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Tittel

Exploration 1992, along the Skogfoss arch in Pasvik, Finnmark.
Oksfjell, Svartfjell, Finntjørn areas.
Tekstdel med figurer og tabeller.

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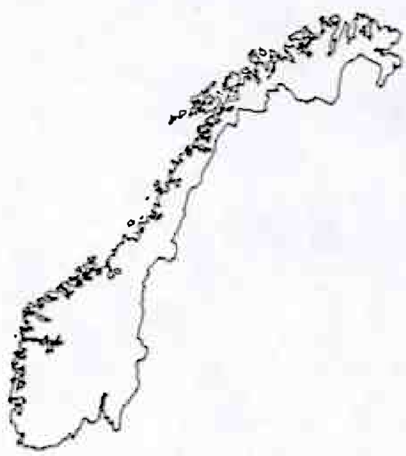
Sammendrag

Dette er tekstdelen til en stor samlerapport fra arbeidene innen mutingsområdene i Skogfoss - Oksfjellområdet i Pasvik.
BV 3842 Tekstdel med figurer og tabeller.
BV 3843 Apendix A. Summary of Oksfjell 1992 Drilling
BV 3844 Apendix B. Drill log and sections
BV 3845 Apendix C. A report on a combined helicopter-borne Mag, EM and VLF-EM survey in Pasvik.
BV 3846 Apendix D. Tecnical report for ground geophysical surves in Skogfoss, Pasvik

1992 EXPLORATION ALONG THE SKOGFOSS ARCH OKSFJELL, SVARTFJELL, FINNTJØRN AREAS, PASVIK, FINNMARK, NORWAY



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Exploration in the Oksfjell area by A/S Sulfidmalm between 1971 and 1982, including 5729 m of diamond drilling in 41 holes, resulted in the discovery of ultramafic rocks similar to the ore hosts at Pechenga, but failed to uncover any significant mineralization.

The Sulfidmalm exploration program was reactivated in 1990 based on more detailed stratigraphic correlation of Pechenga and Pasvik by the Norwegian Geological Survey (NGU) and the possibility to obtain more detailed information on the Pechenga deposits through visits to the Pechenga area. The 1991 exploration program involved a regional airborne geophysical survey followed by regional mapping, drill core re-logging a field excursion to the Pechenga district, and detailed mapping and ground geophysics over Sulfidmalm claims at Oksfjell.

The 1992 follow up drill program was designed to test the potential for nickel mineralization in several previously undrilled magnetic (inferred ultramafic) bodies and to priority rate the bodies in terms of nickel ore potential. Eleven (11) holes (42 to 52) totalling 1918.12 metres were drilled by A/S TerraBor between July 1 and August 14. The drilling was supported by subsidy money from Bergvesnet (Trondheim) and Finnmark Fylke (Vadsø). Geological mapping of the Svartfjell and Finntjørn claim blocks was completed in addition to the drilling.

ii Results and Conclusions

The drill program did not reveal any significant Ni-Cu mineralization. Six differentiated gabbro-ultramafic bodies which are petrologically similar to Type 2b Pechenga ore hosts were defined in the Oksfjell East area. However, the bodies' low stratigraphic position, lack of Ni-sulphides and the low sulphur content of their ultramafic portions suggests that they are unlikely to host a Ni-Cu deposit. Type 1a, thin (<5 m) undifferentiated ultramafics, and Type 1b, 5-36 m thick differentiated ultramafics, were tested during the 1992 and previous programs. Although some of the Type 1b bodies, including that at Svartfjell, are weakly mineralized, they were shown to have low Ni-Cu ore potential due to their size and limited extent. Ultramafic boulders at Finntjørn, whose source may be a magnetic (ultramafic) body in Pil'guyarvi volcanics, are geochemically similar to the Oksfjell ultramafics. However, they have low S contents, no Ni sulphides, and low mineralization potential.

On the basis of the above findings, and at our current level of understanding of controls over mineralization at Pechenga, it is concluded that the potential for economic nickel - copper deposits at Oksfjell are not sufficient to warrant an immediate follow up drill program.

iii. Recommendations

* Discontinue follow up drilling at Oksfjell.
* Reduce the ground position within the Oksfjell claim block,to cover the Type 2a bodies drilled in 1992.
* Allow the Finntjørn and Svartfjell claim blocks to lapse.
* Continue assessing data from Pechenga to determine any new potential at Pasvik.

1.0 INTRODUCTION

1.1 LOCATION, ACCESS AND INFRASTRUCTURE

The Oksfjell property is located approximately 45 km directly south-south west of the port of Kirkenes in Sør-Varanger kommune, Finnmark fylke, northern Norway (Figure 1). It is 20 km SW of the Pechenga Kombinat Nikel smelter and refinery complex. The property is accessible by dirt road and track less than 10 km from Highway 885. The Svartfjell claim group is located 6 km ESE of the Oksfjell block, 3 km from Highway 885, near Kobbfoss. The Finntjørn claims are located three kilometres west of Hauge.

1.2 CLAIM STATUS

Fifty-four 25 hectare claims were staked in the Oksfjell area on December 18, 1990. An additional twenty 25 hectare claims were staked on March 11, 1992. Of these, eight claims were staked at Svartfjell, northwest of Skogfoss, and twelve claims were staked due west of Hauge at Finntjørn (Figure 2). Claim locations are depicted in Figure 2.

1.3 BACKGROUND

Between 1971 and 1982 A/S Sulfidmalm, initially in joint venture with A/S Sydvaranger, conducted helicopter electromagnetic (EM) surveys, ground magnetometer, EM and VLF-EM surveys, 1:10,000 scale geological mapping, Quaternary geology, till geochemistry and diamond drilling (40 holes; 5,729 metres) in the Pasvik area (Table 1). This work resulted in the discovery of ultramafic bodies but no significant mineralization.

The A/S Sulfidmalm exploration program was reactivated in 1990 to explore in Pasvik for the extension of the highly productive Pechenga nickel belt (Table 2). This was due to efforts by the NGU in co-operation with Russian geoscientists and the possibility to visit the Pechenga area. The objective was to trace the favourable Pechenga stratigraphy into Norway and apply an empirical or genetic ore deposit model to guide the exploration efforts.

The 1991 exploration program involved a regional airborne survey, followed by regional (1:10,000) and detailed (1:5000) mapping (see Maps, Back Pocket), limited ground mag and EM, drill core re-logging and importantly, a field excursion to the Pechenga district in Russia to examine ore bodies and geology. The program produced four significant results: (1) the Pechenga Group was correlated across the border into Pasvik, Norway, (2) the importance of the Productive Formation as a host to Ni-Cu deposits was emphasized, (3) a structural history of the region and structural controls on ore bodies were defined and (4) Several previously undrilled magnetic anomalies (probable ultramafic bodies) within the Productive Formation were identified in Pasvik. These results led to the 1992 drill program, designed to test the potential for nickel mineralization in the various inferred ultramafic bodies.

1.4 1992 EXPLORATION AND EXPENDITURES

The 1992 exploration program included diamond drilling, mapping and ground geophysics. Drilling was carried out from July 1 to August 14 by TerraBor A/S. Eleven (11) holes (PS-42 to -52) totalling 1918.12 metres were drilled and are summarized in Appendix A. Results and Expenditures for 1992 are reported in Appendix A.

The following personnel were involved in the 1992 exploration:

Oyvind Hushovd	President	A/S Sulfidmalm
Jørn Jacobsen	Accountant	Falconbridge Nikkelverk
Tony Green	Regional Exploration Manager	Falconbridge Limited
Daryl Hodges	Senior Project Geologist	Falconbridge Limited
Karen Hudson-Edwards	Consulting Geologist	
Trond Watne	Senior Geological Assistant	A/S Sulfidmalm
Jon Erik Eriksen	Junior Geological Assistant	A/S Sulfidmalm

In addition to these persons, consultation was conducted with R.D. Stewart, District Geologist, and A. Watts Chief Geophysicist, both with Falconbridge Limited.

2.0 REGIONAL GEOLOGY

2.1 PECHENGA

The Pechenga deposits are situated in Russia at the extreme northwestern corner of the Kola Peninsula, close to the Norwegian border (Figure 1, 3). They occur within the Pechenga-Imandra/Varzuga Structural Facies Zone, an Early Proterozoic tectonic trench which formed between two Archean blocks. Four of the six major nickel camps in the Kola Peninsula, namely, Fedoro-Panskie Tundry, Monchegorsk, East Pechenga and Pechenga, are situated within this Zone (Gorbunov et al., 1985).

The Lower Proterozoic Pechenga structure comprises two zones: the Northern Zone and the Southern Zone (Zagorodny et al., 1964). These zones to the Pechenga Group in the north and South Pechenga Group in the south, separated by the major syn-volcanic Poritash Fault. The lower age limit of the Pechenga Group is constrained by inclusions in the Akhmalahti Sedimentary Formation of pebbles of the 2453 ± 42 Ma (Sm-Nd, Bakushkin et al., 1990) Mt. Generalskaya gabbro-norite intrusion. The upper age limit is bracketed by the 1810 ± 50 Ma (U-Pb age, Pushkarev et al., 1978) Litsa-Araguba granite which intrudes the South Pechenga Group.

The Pechenga Group is composed of four formations, each beginning with sedimentary rocks and ending with a thicker pile of mainly basaltic volcanic rocks (Zagorodny et al., 1964). Volcanic rocks have a total thickness of 10,000 to 12,000 metres and form 80 percent of the Pechenga Group. The formations are, from oldest to youngest, the Akhmalahti, Kuetsyarvi, Kolasyoki and Pil'guyarvi Sedimentary and Volcanic Formations (Table 3). The Pil'guyarvi Sedimentary, or 'Productive Formation', hosts the Pechenga Ni-Cu deposits. The rocks have undergone varying metamorphism, from prehnite-pumpellyite to greenschist facies in the central part of the Pechenga area to amphibolite facies towards the peripheral zones.

Intrusion and extrusion of nickeliferous, ultramafic and mafic-ultramafic bodies into the Productive Formation and the Kolasyoki Volcanic Formation along the Kolasyoki fault coincided with the start of Pil'guyarvi volcanism. Two types of ultramafic body are recognized at Pechenga (Gorbunov, 1968):

TYPE 1: ULTRAMAFIC FLOWS AND POSSIBLY INTRUSIONS
Type 1a: undifferentiated, usually thin ultramafic (serpentinite) bodies.
Type 1b: differentiated ultramafic - pyroxenite, generally thicker ultramafic bodies which sometimes display globular and quench textures.
Type 1c: Ni-Cu ore bearing Type 1b ultramafic bodies.

TYPE 2: ULTRAMAFIC-PYROXENITE-GABBRO INTRUSIONS (GABBRO-WERHLITES)
Type 2a: differentiated gabbro-ultramafic (wehrlite) bodies (generally intrusions) consisting in upward succession of altered peridotites (serpentinites), pyroxenites, gabbros and monzonitic gabbros, and
Type 2b: Magmatic Ni-Cu ore-bearing Type 2a gabbro-ultramafic bodies.

2.2 PASVIK CORRELATION

Mapping in the Pasvik area in 1957 by A/S Sydvaranger revealed that the Russian Pechenga Group extends into Norway. This interpretation has been confirmed by A/S Sulfidmalm and NGU efforts in 1991 (Figure 3). The belt of rocks, known as the Skogfoss Arch, extends for 34 kilometres across Norway. It is 5.5 kilometres wide at the Russian border and 1.2 kilometres wide at the Finnish border. Equivalents of the Akhmalahti, Kuetsyarvi, Kolasyoki and Pil'guyarvi Formations and the South Pechenga Group all are present in the Pasvik area (Table 3) about 23 kilometres along strike from the Kaula deposit. The Productive Formation equivalent in Norway is thickest in the central Oksfjell area where the density and size of magnetic ultramafic bodies also is the greatest (Figure 5).

3.0 1992 EXPLORATION

3.1 PURPOSE

The 1992 diamond drill program had several objectives:

(a) To confirm the presence of several inferred ultramafic bodies in or near the Productive Formation at Oksfjell.
(b) To discover Ni-Cu mineralization related to these ultramafic bodies, and/or
(c) To priority rank the bodies in terms of Ni ore potential.

The purpose of the 1992 ground geophysics was to confirm the location of airborne magnetic targets on the ground for drilling. The purpose of the 1992 mapping was to obtain further detailed structural information to interpret possible controls on mineralization and to determine the potential for prospective ultramafics at Svartfjell and Finntjørn.

3.2 GEOLOGY AND GEOCHEMISTRY

3.2.1 Oksfjell Geology

The Oksfjell area is the central part of the Pasvik Skogfoss Arch. Each formation of the Pasvik Pechenga Group is thickest, and ultramafic bodies are most abundant in this area (Figure 5). This thick portion is bounded by faults which could be analogous to the synsedimentary faults bounding the ore - hosting Productive Formation in Pechenga.

The Productive Formation dominates the Oksfjell area (Figure 5). It can be subdivided into two members: (A) a 'Lower' part consisting of generally equal parts of sandstones, siltstones and mafic volcaniclastics, and (B) a 'Middle' part consisting of 60 to 90 vol% black, carbon- and sulphide-bearing shales and rhythmites, with lenses of massive pyrrhotite and grey diagenetic carbonate lenses, intercalated with less than 10 vol% mafic volcaniclastics. The presence of graphitic material and sulphides suggests a sulphur - rich biotic environment. Both Productive Formation members are intruded by gabbro-diabase bodies, which comprise up to three-quarters of the volume of the Productive Formation pile (Figure 5, 7).

3.2.1.1 Geology and Petrography of Pasvik Ultramafic Rocks

Several types of ultramafic bodies are present at Pechenga but only the Type 1b and the Type 2b differentiated ultramafic 'gabbro-wehrlite' bodies are ore hosts. Type 2b bodies make up nearly all of the deposits. An important part of the Pasvik exploration effort has been to identify the prospective bodies and to focus future work on these targets. In this regard, petrographic and geochemical studies were carried out on the ultramafic and related rocks to (1) compare them with ultramafic bodies at Pechenga,

(2) define the variation within each body compared to Pechenga, (3) to make comparisons among individual bodies or groups of bodies, to aid in subdividing them for prospecting and (4) compare the metal distribution amongst them and with the Pechenga deposits.

At Pasvik, three types of ultramafic body can be defined and are referred to as: Types 1a, 1b and 2a. One to five metre thick undifferentiated ultramafic Type 1a flows (and possibly intrusions) occur in the lower part of the Lower Productive Formation and at or near the top of the Middle Productive Formation (Table 4, Figure 5, 6). Type 1b bodies range in thickness from 5 to 36 m and occur at the top of the Middle Productive Formation. They show weak differentiation from dunite to probable harzburgite. Several Type 1b bodies were intersected by previous holes 29, 25, 32, 36, 34 and hole 48 in the 1992 drilling (Table 4). Both varieties of Type 1 ultramafics are grey, massive, porphyroblastic, generally intensely sheared and boudinaged, and often carry inclusions of sedimentary rocks.

Three differentiated gabbro-wehrlite Type 2a bodies, each in two parts, are located in the Oksfjell East area. They occur in the upper Kolasyoki Volcanic and Lower Productive Formations, (Table 4, Figures 5, 6), range in thickness from 28 to 109 m, and pass upwards from ultramafic through pyroxenite and gabbro, with local centimetre - wide granophyric portions. The bodies are designated, from west to east, bodies A (parts A1, A2), B (B1, B2) and C (C1, C2) (Figure 5, Table 4). Most bodies are intact, except for the ultramafic portions of bodies A1 and C2 intersected in holes 1 and 52, respectively (Table 4). Body A has the greatest strike length (1.25 km total A1+A2 based on magnetic interpretations), thickness (108.61 m, hole 41 intersection) and ultramafic to mafic ratios (range 3.54 to 19.00). The latter are similar to ratios for Ni-Cu ore-bearing bodies in the western part of the Pechenga ore-field (Kaula, Kotselvaara, Kammikivi, average 2.31, Table 5; Smol'kin, 1974, Table 4). Minor thin upper granophyric portions occur in Bodies A (hole 41) and B (hole 44).

All of the ultramafic rocks are completely metamorphosed to mixtures of iron-rich chlorite, kaersutite, biotite, talc, carbonate, serpentine, magnetite and minor pyrrhotite. The pyroxenites and gabbros are medium- to coarse-grained, monoclinic pyroxene-plagioclase-chlorite-actinolite and lesser ilmenomagnetite-sphene-leucoxene-carbonate-epidote and trace chalcopyrite-bearing rocks.

3.2.1.2 Geochemistry of Ultramafic Rocks

Ultramafic rocks at Pechenga and Pasvik have distinct geochemical compositions. They have high MgO (generally >20 wt%), FeO_t (>14 wt%), TiO_2 (generally >0.8%), Ni (>500 ppm), Cr (>600 ppm), Co (>60 ppm) and Zr (150-250 ppm) contents and strongly negatively sloped REE patterns. Pechenga ultramafic volcanics were named by Hanski and Smolkin (1989) as ferropicrites, and were shown to be coeval with Ni-Cu-bearing Type 2b gabbro-wehrlite intrusions. The same ferropicrite classification can be applied to the Pasvik ultramafics.

The Pasvik Type 1 (1a, 1b) and Type 2a ultramafic bodies have distinct geochemical characteristics (Table 6). Generally, the Type 2a's have higher TiO_2 and Ni contents than the Type 1's. On major element plots (Figure 7a, 7b, 7c), the Type 2a bodies group into a tight cluster compared with the more scattered Type 1's and Pechenga host rocks (Figure 7d).

Geochemical profiles for Pechenga Type 2 bodies from Pil'guyarvi and Kammikivi are presented in Figure 8. Pasvik Type 2a gabbro-wehrlite bodies A1, A2, B2, C1 and C2 are shown in Figure 9. Only the oxides MgO, TiO2, CaO and Al_2O_3, and elements Ni, Cu and S were plotted, as these give the best petrological fingerprints. Efforts were made to sample the ultramafic portions of the bodies consistently and near the contacts to ensure a complete profile. Several comments can be made from the profiles and geochemical plots comparing Pasvik to Pechenga:

(a) The ultramafic-pyroxenite and pyroxenite-gabbro contacts are easily distinguished geochemically in both areas. At Pasvik, the change upwards from ultramafic to pyroxenite is depicted by a sharp decrease in MgO (generally from 20-30 wt% to 10-15 wt%), sharp increases in CaO (from <5 to 12-15 wt%) and notable increases in TiO_2 (from 1-2 to 2-10 wt%) and Al_2O_3 (from ~4 to 5-8 wt%). These changes are due to the occurence of clinopyroxene and Ti-bearing mineral (kaersutite amphibole, Ti-phlogopite, Ti-biotite and ilmenite) fractionation in the pyroxenites.

Similar trends are seen in the change upwards from pyroxenite to gabbro. At Pasvik it is marked by a sharp increase in Al_2O_3 (from 5-8 to ~12 wt%), sharp decreases in TiO_2 (from 2-10 to <5 wt%) and MgO (from 10-15 to <5 wt%) and a weak decrease in CaO (from 12-15 to 7-10 wt%). These changes can be accounted for by an increase in plagioclase and decrease in clinopyroxene fractionation when passing from pyroxenites to gabbros.

(b) The ultramafic portions of bodies A, B and C each have distinct geochemical characteristics:

	Body A	Body B	Body C
	n=18	n=7	n=3
MgO	20.58-29.33	23.97-25.85	21.04-24.27
	(27.12)	(25.08)	(22.33)
TiO_2	1.53-2.56	2.03-2.33	2.13-2.43
	(1.79)	(2.11)	(2.27)
CaO	2.46-6.95	4.32-5.01	5.07-6.65
	(3.90)	(4.60)	(6.04)
Al_2O_3	3.04-5.59	3.92-4.47	4.23-4.62
	(3.66)	(4.23)	(4.47)
Ni	1600-2295	1743-3080	1467-1698
	(2007)	(2088)	(1547)
Cu	56-162	79-130	115-153
	(104)	(108)	(141)
S	<50-425	<50-116	<50-3295
	(72)	(17)	(1688)

Co	Tr-193 (136)	152-169 (59)	123-147 (133)

(c) The boudin portions of the Bodies A1 and A2, and C1 and C2 can be correlated using the profiles (Figure 9a, b, d, e, f). Ultramafic, pyroxenite and gabbro portions show similar MgO, TiO_2, CaO and Al_2O_3 contents. This supports the geological interpretation that A1 and A2, and C1 and C2 each may have been one body that was dismembered.

d) In the Pil'guyarvi profile, Figure 8a, the TiO_2, Al_2O_3 and MgO all show a sharp increase at the base. This could have application in confirming whether the true base of an intrusion has been tested. Geochemical changes are noted in the base of bodies A, B and C. Body A1 (hole 1) (Figure 9a) shows a sharper basal change than body A2 (hole 41) (Figure 9b), suggesting that hole 41 may not have reached the true base of the body. The changes in body B1 (hole 44) (Figure 9c) and body C2 (hole 52) (Figure 9f) are only gradual, suggesting that the true bases may not have been penetrated. The base of body C1 appears to have been penetrated by hole 51 (Figure 9e), but not by hole 50 (Figure 9d).

