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Content:

Ore Exploration in Pasvik, 2004

ScanMining AB 2005-01-20

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1. Introduction

During 2004, ScanMining conducted exploration for Au ores in the Pasvik greenstone belt. On the basis of regional and detailed geochemical till sampling performed 1998 and 1999, five targets were selected for further investigation; Finntjörna (Cu-Au), Skogum (Au), Elgbekken (Au), Gjedde Lake (Au) and Kobbfoss (Au-Cu-Zn). At the moment the focus is on Au mineralisation at Gjedde Lake and Kobbfoss.
The prospects are situated in the Sör-Varanger district, eastern Finnmark county, 60-km south-southwest of Kirkenes, between the Russian and Finish border.

During 1998-1999 geological bedrock mapping and percussion drilling was carried out on each prospect. The percussion drilling program accounted 356 drill holes along profiles perpendicular to the direction of the ancient ice movement. At Gjedde Lake exploration drilling was performed in a grid of 25 meters.
Percussion drilling both on Gjedde Lake and Kobbfoss was conducted during spring of 2004. In total 181 holes were drilled, analysed and logged with encouraging results.
During this summer three diamond drill holes were drilled at Gjedde Lake showing mineralised zones with a width of 5-22m with >0.5 g/t.

As a result of the drilling campaign during the summer of 2004, 78 new applications of exploration licence were made in September 2004. By October 2004 Bergvesenet in Norway granted Scanor Mining those 78 exploration licences covering an area of 1950 ha. 240 surface till samples were collected in the area with good results, especially in the western part.

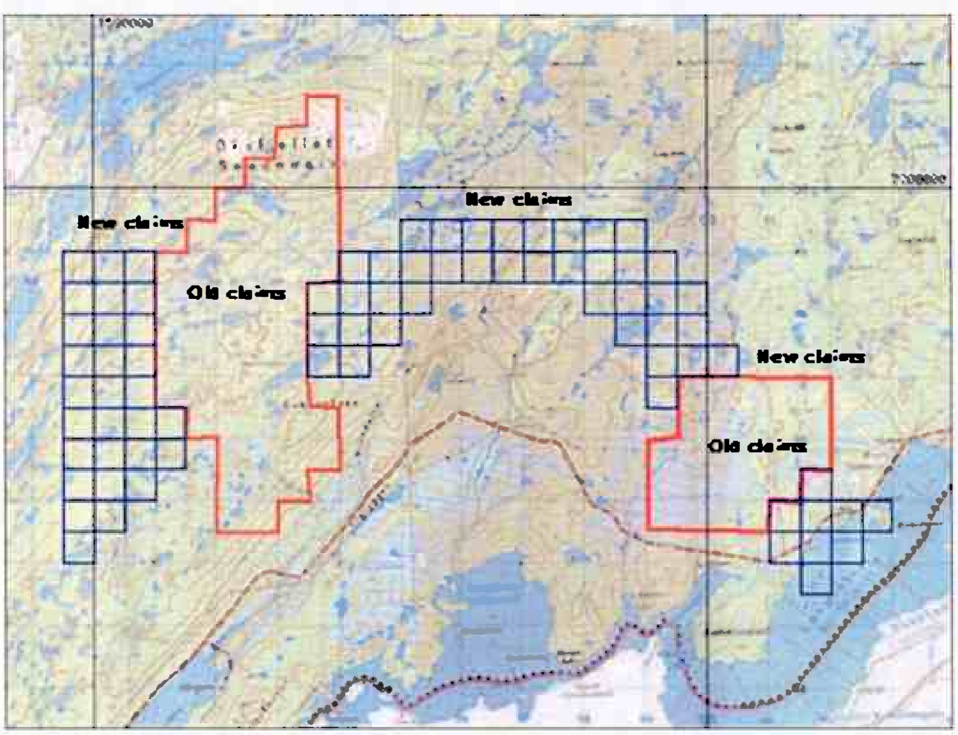

Fig 1. Claims in Pasvik with Gjedde Lake to the west and Kobbfoss to the east.

2. *Historical Background of Exploration in Pasvik Greenstone Belt*

Beside the work within the frame of the Gjedde Lake project, there has been an extensive Ni-Cu exploration done by A/S Sydvaranger and A/S Sulfidmalm in a joint venture during 1971-1973. A/S Sulfidmalm continued exploration in the area during 1975-1985. More than forty drill holes were drilled, totalling more than 5 700m, to test geochemical and geophysical anomalies in the Pasvik Greenstone Belt (Hodges, 1995). During this period no Ni-Cu mineralisation was located. In 1988 Russian and Norwegian geologists started a collaboration in order to correlate the Pechenga Greenstone belt, hosting extensive Ni-Cu-ores, and the Pasvik Greenstone Belt. That emanated in a new period of exploration, which focused on the so-called "productive (Ni-Cu ore) zone" associated to the lower Pasvik Group in the Pasvik Greenstone Belt. Falconbridge ltd. performed core drilling 1991-1993 in the area of Oksfjellet north of Gjedde Lake, which was preceded by aerogeophysical surveying, geological mapping and identification of the "productive zone" within the Pasvik Group.

Not much detailed geological work or geophysical interpretations have been done in the Langvannet Group, beside what is done in connection to the Gjedde Lake gold mineralisation. The Gjedde Lake project started when a Russian geologist, during geological traverse mapping 1993, discovered a gold bearing quartzite on the shore of the Gjedde Lake (Melezhik 1995). Sampling of, what then was thought to be an outcrop, showed that there was significant amount of gold (≤ 10 ppm).

Kenor A/S claimed the area and together with NGU, gold exploration started in vicinity of the lake. Geological mapping and ground geophysical survey was performed (Ettner 1995, Lauritsen 1995, Lauritsen 1996), followed by regional till sampling (Finne 1996) and core drilling (Ihlen et.al. 1996, Ihlen 1998), to test the geophysical and geochemical anomalies. After the core drilling programme, additional dense till sampling was performed aiming to follow the extension of the Au-mineralisation (Finne 1997).

In 1998 Kenor A/S and ScanMining AB formed a jointly owned company, Scanor Mining A/S, to explore the Pasvik Greenstone Belt for gold and base metals. The principal aim of this co-operation was to implement ScanMining's exploration method, Scansystem, which has been successful to find ores in till covered areas. Furthermore Scanor wanted to develop the Au-mineralisation at Gjedde Lake and to bring the new exploration targets to the same level of knowledge as the Gjedde Lake target. This work started in 1998 with regional till sampling, followed by dense sampling in 12 anomalous areas in 1999 from which five promising target areas were selected for continued exploration.

There are two versions of regional geological maps covering the area of interest. One of these is reviewed by the NGU, Berggrunskart Kirkenes 1:250 000 (Siedlecka, 1995). The other two geological maps provided from NGU, Vaggatem (Lieungh, 1988a) and Skogfoss (Lieungh, 1988b), both in scale 1:50 000, finished 1998 are detailed but not reviewed and finally approved by the NGU. They are compiled prior to the regional aerogeophysical survey. Geological descriptions of these map sheets are not published, but an exploration report describing the area exists (Lieungh, 1988c).

The stratigraphy and geological models presented in the two different map sets are mismatching. However, there are some good studies dealing with the tectonic settings of the lower Proterozoic Greenstone Belt, but most of them are done on the other side of the Russian border i.e. Pechenga Greenstone Belt. Although correlation has been made between Pechenga and Pasvik by Russian and Norwegian geologists during the end of the eighties and in the beginning of the nineties (Melezhik et.al. 1995), (Melezhik et.al. 1994a) and (Melezhik & Sturt 1994). The understanding of the timing of deformation and metamorphism is rather limited, at least concerning rocks belonging to the lower and central part of the Langvannet Group.

One of the difficulties when establishing stratigraphy and a geodynamic evolution model of the Pasvik Greenstone Belt is poor exposure of the bedrock. That concerns especially the areas with complex tectonic style, such as the lithologies in the central part of the Langvannet Group, where Gjedde Lake gold mineralisation is situated. In these areas it is rather tectonostratigraphy than lithostratigraphy to be studied due to strongly folded, sheared, thrusted and imbricated rocks.

3. Geological setting

The areas of interest are situated within the *Pasvik Greenstone Belt*, which is a part of the 1000 km long, discontinuously developed, early Proterozoic *Polmak-Opukasjärvi-Pechenga-Imanda/Varzuga-Ust'Ponoy Greenstone Belts*, where the main part is located in Russia (Melezhik et.al. 1995), (Melezhik et.al. 1994a) and (Melezhik & Sturt 1994). These very extensive greenstone belts are interpreted as intracontinental rifts, forming sedimentary basins with mafic volcanic activity, which has created thousands of meters of volcanic piles and sedimentary units.

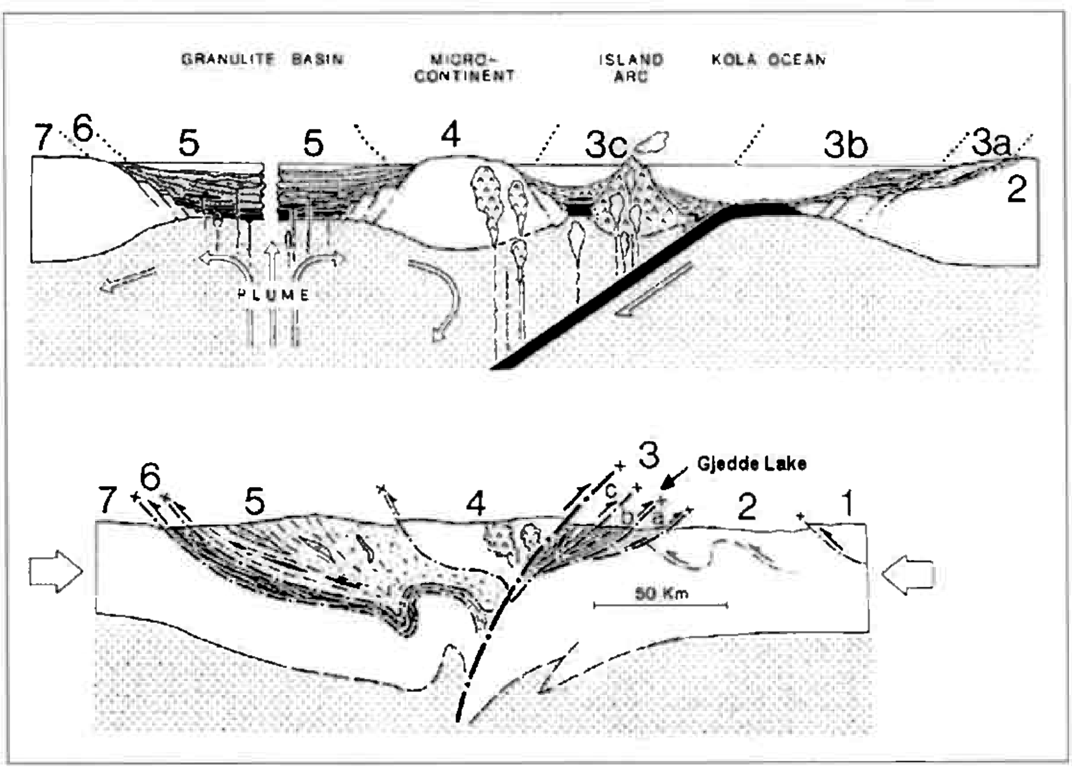

Fig2. Plate tectonic model showing the formation of the Pasvik Greenstone Belt. (from Marker1985)

The *Pasvik Greenstone Belt* is uncomformable overlaying Archean basement to the north. The southern boundary forms a south dipping, low angle thrust where the Archean basement is overthrusted upon the lower Proterozoic rocks. The general stratigraphy of the Pasvik

Greenstone Belt comprises two lithological groups tectonically separated by the major Poritash Fault. The *lower, Pasvik Group*, and the upper *Langvannet group (fig. 3)*.

Stratigraphy of the Pasvik Group is dominated by cyclic sedimentary and volcanic sequences, containing basaltic – andesitic volcanites and volcanoclastic sediments interbedded with thin horizons of graphite bearing schists, red sandstones, dolomitic marbles and rhyolitic – dasitic volcanites. Ultramafic intrusions occur mainly in the central part of the stratigraphy.

The Langvannet Group contains mainly andesitic volcanites and volcaniclastic sediments forming mafic schists interbedded with graphite Fe-sulphide bearing schists, quartzites, and carbonate rock. Small gabbroic sills occur.

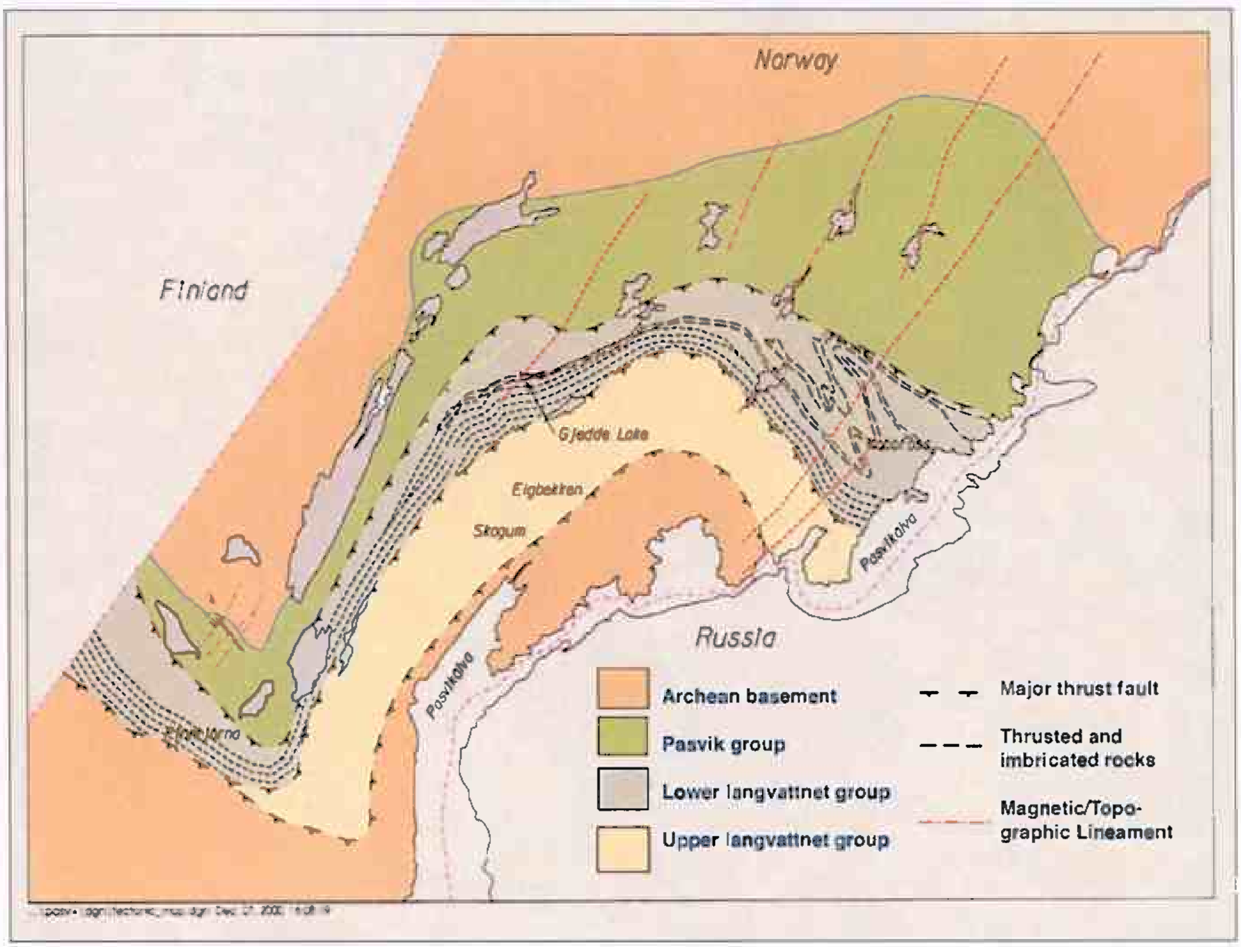

Fig 3. Simplified geology over Pasvik area.

Comprehensive descriptions, especially regarding the mineralogy, tectonic style and the alterations of the Gjedde Lake Au-mineralisation, have been made by Ihlen et.al. (1996) and Ihlen (1998 draft). The results in these works are mainly from the core drilling at the Au-mineralisation. Braathen (1997) has done a regional study of the geological structures and regional tectonic style.

Beside syn-depositional deformations and faulting, three regional deformation stages, D_1 - D_3, can be recognised in the Pasvik Greenstone Belt. The first two, D_1 - D_2, were caused by north-south compression of the crust and the third D_3 was due to east-west compression forming the present shape of the Pasvik Greenstone Belt. The second deformation stage was the most extensive, developing isoclinal folding and extensive low angle thrusts (Braathen, 1997).

According to Braathen, a characteristic structural feature for the Pasvik Greenstone Belt is the increasing strain toward south. From the low strain zone in the Pasvik group via a fold belt in the lower Langvannet Group to the South Pasvik Thrust Zone (SPTZ) (Ihlen, 1998 draft). SPTZ is a, roughly estimated, 900m broad, low angle shear zone dipping 25° - 40° to the south, caused of the second deformation stage D_2 in the region *(see fig. 3)*.

Finntjörna is situated in the upper part of the Pasvik group. Gjedde Lake is in the lower part of the South Pasvik Thrust Zone, Kobbfoss is located just south of the fold belt in the lower part of the Langvannet Group, while Elgbekken and Skogum are in the central part of the Langvannet Group.

The stratigraphy and tectonic style of the Langvannet Group are not well understood, mainly because there is small access to the bedrock, due to thick overburden. The outcropping is less than 1%.

4. Quaternary Geology of the area

The area is characterised by a thin sandy silty till-cover with 1 to 3 meters depth and a till surface rich in boulders.
Surface and lodgement till samples from the exploration campaign carried out in 2000 indicate a short distance transport of material between 50 and 200 meters and an ice movement direction of 30°. This direction corresponds to the conclusion of NGU's Quaternary mapping of the area (Carlson et al. 1983).

In the west, near Gjedde Lake, hummocky moraine characterises the landscape. The topography is low, following the underlying bedrock, which is weathered down to 2 – 4 meters. The thin till-cover together with the weathered bedrock, indicates a weak ice rework, giving rise to a hummocky, slightly drumlinised landscape.

The Kobbfoss prospect is situated in a low land, dominated by a bog, Kobbfossmyran, and some small lakes in the west. The eastern area has a thin till cover with partly good bedrock exposure. The low topography and proximity to Pasvik River make wash out of till possible. However till composition in the area is not differing from till in topographically higher areas. Samples from the surface till sampling program carried out during March 2000 on the frozen Kobbfoss bog, indicated 7 – 10 meters silty sediment beds.

In the middle of the area sampled this year *(see app. 1)* there is a sand field resulting from a ice lake that occurred when the ice sheet retreated toward the south damming up this area and giving rise to the deposit of considerable amounts of sediment.

