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	N-83-6	Tverrfjellet		

Tittel

Oppdal project.

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Bakke, Olav	12	1984	Folldal Verk A/S Amoco Norway Oil Company

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Fagområde	Dokument type	Forekomster
Geologi Geofysikk Geokjemi	Rapport	Oppdal Nyberget Vorhaugen Eggan Hogåsen Reberg Undal Hammersætra Nonhaugen Ramshøkallen
Råstoffgruppe	**Råstofftype**	
Malm/metall	Cu Zn	

Sammendrag / innholdsfortegnelse

The Oppdal project was first started in summer of 1983 to explore for Cu. Zn massive sulphide deposits. Anolmaous areas were first located by an airborne geophysical survey covering the whole project area. The project was given low priority in the 1984 field season, but still it has been establidhed 2 follow-up grids and preliminary prospecting has been done on the most interesting anomalies.

Since so little follow up work is done this year very encouraging results cuold not be expected. Encouraging factors of this years work are that some of the anomalies have shown to have quite interesting geological settings and that we have rock samples containing up to 43 ppm Ag. The project area is at least not less interesting after this years investigations. than it was when we first started in 1983

3 duplikat.

Kartbilagene finnes på **BV3017.**

OPPDAL PROJECT (N-83-6)

FOLLDAL VERK A/S - AMOCO NORWAY OIL COMPANY

DECEMBER 1984

Submitted by:

Olav Bakke.

TABLE OF CONTENT

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The Oppdal project was first started in the summer of 1983 to explore, in a joint venture between Folldal Verk A/S and Amoco Norway Oil Company, for Cu, Zn massive sulphide deposits. Anomalous areas were first located by an airborne geophysical survey covering the whole project area. The project was given low priority in the 1984 field season, but still it has been established 2 follow-up grids and preliminary prospecting has been done on the most interesting anomalies.

Since so little follow-up work is done this year very encouraging results could not be expected. Encouraging factors of this years work are that some of the anomalies have shown to have quite interesting geological settings and that we have rock samples containing up to 43 ppm Ag. The project area is at least not less interesting after this years investigations, than it was when we first started in 1983.

Next year we should continue preliminar prospecting of the anomalies obtained by the airborne geophysics. In this work we should concentrate on geological features as geological settings and host rock alteration. If these features looks encouraging, follow-up grids should be established to measure ground geophysics together with soil sampling and detailed geological investigations.

1. INTRODUCTION

In the summer and fall of 1983 an airborne geophysical survey was carried out by Folldal Verk/Amoco J.V. in the area around the town of Oppdal (fig. 1) to explore for Cu, Zn massive sulphide deposits. The survey which covered approx. 500 square kilometers was done by N.G.U. (Geological Survey of Norway) and contained VLF, Magnetometric and radiometric measurements. In addition to this, a brief overview of the geology was done by car and some follow-up work was done on an interesting radiometric anomaly west of Oppdal.

This year low priority has been given to the Oppdal project. Still it has been established two follow-up grids and prelimi-nar prospecting have covered some of the most interesting geo-physical anomalies.

2. LOCATION AND ACCESS

The project area is centered at 62°50' lat. and 10°00' long. It is located north-west of the Folldal project area approc. 320 km north of Oslo (Fig. 1). The main service supply centers are Oppdal in the southern part and Berkåk in the northern part. The area is crossed by major paved roads and secondary roads can be found throughout. The railway line Oslo - Dombås - Trondheim runs through the project area.

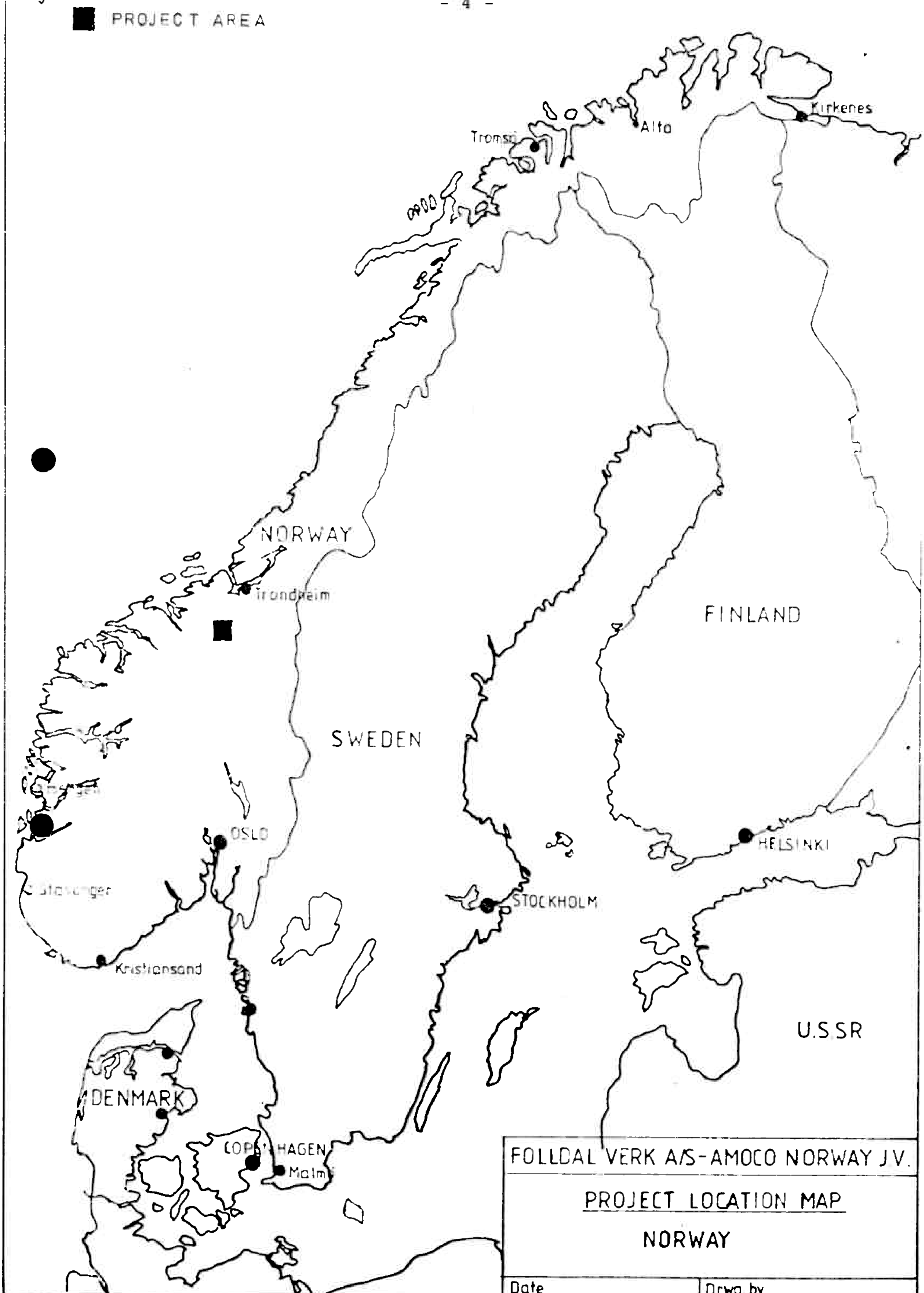
3. LAND STATUS

Folldal Verk A/S currently holds 16 claims (each 500 x 500 m) in one claim group in the Litlefjellet area near Nyberget mine. In addition to these they hold 40 claims in the Skarvatnet area covering parts of a big radiometric anomaly

4. REGIONAL GEOLOGY

The Oppdal project area lies within the southern section of the Trondheim greenstone belt and includes rock types of both sedimentary and volcanic origin. These rocks were deposited in the extensive Caledonian geosyncline during Cambro - Silurian times and can be seen to extend almost the total length of Norway's west coast. The east and west section of the Trondheim greenstone belt show definite rock type correlation especially with the main volcanic units, although the depositional environment was very different.(Se fig. 2). The western section of the belt, which includes Folldal Verk's large Tverrfjellet mine and the

Fig. 1.


