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Sammendrag

Two areas containing economic grades of copper and gold have been outlined in the central parts of the Suovrarappat anticline. Possible resverves are 360.00 tonnes og 1.6 % Cu and 0.6 ppm Au and 500.000 tonnes of unknown grade.

One additional diamond drill hole is recomended in the central parts of the anticline and one hole should be drilled to test a copper-gold-mineralization in albite felsite and argillite 1.5 km to the east of the central field.

Nr. 611.

2/84 FB

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SAKSBEARBEIDER Ragnar Hagen

RAPPORT VEDRØRENDE:

SUOVRARAPPAT 1983.

FORDELING

OSLO:

KIRKENES:

ANDRE:

RESYMÉ:

The Suovrarappat mineralization is a vein type and a disseminated mineralization in albite felsite. Hypogene chalcopyrite and supergene bornite and chalcocite are the main ore minerals.

Two areas containing economic grades of copper and gold have been outlined in the central parts of the Suovrarappat anticline. Possible reserves are 360 000 tonnes of 1,6% Cu and 0,6 ppm Au and 500 000 tonnes of unknown grade.

One additional diamond drill hole is recommended in the central parts of the anticline and one hole should be drilled to test a copper- gold-mineralization in albite felsite and argillite 1,5 km to the east of the central field.

KOMMENTAR:

KONFIDENSIELT

RH/rf

INTRODUCTION

The Suovrarappat area has been considered an interesting target since the first mineralized boulders were found in 1958.

This report gives the complete results of the 1982 diamond driling, with a geological interpretation. A revised geological map is presented. The main boulder trains of the area are discussed with respect to Quarternary geology and ore potential. A microscopic study of the ore minerals gives valuable information about the mineralization.

All available information have been used to estimate the possible ore reserves and give a recommandation for future work.

GEOLOGY

A geological map of the Suovrarappat area on a scale of 1:20 000 is presented in Fig. 1. The map is made by J.S. Sandstad, but is mostly based on the concientious work of H. Delin from 1976. Suovrarappat is situated only a few kilkometers south of the boundary against the autochtonous Eocambrian Dividal Group. The rocks in the Suovrarappat area belong to the Karelidic Caskias Greenstone Group.

The main structure in the area is a north-south striking anticline with a plunge towards south of about 40°. The rocks consist of meta diabase and meta basalt in the lower part of the sequence. Some units of meta tuff are also found, but these rocks become more frequent higher in the succession, locally developet as lapilli tuff. Geological studies of major and trace elements classify the greenstone as subalkaline, tholeiitic ocean floor basalts (Sandstad,J.S, 1981, ASPRO report nr. 1315). Sodium metasomatism (enrichment) is frequently found. Over the area dominated by meta tuff and meta tuffite follows a series of argillites with some carbonate units. The succession ends with the Caravarri sandstone to the east.

Cu-mineralization is found in units of albite felsite associated with graphite felsite in the lower part of the succession. A lowgrade disseminated mineralization (less than 0.2% Cu) is found in the east-west striking units of felsite. A vein type mineralization combined with the disseminated type give local zones of high grade. The main ore minerals are chalcopyrite, bornite, chalcocite and hematite. Carbonate occurs as a gangue mineral in the vein-type mineralization. The mineralization and the geological environment are very similar to the Bidjovagge area.

On the basis of earlier results, 6 diamond drill holes with a total of 640,60 m were drilled in 1982. The location of the 1982 drill holes are shown in Fig. 1. Preliminary results of the drilling were given in a report of Des. 17, 1982. Drill hole sections with chemical analyses are shown in Figs. 2.1 to 2.5. The complete chemical analyses are given in Table 1.

The 1982 drilling was concentrated in two areas in the central part of the anticline. Copper-mineralization was found in 5 of 6 holes. Ddhs 5-82 and 6-82 were drilled in an area called Target area I. A detailed geological map of this area is presented in Fig. 3.1. All available information have beed used to compile this map. In details the area is very complex, and the map is somewhat generalized. Minor faults are present, but not indicated on the map. With the interpretation in Fig. 3.1 the copper mineralization is a stratabound lense-shaped body in the footwall block of a graphite felsite dipping towards east. The most serious interpretation problem is encountered in the section through ddhs 500A, 500B and 8-59 (Fig. 3.2).

The missing correlation between ddhs 8-59 and 500B may be explained by faulting, but a major fault is difficult to fit in with the geophysical pattern. In the interpretation in Fig. 3.1 an explanation of a crosscutting diabase intrusion is favoured. The meta diabase at Suovrarappat usually occurs as an early intruded sill. In this case a crosscutting event may explain both drill hole observations and surface geologi as interpretated from geophysics. The area has been surveyed by Magnetics, Turam, Self Potential and VLF. The VLF-survey was done in the spring of 1982, the result is presented in Fig. 3.3. There is agreement between the VLF and Turam surveys.

The mineralization in Target area I will be discussed later in this report.

Ddhs 1-82 to 4-82 were drilled in Target area II. Because of a lake, some of the holes were drilled at unfavourable angels to the expected strike. The rocks in Target area II are very fractured. The geological interpretation of this area is shown in Figs. 4.1 and 4.2. Three mineralized zones were found in this area. The mineralization seems to be stratabound and probably represent three different zones, not interconnected by folding. The economic potential of these sones will be discussed later in this report. An albite breccia occuring in the south-western part of the area will be discussed later in this chapter.

The new geological information from target area I and II have been used to revise parts of H. Delins geological map of Suovrarappat. The new map is presented in Fig. 5. Apart from changes in the two drilling areas, the map in Fig. 5 is different from Delins map on the following points:

1) On the eastern limb of the anticline the albite felsite in ddh 2-75 have been interconnected with the felsite in ddh 3-59. There is strong geophysical evidence for this interpretation.

2) The western limb of the anticline is cut by a major fault, the Cuovcajavrit fault zone. H. Delin placed a tight syncline under the Cuovcajavri lake. The main evidence for a fault are:

   1. A VLF-anomaly from an airborne survey by Dighem Ltd. in 1982 (fig. 6.1).

   2. The magnetics from the same survey show a strong gradient along the fault (Fig. 6.2). The Turam survey results can be fully explained by a fault. (G.F. Sakshaug, 1962. GM-report 364).

No outcrops are found on the western side of the fault, but the geophysical pattern from airborn surveys indicates tuffites and argillites.

The western side of the fault must have been lowered considerably to fit this interpretation.

The Cuovcajavrit fault zone has probably been activated several times. The albite breccia close to the zone may be an alteration product along an early fault. On satellite- and air photos the zone is seen as a lineament also in Caledonian rocks. This means movements along the zone also in Phanerozoicum. This is in accordance with the very fractured rock found in drill holes close to the zone.

BOULDER TRAINS

Mineralized boulders are numerous in the till of the Suovrarappat area. The main boulder trains are indicated on the geological map, Fig. 1. The boulder trains are discussed in light of recent Quarternary geological work (Hamborg, M, 1982-83, NGU reports 1882/10, 1882/20).

Boulder train A is composed of boulders of albite felsite with chalcopyrite, albite carbonate rocks with chalcocite and two small boulders of massive chalcocite. All these types of mineralization were intersected by the 1982 diamond drilling under the Lake Øvre Cuovcajavri. Boulder-train A is explained by a relative short transport of boulders from the mineralization suboutcropping on the eastern shore and under the bottom of the lake.

The source of boulder-train B is the mineralization in the old diamond drill hole 500A. The apex of this boulder-train is situated directly above the mineralized bedrock.

The source of boulder train C has not been found. The boulders may be explained by a very local mineralization in the east- west- striking units of albite felsite. 3 diamond drill holes from 1959 intersect the felsite in this area, but only very weak mineralization has been found. One of the boulders in this train has been regarded with special interest: A 30 cm diameter boulder of massive chalcocite with some hematite and carbonate, containing an impressive 40% copper. Microscopic studies of this boulder show very clear supergene textures (see also next chapter and Fig. 7.8). This observation makes the source mineralizations of this boulder less interesting from an economic point of view.

Boulder train D is made up of boulders of a greenstone tuff with disseminated bornite and chalcocite, with minor chalcopyrite and covellite. Rich samples of this mineralization have been analysed to contain up to 0,80% Cu, but less than 0,02 ppm gold. The mineral assemblage and textures indicate a supergenous enrichment. This means that the primary mineralization must be very lowgrade. The mineralization has not been found in bedrock. Quarternary geological studies indicate a short transportation. Exposure is fairly good in this area, and the sub-outcrop must be small.

Boulder train E consists mainly of diabase boulders with chalcopyrite veins. The average grade of this mineralization is probably very low. One gold analysis of 0,15 ppm from a mineralized vein does not indicate a special gold enrichment.

A few boulders of albite felsite with chalcopyrite in boulder train E represent a more interesting type of mineralization. An analysis of o,46 ppm gold is normal for this type. The albite felsite is rich in rutile, which is also a positive indication. However, the boulders are few and scattered, and the average grade of the mineralization must be low. Transportation of boulder-train E is assumed to be short, exposure is fairly good, so the sub-outcrop is not considered an interesting target.

The boulders of train F consist of argillite with zones of albite felsite with chalcopyrite, and also small boulders of massive chalcopyrite. Weak mineralization can be seen in outcrops, and the boulders are almost in situ. Two holes have been drilled on this showing. Hole no 2-76 was drilled too short, but hole 6-75 intersects two mineralized zones with respectively 1,47 copper and 0,39 ppm gold over 3 meters and 1,14% copper and 0,56 ppm gold over 4 meters. One chip sample from a quartz-carbonate vein in outcrop close to boulders contained less than 0,02 ppm gold.

In relation to boulders and Turam anomalies, the drill hole intersection is not well situated. The zone should be investigated with one additional short diamond drill hole.

ORE MINERALS AND TEXTURES

The different types of mineralization have been studied by ore microscopy and electron microprobe. The mineral assemblages and their textures are discussed in this chapter. The microscopic study gives important information about the mineralization processes. The minerals are described in the same order as the paragenetic sequence.

Pyrite is scarce in the copper mineralization, but is often found as an accessory mineral in the greenstones. Pyrite occurs as inclusions in chalcopyrite in the rich vein-type mineralization from area I. The texture gives evidence of an early pyrite beeing replaced by chalcopyrite with the formation of carrolite (Fig. 7.1).
The carrolite has been investigated by electron microprobe. An average analysis of the Suovrarappat carrolite is:

Fe	0,86 wt %
Cu	8,41 " "
Ni	11,93 " "
Co	37,96 " "
S	43,32 " "
Total	102,42 wt %

The total of this analysis is bit high. This is caused by a small calibration error of the sulphur standard. The analysis gives the following formula for the Suovrarappat carrolite:

$$Co_{1,91}Ni_{0,60}Cu_{0,39}Fe_{0,05}S_{4,00}.$$

In Fig. 7.2 the result of the analysis is plottet in the Cu, Ni, Co, Fe tetrahedron with published analyses of linnaeites (Vokes FM 1967, Min.Dep. 2, pp. 11-25). The Suovrarappat mineral has got more than 10% Cu in the Cu, Ni, Co triangle, which defines the mineral as Carrolite.

Also the pyrite in association with the carrolite was analysed by electron micr probe. An average of two analyses gives:

Fe	46,15 wt %
Cu	0,39 " "
Co	0,37 " "
Ni	0,03 " "
S	53,55 " "
Total	100,49 wt %

When pyrite was replaced by chalcopyrite, the Co- and Ni in the pyrite could not enter the chalcopyrite, and the carrolite was formed. Pyrite, chalcopyrite and carrolite are believed to be early, hypogene minerals.

All microprobe analyses were done at Sentralinstituttet for Industriell Forskning. The instrument used was a Cameca Camebax Microbeam electron microprobe.

The chalcopyrite is replaced by bornite. The result of this process is often an island texture of chalcopyrite in bornite (Fig. 7.3). There are indications that this replacement is supergene: A. The occurence of hematite in the bornite in Fig. 7.3 indicates an enrichment in the oxidation zone. This is explained by the carbonate content of the rock, which neutralizes the acid solutions, and causes precipitation above the ground-water table. B. In Fig. 7.4 chalcopyrite in a tiny vein has been completly replaced by bornite (plus chalcocite and covellite), while a small inclusion of chalcopyrite in albite felsite is perserved. The solutions descending along the vein have replaced the chalcopyrite in the vein, but have not been able to penetrate the albite felsite.

Bornite is also found as intergrowths with chalcocite, these intergrowths are in places myrmekitic (Fig. 7.5). The chalcocite and bornite are formed contemporaneously during replacement of chalcopyrite in the enrichment zone. The occurence of hematite in Fig. 7.5 indicates an enrichment in the oxidation zone.

The copper in the descending solutions has been leached from zones which today occur as barren hematite, Fig. 7.6. The hematite is poreous, and forms very irregular textures.

Fig. 7.7 illustrates a further devolopment of the enriched mineralization: Bornite is replaced by a finegrained intergrowth of hematite and chalcocite. The concentric textures are a clear indication of a supergene process. Similar concentric textures with chalcocite and hematite can be seen in Fig. 7.8. The sample in Fig. 7.8 is taken from the boulder of massive chalcocite in boulder train C.