The major element chemistry of the Pasvik ultramafic bodies and in particular the Type 2a bodies compare very favourably with the Pechenga gabbro - wehrlite bodies. This and the similar stratigraphic settings and relationships indicate that similar processes were occurring in the two areas at approximately the same time.

3.2.2. Svartfjell Geology

The Svartfjell area is located in the eastern portion of the Skogfoss Arch, northwest of Skogfoss near the Russian-Norwegian border (Figure 2). The Sulfidmalm claim block focuses on the magnetic ultramafic body intersected in hole 32 (Figure 10, Appendix C).

Detailed 1:2000 scale geological mapping over the block outlined the Productive Formation, the hole 32 body and five other ultramafic localities (Figure 10). The hole 32 body is a Type 1b intrusion which had a 36.0 m intersection in the drill hole. The body is wholly massive, fine-grained, dark grey serpentinized ultramafic flow composed of Fe-rich chlorite, serpentine, carbonate, chromite and magnetite. Selected samples from the 'hole 32' ultramafic body show weak enrichment in Cu and Ni (Table 5). The five other bodies are thin (generally <5 m thick), intensely sheared, talcose and carbonate porphyroblastic bodies intercalated with Productive Formation sediments.

The exploration priority of the hole 32 ultramafic flow presently is low, based on (a) the lack of significant mineralization found to date in outcrop and drilling; (b) its classification as a Type 1b body with a low potential to host a large Ni-Cu body; (c) its location and isolation, as there is no other prospective body between it and the closest Type 2a body in the Oksfjell area 6 km to the east.

3.2.3 Finntjørn Geology

The Finntjørn area lies in the south-western part of the Skogfoss Arch, near the Finnish border, at the point where the orientation of the Arch changes sharply from northeast- to east-west trending (Figure 2). The Sulfidmalm claim area centers on two large, rounded magnetic anomalies (Figure 11) in Pil'guyarvi volcanics. Although there is no outcrop in the anomaly area, a 900 m long train of gabbro, pyroxenite and amphibolite boulders is located down-ice of the anomalies.

Whole-rock data collected from 13 boulder samples (Table 6) suggests that they have ferropicritic affinities (18.4-27.4 wt% MgO; 12.4-18.6 wt% Fe_2O_3, 0.538-1.79 wt% TiO_2, 0.12-0.34 wt% Cr_2O_3, 776-1190 ppm Ni). However, their S contents (Table 6, Figure 13) are extremely low for the range of Ni contents, showing that there are no Ni sulphides present.

3.3 GEOPHYSICS

Two geophysical surveys were carried out in 1991. These included a 1409.5 line km helicopter-borne AEM survey by Aerodat-NGU and a 47.71 km ground mag and Slingram EM survey by Suomen Malmi OY of Finland. These surveys results are reported in Appendix C.

The Airborne survey covered the Kuetsyarvi, Kolasyoki and Pil'guyarvi Formations and part of the South Pechenga Group, across Pasvik from Russia to the Finnish border. Magnetic total field and vertical gradient, EM, resistivity and VLF-EM maps were produced.

The Productive Formation is best outlined by the EM maps, where it is depicted as a 34 km, 20 to 500 m thick series of strong conductors. The Formation also has a moderately high magnetic expression on the magnetic maps due to significant quantities of magnetic pyrrhotite within its sediments. Gaps in the Formation conductor clusters and magnetic expressions are due to the presence of non-conductive and non-magnetic gabbro-diabase bodies.

Ultramafic bodies are best distinguished on the vertical gradient magnetic maps as prominent circular to elliptical high-amplitude bodies (Figure 12). It is important to note that the Type 2a A2 and B2 bodies do not have a coincident associated EM anomaly. The coincident EM and body A1 body mag anomaly is deceptive because the two anomalies actually are separated vertically in 3-dimensional space and only **appear** to be coincident due to the 2-dimensional map.

Results from the ground Mag and EM survey over the eastern Oksfjell area (Figure 5, 12) correspond well with those from the airborne survey. The ground survey further delineated the Productive

Formation, and ultramafic and gabbro-diabase bodies.

3.4 STRUCTURAL GEOLOGY

Structural style in the Pasvik area is considered to be very similar to that at Pechenga. Primary bedding (S_0) structures are rarely seen due to the strong primary schistosity (S_1) onto which the S_0 is transposed. Where seen, bedding contacts tend to be highly sheared. They are best preserved in the Productive Formation shales and sandstones.

Primary S_1 fabric occurs consistently as a finely spaced, moderately to well-developed schistosity in all rock types. It parallels the major contacts between the sedimentary and volcanic formations and outlines the shape of the Skogfoss Arch. Elongate, lozenge-shaped boudins of serpentinized ultramafic, quartz veins, gabbros and pillow basalts formed due to the strong compression perpendicular to S_1.

Thrust faulting was related to the primary deformation. Evidence includes strong rodding and slickensides in pillow lavas, localized S_1-parallel mylonites and repetition of ultramafic boudins (Figure 5, holes PS-37, -36, -29, -34).

Contoured data for S_1 and S_0 define a great circle (Figure 13), suggesting that the schistosities are cylindrically folded during a second folding event (F_2). This and the macroscopic open Skogfoss Arch fold are the main evidence of secondary deformation (D_2). There is no associated development of penetrative schistosity. The cause of this folding is uncertain, but may be related to regional compression of the Pechenga Group between Archean plates. Although the Skogfoss Arch F_2 fold axis appears to trend 180° (Figure 3), its orientation given by the pole to the S_0-S_1 great circle is 33.0° -> 206.7° (Figure 13). This may be due to rotation by shearing, described below.

The latest observed deformational event (D_3?) is localized shear zone/fault zone development. These zones strike approximately N25°E and are characterized by localized, intense to mylonitic schistosity, C- and S-fabrics, mineral lineations, and rotation and boudinage of layers with differing competency (such as serpentinized ultramafics). Most of the shear zones in the Oksfjell area have a sinistral sense of shear, recorded in tension gashes and offsets of lithological units. Dextral senses are recorded elsewhere along the Skogfoss Arch. Strike-slip displacement ranges from a few to 250 metres.

Two regional fault systems are evident from air photograph and satellite image lineaments, topographical features, geophysical maps, and extrapolation from outcrop-scale shear zones (Figure 5). The first system is the regional expression of the N25°E trending shear zones. The second strikes N60°W (290°). These faults were likely early syn-sedimentary rift-basin bounding faults which subsequently were re-activated. This is suggested by abrupt facies terminations and changes across faults, and offsets of younger South Pechenga rocks.

3.6 ECONOMIC RESULTS

1992 Pasvik drill logs and sections are reported in Appendix C. The drill program had several results:
(1) Ultramafic rocks were intersected in holes PS-92-42, -43, -44, -45, -48, -49, -50, -51 and -52. All of these bodies lie within the Productive Formation, except for the Hole PS-92-44 body which occurs at the Lower Productive Formation/Kolasyoki Volcanic Formation contact.

At Pasvik, as at Pechenga, the ultramafic bodies can be classified into three types: Types 1a, 1b and 2a (after Gorbunov, 1968). These were described in more detail in section 3.2 and it was concluded that these bodies are essentailly identical. The Type 2a bodies are the differentiated gabbro - wehrlite bodies which host the vast majority of the nickel - copper ore at Pechenga. 'Type 2a' 'gabbro-wehrlite' bodies were intersected in Holes PS-1, -30, -39, -41 from previous drilling and holes -43, -44, -50, -51 and -52 in the 1992 drilling (Table 4, Appendix C).

Observed mineralization at Pasvik is minor and that has frustrated attempts to prove up any kind of economic potential in the past, as now. The following is a brief description of where metallic mineralization has been observed in the 1992 drilling. The gabbro-pyroxenite portions of the bodies in holes PS-44, -50 and -51 contain up to 1% disseminated chalcopyrite. Up to 2% disseminated pyrrhotite was observed in the ultramafic portions. Remobilized chalcopyrite occurs in overlying volcanic rocks (hole 43, 11800 ppm Cu over 10 cm; hole 52) and in xenoliths within the ultramafic portion of the bodies (holes 51, 52) (Appendix C, Table 5). The most sulphidic rocks are the carbon-bearing black shales in the Productive Formation which contain 5 to 30% pyrrhotite and trace to 1% chalcopyrite. Some of the black shales and Type 1 ultramafic bodies are weakly enriched in Ni and Cu (Figure 6a). The trace metal geochemistry sampling was completed to complete the investigation of metal enrichment at Pasvik. With the absense of significant visible mineralization, one anticipates that 'cryptic' trends or associations in the metals can be observed which support further evaluation.

As has been previously stated, the bulk of the ores in Pechenga are related to the diffentiated massifs, and form typical magmatic or 'syngenetic ' ores. The profile in Figure 14a is representative of trends observed in 57 investigated massifs hosting syngenetic mineralization. Of significance are the sympathetic trends of Cu and Ni which show excellent correlation (r=0.79 to 0.99 in Pechenga bodies Kotsel'vaara, Kammikivi, Pil'guyarvi; Kochnev-Pervukhov, 1978). This trend is reported to occur throughout the ore - bearing massifs. In contrast, Pasvik Type 2a Ni and Cu contents and trends show poor correlation (r=0.107) (Figure 9). Examination of the metal profiles from Pasvik shows a sympathetic correlation of Ni and Co, which are both elevated in the cumulate portion of the bodies. The Ni-MgO trend (Figure 7) suggests a magmatic differentiation. This is supported by the Ni-Co relationship (Figure 16) and is in contrast with the elevated Ni observed in the Ni-MgO plot from Pechenga (Figure 7d). Cu and S show a slightly better correlation (r=0.308) and reflect the presence of chalcopyrite in the pyroxenites and gabbros and the low Cu and S contents in the cumulate portions of the bodies. The ultramafic portions of the Type 2a bodies have very low S contents (generally less than background levels of 50 ppm) in the ultramafic portions of the bodies (Figure 9, 15). Relative increases in S occur only at the bases of Body B1 (hole 44; 105 ppm: 116 ppm anhydrous) and C1 (hole 50; 3010 ppm: 3295 ppm anhydrous and hole 51, 1540 ppm: 1637 ppm anhydrous). These can be accounted for by reaction and weak metasomatism at the contacts, or by structural introduction. The increased S contents are not, however, coincident with high Ni values (Figure 9), supporting the observed lack of Ni-sulphides.

Some of the Type 1 ultramafic bodies are weakly enriched in Ni and Cu (Figure 16a, 16b, Table 5). Those Type 1 bodies which are enriched in Cu also are enriched in As and to a lesser extent, Ni (Figure 16a, 16c), suggesting that Ni- Co- arsenides may be present in the rocks.

4.0 DISCUSSION

Petrologically, the Pasvik Type 2a gabbro-wehrlites are the most similar of the Pasvik ultramafics to the main Pechenga Ni-Cu ore-bearing Type 2b gabbro-wehrlites. However, no Ni-sulphides have been observed to date in the Pasvik bodies. The lack of Ni-sulphides *and* low sulphur in the ultramafics suggests that the source Type 2a magma contained little sulphur. The correlation of Ni and Co in the cumulate portions indicates simple fractionation trends whereas the poor Cu - Ni correlation and the low sulphur predicate against magmatic sulphide trends. Also, the results indicate that no contamination by external sulphur sources has occurred therefore it appears that the Type 2a magmas did not assimilate sulphur-bearing sediments from the Productive Formation prior to crystallizing. This is supported by their stratigraphic position in the sulphur-poor Kolasyoki volcanics. Therefore, during crystallization, all of the available Ni in the melt probably partitioned into silicates (olivine).

A late sulphur enrichment is reflected in the gabbro and pyroxenite portions of the bodies. This correlates well with copper (Figure 9b, c, d, e), and is reflected by the presence of chalcopyrite in these rocks. The cause of this sulphur enrichment is unknown, but could be related to supersaturation of sulphur and copper and subsequent precipitation of Cu-sulphides during the late crystallization stages of the Type 2a gabbro-wehrlites. This is supported texturally by the chalcopyrite grains, which are disseminated and appear to be intercumulus rather than fracture-related. Alternatively, the Cu and S could have come from seperate sources and combined during metamorphism, although this seems

unlikely.
Structural study and drill hole correlations suggest that the Type 2a bodies are boudinaged and rotated, possibly due to shearing, and have a very shallow plunge. Lack of further anomalies on magnetic maps, which would be expected with the shallow depths and plunges of the bodies, suggests that there are no additional Type 2a bodies than the six presently documented.

5.0 CONCLUSIONS

The following conclusions are drawn from 1992 drilling in the Oksfjell area, Pasvik, combined with present and previous geological and geophysical data:

(1) No economic Ni concentrations nor Ni-sulphides have been observed in any of the Pasvik rocks. Pasvik Type 2a ultramafic Ni and Cu contents show poor correlation, in contrast to the Pechenga ore-bearing host rocks. Visible chalcopyrite in the gabbroic portions of the gabbro - wehrlite bodies can be expalined by late supersaturation of sulphur and copper which does not partition into silicates as readily as Ni. This and the apparent total silicate partitioning of Co and Ni strongly suggest that the Pasvik Type 2a bodies have a low potential to host an economic Ni-Cu deposit.

(2) The ultramafic portions of the Oksfjell East Type 2a gabbro-wehrlites have extremely low S contents (generally <50 ppm). Sulphur enrichment is noted only at the basal ultramafic contacts, where it can be explained by metasomatic or structural addition, and in the upper gabbro and pyroxenite portions. In the latter, it is associated with weak Cu enrichment.

(3) Three types of ultramafic body, 1a, 1b and 2a, are recognized at Pasvik through drilling and magnetic surveys. Type 1a bodies are <5 m thick, undifferentiated flows. Type 1b bodies are 5 to 36 m thick, weakly differentiated ultramafic bodies occurring at the top of the Middle Productive Formation. Type 2a differentiated gabbro-wehrlite bodies are 28 to 109 m thick, and occur in the upper Kolasyoki Volcanic and Lower Productive Formations.

(4) Type 2a bodies are petrologically most similar to Ni-Cu-bearing Pechenga Type 2b gabbro-wehrlites. Six Type 2a bodies, which probably result from three bodies (A, B, C), boudinaged during shearing, occur in the Oksfjell East area. Bodies A, B and C each have distinct geochemical characteristics and ultramafic to mafic ratios and are considered the only possible Ni ore hosts. The shape of these bodies follow that of regional linear elements, such as rodding, measured in deformed rock units.

(5) The isolated Type 1b ultramafic body intersected by previous drill hole PS-77-32 in the Svartfjell claim block only shows weak Cu and Ni enrichment. Ultramafic boulders on the Finntjørn claim block may have originated from a magnetic (ultramafic) body in Pil'guyarvi volcanics. The boulders have similar general

geochemical characteristics to the Oksfjell Type 1a, 1b and 2a bodies, but have low S and Ni contents.

6.0 RECOMMENDATIONS

The recommendations for Pasvik are:

(1) Discontinue the exploration program at Oksfjell.

(2) Reduce the Oksfjell claim block to 10 claims of 25 ha each, to specifically cover the location of 1992 drilling of the ultramafic bodies.

(3) Abandon the claims at Svartfjellet and Finntjørn.

(4) Continue to obtain and assess deposit-specific information from Pechenga and compare the Pasvik data to this information.

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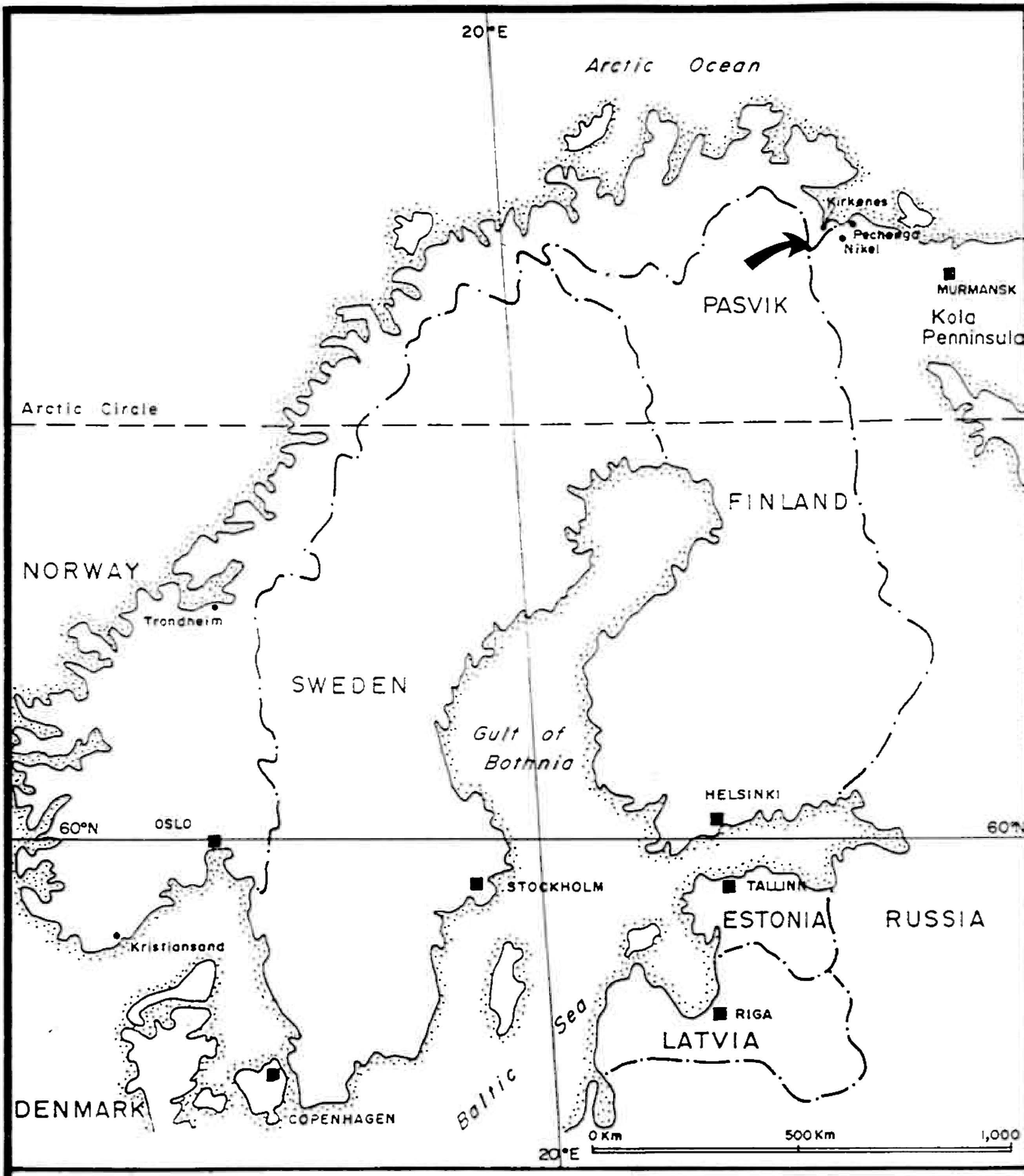
FIGURES.



