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Tungsten in the Godthåb area, West Greenland

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The tungsten mineral scheelite has not previously been reported from the Godthåb area in West Greenland. The first indications of its presence were found in heavy mineral concentrates from a stream on Storø in Godthåbsfjord.

Exploration for scheelite in Greenland is difficult. A systematic stream-sediment programme cannot be undertaken before mid-June because many of the streams are frozen or covered with snow until then. Examination in ultra-violet light must be carried out in darkness so scheelite cannot be looked for before the end of August because of the midnight sun and the work must be finished by early September when snow covers the ground. A minor difficulty in this context is the abundance of lichens with bluish white fluorescence which cover the rock surfaces.

The following report is based on field observations only. Laboratory work was limited to X-ray identification of scheelite in two heavy mineral concentrates and in two rock samples.

General geology

In the Godthåbsfjord area, several major rock forming events have taken place, the most important resulting in the formation of the Amîtsoq gneisses, the Nûk gneisses and the Qôrqut granite.

The Amîtsoq gneisses are the oldest, with isotopic ages of about 3700 m.y. (Black *et al.*,

1971). They are regarded as intrusive, and can be traced for more than 150 km from the Isukasia area north-east of Godthåb to the Buksefjorden area south of Godthåb. The gneisses are generally grey and homogeneous to banded. Inclusions of an older supracrustal belt, the so called Akilia inclusions, occur in the gneisses. The inclusions range in size from a few metres to many hundred metres, the largest being the Isua supracrustal belt which is more than 30 km long. The most important lithologies in the Isua supracrustals and in the Akilia inclusions are weakly banded amphibolites and horizons of banded iron formation, together with minor horizons of metasediments. The Akilia inclusions can be traced continuously from the Isukasia area to the Buksefjorden area, south of Godthåb. It is within these Akilia inclusions that scheelite mineralisation occurs.

The Nûk gneisses comprise banded to homogeneous quartzo-feldspathic intrusive gneisses (McGregor, 1973), formed about 3000 m.y. ago (Pankhurst *et al.*, 1973). Extensive fragments of Malene supracrustal rocks and horizons of anorthosite occur enclosed within the Nûk gneisses.

The Amîtsoq and Nûk gneisses are distinguished in the field by the presence of Ameralik basic dykes in the former (McGregor, 1968). This dyke chronology is very useful, but it has its limitations since not all Amîtsoq gneisses have been intruded by Ameralik dykes.

The formation of the Qôrqt granite 2600 m.y. ago (Pankhurst *et al.*, 1973) is the last major event in the Godthåbsfjord area. The granite is a polyphase intrusive granite, with abundant rafts and enclaves of the country gneisses (Brown & Friend, 1979). One of the granite phases was derived by anatexis of Amîtsoq gneisses (Brown & Friend, 1979). Abundant metre-wide coarse-grained quartz-feldspar-mica pegmatites are found associated with the Qôrqt granite.

Sampling programme

Stream-sediment samples were preferentially collected in streams close to rapids, where the sediments are coarse grained. Where possible, about 4 litres of sediment were collected, ranging in grain size from fine sand to pebbles a few centimetres in size. The samples were sieved through a 6 mesh sieve and the coarse material, usually amounting to some 90 per cent of the sample, was discarded. The heavy minerals in the fine fraction were concentrated by panning. The concentrate was examined in ultra-violet light, and the scheelite grains were counted.

After the initial discovery of scheelite in a stream sediment on central Storø, a semi-regional sampling programme was launched. In this programme all major streams and most minor streams on the islands Storø, Sadelø and Bjerneøen, as well as in the Kobbefjord and south-east Godthåbsfjord areas, were sampled (fig. 18). Close to 100 stream sediments were collected and most of the results are shown in figure 18. The large gaps between some of the sampling sites are due to the presence of near vertical walls. In the inner part of Godthåbsfjord (north-east of fig. 18) a number of stream sediments were collected, many of which contained large quantities of scheelite grains.

