

SUMMARY REPORT

SPARAGMITE PROJECT (N-82-5)

FOLLDAL VERK A/S - AMOCO NORWAY OIL COMPANY

DECEMBER 1983

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MAPS:

Regional Geology Map

Tverrlivola:

Grid Location Map

Geological Map, 900 S- 150 N, 100 W - 1300 E,
 " " , 900 S - 150 N, 0 EW - 1900 W
 " " , 300 N - 1350 N, 0 EW - 1900 W

1350 N-2100 N, 0 EW-1900 W

450 N-2100 N, 0 EW- 600 E

Geochemical Map, Soil Survey, Tverrlivola I , 900 S- 150 N,
100 W-1300 S

" " , " " , Tverrlivola II, 900 S- 150 N,
150 W-1900 W

" " , " " , Tverrlivola III, 300 N-1350 N,
150 W-1900 N

" " , " " , Tverrlivola IV, 1350 N-2100 N,
150 W-1900 W

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Littlefjellet:

Grid Location Map

Geochemical Map, Littlefjellet I , 300 N-1650 N, 450 W-450 E

" " , Littlefjellet II, 300 S- 150 N, 450 W-450 E

Geochemical Map, Soil Survey, 300 N-1650 N, 450 W-450 E

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Gruvsjøhøgda:

Grid Location Map

Geological Map

Geochemical Map, Soil Survey,

VLF-Survey

Gruvsjøen:

Grid Location Map

Geological Map

Gruvsjøen - on the lake:

Grid Location Map

VLF-Survey

Magnetometer-Survey

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Grid Location Map

Geological Map, 600 S-1050 N, 500 E-700 W

" " , 600 S- 600 N, 500 E-1000 W

Geochemical Map, Soil Survey, 600 S-1050 N, 500 E-700 W

" " , " " , 600 S- 600 N, 500 E-1000 W

VLF-Survey, 600 S-1050 N, 500 E-700 W

" " , 600 S- 600 N, 500 E-1000 W

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Geological Map, Ljøsnåvollen I , 1050 S-750 N, 0 EW-1300 W

" " , Ljøsnåvollen II, 1050 S-750 N, 0 EW-1000 E

Geochemical Map, Soil Survey, Ljøsnåvollen I , 1050 S-750 N,
0 OW-1300 W

" " , " " , Ljøsnåvollen II, 1050 S-750 N,
0 EW-1000 E

VLF-Survey, Ljøsnåvollen I , 1050 S-750 N, 0 EW-1300 W

" " , Ljøsnåvollen II, 1050 S-750 N, 0 EW-1000 E

BOX 2

Brennvola

Grid Location Map

Grids Brennvola/Langen, Geological Map, 1 : 5000

" " " , Geochemical Map, Soil-Survey 1 : 5000

" " " , VLF-Survey 1 : 5000

Geological Map, Brennvola I , 0 NS-1050 S, 500 E-1400 W

" " , Brennvola II , 1200 S-2250 S, 500 E-1400 W

" " , Brennvola III, 2400 S-3450 S, 500 E-1400 W

" " , Brennvola IV , 3600 S-4200 S, 500 E-1400 W

" " , Brennvola V , 1800 S-2550 S, 1450 W-1900 W

" " , Brennvola VI , 1800 S-3150 S, 1450 W-2300 W

" " , Brennvola VII, 3300 S-4500 S, 1450 W-2650 W

" " , Brennvola VIII, 4350 S-5700 S, 0 EW-1400 W

" " , Brennvola IX , 4650 S-5700 S, 1400 W-2000 W

Geological Map, Boulder Tracing, 1800 S-3600 S, 1000 W-1900 W

Geochemical Map, Soil survey, Brennvola I , 0 NS-1050 S
500 E-1400 W

" " , " " , Brennvola II , 1200 S-2250 S,
550 E-1400 W

" " , " " , Brennvola III, 2400 S-3450 S,
500 E-1400 W

" " , " " , Brennvola IV , 3600 S-4200 S,
500 E-1400 W

" " , " " , Brennvola V , 1800 S-2550 S,
1450 W-1900 W

" " , " " , Brennvola VI , 1800 S-3150 S,
1450 W-2300 W

" " , " " , Brennvola VII, 3300 S-4500 S,
1450 W-2650 W

" " , " " , Brennvola VIII, 4350 S-5700 S,
0 EW-1400 W

" " , " " , Brennvola IX , 4650 S-5700 S,
1400 W-2000 W

VLF-Survey, Brennvola I , 0 NS-1050 S, 500 E-1400 W

" " , Brennvola II , 1200 S-2250 S, 500 E-1400 W

" " , Brennvola III, 2400 S-3450 S, 500 E-1400 W

" " , Brennvola IV , 3600 S-4200 S, 500 E-1400 W

" " , Brennvola V , 1800 S-2550 S, 1450 W-1900 W

" " , Brennvola VI , 1800 S-3150 S, 1450 W-2300 W

" " , Brennvola VII, 3300 S-4500 S, 1450 W-2650 W

" " , Brennvola VIII, 4350 S-5700 S, 0 EW-1400 W

" " , Brennvola IX , 4650 S-5700 S, 1400 W-2000 W

IP-Survey, Crone Instrument, Line 3600 S

IP-Survey, SGU-Instrument, Line 3150 S

" " , " " , Line 3450 S, 900 W-2350 W

" " , " " , Line 3450 S, 0 EW- 950 W

" " , " " , Line 3750 S, 2700 W-2300 W

" " , " " , Line 3750 S, 250 W-1750 W

" " , " " , Line 4050 S

" " , " " , Line 4350 S

Langen:

Grid Location Map

Map Boulder Tracing

Geochemical Map, Soil Survey

VLF-Survey

IP-Survey, Crone-Instrument, Line 350 E

" " , " " , Line 100 W

" " , " " , Line 300 W

IP-Survey, SGU-Instrument , Line 350 E

" " , " " , Line 100 E

" " , " " , Line 100 W

BOX 3

Tuisingdal:

Grid Location Map

Geological Map, 0 NS-1400 S, 0 EW-1200 W

" " , 0 NS-1500 N, 0 EW-1000 W

" " , 1600 N-2600 N, 0 EW-1000 W

" " , 0 NS-1400 S, 0 EW-1400 E

" " , 0 NS-1600 N, 0 EW-1400 E

" " , 1600 N-2600 N, 0 EW-1400 E

Geochemical Map, Soil Survey, 0 NS-1400 S, 0 EW-1200 W

" " , " " , 0 NS-1600 N, 0 EW-1000 W

" " , " " , 1600 N-2600 N, 0 EW-1000 W

" " , " " , 0 NS-1400 S, 0 EW-1400 E

" " , " " , 0 NS-1600 N, 0 EW-1400 E

" " , " " , 1600 N-2600 N, 0 EW-1400 E

VLF-Survey, 200 S-1000 S, 0 EW-1200 W

Gråhøgda:

Grid Location Map

Geological Map, 0 NS-1400 N, 0 EW- 900 W

" " , 1400 N-2600 N, 0 EW- 900 W

" " , 0 NS-1400 N, 0 EW-1000 E

" " , 1400 N-2600 N, 0 EW-1000 E

Geochemical Map, Soil Survey, 0 NS-1400 N, 0 EW- 900 W
" " , " " , 1400 N-2600 N, 0 EW- 900 W
" " , " " , 0 NS-1400 N, 0 EW-1000 E
" " , " " , 1400 N-2600 N, 0 EW-100 E

Nolsjøen:

Grid Location Map

Geological Map

Geochemical Map, Soil Survey

VLFF-S rvey

Svarthamrane:

Grid Location Map

Geological Map, Svarthamrane I , 150 N-1650 S, 100 E- 800 W
" " , Svarthamrane II , 1800 S-3750 S. 50 E-1000 W
" " , Svarthamrane III, 150 N- 900 S, 1900 E- 150 E
" " , Svarthamrane IV , 1050 S-1950 S, 1900 E- 150 E
" " , Svarthamrane V , 2100 S-3000 S, 1900 E- 50 E
" " , Svarthamrane VI , 3150 S-13750 S, 50 E-1900 E

Geochemical Map, Soil Survey, Svarthamrane I , 150 N-1650 S,
100 E- 800 W
" " , " " , Svarthamrane II , 1800 S-3750 S,
50 E-1000 W
" " , " " , Svarthamrane III , 150 N- 900 S,
1900 E-1 150 E
" " , " " , Svarthamrane IV , 1050 S-1950 S
1900 E- 50 E
" " , " " , Svarthamrane V , 2100 S-3000 S,
1900 E- 50 E
" " , " " , Svarthamrana VI , 3150 S-3750 S,
50 E-1900 E

Tovberga:

Grid Location Map

Geological Map, Tovberga (South)

Geological Map, Tovberga (North)

Geochemical Map, Soil Survey, 0 NS-1400 N, 150 E-1050 W
" " , " " , 0 NS- 650 S, 0 EW-1050 W

VLF-Survey, Tovberga (South)

VLF-Survey, Tovberga (North)

Krokåtsjøen:

Grid Location Map

Geological Map

Geochemical Map, Soil Survey

VLF-Survey

BOX 4

Brydal:

Grid Location Map

Geological Map, 150 W-750 E

" " , 750 E-1500 E

Geochemical Map, Soil Survey, 150 W-750 E

" " , " " , 750 E-1500 E

VLF-Survey, 150 W-750 E

" " , 750 E-1500 E

Elgpiggen:

Grid Location Map

Geological Map

Geochemical Map, Soil Survey

VLF-Survey

Nekkjølen;

Grid Location Map

Geological Map, 900 S- 300 N, 800 W-1100 E

" " , 300 N-1500 N, 800 W-1100 E

" " , 1500 N-2700 N, 800 W-1100 E

Geological Map, 2700 N-3900 N, 800 W-1100 E

" " , 3900 N-4950 N, 800 W-1100 E

" " , 3600 N-4950 N, 1100 E-2600 E

Geochemical Map, Soil Survey, 900 S- 150 N, 800 W-1100 E

" " , " " , 300 N-1350 N, 800 W-1100 E

" " , " " , 1500 N-2550 N, 800 W-1100 E

" " , " " , 2700 N-3600 N, 800 W-1100 E

" " , " " , 3750 N-4950 N, 50 E-2000 E

" " , " " , 4500 N-4950 N, 2050 E-2600 E

" " , " " , 3750 N-4950 N, 0 EW- 800 W

VLF-Survey, 900 S- 150 N, 800 W-1100 E

" " , 300 N-1350 N, 800 W-1100 E

" " , 1500 N-2550 N, 800 W-1100 E

" " , 2700 N-3600 N, 800 W-1100 E

" " , 3750 N-4950 N, 0 EW - 2050 E

" " , 4500 N-4950 N, 2050 E-2600 E

" " , 3750 N-4959 N, 0 EW- 800 W

Brennvoltjørna:

Grid Location Map

Geochemical Map, Soil-Survey, 1100 N- 0 NS, 150 E-1650 W

" " , " " , 250 N-1000 S, 300 E-1000 E

" " , " " , 50 S-1100 S, 150 E-1650 W

Barkaldvola:

Grid Location Map

Geochemical Map, Soil Survey, 0 NS-1800 N, 400 W-1600 W

" " , " " , 0 NS-1800 N, 350 W- 600 E

Holbekktjørna:

Grid Location Map

Geochemical Map, Soil-Survey, 0 NS-1050 N, 0 EW- 800 E

" " , " " , 0 NS-1050 N, 50 W-1400 W

Fossbekken:

Grid Location Map

Geological Map, 600 W- 450 E

" " , 450 E-1500 E

Geochemical Map, Soil-Survey, 600 W- 450 E

" " , " " , 450 E-1500 E

Håsjøen:

Grid Location Map

VLF-Survey, 200 E-1200 E, 0 NS-1600 S

" " , 200 E-1200 E, 0 NS- 600 N

" " , 0 EW-1000 W, 0 NS-1600 S

" " , 0 EW-1000 W, 0 NS- 600 N

" " , 1200 W-2000 W, 0 NS-1600 S

" " , 1200 W-2200 W, 0 NS- 600 N

Stream Sediment Survey (Map sheet Stugusjø/Brekken)

Map Sample Locations

Geological Map

Geochemical Map, Stream Sediments, Pb/Zn

Geochemical Map, Stream Sediments, Cu/Ag

SUMMARY AND CONCLUSIONS

Grid follow-up work was conducted in 1983 in southern Norway. This program was based on a regional stream sediment survey that was carried out in 1982. In addition to that a regional stream sediment survey was conducted to extend the project area further towards the north. The program was run by Folldal Verk A/S in a joint venture with Amoco Norway Oil Company.

The project area is located between the Folldal project area and the border between Norway and Sweden, covering approx. 1750 sqkm. The project target was sandstone-hosted Pb, Zn, Ag mineralization which occurs in basal quartzites of Eocambrian age. These quartzites, or sparagmites, extend throughout Norway and Sweden along the eastern edge of the Caledonian mountain system. They host several lead deposits in Sweden, including Laisvall and Vassbo. They occur near the contact of the sparagmites with the Precambrian basement.

