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Tittel

Stream sediment geochemistry, Egersund anorthosite area, spring 1972.

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Geokjemi	Rapport	Homse Bjørndalsnipen
Råstofftype	**Emneord**	
Malm/metall	Cu Ni	

Sammendrag

FOR FALCONBRIDGE NIKKELVERK A/S

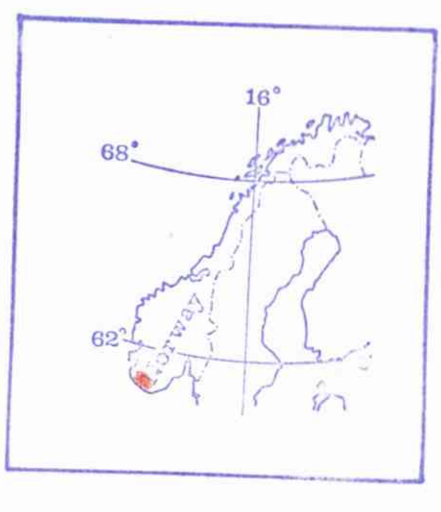
A/S SULFIDMALM

PROSJEKT 905-5

STREAM SEDIMENT GEOCHEMISTRY, EGERSUND ANORTHOSITE AREA, SPRING, 1972.

by

R. HOVLAND



BV 459
195/72/5

INTRODUCTION

This report presents the results of a stream sediment sampling in the Egersund anorthosite area. The following maps are attached:

195-72-5-01, Assay results and gen. geologi
195-72-5-02, Contoured regional component (Ni)
195-72-5-03, Contoured regional component (Cu)
195-72-5-04, Contoured anomaly component (Ni)
195-72-5-05, Contoured anomaly component (Cu)
195-72-5-06, Residual component (Ni)
195-72-5-07, Residual component (Cu)

LOCATION

The Egersund anorthosite area is located in southern Rogaland, along the south-western coast of Norway. Egersund is the nearest town. The railroad and the main road E. 18 from Oslo to Stavanger go through the area.

GEOLOGY

Together with noritic rocks, the anorthosite forms a Precambrian province, about 1000 square kilometers in size, which is easily separated from the surrounding granite gneisses. The map 195-72-5-01 shows the general geology. The western and central part of the area consists of anorthosite, while in the south-eastern part noritic rocks dominate. In the east, one can find the surrounding granite gneisses. The anorthosite is the oldest rock in this province. The noritic rocks are thought to have been developed later during a period of folding within the anorhtosite.

Several small deposits of nickel-bearing pyrrhotite (pentlandite) and chalcopyrite are known within the anorthosite. The largest one is the Homse mine where a small production was established. This production period lasted only a couple of years.

In the noritic rocks, one can find many deposits of ilmenite and magnetite. The largest one is Tellneset, where A/S Titania has a mine (open pit). Besides ilmenite and magnetite, A/S Titania also produses a copper/nickel concentrate based on the very small amount of pyrrhotite and chalcopyrite in the ilmenite/magnetite ore.

The nickel/copper possibilities are the reason for the sampling work done by A/S Sulfidmaln in this area.

WORK CARRIED OUT

165 samples were taken.(Only one sample from each stream). Wet-sieves were used to collect the - 80 mesh material. The samples covered an area of 460 square kilometers. R. Hovland and J. Jacobsen, together with two assistants, did the sampling work. The samples were analysed for Ni and Cu by F.N.L., Vancouver.

TREATMENT OF DATA

The map 195-72-5-01 shows the location of the samples taken and the assay results. A tabular frequency distribution is shown on the same map. Based on this distribution, the following critical values are selected for both Ni and Cu:

possibly anomalous	15-20	ppm	(> 80%)
probably "	20-25	"	(> 90%)
anomalous	> 25	"	(> 95%)

The sampling data are also presented in another way by using a method of interpretation described by J. De Geoffroy, S. M. Wu and R. W. Heins in Economic Geology vol. 63, 1968. The authors say that an observed value (O) of the metal content, at a given point, consists of a regional trend component (T), an anomaly component (A) and a residual component (R).

$$O = T + A + R$$

The regional trend component shows the mean geochemical condition in a certain area (a section). This component varies in a continuous manner throughout the region.

The anomaly component shows the mean local geochemical condition. (within a cell). The residual component is "an anomaly" within the mean local condition.

The maps 195-72-5-02 and 195-72-5-03 show the contoured regional components for Ni and Cu.