Another late process is the alteration of chalcopyrite and bornite to chalcocite and covellite. The replacement has taken place along cracks and grain boundaries (Fig. 7.3).

The following table represent a summary of the paragenetic sequence of the main ore minerals at Suovrarappat:

1.	Py + cp?	-	hypogene
2.	cp + crl	-	hypogene
3.	bn + cc + hm + cv	-	supergene

The microscopic evidence for supergene processes at Suovrarappat are strong. The physical requirements for these processes are also present: The Suovrarappat area is situated close to the Eocambrian cover. During most of the glaciation periods, the area was probably covered by the autochtonous Dividal Group. The bottom of The Dividal Group outlines the position of the precambrian Peneplain.

Fig. 8 is a longitudinal section of the area. Into the section is projected the position of The Dividal Group. The projection shows that the present surface of Suovrarappat in late Precambrian times was at a depth of about 20 m - which should be suitable for supergene processes. The fractured bedrock at Suovrarappat in favourable for the downward migration of meteoric waters. The bornite - chalcocite - hematite - covellite assemblage is found at various depths. This is probably due to a varying permeability of the rock, and a varying content of neutralizing carbonate.

ORE RESERVES, DISCUSSION

Target area I (Figs. 3.1, 3.2).

The thin zones of mineralization in ddhs 500B, 8-59 and 6-82 excludes the possibilities of a large orebody in this area in spite of the very encouraging 15 m of 5% copper in ddh 500A. The most interesting aspect of the area is the intersection of 17 m of hematite rich felsite (plus 4,3 m of 1,43% copper and 1,04 ppm gold) in drillhole 6-82 (Fig. 2.5). As discussed in the previous chapter, this zone may represent a leached copper mineralization. Also chemical analyses support this view: The hematite-rich felsite is almost completly barren, the average copper grade is 0,0053%. ,the average gold grade is 0,059 ppm. This gives a ratio ppm Au/% Cu of 11, which is very high compared to the average ratio of 0,24 for the copper mineralization. The leaching of copper have been more effective compared to the leaching of gold. The distribution of copper and gold in the copper mineralization in ddh 6-82 (fig. 2.5) shows gold enrichment and copper enrichment in different zones, which is also in accordance with supergene processes..

If the mineralization in ddh 500A extends as far north as the graphite felsite in the hanging wall, and is represented by the hematite felsite in ddh 6-82, the area of the primary mineralization is 2000 m^2. If the oxidized zone is shallow, and the axis of the orebody plunges towards north the reserves down to -100 m are 500.000 tonnes. There is not enough information to calculate an average grade of this possible tonnage, but the high grade of the mainly chalcopyrite mineralization in 500 A and the possibilities of an enriched zone indicates a high grade.

The calculations and the theories outlined above, should be tested by one diamond drill hole in profile 9100N, to get an intersection of the zone at a depth of about 100 m.

Target area II (Figs. 4.1, 4.2)

The mineralization in ddh 4.82 seems to have no economic potential. The grade is low (2 m of 1,29% copper and 0,35 ppm gold), and the same stratigraphic level in ddhs 1-62 and 2-62 is not mineralized. The main zone in area II is intersected by ddhs 1-76, 2-82 and 3-82. The average horizontal thickness is 6,5 m. With a strike length of 200 m the reserves down to -100 m are 364.000 tonnes of 1,6% copper and 0,6 ppm gold. This tonnage must be classified as possible reserves. To the west this zone is cut by the Cuovcajavrit fault. The zone is open towards east, but the lack of geophysical anomalies does not indicate the presence of a rich mineralization. Most of the known strike length of this zone is situated in very fractured rocks, under the lake.

The footwall zone in area II is intersected by ddh 1-82 with 6,0 m of 4,13% copper and 0,84 ppm gold. The high grades are caused by supergene enrichment. To the west this zone is cut by the Cuovcajavrit fault, and a weak mineralization in ddh 2-82 limits the zone of economic grades towards east. Also this zone is situated in brecciated rocks under the lake.

The distribution of copper and gold in Target area II also displays the effect of supergene processes. The chalcopyrite mineralization in ddh 3-82 (Fig. 2.3) shows a positive correlation between copper and gold, while in ddh 1-82 (Fig. 2.1) the gold is enriched outside the chalcocite- bornite-mineralization. The gold content of the primary mineralization seems to be too low (0,4 - 0,7 ppm), and the leaching and enrichment not extensive enough to produce gold zones with high economic importance.

The mineralized units seems to thin out towards north on the eastern limb of the anticline (Fig. 5). The short or broken conductors found in Target area I and II are not present towards north, and no further work is recommended here.

The Turam survey indicates a conductor at a depth of 100 m, 1,8 km northwest of the Cuovcajavri lake. This could be the down-faulted continuation of the western limb of the anticline. The mineralization in Target area II is not strong enough to warrant further work on the western side of the fault at present.

The drilling of one diamond drillhole in Target area I and one hole at boulder train F should make up the 1984 investigations at Suovrarappat. The drilling should be done in connection with the drilling of follow-up targets from airborne geophysical surveys 3 km to the east of Suovrarappat.

Stabekk 06.12.1983

Ragnar Hagen

Ragnar Hagen

Diamond drill hole
Borhull nr..........SVR.1-82..................

Prøve nr.	b.m.	% Cu	% Zn	% Pb	% Fe	ppm Au
	38-39	0.99				0.59
	39-40	0,10				1,72
	40-41	3,92				0,28
	41-42	4,79				0,15
	42-43	15,0				0,18
	43-44	0,03				2,16
	44-45					0,19
	45-46					0,02
	46-47					0,02
	47-48					0,02
	48-49					0,02
	49-50					0,02

Diamond drillhole

Borhull nr......SVR..2-82....................

Prøve nr.	meter b.m.	% Cu	% Zn	% Pb	% Fe	ppm Au
	45-46	0,25				0,02
	46-47	0,80				0,02
	47-48	0,41				0,02
	48-49	0,43				0,10'
	49-50	0,23				0,05
	50-51	0,49				0,10
	51-52	0,50				0,02
	52-53	0,39				0,02
	53-54	1,02				0,02
	54-55	0,01				0,02
	55-56	0,00				0,02
	56-57	0,15				0,05
	57-58	0,44				0,04
	58-59	0,05				0,02
	59-60	0,10				0,02
	60-61	0,02				0,02
	61-62	0,11				0,02
	62-63	0,03				0,02
	63-64	0,13				0,02
	64-65	0,51				0,02
	65-66	0,34				0,02
	66-67	0,04				0,02
	67-68	0,51				0,02
	68-69	0,09				0,04
	69-70	0,14				0,02
	70-71	0,04				0,13
	71-72	0,89				0,10
	72-73	0,50				0,03
	73-74	2,59				0,05
	74-75	1,60				0,12
	75-76	0,68				0,50
	76-77	1,69				0,27
	77-78	0,45				0,05
	78-79	4,38				0,55
	79-80	0,96				0,05

Diamond drillhole

Borhull nr......SVR 2-82.......................

Prøve nr.	b.m.	% Cu	% Zn	% Pb	% Fe	ppm Au
	80-81	0,63				0,48
	81-82	2,36				0,21
	82-83	4,82				0,62
	83-84	0,93				0,10
	84-85	0,49				0,04
	85-86	0,45				0,05
	86-87	0,06				0,04
	87-88	0,07				0,02
	88-89	0,09				0,02
	89-90	0,22				0,22
	92-93	0,39				0,02
	93-94	3,27				0,18
	94-95	0,91				0,10
	95-96	0,48				0,02
	96-97	0,38				0,02
	106-107	0,06				0,02
	107-108	5,01				0,21

Diamond drillhole:

Borhull nr.........SVR 3-82.....................

Prøve nr.	b.m.	% Cu	% Zn	% Pb	% Fe	ppm Au
	58-59	0,95				0,53
	59-60	0,99				1,15
	60-61	1,60				2,06
	61-62	0,25				0,03
	62-63	1,97				0,29
	63-64	3,64				1,41
	64-65	0,23				0,24
	65-66	0,13				0,10
	66-67	2,50				0,04

Diamond drillhole

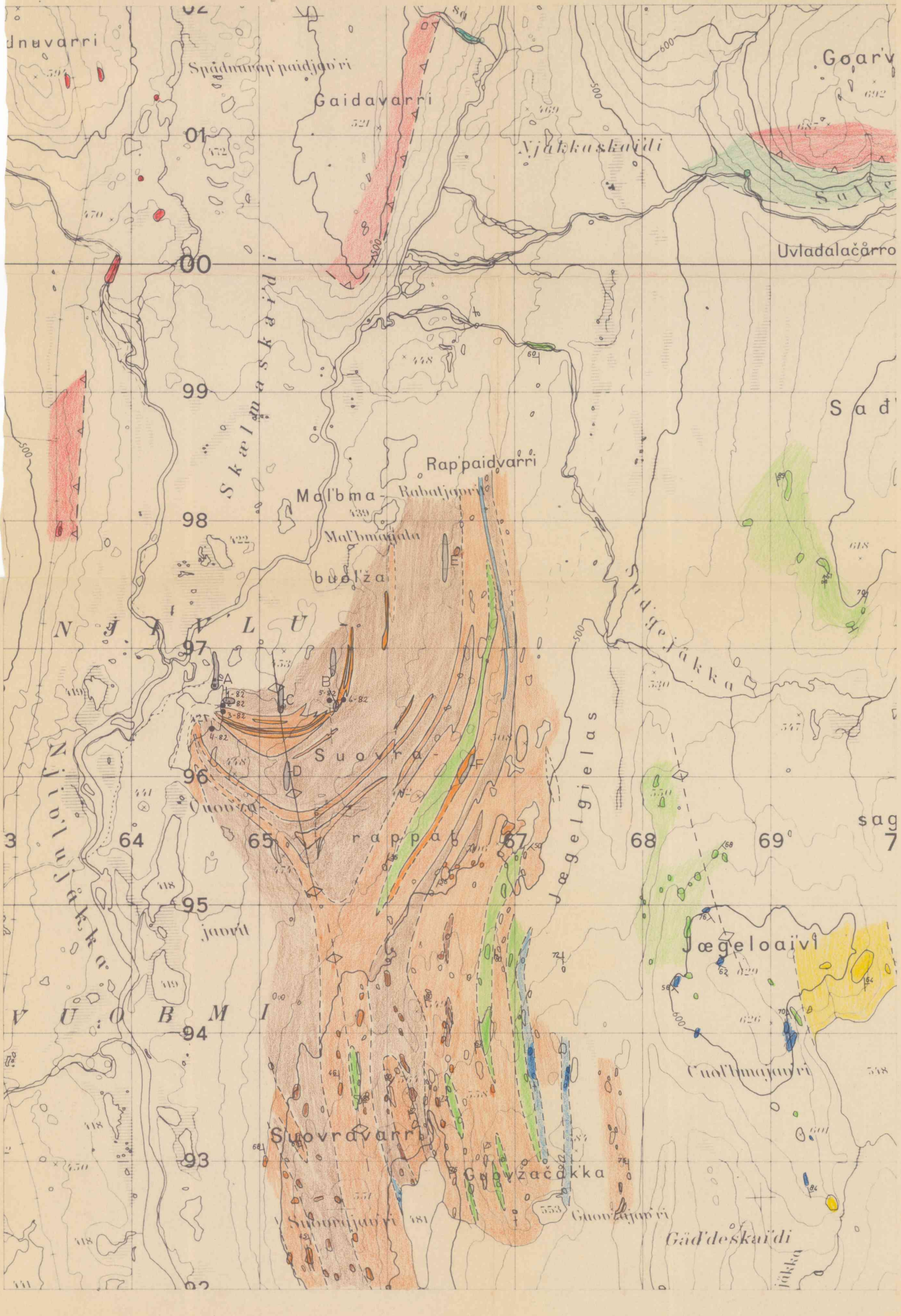
Borhull nr..........SVR 4-82......................

Prøve nr.	b.m.	% Cu	% Zn	% Pb	% Fe	ppm Au
	40-41					0,02
	41-42					0,02
	42-43					0,02
	43-44					0,02
	44-45					0,02
	45-46					0,02
	79-80	1,16				0,32
	80-81	1,42				0,38
	84-84	0,04				0,02
	85-86	0,48				0,02

Diamond drillhole

Borhull nr.......SVR..6-82..................

