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Tittel

Results from magnetic investigations of the Fen area in 1980.

Forfatter	Dato År	Bedrift (oppdragsgiver og/eller oppdragstaker)
C. W. Carstens	30.4 1981	Elkem AS

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Geofysikk		Fensfeltet

Råstoffgruppe	Råstofftype
Malm/metall	Skjelne jorartsmetaller

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Hovedhensikten med å gjennomføre en ny magnetisk undersøkelse på Fensfeltet var uoverensstemmelse melomm de gamle kartene som ble benyttet i 1949 og dagens kartgrunnlag.
Sammenlignet med resultatene fra 1949, er det ikke stor forskjell på måleresultatene. Dagens målinger er imidlertid mer detaljerte.

Et dominerende trekk er en nord-syd anomali som delvis gjennomskjærer flere geologiske strukturer.På basis av susceptibilitets målinger på et av anomaliene, er det klare indikasjoner på at en sovitestruktur med noe magnetitt ligger under et tynt lag av silikatbergarter i syd. Ved å sammenligne noen resultater i den N -S gående anomalien synes det å indikere en mulig korrelsjon mellom magnetiske anomalier og interesant mengde Niob i Sovitten.Vi vet at skjeldne jorartsmetaller kan anrikes og forekomme i interessante mengder i områder med mye magnetitt. Det bør rettes opperksomhet på forhøyede magnetiske anomalier. Slike undersøkelsesobjekter er beskrevet i rapporten.

Rapporten har vedlegg av: kart med magnetisk rådata (1:5000), magnetisk isokotur kar, magnetisk profilkart, geologisk kart, forenklet kart over Håtveit anomalien.

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Elkem as
ES Engineering Division

R E P O R T

To Management Committee of Fenco

From Elkem a/s, Engineering Division, Nydalsvn. 28,Oslo 4.

SUBJECT: Results from magnetic investigations of the Fen area in 1980.

SUMMARY

The main objective by carrying out new magnetic investigations in the Fen complex was significant discrepancies between the previous base map containing the magnetic data and the present base map.

Compared with previous results from 1949 the most important magnetic features do not differ much. However, the present magnetic results are more detailed.

A rather predominant feature of the magnetic results is the north-south running magnetic anomalies which are partly penetrating different geological structures. On the basis of susceptibility investigations on one of those anomalies we have obtained quite clear indications that a søvite structure with some magnetite in it seems to extend below a thin cover of basic silicate rocks in the south.

By comparing some assaying with the N-S running magnetic anomalies it seems to be indications of a possible correlation between magnetic anomalies and interesting amounts of niobium in the søvite. Knowing that also interesting grades of rare earth consentrations may occur together with dikes of magnetite we have to pay attention to elogated magnetic anomalies. Such exploration objects are described in this paper.

So far the magnetic investigations seem to be useful for the evaluations of the Fen complex, but to obtain as much as possible from the magnetic results it is necessary to carry out more susceptibility investigations.

Place/ date

Oslo, April 30, 1981.

C.W. Carstens

C.W.Carstens

1. INTRODUCTION

1.1 Background for the investigations.

The main reason for carrying out new magnetic investigations was the discrepancies between the base map on which the previous magnetic results are presented and the present economical maps.

1.2 Field operations.

The measurements have been carried out in a similar grid system as the previous measurements. The distance between the profile lines are generally 100m, and the space between the stations in the profiles is 20m. At some places where interesting anomalies were obtained some intermediate profiles have been made.

Some of the landowners had organized against any exploration activity on their land. For that reason areas in Vipeto-Rullekollen and the Fensmyra area nas not been investigated systematically.

The majority of the investigations were carried out in four weeks time in November. The crew consisted of two men, one navigator and one operator. The weather was good most of the time and the measurements were carried out without significant problems.

1.3 Magnetic variations at the base stations.

To check the equipment and to have a control of the magnetic pulsations and possible magnetic storms, the instrument was checked 3 times a day on base stations. Most of the time tha base station was kept to the southwestern part of the area. (Coordinates X=50250 Y=141000). In general the magnetic level was rising about 20-30 γ within a periode of one day. The maximum difference in reading was 56 γ during a periode of 9 days.