The grids were established to cover source areas of anomalies that were detected by the regional geochemical stream sediment survey in 1982 and that were proposed to be followed-up on a high priority basis. Geological mapping, prospecting, and a geochemical soil survey were conducted on all of the grids and a VLF-survey on most of them. On two grids an IP-survey was conducted. Altogether 23 grids were mapped, 11287 B-horizon soil samples taken, and about 400 line km were surveyed by VLF. The soils were analyzed for Cu, Pb, Zn, and Ag. The project area was extended towards the north in order to cover an area of approx. 150 sqkm by a regional stream sediment survey. 344 sediments were taken and analyzed for the same elements as the soils.

Several interesting anomalies were detected by the grid follow-up survey. On the Langen/Brennvola grids, situated in the northeastern part of the project area, two boulder

trains were discovered, the boulders containing sandstone-hosted galena mineralization. An IP-survey indicated interesting anomalies in this area especially where the boulder trains cut off. A considerable amount of diamond drilling will be necessary.

In the Gruvsjøen-area 3 holes were drilled close to a Pb, Zn, Ag mineralization. No economic mineralization was found. The type of the occurring mineralization is different from the sandstone-hosted "Laisvall-type" as galena occurs on fractures or as small massive lenses.

On the Brydal grid 4 holes were drilled at a sandstone-hosted Cu/Ag-mineralization. At one hole the ore contained 10 m with about 0,33 % Cu and 15 ppm Ag. The other holes contained only traces of or no Cu-mineralization at all. The extension of this mineralization proved to be too small for economic interest.

On the grids Tverrlivola and Tufsingdal Pb and Zn anomalies were detected that require more detailed follow-up work and eventually diamond drilling. On grid Tufsingdal it is proposed to take soil samples from a large depth, from just above bedrock.

On the grid Nekkjølen Cu -(Ag)mineralization was discovered. An IP-survey and diamond drilling will be necessary.

The regional stream sediment survey detected three anomalies that will require grid follow-up work.

9 "high priority" - anomalies are still left to be followed-up from the 1982 regional stream sediment survey. Grid follow-up work is proposed for these anomalies during the 1984 field season.

1. INTRODUCTION

Grid follow-up work with geological mapping, soil sampling, and geophysical surveys was conducted in southern Norway during the summer and fall of 1983. This program was based on a regional stream sediment survey that was carried out in 1982. In addition to that the project area was extended towards the north to cover an area of approx. 150 sqkm by a regional stream sediment survey.

The project target was mainly sandstone - hosted Pb, Zn, Ag - mineralization, but also a few sandstone-hosted Cu, Ag - mineralizations were found within the project area. Several Pb, Zn, Ag mineralizations of this type are known in this geological environment in Norway, and several deposits, one currently in production, are known in Sweden.

The program resulted in indicating some areas that must be investigated more detailed and some targets have to be drilled. One property was found with two larger boulder trains, the boulders containing sandstone-hosted lead-mineralization. Several drill targets were outlined in this area. The regional stream sediment survey indicated some anomalous areas which will require follow-up work.

2. LOCATION AND ACCESS

The project area is centered at 62°15' lat. and 11°00' long. It is located between the Folldal project area and the border between Norway and Sweden, approx. 250 km north of Oslo (Fig.1). The main service supply centers are Tynset in the north of the central part and Røros in the northeastern part. The area is crossed by numerous small, sometimes paved secondary roads. The railway line Oslo - Røros - Trondheim runs along the west and northwest sides of the area. The town of Røros is serviced daily by jet flights from Oslo and Trondheim.

SPARAGMITE PROJECT

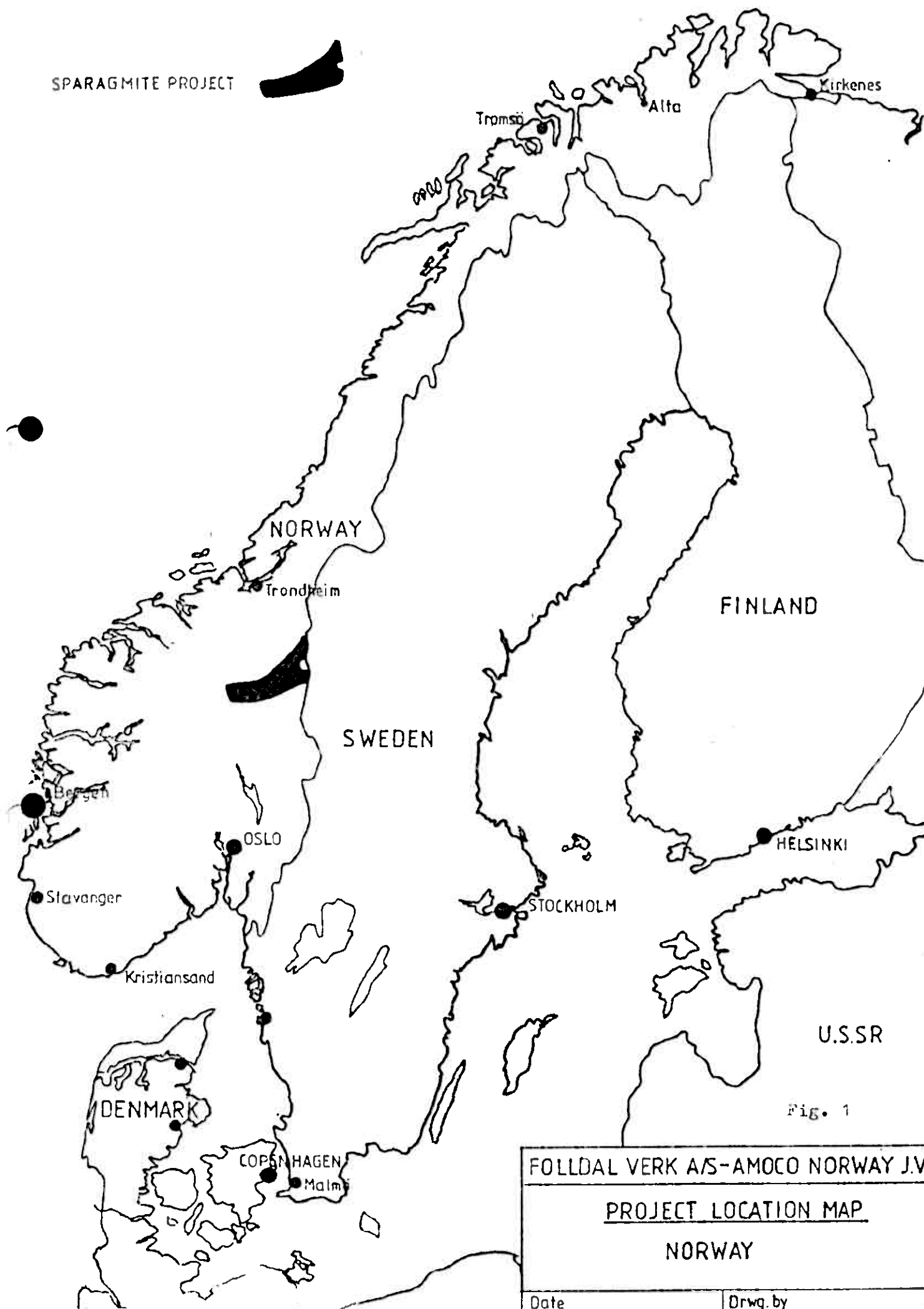


Fig. 1

FOLLDAL VERK A/S-AMOCO NORWAY J.V
PROJECT LOCATION MAP
NORWAY

Date

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3. REGIONAL GEOLOGY

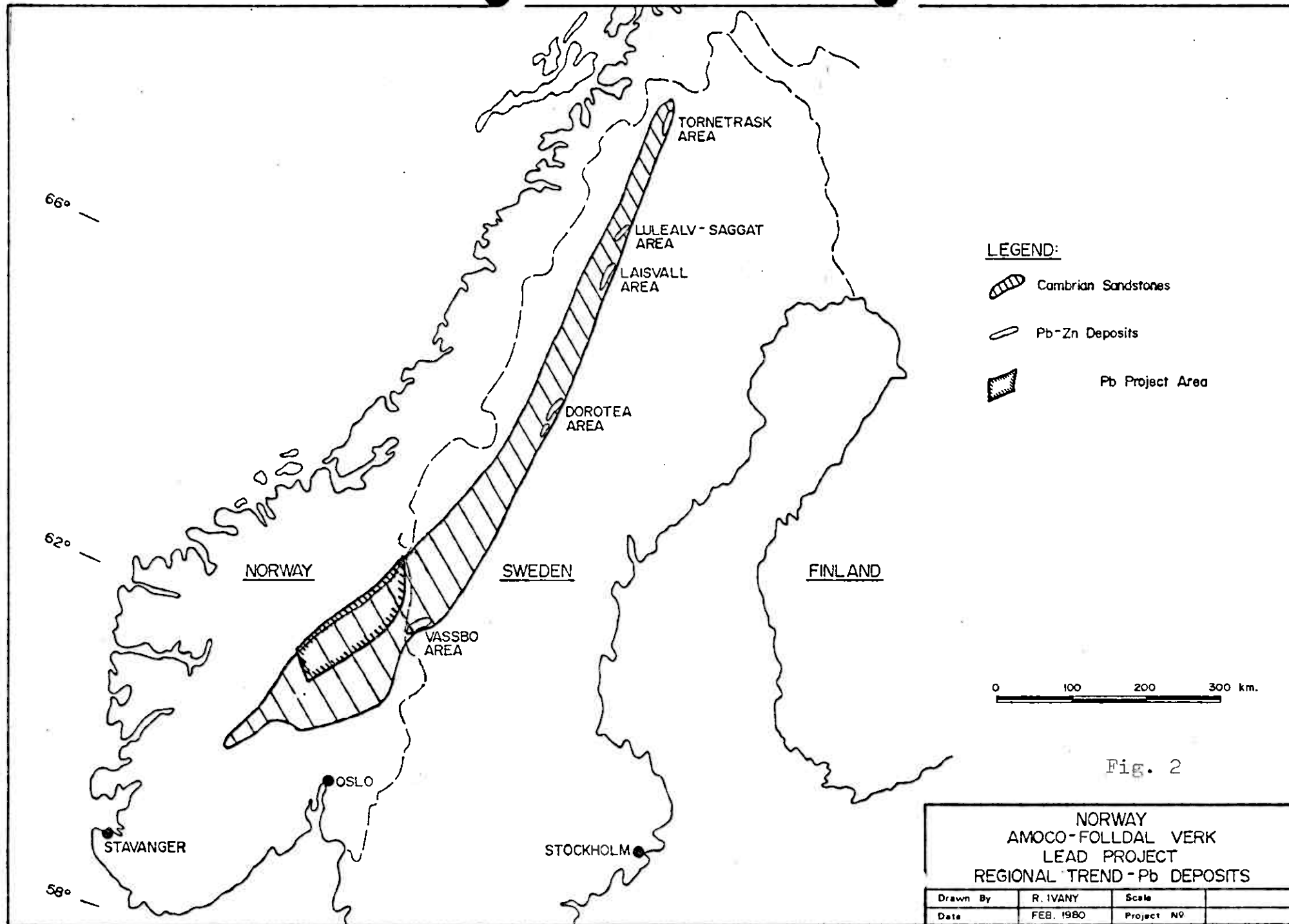
The Eocambrian sandstones and quartzites, or sparagmites, stretch along the eastern border of the Caledonian mountain system through Norway and Sweden (Fig. 2). They represent the initial detrital deposition in the early stages of development of the Caledonian geosyncline. The lead-zinc deposits, of which the Laisvall deposit in Sweden is at present in production, occur as stratabound lenses within the sandstones and quartzites, generally close to the contact with the Precambrian basement, and along the flank of Precambrian paleohighs in particular.

The Laisvall deposit is the largest known of this type in Scandinavia. The mineralization mainly consists of galena, sphalerite, pyrite, fluorite and barite. The deposit contained 80 mm tons of ore with 4,3 % Pb, 0,60 % Zn and 9 g/t Ag. Another deposit, Vassbo, the production of which was finished in 1982, had initial reserves of 3 mm tons of ore with 5,7 % Pb, 0,31 Zn and 18 g/t Ag.

Hydrocarbons have been noted in association with the sulfides and are one of the factors pointing to the similarity of deposition to oil field brines. It is assumed that the metal bearing solutions were low sulphur oil field brines which moved upslope from the Caledonian geosyncline until they came in contact with sulphur-rich solutions near the edge of the basin and around Precambrian paleohighs.

In another genetic model for sandstone lead deposits it is postulated that lead was released during weathering from the underlying basement either directly or via formation of continental arkoses, ground water may then have carried the lead into marine sandstones, where a reducing environment caused precipitation of galena.