Prøve nr.	b.m.	% Cu	% Zn	% Pb	% Fe	ppm Au
	18,7-19,9	4,01				0,48
	20,0-21,1	0,37				0,05
	21,1-22,1	0,50				2,24
	22,1-23,0	0,50				1,80
	23-24	0,0037				0,09
	24-25	0,0014				0,03
	25-26	0,0034				0,02
	26-27	0,0018				0,02
	27-28	0,0070				0,18
	28-29	0,0018				0,02
	29-30	0,0016				0,09



LEGEND

Allochthonous rocks

Quartzite and meta - arkose

Autochthonous rocks
Dividal Group

Shale, sandstone and conglomerate

Precambrian rocks

Silt / sandstone

Pebbly sandstone /conglomerate

Carbonate breccia

Carbonate rocks

Pelites, argillites

Graphite felsite

Albite felsite

Meta - tuft / Meta - tuffite

Meta - diabase / Metabasalt

Rock boundary

Thrust plane

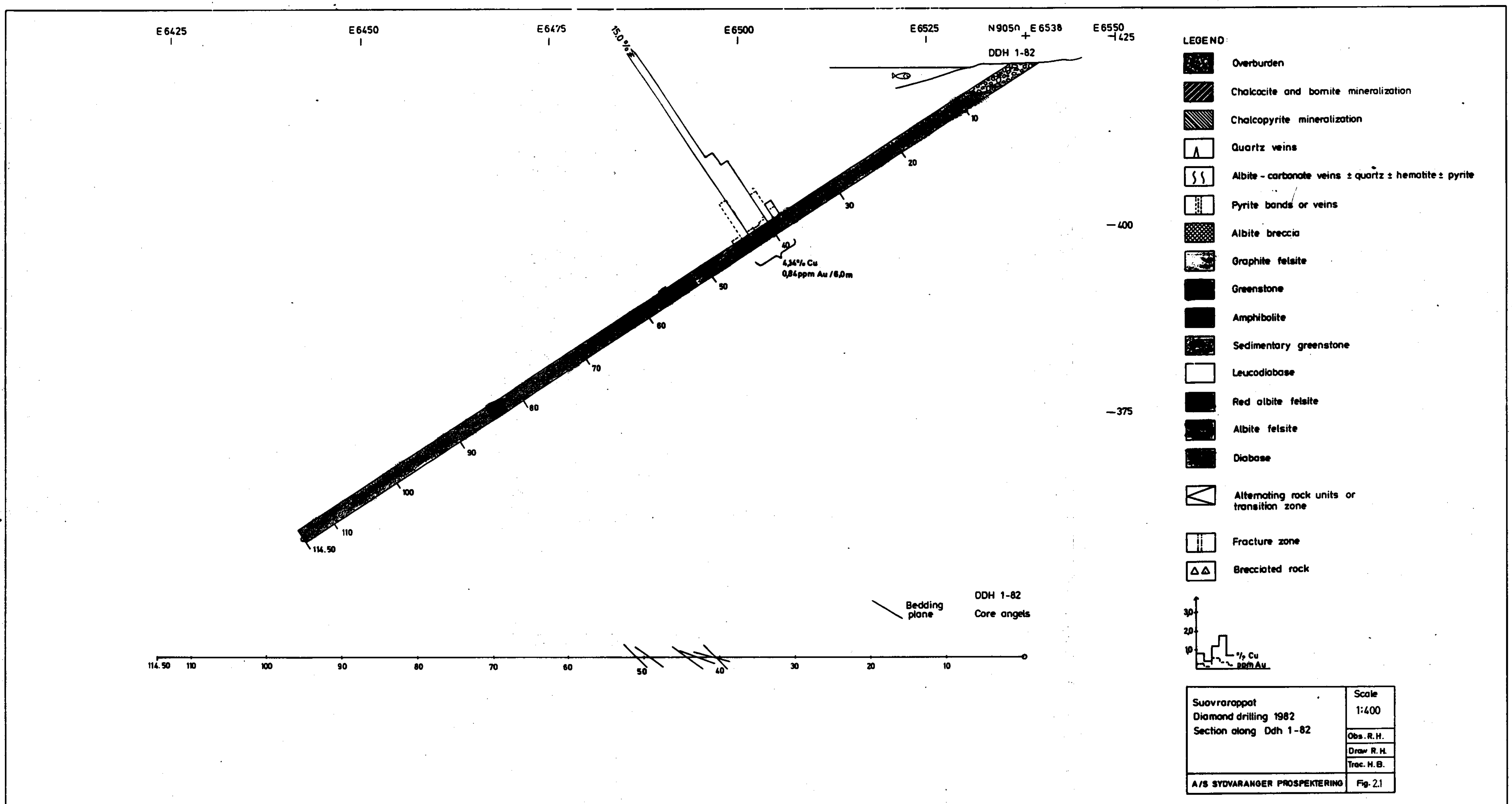
Fault

Fold - axis

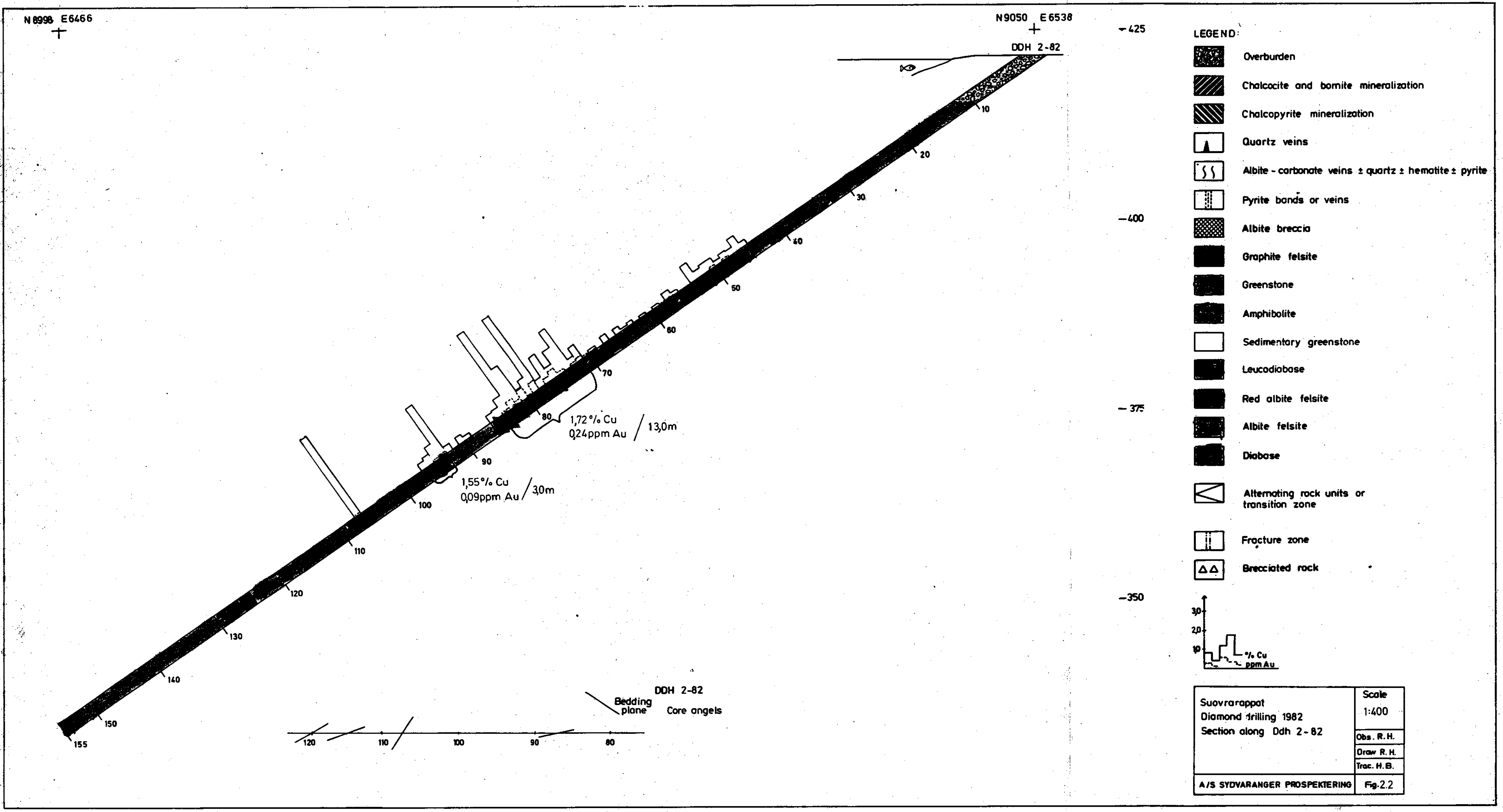
Diamond drill holes 1982

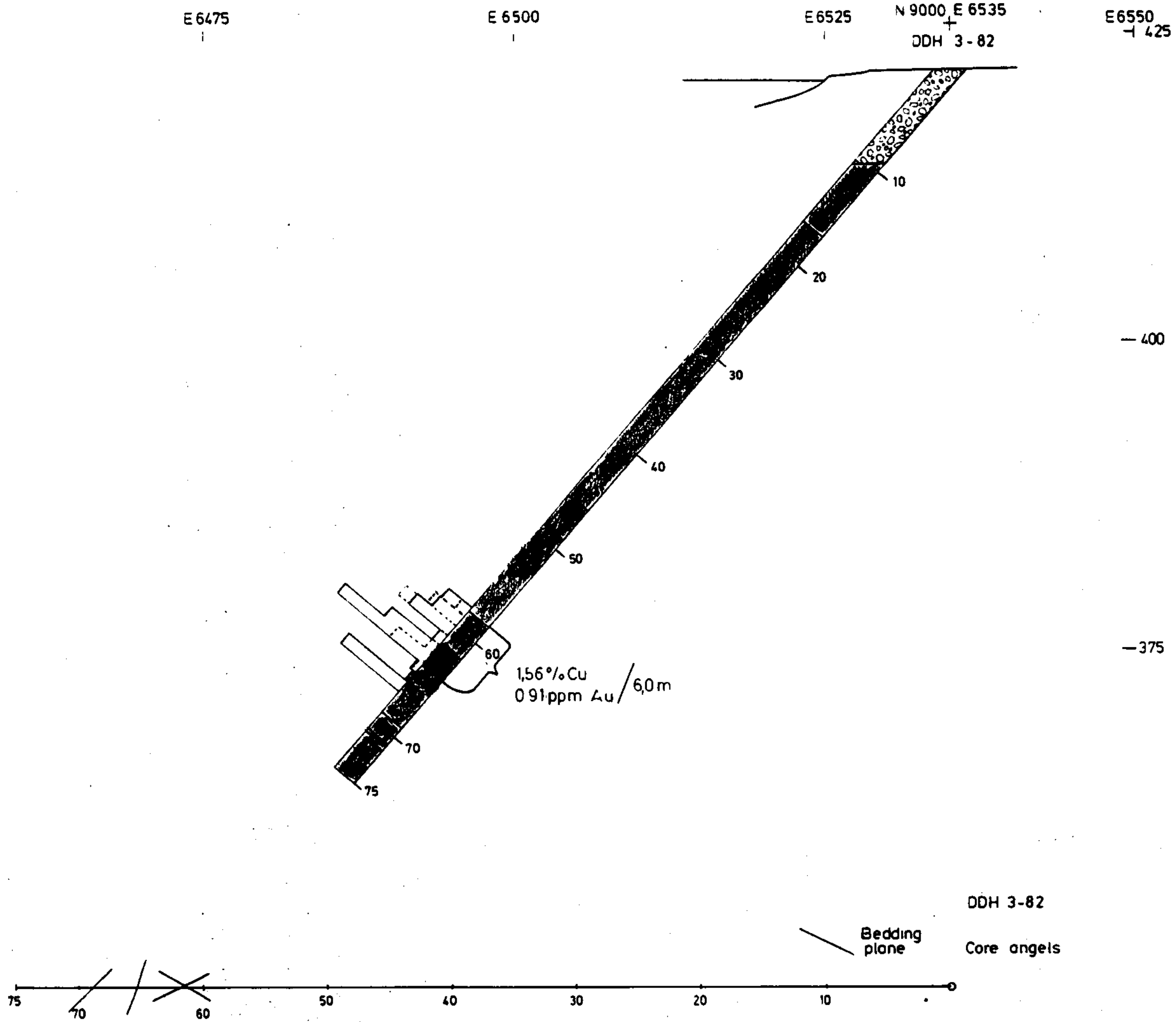
Boulder - train

Suovrarappat Geological map By H. Delin and J.S. Sandstad	Scale 1:20 000
	Obs. H.D. J.S.S
	Draw. J.S.S.
	Trac. H.B.
A/S SYDVARANGER PROSPEKTERING	Fig. 1



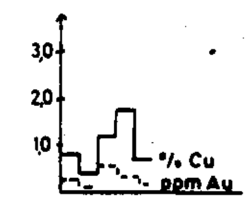
E 6425
E 6450
E 6475
E 6500
E 6525
N 9050 E 6538
E 6550
425
400
375
DDH 1-82
15,0 % Cu
4,34% Cu
0,84ppm Au / 6,0m
10
20
30
40
50
60
70
80
90
100
110
114.50
LEGEND:
Overburden
Chalcocite and bornite mineralization
Chalcopyrite mineralization
Quartz veins
Albite - carbonate veins ± quartz ± hematite ± pyrite
Pyrite bands or veins
Albite breccia
Graphite felsite
Greenstone
Amphibolite
Sedimentary greenstone
Leucodiabase
Red albite felsite
Albite felsite
Diabase
Alternating rock units or transition zone
Fracture zone
Brecciated rock
% Cu
ppm Au
Bedding plane
DDH 1-82
Core angels
Suovrarappat
Diamond drilling 1982
Section along Ddh 1-82
Scale
1:400
Obs. R.H.
Draw R.H.
Trac. H.B.
A/S SYDVARANGER PROSPEKTERING
Fig. 2.1