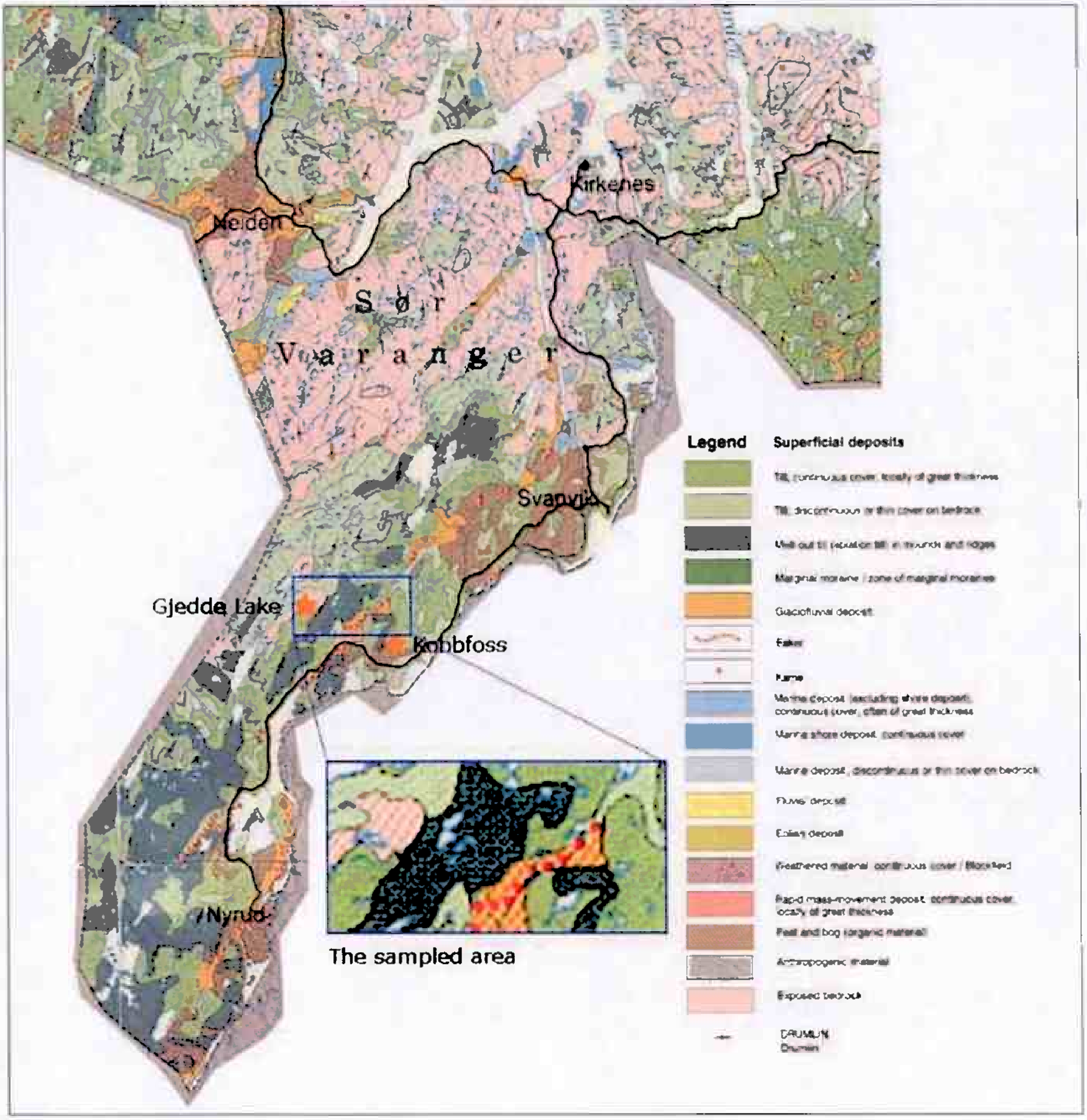

Fig 4. Map of quaternary geology in Pasvik.

5. *Bedrock geology*

5.1 Gjedde Lake

The Gjedde Lake gold mineralisation, situated in the lower part of the South Pasvik Thrust Zone, has been explored since the first gold finding in 1993. There is an even distribution of big boulders or subcrops, often more than $3m^3$ and up to $100m^3$, easily mistaken for outcrops making geological mapping difficult.

Strongly sheared and altered rocks host the gold mineralisation at Gjedde Lake. The first gold finding on the shore of the Gjedde Lake is hosted by grunerite-sulphide-bearing quartzite, which was thought to be an outcrop (Melezhik 1995). Later core drillings showed that it was boulders moved by the ice (Ihlen et.al. 1996).

There are five main rock types defined in the 15 diamond and 58 percussion drillhols at Gjedde Lake. These are **siltstone** (mafic volcanics metamorphosed into mid-grained amphibolite), **mudstone** (very fine-grained amphibolite probably originally from muddy sediments), **graphite bearing schist** with pyrite, **quartzite** with grunerite amphiboles and relicts of **Greywacke** containing quartz-feldspar-biotite *(see fig. 14)*. There are also something that looks like amphibole veins that intrudes the siltstone but it is difficult to distinguish from primary banding in the siltstone. There are possibly more rocktypes that have not been identified and also these five known types could be divided into different sub-types, but the extensive shearing and alteration makes this very difficult.
The rocks form layers of a thickness ranging from decimetres to a few meters, stacked upon each other. At Gjedde Lake the whole package strikes E-W with a dip of 40° to the south.

5.2 Kobbfoss

The Kobbfoss prospect is situated in the lower part of the Langvannet Group within and just south of the isoclinally folded belt. Layers of amphibolite and mica schists with minor quartzite and sandstones dominate the area. In the upper part of this rock unit occur porphyritic mafic volcanites and minor amygdale basaltic lavas, tectonically overlain by the strongly sheared and imbricated rocks of the South Pasvik Thrust Zone.

Tectonically the prospect is situated in the right limb of a D_3 syncline with south plunging fold axes, within the D_2 fold belt. The thickness of this unit in the Langvannet Group is normally less than 1 500 m, but in the area of Kobbfoss it is more than 2 600 m caused by repetition due to isoclinal folding during D_2 deformation. The second deformation phase D_2 has caused isoclinal folding, with axial planes dipping 40° to Southeast. Crenulation cleavage is often shown in the mafic schists, indicating a later D3 deformation phase.

The quartzites are fine grained, light grey and sometimes banded in a brownish colour, the later due to a mostly low content of clino-amphibole (grunerite). Occasionally there is a faint dark grey banding, containing fine disseminated magnetite. They are interpreted as sandy sediments, where the magnetite bands represents horizons of heavy minerals.

The graphite-bearing schists are only observed in bedrock samples from the exploration drilling. They are fine grained, grey to dark grey foliated rocks with different proportion of graphite and sulphides, mainly pyrrhotite. They occur as tens of meters thick beds with extensive lateral extension within the monotonous unit of the mafic schists and are easily recognised on the aeromagnetic map.

6. Exploration work and Results during 2004

6.1 Geochemical till sampling programme

In the area situated between the Gjedde Lake target and the Kobbfoss target a geochemical till sampling campaign was conducted in October 2004.
240 samples were collected over an area of 1230 ha with a grid of 200 m. The samples were taken in the C-horizon.

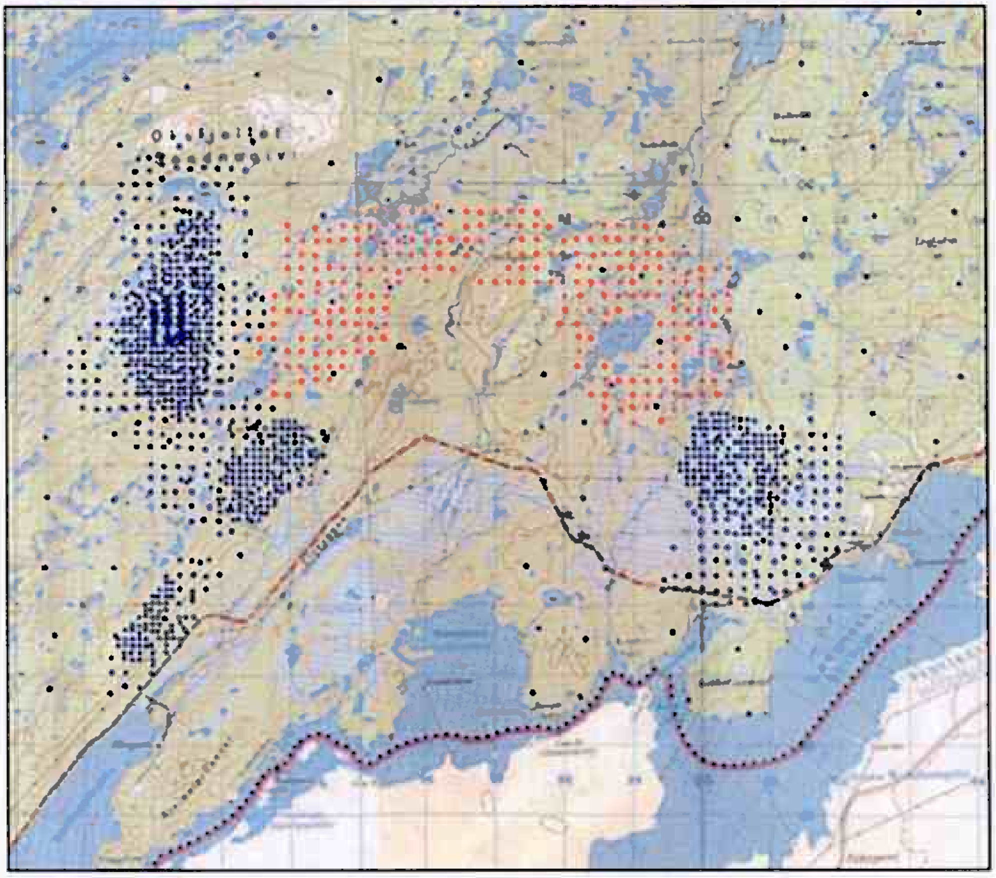

Fig 5. Map of the area showing the location of the samples.
The blue dots show the earlier till samples and the red ones show the 2004 till sampling campaign.

The results from till sampling this year are illustrated in appendix 1.

Geochemical analyses of the till samples show a gold anomaly in the west side of the D_3 fold limb. This gold anomaly appears to follow the SPTZ and possibly a major fault zone with the direction of NNE-SSW, parallel to the transform fault at Gjedde Lake.
In this area gold values are enhanced at almost all samples, and the highest value with 56 ppb also occurs here.

Considering the major ice movement direction the source of the gold anomaly could be expected to be located SW of the till anomaly.

6.2 Gjedde Lake

The work this year at Gjedde Lake has included drilling of 3 diamond drillholes and 58 percussion drillholes, of which 18 are situated on the lake, 24 southwest and 16 north of Gjedde Lake. Apart from analysing bottom till and drill chips, the drill chips has been logged, resulting in interpretation of the geology. The main conclusions are that on the surface mineralisation do not continue towards north, possibly due to the chemical properties and ductile behaviour of the graphitic schist. Though, it could continue on the northern side of the graphitic zone, indicated by anomalous Au in till towards north. There is also a possibility that mineralisation continues to the west, following the contact of the graphitic schist.

Possibly, the mineralisation continues southwards at the surface as different zones, which is indicated in the exploration and diamond drilling.

In the Gjedde Lake area, three diamond drillholes where drilled with azimuth 295° and dip 45°, perpendicular to the previously indicated Au-anomaly.

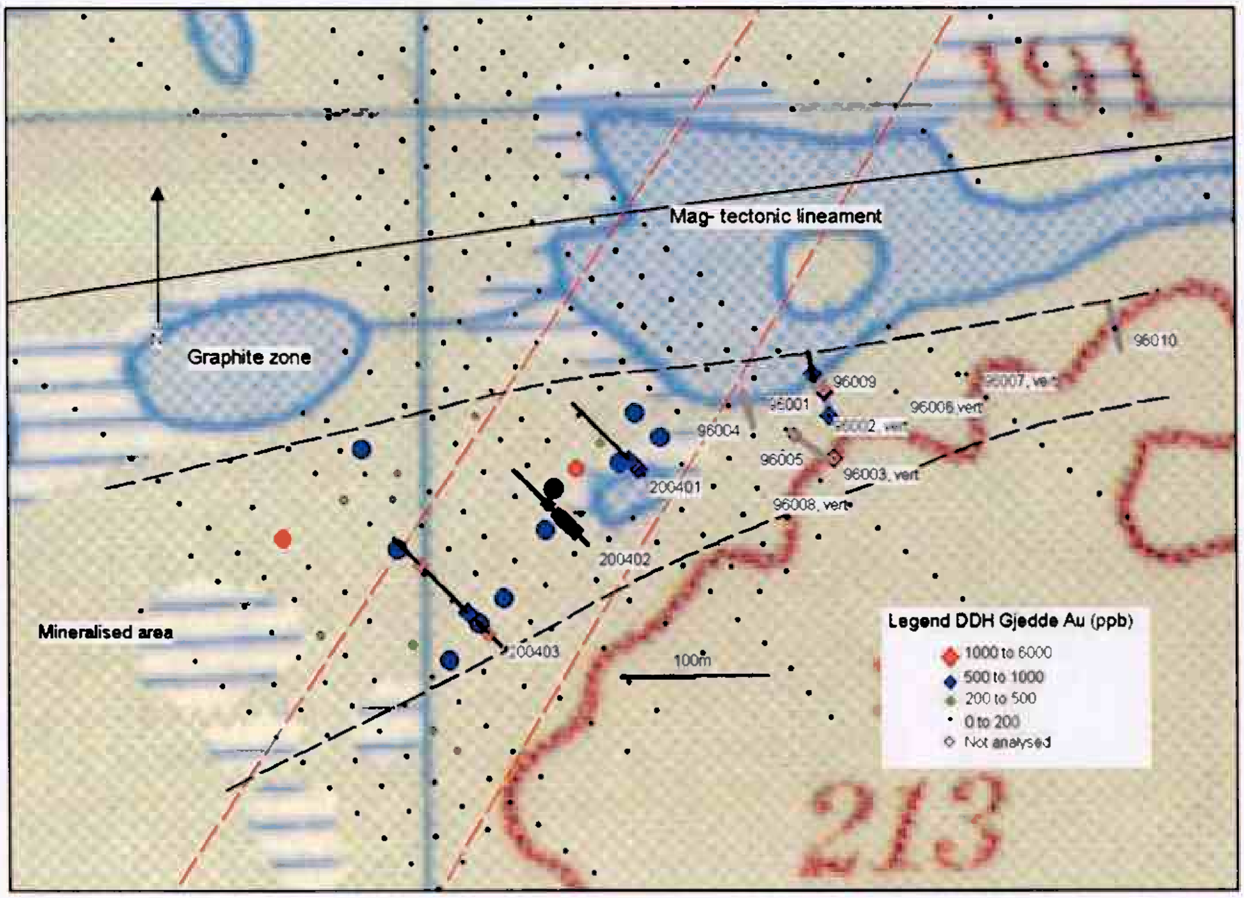

Fig 6. Diamond (diamonds) and percussion (circles) drilling in Gjedde.

Of these, DDH 200401 (furthest to N-E) was drilled 98 m with gold mineralisation of 15 m with 0,69 g/t. *(See fig. 6)* DDH 200402B (in the middle) was drilled 100 m with 22 m Au mineralisation with 0,82 g/t, of these one zone was 5 m with 1,43 g/t and one 5 m zone with 1,08 g/t. DDH 200403 (furthest to S-W) was drilled 149 m with 6 m mineralisation with 0,5 g/t Au. This drillhole also contains one meter with 1,1 g/t at 114 m depth along the hole, which may be connected, at approximately 45°, to a 2,5 g/t percussion drilling result at surface. The mineralisation (approximately Au > 0,5 g/t) was detected in all 3 drillholes with a width of 5-22 m along the drillholes, with maximum grade of 4,1 g over 1 m section.

From new analyses of the 1996 drillholes one new zone of mineralisation that coincides with the already known zones were found. The highest value of 5.66 g/t on a one meter section were found in 96004 at 28m. This is part of a four meter long mineralised zone at average 1.56g/t. At 45° this zone corresponds to a four meter zone in 96005 with the highest value of 2,51 g/t and an average of 1.13g/t. Also this zone was found from analysing new parts of the old drillcore.

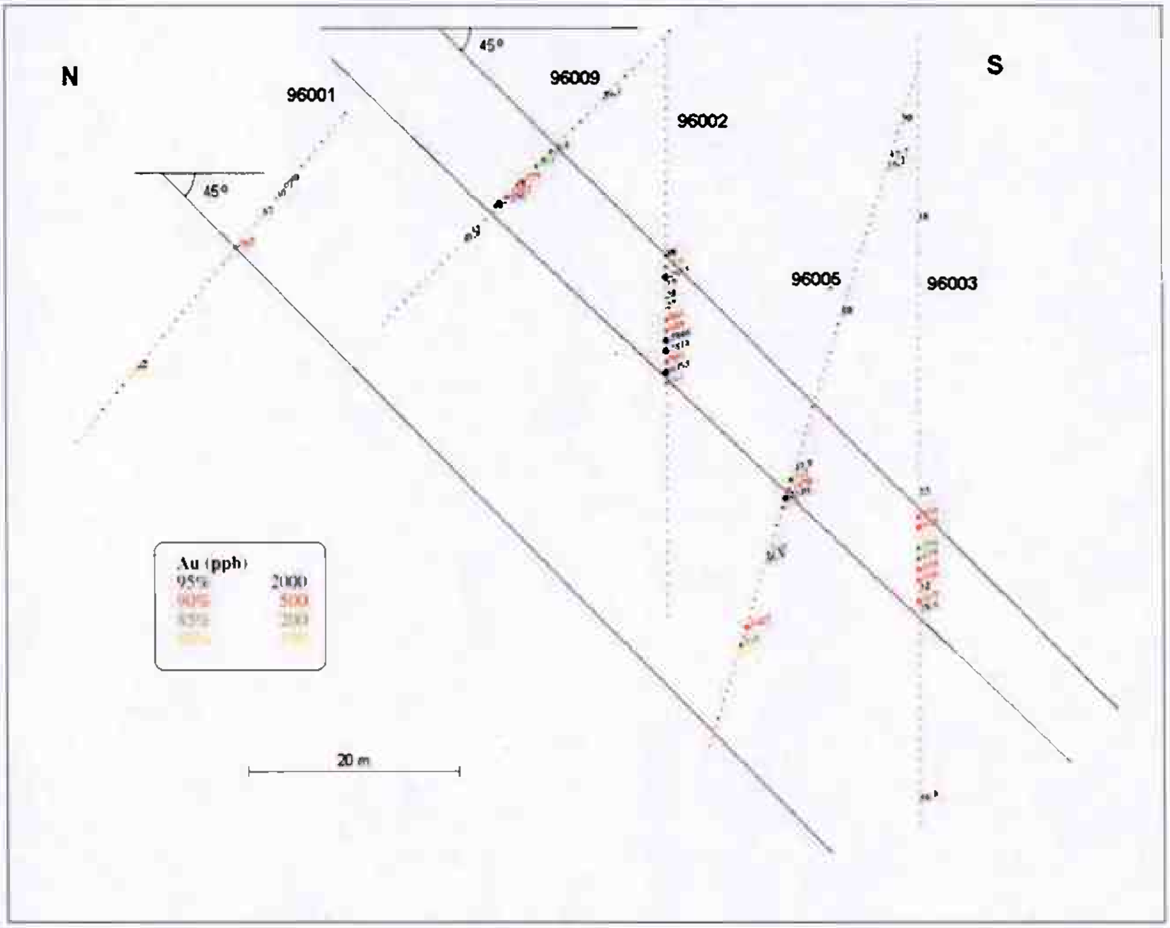

Fig 7. Cross-section 96001-96009-96002-96005-96003.