We did not find any reason for correcting the magnetic raw data for the moderate magnetic variations.

2. RESULTS

2.1 The form of presentation of the magnetic results.

The magnetic raw data within the different profiles are presented on a map of the scale 1:5000 (see fig. 1).

An isocontour map in the same scale has been drawn (see fig.2).

A magnetic profile map has also been drawn. By studying this map alternative directions of the magnetic structures can be studied. In many ways it is easier to make interpretations from a profile map (see fig. 3).

For comparing magnetic and geological results, Sæther's geological map has been transferred into the present economical map. Some of the latest geological information has also been plotted on this map. (see fig.4).

2.2 Magnetic background.

As known from previous magnetic investigations the Fen complex reveals a magnetic high compared to the background values in the surrounding gneiss. The magnetic values in the gneiss varies from about 50050 γ up to 50300 γ . As a simplification the background value is set to 50000 γ . The zero value in the magnetic profile map is 50000 γ.

2.3 General features of the magnetic results.

Compared with the previously known vertical magnetic contour map the present total field magnetic map is more detailed (see fig.2). Especially the thin and elongated magnetic anomalies are more predominating. When speaking about highest magnetic feature the present map does not in principle differ much from the previous one.

In the north-eastern part of the Fen complex the higher magnetic level seems to make up some kind of a circular high. It is worth noticing that the gravity peak is bound to the approximate center of that area.

Another feature about the mentioned high magnetic area is that the magnetic field gradually decreases towards SSW indicating a possible dipping extension of the known bands and lumps of magnetite in that direction.

According to the isomap the magnetic structures are generally running in the N-S direction. This direction is not always in accordance with the known geology of the basic silicate rocks in the south. One explanation is that the raudhaugite ans søvite which do contain most magnetite, partly may plunge below a "cover" of the basic silicate rocks.

2.4 Comparing of magnetic and geological data.

Sæther had previously to some degree interpretated the geology below the overburden by means of the previous magnetic results.

By comparing the geological map with the magnetic results, the following correlation of average magnetic values and some rock units has been estimated:

Rødberg:	50600 - 50800 γ
Raudhaugite:	50500 - 50700 γ
Damtjernite:	50400 - 51500 γ
Søvite:	50300 - 50500 γ
Basic silicate rocks:	50100 - 50300 γ

Because of the fact that the magnetic values are varying much within different rock types, it is rather difficult to differ the rock units in the magnetic way. The differentiation may be less difficult to make in areas which are relatively magnetic low.

The less difficult rocks to differ seems to be the søvite and basic silicate rocks when they occur together.

One striking feature of the magnetic results is that most of the rock units in the Norsjø area are significantly magnetic lower compared with the same rocks in other parts of the area. The difference in the magnetic level may vary from 100-300 γ . One of the reasons may be a stronger degree of fenitization of the rocks in the Norsjø area.

2.5 Results from Grubeåsen.

The magnetic structure in Grubeåsen area is running Northwest-Southeast, a direction which is in good accordance with the strike of the known dikes of hematite.

The two highest magnetic anomalies of about 3500γ and 4000γ seems to reveal areas in which small dikes of hematite are found. (A mine map has been compared with the magnetic map).

The most possible reason for these magnetic highs is supposed to be that the hematite dikes consist of 5-6% magnetite as massive bands or lumps rather than impregnation of magnetite in the surrounding rødberg.

Because of the high magnetic level of the rødberg itself (500-1000 γ) no correlation between the grade of rare earth minerals and magnetic results can be seen.

2.6 Exploration objects in the Vipeto area.

The magnetic contour map is showing interesting north-south running magnetic anomalies which seems to penetrate the Fen area from the southern border up to the Skippervolden and Bolladalen areas. The magnetic anomalies generally have the size of 800-1500 γ which means that the outcrops corresponding to these values may contain 1-3% magnetite.

