ARCO Norway, Inc.

Hard Minerals Section

Report No. 83-670-6

Geological Field-Report, 1983

The Precambrian Rombaken Window

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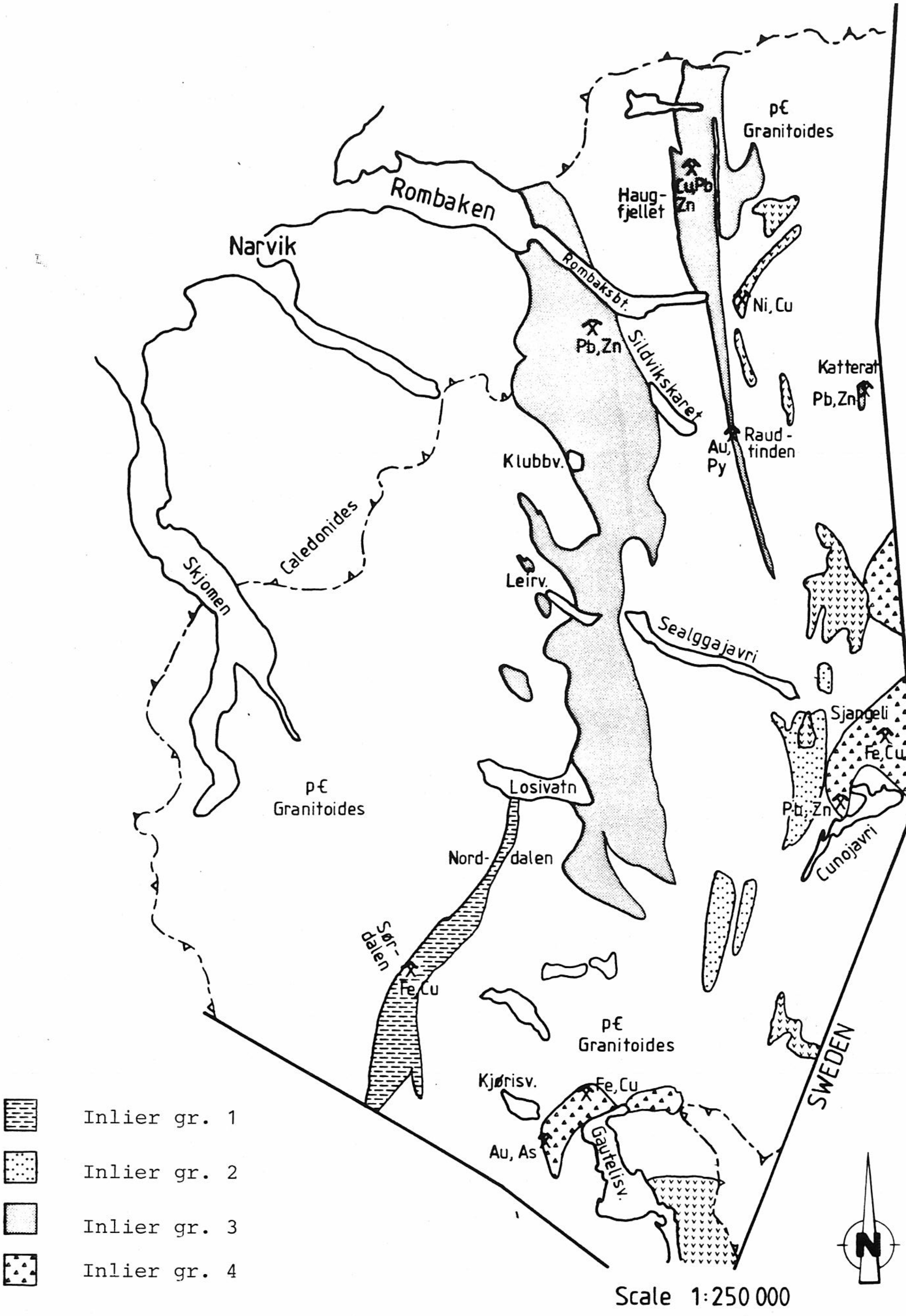
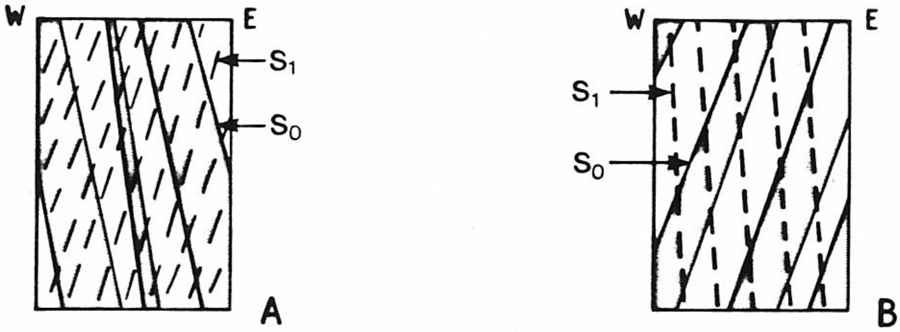


Fig. 2 Map showing the different groups of inliers.



Principal vertical sections indicating the relation between S and S in two dimentions.

A Haugfjellet and eastern part of the main group 3 inlier at Rombaksbotn.

B Group 3 inlier in Norddalen and group 1 inlier in Sørdalen.

Fig. 9

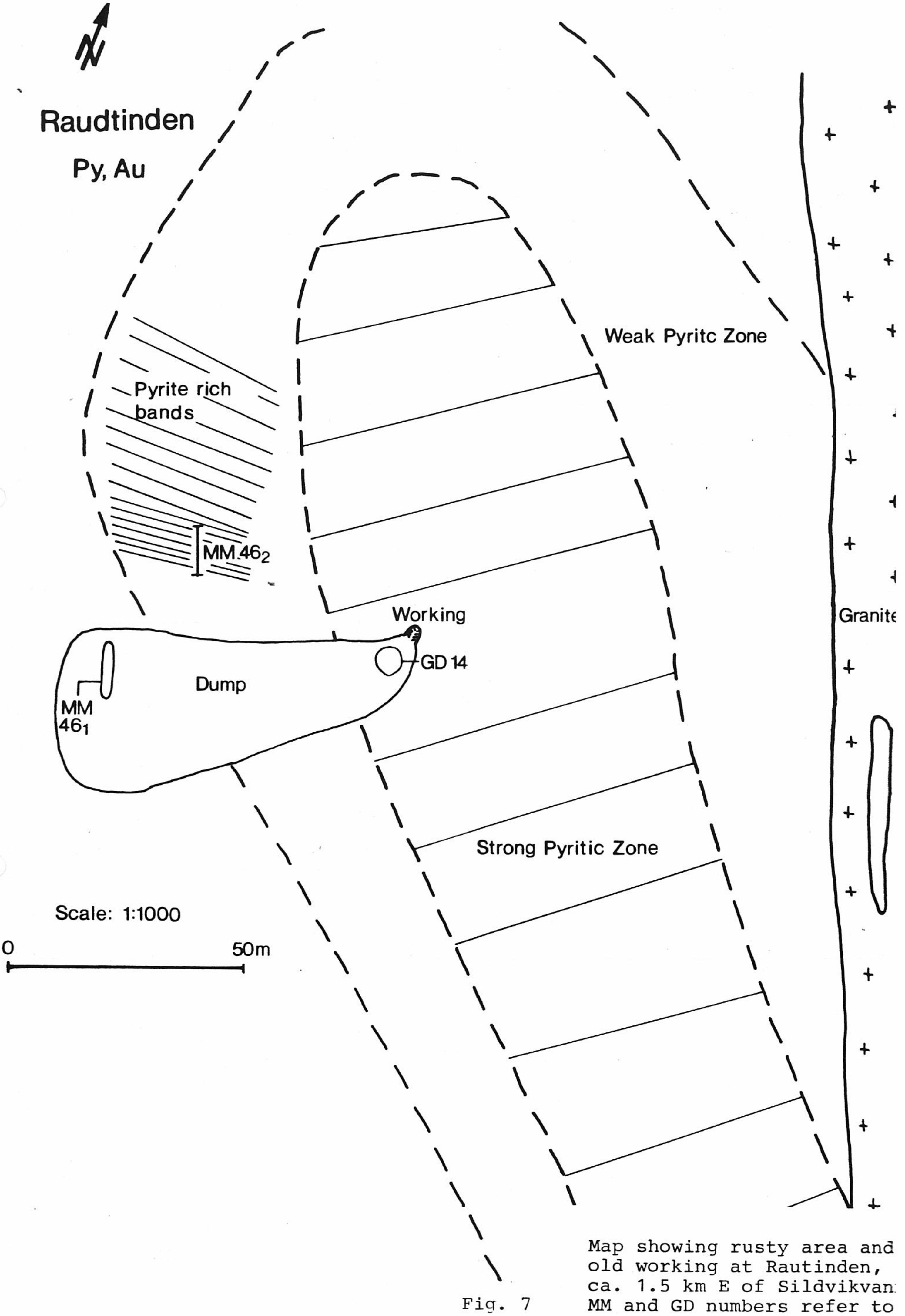


Fig. 7

Map showing rusty area and old working at Rautinden, ca. 1.5 km E of Sildvikvan[illegible] MM and GD numbers refer to chip samples.

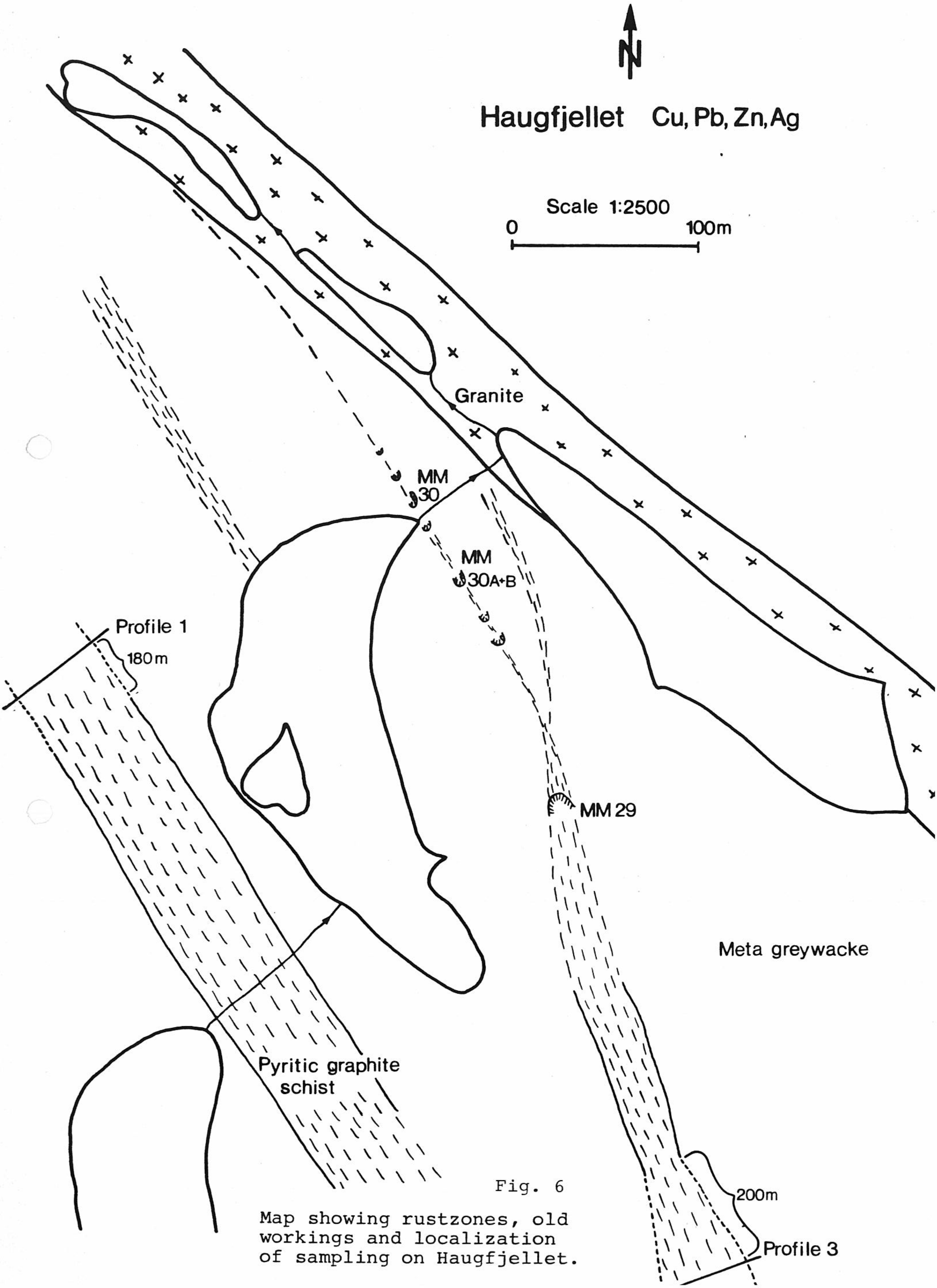


Fig. 6

Map showing rustzones, old workings and localization of sampling on Haugfjellet.

Report No. 83-670-6

GEOLOGIC FIELD-REPORT, 1983 THE PRECAMBRIAN ROMBAKEN WINDOW

1. INTRODUCTION

1.1 Location

The Rombak-window is located approx. 10 km east of Narvik in Nordland County, north Norway (Fig.1).

The investigated are is limitated by the Swedish-Norwegian border in south and east. The window, however, continues a short distance into Sweden. The Norwegian part of the window extends about 60 km north-south and is up to 35 km wide.

1.2 Physiography

The topography is very steep, ranging from sealevel to 1800 m. Within the high central part of the area the ground is heavily covered by smaller glaciers, morains and scree. Good outcrops are only found along the steep walls. Except for this area and the deepest vallies exposure is good. The soil layer is mainly thin or absent and vegetation sparce and dominated by heather, birch and pine. Most of the area is above the timber-line.

Mean temperature for January at sealevel is -2,2^{o}C and for June 10,5^{o}C. Mean precipitation for January is 52 mm and for June 50 mm. The summer 1983 was extremely wet.

1.3 Objective

The geological mapping and rock chip sampling reported here has been part of a comprehensive exploration program also including stream sediment sampling (Report 83-670-7) and stream heavy fraction sampling as well as magnetic orientation survey (Report 83-670-5).

The objective with this program has been to search for polymetallic sulfide deposits with gold-silver credits as well as gold-arsenic deposits. A potential for these types of mineralization the Rombaken Precambrian window was indicated during reconnaissance work early in 1983 season.

