LETTERS TO THE EDITORS

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Rock Magnetism in Iceland

RECENT studies by J. Hospers[1] have revealed that Icelandic basalts fall into two groups with respect to their remanent magnetization. In one group the direction of magnetization is close to the present direction of the geomagnetic field. In the other group the magnetization has the opposite direction. Intermediate directions are rarely found. Studies made by A. Roche[2] have revealed the same fact for French basalts of Quaternary and Tertiary age. These findings have been interpreted in terms of repeated reversals of the geomagnetic field.

For an extensive survey of the two magnetic groups it is necessary to use a quicker and more convenient method than that of conventional magnetometer measurements in order to distinguish one group from the other. It is of primary importance to be able to tell in the field to which group a certain rock formation belongs.

For this purpose we have used an ordinary field compass. A specimen of convenient size is removed from the rock, and its magnetic polarity tested by moving it close to the compass. In most cases the permanent magnetization of basalt is strong enough to give an easily detected deflexion of the magnetic needle. If the north magnetic pole of the specimen points downwards when this is placed in the original position, the specimen is normally magnetized; if it points upwards it is inversely magnetized.

During the year 1954 we examined several thousand specimens distributed over all parts of Iceland. This study has revealed close correspondence of the magnetization with distinct formations. As a rule, specimens taken from the same volcanic formation all have the same polarity.

Exceptions are found in old basalts where a weak and irregular magnetization sometimes prevents the determination of the polarity of the rock formation as a whole. In conglomerates the rounded pebbles usually show a random distribution of polarization; but occasionally conglomerates with uniform polarization have been found in the older rocks. In recent conglomerates which have been under the influence of hot-spring water normal polarization has been found prevailing in basalt pebbles taken at the surface, although the underlying basaltic layers which have been exposed to the same temperature (*c.* 100° C.) retain the original inverse magnetization as revealed by cores from bore-holes. It therefore seems likely that the change in magnetization of the pebbles is due to chemical alteration promoted by presence of the oxygen of the air. Irregular magnetization in old basalts may have a similar explanation.

On level ground it is customary to find a uniform magnetization extending over an area of some tens or hundreds of square kilometres.

In basaltic mountains built up of nearly horizontal lava-flows, of 5–10 m. thickness each, we find layers of normal and inverse magnetic polarization respectively one on top of the other. Each of these magnetic ensembles contains from several to more than one hundred lava-flows. The boundaries between the magnetic ensembles are distinct and usually follow a layer of sediments separating the basaltic flows.

The total thickness of sections we have tested in different parts of Iceland is 21,000 m. 10,000 m. have been found normally magnetized, 9,000 m. inversely magnetized and 2,000 m. irregularly magnetized.

From this we conclude that the amount of inversely magnetized basalt in Iceland is of similar magnitude to that of the normally magnetized.

As to area, we find a greater extension of normal than of inverse polarization; but this is only due to the fact that a large part of the country is covered by tuffs and lavas younger than Lower Quaternary and all these young rocks are found normally magnetized.

Between the basaltic lava-flows there are frequently thin layers of red baked clay which is just as strongly magnetized as the basalt itself. This clay always shows the same polarization as the basalt on top of it.

Basaltic dykes usually show a regular polarization. The same polarization is always found in the country rock close to the dyke regardless of whether it cuts through basalt or clay.

This has been tested for all combinations of dyke and country rock magnetization.

To explain the fact that widely different materials which were erupted or heated during certain periods of time all acquire an inverse magnetization, we see no other possibility than to assume that the magnetic field of the earth had the opposite direction of what it has to-day. Our observations indicate that there are found in the Icelandic basalts at least three periods, during which there was reversion of the magnetic field. The last period of reversion seems to cover the Pliocene–Pleistocene boundary and may thus be compared with the last period of inverse magnetization in France, as found by Roche. If parallelism with Roche's findings is assumed for the older units, the Icelandic rocks tested by us reach back to the Oligocene.

This field work will be further extended in order to map the distribution of the various magnetic ensembles. In continuation of the field survey exact laboratory measurements of rock magnetism with an accurate magnetometer are now in progress.

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[1] Hospers, J., *Nature*, 168, 1111 (1951); *Proc. K. Ned. Akad. Wet.*, B, 56, 467 (1953); B, 57, 112 (1954).

[2] Roche, A., *C.R. Acad. Sci., Paris*, 236, 107 (1953).

Geophysical Work in North Greenland

THE purpose of this communication is to record briefly those results of the geophysical work of the British North Greenland Expedition which would be of interest to others visiting this area.

One of the aims of the work was to measure thicknesses of ice by seismic reflexion methods at points along the traverses indicated on the map, Fig. 1. In the first year of the Expedition (1953) a 6-channel reflexion unit was used, in the second a 12-channel unit.

Except near the extreme eastern edge of the ice-sheet, no definite reflexions from an ice-bedrock interface were detected east of a line running approx-