CORRESPONDENCE

A LOCAL SURVEY OF THE EARTH'S MAGNETIC FIELD IN THE VICINITY OF ROYAL SOCIETY BASE, HALLEY BAY

The establishment of geomagnetic observatories on floating ice shelves during the I.G.Y. presented certain problems not encountered when observatories are built on rock. One difficulty is that ice shelves are normally moving slowly forward in relation to the underlying sea bed. It is therefore necessary to analyse slow changes in the recorded magnetic field at a station in order to decide the proportion of the change which is due to the movement of the station, and the proportion which represents a genuine secular change of the earth's magnetic field.

At Halley Bay definite movement of the ice shelf has not so far been detected by astronomical measurements. That movement does take place is however confirmed by movement apart of two points on a north–south line, three miles from the ice front, of 1·22 parts in 1000 per year. Also movement is necessary to explain the constant surface level of the ice shelf well clear of the ice front of 94 ft. (29 m.) above sea level, in spite of a yearly net accumulation of about 3 ft. (1 m.) of snow.

A local survey of the vertical force of the geomagnetic field was therefore made during October 1958. The nine stations occupied covered an area of about 4 km. square around the non-magnetic hut and the measurements were made by two observers with a B.M.Z. magnetometer. The sites of the stations were judged by eye to be at roughly the same level. Any difference between the stations was considered less than 10 ft. (3 m.). Measurements were referred to the central station near the north door of the non-magnetic hut after due allowance for changes with time indicated by the variometers.

The following table shows the result of the observations:

Station	Observer		Mean difference from reference station (γ)
	J.M.D. (γ)	A.B. (γ)	
Reference	43,493	43,498	–
North	43,693	43,701	+203
North-east	43,297	43,309	−191
East	43,216	43,215	−278
South-east	43,229	43,233	−263
South	43,203	43,208	−288
South-west	43,473	43,480	−18
West	43,736	43,741	+244
North-west	43,360	43,368	−130
Reference	43,488	43,496	–

The position of the survey points was placed on a map showing the ice front in 1956 and isogonals were drawn (see Fig.). It was immediately apparent that the isogonals were closely associated with the features of the ice front.

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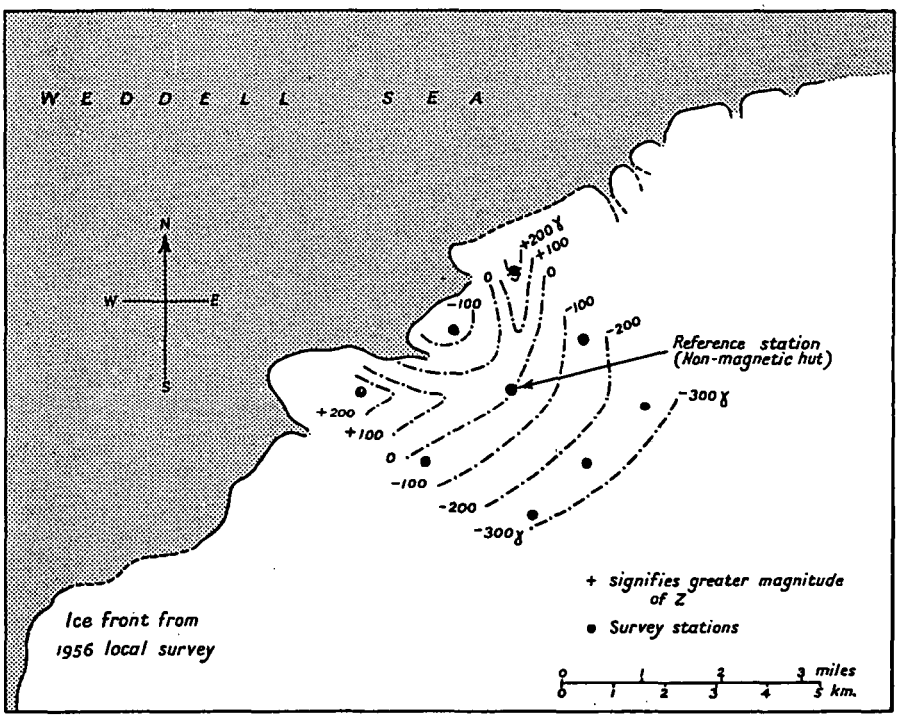
This fact tends to confirm that the features of the ice front were due to geological structure below the ice shelf. This appears to fit the hypotheses put forward by Swithinbank, 1955, after a study of air photographs and a limited number of soundings of the depth of the sea off ice shelves, that although the major part of an ice shelf may be afloat, considerable sections of its seaward boundary may be just aground on shoals.



Survey of geomagnetic vertical force at Halley Bay, 1958.

As the contours of the geomagnetic anomaly are fixed to the geological structure below the ice shelf, a measurement of the absolute movement of the ice shelf is necessary to make small corrections to the geomagnetic secular change. In this connection it was noted that in 1958 the vertical force survey showed the change of field towards the sea was minimal; consequently the site of the observatory was, by good fortune, the best possible one in the small area examined. A measurement of the movement of the ice shelf may be possible by repeating the geomagnetic survey after sufficient time has elapsed for the movement to be detected in relation to the contours.

In view of its simplicity, this method of investigation of certain problems in relation to glaciology and geology is to be commended to future workers in Antarctica.

I am indebted to Mr A. Blackie for his assistance with the Geomagnetic Survey, to the I.G.Y. Expedition's Advance Party for their 1956 ice front

survey, and to The Royal Society for permission to publish these results. The work was done whilst I was seconded from the Meteorological Office to The Royal Society I.G.Y. Expedition.

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ANTARCTIC ICE TERMINOLOGY: ICE DOLINES[1]

Large steep-sided depressions in the glacier ice of the George VI Sound region were reported by members of the British Graham Land Expedition 1934–37 and by aviators of the American "Operation Highjump" in 1947. Fleming (*Geographical Journal*, Vol. 91, No. 6, 1938, p. 512) called the holes "ice calderas" and Stephenson (in Rymill's *Southern Lights*, London, 1938, p. 194) talks of "a crater-like formation". Byrd (*National Geographic Magazine*, Vol. 92, No. 4, 1947, p. 504) used the term "ice volcanoes". Similar, but rather bigger, depressions are found around the borders of the Amery Ice Shelf in MacRobertson Land and a number of them have been photographed by the Australian National Antarctic Research Expeditions.

It is likely that the depressions result from collapse of the surface ice after bodies of englacial water are drained, the mode of formation being similar to that of the smaller holes found on Greenland glaciers. (Details are given in an article by Mellor and McKinnon on p. 33.) The earlier names used for these features are inappropriately suggestive of volcanism and it seems better to draw a parallel with the subsidences which occur in karst country after the collapse of underground chambers. The name "ice doline" was suggested by Dr F. Loewe and I would now like to propose this term as an addition to Antarctic ice nomenclature.

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[1] See photograph facing p. 84.