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Exploration 1992, along the Skogfoss arch in Pasvik, Finnmark.
Oksfjell, Svartfjell, Finntjørn areas.
Tekstdel med figurer, tabeller og borseksjoner og er et utdragdrag av BV 3842-3846.

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Sammendrag

Dette er en rapport for Prospekteringsfondet og omfatter tekstdel med figurer, tabeller og borseksjoner. Den kan betraktes som et utdragdrag av samlerapporten BV 3842-3846.Skogfoss - Oksfjellområdet i Pasvik.

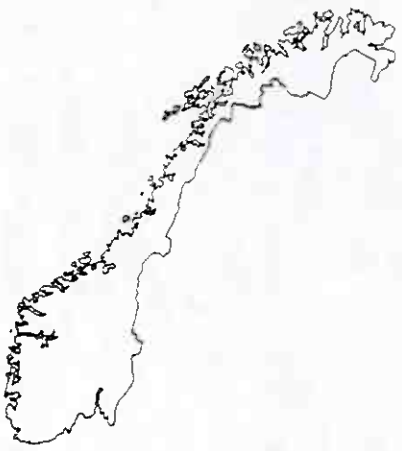
Se også:
BV 3842 Tekstdel med figurer og tabeller.
BV 3843 Apendix A. Summary of Oksfjell 1992 Drilling
BV 3844 Apendix B. Drill log and sections
BV 3845 Apendix C. A report on a combined helicopter-borne Mag, EM and VLF-EM survey in Pasvik.
BV 3846 Apendix D. Tecnical report for ground geophysical surves in Skogfoss, Pasvik

1992 EXPLORATION ALONG THE SKOGFOSS ARCH PASVIK, FINNMARK, NORWAY

A/S Sulfidmalm
January, 1993

1992 EXPLORATION ALONG THE SKOGFOSS ARCH

PASVIK, FINNMARK, NORWAY



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Prepared for
A/S Sulfidmalm

November, 1992

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i. Summary

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

Six differentiated gabbro-ultramafic bodies which are petrologically identical to Type 2b Pechenga ore hosts were defined in the Oksfjell East area. However, no significant Ni-Cu mineralization was intersected. In addition, the bodies' low stratigraphic position, relative to the Productive Formation, lack of Ni-sulphides and the low sulphur content of their ultramafic portions suggests that they are uniikely to host a Ni-Cu deposit and . 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 mineraliization 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. 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).

The nickel orebodies formed by the intrusion and extrusion of nickeliferous, ultramafic and mafic-ultramafic bodies into the Productive Formation, composed of significant amounts of sulphidic black shale. 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, in the Pechenga belt (Figure 4). 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

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 and is intruded by the largest ultramafic bodies.

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). 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.

3.3 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 on 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 6).

Results from the ground Mag and EM survey over the eastern Oksfjell area (Figure 5, 6) 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.

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. This is believed to be the deformation event which had the final control on the shape of the Type 2a ultramafic bodies at Oksfjell, and would probably control the shape of mineralized ore shoots.

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. 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 7a 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 ($r=0.107$). 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 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 8). 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 8), supporting the observed lack of Ni-sulphides.

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 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.

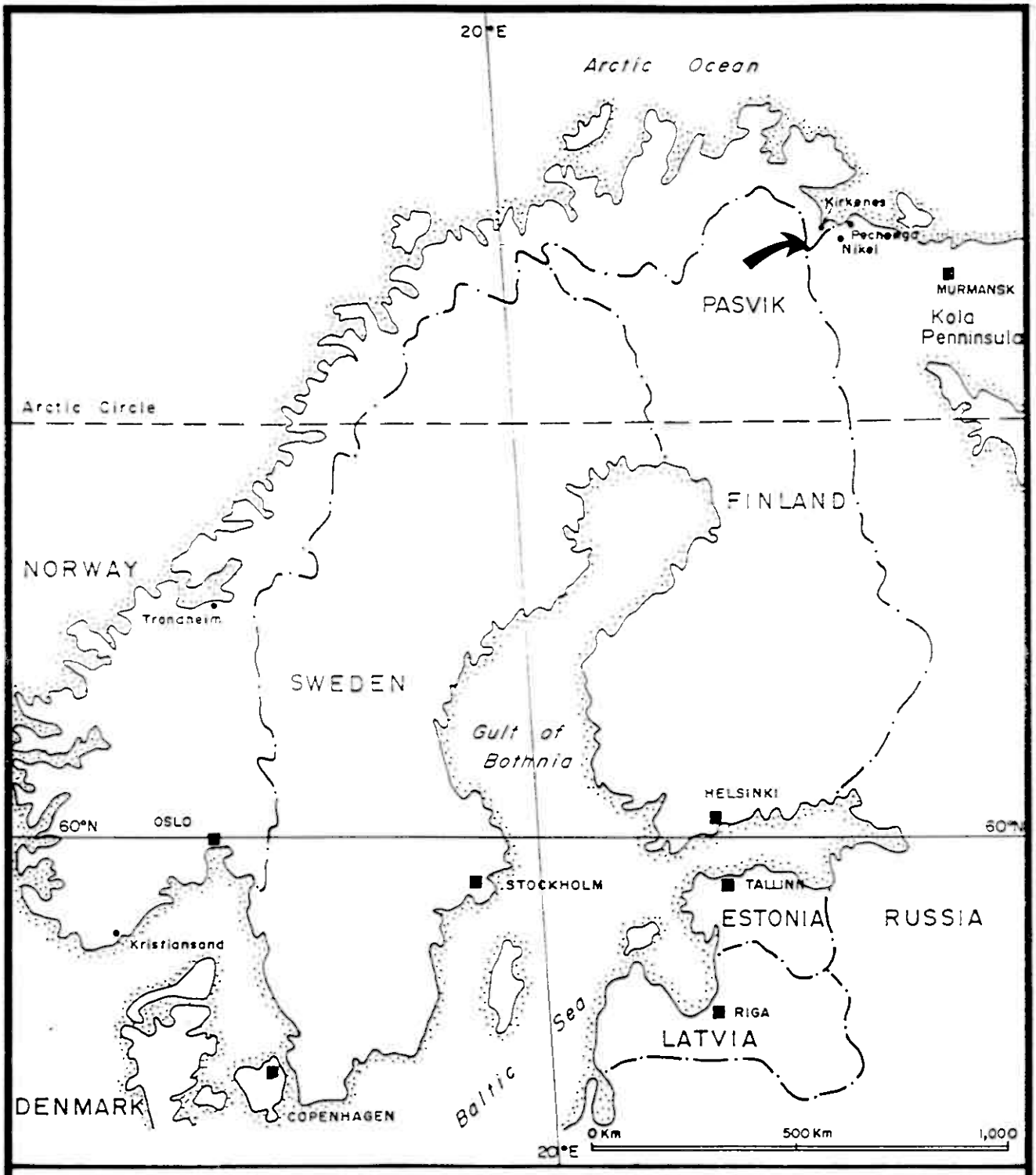
(2) Reduce the Oksfjell claim block to 10 claims of 25 ha each, to specifically cover the location of 1992 drilling of the ultramafic bodies.

(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.

Respectfully Submitted,

Ingrid Stadgen



A/S SULFIDMALM — Exploration Department, Kristiansand, Norway

PASVIK AREA LOCATION

SCALE:

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

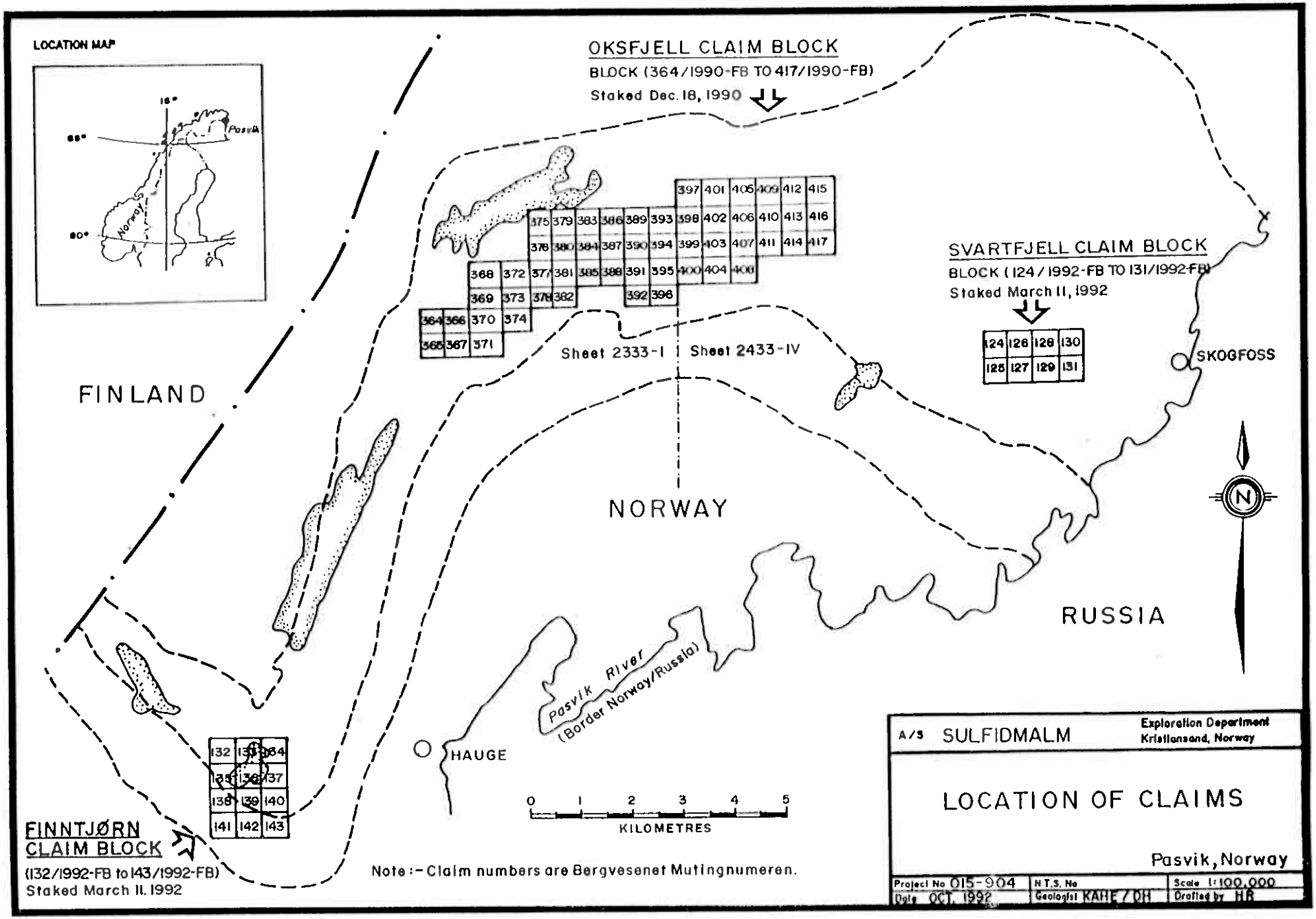

LOCATION MAP
Pasvik
Norway
OKSFJELL CLAIM BLOCK
BLOCK (364/1990-FB TO 417/1990-FB)
Staked Dec. 18, 1990
SVARTFJELL CLAIM BLOCK
BLOCK (124/1992-FB TO 131/1992-FB)
Staked March 11, 1992
Sheet 2333-I
Sheet 2433-IV
SKOGFOSS
FINLAND
NORWAY
RUSSIA
Pasvik River
(Border Norway/Russia)
HAUGE
FINNTJØRN
CLAIM BLOCK
(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
N.T.S. No
Scale 1:100,000
Date OCT. 1992
Geologist KAHE / OH
Drafted by HB

Figure 2

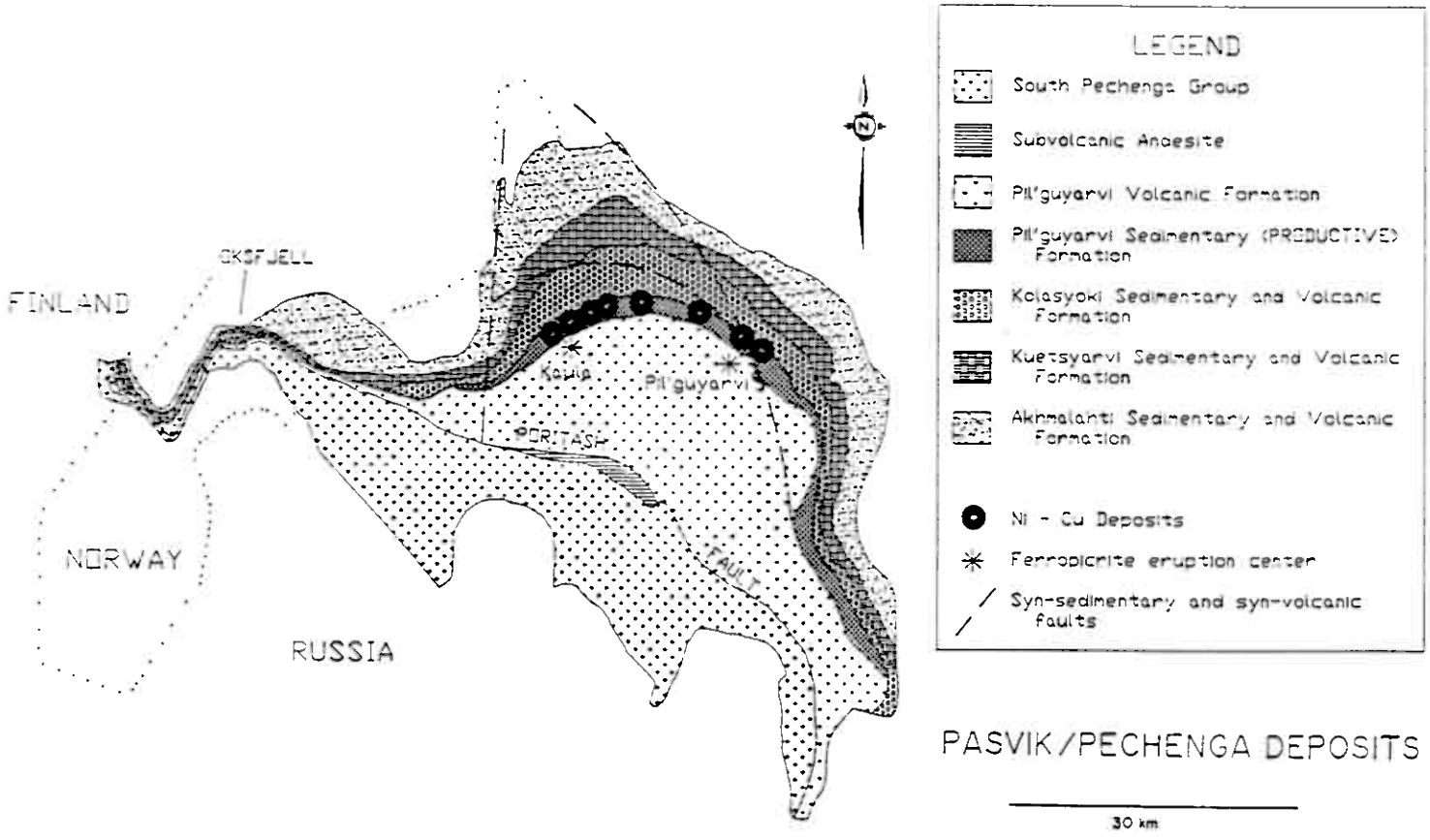

LEGEND
South Pechenga Group
Subvolcanic Andesite
Pil'guyarvi Volcanic Formation
Pil'guyarvi Sedimentary (PRODUCTIVE) Formation
Kolasyoki Sedimentary and Volcanic Formation
Kuetsyarvi Sedimentary and Volcanic Formation
Akhmalahti Sedimentary and Volcanic Formation
Ni - Cu Deposits
Ferropicrite eruption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