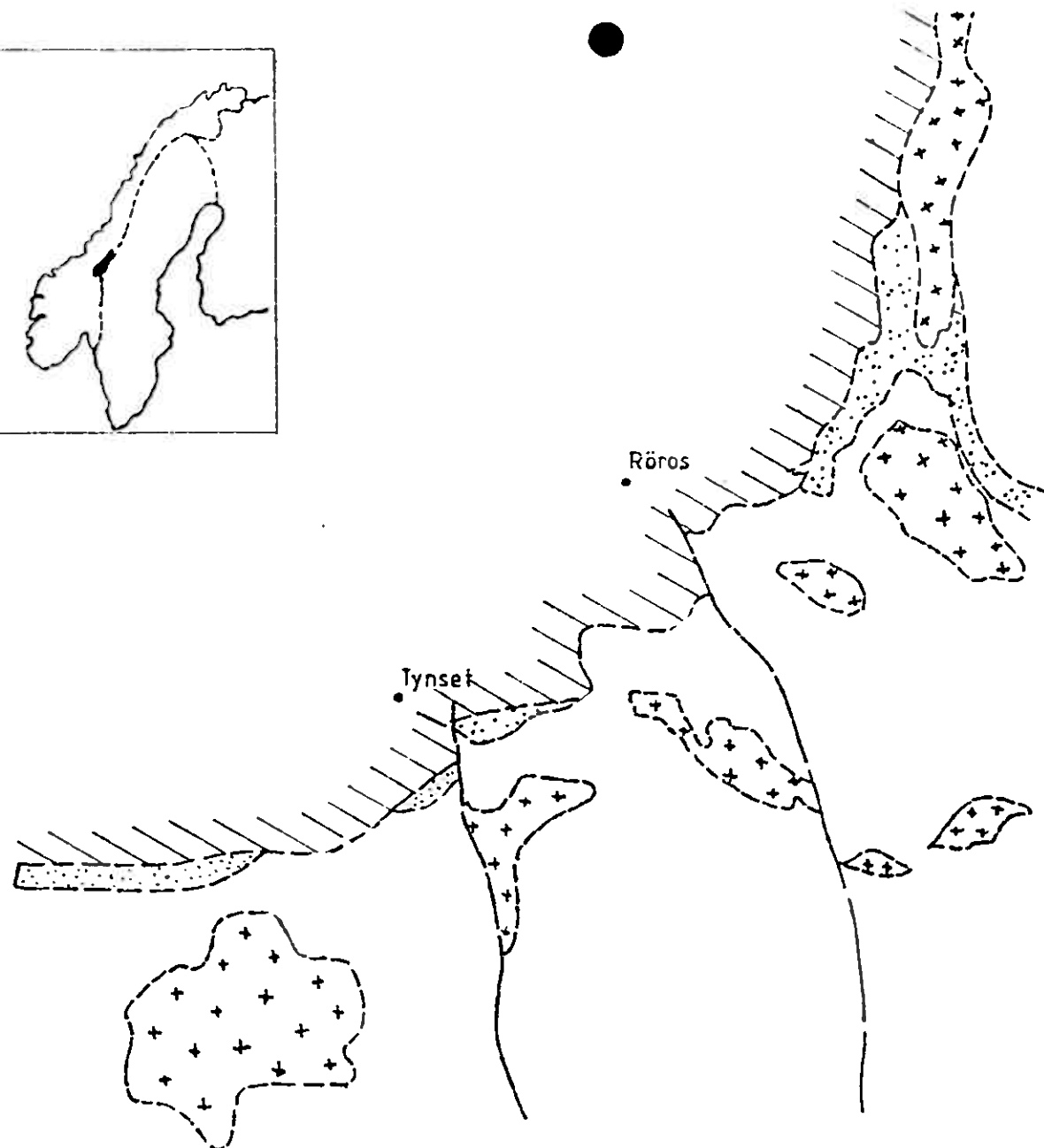
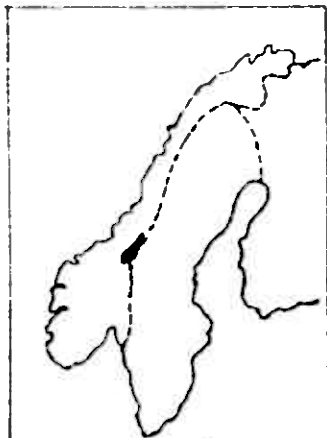
The project area is situated in the southern part of the Eocambrian sandstone belt and is stretching over a length of 140 km parallel to the edge of the Caledonian mountains. A number



of outcropping paleohighs that are formed by granites and porphyritic rocks, are exposed (Fig. 3). From the SW to the NE they are called the "Atna-Window", the "Finstad-Window", and the "Vingelen-Window". In between these "windows" there are to be found several other outcrops of Precambrian basement. In many places the basement is overlain by a thin layer of conglomerates or tillites which represent the basal part of the sparagmites. The sparagmites are mostly grey meta-arkoses and are often interlayered with schists or black schists, and sometimes with limestones, too. The Augengneiss, that is believed to be a mylonitized and recrystallized arkose, occurs close to the thrust plane of the "Trondheim-Nappe" that consists mostly of metavolcanics and of metasediments. All rocks were subjected to regional metamorphism. A large part of the project area is covered by moraine from the last glaciation period.

Previous known Pb, Zn mineralizations can be found in two places within the project area. One old small Pb, Zn, Ag mine is located west of Tufsingdal, about 30 km southwest of the town of Os, in the central part of the project area. The mineralization is associated with black schists and quartzites and consists of pyrite, pyrrhotite, galena, sphalerite, and little chalcopyrite. The ore was mainly mined because of the silver content in the galena. Data about the tonnage are not available. Another Pb, Zn, Ag mineralization is located at the northeastern shore of the Gruvsjøen-lake, about 10 km northeast of the town of Brekken in the northeastern part of the project area. Here a trench was made that dates back to 1910. The mineralization consists of a silver-rich galena, sphalerite, pyrite, pyrrhotite, and little chalcopyrite. The associated rocks are light grey, quartzitic rocks and black schists. A copper-(silver) mineralization can be found at Brydal, southeast of Tynset, where a 70 km long zone within the sparagmite sequence is covered with secondary copper minerals. Bornite, chalcopyrite, pyrite, and a little chalcocite can be observed finely disseminated within the sandstones.

Much of the outcrop area of the sparagmites is associated with thrusting and nappe structures, with movement from the north-



LEGEND:

-  PRECAMBRIAN
-  AUGÉN GNEISS
-  QUARTZITES & PHYLLITES
-  CALEDONIAN VOLCANICS & SEDIMENTS.

20 Km

Fig. 3

FOLLDAL VERK A/S - AMOCO NORWAY J.V.

SPARAGMITE Pb
Project

Date

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east. Therefore not all of the exposure of these sandstones is in place and the contact with the Precambrian basement is often a thrust contact. If one of the above mentioned ore genesis models is valid, then the best area for exploration would be in autochthonous sediments around paleohighs, that means where the basal conglomerates or tillites are in contact with the granites. Both the Laisvall and the Vassbo deposits are described as occurring in autochthonous sediments on Precambrian paleohighs. This geological situation is the case in many locations within the project area.

4. HISTORY AND PREVIOUS EXPLORATION

In the summer and fall of 1982 a regional stream sediment survey was carried out by Folldal Verk/Amoco J.V.. Very little information is available about previous work in the project area.

One small Pb, Zn, Ag mine is located west of Tufsingdal, about 30 km southeast of the town of Os, in the central part of the project area. The mining activities date probably back to the beginning of this century. This year the area around this old mine was covered by a grid as a part of this survey with geological mapping, soil sampling, and partly a VLF-survey.

Another Pb, Zn, Ag mineralization is located at the northeastern shore of the Gruvsjøen-lake, about 10 km northeast of the town of Brekken, in the northeastern part of the project area. Here a trench was made in about 1910. A few tons of ore were taken out and brought to Falun in Sweden where the ore was processed. Folldal Verk/Amoco J.V. investigated this property as a part of the sparagmite project in 1982/83 by detailed geological mapping, soil geochemistry, and VLF. Altogether 6 diamond drill holes were drilled in this area.

Another little trench can be found at a copper/silver minerali-

zation near Brydal, south of Tynset. This property was also investigated by Folldal Verk/Amoco J.V. in 1983 by grid follow-up work and 4 diamond drill holes.

Most of the exploration for lead has apparently been concentrated along the south side of the project area, at the erosional contact of the Eocambrian sparagmites and the underlying Precambrian basement. The Geological Survey of Norway (NGU) has conducted most of the investigations in this area with a regional stream sediment program, follow-up soil sampling, geophysics, and drilling between 1968 and the early 1970'ies. Several lead prospects were discovered as a result of this work but none of sufficient grade for commercial use.

5. FIELD ACTIVITIES 1983

5.1 Staff and Accommodation

During the field season of 1983, 33 different persons were involved in the sparagmite project altogether. Mostly geology students from the Technological High School in Trondheim or local people were hired.

One crew, consisting of 1 student and three, later four, helpers, was based in Brekken, in the northeastern part of the project area, from the end of June to the end of August. The student was accommodation in a camping hut, whereas the helpers for sampling were local people, living in their homes. This crew was responsible for the work on the grids Tverrlivola, Littlefjellet, Gruvsjøgøgda, Gruvsjøen, and Øya. The same crew conducted also the regional stream sediment survey. During this time the people were living partly in a holiday cabin.

A second crew was first based in the southern, later in the central part of the project area from the middle of June to the end of August. They conducted the investigations on the grids Svarthamrane, Nolsjøen, Tovberga, Krokåtsjøen and Brennvola. The crew consisted of 1 geology student for mapping and two first year students for soil sampling. The people were

accommodated first in a rented house, later in camping huts and for some periods of time in tents.

A third crew was based in the western part of the project area from the middle of June to the end of August and did the work on the grids Elgpiggen, Nekkjølen, Brydal, Fossbekken, Brennvoltjørna, Barkaldvola and Holbekktjørna. The group consisted of one student who was accommodated on a farm, and three, later four local helpers, living in their homes.

From the beginning of July to the beginning of August, a crew consisting of one student and two helpers investigated the grids Tufsingdal and Gråhøgda. These people were accommodated in camping huts.

Two students were running the VLF-surveys from the middle of June to the middle of August, travelling from grid to grid. The people were living in camping huts. In the middle of August these people were replaced by two other helpers who worked until the middle of October.

Two students were hired for boulder tracing on grid Langen for one week during July and one student for three weeks during August/September for prospecting on and around grid Brennvola. These people were based in camping huts.

A crew consisting of one student with three helpers was hired for three weeks in the end of August to extend the grid Brennvola. They were accommodated in a camping hut.

A geophysicist from the Technical High School in Trondheim with two helpers did an IP-survey on grid Langen for one week early in October. They were accommodated in a camping hut.

Folldal Verks geophysicist Killi and two helpers ran an IP-survey for almost two weeks on the grids Langen and Brennvola in the end of October and the beginning of November. They were accommodated in the Langen inn.

In the early spring 1983, two people did the VLF-survey on the Gruvsjøen-lake within three days. During Easter two students started a VLF-survey on grid Håsjøen. They were accommodated on a camping site in huts.

5.2 Survey Procedure

5.2.1 Stream Sediment Sampling Procedure and Sample Preparation

Altogether 344 stream sediment samples were taken. The sediments were taken by hand in intervals of about 400 m along the stream wherever possible. Only active inorganic sediments were taken from the middle of the streams. If a sample contained a little organic material, that fact was marked on the sample bags and on the geochemical sample data sheets. About 1 kg of one sample was filled into a kraftpaper bag. After that the samples were dried at about 60°C in drying cupboards and then sieved through nylon screens. The minus 180 µm fraction (minus 80 mesh) was filled into small plastic bags and sent to X-RAY ASSAY LABORATORIES, Don Mills, Ontario by air freight. The samples were analyzed for Cu, Zn, Pb and Ag.

5.2.2 Soil Sampling Procedure and Sample Preparation

Altogether 11,287 B-horizon soil samples were taken by grubhoes in intervals of 50 m along the grid lines. The spacing between the lines was in general 150 m, on some grids 200 m. About 300 g of sample material were filled into kraftpaper bags. In some spots it was difficult to get samples from the B-horizon but only the white bleached A II horizon was available as the B-horizon was lying too deep. If that was the case, the fact was marked on the sample bags and on the geochemical sample data sheets. The samples were dried at about 60°C in drying cupboards and then sieved through nylon screens. The minus 180 µm (minus 80 mesh) fraction was filled into small plastic bags and sent to X-RAY ASSAY LABORATORIES, Don Mills, Ontario by air freight. The samples were analyzed for Cu, Zn, Pb and Ag.

