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Postboks 3021, N-7441 Trondheim

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Tittel

Kort utdrag fra Rapp. -82 : Fremstfjell-underskelsene

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Ryan, Mike	10.09.	1983	Grong Gruber A/S

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Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geologi		Fremstfjell Skardfjell Gaizervatn Y-tjern

Råstoffgruppe	Råstofftype
Malm/metall	Mo, Cu, Py

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Beskrivelse av litologier, omvandlinger og strukturer i Fremstfjellområdet.
Beskrevet en kort befaring i Skardfjell hvor rustsoner med cu er observert ved Y-tjern
Ved Gaizervatn beskrives tuffsone med pyritt-magnetitt og sonen med Mo.

Forslag til videre arbeider.

KORT UTDRAG FRA

RAPP -82

FREMSTFJELL UNDERSØKELSENE

Grong Gruber A/S
N-7894 Limingen
10.09.83.

No major folds were mapped out. It may be that the granodiorite towards the western edge of the mapped area plunges gently eastwards on a gentle fold with an E - W exis. Because this area contains the quartz-molybdenum vein concentration, this model perhaps requires further study.

J. L. Enderby: Field-work at Fremstfjellet, Skardfjellet and Gaizervatn

Most time was spent at Fremstfellet, on and around the main mineralised area. A brief one-day excursion was made to Skardfjell, where molybdenum and copper anomalies had been discovered, and a two-day visit to Gaizervatn, with the object of comparing the three areas.

Fremstfjell

Lithologies

The different rock types seen at Fremstfjell were:

1. Greenstone
2. Gabbro
3. Granodiorite (trondhjemite)
4. Leucotrondhjemite
5. Metadolerite dykes.

1. Greenstones were dark green, fine/medium-grained strongly foliated or schistose and frequently rusted, due to rich pyrite content. They represent metabasic and intermediate volcanics; relict amygdales occur 200 m SE of borehole No. 9. Elsewhere (see report of S. Swatton) the 'greenstones' consist of metasediments, e.g. NE of Olavtjern.

2. Gabbro occurs as blocks up to 5 m across, and as elongate sheets or screens. These blocks etc. form a zone up to 200 m wide which runs NNW-SSE from Olavtjern to west of Bergtjern, more or less parallel with the greenstone/granodiorite boundary. Gabbro blocks were also found 200-250 m west of trig. point 689 m. Most were found in granodiorite. The northernmost outcrops appeared to be more basic/ultrabasic in character - in some places feldspathic pyroxenite was the field description used. To the south the blocks are strongly veined by

quartzo-feldspathic material and to the north epidote veining occurs in addition. When the gabbro was strongly altered it took a bright green colour.

3. 'Granodiorite' covers a wide variety of rock types varying from 'leucotrondhjemite' at one end of the scale to quartz-diorite/diorite at the other end. The rocks are medium to coarse-grained, contain dark chloritised hornblende and cream/yellowish green coloured feldspar. The granodiorites always show crude foliation and may be strongly schistose along the several shear zones that cut the intrusive. The granodiorite is often altered by epidotisation, sericitisation, silicification and/or K-feldspathisation.

4. Leucotrondhjemite formed an irregular-shaped body within the granodiorite - the interfingering boundary tending to follow the E-W trending foliation. The leucotrondhjemite was not always foliated - especially, e.g. in trench no. 3. Ideally, no dark coloured minerals were present, and the rock was frequently veined with quartz, K-feldspar, epidote etc., giving a variety of pale colours, white, grey, cream, yellowish-green, pink etc., depending on the type of alteration/mineralisation.

5. Metadolerites occurred as dykes as pale/medium greenish-grey coloured rocks, fine-grained, containing pyrite cubes - but not containing 'vein-type' mineralisation.

Relationships between lithologies

The relationship between granodiorite and greenstone is clearly an intrusive one - with a sharp boundary and dykes of granodiorite cutting the greenstone. An intrusive nature is also implied by the common presence of greenstone xenoliths.

The occurrence of gabbro blocks suggests that the igneous complex is of a zoned character, from early basic to late acid, with the gabbro clearly a solid body subsequently broken-up during granodiorite intrusion.

The relationship between granodiorite and leucotrondhjemite is less easy to comprehend. Nowhere could there be seen a sharp contact between the two. There are two main possibilities for the nature and origin of the leucotrondhjemite:

(i) metasomatic alteration of granodiorite by sericitisation/epidotisation/silicification/K-feldspathisation - the interfingering contact produced by preferential alteration along the pre-existing foliation in the granodiorite.

