Hansen, 1968), and a possibility still exists that the mineralisation in the ENE-trending structures in the vicinity of the Igdlerfigssalik centre belongs to a more extensive Gardar mineralising event.

Conclusions

The occurrences of Th-U radioactive mineralisation which, wholly or in part, can be related to the neighbouring Igdlerfigssalik centre, are small and scattered; only those in the ENE-directed structures have dimensions of some interest. The available analyses indicate that the radioactivity is mostly due to thorium and the possibility of finding economic uranium-occurrences in this area is regarded as unlikely.

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Uranium-bearing metasediment and granite in the Tasermiut area, South Greenland

Bjarne Leth Nielsen and Tapani Tukiainen

Regional exploration for uranium was carried out in South Greenland in 1979 and 1980. From the planning stage the area between the fjords Tasermiut and Søndre Sermilik (fig. 16) was considered a favourable target because uranium deposits from geological environments of similar age, structure and lithology are known, e.g. the Makkovik Bay area in Labrador (Gandhi *et al.,* 1969; McMillan, 1976). The deposits sought were mainly pegmatitic or vein type deposits related to a Proterozoic unconformity (Nielsen, 1980). During the South

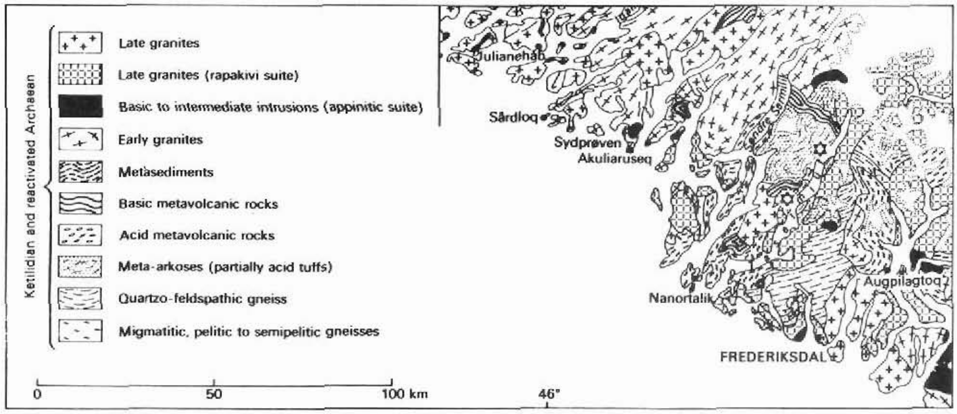

Fig. 16. Simplified geological map of the Tasermiut area. Pitchblende occurrences indicated with stars.

Greenland uranium exploration project the area was covered in 1979 by a regional reconnaissance gamma-spectrometric survey and by drainage geochemistry (stream sediments and stream waters). Several areas of anomalous radioactivity were recorded (Armour-Brown *et al.*, 1980), and on the basis of this and short field visits in 1979 it was decided to undertake a more systematic follow-up in 1980. The preliminary results of this work are reported below.

Geology

Important contributions to the understanding of the geology of the Tasermiut area are presented by Escher (1966) and Dawes (1970). Escher discussed the migmatisation and deformation of the Ketilidian supracrustal rocks and advocated extensive post-kinematic formation of granite during granitisation. Dawes focussed on the general Precambrian evolution of the region with special reference to the plutonic rocks. He distinguishes between two suites of granite, an older one, containing enderbite, hypersthene granite, granodiorite and alaskite, which belongs to the gneiss complex of high metamorphic grade, and a younger suite of autochthonous and allochthonous granite comprised of microgranite and rapakivi granite post-dating the formation of the gneiss complex.

Exploration results and discussion

Anomalous uranium contents in samples of stream silt and stream water as well as anomalous radioactivity were located in some of the granitic rocks and in the supracrustal sequence of quartzite and meta-arkose. These areas have been prospected in more detail with field radiometric techniques.

Most of the field work was confined to the metamorphosed sedimentary sequence lying north-west of the inner part of Tasermiut. A large number of anomalous areas were reflown with a helicopter-installed scintillation counter and were visited in the field.

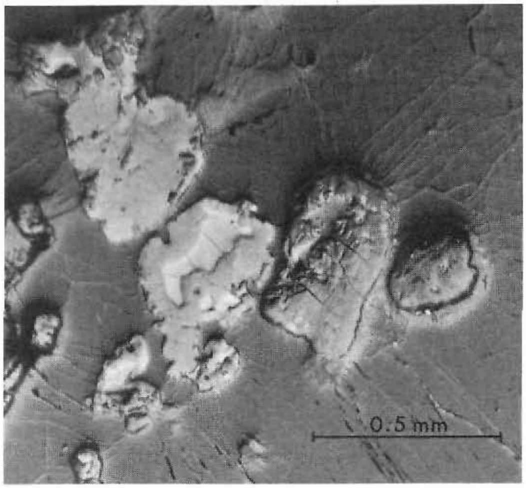

Fig. 17. Photomicrograph of a polished section with pitchblende. Two phases (1–2) of pitchblende are indicated together with secondary uranium minerals (3). The relief differences between the phases are enhanced with microscopic inteference phase contrast equipment. Note radial expansion fissures.

The lithological variation in the sequence ranges from pure quartzite to meta-arkose. Locally conglomeratic horizons occur. Although they are strongly metamorphosed, original sedimentary structures are frequently preserved. During the regional metamorphism partial melting of the arenite took place and a granitic pegmatitic neosome was formed. Subhorizontal, concordant pegmatite occurs as pinching and swelling sheets up to several metres in thickness and also as more irregular cross-cutting veins or bodies with dimensions typically up to 20–30 metres. The neosome frequently contains remnants of meta-arenite and sometimes metabasite. The latter can also be found as irregular sheets in the metasediment and represent basic volcanic rocks in the supracrustal sequence.