5.2.3 LF-Survey

For the VLF-survey two PHOENIX VLF-2 instruments were used. Readings were taken for the dip angle and the maximum horizontal field strength in 25 m intervals on the lines. The received radio stations for SW - NE striking rock units were Oxford or Rugby/UK and for the NW - SE striking rock units Cutler/Maine. The Cutler station was also used for E - W striking directions. The readings of the horizontal field strength showed often variations during the surveys. Therefore the maximum horizontal field strength was set outside the grid on a reading of 100 before the survey was started. Then readings were taken along the base line and whenever a profile line crossed the base line readings were taken. When doing the survey along the profile lines the readings of the horizontal field strength were always corrected when crossing the base line. Later the PHOENIX instruments were replaced by two CRONE RADEM VLF receivers as these proved to enable better readings of the horizontal field strength.

5.2.4 IP-Survey

IP-surveys were only conducted on some lines on the grids Langen and Brennvola.

One survey was done with an IP sports model with time domain, designed by the Swedish Geological Survey (SGU). The dipol/dipol method was used with an electrode spacing of 50 m (max. 150 m). This instrument had a low effect as the current was only 10 mA. This instrument was later replaced by a CRONE generator with time domain (2 sec. current/2 sec. deadtime) and an ELLIOT receiver type R-10-A. Also here the dipol/dipol method was used. This instrument showed a much better effect as the current was at 0,1 - 0,3 A and the electrodes could be separated up to 300 m.

6. DISCUSSION OF RESULTS WITH RECOMMENDATIONS FOR FUTURE INVESTIGATIONS

6.1 Grids

As a result of the regional geochemical stream sediment survey from 1982 several grids were established to cover source areas of anomalies that were proposed to be followed-up on a high priority basis. The line spacing was in general 150 m, on some grids 200 m. The direction of the base lines was chosen parallel with the strike direction of the rock units. On all grids geological mapping, prospecting, and a geochemical soil survey, and on most of the grids a VLF-survey, were conducted. On two grids an IP-survey and boulder tracing were conducted. On two of the grids targets for Pb/Zn and Cu/Ag mineralization were drilled. Recommendations are given for future investigations and drilling targets for the next field season are outlined. All the grid locations can be seen in fig. 4.

6.1.1 Tverrlivola

The grid is located about 4 km southeast of Finnflokkampane, around Tverrlivola, map sheet Brekken 1720 II. Anomalies for Pb, Zn, Cu and Ag were detected by the regional stream sediment survey in this area. To cover all the anomalies in this drainage system a larger grid was established.

The grid area is located just east of the thrust plane of the Trondheim-nappe and covers rock units that belong to the sedimentary sparagmite/augengneiss complex. The occurring rock types are meta-arkoses, quartzites, black schists, and augengneisses. The general strike direction is about NE - SW but it is varying considerably in places, probably caused by complex faulting and thrusting as mylonitized rock types can often be found. Large parts of the area are covered by glacial drift and marsh.

The geochemical soil survey indicated an area with slight anomalous values for Pb (between 50 and 130 ppm). This area

- | No | Grid |
|----|-------------------------|
| 1 | Tverrlivola |
| 2 | Littlefjellet |
| 3 | Gruvsjöhögda |
| 4 | Gruvsjoen |
| 5 | Gruvsjoen - on the lake |
| 6 | Oya |
| 7 | Ljósåvallen |
| 8 | Brennvola |
| 9 | Langen |
| 10 | Tufsmgdal |
| 11 | Gråhögda |
| 12 | Nolsjoen |
| 13 | Svarthamrane |
| 14 | Tovberga |
| 15 | Krokåtsjoen |
| 16 | Brydal |
| 17 | Elgpiggen |
| 18 | Nekkjolen |
| 19 | Brennvolljörna |
| 20 | Barkaldvola |
| 21 | Holbekktjörna |
| 22 | Fossbekken |
| 23 | Håsjoen |

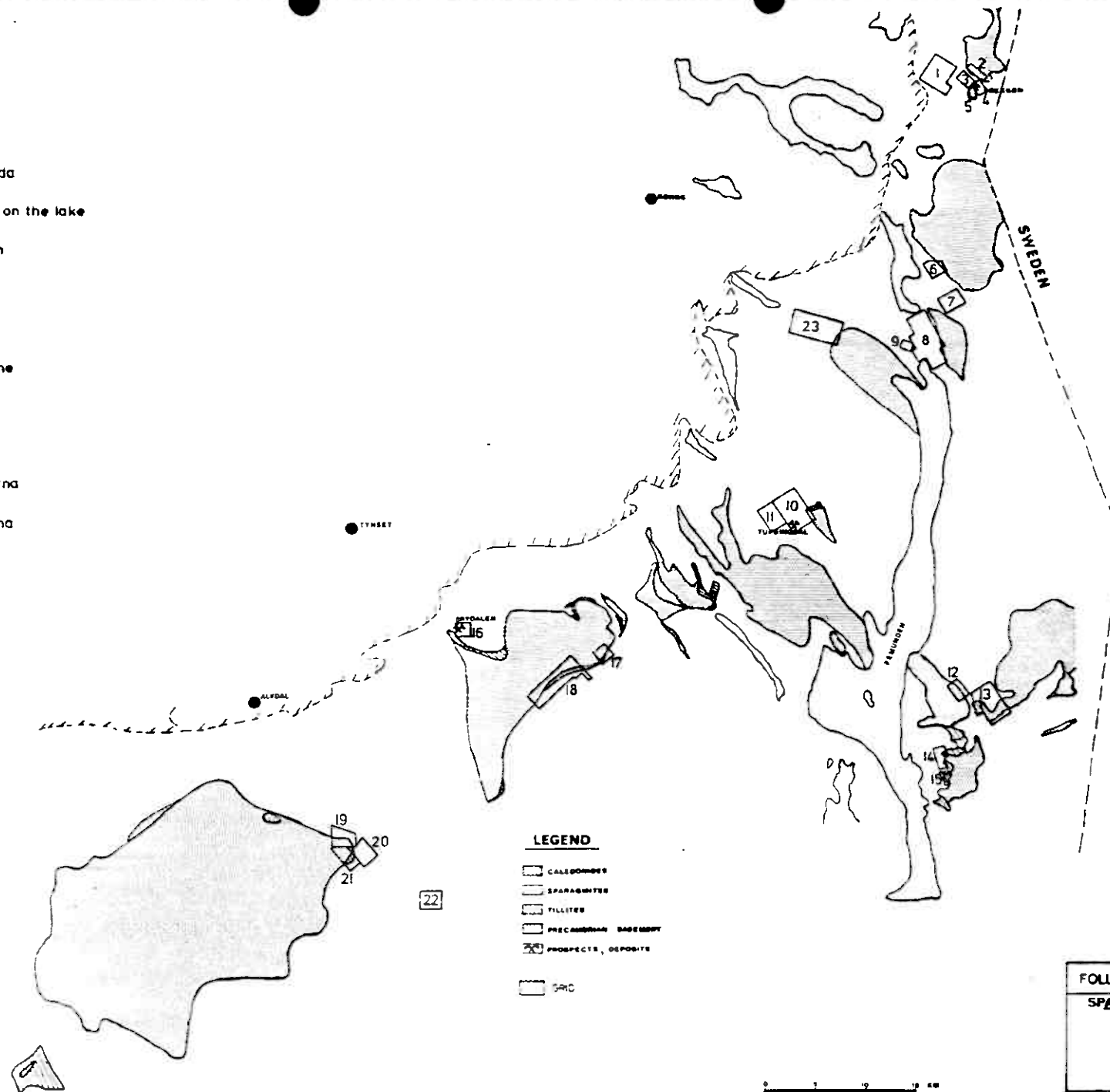
● FOLLDAL

● TYNSET

● ALFDAL

LEGEND

- CALDERIMIDES
- SPARGMITES
- TILLITES
- PRE-CAMBRIAN BASEMNT
- PROSPECTS, DEPOSITS
- GRID



0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Fig. 4

FOLLDAL VERK A/S-AMOCO NORWAY J.V.
SPARGMITE PROJECT N-82-5
REGIONAL GEOLOGY MAP
WITH GRID LOCATIONS

Date: 11/11/82 Scale: 1:50,000

is located on the lines 1050 N, 1200 N, and 1350 N, between 100 E and 600 E, west of the mountain Gruvsjöhøgda. The occurring rock types in this area are augengneisses but outcrops are scarce. A stream draining this area was anomalous in Pb and Zn. Up to now a VLF-survey has been not conducted on this grid.

It is proposed to investigate the anomalous area more detailed during the next field season. A new grid should be established with close line spacing. As the anomaly is located at the edge of grid Tverrlivola, the new grid should also cover the area further to the east. Soil sampling, a VLF-survey, and eventually an IP-survey should be conducted. If these surveys should be successful drilling will be necessary.

6.1.2 Gruvsjøen/Gruvsjøen - on the lake/Gruvsjöhøgda

These three grids are situated at the Gruvsjøen-lake, about 8 km northwest of the town of Brekken, map sheet Brekken 1720 II.

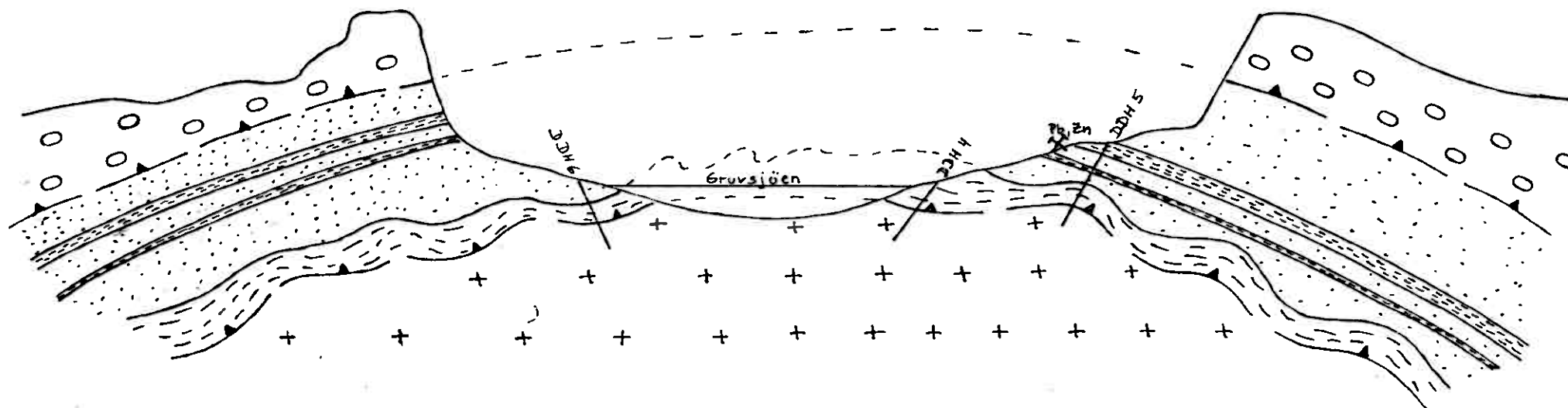
Already during the last year the Gruvsjøen-grid has been subject for exploration, since widespread Pb, Zn mineralization had been found within quartzitic rocks. Geological mapping was conducted, as well as a geochemical soil survey, a VLF-survey, and a CEM shoot back survey. Three targets were drilled without the discovery of any economic mineralization.

During the spring of 1983 a VLF-survey was conducted on the Gruvsjøen-lake but no significant anomalies were detected.

During the summer of 1983 detailed geological mapping was conducted on the Gruvsjøen grid in order to outline locations best suited for drilling. The grid area is located on the eastern flank of a flat dome-type structure (Fig. 5).

W

E



-  Augengneiss
-  Quartzite
-  Graphite Schist
-  Dark Quartzitic Schist
-  Granite (Basement)
-  Thrust

Fig.5: Simplified geological cross section
of the Gruvsjön area

The core of the dome consists of Precambrian granitic rocks and represents a paleohigh. The granites are not exposed within the investigated area. They are overlain by a sedimentary sequence that consists of (base to top): dark grey quartzitic schists that sometimes contain mineralization of galena, sphalerite, and chalcopryite, followed by light quartzites with intercalations of partly thick graphite schists horizons. Both, quartzites and graphite schists sometimes contain galena-mineralization. These rocks are overlain by augengneisses. The contact is probably a thrust contact. The strike direction is NW-SE with a dip of about 10° towards the NE.

In the known Swedish deposits sandstone-hosted galena mineralization occurs in those sediments that lie autochthonous directly on the basement rocks. Therefore it was important to find the stratigraphically lowest sedimentary beds that were exposed in the area. Those beds were the galena - and sphalerite-bearing dark quartzitic schists. Therefore the first drill hole (DDH No. 4) was driven into these schists on a location where relatively much Pb, Zn mineralization was visible (Coord. 400 S/375 W). No economic sandstone-hosted Pb-mineralization was hit. Instead galena and sphalerite could sometimes be found as lenses or on fractures. The basement granite was hit at a depth of 110 m. The second hole (DDH No. 5) was drilled not far from the first hole (Coord. 305 S/40 W) to test the source of a large gossan. The source turned out to be a thick graphite horizon containing very much pyrrhotite. Also this hole was drilled down to basement. The third hole (DDH No. 6) was placed on the western flank of the dome structure, on the western side of the Gruvsjøen-lake. Only low galena contents were found within quartzitic rocks. The granites were hit at a depth of 105 m.