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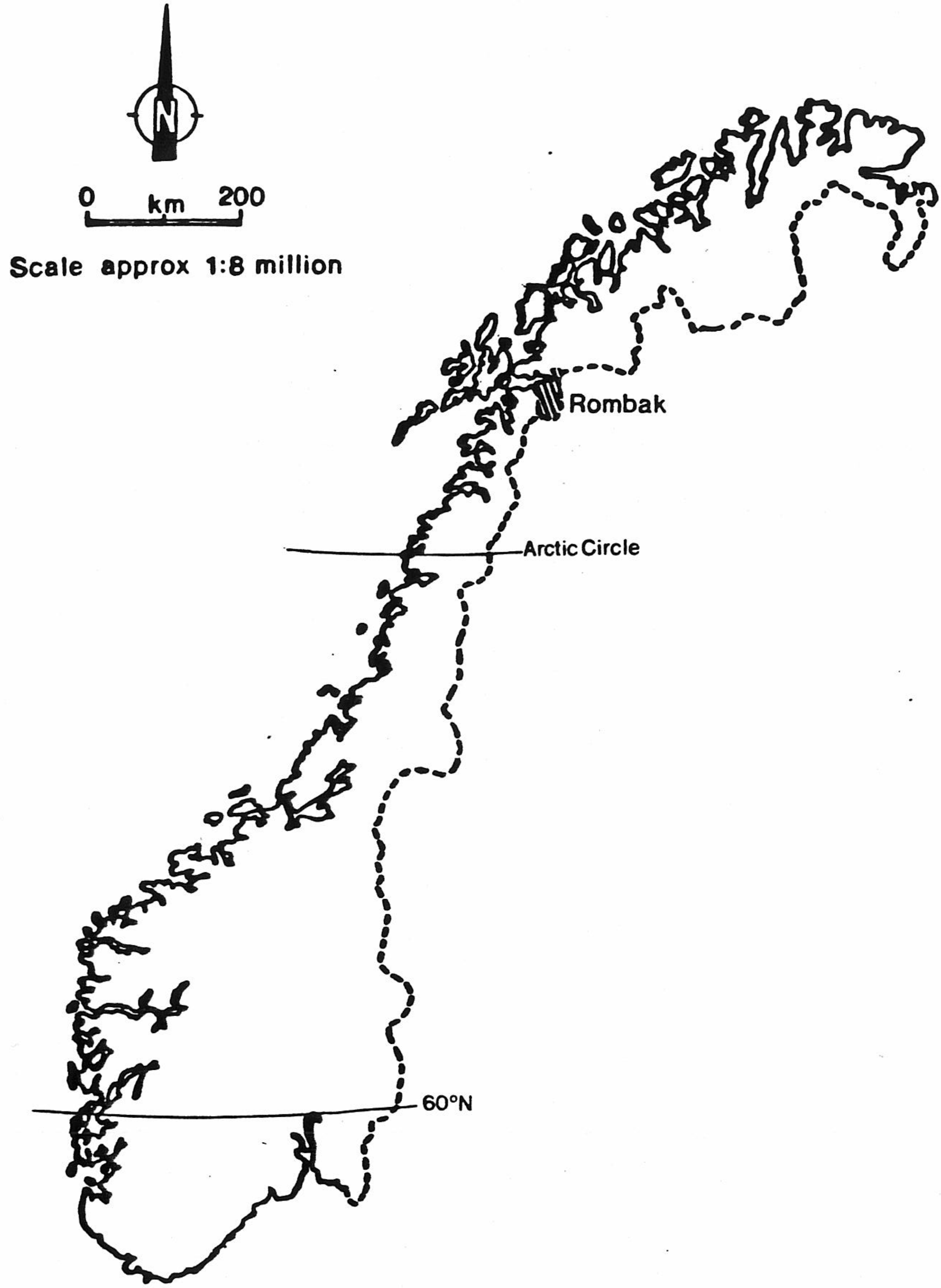


Location Map

fig 1.

2. GEOLOGICAL SETTING

2.1 Introduction

The Rombaken-window is a Precambrian window surrounded by supposed Cambro-Silurian rocks. These rocks are divided into: 1. an autochthon discontinuous unit consisting of Eocambrian (?) basal quartz-conglomerate and quartzite, and 2. an allochthon unit of mainly metasediments thrusted during the Caledonian orogeny.

2.2 The Rombaken-window

The main rock units within the Precambrian window are besides granitoids, quartz-biotite schists (used as a general nomenclature for the sedimentary rocks) with different types of volcanics of possible Archean age (T. Vogt, 1941).

The supracrustals are intruded by the following intrusives mentioned from youngest to oldest after T. Vogt (T. Vogt, 1941). 1. Hornblende-biotite-gabbro, 2. the Sildvik-granite (fine-grained microcline granite), 3. the Rombaks-granite and the Hunddalen-syenite (coarse-grained microcline rich rocks) and 4. fine-grained gabbroic rocks.

The Rombaks-granite and the Hunddalen-syenite have been Rb/Sr dated to 1707 ± 40 million years ($= 1,39.10^{-11}$, Heier and Compstone, 1969).

2.3 Supracrustals

The supracrustals are found as several inliers ranging from xenolithic in size to 35 km long and 6 km wide (Fig.2). They are mainly floating within the granites. The inliers are striking north-south or northwest-southeast with vertical or steep westward dip.

3. PREVIOUS WORK

The main field work in the area was done by T. Vogt and co-workers during the 1920's and 1930's (T. Vogt, 1941) and on a geological map (T. Vogt, Narvik 1:100 000, 1950). Later publications and maps by M. Gustavson (M. Gustavson, Narvik 1:250 000, w.descriptions, 1974) and by T. Birkeland (T. Birkeland, Skjomen 1:100 000, 1976) are partly based on the work done by T. Vogt and partly on their own field work. Several of the old workings have been briefly examined and described in Bergarkivets reports (BA. no. 4565, 4567, 1502, 4200, 3146, 2071).

More recent investigations of the mineralized areas at Kateratt and Sildvikskaret by NGU have been reported by I. Lindahl and O.A. Malm (1976/78 a,b).

4. CURRENT WORK

4.1 Introduction

The field work was carried out by M. Martinsen and G. Dalen July the 1st,- September the 22nd, 1983.

The work consists of geological mapping at scale 1:50 000 as well as rock sampling for assays and petrographic studies. Altogether 229 rock samples have been assayed (see report 83-690-9) and 10 polished sections and 64 thin sections have been examined. Section descriptions are filed separately in the Oslo office.

During the mapping the supracrustals have been shown to be more complex than previously described.

4.2 Descriptions of existing supracrustal inliers

The inliers have been separated into 4 groups, see Fig. 2. The term group is here not used in a formal stratigraphical manner.

4.2.1 Group 1

This group represents the south-western sedimentary-volcanic complex. It is one single inlier consisting of acid, intermediate and mafic volcanics as well as undifferentiated sedimentary rocks and several conglomerate horizons. A small Cu-magnetite working occur within this group. Current work by NGU will result in a detailed map of this inlier.

4.2.2 Group 2

The south-eastern acid volcanic unit. This is a rather homogen inlier east in Norddalen consisting of an acid volcanic rock. The unit is generally more magnetic than the background in the area, and some horizons within the unit are more magnetic than others.

4.2.3 Group 3

The central group include supracrustals on Haugfjellet. This consists of the two greatest inliers within the window as well as some smaller ones in Norddalen west of the main inlier. In the central group one has also included smaller inliers in the area north of Lossivann and one west of the main inlier on Haugfjellet.

The dominating rock-type is metagreywacke, however large parts of the areas are mapped as undifferentiated sedimentary rocks.

In the southern part, in Norddalen, the main inlier is very complex. It consists of undifferentiated sediments, acid and intermediate volcanic rocks. There are also some mafic rocks that may be volcanics, but some are clearly intrusives. The smaller inlier west of the main one in Norddalen are composed of quartzite and alkalifeldspar fels. The quartzite contains some thin recrystalized magnetite in concentrated bands (BIF-horizon).

The amount of volcanic rocks diminish northwards and disappear north of Lossivann. However, the high area here is poorly investigated.

On Haugsfjellet the main inlier is dominated by a metagraywacke-unit containing an amphibolite horizon of considerable thickness. West of the main inlier on Haugfjellet occur a smaller one dominated meta-greywacke. The amphibolite on Haugfjellet represents most probable a mafic volcanite. This gives us another domain of volcanics, but in this case much more homogeneous than in south.

Small workings on py, Cu, Pb, Zn, Ag and Pb, Zn occur within Group 3.

4.2.4 Group 4

The southern and the eastern volcanic-sedimentary inlier (Fig.2). The group is composed of two highly complex inliers. One located in the southermost part of the window, the other one in the eastern-most part.

The inliers consists of several types of metasediments mapped as undifferentiated rocks, calcite marble, low-An plagioclase fels, intermediate and mafic volcanics. The units are associated with gabbro and ultramafics. As/Au and Cu/magnetite workings are located at the border between undifferentiated sediments and marble in the southern inlier.

Cu/magnetite workings are located along small marble horizons within metabasalt and a Zn, Cu mineralization occur within graphitic mica schist in the eastern inlier.

4.3 Descriptions of individual rock types within the inliers

4.3.1 Acid volcanics

Acid volcanic rocks are found in the group 1, 2 and southern part of group 3. There is doubt about the acid rocks of group 3, if they are intrusives or extrusives. In the present report they are described as the latter. The distributions of the acid volcanics are shown on the enclosed map sheet Skjomdalen (Fig.3). In addition to the mapped horizon in group 1 there are smaller acid layers within the same volcanic pile. The acid layers within the eastern-most sediments of group 1, may also be volcanics.

The composition of the acid volcanics vary from rhyolitic to dacitic in both group 1 and 3 which have been examined i thin sections. Group 2 rocks have not been studied with in the microscope.

Quartz, microcline and smaller amounts of low-An plagioclase, muscovite, green biotite, epidote and clinozoisite are the main mineralogy. Accessory garnet, tourmaline and sphene occur. Veinlets of tourmaline have been observed at Kobbelven in the group 1 inlier.

The few thin sections studied give a trend from rhyolitic to dacitic from east to west in the main group 3 inlier in Norddalen.

The overall texture of the rock is aphanitic, somewhere with a weak banding and foliation. In group 2 several porphyritic zones exist. With feldspar occuring either as fenocrysts or porphyroblasts. In this inlier there also exists an agglomerate horizon that is shown on the map. In the western part of the inlier south of Lossivann the acid volcanic is inter-layered with amphibolite horizons.

The high magnetic anomaly in eastern Norddalen is associated with these acid volcanics (Report 83-670-5). The magnetic anomalies on the group 1 inlier in Sørdalen are not clearly associated with the acid volcanics (Report 83-670-5, NGU report no. 1836 by H. Håbrekke, 1982), in group 2 and east in group 3 weak and thin (1mm) magnetite rich bands have been observed.

The relations between the acid volcanics and the adjacent units can not easily be identified as primary or as later tectonic borders, because of the general strain configuration in the area. However, the borders in group 1 are supposed to be primary.

4.3.2 Intermediate volcanics

Intermediate volcanic rocks dominate the group 1 inlier. They also occur in the main inlier of group 3 in Norddalen and in the southern inlier of group 4 (see Fig.3).

The mineralogy based on thin section studies from groups 1 and 3 shows the following: Sausseritic plagioclase dominates, green (locally brown) biotite, green hornblende, epidote and clinozoisite are the main minerals in addition to 0-15% quartz and 0-10% microcline. Accessoric minerals are: Sphene, garnet, muscovite and chlorite.

The rock is in most cases porphyritic. Except for a few horizons east in the group 1 inlier, the porphyres are light greenish, sausseritic plagioclase with longest axis ranging up to 1 cm. The other porphyritic horizons have amphibole porphyres. The content of plagioclase porphyres in the group 1 inlier increase successively against east with a sudden drop. This is repeated a couple of times. The porphyres are supposed to be fenocrysts. In Sørdalen also a biotite spotted variety of the rock is seen.

As previously described there are several acid volcanic horizons and conglomerates within the intermediate rock in group 1 in Sørdalen.

Within the mapped intermediate volcanic layers in the southern group 4 inlier are several horizons of sediments and different varieties of volcanics. Individual layers range from 0,5-40 m. The layering is however disturbed by granitic intrusions and later faulting.

The porphyritic variety is also dominating within this inlier. The other varieties are bedded tuff and massive band. Some bands contain 1 cm big pebbles of very fine-grained dark grey material. probably bombs originated from a sedimentary rock much like the pelitic layers in the metagraywacke of the group 3 inliers. The rock has, however, not been studied in thin sections.

The intermediate volcanics in group 3 are located in the eastern-most part of the main inlier in Norddalen. The rock is mainly porphyritic. At this stage it seems that these volcanics are forming lenticular shaped bodies.

The contact-relationships of the intermediate volcanics looks primary in group 1 inlier, primary and locally affected by later faulting in group 4 and intrusive against the granite here. The relationship in group 3 is not worked out.

4.3.3 Mafic volcanics

The concordant layers of mafic, fine-grained rocks within the supracrustal package of groups 1 and 4 inliers are described under this heading as well as the amphibolite layers of group 3 on Haugfjellet.

The amphibolite on Haugfjellet shows the following mineralogy: Green pleocroitic hornblende (approx. 50%), sausseritic plagioclase, quartz, brown biotite, chlorite, epidote, clinozoisite, sphene and accessory garnet. The mafic volcanic layers of groups 1 and 4 have not been studied in thin sections.

The amphibolite layer on Haugfjellet (see enclosed map sheet Narvik, Fig.4) have a maximum thickness of more than 500 m. The unit is thinning out northwards.

To the south-east the rock is well banded with fine and medium grained bands of variable thicknesses. Generally the fine-grained bands have a higher quartz content than the coarser ones. Because of relatively low state of strain in the area the banding seems to be a primary feature, and it most likely originated as a mafic tuff with primary bedding. Some of the layers may be sedimentary and in that case the rock is locally a tuffite. Westwards across strike and northwards along strike the grain size decreases and the rock becomes more massive, but locally foliated. Also in this part sporadically a fine banding is observed.

The two mafic volcanic horizons, about 300 and 150 m thick, in the eastern inlier of group 4 contain several thin sedimentary layers of different composition (see Fig.3 and the profile at Ruvsot, Fig.5). The mafic layers here are fine to medium-grained and massive except for local highly schisteous zones especially in west.

The fine-grained mafic rock within the southern inlier of group 4 is found as meter thick massive layers within the undifferentiated sediments. The mafic layers are not shown on the map.

The mafic volcanics of group 1 occur as an about 200 m thick layer in the eastern part of the inlier (Fig.3). The rock is massive to porphyritic. Amphibole porphyres are common to the east. Westwards both amphibole and light greenish plagioclase porphyres occur. The porphyres are supposed to be fenocrysts. Locally there are quartz and amphibole filled vesicles. Epidote noddles exist in the eastern-most part together with some irregular bodies of about 1/2 m length of mafic material. These bodies have briefly been described as pillows or bombs and screws.

The amphibolite on Haugfjellet lies stratigraphically concordant within the metagraywacke. The extension in strike direction is however fault controlled. The mafic volcanics in the other inliers have also probably primary borders, but the borders of the eastern inlier of group 4 is highly affected by faulting.

4.3.4 Alkali feldspar and low-An plagioclase fels

The alkali feldspar fels is located in several small inliers of group 3 west of the main one in Norddalen (Fig.3). The rock contains approx. 90% microcline and perthite. Plagioclase also occurs as inclusions in the alkali feldspar. The microcline and perthite are fractured and some of the fractures are filled with recrystallized quartz and some are filled with pericline plus quartz.

The low-An plagioclase fels is located within the southern inlier of group 4 along the north-eastern coastline of Gautlisvann (Fig.3). Except for the plagioclase (oligoclase?) the rock contains small amounts of diopside, actinolite-tremolite, epidote, clinozoisite, sphene, green to brown biotite and chlorite. The two thin section studied show plagioclase content from 85%-95%. The one with the lowest plagioclase content is light greenish.

Some of the layers in eastern group 4 inlier which have been interpretated as quartzites are also light greenish and may in fact be felses.

The contact relationships of the felses can at this stage not be stated for sure.

4.3.5 Metagreywacke

The units previously mapped as quartz-biotite schist are shown to be composed of different metasedimentary and volcanic rocks. The dominating rock type is a medium to fine-grained metagraywacke which is grading into a tight pelittic rock. Work has not been done to map the different varieties.

Metagreywacke is found in all groups of inliers except of group 2. Reconnaissance within the undifferentiated rock indicates that metagreywacke also is a major constituent there, however more mapping must be done to work this out. Present descriptions are based on the metagreywacke in the group 3 inliers (Fig.4). The profile (Fig.5) shows the localization of the metagreywacke in the eastern group 4 inlier on the geological map (Fig. 3).

Even though the rock exhibit variations the general composition is: Quartz, biotite, feldspar, epidote, clinozoisite and chlorite. Some layers contain considerable amounts of amphibole. Tourmaline (schorlite) is a common accessory mineral. In one thin section from the smaller inlier north-west on Haugfjellet it constitutes about 5% of the rock. Specially garnet but also muscovite and sphene are common accessory minerals. Garnet occures normally as small subhedral crystals. Zircon is an accessory mineral in some layers. No carbonate layers have been observed in the metagreywacke, but disseminated carbonate makes up about 20% of a thin section close to an old sphalerite/galena working at the road to Sildvikvann. Carbonate is not seen in other thin sections from the metagreywacke. Disseminated graphite is common and easily distinguished in hand speciments.

At Klubbvann blocks of tight fine-grained rock with mm-cm scale amugdules filled with mainly quartz are found. Elongated, lenticular shaped amygdules of same size are also found in the metagreywacke on Haugfjellet not far from the north-eastern termination of the unit. These amygdules are filled with quartz and feldspar.

Fine-grained rather pure quartz-biotite-schists are found both on Haugfjellet and within the main unit south of Rombaksbotn. In the eastern part of this last unit a conglomerate horizon is also found. Few thin mafic layers have been observed on Haugfjellet. One of them located in a new road cutting north of Jernvann. The metagreywackes contain a lot of rustzones and some old workings. These will be described later.