The dominant rock type in the mineralised zones consists of strongly sheared biotite-amphibole altered volcanic siltstone, which has experienced very strong Ca-metasomatism. The carbonatisation completely chances the mineral composition of the rock by forces everything but ilmenite and K-feldspar out of the rock and replaces it with calcite, re-crystallised quartz and sulphides including Au. The K-feldspar is altered into the Ca-rich plagioclase, anorthite. In thin sections we can see that the carbonate fluids forces biotite and amphiboles away both chemically and mechanically. *(see app. 2)* This possibly indicates that highly deformed and tectonised zones was porous enough to be flooded by carbonate rich fluids. This, rather than lithology, controls mineralisation. The mineralised zones are well defined between drillholes with a dip of 30-45° to SE, which also is supported by previous fieldmapping in the area.

In order to further investigate the differences between the mineralised zones and barren rock, 110 samples have been chosen for ICP analyses.
Three sections were selected from drillhole 200401, of which one section was mineralised. From drillhole 200402 two sections were selected where one was not mineralised and the other contained both mineralised and not mineralised zones. Three sections were also selected from drillhole 200403 where one was mineralised, one not mineralised and the third partly mineralised. Several interesting correlations and anticorrelations where observed. It seems that we have rather good correlation in the mineralised zones between As and Au. Notable is that within the mineralised zone there sometimes occur one or two rather low gold values but the As content is still high. In the samples with high W content there is always high gold content, though, there is not always high W where there is high gold. This correlation is also

seen in the till sampling where the only anomalous W value occur in the same sample as the highest Au. However, since W and Au occurs rather close in the periodic table they give similar peaks in mass spectrometry and therefor there is a small possibility that the W values actually are misinterpreted Au. (Hellingwerf, pers.com.)
Outside the mineralised zones there seems to be higher Al-content, probably due to chloritisation outside the strongly altered zones. A weak anticorrelation seems to exist between Cu-Au. A small but significant increase in the Cu-content is seen just outside the mineralised zones.

Microscopical investigations were made on 9 thin sections and 4 polished sections, which gave detailed information of the history and alterations of the rocks. (Hellingwerf, 2004) The complete report can be found in appendix. 2. One of the most important results that the thin section gave, except confirming many of our observations and theories, is a paragenetic sequence of the area. *(see fig. 8)* This helps us to understand the origin and timing of mineralisation so that we know what indicators we should look for.

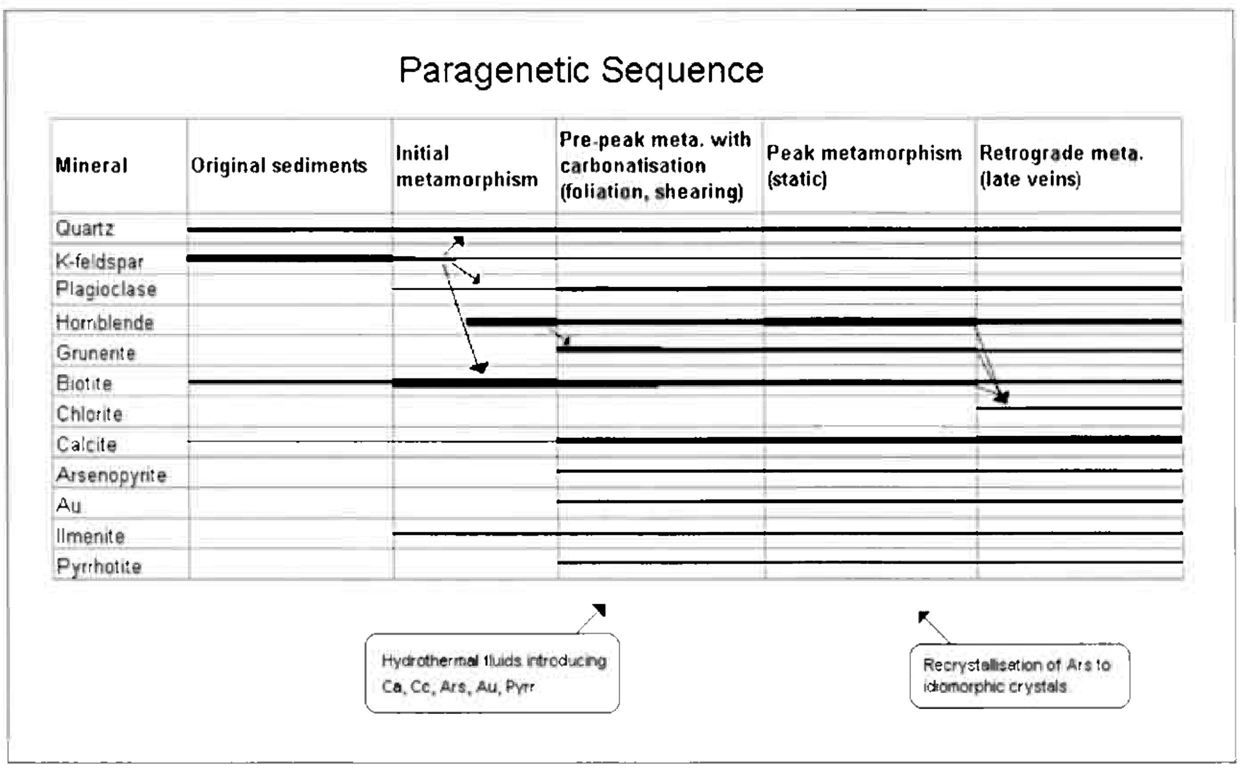

Fig 8 Paragenetic sequence of Gjedde Lake.

We were also able to identify the composition of the immature fluids that formed the grunerite, which is formed just before mineralisation, by defining its composition. This indicates the there were a Fe-rich, S-poor fluid preceding the Ca-metasomatism, that brought the gold.

Leach test was performed on meter 27 from drillhole 200402 which in the original Fire Assay analyse had a grade of 2.4 g/t Au. One analyse gave 14.5 % refractory gold and the duplicate sample gave a result of 5.5 % refractory gold *(see results below)*. Analysing methods where GTK method 235A and method +705P, where the analyses covered by method code +705P are covered by the scope of accreditation.

Laboratory Sample ID	Customer Sample ID	Au mg/kg 235A	Au µg/kg + 705P
L04098643	04D3127	2,0	290
L04098643U	04D3127	2,3	128
L04098644	QCSOKEA	<0,1	<5
L04098645	QCKU130C	0,9	-
L04105089	QCCGS4	-	2060

6.3 Kobbfoss

In the first campaign this year at Kobbfoss 123 percussion drillholes has been drilled and sampled for bottom till and bedrock. The bedrock samples has been logged and interpreted geologically. Surface till Au anomaly has been picked up by the bottom till as well as in bedrock samples. This encouraged further exploration drilling focused on the western part of the drilled area.

During July-August 2004, exploration drilling was carried out with Odex 76 technique. Out of 80 planned drillholes, 63 were drilled. The 17 left out could not be drilled due to wet bog conditions. The highest gold value found in bedrock sample at Kobbfoss is 0,8 g/t, followed by 0,46 g/t. These values are located along the stratigraphic boundary between quartzite and mica schist along strike of South Pasvik Thrust Zone.

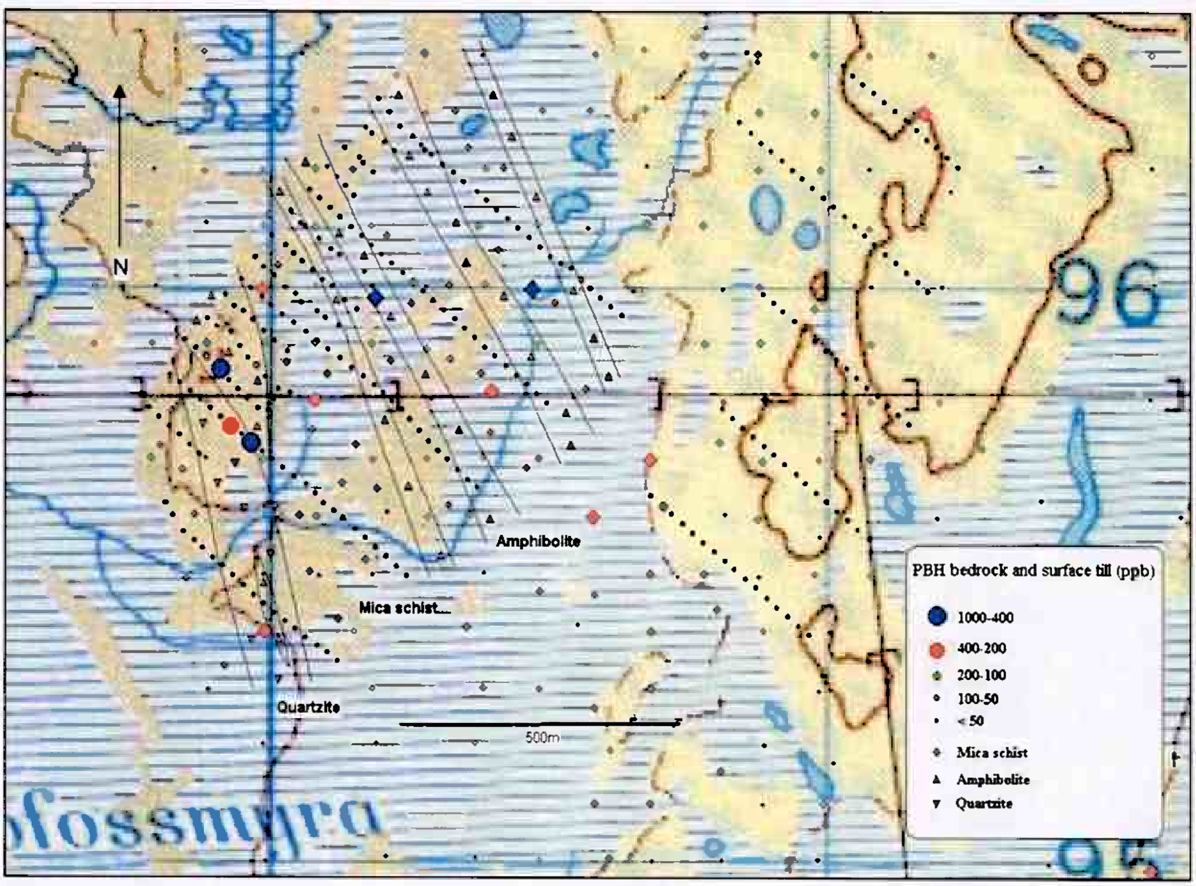

Fig 9. Au in surface till (diamonds) and bedrock (circles) at Kobbfoss.

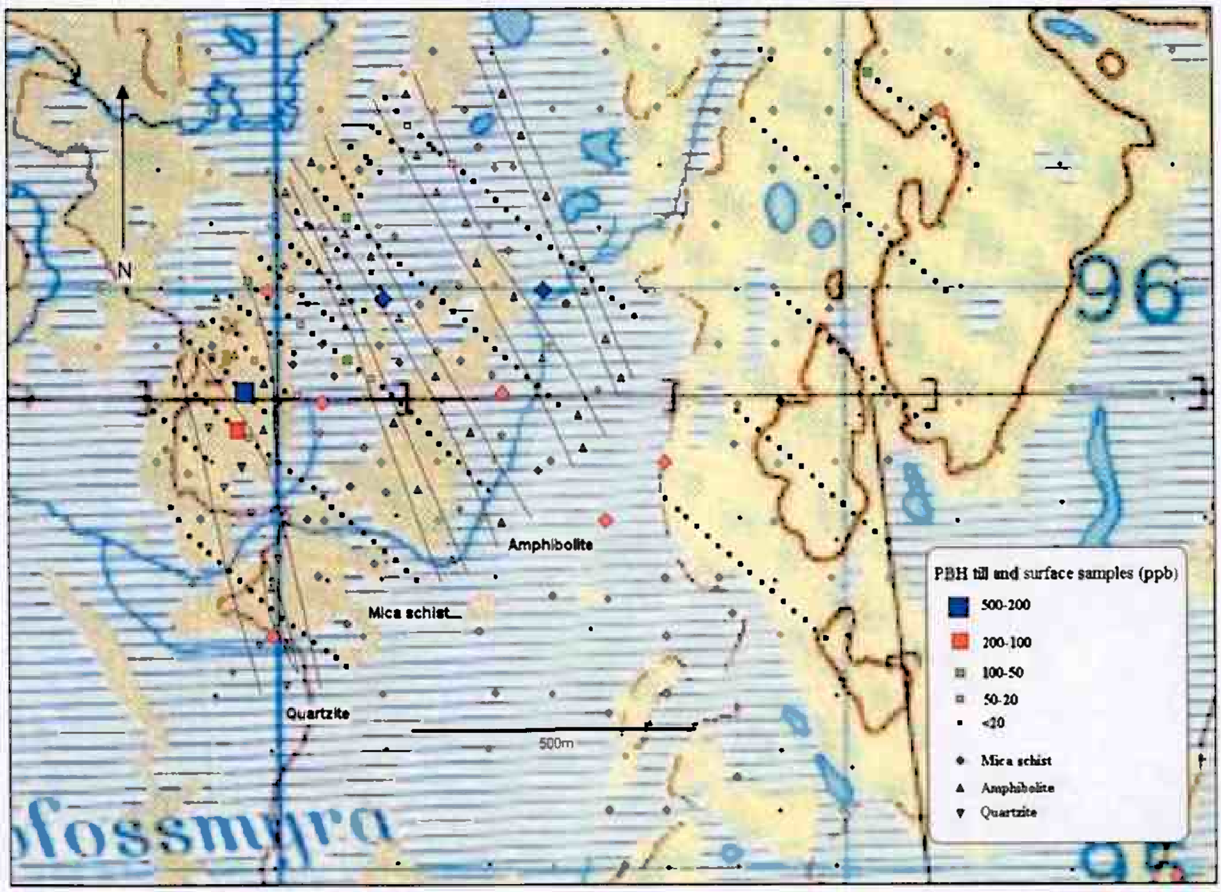

Fig 10. Au in surface (diamonds) and bottom (squares) till at Kobbfoss.

7. Interpretation

7.1 Till sampling

The gold anomalies seem to follow a transform fault parallel to the one found in Gjedde Lake or the South Pasvik Trust Zone. There is also a possibility that the fault, when meeting the SPTZ, bend of to the SW and follows the trust zone. About 2 km SW of this years sampling along the SPTZ a till sample with 400 ppb gold is located. This sample and the anomalies from this year are all situated in a topographically low area with lots of bogs and the Harrvattnet Lake. The low topography could indicate a fault zone making the underlying bedrock more easily weathered.

7.2 Gjedde Lake

As discussed above, it was earlier assumed the mineralisation only occurs in grunerite-quartzite, but we have observed that it appears elsewhere and is not restricted to one lithology. From re-logging we also found out that the grunerite-needles appears as shear indicators in the quartzite in the same way as the shear bands do in the amphibole altered volcanic siltstone, and that the mineralisation in the quartzite also is restricted to zones of later alteration. The fact that the quartzite earlier was thought to be non-metamorphosed could be explained by that the quartzite is more competent than siltstone and therefore appear less deformed.

The original volcanic sediments and four phases of alteration have been found and are described below. *(see also fig. 8)*

1. Original sub-marine volcanic sediments with quartz, K-feldspar, calcite and mica as major components. The mineralogical variation has led to an original banding. Relict quartz and feldspar phenocrysts can still be seen. This quartz can be seen as rotated "snowballs" between shear band in amphibole altered siltstone.

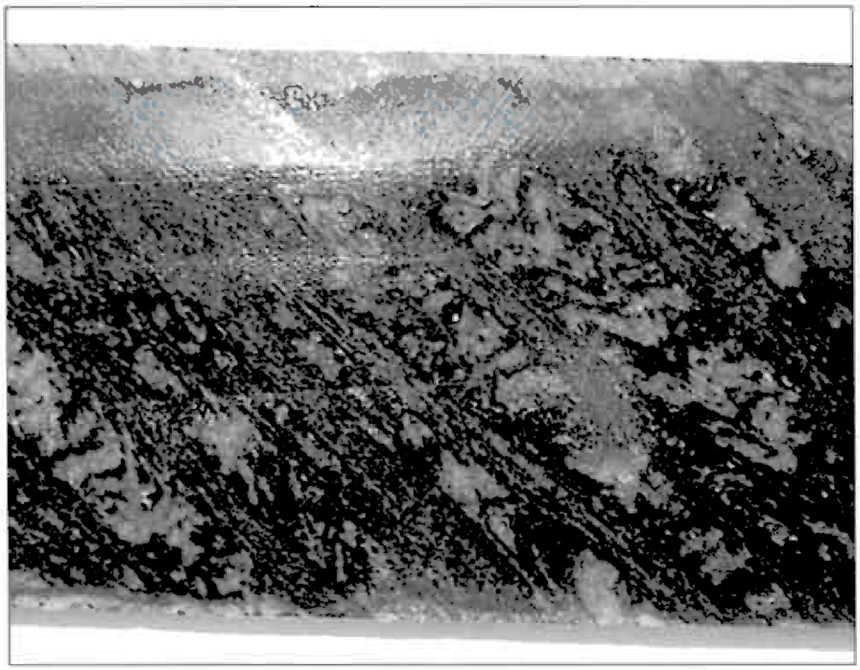

Fig 11. Quartz phenocrysts in original banding with strong shear bands in-between.

2. Initial stage of metamorphism that folds the rock and gives the biotite a "wavy" appearance. This is either part of D1 or early in D2 deformation. These folds are preserved by extensive ilmenite that is formed during this event. Considering the large amount of ilmenite it is most likely to have been hydrothermaly introduced. The ilmenite form bands following the first foliation and is then unaltered throughout the other hydrothermal/metamorphic events.
Alteration of K-feldspar into biotite, plagioclase and quartz also start to take place. When changing K-feldspar to plagioclase there is some excess K that helps forming additional biotite. Both plagioclase and biotite consist of less silica than K-feldspar and therefore crystallisation of quartz take place. This can be see as one form of silicification but there is no added silica to the rock. This alteration starts late in this phase and continuous into the next phase.

