Conclusions

The main E–W fault zone crossing the investigated area shows a sinistral displacement at a minimum of 150–200 m. Within the zone, pitchblende veins have been found. Two of the veins follow closely the direction of the major fault zone, but the third has a trend which could be a tension fracture filling. Also the minor radioactive spots located in the area are found within the fault zone. Vein samples assayed by gamma spectrometry contain from 0.75 to 6.3% U and very little thorium. The high values from vein 2 may be due to oversampling of pitchblende chips.

The geophysical investigations described here have shown that magnetic and VLF profiling, supported by susceptibility and VLF resistivity measurements, are excellent methods for mapping various structures connected with a fault zone. The width of the fault zone is well defined by both magnetic and VLF EM methods, and features revealed as VLF conductors were observable over several profiles.

The distinct magnetic low over the strongly altered fault zone is probably due to the decomposition of magnetite. The magnetic highs can be correlated with some of the dykes, and the VLF conductors can be correlated with fault planes and the breccia-like quartz veins. The pitchblende vein inside the grid lies close to a very strong VLF anomaly, possibly a fault plane, but no other outcrops are seen along the trend of the anomaly.

It is obvious that regional geophysical mapping of such structures will be possible. Ideally, this should be done as an airborne survey, but further production-type ground-based geophysical surveys would also be useful in defining potential structures carrying an occurrence of uranium minerals.

References

Armour-Brown, A., Tukiainen, T. & Wallin, B. 1981: Uranium districts in South Greenland. *Rapp. Grønlands geol. Unders.* **105**, 51–55.

Emeleus, C. H. & Upton, B. G. J. 1976: The Gardar period in southern Greenland. *In* Escher, A. & Watt, W. S. (edit.) *Geology of Greenland,* 154–181. Copenhagen: Geol. Surv. Greenland.

Fraser, D. C. 1969: Contouring of VLF-EM data. *Geophysics* **34**, 958–967.

Van Breemen, O., Aftalion, M. & Allaart, J. H. 1974: Isotopic and geochronological studies on granites from the Ketilidian mobile belt of South Greenland. *Bull. geol. Soc. Am.* **85**, 403–412.

Archaean gneisses and supracrustal rocks of the Tingmiarmiut region, South-East Greenland

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In August 1981 a mapping programme was initiated which aimed at the production of the 1:500000 geological map sheet of the Tingmiarmiut–Angmagssalik region (sheet No. 14) (Escher & Nielsen, 1982). In 1982 this programme was continued in the Tingmiarmiut Fjord

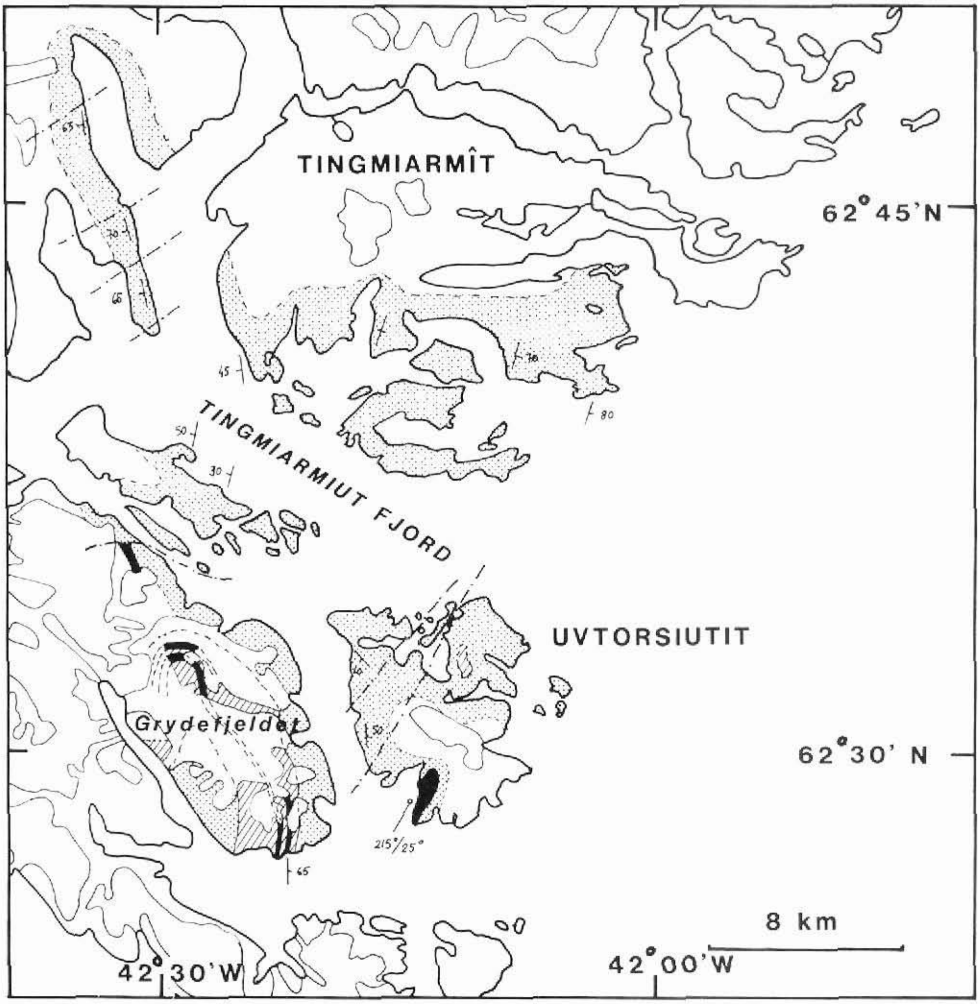

Fig. 27. The Tingmiarmiut Fjord area. Dotted, agmatitic gneiss; black, supracrustals; lined, granitic sheet complex.

region (fig. 27). Due to exceptionally bad ice conditions and other misfortunes only a few days' work was carried out. As in 1981, the logistic support was provided by the GGU motor cutter *K. J. V. Steenstrup* and rubber dingies.