The rocks in all the three holes had one thing in common: The rocks at the contact between the basement granites and the overlying sediments were looking crushed and mylonitized

which suggests that this contact is a thrust contact. Sandstone-hosted mineralization can mainly be found in autochthonous sedimentary environments. That means that the grid area is probably not located in a favourable geological environment.

The occurring Pb, Zn-mineralization seems to be of different nature as the sandstone-hosted type, as galena and sphalerite occur mainly as fracture fillings or minor massive lenses.

The detailed geological mapping on grid Gruvsjøen showed also another result. The VLF-anomalies as well as the high geochemical soil anomalies that were detected in 1982 can be correlated with graphite schists units. The graphite schists are apparently relatively rich in lead. A second grid, Gruvsjøhøgda, was established as a northern continuation of grid Gruvsjøen. Also here one can find high geochemical soil anomalies that correlated to the VLF-anomalies. These anomalies are related to graphite schists.

Since the geological situation as well as the sources for the geochemical and the geophysical anomalies is clarified now, the chance to find sandstone-hosted Pb, Zn-mineralization in the Gruvsjøen area is believed to be low. Therefore it is not proposed to conduct more investigations in the Gruvsjøen area. The area is highly anomalous in Pb and Zn, however. This should encourage the investigations on grids lying close by as grids Tverrlivola and Litlefjellet.

6.1.3 Litlefjellet

This grid is located about 1,5 km west of Litlefjellet, map sheet Brekken 1720 II. Anomalies for Pb, Zn, and Cu were detected by the regional stream sediment survey.

A grid was established covering two anomalies that lie very close to the contact of the Precambrian basement rocks with

the overlying Eocambrian sediments. In the eastern part of the grid area granites and rhyolites are exposed representing the Precambrian basement. In the western part of the grid one can find sediments as arkoses and quartzites. The general strike direction is NW-SE. A Pb anomaly was detected by the geochemical soil survey. On lines ONS and 150 N between 100 W and 200 W values between 50 and 190 ppm Pb were analyzed in the soils. This area is drained by one of the streams showing high Pb and Zn values. Further towards the south in the striking continuation little chalcopyrite can be found within the sediments. A VLF-survey was not conducted on this grid.

For the next field season it is proposed to conduct a VLF-survey and detailed prospecting over the anomalous area and further towards the south. *2. hver for. ?* *Ye.*

6.1.4 Øya

The grid is located about 6 km southwest of Støten, map sheet Brekken 1720 II. Anomalies for Pb, Zn, Cu, and Ag were detected by the regional stream sediment survey.

The rocks of the Precambrian basement that is exposed in one outcrop with rhyolites occur in the eastern part of the grid. The basement is overlain by sediments as arkoses and quartzites that are dipping very gently towards the west. The strike direction is NW-SE.

Anomalous areas were not detected by the geochemical soil survey. The results of the VLF-survey show a strong anomaly for dip angles and the field strength running through the whole grid area from NW to SE. The anomaly is probably caused by a thick graphite schist horizon. It is located very close to the contact of the basement with the sediments. Another much weaker anomaly runs in the central part of the grid parallel to the strike direction of the rock units.

As the survey did not result in the detection of promising anomalies, it is not proposed to conduct further investigations on grid Øya. The geochemical stream sediment anomalies are possibly caused by the graphite horizon in the eastern part of the grid, similar as on grid Gruvsjøen. o. l.

6.1.5 Ljøsnåvollen

The grid is located about 4 km north of Brennvola, map sheet Røa 1719 I. In this area anomalies for Pb and Zn were detected by the regional stream sediment survey.

Outcrops of quartzites and arkoses occur within the grid area. The strike direction is NW-SE with a dip towards NE. A large part, especially the eastern part of the grid area is covered by glacial drift and marsh. Several VLF-anomalies were detected within the area, some in all probability related to graphite schists. Some weaker anomalies limited in extension can be found, too. The geochemical soil survey did not show any anomalies. Therefore it is not proposed to conduct further exploration work on this grid.

6.1.6 Brennvola/Langen

From the 1982 regional survey anomalies for Pb and Zn were detected in a creek draining an area west of the mountain Brennvola. Before any grid was established prospecting was conducted in the area. Beside a trail going into the anomalous area a boulder with sandstone-hosted galena-mineralization was discovered. The location is about 3 km east of Langen.

A grid was established in this area and one further to the east in the anomalous area, west of Brennvola, both on map sheet Røa 1719 I. These two grids shall here be discussed together because of their geographical neighbourhood and their geological similarities.

Grid Langen was established first. No outcrop can be found in this area, as it is totally covered by glacial drift that is estimated to be 1 - 2 m thick. The direction of the ice-movement was from the SE towards the NW.

Boulder tracing was conducted and a boulder train with boulders containing disseminated galena in arkoses could be found. The boulders are mostly angular and up to 2 m in diameter. The boulder train runs in SE-NW direction and is at least 1,2 km long and cuts off on a lake at the eastern edge of the grid. Two samples were assayed, running 5,22 and 2,60 % Pb and 0,33 and 0,35 oz/ton Ag.

After that a VLF-survey was conducted indicating no significant anomaly. In the eastern part of the grid, however, a zone with higher background values for the horizontal field strength was detected.

The geochemical soil survey did not result in indicating an anomalous area.

An IP-survey was conducted, first with the SGU-sports model and later with the CRONE-instrument. The SGU-instrument did not pick up any significant anomaly. With the CRONE - instrument, however, good anomalies were detected on all the three lines surveyed. On line 350 E a strong IP-anomaly with relatively low resistivity was detected at around station 125 S. This is almost exactly the area where the boulders cut off. On this station a vertical drill hole is proposed, as the geological units dip flatly in the area. Also on the lines 100 W and 300 W good IP-anomalies were detected. The anomalies indicate a chargeable bed in the northern part of the grid dipping towards the south. A drill hole is proposed on line 100 W, station 150 N, with a dip of 55° towards north, and one on line 300 W, station 325 N, vertical. Apart from the anomalies described above also a weaker anomaly was detected in the southern part of the grid that might require drilling.

sammeln
med IP.

ES-opp.

by komme
kodel høyre
bedre over
IP-sone.

Kan vel
flyttes til
B.L. !!

063.
dette kan
bli for
langt!!

On grid Brennvola outcrops can be found in the central and southern part of the grid. The west of the area is covered by glacial drift. Basement granites are exposed in the east. These are overlain by arkoses, quartzites, and graphite schists. The sediments are lying flat forming a gentle syncline in the central part of the grid. The graphite schists can be easily traced by the results of the VLF-survey. High field strength readings outline clearly the syncline structure. Some higher readings, probably not caused by graphitic schists, can be observed in the western part of the area, close to the connection with grid Langen.

A long boulder train, 1,2 km in length and running in SE-NW direction, with disseminated galena and pyrite within arkoses, was found. The train cuts off on line 3450 S, station 1350 W. In this place one can find at least 22 mineralized boulders that are mostly angular and up to 4 m in length. No outcrops are exposed in this place. From several boulders samples were taken and assayed. They were running:

Sample:	Cu %	Zn %	Ag oz/ton	Pb %
BV-83-4-B	NIL	NIL	0,39	4,06
BV-83-5-B	NIL	NIL	0,10	1,24
BV-83-7-B	NIL	TRACE	0,13	1,00
BV-83-9-B	NIL	TRACE	0,30	3,79
BV-83-10-B	NIL	NIL	NIL	0,04
BV-83-11-B	NIL	TRACE	0,12	1,27
BV-83-13-B	NIL	NIL	0,60	5,76
BV-83-17-B	NIL	NIL	0,52	4,32
BV-83-18-B-1	NIL	NIL	1,16	10,5
BV-83-18-B-2	NIL	NIL	1,55	13,6

Later a geology student from Oslo did detailed prospecting on and around the grids Langen and Brennvola without finding more mineralized boulders.

The geochemical soil survey indicated some geochemical anomalies NW and N of the cutoff of the boulder train. It might

also be possible that similar as on grid Gruvsjøen, these anomalies are caused by graphitic schists that occur in this area. One sample, however, ran 1900 ppm Pb on the most southern line of the grid. This location must be followed up during the next field season.

An IP-survey was conducted on some few lines on grid Brennvola, across the boulder train and south of it. The results, however, are difficult to interpret as the flat lying graphite horizons with very low resistivities cause some high anomalies. Another anomaly is located just in the southern continuation of the cut off of the boulder train. Unfortunately in this place a fence is located. So it is not clear if the anomaly is caused by the fence. It is difficult to outline any drill targets by this survey.

Therefore it is proposed to drill a fence of holes along line 3600 S, starting at station 1600 W and stopping at station 1000 W. The spacing between the holes should be not more than 50 m. This low spacing is proposed as the Laisvall-deposit for example is very narrow but large in length. One hole should be drilled just south of the cut off of the boulders train. All holes should be drilled vertical.

The type of mineralization found in the boulders is very similar to that of the Swedish deposit Laisvall. Galena, together with pyrite, can be found disseminated throughout the whole sparagmite, following bedding planes, or partly also as "spotty galena". In one boulder on grid Langen also fluorite was found. As the mineralized boulders are mostly very large and angular (at the cut off), their source can not be very far. Therefore it is believed that there exists a good chance to find a deposit with sandstone-hosted lead mineralization in the Langen/Brennvola area.

6.1.7 Tufsingdal

Grid Tufsingdal is located just west of Tufsingdal, map sheet Narbuvo11 1719 IV. Anomalies for Pb, Zn, and Cu were detected by the regional stream sediment survey. The old Tufsingdal Pb, Ag-mine is located in the same area.

A grid was established covering the main anomalies and the area around the old mine. In the southeastern part of the grid outcrops of basement, overlain by a coarse polymict conglomerate at their northern and western edge can be found. These rock units are overlain by sediments as quartzites, schists, and black schists. The general strike direction of the rock units is N-S with a dip towards the east.

The geochemical soil survey indicated a larger area, anomalous in Pb and Zn, southeast of the old Pb, Ag mine. On the western edge of the granites a zone that is highly anomalous in Zn stretches in NW-SE direction crossing the lines 100 S, 800 S, 600 S, and 400 S, between OEW and 600 E. A smaller area, anomalous in Pb (lines 400 S and 600 S/100 E - 200 E) correlates with the Zn anomalies. A strong Pb-anomaly is located on lines 800 S and 600 S/650 W - 800 W. In between these areas another Pb-anomaly is located on lines 600 S and 800 S. According to the geology map quartzites should occur in these anomalous areas, but on line 1000 S conglomerates occur, too.

A part of this area was covered by a VLF-survey on lines 1000 S - 200 S/OEW - 1200 W resulting in an anomaly on all the lines at about station 200 W. This anomaly is so strong that it might be caused by a graphite horizon. Another weak anomaly is located at about stations 500 W - 600 W on the surveyed lines.

It is proposed to cover the whole anomalous area by a new grid with close line spacing (100 m) and low spacing between the stations (50 m). The corner points of this grid should be located at coord. 1000 S/1200 W, 200 S/1200 W, 200 S/650 E,

*See anomaly
of granite.*

*Hva med basistru: dette
nye nettsted, blir vel bli
ca. 11 strik.*

1000 S/650 E. This area would include the old mine. Soil sampling should be conducted as well as an IP-survey. The soil samples should not be taken by grubhoes, but from a larger depth (see chapter 6.1.19). Supplementary equipment will be necessary for that. The obtained results will probably require drilling.

The target area is believed to be located in a favourable geological environment as it is located west of the basement granites with occurring conglomerates, which implies an autochthonous sedimentary environment. The occurrence of an old Pb, Ag-mine and pyrite in quartzites encourage exploration work in this area, too.

6.1.8 Gråhøgda

Widespread Pb and especially Zn anomalies were detected in this area by the regional stream sediment survey. A grid was established in the western neighbourhood of grid Tufsingdal that covers possible source areas (map sheet Narbuvoil 1719 IV).

Very little outcrops can be found within the grid area. Only quartzites and one outcrop with grey-coloured schists are exposed on the eastern edge. The geochemical soil survey indicates only a few slightly anomalous spots for Pb on the grid area. A VLF-survey was not conducted.

Make VLF på anomalien på blad I

It is proposed to do preliminary no further investigations on this grid. If the exploration work on grid Tufsingdal should turn out to be successful, however, further exploration work should be conducted also on this grid.

6.1.9 Nolsjøen

The grid is located about 5 km southwest of Elgåhogna, map sheet Elgå 1719 II. Anomalies of Pb, Zn, Cu and Ag were indicated by the regional stream sediment survey.

