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Geologi	Rapport	

Råstofftype	Emneord
Malm/metall	Ni Co Cu S

Sammendrag

Dette er en oppsummering av tilgjengelig informasjon om Lyngengabbroen fra før "Operasjon Phoenix" startet i 1973.

FOR FALCONBRIDGE NIKKELVERK A/S

A/S SULFIDMALM

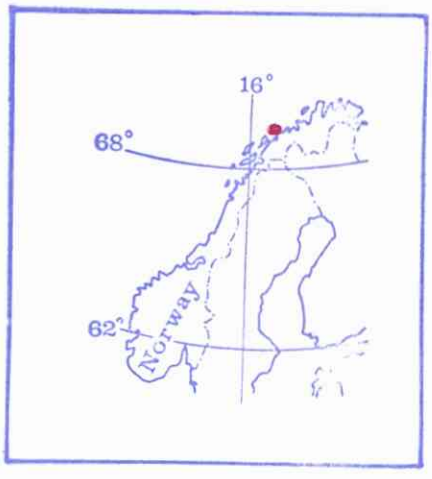
PROJECT 905-22

LYNGEN PENINSULA, TROMS.

JANUARY 1973

by

H. A. ROSENQVIST



LYNGEN PENINSULA, TROMS.

INTRODUCTION.

The Lyngen peninsula, located some 30 km E of Tromsø in N. Norway, is largely built up by one of the biggest gabbro massifs of the country.

Falconbridge's interest in the Lyngen gabbro and its Ni-Cu potential was initiated by G. P. Mitchell as far back as in 1962, i.e. the year A/S Sulfidmalm was formed. A 3 week reconnaissance of part of the area was taken without encouragement. In 1963 S. N. Charteris suggested a full assessment of the area (2 month's field program) but his proposal was precluded by budget limitations that year.

A 5-day reconnaissance in the area was taken on Sulfidmalm's behalf by T. Birkeland (Univ. of Tromsø) in 1972. His work showed the existence of sulphide "enriched" layers within the gabbro complex, the sampled ones being however of low content.

The Lyngen area is included in the plans for the helicopter supported program 22-PHOENIX 1973, whereby a full assessment (by prospecting) of its sulphide potential is planned to be made. This report is intended to summarize our present knowledge of the area.

GEOGRAPHY.

The Lyngenhalvøya (69° 30' N/20° E) is a 85 km long, 15 km wide N-S elongated peninsula bounded by Lyngenfjord (E), Ullsfjord (W) and Balsfjord (SW). It is characterized by rough mountaineous topography, the highest peaks reaching attitudes well above 1.500 m a.s.l.

Motor roads run along the fjords around the peninsula, the NE part being an exception. The municipal center of the area, Lyngseidet, can be reached by car from Tromsø in 1-2 hours.

Lyngen area is covered by good four-colour 1:50.000 topo map sheets. These are based on aerial photographs approx. 1:40.000 dated 1953-54.

GEOLOGY.

The dominant feature of the Lyngen area is the central core of layred gabbro, being exposed over approximately 400 km^2. The coastal areas of the peninsula are built up by Cambro-Silurian metamorphic rocks (largely metasedimentary), tectonically separated from the interior gabbro. The geology of the Lyngen area, as presented by Randall (1971), is shown in figs. 1 and 2.

(1) IGNEOUS ROCKS (Fig. 2)

a) Lyngen gabbro: This is a layered hypersthene gabbro striking approximately parallel to the peninsula and dipping to the west. The layering appears as variation in mineral composition as well as grain size. Individual layers, varying in width from 1-2 cm to several hundred meters, have been observed for several kilometers strike length. The gabbro is foliated parallel to the layering. Scattered but uncertain observations of rythmic layering suggests a bottom direction towards East. The internal structure of the layered gabbro has not been investigated. It is only described as complex due to thrusting faulting and folding.