PROJECT AREA
Kirkenes
Alta
Tromsø
NORWAY
Trondheim
FINLAND
SWEDEN
OSLO
HELSINKI
Stavanger
STOCKHOLM
Kristiansand
U.S.SR
DENMARK
COPENHAGEN
Malmö
FOLLDAL VERK A/S-AMOCO NORWAY J.V.
PROJECT LOCATION MAP
NORWAY
Date
Drwg by

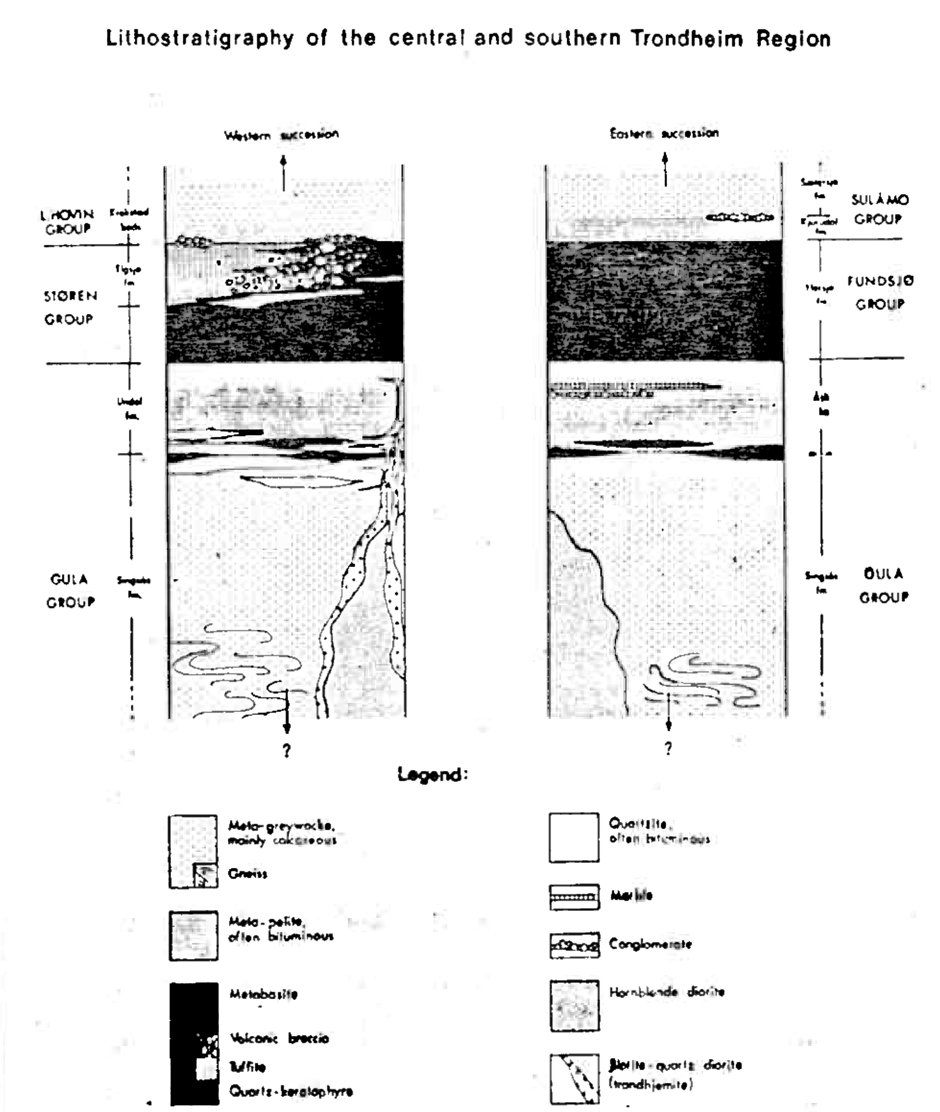


Fig. 2. Lithostratigraphical column of the central and southern Trondheim region.
after O. Nilsen

even bigger mine Løkken Gruber (30 m m tonnes), is generally thought to be closely associated with ocean floor volcanic activity, and includes rocks of more tholeiitic compostion. The eastern limb of the geosyncline, which includes the Folldal project area, can be seen to belong to a much more differentiated rock type, perhaps indicating island arc deposition. (Fig. 3).