N 8998 E6466
N9050 E6538
DDH 2-82
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
155
1,72 °/o Cu
0,24ppm Au
13,0m
1,55 °/o Cu
0,09ppm Au
3,0m
-425
-400
-375
-350
LEGEND:
Overburden
Chalcocite and bornite mineralization
Chalcopyrite mineralization
Quartz veins
Albite - carbonate veins ± quartz ± hematite ± pyrite
Pyrite bands or veins
Albite breccia
Graphite felsite
Greenstone
Amphibolite
Sedimentary greenstone
Leucodiabase
Red albite felsite
Albite felsite
Diabase
Alternating rock units or transition zone
Fracture zone
Brecciated rock
3,0
2,0
1,0
°/o Cu
ppm Au
DDH 2-82
Bedding plane
Core angels
120
110
100
90
80
Suovrarappat
Diamond drilling 1982
Section along Ddh 2-82
Scale
1:400
Obs. R.H.
Draw R.H.
Trac. H.B.
A/S SYDVARANGER PROSPEKTERING
Fig. 2.2

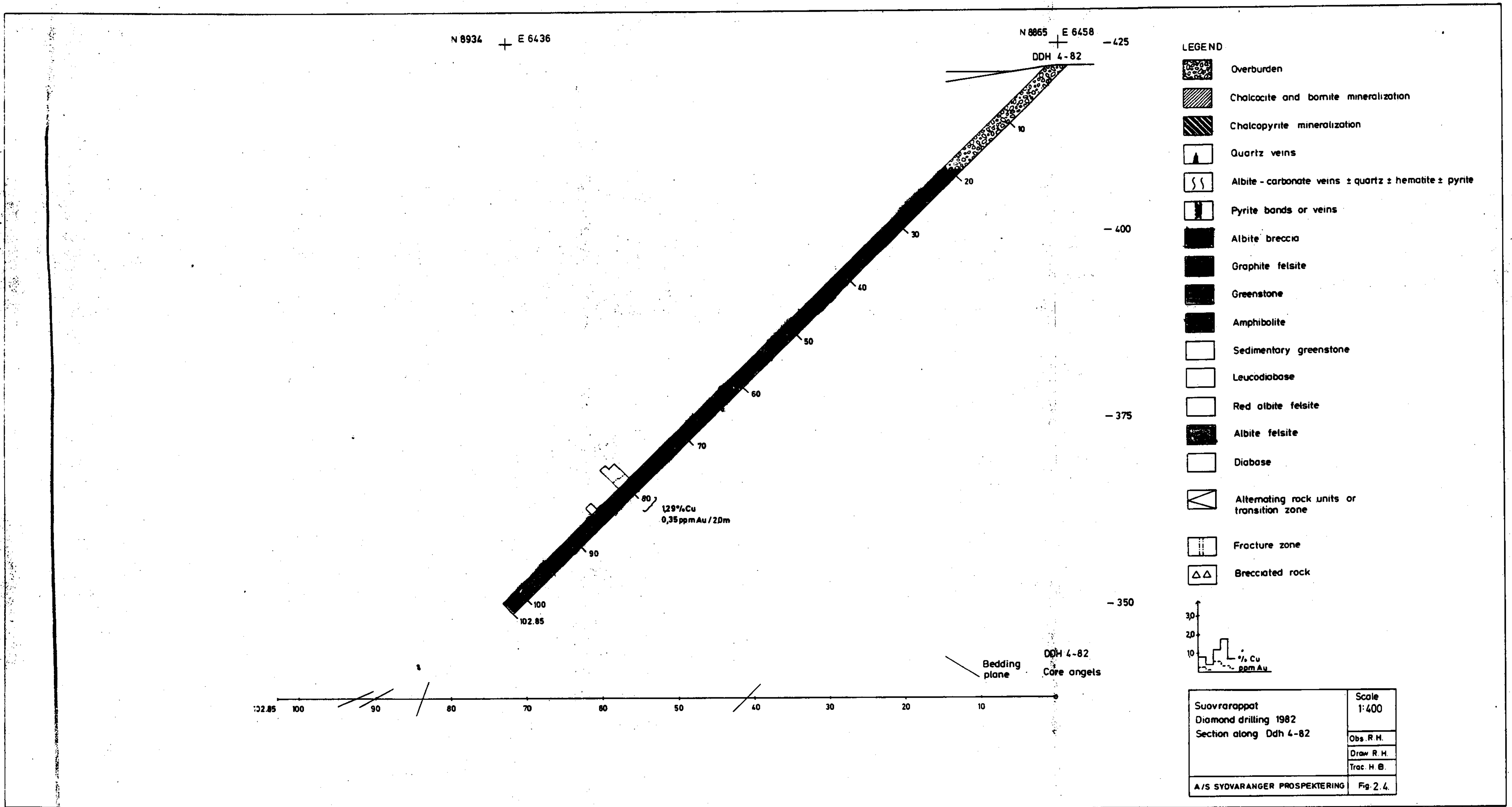


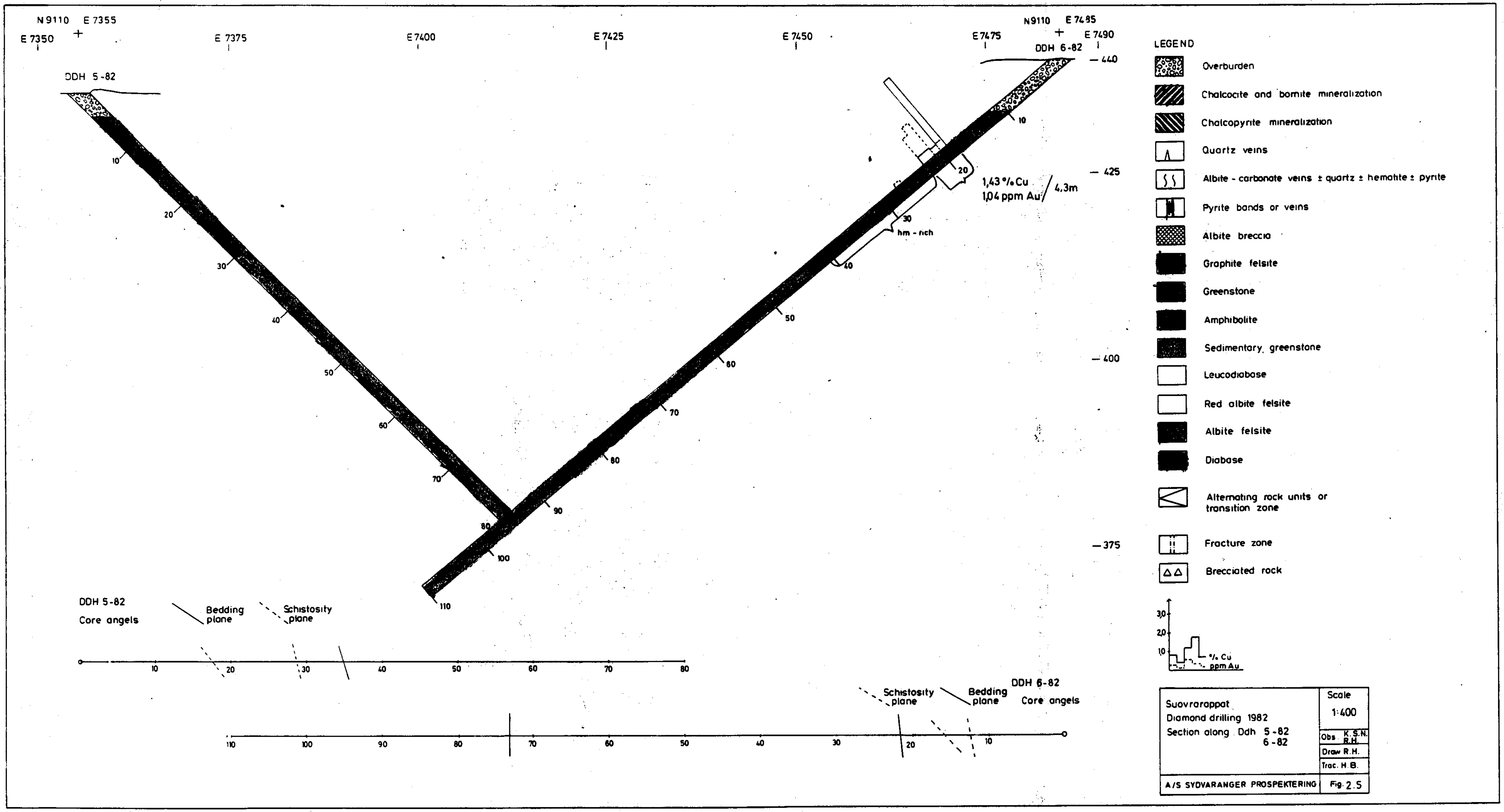
LEGEND

- Overburden
- Chalcocite and bornite mineralization
- Chalcopyrite mineralization
- Quartz veins
- Albite - carbonate veins ± quartz ± hematite ± pyrite
- Pyrite bands or veins
- Albite breccia
- Graphite felsite
- Greenstone
- Amphibolite
- Sedimentary greenstone
- Leucodiabase
- Red albite felsite
- Albite felsite
- Diabase
- Alternating rock units or transition zone
- Fracture zone
- Brecciated rock

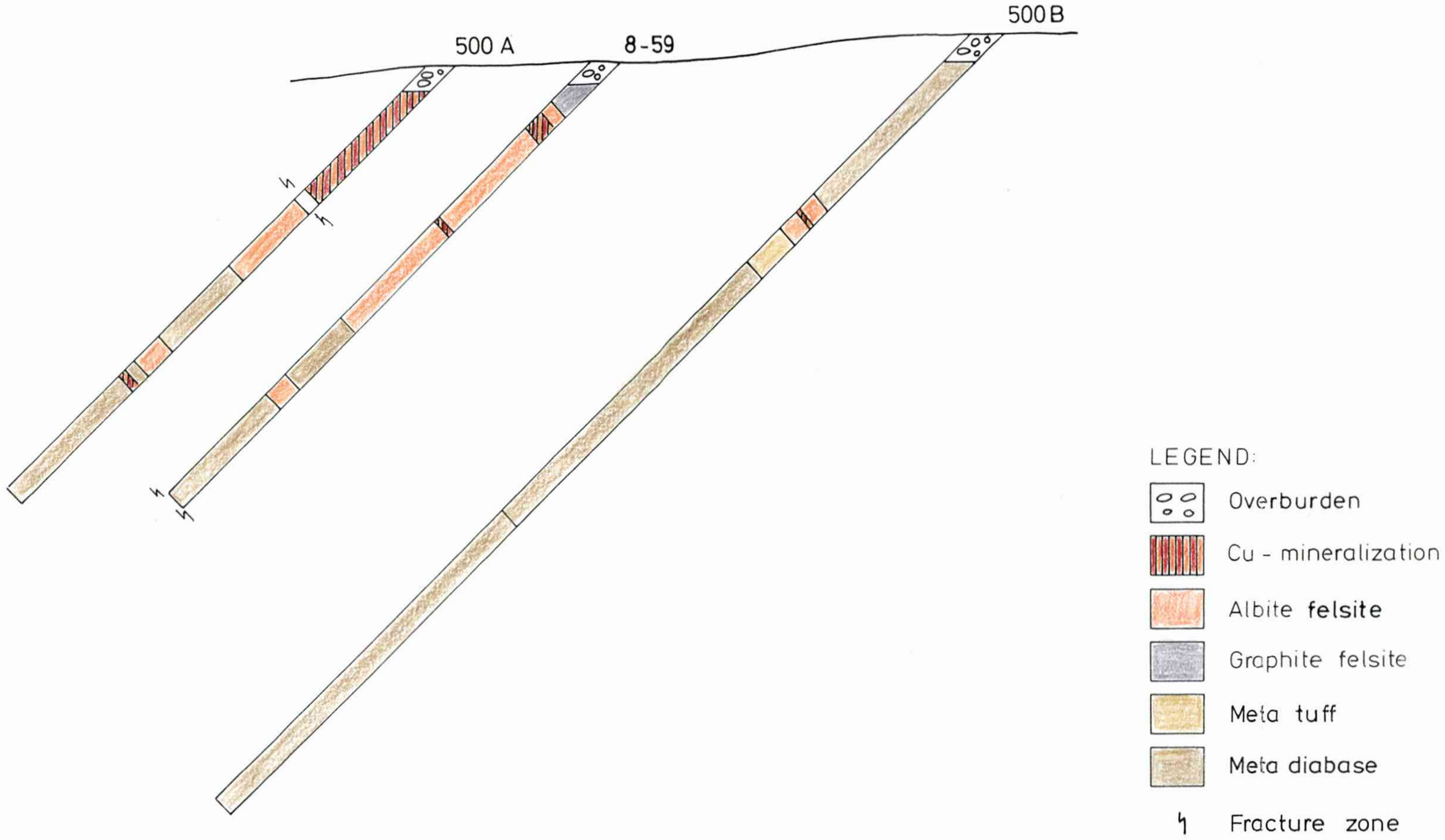


Suovrarappat Diamond drilling 1982 Section along Ddh 3-82	Scale 1:400
	Obs. R.H.
	Draw R.H.
	Trac. H.B.
A/S SYDVARANGER PROSPEKTERING	Fig. 2.3


N 8934 E 6436
N 8865 E 6458
DDH 4-82
-425
-400
-375
-350
10
20
30
40
50
60
70
80
90
100
102.85
1,29%Cu
0,35ppmAu/2,0m
Bedding plane
DDH 4-82
Core angels
102.85
100
90
80
70
60
50
40
30
20
10
LEGEND
Overburden
Chalcocite and bornite mineralization
Chalcopyrite mineralization
Quartz veins
Albite - carbonate veins ± quartz ± hematite ± pyrite
Pyrite bands or veins
Albite breccia
Graphite felsite
Greenstone
Amphibolite
Sedimentary greenstone
Leucodiabase
Red albite felsite
Albite felsite
Diabase
Alternating rock units or transition zone
Fracture zone
Brecciated rock
3,0
2,0
1,0
% Cu
ppm Au
Suovrarappat
Diamond drilling 1982
Section along Ddh 4-82
Scale
1:400
Obs. R.H.
Draw R.H.
Trac. H.B.
A/S SYDVARANGER PROSPEKTERING
Fig. 2.4.