The Lyngen gabbro is reported as extensively saussuritised and uralitised. The original composition according to Randall (1971) was that of a hypersthene gabbro characterizedby bytoronite, hypersthene (En 70) and clinopyroxene. Munday (1970), who worked in the northernmost parts of the peninsula, reported fresh gabbro principally consisting of plagioclase (An 78), diopsid, olivine, hypersthene and magnetite.

b) The Furuflaten gabbro is a small mass, forming a prominent peak 10 km S of Lyngseidet. The gabbro shows similar alteration to that of the main Lyngen gabbro, but they differ from each other in contact relationships. The Furuflaten gabbro has developed a metamorphic contact aureole (garnets associated with poikioblastic hornblende) whereas the contacts of the Lyngen gabbro are tectonic.

c) Several Ultramafic bodies, emplaced within the Lyngen gabbro, have been mapped (Fig. 2). These are dunites - pyroxenites, being exposed as elongated masses 1/4 - 2 km in length. In a considerable portion of the Lyngen gabbro, the ultramafics are located close to the eastern contact. They could be interpreted as early differentiates of the main gabbro, however tectonic contacts have been observed and in some instances fresh ultramafics are surrounded by strongly altered gabbro. Birkeland (1972) suggests the possibility of ultramafic intrusions along thrustplanes. The main ore mineral of the ultramafics is magnetite often with a small core of cromite (Randall 1971).

d) At the northern tip of the peninsula occures minor bodies of a strongly altered hornblende - clinozoisite - oligoclase rock. These extensively sheared bodies are interpreted by Randall as originally troctolites.

e) A number of serpentinites are located along the major dislocation, which forms the W boundary of the metasedimentary Vardtind Formation. In the south these are small (100-200 m long) bodies but in the north a dike like serpentinite of several km's length occure. The northern serpentinite is characterized by large magnetite octahedia and alteration to talc and carbonate.

f) Several small bodies of olivine-enstatite-dolomite rocks, named sagvandites, occure within the metasedimentary Lyngseidet group. An igneous as well as metamorphic (metasomatism of limestone) origin for the sagvandites has been suggested in the literature.

g) Meta-dolerite dikes occure within the metasedimentary Ullsfjord group as shown on fig. 2.

(2) COUNTRY ROCKS (Fig. 1)

The gabbro core of Lyngen peninsula is surrounded by largely sedimentary metamorphic rocks. Their general trend is sub-parallel both to the gabbro outcrop and the fiords.

- The country rocks W of the gabbro all belong to the greenschist metamorphic facies and consist of quartz-feldspar-mica schists, quartzite, pure and impure (sandy) limestones, conglomerates and chloritic phyllites. The phyllites of the Vardtind Group is found adjacent to the gabbro and has a faulted relation to the other rock groups (cf. 1 e).

- East of the gabbro amphibolites, graphitic phyllites, feldsphatised quartz-garnet-mica schists and limestone have been mapped. The metamorphic grade varies from greenschist (phyllites) to high amphibolite facies (schists).

  Chemical evidence and field resemblence with sheared gabbro suggests the possibility of an igneous parentage for the amphibolites of the Kjosen Formation (Randall 1971).

(3) STRUCTURE.

All the contacts of the Lyngen gabbro are described to be of tectonic origin and there is no evidence of a metamorphic ameole. In the west a steep westerly dipping fault marks the border. The eastern contact is sheared and of less clear character. Possibly it represents a thrust plane. It is considered that the Lyngen gabbro has been thrust, from the west, to its present position.

Randall (1971) identified three main fold episodes in the Lyngen area:

F_1 Some evidence of this can be seen in most of the metamorphic groups, but it is dominant in the Lyngseidet Group where a NW lineation is developed parallel to fold axes.

F_2 The second folding is visible as both major and minor folds and is responsible for the main distribution of rock groups. The axial planes and cleavage have a consistent strike (15°) but may vary markedly in dip. It is thought that the thrusting from the west which controls the boundaries of the Vardtind formation, the Lyngen gabbro and to a large extent the internal structure of the gabbro, was associated with this deformation.

F_3 The third deformation produced a strong almost vertical cleavage of similar strike to that of F_2 and some minor upright folds.