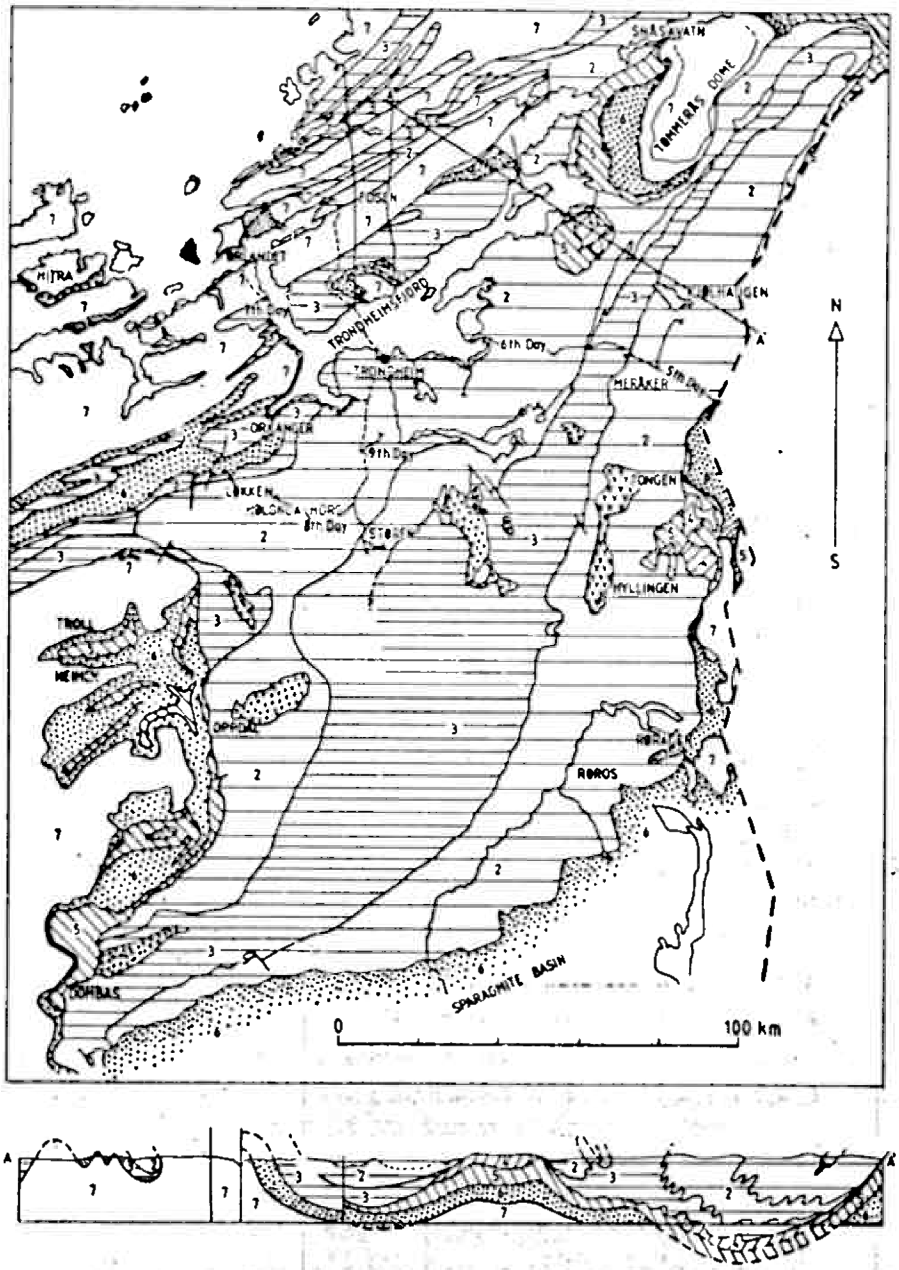


*Fig.*3. Map of the major tectonic and autochthonous units within the Trondheim region; from Wolff (1979), with modifications; Trollheimen-Oppdal district geology simplified from Krill (unpubl. map, 1979). 1) Old Red Sandstone molasse deposits. 2) Støren Nappe. 3) Gula Nappe; in western areas partly belonging to the Lower allochthonous complex. 2+3) Trondheim Nappe Complex. 4) Levanger-Øyfjell Nappe unit. 5) Skjøtingen-Essandsjø Nappe unit; near Dombås, the Andberghøi Complex. 6) Leksdal-Remsklepp Nappe unit (excluding the basal allochthonous Precambrian rocks) in the north and east, with correlative tectonic units in the west and southwest and sparagmites in the southeast. 7) Precambrian basement, mainly autochthonous. The map also shows the routes of the excursions, days 5 to 9. The cross-section, A-A', has been enlarged to fit the width of the figure. Crosses — trondhjemite/diorite. v ornament — gabbro complex.

after C.Oftedal 1980

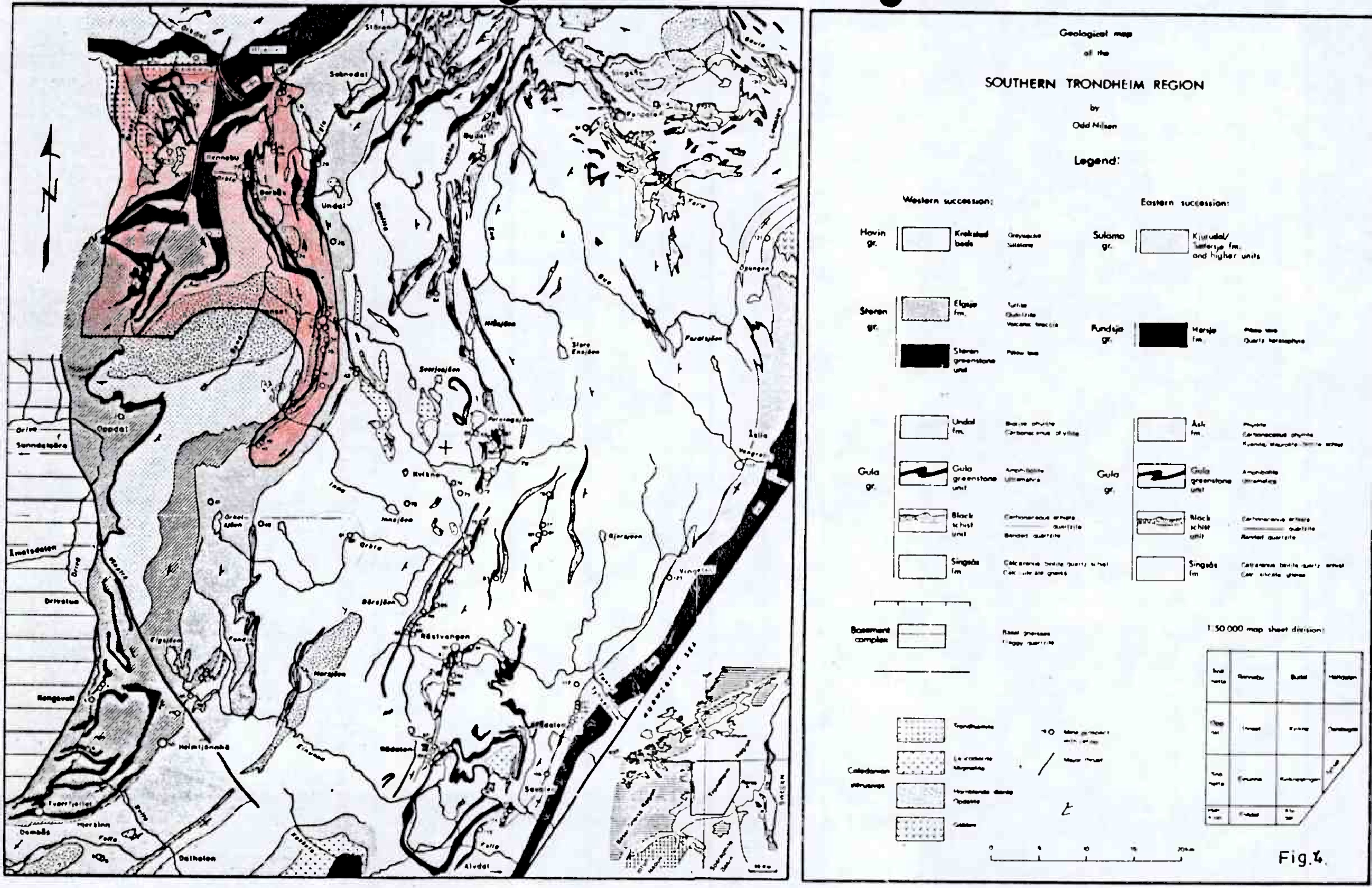
The Trondheim greenstone belt constitutes an important metallogenetic province of the Scandinavian Caledonides. A great number of metamorphosed pyritic base-metal sulphide deposits are confined to different but restricted formations of the Palaeozoic allochthon, the Trondheim Nappe of Wolff (1967). Rocks of the Gula Group underlie the central part of the region and have been considered to represent the oldest, assumed late Precambrian/Cambrian member of the partly inverted stratigraphical succession, predating the volcanogene Støren Group of probable Lower Ordovician age, although alternative opinions on the age of the Gula group, based on geotectonic considerations, have been put forward in later years. A classification of the ore mineralizations based on their specific geological environment, association with minor iron-formations and to their metamorphism , is made for this area by Odd Nilsen 1978. (Table 1).