Primary structures are common. The best localities are found along the southern coastline of Rombaksbotn, in the western part of the area south of Rombaksbotn and north-east on Haugfjellet.

At Rombaksbotn layers of variable thickness, normally 20-30 cm often show graded bedding, cross bedding and a lot of soft sedimentary deformation structures. The bottom of individual layers often exhibit erosional contact (plate 1-4). The cross bedding indicated facing both against north-east and against west, as a result of folding. Within this sequence some white layers of about 10 cm thickness occur (plate 5 and 6). Sometimes these beds can be followed for several meters other places the beds are not continues and make irregular rounded corps within what seems to be a horizon. These white bands are difficult to interpret, but they show locally load cast like structures (plate 6) and can be sedimentary units. They have been interpreted as possible volcanic beds by Lindahl & Malm (1976/78a).

In an area just around the Rombaken bridge there is a rock with some peculiar features that is supposed to be slump structures (plate 7 & 8).

Graded bedding is also common north-east on Haugfjellet. Scour and fill structures in this area indicate facing against west.

The area south of Rombaksbotn also exhibit graded bedding. Thin pelitic layers within medium grained metagreywacke here show soft sedimentary deformation structures.

Graded bedding is also found in the conglomerate horizon and in the continuation of the main Haugfjellet inlier south of Rombaksbotn.

In addition to these clearly sedimentary structures benches of the different varieties of the metagreywacke are supposed to reflect the bedding. On eastern Haugfjellet lithological changes from dm scale tigth pelitic benches (often showing boundinage structures) to m scale medium grained metagreywacke are common. At this early stage it seems that the lithology in the western and central part of the main Haugfjellet inlier are more consistent and are dominated by fine grained metagreywacke (or pelitic sediments).

In the main inlier south of Rombaksbotn the dominating variety is a medium to fine-grained metagreywacke in tens of m thick benches with thin pelitic layers in between. Some of the medium grained layers are biotite spotted. These are much like some of the acid layers in the group 1 inlier in Sørdalen.

The metagreywacke exhibits variable grade of schistosity. This will however be treated later.

The amphibole on Haugfjellet is stratigraphically related to the metagreywacke. The borders to the granite are both of igneous and of tectonic character. The fingers of granite within the metagreywacke on Haugfjellet are fault controlled. The faults are dipping steeply westwards. The western border of the inlier, and the continuation of it south of Rombaksbotn is a steep fault as well as the easternmost margin of the main inlier on Haugfjellet. From Øvre Jernvann and about 3 km southwards the eastern margin of the main inlier is interpreted to be of igneous character based on gradational decrease of the grain size within the granite and absence of increasing deformation at this border. Eastern margin of the continuation of the Haugfjellet unit south of Rombaksbotn is also interpreted as igneous based on the presence of numerous xenolithes within the granite here.

Locally the eastern border of the main inlier south of Rombaksbotn may be tectonic but as a whole this border is interpreted as igneous. The grain size of the granite is gradually reduced against this border. The quartz in the granite is often blue. The western margin of this metagreywacke unit has a thrust relationship to the Caledonides above. The border to the granite at the western margin have not been checked.

The basal quartz-conglomerate and quartzite are laying discordant above the metagreywacke units.

4.3.6 Conglomerates

Conglomerate layers have already been mentioned. Three beds are located in the group 1 inlier. One bed is observed in the southern group 4 inlier and one in the main group 3 inlier south of Rombaksbotn. Common for the conglomerate beds are their very limited strike extension. Graded bedding is common but satisfying facing criteria have not been observed.

Two of the conglomerate horizons within the group 1 inlier are laying close to each other in the western part of the inlier in the river section (Kobbelven) in Sørdalen (Fig.3). They are interlayered with mixed volcanic rocks. The thickness of the western unit is about 15 m, the other one is somewhat thicker. The third conglomerate horizon in this inlier is located in the eastern-most undifferentiated sedimentary layer, thickness exceeds 5 m. This horizon shows imbrication structures.

The imbrication zone is boulder supported. Elsewhere the rock is matrix supported as the other conglomerate layers in this inlier. They are all polymict. The boulders are rounded and consists of variable volcanic materials as well as sedimentary. The biggest boulders ranging up to a couple of dm in size, consist of mainly acid volcanic material.

The conglomerate in the southern group 4 inlier is located within the complex succession at the north eastern coastline of Gautlisvann. Thickness is about 10 m. Another conglomerate layer about 1 m thick is laying south of this one. The conglomerate is also found as big xenoliths within the granite here.

Both of these two horizons are matrix supported and polymict. However, boulders of sedimentary material are not so common as in the previous described horizons. The boulders are well rounded and the size grades upwards to 2-3 dm. Acid volcanic material makes up the biggest boulders, but mafic material dominates. The matrix is green.

Also the conglomerate in the main group 3 inlier south of Rombaksbotn is matrix supported and the matrix is light green. Thickness is more than 4 m. The conglomerate is polymict but mafic material dominates in the boulders. There exist some finely laminated metagreywacke lenses within the conglomerate.

Where the contact relationship to the wall rock have been observed it is primary sedimentary. In the southern group 4 inlier these primary contacts have been affected by later faulting. Here the conglomerate has an intrusive border to the granite. The termination in strike direction have not been observed in any of the other horizons.

4.3.7 Quartzite

In this chapter, the basal quartzite between the Precambrian rocks and the Caledonian nappes will not be treated. Thin section investigations have only been done for the quartzite in the western most of the smaller group 3 inliers in Norddalen. Here the quartzite is associated with the alkali feldspar fels. More work must however be done to work this relationship out.

The quartzite contain thin (mm scale) magnetite rich bands. It also contains highly deformed feldspar grains. Some bands are concentrated in feldspar. Chlorite and green-brown biotite occur. Garnet, epidote and clinozoisite are accessoric minerals. Quartzite have also been observed in eastern group 4 inlier, but not in mapable units. (See cross section, Fig.5). As earlier mentioned these layers may be wrongly interpretated and may well be felses. The contact relationships of the quartzite are at this stage not sufficiently investigated.

4.3.8 Calcite marble

Calcite marble is not a prominent rock type within the Rombaken -window. It has only been found in the group 4 inliers. However, the marble exhibit an important position in the rock pile. It represents rather continuous horizons and is often associated with mineralization. As previously described the marble is associated with gold/ arsenic and copper/iron mineralization.

Only one thin section of the marble have been studied from north of Gautlisvann. The thin section consists of about 85% calcite, 10% of an unidentified mineral and small amounts of chlorite, microcline and opaque minerals. The unidentified mineral stands out on weathered surfaces.

In the southern inlier a marble bed can be followed from the south-western-most extension of the inlier to north of Gautlisvann where the supracrustals are intruded by granite. A marble bed is also found on north-eastern side of Gautlisvann (Fig.3). These may be the same beds. The western-most of these layers exhibit complex folding, specially where the gold/arsenic workings are located. As a result of deformation the thickness variates from dm scale to tens of m.

West of this inlier there are some small (a couple of hundred m long) inliers of calcite marble. So far these have just been briefly investigated.

The eastern group 4 inlier contains several about 1 m thick calcite marble layers within the mafic volcanic units (Fig.5). In addition to this there is a big calcite marble lense to the south-east. The main part of this one is located in Sweden.

The marbles within the volcanics are isoclinal folded. It is however not stated if any of the different horizons in the profile are repetitions due to folding.

Primary bedding is preserved in the marbles in both inliers but often disturbed by later deformation.

The northern termination of the marble north of Gautlisvann (southern inlier) is a fault and so is the eastern termination of the marble east of Gautlisvann.

Because of the general state of strain the contact relationships of the marble elsewhere can not be stated with great security.

4.3.9 Undifferentiated sedimentary rocks

Rustzones is a dominating feature in the group 3 inliers. This feature and the fact that only sampling and reconnaissance work have been done in most of the main group 3 inlier are the reasons why the different rock types in the central and southern part of this inlier have not been distinguished. Parts of groups 1 and 4 and some inliers west of group 1 (Fig.3) have also been mapped as undifferentiated sedimentary rocks.

Metagreywacke probably makes up a great proportion of these units, but several other rock types have been observed.

A profile from east to west along the southern coastline of Lossivann (Fig.3) exhibit the following rocks: Mixture of quartz-biotite schist and mafic fine grained rocks possibly with volcanic bombs or pillows. Westwards the amount of bombs or pillows diminish. Abrupt facies change against epidote-banded quartz-biotite schist. Almost pure biotite schist with 1 cm big rounded spots of quartz followed in the west by meta-gabbro and alternating biotite schist and gneiss with increasing amount of feldspar in the schist. Further west comes a massive granite. At the beginning of the profile in east, fluorite is associated with a granitic vein. Granitization is observed several places in this rock pile.

A profile through the undifferentiated unit north of Gautlisvann in the southern group 4 inlier indicates that 5-10% of the unit consists of mafic fine-grained igneous rocks more or less as boudins variating from dm to several m in thickness.

In the eastern group 4 inlier metagreywacke, quartz-biotite schist, muscovite-chlorite schist, quartzite and granite have been recorded in the undifferentiated unit (see profile, Fig.5).

Up to 20 m thick horizons of quartz-biotite schist are located west of Iptovann as inliers in the granite (Fig.3). The inliers create anomalies on an aeromagnetic survey done by NGU (H. Håbrekke, NGU Report 1836, 1982). Pyrite plus/minus chalcopyrite is disseminated in parts of the sedimentary rocks. Chlorite is disseminated in thin horizons.

In the northern of the two smaller group 3 inliers north of Lossivann supposed in situ blocks of acid and intermediate volcanic material have been found.

Quartz-tourmaline veins with sulfides have been found in outcrops east of Lossivann and in boulders at the south-eastern outlet of the lake. Both in the Lossivann area and at Gautlisvann (southern group 4 inlier) the rock is banded. So far it has not been stated if this banding represents a primary bedding. In that case it is a highly deformed bedding or it might even be a transposed bedding.

The profiles and the more or less sporadic observations illustrates that the units are complex and more work has to be done to get more informations of the internal of the units. Specially the central part of the main inlier south of Rombaks botn is very little known. This is the most rusty area and also an area with gold anomalies in stream sediments (Report 83-670-7). Gold has also been detected from heavy fraction sampling in this area (Report 83-670-5).

Except for the intrusive borders to granite south of Lossivann and to the granitic outlier east of Lossivann the character of the border are not known. The unit however, is supposed to have primary stratigraphic borders to the volcanic rocks in the group 1 inlier.

4.4 Intrusives

As the present work does not include investigations in the intrusives these short descriptions are mainly based on earlier work (T. Vogt, 1941 and M. Gustavson, 1974).

Gabbros:

The gabbros represents the oldest part of the intrusive rocks in the Rombaken window. It is a dark mainly fine grained rock with its greatest extension in eastern part of the window.

The gabbro and the ultramafic rocks which in the present report are incorporated in the group 4 inliers have not been noted on the earlier maps. The units are located in areas which have been highly affected by faulting. The time relationship to the wall rocks are therefore uncertain. It is not proved that these rocks intrude the supracrustals, we don't either know if these have any genetic connection with the gabbroes described in the literature.

These gabbroes are much more retrograded than the gabbroes elsewhere. It is a light green medium to coarse-grained rock.

The youngest of the intrusives is also a gabbro (T. Vogt, 1941). The rock is a fine-grained hornblende-biotite gabbro. Regarding the literature the only occurrence of this is in the Skjomen area in western part of the window.

Ultramafics:

Ultramafic rocks have been found in both group 4 inliers. In the southern inlier the ultramafic is a lense of max. 150 m thickness within the retrograded gabbro (see Fig.3). Central part of it is a medium-grained, dark, massive rock with red weathering surface. The rock consists of olivine now altered to antigorite and magnetite, augite partly altered to actinolite-tremolite and of about 5% carbonate. Plagioclase and quartz are accessoric minerals. based on this composition, the rock is classified as a wherlite. Against its borders the rock is sheared and it looks like a serpentinite schist, specially against the northern border which have been interpretated as a fault.

The eastern group 4 inlier incorporates 10-50 m thick lenses of ultramafic rocks. Some of the lenses are found between undifferentiated sedimentary rocks and retrograded gabbro and some within calcite marble (see Fig.3). The ones within the marble have been little investigated and not sampled.

However, these seem to be less altered than the other ones in this inlier which are totally altered to a light talc-serpentinite schist. This rock is also containing some chlorite and carbonite. Magnetite is making up about 10% of the rock. The borders of the ultramafic in the eastern inlier seems to be tectonic.

Granites and syenites:

The oldest of the granite, the Rombak-granite, is a coarse-grained microcline granite. All compositional variations from this to a coarse-grained syenite, the Hunddal-syenite, exists. Dark minerals may both be biotite and hornblende. The Rombak-granite is more uniform in the western part of the window than in east, but the dominating type in east equals the western uniform type.

One thin section from coarse grained granite at Rombaksbotn contains both microcline and low-An plagioclase, quartz, green biotite, epidote, muscovite and accessoric zircon. A coarse-grained granite at Gautlisvann exhibits the same mineralogy, but lesser biotite. This however, contains chlorite.

The Sildvik-granite is more fine-grained and younger. It contains lesser proportions of dark minerals. Parts of it have in this report been reinterpretated as being an acid volcanic rock representing the older supracrustals.

4.5 Rock units within the Caledonian nappes

Investigations within the Caledonian allochthones have been out of the task of this work. Reconnaissance in the area between Rombaksfjorden and beisfjorden (see Fig.4), however, indicates the following rock pile: Phylite with quartz and calcite lenses thrusted onto the basement, tectonically overlain by a banded garnet-mica-schist/greywacke unit and above this a calcite marble followed by a coarse-grained garnet-mica-gneiss. On top of this is a well developed mylonite.

The caledonian outlier to the west of the eastern group 4 inlier (see Fig.3) exhibit a repetition of a quartz rich sedimentary rock, quartz-biotite schist and amphibolite. The two last members are much like units in the Precambrian supracrustals. This package have been interpreted as a Caledonian allochthon (M. Gustavson, 1974) or as a para-autochthon (T. Birkeland, 1976).

4.5.1 Basal quartz-conglomerate and quartzite

These rocks are located between the basement and the lower-most Caledonian nappe, along the northern termination of The Rombaksfjorden and Beisfjorden. The unit are laying with a primary contact to the basement. It is a rather pure quartz-conglomerate and quartzite. Several conglomerate horizons have been observed.

4.6 Interpretations of the rock pile

At this early stage of the project interpretations of the rock pile can not be drawn so far.

What, however, is known from earlier work and confirmed hereby is that concordant layers of sedimentary and fine-grained (somewhere porphyritic) igneous rocks are sitting as inliers of variable size in intrusives dominated by coarse-grained granite.

The previous interpretation of the concordant igneous layers as volcanics have not been proved, but to the authors this seems to be the most likely interpretation. Features that very much look like bombs have been mentioned from the southern group 4 inlier. Mafic bodies of 1/2 m length looking like bombs and screws or pillows have been mentioned from the group 1 inlier. These observations do at least agree with the previous interpretations.

Present work indicates, however, several more volcanic layers. The amphibolite on Haugfjellet and the fine-grained acid rock east in Norddalen are here interpreted as volcanics. The amphibolite have not been mentioned in previous work and the acid rock has been interpretated as granite.

The interpretation of the amphibolite is based on the composition of the rock, the concordant character and the existence of a bedding in it. The bedding is supposed to indicate that the rock represents a tuff. The new interpretation of the acid rock in Norddalen is stated by reason of correlation to other concordant igneous rocks previously interpreted as volcanics. This correlation is based on similar compositional, textural (aphanitic) and magnetic characteristics.

If the 1/2 m long irregular bodies in the mafic volcanics of group 1 are bombs and screws this may indicate that one is close to a volcanic centre in Sørdalen.

Alternatively the concordant igneous horizons may represent a set of sills. In that case the authors can not find any reasonable explanations for the structures mentioned above. It is also hard to imagine how a sill complex like this could generate without volcanism because the depth of the intrusive can hardly be so great as long as similar rocks have been found as boulders in the conglomerate and new similar igneous layers are located above. This relation is independent of direction of facing. However, some layers may of course represent sills.

The metagreywacke could well be a thick turbidite sequence. The features found in the package just around the Rombaken bridge (plate 7 & 8) are supposed to be slump structures, but as the rock seems to be partly brecciated it may have been partly consolidated prior to the slumping

Because of the size and the orientation of the big inliers, it is unlikely to interprete them as xenoliths. Instead they are interpreted as remnants of a roof zone. The present outlook as inliers is by reason of folding, faulting and erosion.

