Bergvesenet

Postboks 3021, N-7441 Trondheim

Rapportarkivet

Innlegging av nye rapporter ved: Arve

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
5038				

Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Elkem Skorovas AS	P4-12-61	Elkem Skorovas AS		

Tittel

Geological investigations in the Meråker area, preliminary report

Forfatter	Dato	År	Bedrift (Oppdragsgiver og/eller oppdragstaker)
Pokorny, Joel	10.01	1968	Elkem Skorovas AS

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Meråker	Nord-Trøndelag		17214	Trondheim

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geologi		Fonnfjell-/Mandfjell-området Meråkerfeltet sentralt

Råstoffgruppe	Råstofftype
Malm/metall	Cu, Zn

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Geologisk kartlegging rundt Røshaugen, vest i Fonnfjell.
Kompleks basisk geologi i øst med keratofyrer og grønnstein. Mange typer gabbro (gabbrodioritt) sentralt. I vest Sonvann-serien med paragneisser.
Pegmatittområde ved Sonvann; en mindre Mo-forekomst.
Det kommenteres på geokjemiske bekkesedimenter.
Fra en foreløpig vurdering av malmtyper og mineraliseringsopptreden, foreslås at videre prospectering blir konsentrert i det østlige malmdrag i Meråker. Det er dog mer behov for geologisk kartlegging i vest.
Original rapport vedlagt geologisk kart 1: 35.000 og 10 stk foto-illustrasjoner.

Engelien
P4-12-61

-8 APR 1968

Johannes Haugen fått 1 eks.

Dr. Joel Pokorný :

Geological investigations in the Meråker area.

/Preliminary report./

Prague, 1968

Geological investigations in the Meråker area.

/Preliminary report./

Dr. Joel Pokorný, Geological Survey of Czechoslovakia.

In August 1967 /from 1. 8. till 28.8./ I made some geological studies and investigations in the area south of Meråker /Central Norway/ together with a geological prospecting group of the Skorovas Mine /Elektrokemisk A.S./. This study journey was negotiated by Dr. F. Ch. Wolff /N.G.U. Trondheim/ and the expenses of the stay were payed by Elektrokemisk A.S.

Before leaving the field base in Meråker I handed over the air-photographs, the other aids and rock samples to be sent to Skorovas. Later during my visit to Skorovas /28.8.1967/ I delivered in person to Mr. N.Ch.Hald two notebooks, a manuscript geological map of the Röshaug area, a map of the documentary points and a small geological sketch of the area SW Klepptjörn with nickel anomalies in the running water sediments.

The main results of this geological investigation are described in this preliminary report. I shall return to all these data later in the main report in greater detail.

1. Geological investigations in the Röshaug area.

The area in the close neighbourhood of Röshaug /1111m/ occupies approximately 35 km^2 between the lake Sonvatn and the hill Fonnfjell. It fills in the hitherto blank spot on the geological map 1: 35000 compiled by M.Fišera, G. Grammelvedt, A.Haug, Z.Pelc, A.Siedlicka and F.Chr.Wolff.

In the central part of the area a varied complex of basic rocks and metabasics occurs, including elongated bodies of granitoids. In the east.this rock complex passes into a greenstone zone with keratophyres. The boundary can be hardly seen because of a strong mylonitization of both complexes. NB.

The basic complex proper is built by gabbros of different appearance, by gabbro-porphyrites with white felspar phenocrysts and by metabasites /gabbro-amphibolites/. Very often, they are foliated and mylonitized /planes of schistosity strike to the NNE and dip mostly to the W/. The petrography and the relationships of the gabbroidic rocks could not be studied and distinguished in the geological map. The basics contain thin to very thick sills of quartz porphyries and porphyroides, which attain the greatest thickness in the SE part of the area. The porphyry and porphyroid sills are very numerous and therefore only the largest of them could be designated in the map.

The microscopic studies of porphyroids are very important, because a part of them might represent a mylonitized granitoid.

The gabbroidic complex with porphyroids comprises numerous elongated bodies of granitoids /probably granites, granodiorites and trondhjemites/. In some places, younger dykes of fine-grained gabbros intruding into the granite were observed. It is hardly probable, that the whole gabbro-complex is younger than the granite /the concertion of dyke-like and elongated granite xenoliths is untenable/. The biggest granite body is situated in the central part of the investigated area /Fig.3/. In pinches out finger-like to the N, and on the eastern side it is accompanied by several subparallel thin granite bodies /Fig.7/.