As mentioned above the internal structure of the gabbro core is described as complex. Fig. 3 shows a simplified profile over the gabbro as mapped by Birkeland in 1972. The gabbro is here folded in angular folds with N-S to NE-SW trending and moderately to low dipping axes. This means that approximately the same levels of the gabbro are exposed both in E and W.

(4) GRAVITY.

A gravity profile by Chroston (1972) across the Lyngen peninsula has revealed a positive 16 mgal anomaly associated with the gabbro (Fig. 4). Interpretation of the anomaly suggests that the gabbro is essentially wedge-shaped with the maximum thickness 1.5 km occurring at the western contact (Fig. 5). This shape is consistent with the hypothesis that the gabbro has been thrust in from the west.

Worth noting in fig. 5 are the gravity low Z and adjacent high Y. Following Chroston (1972) a possible interpretation for Z is faulting or thrusting of lower density rocks into the gabbro. The position of such a fracture approximately coincides with the line of ultramafic bodies, described above (1 c). It may be argued, says Chroston, that in fact the important feature is the complementary positive anomaly Y and that this is due to the higher density of the ultramafics. However their extent as indicated by their surface outcrop would not be sufficient to cause the anomaly.

RECONNAISSANCE PROSPECTING.

1962: Some 3 weeks in the area were spent by Per Lund, NGU-geologist. His main task was to prospect the ultramafic bodies, shown on the 1:1 milj. geological map of Norway i.e. a very limited number of the ultramafics now known to exist. Lunds investigations were discouraging and no sulphide mineralization was reported.

Lund also mapped out the gabbro contacts in the vicinity of Kjosenfjord and some scattered portions in the south.

1972: A brief reconnaissance (5 days) by T. Birkeland (Univ. of Tromsø), covering a considerable area N and S of Kjosen-fjord, was taken this summer. Rusty layers, of 10-100 m width, were commonly observed in the gabbro. The most prominent rust localities are marked on a 1:50.000 map together with sample localities. Rustiness is caused by sulphide dissemination evenly dispersed through out the layer. Concentrations were nowhere observed. Due to severe topography sampling was restricted to local talus and in some instances completely. Three mineralized rock samples have been assayed:

	Ni	Co	Cu	S	
TB Lyngen 3 B	0,15	<0,01	0,05	0,65	%
" " 4	0,07	"	0,18	0,60	"
" " 5 B	<0,05	"	<0,05	0,62	"

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ENCL. Fig. 1-5.