N9110 E 7355
E 7350
E 7375
E 7400
E 7425
E 7450
E 7475
N9110 E 7485
E 7490
DDH 6-82
DDH 5-82
— 440
— 425
— 400
— 375
1,43 % Cu
1,04 ppm Au
4,3m
hm - rich
LEGEND
Overburden
Chalcocite and bornite mineralization
Chalcopyrite mineralization
Quartz veins
Albite - carbonate veins ± quartz ± hematite ± pyrite
Pyrite bands or veins
Albite breccia
Graphite felsite
Greenstone
Amphibolite
Sedimentary greenstone
Leucodiabose
Red albite felsite
Albite felsite
Diabase
Alternating rock units or transition zone
Fracture zone
Brecciated rock
% Cu
ppm Au
DDH 5-82
Core angels
Bedding plane
Schistosity plane
DDH 6-82
Core angels
Schistosity plane
Bedding plane
Suovrarappat
Diamond drilling 1982
Section along Ddh 5-82
6-82
Scale
1:400
Obs. K.S.N. R.H.
Draw R.H.
Trac. H.B.
A/S SYDVARANGER PROSPEKTERING
Fig. 2.5


LEGEND:
Turam indications:
Very strong anomaly
strong
weak
very weak
GEOLOGY:
Hematite mineralization
Chalcopyrite / Bornite mineralization.
4 Graphite felsite
3 Albite felsite
2 Banded greenstone
1 Metadiabase
Diamond drill holes
7400E
7500E
7600E
9200N
9100N
9000N
8900N
5B-75
5A-75
5-82
6-82
3-59
500 A
81-59
500B
10-59
492 A
9-59
Suovrarappat
Target area I
Scale 1:1000
R. Hagen
Nov. 1983
PROSPEKTERING A/S
Fig. 3.1



Suovrarappat

Section through d.d.hs 500 A 500 B and 8-59

Scale 1:500

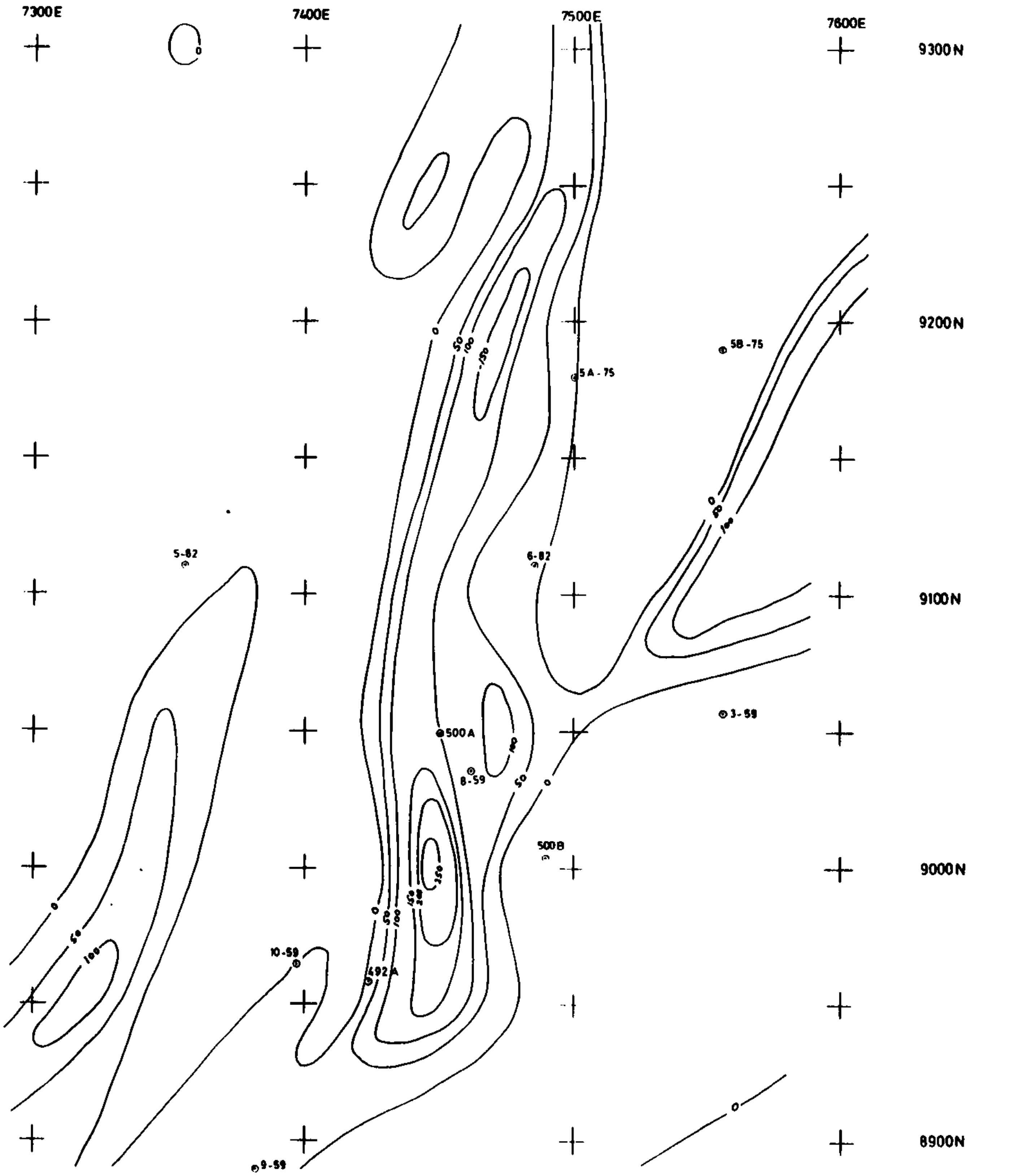
Obs.

Draw. R.H. 83

Trac. H.B. 83

PROSPEKTERING A/S

Fig. 3.2

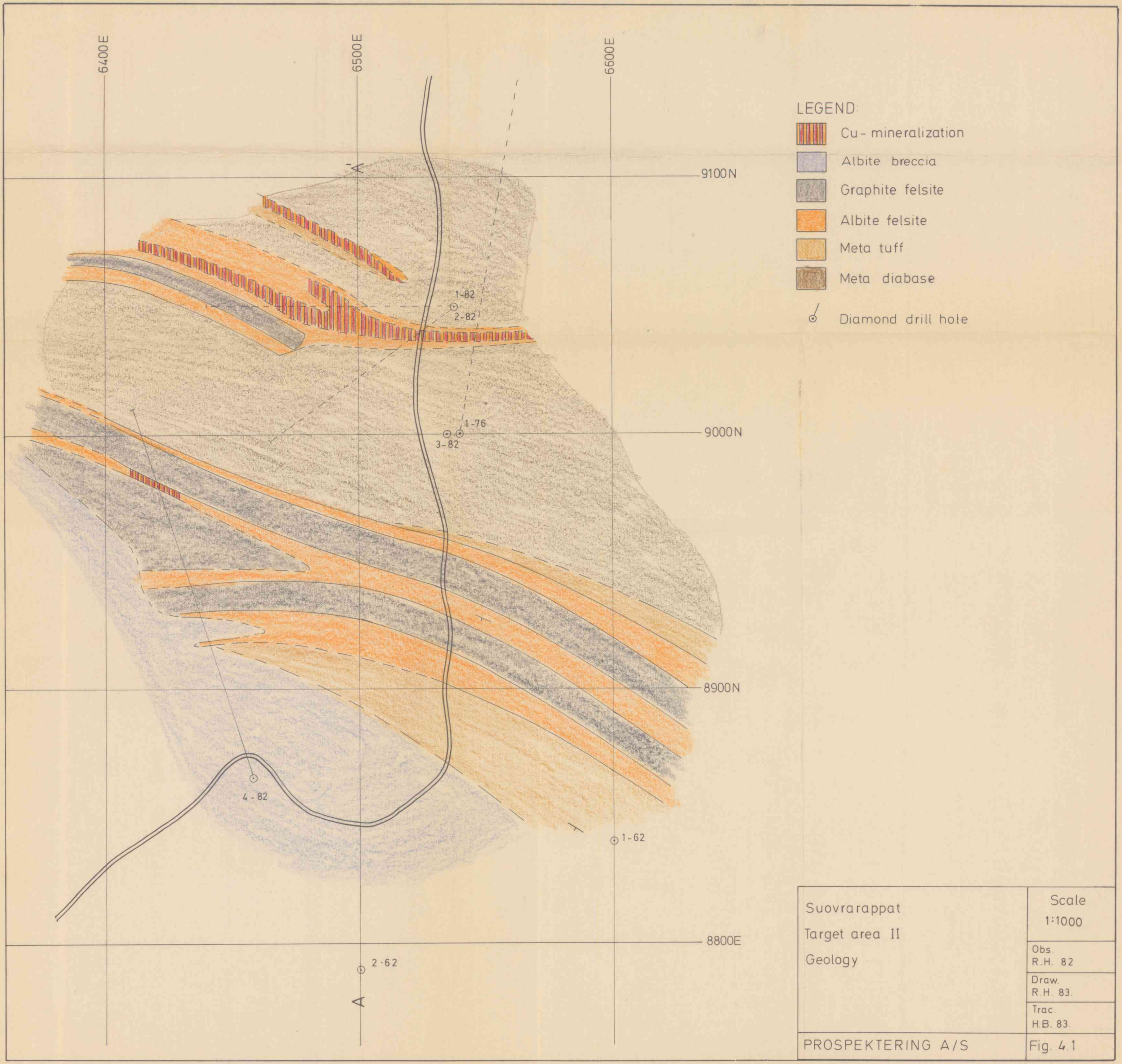


LEGEND:

100 — Contoured Fraser figures (From dip-angle values in%)

⊙ 500A — Diamond drill hole

Suovrarappat Target area I VLF survey Contoured Fraser figures	Scale 1:1000
	Obs. L.E.F. 7/82
	Draw. R.H. 8/82
	Trac. H.B. 10/82
A/S SYDVARANGER	Fig. 3.3