By subtracting the regional trend component form the observed values, one gets the sum of the components A + R. By taking the mean of the sums of these components in a certain area, one gets the anomaly component (A). Only positive deviates of A + R are significant and are used for calculation of the anomaly component.

The maps 195-72-5-04 and 195-72-5-05 show the contoured anomaly component. (Because of too few sample points, one has to use the same area for the anomaly component calculations as for the trend component calculations). By subtracting the anomaly component A from the positive deviates (A + R) in a given area (the cell), one gets the residual component R.

The maps 195-72-5-06 and 195-72-5-07 show the residual component. Many of these components are grouped. Such a group is called a cluster.

For evaluating the different clusters, one has a rating index (K-index), which is made up of two factors:

a) a local factor representing the geochemical conditions prevailing within a given area (a cell).

b) a regional factor representing the geochemical landscape which includes the given area.

../4

TABLE 1:

Calculation of K-index values for clusters shown on map 195-72-5-06 (Ni).

Reference no. of cluster	Local factor (2Nc-1).Mc	Regional factor Ns.Ts/18	K-Index
1	0,5	14,4	14,9
2	26,5	14,4	40,9
3	3,3	14,4	17,7
4	1,3	14,4	15,7
5	9,9	14,4	24,3
6	9,0	14,4	23,4
7	35,0	14,4	49,4
8	5,2	14,4	19,7
9	2,9	14,4	17,3
10	4,4	14,4	18,8
11	21,9	14,4	36,3
12	2,6	14,4	17,0
13	8,7	13,1	21,8
14	2,9	13,1	16,0
15	6,7	13,1	19,8
16	2,3	13,1	15,4
17	86,0	13,1	99,1
18	3,5	13,1	16,6
19	1,8	13,1	14,9
20	11,9	13,1	25,0
21	9,8	13,1	22,9
22	10,2	13,1	23,3
23	4,7	12,0	16,7
24	3,3	12,0	15,3
25	2,0	12,0	14,0
26	11,9	12,0	23,9
27	1,0	12,0	13,0

Nc = number of residuals in the cluster.

Mc = mean of the residuals in the cluster.

Ns = total of residuals in an area consisting normaly of 16 cells (a section).

Ts = trend value of the section.

K - index is the sum of the local and the regional factors.

TABLE 2:

Calculation of K-index values for clusters shown on map 195-72-5-06 (Cu).

Reference no. of cluster	Local factor (2Nc-1).Mc	Regional factor Ns.Ts/16	K-index
1	12,0	11,7	23,7
2	19,0	11,7	30,7
3	3,4	11,7	15,1
4	7,5	11,7	19,2
5	4,4	11,7	16,1
6	6,7	11,7	18,4
7	9,9	11,7	21,6
8	26,1	11,7	37,8
9	13,5	11,7	25,2
10	1,3	11,7	13,0
11	6,0	10,0	16,0
12	8,4	10,0	18,4
13	26,1	10,0	36,1
14	1,3	10,0	11,3
15	13,1	10,0	23,1
16	8,0	10,0	18,0
17	6,8	16,5	23,3

Reference no. of cluster	Local factor (2Nc-1).Mc	Regional factor Ns.Ts/16	K-index
18	19,8	16,5	36,3
19	18,8	16,5	35,3
20	4,1	16,5	20,6
21	1,0	16,5	17,5

Discussion of results.

a) Choice of method.

The following table shows the number of anomalous sample-points (Cu+Ni) found by the two different methods.

The possibly anomalous, the probably anomalous and the anomalous points are put together in one group (method 1).

TABLE 3:

"Anomalous" sample-points (Cu+Ni).

Method	in anorthosite	in noritic rocks	in granite gneiss	Total
1	35	17	11	63
2	59	20	13	92

The table shows clearly that one gets more anomalous points by using method 2 (component calculation). But these points are mainly situated in the anorthosite. Therefore, it looks as though the noritic and gneissic rocks have such a high geochemical background that the weaker anomalies in the anorthosite are hidden, when the simple frequency distribution of method 1 is used.

In the sections A, F, G, K, L on the maps, one has the known Cu/Ni-deposits in the sampled area. With method 1, one gets some weak Ni-anomalies in this area, but none of any significance. The Cu-picture is even worse, in order to get any anomalies at all one has to lower the critical value to 7 ppm. But this would create anomalies in every stream in the noritic and gneissic rocks. More than 50% of the samples would then be "anomalous" (possibly+probably+ anomalous).

