Tungsten mineralisation in the Godthåb area, West Greenland

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The discovery in 1982 of scheelite in stream sediments in the Godthåb area and *in situ* mineralisations in the early Archaean Akilia rocks on Storø in Godthåbsfjord (Appel, 1983) was followed up by field work in the summer of 1983. The regional stream sediment sampling programme was extended to Ameralik fjord, south of Godthåb, and to the inner parts of Godthåbsfjord. Field work at night with ultra-violet light examination was carried out on Storø and Sadelø in Godthåbsfjord and in Kobbefjord, south of Godthåb. The latter part of the programme was carried out with the assistance of volunteers from Ungdomstjenesten (Greenland's Youth Organisation).

The following report is based on field observations only. Laboratory work has been limited to X-ray identification of scheelite in four rock samples; two from Storø, one from Sadelø and one from Kobbefjord.

General geology

The oldest rocks in the Godthåb area are the early Archaean Amîtsoq gneisses which can be traced for more than 150 km from the Isukasia area, north-east of Godthåb, to the coastal area south of Godthåb. The radiometric age of the Amîtsoq gneisses is about 3700 m.y. (Black *et al.*, 1971). In these gneisses remnants of a supracrustal belt occur, the so-called Akilia enclaves. They range in size from a few metres to several kilometres in length. The biggest enclave is the Isua supracrustal belt, situated 150 km north-east of Godthåb. The most important lithologies in these supracrustal enclaves are acid and basic metavolcanics with interlayered horizons of banded iron-formation (Appel, 1980). It was in some of the layered amphibolites in the Akilia enclaves that scheelite mineralisations were discovered (Appel, 1983).

The Nûk gneisses comprise banded to homogeneous quartzo-feldspathic intrusive gneisses which enclosed extensive fragments of Malene supracrustal rocks, as well as anorthosites. The supracrustal rocks can be traced from the inner part of Godthåbsfjord to the Buksefjorden area, south of Godthåb, and they can probably be correlated with the supracrustal rocks of the Fiskenæsset area 150 km south of Godthåb. Zircons from Malene metasediments show a metamorphic age of 2500–3000 m.y. (Baadsgaard, 1976). The Amîtsoq and Nûk gneisses have suffered several metamorphic events and have been strongly deformed. They can be distinguished in the field by the presence in the former of basic Ameralik dykes.

The youngest major event in the Godthåb area is the formation of the Qôrqut granite (fig. 25). This granite is intrusive and contains enclaves and fragments of Amîtsoq gneisses.

Sampling programme

Sediment samples were collected in all major streams in the Ameralik fjord area south of Godthåb, in the inner part of the Godthåbsfjord and in the Isukasia area. At each site 5 litres of coarse gravel was sampled and passed through a plastic sieve with 1 mm holes. The coarse fraction, amounting to about 90 per cent, was discarded. The fine fraction was panned and