Gula Group	Storen/Fundsjo Groups
Kvikne type Sulphide deposits associated with the Gula greenstone and/or their adjacent oxide/silicate iron formations.	*Rennebu type* Sulphide deposits associated with Storen Group pillow lavas and their adjacent oxide iron-formations ('vasskis').
Budal type Sulphide deposits associated with graphitic schists and quartzites.	*Elgsjo type* Sulphide deposits associated with tuffaceous metasediments.
Olkar type Cu/Ni-deposits associated with mafic and ultramafic pods associated with the Gula greenstone.	*Saval type* Sulphide deposits associated with felsic and mafic metavolcanics of the Hersjo Formation.

Table 1

A list of mines and prospects of the southern Trondheim region is given in Table 2 and the locations in fig. 4. The Oppdal project area (area covered by airborne geophysics) is marked with red colour on fig. 4.

Geological map of the southern Trondheim region.



Appendix

Mines and prospects of the southern Trondheim region, listed according to the reference numbers on the geological map (Plate 1).

Abbrevations:

Map sheet 1:50,000

A	– Alvdal	1619 III
B	– Budal	1620 IV
D	– Dalsbygda	1620 II
E	– Einunna	1519 I
H	– Haltdalen	1620 I
Hj	– Hjerkinn	1519 III
I	– Innset	1520 II
K	– Kvikne	1620 III
Ks	– Kvikneskogen	1619 IV
O	– Oppdal	1520 III
R	– Rennebu	1520 I
S	– Snøhetta	1519 IV
T	– Tynset	1619 I

Mineralogy:

Po – Pyrrhotite
Py – Pyrite
Cp – Chalcopyrite
Sl – Sphalerite
Gn – Galena
As – Arsenopyrite
Mt – Magnetite
Hm – Hematite
Il – Ilmenite
Cr – Chromite
Pn – Pentlandite
Mo – Molybdenite

● – Major component
o – Minor component
x – Accessory component

Type:

B – Budal type
E – Elgsjø type
K – Kvikne type
O – Olkar type
R – Rennebu type
S – Søvai type
1 – Within basal gneiss complex
2 – Pegmatite vein type

Type of aggregate:

D – Dissemination
M – Massive

Foslie no.:
Reference numbers according to Foslie (1925).

No.	Mine/prospect	Map sheet 1:50,000	UTM grid ref.	Type	Mineralogy Po	Py	Cp	Sl	Gn	As	Mt	Hm	Il	Cr	Pn	Mo	Aggr.	Foslie no.
1	Leverdiken	O	362 564	R	x	x					●						D	
2	Skjerdola	O	330 427	R		●					●						D	
3	Svartholhaugen	S	326 291	1										●			D	154
4	Vårstigen	S	334 138	E	x	●							x				M	152
5	Slåkbekken	S	324 117	E	x	●											M	
6	Kongsvoll	S	318 066	R	●		x										D	
7	Tverrfjellet	Hj	270 997	E,R	o	●	o	o	x		x						M	
8	Ovnbekken I	Hj	336 950	B	●	o				x							D	
9	Ovnbekken II	Hj	334 951	B	●												D	
10	Skamfjell	R	373 805	R	o	●					x		x				D	108
11	Jorfjell	R	419 806	R	o	●					x		x				M	106
12	Mærk	R		R		●											M	111
13	Hakefjellet	R	506 794	R		●					●						M	
14	Kalddalen I-VIII	R	513 799	R	o	●	x				●						M	
15	Hestvatnet	R	511 775	B	●	o		x		x							D	
16	Ilbogen	R	516 775	B	o	●		x		x							M	112
17	Ilbogen prosp. I-II	R	515 778	B	o	●											D	
18	Brennfjell	R	516 782	B	●	o											D	
19	Vasli	R	509 725	B	●	o											D	116
20	Sliper	R	473 696	R							o	●					D	113
21	St. Olaf	R	478 680	R							●	o					M	114
22	Hammersæter	R	488 661	E	o	●		x									M	118
23	Ramfjell	R	441 621	R		o					●						M	115
24	Vora	R	526 605	B	o	●											D	121
25	Nertjenna	R	567 618	B	●	x											D	
26	Undal	R	536 660	B	o	●	o	x			x						M	119
27	Nylykkja	R	535 674	B	o	●											D	
28	Bjorkås	R	553 705	B	●		x	x		x							D	
29	Auneroa	R	508 723	B	o	●											D	
30	Innsetlia	I	563 538	R	o	●											M	127
31	Nyberget	I	560 535	R	o	●	x	o			x						M	128
32	Bergstjern III	I	557 529	R		●					o						D	
33	Bergstjern I-II	I	563 522	R	●	●	x	x									D	
34	Langfjellet	I	564 508	B	●		x	x					x				D	
35	Litlfjell	I	561 500	B	o	●	x	x		x							D	129
36	Tverrfjellet pr.	I	555 476	R	●	o	x										D	
37	Kletten	I	558 462	B	●												D	
38	Bustaden	I	524 436	R							x						D	
39	Næringhoa I	I	496 402	B	●			x									D	134
40	Næringhoa II	I	493 400	B	●												D	
41	Orkelsjoen	I	447 338	B	●	o	x				x						D	
42	Orkelhoa	I		B	●	o											D	135
43	Breidvad III-IV	I	595 477	K,B	●		x										D	
44	Breidvad I-II	I	595 480	K	●		x						x				D	
45	Elgsjøtangen I	E	445 149	E		●			x		x						M	149
46	Elgsjøtangen II	E	445 148	E		●					x						M	
47	Elgsjøtangen III	E	441 143	E		●											M	
48	Elgsjøbekken	E	427 128	E	o	●			x							x	M	150
49	Steindalkollen	E	415 114	E	●	o											D	
50	Heimtjørnhoi	E	403 083	E	x	●	x	x			x					x	M	151
51	Dølvad	E	594 301	2		●			o								D	
52	Rogstad	B	682 856	B	o	●											D	123
53	Hogsegga	B	694 803	B	●	●	x										M	124
54	Høgsegga prosp. I-III	B	695 796	B	●	o	x										D	
55	Rød	B	647 752	B	●	o	x		x								D	