The method 2 gives 11 anomalous Ni-values in the mentioned are, grouped together in 4 clusters. The Homse mine and four of the other deposits are situated within the clusters. Two of these clusters are among the three highest clusters in K-Index.

The Cu-map shows 13 anomalous values in the sections, grouped in four clusters. Four of the known deposits lay within clusters, and Homse mine lays very near two of them. The K-Index calculation shows that two of the clusters have a high value.

In the mentioned area, there is no doubt that method 2 has worked better than method 1.

b. Possible targets.

In the anorthosite the K-Index calculation for clusters (both Ni and Cu) shows that the area within the sections A, F, K, G, L has the highest values. There values, combined with the fact that there are several small deposits known here, points out the area for further work. The small deposits known are probably only partly responsible for the anomalies.

The section M, covered by cluster 11 (Ni) and cluster 7 (Cu) is another area of interest in the anorthosite. Ca. 2 km south of this area, there are other small deposits of Cu and Ni.

If further work in these areas gives interesting results, it would be worthwhile having a closer look at some of the other anomalies too.

In the noritic rocks, the section E covered by cluster 17 (Ni) and cluster 13(Cu) points itself out. Here we have the highest K-Index value both for Ni and Cu.

An other section with high K-Index value is D, covered by cluster 22 (Ni) and cluster 15 (Cu).

In the granite gneisses we have the largest anomaly in section K, covered by cluster 26 (Ni) and cluster 19 (Cu).

A large rusty zone is known here, and the anomalies can be caused by this zone. The few samples taken of the zone have not shown any interesting Cu or Ni values.

In the possible target areas, further work ought to include geological mapping and prospecting, ground geophysics and perhaps more detailed geochemical work.

Conclusions.

1. The stream sediment sampling in the Egersund anorthosite area has given targets for further exploration both in the anorthosite and in the noritic rocks.

2. If diamond drilling at Bjørndalsnipa grid (see seperate report) shows interesting mineralization, further work should be done in the proposed anorthosite areas. In the area south of our region a sampling program should also be carried out.

3. Even if the work in the anorthosite is discontinued, one ought to have a closer look at the anomalies within the noritic rocks.

A/S SULFIDMALM

INTER-OFFICE MEMORANDUM

Date: 2nd January, 1973

To: Falconbridge Nikkelverk A/S ✓

cc: A.M. Clarke, D.R. Lochhead,
R.B.Band/I. Elliot, R. Hovland

From: J.B. Gammon

Subject:

905-5, Egersund Anorthosite area, Southwest Norway,
Report No. 195-72-5.

Please find attached Hovland's report on stream sediment geochemistry in the Egersund anorthosite area. In this work he has applied a data treatment which automatically compensates for varying background levels due to different regional rock types. This has enabled a much more sensitive and sophisticated analysis of the results, which indicate anomalies worthy of further attention if our planned drilling of the Bjørndalsnippa anomaly near Homse gives encouraging results.

J.B. Gammon

MOTTATT 04. 01. 73

ADM. DIR.	VRg	FORSKN./UTV.	
TEKNISK DIR.		EL. LYSEAVD.	
PERSONALDIR.		M.L. AVD.	
ADM. SJEF		R. & SM. AVD.	

3 SAKSBEARB. Nixon.


EGERSUND Anorthosite area
Showing assay results of
stream sed. and gen. geology.
SCALE 1:50000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK.
MAP NO. 195-72-5-01
MAP SHEET
A/S SULFIDMALM
N
ppm
Σ > 30 ppm
% Frequency
Ni
Cu
Possibly anomalous 15-20 ppm 15-20 ppm >80 %
Probably " 20-25 " 20-25 " >90 %
Anomalous >25 " >25 " >95 %
LEGEND
Ni possibly anomalous
Ni probably "
Ni anomalous
Cu possibly "
Cu probably "
Cu anomalous
Anorthosite
Norite-migmatite
Quartz-monzonite
Mangerite
Granite gneisses.
Ni Cu Values in ppm
Bjårvatnet
HOMSE VANN
Eike-vatnet
E18
Botnavatnet
Takse-vatnet
Bilstadvatn