In the western half of the map dominates a big body of medium- to coarse-grained amphibole-bearing rocks. The rocks named preliminary "gabbrodiorites" have a very irregular texture and structure indicating a metasomatic origin /Fig.6/. The contact boundaries are not sharp and in their proximity there are numerous dissolved xenoliths of fine-grained gabbros which can be often seen as nebulitic relics only. In fine-grained gabbros and other basic rocks in the exocontact zone of this "gabbrodiorite" there very frequently occur recrystallized aggregates of nest-like or veinlet-like forms.

The "gabbrodiorite" massif east of lake Sonvatna is a big arch-shaped body of a size of 2 x 4 km approximately. On its surface there are plentiful mantle relics represented mostly by fine-grained rocks /gabbro-amphibolites, biotite hornfelses/. In the field they are well visible and they are strongly crushed and coloured by limonite /Fig.4/.

Farther to the NW there occurs the sonnvan-series represented here by biotite paragneisses to mica schists, sometimes migmatized and containing numerous beds of orthogneisses and amphibolites /Fig.2/. In these places, the geological map is strongly simplified. This simplification can be improved later after the completion of the geological map farther to the NW. In the NE neighbourhood of lake Sonvatna a pegmatite field extends which is discussed in the next chapter 2.

In the mapped area the foliated rocks strike commonly to the NE or NNE and dip to WNW. They include very often broad mylonitized zones. The fold axes in the amphibolite NE from the lake Sonvatna /Fig.1/ are dipping at low angle 10° to NE. The "gabbrodiorite" massif has a dome-like form.

The most important joint-system in foliated granitoids /d.p.93, C23 1400/ is 100°/60°. In the foliated medium-grained "gabbrodiorites" /d.p.17, C23 1400/ two joint systems can be seen: 105°/82° and 190°/87°. Occasionally the third joint system appears /d.p.6, C23 1400/: 115°/90°, 190°75° and 160°/12°. In a tectonically crushed zone in "gabbrodiorite" three joint-systems were observed /d.p.162, C23 1400/: 105°/60°, 30°/87°, 310°40°.

On the land surface and in the air-photographs some faults are well visible. The most striking is a fault of NNW direction and numerous faults striking to the NW. An analogical fault system of the NE direction is not well developped, other directions are rare. These faults are probabely big tension cracks without any noticeable movement along them. Most likely, their origin is connected with a young vaulting in this part of the Scandinavian penninsula.

2. The Sonvatn pegmatite field.

The purpose of the geological investigations in the described area was also a revision of a molybdenite occurrence not far from the NE end of lake Sonvatna. During the geological investigations and mapping a pegmatite field with about 20 significant pegmatite bodies was found. A part of this pegmatite field is situated under the water surface of the lake.

The pegmatite bodies of small thickness are without any well-developped zoning and they can be called simple pegmatites. They form layered contaminated dykes in the amphibolite complex /Fig.8/ or they fill complicated systems of fractures in /NE from the p. 156 or d.p. 26/.

The bigger pegmatite lenses show a not very well developed zoning but they can be considered as complex bodies. The outer zone is represented by a coarse-grained biotite-pegmatite, followed by a medium- to fine-grained pegmatite. The central part is represented by a solid massive core of barren white quartz. The form of the quartz core is very irregular, and it contains sometimes /d.p.63/ discontinuous branched nests of medium-grained pegmatite with a high muscovite content. In some places big felspar crystals were observed /Fig.10/.

The thickness of the pegmatite bodies is 5 - 15m. Mineralization was not observed, with the exception of small aggregates of molybdenite on the d.p. 63 and 101. The Sonvatn molybdenite mine is only a small working /d.p.101/ approximately 2 x 2 x 2m with molybdenite accessories in the endocontact zone. In the point 63 molybdenite occurs in the central zone in the close neighbourhood of the quartz core.

The pegmatites are probabely without any economic value with regard to molybdenite, felspar and quartz. Nevertheless, I recommend some more detailed observations, as e.g. the identification of feldspars in the separate zones and farther studies of the rare mineralization.

3. The magnetic anomaly at the lake Sonvatna.

The elctric and magnetic geophysical measurements are an important supplement of the classic geological prospecting work in the Meråker district. The aeromegnetic results must be controlled by surface geomagnetic measurements, because there are some differences between the anomalies in the map and the real position of the magnetized bodies which are due to a great height

of the measurements-taking airplane, to a strongly articulated morphology and different positions of the disturbing bodies.