3. This phase commences with an increase in Fe-activity, which alters the composition of the amphiboles from hornblende to grunerite. The grunerite is the main amphibole in the quartzite and occurs mainly as rims around hornblende in the other rock types.
During this event the main folding and shearing took place and it is also possible that the transform fault seen west of Gjedde Lake is created here.
The most important feature for the mineralisation occurs during this event in association with strong Ca-metasomatism. This carbonisation formed the Ca-rich plagioclase end member, anorthite, and introduced calcite, arsenopyrite, pyrrhotite and gold. The metasomatism almost

completely washed out all existing minerals except ilmenite, leaving a so-called "ghost structure", which contains about 50% calcite and 50% quartz and plagioclase. *(see fig. 12)*

Fig 12. Very strong carbonatisation is seen in the right part creating a "ghost structure" This destroys the dark minerals (biotite and amphibole) both chemically and mechanically almost completely. The dark bands seen in the right part mainly consist of ilmenite.

4. Peak metamorphism occurred during this event, which was static i.e. there occurred no shearing or folding. This made it possible for the hornblende to grow in all directions along the foliation planes. These hornblends are the one previously called "garben" and can be seen as fans in the cores. No fluids where present during this event, therefore it can not be associated with the mineralisation. However, arsenopyrite re-crystallised during this event to idiomorphic crystals and gold was re-mobilised into fractures and onto the surface of these arsenopyrite crystals. In the quartzite non-metamorphosed patches of quartz and biotite, containing some Au can be seen. These were probably formed during this event in open spaces with Au migrating from the surrounding rock into these low-pressure areas. *(see fig. 13)*

The temperature of the peak metamorphism is close to, but not above, 500° C. This is shown by pyrrhotite in direct contact with chalcopyrite, and calcite in contact with quartz without forming cubanite respective wollastonite. (Hellingwerf, 2004)

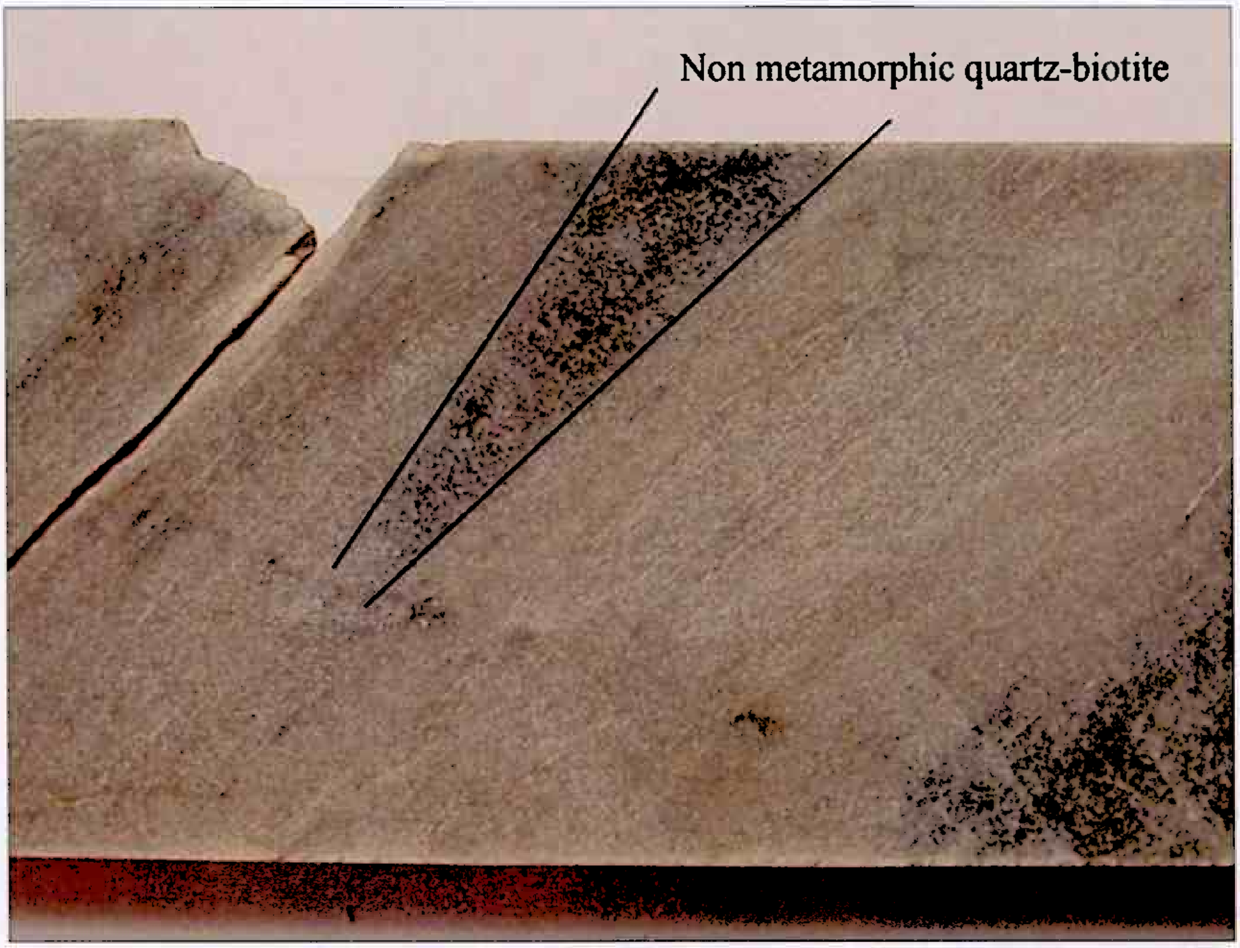

Fig 13. Patch of non-metamorphic quartz- biotite in grunerite quartzite. This 25-cm section contains 0.8 g/t Au.

5. The last phase of the sequence is late brittle fractures filled by pure white quartz and calcite. The veins can be up to tens of centimetres wide and are sometimes seen reopening old mineralised veins and could therefor be mistaken for containing sulphides. However, in thin section it is clear that these veins are non-mineralised.

In the cores there is non-metamorphosed greywacke relicts seen with extensive shear band surrounding them. *(see fig. 14)* The fact that the extensive shearing did not destroy the greywacke might seem strange but it probably survived in pressure shadow throughout the early stage of the event. Once shear bands had developed all around the relicts all deformation took place in the softer bands.

If it really is greywacke and quartzite, which are formed in close proximity to the shore, is not completely understood since it doesn't match the deep-sea signatures of graphite schist. Since formation of these rocks took place during very long time it is possible to have both coastal and deep ocean formation together. The extensive thrusting has also moved rocks long distances so that rocks that were formed far apart may now lie next to each other. *(see fig. 2)*

Fig 14. Relict greywacke.

In this years drilling a clear sequence of mineralisation was discovered. *(See fig. 15)* Above the mineralisation there is a layer of mudstone or graphite bearing schist. This is thought to limit the mineralised fluids way upwards due to low permeability. Right above the mineralisation, or sometimes in it, is a zone of garnets. This could indicate that the metamorphic grade was higher here or different composition of the original rock. The zone itself contains arsenopyrite and is strongly carbonised as described above. Mineralisation also lack amphiboles growing in two dimensions e.g. "garben" and strong chloritisation, which we have in the rest of the core. If this is due to higher metamorphic grade or difference in original composition, is still under investigation. Below mineralisation there is a layer of mudstone rock. The two impermeable layers above and below mineralisation are believed to form a trap or funnel concentrating gold to the area in between. In the old drilling this sequence is not as clear but garnets are sometimes present around mineralised zones.

Using the tools mentioned above it is possible to identify interesting areas in the drillcores with good accuracy. This should also be of great help when trying to locate new areas with a good potential for mineralisation.

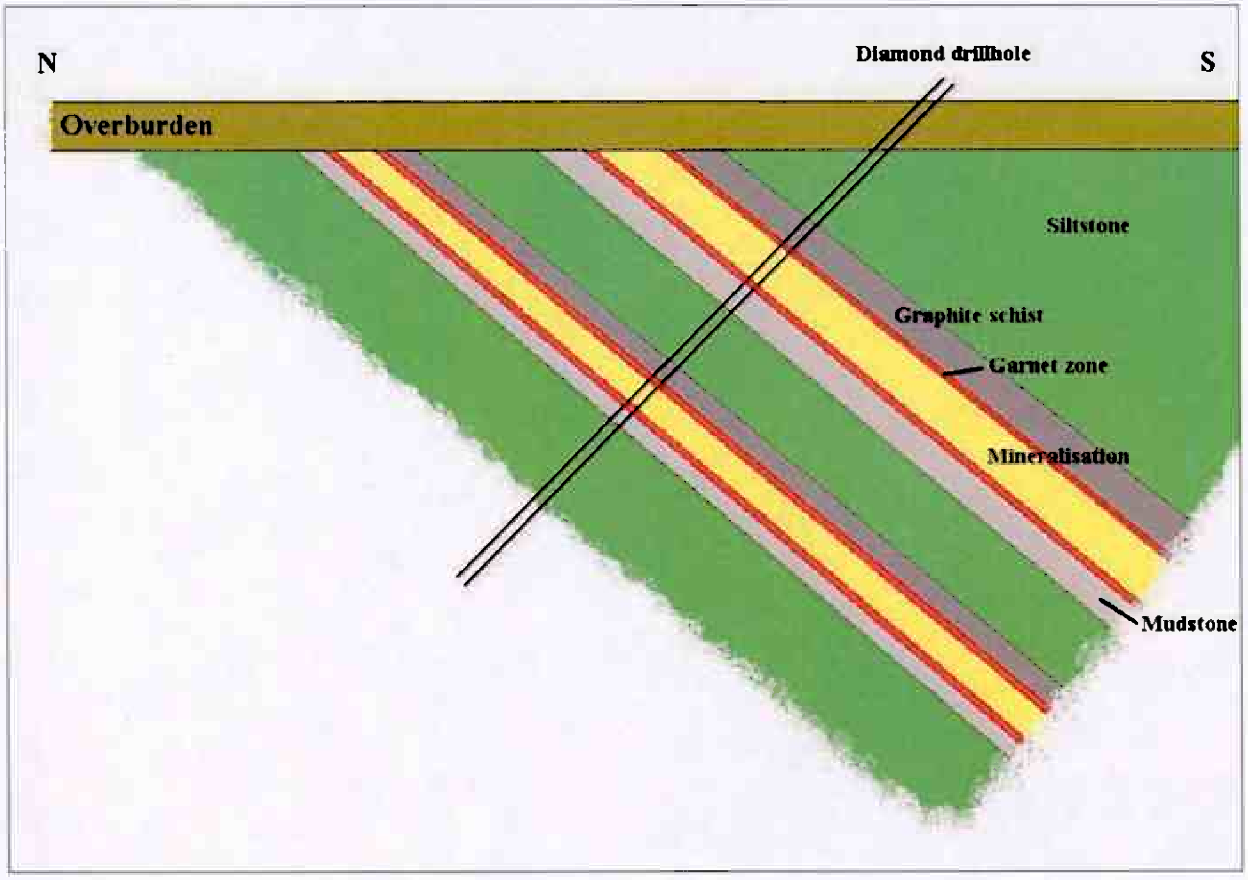

Fig 15. Simplified picture of the mineralised sequence.

Airborne magnetic measurements show a wide zone of graphite bearing schist across the lake, continuing on both ends with a strike direction of E-W. This matches our results from exploration drilling where samples from the lake have high graphite content, sometimes with slickensides, and slightly different mineralogy. All three diamond drillholes also end in graphite rich zones. This is very interesting since the graphite could constitutes a boundary for mineralised fluids and also be of importance for its formation. These layers can be traced throughout the belt, giving suitable conditions for more mineralised zones, which together with faults could be concentrated into orebodies.

The southern margin of the thrust belt is uncertain because of poor bedrock exposure. Although, local boulder with sheared rocks belonging to the thrust zone can be observed approximately 900 m south of the lake. Further to the south the lithology changes to a white mica bearing andesitic sandstone.

The formation of the gold mineralisation has been debated by different authors, whether it is the result of selectively sulphidised Fe-oxide replacement in Banded Iron Formation or sulphidised, shear-hosted mafic silicate alteration zones (Melezhik, 1995; Ettner, 1995; Covello, 1997). What we have seen so far supports the later theory about sulphidised, shear-hosted mafic silicate alteration zones. Melezhik (1995) and Ihlen et.al. (1996) showed that Au and S are correlating, but there are also high S values without gold. One possibility is that pyrite is responsible for the high S found without gold. Pyrite seems to have no correlation with Au and are found throughout the rocks, with a stronger concentration in the graphite schist. Maybe this pyrite is formed under anaerobe condition when organic material decayed producing hydrogenic sulphide, which reacted with iron forming pyrite, similar the to

formation of framboids. Pyrrhotite, chalcopyrite and minor marcasite have close time and spatial relation with the gold, shown by microscopic studies where fractures in arsenopyrite contain native gold and other sulphides. (Ihlen et.al., 1996). These fractures were probably created when arsenopyrite re-crystallised during metamorphic phase 4. *(see fig 8)*
A log/log plot of all assays demonstrates correlation between As and Au, but some of the high gold values are not associated with As, although high As values are mostly associated with anomalous Au. Thin section studies showed that native gold probably was re-mobilised during peak metamorphism, filling fractures or being situated on the boundaries of arsenopyrite crystals. This could explain the discrepancy between As and Au if gold migrated away from or were mobile longer then the arsenopyrite.

Marcasite is the orthorhombic dimorph of pyrite, formed at lower temperatures and is more easily weathered than pyrite. Why marcasite, instead of pyrite, forms together with Au is not fully understood but it could be a useful pathfinder.
In the percussion drilling As can be seen to form a halo around gold anomalies. This can also be used as a pathfinder by creating a larger target.

It is obvious that the first found Au mineralisation is structurally controlled and mainly of epigenetic origin. The gold appears in fractures in broken, mainly euhedral arsenopyrite crystals, orientated parallel to the schistosity. Native gold also occurs along the margins of pyrite and in veinlets in quartz.

Formation of vertical to sub-vertical transform faults facilitated the escape of the gold bearing fluids allowing the main gold content to precipitate. The geometry of the gold mineralisation found in this years diamond drilling indicates presence of a transform fault, which in combination with shear zones creates the anomaly.

On the south shore of Gjedde Lake geophysical measurement were made by NGU in 1995 and 1996. The methods used were IP, SP, resistivity, VLF and total magnetic field measurements. Since IP, SP and VLF are all used to look for aquifers it is difficult to make any clear conclusions of the results.
New interpretation of VLF measurements performed during 1996 gave interesting results and supports earlier observations. The transform fault across the west part of the lake is well defined north of the graphite schist, with a strong negative anomaly. Where the mineralised zone intercept the fault, the anomaly disappears and instead there is a very weak positive anomaly typical for the mineralisation. That the fault becomes invisible for VLF at the mineralisation could be the result of the gold-rich carbonate fluids *(see fig. 12)* flooding the fault and filling any open spaces. The mineralised zone does not seem to produce any significant anomaly and is seen as a flat weak high just before the graphite rich zone.
The graphite schist across the lake is clearly shown as a strong negative anomaly, which in some parts coincides with the fault zone and then gives an even deeper anomaly.
The graphite zone is also well defined both in resistivity and magnetic measurements all along the lake. How important for the mineralisation the graphite is and in what way, is not completely understood but it definitely is of some importance.

The other geophysical measurements total magnetic field, IP and SP, indicates a complex geology with discontinues features trending NNE-SSW. This corresponds with observations made from drilling and the geological mapping. There is also a weak IP anomaly in a magnetic low area, which could indicate some sulphide content.

7.3 Kobbfoss

The best values are founds on the contact between quartzite and mica schist, which is very interesting since this contact can be followed for about 10 km. There are also other similar interesting contacts in the area, which has not been investigated. For example, north of Gjedde Lake there is also a layer of quartzite with some good Au values from the first till sampling campaign. This area has not been investigated since, but considering the results from Kobbfoss should be given higher priority.

8. Conclusions and recommendations

From the till sampling programme the presumed mineralised structure is indicated by scattered enhanced gold values. The scattered picture is indicating the need of a denser sampling grid, 100 meter, probably in conjunction with wide spaced percussion drill profiles. The ice abrasion of the bedrock surface is rather weak in the area as mentioned on page 6 this also explain the weak gold anomalies both at Gjedde as in the area north east of Gjedde.

The high gold values in the till samples seem to follow a major fault or lithological boundary, which is positive since it could produce a large mineralisation. This also shows that there is an extensive target area for further exploration in the area, in addition to Gjedde Lake and Kobbfoss.

The distance between Gjedde Lake and Kobbfoss is about 10 km and the geological unit, the lower Langvattnet group, in which both Gjedde and Kobbfoss is situated is about 5 km across. This geological unit, which has increasing metamorphic grade towards the south, contains a lot of possible target areas for further exploration work. These should be investigated using the results from last year's exploration work performed at Gjedde Lake. The results could then be applied on the structure between Gjedde Lake and Kobbfoss, which should give a good idea about its potential.
At Kobbfoss the best results are found along the contact between quartzite and mica schist *(fig. 9-10)* why we recommend further percussion drilling along this contact to the northwest. In the first stage we recommend a quite sparse grid for exploration drillholes 25 x 200 across the expected mineralised area. Together with the drilling some ground geophysics should be considered to connecting the drilling profiles, for example magnetics together with IP or VLF.

A percussion drilling programme of 200 holes is therefor suggested following the contact in Kobbfoss, continuing south of Gjedde Lake to the 400 ppb till sample and along the structure from this till sample to the 56 ppb sample from 2004 till sampling.

Results from the drilling campaign at Gjedde Lake this summer indicate a structural controlled mineralisation, which may have a very large extension. The work performed during 2004 gave new light on what processes controlling the mineralisation and how it is formed. The lihtology needed is strongly sheared sediments, which are completely altered by Ca-metasomatism that introduced the gold. Gold ores together with carbonatisation is common worldwide and is a well-studied ore forming process. This fluids moves along the shear zones but are only allowed to crystallise when the fault zones opens up the rock and by the reducing effect of the graphite schist

The extension of the indicated mineralisation at Gjedde Lake should be further investigated using a combination of exploration methods. It should be investigated both to the NW of this years diamond drillings to see if there is a continuation of the zone towards the graphite contact, and to the south where we could expect parallel zones.