Figure 3

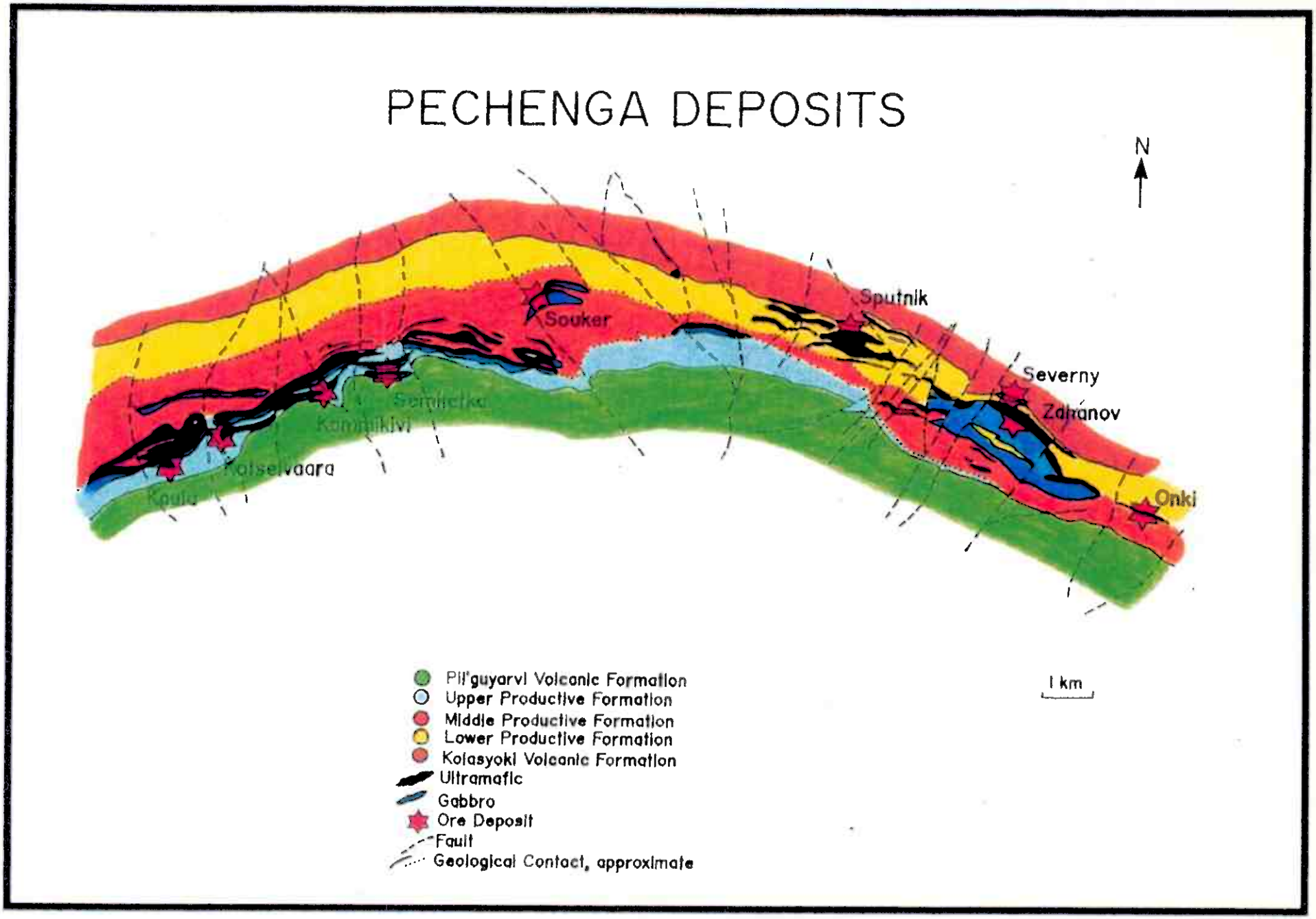

PECHENGA DEPOSITS
N
Souker
Sputnik
Severny
Zapanov
Onki
Kaula
Kammikivi
1 km
Pil'guyarvi Volcanic Formation
Upper Productive Formation
Middle Productive Formation
Lower Productive Formation
Kolasyoki Volcanic Formation
Ultramafic
Gabbro
Ore Deposit
Fault
Geological Contact, approximate

Figure 4

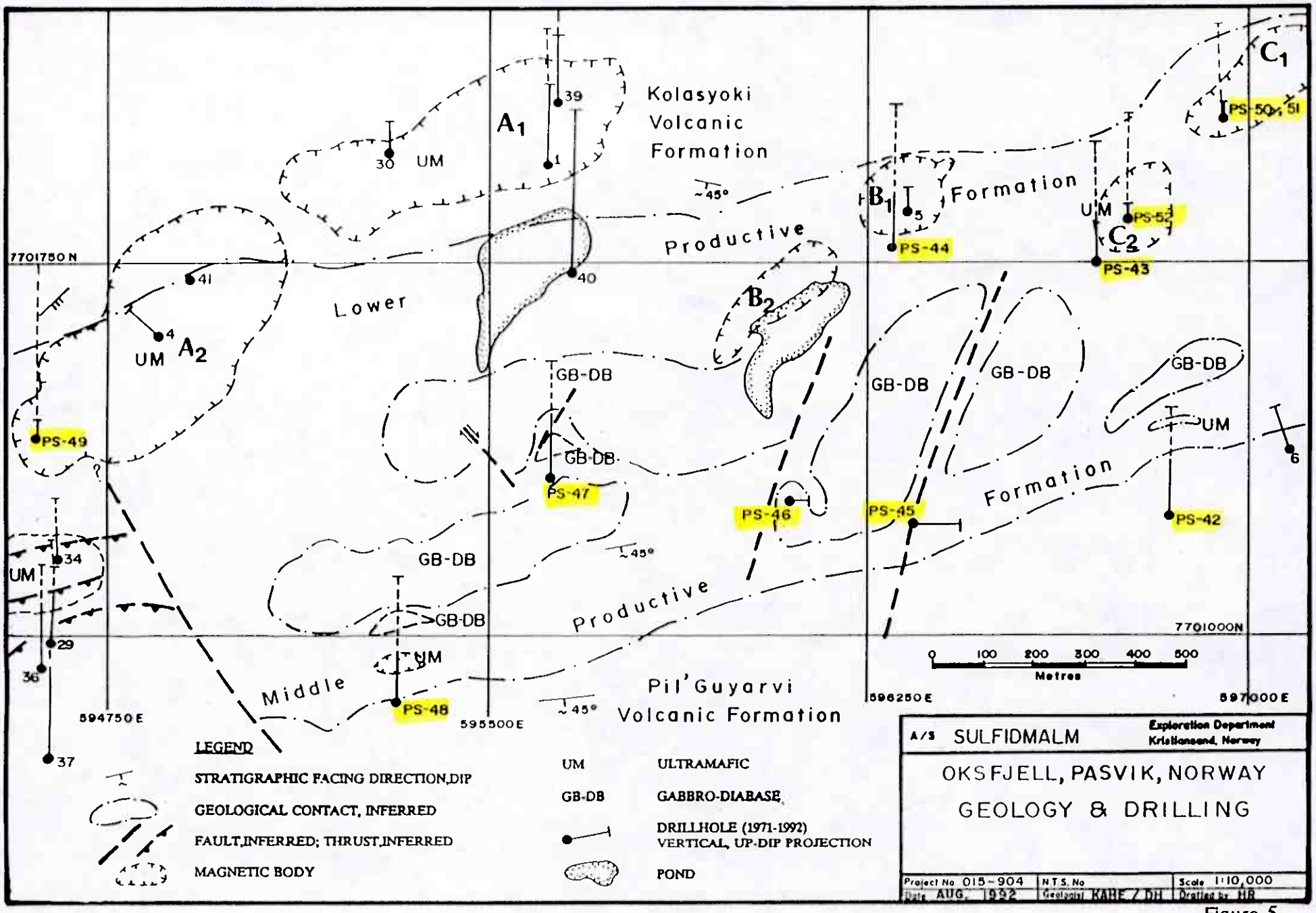

Kolasyoki Volcanic Formation
Productive Lower Formation
Productive Middle Formation
Pil'Guyarvi Volcanic Formation
A1
A2
B1
B2
C1
C2
UM
GB-DB
PS-42
PS-43
PS-44
PS-45
PS-46
PS-47
PS-48
PS-49
PS-50
PS-51
PS-52
7701750N
7701000N
594750E
595500E
596250E
597000E
0 100 200 300 400 500
Metres
LEGEND
STRATIGRAPHIC 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
NTS. No
Scale 1:10,000
Date AUG. 1992
Geologist KARE Z DH
Drafting by HB

Figure 5

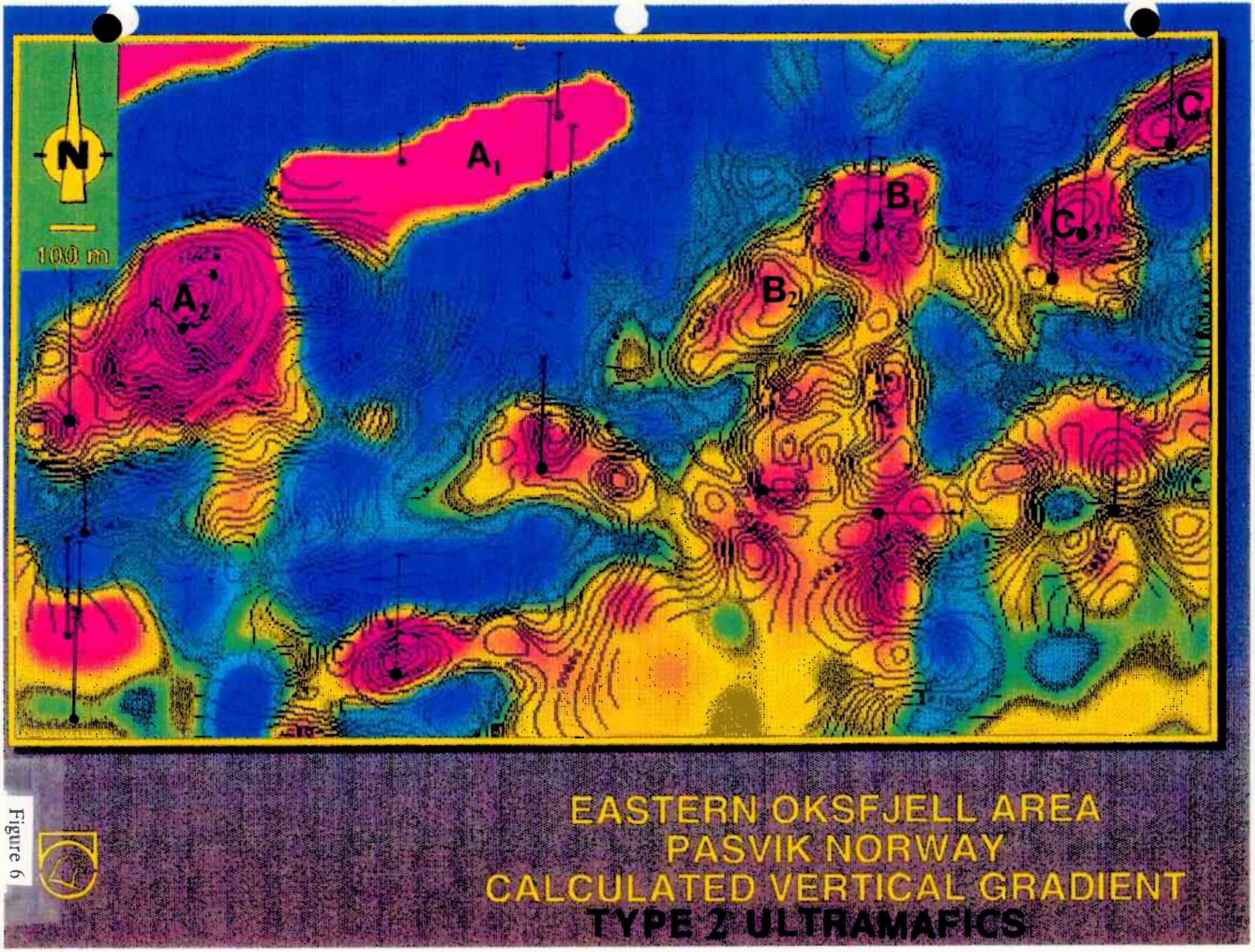
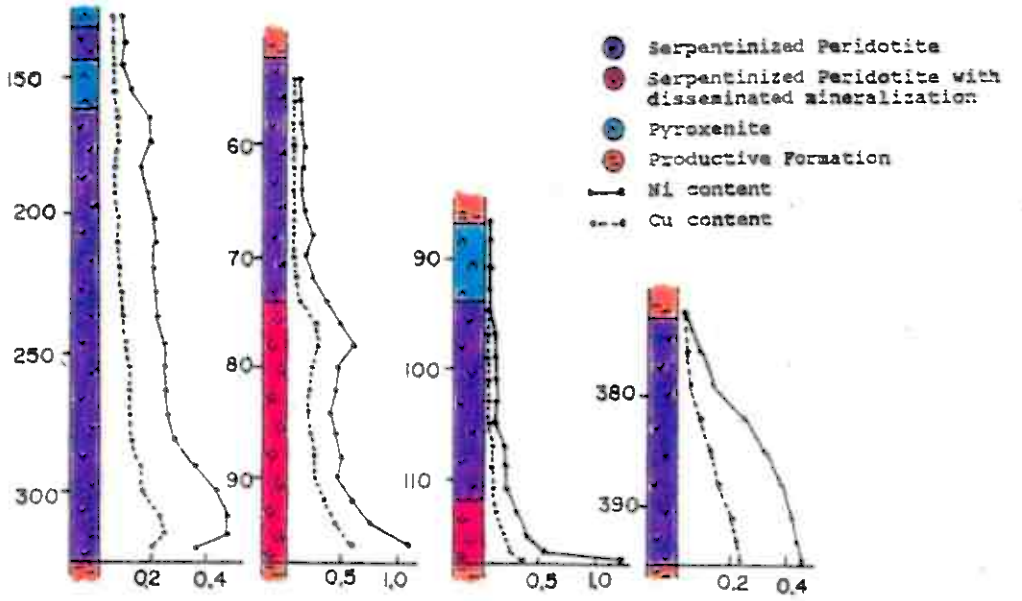