More complex are the two group 4 inliers. Here the only outcrop of marble layers except of few smaller inliers in Sørdalen and ultramafics have been found in addition to variable volcanics and sedimentary rocks. These two inliers are therefore interpreted to represent more or less the same stratigraphic level in the pre-existing roof. Similarities between the two big group 3 inliers and the smaller ones north of Lossivann are supposed to indicate that these are laying stratigraphically close to each other. Any correlation between the other inliers have not been possible to draw.

Because of sparce observations of facing criteria and absence of connections between the different inliers the stratigraphy of the supposed pre-existing supracrustal roof have at this stage not been worked out.

Neither do we know in what type of environment the rocks have been deposited.

4.7 Mineralizations

4.7.1 Introduction

a, rustzones: Within the "greywacke-sediments" in Rombaken area there are a very high number of rustzones; from small 0,5 m thick, up to a zone of hundred meter more or less intens rusty.

The rustzones seem both parallel and sub-parallel to primary bedding. They are generally difficult to follow because of their pinch and swell structure.

Locally it looks as if the rustzones follow later faults cutting through earlier, primary? rustzones (Sildvik-vein; Ytre Sildvik skjerp).

b, old workings: Only a few, old reports on old workings exist from the Rombaken area. The workings are found in gabbroic rock and in quartz-biotite schists. The mineralizations are normally found disseminated in rust-horizons (......-bands) with dominating pyrrhotite, or more massive in veins with galena, sphalerite and often chalcopyrite as the most important minerals.

In the southern part of the area there has been a totally different depositional environment with mainly amphibolites, and limestones and acid- and intermediate tuffs. From this part of the area there are reports on mineralizations of arsenopyrite and gold, galena and sphalerite, and magnetite and chalcopyrite.

4.7.2 Rustzones

Rustzones are a common feature in much of the supracrustals of the Rombaken window. Small horizons some with old workings are found in most of the inliers. The big and most intense rusted zones are observed in the main group 3 inlier (see Fig. 3 & 4).

The intensity of the rust makes it difficult to observe the primary bedding and to identify the ore minerals.

The rust occures either as intense rusted bands or as disseminated less rusted areas. The bands are variating from dm scale to several hundreds of m in thickness. They are generally striking north-south. The intensity is variating both across and along strike. The bands often exhibit pinch and swell structures and are therefore difficult to follow over long distances. Because of this and the fact that bedding, foliation and some of the later faults are subparallel in great parts of the area it is in most cases difficult to state if the rustzones are stratabound or controlled by later deformation structures.

In the western part of the norther metagreywacke unit in the main Haugfjellet inlier, several intense rusted bands occur in a rust disseminated area. The other bands are less continuous and much thinner. The old workings here are located east of the thick band. Except where the workings are loated and one locality in the western-most part of the area ore minerals have not been identified. The mineralogy of the workings are described in next chapter. In the western locality pyrite and sphalerite have been observed.

Even though the metagreywacke on north-western Haugfjellet are heavily rusted, not zones along the north-west-south-east and the north-east-south-west going faults have been observed. However, some north-south striking rustbands seems to follow faults.

At Rombaksbotn the whole sedimentary package of the main Haugfjellet inlier are a rustzone. A continuation of this have not been found in the area north of the fjord, but much of this area have not been visited. South of the fjord there are locally intense rusted zones in this package.

The most intense rustzone in the main group 3 inlier south of Rombaksbotn are found in the central part of it. Here hundreds of m thick rustzones are observed (plate 9 & 10). They are generally striking north-south. The best exposures are in the steep walls. Because of moraine, scree and glacier cover they can not be followed for long distances. The central part of the main group 3 inlier have only been briefly investigated.

North and south-wards the amount of rust diminishes, but still heavy rusted bands ranging to tens of cm scale in thickness exist. At Sildvikskaret two old galena/sphalerite workings are known (see chap. 4.7.3). The road through the metagreywacke south of the Rombaksbotn cuts alot of rustbands (plates 11, 12 & 13). Pyrite and chalcopyrite have been observed in few of them. The rustzones here are folded and some of the rustbands represent repetitions of the same band.

At the bridge on the road to Sildvikvann two cross-cutting rustbands may exist. One of them are tight folded. This relation is, however, not clear.

In the souther part of this inlier at Lossivann several gently folded rustbands occur. The unspecified sedimentary rocks here are often banded and some of the smaller rustbands (specially one at the south-eastern outlet of Lossivann) are clearly concordant with the banding. The mentioned locality also exhibit some thin (ca. 1 cm) rusty north-south striking fractures cutting the concordant thickness (ca. 10 cm) rustbands.

Bands of graphite schist are laying in some of the rustbands (Fig. 3 & 4). The two southern-most graphite-containing rustbands at Lossivann have both two 1/2 m thick bands of nearly pure graphite schist. A rustzone in the northern part of the same inlier contains some graphite and some supposed porphyroblasts (1 cm) now altered to an aggregate of muscovite, feldspar, quartz and some biotite.

In the group 4 inliers rustbands are associated with the old workings and along the marble layer east of Gautlisvann. A rusty area is also observed in the undifferentiated rocks north of Gautlisvann.

The primary bedding and at least some of the rustzones south of Rombaksbotn are folded the same way. It can not be stated if these rustzones are concordant with the bedding, but they clearly predate the north plunging folds.

The main part of the rustbands on Haugfjellet are parallel or subparallel the bedding. A few rather weak rustbands here seems not to be related to the bedding, but to north-south striking faults.

If the banding in the undifferentiated rock at Lossivann is the primary bedding then the locality at the south-eastern outlet of the lake exhibit a 10 cm thick stratabound rustband which is cut by a rusty fracture of 1 cm thickness. The ore minerals in the fraction is supposed to be mobilized from "stratabound rusty layers".

The interpretation of this locality seems at this stage to illustrate the general situation. That means that the big rustzones in the area are interpreted as stratabound and that there in addition exist smaller north-south striking fault controlled rustzones.

4.7.3 Workings

a) Previous described ..new

- The sedimentary unit of Jernvann (Haugfjellet)

  Within this unit there are a lot of rust-horizons with variable thicknesses; from less than a meter to more than hundred meters in width in some of these rustbands one can see iron-hats, and there it is very difficult to define the sulphide-phases.

In one 2 m broad rust-band there is a 0,2-0,5 m sulphide-zone mineralized on galena, sphalerite and chalcopyrite; occasionally one can perhaps observe arsenopyrite (see Fig. 6, local map Haugfjellet Cu, Pb, Zn, Ag; MM30, 30A + 30B). Northwards from these workings the mineralized zone thins out and disappears against a 50 m wide granite dyke.

100 m south of the workings MM30, 30A & 30B, there is another old working lying in a E-W-trending fault (?). Here one can only observe pyrrhotite, pyrite and some chalcopyrite. Further south along this horizon the massive mineralization gradually goes over to a "normal" rustzone/fahlband, more than 10 m in width.

Most of the mineralization was enclosed within the quartz-biotite schists, but zones of graphitic schists and amphibolite/mafic volcanics seemed to be subparallel to the mineralization zone.

It seemed in some places that the galena-rich part and the sphalerite-rich part were separated, but in other places galena, sphalerite and chalcopyrite were mixed in a coarse-grained mass.

In the E-most part of this sediment unit there is another massive mineralization with Pb/Zn/Cu (Urdalen). This mineralization was some meter long and 3-4 dm thick, and both in northern and southern directions the massive mineralization went in to a rustzone which was difficult to trace; it showed pinch and swell structure.

In the northern part of this greywacke-unit one has found up to 50 cm bands loaded with biotite, later brecciated by veins, partly filled with chalcopyrite.

North of Jernvannet there are small bands with veins of pyrrhotite, often associated with flames of pentlandite, and small grains of bravoite. Chalcopyrite intrudes later the pyrrhotite and replaces it. Sphalerite is reported to follow the chalcopyrite. In the matrix between these veins there are small amounts of arsenopyrite, pyrrhotite and chalcopyrite. Graphite has been observed in small amounts.

South of Rombaken, in the same sediment unit, one has found a very rust-dominated area with old surface workings in it at Randtinden, ca. 1,5 km E of Sildvikvann (Fig.7). In this area there are found several boulders of nice gossan.

- The sedimentary unit of Sildvik

In the northern part of the unit there are several old workings with mainly Pb/Zn mineralizations within a thick turbidite sequence. The rust-horizons seem to be parallel to subparallel to the sedimentary primary horizons. The mineralizations lie constant at a distance 1 km from the contact of the granite.

The richest Pb/Zn mineralizations are found in dykes, cutting through the sediments and "primary" rust-zones. The pinch and swell structures of the rust-zones make them difficult to trace in the field, but as a whole one can follow more or less rusty bands for about 4 km in a NNW/SSE-direction.

In these rust-zones it is found pyrrhotite and pyrite ±chalcopyrite (Lindahl = NGU Rapport ... 1430/4B) and in one place small amounts of only chalcopyrite and bornite within a 1/2 m broad schist-horizon. One magnetite-bearing horizon is also observed.

The Pb/Zn mineralizations are small often found in bands with max. 1/2 m thickness with almost pure sphalerite. In one place (Ytre Sildvikskar skjerp) one can find several dm-thick sphalerite rich band over more than 10 m, and with small amounts of galena-rich bands, but mineralizations like that are very local. 500 m further to the south there are several underground workings with is dominated by galena-rich band. Galena, sphalerite, and chalcopyrite are reported from the area (Linddahl) to be intergrown in a coarse-grained, simple way.

In short boreholes from the area, Linddahl has found fahlertz. Locally in bands with sphalerite, galena and pyrrhotite there are accessoric arsenopyrite, fahlerts and molybdenite.

Descriptions of individual mineralizations

- Cu-show close to the river in Sørdalen

The mineralization lies within a vesicular lava-like rock with a stratabound thin horizon with magnetite, malacite, chalcopyrite and fluorite, associated with epidote-veining.

The mineralized zone is max. a few dm.

Bjørnfjell: Allavarre malmfelt
NGU Bergarkivet Rapport nr. 4565 (9/9-1929: H.H. Smith)
Nedre Allavarre:
Several rust-band lying within the gabbro with strike and dip N60/65NW.
The mineralized zone is 1,40 m broad with 2 cm of sphalerite, some cp and po with traces of galena.

In Øvre Allavarre, old workings cut the same rust-zone, but here one can only see weak impregnation of pyrrhotite (po).

Jernmalmformasjoner i Sør-Skjomen, Ankenes, Nordland
NGU. Bergarkivet Rapport nr. 3146 (24/8-1960: Johs. Farden)

Lappheimen: Impregnation in 10 cm thick stripes cutting through the schistocity of a mica schist or a mica-rich gneiss.

Matlilemmen: One upper 0,5 m mighty mt-layer with an underlying mica schist or gneiss of a garnet-bearing mica schist. Under this unit there is a 2.1 m thick mt-band which is the main mineralized body. This body may have been folded to double thickness.

Southern part of Rombaken area.

Kjørisfjell
The mineralization of Kjørisfjell consists of max. 2½ m zone rich on arsenopyrite. This thickness is probably due to a folding. The real thickness of the mineralized zone is about 1,3 m most massive, but some of it is just impregnation (S. Foslie, NGU. Bergarkiv Rapport No. 1502).

The mineralization is related to the border between a amphibole-schist and a limestone, and is of a length between 60 and 160 m. Associated with the arsenopyrite there is some quartz, and in the impregnation-zone the amphibole-schist is matrix.

Old analysis show around 25% As and 10 ppm Au. The old workings were not accessable because of snow.

<u>Kobbelven</u> from S. Foslie (1917); NGU. Bergarkivet Rapport no. 1502;

The mineralization lies within an amphibole-schist. The lowest 30 cm of the mineralization, which is the poorest part of it, is loaded with garnets. Other parts of the mineralization lies between limestone and amphibole-schist.

The mineralization consists mainly of pyrrhotite with some chalcopyrite. The thickness of the mineralization is difficult to define, but the massive sulphide area is about 80 cm, with a length of ...... m.

Within the mineralization there are also found arsenopyrite, sphalerite and galena in association with quartz. The best part of the mineralization contains 0,97% Cu.

Further E against Gautelisvann one can find several hundreds of meters with amphibole-schist, often very rust-rich. Against the W-border to the granite, there are dm til m-thick alternating limestone units within the amphibole-schist. In one of these limestone-zones it was found an old working with small amounts of malachite.

In a 5-10 m thick limestone units against the border of the granite, there is a 10 x 10 m concentration of magnetite. Magnetic measurement on foot showed thin magnetite bands locally in some limestone-units.

Kattervatvatn Pb/Zn-mineralization
(Lindahl 1976/78: NGU-rapport no. 1430/5A)

The Katterat-area is composed of precambrian rocks; granites with gabbroic intrusions from dm to several hundred meters bi and coarse-grained syenites, with remnants of old supracrustals and rock of Dividalen-group. The inclusions are oriented along the direction of foliation: N-S. The supracrustals are dominated by volcanites and clastic sediments with primary textures.

The mineralization is divided in two groups:

a, The main part of the old working are done on dm-thick vertical calcite-dykes with massive coarse-grained galena, mainly within the granite, but can cut into the inclusions. The dykes are related to fractures. Small amounts of sulphides, sphalerite, quartz and fluorite can locally be observed.

b, The other type is sulphide-mineralizations within the inclusions of gabbros and supracrustals. The mineralization consists mainly of pyrrhotite and is exposed by weak rust-zones.

Zn-working at Cunojavrri.

The mineralization lies with weakly migmatised mica-rich schist. A 0,45 cm broad vertical band of sphalerite can be followed for about 30 meters. Small pegmatitic body of quartz and sphalerite are locally found.

Very close and parallel to this sphalerite rich zone, one can see a 2-3 meters broad rust-horizon. This zone is weakly mineralized with pyrite, and graphite and chalcopyrite is locally seen. This rust-horizon can be followed over several hundred meters because it stands out as a little hill in a flat landscape.

Fe-workings marked on the map north of Cunojavrri

Here one can observe thin bands of pyrrhotite along the foliation of the quartz-biotite schist. Later this pyrrhotite bands are cut by fractures filled with magnetite.

Rossot-toppen

In lenses within carbonate-horizons there are magnetite bands with very variating thicknesses; from dm to several meter (foliated).

In the lower part of the magnetite-rich band there are a lot of chalcopyrite, while pyrite is observed with magnetite in the intermediate part. Some of the band have chalcopyrite as dominating Cu-mineral, while other have bornite and chalcocite as dominating Cu-minerals (pers. com. A. Corneliussen).

4.8 Structure geology

4.8.1 Introduction

Too little work is done to make a structure analysis of the area. The observed structures, the relation between different structures and a short interpretation of them will be presented here. The primary structures are described in chap. 4.3. It is important to mention that the interpretations here are based on very few observations.

4.8.2 Folding

Several indications of folding have been observed. Both gentle and tight nearly symetric folds have been observed in the Fjeldheimen area (in the group 3 inlier south of Rombaksbotn). The folds in this area have weak to moderate north-north-westwards plunging axis. Amplitude is some tens of m. Asymetric, open folds with somewhat bigger amplitude have been observed south in the same inlier at Losivann and in the main Haugfjellet inlier. On Haugfjellet these have S-shape and are plunging moderate northwards. At Losivann they have Z-shape and plunge about 60^{o} against north. There are also small scale parasitic folds here. Gentle horizontal to moderate north-north-westwards plunging nearly symetrical folds have also been found in the southern group 4 inlier as well as in the Caledonian autochthons.

With few exceptions the only foliation (S_1) observed is generally defined by biotite, but other phyllosilicates as muscovite and chlorite as well as amphiboles and flattened aggregates of various composition also occur in the foliation somewhere. The orientation of the foliation is shown on the stereograms (Fig.8 A&B) and on the enclosed map sheets. With few exceptions it is north-south striking and have steep to vertical dip.