Depending on the results of the above programme we could expect a need of approximately 20 diamond drillholes totalling 4000 m, to be drilled during the second part of 2005. These drilling will be dependent on results from percussion drilling, geophysics and mapping but a suggestion for nine drillhols in Gjedde Lake is presented below. *(see fig. 16)* These drillholes should be divided into two campaigns together with drilling in other areas.
This drillings are motivated by the relations we have seen between this years drilling, with a quite wide zone of carbonatisation containing high gold, together with the investigation of the old drillcores and the geophysical interpretations. The drillings will hopefully result in an extension of the mineralisation and give us a better knowledge and understanding. Additional information about the interception between the mineralised transform fault to the west and the mineralised thrust zone found in the drillings from 1996 will also be obtained

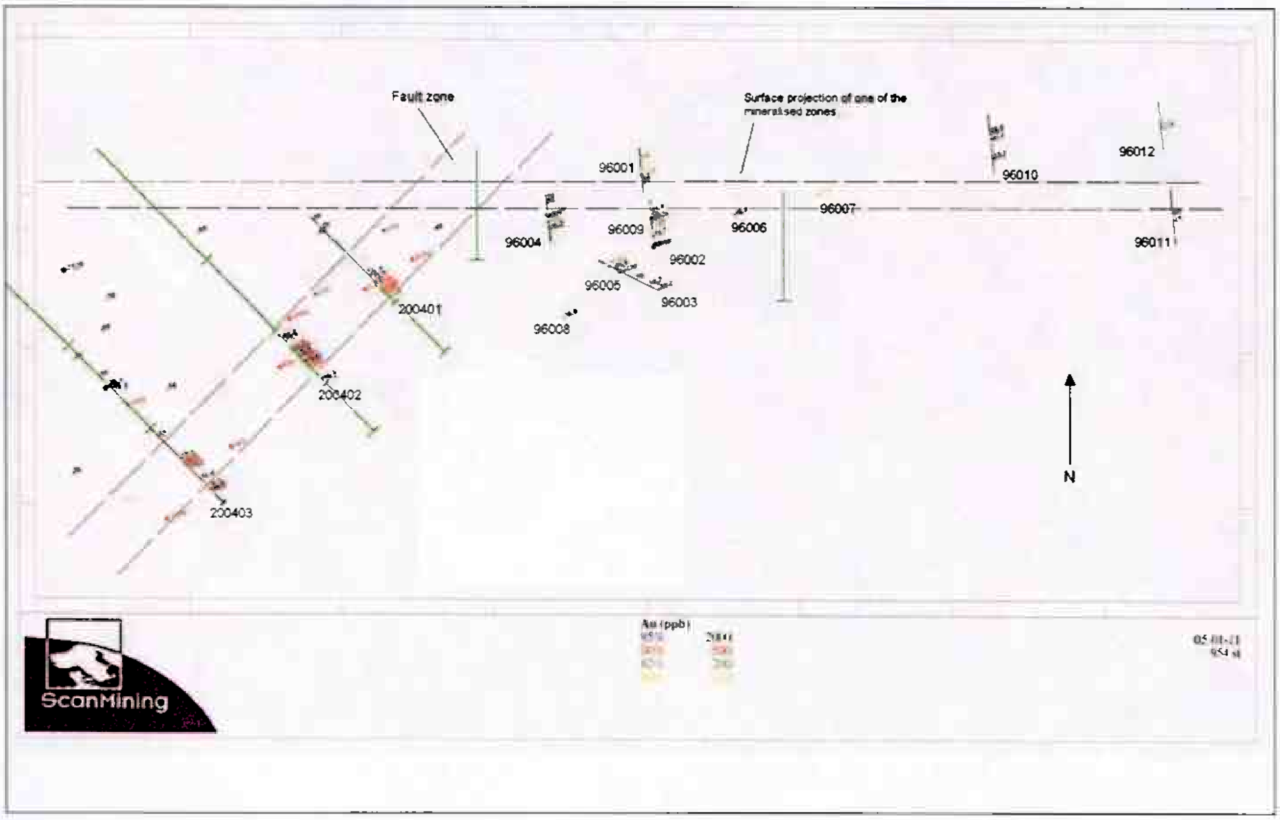

Fig. 16 Suggested diamond drill holes.

To further investigate the area northwest of 2004 years diamond drilling, where the surface projection of the previous found mineralised zone could continue towards west. This also coincides with high Au-value (2520 ppb) in bedrock samples from percussion drilling.

This drilling plan above also includes additional drillholes behind 200401 and 200402 targeting possible parallel mineralisation and to intercept the mineralised zone from 2004 at depth, to get a more reliable estimation of the dip.

Previous drillholes 96006, 96007, 96010, 96011 and 96012 are all drilled to far north and therefor missed the mineralisation. *(see app. 3a)* Also hole 96008 is too short and does not reach the mineralised zone, as shown in appendix 3b.

The leach test carried out in 2004 showed that the gold is leachable but the spread (5 resp. 15%) between the two samples proves that further tests are necessary. To get a safer estimation of the leachability a few more tests is recommended.

8.1 Proposed budget for exploration in Pasvik 2005

Phase 1

Percussion drilling of 200 drillholes incl. Establishment, chemical analyses and various help from local entreprenours	960 000 SEK
Extended leachtests	50 000 SEK
Geophysical groundmeassurements	500 000 SEK
Core drilling of 1500 m including establishment, chemical analyses, geologists and corecutting	1 650 000 SEK

Phase 2

Core drilling of 2500 m including establishment, chemical analyses, geologists and corecutting	2 750 000 SEK
Project management, geological evaluation and report	200 000 SEK
	6 110 000 SEK

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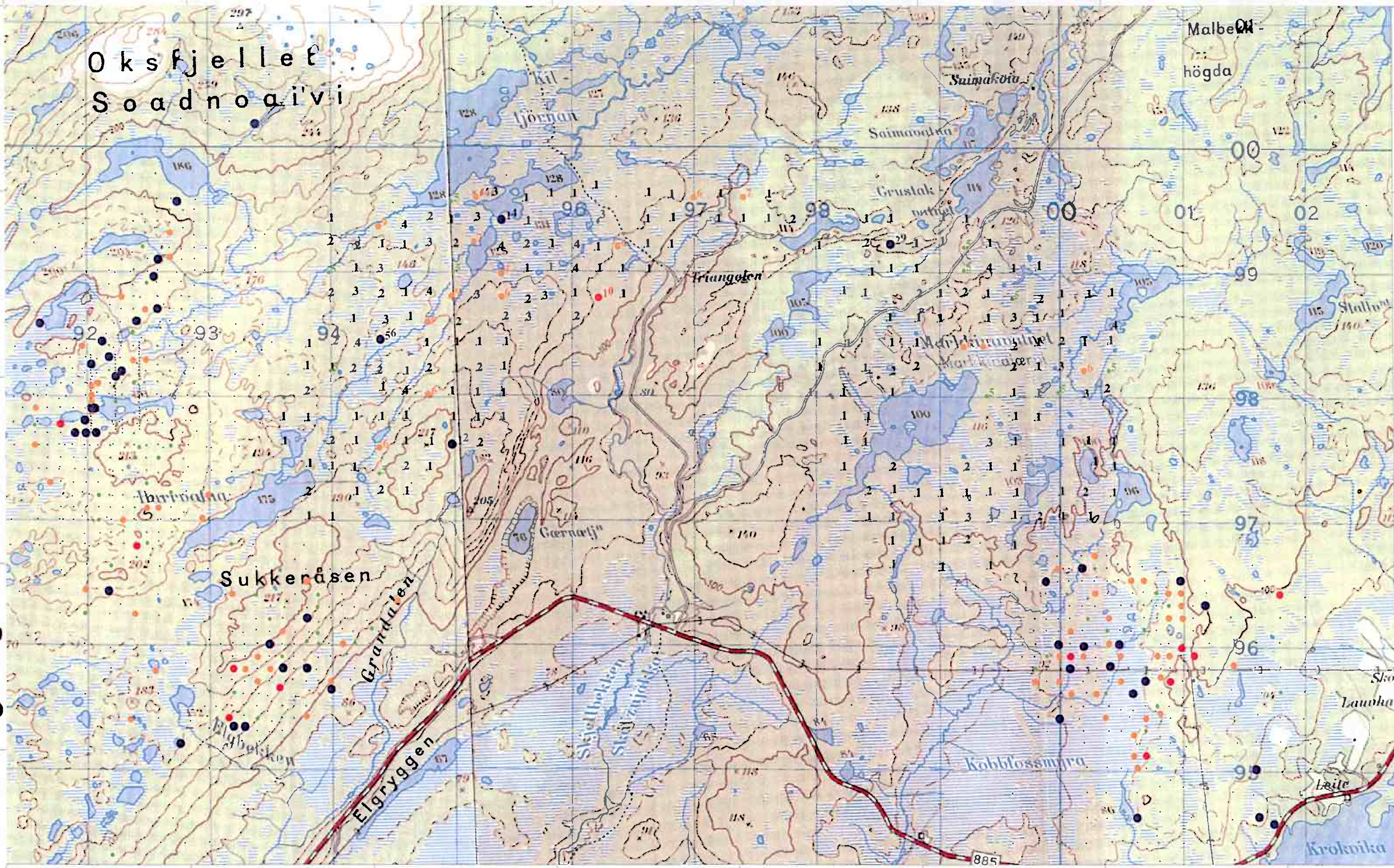
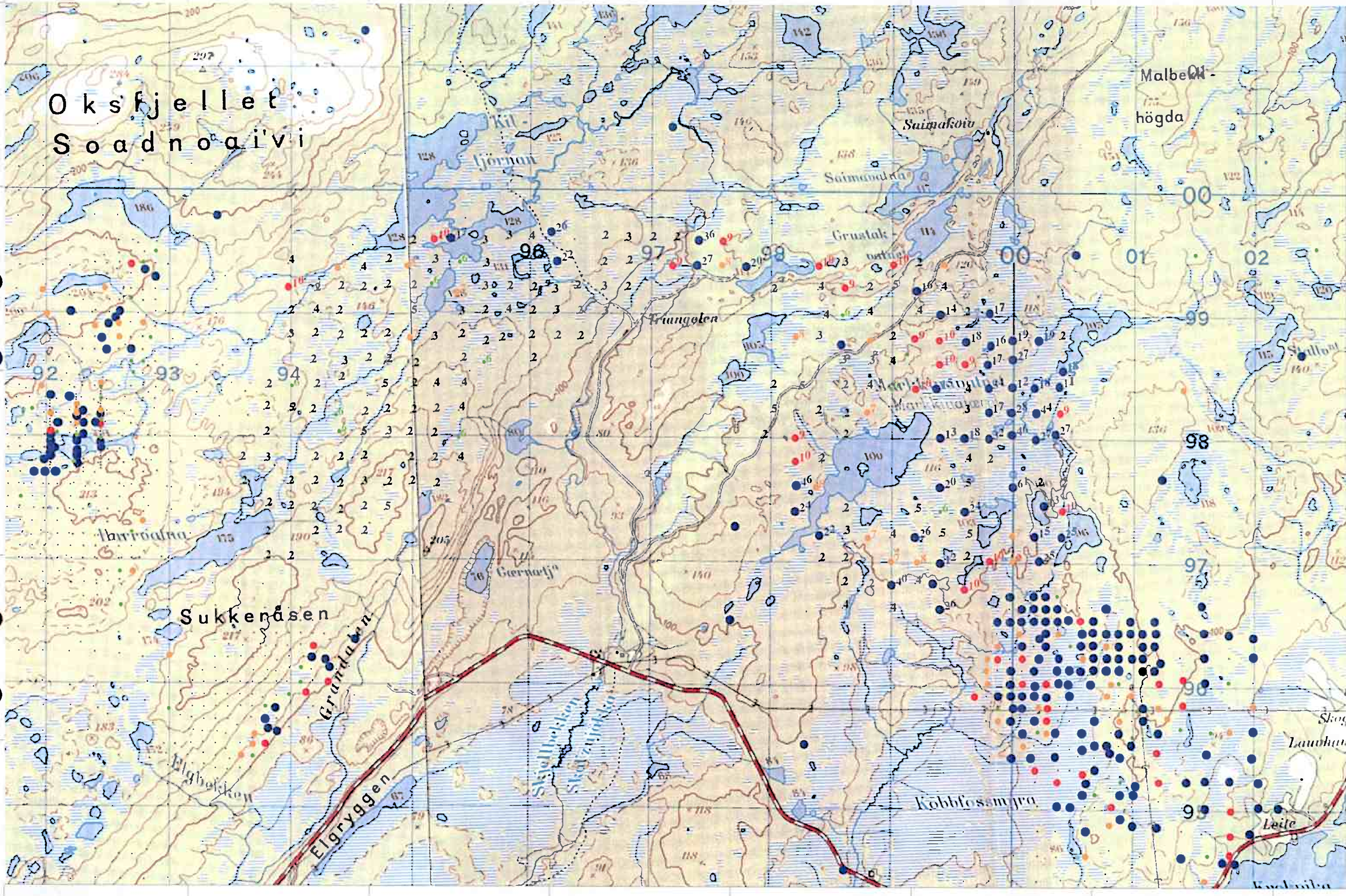


Au (ppb)

95%	12
90%	10
85%	6
80%	5

ScanMining

Geochemical till samples Pasvik
04-12-02
240 st
Skala: 1:30000



As (ppm)

95%	11
90%	9
85%	7
80%	6

Geochemical till samples Pasvik
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240 st
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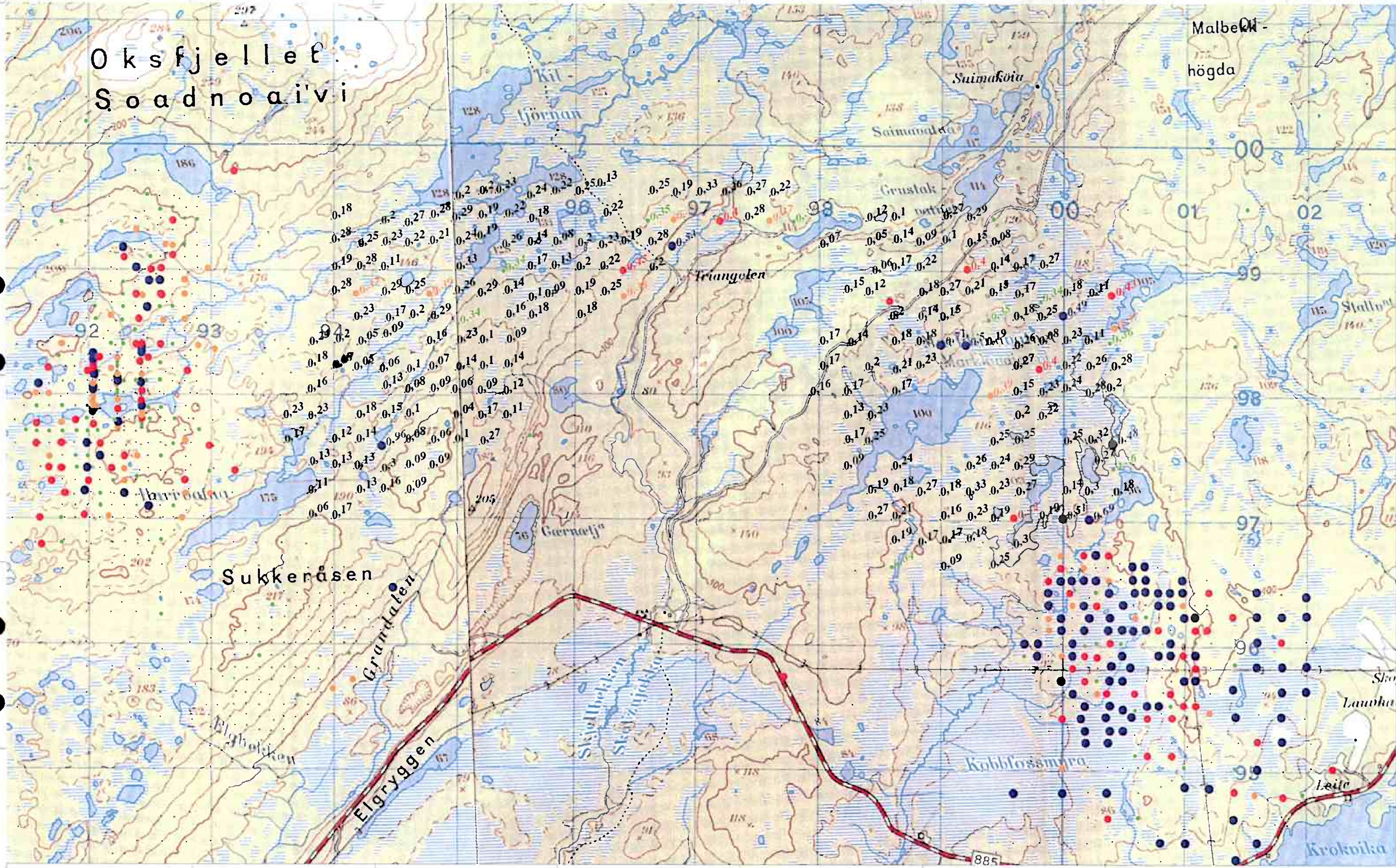

Ca (%)	
95%	0,47
90%	0,4
85%	0,37
80%	0,34

Geochemical till samples Pasvik

04-12-02

1280 st

Skala: 1:30000

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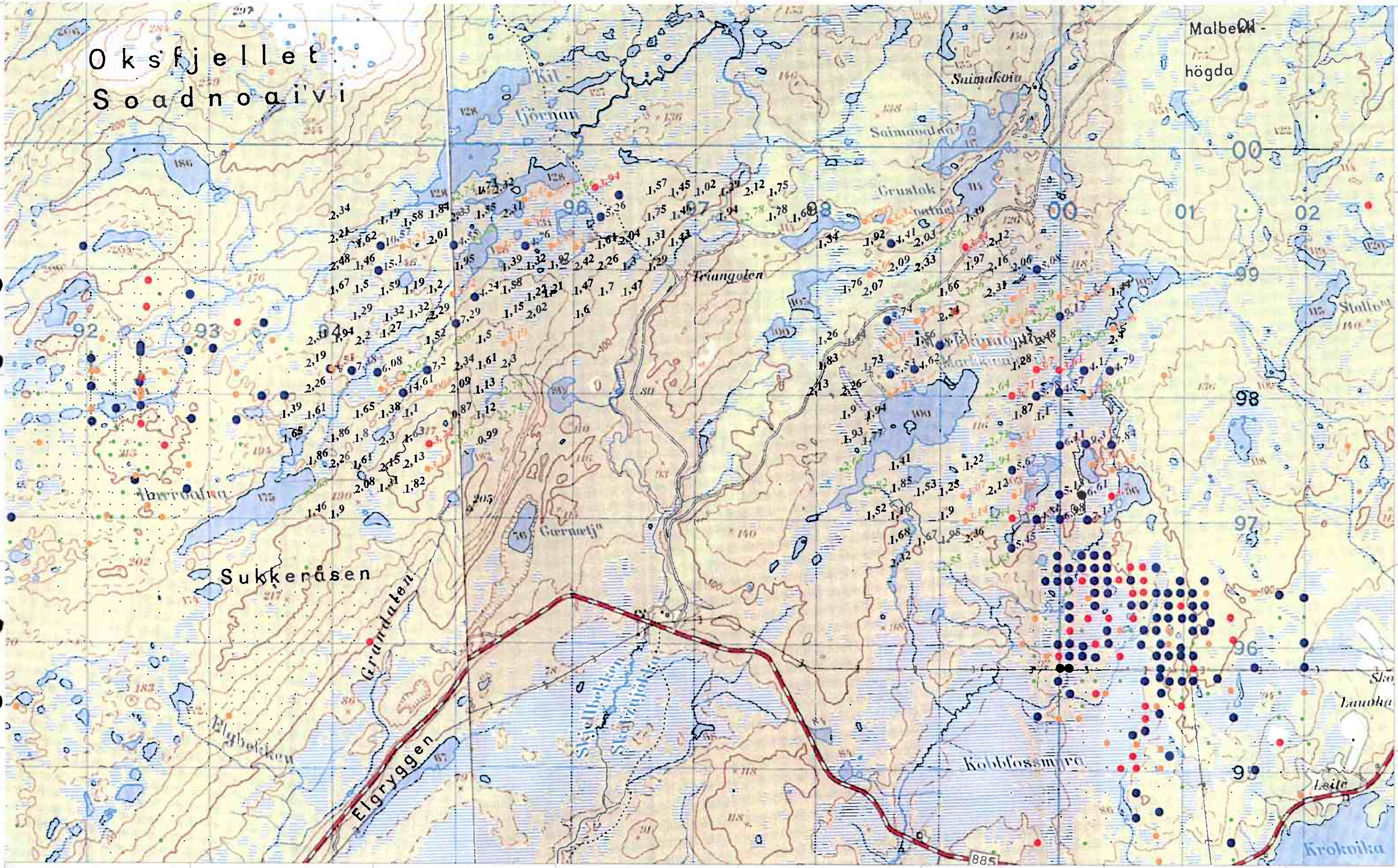