The western anomaly passing through the road cut in the søvite has been investigated by susceptibility tests. The tests confirm that the magnetic high in the søvite corresponds with the magnetic values. However, the susceptibility tests in the basic silicate rocks into which the magnetic anomaly is running, do not correspond to the magnetic field values. In this way we have obtained a geophysical result which indicates that the søvite dike may extend below a rather thin cover of basic silicate rocks.

In the Vipeto area it is worth noticing that the highest content of niobium in the søvite corresponds fairly well with the magnetic anomalies. The niobium content has been plotted on the magnetic profile map (see fig.3).

2.7 Exploration objects around the Håtveit creek.

In the areas around the Håtveit creek between Håtveit, Tuftehavna and Granheim there is a rather complex system of magnetic anomalies running north-south. Similar to the Vipeto Raudhaug area, the size of the anomalies are in the range 800-1500 and may therefore reveal outcrops with a magnetite content of approximately 1-3%.

Due to agricultural land and forest vegetation very few outcrops have so far been found. Two outcrops of søvite in the Håtveit creek and one small cross creek have been examined by susceptibility measurements and also some samples have been analysed for niobium.

The susceptibility results correlates fairly well with the obtained ground magnetic values. The niobium content in the cross creek was very low, but one sample in the Håtveit creek is showing an interesting grade of niobium (see fig.3).

According to Sæther's geological map our outcrops in the Håtveit creek are bound to basic silicate rocks instead of søvite rocks. The discrepancies are assumed to be due to inexact transformation of his original data to the new econimical base map (see fig.4).

The magnetic results in the area have been somewhat simlified and the magnetic high has been split up into 3 areas in which søvite containing some magnetite may occur (see fig.5).

2.8 Other exploration objects.

A fault zone containing some magnetite with interesting amounts of rare earth minerals associated with magnetite, has been discovered by the geological investigations of the Tuftestollen. It is a possibility that the weak magnetic anomaly running from the coordinate X=51220 Y= 142150 towards the Norsjø may correlate with the fault zone. However, the magnetic picture seems to reveal a very shallow and thin zone containing very little magnetite rather than compact bands of magnetite. Anyway, this zone should be an object for follow-up exploration.

By comparing Sæther's geological map with the magnetic results, it can be seen that the magnetic picture seems to be a little disturbed just above the position of the Hydro dike. However, the magnetic features are so weak that it would hardly had paid any attention if the position of the Hydro dike had been unknown.

At the east side of Holla Prestegård there is a magnetic high (up to 200 γ) with a length of 500 m. We cannot exclude that the anomaly may reveal a continuation of a dike similar to the Hydro dike.

East of the previously described magnetic high around the Håtveit creek there are two magnetic anomalies (500-800 γ) following after each other. According to the geological map the anomaly is bound to søvite and raudhaugite (see fig.4).

Other interesting magnetic structures could be mentioned in this paper, but depending on how Fenco A/S will give priority to further exploration those should be more closely studied.

3. STATUS AND RECOMMENDATIONS FOR FUTURE EXPLORATION

Except for the areas in the Vipeto Rullekollen and Fensmyra area the Fen complex is now assumed to be fairly well covered with ground magnetic measurements.

It is assumed to be possibilities for potentials of both niobium and rare earth minerals to be concentrated into dikes in which there are some magnetite. Pricipally we therefore have to pay attention to magnetic anomalies that may reveal such dikes.

Anomalies that should be interesting have been described in chapter 2. So far the Vipeto anomalies seems most interesting and we should try to persuade the landowners there to get permission for more exploration. The anomalies on Cappelen's land around the Håtveit creek is also interesting. Prior to any drilling exploration some more magnetic measurements should be done on some anomalies.

Before carrying out any more magnetic measurements, we must get more susceptibility information which is important for the understanding and interpretation of magnetic anomalies. Having very few outcrops it will be necessary to make some trenches to get down to the outcrops. It is believed that such removing of overburden also will be useful for geological evaluations. Using a crew of 1-2 men susceptibility measurements could be carried out within two weeks time.