No.	Mine/prospect	Map sheet 1:50 000	UTM grid ref.	Type	Mineralogy												Aggr.	Fossile no.
					Po	Py	Cp	Sl	Gn	As	Mt	Hm	Il	Cr	Pn	Mo		
56	Svardal	B	732 748	B	●	o	x										D	
57	Sæter prosp.	B	730 744	B	●	x	x	x	x								D	
58	Sæter	B	728 744	B	●	x		x									D	
59	Storhogda	B	725 713	B	●	o	x										D	
60	Bjorndalen	B	701 668	B	o	●	o	o	x								M	125
61	Rauhammeren	B		K	●													274
62	Langrod	B	857 748	B	●	x	x	x	x								D	
63	Hea	B	864 756	B	●	x	x		x								D	
64	Grubehogda	K	674 560	B	●		x		x								D	126
65	Falningen	K		B		●												130
66	St. Hallvard	K	744 407	K	●		x			x	x		x				D	131
67	Sæterfjell I-II	K	747 414	K	●	o	x						x				D	
68	Svartsjoen	K	752 395	K	●	o	x		x		x		x				D	132
69	Rutsu	K	752 398	K	●	o											D	
70	Vang	K	731 370	K	●		o										D	133
71	Kvikne: Gabe Gottes	K	735 364	K	●	o	●	o			x		x				M	133
	Segen Gottes	K	735 365	K	o	●	o	o	x		x		x			x	M	133
	Harken	K	735 366	K	o	●	o				x		x			x	M	133
	Mine 170	K	735 366	K	●	●	o	o			x		x			x	M	133
	Dalsgruben	K	734 370	K	●	o	●	o			x		x			x	D	133
	Kojan I-II	K	731 362	K	●		x				x		x				D	133
	Odden I	K	733 371	B	x												D	133
	Odden II	K	734 371	K	●												D	
	Odden prosp.	K	731 375	B	●		x										D	
	Storbekken	K	736 369	K	●								x				D	
	Gjokåsen	K	737 368	K	●	●	o	o									M	
	Esterisvangen I	K	730 365	K	●		x						x				D	
	Esterisvangen II	K	733 366	K	●		x				x		x				D	
	Grubeåsen	K	731 360	K	●		x						x				D	
72	Berstjern I-III	K	728 354	K	●	x	x						x				D	139
73	Kaltberget	K	711 351	O	●		o								●		D	[illegible]
74	Olkar	K	700 357	O	●		●								o		D	137
75	Vakkerlien	K	653 329	O	●		o								o		D	136
76	Eidsfjellet	K	737 319	K	●	x							x				D	142
77	Magnilsæter I	K	800 315	K	●								x				D	
78	Rundhaugen	K	808 351	K	●	o	x	x									D	
79	Stoa	Ks	719 304	K	●		x						x			x	D	141
80	Magnilsæter III	Ks	799 308	K	●												D	
81	Magnilsæter II	Ks	801 305	K	●						x		x				D	
82	Bjerkeng	Ks	714 286	K	●		x										D	
83	Mysmordalen	Ks	755 264	K	●												D	
83	Lykkja	Ks	698 253	K	●	o	x	x	x	x							D	143
85	Gråho	Ks	686 228	K	●						o		x				D	
86	Borsjøho prosp.	Ks	676 217	K	●		x										D	
87	Borsjøho	Ks	665 203	K	x	●	o	o	x							x	M	147
88	Hamdal	Ks	659 201	K	o	●	o	o	x							x	M	
89	Finnhaug	Ks	663 196	K	x	●	o	x	x								M	
90	Rostvangen	Ks	712 179	K	o	●	o	o			o					x	M	145
91	Rostvangen prosp.	Ks	715 181	K	●						x						D	
92	Gløta	Ks	702 171	K							●						D	
93	Gløtlisæter	Ks	715 170	K	●												D	
94	Lykkjevangen	Ks	708 155	K	●						x						D	
95	Loken	Ks	708 153	K	●						x						D	
96	Søgardsvangen	Ks	702 136	K	●						x						D	
97	Strålbergsætra	Ks	686 082	K	●						o		x				D	

No.	Mine/prospect	Map sheet 1:50 000	UTM grid ref.	Type	Mineralogy Po	Py	Cp	Sl	Gn	As	Mt	Hm	Il	Cr	Pn	Mo	Aggr.	Foslie no.
98	Ulvdalen I	Ks	685 075	K	●						o						D	
99	Ulvdalen II	Ks	684 074	K	●						o						D	
100	Rodalen: Draaiten	Ks	684 071	K		x	x				●						D	181
	Helene Cathrine	Ks	683 070	K	●	x	o	x					x			x	M	181
	Nygruben	Ks	683 070	K	o	●											M	181
	Gammelgruben	Ks	683 069	K		●	o	x			x						M	181
	Klettgruben	Ks	682 068	K	o	●	o	x									M	181
101	Gruvkletten	Ks	684 059	K	●												D	
102	Veslehoa I	Ks	703 075	S	●	o	x										D	
103	Veslehoa II	Ks	703 075	S	●	o	x										D	
104	Gressgodtvangen	Ks	778 094	S	x	●	x	o									M	
105	Svartisen	Ks	809 049	K	●		x			o			x				D	195?
106	Haugen	Ks	830 100	K	●		x			x	x		x				D	
107	Klettvang I	Ks	832 107	K	●												D	
108	Klettvang II	Ks	832 110	K	●												D	
109	Klettvang III	Ks	835 118	K	●												D	
110	Klett I	Ks	837 120	K	●	o	o	o	x								M	199
111	Klett II	Ks	839 123	K	●	o	o	o	x								M	199
112	Rodhammer	Ks	839 145	K	●						x						D	
113	Lomnesvola	A	737 992	K	x		x										D	
114	Lomsjovola	A	764 001	K	o	●	x				o		x			x	M	193
115	Galtbekken	A	769 006	K	x						x						D	
116	Lauvbekken	A	772 010	K	x												D	
117	Flottum	H	875 757	B	o	●	o	o	x	x							M	273
118	Fora	H	893 725	B	●	o	x	o									D	
119	Grisbudalen	H	911 770	B	●	x	x	x									D	
120	Svartåsen	H		B		●											D	272
121	Rehovde	H	027 627	K	●												D	
122	Fos	D	009 388	K	o	●	o	o	x								M	211
123	Litivola	T	933 262	K	●												D	

5. HISTORY AND PREVIOUS EXPLORATION

The mine industry within the southern Trondheim region has long traditions. From the year 1632 when the Kvikne mine was put into operation and down to the turn of the 19th century, a great number of cupriferous sulphide deposits were discovered and exploited. In the central and western areas under consideration the chief activities took place within two periods during the 350 years since the Kvikne ores were discovered.

The first period was from 1650 to 1750 when three independent smelting works were established for the production of copper in the region, viz. at Kvikne, Soknedal and Budal. The Kvikne works became the largest industrial enterprise in the region, operating a dozen smelters down the river Orkla during the first era. The last smelter in production, the Innset smelter in Næverdalen, treated the ores from the mines at Kvikne (71), Nyberget (31) and periodically from the mines at Undal (26) and Bjørndalen (60) until 1872.

After a standstill during the 19th century a second mining era was initiated at the beginning of the present century by the increasing demand for pyrite ore. The new era brought about a reopening of the Undal (26) mine. In addition to the production of copper and pyrite ore, mining and smelting of iron ore took place on a limited scale in the Rennebu district at St. Olaf mine (21) around 1850.

The pyrite production at Undal mine ceased during the twenties, but it was again reopened in 1952. It then closed down in 1971. In 1968 production started at the Tverrfjellet mine (7) at Hjerkinn which today contains the largest pyrite reserves of the southern Trondheim region. Compared with the Røros and Meldal districts, the mines in the project area have played a minor role in the total copper an pyrite production. The majority of the mineralizations do not reach ore grade, and the few workable ores can be considered as marginal deposits with ore quantities well below 1/2 mill. tons each. The known deposits of the project area have been described by Gulliksen & Vogt (1899), Bugge (1910), Brodtkorb (1926), Waltham (1968), Lindberg (1971) and Nilsen (1978). (After Odd Nilsen 1978).