All anomalies which were investigated could be traced to enrichment of uranium in pegmatitic neosome within the meta-arenite. In no case was radioactive mineralisation located in the sedimentary rocks.

The mineralisation occurs as small patches or nests in the pegmatite which are defined by irregular areas of elevated radioactivity displaying abrupt changes over short distances. These patches with secondary uranium minerals rarely exceed 10–20 cm in diameter. The secondary uranium minerals are found either in micro-fractures or as cubic pseudomorphs of 1–2 mm. At two localities (fig. 16) primary uraninite/pitchblende was found. Microscopically it is seen to be composed of two phases of slightly different reflectivity (fig. 17). A preliminary microprobe test shows that the two pitchblende/uraninite phases have identical chemical composition, but the phase of least reflectance is slightly hydrated. Partly dissolved grain boundaries provided material for precipitation of yellow secondary uranium minerals in expansion fissures and silicate minerals surrounding the pitchblende.

The mineralogy of the granitic neosome is simple (quartz, feldspar, micas, amphibole) and apart from pitchblende only small amounts of copper sulphides and tourmaline have been observed.

Delayed neutron analysis and gamma-spectrometric assays of a few samples show the following orders of magnitude for uranium and thorium contents in metasediments and granitic neosome:

	U ppm	Th ppm
Quartzite, meta-arkose, conglomerate	3–7	10–60
Granitic neosome	50–70	5–330
Granitic neosome, U-mineralised	980–1530	160

Both the field radiometry, the stream sediment geochemistry and chemical analyses show that the uranium content in the arenite is fairly high compared with similar geological environments. It is assumed that a substantial part of the uranium was mobilised during the partial melting of the arenite, and it is suggested that the metasedimentary sequence is the source of the uranium and that the mineralisation and the pegmatitic granitic neosome are syngenetic. As the pitchblende occurs close to sheets or blocks of basis rocks, these may have played a role in the deposition of the uranium minerals.

The size and scattered distribution of the neosome implies that concentrations of uranium in economic quantities are unlikely to be found. One might be tempted to look for a second redistribution into favourable traps in the metasediments. Such traps, e.g. graphitic horizons, faults and fractures are, however, very scarce and with the low permeability of the metamorphosed arenite the possibility of finding epigenetic uranium mineralisation is regarded as low.

Within the granite most anomalies seem to be caused by difference in background content of radioactive elements. Thus no radioactive mineralisation was found within the youngest suite of granite. The exceptionally high geochemical anomalies recorded from this environment may possibly be explained as local seepage enrichments from fine grained talus material, and this is being investigated. Within the older granite suite a number of radiometric anomalies emerge from the aerial gamma-spectrometric survey. During a field check in a pyroxene-garnet granite north-west of Frederiksdal mineralisation was found with secondary uranium minerals. This granite, and similar complexes, merit further investigation.

Small uranium occurrences were also found in sulphide-bearing graphitic horizons of the pelitic gneiss/schist which are stratigraphically lower than the quartzite and meta-arkose (Escher, 1966). These formations are exposed mainly to the south and to the west of Tasermiut. Although no major anomalous districts were found in the gneiss and pelitic schist during the regional survey the uranium potential of these rocks still remains to be investigated in more detail.

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Uranium districts in South Greenland

Ashlyn Armour-Brown, Tapani Tukiainen and Bjarne Wallin

From the preliminary evaluation of the reconnaissance exploration results in 1979, two areas were outlined as having some potential for uranium mineralisation (Armour-Brown *et al.*, 1979). Further evaluation of the data extended the northern of these two areas to include the area which lies just south of the Igaliko Fjord (Vatnaverfi area, fig. 18). In addition the northern part of the Igaliko nepheline syenite complex, the Motzfeldt centre, was shown to be more interesting as a result of the evaluation of gamma-spectrometer results and the identification of uraniferous pyrochlore from some of the rock samples. Some smaller anomalous areas in the Kobberminebugt area north-east of Nunarssuit, and Kap Farvel region, particularly in areas of metasedimentary rocks, were identified by reconnaissance geochemistry.

The 1980 field season was devoted mostly to gathering data to assist in the interpretation of the reconnaissance results. During the course of this work extensive areas with high radioactivity were found over the eastern and northern parts of the Motzfeldt centre. Six pitchblende occurrences and numerous radioactive occurrences were found in the 'Granite Zone' (fig. 18). Uraninite was also found in the Tasermiut area (Nielsen & Tukiainen, this report).

Gamma-spectrometer results (thorium, uranium) of the aerial survey covering the more interesting parts of the field area were compiled and plotted before the field season and were used in the field work. During this field season some 1500 km of gamma-spectrometer flight routes were measured. This allowed the completion of the reconnaissance flight routes at a more or less even density over the whole field area, as well as some closer spaced lines in some smaller areas of interest, in order to test the usefulness of the method in follow-up work in the different terrains.

Motzfeldt centre

Based on the results of the 1979 reconnaissance a more detailed airborne gamma-spectrometer survey was made and geological mapping of a reconnaissance nature was carried out over the Motzfeldt centre.

The airborne survey revealed extensive areas, as well as numerous minor localities, of highly radioactive rocks which are situated within the syenite units SM 1 and SM 2 in the northern part of the centre and within the 'East Motzfeldt Syenite' (Emeleus & Harry,