REFERENCES

1. Nye, J. F. A method of calculating the thicknesses of the ice-sheets. *Nature*, Vol. 169, No. 4300, 1952, p. 529–30.
2. —— The mechanics of glacier flow. *Journal of Glaciology*, Vol. 2, No. 12, 1952, p. 82–93. (Reference on p. 86.)
3. Baird, P. D., *and others*. Baffin Island Expedition, 1950: A preliminary report. *Arctic*, Vol. 3, No. 3, 1950, p. 131–49.
4. Littlewood, C. A. Gravity measurements on the Barnes Ice Cap, Baffin Island. *Arctic*, Vol. 5, No. 2, 1952, p. 118–24.
5. Baird, P. D., Ward, W. H., *and* Orvig, S. The glaciological studies of the Baffin Island Expedition, 1950, Parts I and II. *Journal of Glaciology*, Vol. 2, No. 11, 1952, p. 6.
6. Glen, J. W. Experiments on the deformation of ice. *Journal of Glaciology*, Vol. 2, No. 12, 1952, p. 111–14.
7. Goldthwait, R. P. Development of end moraines in East-Central Baffin Island. *Journal of Geology*, Vol. 59, No. 6, 1951, p. 569.
8. Baird, P. D., Ward, W. H., *and* Orvig, S. *Op. cit.*, p. 11.

COMMENTS ON DR. ORVIG'S PAPER

By W. H. WARD

THE existence of relatively high values of the calculated bed shear stress on the traverse A-142 to D-153, and of the greater rates of flow implied, prompts me to suggest the possible causes of this condition.

Most of the exceptionally low values of τ on the other traverses appear to be associated with the line of the traverse being appreciably different from the line of greatest slope, but even neglecting these low values the A-142 to D-153 values are relatively high. Some variation in τ on any radial traverse might be expected. Sliding on the bed is not likely near the centre of an ice cap, but it must occur towards the edge since it is the only way in which rock debris can be brought to the surface of the ice under these conditions. Thus one might anticipate some increase in τ from the centre towards the zone where shearing on the bed has involved the entrainment of rock debris, because the shearing resistance of rock debris on rock is pressure-conditioned. Close to the edge, where the flow is compressional, and overthrusting occurs over stagnant ice, the value of τ might decrease. The values of τ in traverses A–B and A–C suggest this type of variation.

The shape of the whole ice cap has one particular feature that is perhaps significant in respect of the high values of τ along traverse A-142 to D-153. The ice cap is highest along a ridge that lies roughly parallel to, but curiously closer to, its north-east side (see Fig. 2 in Part I of this series of papers [1]), and in the south-eastern lobe at least, the bed profile does not account for this displaced ridge.

The causes may be directly climatological, but I am inclined to discount this view. No large variations in the quite small total accumulation were found, and the current marginal accretion by perennial snowdrifts mentioned by Goldthwait,[2] particularly along the north-east side, would tend to flatten the slope and decrease τ. It has been shown [3] that much of the ablation energy is discharged to the lakes adjoining the ice cap. At present, however, only a small part of the north-east side forms cliffs fringing these lakes. This is unlikely to cause a significantly greater discharge of ice, except in the immediate vicinity of the lakes where underwater ablation might make sufficient difference. There is plenty of evidence, however, that the lakes on the north-east side have been much deeper and more extensive in recent times. A noticeable strandline, some 200 ft. (61 m.) above the present level of Generator Lake, is visible about one-third of the way up the hillside in the background of Fig. 3 in Part II of this series of papers.[4] Goldthwait has mentioned other strandlines to me, and a study of the R.C.A.F. aerial photographs of the larger lakes near the north end of the ice cap reveals the existence of scores of miles of high strandlines surrounding the present lake limits. In the past, almost the whole of the north-east side of the ice cap must have impounded water with a line of fringing ice cliffs. The effect of a general lowering of the water level of these formerly extensive lakes is to remove a large stabilizing force from the north-east side of the ice cap. This would cause a noticeable increase in the rate of flow of the ice towards the lakes that is likely to persist for a long time. The action is similar to the incidence of landslips following the lowering of lake levels.

In conclusion, the particular instance mentioned above calls for some consideration to be given to the numerous records of extinct glacial lakes and the substantial effects that their disappearance may have had on the motion of adjoining ice fronts.

REFERENCES

1. Baird P. D. Method of nourishment of the Barnes Ice Cap, 1950. *Journal of Glaciology*, Vol. 2, No. 11, 1952, p. 3.
2. Goldthwait, R. P. Development of end moraines in East-Central Baffin Island. *Journal of Geology*, Vol. 59, No. 6, 1951, p. 567–77.
3. Ward, W. H., *and* Orvig, S. The heat exchange at the surface of the Barnes Ice Cap during the ablation period. *Journal of Glaciology*, Vol. 2, No. 13, 1953, p. 158–68.
4. Ward, W. H. The physics of deglaciation in central Baffin Island. *Journal of Glaciology*, Vol. 2, No. 11, 1952, p. 19.

GLACIOLOGICAL WORK IN TERRE ADÉLIE* IN 1951†

PRELIMINARY REPORT

By F. Loewe
(Department of Meteorology, University of Melbourne)

During a stay of one year in Terre Adélie some studies were made of the mass and heat economy of the surface. I acted as Observer for the Australian National Antarctic Research Expedition with the French team, led by Lt. de Vaisseau M. Barré of the Expédition Antarctique Française, 1951 (Expéditions Polaires Françaises, Missions Paul-Émile Victor). The heavy gales and dense snow drifts of Adélie Land made glaciological work, and indeed all outdoor work, difficult. The Base at Port Martin had an annual mean wind velocity of 19 metres per second (42 miles per hour).

Instruments and Methods

From the coast to a distance of 50 km. southward on the ice cap accumulation and ablation stakes were established. Unfortunately, during my absence on a sledging trip during midsummer, melting and wind caused the stakes near the coast to fall. The amount of ablation in the coastal zone is, therefore, not well known. Short numbered aluminium tubes are recommended for use as ablation stakes. These are placed on top of each other in a bore hole.

To measure the transport of snow by the wind, the most important item in the mass economy of the coastal region, two drift-snow collectors were used. One was a square box with a funnel on the windward side and an opening at the rear like the one used by Mawson.[1a,b] The second was based upon the same principle, but it was in the shape of a section of an aeroplane wing to allow smoother flow of the snow-carrying wind. This instrument caught more drift-snow than the first. This showed that the Mawson collector which could be used over a longer period, gave minimum values only.

To observe the stratification of the snow and firn, pits were dug at different points on the ice cap.

Firn temperatures were measured on the ice cap to a depth of 9 m. in pits and bore holes from the firn limit to a distance of 300 km. on the ice cap. Toluol and mercury thermometers and, to a limited extent, resistance thermometers were used.

Snow and firn densities were determined by cutting and weighing samples of known volume.

* Adélie Land, Antarctica.

† An account of the glaciological and other scientific work of this expedition, with some illustrations, will be found in *Expédition en Terre Adélie, 1950–52, Expéditions Polaires Françaises, Missions Paul-Émile Victor*, Rapports Préliminaires, 20, Série Scientifique. *Ed.*