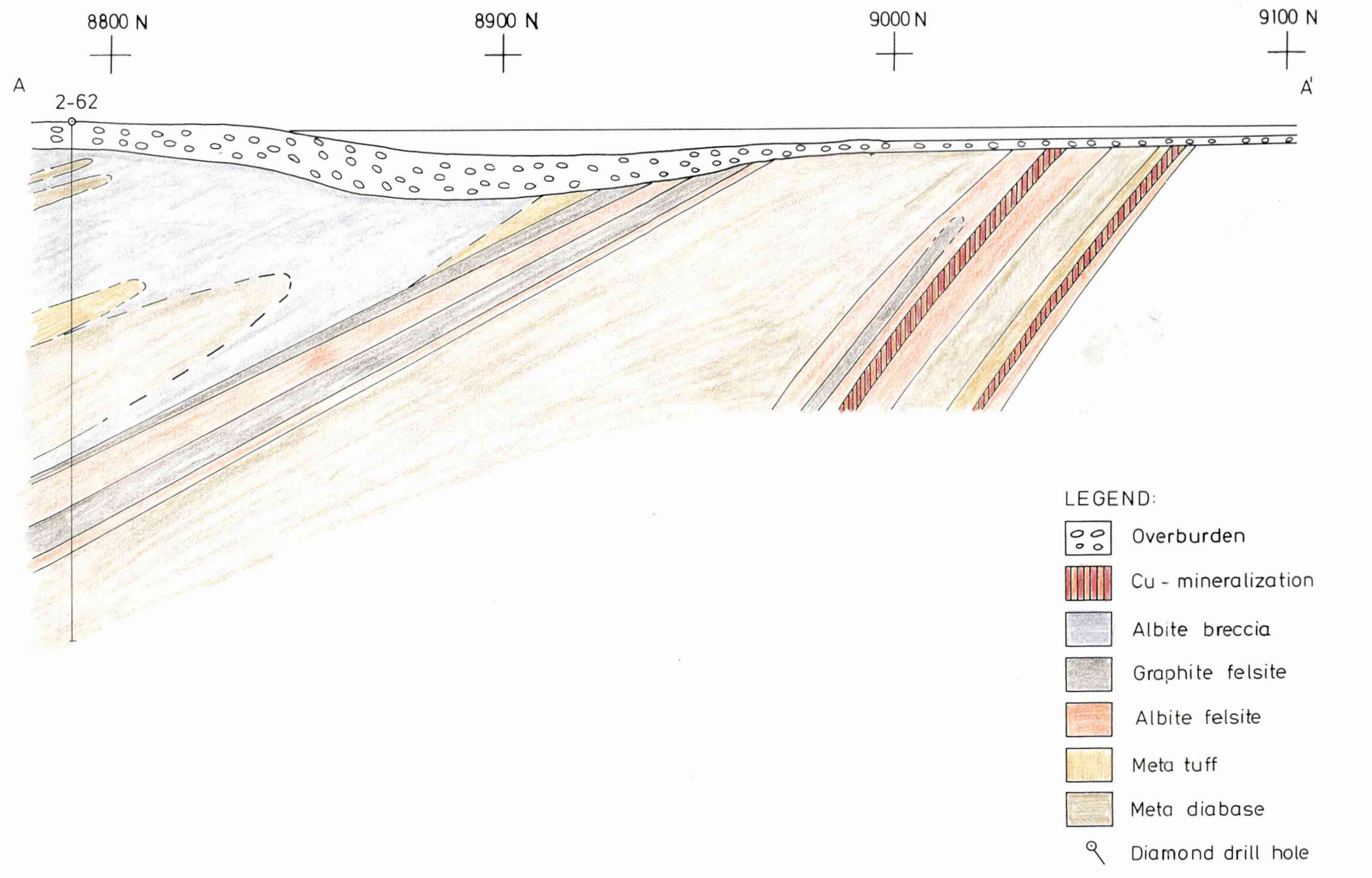
Suovrarappat
Target area II
Geology

Scale 1:1000

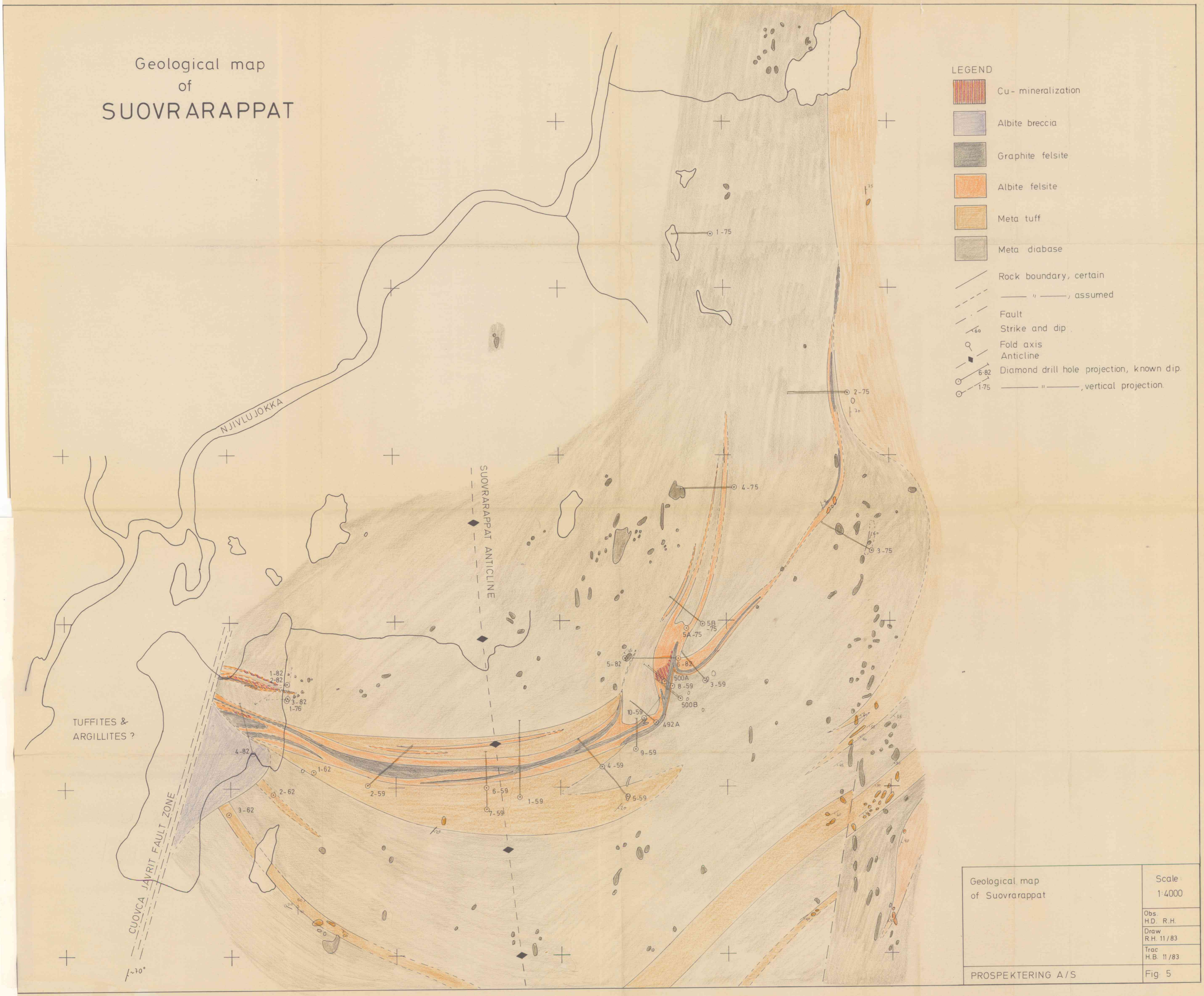
Obs. R.H. 82
Draw. R.H. 83.
Trac. H.B. 83.

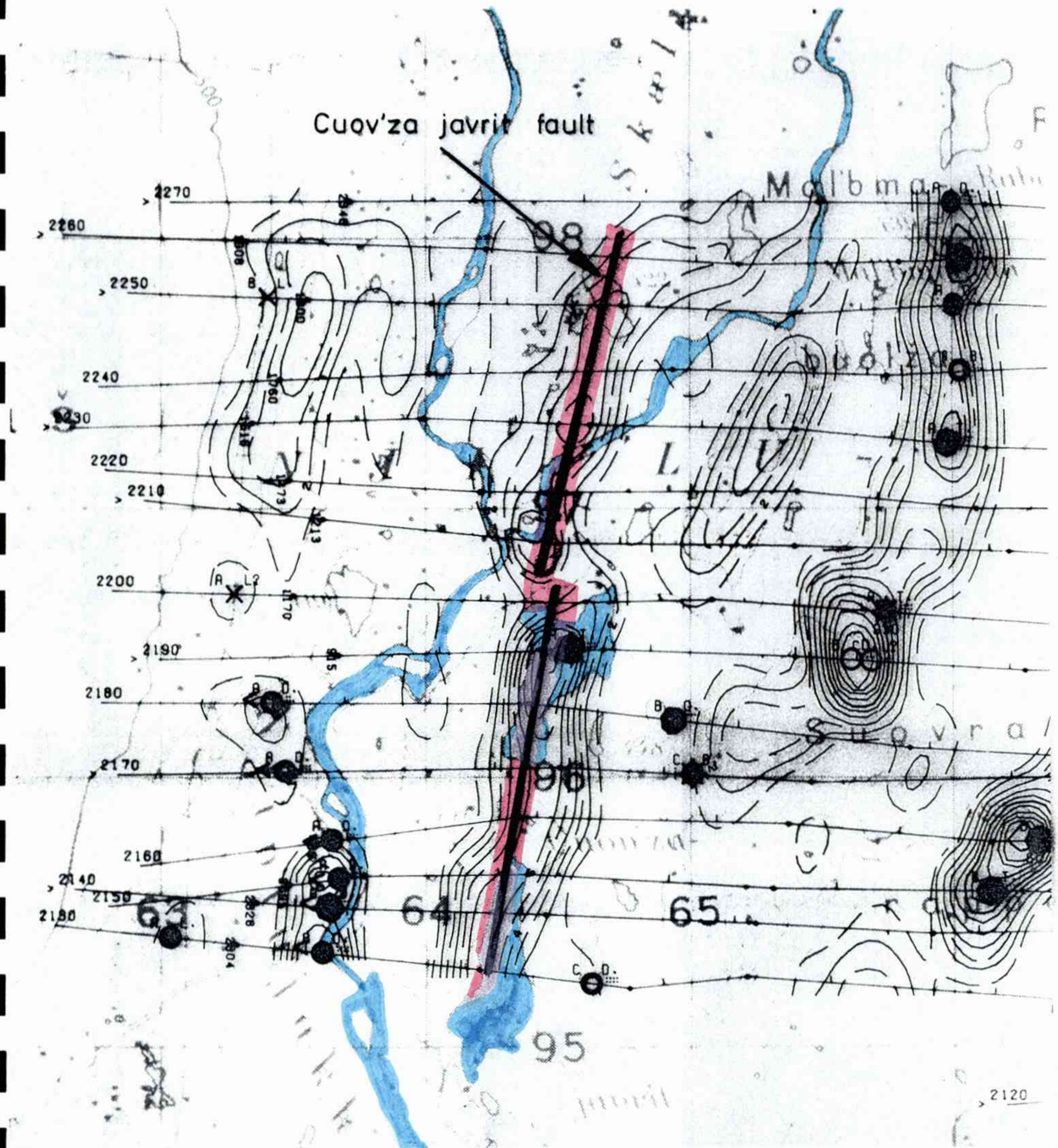
PROSPEKTERING A/S

Fig. 4.1



Suovrarappat Target area II Geological section. 6500 E	Scale 1:1000
	Obs.
	Draw. R.H. 83
	Trac. H.B. 83
PROSPEKTERING A/S	Fig. 4.2


Geological map
of
SUOVRARAPPAT
LEGEND
Cu- mineralization
Albite breccia
Graphite felsite
Albite felsite
Meta tuff
Meta diabase
Rock boundary, certain
" , assumed
Fault
Strike and dip
Fold axis
Anticline
Diamond drill hole projection, known dip.
" , vertical projection.
6-82
1-75
NJIVLUJOKKA
SUOVRARAPPAT ANTICLINE
TUFFITES &
ARGILLITES ?
CUOVCA JAVRIT FAULT ZONE
1-75
2-75
4-75
3-75
5B
-75
5A-75
5-82
6-82
500A
8-59
3-59
500B
10-59
492A
9-59
4-59
5-59
1-59
6-59
7-59
2-59
1-62
2-62
3-62
4-82
1-82
2-82
3-82
1-76
Geological map
of Suovrarappat
Scale
1:4000
Obs.
H.D. R.H.
Draw
R.H. 11/83
Trac
H.B. 11/83
PROSPEKTERING A/S
Fig. 5



LEGEND

Contours in percent

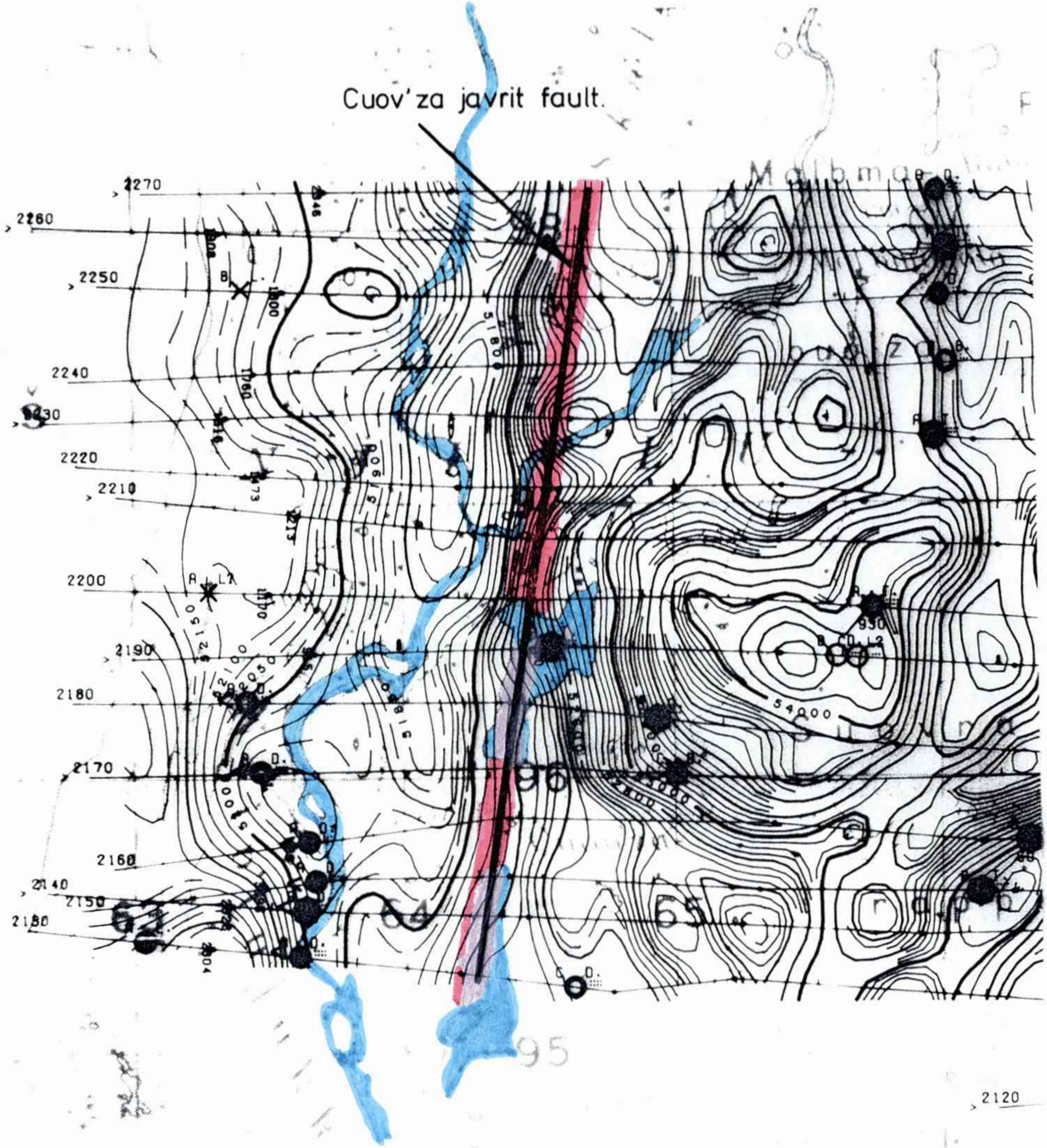
10

4

2

The numbers face in the direction of increasing value

Suovrarappat Airborne VLF. Filtered total field. Dighem -82	Scale : 1:20 000
	Obs :
	Draw :
	Trac : H.B.-83
PROSPEKTERING A/S	Fig. 6.1.



