Summary

The regional variation in conductivity, U and F concentrations in stream water is greater than the variation in a local sampling area. The variation within map sheet 66 V.2 (10 000 km^2) reflects predominantly topographical differences. This is mainly due to the chemical uniformity of the bedrock in the area.

The Sarfartôq carbonatite complex and two occurences of hydrothermal mineralisation in South Greenland are distinguished by high F concentrations in the stream water, relative to waters with the same conductivity.

Filtration of the stream water samples does not affect the measured conductivity, U or F concentrations. Addition of acid causes an increase in the measured U concentrations.

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Detailed ground magnetic survey in the central part of the Sarfartôq carbonatite complex, southern West Greenland

K. Secher and L. Thorning

Introduction

A detailed ground magnetic survey was carried out by the authors and Egon Hansen, electronics technician, during the spring of 1981 in the central part of the Sarfartôq carbonatite complex near Søndre Strømfjord. It was important for the survey that there was continuity of measurements over the whole area, and as most of the area was covered by swamp in the bottom of the valley Arnangarnqup kûa, it was most convenient to make the survey when the surface was frozen.

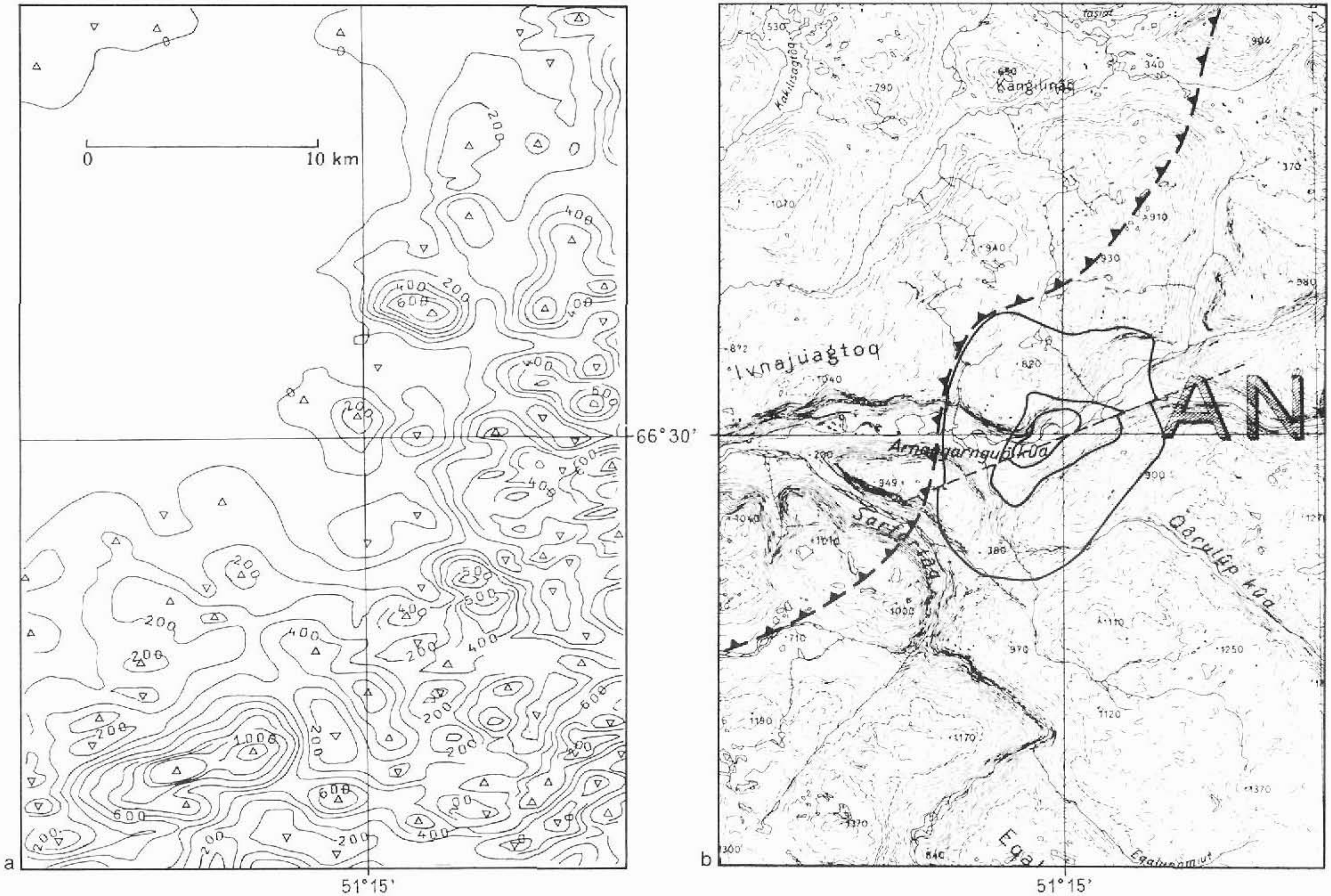


Fig. 10a. Aeromagnetic map of the area around Sarfartôq. Measurements taken at 3000 ft [barometric altitude] with a proton precession magnetometer (Thorning, 1976). Flight line spacing 1,5 km. IGRF75 subtracted. Machine contoured using programs described in Thorning (1980).
Fig. 10b. Topographical map of the area covered in (a). The position of the carbonatite complex and the Archaean–Nagssugtoqidian boundary is shown.

Geological and geophysical setting