Fe (%)
95% 4
90% 3,5
85% 3
80% 2,5

Geochemical till samples Pasvik
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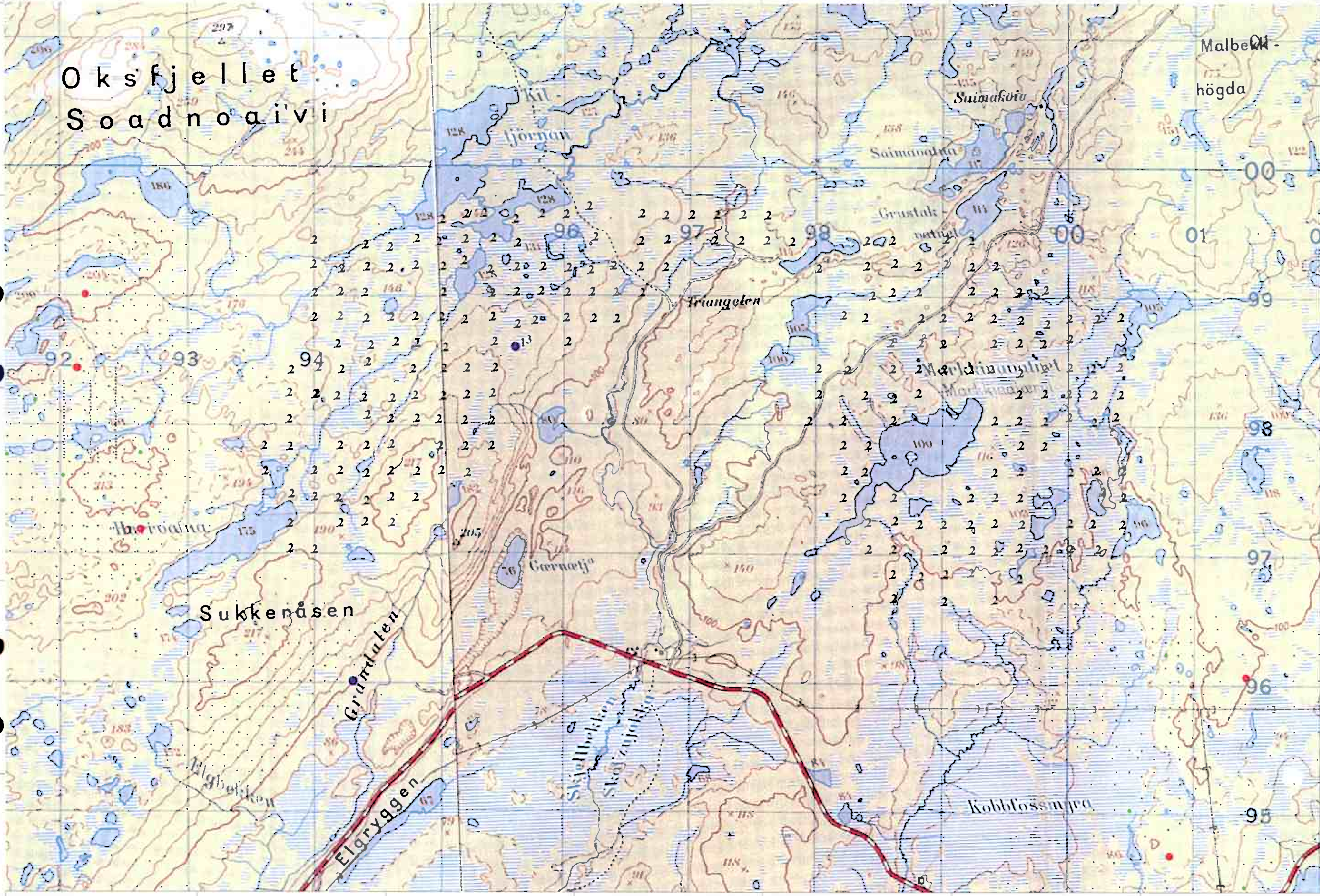
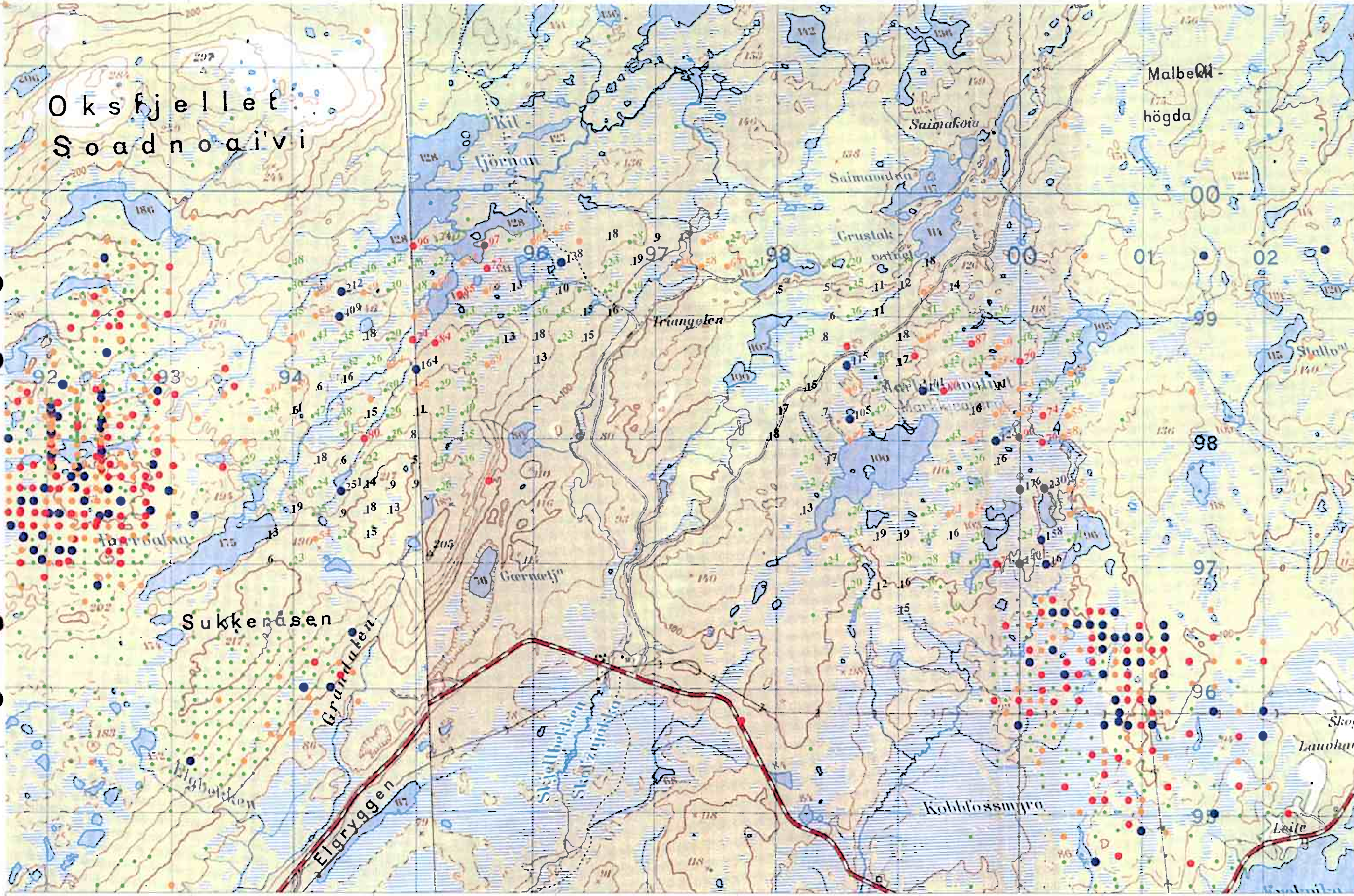


W (ppm)	
95%	6
90%	4
85%	3.5
80%	3

Geochemical till samples Pasvik
04-12-02
240 st
Skala: 1:30000

ScanMining



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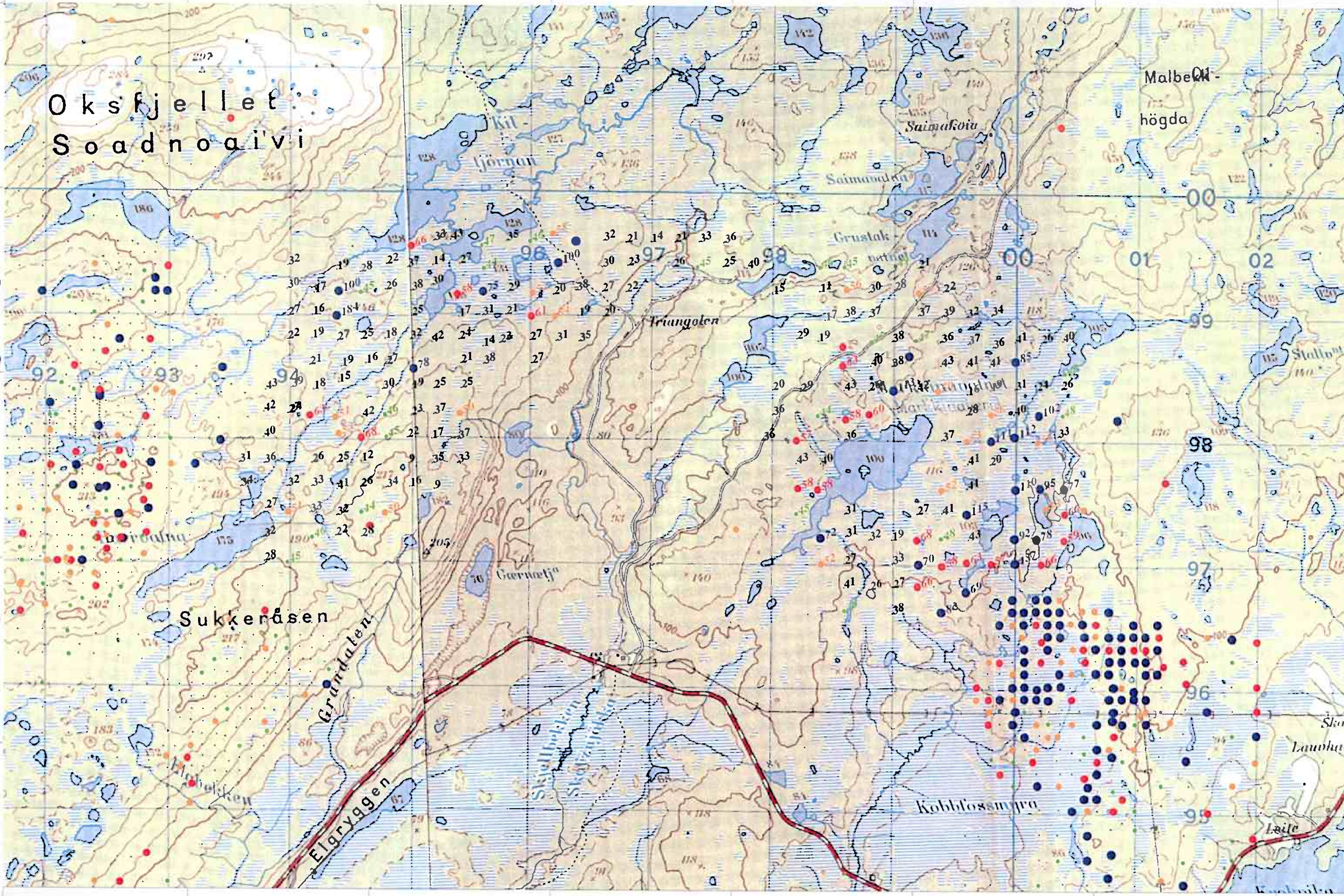
Cu (ppm)	
95%	100
90%	70
85%	50
80%	20

Geochemical till samples Pasvik

04-12-02

1248 st

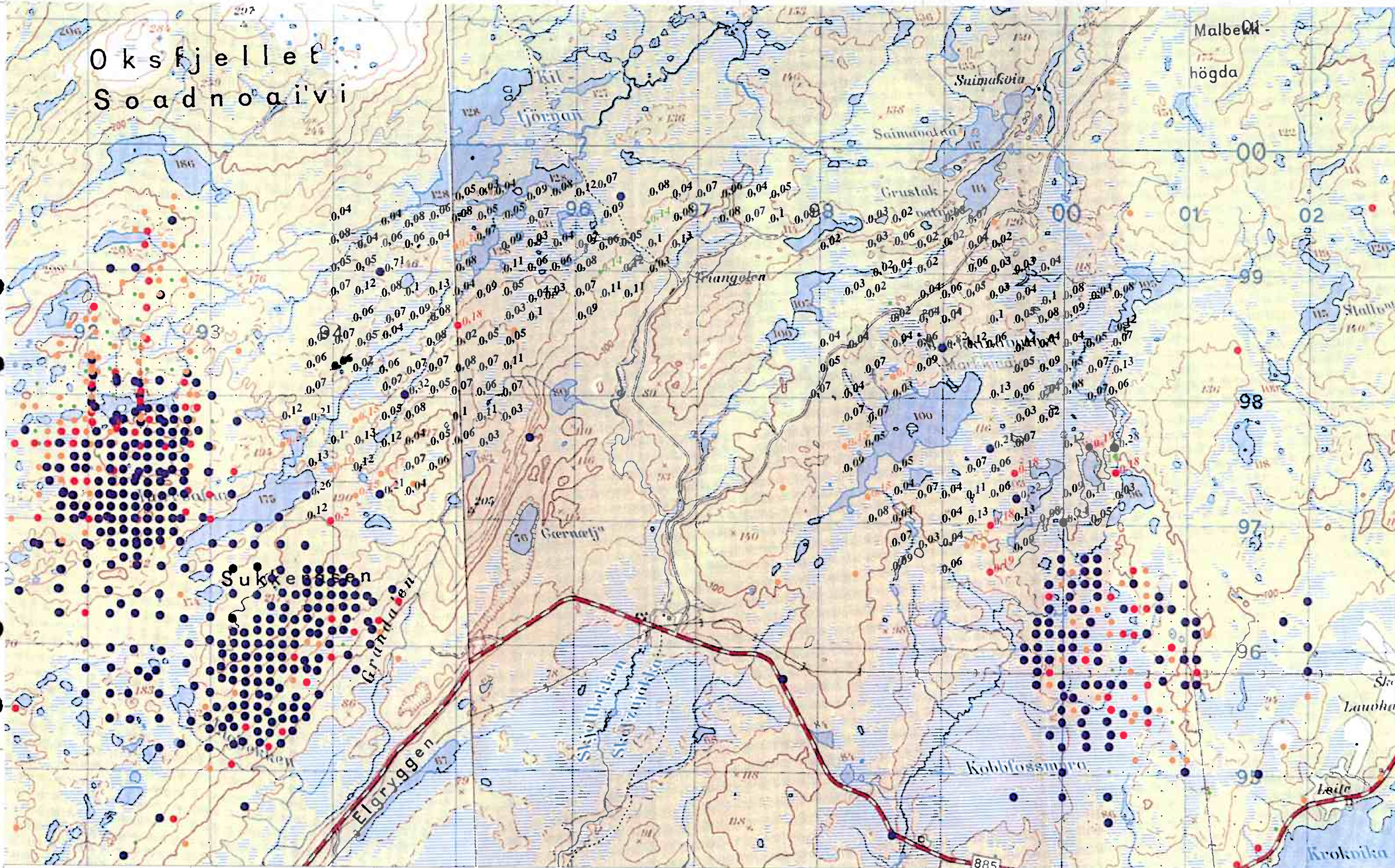
Skala: 1:30000



Zn (ppm)	
95%	69
90%	57
85%	50
80%	44

Geochemical till samples Pasvik
04-12-02
1248 st
Skala: 1:30000

ScanMining



K (%)

95%	0.21
90%	0.18
85%	0.15
80%	0.14

Geochemical till samples Pasvik

04-12-02

1280 st

Skala: 1:30000

ScanMining

Appendix 2

H G R AB

REPORT ON MICROSCOPICAL INVESTIGATION OF SCANMINING POLISHED THIN SECTIONS

DEC 2004

HELLINGWERFS GEOLOGICAL RESEARCH AB

Address	Tel	Mobile	Bank	Bankgiro	PostGiro
Bohusgatan 5	nat 031 - 18 30 46	070 - 589 0321	SEB no 5041-33 029 62	5318 - 5443	489 72 47 - 5
411 39 Gothenburg	internat +46 31 18 30 46	+46 70 589 0321	E-mail rob@hgrab.com	Reg nr 556421 – 0317	
			Website: www.hgrab.com		

H G R AB

Protokoll Tunnslipsbeskrivning

Uppdragsgivare	**Linda Olsson, ScanMining**
Materialtyp	Borrkärnprover
Mottagningsdatum och plats	November 2004, Filipstad
Provberedning	9 stycken tunnslip, 20-30 mikrometer, framställda på Bergsskolans Berglab, MO
Bergarts- och mikrostrukturanalys	Genomfördes med Zeiss transmissionsmikroskop med digital fotoutrustning
Provnr	96002 9.10-9.15 96004 13.2-13.4 96009 25.8 96010 24.4 200401 9.10-9.17 200401 16.25-16.40 200401 24.70-24.75 200401 39.9-40.0 200402 25.5-26.9
Resultat	Mikroskopisk undersökning tyder på tre bergartstyper påverkade av varierande hydrotermala omvandlingar och malmbildande processer under olika metamorfa stadier.