4. CONCLUSIONS

As expected the present magnetic result is not very different from the previous results. However, we have got more detailed results. A rather predominant feature of the magnetic results is the north-south running structures. An interesting indication of a certain correlation between magnetite and niobium has been obtained. It is believed that magnetic results can contribute rather much to the future exploration and evaluation of the Fen complex.

NORSJØ

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File: 1

THE FEN AREA

Geology adopted from Sæther, 1951 and 1957

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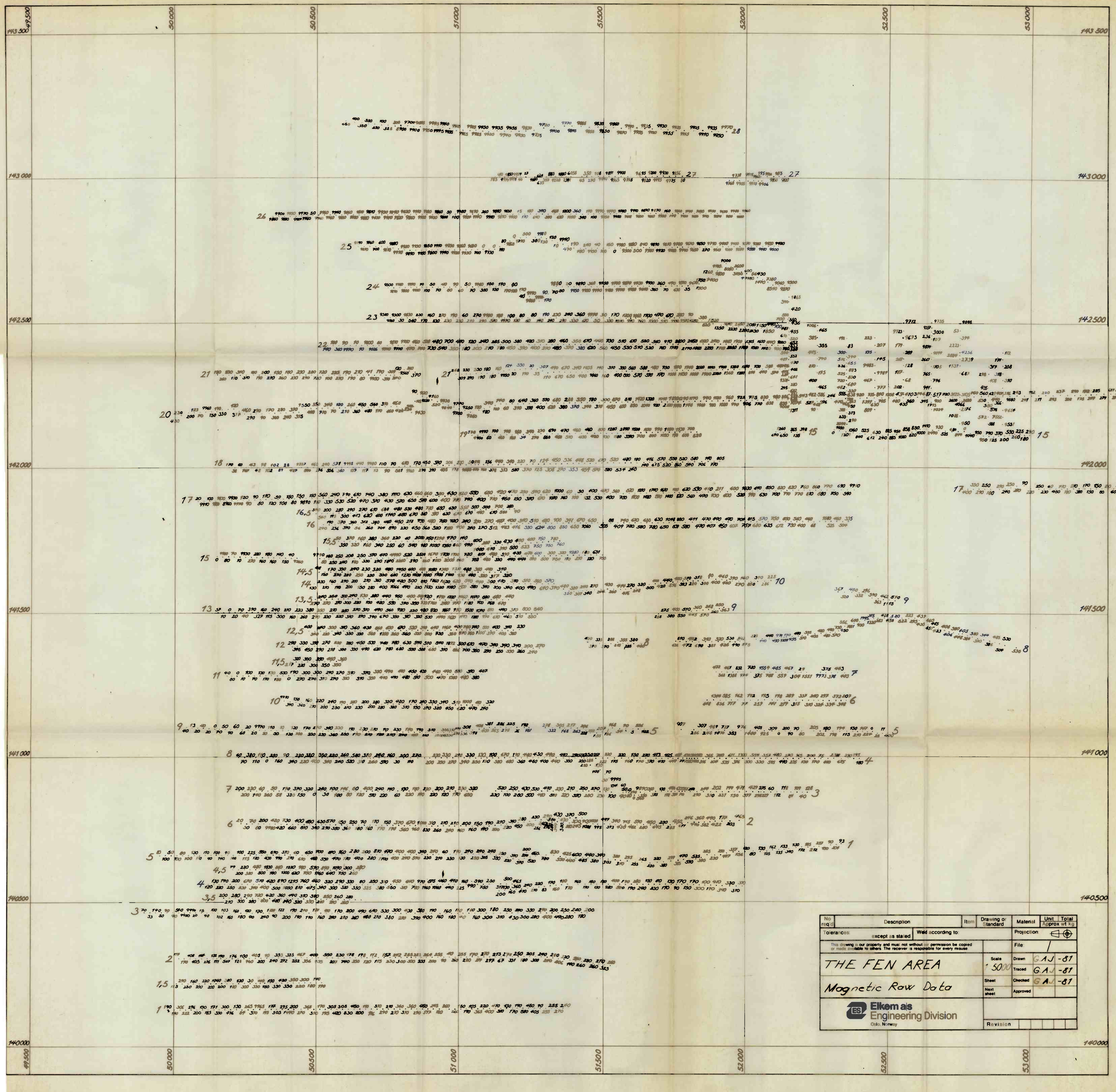
Engineering Division