This study complements the geological ground survey of the carbonatite complex carried out from 1976 to 1979 when the complex was found, mapped and examined for economic minerals (Secher, 1976, 1979, 1980a, 1980b; Secher & Larsen, 1978, 1980). An airborne magnetic survey covering major areas in West Greenland, including the complex, had been carried out simultaneously by Thorning (1976, 1977). The igneous carbonatite complex is approximately 90 km^2, and consists of a carbonatite-fenite core (about 15 km^2) surrounded by a marginal zone of hydrothermal alteration and mineralisation (about 75 km^2). Associated intrusions of silicate rocks have only been found as dykes of lamprophyre and kimberlite (Larsen, 1980).

The aeromagnetic map (fig. 10a) is dominated by two main features:

1. The boundary between the magnetically smooth Nagssuqtoqidian rocks to the north-west and the highly active magnetic field associated with the Archaean basement to the south-east. The difference in magnetic signature can be followed along major parts of the boundary and has been related to differences in metamorphic grade (Thorning, 1976).

2. The anomaly at the site of the carbonatite complex (fig. 10b) masks the boundary in its neighbourhood. A pronounced, oval shaped, positive anomaly of just over 200 nT is surrounded by a marginal magnetic low. It can be related to a narrow (1–3 m) steeply outward-dipping sheet (marker horizon) of nearly pure magnetite rock which is embedded in mainly rauhaugitic carbonatite representing the inner core. This marker horizon is exposed in the northern part of the core at two major localities, the easternmost of which is divided into three separate lenses of magnetite rock in a sequence about 20 m wide. In the southern part of the core, however, the magnetite horizon is not exposed and is probably hidden under thick layers of glaciofluvial deposits in the middle of the valley.

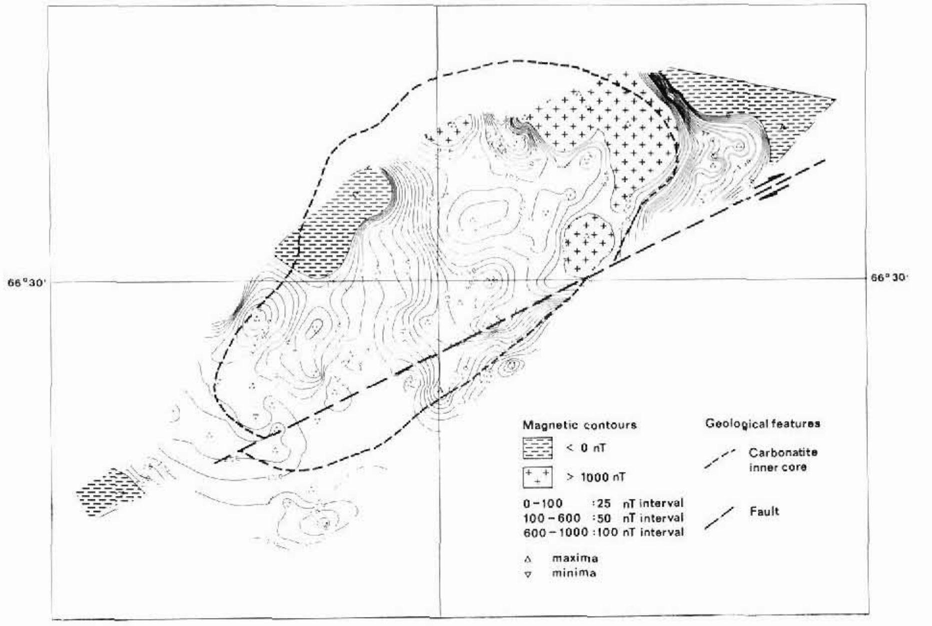
The marginal zone of low magnetic response is probably explained by the lower susceptibility of newly formed iron minerals which are the result of oxidation in the hydrothermally active zone resulting in abundant hematite. The complex is a NE–SW flattened conical body with a NW-dipping central axis. The exact dimensions of the core are unknown.