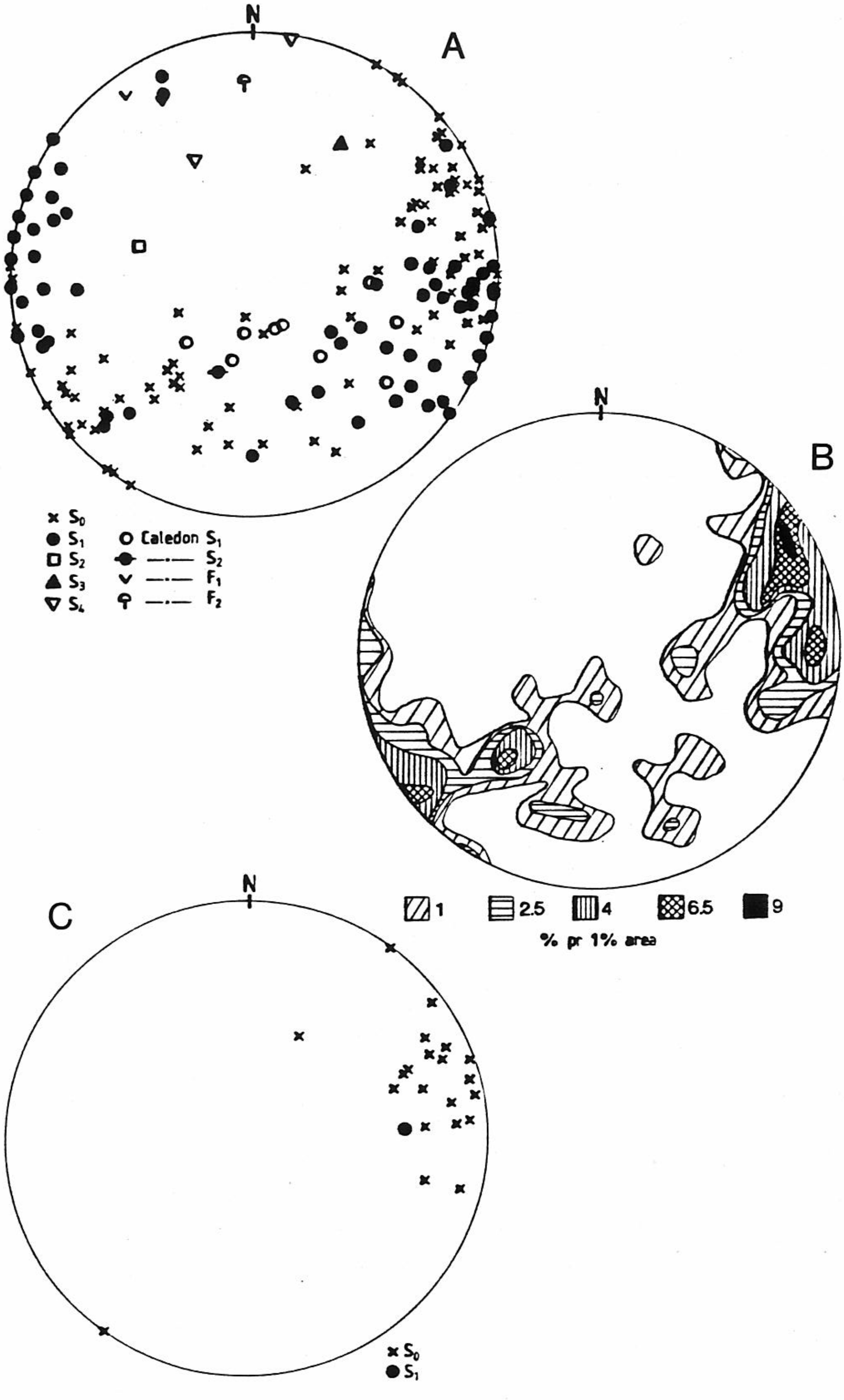
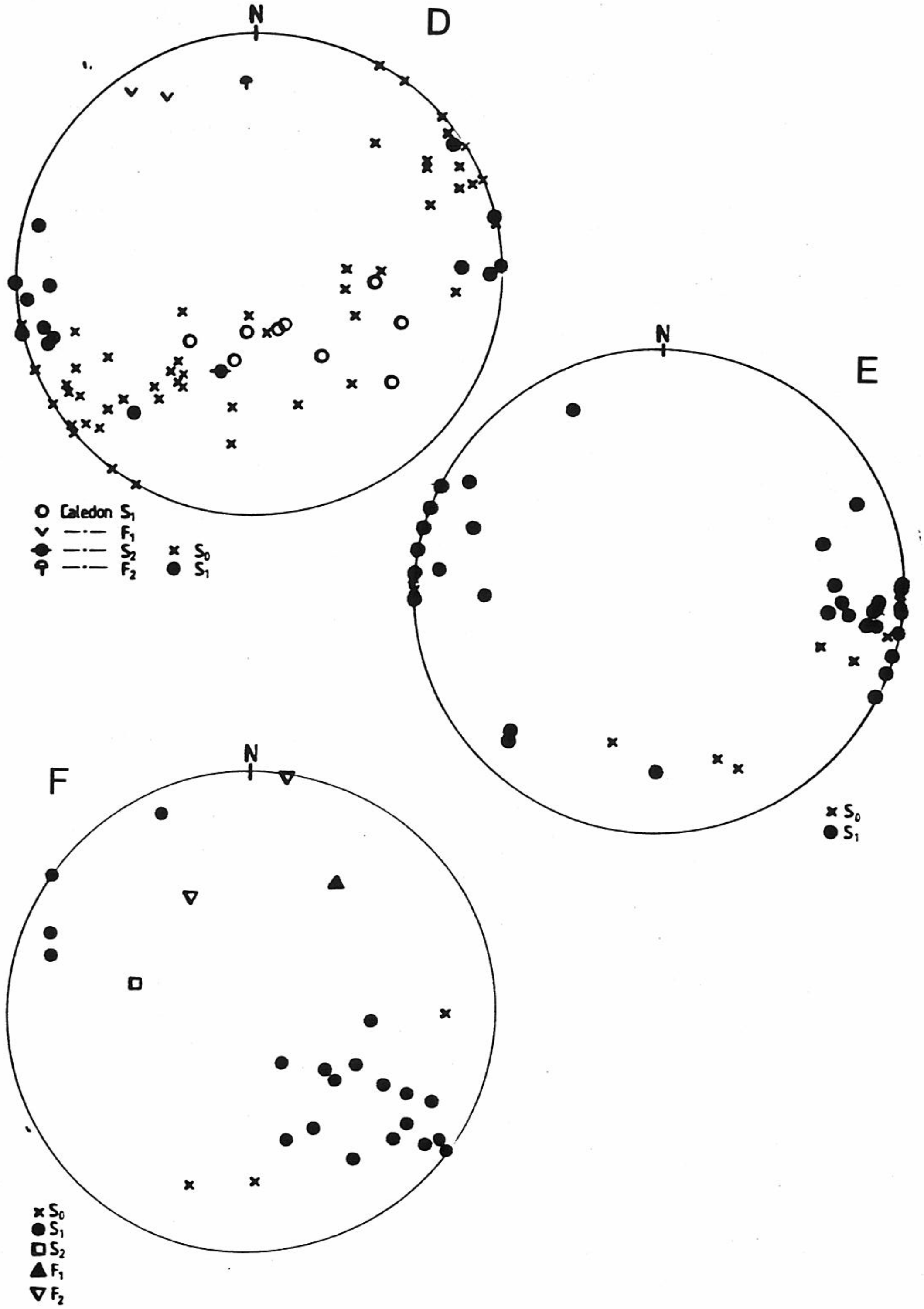


Fig. 8. Stereografig projections. Lambert equal area. Lower hemisphere. All structures represented by poles.

A. All measured structures from the whole project area.

B. Contoured diagram of So for the whole project area. Contour intervals: 1-2,5-4-6,5-9% pr 1% area. Contoured by Kalsbeck diagram.

C. So and S_1 data from Haugfjellet area.



D. All the measured structures from the Fjeldheimen area.

E. So and S_1 from mapsheet Skjomdalen except for the Gautlisvann - Kjørisvann area.

F. All measured structures from Gautlisvann - Kjørisvann area.

Cross cutting relationships between S_0 and S_1 have been observed on Haugfjellet, in the eastern part of the main group 3 inlier at the southern coastline of Rombaksbotn, in the same inlier in Norddalen and in the group 1 inlier in Sørdalen. The different relations are shown on the Fig.9 A&B. The intersection lines in the two first mentioned areas are plunging moderate northwards. At Lossivann about 60° against north and in Sørdalen about 60° against south-south-west.

Two foldfaces have been observed within the Caledonian autochthons. The first represents small intrafolial folds in the main planar structure. The second are the mentioned gentle folds. One observation of a crenulation cleavage as axial plane cleavage to the second folds exhibit south-south-east - west-north-west strike and dip 35° northwards.

4.8.3 Interpretations of the folding

It is obvious that the supracrustals have been rotated from a horizontal position to a nearly vertical, indicated by the present orientation of S_0 (see Fig.8 A&B and enclosed map sheets). The authors suggest that his happened during a main Precaledonian foldface. This is based on the fact that the rocks of the Precambrian window are discordant overlain by gently dipping Pre-caledonian basal conglomerate and quartzite.

The S_1 is also steep and is not observed in the discordant overlaying rocks. S_1 is in nearly all of the area the only foliation and it is in some cases representing an axial plane cleavage to small scale folds. By these reasons S_1 is interpretated as axial plane cleavage to the supposed big scale Precaledonian folding.

One structural problem that is not solved is the effect of the Caledonian folding on the rocks of the window. The absence of cleavage and the style of the gentle "symetric" folds within the window may fit well with the second folds in the autochthons.

Using the existence of the "biotite" cleavage as a criteria for the Precaledonian folding, the relation between S_0 and S_1 to indicate the location on the fold and the intersection as direction of the F_1-fold axis the Haugfjellet inlier (Fig.8 C) and at least eastern part of the main inlier at the southern coastline of

Rombaksbotn are located on eastern limb of a moderate northwards plunging F_1-antiform. The group 3 inlier in Norddalen and the group 1 inlier in Sørdalen are then located on a western limb of an F_1-antiform. If the S -folds on Haugfjellet and the Z-folds in Norddalen are parasite folds on a bigger F_1 structure this fits well with the mentioned interpretation. As this is based on very few observations the limbs may refear to different folds.

Based on facing criteria the rocks in the north-eastern corner of the main Haugfjellet inlier have to be inverted prior to F_1 if they are located on the same limb as mentioned for Haugfjellet. However, few observations have been done in the area and as no other indications for an earlier folding have been observed the authors suppose that this locality are laying on an opposite limb with a synform in between. Facing criteria along the southern coastline of Rombaksbotn indicate right way up.

It is not clear if the folding in the central part of this inlier along the fjord (Fig.8 D) is F_1 or a later structure. If it is a later structure, it could well be of Caledonian age. Both the Caledonian .... and F_1 may have moderate northerly plunging axis here and both may be represented. The S_2 and F_2 in the southern group 4 inlier (Fig.8 F and Fig.3) clearly postdate S_1 and F_1, but the relations to the Caledonian structures are not clear.

Regarding the S_0/S_1 relationship the Sørdalen and the Norddalen area are located on the same limb but opposite of what the main part of Haugfjellet is. However S_0 have close to the same orientation in these areas. This can be seen by comparing diagram C and E in Fig.8. This may be due to that F represents an isoclinal folding, but not knowing the effect of the later folding this can not be stated so far. On the other hand observations of subparallel S_0 and S_1 also indicate tight F_1 folding.

4.8.4 Faulting

The area is clearly affected by faulting and some of the borders between the supracrustals and the intrusives are faults (see descriptions in chap. 4.3). Nearly north-south striking faults are found on Haugfjellet. Observations indicate that the western margin of the main group 3 inlier on Haugfjellet may be a steep fault all the way also south of the fjord. The fault to the east of the thickest granite "finger" on Haugfjellet seems to be a westwards dipping reverse fault with a small sinistral shear component (regarding the present orientation). Some marked north-west - south-east and some north-east - south-west going glens are supposed to be related to faulting, but no offset is observed along them. The small north-western inlier on Haugfjellet are located along the northern side of one of these.

A set of parallel faults are located in the southern group 4 inlier, they are striking north-east - south-west and dipping moderately north-westwards (see Fig.3). Some of these seem to be reverse faults. The easternmost are folded.

Alot of other faults exist and where they represent lithologic borders they are mentioned in the descriptions. We have so far very little knowledge of the relative movements along the fault planes.

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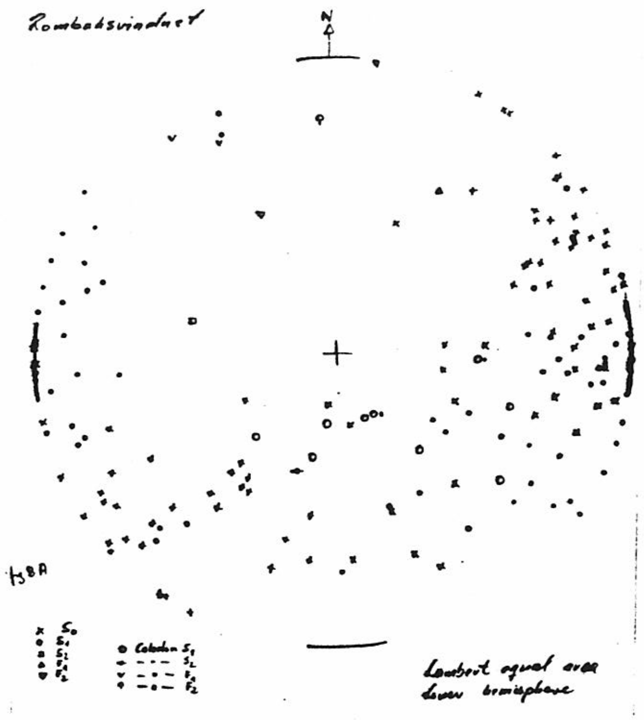
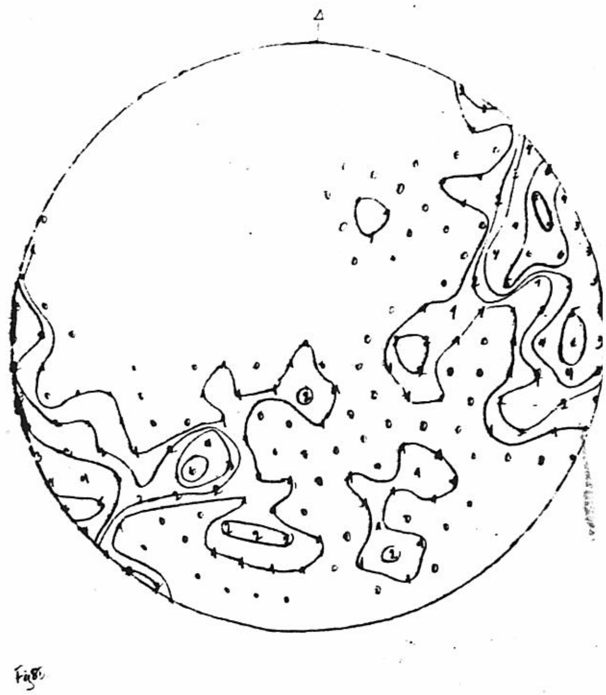
Text to the plates:

Plate 1 - 4:	Primary bedding in metagreywacke at Rombaksbotn. Graded bedding is best seen on plate 2. A f...... upwards sequence is seen with load cast structures at the base.
Plate 5:	A discontinuous light band is seen in the middle of the picture. Some ...ticular shaped light bodies are located in the continuation of this band. From the southern coastline of Rombaksbotn.
Plate 6:	Close up picture of a light band as shown on plate 5. The irregular shape may be due to load cast. From the southern coastline of Rombaksbotn.
Plate 7 & 8:	Slump structures in the metagreywacke at the southern coastline of Rombaksbotn close to the bridge.
Plate 9:	View of the rustzone ENE of Leirvatnet in the central part of the main group 3 inlier.
Plate 10:	View of a rustzone N of Basejavri in central part of the main group 3 inlier. The border between rusty sediments and granite is cutting across Vourtinden.
Plate 11:	Rustzone in metagreywacke at the Sildvik-road.
Plate 12 & 13:	Rusty metagreywacke at the southern coastline of Rombaksbotn.