Oslo, Norway

Fen Area. Legend (Sæther, 1957).

- Archaean bedrock, mostly gneiss and grey coarse granite
- Granite breccia
- Fenitized gneiss and breccia.
- Massive fenite at some places also comprising nepheline syenite (ijolite)
- Vipetorite
- Melteigite, ijolite, and urtite
- Different basic silicate rocks, to a large extent altered to biotite-carbonate and chlorite-calcite rocks.
- Pyroxene-sövite and sövitic melteigite
- Sövite in dykes, at some places together with rauhaugite type 1
- Extended complexes of sövite together with rauhaugite type 1 and biotite-calcite rocks.
- Damtjernite in dykes
- Damtjernite and damtjernite breccia in extended bodies.
- Rauhaugite type 2
- Rødberg (carbonate-hematite rock)
- Concentration of iron ore, in the rauhaugite magnetite, in the rødberg mostly hæmatite.
- Faults. Cross-marks on down-throw side, on both sides if the direction of dislocation is not known. Observed faults fully drawn, interpredctions stippled
- 1,5 Susceptibility $\times 10^{-3}$



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Magnetic Raw Data			Sheet	Checked	G.A.J	-81
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Elkem a/s Engineering Division, Oslo, Norway				Revision		

N

Norsjø

Dåmtjøn

Høivei-tjøn.

KONTURINTERVALLER

56000 - 55000	50200 - 50100
55000 - 54000	50100 - 50000
54000 - 53000	50000 - 49900
53000 - 52000	49900 - 49800
52000 - 51500	49800 - 49700
51500 - 51000	49700 - 49600
51000 - 50750	49600 - 49500
50750 - 50500	49500 - 49250
50500 - 50400	49250 - 49000
50400 - 50300	49000 - 48500
50300 - 50200	48500 - 48000
	48000 - 47500
	47500 - 47000

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THE FEN AREA

Iso magnetic map.

Scale 1:5000

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Revision

N

Norsjø

Gammas(r) Scale

52 000
51 000
50 000

100 200 300 Meter.

17 Profile number.

EL. Possible sivil disturbancies.

- > 0,3 % Nb
- 0,25-0,3 %
- 0,20-0,25 %
- 0,15-0,20 %
- 0,10-0,15 %
- 0,05-0,10 %
- < 0,05 %