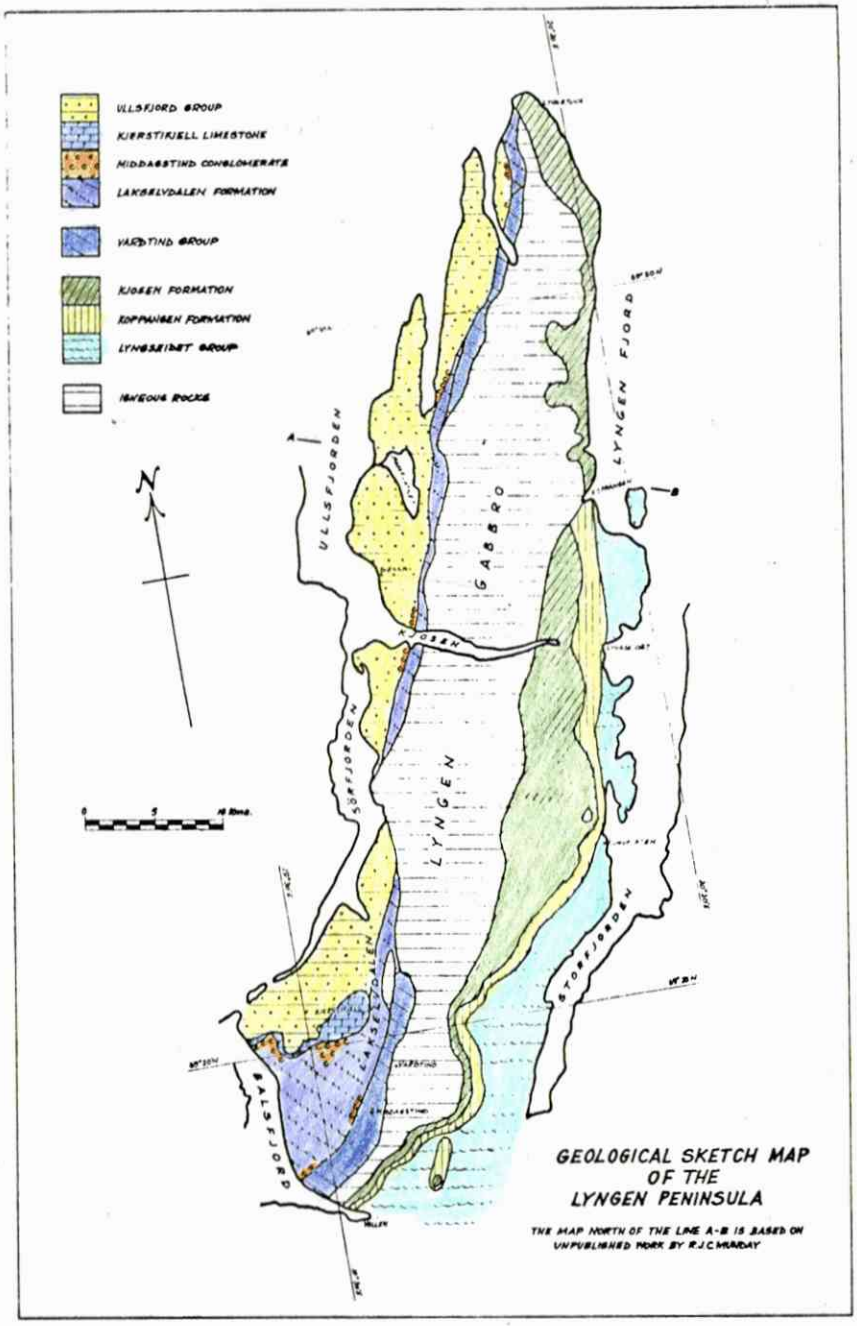


Fig. 1. Geological sketch map of the Lyngen peninsula.

RANDALL (1971)