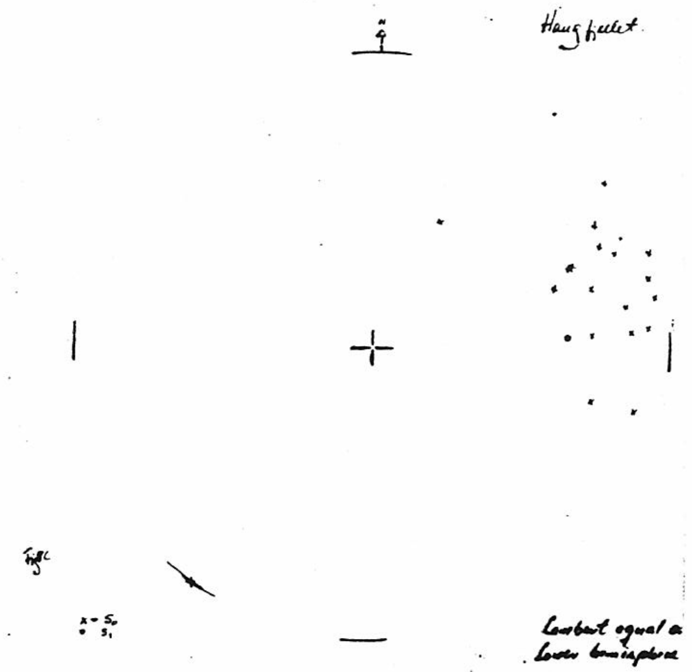
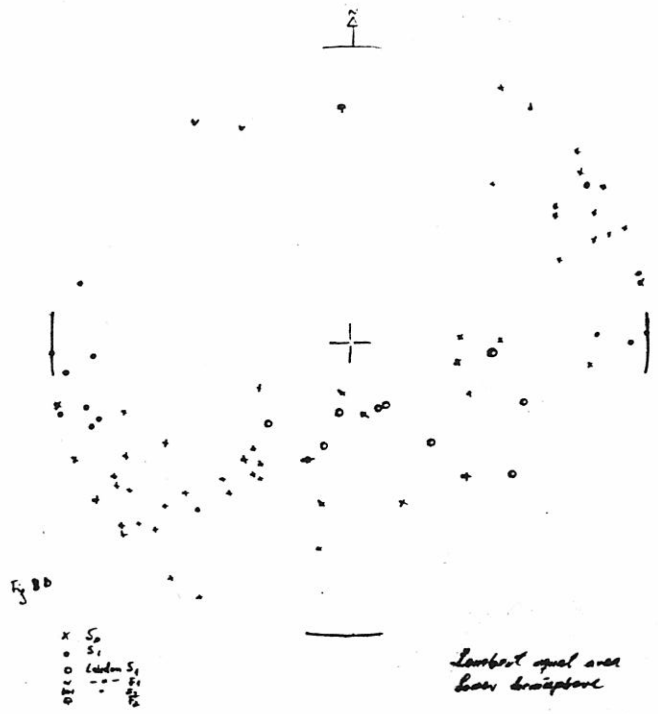


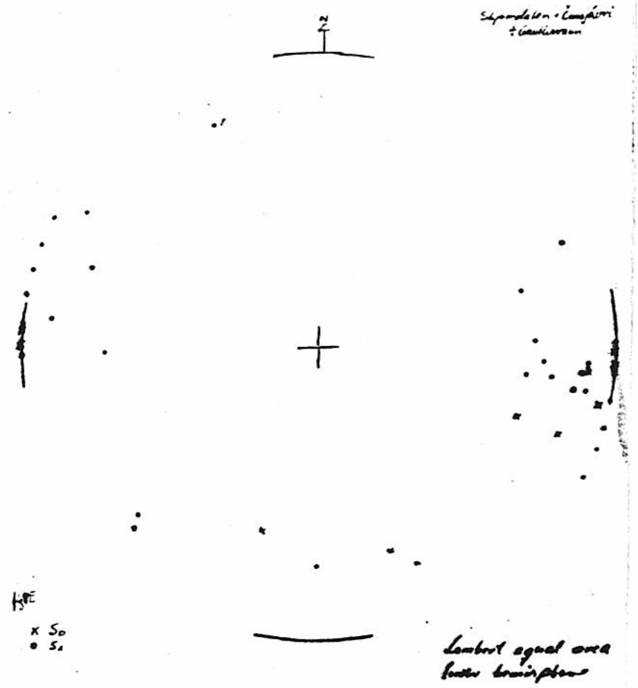
Fig 8. Stereografig projections. Lambert equal area. Lower hemisphere. All structures represented by poles.

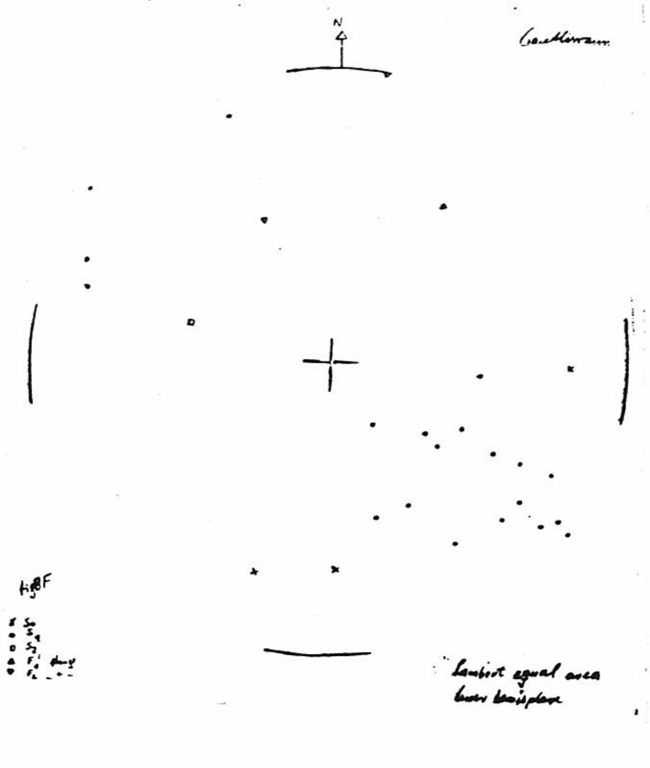
A. All mesured structures from the whole project area.

B. Contoured diagram of So for the whole project area. Contour intervals: 1 - 2,5 - 4 - 6,5 - 9 % pr 1 % area. Contoured by Kalsbeck diagram.

C. So and S_1 data from Haugfjellet area.







D. All the measured structures from the Fjeldheimen area.

E. S_0 and S_1 from mapsheet Skjomsdalen exept for the Gautlisvann - Kjórisvann area.

F. All measured structures from Gautlisvann - Kjórisvann area.

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Plate 12 & 13. Rusty metagreywacke at the southern coastline of Rombaksbotn.

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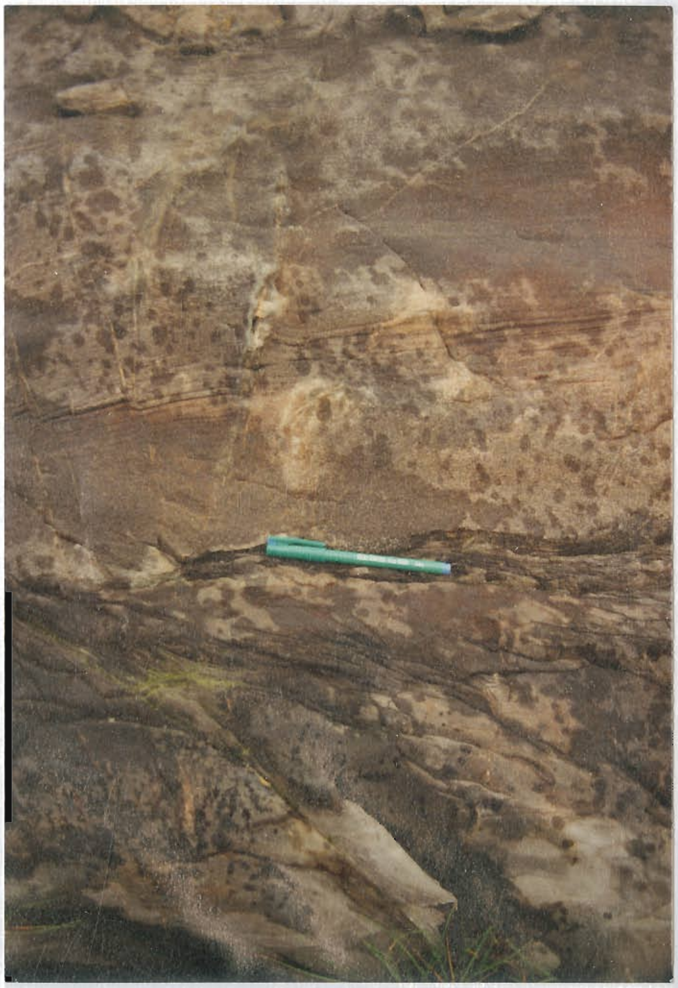

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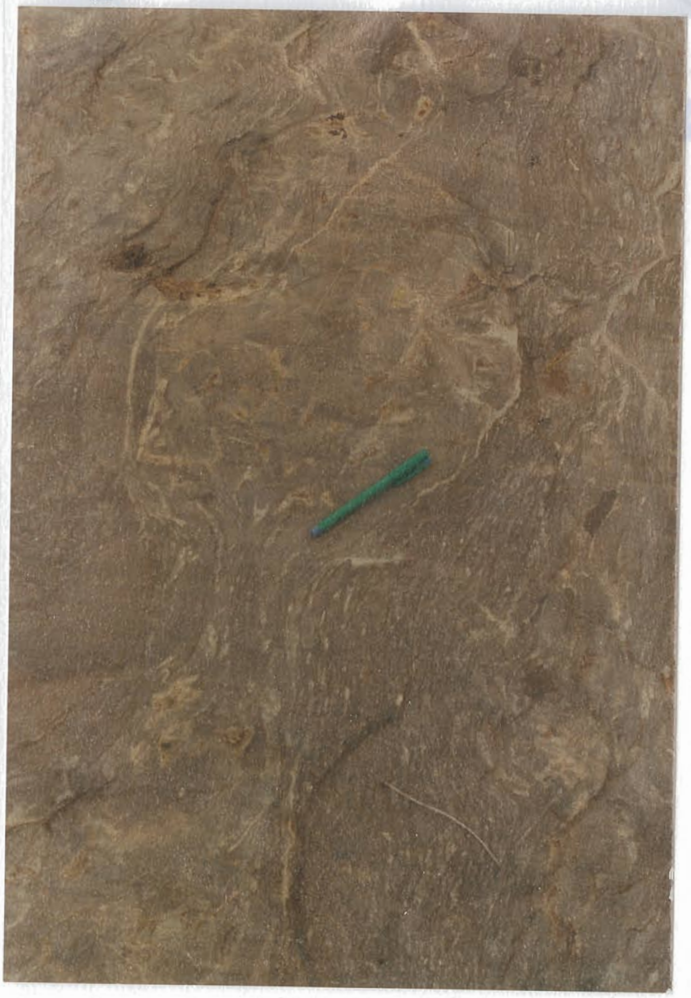

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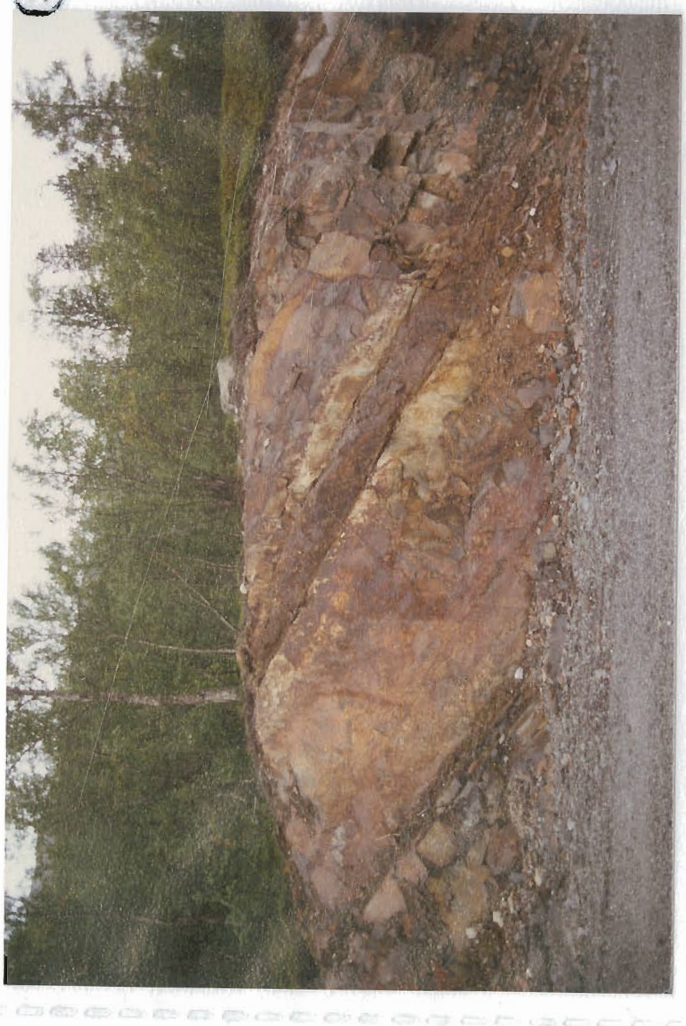

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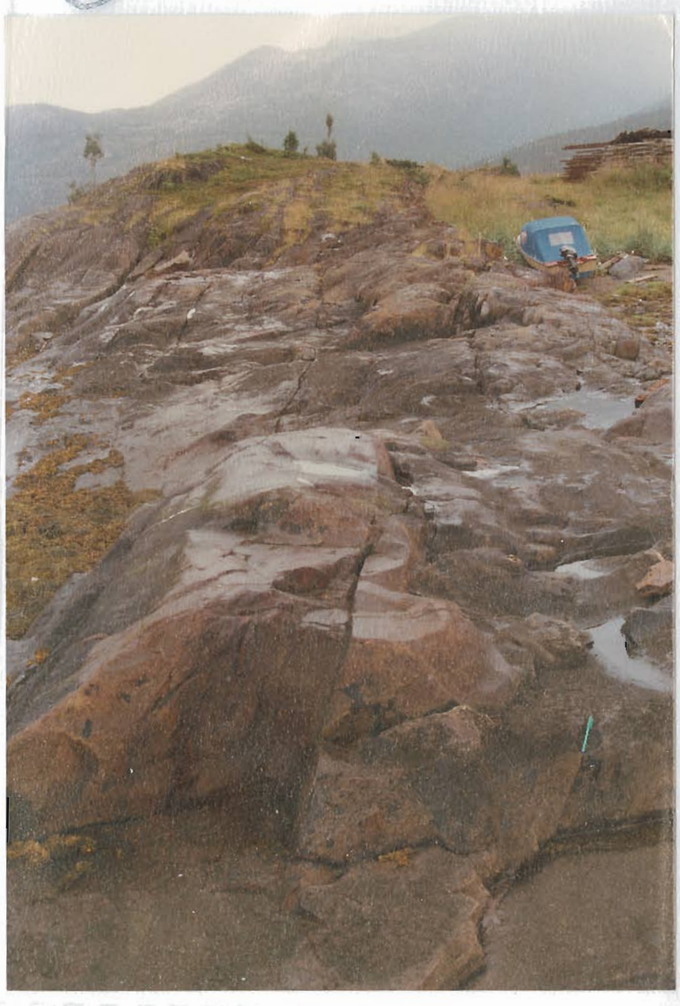

Appendix 2.

Plate 1. Thin section 83/MM 14. Aggregates of quartz in the matrix.

Plate 2. Thin section 83/MM 15. Vein of quartz and biotite cuts through the biotite mass in the matrix.
b. = biotite, q = quartz

Plate 3. Thin section 83/MM 17. Larger phenocrystals of microcline are replaced by albite. Interstitially between microcline grain one observe aggregates of tourmaline and subhedral sphene.
mi = microcline, t = tourmaline, ab = albite, sph = sphene

Plate 4. Thin section 83/MM 33. Vein of clinozoisite (?) cuts through the matrix and a recrystallized aggregate of quartz. A phenocryst of microcline seems to disturb a foliated band of muscovite.
q = quartz.

Plate 5. Polished section no 83/MM 33. A grain of crushed pyrotite and corroded chalcopyrite.
po = pyrhotite, cp = chalcopyrite.

Plate 6. Polished section no 83/MM 33.
po = pyrrhotite, cc = chalcocite (?)

Plate 7. Thin section 83/MM 34, A 2mm broad vein is displaced 2mm

q = quartz.

