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Forfatter H A Rosenqvist		Dato nov 1972	Bedrift Sulfidmalm A/S	
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Fagområde Geologi	Dokument type Rapport	Forekomster Risfjord Kamøyvær		
Råstofftype Malm/metall	Emneord Ni Cu Fe S			
Sammendrag				

Ksant

FOR FALCONBRIDGE NIKKELVERK A/S

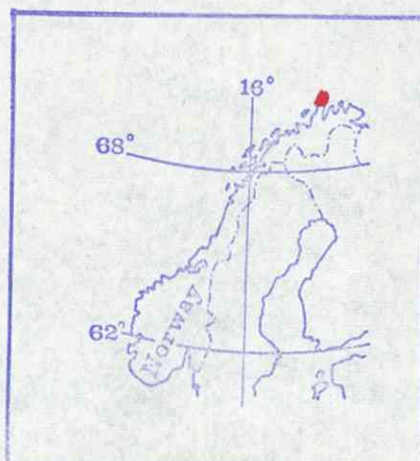
A/S SULFIDMALM

PROJECT 905-16

THE MAGERØY GABBRO COMPLEX,
WEST-FINNMARK, NORWAY.
NOVEMBER, 1972.

by

H. A. Rosenqvist



A/S SULFIDMALM
INTER-OFFICE MEMORANDUM

Date: 8th December, 1972
To: Falconbridge Nikkelverk A/S ✓
cc: A. M. Clarke, D. R. Lochhead
H. A. Rosenqvist
From: J. B. Gammon
Subject:

905-16, Magerøy, Finnmark. (Report Nr. 201-72-16).

Please find attached Rosenqvist's report on prospecting activities on the island of Magerøy, northernmost Norway. The available geological and geophysical information is encouraging as to general environment and some of the assay results are quite encouraging. Further detailed prospecting and reconnaissance geophysics is planned for the area on a lower priority basis if funds and time are available in 1973.

J. B. Gammon

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THE MAGERØY GABBRO COMPLEX, WEST-FINNMARK;

INTRODUCTION.

The geological map of Norway shows a gabbro massif on the island Magerøy, northernmost Norway. Within this massif considerable amounts of ultramafic rocks occur, the general geology hence giving some Ni-Cu potential to the area.

Sulphide disseminated portions within the gabbro complex were shown to exist by brief orientation visits and rough prospecting in the area. (HAR/EK 11.-12.4.72, HAR/FE 9.-10.6.72, FE 11.-17.6.72.).

Further new information on the area has been obtained from Jane Curry (Univ. of Dundee), presently mapping the geology, and Willy Jan Lønne (Jordskjelvestasjonen, Bergen), who carried out a gravity/magnetic survey.

This report summarizes our present knowledge of the area and intends to give a preliminary assessment of the Ni-Cu potential.

LOCATION.

The island Magerøy (26° E/71° N) in Finnmark, Norway is known as the northernmost part of Europa, the famous tourist attraction North Cape being located on the island.

The gabbro complex dominates the southeastern part, where also the municipal center Honningsvåg lies (fig. 1). Motor roads make accessibility comparatively easy to all parts of the gabbro complex. Magerøy is connected to the mainland by regular ferries.

The topography is rugged, although hills only reach attitudes below 400 m a.s.l. Soil cover and vegetation is almost nonexistent in the majority of the gabbro area.

GEOLOGY

CONGLOMERATES OF CARBONATE ROCKS AND A

1. General:

The oldest rocks of eastern Magerøy are metasediments, mainly represented by biotite-rich schists, but also including beds of quartzite, carbonate rocks, tillite like unsorted conglomerate (Fig. 1). Finds of fossils have indicated a Silurian age for the metasediments (Føyn 1967).

The metasediments are intruded by mafic-ultramafic rocks, constituting the so called Magerøy gabbro complex. The existence of fossils proves that the intrusion(s) were not older than Silurian age. The gabbro complex should consequently not be considered as a part of the older "Seiland mafic-ultramafic province" of West-Finnmark.

The gabbro complex is enveloped by contact metamorphic rocks, hornfelses. These quite thoroughly recrystallized rocks (containing pyroxene, basic plagioclase, altered olivine, amphibole, biotite, calcite, zoisite etc.) sometimes contain relict sedimentary rocks and structures (Reitan 1960).