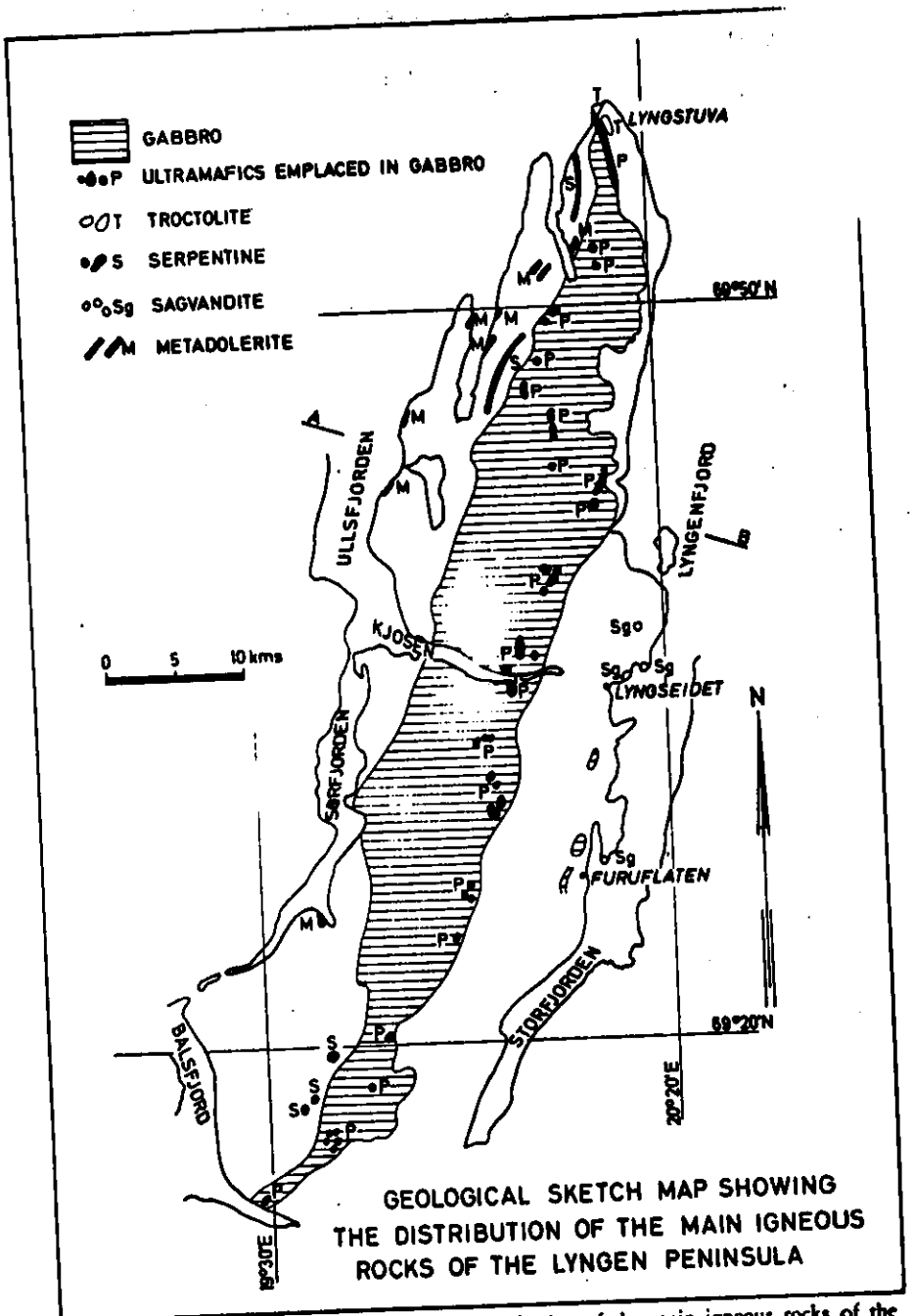
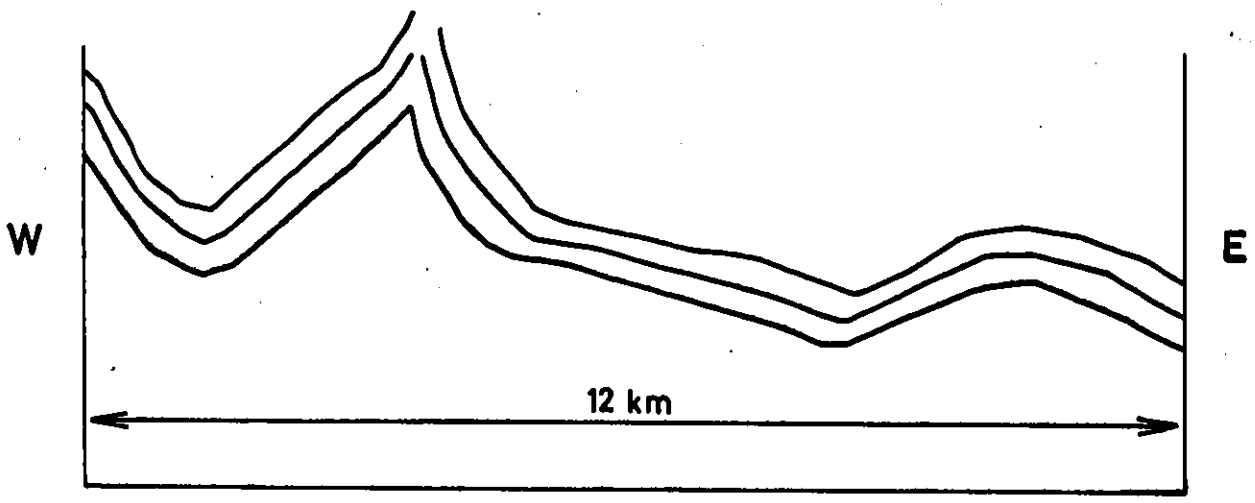


Fig. 2. Geological sketch map showing the distribution of the main igneous rocks of the Lyngen peninsula. The area north of the line A-B is based on unpublished work by R. J. C. Munday.