N
100 m
A1
A2
B1
B2
C1
C2
EASTERN OKSFJELL AREA
PASVIK NORWAY
CALCULATED VERTICAL GRADIENT
TYPE 2 ULTRAMAFICS

Figure 6

PECHENGA NI-CU ORES

Syngenetic Ores



Epigenetic Ores

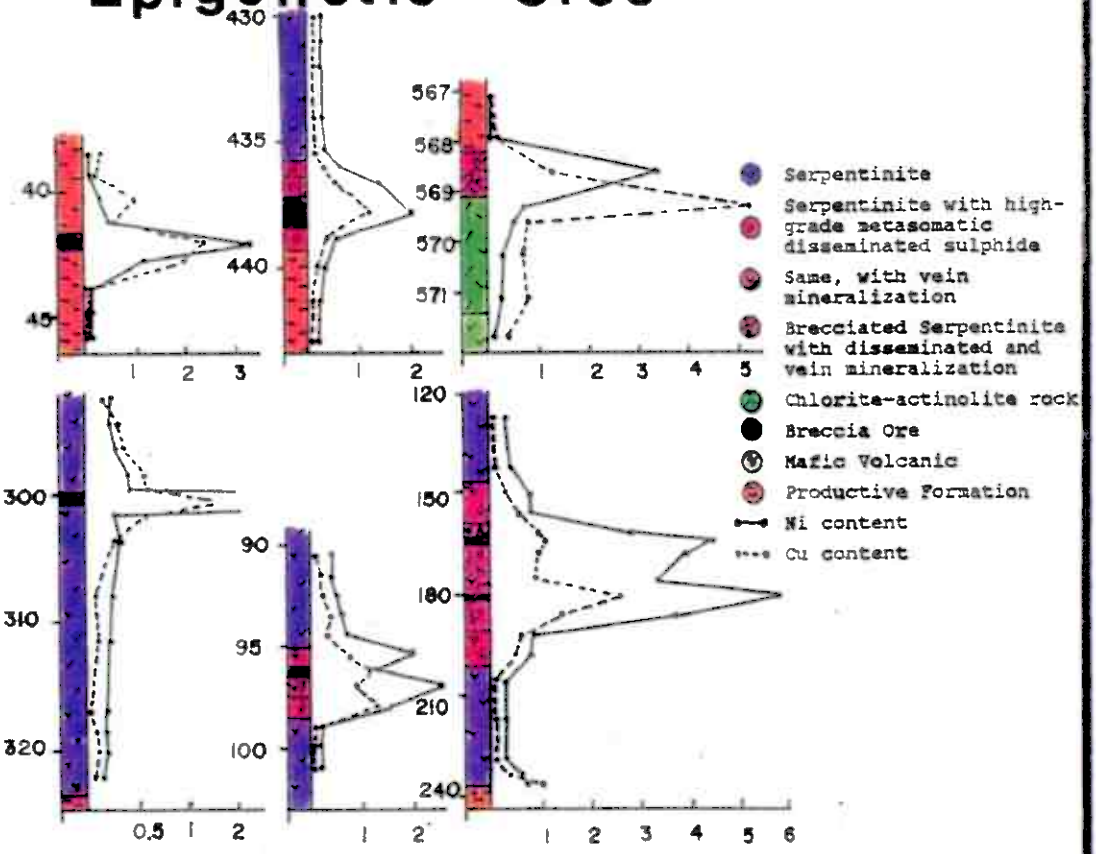


Figure 7

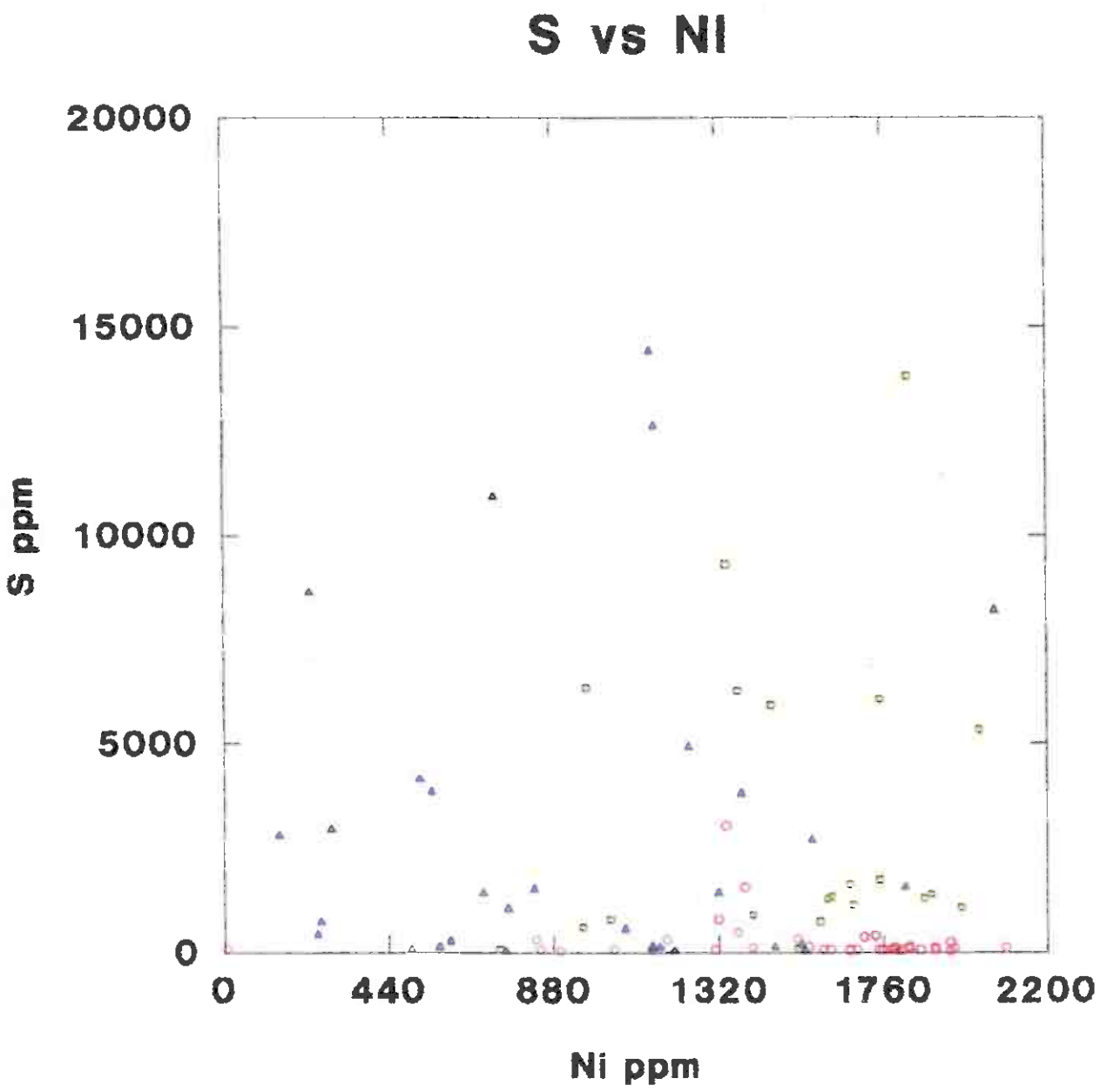

S vs Ni
20000
15000
10000
5000
0
S ppm
0
440
880
1320
1760
2200
Ni ppm
Pasvik Ultramafic Bodies
Type 1a
Type 1b
Type 2a
Finntjorn

Figure 8

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 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	100-800	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	46.00-50.10; 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

Hole/Body	Intersections (depth downhole, m)						Total Thickness	Thickness (m) / Proportion of Body			UM:Mafic Ratio
	Gabbro		Pyroxenite		Ultramafic			Gabbro	Pyroxenite	Ultramafic	
	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	Thickness (m)			
		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
KammikM	90	20/22%	5/6%	65/72%	2.57
Western Ortalv	180	57/31%	3/2%	120/67%	2.03
Eastern Ortalv	90	64/71%	0%	26/29%	0.41
EASTERN					
Soukejoky	185	80/43%	0%	105/57%	1.32
Rajsolvy	95	40/42%	5/5%	50/53%	1.13
Pil'guyarvi	466	320/69%	11/2%	135/29%	0.41

TABLE 5

SELECTED METAL-ENRICHED PASVIK SAMPLES								ppm
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								

0.18% = 1800 ppm.

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

APPENDIX A
SUMMARY OF OKSFJELL 1992 DRILLING

TABLE 1. DRILL RESULTS PASVIK, NORWAY (OKSFJELL) (1)

Hole	Location (UTM)	Az/Dip/Length	Target/Result
PS-42	596850E / 7701275N	000° / -55 /163.5 m	T: Ultramafic #3, located within Upper Productive Fm, tested toward boudined end. R: Hole intersected 4.36m Ultramafic w/ 1% dissem Po in Middle Productive Formation
PS-43	596710E / 7701740N	000° / -55 /183.23	T: Offset of proposed Ultramafic #2. Penetration from upper faulted contact. R: Hole intersected 3.52m Ultramafic Body w/in Lower Productive Formation; 1-2% Vein Cpy in sediments above UM; & wide hornfelsed zone (2.36m above, 0.9m below)
PS-44	596298E / 7701765N	000° / -55 /189.9 m	T: Ultramafic #2, at north intersection of N-S conductive zone and Lower Productive Formation. R: Hole intersected 60.72m Gb-Wehrlite Body (41.48m Ultramafic) with 2 carbonate-magnetite Bx zones (.37 & 1.2m) w/ 2-3% Cp
PS-45	596350E / 7701230N	090° / -50 /167.40	T: Intersection of N-S conductive zone, strong N-S fault (?), Upper Productive Formation and possible tectonized extension of Ultramafic #3. R: Hole intersected 3 UM bodies (3.28, 3.09, 4.34m) in Mid Prod Fm, 2 w. 3-4% Po, Tr Cpy
PS-46	596100E /7701282.5	090° / -80 /175.45	T: Test magnetic body within N-S conductive zone. R: Hole intersected 82.33m Gabbro-Diabase body in Middle Productive Formation
PS-47	595625E / 7701320N	000° / -55 /171.18	T: Ultramafic # 2 in Middle Productive Fm. R: Hole intersected Middle Productive Fm and ended in 73m of Gabbro-Diabase
PS-48	595325E / 7700850N	000° / -55 /180.80	T: Ultramafic #2 or #3 in the Upper Prod Fm R: Hole int 4 UM bodies (3.70, 2.15, 3.55, 10.10m) in Middle Productive Formation
PS-49	594600E / 7701400N	000° / -80 / 275.3	T: Down plunge (faulted?) extent of Ultramafic #1. Complex pinchout, irregular EM conductor at surface. R: Hole intersected 5.28m Ultramafic Body within Lower Productive Formation, but failed to intersect proposed extension of Hole 41 ultramafic
PS-50	596954E / 7702032N	000° / -80 / 159.8	T: Test strong magnetic body (Ultramafic) within Lower Productive Formation. R:Hole intersected 64.46m Gabbro-Wehrlite Body w/ Tr-1% Cpy in Pxenite & Tr-1% in UM
PS-51	596954E / 7702032N	000° / -80 / 86.0 m	T: Test up-dip projection of strong magnetic body (Ultramafic) intersected in Hole 50 within Lower Productive Formation R: Hole collared in and intersected 55.85m Gabbro-Wehrlite body w/ Tr Cpy specks & Tr-2.5% Po in UM
PS-52	596770E / 7701820N	000° / -80 / 165.56	T:Follow-up DDH PS-43: continue to test strongly magnetic Ultramafic in Lower Productive FormationProductive Formation R: Hole intersected 28.84m Ultramafic Body with Tr-2% Po over 4.15m near base of body and 1-2% Cpy in 0.5m qtz zone above body
	TOTAL:	**1918.12m**	

ED-50 ED-50 1992 OKSFJELL, PASVIK DRILLING

Hole	UTM E	UTM N	Elev (m)	Az	Dip	Length(m)	Start	Stop	Logged	Contract Cost(NOK)	NOK/m
PS-92-42	596850	7701275	128	000°	-55°	163.50	1 Jul	4 Jul	KAH-E	75669	463
PS-92-43	596710	7701740	141	000°	-55°	183.23	4 Jul	7 Jul	KAH-E	80315	438
PS-92-44	596298	7701765	141	000°	-55°	189.90	7 Jul	10 Jul	KAH-E	84140	443
PS-92-45	596350	7701230	130	090°	-50°	167.40	10 Jul	13 Jul	KAH-E	74515	445
PS-92-46	596100	7701282	141	090°	-80°	175.45	13 Jul	16 Jul	KAH-E	79035	450
PS-92-47	595625	7701320	148	000°	-55°	171.18	16 Jul	19 Jul	DH	78561	459
PS-92-48	595325	7700850	130	000°	-55°	180.80	20 Jul	23 Jul	KAH-E	80814	447
PS-92-49	594600	7701400	210	000°	-80°	275.30	27 Jul	1 Aug	KAH-E	126908	461
PS-92-50	596954	7702032	130	000°	-80°	159.80	5 Aug	9 Aug	KAH-E	71805	449
PS-92-51	596954	7702032	130	000°	-45°	86.00	9 Aug	11 Aug	KAH-E	39849	463
PS-92-52	596770	7701820	141	000°	-80°	165.56	11 Aug	14 Aug	KAH-E	73079	441
Mobilization										56000	
De-mobilization										50000	
					TOTAL	1918.12			TOTAL	970690	AV:451

* ED-50 : gml UTM koord.

A/S SULFIDMALM

Recapitulation of Pasvik Area Exploration Expenses

Pasvik (904) and Sout Pasvik

Expenditure	Proposed Project 904	Actual Project 904
SALARIES		
Geology	150,000	290,172
Geophysics	70,000	23,345
Drilling	280,000	126,597
Subtotal	500,000	440,114
TRAVEL	80,000	64,094
FIELD EXPENSES		
Geology	80,000	143,936
Geophysics	25,000	21,406
Drilling	120,000	98,457
Subtotal	225,000	263,799
ASSAYS		
Geology	25,000	0
Drilling	100,000	21,720
Subtotal	125,000	21,720
GEOLOGY CONTRACTS	0	128,700
GEOPHYSICS CONTRACTS		
Ground	180,000	0
Airborne	0	0
Subtotal	180,000	0
DIAMOND DRILLING CONTRACTS	1,000,000	1,174,226
ENVIRONMENTAL	0	15,451
PROPERTY	90,000	
Acquisition		0
Maintenance		14,150
Subtotal	90,000	14,150
TOTALS	2,200,000	2,122,254

*

Daryl Hodges
Senior Geologist

APPENDIX B
SUMMARY DRILL LOGS AND SECTIONS

SUMMARY LOG AND DESCRIPTION
PS-92-42

LOCATION: 596850E, 7701275N, elevation 128m
AZIMUTH: 000° **DIP:** -55°
TOTAL DEPTH: 163.5 m **PROPOSED DEPTH:** 150.0 m
STARTED: 1 July 1992 **COMPLETED:** 4 July 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: Test 'Ultramafic #3', located within Upper Productive Formation, tested toward boudined end.
RESULTS: Hole intersected (A) ultramafic tuff in Upper Productive Formation with 3% vein Po+Tr Cpy over 72 cm & 70% massive Po+Tr Cpy over 3 cm; (B) three ultramafic bodies in Middle Productive Formation with Tr-1% Po+Tr Cpy over 25 cm in middle body.