(ii) crystallisation of a separate, late-stage, felsic magma, again the interfingering contact being governed by the pre-existing foliation.

Metadolerites were clearly a late-stage intrusive event, cross-cutting all other lithologies, but themselves succeeded by a foliation-producing event.

Structures

There are two sets of large-scale linear features - one set trending 070°, the other 160°. It was not always possible to prove that these features were faults, but where it was possible, there appeared to be no regular sinistral/dextral movement pattern.

The present mapping has extended the outcrop areas of 'leucotrondhjemite' to the north-west and it is possible that the segmented outcrop pattern is due to faulting splitting up a formerly more linear NNW-SSE leucotrondhjemite body into the three 'bodies' seen.

ENE-trending foliation affects the granodiorite, greenstone and, to greater or lesser extent, the leucotrondhjemite - and dips steeply to the north. There is great variation in foliation intensity - sometimes it may be so strong and accompanied by, e.g. silicification/sericitisation that identification of the original rock is not possible.

Vein orientations show two main trends - 050/090° and 120/140° - but orientations of all directions were seen to occur.

Dominant fracture and joint orientations in the granodiorite/leucotrondhjemite were 030/050, 060/080, 090/100.

The major structural trend for the above features as a whole was 060-080 - coinciding with that of the foliation.

Alteration and Mineralisation

Four types of alteration were seen at Fremstfjell:

(i) K-feldspathisation - field identification of pink feldspar.

(ii) Epidotisation - spotting the rock by alteration of plagioclase, also in discrete veins and clots.

(iii) Sericitisation - imparts a silvery sheen and good foliation.

(iv) Silicification - produces a hard, brittle, splintery or sugary textured rock.

Metalliferous mineralisation includes molybdenite, pyrite, chalcopyrite and magnetite (possibly with bornite).

Pyrite is ubiquitous, to greater or lesser degree. Greenstones are commonly rich in pyrite and the pyrite content of the granodiorite appears to show an inverse relationship with the distance from the greenstone contact - suggesting that the hot, magmatic granodiorite may have leached at least some of its pyrite from the greenstones.

The great majority of the molybdenite was found within leucotrondhjemite north of B.H.3 and south of B.H.1 - in an area of about 160,000 m^2. It occurred as quartz-pyrite-molybdenite veins, dry moly-paint on joints and cracks, disseminated throughout the rock, or as fine dust in quartz.

Chalcopyrite was found only rarely, sometimes associated with greenstone xenoliths; green secondary copper minerals formed thin films on joints etc.

Magnetite-pyrite-chalcopyrite ± ? bornite occurs in a small isolated pod associated with gabbro blocks north of Pistoltjern.

The apparently richer mineralisation along the Nedrebeckken shear zone and along the linear feature north of Smaltjern could be due to the 'faults' being already present before the onset of mineralisation. It is possible that the numerous faults and shear zones that cross-cut the area acted as channelways for the mineralising fluids.

Skardfjell

A brief reconnaissance of the Skardfjell area was made in an attempt to explain the molybdenum and copper anomalies in that area. Although the attempt was unsuccessful, it was useful to compare the geology with Fremstfjell and, later, Gaizervatn.

East of the Y-shaped lake (Bevertjern) east of trig. point 908 m, typically well foliated greenstones are very strongly rusted, parallel with the lake's elongation, with semi-massive pyrite-chalcopyrite. South of the star-shaped lake (Sternevatn) pyrrhotite occurs in rusty greenschists.

On the descent northwards from Sternevatn the contact with grandodiorite was crossed - typical granodiorite but strongly epidotised, with epidote and chlorite veins in a three-dimensional framework, and ? K-feldspar. Quartz- and quartz-feldspar veining increased in intensity northeastwards, where typical leucotrondhjemite was seen - but without conspicuous sericitisation, pyritisation or widespread silicification - and no molybdenum mineralisation. Only very occasional thin veins of pyrite occur. Although the rusting in the nearby greenstones was very strong, it was absent from the pyrite-free granodiorite and leucotrondhjemite. Vein orientations and joint patterns are similar to those at Fremstfjell.

From this brief comparison with Fremstfjell (and later Gaiservatn) it seems that the absence of pyrite and widespread sericitisation and silicification also marks the absence of molybdenum.

Gaizarvatn

One and a half days were spent around the eastern and southern end of Gaizervatn. Rock types were similar to those found elsewhere with, in addition, black cherty pyrite-magnetite rich rock - probably volcanic exhalative within greenstones.