RANDALL (1971)

Fig 3.



Simplified profile E-W through the Lyngengabbro along Stortinddalen - Russedalen.

BIRKELAND (1972)

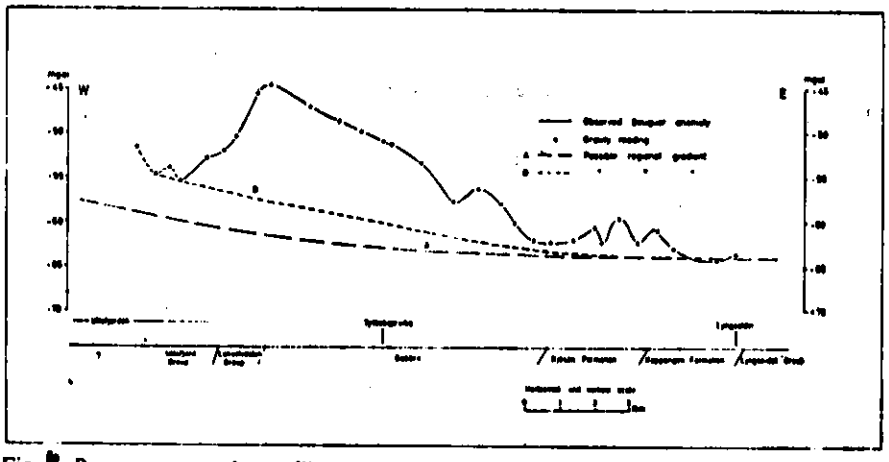


Fig. 4. Bouguer anomaly profile and sketch geology across Lyngenhalvøya.

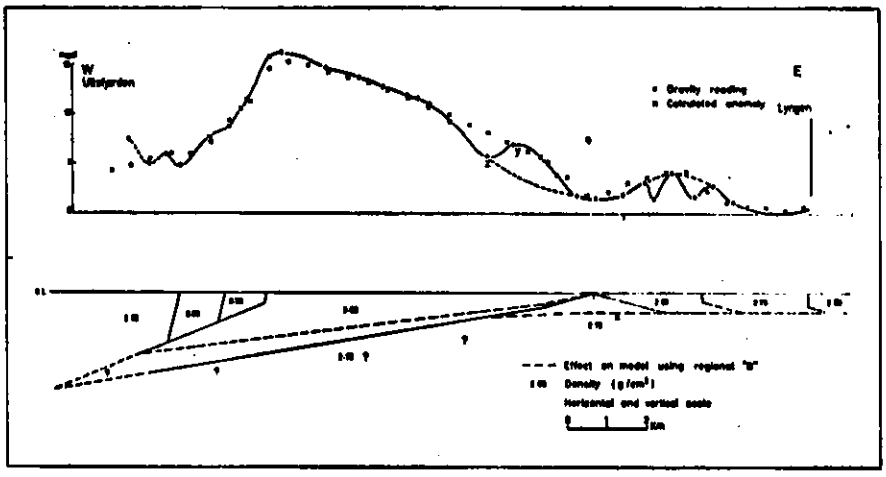


Fig. 5. Computed model for the residual anomaly based on regional gradient A.

A/S SULFIDMALM

INTER-OFFICE MEMORANDUM

Date: 19th February, 1973

To: Falconbridge Nikkelverk A/S ✓

cc: A. M. Clarke, D. R. Lochhead, R. B. Band, H. A. Rosenqvist

From: J. B. Gammon

Subject:

905-22, Lyngen Peninsula, Troms (Report No. 211-72-22).

Please find attached Rosenqvist's summary of available information on the Lyngen gabbro area which will be covered by "Operation Phoenix" in 1973. This major basic body (400 sq.kms.) is almost completely uninvestigated in its interior portions due to severe topography which has hindered access.

J. B. Gammon