In the Röshaug area in a distance of 1,5 km east from the southern end of the lake Sonvatna a magnetic anomaly was observed. It has a direction NNW and the length of about 750m /the isoline 51000 γ/. It was found during the field investigations that the cause of this anomaly is probably an ore zone opened in a small mine named the "Sonvann gruve". The ore zone is represented by a tectonic crushed zone about 2 m thick /in gabbro-amphibolites/ including a compact magnetite bed 30 cm thick and accompanied by a sulphide impregnation / chalcopyrite, pyrrhotite, some sphalerite/. I recommend in this area a surface magnetic measurement in a profile net 100 x 10m /the length of the profiles 300m/.

The anomaly terminates in an arched form to the NNE and the last weak prominence /isoline 50400 γ / has its place 2 km to the E from the NE end of the lake. The cause of this anomaly must be found in the mantle relics laying on the surface of the "gabbrodiorite" massif. The anomaly can be hardly considered as prospective for ores. It will be sufficient to carry out only 1 or 2 interpretation magnetic profiles about 500m long.

4. Some comments to the geochemical prospecting.

In the area south of Meråker the drainage survey method was applied. It is practically the only geochemical prospecting method that can be used in this geographical conditions with success. The obtained concentration values of metals must be estimated on the basis of statistical calculations /Hawkes - Webb, 1962, Geochemistry in mineral exploration; I.A.Tumanov, 1963, Sb. Glubinnye poiski rudnych mestoroždenii, Gosgeoltechizdat, Moskva; B.J. Jufa - J.M.Gurvitsch, 1964, Geokhymia, No.

izdat, Moskva; B.J.Jufa - J.M.Gurvitsch, 1964, Geokhymia, No. 8, 817 - 824, Moskva/. In this way, the contrast between the th threshold values and actual anomalies can be found.

In summer 1967 the stream sediment analyses from the left tributaries of Torsbjörkja were at the disposal. I revised the most important points in the field and came tot the following conclusion:

a/ The marked copper and zinc anomalies are present in the proximity of the old mines Mansfjell gruve, Torsbørk gr. and Kongens gr. The northern group of old workings as Nye and Gamle Fondfjell gr., Gratlås gr., Löulibekk skj., Finnekar skj., Øytrå skj. and a mine signed in the map as P´ are accompanied by very small increase of Cu Zn concentrations. An important copper-zinc anomaly exists about 1 km SW of the old mine Mansfjell. On this very spot a small shaft and a dump with pyrite ores were found /docum. point 1, C 24 1400/. An insignificant ore occurrence on the d.p. 225, C 23 1400 does not cause any change in the metal content of the stream sediments.

The position of all strong copper-zinc anomalies is in the proximity of small ore bodies /pyrite beds with a little chalcopyrite and sphalerite /with a natural supergene régime affected by old open mines. Waters comming from the shafts and colar adits have a very low pH and they leached easily copper and zinc out from the pyrite ore bodies. The vegetation in the close neighbourhood of the colar adits is completely destroyed and on the boulders in the streams there are rusty films of iron oxides.

b/ Approximately 2,5 km WSW from the Kongens mine there is a very interesting nickel "anomaly" on the top of a mountain ridge where several small streams begin. I compiled a small geo-

logical sketch of this area with Mr. Løvaas. The western part lies on monotonous biotite mica-schists /schistose paragneiss/ with high mica content and sometimes with flat lenses of white secretion quartz. The eastern part is built by a basic complex containing metabasics, gabbros and gabbro-porphyrites.

The source of the nickel in stream sediments is undoubtedly in the basic rocks. The higher content in the western part can be explained by the presence of very fine sediments with organic matter and by the presence of pebbles from the basic complex transported here during the advance of the glacier. Farther to the E where the streams are more powerful the content of the fine-grained fraction with organic matter and therefore also the nickel concentration decrease. Consequently, the topography of nickel anomalies is in an apparent contradiction with the geological map in this area. In the basic rocks the sulphide accumulations were not observed. In foliated metabasics there are only fine-grained disseminated pyrrhotites and in porphyrites small veinlets of pyrrhotite.

c/ On the mountain ridge south of Meråker a very interesting "lead zone" can be observed. It strikes to the NNE and has typical higher concentrations of lead in the stream sediments. The lithology of these sediments and their position at the beginning of the streams are very similar to those in the case b/. The source of lead are very probably granitoids or porphyritic rocks. It will be possible to say more to this problem after the analyses of stream sediments from the western slope of the mountains have been placed at the disposal.