DIRECT DRILLING COST: 68,825 NOK

SUMMARY LOG:

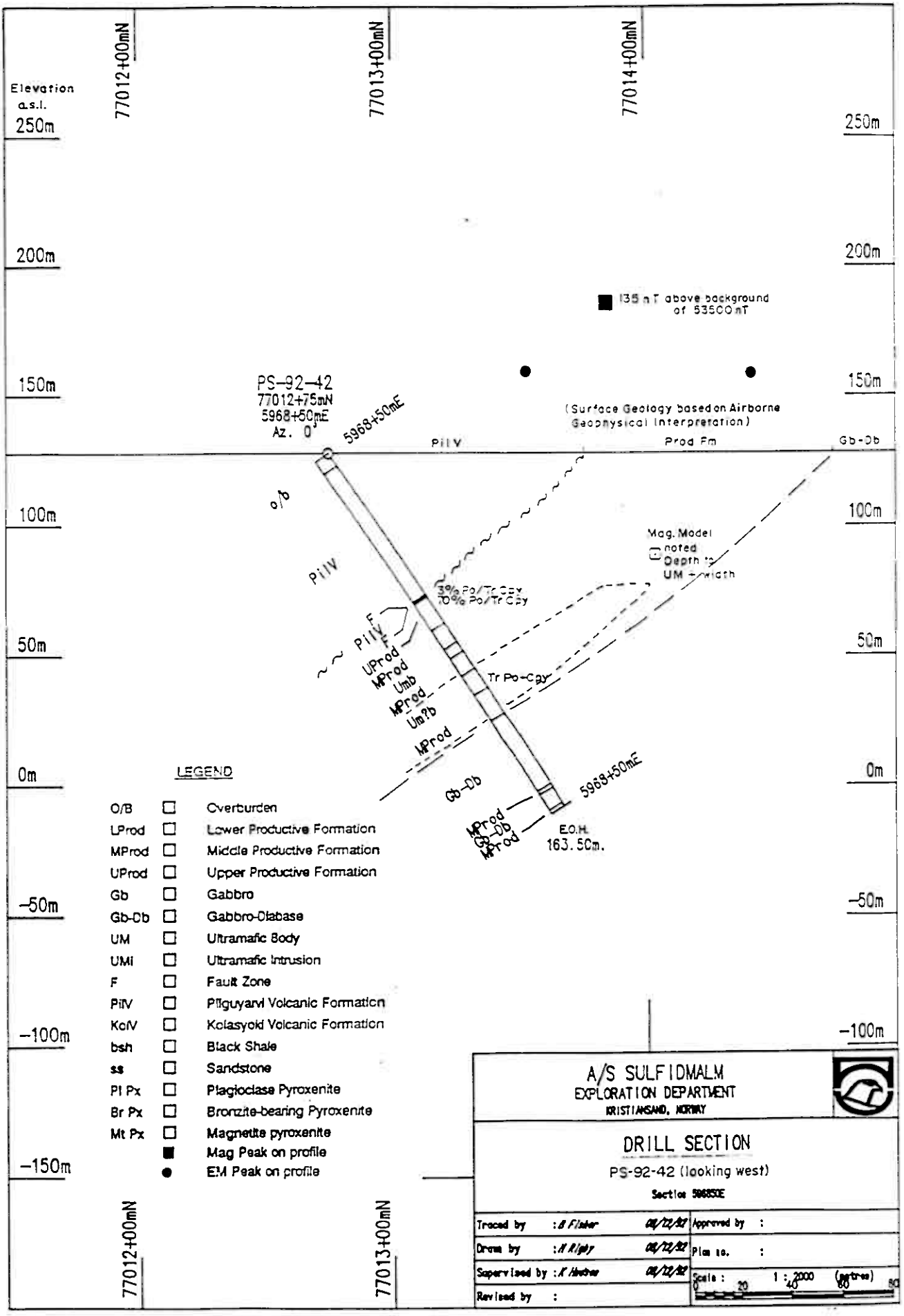
0.00 - 5.78m	Overburden
5.78 - 66.07m	Pil'guyarvi Volcanic Formation Mafic tuff and flow
66.07 - 66.49m	Fault Zone
66.49 - 66.91m	Pil'guyarvi Volcanic Formation Mafic tuff and flow
66.91 - 67.14m	Fault Zone
67.14 - 79.31m	Pil'guyarvi Volcanic Formation Ultramafic tuff, carbonate-rich. 67.14-67.86m: 3-5% vein Po+Tr Py+Cpy; 69.57-69.60m: ~70% massive Po+Tr Cpy
79.31 - 88.10m	Middle Productive Formation 81.00-82.52m & 83.64-84.60m: Ultramafic Tuff (talc-carbonate); rest graphitic black shale, 82.52-83.64m: 50-60% Po-Py breccia+Tr Cpy
88.10 - 92.46m	Ultramafic Body (talc-carbonate) Tr-4% disseminated Po
92.46 - 100.45m	Middle Productive Formation 95.94-97.61m: Ultramafic Tuff (talc-carbonate); rest black shale & mafic tuff
100.45 - 109.22m	Ultramafic Body Talc-carbonate rock. 107.55-108.00m: 3-4% Po+Tr Cpy in shear zone
109.22 - 115.20m	Middle Productive Formation Dominantly black shale
115.20 - 120.10m	Ultramafic Body Talc-carbonate, Tr-2% finely disseminated Po
120.10 - 121.05m	Middle Productive Formation Mainly graphitic black shale, 1-5% Po
121.05 - 161.82m	Mainly Gabbro-Diabase 153.14-154.80m: Black shale, 3-5% Po; 154.52-154.67m:

80% Po breccia

161.82 - 163.50m Middle Productive Formation

Black shale, ~3% Po veinlets

Geochemical Samples: 10; Whole rock Samples: 4.


77012+00mN
77013+00mN
77014+00mN
Elevation a.s.l.
250m
200m
150m
100m
50m
0m
-50m
-100m
-150m
135 nT above background of 53500nT
PS-92-42
77012+75mN
5968+50mE
Az. 0°
5968+50mE
(Surface Geology based on Airborne Geophysical Interpretation)
PilV
Prod Fm
Gb-Db
o/b
Mag. Model
noted
Depth to
UM + width
3% Po/Tr Cpy
10% Po/Tr Cpy
F
UProd
MProd
Umb
Um?b
Tr Po-Cpy
Gb-Db
5968+50mE
E.O.H.
163.50m.
LEGEND
O/B Overburden
LProd Lower Productive Formation
MProd Middle Productive Formation
UProd Upper Productive Formation
Gb Gabbro
Gb-Db Gabbro-Diabase
UM Ultramafic Body
UMi Ultramafic Intrusion
F Fault Zone
PilV Pilguyarvi Volcanic Formation
KolV Kolasyoki Volcanic Formation
bsh Black Shale
ss Sandstone
Pl Px Plagioclase Pyroxenite
Br Px Bronzite-bearing Pyroxenite
Mt Px Magnetite pyroxenite
Mag Peak on profile
EM Peak on profile
A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY
DRILL SECTION
PS-92-42 (looking west)
Section 5968SE
Traced by : S Fisher 08/12/92
Drawn by : N R/pt/ 08/12/92
Supervised by : K Hoshow 08/12/92
Revised by :
Approved by :
Plan no. :
Scale : 1 : 2000 (metres)
0 20 40 60 80

SUMMARY LOG AND DESCRIPTION
PS-92-43

LOCATION: 596710E, 7701740N, elevation 141m
AZIMUTH: 000° **DIP:** -55°
TOTAL DEPTH: 183.23m **PROPOSED DEPTH:** 175.0 m
STARTED: 4 July 1992 **COMPLETED:** 7 July 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: To test offset of proposed 'Ultramafic #2'. Penetration from upper faulted contact.
RESULTS: Hole intersected 3.52 m of Ultramafic within Lower Productive Formation. Width of hornfelsed zone suggests ultramafic body is larger than the intersection shows. 1-2% Cpy and 1-2% Po in veins over 10 cm in mafic tuff 0.72 m above ultramafic body.

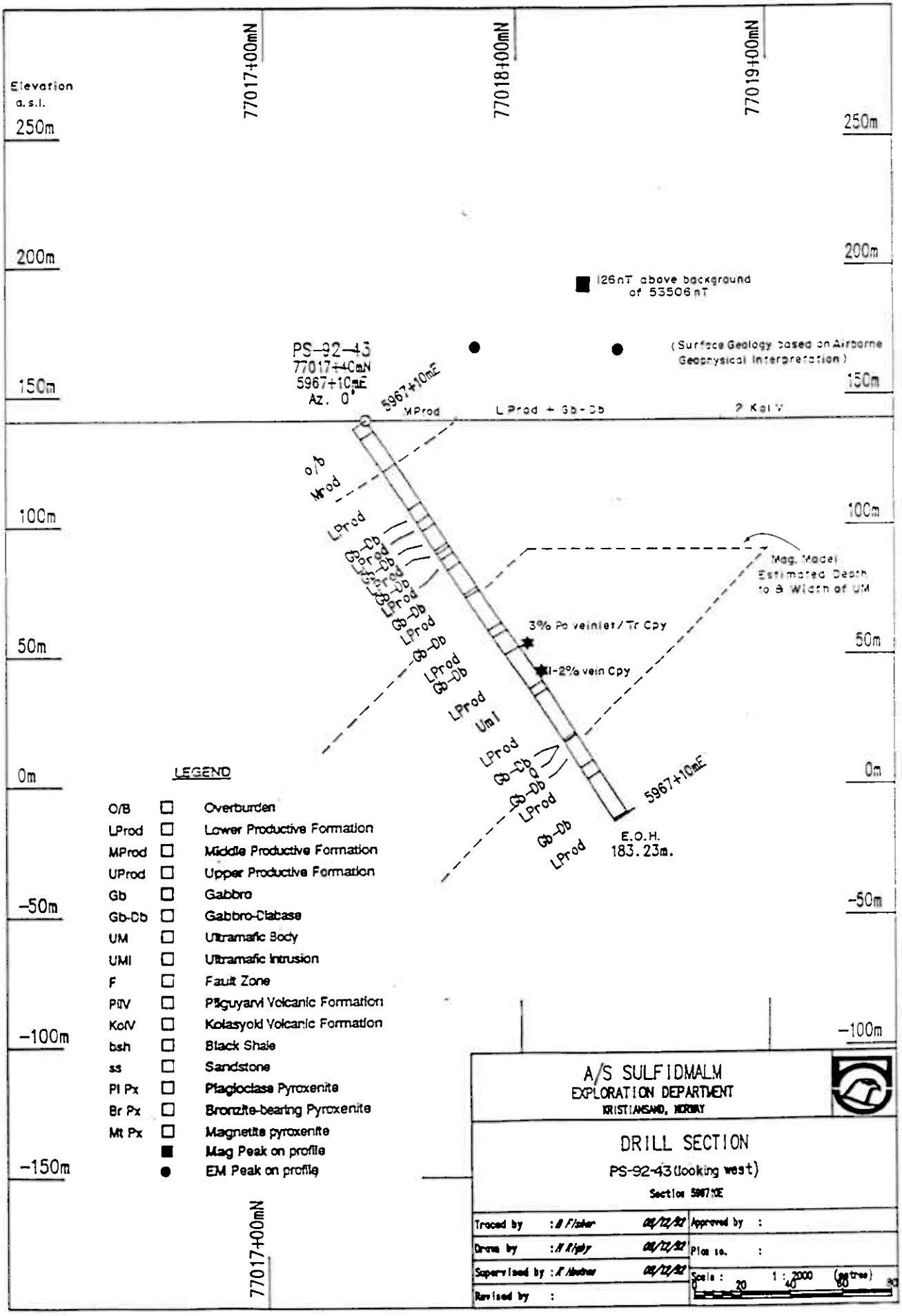
DIRECT DRILLING COST: 79,415 NOK

SUMMARY LOG:

0.00 - 5.00m	Overburden
5.00 - 20.00m	Middle Productive Formation Black shale w/ 3-5% Po + Tr Cpy
20.00 - 37.90m	Lower Productive Formation Mafic tuff and black shale (1-3% veinlet Po + Tr Py)
37.90 - 43.95m	Gabbro-Diabase
43.95 - 47.91m	Lower Productive Formation Black shale (Tr-2% Po) and lesser mafic tuff
47.91 - 56.95m	Gabbro-Diabase
56.95 - 58.62m	Lower Productive Formation Mafic tuff and lesser black shale (1% Po veinlets)
58.62 - 61.38m	Gabbro-Diabase
61.38 - 66.17m	Lower Productive Formation Black shale (1-2% Po threads), sandstone & mafic tuff
66.17 - 77.48m	Gabbro-Diabase
77.48 - 78.93m	Lower Productive Formation Sandstone with Tr Po specks
78.93 - 94.22m	Gabbro-Diabase
94.22 - 97.60m	Lower Productive Formation Mafic tuff and lesser sandstone/black shale (Tr Po)
97.60 - 105.61m	Gabbro-Diabase
105.61 - 121.54m	Lower Productive Formation Mafic tuff, black shale and sandstone (2% Po); 1-2% vein Cpy w/ 1-2% Po in mafic tuff over 10 cm (120.72-120.82m); hornfelsed zone 119.01-121.37
121.54 - 125.06m	Ultramafic Body, Tr dissem Po
125.06 - 145.38m	Lower Productive Formation Amygdaloidal mafic flow and lesser sandstone/siltstone (Tr Po); Hornfelsed zone in mafic flow @125.60-126.50m
145.38 - 146.32m	Gabbro-Diabase

146.32 - 146.50m	Fault
146.50 - 158.40m	Gabbro-Diabase
158.40 - 163.69m	Lower Productive Formation Sandstone (Tr Po) and mafic tuff
163.69 - 182.33m	Gabbro-Diabase
182.33 - 183.23m	Lower Productive Formation Black shale, 2-3% Po veinlets
183.23m	End of Hole

Geochemical Samples: 2; Whole rock Samples: 1.



A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY

DRILL SECTION
PS-92-43 (looking west)
Section 5967 OE

Traced by	: B Fisher	08/12/92	Approved by :
Drawn by	: A Rigby	08/12/92	Plot no. :
Supervised by	: K Hudson	08/12/92	Scale : 1 : 2000 (metres)
Revised by	:		

SUMMARY LOG AND DESCRIPTION
PS-92-44

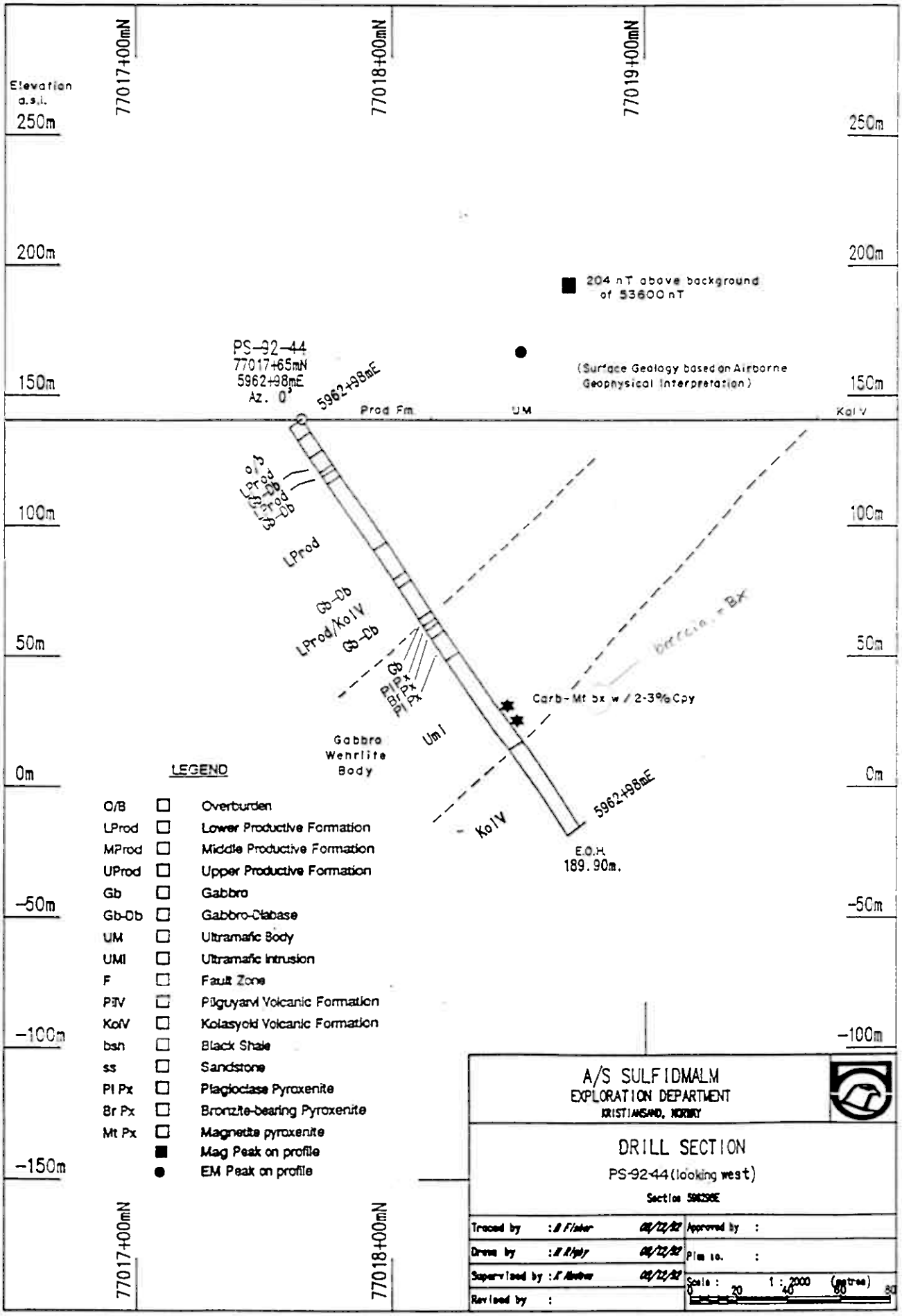
LOCATION: 596298E, 7701765N, elevation 141m
AZIMUTH: 000° **DIP:** -55°
TOTAL DEPTH: 189.90m **PROPOSED DEPTH:** 175.0 m
STARTED: 7 July 1992 **COMPLETED:** 10 July 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: To test Ultramafic #2, at north intersection of N-S conductive zone and Lower Productive Formation.
RESULTS: Hole intersected a 60.72m gabbro-wehrlite intrusion (41.48m Ultramafic, 15.62m Pyroxenite, 3.62m Gabbro), with two carbonate-titano magnetite breccia zones with 2-3% vein Cpy over 0.37m and 1.20m in the ultramafic.