A/S SULFIDMALM

Exploration Department
Kristiansand, Norway

PASVIK AREA LOCATION

SCALE:

DATE OF WORK:		CLAIMS:		Figure Nº
ORIGINAL BY:	Date:	PROJECT NUMBER:	015-906	1
REVISED BY:	Date:			
DRAWN BY:	Date:	N.T.S. Nº:		
APPROVED BY:	Date:	MAP Nº:		

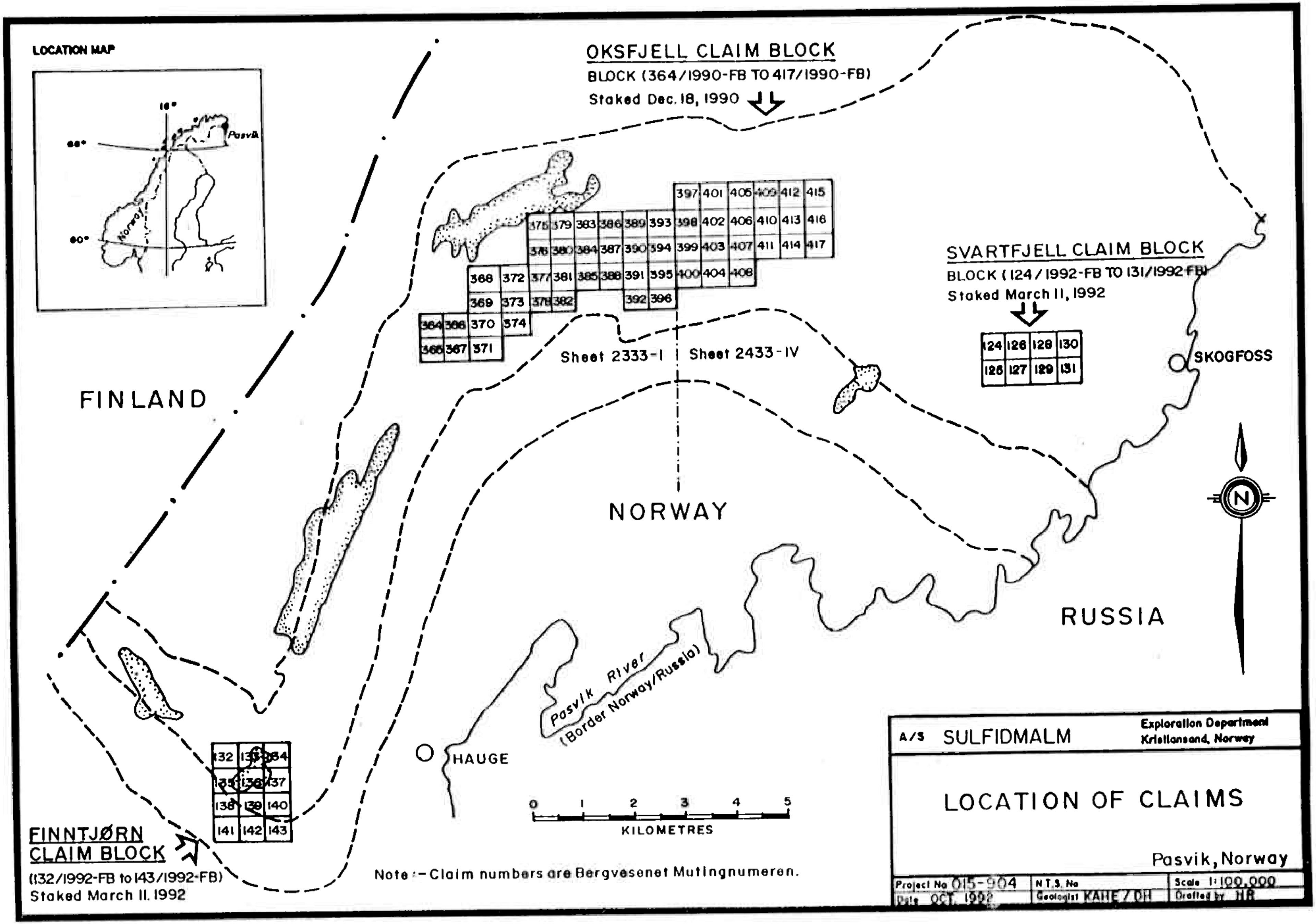

LOCATION MAP
Pasvik
Norway
OKSFJELL CLAIM BLOCK
BLOCK (364/1990-FB TO 417/1990-FB)
Staked Dec. 18, 1990
SVARTFJELL CLAIM BLOCK
BLOCK (124/1992-FB TO 131/1992-FB)
Staked March 11, 1992
FINLAND
NORWAY
RUSSIA
Sheet 2333-I
Sheet 2433-IV
SKOGFOSS
HAUGE
Pasvik River
(Border Norway/Russia)
FINNTJØRN
CLAIM BLOCK
(132/1992-FB to 143/1992-FB)
Staked March 11. 1992
0 1 2 3 4 5
KILOMETRES
Note :- Claim numbers are Bergvesenet Mutingnumeren.
A/S SULFIDMALM
Exploration Department
Kristiansand, Norway
LOCATION OF CLAIMS
Pasvik, Norway
Project No 015-904
Date OCT. 1992
N.T.S. No
Geologist KAHE / DH
Scale 1:100,000
Drafted by HR

Figure 2

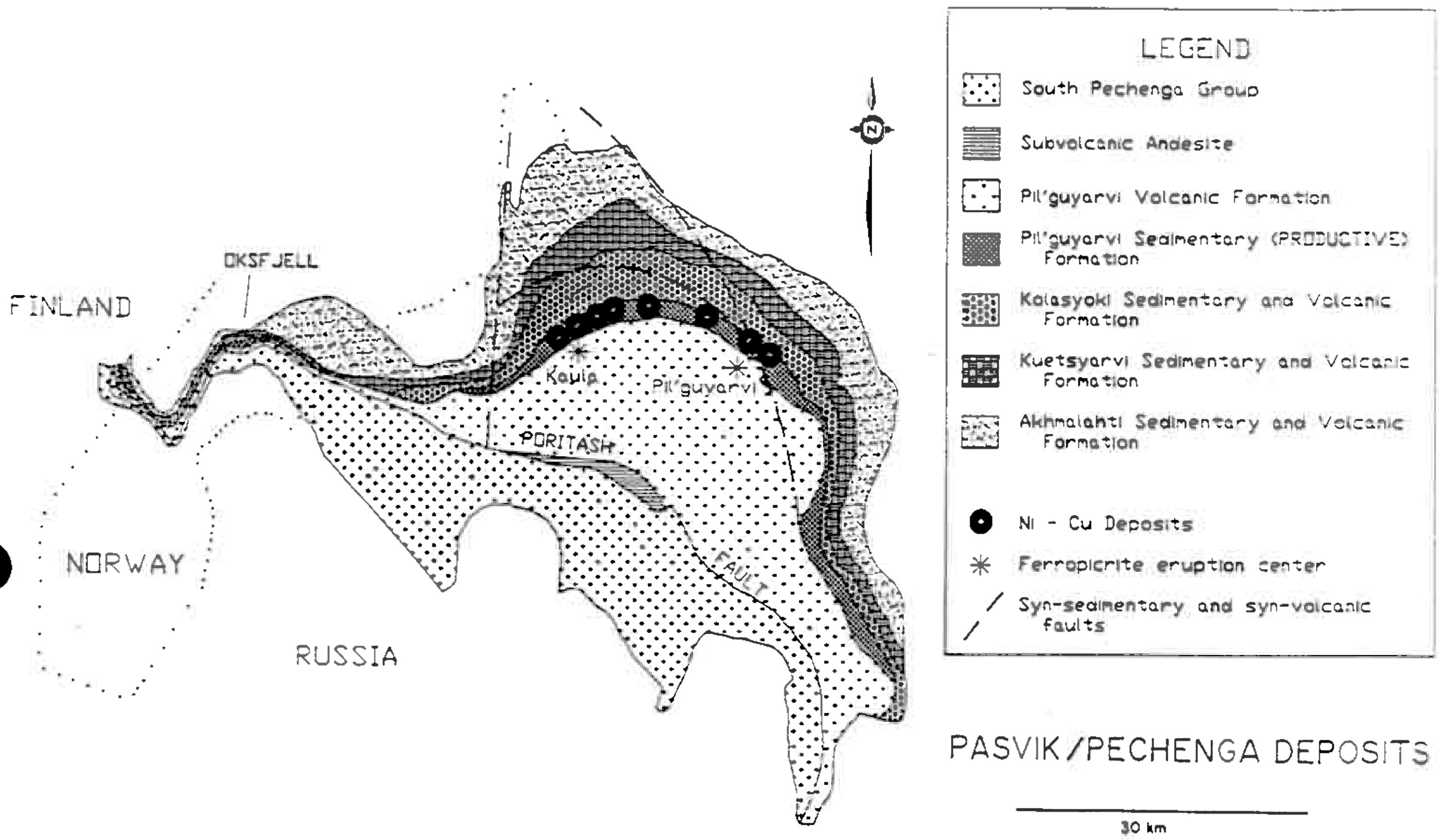

LEGEND
South Pechenga Group
Subvolcanic Andesite
Pil'guyarvi Volcanic Formation
Pil'guyarvi Sedimentary (PRODUCTIVE) Formation
Kolasyoki Sedimentary and Volcanic Formation
Kuetsyarvi Sedimentary and Volcanic Formation
Akhmalahti Sedimentary and Volcanic Formation
Ni - Cu Deposits
Ferropicrite eruption center
Syn-sedimentary and syn-volcanic faults
FINLAND
OKSFJELL
NORWAY
RUSSIA
Kaula
Pil'guyarvi
PORITASH
FAULT
N
PASVIK/PECHENGA DEPOSITS
30 km

Figure 3

PECHENGA DEPOSITS

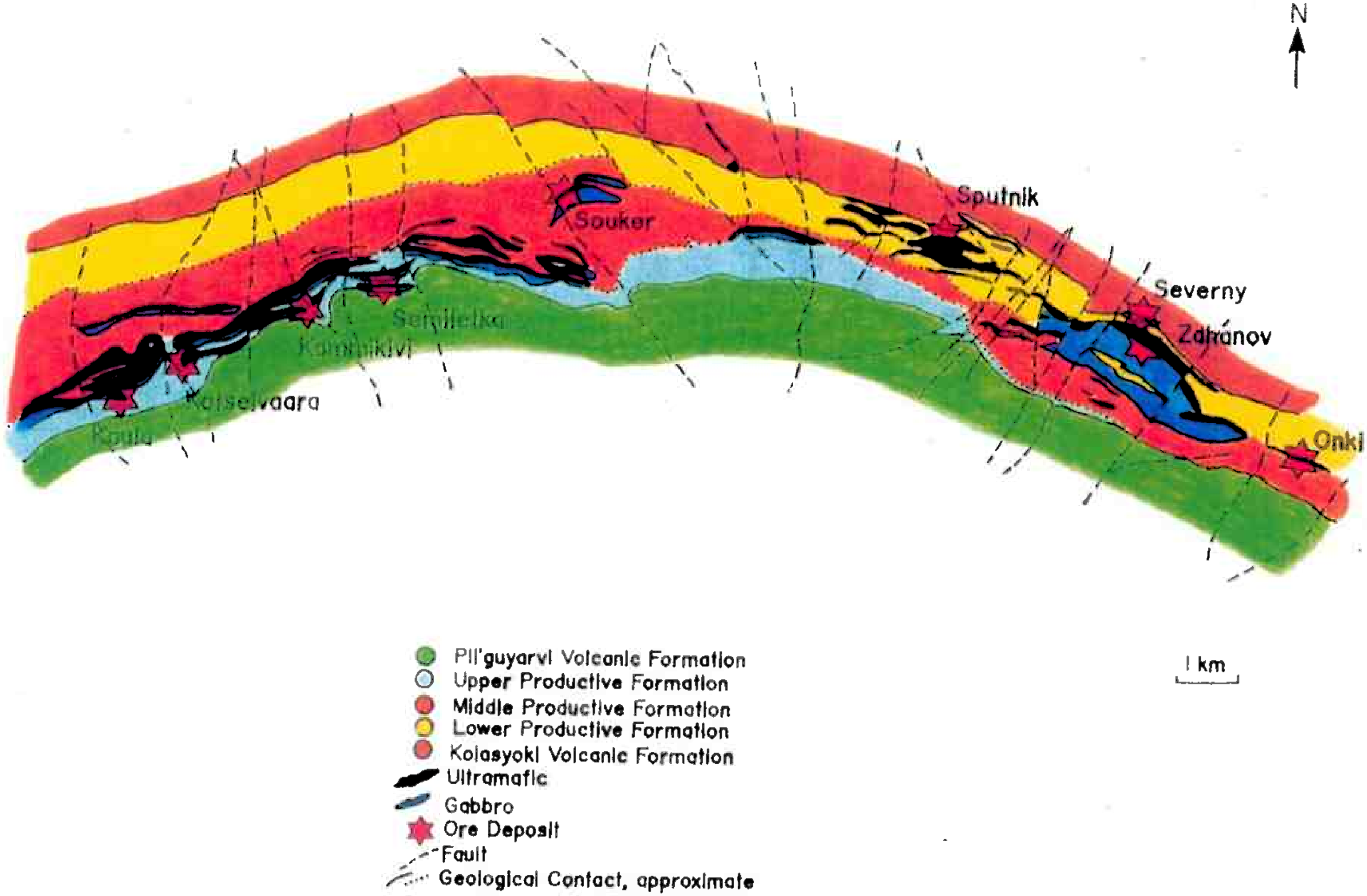
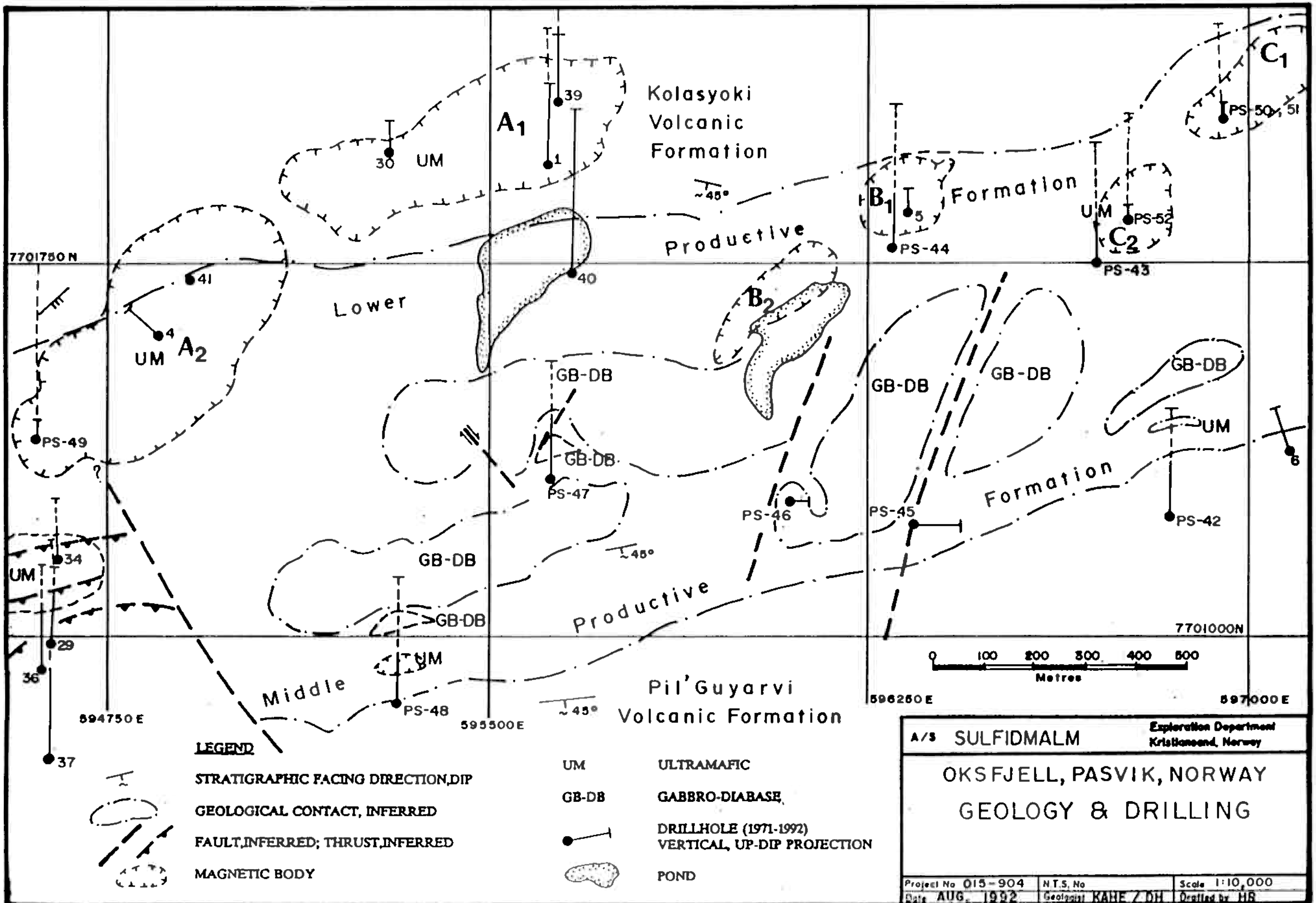


Figure 4



Kolasyoki Volcanic Formation
A1
UM
30
39
1
40
41
4
A2
UM
Lower
Productive
Formation
B1
5
PS-44
B2
C1
PS-50, 51
UM
C2
PS-52
PS-43
7701750 N
~45°
PS-49
GB-DB
GB-DB
PS-47
PS-46
GB-DB
GB-DB
PS-45
Formation
GB-DB
UM
PS-42
6
34
UM
29
36
37
GB-DB
~45°
GB-DB
UM
Productive
Middle
PS-48
Pil'Guyarvi Volcanic Formation
~45°
594750 E
595500 E
596250 E
597000 E
7701000N
0 100 200 300 400 500
Metres
LEGEND
STRATIGRAPHIC FACING DIRECTION, DIP
GEOLOGICAL CONTACT, INFERRED
FAULT, INFERRED; THRUST, INFERRED
MAGNETIC BODY
UM ULTRAMAFIC
GB-DB GABBRO-DIABASE
DRILLHOLE (1971-1992) VERTICAL, UP-DIP PROJECTION
POND
A/S SULFIDMALM
Exploration Department Kristiansand, Norway
OKSFJELL, PASVIK, NORWAY
GEOLOGY & DRILLING
Project No 015-904
N.T.S. No
Scale 1:10,000
Date AUG. 1992
Geologist KAHE / DH
Drafted by HR

Figure 5

STRATIGRAPHIC MODEL: PASVIK PROJECT

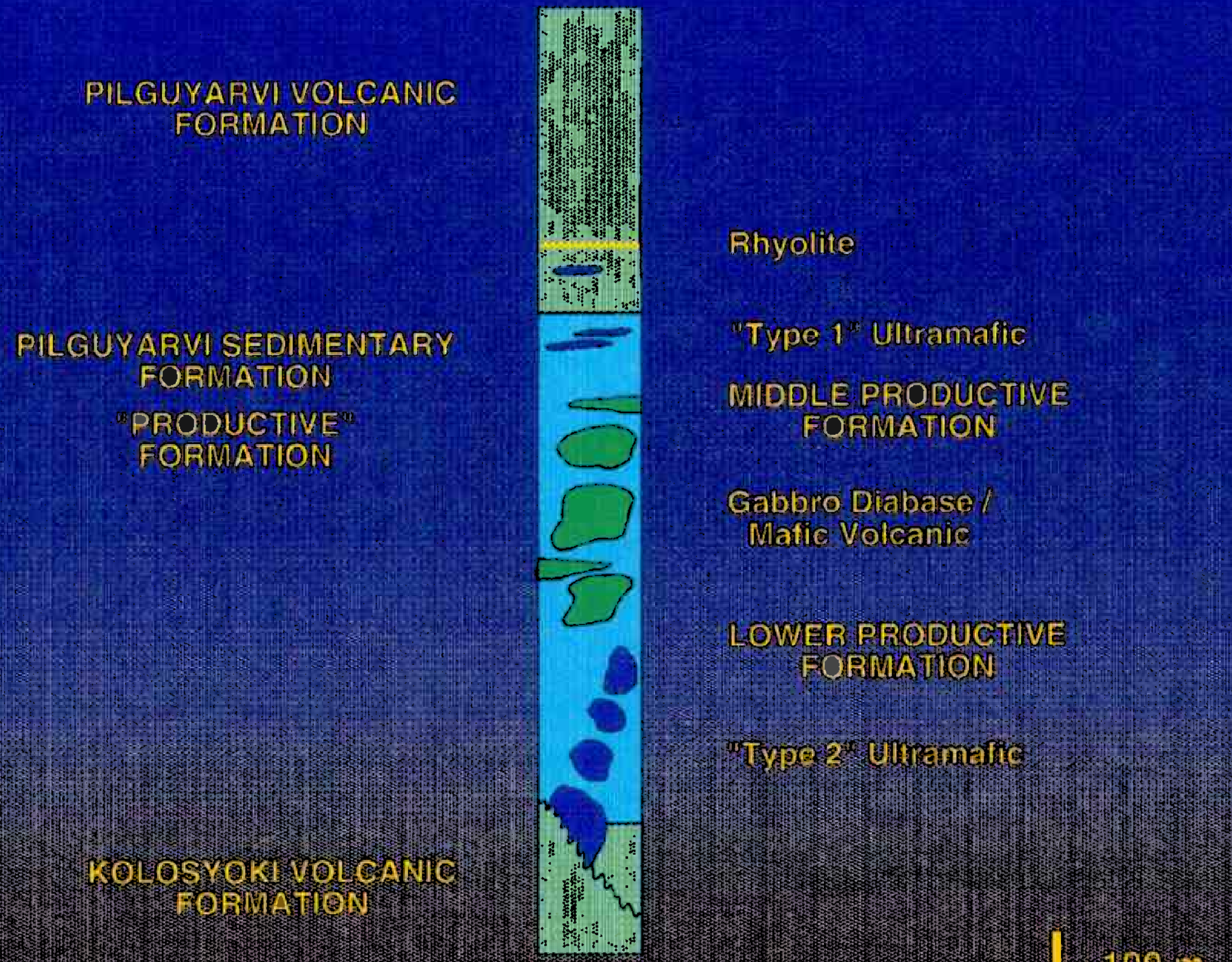


Figure 6.

