Heiberg Island, Queen Elizabeth Islands. Preliminary report of 1959-1960, by Fritz Müller and members of the expedition. Edited by Barbara S. Müller.* Montreal, McGill University, 1961. x, 219 p.

F. MÜLLER and others. Preliminary report 1961-1962, [by] F. Müller and others. *Axel Heiberg Island Research Reports, McGill University, Montreal. [Jacobsen-McGill Arctic Research Expedition 1959-1962]*, 1963, xiv, 241 p. \$4.50. Map supplement. \$1.50.

R. H. ANDREWS. Meteorology. No. 1. Meteorology and heat balance of the ablation area, White Glacier, Canadian Arctic Archipelago—summer 1960 (Lower Ice Station: 79° 26' N, 90° 39' W, 208 m.). *Axel Heiberg Island Research Reports, McGill University, Montreal. Jacobsen-McGill Arctic Research Expedition 1959-1962*, 1964, viii, 107 p. \$2.00.

These reports may be obtained from the office of the Axel Heiberg Expedition, McGill University, 3675 Peel Street, Montreal 2, P.Q., Canada. The *Preliminary report of 1959-1960* is out of print. Reprinting depends on the number of requests for it.

IN 1959 McGill University sponsored the first of its expeditions to Axel Heiberg Island and these reports cover the activities of this and three later visits. The island lies off Ellesmere Island, and is one of the most northerly of the Canadian Arctic islands, lying between lat. 78° N. and lat. 81° N. It covers a similar area to that of Switzerland and is uninhabited being but rarely visited even by hunting Eskimos. The central mountainous backbone rises to a height of 2,000 m. and is largely covered by two ice caps, 26 small highland ice fields and *c.* 200 glaciers. Most of the latter act as outlets for the ice caps, though a few, such as White Glacier, possess independent alimentations areas of alpine type. The first expedition established a base camp near White Glacier which will ultimately serve as a high Arctic research station for McGill University.

Although the work of the expedition in 1959 and 1960 was largely of an exploratory character, a considerable number of detailed observations were made especially in the fields of meteorology and glaciology, and the surveyors established 105 ground control stations for aerial survey. Preliminary surveys of the geology and botany were also carried out. The geologists found an interesting series of gypsum diapirs, allied to salt domes caused by the flow of gypsum under intense earth pressures. The mimeographed reports are short and to the point giving summaries of the results obtained in the field.

The second preliminary report is a much more finished document, both typographically and scientifically. The individual papers are based upon the work of four seasons and the authors are in a better position to draw some preliminary conclusions from their work. The leader, Fritz Müller, contributes a series of papers on glaciology, chiefly concerned with mass budget, glacier movements and temperatures. Other reports deal with geophysics (especially seismic, and gravity work on glaciers), meteorology, geomorphology, botany, zoology and permafrost. The geomorphological programme was chiefly concerned with ice-marginal features and the study of processes operating in this cold and relatively dry area. Besides purely botanical studies of fungi, other biologists were concerned with the contribution of tree-ring and pollen analysis to the understanding of the recent geological history of the island. Once again the papers are models of condensation without losing readability, and maps, diagrams and tables are used extensively to present data in a digestible form. The map supplement contains two geological, two topographical and two geomorphological maps. The map of Thompson Glacier region at the scale of 1 : 50,000 is a really beautiful production with ice and rock relief shown by contours and skilful hill-shading.

Mr. Andrews' short monograph is one of the first of the detailed studies to be published. This deals with four months of intensive work on White Glacier, which took over a year of full-time preparation. This work has been co-ordinated with the world-wide scheme of the

Commission on Snow and Ice of the I.U.G.G. to study the variations and mass budget of typical glaciers. Andrews concludes that for the summer of 1959 47.6 per cent of the heat supply came from radiation with sensible heat and latent heat contributing 32.4 and 20.0 per cent respectively. He also concluded that 91.7 per cent of the total heat was used to melt the ice, the remainder being conducted downwards to heat the glacier. The wind strength was found to be very important in the ablation process, especially under foehn-wind conditions. As in the shorter reports, the data are clearly presented and the analysis is clear and to the point.

Dr. Müller and his colleagues are to be congratulated on the great amount of detailed quantitative measurement that they have carried out under trying conditions and also for their successful attempt to convey to their co-workers the essential features of their experience without confusing the issue with irrelevant detail.

GORDON T. WARWICK

HERFRIED BERGER. *Vorgänge und Formen der Nivation in den Alpen: ein Beitrag zur geographischen Schneeforschung*. Klagenfurt, Verlag des Landesmuseums für Kärnten, 1964. 88 p., illus., [20 plates]. (Buchreihe des Landesmuseums für Kärnten, 17. Bd.)

IN comparison with the voluminous literature upon glacial erosion the study of the geomorphological effects of snow has been sadly neglected, though as Costin and others recently pointed out in this *Journal* (Vol. 5, No. 38, 1964, p. 219–28) agreement has not been reached about the ability of snow to erode. Herr Berger has helped to swell this literature with a useful account of the form and mechanism of moving, static and melting snow and of the resulting effects, with special reference to the Austrian Alps, though general considerations predominate over the particular.

Berger classified the alpine snow into five main classes with thirteen subdivisions, based largely upon measurements of the density and porosity and of more general descriptions of the dampness, grain size and hardness. He has proposed conventional signs for each type but does not provide any map showing their use in the field. He also describes the physical processes in some detail before classifying the nivation forms. Some of the classifications are supported by the generalized results of quantitative work. It would appear that the more detailed results are to be published later.

In the morphological section Berger makes a fundamental distinction between the upper and lower zones which merge about 2,400 m. above sea-level. In the upper zone nivation features such as snow basins and niches tend to be more concentrated and to dominate the landscape, whereas below more linear forms prevail and are less dominant features and are more scattered in their distribution.

The author provides a very valuable bibliography of 149 items and the text is illustrated by 14 clear line diagrams and at the end are 31 photographs of somewhat variable quality though most are of considerable scientific interest and a few possess great artistic merit.

Future workers will be indebted to Herr Berger for this introduction to high mountain morphological processes, but not all will agree with his classifications which, to Anglo-American readers at least, appear to be a little too tidy and precise to fit the various gradations which one encounters in the field.

GORDON T. WARWICK