Following the semi-regional sampling programme, a detailed follow-up stream sediment programme was carried out on central Storø, where about 40 samples were collected. *In situ* scheelite mineralisation was found as a result of this programme. This discovery was unfortunately made very late in the field season, so only a few nights of field work could be spent on the scheelite showings.

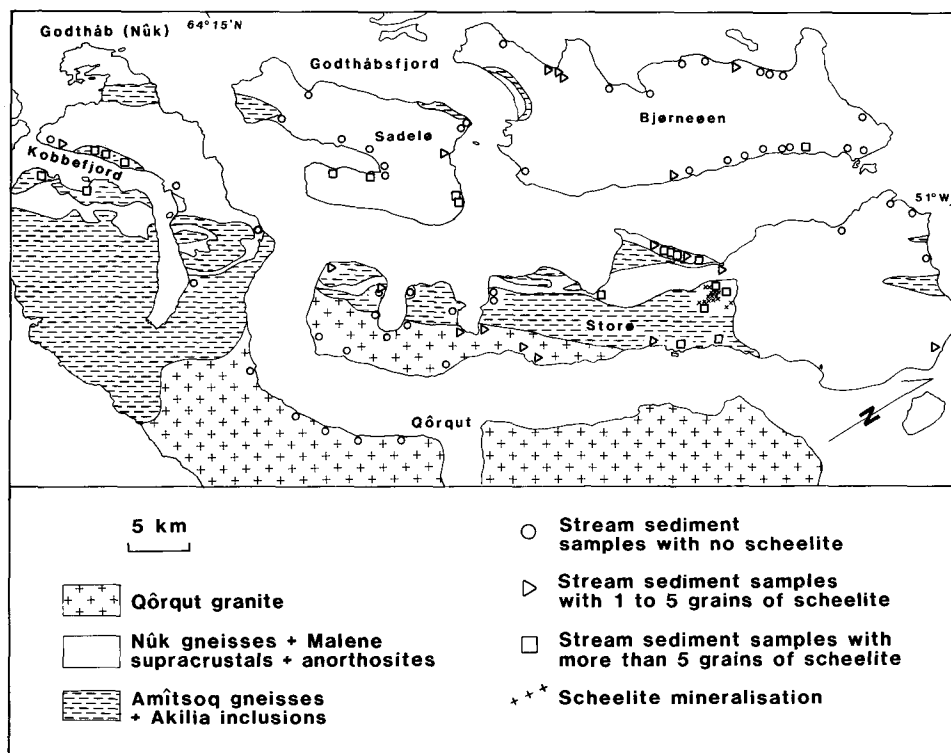


Fig. 18. Geological sketch map of the Godthåbsfjord area, showing sample sites for stream sediments and *in situ* scheelite mineralisation

Scheelite mineralisation

The stream-sediment sampling programme shows clearly that the majority of scheelite anomalies originate in areas where Amîtsoq gneisses occur. Nûk gneisses and Qôrqt granite contain apparently no scheelite. It is noteworthy that just one grain of scheelite in a stream sediment sample indicates that areas of scheelite mineralisation occur in the hinterland, since streams draining areas with Nûk gneisses and Qôrqt granite are barren. There are, however, a few exceptions. On Sadelø and Bjørnøen scheelite anomalies are found in areas where no Amîtsoq gneisses have been recorded. A likely explanation is that Amîtsoq gneisses are more extensive than the map indicates. In this context it must be borne in mind that the gneisses are quite similar in the field, the main distinguishing feature being the presence or absence of Ameralik dykes. It is thus possible that scheelite can be used to delineate areas with Amîtsoq gneisses. The scheelite anomalies on south-east Storø in Qôrqt granite, can all be ascribed to Amîtsoq gneisses, since the streams originate in areas with Amîtsoq gneiss.