Main rock types and field relations

The rocks of the Tingmiarmiut region are of amphibolite facies metamorphic grade. Only along the many NE–SW trending shear zones, which cross-cut the country, are the rocks downgraded to greenschist facies. So far no evidence has been found for an earlier granulite

Fig. 28. Agmatitic gneiss from Tingmiarmiut weather station. Disorientated inclusion of pale, altered banded amphibolite in migmatitic matrix.

facies metamorphism. Three major rock groups are distinguished: (a) agmatitic gneiss, (b) supracrustal amphibolites with metasedimentary units, and (c) a granitic to granodioritic sheet complex.

(a) Agmatitic gneiss. The dominant rock type of the region is an agmatitic gneiss which represents the very strongly migmatised and partly remobilised Archaean basement. Together with the supracrustal units it has been strongly deformed during different phases of deformation and has a well developed foliation. The matrix of the agmatitic gneiss forms 80–90 per cent of the rock and consists of a mixture of several generations of granitic and granodioritic veins. The matrix is often partly remelted and encloses many disorientated fragments of basic and ultramafic rock types. The inclusions vary in size from a few centimetres to several metres and have a well developed internal foliation which is discordant to the foliation of the matrix. Several inclusions show evidence of early phases of superimposed folding which are not observed in the matrix. Up to now only basic and ultramafic inclusions have been found. The most common type is a medium- to fine-grained, dark grey, banded amphibolite. It forms distinct trains of inclusions which can be followed for several tens of metres. They are interpreted as broken up basic dykes which were intruded in the region prior to the main phase of migmatisation.

Ultramafic inclusions are fairly common. They include dunitic, hornblenditic, gabbroic and noritic rock types and are unevenly distributed in the agmatite. Some small areas may contain a relatively large proportion of a certain ultramafic rock type, suggesting that large intrusive masses existed prior to the migmatisation.

A less common but characteristic type of inclusion is a pale coloured, banded amphibolite, which in the field is easily confused with pale weathered gneiss (fig. 28). The inclusions are found throughout the entire region. Locally, however, they occur in great numbers, suggesting that larger units existed prior to the migmatisation. In contrast to the dark grey amphibolite inclusions, which are relatively fresh hornblende-plagioclase rocks, the pale amphibolite inclusions are strongly altered with sericite, epidote, zoisite, chlorite and calcite, suggesting an early retrogression to greenschist facies prior to the migmatisation.

(b) Supracrustal amphibolites with metasedimentary units. Supracrustal units are uncommon in the Tingmiarmiut region as compared with areas further north around Graahs Fjord (Escher & Nielsen, 1982). A few bands of metavolcanic amphibolites occur south-west of Tingmiarmiut weather station, and the most prominent forms a large closed fold structure through Grydefjeldet (fig. 27). This unit is about 240 m wide and can be followed over a distance of more than 10 km. The lithologies present include grey amphibolite and minor quartzo-feldspathic layers, mostly sillimanite and garnet-bearing. The supracrustal units resemble many of the supracrustal horizons described from the Archaean of West Greenland. The metavolcanic amphibolites range from hornblendites to diorites. The sillimanite-garnet bearing metasediments occur near the centre of the unit together with felsic amphibolites. Locally they contain sulphides which give a rusty appearance to the rock. Although the supracrustal unit is strongly foliated and sheared, it has not been broken up, but the intense deformation has obliterated the original stratigraphy and the primary structures.

(c) The granitic to granodioritic sheet complex. Granitic to granodioritic sheets are found within the supracrustal unit and along the contact to the agmatitic gneiss. Field observations indicate that the sheets have been intruded along the contacts at a late stage of the regional deformation. The sheets are up to 50 m thick and contain only few inclusions of the country rocks. They are not migmatised and show only a weak foliation.

Dykes

Two sets of undeformed dykes of assumed Proterozoic age are observed in the Tingmiarmiut region. Most prominent is a group of E–W trending doleritic dykes up to 200 m wide. A second NNW–SSE set of dykes shows greater variation, from fine-grained to coarse-grained and varying in width from 1 to 25 m. The relative age relationship of the two sets is unknown.

Future work

In view of the logistic problems encountered during the summers of 1981 and 1982, the continuation of the mapping programme in the Tingmiarmiut–Skjoldungen area is dependent on helicopter support.

Reference

Escher, J. C. & Nielsen, T. D. F. 1982: Reconnaissance mapping of the Precambrian rocks between Uîvaq (63°03′N) and Bernstorffs Isfjord (63°38′N), South-East Greenland. *Rapp. Grønlands geol. Unders.* **110**, 77–80.