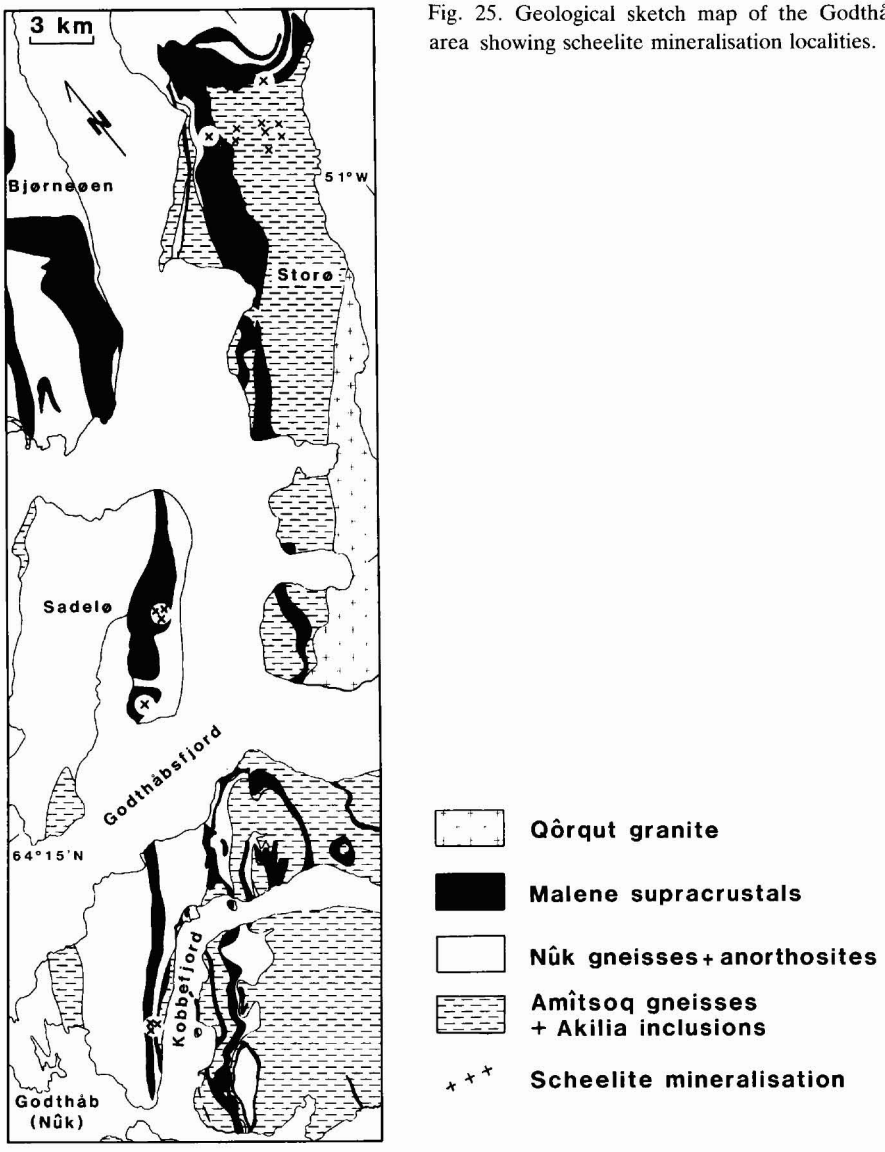

Fig. 25. Geological sketch map of the Godthåbsfjord area showing scheelite mineralisation localities.

the heavy mineral concentrate was examined in the field in ultra-violet light. The scheelite grains were counted and the approximate size of the grains was estimated and the fluorescence colour noted. One hundred samples were collected in the initial sampling programme, and about 50 samples in the follow-up programme.

The main difficulty in evaluating the sampling results is that even well mineralised horizons only produce small anomalies in the stream sediment. Sediments with as few as three to five grains of scheelite are anomalous, and stream sediments with more than 50

grains of scheelite are exceedingly rare, even in close proximity to known scheelite mineralisations. An example from Storø illustrates the problem. In the Malene supracrustals on Storø a well mineralised hornblendite occurs, with closely spaced joints covered with scheelite. This hornblendite is crossed by a stream, and in ultra-violet light the scheelite mineralisation can be traced in the river-bed right across the stream. The mineralisation zone is 0.5 to 1 m wide. Sediment samples collected 10 and 60 m downstream contained nineteen and eight grains, respectively. This demonstrates that even stream sediment samples with a few grains of scheelite should be followed up.

Scheelite mineralisation

An important result of the summer's field work was the discovery that scheelite mineralisation also occurs in the younger Malene supracrustal rocks. Furthermore, it is now clear that scheelite is found in larger quantities in Malene rocks than in the older Akilia amphibolites.