N
KEY:
Mine
Claim, small pit
Cell centroid for trend component
Cell centroid based on one sample
contour interval is 2 ppm (over 15 ppm, the interval is 5 ppm)
0 - 6 ppm
6 - 10 "
10 - 15 "
15 - 20 "
>20 "
TREND VALUE
TREND VALUE (only one sample)
EGERSUND ANORTHOSITE AREA
CONTOURED REGIONAL COMPONENT
NICKEL IN STREAM SEDIMENTS
SCALE
1:50.000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK. RH 11-72
MAP NO.
195-72-5-02
MAP SHEET
% SULFIDMALM
Bjørvatnet
Botnavatnet
Bilstadvatn
HOMSEVANN
6 ppm
8 ppm
10 ppm
12 ppm
15 ppm
20 ppm
25 ppm
11,7
10,8
5,3
6,7
9,5
22,5
11,5
7,0
28,0
9,4
6,01
7,6
8,3
6,3
7,8
12,8
22,0
12,0
10,7
9,3
7,3
7,5
10,6
13,5
11,4
9,4
14,3
17,3
14
16,0
19
16,7
29,5
5,0
23,3
10
E 18


LEGEND
mine
claim, small pit
cell centroid for trend component
cell centroid based on one sample
Contour interval is 2 ppm. (Over 15 ppm, the interval is 5 ppm.)
0 - 6 ppm
6 -10 "
10 -15 "
15 - 20 "
> 20 "
N
EGERSUND Anorthosite area
Contoured regional component
Copper in stream sediments.
SCALE
1:50000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK.
A/S SULFIDMALM
MAP NO.
195-72-5-03
MAP SHEET
Bjårvatnet
Botnavatnet
Bilstadvatn.
E18
R-9
8 ppm
6 ppm
10 ppm
12 ppm
15 ppm
20 ppm
25 ppm
7,7
11,0
14,0
10,5
16,5
9,0
23,0
14,8
7,5
12,0
15,6
29,0
9,0
4,5
6,3
4,8
5,0
5,3
9,2
13,5
12,4
10,6
14,7
13,5
4,0
4,6
4,5
4
8,0
8
7,5
12,7
3,0
7,3
7
15,5
1,8
13,8
11,7
14,5
12,0
14,6
21,5
11,8
7,0
8,0
23


N
KEY
CELL CENTROID FOR ANOMALY COMPONENT
POSITIVE DEVIATE
NEGATIVE DEVIATE
MINE
CLAIM, SMALL PIT
0 - 1 ppm
1 - 1,5 "
1,5 - 2 "
2 - 3 "
>3 "
HOMSEVANN
Bjårvatnet
Botnavatnet
Bilstadvatn.
EGERSUND ANORTHOSITE AREA
CONTOURED ANOMALY COMPONENT
NICKEL IN STREAM SEDIMENT
SCALE
1:50 000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK. RH 11-72
MAP NO.
195-72-5-04
A/S SULFIDMALM
MAP SHEET


N
KEY
CELL CENTROID FOR ANOMALY COMPONENT
POSITIVE DEVIATE
NEGATIVE DEVIATE
MINE
CLAIM, SMALL PIT
0 - 1 ppm
1 - 1,5 "
1,5 - 2 "
2 - 3 "
> 3 "
EGERSUND ANORTHOSITE AREA
CONTOURED ANOMALY COMPONENT
COPPER IN STREAM SEDIMENTS
SCALE
1:50 000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK. RH 11-72
A/S SULFIDMALM
MAP NO.
195-72-5-05
MAP SHEET


N
KEY
4,1 POSITIVE RESIDUAL COMPONENT
NEGATIVE " "
RESIDUAL CLUSTER
CATCHMENT AREA FOR POSITIVE COMPONENT
Bjårvatnet
Eukje-vatnet
Tekse-vatnet
Botnavatnet
Bilstadvatn
E18
EGERSUND ANORTHOSITE AREA
RESIDUAL COMPONENT
NICKEL IN STREAM SEDIMENT
SCALE 1:50 000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK. RH 11-72
MAP NO. 195-72-5-06
A/S SULFIDMALM
MAP SHEET

N
KEY
4,1 POSITIVE RESIDUAL COMPONENT
NEGATIVE " "
RESIDUAL CLUSTER
CATCHMENT AREA FOR POSITIVE COMPONENT
Bjårvatnet
Botnavatnet
Bilstadvatn
Tekse vatnet
E18
EGERSUND ANORTHOSITE AREA
RESIDUAL COMPONENT
COPPER IN STREAM SEDIMENT
A/S SULFIDMALM
SCALE 1:50 000
OBS.
DRAW. RH 11-72
TRAC. BL 11-72
CHK. RH 11-72
MAP NO. 195-72-5-07
MAP SHEET