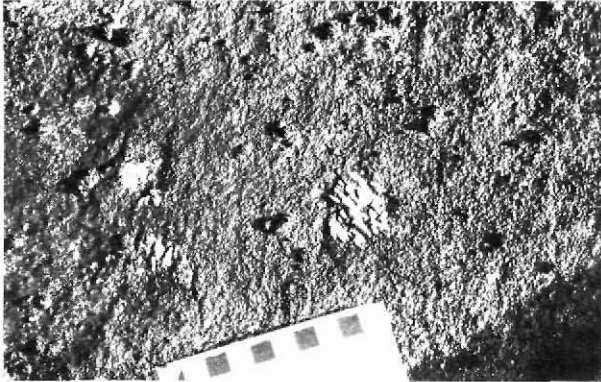


Fig. 19. Scheelite crystals on a joint surface in a grey supracrustal amphibolite.

The scheelite in the Amítoq gneisses has several modes of occurrence,

1. Scheelite in enclaves of supracrustal rocks (Akilia)
2. Scheelite in a discordant quartz vein
3. Scheelite in a gneiss boulder.

Most of the scheelite mineralisation found so far occurs in the Akilia supracrustals. Here, the most common host rock is a dark grey to black, weakly layered to bedded, amphibolite, where the scheelite occurs as tiny grains arranged parallel to the bedding or layering. This 'stratabound' type of scheelite mineralisation can be traced for several hundred metres. Thin scheelite-bearing mica schists are found associated with these amphibolites. Ultrabasic lenses are common in the Akilia inclusions. The outer parts of these lenses are frequently altered to a well lineated almost monomineralic, greenish, gedrite rock. In these gedrite rocks a peculiar type of scheelite mineralisation is found. It is a molybdenum-rich scheelite (see below) occurring as scattered grains and in tiny veinlets.

In the Amítoq gneisses several isolated, up to 2 m wide, grey layered Akilia amphibolites with scheelite are found. Most of the scheelite in these amphibolites is found on joints, as thin coatings and as centimetre-size crystals (fig. 19). Scheelite-bearing joints are quite common in the amphibolites, but are never found to continue out into the host gneisses.

The Amítoq gneisses on central Storø are cut by numerous pegmatites, and veins of almost pure quartz. Many of these pegmatites and quartz veins have been scrutinized for scheelite in ultra-violet light, but only one about 20 cm wide quartz vein with a few grains of scheelite was found.

No scheelite has been found *in situ* in the Amítoq gneisses. However, in a stream one boulder of grey gneiss with a few specks of scheelite was seen.

Field examination of scheelite in ultra-violet light showed that the scheelite apparently has a varying molybdenum content, depending on the host rock. This molybdenum content was determined by comparison with standards prepared by USGS. In the 'stratabound' type, the molybdenum content ranges from 0.05 to 0.24 per cent. Scheelite on joints in amphibolites contain 0.05 to 1.4 per cent molybdenum, whereas the scheelite in the gedrite-rich rocks contain 2.4 to more than 4.8 per cent molybdenum.

Discussion

The regional distribution pattern of scheelite in stream sediments shows a clear correlation with the presence of Amîtsoq gneisses in the hinterland. The Nûk gneisses and the Qôrqt granite contain no scheelite. A tentative explanation of the few exceptions is that Amîtsoq gneisses may have been mistaken for Nûk gneisses on parts of Sadelø and Bjørneøen.

With the exception of one loose gneiss boulder and one thin quartz vein, all scheelite found so far occurs in Akilia supracrustals enclosed in Amîtsoq gneisses. The biggest Akilia supracrustal enclave is the Isua supracrustal belt which is 30 km long. No attempt has so far been made to look for scheelite in this belt and the discovery of scheelite calls for a detailed investigation in this area. The present extent of scheelite anomalies is about 100 km. If the Isua supracrustal belt is included, it will enlarge the area with possible scheelite mineralisations to more than 150 km.

Whether a high-grade tungsten deposit occurs in the Godthåbsfjord area or not is of course highly speculative at the present time. However, the regional extent of scheelite indicates the possibility that high-grade deposits exist. Furthermore, the area has been metamorphosed at least twice, and has been intruded by the Qôrqt granite. Both the metamorphic events and the intrusive event have probably caused mobilisation, with subsequent concentration of scheelite, which could have resulted in the formation of high-grade ore bodies.

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