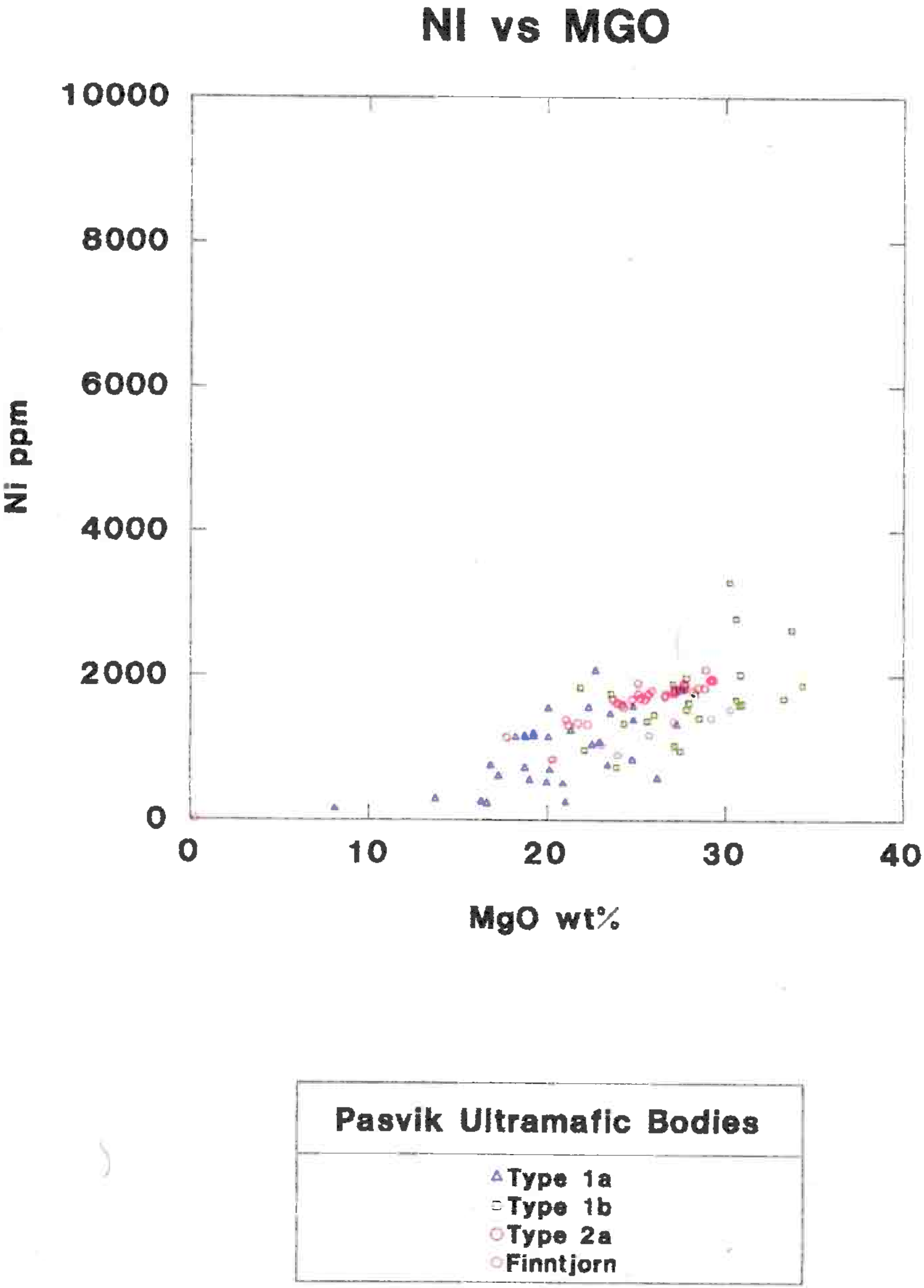
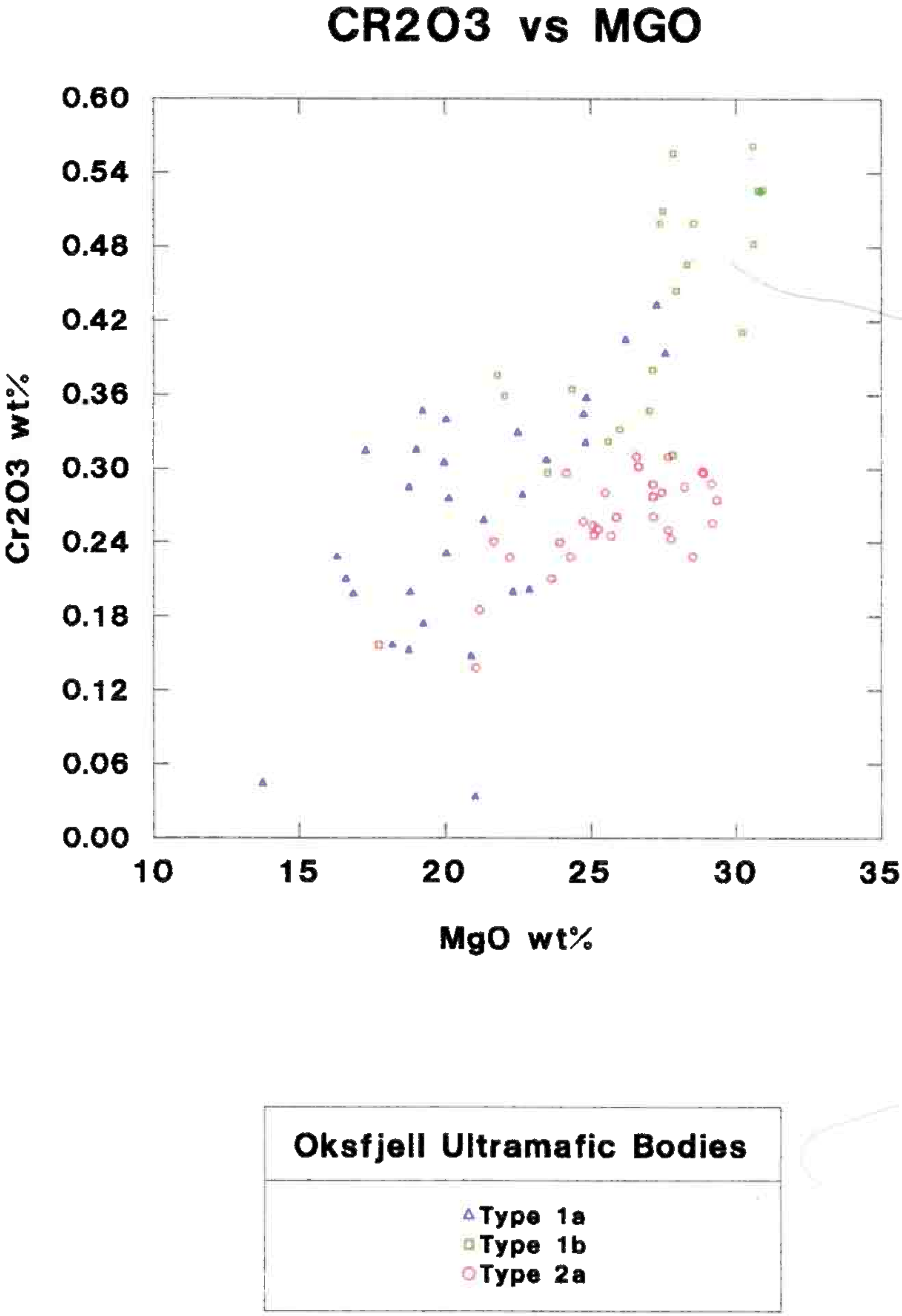

NI vs MGO
10000
8000
6000
4000
2000
0
Ni ppm
0
10
20
30
40
MgO wt%
Pasvik Ultramafic Bodies
Type 1a
Type 1b
Type 2a
Finntjorn

Figure 7a



CR2O3 vs MGO
0.60
0.54
0.48
0.42
0.36
0.30
0.24
0.18
0.12
0.06
0.00
Cr2O3 wt%
10
15
20
25
30
35
MgO wt%
Oksfjell Ultramafic Bodies
Type 1a
Type 1b
Type 2a

Figure 7b

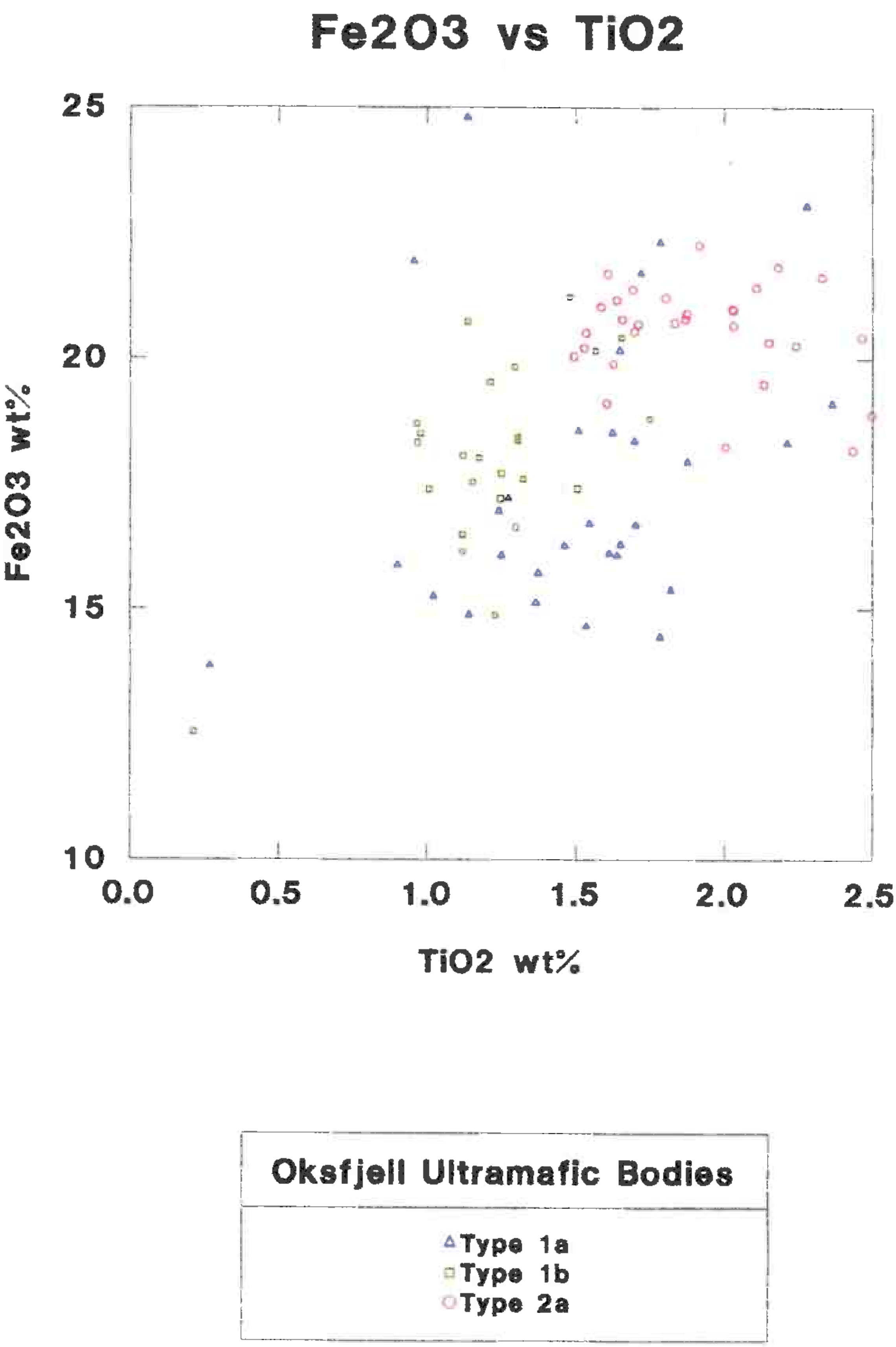

Fe2O3 vs TiO2
25
20
15
10
0.0
0.5
1.0
1.5
2.0
2.5
Fe2O3 wt%
TiO2 wt%
Oksfjell Ultramafic Bodies
Type 1a
Type 1b
Type 2a

Figure 7c

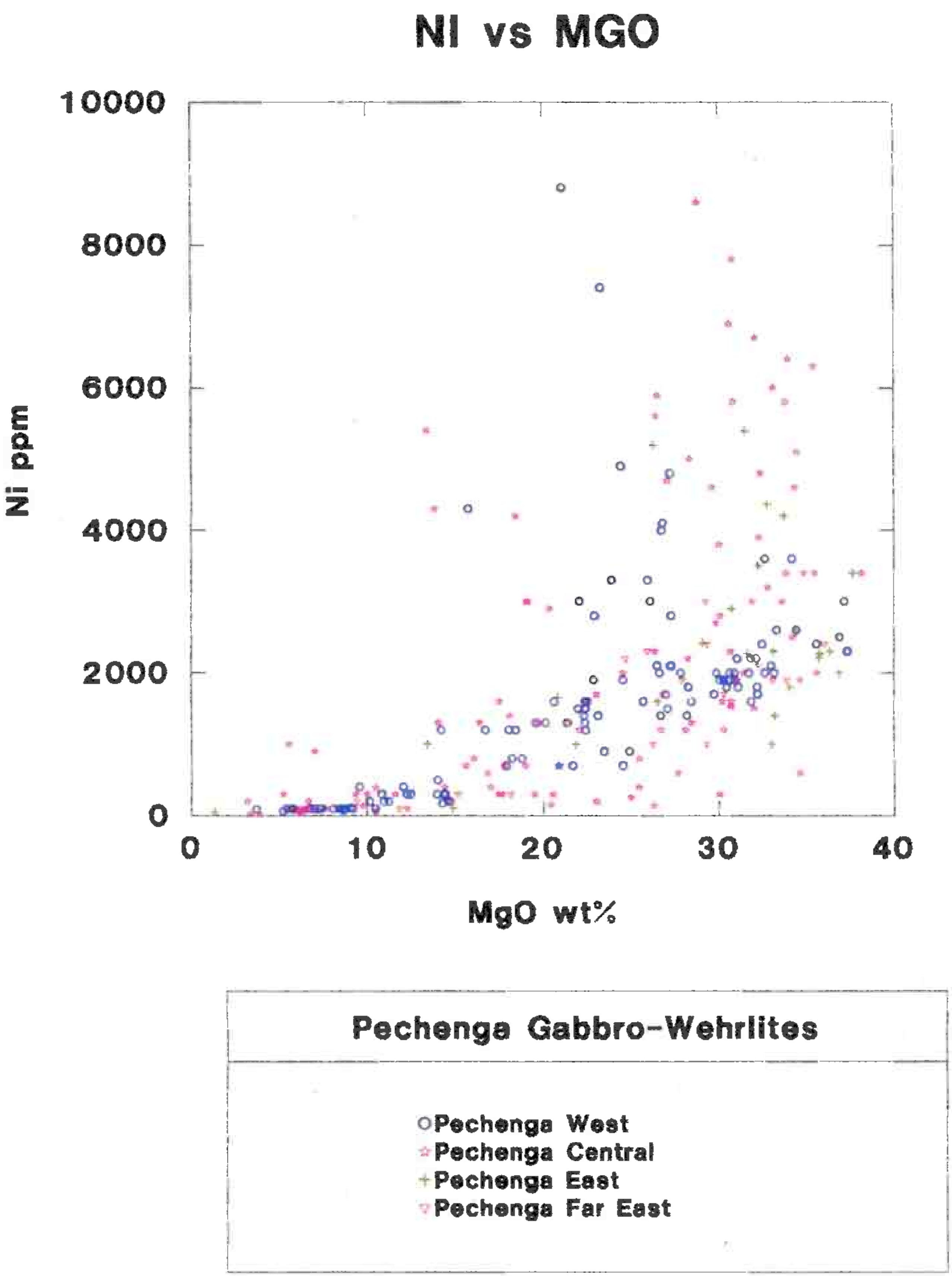

NI vs MGO
Ni ppm
10000
8000
6000
4000
2000
0
0
10
20
30
40
MgO wt%
Pechenga Gabbro-Wehrlites
Pechenga West
Pechenga Central
Pechenga East
Pechenga Far East

Figure 7d

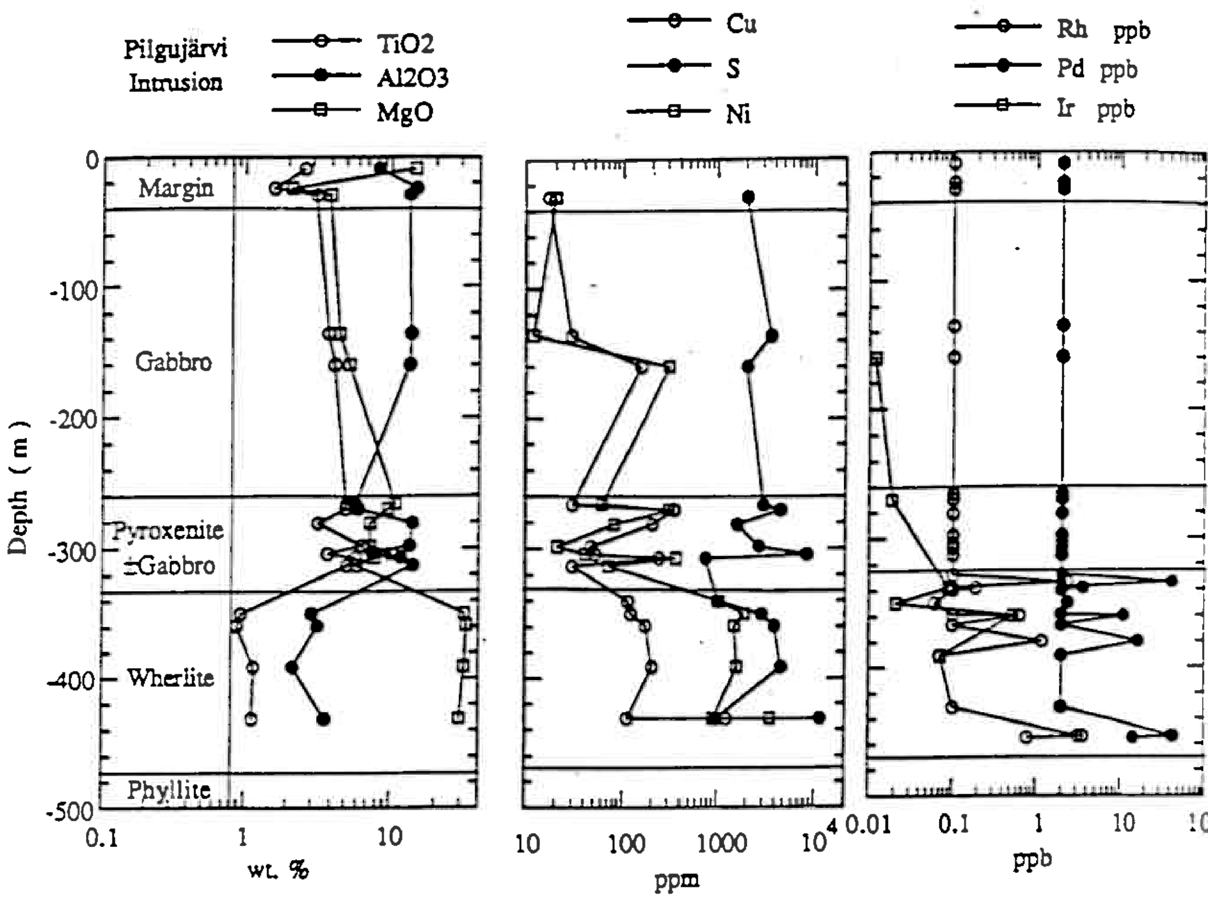


Figure 8a Compositional variations along a Profile of the Pilgujärvi intrusion.