Damtjørn

Hølvoit-tjørn

THE FEN AREA

Magnetic profiles

Scale 1:5000

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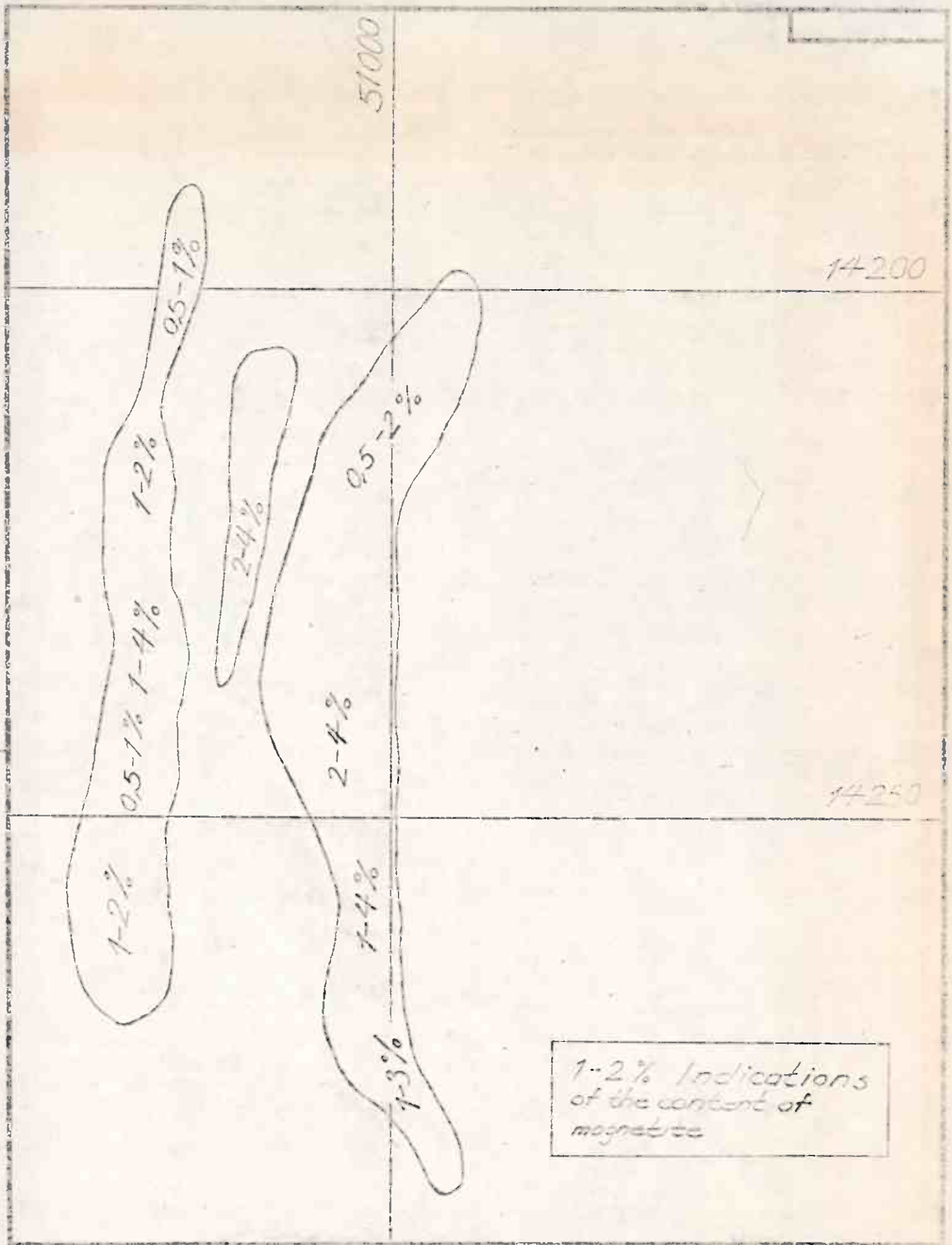

1-2% indications of the content of magnetite

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Simplifications of the Hotveit anomaly