A large part of the area is covered by glacial drift but some outcrops of quartzites and meta-arkoses can be found. The general strike direction is about E - W with a dip towards the south. Prospecting in the grid area resulted in finding two or three boulders of a meta-arkose that were mineralized with pyrrhotite and pyrite. The geochemical soil survey did not result in showing any anomalies. The background values are also relatively low. The VLF survey did not show any clear anomaly either except on a power line running along the eastern edge of the grid.

The source for the geochemical stream sediment anomalies is unknown. Therefore it is proposed to do no more investigations on this grid.

6.1.10 Svarthamrane

The area is located 5,5 km west of Sushøgda, sheet Elgå 1719 II. Anomalies for Pb, Zn, Cu, and Ag were detected by the regional stream sediment survey.

The central part of the grid area is dominated by Precambrian basement rocks that are laterally overlain by quartzites and arkoses. In the western part of the grid a coarse conglomerate with calcite fragments and another conglomerate with quartz pebbles is exposed. Within the sandstones some thrust planes striking NW-SE can be observed. The general strike direction of the rock units is NW-SE with a dip generally towards the NE. In the southeastern part of the grid the strike direction turns NE-SW with a dip towards NW.

Within the Precambrian basement mineralization of chalcopyrite and little galena was found in granites. Outcrops

with mineralization can be found on the lines 1650 S, 1950 S, 2100 S, 2400 S, and 2550 S between the base line and a few hundred meters towards the west (see geology map). The content of sulfides is low. Two rock samples with sulfides were analyzed containing less than 0,1 % Cu and Pb. In some places the Cu content is apparently higher as chalcopyrite is well visible as an accessory mineral. A larger mineral occurrence is not to be expected as the geochemical soil survey indicates only two sample sites in the western part of the grid with slight copper anomalies. The values for Pb are in general very low only with about 4 - 5 isolated sample sites with slightly over 50 ppm. A VLF-survey was not conducted on the grid.

The anomalies that were detected by the regional stream sediment survey are probably caused by the disseminated sulfides in the granites and not by sandstone-hosted Pb/Zn mineralization. As the mineralization in the granites seems to be very low grade and of no economic interest, it is not proposed to conduct future work on this grid.

6.1.11 Tovberga

The grid is located close to Tovberga on map sheet Elgå 1719 II. Here anomalies for Pb, Zn, and Cu were detected by the regional stream sediment survey.

Mainly outcrops of sparagmites can be found within the grid area. Apart from these, two narrow horizons with conglomerates and conglomeratic sandstones occur. The conglomerates contain pebbles of basement rocks as granites and gneisses. The general strike direction of the rock units is about 50 - 60° with a dip towards the NW. Large parts of the area are covered by glacial drift or marsh.

Neither the geochemical soil survey nor the VLF-survey detected any anomalies on the grid. Prospecting did not give any positive results either. The source of the geochemical stream sediment anomalies is unknown. It is proposed to conduct no more investigations on grid Tovberga.

6.1.12 Krokåtsjøen

The grid is located about 4 km northwest of Sorkvola, at the Krokåtsjøen lake. An anomaly for Pb, Zn, and Cu was found in one sample by the regional stream sediment survey.

Outcrops of sparagmites and conglomerates that contain pebbles of basement rocks can be found within the grid area. In the northern part a few outcrops of basement (rhyolites) occur. The strike and dip directions vary considerably. Neither the geochemical soil survey nor the VLF-survey indicated anomalous areas. Therefore it is not proposed to conduct further investigations on grid Krokåtsjøen.

6.1.13 Brydal

A Cu/Ag mineralization is located near Brydal, about 15 km southeast of the town of Tynset (UTM coord. 605250, 6896050). It is located within sparagmites not far from the Precambrian basement that is exposed 1,5 km further south. A grid was established covering the mineralization and the area east of it, as here a weak Cu-anomaly was detected by the regional stream sediment survey. Geological mapping, prospecting, a geochemical soil survey, and a VLF-survey were conducted.

The geology of the grid area is dominated by light grey, slightly conglomeratic arkoses that sometimes contain layers of clay-rich material, which give the arkoses the character of chlorite schists in some places. In the southern part of the grid quartz conglomerates that represent the basal sequence of the sandstone are exposed. The conglomerates overlie the granites of the Precambrian basement that is exposed further towards the south. The general strike direction of the rock units is 120° with a dip of $20 - 30^{\circ}$ towards NE. The area is thickly covered by coarse moraine and blocks of local origin.

An outcrop with sandstone-hosted copper mineralization is located on coordinate ONS/OEW and another one further to the

north on 225 N/50 W. The rocks in both outcrops belong to the same bed. At the larger of these outcrops (ONS/OEW) a steep wall of rocks is coated by secondary copper minerals as malachite and azurite. Very seldom some small grains of bornite, chalcopryrite, or pyrite can be observed. The coated zone is exposed over a length of about 70 m and a height of more than 10 m. Some rock samples were taken and assayed, containing in average about 0,3 % Cu and 20 ppm Ag. The second outcrop is located about 225 m north of the first one. Here one can also see malachite as coatings but more sulfides such as chalcopryrite, bornite and very little chalcocite. The content of sulfides is in places up to 1 %.

Only one anomaly for Cu was detected by the geochemical soil survey located at the larger outcrop with copper mineralization. No other geochemical anomalies were detected within the grid area. The VLF-survey did not indicate any clear anomaly close to the known showings. The readings of the horizontal field strength, however, show a very slight increase close to the mineralization and from there further towards the south.

*Cu-gehaltet angiv
d. g. strukturer
i området.*

*Vin 0910
strukturen
i feltet.
s. nylt'g.*

Altogether four diamond drill holes were drilled on the grid. Hole no. 1 (BH-BRY-83-01) was drilled just above the main showing at coordinate 40 E/50 N with a direction of 220° and a dip of 60° like all the other holes (except no. 4). The mineralization was hit just below the overburden and Cu-sulfides were visible down to a depth of 54 m. The Cu-mineralization shows a clear zonation with a zone of disseminated bornite that is more than 10 m thick at the top. Below that, one can find a zone of about 15 m thickness with bornite and chalcopryrite followed by 10 m thick zone with chalcopryrite and a 10 m thick zone with chalcopryrite and pyrite. All the sulfides occur disseminated within the sandstones. The content is low, however, less than 1 %. The first 55 m of this hole were sent for assays but the results were not obtained yet while this report was prepared.

The best zone seems to be between 10 and 20 m with an average Cu-content of probably 0,33 % and about 15 ppm Ag. This was found out by preliminary half-quantitative assays at Follidal Verks mine Tverrfjellet. Characteristic for the mineralized rocks is that they are hematitized. Hematite can be found on fractures and disseminated. The most intensive hematitization can be found at a depth of around 65 m and around 78 m, that means below the copper mineralization. The hole was drilled to a depth of 195 m, but the granitic basement was not hit. The basal conglomerates were hit at a depth of 143,50 m.

The second hole was drilled at 45 E/160 N, more than 100 m north of hole no. 1. The mineralization was hit at a depth of about 39 m. In this hole it was only 2 m thick with disseminated bornite but no other Cu-sulfides. 10 m of this ore were sent to assay.

Hole no. 3 was drilled at 50 E/350 N, about 200 m north of hole no. 2. At a depth of 72,25 m a 0,5 m thick zone with malachite and disseminated chalcopyrite (less 1 %) was found.

Hole no. 4 was drilled 200 m east of hole no. 1, in its striking continuation. This hole was also drilled with a 220° direction but with a dip of 70°. At the depth of 120m a 7 m thick zone with intensive hematitization was found, but without sulfides.

The drill results show that the mineralization is very limited in its extension. Also the grade is apparently too low. Therefore it is proposed to do no more drilling on this property. The regional stream sediment survey of 1982, however, indicated anomalies a few km further to the east in the same geological environment (contact granite/sparagmites). These anomalies should be followed up in the next field season. Recommendations for this work are given in chapter 6.2.2.

6.1.14 Elgpiggen

Anomalies for Pb, Zn, and Ag were detected by the regional stream sediment survey 3,5 km southwest of Elgpiggen, map sheet Holøydal 1719 II. A grid was established to cover possible source areas of these anomalies.

Most of the grid area is dominated by basement granites. In the southern part quartzites occur and in the southeastern part conglomerates lying in contact with the granites were found. The strike direction of the conglomerates is about 40° with a dip towards SE.

The VLF-survey resulted in indicating a weak anomaly running almost parallel to the strike direction of the rocks. The anomaly is strongest on lines 300 N and 450 N at about station 200 W. The geochemical soil survey did not pick up any anomaly at all.

The reason for the geochemical stream sediment anomalies is difficult to explain. Since the follow-up work did not show any promising results further follow-up work on this grid is not recommended.

6.1.15 Nekkjølen

At Nekkjølen, northeast of Langkletten, map sheet Tyllidal 1619 II/Holøydal 1719 II, a large Cu-anomaly was detected by the regional stream sediment survey. Anomalies for Pb, Zn, and Ag were detected as well. A large grid was established that covers possible source areas for the anomalies.

The area is located at the eastern margin of the "Finstad-window" that represents a Precambrian paleohigh within the sparagmite sequences. Therefore the occurring rock types in the western part of the grid are granites, whereas the central and eastern parts are dominated by polymict conglomerates and quartz pebble conglomerates that are overlain by schistose

arkoses. The strike direction is NE-SW. The sediments dip gently towards the SE. Apart from geological mapping prospecting, a geochemical soil survey, and a VLF-survey were conducted on this grid.

A small copper-mineralization that was already known before is located within the grid area (675 N/75 E). A small outcrop of probably arkoses (?) can be found. Mostly malachite is visible. Very little disseminated bornite can be found, too. Some samples were running up to 0,4 % Cu and 20 ppm Ag. Also in the underlying conglomerates a little chalcopyrite was visible.

Prospecting was conducted in the possible source area of the large Cu-anomaly where an old trench was discovered (3200 N/150 W). The occurring rock type is probably a mylonitized granite containing large amounts of chalcopyrite. In some samples, however, the Cu-mineralization seems to follow bedding planes. So an accurate determination of the type of host rock is not possible. Some samples were running up to 5 % Cu with a considerable amount of Ag (20-30 ppm). On several lines, north and south of this showing, Cu-anomalies were detected by the geochemical soil-survey. These require further follow-up work. On the northernmost line of the grid the geochemical soil survey indicates a Pb-anomaly located within the basal sequence of the sparagmites.

The VLF-survey resulted also in indicating some anomalies. None of the VLF-anomalies correlates with any geochemical anomaly, however.

en samhet med modifierings.

For the field season 1984 it is proposed to conduct an IP-survey in the anomalous area north and south of the Cu-trench on lines 2700 N - 3600 N between 500 W and 300 E.

If positive results should be obtained diamond drilling will be necessary. The Pb-anomaly on the northernmost line must be followed-up by detailed prospecting. The grid should be extended further towards the north in this area.

*er Cu-mineraliseringer i en samme type som i Lilligehus har vært borte i Svarthamnsområdet?
~~Forfølgelse~~ of flere andre områder?*

6.1.16 Brennvoltjørna/Barkaldvola/Holbekktjørna

The area is located around the Nordisætervola, map sheet Hanestad 1918 IV, where a large area with high Pb-anomalies and some Zn, Ag, and Cu anomalies were detected by the regional stream sediment survey.

The grids Brennvoltjørna, Barkaldvola, and Holbekktjørna were established to cover central source areas of the anomalies. The area was already mapped in 1982 i scale 1 : 50.000 (see Fig. 6). The anomalous area is situated close to the contact of Precambrian basement (granite and quartz porphyry) with overlying Eocambrian sandstones. A tillite formes the base of the sediments. The overburden is in general not very thick in the area.

On none of the grids a geochemical anomaly was detected. The background values are very low. Prospecting in the area did not give any positive result either. This is surprising as the geochemical stream sediment survey indicated very high values all over the investigated area, mainly for Pb. Streams with high Pb drain also granites.

In the lead-project that NGU conducted in 1968 - 1971 high anomalies for Pb were also detected in creeks draining granitic rocks. NGU thinks that the granites contain small amounts of galena. This is set free by wheathering and the lead is then accumulated in the stream sediments. This might be an explanation for the anomalies in our project area. A VLF-survey was not conducted on these grids. It is not proposed to continue with further exploration work on these grids.

6.1.17 Fossbekken

The grid is located 9,5 km southeast of Nordisætervola, map sheet Hanestad 1918 IV.