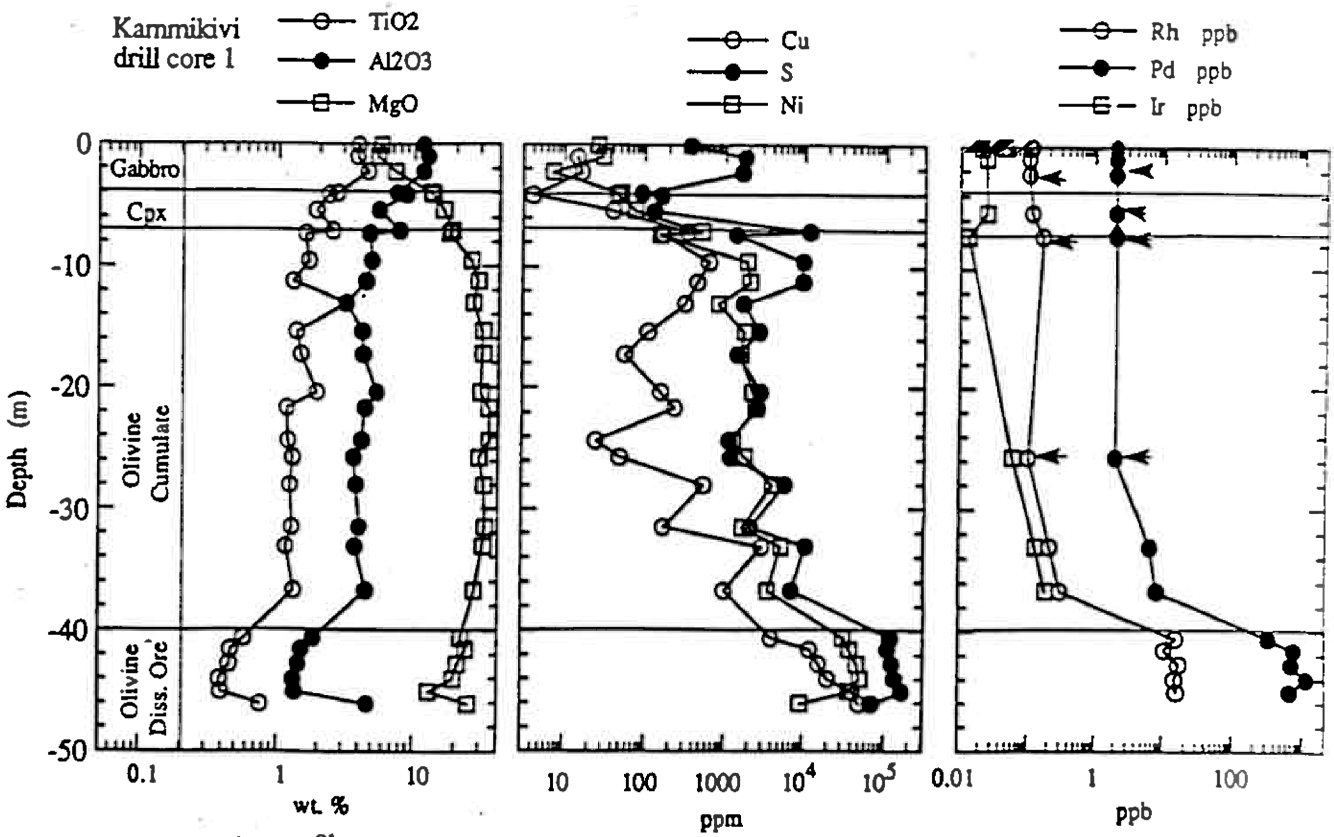
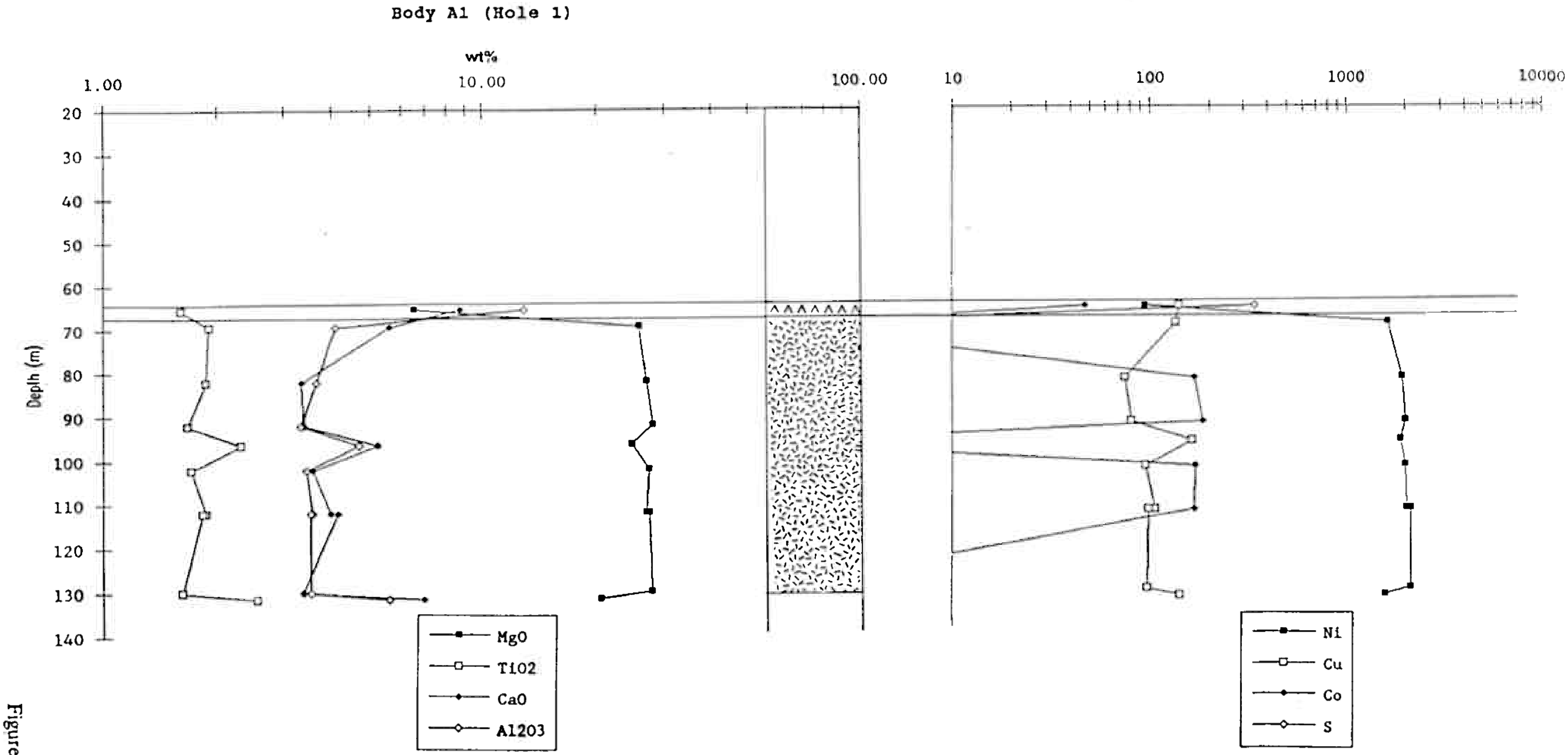


Figure 8b Compositional variations along a Profile of the Kammikivi intrusion.

Source: Brügmann et al., 1991.



Body A1 (Hole 1)
wt%
1.00
10.00
100.00
10
100
1000
10000
20
30
40
50
60
70
80
90
100
110
120
130
140
Depth (m)
MgO
TiO2
CaO
Al2O3
Ni
Cu
Co
S

Figure 9a

Body A2 (Hole 41)

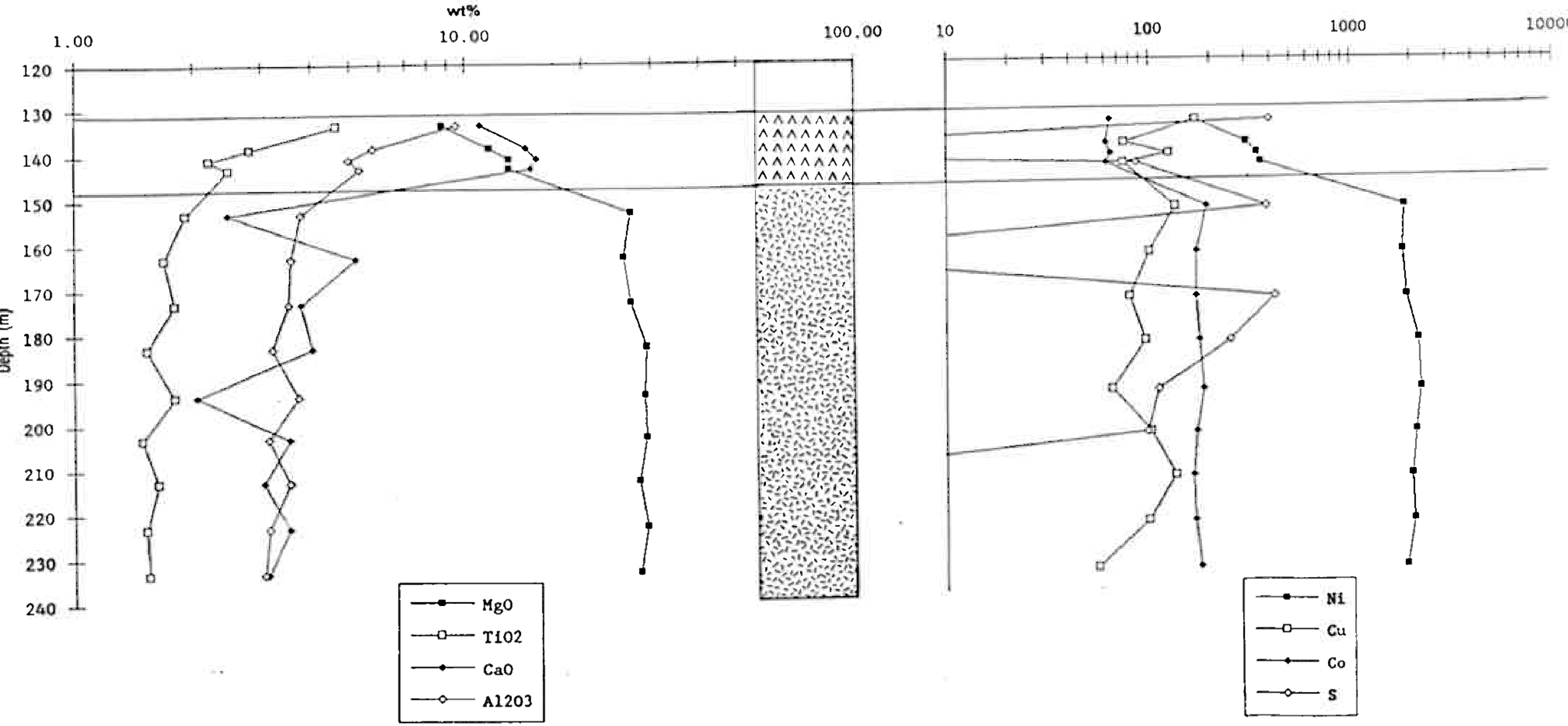


Figure 9b

Body B1 (Hole 44)

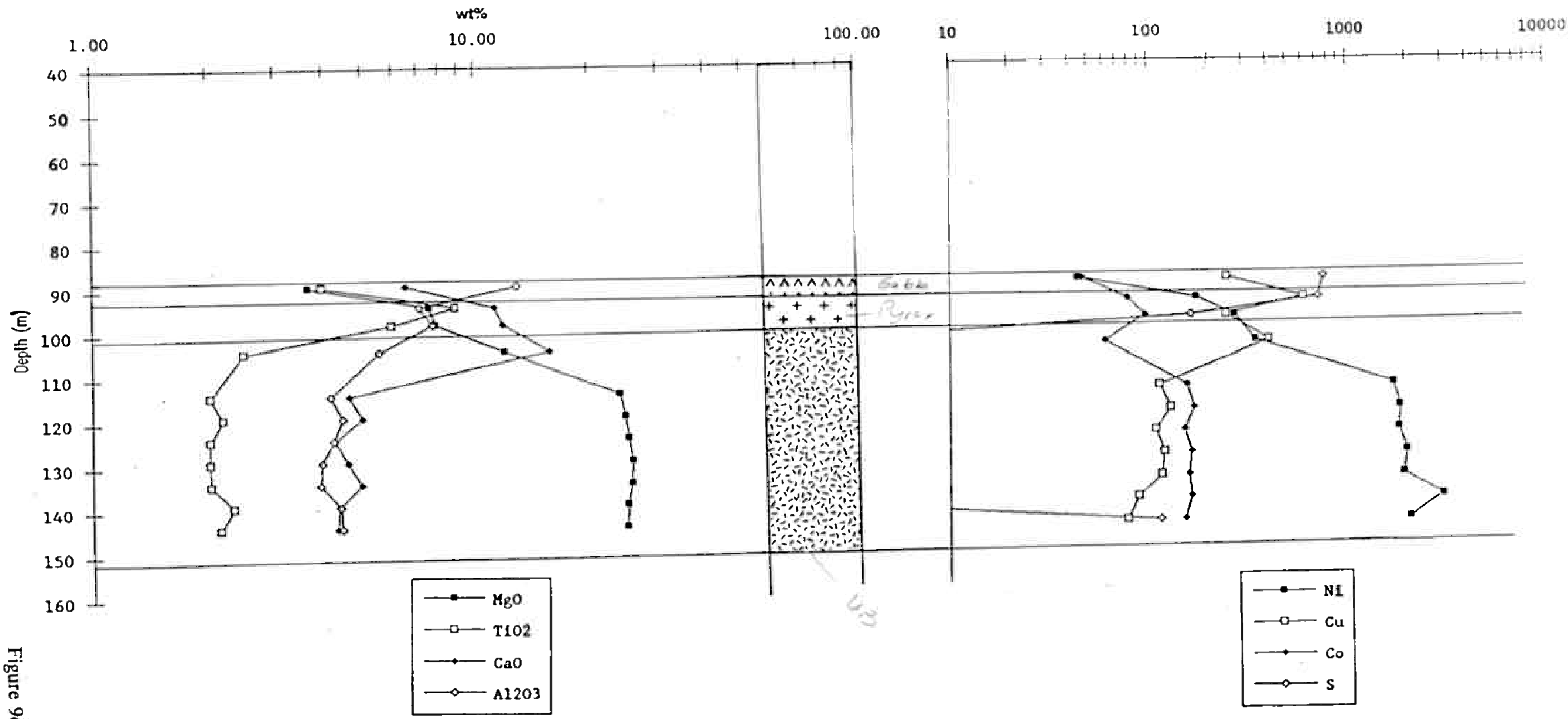
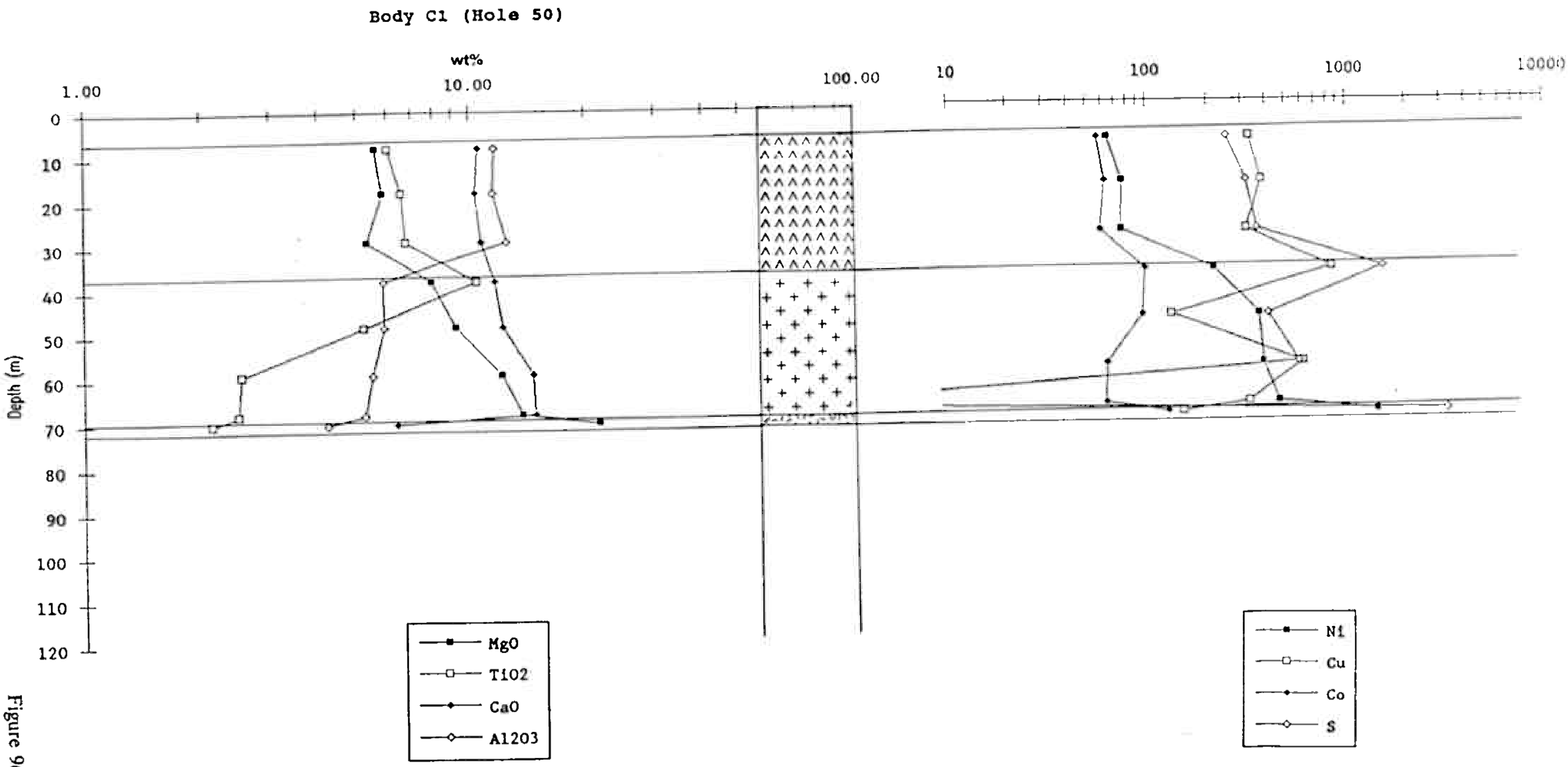


Figure 9c



Body C1 (Hole 50)
wt%
1.00
10.00
100.00
10
100
1000
10000
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
MgO
TiO2
CaO
Al2O3
Ni
Cu
Co
S

Figure 9d

Body C1 (Hole 51)