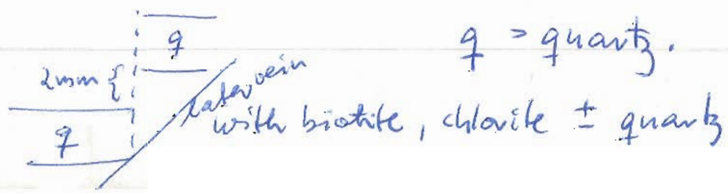

Plate 8. Polished section no 83/MM 34. Small flames of pentlandite and chalcopyrite within the pyrrhotite. po = pyrrhotite, cp = chalcopyrite, ptl = pentlandite.

Plate 9. Polished section no 83/MM 34.
po = pyrrhotite, cp = chalcopyrite, ptl = pentlandite.

Plate 10. Polished section no 83/MM 34.
cp = chalcopyrite, po = pyrrhotite, id = idaite, brav = bravoite.

Plate 11. Thin section no 83/MM 35. Black patchy areas with augmented amount of sulphides, epidote and chlorite in a lighter matrix of quartz, biotite and plagioclase.

Plate 12. Polished section no 83/MM 35. Chalcopyrite altered to chalcocite(?).
po = pyrrhotite, cp = chalcopyrite, cc = chalcocite (?).

Plate 13. Thin section no 83/MM 73. The line shows an approximate border between no stabile biotite area, and stabil biotite area. On bouth sides of this line there are amphibole, quartz, plagioclase and sphene. am = amphibole, b = biotite.

Plate 14. Thin section no 83/MM 73, Band rich on biotite with foliation of biotite that cuts through the band. am = amphibole, b = biotite

Plate 15. ~~Thin secti~~ Polished section no 83/MM 73. mt = magnetite, ilm = ilmenite, hem = hematite.

Plate 16. Thin section no 83/MM 74. The matrix of quartz, microcline, plagioclase and som "large" muscovite grains. mu = muscovite.

Plate 17. Polished section no 83/MM 74. Magnetite starts to oxydize to hematite. mt = magnetite, hem = hematite.

Plate 18. Thin section no 83/MM 75. Matrix of quartz, biotite, plagioclase ± epidote and muscovite.

Plate 19. Thin section no 83/MM 75. Magnetite rich bands with plagioclase, biotite, muscovite, quartz ± epidote.

Plate 20. Polished section no 83/MM 75. Hematite replacing magnetite. Polarized light. hem = hematite, mt = magnetite

Plate 21. Thin section no 83/MM 76. Matrix of quartz, plagioclase, microcline and biotite.

Plate 22. Thin section no 83/MM 76. Vein of epidote cut by a vein of muscovite, biotite and quartz ± epidote, sphene, and opaque minerals. mu = muscovite, bi = biotite.

Plate 23. Polished section no 83/MM 76. Small aggregate ~~of~~/veins of magnetite. mt = magnetite.

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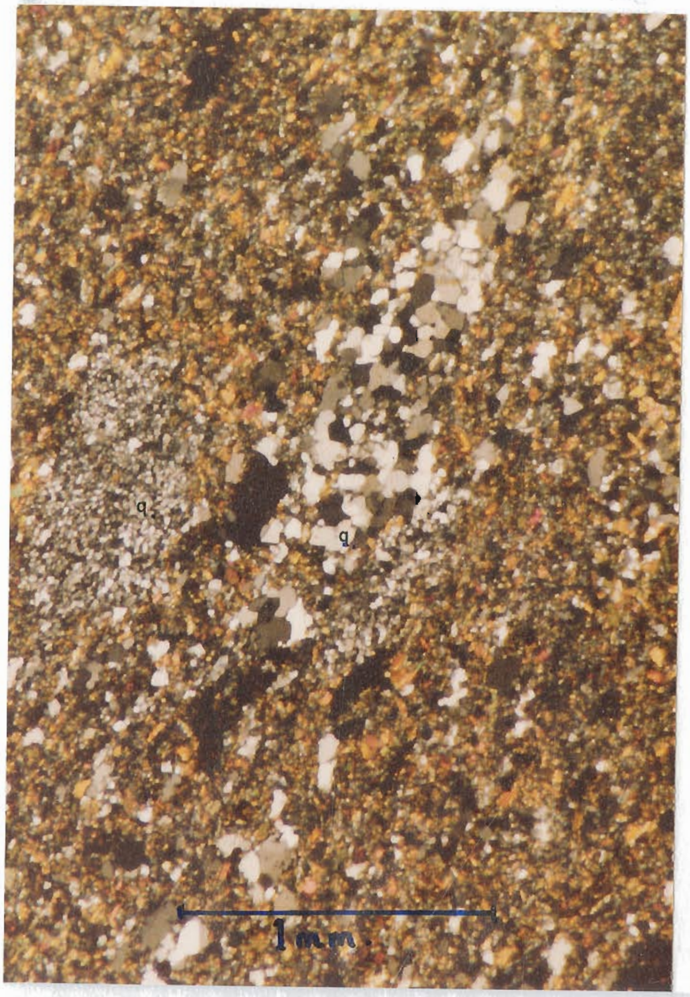

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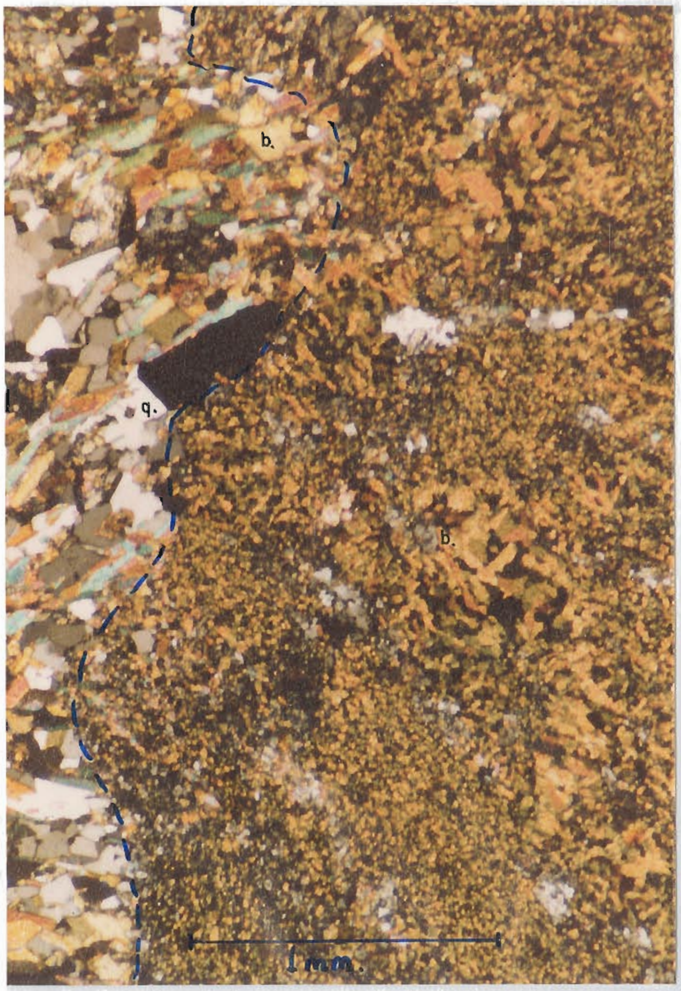

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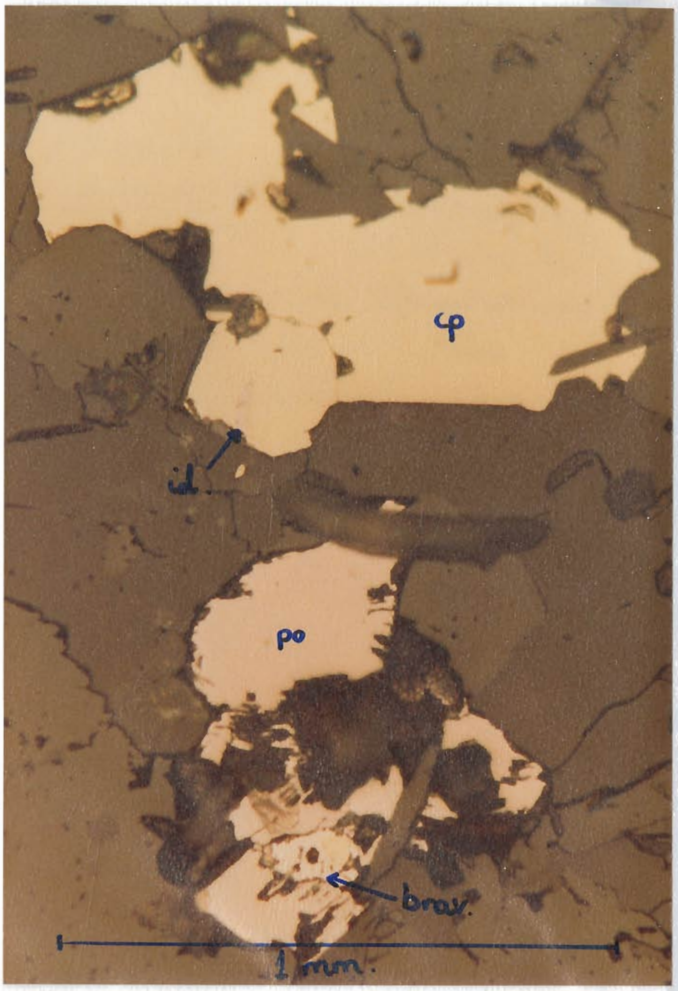

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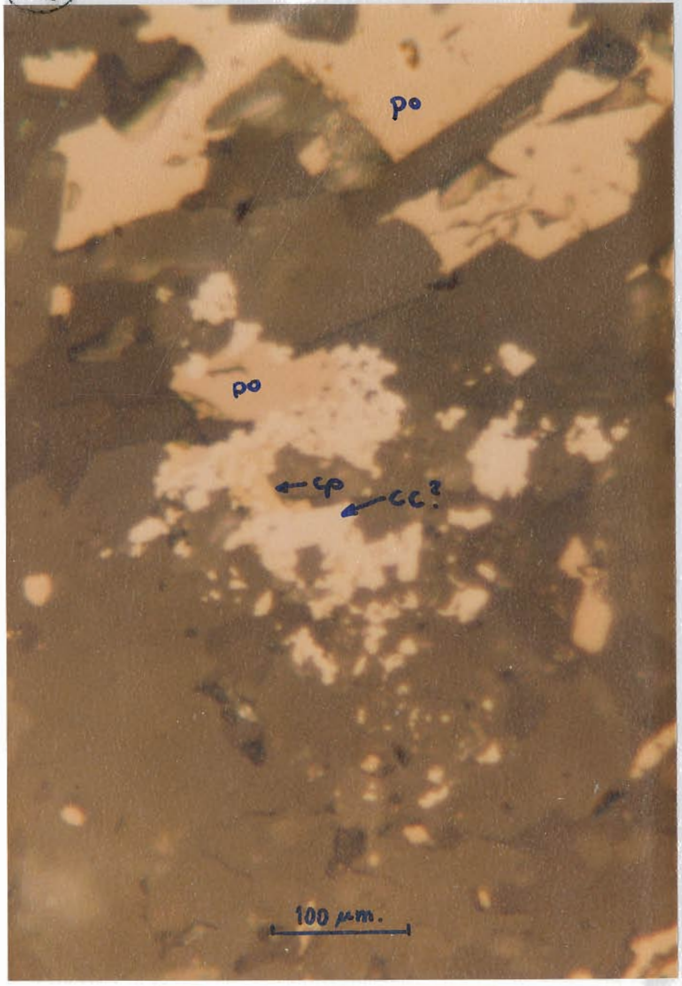

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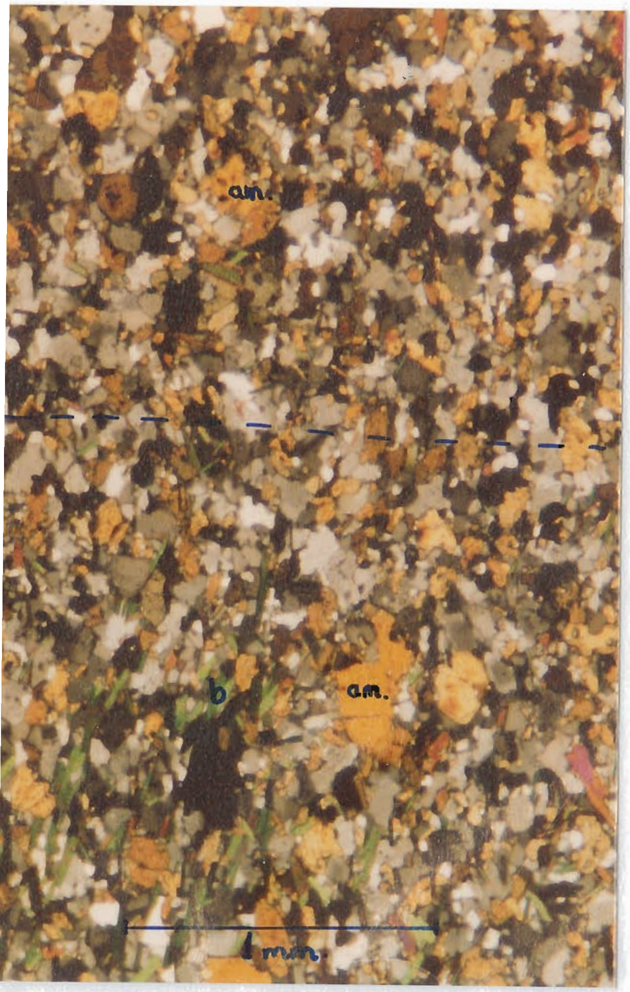

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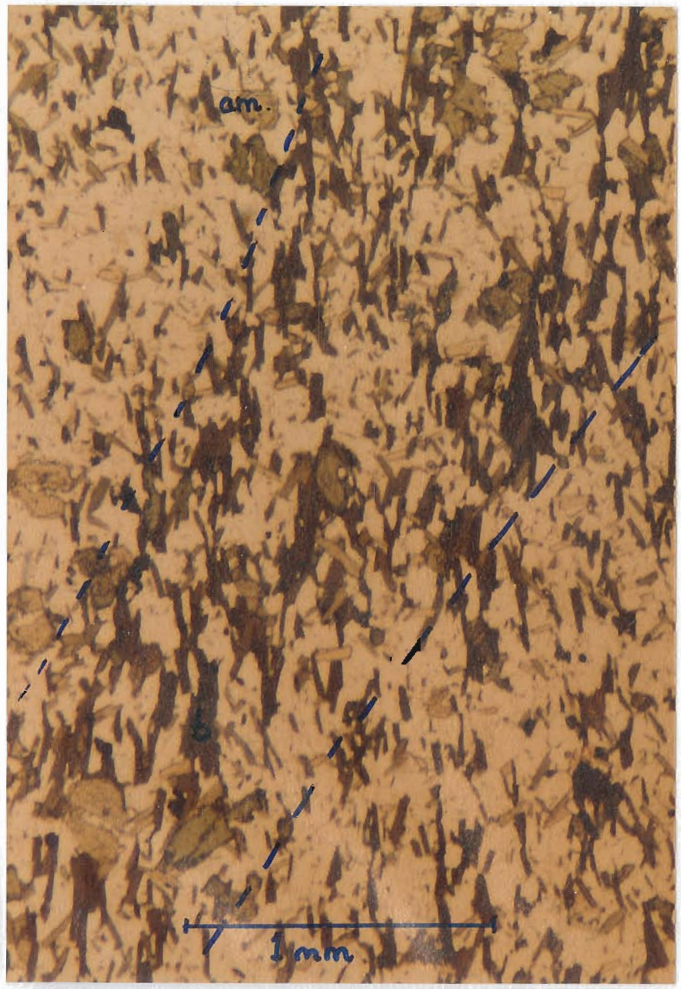