5. Some comments to the prospection methods used in the Meråker area.

Geological field investigations and the geological mapping in the scale 1: 35000 are the central point of the prospection methods. They can be considered as mostly effective though a lack of rock exposures in the lower parts makes some difficulties.

The method of drainage surveys is a single promissing geochemical prospecting method in this geographical conditions. For special purposes the hydrochemical method /the ratio of chloride and sulfate concentrations / can be used. The application in a regional scale is not possible because there are many pyrite-bearing horizons in the greenstone series.

From the geophysical methods the magnetic, electromagnetic and IP measurements are the most important. The use of SP measurement is suitable for special mapping problems /graphite zones/ and the swampy surface is the cause of many of its difficulties. In the places where the IP measurement is followed by diamond drilling, I can recommend a supplementary measurement with another arrangement /deeper range/.

The prospecting group of Elektrokemisk A.S. in the Meråker area was well organized and led by Mr. Hald. Prof.Bugge was its expert. I believe the working conception of this group based on the geological mapping combined with modern geophysical and geochemical methods was a very useful and an economical one.

During 1968 the mapping in the area south of Meråker will be probably finished. It will be necessary to entrust the problem to one geologist who will be able to summarize all work of different authors and to formulate special problems of detailed research necessary for the prognostic conclusions. I recommend

more detailed work in structural geology. In this way the research work of Mr. Rüi /assistant of prof. Bugge in Oslo/ is extremely important and it can be also applied in the Meråker area.

The main ore guides for ore deposits are in all cases exposures of ore-bearing rocks. In cases appearing suitable for diamond drilling, I should prefer detailed drilling in one or two sections to find the axis of the ore deposit and the distribution of metals in the ore body. This is more useful for thr prognostic conclusions then the extensive strike exploration.

6. The preliminary review of the Meråker area.

The prognostic conclusions cannot be formulated until 1969 when the geological mapping and laboratory studies will have been finished. I give only some preliminary comments in advance. Very propably, the most interesting ore mineral in the area is chalcopyrite. Sphalerite, pyrite and galena are less important. The chalcopyrite mineralization sometimes accompanied by sphalerite and pyrrhotite is concentrated in older bedded stratiform pyrite bodies /1/ such as in the zone Nye & Gamle Fondfjell gruve - Mansfjell gr. - Torsbørk gr., in magnetite accumulations /2/ of the Sonvann gr., or in favourable geological structures /3/ in the zone south of the lake Fossvatn on the localities Knoll, Dudu, Anna etc.

I assume that the type 3 based on favourable structures is more important from the prognostic point of view than the type 1,2 depending on a suitable tapomineral situation. The favourable geological structures are anticlines, contact surfaces of gabbro bodies, structural turns in metamorphosed complexes

etc. Therefore, the prospecting work should be concentrated in the eastern zone of the Meråker district.

Prague, 10. 1. 1968

Dr. Joel Pokorný
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J. Pokorný

Fig.1. Folding in the amphibolite complex. The fold axis dipping at low angle to the NE. Docum. point 33/ C 23 1400.

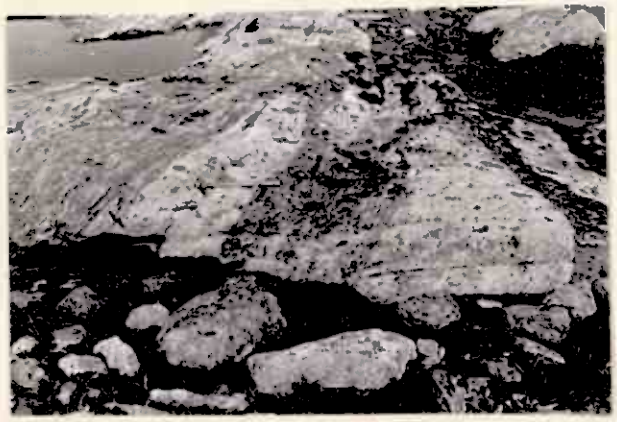

Fig. 2. Structure of the "varied amphibolite complex" NW from the hill Röshaug /1111m/.

Fig.3. A view of the granite body from the point 92/ C 23 1400 to the W. On the slope to the left there occur fine-grained gabbros and above them medium-grained "gabbro-diorites".