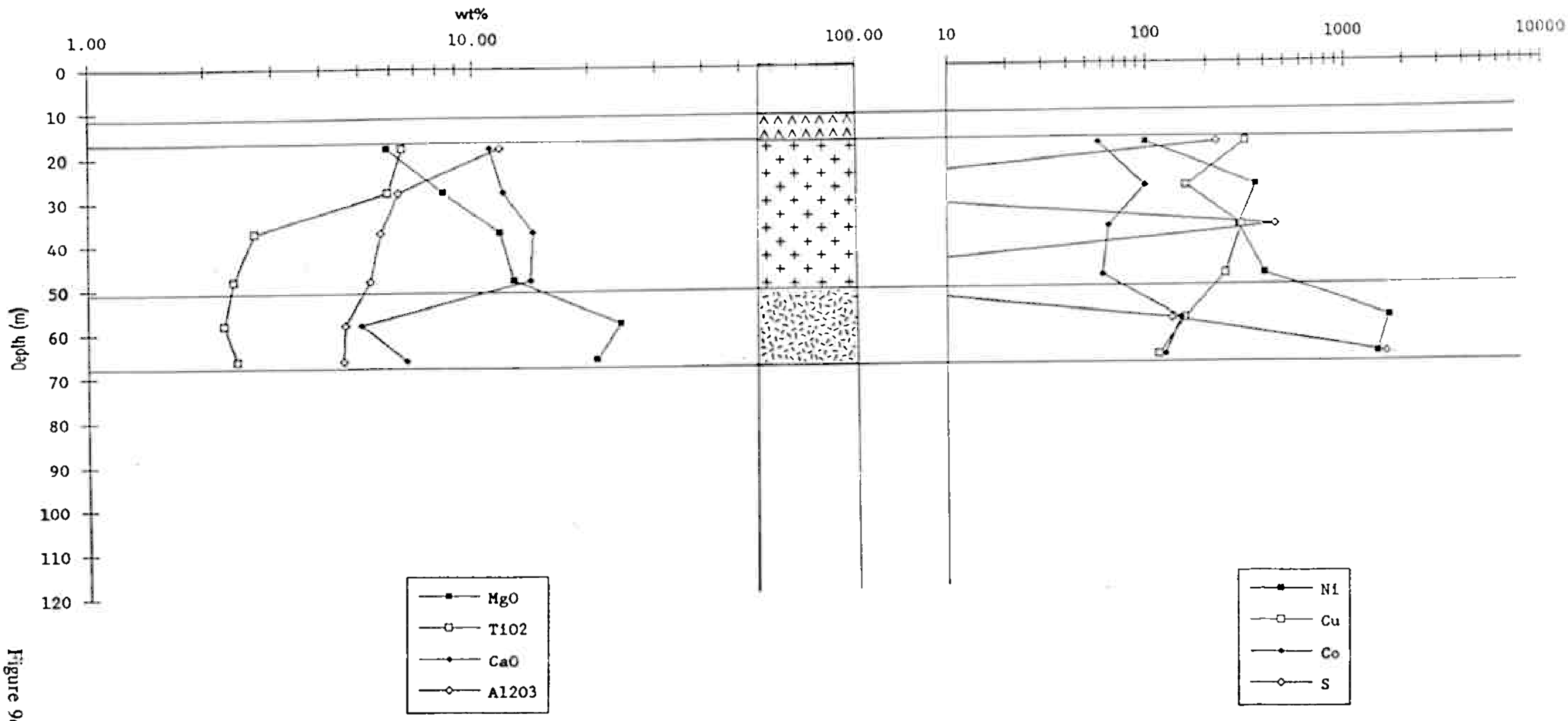
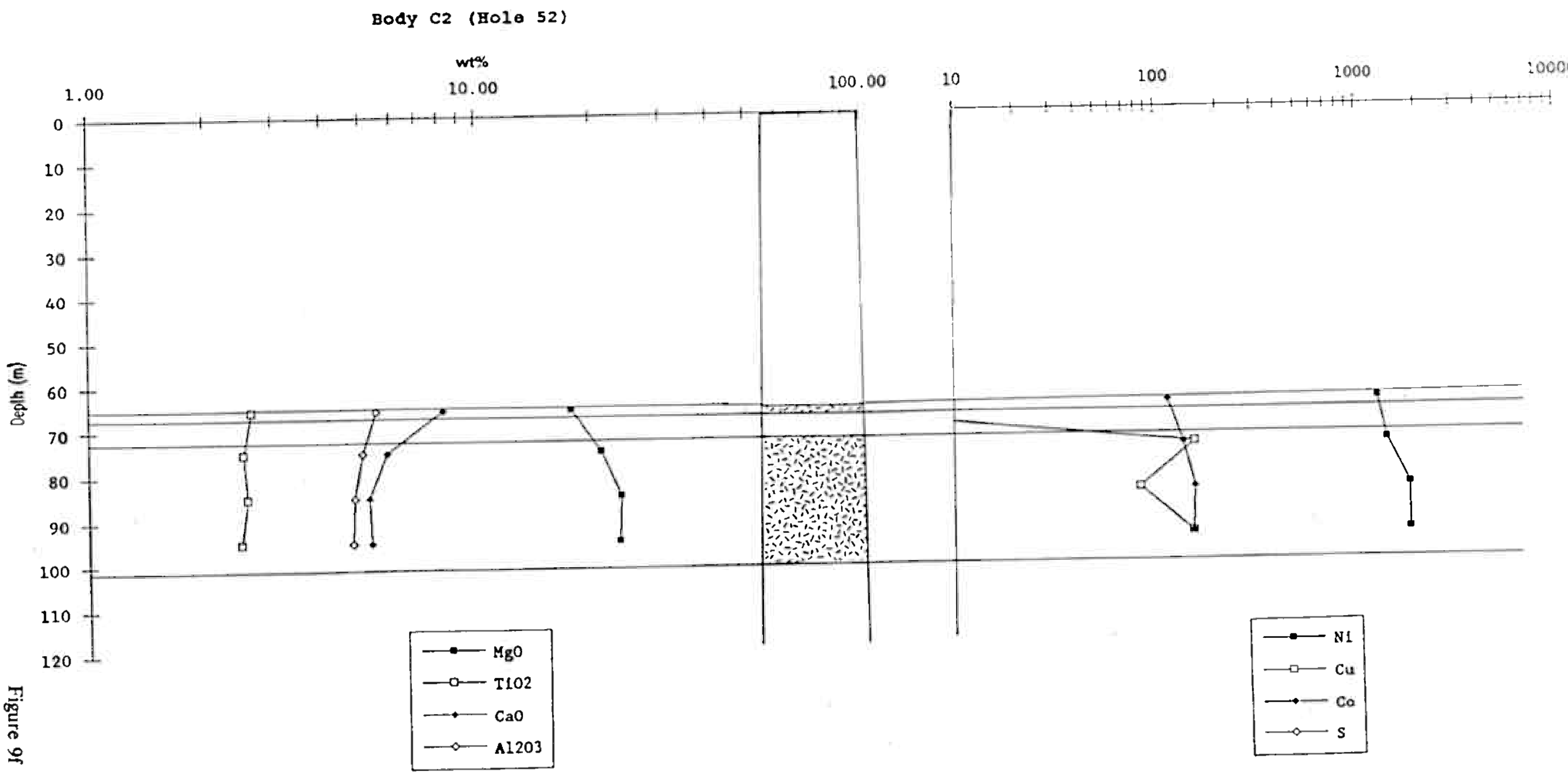
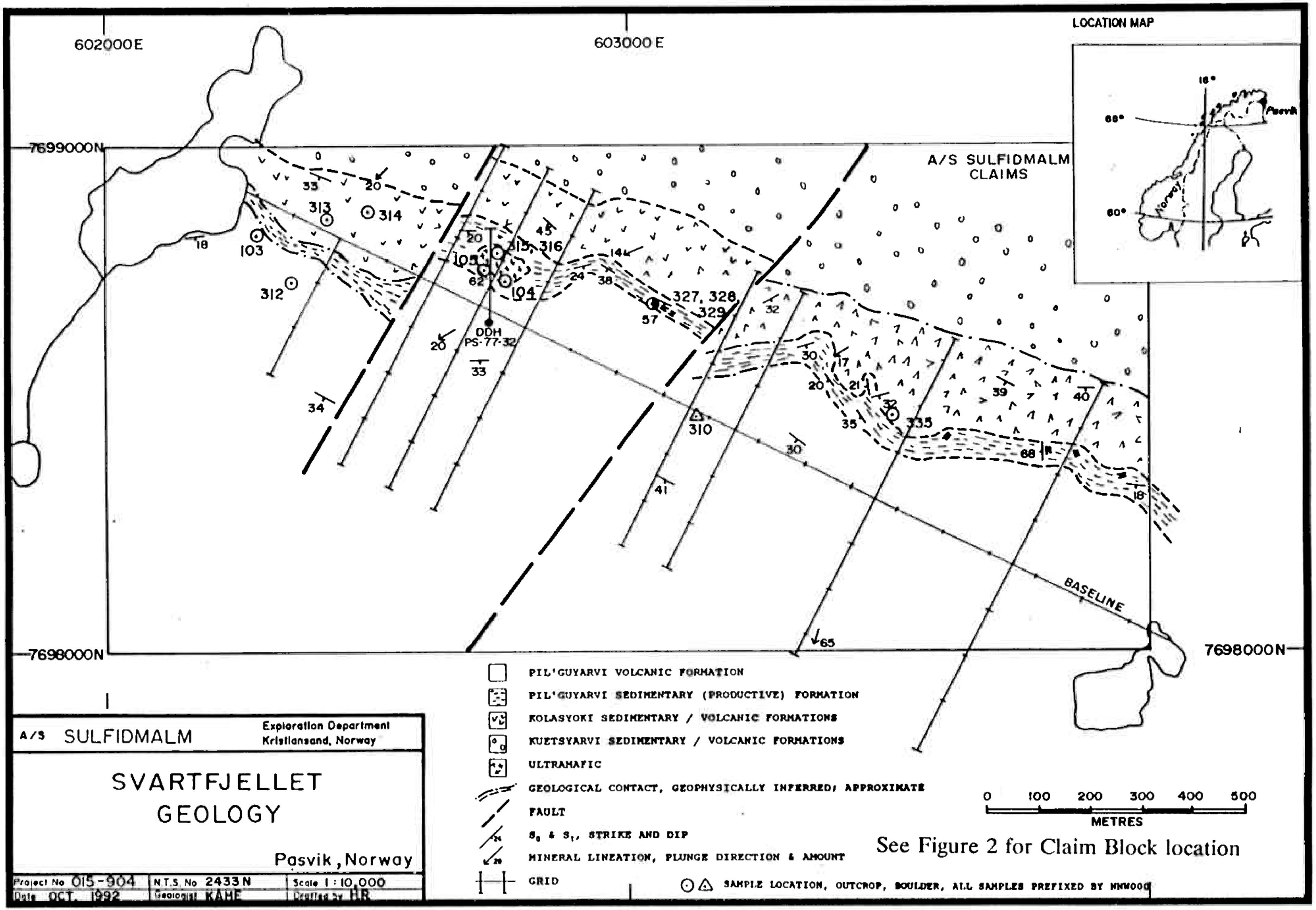


Figure 9e



Body C2 (Hole 52)
wt%
1.00
10.00
100.00
10
100
1000
10000
Depth (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
MgO
TiO2
CaO
Al2O3
Ni
Cu
Co
S

Figure 9f



See Figure 2 for Claim Block location

Figure 10

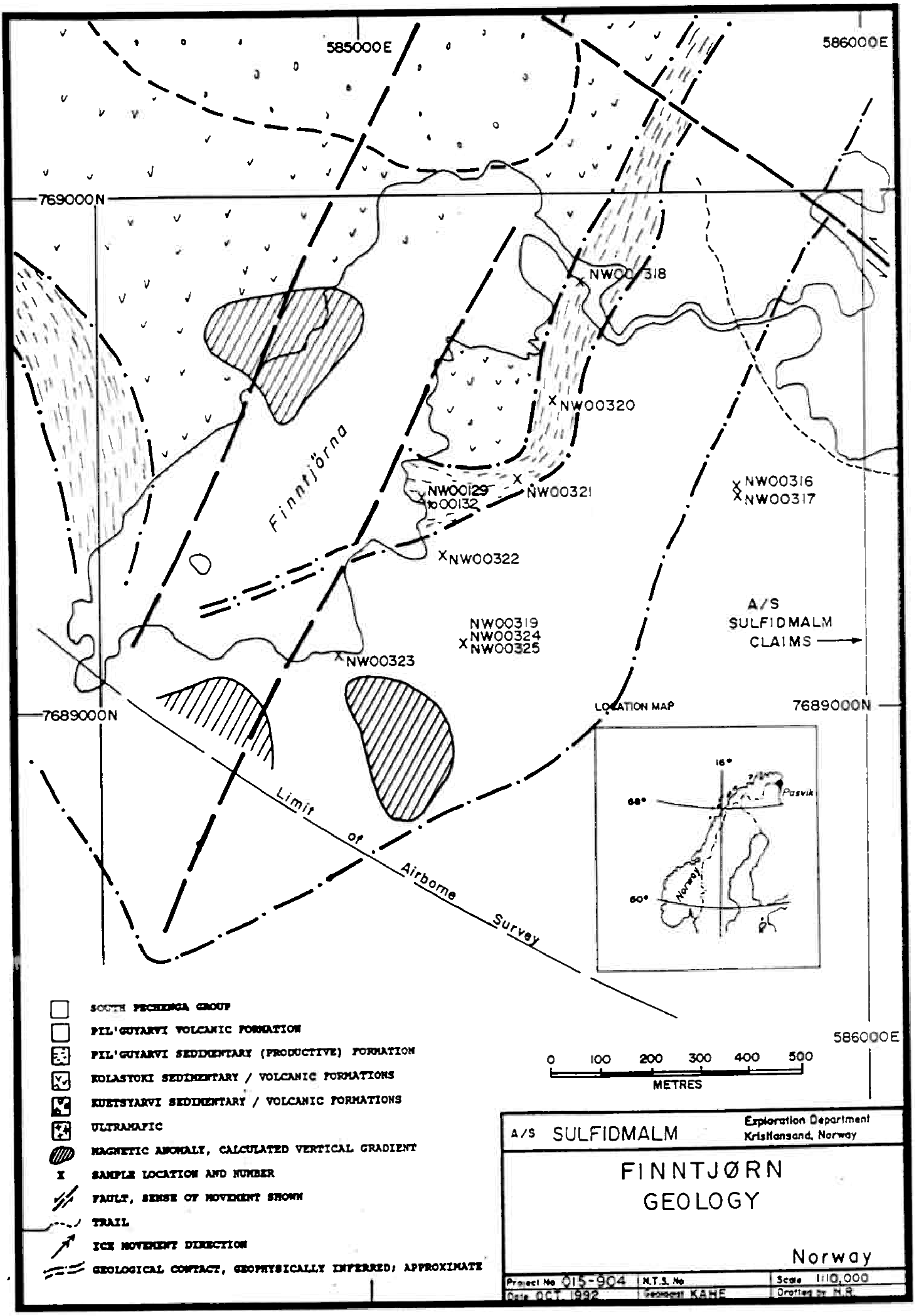
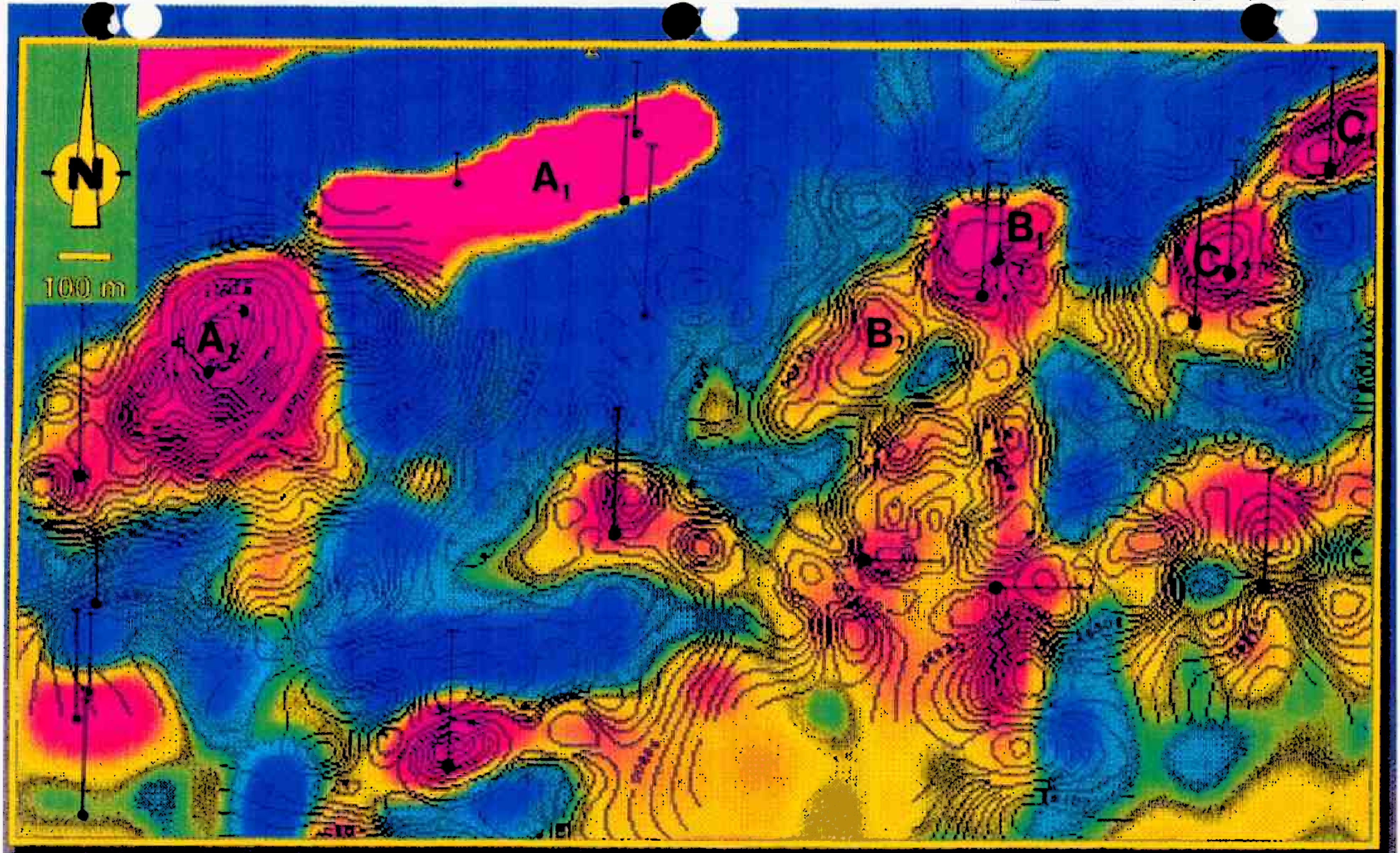
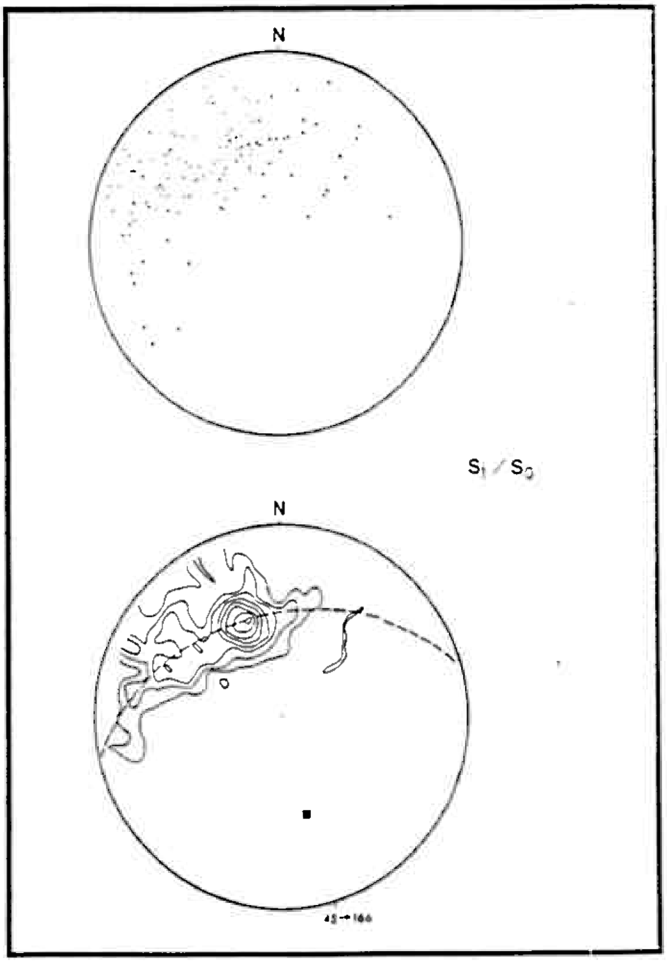

585000E
586000E
769000N
NW00318
NW00320
Finntjörna
NW00129
to 00132
NW00321
NW00316
NW00317
NW00322
NW00319
NW00324
NW00325
A/S
SULFIDMALM
CLAIMS
NW00323
LOCATION MAP
7689000N
16°
68°
60°
Pasvik
Norway
Limit of Airborne Survey
586000E
0 100 200 300 400 500
METRES
SOUTH PECHENGA GROUP
PIL'GUYARVI VOLCANIC FORMATION
PIL'GUYARVI SEDIMENTARY (PRODUCTIVE) FORMATION
KOLASYOKI SEDIMENTARY / VOLCANIC FORMATIONS
KUETSYARVI SEDIMENTARY / VOLCANIC FORMATIONS
ULTRAMAFIC
MAGNETIC ANOMALY, CALCULATED VERTICAL GRADIENT
SAMPLE LOCATION AND NUMBER
FAULT, SENSE OF MOVEMENT SHOWN
TRAIL
ICE MOVEMENT DIRECTION
GEOLOGICAL CONTACT, GEOPHYSICALLY INFERRED; APPROXIMATE
A/S SULFIDMALM
Exploration Department
Kristiansand, Norway
FINNTJØRN
GEOLOGY
Norway
Project No 015-904
N.T.S. No
Scale 1:10,000
Date OCT 1992
Geologist KAHF
Drafted by H.R.