ISOMAGNETIC LINES

(total field)

1000	1000 gammas
200	200 gammas
50	50 gammas
	25 gammas
	magnetic depression

Suovrarappat Airborne Magnetics. Total Field Dighem-82	Scale : 1:20 000
	Obs:
	Draw:
	Trac: H.B.-83
PROSPEKTERING A/S	Fig. 6.2.

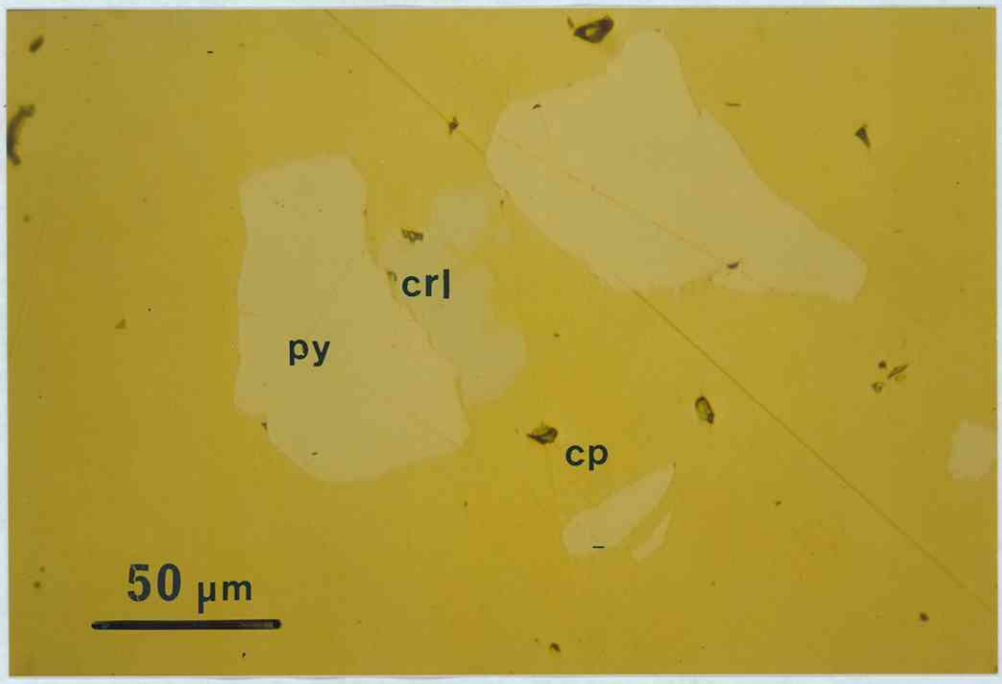


Fig. 7.1. Microphoto of pyrite (py) replaced by chalcopyrite (cp). Carrolite (crl) occurs in association with the pyrite.

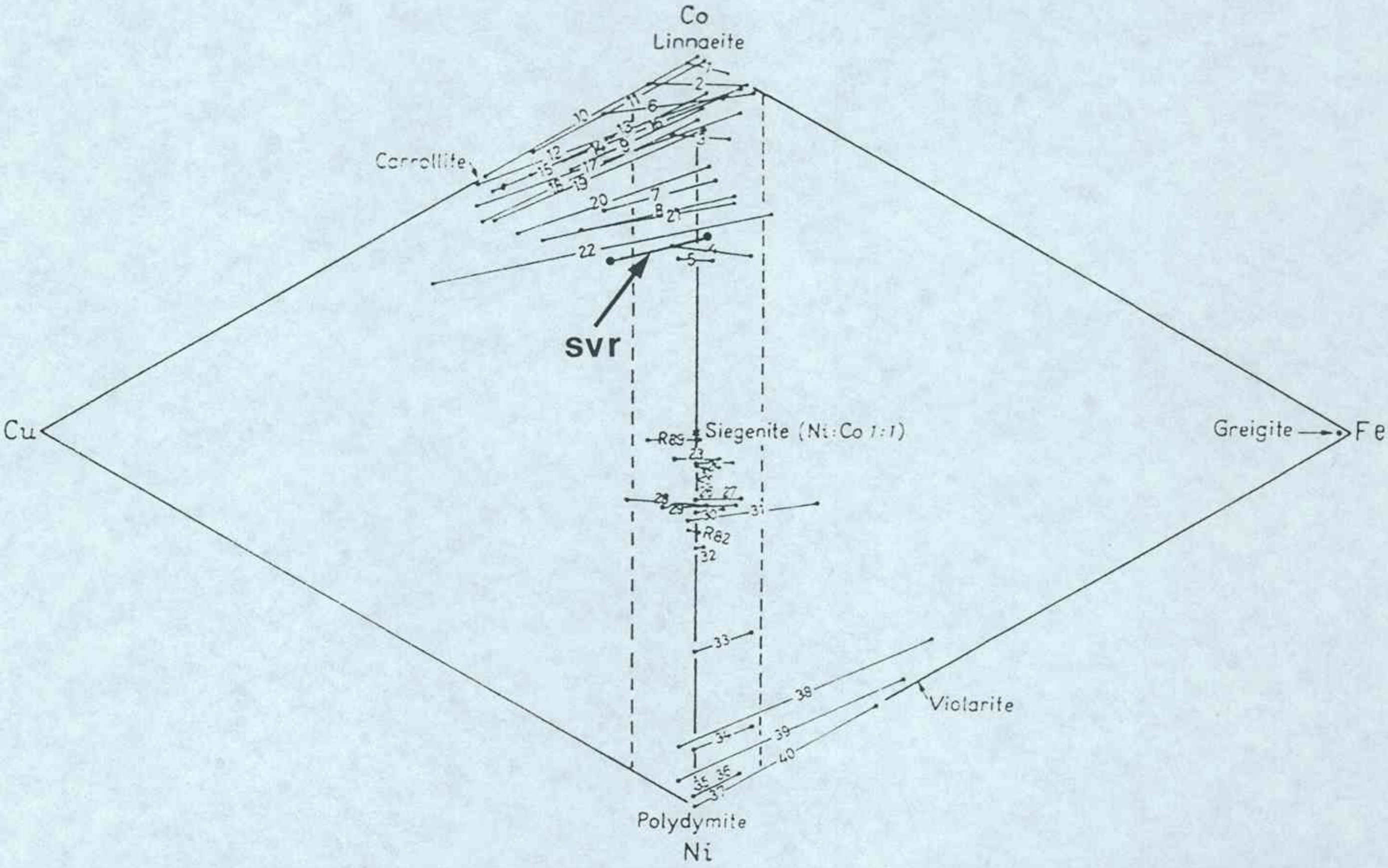


Fig. 7.2. Carrolite from Souvrarappat plotted in the Cu-Co-Ni and Fe-Co-Ni triangles. Diagram after Vokes, 1967.

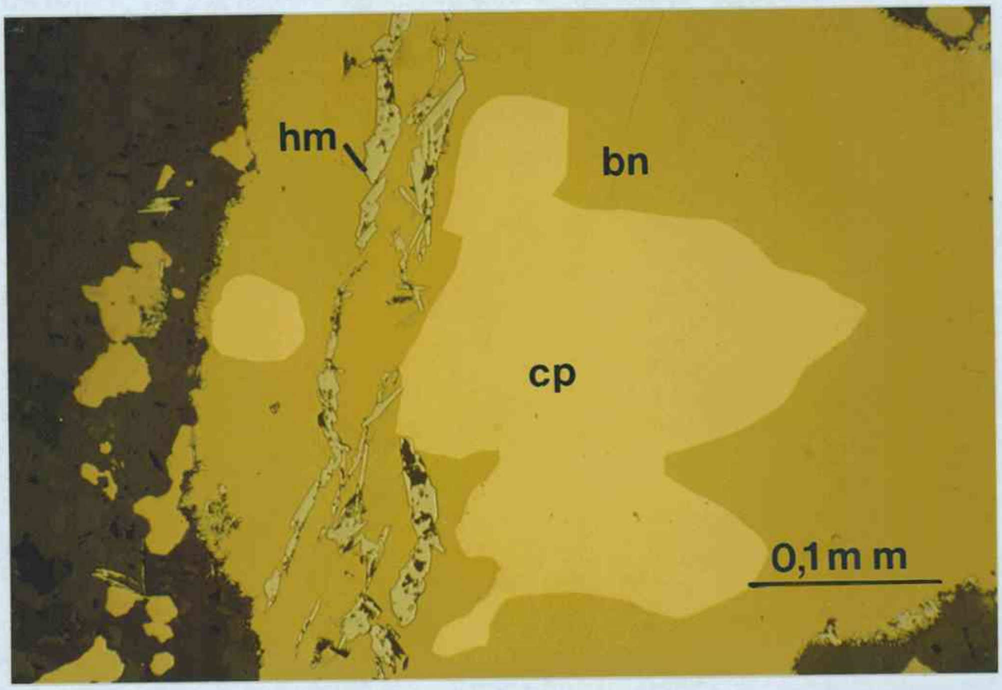


Fig. 7.3. Microphoto of chalcopyrite (cp) replaced by bornite (bn) and hematite (hm).

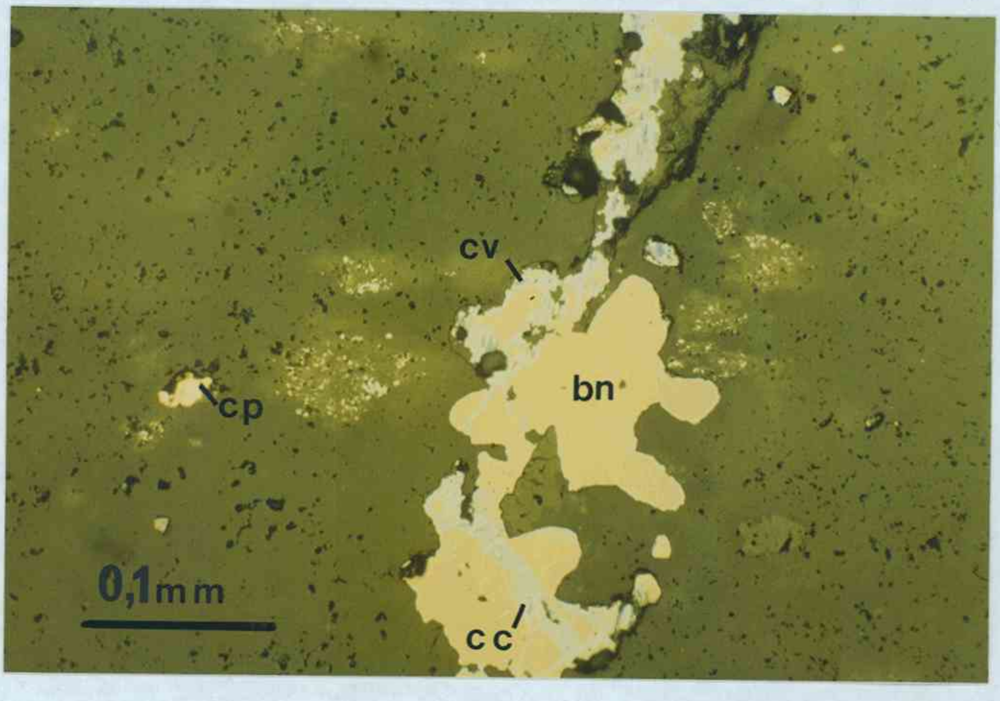


Fig. 7.4. Microphoto of bornite (bn), chalcocite (cc) and covellite (cv) which have completely replaced a vein of chalcopyrite. An inclusion of chalcopyrite in albite felsite is perserved.