Fig.4. Relics of metamorphics upon the "gabbrodiorite" are strongly crushed and limonitized. Docum. point 165/ C 23 1400.

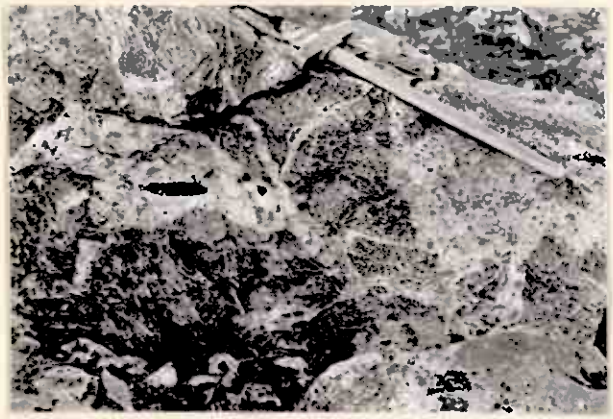

Fig.5. Irregular structures /agmatite/ in the "gabbro-diorite". Docum.point 41/ C 23 1400.

Fig.6. Inhomogeneity of the structure in the "gabbrodiorite. Docum.point 13/ C23 1400.

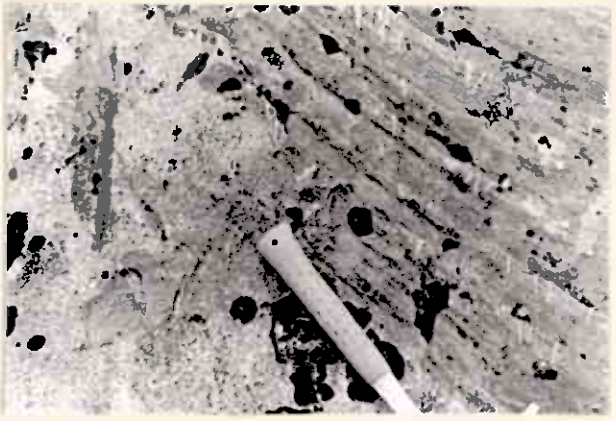

Fig.7. A contact between the granite /on the left/ and fine-grained gneisses. A phlebite-stromatitic migmatitizetion in the gneisses. Docum.point 86/ C 23 1400.

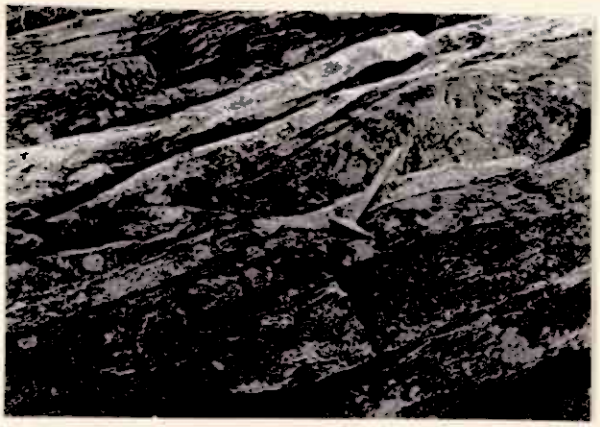

Fig.8. Sill-like fine-grained contaminated pegmatites in the amphibolite complex. Docum. point 34/ C23 1400.

Fig.9. Medium-grained pegmatite with an irregular qurtz core. The country rock is a coarse-grained "gabbrodiorite". Docum. point 38/ C 23 1400.

Fig. 10. Large felspar crystals in a pegmatite. Docum. point 101/ C 23 1400.

greenstone complex with intercalations of keratophyres

basic gabbro complex
metabasites of the Roshaug zone (varied gabbro-amphibolite serie)
amphibolites and amphibole gneisses of the Sonvann-serie

granitoides (granitoides contaminated granites, diorites)

quartz porphyre, felsitic porphyre, porphyroides

middle to coarse grained gabbro-diorite of the Roshaug type

gneissic rocks of the Sonvann-serie, hornfels gneisses on the gabbro-diorite

orthogneisses

pegmatites

mylonites

faults

old mines and exploration workings

Geological map of the Roshaug area Dr Joel Pokorny 1967	Målestokk 1:35,000	Tegn. Trac. Kfr.
	Erstatning for	
Elektrokemisk A/S Skorovas Gruber		
	Erstattet av	

A 2