The granodiorite was again of varied composition - probably silicified to a greater extent than at Fremstfjell, and also strongly sericitised. Compared with the other areas epidotisation and K-feldspathisation are only slight or absent.

Molybdenum mineralisation occurs chiefly in separate, large veins varying from 6 cm to 1.5 m in width, along with pyrite. The area of granodiorite containing disseminated pyrite and quartz-molybdenite veins measures about 800 m along the strike by 600 m across the strike - a similar size to that of Fremstfjell (but it must be remembered that only six or seven molybdenite-bearing veins have been observed within that area. On the other hand, the degree of exposure is not great and several more veins may well occur).

It seems reasonable to suppose that this area represents a different (higher) structural level than at Fremstfjellet and Skardfjell and that beneath it could lie Fremstfjell-type porphyry-type mineralisation.

S. Swatton: Field-work in the area north and north-east of Fremstfjell

The rocks of the area include the following:

1. Granodiorite (trondhjemite) - coarse-grained, quartz - plagioclase - hornblende rocks.
2. Leucotrondhjemite - essentially coloured mineral-free quartz - plagioclase ± alkali feldspar rocks.
3. Diorite
4. Gabbro xenoliths in trondhjemite.
5. Greenstones - metavolcanics and metasediments.
6. Calcareous metasediments.
7. Gabbro associated with diorite.
8. Magnetite rock within gabbro.

Summary of field results and suggestions for further work

At the main mineralised area of Fremstfjell no major new mineralised localities have been discovered. However, Jane's work shows leucotrondhjemite extending north-westwards - albeit lacking mineralisation. She has speculated that the leucotrondhjemite may have been elongate more or less N-S, subsequently split by faults into the three bodies now seen. From the 1980 geophysics and 1981 drilling, the mineralisation appears to plunge northwards - thus this possible north-westward extension of leucotrondhjemite may be of significance. In the leucotrondhjemite west and north-west of BH1 she notes "leucotrondhjemite becomes more and more barren to the north-west".

The comparison of Fremstfjell with Gaizervatn - involving the work of Jane, Don and Jon - highlights the different styles of mineralisation and different types of alteration with Skardfjell showing a third type. It was pointed out that Fremstfjell, with its porphyry style mineralisation and alteration (including K-feldspathisation, epidotisation, sericitisation, silicification, widespread pyritisation) differs from Gaizervatn, with its small number of thick quartz-moly-pyrite veins and alteration lacking conspicuous K-feldspar and epidote. Skardfjell, on the other hand, showed the presence of K-feldspar, epidote - and chlorite - veining but lacked widespread sericitisation, pyrite and molybdenite mineralisation.

From the current work and the Grongprosjektet 1974 geological mapping, the mineralised area SE and S of Gaizervatn appears to coincide more or less with the central part of a complex, elongate granodiorite body which either plunges below, or is in contact with, greenstones to the SW and NE. The 800 x 600 m dimensions of the rusty, pyritised area at Gaizervatn compare with those of Fremstfjell. If, as seems likely, we are dealing with different structural levels at Gaizervatn and Fremstfjell, it is interesting to speculate as to whether porphyry-style mineralisation and alteration lies beneath the Gaizervatn mineralised area.

The work of Steve, Pete and Garry confirms that no significant moly-mineralisation occurs outside the Fremstfjell area. Steve's discovery of a round-shaped gabbro-diorite body north of Olavtjern - along with evidence from previous mapping - lends support to the idea that the igneous complex

is of multiple intrusion type. Garry's work along the southern margin of his area has led him to propose a structural control on the Amoebtjern copper mineralisation.

Suggestions for further work

1. Extend the geological mapping NW of Fremstfjellet.

2. Further trenching and drilling at Fremstfjellet to define more accurately the limits of mineralisation -

   Eg. (i) trench northwards from BH2 to Smaltjern;

   (ii) extend trench no. 2 northwards and southwards;

   (iii) trenching and/or drilling between the BH3, 4, 5, 6 and BH7, 8 profiles.

   (iv) trenching west of trench no. 1 and BH1;

   (v) trenching and/or drilling between the BH5 and BH2 profiles; more holes on the BH2 profile to N & S.

   (vi) Extend, i.e. deepen BH's 4, 5 & 6.

3. Reconnaissance of the Reinsjöen - Nesapiggen geochemical anomalies.

4. ?? Deep drilling at Gaizervatn to probe the possibility of further mineralisation at depth.