A ground magnetic survey was designed to bring out further details of the structure of the central part of the carbonatite core. The inner core outline should be revealed by the effect of the magnetite sheet, where it is present.

Acquisition and compilation of magnetic data

During the nine days available for field work 18 km of magnetic profiles were obtained. The resultant net is shown in fig. 11 and is based on about 900 readings (each an average of three to five measurements) taken 20 m apart along the lines of the net. The baseline SA010 was fixed by theodolite sightings from the eastern end of the line: the positions of the other profiles were measured from the baseline. The pre-planned grid was to some extent modified in the field to allow for the terrain and the time available.

Measurements were taken with a Geometrics G-816 proton magnetometer with a sensor on a 7 ft staff (1 nT resolution)(fig. 12) at distances depending on the magnetic gradient. To correct for diurnal variation a Geometrics G-806 base magnetometer with a Phillips (PM 8110) strip chart recorder and a Geometrics G-724 data logger was used for continuous reading of the temporal variations in magnetic field.



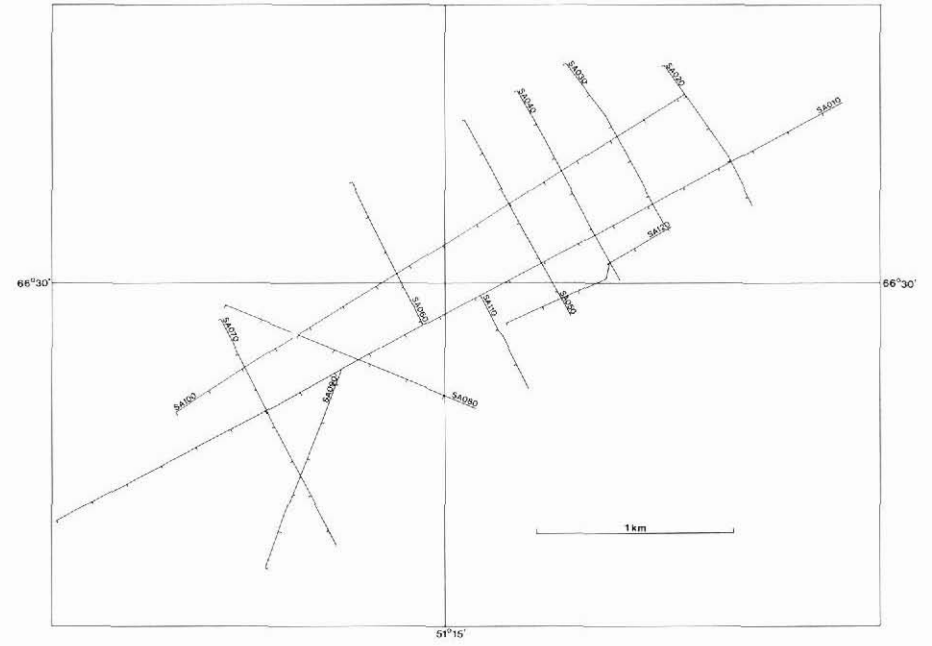


Fig. 11. Preliminary contour map of severely smoothed total magnetic field after correction produced by the contouring program described by Thorning (1980) using a coarse grid. Layout of profile lines measured are shown with marks at 200 m intervals. Main geological features are indicated. Variable contour interval.

Fig. 12. Magnetic survey operations under winter conditions near Sarfartôq base camp.

Corrected magnetic total field values were calculated for each station by subtraction of a smoothed base magnetometer field. This is acceptable since the separation of base magnetometer and survey area is less than 3 km. The zero level of the magnetic profile data is defined as the average magnetic field at the base station, here determined to be 55559 nT, a few hundred nT lower than the IGRF75 at this position. The calculated anomalies were used for qualitative interpretation in the field and later entered into a data base for interpretation by computer as described by Thorning (1980).