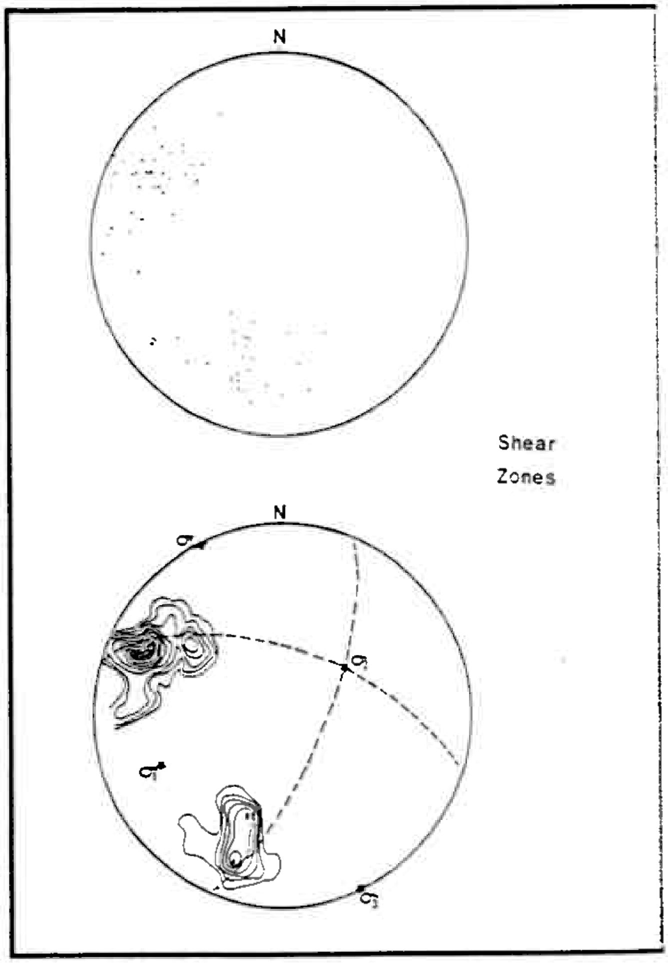
Figure 11



EASTERN OKSFJELL AREA
PASVIK NORWAY
CALCULATED VERTICAL GRADIENT
TYPE 2 ULTRAMAFICS

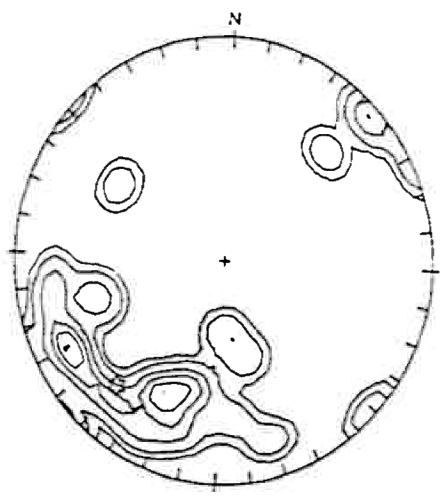
Figure 12





Mineral Lineations

Oksfjell, Pasvik



Contours:
1 2 4 6 8 10

n = 54

Average = 219° Az, Plunge 26°

Figure 13

PECHENGA NI-CU ORES

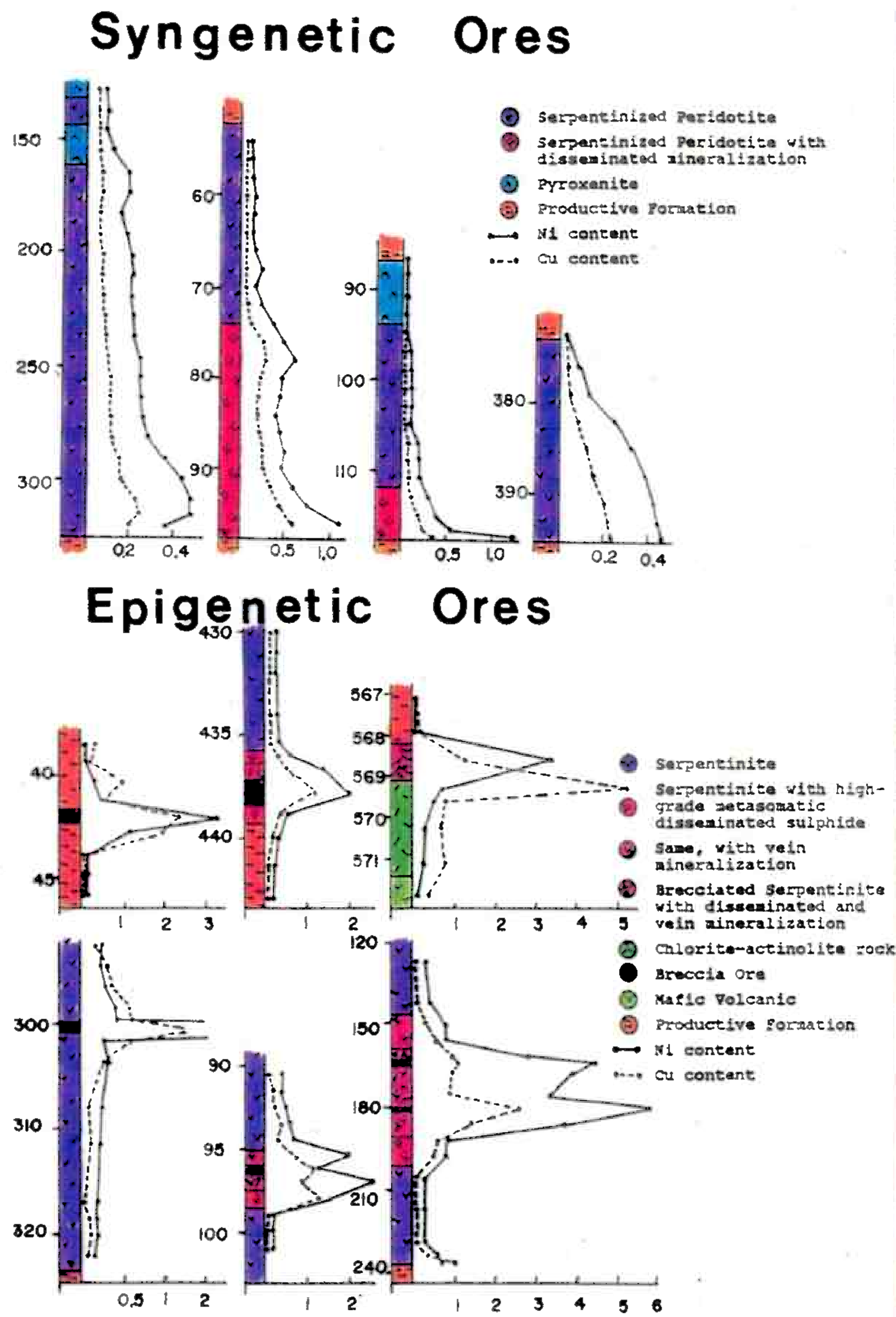


Figure 14

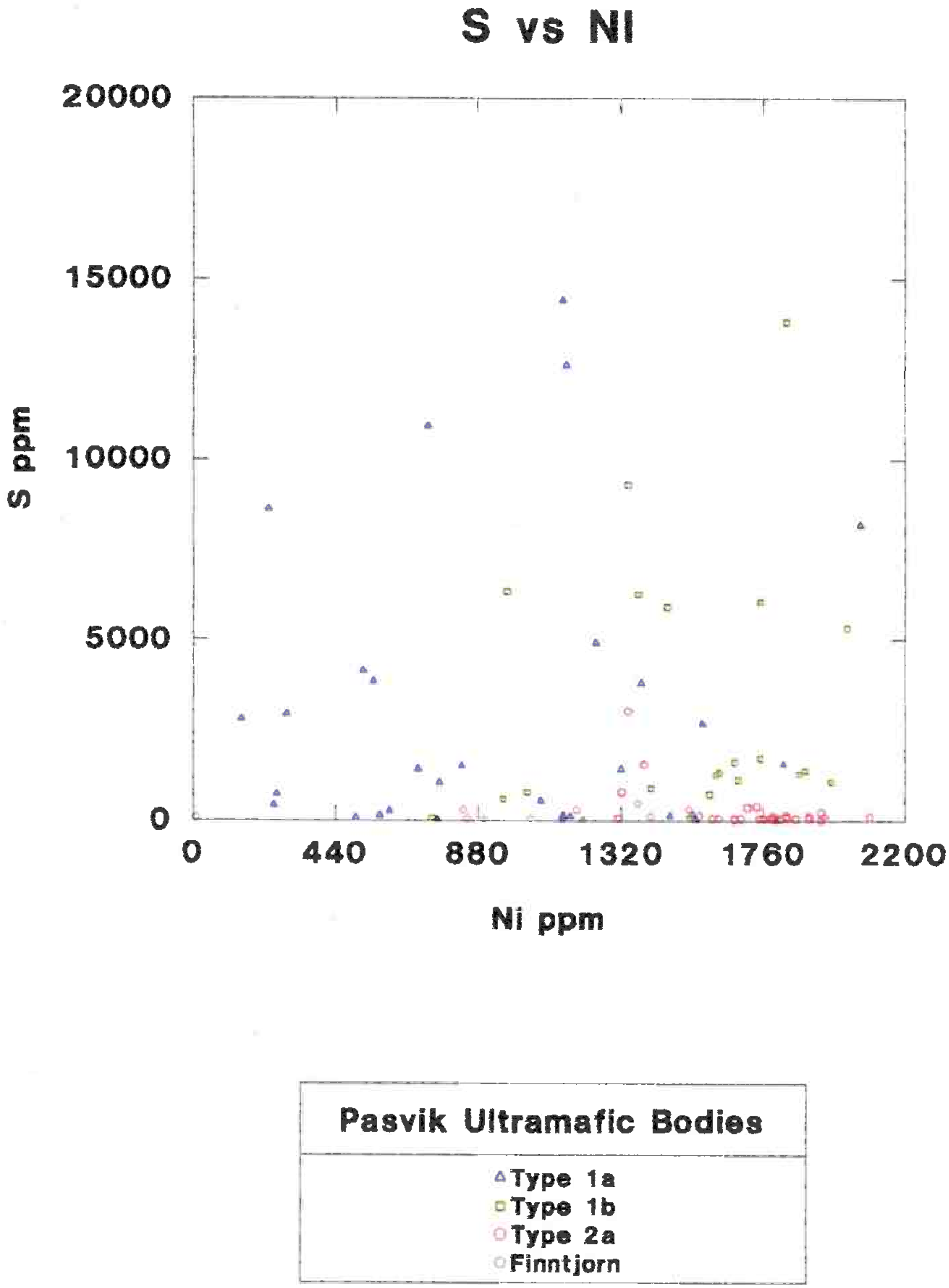

S vs NI
20000
15000
10000
5000
0
S ppm
0
440
880
1320
1760
2200
Ni ppm
Pasvik Ultramafic Bodies
Type 1a
Type 1b
Type 2a
Finntjorn

Figure 15

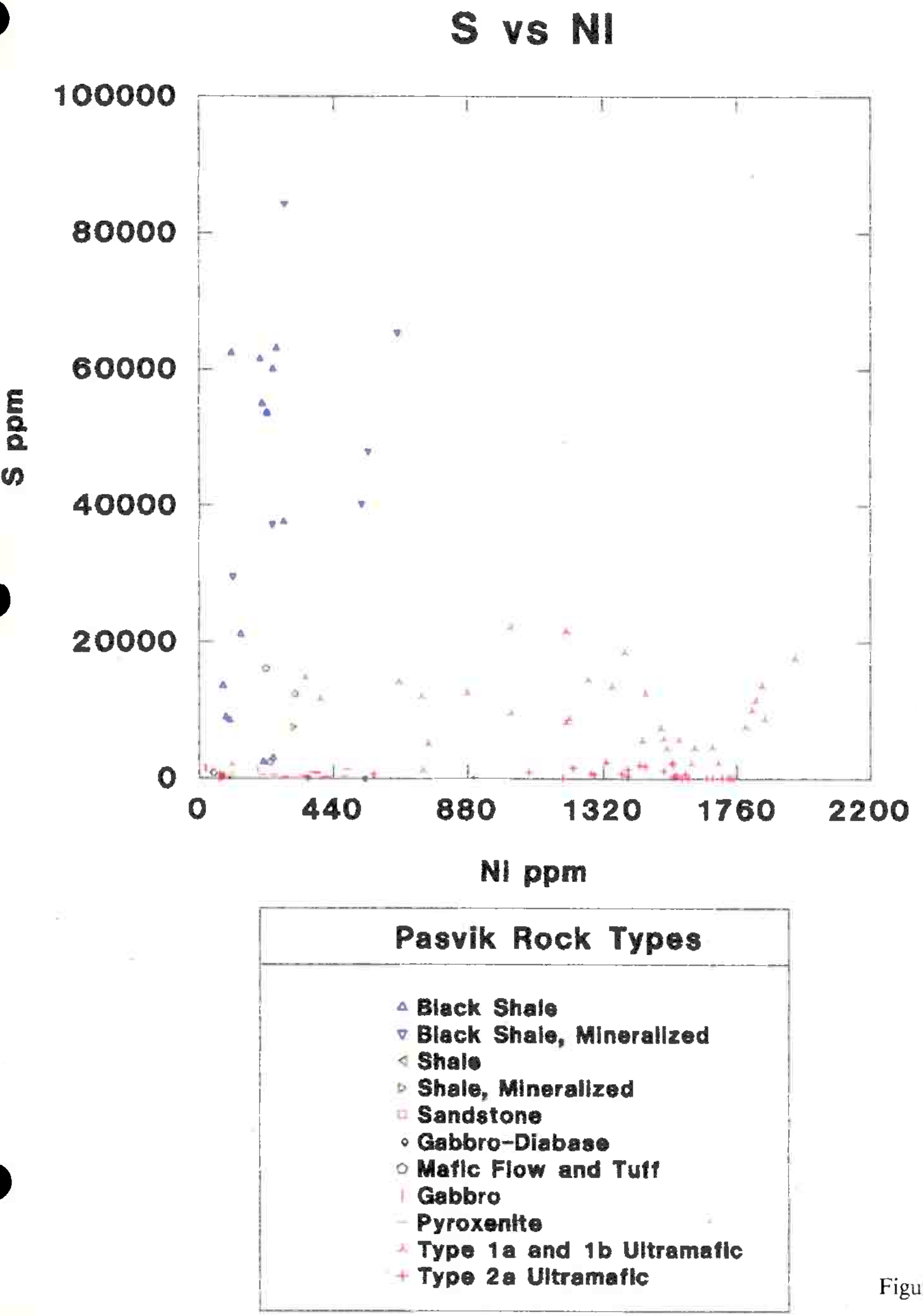
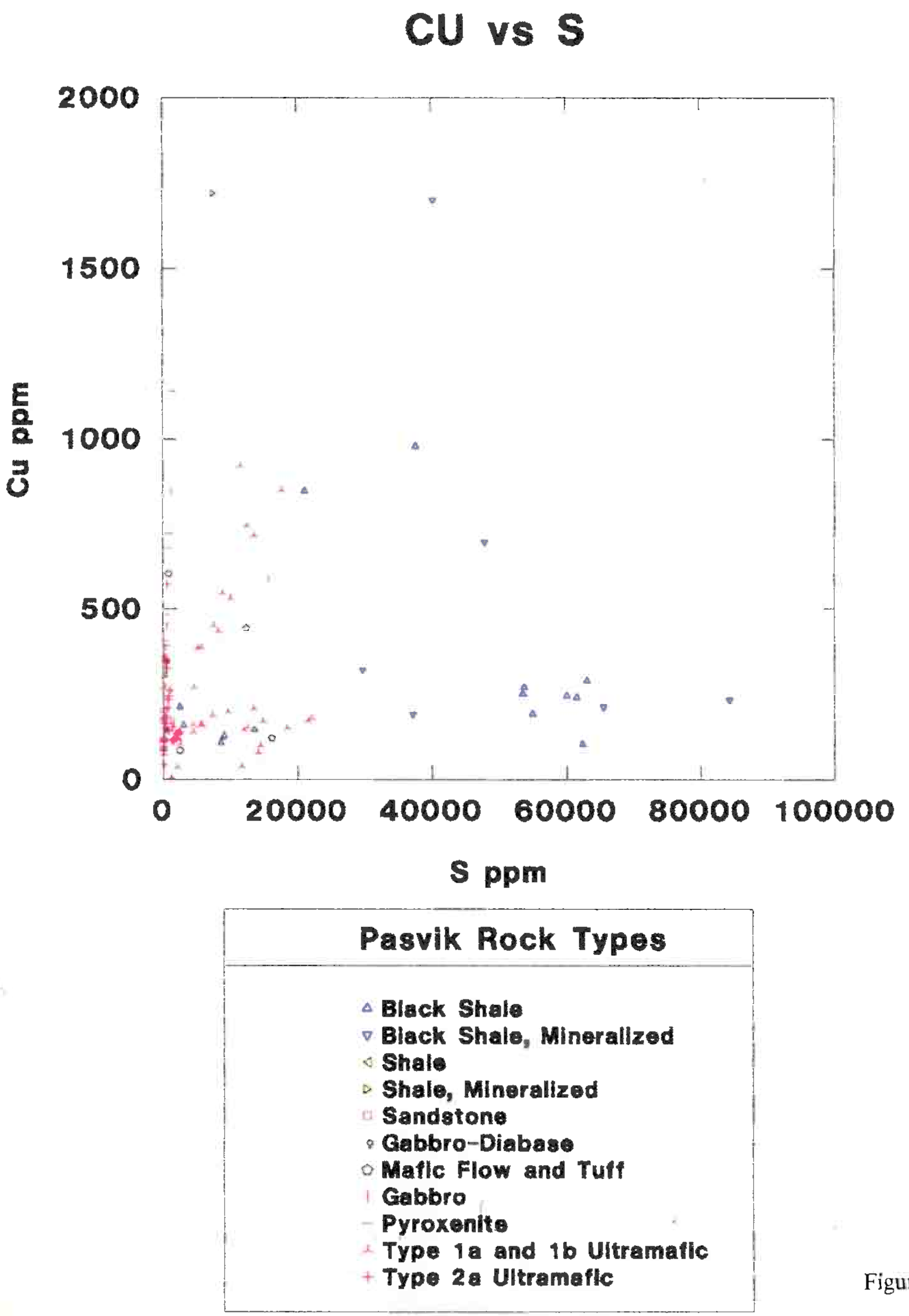
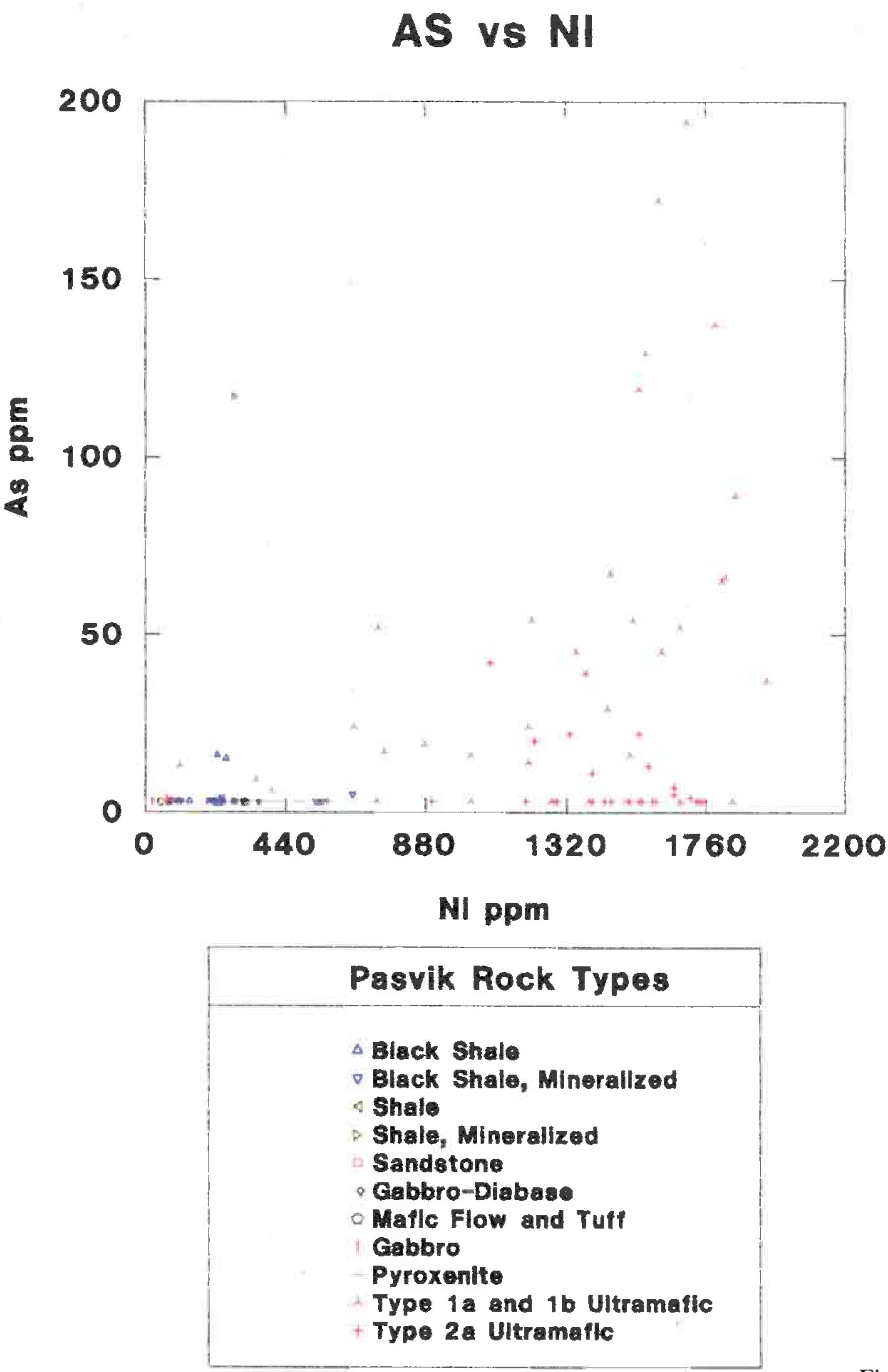

