The minerals of the granite pegmatite at Spro, Nesodden, near Oslo.

A preliminary report.

By

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Abstract.

A Precambrian granite pegmatite formerly mined for feldspar is situated at Spro, Nesodden, 20 km SSW of Oslo, Norway. It is shown to consist of two different phases. The paragenesis seems to be as follows: 1) Older phase, characteristic minerals: microcline, muscovite, monazite, thorite, samarskite, columbite, beryl(?). 2) Younger phase, characteristic minerals: fine-grained albite, green muscovite, tourmaline, topaz, microlite, apatite, calcite, fluorite.

Introduction.

The pegmatite concerned is situated close to the sea shore a few hundred metres north of Northern Spro quay on the western side of the Nesodden peninsula, some 20 km SSW of Oslo. The countryrock is a highly varied Precambrian leptite migmatite (Gleditsch 1952) with fold axis and foliation nearly parallel to the pegmatite dike, which is lens shaped and about 230 m long with the main axis lying N-S. Its greatest width, exposed by the underground workings, is 24 m. See fig. 1.

Mining for feldspar and quartz took place on a large scale in the period 1904–18, although the mine was opened before that time, probably around 1880–90. The form and size of the mine (summer 1963) is given in fig. 1. The pegmatite has yielded several thousand tons of feldspar.

Mineral Descriptions.

Microcline perthite is the chief mineral of the pegmatite. It has a white to reddish colour. In contact with radioactive minerals the feldspar is stained red and is more brittle than usual.

Albite. The albite is white and has an anhedral granular texture which varies from moderately fine grained to sugary. Crystals of typical cleavelandite habit have not been encountered. The age relationships of the two feldspars are indicated in places near the border of the pegmatite, by the microcline being brecciated and the cracks filled with albite.

Quartz. This mineral possesses the greyish and milky appearance typical of quartz in Norwegian Precambrian pegmatites.

Muscovite. Ordinary silvery muscovite is most common; a single specimen shows a globular form ("ball mica"). In addition there occurs a greenish muscovite in small scales and crystals together with albite. Bjørlykke similarly reports greenish muscovite accompanying cleavelandite in the younger phase of the Iveland pegmatites (Bjørlykke 1935, p. 247). Optical spectrograms of the two mica types show them to be ordinary muscovites, with only slight differences in composition and no appreciable Li.

Fluorite. A green variety showing a weak fluorescence is found in quartz. A violet type is more widely distributed, either in small masses or as a coating on cracks. Both types give a fairly strong thermoluminescence.

Calcite. A few large accumulations of calcite (10–20 cm) intersected by crystals of green muscovite occur together with violet fluorite and in contact with albite, microcline, and quartz.

Tourmaline is very common in euhedral crystals together with albite and green muscovite. The crystals are often fractured and the fractures filled with quartz or albite. The colour is commonly black, but sometimes small crystal fragments possess a blue colour. An optical spectrogram reveals that the tourmaline is rich in Na and Fe. Marked pleochroism, O = strongly blue, E = light yellow.

Beryl was identified by its X-ray powder pattern. Euhedral crystals in quartz reach 1–2 cm in diameter, and are sometimes seen to enclose quartz and tourmaline. The mineral is usually strongly altered. A few small, clear crystals were observed in albite/quartz aggregates. These may represent recrystallized beryl material derived from the alteration of primary (?) beryl.

Topaz is occasionally met with as fresh crystals, up to 1 cm across, in quartz, – but more commonly the crystals are partially or wholly altered to muscovite. The mineral is only observed close to tourmaline. An optical spectrogram showed a Ge content of a few hundred ppm (Oftedal 1963).

Microlite. A rare mineral, occurring in euhedral brown crystals up to 3 mm in diameter and as irregular masses in quartz with finegrained