Preliminary results

The interpretation of the magnetic data from Sarfartôq is difficult due to the glaciofluvial sediments covering the valley bottom containing an unknown proportion of more or less magnetic boulders. This causes a varying amount of noise in the ground magnetic measurements and obscures the magnetic expression of the sediment/basement contact. Consequently a smoothing has been carried out using a Hanning filter (Thorning, 1980); this eliminated short wavelength anomalies from boulders etc., but the effect of river terraces can still be observed in the data as level shifts and minor, step-type anomalies. Also, the valley side relief has created large negative anomalies, masking the magnetic picture in key localities close to valley slopes. This was expected, and work is in progress to eliminate such effects.

The marker horizon of magnetite is reflected very distinctly in the magnetic data. At the northern end of line SA030 three separate anomalies were detected with a maximum amplitude of about 9800 nT after correction which correlate well with known exposures. This multiple maximum can be traced to lines SA100 and SA010, but not on SA020, thus delineating the position of the marker horizon in this part of the valley bottom.

A preliminary, severely smoothed, contour map of the magnetic field is presented in fig. 11; the most likely position of the magnetite sheet is seen as a crescent shaped maximum in the eastern part of the core. To the south-west there are no large anomalies.

In the portion of the inner core, totally hidden by glaciofluvial deposits, two different magnetic levels are observed indicating the existence of different rock types within the inner core. One of these levels shows a very low magnetic response, unlike that of any other exposed rock type in the area. Geological field observations have so far revealed a core composed of magnetite-carrying rauhaugite with only minor lenses of sövitic rocks. The magnetic measurements appear to indicate the presence of a greater proportion of magnetite-poor sövite in parts of the inner core, as in other composite cores in carbonatite complexes.

One line, SA120, exhibits unexpectedly large magnetic variation over short distances. From geological observations in summer 1981 the existence of a NE–SW trending vertical major transcurrent fault cutting through the complex was indicated. In adjacent areas this fault is now known to displace the country rock 150–200 m. By chance the line SA120 was located over and along the fault, before its existence was known. Its complex magnetic field can be reasonably explained as the effect of fault disturbances of the magnetite marker horizon.

Preliminary depth to magnetic basement has been calculated for all lines using several different methods included in the MAPRAN system (Thorning, 1980). Depths fall very consistently in the range of 10–50 m which is interpreted as the thickness of the glaciofluvial deposits. A few depths fall in the range of 200–300 m and are attributed to intra-basement variations of susceptibility, e.g. of the inner core. More refined depth calculations taking the strike and the extent of the anomalies into account are in progress.

Conclusions

1. The marker horizon of magnetic rock can be followed in the eastern and southern part of the valley, delineating this portion of the inner core. The magnetic sheet is apparently pinching in and out and may be missing in the western part of the core.
2. Part of the inner core is a large mass of low magnetic rock which may be pure sövite.
3. The inner core appears to be oval shaped and about 3 km^2.
4. The thickness of the glaciofluvial deposits in this part of the valley is in the range of 10–50 m.

The quality of the magnetic data obtained is excellent, and from a logistic point of view the winter operation was a success. It would be impossible to obtain a similar systematic coverage in a summer operation.

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A minor carbonatite occurrence in southern West Greenland: the Tupertalik intrusion

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In addition to the two large carbonatite complexes of Cambrian age occurring in southern West Greenland, the Sarfartôq and Qaqarssuk complexes (Secher & Larsen, 1980; Gothenborg & Pedersen, 1975) a third small intrusion of carbonatite was found in 1971 during regional prospecting by Kryolitselskabet Øresund A/S. This intrusion is situated approximately 50 km east of the town Sukkertoppen, only 11 km north-north-west of the Qaqarssuk complex of which it may be regarded as a satellite (fig. 13). The outcrop measures only 500 m by 200 m. It is situated on a gently south-east sloping, relatively vegegation covered hillside in a depression between 800 m and 1000 m high mountains, the most prominent of which is Tupertalik ('the place with a tent') after which the intrusion is named.

Mainly due to its small size the intrusion has not received much attention. GGU samples collected during short visits there included rock types different from those found in the Sarfartôq and Qaqarssuk complexes, and among these were samples of sky-blue lapis lazuli. During the 1981 field season the intrusion was mapped in detail with a plane table. A map at a scale 1:1000 was produced; a simplified and interpreted version is presented in fig. 14.