As far as we know, little exploration work has been carried out in the project area, at least after the second mining era. However it is known that several companies have done some prospecting in connection with known deposits also after the second mining era During the second world war Turam measurements were done in the area around Undal mine. A few of these Turam anomalies, which also are detected by the airborne survey of this project, were drilltested. Drill logs are not available, but the anomalies were explained as graphite horizons.

Big exploration programs have not been carried out in any parts of the project area since the Turam measurements near Undal Verk during the second world war.

6. PROSPECTING PHILOSOPHY.

The Oppdal project area is situated about 40 to 80 km north of the large Tverrfjellet mine opperated by Folldal Verk A/S, and in the same volcanic belt. It is therefore obvious that we in this area hope to find an ore deposite simular to Tverrfjellet massive sulphide ore deposit

Using the Odd Nilsens classification of sulphide depostis, there are the Rennebu- and Algsjø-type of mineralization we must look for. The location of these types is restricted to the volcanic Støren group. Within these volcanic rocks we have received very few electromagnetic anomalies. Therefore all of them should be checked, even if they are weak. The magnetic map from the area outlines the volcanic belt very good. That means that the background values of these rock types is higher than of the surrounding rock types. Therefore it is difficult to sort out what anomalies correspond to EM-anomalies and what anomalies are caused by changes in rock types (back ground values).

Outside the volcanic belt we have reserved a lot of EM- and MAG-anomalies. In this area we have good chances of finding an ore-deposit of the Budal type. These ore deposits are however probably small, at least if we look at the until now known mineralizations of the area. These ore deposits could however be rich and contain a considerable amount of gold, which could make them an interesting prospecting object.

Massive sulphide deposits of Budal-type are restricted to the Gula group, and in our case to the Undal formation. The main rock type in this formation is dark calcareous biotite-phyllite, micaschist and graphitic phyllite. Therefore most of the EM-anomalies that we have got are caused by graphitic phyllites. In my opinion there are good chances of finding an ore deposit of Budal type in this area, but it will be very expensive to check all the anomalies and in addition the ore deposit will probably be small and of marginal economic interest. We should therefore give the Undal formation low priority in the proceeding follow-up work. The most interesting anomalies should although be visited and if they look encouraging more effort should be done to detect the cause of the anomalies.

In the Oppdal project area there are mainly a thin glaciated overburden with reasonable many outcrops. This gives us an great opportunity to do preliminar geological investigations before we establish follow-up grids. Using our experience from the Folldal Project we should be able to exclude anomalies that have no or little potential for an ore deposit . In my opinion an anomaly should have an encouraging geological setting before an follow-up grid is established.

Because there are a lot of outcrops,we should make an effort to understand the geological features in connection with massive sulphide deposites. One important feature which could be of great importance in the proceeding work,is the study of alterations near ore deposits. Tectonic features as faultings and especially foldings are often found in near relation with massive sulphide ores. Folding of this type can be observed both in mesoscopic and makroscopic scale. Therefore when foldings are observed,it should always be noted.

The mineral paragenesis should also be held in mind when mapping in this area, especially in connection with iron formations. There are several types of iron formation in the area. One of them is the same type as the one that is common in the Folldal project area with pyrrhotite, cummingtonite, garnets and magnetite. Another type is the so called "Vasskis" which is mostly found in ocean floor environment and often quite a long distance distal from the main massive sulphide deposite. Iron oxides in cherts are also common in this area. Iron formation may be helpfull either as a direct guide to ore or to detect volcanic centers. Regional geological mapping with special interest of locating volcanic centers could also be of great importance.

The Oppdal project area has not only potential for base metals (Cu - Zn) but also silver and gold may be of economic interest. These elements are probably mainly restricted to other ore minerals. Therefore every rock sample taken from old diggings or mines should be assayed for gold and silver.

Some of the weak airborne radiometric anomalies should be followed up by using a scintillometer in the field. These anomalies are mainly potential for rare earth elements.

7. DISCUSSION OF RESULTS WITH RECOMMENDATIONS FOR FUTURE INVESTIGATIONS.

Since this project was given a low priority in the joint venture of this year, very little follow-up work is done. The Oppdal project budget of 70.000 NOK has just permitted us to etablish 2 follow-up grids and to do some preliminar investigation of the most interesting anomalies received from the airborne geophysics. Some comments will be given on some of the anomalies where there has been done some prospecting this year.

1. NYBERGET GRID

Baseline : 100 N to 1400 S
Profile length : 500 W to 800 E
Follow-up work 1984 : VLF, MAG, CEM, Geological mapping and some soil and rock sampling.

This grid is situated at the border between the volcanic Støren group and the sediements of the Undal formation. In the northern part of the grid, it is an old Cu-Zn mine called Nyberget (31 in fig. 4). The Nyberget mine and the adjocent prospects constitute some Rennebu type sulphide deposits within a higher-grade metamorphic environment. A lateral thinning of the greenstone units and an increasing influx of tuffaceous material is apperant here. The ore body at Nyberget mine appears as a composite sheet, 0.5 - 3 m in thickness, conformably emplaced between two greenstone units and has been followed for about 300 m along strike. A schematic vertical profile across the ore zone at Nyberget mine is shown in fig.5. Four rock samples are collected from the tailings and assayed for Au, they ran: NYBERGET 1-83 100 ppb Au, NYBERGET 2-83 410 ppb Au, NYBERGET 3-83 79 ppb Au and 84-NYB-7 120 ppb AU+ (1.15 % Cu, 7.23 % Zn, 440 ppm Pb, 190 ppm Ag and 36.0 ppm As.

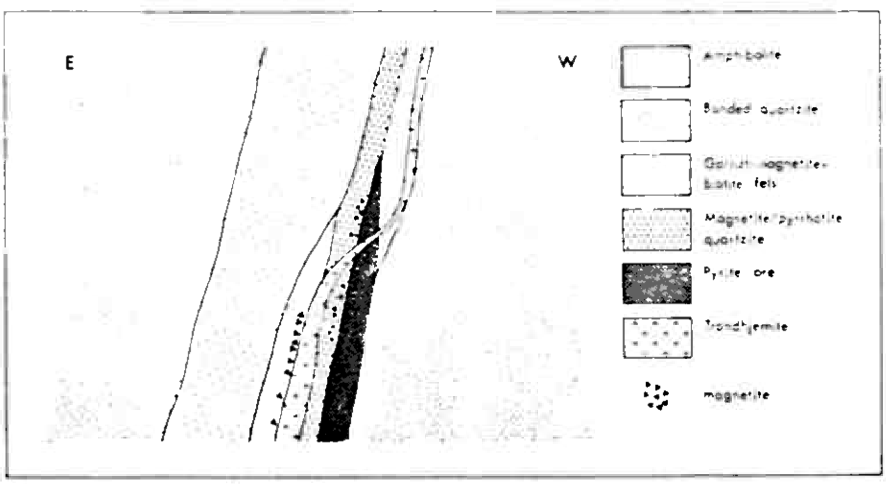


Fig. 5 . Schematic vertical profile across the ore zone at Nyberget mine, Innset.
after O. Nilsen 78

The bedrock of the grid consists mainly of a volcanic sequence to the west and a sedimentary sequence to the east. The section is cut by a lot of Trondhjemite dykes and bodies. At both sides of the volcanic flows, there are tuffaceous rock types which are very hard to distingish from the sedimentary unit.