DIRECT DRILLING COST: 82,745 NOK

SUMMARY LOG:

0.00 - 6.00m		Overburden
6.00 - 14.24m		Lower Productive Formation Mafic tuff (Tr Py) and black shale (2-3% veinlet Po)
14.24 - 20.99m		Gabbro-Diabase
20.99 - 22.92m		Lower Productive Formation Black shale, 3-5% Po+Py veinlets
22.92 - 26.32m		Gabbro-Diabase
26.32 - 57.20m		Lower Productive Formation Interbedded mafic tuff and black shale (2-3% veinlet Po)
57.20 - 70.82m		Gabbro-Diabase
70.82 - 74.75m		Lower Productive Formation/Kolasyoki Volcanic Formation Amygdaloidal mafic flow and tuff
74.75 - 89.33m		Gabbro-Diabase
89.33 - 150.05m		Gabbro-Wehrlite Body
	89.33-92.95m	Gabbro @ 89.33-89.52 1% Cpy
	92.95-94.30m	Plagioclase Pyroxenite 1-2% Po & Tr dissem Cpy
	94.30-98.40m	Bronzite-bearing Pyroxenite
	98.40-108.57m	Plagioclase Pyroxenite @ 108.40 Tr-1% dissem Cpy + Bornite
	108.57-150.05m	Ultramafic (Peridotite) 1% Po; @ 135.48-135.86 & 140.80-142.00 carbonate-Ti magnetite breccia zones w/ 1-2% patchy Cpy
150.05 - 189.90m		Kolasyoki Volcanic Formation Mafic flow and tuff
189.90m		End of Hole

Geochemical Samples: 21; Whole rock Samples: 11; Thin Sections: 3; Polished Thin



A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY

DRILL SECTION

PS-92-44 (looking west)

Section 5962SE

Traced by	: S Fisher	02/12/92	Approved by :
Drawn by	: S Fisher	02/12/92	Plan no. :
Supervised by	: F Barlow	02/12/92	Scale : 1 : 2000 (metres)
Revised by	:		0 20 40 60 80

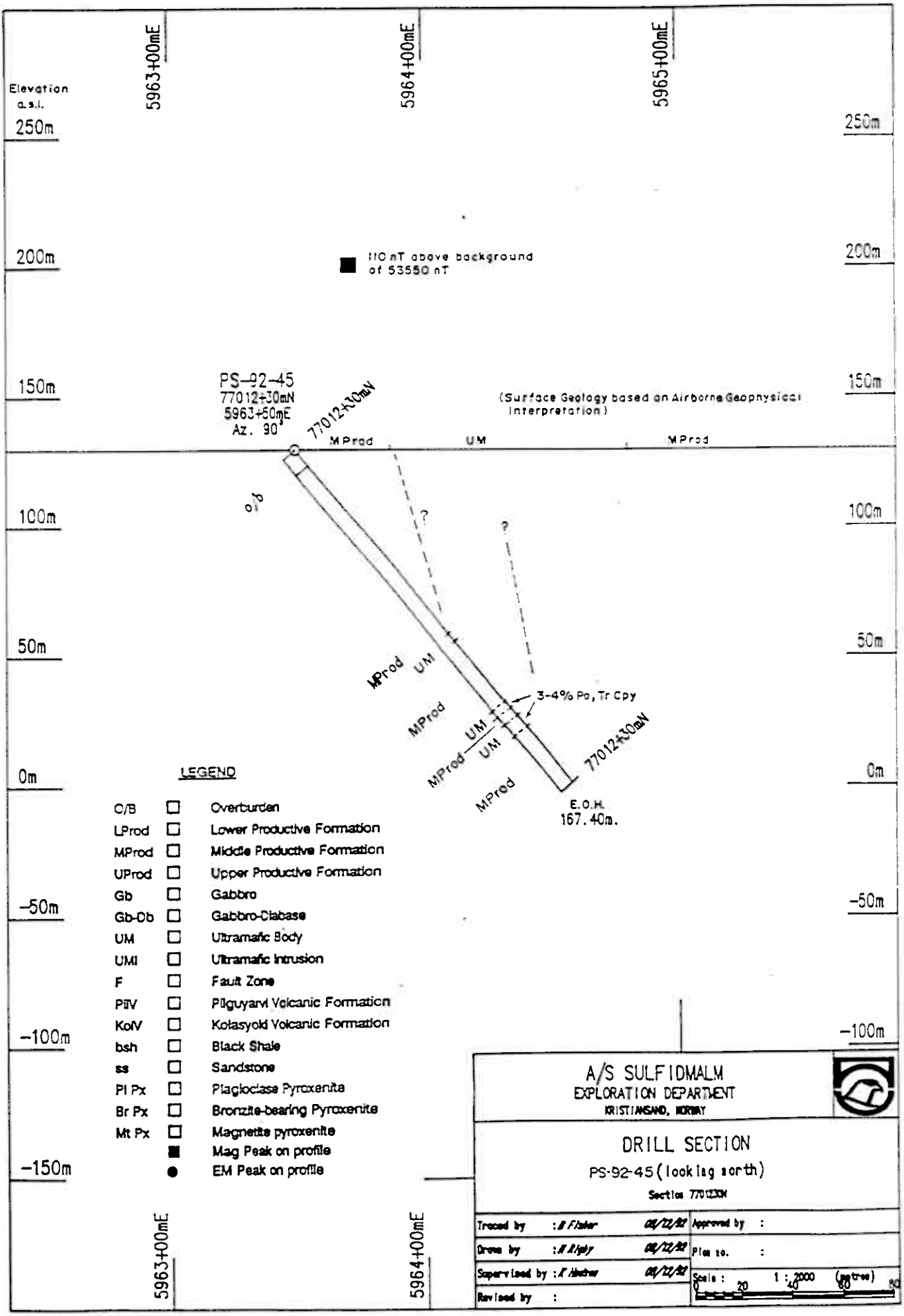
SUMMARY LOG AND DESCRIPTION
PS-92-45

LOCATION: 596350E, 7701230N, elevation 130m
AZIMUTH: 090° **DIP:** -50°
TOTAL DEPTH: 167.40 m **PROPOSED DEPTH:** 175.0 m
STARTED: 10 July 1992 **COMPLETED:** 13 July 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: To test intersection of N-S conductive zone, strong N-S fault (?), Upper Productive Formation and possible tectonized extension of Ultramafic #3.
RESULTS: Hole intersected black shale- and sandstone-dominant Middle Productive Formation, with three ultramafic zones (3.28m, 3.09m, 4.34m thick), latter two have 3-4% Po, Tr Cpy disseminated.
DIRECT DRILLING COST: 64,520 NOK

SUMMARY LOG:

0.00 - 8.00m	Overburden
8.00 - 167.40m	Middle Productive Formation
	Dominantly sandstone and Po-rich (Tr-40%) contorted & brecciated black shale, @ 28.85-29.20, 41.92-42.92, 48.83-49.80, 55.06-55.72, 63.76-64.23, 153.78-154.18: Po-rich (15-60%) black shale breccia
92.22-95.50m	Ultramafic, Tr-1% dissem Po
95.68-96.40m	Ultramafic, Tr Po specks
126.72-129.81m	Ultramafic, 3-4% Po, Tr dissem Cpy
134.47-138.81m	Ultramafic, 3-4% Po, Tr dissem Cpy
167.40m	End of Hole

Geochemical Samples: 14; Whole rock Samples: 5.


5963+00mE
5964+00mE
5965+00mE
Elevation a.s.l.
250m
200m
150m
100m
50m
0m
-50m
-100m
-150m
110 nT above background of 53550 nT
PS-92-45
77012+30mN
5963+50mE
Az. 90°
77012+30mN
(Surface Geology based on Airborne Geophysical Interpretation)
MProd
UM
MProd
O/B
?
?
MProd
UM
MProd
UM
MProd
UM
3-4% Po, Tr Cpy
77012+30mN
MProd
E.O.H.
167.40m.
LEGEND
C/B Overburden
LProd Lower Productive Formation
MProd Middle Productive Formation
UProd Upper Productive Formation
Gb Gabbro
Gb-Db Gabbro-Diabase
UM Ultramafic Body
UMI Ultramafic Intrusion
F Fault Zone
PiV Pilguyarvi Volcanic Formation
KolV Kolasyoki Volcanic Formation
bsh Black Shale
ss Sandstone
Pl Px Plagioclase Pyroxenite
Br Px Bronzite-bearing Pyroxenite
Mt Px Magnetite pyroxenite
Mag Peak on profile
EM Peak on profile
A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY
DRILL SECTION
PS-92-45 (looking north)
Section 77012.30N
Traced by : S. Fisher 08/12/92
Drawn by : S. Wright 08/12/92
Supervised by : F. Hatcher 08/12/92
Revised by :
Approved by :
Plan no. :
Scale : 1 : 2000 (metres)
0 20 40 60 80

SUMMARY LOG AND DESCRIPTION
PS-92-46

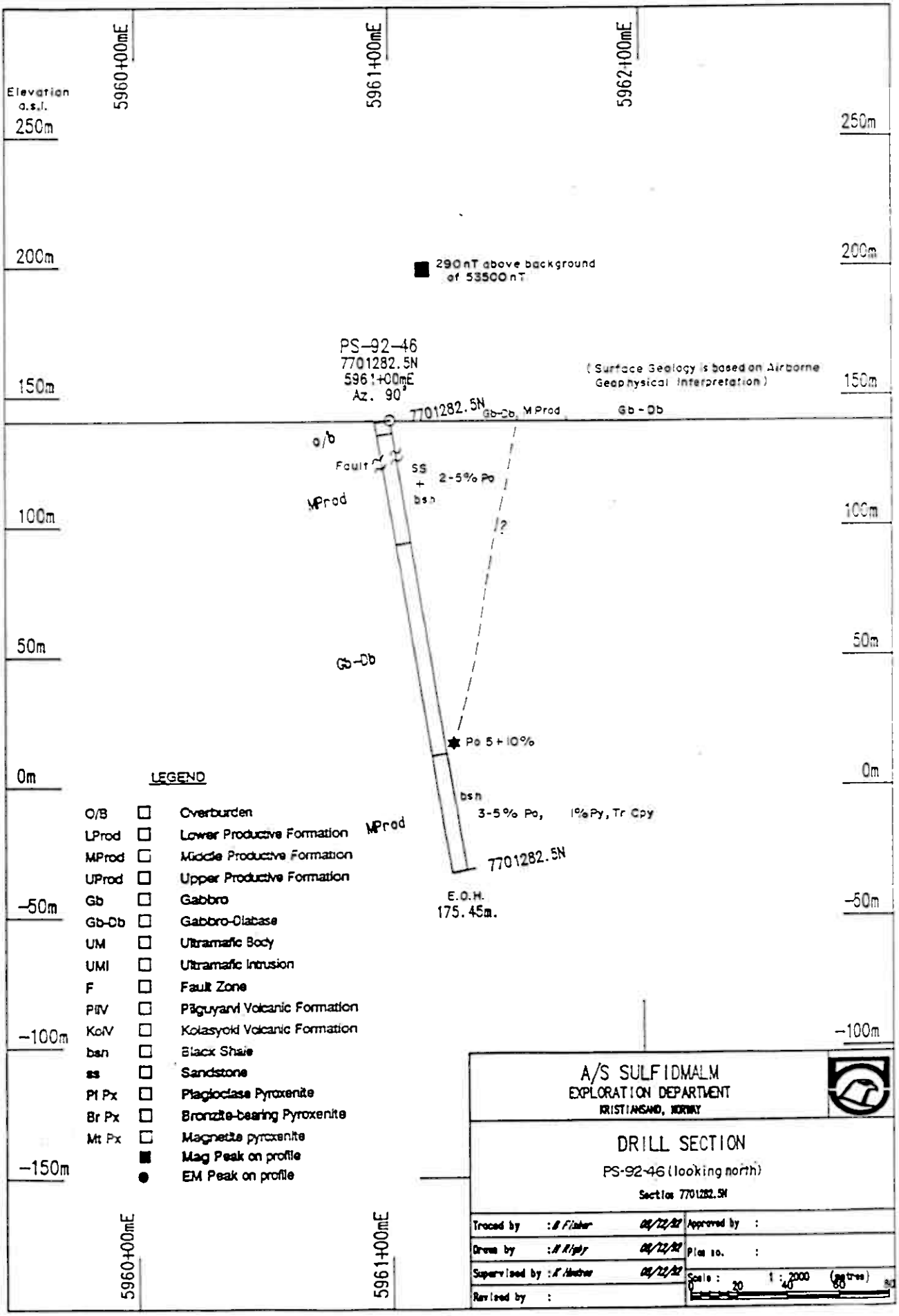
LOCATION: 596100E, 7701282.5N, elevation 141m
AZIMUTH: 090° **DIP:** -80°
TOTAL DEPTH: 175.45 m **PROPOSED DEPTH:** 175.0 m
STARTED: 13 July 1992 **COMPLETED:** 16 July 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: To test magnetic body within N-S conductive zone.
RESULTS: Hole intersected 47.57m of sulphidic Middle Productive sandstones and black shales above and 47.45 m of sulphidic (3-5% Po) Middle Productive Formation black shale beneath 82.33m of Gabbro-Diabase.

DIRECT DRILLING COST: 75,927.50 NOK

SUMMARY LOG:

0.00 - 5.00m	Overburden
5.00 - 47.57m	Middle Productive Formation Mainly sandstone and black shale, 2-5% Po overall; fault zone @ 10.92-13.99
47.57 - 129.90m	Gabbro-Diabase 129.45-129.72: Po 2-10%
129.90 - 175.45m	Middle Productive Formation Mainly black shale w/ 3-5% Po, up to 1% Py, Tr Cpy
175.45m	End of Hole

Geochemical Samples: 6; Whole rock Samples: 0.