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H G R AB

Protocol thin section descriptions

Assigner	**Linda Olsson, ScanMining**
Type of material	Drill core samples
Date and place of submission	November 2004, Filipstad
Sample preparation	9 thin sections and 4 polished core sections prepared at Bergsskolan by MO, Filipstad
Rock-type - and microstructure analysis	Carried out using a Zeiss transmissionsmicroscope with digital photographic equipment
Sample nrs	96002 9.10-9.15 96004 13.2-13.4 96009 25.8 96010 24.4 200401 9.10-9.17 200401 16.25-16.40 200401 24.70-24.75 200401 39.9-40.0 200402 25.5-26.9
Result	Microscopic investigation reveals three different, but related rock-types, affected by a variety of hydrothermal alterations and mineralisations during a number of metamorphic stages.

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SUMMARY OF MINERALOGY, MICROSTRUCTURAL ANALYSIS AND HYDROTHERMAL ALTERATIONS

Rock-types, texture and mineralogy: **amphibolite** **amphibole-quartz-calcite metatuffite** **quartzite**	The samples submitted constitute in principle one continuous series of metamorphosed and hydrothermally altered sub-marine volcanic-sedimentary rocks, ranging from pure amphibolite to pure quartzite, with all intermediate rock-types in between: amphibole-rich quartz-feldspar-biotite-calcite gneis, quartz-calcite-amphibole gneis, and quartz-calcite-biotite gneis. The textures range from moderately banded to well-foliated and from granoblastic to porphyroblastic. Original sub-marine volcanic sediment with quartz (SiO_2), feldspar ($(Na,Ca)AlSi_3O_8$), calcite ($CaCO_3$) and mica ($(K_2(Mg,Fe)_{6-4}(Fe,Al,Ti)_{0-2}[Si_{6-5}Al_{2-3}O_{20}](OH,F)_4$) as major components. The mineralogical variation has led to an original banding. Relict quartz and feldspar phenocrysts point to an volcanic component.
Mineralogical composition	A microscopical estimate leads to the following mineralogical proportions: 10 - 85 % quartz 0 - 45 % feldspar 0 - 30 % biotite 2 - 40 % calcite 5 - 75 % amphibole 0 - 25 % chlorite 0 - 2 % ilmenite, pyrrhotite, arsenopyrite, chalcopyrite
Mineral-chemical alterations	K-feldspar has partly been replaced by plagioclase into "chess board albite", biotite partly into hornblende (prograde) and chlorite (retrograde), and hornblende partly into grunerite (prograde) and chlorite (retrograde).
Veins, fractures and hydrothermal alterations	1. Old diffuse, folded and obliterated veins with ilmenite, pyrrhotite, chalcopyrite and arsenopyrite points to an early mineralising stage. 2. Micro-shearing with quartz mylonitisation, mineralisation, and quartz(-calcite) veining (directly after shearing) occurred prior to peak metamorphism. 3. Development of grunerite reveals increased Fe-Mg activity subsequent to peak metamorphism (post-foliation) under static conditions. 4. Late stage, cross-cutting calcite veins delineate the end of hydrothermal activity.

Paragenetic sequence and hydrothermal evolution	1. Volcanic-sedimentary stage with deposition of volcanogenic (groundmass and phenocrysts) quartz-feldspar-mica (clay) in a calcareous submarine environment. The resulting tuffitic material ranges in composition from felsic (to become quartzite) through intermediate (to become quartz-feldspar-amphibole gneis) to mafic (to become amphibolite). 2. Progressive metamorphic stage with compressive deformation and development of penetrative foliation. Quartz and feldspar in the groundmass recrystallise. K-feldspar is replaced by plagioclase, and the excess K incorporated into biotite. Biotite further develops and contributes to a foliated fabric. With increasing stress local shearing results in (micro-) mylonitic zones (as far as information goes from thin sections only), opening up for mineralising hydrothermal fluids. Quartz (-calcite) veins develop, parallel to the main foliation. This metamorphic stage is relatively fluid-dominated, which explains the major amount of ilmenite, pyrrhotite, chalcopyrite, arsenopyrite and pyrite to be precipitated along the planes of foliation. 3. Peak metamorphic stage during which, or where soon after, grunerite develops partly on expense of hornblende, triggered by enhanced Fe-Mg activity which is comparable to iron-magnesium metasomatism. This stage is clearly post-foliation and "static", i.e. without tectonic movement. As neither wollastonite nor cubanite was formed, the prevailing temperatures must have been below 500 °C; calcite is stable and in direct contact with quartz, and pyrrhotite in direct contact with chalcopyrite. Arsenopyrite recrystallised into idioblastic grains. 4. Late retrogressive stage with some tectonic ectivity leading to a cracking of amphibole and development of calcite veins marking the end of hydrothermal activity. At some stage biotite and amphibole were partly replaced by late chlorite.

PETROGRAPHIC DESCRIPTIONS OF THIN SECTIONS - APPENDIX

Sample ID 96002 9.10-9.15

Rock-type Fine-medium-grained schist/amphibolite

Microstructure Well-foliated quartz-calcite-amphibole groundmass

General mineralogical composition in vol%

Quartz	15
Calcite	05
Amphibole	75
Opaque	05

Petrographic observations

Amphibole dominates the groundmass while the parallel orientation of the needles, locally up to 1 mm long, constitutes a well-defined foliation/lineation. Elongate lenses of **quartz** and **calcite** accentuate the foliation.

Metamorphic phase

Low-pressure amphibolite facies

Veins/fractures

None observed

Hydrothermal alterations

Not apparent

Sample ID 96004 13.2-13.4

Rock-type Quartz-calcite-biotite gneis

Microstructure Banded and foliated groundmass dominated by quartz-calcite-biotite with a clear mineralogically banded appearance.

General mineralogical composition in vol%

Quartz	30
Calcite	40
Biotite	15
Amphibole	05
Chlorite	05
Opaque	05

Petrographic observations

Calcite and **quartz** dominate the groundmass with up to 1 mm grains with irregular grain boundaries. Aggregates and lenses of **biotite** and **amphibole** appear roughly parallel to the foliation. The long and slender needles showing polysynthetic twinning lamellae suggests a **grunerite** composition. Some chlorite is seen to replace biotite.

Metamorphic phase

Low-pressure amphibolite facies

Veins/fractures

Some micro-shear zones with deformed **biotite** and granulated **quartz** can be observed. The contents of opaque seems higher along these zones, compared to the non-sheared part of the groundmass. A single, late calcite vein cuts across the entire fabric.

Hydrothermal alterations

No obvious alterations observed.

Sample ID	96009 25.8
Rock-type	Coarse-grained, gneissic calcareous metatuffite
Microstructure	Well-foliated, gneissic porphyroblastic volcanic sediment with a dominantly quartz-calcite groundmass and a clear mineralogically banded appearance.

General mineralogical composition in vol%

Quartz	35
Calcite	35
Amphibole	25
Opaque	05 - mostly ilmenite
Accessorial	K-feldspar, biotite partly replaced by chlorite, apatite, opaque up to 1 mm in size

Petrographic observations

Quartz and **calcite** grains in the groundmass are up to 500 micrometer in diameter with irregular grain boundaries. Fine strings of opaque (**ilmenite**) phases accentuate the foliation throughout the rock. Nematoblastic amphibole appears up to 5 mm in size and includes ("runs over") the older foliation with opaque phases. **Amphibole** is of typical **hornblende** composition.

The oblique orientation, cutting across the quartz-calcite-opaque foliation indicates that amphibole development took place some time AFTER peak deformation, under more static conditions.

Metamorphic phase

Upper greenschist to low-pressure amphibolite facies

Veins/fractures

Up to 1 mm wide micro-shear zones can be observed (Figure 1), outlined by zones of intense mylonitisation, in which **quartz** has been granulated into extremely fine-grained lenses and aggregates. These micro-shear zones are clearly associated with mobility of opaque phases.

Coarse-grained **quartz-calcite** veins up to 4 mm wide and parallel to the plane of foliation post-date the micro-shearing (Figure 1).

Figure 1

Microphoto showing micro-shear zone with intense mylonitisation, in which quartz has been granulated into extremely fine-grained lenses and aggregates. This shear zone is bordered by coarse-grained, undeformed quartz-calcite. Field of view 3 mm, crossed nicols.

Hydrothermal alterations

The quartz-calcite groundmass represents a mineralogical-chemical equivalent of the original sedimentary composition. The observation of fine-grained opaque phases - ilmenite - orientated along the folded foliation planes (Figure 2) points to an early hydrothermal-mineralising stage affected by later compressive deformation. Apparently, amphibole development occurred after folding of the foliation as it includes the traces of opaque fases. A later remobilisation is demonstrated by the micro-shear zones with crushed quartz and abundant opaque.

Figure 2

Microphoto showing fine-grained opaque phases (mostly ilmenite) orientated along the folded foliation planes. Field of view 3 mm, crossed nicols.

Sample ID	96010 24.4
Rock-type	Medium-coarse-grained quartzite
Microstructure	Slightly foliated, close to granoblastic quartz-rich groundmass with minor interstitial calcite, and parallel oriented hornblende-grunerite constituting a well-spaced foliation.

General mineralogical composition in vol%

Quartz	85
Calcite	02
Amphibole	13
Accessorial	chlorite, apatite

Petrographic observations

Quartz appears as up to 1 mm grains with close to granoblastic textures. In some zones the quartz is flattened with the elongate grains outlining a weak foliation. Nematoblastic **amphibole** accentuates the foliation by a parallel orientation of the slender needles. Amphibole is of typical **hornblende** composition, with a conspicuous **cummingtonite/grunerite** component showing the characteristic polysynthetic twinning lamellae. Optical properties (Figure 3) for the cummingtonite/grunerite are: γ:Z=14-16 °, 2V 85-95°, optical sign (-), dispersion r>v, indicating a **grunerite**-dominated composition.

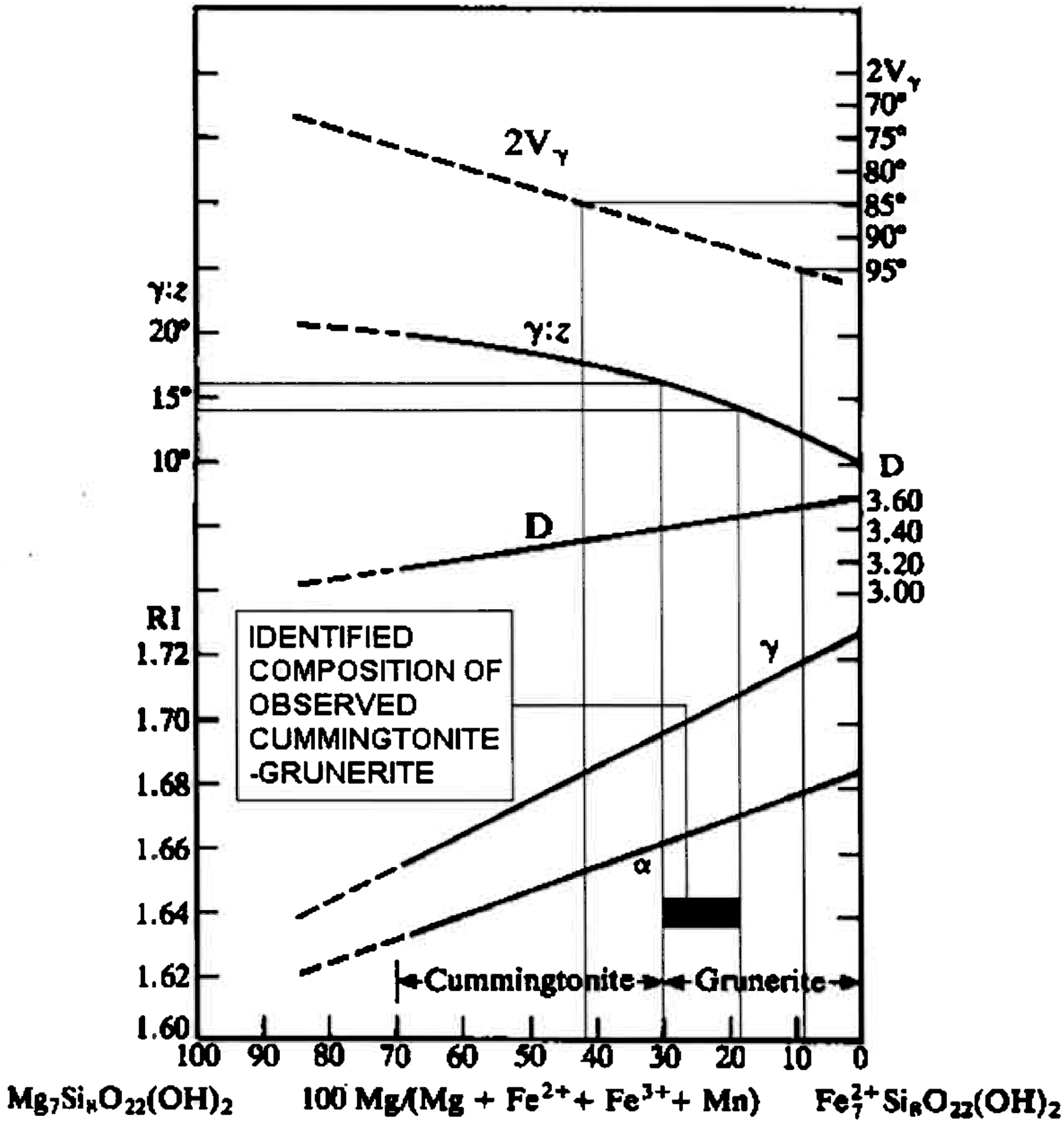


Figure 3 Observed optical properties for the cummingtonite-grunerite rich amphiboles replacing hornblende.

<u>Metamorphic phase</u>

Low-pressure amphibolite facies

<u>Veins/fractures</u>

Nearly perpendicular to the foliation a number of thin **calcite** veins can be observed, cutting across both quartz and amphibole, indicating a post-metamorphic stress relief.

<u>Hydrothermal alterations</u>

Apart from the delicate calcite veining, no other alteration than a late phase of carbonatisation can be noted.

Sample ID	200401 9.10-9.17
Rock-type	*Gneissic calcareous metatuffite*
Microstructure	Well-foliated, mineralogically banded quartz-feldspar-biotite-calcite groundmass with amphibole porphyroblasts (Figure 4). A clear preferred orientation is expressed by a parallel orientation of brown biotite and elongate lenses of quartz and plagioclase (Figure 4).

General mineralogical composition in vol%

Quartz	25
Plagioclase	15
Biotite	15
Calcite	10
Amphibole	35
Opaque	05 (ilmenite, pyrrhotite with traces of chalcopyrite, and up to 4 mm arsenopyrite)
Accessorial	chlorite, apatite

Petrographic observations

Quartz and **feldspar** grains in the groundmass are up to 2 mm in diameter with undulose extinction, subgrains and semi granoblastic grain boundaries. Wedging and bent albite-law twinning systems in groundmass **plagioclase** points to compressive deformation. The dominant groundmass phase is brown, deformed, but entirely recrystallised **biotite**, partly replaced by porphyroblastic **amphibole** (prograde) up to 3 mm in size. Amphibole is of typical **hornblende** composition, but locally, mostly along the margins of hornblende, **grunerite** appears (with characteristic polysynthetic twinning), depending on the variable composition of the groundmass. The oblique orientation of undeformed hornblende, cutting across the biotite foliation indicates that amphibole development took place some time AFTER peak deformation, under more static conditions. Locally, late **chlorite** replaces amphibole.

Ilmenite occurs as rectangular crystals (100-300 micrometer) parallel to the plane of foliation, commonly associated with biotite and amphibole. **Pyrrhotite** appears as irregular grains with small inclusions of **chalcopyrite**, without any evidence for cubanite. **Arsenopyrite** occurs as idiomorphic blasts with the longest axis parallel to the plane of foliation (Figure 4).

Phenocrysts of **quartz** and **plagioclase** have been flattened and partly recrystallised into agregates with new grains.

Figure 4 Microphoto showing colourless quartz, off-white plagioclase and calcite, brown biotite, light green amphibole, fine-grained ilmenite (black rectangular) and pyrrhotite (black irregular but // foliation), and coarse-grained (black) arsenopyrite. Field of ca 1.5 cm, one nicol.

Metamorphic phase

Low-pressure amphibolite facies, succeeded by retrogressive greenschist facies (chlorite replacing biotite and hornblende).

Veins/fractures

Micro-shear zones with granulated **quartz** and abundant **ilmenite-pyrrhotite** (Figure 5). Undeformed, coarse-grained quartz occurs in up to 4 mm wide veins of late-tectonic origin.

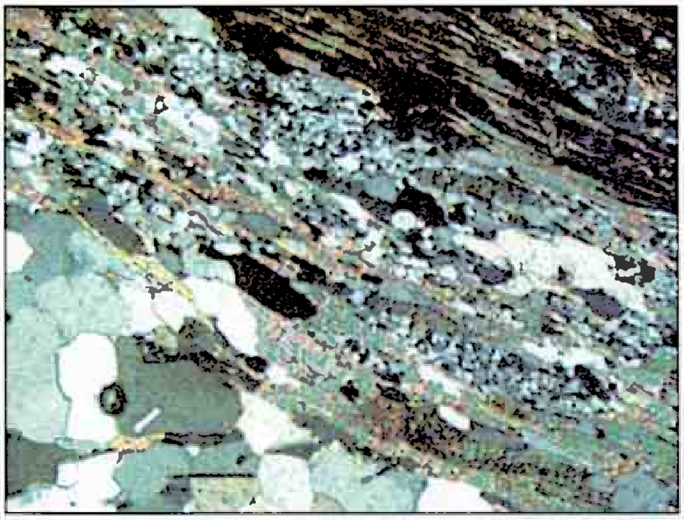


Figure 5

Microphoto showing micro-shear zones with granulated quartz, biotite and abundant ilmenite-pyrrhotite. Field of view 3 mm, crossed nicols.

Hydrothermal alterations

The quartz-feldspar-biotite-calcite groundmass represents a mineralogical-chemical equivalent of the original sedimentary composition. The observation of fine-grained ilmenite-pyrrhotite orientated along the planes of foliation with abundant biotite points to an early hydrothermal-mineralising stage affected by later compressive deformation.

Sample ID	200401 16.25-16.40
Rock-type	Gneissic calcareous metatuffite
Microstructure	Well-foliated, relict porphyritic and porphyroblastic volcanic sediment with quartz-feldspar-biotite-calcite groundmass with relict phenocrysts of plagioclase and quartz. A clear preferred orientation is expressed by a parallel orientation of older biotite and newer hornblende.

General mineralogical composition in vol%

Quartz	10
Plagioclase	25
Biotite	30
Calcite	20
Amphibole	10
Opaque	05 (ilmenite, pyrrhotite with traces of chalcopyrite, and up to 1 mm arsenopyrite)
Accessorial	K-feldspar, apatite

Petrographic observations

Quartz and **feldspar** grains in the groundmass are up to 200 micrometer in diameter with irregular grain boundaries. Wedging and bent albite-law twinning systems in groundmass plagioclase points to compressive deformation. The dominant groundmass phase is brown, deformed, but entirely recrystallised **biotite**, partly replaced by nematoblastic **amphibole** (prograde) up to 3 mm in size.