At least 10 prospects are found within the grid area. They can all be interpreted to follow VLF or CEM anomalies. Because there are quite a lot of outcrops in the area, most of the VLF anomalies can be seen corresponding to rust zones or small graphitic horizons. They are often restricted to rocktype boundaries and especially to thin chert horizons. Some short profiles with soil sampling covering the most interesting VLF anomalies were all negative. Strong magnetic anomalies near Bergstjern do all correspond with old diggings and VLF-anomalies because the "ore bodies" are dominated by pyrrhotite. Rock samples from these diggings shows Cu ranging from 110 to 230 ppm, Zn from 100 to 640 ppm, Pb from 28 to 48 ppm, Au from 9 to 92 ppb, As from 7.2 to 250.0 ppm and Ag $<$ 0.1 ppm.

Within the greenstones the magnetic anomalies does not correspond so well with the VLF anomalies, because at least some of the MAG-anomalies are caused by disseminated magnetite outside sulphide mineralizations. At least two iron-prospects with magnetite as the main "ore" mineral is located west of the grid and not covered by magnetic measurements.

One interesting prospect is found at the western boundary of the greenstone unit (880 S, 530 W). This prospect lies within a chert horizon which can be followed more or less continuous from 1000 S, 525 W to 420 S, 315 W. Where it is exposed it is always rusty andcontains sulphide mineralizations. Two rock samples are collected from this prospect and they have the following assay result:

NYBERGET 84-1: 1300 ppm Cu, 2900 ppm Zn, 3600 ppm Pb, 43 ppm Ag, 60 ppb Au and 2.3 ppm As.
NYBERGET 84-2: 1500 ppm Cu, 1100 ppm Zn, 1600 ppm Pb, 32 ppm Ag, 110 ppb Au and 6.1 ppm As

Note the good Ag assaies and that there is more lead than copper and zinc, which is very uncommon in this district.

The Nyberget mine is just weakly detected by shoot-back and VLF on line 0-NS. This can be explained by the fact that the orebody is almost totally won out. The MAG is strong in the footwall rock of the mine.

Recommendation.

This grid should be extended both to the south and to the west next year, to cover known old prospects and anomalies obtained from the airborne geophysics. The area has potential for sulphide mineralization of Rennebu type with good gold and silver contents.

7. VORHAUGEN GRID.

Baseline	:	200 S to 400 N
Profile length	:	150 E to 250 W
Follow-up work 1984	:	VLF, MAG, Geological mapping and some soil and rock sampling.

This grid is located near the border between the sediments of the Undal formation and amphibolites of the Støren group, but totally within the sediments. About 700 m north of the grid there is an old digging on a sulphide deposit (marked no. 24 on fig. 4). The major component of this ore is pyrite and the minor component is pyrrhotite. About 50 m west of this deposit there is a 1 km long dyke shaped ultrabasic rock (probably an altered gabbroic intrusion). Because of this specific geological setting, there have been taken some rock samples from the digging and they are being analysed for Au. The result of this analysis are still not received.

The rock type in the grid is mainly mica schist, which may have an volcanic origin in the west, and more phyllitic schists in the east. In addition there are some intrusive Trondhjemites. Both the MAG and the VLF show one strong anomaly running through the whole grid from 200 S, 50 E to 400 N, 75 W. In out-crops near this anomaly there are in several places found ore indications as rusty zones, Pyrrhotite and pyrite and alterations. The anomalies are most probably caused by a massive pyrrhotite/pyrite ore similar to that found in the digging. The strong VLF could also partly be caused by a content of graphite in connection with the sulphides as found in the digging. There are taken 5 rock samples from the grid, and we have still not received Au-analysis of them.

Recommendation.

If the Au-analysis from the digging and the grid is not good, no further work is recommended for this grid. If good Au-results are received it should be drill tested.

3. EGGAN ANOMALY

Follow up work 1984: 6 profiles with VLF
Geological mapping and some rock sampling

This anomaly is located in the sediments of the Undal formation. At the 1 : 50.000 map sheet Rennebu the rocks are mapped as dark calcareous biotite-phyllite, mica-schist and graphitic-phyllite, but the preliminar geological mapping has shown outcrops of greenstone. The fact that there are volcanic rocks near the anomaly makes it more interesting. The grid is mostly covered with glacial drift, but in the North east and west of the grid there are a few outcrops. In north west there are mica schists and amphibolite and a rusty zone that are corresponding to the VLF-anomaly. Three rock samples are taken near this rusty zone (Eggan 9-11-84). In the western part there are mainly phyllitic schists dipping 30^{o} - 40^{o} to the east. Comformable layers of quartz-conglomerate are found inbetween. These are often rusty, and 3 rock samples are collected. Eggan (1-2,4-84). In one place the conglomerate is cut by a small intrusive, which is altered to Soap-stone. (Eggan 2-84). Eggan 4-84 is taken from a 1 x 5m lense of massive pyrite. Two short old drill holes where found in this lense. Four samples (Eggan 5-8-84) are collected from thin layers of pyrrhotite with some graphite in the phyllite. These layers are probably of little interest in the prospecting, but if they represent so called "Vasskises" they are known to be found distal from massive sulphide deposits. The analysis of all the rock samples are listed below. (We still await Au-analysis).

Eggan 1-84	19 ppm Cu	199 ppm Zn	≤ 120 ppm Pb
Eggan 2-84	211 ppm Cu	147 ppm Zn	- " -
Eggan 4-84	848 ppm Cu	171 ppm Zn	- " -
Eggan 5-84	335 ppm Cu	177 ppm Zn	- " -
Eggan 6-84	429 ppm Cu	173 ppm Zn	- " -
Eggan 7-84	652 ppm Cu	91 ppm Zn	- " -
Eggan 8-84	568 ppm Cu	132 ppm Zn	- " -
Eggan 9-84			
600 N-155 Ø	95 ppm Cu	106 ppm Zn	- " -
Eggan 10-84			
720 N-210 Ø	72 ppm Cu	109 ppm Zn	- " -
Eggan 11-84			
750 N-235 Ø	18 ppm Cu	170 ppm Zn	- " -
Eggan 12-84			
170 N-15 Ø	35 ppm Cu	99 ppm Zn	- " -

The VLF shows one strong anomaly running from 200 S, 25 W to 800 N, 240 E. The conductivity of this anomaly is strong from 0 NS to 400 N and weaker in both ends.

Recommendations.

