CORRESPONDENCE

The Editor,

The Journal of Glaciology

SIR, *Ice shelves*

Glaciologists must be pleased to see that a scientist as serious as Dr. H. Wexler has come to their support by studying with success a problem as complex as that of ice shelves.[1]

Generally speaking, I believe that the fundamental problem is one of ice flow.

Taking the Ross Ice Shelf as an example, we can try to get an idea of its mass balance. With a surface area of 510,000 km.^{2} and an accumulation of 17 cm. water (already determined by Shackleton in 1908), the total annual accumulation is 87 km.^{3} water. Neglecting super- and subglacial melting, discharge is mainly in the form of icebergs. The total loss is:

400 m./yr. $\times$ 850 km. (front) $\times$ 250 m. (thickness) = 85 km.^{3} of ice, i.e. 77 km.^{3} water/yr.

Then, there is 87 km.^{3} of accumulation and 77 km.^{3} of loss as icebergs. It would therefore seem that the Ross Ice Shelf is almost in balance.

But in reality it is not, for we must add the contribution of big glaciers (for instance, the Beardmore Glacier) coming down from the ice cap, which is difficult to estimate. It seems sensible that, at its confluence with the ice shelf along a 40 km. front, the thickness of the Beardmore Glacier is about 500 m. and its velocity about 5 m./day; this gives a contribution of 33 km.^{3} water/yr. We must also add the contributions of all the other glaciers. Do these not double the accumulation?

The Ross Ice Shelf is (by rough estimate) balanced and its accumulation cannot be more important than its discharge. We must therefore infer that the discharge as icebergs must be more important than the estimated one. A consequence of this is that there must exist ice streams like those draining the Greenland Ice Sheet. There are active zones and quiet zones, the former having a block-movement, as described by Finsterwalder, which does not obey the ordinary laws of flow.

Until the questions of ice shelf discharge and contribution of glaciers, i.e. the mass balance of the Ross Ice Shelf, have been clarified, I think it will be difficult to solve the problem studied by Dr. Wexler.

By research we must try to determine (1) the contribution of glaciers coming down from the ice cap, and (2) the movement and the loss by icebergs along the front of the Ross Ice Shelf.

These two problems can be solved by aerial photogrammetry without topographic preparation, following the methods developed during the I.G.Y. It would be ridiculous to try classical geodetic methods of velocity determination by following guiding marks with a theodolite.

When the ice streams have been determined and the respective velocities of the front of the ice shelf and affluent glaciers are known, the discharge can be estimated by using known values for thickness.

We hope that such studies will be undertaken in the near future.

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REFERENCE

1. Wexler, H. Heating and melting of floating ice shelves. *Journal of Glaciology*, Vol. 3, No. 27, 1960, p. 626-45.

SIR, *Recent moraines of a lobe of the Taylor Glacier, Victoria Land, Antarctica*

We have read with interest the letter by Drs. H. J. Harrington and I. G. Speden in the March 1960 issue of this journal.[1] However, after an examination of the photograph attached to that letter the writers would suggest a glacial chronology different from that of the original correspondents.

To us the most striking feature of this photograph is the presence of uniformly well developed patterned ground over the entire valley floor and parts of the valley sides. We feel that a relatively recent retreat such as that proposed by Drs. Harrington and Speden does not allow sufficient time for the development of patterned ground up to the very edge of the glacier. Rather, we believe that the most probable sequence of events is: (1) retreat, with four stillstands, a long time ago; (2) formation of patterned ground during the long interval when the ice edge was either at its present position or further back—the position of the ice edge in 1959 may well represent a relatively recent advance over the

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