The scheelite-bearing amphibolites found in 1982 on Storø (Appel, 1983) were investigated in more detail, and a large number of new mineralisations were discovered. Most of the scheelite occurs in dark grey to black, weakly layered to banded amphibolites. The amphibolites range in size from less than one metre up to a few tens of metres across strike, and can be traced for up to one kilometre along strike. The scheelite in the amphibolites is found as disseminated grains often particularly abundant along the layering. This scheelite has normally a bluish fluorescence colour. In the amphibolites, scheelite, often with white fluorescence colour, occurs as joint coatings, centimetre size porphyroblasts and massive sheelite in veinlets. The scheelite veins are up to several centimetres wide and up to one metre long. Scheelite has also been found in mica schists and altered ultrabasics. This scheelite often contains up to a few per cent molybdenum, estimated from the strong yellow fluorescence colour. Occasional specks of scheelite were observed in Amîtsoq gneisses and even in Ameralik dykes.

In the Isukasia area, about 150 km north-east of Godthåb, 22 stream sediments were collected and most of these carried scheelite. Lack of time prevented a search for *in situ* mineralisation, but the distribution of scheelite in the streams shows that the mineral does occur in the Isua supracrustal belt.

Scheelite mineralisation in Malene supracrustal rocks has been observed on Storø, Sadelø and in Kobbefjord (fig. 25) in various rock types.

On Storø, scheelite has been found as scattered disseminated grains in a dark grey, banded amphibolite and as coatings on closely spaced joints in hornblenditic rocks. The width of the best mineralised hornblendite is 0.5 to 1 m with an exposed strike length of a few tens of metres, but open at both ends. The bluish fluorescent scheelite is mostly fine grained, but occasional centimetre size porphyroblasts occur. These scheelite mineralised amphibolites and hornblendites could not be mapped along strike owing to bad weather and the steep topography.

On Sadelø, scheelite was found in black hornblenditic rocks, in dark grey, slightly layered amphibolites and in greenish irregularly banded amphibolites. The latter seem to host the highest grade mineralisations. Locally small amounts of molybdenum-bearing scheelite are seen, but most of the scheelite contains only trace amounts of molybdenum. The scheelite on Sadelø is mainly disseminated, with local enrichment along the banding, but the mineral is

also seen on joints, in thin veinlets and as porphyroblasts. Scattered chalcopyrite grains are associated with the scheelite mineralisation.

The most extensive scheelite mineralisation found so far occurs on Malene mountain on the north side of Kobbefjord a few kilometres from Godthåb (fig. 25). Scheelite was observed in a number of small, dark grey amphibolites as disseminations and as porphyroblasts. These amphibolites occur close to the shore of Kobbefjord; they could be of either Akilia or Malene age. A few hundred metres uphill a 70 m wide steeply dipping sequence of hornblendites, dark grey banded amphibolites, greenish amphibolites and thin mica schists occur. The sequence can be traced for at least 10 km along strike, possibly extending to Sadelø and Bjørneø (fig. 25). Within this extensive sequence several scheelite-bearing zones occur. The zones are 1 to 2 m wide and carry appreciable amounts of scheelite as disseminated grains along the layering, on joints, in veinlets and as porphyroblasts. The mineralised zones were traced at intervals for about 100 m along strike; further along strike the mountain was inaccessible particularly for night time climbing. However, boulder tracing in the streams suggests that the scheelite mineralisation is more than one kilometre long. In between the mineralised zones, scattered grains of scheelite were observed. The whole sequence has been intruded by large Qôrqut pegmatites which however, are barren of scheelite.

Discussion

The scheelite mineralisation in the 3700 m.y. old supracrustal rocks and in the 3000 m.y. old Malene supracrustal rocks of the Godthåb area has the same mode of occurrence. It is confined to amphibolitic and hornblenditic horizons, where the distribution pattern indicates that the scheelite is stratabound. Later metamorphic and tectonic events caused mobilisation of the scheelite into veinlets and joints. It is noteworthy that the same type of ore forming processes were active in this area, with a time gap of about 700 m.y.

The known extent of the scheelite province is 30 by 150 km, with a possible extension of more than 150 km further southwards. The post-depositional events known to have affected the area, e.g. the metamorphism and the emplacement of the Qôrqut granite which are known to have caused mobilisation of the stratabound scheelite, increase the possibility of finding a tungsten deposit in the Godthåb region.

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