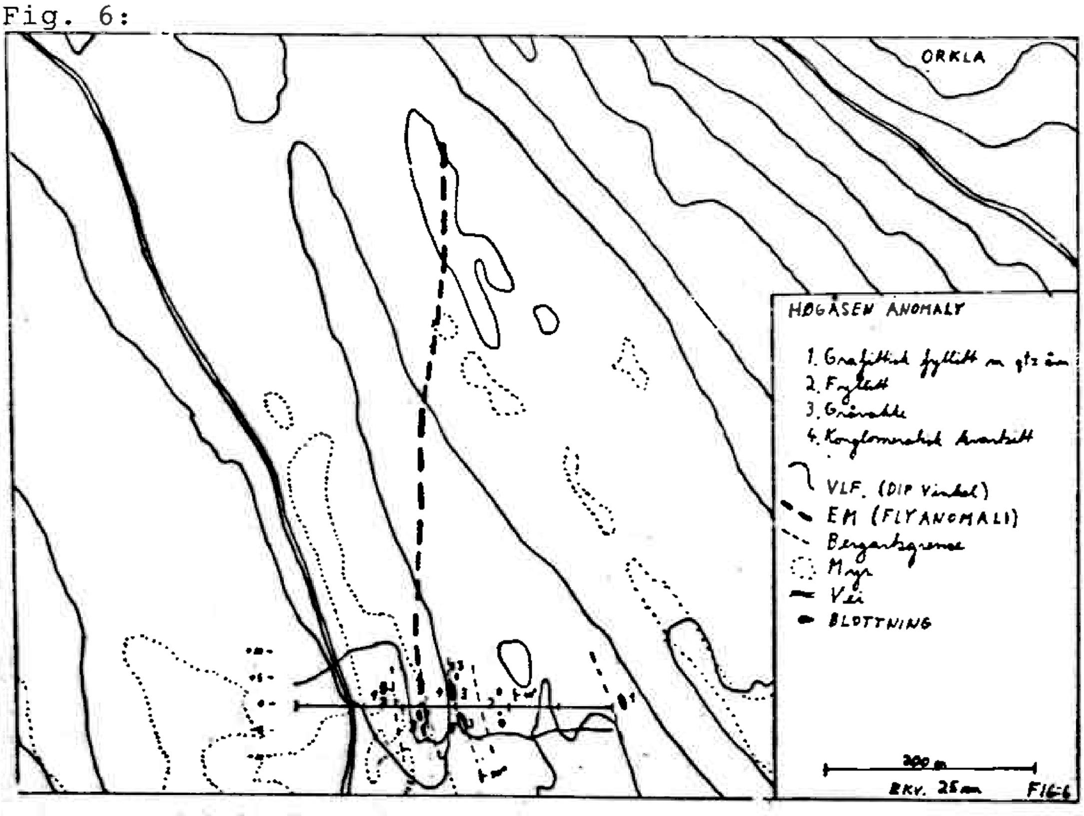
This anomaly is probably caused by a graphitic horizon, based on the geological setting and the strong conductivity. Still, since there are amphibolites not far from the anomaly we could hope to find a sulphide deposite of Budalen type. Therefore I would recommend a more detailed geological mapping, some soil sampling and a magnetic survey.

4. HØGÅSEN

Follow-up work in 1984: 1 profile with VLF
1 profile with geological mapping.

This anomaly is situated in the sediments of the Undal formation probably in the same stratigraphic position as anomaly Eggan. Graphitic phyllite was found near the top of the VLF anomaly (Fig. 6).

Fig. 6:



Recommendations.

This anomaly should be given low priority next year. If anything should be done, I would propose prospecting on the top of the anomaly.

5. REBERG

Follow up work 1984: Geological mapping and some rock sampling.

This anomaly is located in the western part of the project area, in volcanic rocks which are cut by a lot of trondhjemite intrusions.

The preliminary mapping showed a very interesting lithological sucession with tuffaceous sediments below the anomaly, amphibolite, greenstone and possibly some thin layers of quartz keratophyre, near the anomaly and agglomerates and banded chert above the anomaly. The whole sucession seems to be cut by a big trondhjemite intrusion.

Some VLF profiles showed that there are two separate anomalies. In outcrops near the top of both these anomalies there are rust, pyrite, pyrrhotite and garnets. 5 rock samples are collected from these rusty outcrops and they run:

Reberg 1-84	688 ppm Cu	132 ppm Zn	$\leq$ 120 ppm Pb
Reberg 2-84	470 ppm Cu	107 ppm Zn	- " -
Reberg 3-84	36 ppm Cu	305 ppm Zn	- " -
Reberg 4-84	95 ppm Cu	93 ppm Cu	- " -
Reberg 5-84	3076 ppm Cu	112 ppm Zn	- " -

The values of these analyses are not very high, but at least it shows that it is a potential for a base-metal mineralization bound to the EM-anomaly

Recommendation.

This anomaly should be given high priority in the follow-up work of 1985. I would recommend that we establish a grid covering both anomalies and do geophysics (VLF, MAG and Apex-max min.) soil and rock sampling and geological mapping both inside and outside the grid. If the results are encouraging the anomalies should be drill-tested.

6. UNDAL anomalies.

Near the old mine Undal Verk (closed in 1971) we have received interesting EM-anomalies in the continuation of the known deposit . Most of these anomalies are known from geophysical ground survey (Turam) done by Undal Verk during the second World War. Some of them are drill-tested with short holes, but the results of this drilling are unknown. From field prospecting we have found that most of the anomalies around Undal Verk are caused by graphitic horizons.

Recommendation.

Since there are many graphite horizons, the potential for a big ore deposit is small (Budalen type) and most of the anomalies are known from previous investigations I would recommend thatwe give this target a low priority. I would though recommend that we try to find out more about what is done in this area by Undal Verk and other companies, and compare their result with our airborne geophysical anomalies.

7. HAMMERSÆTRA prospect and NONHAUGEN anomaly.

This anomaly is located near the border between the sediments of Undal formation and the volcanics of Støren group. There are 3 diggings with pyrite mineralization corresponding to the

EM-anomaly. The mineralization, which consists of 5 parallell layers where each is up to 3 m wide, can probably be followed for at least 1.5 km. Detailed geological mapping shows that the mineralization is restricted to a thin layer of greenstone. To the east there are banded cherts and to the west there are phyllites.

We await results of rock samples from these diggings, but from old reports it is described that the ore has from 40 to 48 % S and has very little Cu.

From the airborne geophysics it seems that the EM is very much stronger in the southern part of the mineralized zone and that there is no corresponding MAG anomaly.

Recommendation.

Detailed geological mapping together with geophysics as VLF, MAG and possibly CP should be done in this area. The terrain is very steep and therefore it would not be suitable to use Apex max-min.. Rock samples should be collected from various spots along the strike of the mineralization. If we get encouraging results it would be proper to drill-test this anomaly.

8. RAMSHØKALLEN.

The sharp radiometric anomalies at Ramshøkallen is followed up with a scintillometer. The eastern anomaly seems to be restricted to a 20 - 100 m wide agglomerate horizon with partly conglomeratic quartzite at the east side and green flysch sediments at the west side. The back-ground counting is about 2000 c/min. and the anomalous values above the agglomerate is 10.000 - 20.000 c/min.. 3 rock samples are collected from this rock and analysed for rear earth elements. We have still not received the result of these analysis.

Another radiometric peak further to the west is caused by a rhyolite. This rock is similar to the big rhyolitic body found near Skardsvatn 10 km further south. One sample is taken from this rock, but we should not expect any good result of it.

Recommendation.

If the rock samples don't give any good results we should not do any more work in this area.

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