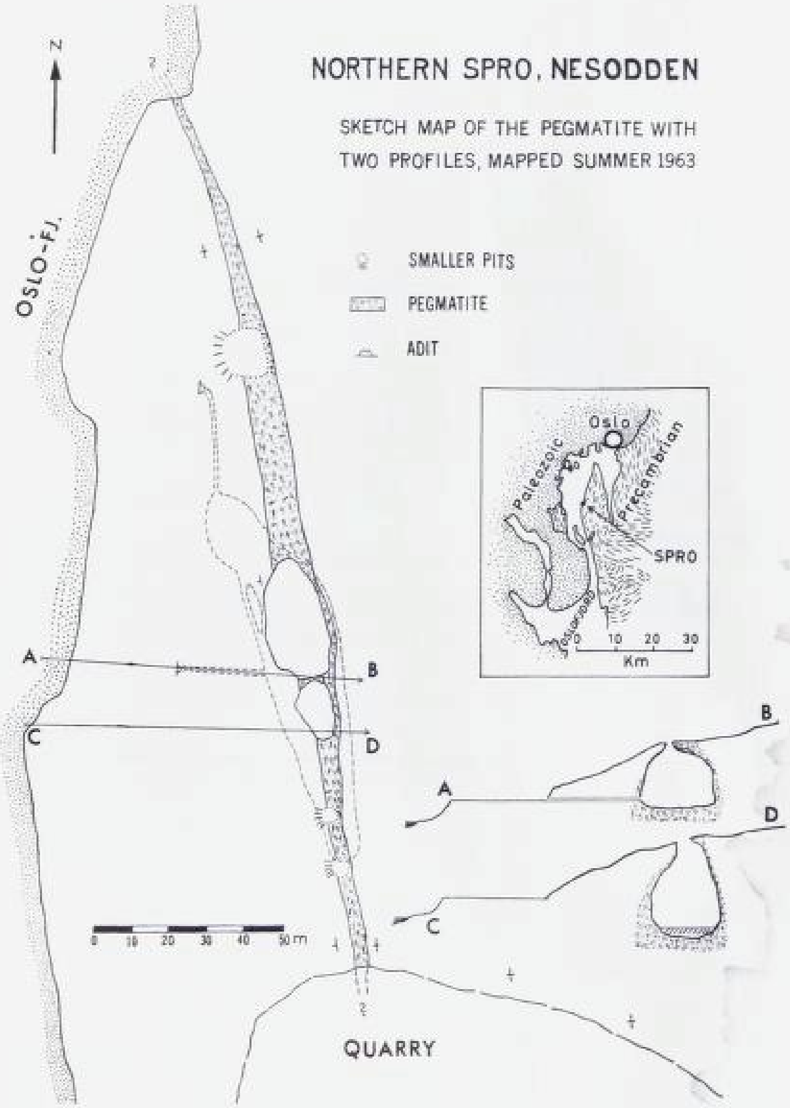

Fig. 1. The map is only very approximate, but gives a general idea of the situation. The quarry on leptite in the southern part of the area has been worked for road material.

albite and tourmaline, was identified by X-ray powder data as a non-metamict pyrochlore mineral. The crystals are somewhat rounded and show many forms. An optical spectrogram gave: Ca $\geq$ Na, Ta $>$ Nb

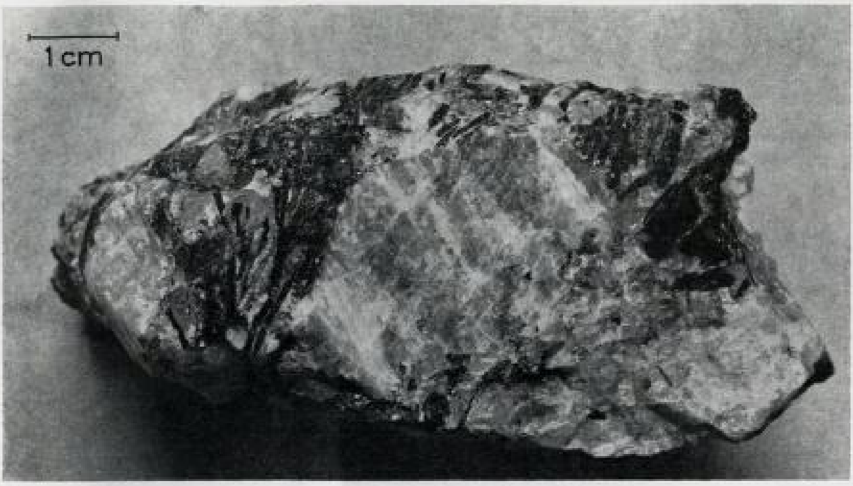

Fig. 2. Remnant of microcline, in the centre (older phase), surrounded by black tourmaline and quartz (younger phase).

> Ti, Pb, etc., which is in good accordance with the general formula of microlite.