S vs Ni
100000
80000
60000
40000
20000
0
S ppm
0
440
880
1320
1760
2200
Ni ppm
Pasvik Rock Types
Black Shale
Black Shale, Mineralized
Shale
Shale, Mineralized
Sandstone
Gabbro-Diabase
Mafic Flow and Tuff
Gabbro
Pyroxenite
Type 1a and 1b Ultramafic
Type 2a Ultramafic

Figure 16a



CU vs S
Cu ppm
S ppm
0
500
1000
1500
2000
0
20000
40000
60000
80000
100000
Pasvik Rock Types
Black Shale
Black Shale, Mineralized
Shale
Shale, Mineralized
Sandstone
Gabbro-Diabase
Mafic Flow and Tuff
Gabbro
Pyroxenite
Type 1a and 1b Ultramafic
Type 2a Ultramafic

Figure 16b



AS vs NI
As ppm
0
50
100
150
200
Ni ppm
0
440
880
1320
1760
2200
Pasvik Rock Types
Black Shale
Black Shale, Mineralized
Shale
Shale, Mineralized
Sandstone
Gabbro-Diabase
Mafic Flow and Tuff
Gabbro
Pyroxenite
Type 1a and 1b Ultramafic
Type 2a Ultramafic

Figure 16c

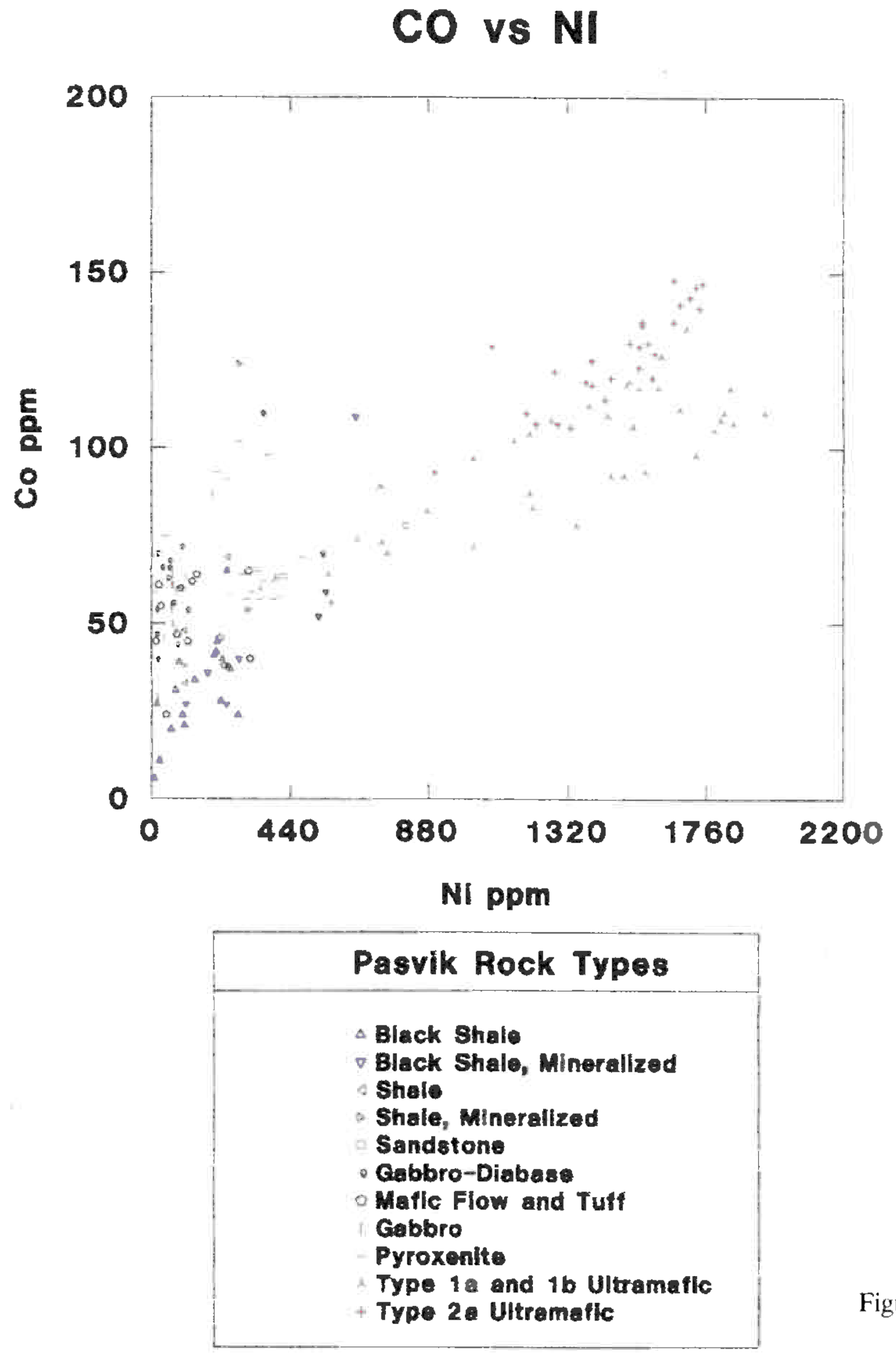

CO vs NI
200
150
100
50
0
Co ppm
0
440
880
1320
1760
2200
Ni ppm
Pasvik Rock Types
Black Shale
Black Shale, Mineralized
Shale
Shale, Mineralized
Sandstone
Gabbro-Diabase
Mafic Flow and Tuff
Gabbro
Pyroxenite
Type 1a and 1b Ultramafic
Type 2a Ultramafic

Figure 16d

TABLES.

TABLE 1

PREVIOUS WORK IN PASVIK, NORWAY		
Year	**Activity**	**Results**
1957	1:20,000 Geological Mapping	Found extension of Pechenga Group in Pasvik
1960	NGU Airborne Em/Mag Survey	1:50,000 maps showing Pasvik Pechenga Group
1961	NGU Ground Mag, EM, SP	Outlined conductive zones
1965	NGU Stream Sed Geochemistry	Ni+Cu anomaly near Skogfoss
1968	Terratest helicopter EM/Mag Survey over 96 km2, 915 line km	1:20,000 maps over most of Pasvik Pechenga Group
1971	Drilling of 3 holes (1 to 3) by A/S Sydvaranger	Hole 1 intersected 60m of unmineralized ultramafic
1972	Falconbridge became involved	
1973	Till Geochemistry Survey Ground EM, Mag, VLF Drilling of 13 holes (4 to 16) Geological Mapping (1:20,000) Boulder Tracing	Definition of Drill Targets Definition of Drill Targets No significant ore-bearing ultramafic bodies Definition of Crude Stratigraphy of Pechenga Group in Pasvik Po-Cpy mineralized boulders found at Skjellbekken, Skogfoss and Kobbfoss
1974	Grid cutting and VLF Geological Mapping	Definition of Drill Targets Outlining of 50 X 250m ultramafi body in Oksfjell West
1975	Drilling of 15 holes (17 to 31)	DDH 29 cut 0.332% Ni & 0.15% Cu over 1.7m in a thin ultramafic
1977	Drilling of 3 holes (32 to 34)	Unmineralized ultramafic bodies intersected in holes 32 and 34
1981	Detailed Oksfell mapping Drilling of 5 holes (36 to 40)	Recognition of possible structural control on ultramafics No significant results nor down-plunge extension of mineralized DDH 29 ultramafic found
1982	Drilling of 1 hole (41)	Large (108.61m) unmineralized ultramafic-gabbroic body
1991	NGU/Aerodat helicopter AEM survey flown over whole Pasvik Pechenga Group Drill core re-logging Geological Mapping Ground EM/Mag	Outlined full extent of Productive Formation (from Russia to Finland) and several ultramafics Showed similarity of Pasvik Pechenga Group' to Russian Pechenga Group in terms of stratigraphy and ultramafics Refined Geological contacts & Russian-Norwegian correlation, and defined structural history Definition of Drill Targets in Oksfjell East

TABLE 2

PECHENGA DEPOSITS - RESERVES AND PRODUCTION						
Deposit	**Ore** 10 mt	**Ni** %	**content** 10 mt	**Co** %	**content** 10 mt	**Production**
Western Group						
Kaula	18	2.5	0.45	0.03	0.005	1.4 mt/a @ 0.7% Ni
Kotselvaara	18	1.1	0.198	0.02	0.004	
Kammikivi						
Semiletka						
(West Ortoaivi)						
Central Group	110	1.8	1.98	0.05	0.053	
East Ortoaivi						
N. Soukerjoki						
Mirona						
Eastern Group						
Sputnik						
Severny	13.8	2.11	0.29			0.65 mt/a, 1.4% Ni+Cu
Zhdanov	135	0.56	0.76	0.05	0.057	6 mt/a @ 0.51% Ni

Source: Green, 1991; German reserve estimates, 1989.

absolutt ikke åpen!

TABLE 3

PECHENGA-PASVIK STRATIGRAPHIC CORRELATION					
FORMATION	MEMBER	Thick ness (m)		Location of Differentiated Type 2 Gb-Um Bodies	
		PECHENGA	PASVIK	PECHENGA	PASVIK
Pil'guyarvi Volcanic	Upper	>2500	0-300		
	Lower	0-500	0-250		
Pil'guyarvi Sedimentary (Productive)	Upper (Lammas)	0-700	—	***	
	Middle	0-400	0-200	***	
	Lower	0-400	0-300	***	***
Kolasyoki Volcanic	Upper Basalt	0-1000	0-500	***	***
	Graywacke	0-300	0-50	***	
	Lower Basalt	0-1000	0-100		
Kolasyoki Sedimentary	Black Shale	0-40	0-50		
	Dolomite	0-40	0-30		
	Red Bed	0-120	0-25		
Kuetsyarvi Volcanic	Upper Basalt	150-900	20-100		
	Orshoayvi	100-600	10-500		
	Lower Basalt	50-100	20-500		
Kuetsyarvi Sedimentary	Dolomite	0-110	0-20		
	Quartzite	0-90	0-30		
Akhmalahti Volcanic		800-2000	50-1600		
Akhmalahti Sedimentary		0-200	0-200		
Source: Melezhik et al., 1992					

TABLE 4

SUMMARY OF PASVIK ULTRAMAFIC BODIES INTERSECTED			
TYPE 1 BODIES			
Hole	Ultramafic Intersections (depth downhole, m)	No. of Bodies	Thicknesses (m)
TYPE 1A BODIES			
5	59.00-61.00; 63.00-63.50	2	2; 0.5
6	56.86-57.77; 51.43-56.23; 70.32-70.82; 70.93-72.41	4	0.91; 4.8; 0.5; 1.47
16	40.00-42.00	1	2
25	64.32-70.00; 78.50-80.00	2	5.68; 1.5
29	45.00-56.42; 63.55-67.78	1	0.73
33	48.00-50.10; 57.00-62.70; 63.60-68.60	3	2.1; 5.7; 5
34	46.37-48.00	1	1.63
36	139.55-140.65; 164.45-164.85	2	1.1; 0.4
37	130.9-133.3; 150.45-151.75; 267.5-270.4; 273.1-273.3	4	2.4; 1.3; 2.9; 0.2
42	88.10-92.45; 100.45-109.22	2	4.35; 8.77
45	92.22-95.50; 95.68-96.40; 126.72-129.81; 134.47-138.81	4	3.28; 0.72; 3.09; 4.34
48	27.60-31.30; 37.45-39.60; 50.10-53.65	3	3.7; 2.15; 3.55
49	9.14-14.42	1	5.28
TYPE 1B BODIES			
25	32.90-49.14; 51.60-64.00	2	16.24; 12.4
29	45.00-56.42	1	24.09
32	30.00-66.00	1	36
34	3.85-9.10; 11.40-14.73; 17.25-21.60; 27.03-42.40	4	5.25; 3.33; 4.35; 15.37
36	80.80-100.60; 105.30-124.40	2	19.8; 19.1
48	56.20-66.30	1	10.1

TYPE 2A BODIES											
	Intersections (depth downhole, m)						Total	Thickness (m) / Proportion of Body			
Hole/Body	Gabbro		Pyroxenite		Ultramafic		Thickness	Gabbro	Pyroxenite	Ultramafic	UM:Mafic Ratio
	Start	Finish	Start	Finish	Start	Finish					
Body A1											
1	64.08	67.65			67.65	131.00	67.22	3.57/5%		63.65/95%	19.00
					150.50	161.75	11.25			11.25/100%	
30	27.73	35.3			35.30	62.50	34.77	7.57/22%		27.2/78%	3.54
39	7.45	16.35			16.35	67.10	59.65	8.9/15%		50.75/85%	5.67
Body A2											
41	131.49	147.28			147.28	240.10	108.61	15.79/15%		92.82/85%	5.67
Body B1											
44	89.33	92.95	92.95	108.57	108.57	150.05	60.72	3.62/6%	15.62/26%	41.48/68%	2.12
Body C1											
50	7.00	37.12	37.12	69.00	69.00	71.64	64.64	30.12/47	31.88/49%	2.64/4%	0.04
51	11.80	16.86	16.86	51.00	51.00	67.65	55.85	5.06/9%	34.14/61%	16.65/30%	0.43
Body C2											
43					121.54	125.06	3.52			3.52	---
52					72.81	101.65	28.84			28.84	---

PECHENGA TYPE 2B BODIES					
Deposit	Total	Thickness (m)			
	Thickness	Gabbro	Pyroxenite	Ultramafic	UM:Mafic Ratio
WESTERN					
Kaula-I	246	93/38%	6/2%	147/60%	1.50
Kaula-II	218	55/25%	8/4%	155/71%	2.45
Kammikivi	90	20/22%	5/6%	65/72%	2.57
Western Ortalvi	180	57/31%	3/2%	120/67%	2.03
Eastern Ortulvi	90	64/71%	0%	26/29%	0.41
EASTERN					
Soukejorky	185	80/43%	0%	105/57%	1.32
Rajsolvy	95	40/42%	5/5%	50/53%	1.13
Pil'guyarvi	468	320/69%	11/2%	135/29%	0.41

TABLE 5

SELECTED METAL-ENRICHED PASVIK SAMPLES								
Sample	Drill Hole	Intersection		Ni	Cu	Co	As	S
		From	To					
1a ULTRAMAFIC								
NW00240	45	134.58	135.00	1950	848	110	37	17600
NW00361	48	65.00	66.30	1840	715	117	3	13500
NW00371	48	38.05	38.60	1820	920	110	67	12400
NW00370	48	37.50	38.05	1460	743	92	66	11400
1b ULTRAMAFIC								
AF09149	32	58.16	58.60	2640	291	160	---	1690
NW0027	near 25			2020	342	153	---	5330
NW0029	near 25			2790	303	180	---	4710
NW00169	48	60.00	60.50	3290	12	138	---	50
2a GABBRO								
NW00431	50	37.00	38.00	189	845	87	3	1230
NW00400	51	27.00	28.00	349	149	110	3	146
2a PYROXENITE								
NW00392	50	60.50	61.50	384	722	62	3	723
NW00404	51	46.50	47.00	482	1140	69	3	1380
NW00440	51	22.00	23.00	205	678	93	3	508
NW00442	51	42.00	43.00	387	720	57	3	944
GABBRO-DIABASE								
NW00244	46	129.00	129.90	763	903	90	3	50600
PRODUCTIVE FORMATION SHALE								
NW00215	48	60.00	60.50	136	847	34	3	21100
NW00246	46	131.00	131.50	531	1700	52	3	40200
NW00249	46	132.68	133.68	276	978	24	3	37600
NW00410	51	62.33	62.65	308	1720	54	3	7520
NW00351	47	27.49	28.00	280	294	124	117	15300
PRODUCTIVE FORMATION MAFIC TUFF								
NW00214	43	120.72	120.82	43	11800	73	3	25200
NW00417	52	67.00	67.50	47	604	24	3	828
* Background element values can be observed in S vs Ni, Cu vs S, As vs S and Co vs Ni plots								

TABLE 6

	PASVIK ULTRAMAFIC ROCKS							
	Type 1a (n=32)		Type 1b (n=24)		Type 2 (n=33)		Finntjorn (n=13)	
	Average	Range	Average	Range	Average	Range	Average	Range
SiO2	42.18	35.4-51.7	39.25	34.3-47.2	38.53	35.9-43.6	41.61	36.6-46.7
Al2O3	6.21	2.97-16.6	3.86	2.35-11	3.60	2.77-5.38	4.06	2.07-8.72
CaO	5.46	0.18-14.4	2.71	0.24-6.44	4.09	1.86-7.33	7.97	4.52-12
MgO	19.09	12.3-24.5	24.95	20.3-30.9	23.07	15.8-26.7	22.77	18.4-27.4
Na2O	0.07	0-0.12	0.07	0-0.10	0.02	0-0.07	0.07	0-0.24
K2O	0.11	0-0.71	0.01	0-0.02	0.03	0-0.23	0.03	0-0.16
Fe2O3	16.03	12.4-23.6	16.05	11.3-20.1	18.26	16.00-20.1	15.26	12.4-18.6
MnO	0.19	0.07-0.34	0.19	0.08-0.33	0.21	0.18-0.24	0.21	0.19-0.28
TiO2	1.42	0.237-2.41	1.08	0.187-1.59	1.76	1.33-2.46	1.02	0.538-1.79
P2O5	0.12	0.02-0.21	0.1	0.02-0.18	0.16	0.11-0.23	0.05	0.02-0.12
Cr2O3	0.25	0.03-0.37	0.42	0.27-0.72	0.22	0.12-0.28	0.23	0.12-0.34
LOI	7.23	3.08-14.8	10.51	5.23-15.8	9.24	4.00-11.3	5.71	2.85-10.4
SUM	98.35	94.8-100.63	99.27	95.9-100.77	99.10	96.5-100.22	99.1	97.6-100.4
S	7799	53-26000	2908	77-13800	363	<50-3010	314	<50-881
Ni	961	228-2060	1717	734-3290	1649	1310-1950	1090	776-1190
Cu	144	0-647	188	12-468	101	68-141	230	54-507
Co	86	48-146	130	85-180	139	100-162	98	69-175
Rb	12	0-31	18	0-31	8	<10-28	6	3-14
Sr	68	0-165	38	0-105	159	95-237	146	38-487
Zr	101	28-173	83	20-206	123	90-151	47	26-75
Nb	21	6-38	27	0-107	20	15-33	12	3-30
Ba	98	19-197	102	73-133	133	67-172	99	51-150