GEOLOGY MAP OF THE NORDISAETHERVOLA AREA

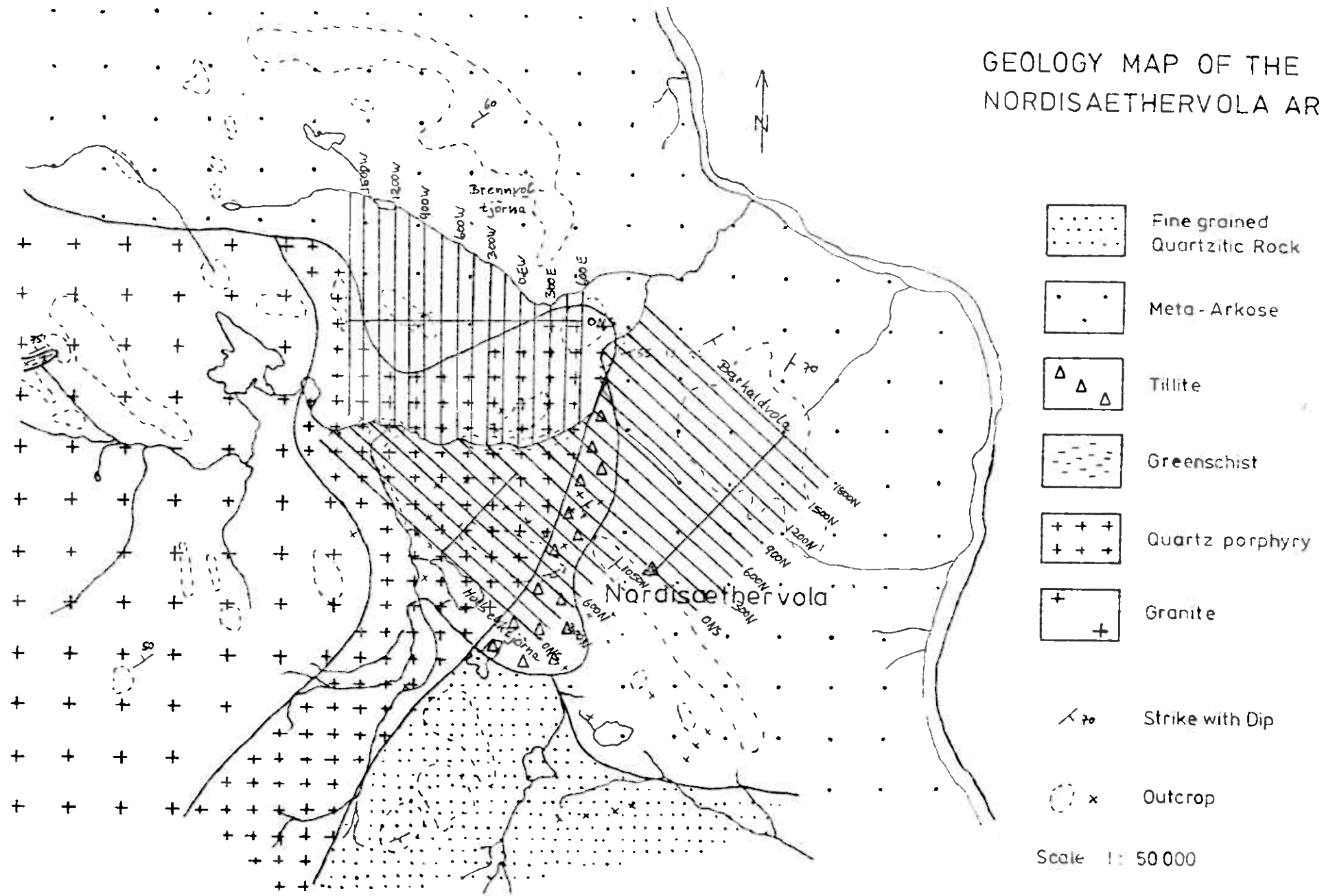


Fig. 6

In this area anomalies for Pb, Zn, Ag, and F were detected by the regional stream sediment survey.

Outcrops of arkoses can be found mostly in the eastern part of the grid. The general strike direction is 80° - 100° with a dip towards SE. In the most southeastern part it seems to be more N - S with a dip towards the east. Most of the area is covered by overburden, however. The geochemical soil survey showed low values for all the elements analyzed except on coordinate 150 W/100 S where one single sample with 130 ppm Pb was detected. A VLF-survey was not conducted.

The source for the geochemical stream sediment anomalies is not known. It is not recommended to conduct more investigations on this grid.

6.1.18 Håsjøen

South of the Håsjøen lake, about 6 km west of grid Langen, map sheets Narbuvoll 1719 IV/Røa 1719 I, a grid was established in spring 1983. Anomalies for Pb, Zn, and Ag were detected by the geochemical stream sediment survey in this area.

Only a VLF-survey was started in early spring, the crew working on skis. One anomaly was detected in the southeastern part of the grid. Later in summer, before any other work was conducted, prospecting was done within the grid area. Almost the whole area was found out to be located within granites. Consequently the area is not situated in a favourable environment for finding sandstone-hosted Pb, Zn mineralization. Therefore all further work on this grid was stopped.

6.1.19 General Remarks

The cause for many of the anomalies that were detected by the regional stream sediment survey could not be explained as their source is unknown. On many of the grids the geochemical soil surveys did not show any anomalies whatsoever. It should now be considered if the follow-up soil sampling procedure was always the correct method. A fact is that thick overburden can be found on many of the grids. On some other grids, however, the overburden is very thin or not present at all as for example on grids Gruvsjøen or Gruvsjøhøgda. On these two grids strong geochemical soil anomalies were obtained that can clearly be correlated with the bedrocks. A possible explanation that no anomalies were detected on other grids might be that the overburden is too thick or too far transported to cause anomalies in the soils that are related to the underlying bedrock.

Therefore it is proposed, as a test, to conduct soil sampling on one grid by taking the samples from a larger depth just above the bedrock. This would require a type of drill equipment that is available here in Norway. The proposed test grid would be the Tufsingdal area (see chapter 6.1.7). In this area partly thick overburden can be found and relatively weak anomalies for Pb and Zn were indicated by the geochemical soil survey.

6.2 REGIONAL STREAM SEDIMENT SURVEY

6.2.1 Survey 1983

The regional stream sediment survey 1983 was conducted in order to extend the project area further towards the north into the area on map sheet Stugusjø 1720 I, as the area on map sheet Brekken 1720 II, south of sheet Stugusjø, proved to have an unusual high background in Zn and Pb. The survey covered areas of the sparagmite sequence that lie close to the contact with Precambrian basement rocks. Several anomalies were detected.

Anomaly 5 km northwest of Littlefjellet (map sheet Brekken):

According to NGU's geological map sparagmites should occur in this area but no outcrops are marked on the map. The area is located close to the Precambrian basement that is exposed east of the anomaly.

Very high Zn-values were detected (up to 2700 ppm) over a wide area (sample no. 233, 234, 237, 238, 239, 278, 279, 240, 241, 277, a.s.o.). These are accompanied by anomalous Ag and Pb values.

It is proposed to establish a larger grid in this area. Prospecting, geological mapping, a geochemical soil survey, and a VLF-survey should be conducted during the field season 1984. This work must be completed on a first priority basis. Furthermore it is proposed to stake claims, covering the source areas of these anomalies since B.P. Minerals is conducting exploration work in Tydal, several km NW of the anomalous area.

Anomaly 5 km southwest of Ijsengealta (sheet Stugusjø):

Several samples with anomalous values for Pb were taken about 5 km southwest of Ijsengealta (sample no. 15, 16, 17, 18, 19, 20). The creek is draining rhyolites of the Precambrian basement.

Since the anomalies are not located within the sparagmites or close to the contact of the sparagmites with the rhyolites it is recommended to follow this anomaly up on a low priority basis, eventually by prospecting.

*Et d'm rhyolitene
av samme type som
Oppdal. 2.?*

Anomaly just east of the Rien-lake (sheet Stugusjø):

Some samples (no. 114, 117, 31) were detected to be anomalous in Pb, Zn, and Ag. Two anomalous creeks are draining sparagmites.

It is proposed to conduct follow-up work in this area by establishing a grid over the drainage area of the two creeks with subsequent geological mapping, prospecting, soil sampling, and a VLF-survey. This work should be conducted on a high priority basis.

Anomaly 3 km east of the Rien-lake (sheet Brekken):

A strong anomaly for Pb, Zn, Cu, and Ag was detected in one sample (no. 188) about 3 km east of the Rien-lake in a short creek that is connecting two lakes. It is located within the sparagmites. As the source area of this anomaly can not be very far it is proposed to conduct soil sampling on a line that runs parallel to the bank of the creek. The spacing between the samples should be less than 50 m. The sampling should be conducted on both sides of the creek. If the results should turn out to be promising a grid must be established in the area with subsequent detailed exploration work. This work should be conducted on a high priority basis.

Apart from the anomalies described above a few other weaker anomalies can be found scattered over the area.

6.2.2 Survey 1982

From the regional stream sediment survey 1982 there are still some anomalies left that were not followed-up during the field season 1983 and that were proposed to be followed

up on a high priority basis. This work should be conducted during the field season 1984. Geological mapping, prospecting, soil sampling, and a VLF-survey are proposed on each of the grids in the same way as the grids were surveyed in 1983. The following anomalies are recommended for follow-up work:

- Anomaly 3,7 km southeast of Gråhøgda (map sheet Sollia 1818 I):

A high Pb, Zn, Ag anomaly is located 3,7 km southeast of Gråhøgda (sample no. 3129). Further downstream two anomalous samples for Pb were found (sample no. 3184, 3665). The anomaly is situated very close to the southern border of the Atna-window. As the anomaly was so high and situated in a good geological setting, the anomaly was proposed to be followed-up on a high priority basis.

- Anomaly 1,25 km SW of Volldalshøgda (map sheet Brekken 1702 II):

A Pb, Zn, Cu, Ag-anomaly was detected 1,25 km southwest of Volldalshøgda (sample no. 4266). It is located within arkoses.

- Anomaly 3 km SW of Volldalshøgda (map sheet Brekken 1720 II):

In a stream about 3 km southwest of Volldalshøgda a quite wide Pb, Zn, Cu, Ag anomaly was found (sample no. 2237 - 2243). In the upper part the stream drains the granites of the Vingelen-window whereas in the lower part it drains the overlying arkoses. It is proposed to establish a grid in the area where the stream crosses the geological contact between the granites and the arkoses. This is at about sample no. 2239. In this area the best anomalies can be observed.

- Anomaly 2 km SW Finnrohøgda (map sheet Elgå 1714 II):

In a marsh area 2 km SW of Finnrohøgda high values for Pb and Zn were detected by the stream sediment survey. The area is located only a few km southeast of the old Tufsingdal mine. A base line is already staked.

- Anomaly 1,5 km northeast of Brurhøgda (map sheet Holøy-dal 1714 II):

High anomalies for Pb were found 1,5 km northeast of Brurhøgda (sample no. 2628, 2629, 2630, 2663, 2665). The anomalous area is situated at the northeastern end of the Finstad-window, where tillites and conglomerates overlie the Precambrian granites. Therefore the anomaly is located in a favoured geological environment.

- Anomaly 1,75 m east of Klettsäterklettan (map sheet Tyllidal 1619 II):

This anomaly (sample no. 720) is located in the striking continuation of the anomaly at Nekkjølen (investigated in 1983). Anomalous values for Pb, Zn, and Ag were detected.

- Anomaly 4 km south of Klettsäterklettan (map sheet Tyllidal 1619 II):

A Pb, Zn, Ag anomaly was detected about 4 km south of Klettsäterklettan. The anomalous values of the elements can not be found altogether in the samples. Anomalous Zn can be found more downstream, whereas Ag shows anomalous values more upstream. A Pb anomaly is located in the center. The geological setting is a favoured one as the anomalous area is situated only a few hundred meters away from the contact to the rocks of the Finstad-window. The anomaly is probably located in the southern striking continuation of the rock units occurring on grid Nekkjølen.

- Anomaly 3 km east of Langhøa (map sheet Tyllidal 1619 II):

A very high Pb, Zn, Ag, Cu anomaly was detected about 3 km east of Langhøa (sample no. 334). The anomaly is located at the northern margin of the Finstad-window close to the contact with the sediments. A few km further to the west the Brydal grid is located also at the northern margin of the window. That's why this anomaly is especially interesting to follow-up.

- Anomaly 5 km northeast of Høgkuven (map sheet Alvdal 1619 III):

About 5 km northeast of Høgkuven a Pb, Zn, Ag anomaly was detected (sample no. 575, 576, 579, 580). The values are very high in Ag (4,5 - 6,0 ppm). The anomalous area is located within light grey arkoses. Numerous quartz veins within the sandstones and partly a strong enrichment in hematite can be observed. No mineralization could be found by prospecting.