A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY

DRILL SECTION

PS-92-46 (looking north)

Section 7701282.5N

Traced by	: B Fisher	08/12/92	Approved by	:
Drawn by	: M Rigby	08/12/92	Plan no.	:
Supervised by	: K Mosher	08/12/92	Scale	: 1 : 2000 (metres)
Revised by	:			

SUMMARY LOG AND DESCRIPTION
PS-92-47

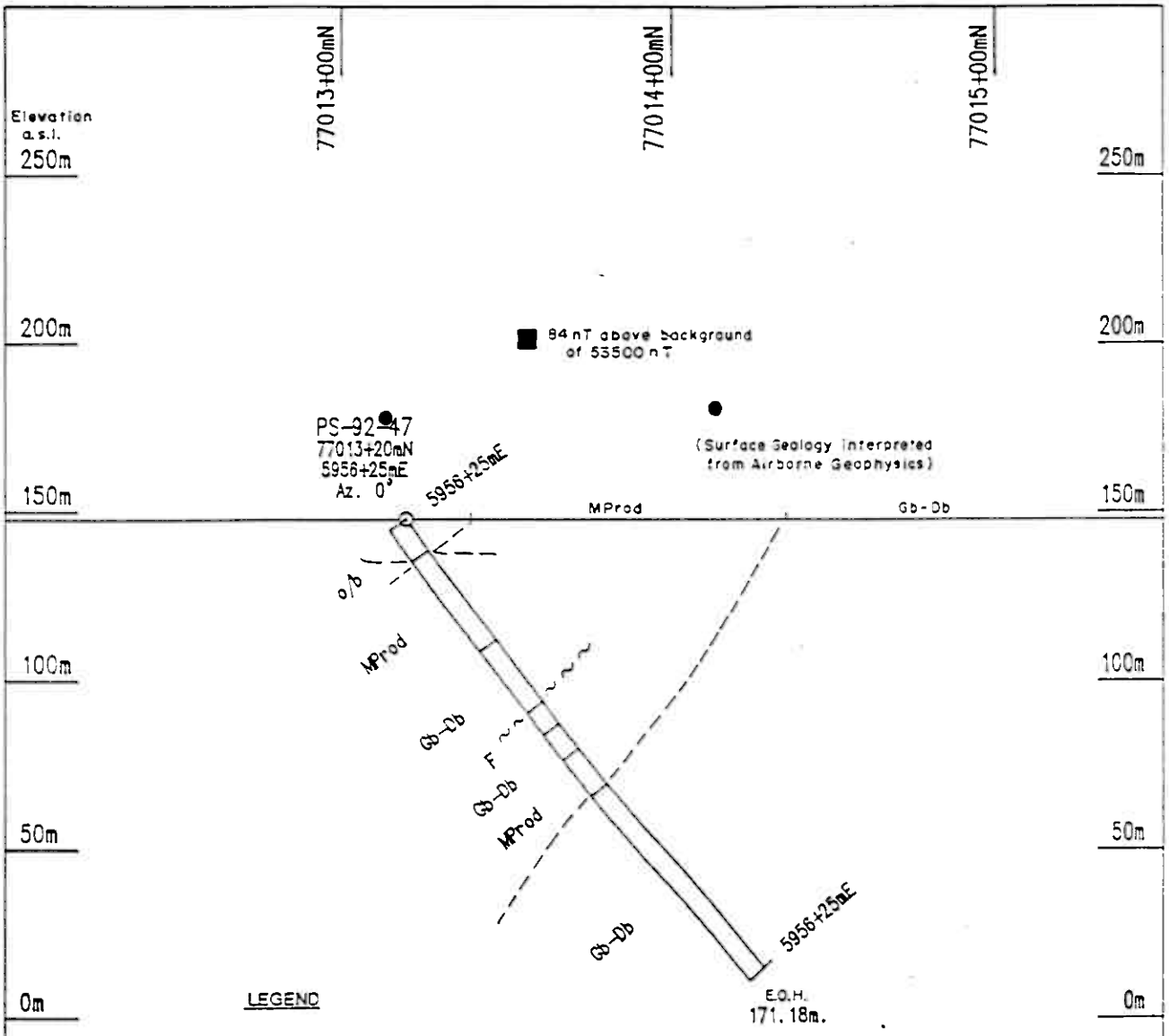
LOCATION: 595625E, 7701320N, elevation 148m
AZIMUTH: 000° **DIP:** -55°
TOTAL DEPTH: 171.18 m **PROPOSED DEPTH:** 175.0 m
STARTED: 16 July 1992 **COMPLETED:** 19 July 1992
LOGGED BY: Daryl Hodges
PURPOSE: To test Ultramafic #2 in Middle Productive Formation
RESULTS: Hole did not intersect ultramafic body, but intersected Middle Productive Formation and a large Gabbro-Diabase body

DIRECT DRILLING COST: 78,561.50 NOK

SUMMARY LOG:

0.00 - 11.23m	Overburden
11.23 - 44.27m	Middle Productive Formation Dominated by tuffaceous mafic volcanics with lesser black shale, average 10% Po
44.27 - 67.27m	Gabbro-Diabase
67.27 - 75.67m	Bull Quartz/Fault Zone
75.67 - 85.15m	Gabbro-Diabase
85.15 - 98.90m	Middle Productive Formation Dominated by black shale-sandstone turbidites, 5-10% Po
98.90 - 171.18m	Gabbro-Diabase
171.18m	End of Hole

Geochemical Samples: 1; Whole rock Samples: 0.



LEGEND

O/B	☐	Overburden
LProd	☐	Lower Productive Formation
MProd	☐	Middle Productive Formation
UProd	☐	Upper Productive Formation
Gb	☐	Gabbro
Gb-Db	☐	Gabbro-Diabase
UM	☐	Ultramafic Body
UMi	☐	Ultramafic Intrusion
F	☐	Fault Zone
PiV	☐	Pilguyarvi Volcanic Formation
KoV	☐	Kolasyoki Volcanic Formation
bsh	☐	Black Shale
ss	☐	Sandstone
Pl Px	☐	Plagioclase Pyroxenite
Br Px	☐	Bronzite-bearing Pyroxenite
Mt Px	☐	Magnetite pyroxenite
	■	Mag Peak on profile
	●	EM Peak on profile

A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY

DRILL SECTION
PS-92-47 looking west)
Section 5956E

Traced by	:		Approved by :
Drawn by	:		Plan no. :
Supervised by	:		Scale : 1 : 2000 (metres)
Revised by	:		

SUMMARY LOG AND DESCRIPTION
PS-92-48

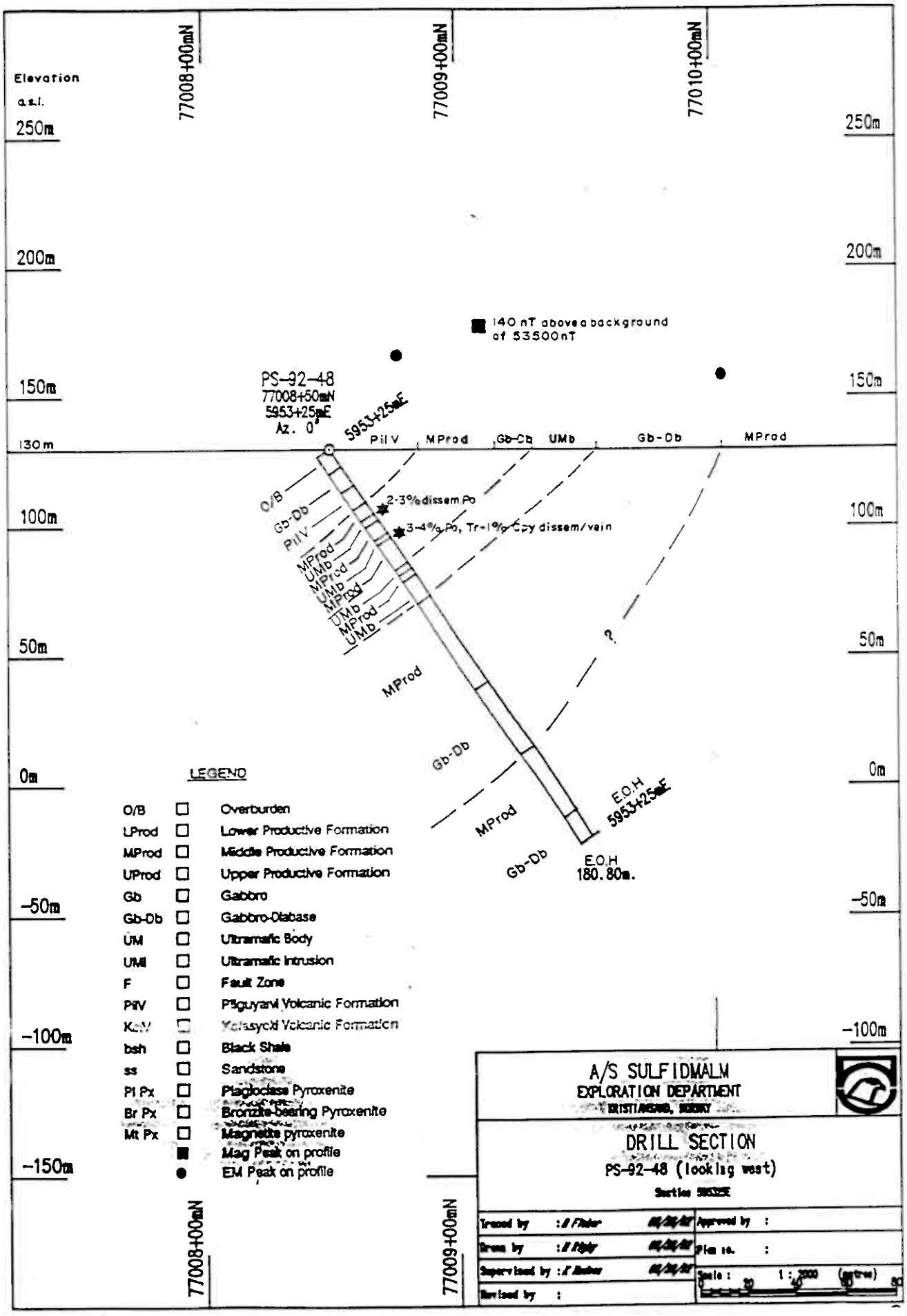
LOCATION: 595325E, 7700850N, elevation 130m
AZIMUTH: 000° **DIP:** -55°
TOTAL DEPTH: 180.80 m **PROPOSED DEPTH:** 175.0 m
STARTED: 20 July 1992 **COMPLETED:** 23 July 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: Test Ultramafic #2 or #3 in the Upper Productive Formation.
RESULTS: Hole intersected 4 Ultramafic bodies (3.70m, 2.15m, 3.55m, 10.10m) within Middle Productive Formation, 2.15m body has 3-4% disseminated Po, in veinlets and 5-7mm clots w/ Tr-1% Cpy.

DIRECT DRILLING COST: 80,814 NOK

SUMMARY LOG:

0.00 - 6.80m	Overburden
6.80 - 14.65m	Gabbro-Diabase
14.65 - 23.50m	Pil'guyarvi Volcanic Formation Mafic tuff and flow
23.50 - 27.60m	Middle Productive Formation Mafic tuff w/ minor black shale (1-3% stringer Po)
27.60 - 31.30m	Ultramafic body 2-3% Po disseminated and veinlet
31.30 - 37.45m	Middle Productive Formation Black shale and black shale Po breccia (10-15% Po)
37.45 - 39.60m	Ultramafic body 3-4% Po disseminated, in veinlets and 5-7mm clots w/ Tr-1% Cpy
39.60 - 50.10m	Middle Productive Formation Black shale (10-15% Po), sandstone (2-4% 1-3mm stringer Po) and mafic tuff
50.10 - 53.65m	Ultramafic body 1-2% clots of 3-4mm Po @ 50.30-53.65
53.65 - 56.20m	Middle Productive Formation Mafic flow, biotite-rich
56.20 - 66.30m	Ultramafic Body, nil-Tr Po
66.30 - 107.27m	Middle Productive Formation Black shale (< 1-10% Po, except in rare Po breccia zones (75-80% Po) and mafic volcanoclastics (Tr-3% dissem Po)
107.27 - 136.78m	Gabbro-Diabase
136.78 - 166.95m	Middle Productive Formation Black shale (1-5% veinlet Po), mafic tuff (rare Po stringers) and lesser sandstone (3-5% Po veinlets)
166.95 - 180.80m	Gabbro-Diabase
180.80m	End of Hole

Geochemical Samples: 25; Whole Rock Samples: 7; Thin Sections: 1; Polished Thin Sections: 2.


Elevation
a.s.l.
77008+00mN
77009+00mN
77010+00mN
250m
200m
150m
100m
50m
0m
-50m
-100m
-150m
140 nT above a background of 53500nT
PS-92-48
77008+50mN
5953+25mE
Az. 0°
5953+25mE
130 m
PilV
MProd
Gb-Db
UMb
Gb-Db
MProd
O/B
Gb-Db
PilV
MProd
UMb
MProd
UMb
MProd
UMb
MProd
UMb
2-3% dissem Po
3-4% Po, Tr-1% Cpy dissem/vein
?
MProd
Gb-Db
MProd
Gb-Db
E.O.H
5953+25mE
E.O.H
180.80m.
LEGEND
O/B Overburden
LProd Lower Productive Formation
MProd Middle Productive Formation
UProd Upper Productive Formation
Gb Gabbro
Gb-Db Gabbro-Diabase
UM Ultramafic Body
UMI Ultramafic Intrusion
F Fault Zone
PilV Pilguyarvi Volcanic Formation
KoV Kolasyoki Volcanic Formation
bsh Black Shale
ss Sandstone
Pl Px Plagioclase Pyroxenite
Br Px Bronzite-bearing Pyroxenite
Mt Px Magnetite pyroxenite
Mag Peak on profile
EM Peak on profile
A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY
DRILL SECTION
PS-92-48 (looking west)
Section 5953E
Traced by : J. Fisher
Drawn by : J. Rigby
Supervised by : K. Barker
Revised by :
Approved by :
Plan no. :
Scale : 1 : 2000 (metres)

SUMMARY LOG AND DESCRIPTION
PS-92-49

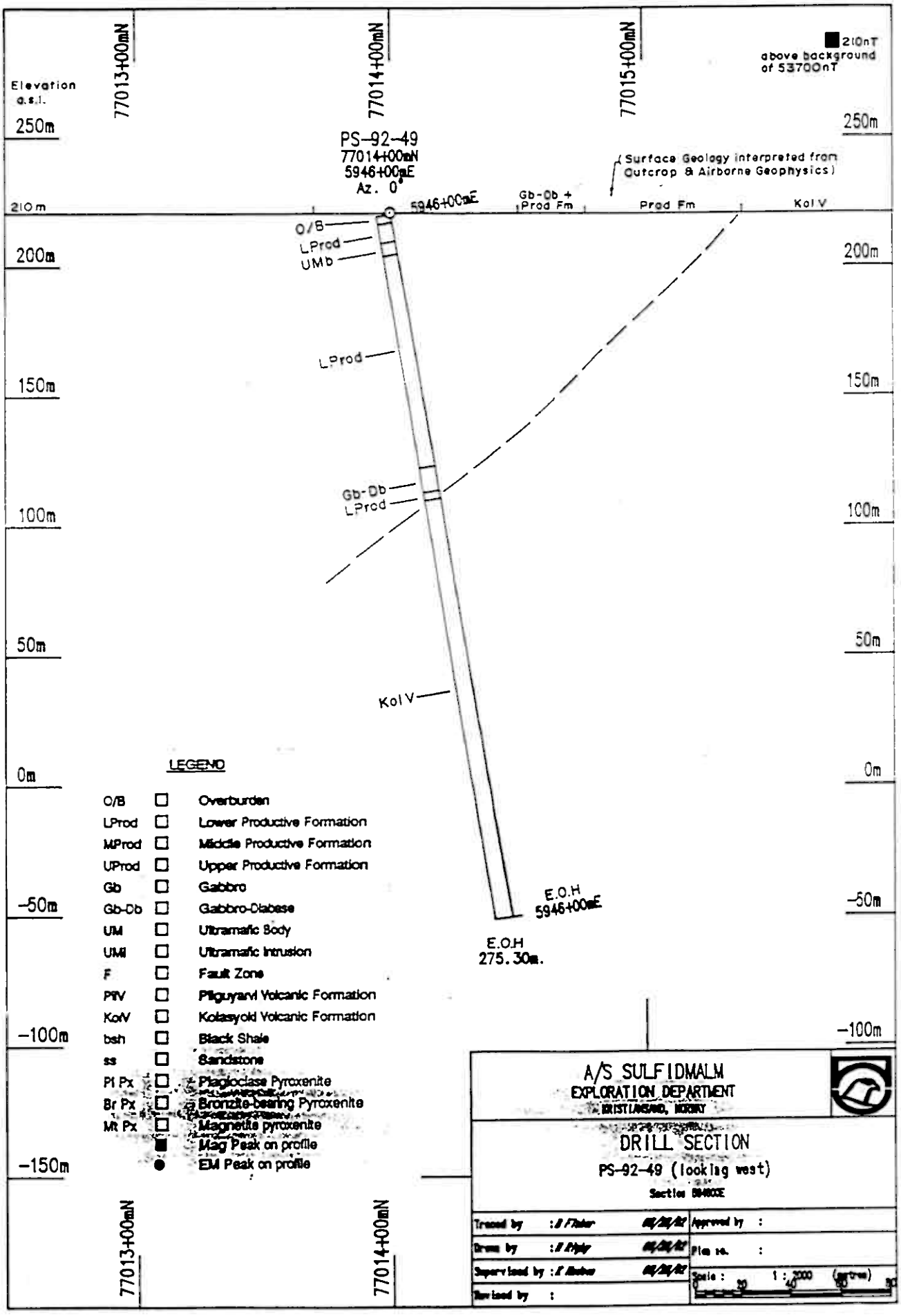
LOCATION: 594600E, 7701400N, elevation 221m
AZIMUTH: 000° **DIP:** -80°
TOTAL DEPTH: 275.3 m **PROPOSED DEPTH:** 275.0 m
STARTED: 27 July 1992 **COMPLETED:** 1 August 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: Test down plunge (faulted?) extent of Ultramafic #1. Complex pinchout, irregular EM conductor at surface.
RESULTS: Hole intersected 5.28m ultramafic body within Lower Productive Formation, but failed to intersect proposed extension of "ultramafic #1" (Hole 41 ultramafic).