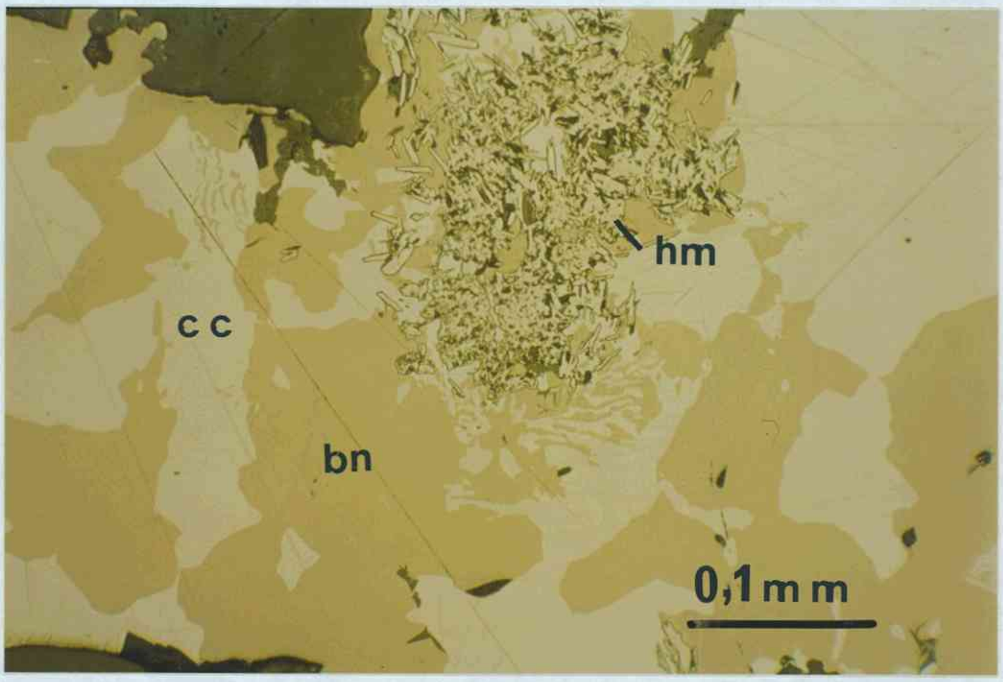


Fig. 7.5. Microphoto of myrmekitic intergrowt of bornite (bn) and chalcocite (cc). The presence of hematite (hm) indicate enrichment in the oxidiation zone.

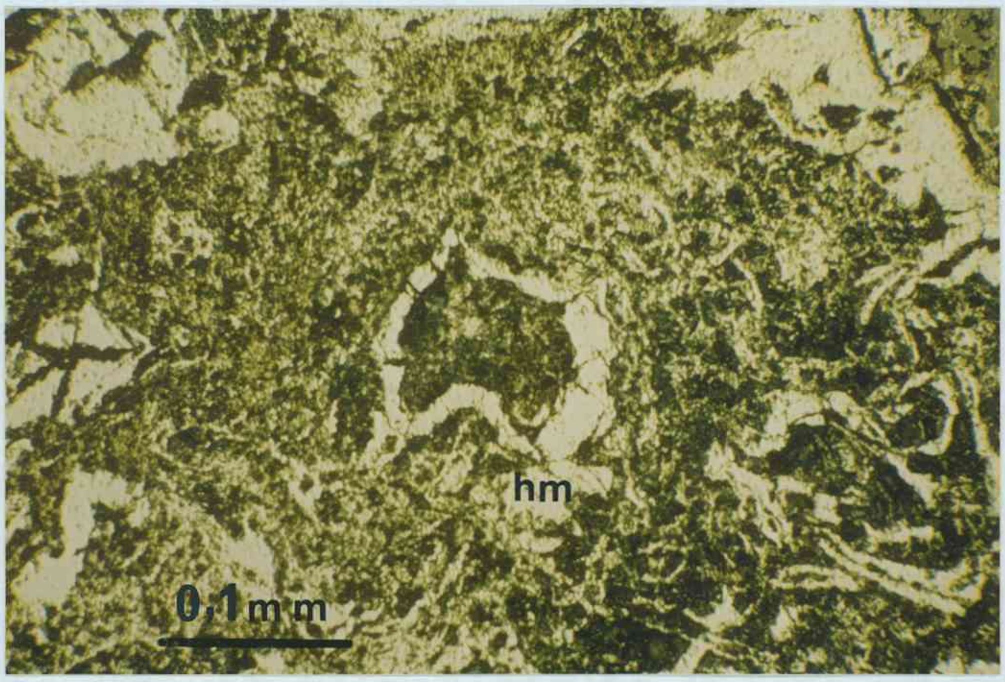


Fig. 7.6. Microphoto of barren hematite (hm).

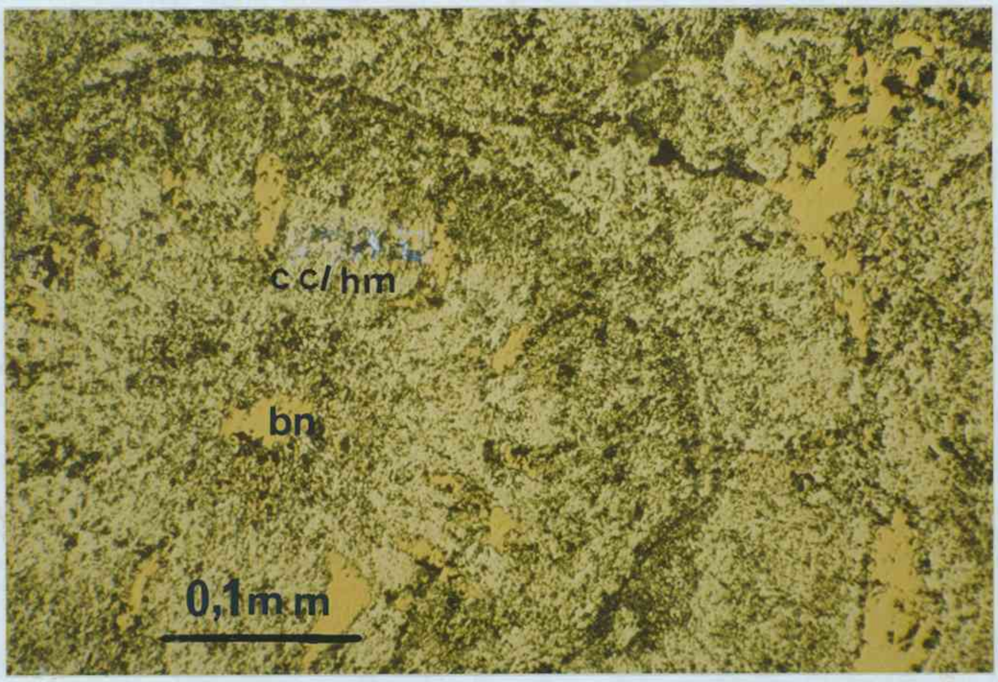


Fig. 7.7. Microphoto of bornite (bn) replaced by an intergrowt of chalcocite and hematite (cc/hm). Concentric supergene textures are present.

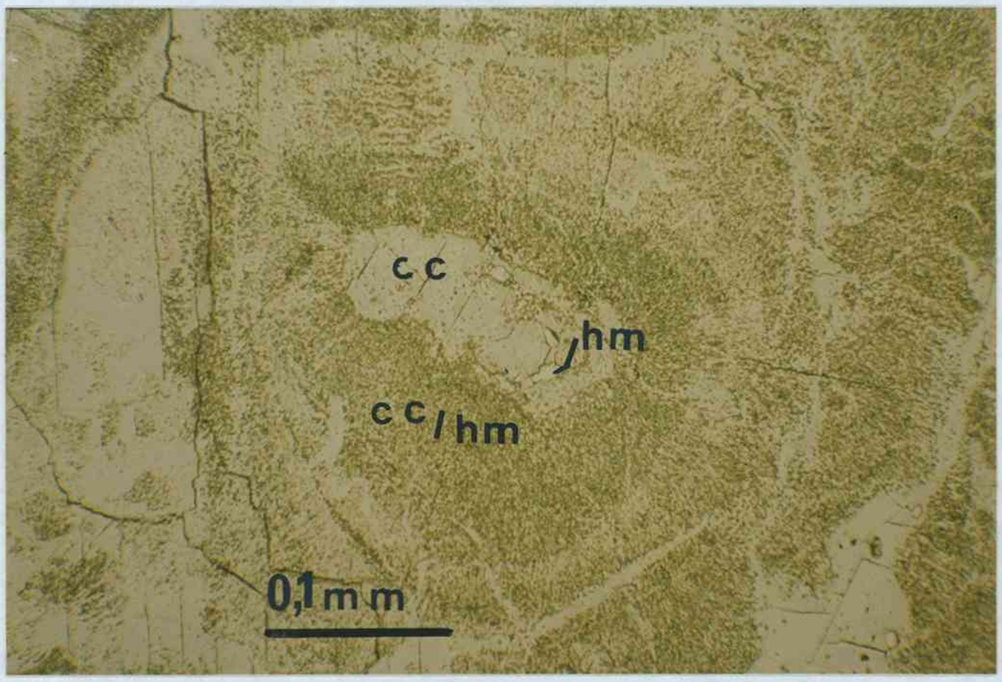
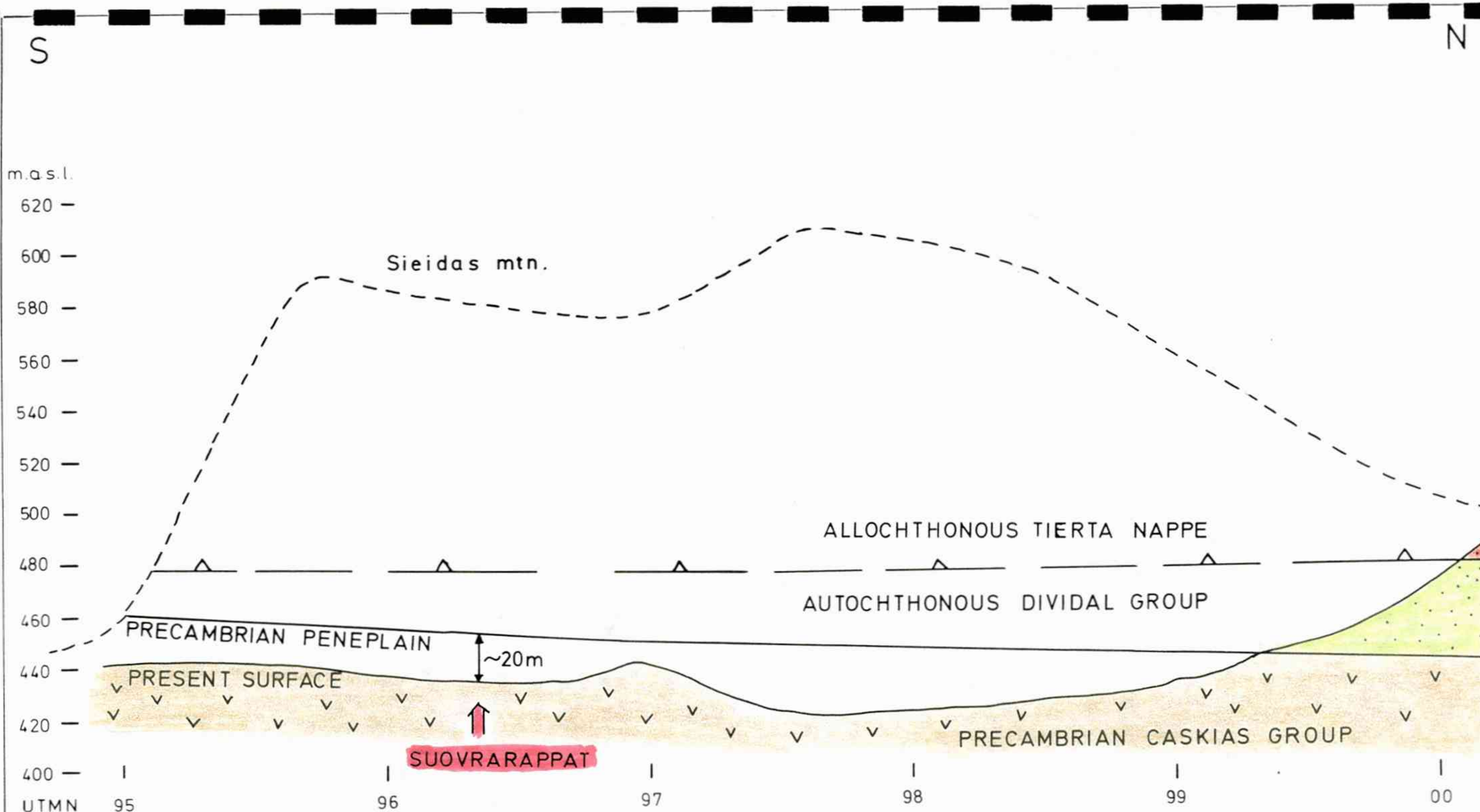


Fig. 7.8. Microphoto of supergene chalcocite (cc) intergrown with hématite (hm) in concentric textures.



Suovrarappat Longitudinal Geological Section	Scale: 1:200 1:20 000
	Draw: R.H.-83
	Trace H.B-83
PROSPEKTERING A/S	Fig. 8