7. SUMMARY OF RECOMMENDED PROGRAM

Detailed exploration work on grids already established in 1983:

- Tverrlivola : grid with close line spacing, prospecting, soil sampling, VLF-survey, IP-survey, diamond drilling. *o.k. jordprøve har kuttet gode anomalier, husk for flue !!*
- Littlefjellet: VLF-survey, detailed prospecting *o.k. begreint VLF*
- Brennvola/Langen: prospecting, diamond drilling. *IP !!*

- Tufsingdal: grid with close line spacing, "deep soil sampling", IP-survey, diamond drilling. *Hva med orientering a b.l.?*
- Nekkjølen: IP-survey, diamond drilling, extension of the grid with soil sampling, prospecting. *a.l. men begynte omridet.*

Establishment of new grids as follow-up work of the regional stream sediment surveys of 1982 and 1983 (includes geological mapping, prospecting, soil sampling, and a VLF-survey):

- Map sheet Brekken:
- Anomaly 5 km northwest of Littlefjellet.
 - Anomaly 3 km east of the Rien-lake.
 - Anomaly 1,25 km southwest of Volldals-høgda.
 - Anomaly 3 km southwest of Volldals-høgda.

Map sheet Stugusjøen:

- Anomaly just east of the Rien-lake

Map sheet Holøydal: - Anomaly 1,5 km northeast of Brurhøgda.

Map sheet Tyllidal: - Anomaly 3 km east of Langhøa.
- Anomaly 4 km south of Klettseterklattan.
- Anomaly 1,75 km east of Klettseter-klettan.

Map sheet Alvdal: - Anomaly 5 km northeast of Høgkuven.

Map sheet Sollia: - Anomaly 3,7 km southeast of Gråhøgda.

Map sheet Elgå: - Anomaly 2 km southwest of Finnrohøgda.

This work would total in:

Man days:

- 45 sqkm detailed geological mapping and prospecting on 17 different grids

90 ÷ 26

No not reduced now

	Man days
- 21 line km IP-survey	68
- 5000 soil samples (analyzed for Cu, Zn, Pb, Ag) <i>Yours?</i>	165 <i>÷ 4</i>
- 250 line km VLF-survey	75 <i>1 pers. 3 mnd.</i>
- 200 "deep soils" <i>÷</i>	
- 2000 m diamond drilling <i>✓</i>	

8. LAND STATUS

30 claims (each 500 x 500 m) in one claim group are held by Folldal Verk in the Gruvsjøen area.

On grid Elgpiggen 15 claims were staked in one claim group.

53 claims in one claim group were staked on grid Nekkjølen.

At the Brydal property 64 claims were staked in 2 claim groups.

On and around the grids Brennvola/Langen 151 claims were staked in one claim group.

Altogether 313 claims are held in the sparagmite-project area. The claims are valid for seven years.

FOLLDAL VERK A/S

PAGE 2

[illegible]

DIAMOND DRILL LOG

FOLLDAL VERK A/S

PAGE 9

J.D.H. No.		Azimuth		Started		Directional surveys								
Property		Angle		Finished		Depth	Azim.	Dip	Depth	Azim.	Dip			
Co-ord.		Depth		Logged by										
5		200°E		9.8.83										
Gravsjøen		30°		10.8.83										
5055-408		84.25m		Krause										
From		To		Description		Interval		Assays						
						From	To	Cu	Mo	Pb	Zn	Au	Ag	
0	3.00			Overburden										
3.00	31.20			Graphite schists										
				Black, very graphite rich schists. They are characterized by their high amount of pyrrhotite (often more than 10%). Some grains of chalcopyrite can be seen, too. The schists contain many schlieren of quartz and carbonate material. At 26.30 to 31.20 the schists are more like dark quartzites with narrow layers of graphitic material. The angle of bedding is in this series between 80 and 90°.										
31.20	75.60			Quartzites										
				As 31.20-53.90: white-grey, very fine-grained quartzite with numerous thin layers of clay rich material, in parts conglomeratic with quartz pebbles less than 1 cm in size. At 51.30-53.90 the quartzite is intensively brecciated. From 63.90 to 75.60 one can find a very light quartzite with numerous fractures that are filled with chlorite. Galena, chalcopyrite, and pyrite can be found in thin schlieren and on fractures between 57.20 and 57.70. Throughout the whole quartzite sequence the rocks are weakly impregnated with pyrite. At 50.30-58.70 coarse aggregates of fluorite can be seen on a fracture. The angle of bedding to core axis is about 90° through this whole series of rocks.										

DIAMOND DRILL LOG

FOLLDAL VERK A/S

PAGE 2

[illegible]

DIAMOND DRILL LOG

FOLLDAL VERK A/S

PAGE 1

D.D.H. No.		6		Azimuth		70°		Started		11.8.83		Directional surveys							
Property		Grube, Jøen		Angle		60°		Finished		15.8.83		Depth	Azim.	Dip	Depth	Azim.	Dip		
Co-ord.		348 40/ Sheet: Fokkron 605200		Depth		109.45m		Logged by		Kruse									
From		To		Description								Interval		Assays					
												From	To	Cu	Mo	Pb	Zn	Au	Ag
0		3.50		Overburden															
3.50		20.20		Dark schists															
				Dark grey-greenish schists, fine grained, often with narrow quartz bands and numerous small folds. At 19.80 a 2mm thick band of chalcopryite. At the base of the schists a 20cm thick horizon of graphitic schists that are rich in pyrrhotite and contain some grains of chalcopryite. The angle of bedding varies between 70 and 80°.															
20.20		27.40		Light quartzites															
				Light grey, very fine grained, well bedded quartzites. No visible ore mineralization. Intercalation of dark schists (as 3.50-20.20) at 22.50-24.50. The angle of bedding is around 75-80°.															
27.40		34.20		Dark schists															
				as 3.50-20.20															
34.20		44.50		Graphite schists															
				Graphite schists, rich in pyrrhotite, with numerous folds. Contains some 10-20cm thick intercalations of light quartzites. The angle of bedding varies between 50 and 70°.															
44.50		55.00		Light grey quartzites															
				Light grey quartzites with numerous narrow bands of chlorite (clay) rich material. The quartzites are															

DIAMOND DRILL LOG

FOLLDAL VERK A/S

PAGE 2

From	To	Description	DDH No.	E	Interval		Assays					
					From	To	Cu	Mo	Pb	Zn	Au	Ag
		conglomeratic at 51.60-53.10 with quartz pebbles that are often elongated. Between 50 and 52m the angle of bedding is about 10-10°, at 53-54 m it is 80-85°.										
55.80	61.60	Graphite schists As 54.20-55.90 with some intercalations of quartzites. The angle of bedding to core axis varies between 70 and 90°.										
61.60	70.05	Light quartzites Light grey quartzites that are rich in chlorite material. They contain some graphitic intercalations at 66.70- 7.00, 67.40-68.00, and 68.70-69.00. The angle of bedding varies between 75° at 62 m, 90° at 64 m, and 80° at 68m.										
70.05	77.10	Graphite schists As 66.20-66.90. The angle of bedding is about 90°.										
77.10	105.30	Light conglomeratic quartzites Light conglomeratic quartzites, rich in chlorite. Contain numerous elongated quartz pebbles that are usually about 1 cm long. A graphite schist section can be found at 80.50-100.00. At 80-85m the angle of bedding is about 90°, at 90 m 10°, and at 100 m 80°.										
105.30	109.40	Granite Coarse grained granite. The upper 2 m are crumpled and mylonitized.										

DIAMOND DRILL LOG

FOLLDAL VERK A/S

PAGE 1

D.D.H. No.		Azimuth	Started	Directional surveys					
BH-BRY-83-01		220°	8.9.83	Depth	Azim.	Dip.	Depth	Azim.	Dip.
Property		Angle	Finished						
Brydal		60°	16.9.83						
Co-ord.		Depth	Logged by						
40E-50N		194.70m	Krause						

From	To	Description	Interval		Assays (ppm)					
			From	To	Cu	Mo	Pb	Zn	Au	Ag
0	7.30	Overburden	7.3	8 m	40		4	37		0.5
7.30	143.50	Sandstone	8	9	75		8	58		0.5
		9	10	37		6	51		1.0	
		Grey-greenish, slightly conglomeratic feldspathic sandstone, that is characterized by disseminated copper sulfides with zonation and partially intensive hematitization.	10	11	350		10	36		2.5
		Zonation of copper sulfides:	11	12	1600		10	29		7.0
		7.30-about 20 m: finely disseminated bornite, that is good visible on fractures and sometimes in narrow bands. content less than 1%. Most bornite visible at 10-20 m. In this zone fractures are sometimes filled with malachite.	12	13	3500		4	12		20.0
		20-35m: bornite+chalcocite. Both minerals occur finely disseminated. Content of bornite very low but more chalcocite up to 1%.	13	14	4600		8	15		31.0
		35-45m: chalcocite, disseminated, less than 1%	14	15	5400		3	17		33.0
		45-54m: chalcocite+pyrite, less than 1%	15	16	4400		16	12		29.0
		54m-e.o.h.: very little pyrite, less than 1%	16	17	4000		6	15		27.0
		zones with intensive hematitization: 63-69.50m, 76.50-82.50, and 89-92.70	17	18	2900		4	11		18.0
		At about 60-70 m one can find a silver coloured ore mineral with low hardness (chalcocite?), very low content.	18	19	1400		4	13		9.0
		Description of rocks:	19	20	1900		6	11		12.0
		7.30-44.00 Grey feldspathic sandstones. In parts with a higher content of chlorite that gives a more greenish colour. Here the sandstone gets more the	20	21	1200		18	250		6.5
			21	22	1400		22	290		7.5
			22	23	1900		10	130		8.0
			23	24	990		14	170		1.5
			24	25	1100		14	170		2.0
			25	26	750		10	130		1.0
			26	27	1200		8	100		5.0
			27	28	480		10	110		1.5
			28	29	670		12	160		1.5
			29	30	1500		22	300		1.5
			30	31	1600		18	160		5.0
			31	32	2600		26	330		9.5
			32	33	3700		12	22		20.0
			33	34	2400		8	24		14.0
			34	35	1300		8	43		6.0

DIAMOND DRILL LOG

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From	To	Description	DDH No 3h-DRY- 62-01	Interval		Assays (ppm)					
				From	To	Cu	Mo	Pb	Zn	Au	Ag
		character of chlorite schists. Contains numerous		35	36 m	1600		8	16		7.0
		pebbles of feldspar (red) and quartz up to 2 mm in		36	37	1800		8	33		10.0
		size. In some places the rocks are very well bedded.		37	38	2300		6	20		14.0
		Hematite is very common- disseminated or on frac-		38	39	1100		6	23		6.0
		tures.		39	40	1100		10	22		5.0
		44.00-45.00 Conglomerate with partially elongated		40	41	1100		12	22		2.5
		red feldspar pebbles up to 1 cm in size.		41	42	1200		48	27		2.0
		45.00-98.40 sandstone as 7.50-44.00 with three zones		42	43	510		53	25		1.0
		of intensive hematitization. Here hematite (grey		43	44	430		63	24		1.5
		and red) occurs in bands and schlieren and looks		44	45	1600		8	48		1.5
		often very similar to native copper. Often hydro-		45	46	1300		4	24		5.5
		thermal quartz is associated with the hematite.		46	47	1000		8	29		1.5
		98.40-107.80: Conglomerate with rounded quartz		47	48	340		8	44		1.0
		pebbles up to 2 cm in size. Partially hematitized.		48	49	1600		6	40		2.0
		107.80-135.00 Sandstone with character of chlorite		49	50	610		10	22		1.0
		schists. Contains pebbles of feldspar and quartz		50	51	880		6	34		1.0
		up to 0.5 cm in size. Hematite in narrow bands.		51	52	540		8	22		1.0
		lenses or on fractures.		52	53	730		350	36		1.0
		135.00-143.50: dark grey, very fine grained quartzite		53	54	210		12	15		0.5
		with small quartz pebbles at the base.		54	55	90		32	19		0.5
143.50	194.70	<u>Conglomerates</u>									
		143.50-162.50: Conglomerate with dark grey quartzitic									
		matrix, contains subangular quartz pebbles that									
		are up to 2 cm in size. No visible ore minerals,									
		sometimes a little hematite on fractures.									
		162.50-194.70: Conglomerate with a greenish,									
		chlorite rich groundmass. Contains rounded and sub-									
		rounded pebbles of red feldspars and quartz. Hematite									
		can be found in bands or on fractures.									
		The angle of bedding to core axis is in the whole									
		drill core at about 80°.									

FOLLDAL VERK A/S

D.D.H. No.	Azimuth		Started	Directional surveys					
BH-BRY-33-02		220 ^S	16.9.83	Depth	Azim.	Dip.	Depth	Azim.	Dip.
Property	Angle		Finished						
Brydal		60°	19.9.83						
Co-ord.	Depth		Logged by						
45E/160N		66.30m	Krause						

[illegible]

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D.D.H. No.	Azimuth	Started	Directional surveys					
22-8-5-10	220°	22.9.83	Depth	Azim.	Dip	Depth	Azim.	Dip.
Property	Angle	Finished						
Crystal	20°	25.9.83						
Co-ord.	Depth	Logged by						
2508/503	196.25m	19/9/84						

[illegible]