Amphibole is of typical **hornblende** composition, but locally **grunerite** appears (with characteristic polysynthetic twinning), depending on the variable composition of the groundmass. The oblique orientation, cutting across the biotite foliation indicates that amphibole development took place some time AFTER peak deformation, i.e. under more static conditions.

Ilmenite occurs as rectangular crystals (100-300 micrometer) parallel to the plane of foliation, commonly associated with biotite and amphibole. **Pyrrhotite** appears as irregular grains with small inclusions of **chalcopyrite**, without any evidence for cubanite. **Arsenopyrite** occurs as up to 1 mm idiomorphic blasts with the longest axis parallel to the plane of foliation (Figure 6). Phenocrysts of **quartz** have been recrystallised into flattened agregates with new grains.

Metamorphic phase

Upper greenschist to low-pressure amphibolite facies

Veins/fractures

None observed

Hydrothermal alterations

The quartz-feldspar-biotite-calcite groundmass is approximately a mineralogical-chemical equivalent of the original sedimentary composition. The observation of fine-grained ilmenite, pyrrhotite and up to 1 mm arsenopyrite points to an early hydrothermal-mineralising stage affected by later compressive deformation.

Figure 6 Microphoto showing colourless quartz, off-white plagioclase and calcite, brown biotite, light green amphibole, fine-grained ilmenite (black rectangular) and pyrrhotite (black irregular but // foliation), and coarse-grained (black) arsenopyrite. Field of ca 1.5 cm, one nicol.

Sample ID 200401 24.70-24.75

Rock-type Gneissic metatuffite

Microstructure Well-foliated, porphyritic, initial granoblastic quartz-biotite-calcite groundmass with relict 3 mm phenocrysts of quartz. Nematoblastic hornblende up to 6 mm in length replaces the quartz-calcitic-biotite components of the groundmass.

General mineralogical composition in vol%

Quartz	25
Biotite	10
Calcite	15
Amphibole	20
Chlorite	25
Opaque	05
Accessorial	plagioclase, apatite

Petrographic observations

Quartz and **calcite** in the groundmass are up to 350 micrometer in diameter with partly straight grain boundaries (granoblastic). Opaque phases are aligned in strings, parallel to the foliation. Brown, deformed and elongated **biotite** is partly replaced by prograde nematoblastic **amphibole** and by retrograde **chlorite**. Amphibole is of typical **hornblende** composition. Lenses of **chlorite** are aligned parallel to the biotite foliation and seem to represent re-activated zones of mobility. At an angle to this, most amphiboles have been pervasively cracked as a response to stress (Figure 7).

Phenocrysts of **quartz** have been partly recrystallised into agregates with sub-grains and new grains.

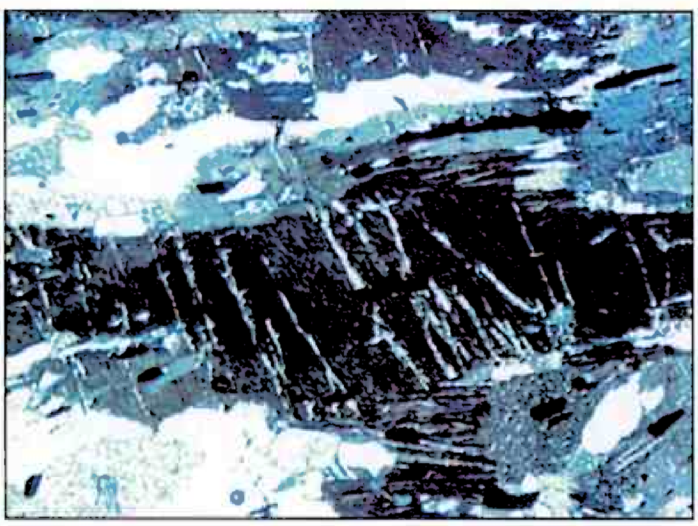


Figure 7

Microphoto showing pervasive cracking in amphibole nearly perpendicular to the plane of foliation, i.e. plane of slip. Field of view ca 2 mm, crossed nicols.

Metamorphic phase

Low-pressure amphibolite facies, succeeded by retrogressive greenschist facies (chlorite replacing biotite and hornblende).

Veins/fractures

Illustrative micro-shearzones with granulated quartz and abundant opaque.

Hydrothermal alterations

The quartz-biotite-calcite groundmass represents the mineralogy of the original sedimentary composition. Hornblende points to a static phase of metamorphism, while intensive development of chlorite suggests a retrogressive, water-dominated hydrothermal phase.

Sample ID	200401 39.9-40.0
Rock-type	Calcareous gneiss
Microstructure	Well-foliated/banded quartz-biotite-calcite-chlorite groundmass with porphyroblastic hornblende up to 1 mm.

General mineralogical composition in vol%

Quartz	20
Biotite	10
Calcite	20
Amphibole	25
Chlorite	15
Opaque	10 (ilmenite, pyrrhotite with traces of chalcopyrite, and pyrite)
Accessorial	apatite

Petrographic observations

Quartz and **calcite** grains in the groundmass are up to 300 micrometer in diameter with partly straight grain boundaries (granoblastic). Quartz, however, seems to occur in two populations, one as fine-grained aggregates and lenses associated with biotite and chlorite (probably micro-shear zones), and one as coarse-grained bands together with calcite (recrystallised groundmass). The Opaque phases are aligned in strings, parallel to the foliation. Brown, deformed and elongated **biotite** is partly replaced by prograde porphyroblastic **amphibole** and by retrograde **chlorite**. Amphibole is of typical **hornblende** composition. Lenses of **chlorite** are aligned parallel to the biotite foliation and seem to represent re-activated zones of mobility.

Ilmenite occurs as rectangular crystals (100-300 micrometer) parallel to the plane of foliation, commonly associated with biotite and amphibole. **Pyrrhotite** appears as abundant irregular grains (Figure 8) with small inclusions of **chalcopyrite**, without any evidence for cubanite. **Pyrite** occurs as up to 0.5 mm idiomorphic blasts.

Figure 8 Microphoto showing colourless quartz, off-white plagioclase and calcite, brown biotite, light green amphibole (oblique porphyroblasts), fine-grained ilmenite (black rectangular) and elongate lenses of pyrrhotite (black irregular but // foliation). Field of ca 1.5 cm, one nicol.

Metamorphic phase

Low-pressure amphibolite facies, succeeded by retrogressive greenschist facies (chlorite replacing biotite and hornblende).

Veins/fractures

The fine-grained aggregates and lenses associated with **biotite** and **chlorite** probably repreent micro-shearzones in which **quartz** was granulated and only partly recrystallised.

Hydrothermal alterations

The obvious distribution of ilmenite and pyrrhotite along the planes of foliation, i.e. planes of (micro-)mobile zones suggest a mineralization stage pre- to syn tectonic activity.

Sample ID	200402 25.5-26.9
Rock-type	Gneissic metatuffite
Microstructure	Banded, porphyritic, initial granoblastic quartz-feldspar-biotite-calcite groundmass with relict phenocrysts of plagioclase, quartz, and old (relict) microcline replaced by plagioclase. A weak preferred orientation is expressed by the parallel orientation of older biotite and newer hornblende.

General mineralogical composition in vol%

Quartz	25
Plagioclase	35
K-feldspar	10
Biotite	10
Calcite	10
Amphibole	05
Opaque	05 (ilmenite, pyrrhotite with traces of chalcopyrite, and up to 1 mm arsenopyrite)
Accessorial	chlorite, apatite

Petrographic observations

Quartz and **feldspar** grains in the groundmass are up to 250 micrometer in diameter with locally abundant straight grain boundaries, tending towards granoblastic textures. Wedging albite-law twinning systems in groundmass plagioclase points to compressive deformation. The appearance of chess-board albite structures is indicative of replacement of early **K-feldspar** by **plagioclase**. Brown, deformed, but entirely recrystallised **biotite** is partly replaced by porphyroblastic **amphibole** (prograde, up to few mm) and by **chlorite** (retrograde). **Amphibole** is of typical **hornblende** composition, but locally **grunerite** appears (with characteristic polysynthetic twinning lamellae), depending on the variable composition of the groundmass.

The oblique orientation, cutting across the quartz-calcite-opaque foliation indicates that amphibole development took place some time AFTER peak deformation, under more static conditions. The grunerite-development indicates an increase in Fe-Mg activity, just after peak metamorphism. **Ilmenite** occurs as rectangular crystals (100-300 micrometer) parallel to the plane of foliation, commonly associated with biotite and amphibole. **Pyrrhotite** appears as irregular grains with small inclusions of **chalcopyrite**, without any evidence for cubanite. **Arsenopyrite** occurs as up to 1 mm idiomorphic blasts with the longest axis parallel to the plane of foliation (Figure 9).

Phenocrysts of **quartz** have been recrystallised into agregates with sub-grains and neocrystallisation.

Figure 9 Microphoto showing colourless quartz, off-white plagioclase and calcite, brown biotite, light green amphibole, fine-grained ilmenite (black rectangular) and pyrrhotite (black irregular but // foliation), and coarse-grained (black) arsenopyrite. Field of ca 1.5 cm, one nicol.

Metamorphic phase

Upper greenschist to low-pressure amphibolite facies

Veins/fractures

Deformed and diffuse fractures occur with chlorite-pyrrhotite. Some **chlorite** pods (< 1 mm) seem aligned along an old and folded (diffuse) vein system where also fine-grained **pyrrhotite-ilmenite** can be observed. Some minor network veining with pyrrhotite can be observed.

Hydrothermal alterations

The quartz-feldspar-biotite-calcite groundmass represents a mineralogical-chemical equivalent of the original sedimentary composition. The observation of folded and diffuse veins with pyrrhotite (Figure 10) points to an early hydrothermal mineralising phase. The chess-board albite structures suggest an additional alteration where K was mobilsed away from K-feldspar into biotite, forming plagioclase using Ca from the groundmass. This alteration most likely occurred during amphibolite facies metamorphism. The observed grunerite-development indicative of an increased Fe-Mg activity after peak metamorphism may be attributed to a mild phase of Fe-Mg metasomatism.

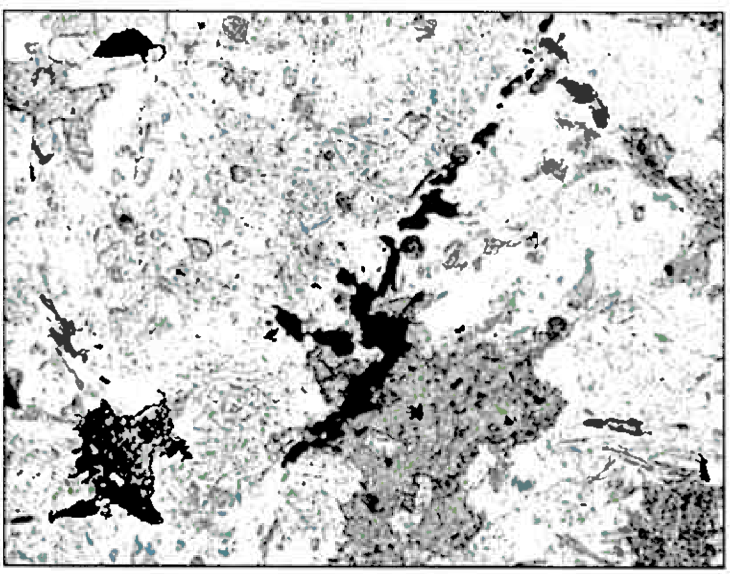
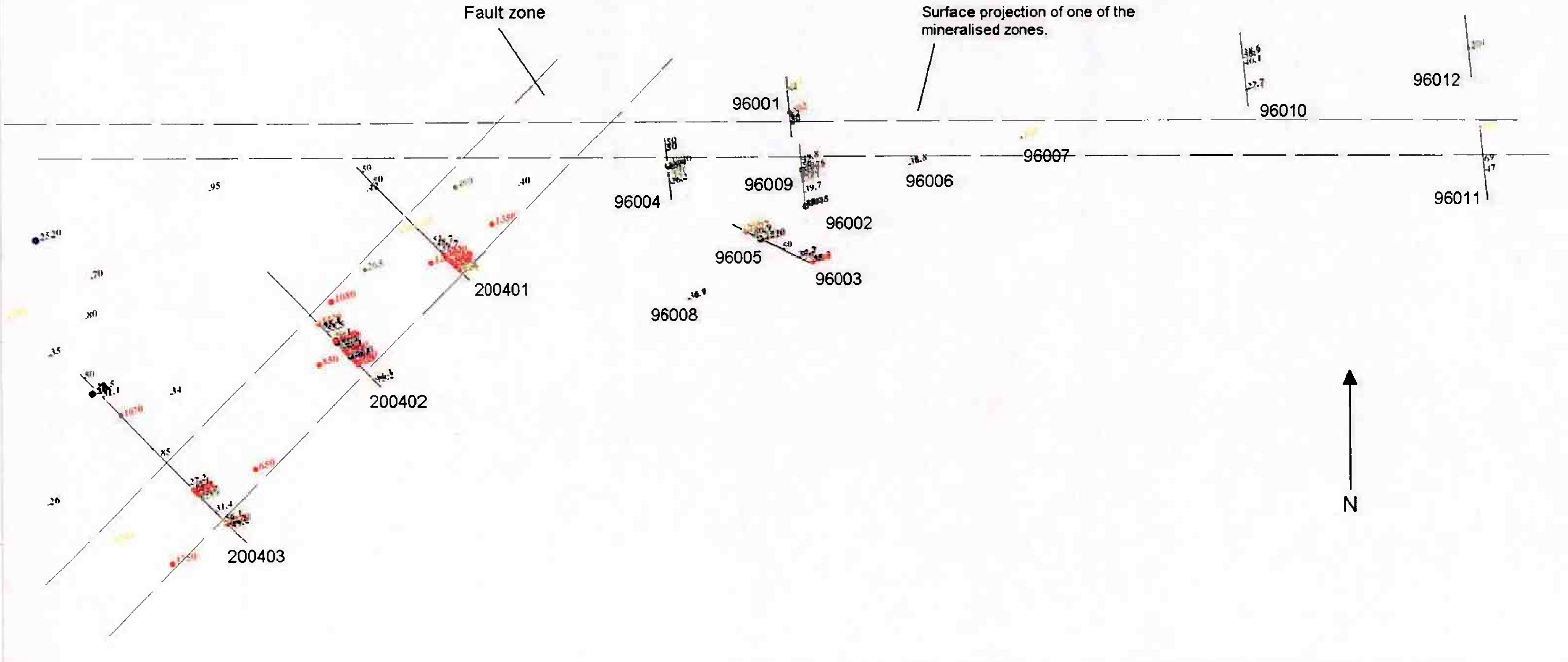


Figure 10

Microphoto showing folded and discontinuous / diffuse veins with pyrrhotite-ilmenite. Field of view 3 mm, crossed nicols.

Appendix 3a



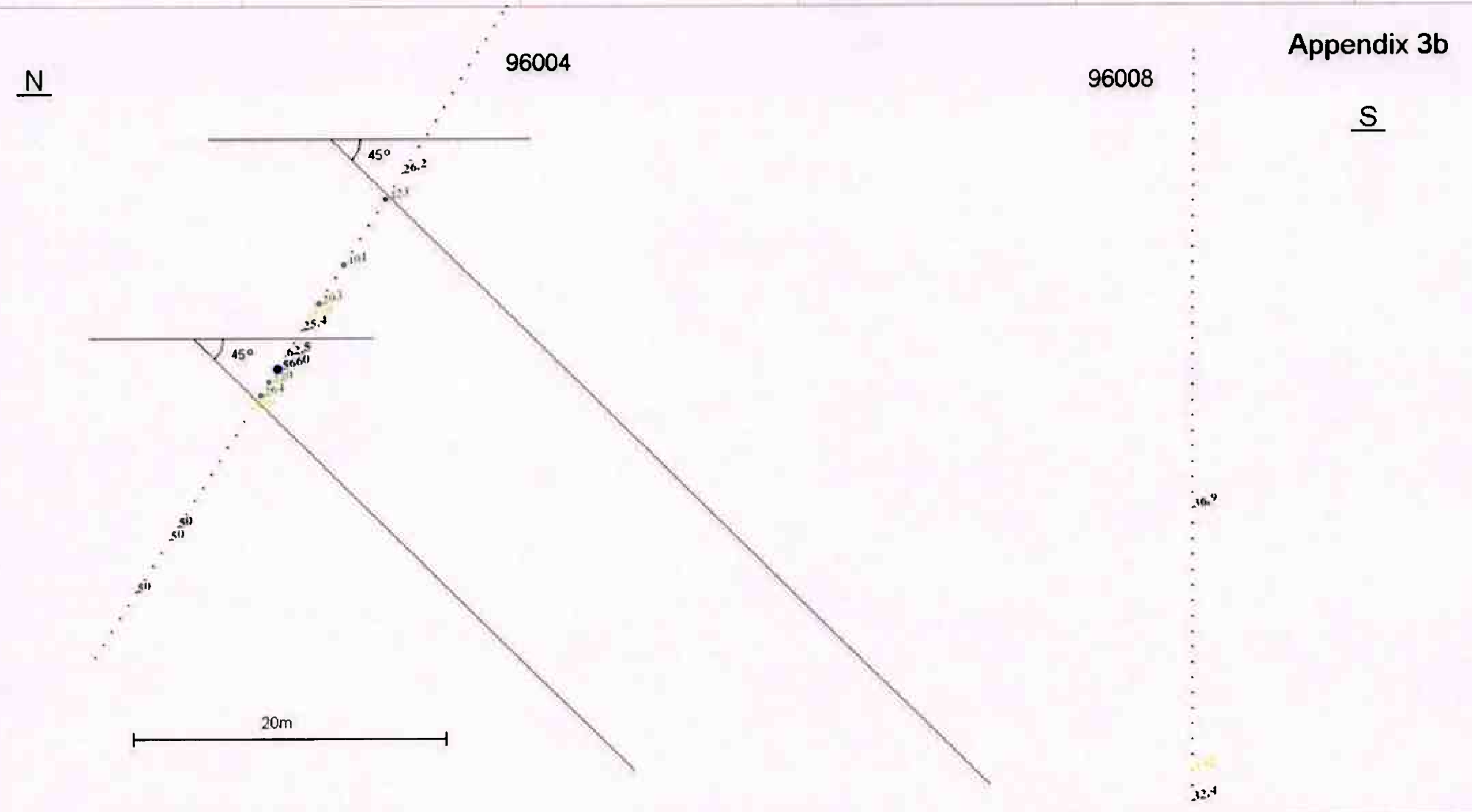
Au (ppb)

95%	2000
90%	500
85%	200
80%	100

ScanMining

05-01-11
954 st

Appendix 3b



Au (ppb)

95%	2000
90%	500
85%	200
[illegible]	[illegible]

05-01-11
102 st