DIRECT DRILLING COST: 121,082.50 NOK

SUMMARY LOG:

0.00 - 1.50m	Overburden
1.50 - 9.14m	Lower Productive Formation Sandstone (1-2% flecks Po) and mafic tuff; fault zone @ 4.36-5.42 & 9.00-9.14
9.14 - 14.42m	Ultramafic body 2-3% wispy Po @ 13.60-14.42m
14.42 - 98.76m	Lower Productive Formation Dominantly sandy black shale (3-5% dissem/veinlet Po), w/ lesser sandstone (3% wispy Po) & one mafic tuff horizon (3-4% dissem Po)
98.76 - 107.99m	Gabbro-Diabase
107.99 - 110.29m	Lower Productive Formation Black shale w/ interbedded sandstone (1-2% fine veinlet Po)
110.29 - 275.30m	Kolasyoki Volcanic Formation Mafic flow, gabbro-diabase and minor tuff
275.30m	End of Hole

Geochemical Samples: 2; Whole rock Samples: 1.



A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY

DRILL SECTION
PS-92-49 (looking west)
Section 5946OOE

Traced by	: J. Fisher	08/20/92	Approved by :
Drawn by	: J. Philp	08/20/92	Plan no. :
Supervised by	: J. Fisher	08/20/92	Scale : 1 : 2000 (approx)
Reviewed by	:		

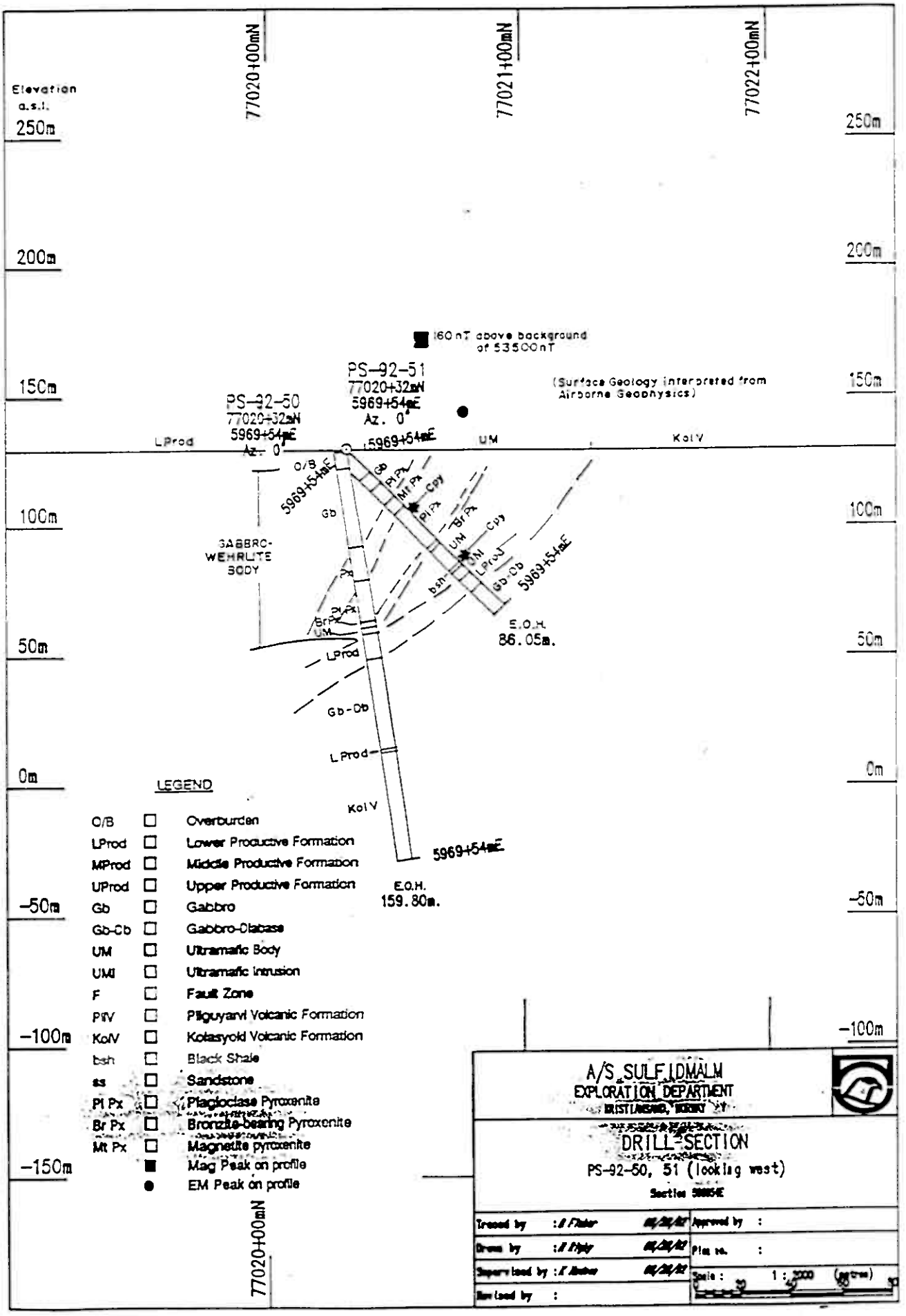
SUMMARY LOG AND DESCRIPTION
PS-92-50

LOCATION: 596953.8E, 7702031.5N, elevation 130m
AZIMUTH: 000° **DIP:** -80°
TOTAL DEPTH: 159.80 m **PROPOSED DEPTH:** 175.0 m
STARTED: 6 August 1992 **COMPLETED:** 9 August 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: Test strong magnetic body (Ultramafic) within Lower Productive Formation
RESULTS: Hole intersected a 64.64m Gabbro-Wehrlite body with Tr-1% Cpy in zones in Pyroxenite and Tr-1% Po in Ultramafic
DIRECT DRILLING COST: 71,805 NOK

SUMMARY LOG:

0.00 - 7.00m		Overburden
7.00 - 71.64m		Gabbro-Wehrlite Body
	7.00-37.12m	Gabbro
		Tr Cpy @ 7.00-26.50m
	37.12-50.20m	Pyroxenite
		Tr-1% Cpy
	50.20-66.61m	Plagioclase Pyroxenite
		1% dissem Cpy 60.8-61.2; 65-66.0m
	66.61-69.00m	Bronzite-bearing Pyroxenite
	69.00-71.64m	Ultramafic (Peridotite)
		Tr-1% dissem Po
71.64 - 81.15m		Lower Productive Formation
		Equal parts black shale (1% wispy Po) and mafic tuff
81.15 - 116.15m		Gabbro-Diabase
116.15 - 116.71m		Lower Productive Formation
		Contorted black shale (nil sulphide)
116.71 - 159.80m		Kolasyoki Volcanic Formation
		Mainly mafic flow with lesser mafic tuff, nil sulphide
159.80m		End of Hole

Geochemical Samples: 24; Whole rock Samples: 8; Thin Sections: 2; Polished Thin Sections: 6.


77020+00mN
77021+00mN
77022+00mN
Elevation a.s.l.
250m
200m
150m
100m
50m
0m
-50m
-100m
-150m
160 nT above background of 53500nT
PS-92-50
77020+32mN
5969+54mE
Az. 0°
PS-92-51
77020+32mN
5969+54mE
Az. 0°
(Surface Geology interpreted from Airborne Geophysics)
LProd
UM
KolV
O/B
Gb
Pl Px
Mt Px
Cpy
Br Px
GABBRO-WEHRLITE BODY
bsh
Gb-Ob
E.O.H.
86.05m.
E.O.H.
159.80m.
5969+54mE
LEGEND
O/B Overburden
LProd Lower Productive Formation
MProd Middle Productive Formation
UProd Upper Productive Formation
Gb Gabbro
Gb-Ob Gabbro-Olabase
UM Ultramafic Body
UMI Ultramafic Intrusion
F Fault Zone
PiV Pilguyarvi Volcanic Formation
KolV Kolasyoki Volcanic Formation
bsh Black Shale
ss Sandstone
Pl Px Plagioclase Pyroxenite
Br Px Bronzite-bearing Pyroxenite
Mt Px Magnetite pyroxenite
Mag Peak on profile
EM Peak on profile
A/S SULFIDMALM
EXPLORATION DEPARTMENT
DRILL-SECTION
PS-92-50, 51 (looking west)
Section 5965E
Traced by :
Drawn by :
Supervised by :
Revised by :
Approved by :
Plan no. :
Scale : 1 : 2000 (metres)

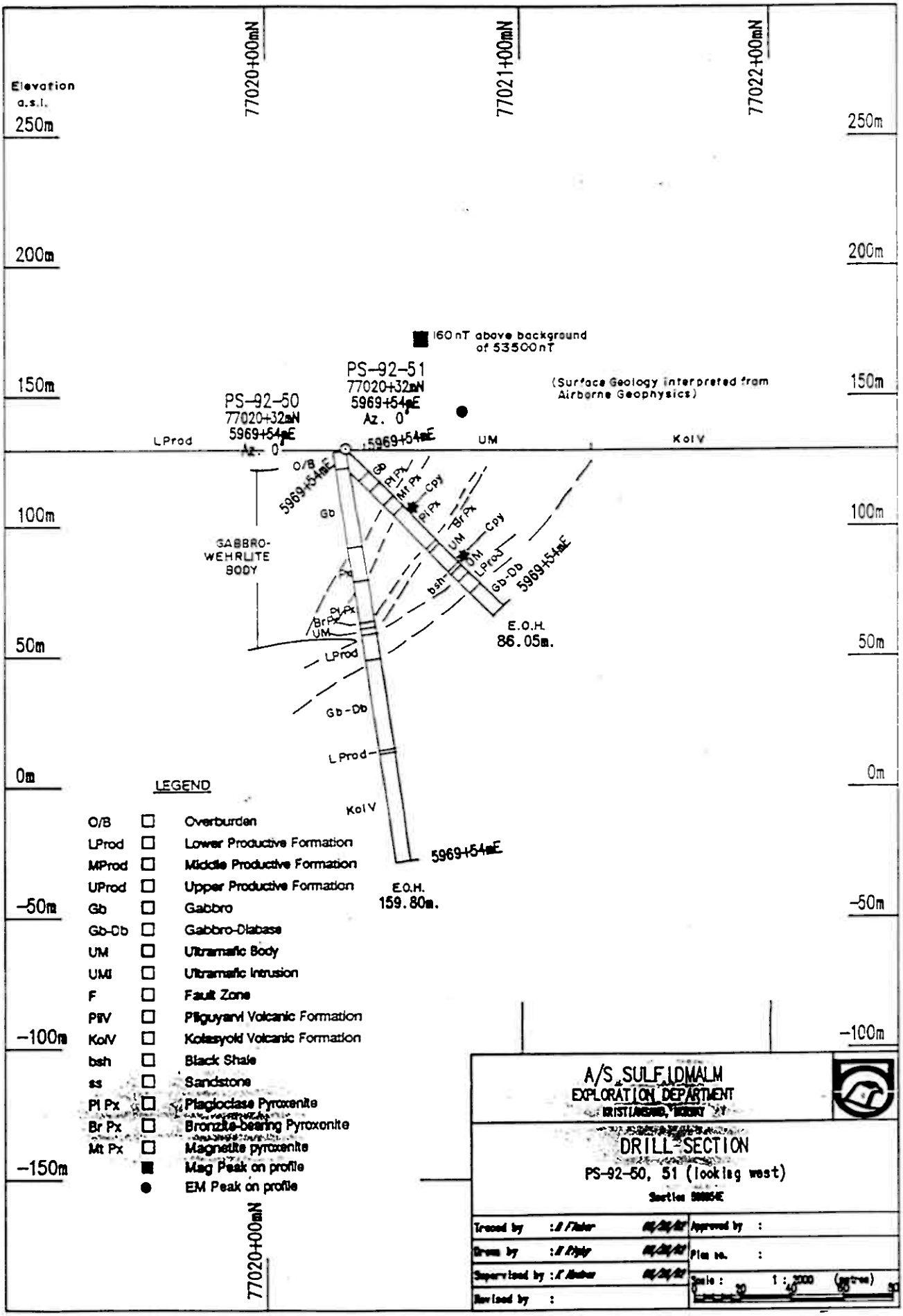
SUMMARY LOG AND DESCRIPTION
PS-92-51

LOCATION: 596953.8E, 7702031.5N, elevation 130m
AZIMUTH: 000° **DIP:** -45°
TOTAL DEPTH: 86.05 m **PROPOSED DEPTH:** 80.0 m
STARTED: 9 August 1992 **COMPLETED:** 11 August 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: Test up-dip projection of strong magnetic ultramafic body intersected in Hole 50 within Lower Productive Formation
RESULTS: Hole collared in and intersected 55.85m gabbro-wehrlite body with Tr Cpy specks and Tr to 2.5% Po in ultramafic portion.
DIRECT DRILLING COST: 41,239 NOK

SUMMARY LOG:

0.00 - 11.80m	Overburden	
11.80 - 67.65m	Gabbro-Wehrlite Body	
	11.80-16.86m	Gabbro Tr Cpy overall & blob of Cpy @ 13.50
	16.86-24.45m	Plagioclase-bearing Pyroxenite
	24.45-30.00m	Magnetic Pyroxenite 9% magnetite (after chromite)
	30.00-49.73m	Plagioclase-bearing Pyroxenite Tr Cpy @ 36.00-44.00 & 1% Cpy in quartz vein @ 38.80 & 46.85-46.90
	49.73-51.00m	Bronzite-bearing Pyroxenite
	51.00-61.46m	Ultramafic (Peridotite) Tr Po @ 60.00-61.52
	61.46-62.70m	Xenolith of sandy black shale, 1% Cpy veins @ 62.33-62.55
	61.70-67.65m	Ultramafic (Peridotite) Tr Po 62.67-65.67; 1% Po 65.67-66.72; 2.5% dissem Po 66.72-67.22
67.65 - 73.58m	Lower Productive Formation Black shale (<1% veinlet Po) and lesser mafic tuff	
73.58 - 86.05m	Gabbro-Diabase	
86.05m	End of Hole	

Geochemical Samples: 23; Whole rock Samples: 6; Polished Thin Sections: 3.


