GLACIOLOGICAL RESEARCHES IN GREENLAND

GLACIOLOGIE. GROENLAND. VOL. I: FORAGES SUR L'INLANDSIS. JEAN-CHARLES HEUBERGER. *Expéditions Polaires Françaises*. V. Paris, Hermann & Cie. 1954. 64 pages, 14 text-figures, 3 pages of plates.

GLACIOLOGIE. GROENLAND. VOL. II: LE GLACIER DE L'EQE. ALBERT BAUER. *Expéditions Polaires Françaises*. VI. Paris, Hermann & Cie. 1955. 118 pages, 48 text-figures, 26 pages of plates.

M. HEUBERGER's book describes the technique used for drilling two holes in the firn of the Greenland Ice Cap, one at an elevation of 1600 m. (Camp VI) to a depth of 125 m. and another at 2990 m. (the Central Station) to 151 m. depth. A normal diamond drilling rig was used. The holes were sunk dry by continuously coring with a saw-toothed tube, 3 or 6 m. long and about 3·5 to 5 cm. in diameter. The task must have been arduous and is a worthy achievement. The lack of detail about firn stratification and structure is, in the circumstances, to be expected.

The density measurements and descriptions of the profile at Camp VI are typical of the lower part of the accumulation zone of a polar ice cap, but attention is drawn to a series of three dense ice layers, about 2 m. thick, at intervals of about 30 m. At the Central Station the firn density increases gradually to a fairly steady value of about 0·8; lenses of ice are much less frequent than at Camp VI. These density measurements are interpreted on the basis of a "theory of decompression", and the reader may wonder why those at Camp VI are not treated in the same way. No one familiar with firn coring is likely to accept the assumptions underlying the theory. It is suggested that thermal expansion and relief of overburden pressure, as the core is cut, accounts for the apparent decompression, but surely the disruption and bulking always associated with coring in dense firn is the dominant factor.

Two thermistors, apparently lowered into the open boreholes, were used to measure the firn temperature gradients. Following a section specifying the precision of these measurements (not closer than 0·06° C. in absolute value and 0·03° C. in gradients), it is a trifle disturbing to discover in the next section the existence of a variation in resistance of the thermistors in the course of an hour's reading amounting to about 0·2° C. When taking measurements at a given level the thermistor first decreases in resistance, then, after passing through a minimum, it stabilises. The author is unable to explain this phenomenon, but it is almost certainly the well-known heating effect due to using too large a current in the Wheatstone bridge circuit. This can be reduced to a negligible amount by reducing the current. Despite this criticism the records of the temperature gradients are of considerable value. At the Central Station the temperature decreases from about −27° C. at 20 m. depth to about −27·8° C. at 100 m., and then remains almost constant to 150 m. At Camp VI the temperature decreases much more rapidly, from −12·3° C. at 10 m. to −16·3° C. at 120 m. The latter result Mr. G. Robin has recently attempted to explain in terms of the flow of the ice cap and its accumulation.

Professor Bauer's book is well documented with figures and photographs. It is dominated by two Eskimo names "Eqe" and "Eqip Sermia". Are they two names for the same glacier or of different glaciers? Perhaps the former word is an expedition invention abbreviating the latter? Unless the reader is an Eskimo or knows the district, these questions will not be answered unless he reads methodically to page 30. There is a logical reason for two names on the same glacier.

Eqip Sermia is the name of one of the outflows of the inland ice that discharge into Ata Sund, north of Jakobshavn on the west coast of Greenland. The character of the large outflows of ice from the inland basin is discussed in general terms. The old name "ice stream" (fleuve de glace, Eisstrom), suggested by Rink, is adopted. An ice stream is defined as a glacier of great length and discharge, consisting of a current of ice within the inland ice. It only becomes visible as an entity below the firn line, where it forms a highly-crevassed superficial valley. Its course is determined by a sub-glacial rock valley. Near to its tongue it may become a typical valley glacier.

Eqip Sermia has a visible length of about 80 km. and is some 10 km. wide, only its lower four kilometres can be called a valley glacier and its name is the Eqe Glacier.

The major part of the book is devoted to the movements of the frontal sea cliff (about 4·5 km. long and up to 100 m. high) of the Eqe Glacier, to observations of its surface velocity, and to the chronology of its moraines. Comparisons of early maps and records show that the front retreated from 1904 to 1912, advanced about 1920, retreated to its 1912 position in 1929 and retreated another 2 km. by 1948. These movements confirm the position and date of the moraines adjacent to the tongue. The glacier surface is broken into seracs and, as expected, its daily movement is quite irregular in magnitude and direction. The net displacements over a period of one week seem to give a reasonable direction for the general flow and an average velocity of about 3 m. per day. This is small compared to the speed of many Greenland glaciers. The speed adjacent to the edges of the glacier appears to be as great as it is in the centre and the author suggests that it is moving like a block. This view is hardly compatible with the highly-crevassed nature of its surface.

It is pointed out that the glacier front is not afloat, since the minimum height of the cliff is 50 m. above sea level and the ice extends to a maximum depth of 150 m. below sea level. Yet in estimating the shear stress on the bed no account is taken of the buoyancy of the sea. It seems very likely that this force is effective and it decreases the calculated value of the bed shear stress from 1·6 to about 1 bar.

This book is a useful record for future visitors to the area.

W. H. Ward

SNOW COVER IN THE SIERRA NEVADA, CALIFORNIA. David H. Miller. University of California Publications in Geography, Vol. 11. Berkeley and Los Angeles, University of California Press, 1955. 218 pages, 11 text-figures. Price $3.00.

The Sierra Nevada of California is covered by a deep mantle of snow in winter and spring, but in spite of this the spring days are warm and even the nights are mild. This departure from the classic belief that snow surfaces must give rise to a severe climate is examined in great detail, and is traced to two main and a variety of subsidiary causes. First, the anticyclonic curvature of the air circulation at the 700 mb. (about 10,500 ft., 3200 m.) level on many days results in very dry subsiding air. This permits a great deal of solar radiation to penetrate to the ground, and also brings down heat from above by day though not by night. This accounts for the warm days. Secondly the climate is considerably modified by the open forests which cover 40 per cent of the area. The albedo of trees is low, and they absorb a great deal of the solar radiation; in calm weather leaves may be 10–12° C. warmer than the air. This heat is transferred to the air and ground, and some of it is conserved until night. Some other factors work in the same direction. The albedo of fresh snow is high, but in the long sequences of "weathering days" between storms it decreases rapidly, especially in spring. Melt water formed during the day sinks into the snow and some of it freezes again at night, releasing its latent heat. The large amount of run-off is itself evidence of the mild spring climate.

This University thesis is a mine of information about the Sierra Nevada (there are 84 tables of data), but also contains a great deal of well-documented material about the physics of snow in other mountain ranges. The bibliography of some 400 items is evidence of the author's wide reading.

C. E. P. Brooks

https://doi.org/10.3189/S0022143000033190 Published online by Cambridge University Press