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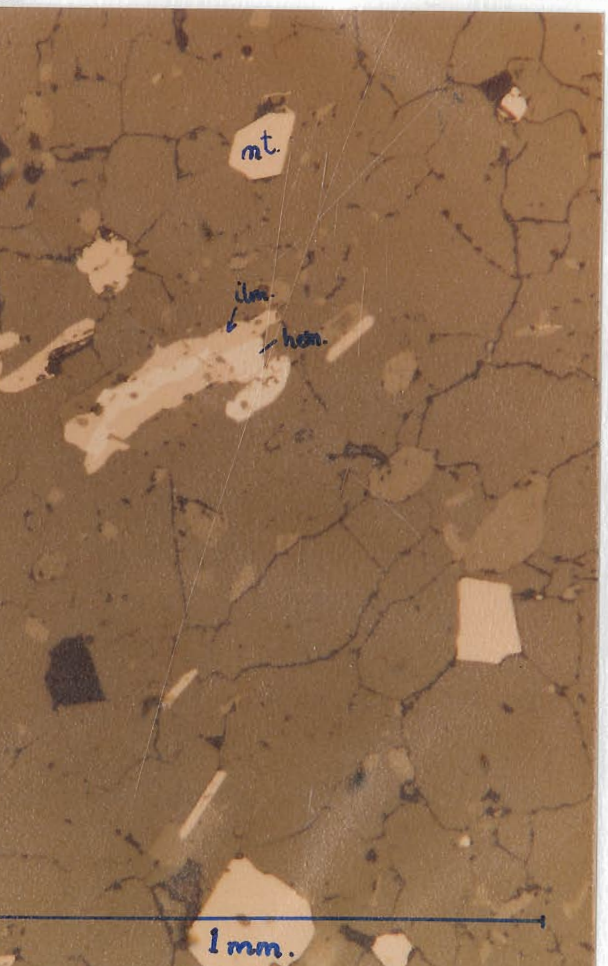

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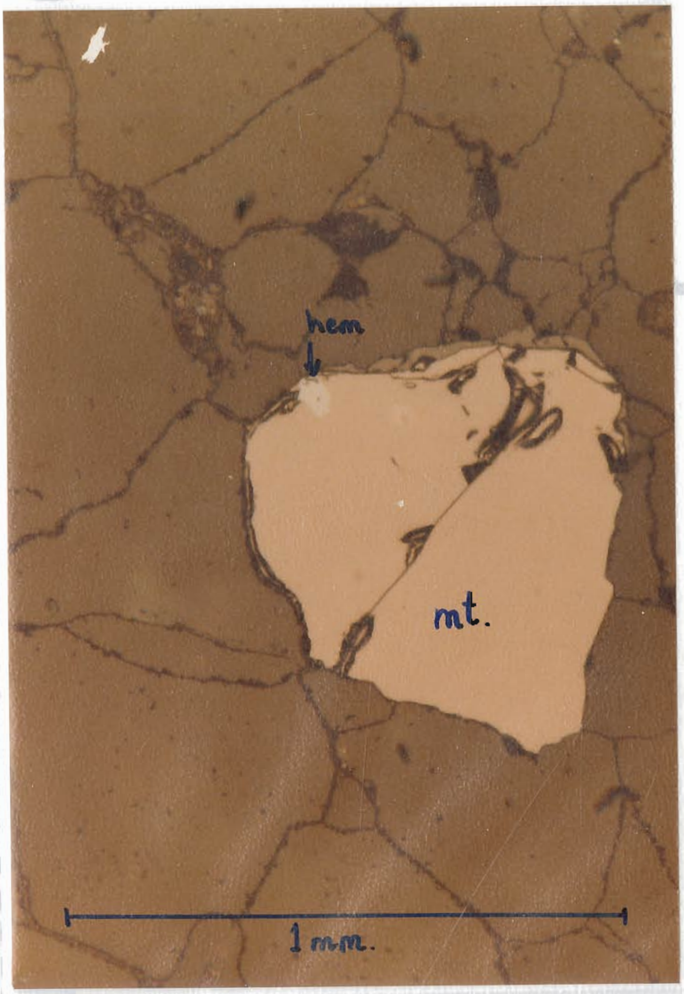

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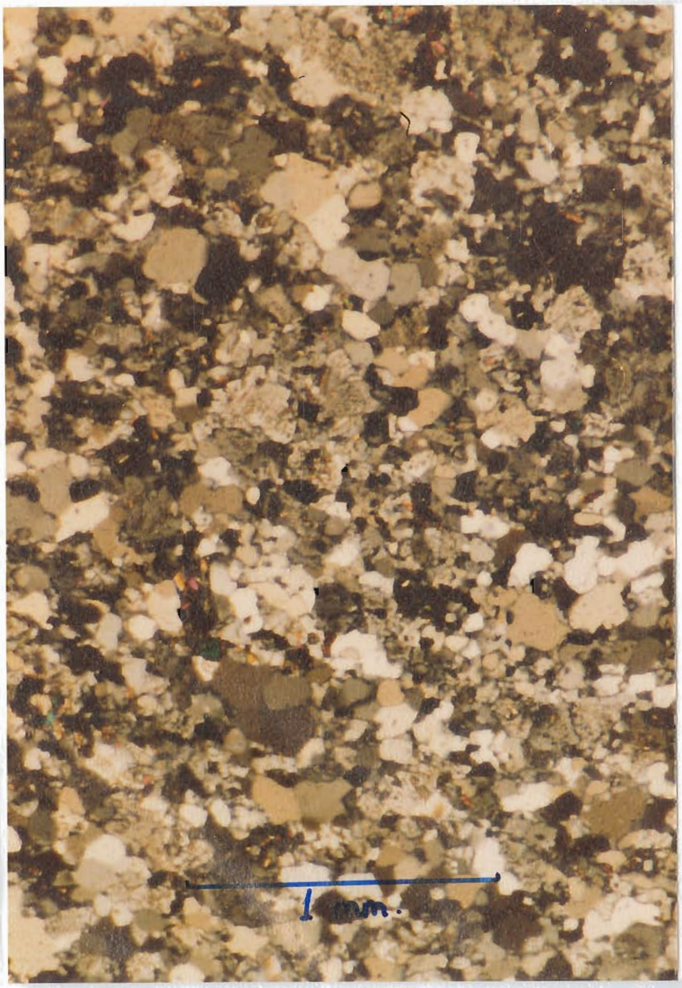

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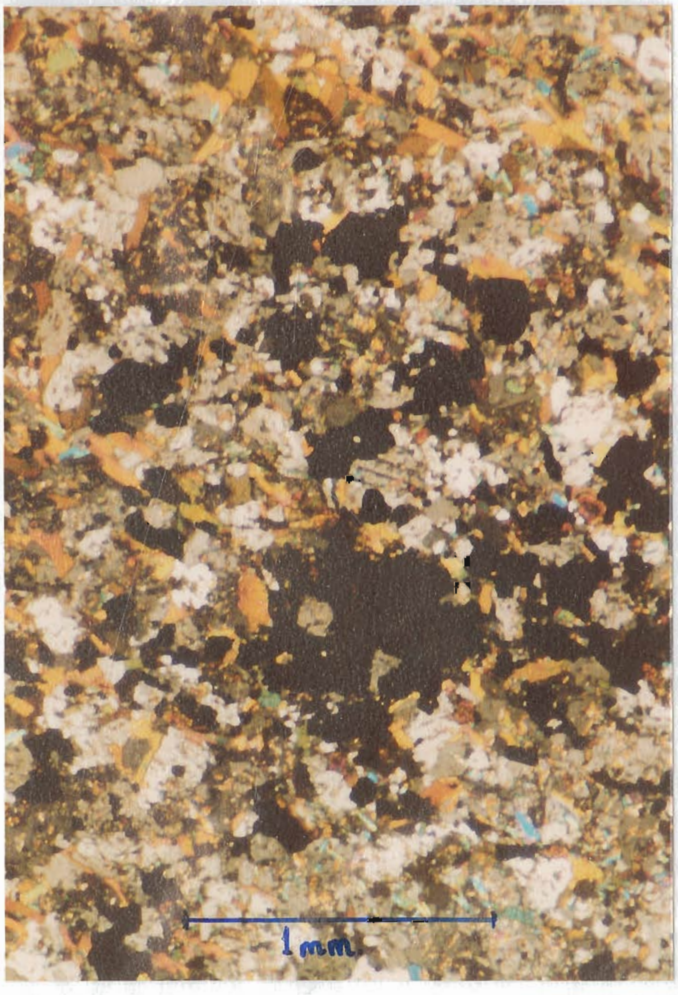

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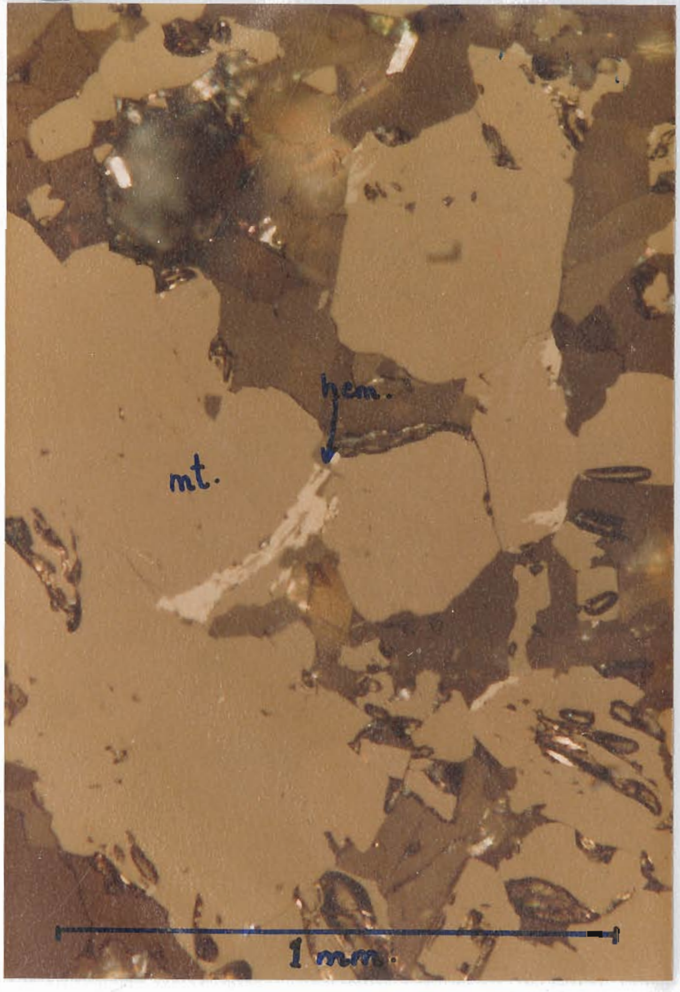

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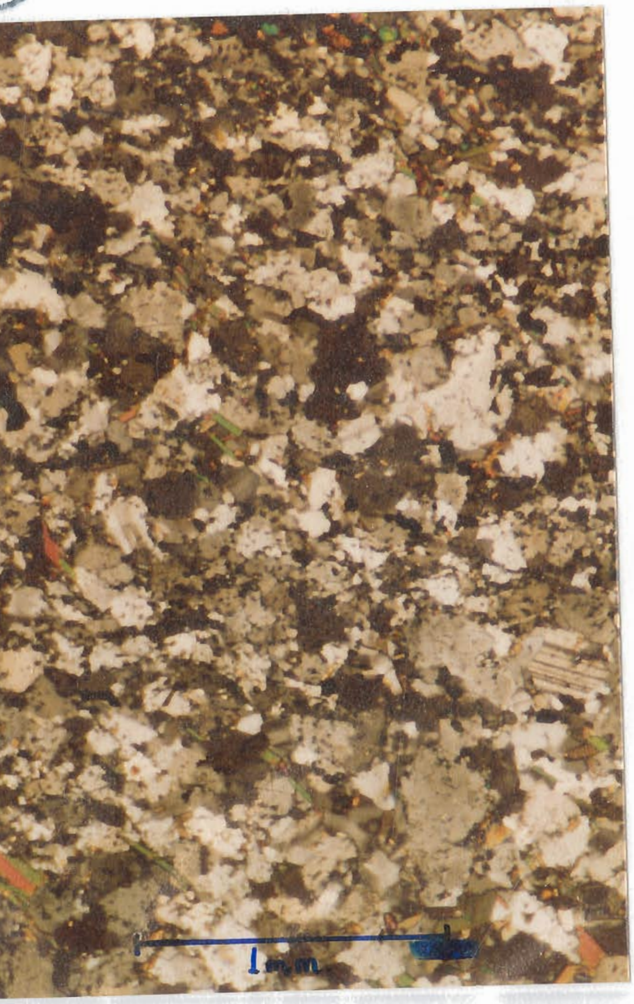

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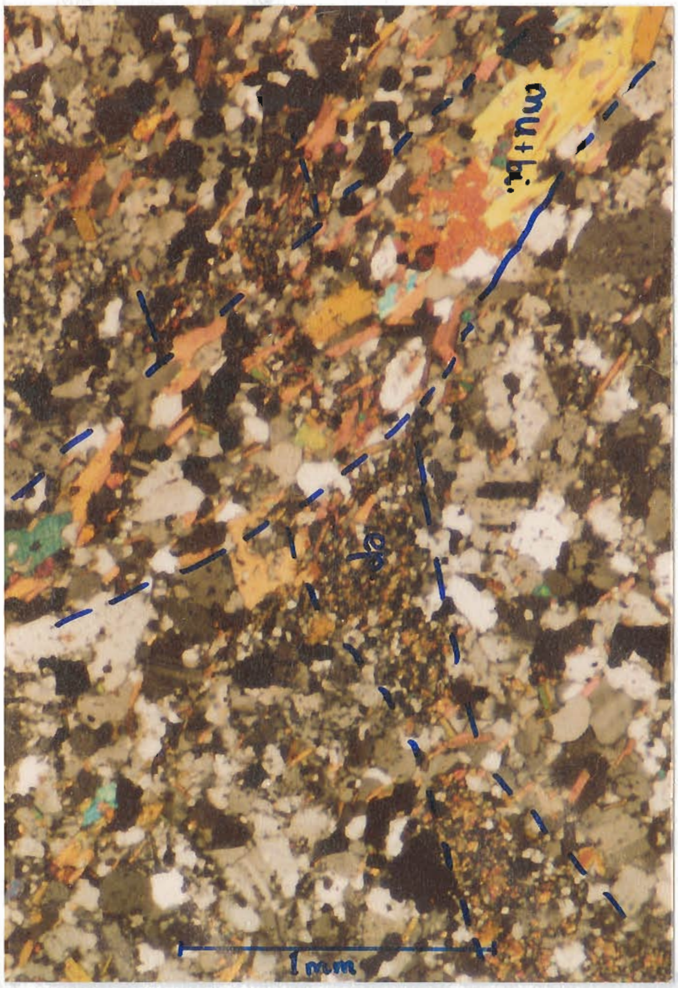

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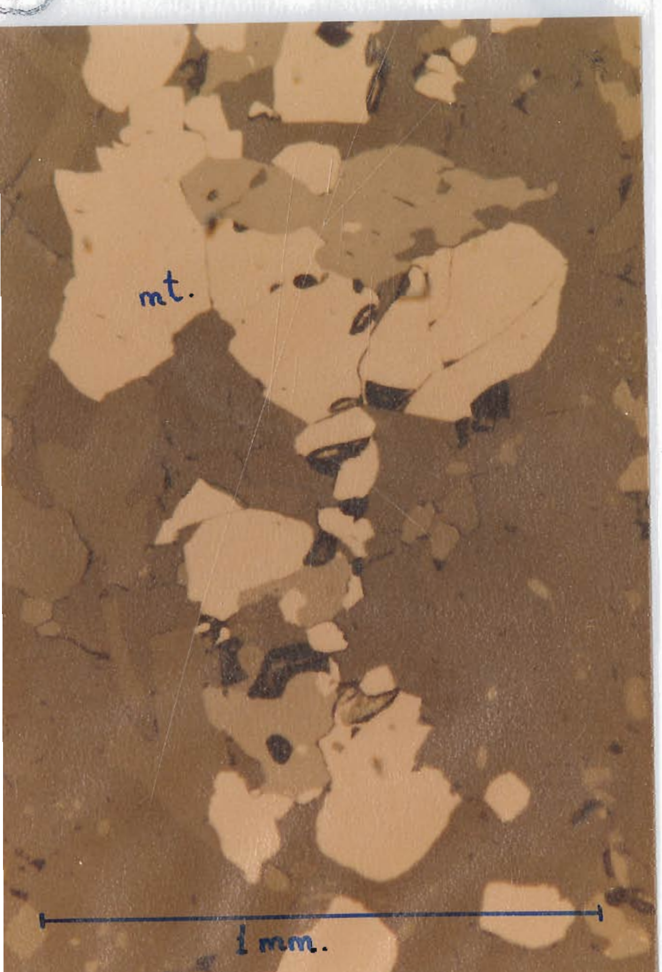

80/mm/75

Foto no 19

Magnetite rich bands with plagioclase, biotite, muscovite, quartz ± epidote.