77020+00mN
77021+00mN
77022+00mN
Elevation
a.s.l.
250m
200m
150m
100m
50m
0m
-50m
-100m
-150m
160 nT above background of 53500nT
(Surface Geology interpreted from Airborne Geophysics)
PS-92-50
77020+32mN
5969+54mE
Az. 0
PS-92-51
77020+32mN
5969+54mE
Az. 0
LProd
UM
KolV
O/B
Gb
Pl Px
Mt Px
Cpy
Br Px
GABBRO-WEHRLITE BODY
bsh
Gb-Db
E.O.H.
86.05m.
E.O.H.
159.80m.
LEGEND
O/B Overburden
LProd Lower Productive Formation
MProd Middle Productive Formation
UProd Upper Productive Formation
Gb Gabbro
Gb-Db Gabbro-Diabase
UM Ultramafic Body
UMI Ultramafic Intrusion
F Fault Zone
PlV Pilguyarvi Volcanic Formation
KolV Kolasyold Volcanic Formation
bsh Black Shale
ss Sandstone
Pl Px Plagioclase Pyroxenite
Br Px Bronzite-bearing Pyroxenite
Mt Px Magnetite pyroxenite
Mag Peak on profile
EM Peak on profile
A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY
DRILL SECTION
PS-92-50, 51 (looking west)
Section 5969E
Traced by :
Drawn by :
Supervised by :
Revised by :
Approved by :
Plan no. :
Scale : 1 : 2000

SUMMARY LOG AND DESCRIPTION
PS-92-52

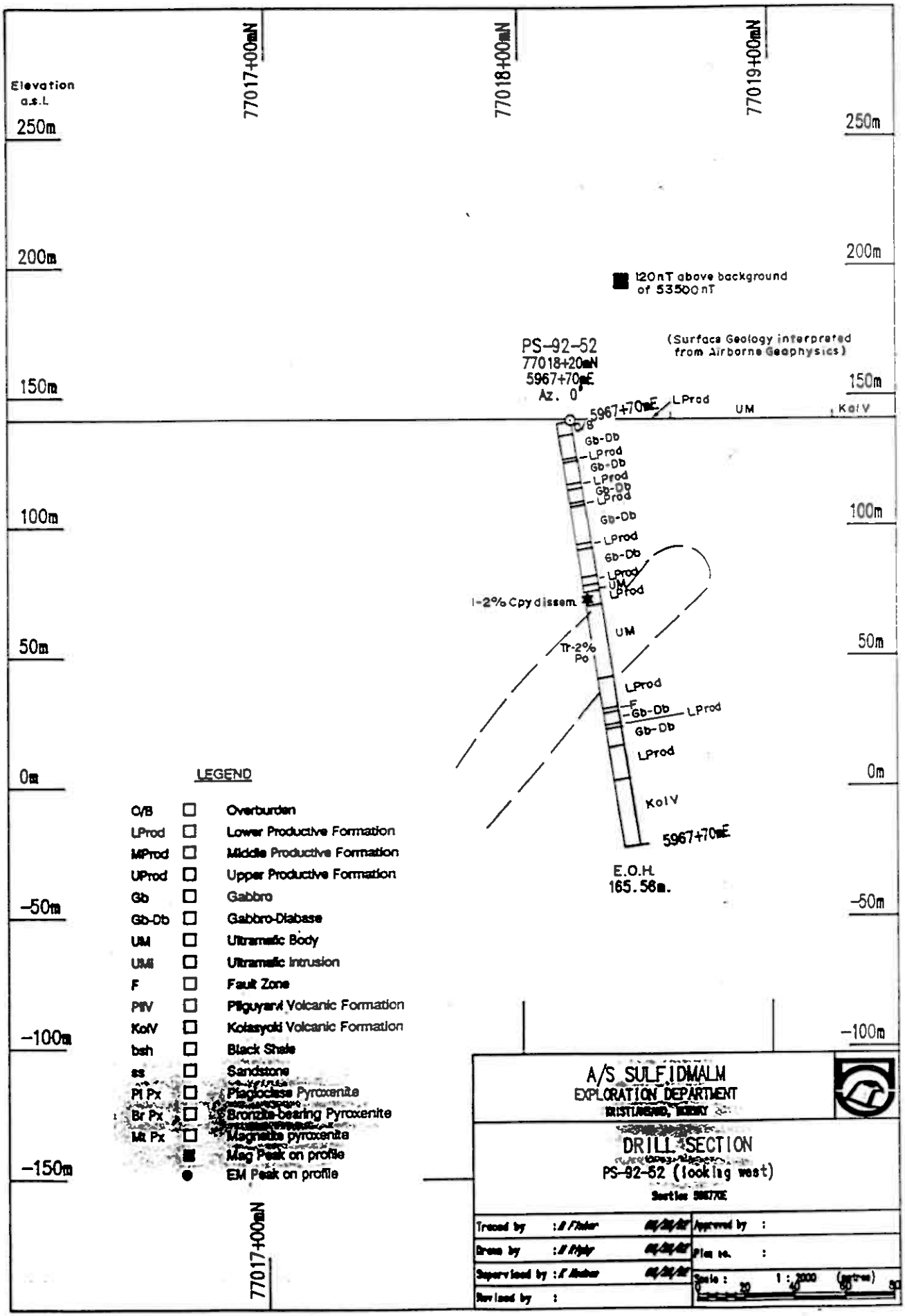
LOCATION: 596770E, 7701820N, elevation 141m
AZIMUTH: 000° **DIP:** -80°
TOTAL DEPTH: 165.56 m **PROPOSED DEPTH:** 175.0 m
STARTED: 11 August 1992 **COMPLETED:** 14 August 1992
LOGGED BY: Karen Hudson-Edwards
PURPOSE: Follow-up DDH PS-43: continue to test strongly magnetic Ultramafic in Lower Productive Formation.
RESULTS: Hole intersected 28.84m Ultramafic Body with Tr-2% Po over 4.15m near base of body and 1-2% Cpy in 0.5m quartz zone above body.
DIRECT DRILLING COST: 73,079 NOK

SUMMARY LOG:

0.00 - 5.88m	Overburden
5.88 - 15.91m	Gabbro-Diabase
15.91 - 16.36m	Lower Productive Formation Black shale with 2-3% stringer Po
16.36 - 25.61m	Gabbro-Diabase
25.61 - 26.75m	Lower Productive Formation Black shale (1-2% veinlet Po) and mafic tuff
26.75 - 32.62m	Gabbro-Diabase
32.62 - 33.90m	Lower Productive Formation Black shale w/ < 1% veinlet Po
33.90 - 48.51m	Gabbro-Diabase
48.51 - 51.14m	Lower Productive Formation Mainly black shale, 1-2% dissem Po
51.14 - 61.60m	Gabbro-Diabase
61.60 - 65.10m	Lower Productive Formation Mafic tuff, 1% Po veinlets
65.10 - 66.88m	Ultramafic flow(?) (or part of larger body below) Tr-1% finely disseminated Po
66.88 - 72.81m	Lower Productive Formation Biotite-bearing mafic tuff, @67.00-67.50, 1-2% Cpy, Tr Po
72.81 - 101.65m	Ultramafic body @80.50-81.25, 97.50-101.65 Tr-2% Po
101.65 - 113.67m	Lower Productive Formation Interbedded mafic flow & black shale (5% Po @ 101.08-101.19; 1-2% Po @ 101.55-101.72)
113.67 - 115.29m	Quartz/Fault Zone
115.29 - 119.51m	Gabbro-Diabase
119.51 - 120.23m	Lower Productive Formation Black shale (1% veinlet Po) & mafic tuff; fault zone @ 128.55-128.82 & 140.56-141.00
120.23 - 128.55m	Gabbro-Diabase
128.55 - 141.00m	Lower Productive Formation

	Black shale, mafic tuff & siltstone, generally 1% veinlet & dissem Po
141.00 - 165.56m	Kolasyoki Volcanic Formation
	Mainly mafic flow, nil sulphide
165.56m	End of Hole

Geochemical Samples: 8; Whole rock Samples: 4.


77017+00mN
77018+00mN
77019+00mN
Elevation a.s.l.
250m
200m
150m
100m
50m
0m
-50m
-100m
-150m
120nT above background of 53500nT
(Surface Geology interpreted from Airborne Geophysics)
PS-92-52
77018+20mN
5967+70mE
Az. 0°
5967+70mE
LProd
UM
KolV
O/B
Gb-Db
LProd
Gb-Db
LProd
Gb-Db
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Gb-Db
LProd
Gb-Db
LProd
Gb-Db
LProd
UM
LProd
1-2% Cpy dissem.
UM
Tr-2% Po
LProd
F
Gb-Db
LProd
Gb-Db
LProd
KolV
5967+70mE
E.O.H.
165.58m.
LEGEND
O/B Overburden
LProd Lower Productive Formation
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F Fault Zone
PfV Pfiguyarvi Volcanic Formation
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bsh Black Shale
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Pl Px Plagioclase Pyroxenite
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Mt Px Magnetite pyroxenite
Mag Peak on profile
EM Peak on profile
A/S SULFIDMALM
EXPLORATION DEPARTMENT
KRISTIANSAND, NORWAY
DRILL SECTION
PS-92-52 (looking west)
Traced by :
Drawn by :
Supervised by :
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Plan no. :
Scale : 1 : 2000 (metres)

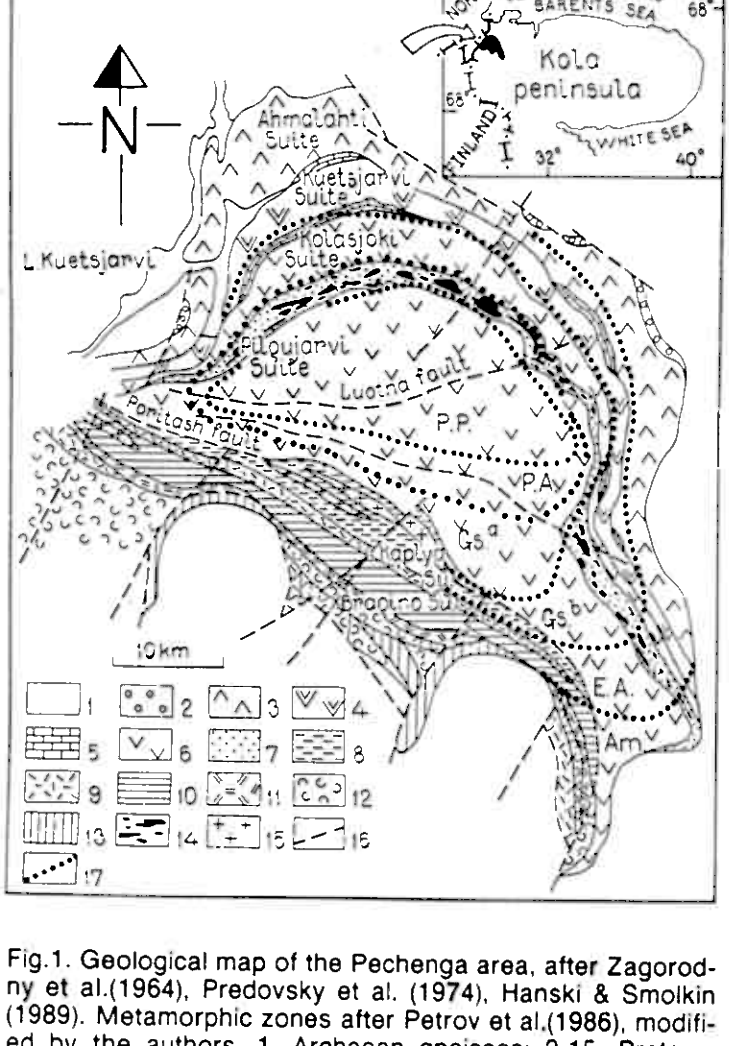

Fig.1. Geological map of the Pechenga area, after Zagorodny et al.(1964), Predovsky et al. (1974), Hanski & Smolkin (1989). Metamorphic zones after Petrov et al.(1986), modified by the authors. 1, Archaean gneisses; 2-15, Proterozoic Pechenga Complex: 2, conglomerates; 3, andesites and basalts; 4, trachybasalts, trachyandesites; 5, quartzites, dolomites; 6, basalts, picrites; 7, Productive Zone: sandstones, silt-stones, pelites and tuffs, with abundant sulphides and carbonaceous matter (gabbro-diabases, intruding the Productive Zone not shown); 8, phyllites, dolomites; 9, basalts; 10, psammites, siltstones; 11, picritic tuffs and tuffites, basalts; 12, andesites, dacites; 13, basalts, andesites, dacites; 14, Ni-bearing gabbro-wehrlite intrusions; 15, extrusive andesitic porphyrites; 16, faults; 17, boundaries of metamorphic facies and subfacies: P.P.- prehnite-pumpellite, P.A.- prehnite-actinolite, Gs-greenschist (a - muscovite-chlorite and b - biotite-chlorite subfacies), E.A.- epidote-amphibolite, Am.- amphibolite.

basalts are abundant with minor felsic volcanites, whereas the upper volcanic suites contain minor picrites (Predovsky et al. 1974, Hanski & Smolkin 1989).

The South-Pechenga series, comprising the Bragino and Kaplya suites, is situated south of the Poritash Fault and is composed of vol-

The age of the rocks of the Pechenga s racrustal belt ranges from c.2.4 Ga to c. Ga. The lower age boundary is an empla ment age for a layered gabbro-norite intrus on Mt.Generalskaya, situated in the Archa basement and overlain by rocks of the Pech ga belt (Bakushkin et al. 1990). The upper boundary is provided by a U-Pb zircon for the Litsa-Araguba granites (Pushkarev al. 1978). Regional metamorphism in the chenga belt varied from prehnite-pumpe facies in the central part of the structure (Fi to amphibolite facies on the flanks (Petrov al. 1986).

The supracrustal rocks are cut by gabb diabase intrusions and differentiated ma ultramafic sills of the gabbro-wehrlite asso tion (Hanski 1986) bearing Cu-Ni sulphide or The age of the gabbro-wehrlite intrusions a comagmatic picrites of the Pilgujarvi suite h been determined by different methods (Han et al. 1990) and is c.1.99 Ga.

Metamorphism led to intensive serpentini tion and talc-carbonate alteration of the ult mafic rocks. Metamorphosed intrusions co ain numerous hydrothermal veins of vary compositions. Carbonate and talc-carbon veins are more or less ubiquitous where serpentine and rodingite veins are rather le common (Smolkin & Abzalov 1990). Roding veins have been dated by the Pb-Pb who rock method (Pushkarev et al. 1985) and ga an age 1.81 ± 0.03 Ga for the metamorp alteration of the Ni-bearing intrusions.

Most of the ore-bearing intrusions and ass ciated Cu-Ni deposits are confined to sedime tary units of the Pilgujarvi suite (Fig.1), t so-called Productive Zone (Gorbunov et 1985). The majority of the Cu-Ni deposits a located in one small area, in the part of t Productive Zone situated to the northwest the Luotna Fault (Figs.1 & 2). This area (Fig is known (Gorbunov 1968) as the Pechen ore-field.

The Cu-Ni deposits contain three princip types of ores: (1) high-grade massive a breccia ores, situated in the basal parts of t massifs and along tectonic zones;(2) disser