Samarskite. Brøgger mentioned this mineral from Spro and identified it as either euxenite or samarskite (Brøgger 1906). It is a quite common mineral forming anhedral aggregates in microcline. The colour varies widely, from nearly black to brown and translucent yellowish brown. It is always metamict, giving the powder pattern of samarskite only after heating. An optical spectrogram showed Ta $\sim$ Nb, Fe, Ti, Y, Be, Pb (indicating U, Th). It is also worthy of mention that the W content is in the order of 1% (Oftedal 1961). Semi-quantitative X-ray spectrograms gave the following results: 1) Sample of nearly black mineral from microcline: 0,8% TiO_2, high U and low Y content (relative to sample 2). 2) Light brown mineral from an association with columbite: 10% TiO_2 (rather high for samarskites), relatively low U and high Y content. Both samples are unusually rich in Ta, suggesting that the composition is intermediate between samarskite and yttrotantalite. The two samples were heated and then X-rayed. They gave identical powder patterns of samarskite.

Euxenite. Brown euxenite in microcline from Spro was found in a sample belonging to the Mineralogisk–Geologisk Museum in Oslo (identified from the powder pattern after heating). It was collected in 1905. The author has not been able to find this mineral, which possibly had a very limited occurrence.

Columbite frequently occurs in crystals up to 2 cm long in albite and coarse muscovite, where it is always corroded and partly replaced by albite. It is also found in small irregular masses within samarskite. From an optical spectrogram it is seen to have a normal composition with a relatively high Mn:Fe ratio. The content of W is very low, of the order of a few thousand ppm.

Thorite together with samarskite occurs in small brown nodules. It was identified by the X-ray powder method.

Monazite. Some crystal fragments have been encountered in microcline.

Apatite. Two small masses of nearly white apatite fluoresceing yellowish red were identified optically; quartz with topaz are the host minerals.

Pyrite is found in small quantities only.

Chalcopyrite is still more rare.

Molybdenite. A few nodules and rosettes occurred near albite.

Gypsum as a cover on muscovite blades is a relative recent formation.

Malachite is a secondary product from chalcopyrite.

Some Remarks on the Mineral Paragenesis.

The granite pegmatite at Spro consists of two different phases. The following minerals most likely belong to *the older phase*: Microcline perthite, quartz, muscovite, samarskite, euxenite, columbite, thorite, monazite, and probably beryl. The W contents of samarskite and columbite have been mentioned above. Thus the samarskite contains about 10 times more W than the columbite. This is a very curious fact, as all evidence suggest a close genetical relationship between the two minerals.

The younger phase comprises the following minerals: Albite, quartz, green muscovite, tourmaline, topaz, microlite, apatite, calcite, beryl (recrystallized). Green fluorite also belongs here, and probably the violet variety as well. Calcium and boron are characteristic elements of this younger phase.

The position of pyrite, chalcopyrite, and molybdenite is more uncertain, they may belong to the older phase.

Gypsum and malachite are quite recent formations.

It must be emphasized that the present interpretation is only preliminary. A full clarification of this problem would require further work.

Acknowledgements.

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Sammendrag.

Mineralene i granittpegmatitten ved Spro, Nesodden, nær Oslo.

Den beskrevne pegmatitt ligger straks nord for Spro pukkverk, Nordre Spro, Nesodden, ca. 20 km SSW for Oslo. Den danner en stor linse i et prekambrisk leptitt-kompleks. Lengden er ca. 230 m og største observerte bredde i dypet 24 m. Pegmatittlinsen står nær loddrett og har hovedaksen omtrent N–S, som her også er retningen for leptittens foliasjon.

Pegmatitten er drevet på kalifeltspat og kvarts i årene 1904–18. Fig. 1 gir et begrep om gruvens størrelse.

Det er påvist og beskrevet i alt 21 mineraler, fordelt på to adskilte faser. Følgende mineraler hører til *den eldre fase:* mikroklin (perthittisk), kvarts, muskovitt, samarskitt, euxenitt, columbitt, thoritt, monazitt og sannsynligvis beryll. Et merkelig forhold er at samarskitten inneholder ca. 10 ganger så mye W som columbitten, selv om disse mineralene synes å være genetisk sammenhørende. Samarskittens Ta-innhold er forøvrig nokså høyt, slik at mineralet nærmer seg yttrotantalitt. TiO_2-innholdet kan gå opp i 10%.

Den yngre fasen omfatter: finkornet albitt, kvarts, grønnlig muskovitt, turmalin, topas, mikrolitt, apatitt, kalkspat, rekrystallisert beryll og antagelig grønn og fiolett flusspat.

Svovelkis, kopperkis og molybdenglans opptrer sparsomt; de tilhører muligens den eldre fase.

Gips og malakitt er sene dannelser.

Det bør understrekes at ovenstående tolkning er rent foreløpig.

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