Scale 1:5000

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Fig. 5

Revision

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Engineering Division

NOTAT

TIL: Jan Egil Wanvik

KOPI: L.Kopperstad, B.Raae, K.Granli

FRA: R.Jensen

DATO: 19. oktober 1981
SF

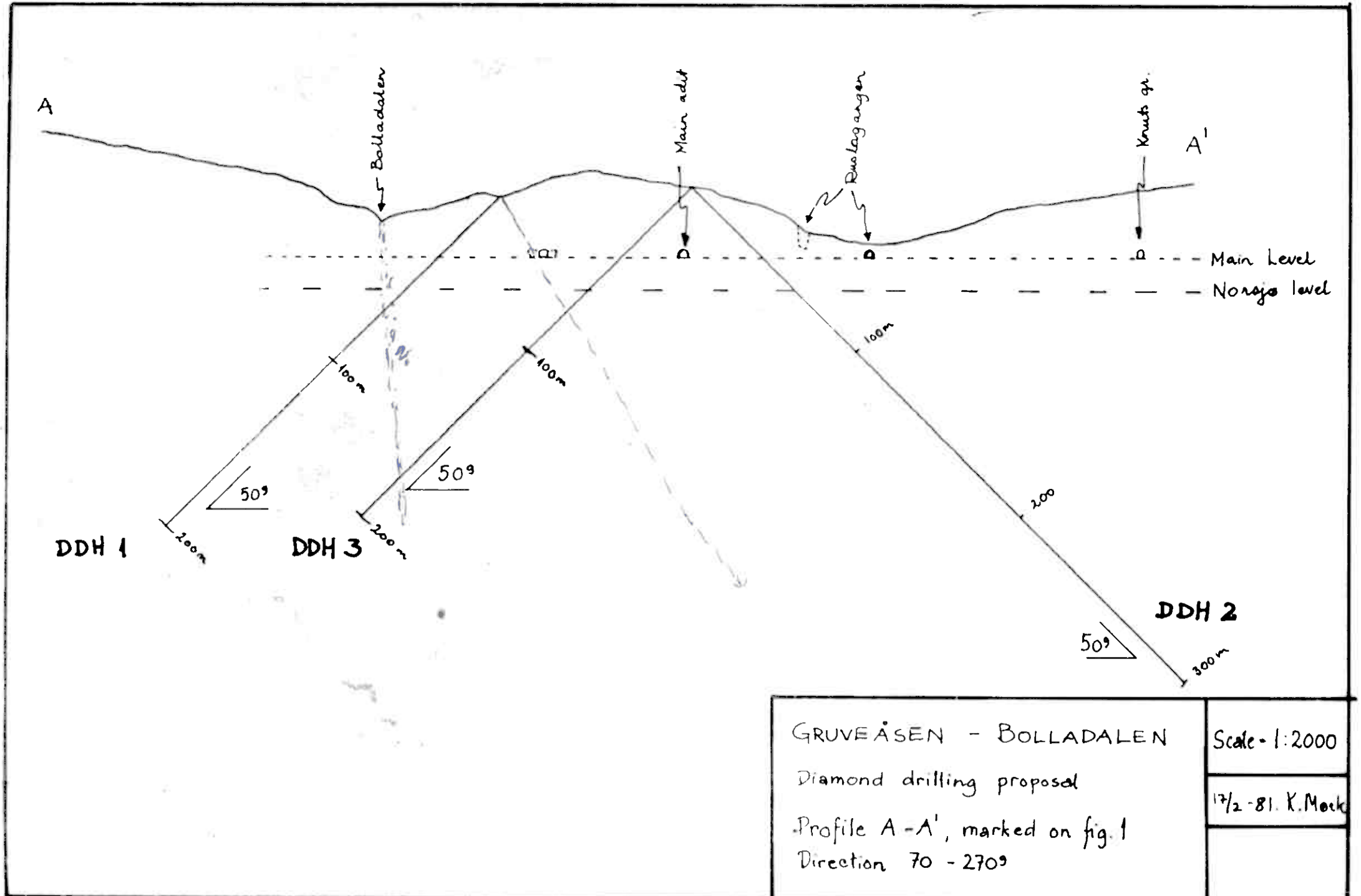
NEFELIN FEN

Steven Olmore viste et geologisk kart over Fen med et område ca. 150 x 200 m S for Melteig der bergarten er beskrevet som en nesten ren nefelinbergart.

7.37% K_2O	34,55% Al_2O_3
41,96% SiO_2	0,63% Fe_2O_3
0,07% TiO_2	0,48% CaO
0,639% MgO	15,85% Na_2O

Kan du skaffe mere info. om denne som mulig Alumina-råstoff. (Jerninnholdet er antatt å være prohibitivt høyt). Mulig annen anvendelse som et nefelinråstoff må også vurderes.

Roar Jensen



GRUVEÅSEN - BOLLADALEN

Diamond drilling proposal

Profile A-A', marked on fig. 1

Direction 70 - 270°

Scale - 1:2000

17/2 -81. K. Mock