2. The gabbro complex:

Southeastern Magerøy, which is dominated by the gabbro complex, was preliminary investigated by Geul (Fig. 1). Recently Jane C. Curry (Univ. of Dundee) has been mapping in the area (map 1-201-72-16). The following description summarizes information, mainly obtained from miss Curry.

I Rock types.

The complex is divided into the following units:

- A. Banded olivine gabbro.
- B. Homogenous lencogabbro.
- C. Peridotites.
- D. Norite.
- E. Pegmatitic gabbro.

The distribution of these units is shown on Curry's preliminary map (1-201-72-15). It should be noted that the geological picture of Kamsyvaer peninsula was slightly revised during minor prospecting work this summer (2-201-72-16).

A: Layering, where distinct dark and light bands are present, is developed occasionally in this gabbro unit. For the greater part a streakiness or ill-defined layering is present and sufficiently striking to give a very definite orientation to the rock.

Olivine is always present in this unit, alternating with labradorite in various proportions to give rise to the planar element in the rock.

The proportion of olivine/plagioclase does not undergo any constant change in any particular direction. Cryptic layering, as regards the composition of the olivines, is not present either.

B: This is a leucocratic gabbro, plagioclase constituting ca. 50% of volume. The predominant mafic mineral is augite, olivine being rarely present.

The homogenous leucogabbro shows cross cutting relations to the banded gabbro unit (A).

C: As shown by the map, peridotites are fairly wide spread within the gabbro complex. Peridotitic rocks occur within the banded gabbro as cutting dikes, deformable sheets and more undefined features (pipes, lenses).

The several varieties of peridotites, mode of occurrence as well as composition, are all considered as formed by a liquid ultramafic, invading the banded gabbro.

3 main types of peridotites are present:

- (1) Ultramafic peridotite (dunite), which originally intruded the banded gabbro, is seen in dikes and sheets and also as preserved xenoliths within (2) and (3).

- (2) "Contaminated peridotite", formed by assimilation of with gabbro. This can intrude (3) as well as reintrude (1). A vein of contaminated peridotite may be cut by a similar vein, suggesting pulses of intrusion.
- (3) Troctolite, which is remobilized gabbro and may cut the above types.

As shown on the map peridotites are especially abundant in the western part of the gabbro complex. Small ultramafic outcrops on the Helnes peninsula have also been reported.

- D: At least 2 large sheets of massive norite have been mapped in the area adjacent to Honningsvåg at the periphery of the gabbro complex.

The dominant mafic mineral, orthopyroxene, is much more unalitized in the Helnes norite than in the western body. On the Helnes peninsula the norite is intimately mixed with hornfelses, suggesting this area to represent a high level (roof area) of the gabbro complex.

- E: Pegmatitic gabbro phases are observed as occasional bands in the banded gabbro and also as a large, spheroidally weathered, outcrop just north of Honningsvåg.

The rock consists of coarse olivine, pyroxenes, mica and plagioclase.

II Possible position of gabbro complex.

As mentioned above, layering (streakyness) in the banded gabbro does not give any indications on the floor resp. roof of the intrusive complex.

However some general observations suggest that the deeper sections of the complex lie towards NW.

- Sediments west of the gabbro complex show higher metamorphic grade towards west (Fig. 1).
- Sediments east of the gabbro complex show even lower metamorphic grade.
- The above mentioned intimate mixture of intrusive norite and sedimentary relics on Helnes peninsula (SE).

Also the relative abundance of peridotitic rocks in W and NW and their effects on the banded gabbro, might be taken as an indication of deeper level here.

III Sulphide mineralization.

The Ni-potential geology of eastern Magerøy prompted some brief reconnaissance visits to the area, although sulphides had not been recorded by previous investigations.

Rough prospecting within the gabbro complex carried out in April and June 72, revealed faint po-dominated sulphide disseminations particularly associated with mafic portions within the banded gabbro.

Most of the mineralized portions were found in the area around Risfjord, including the Kamøyvaer peninsula. Dictated by impressions from the first orientation visit (HaR/EK April 72) and the general rock distribution, this area was favoured during prospecting in June. A total of 21 Sulfidmalm claim points cover the area.

The observed sulphides, mainly pyrrhotite with subordinated chalcopyrite, occur interstitially between silicates preferably within troctolitic rock types. No large scale mineralization was found, the disseminations being irregular and of modest dimensions.

A total of 35 rock samples were collected, 18 of which have been analysed for Ni, Cu and S. Generally samples were collected only from sulphide carrying rocks. The samples and assay results (Kristiansand lab.) are listed below; sample locations are given in fig. 2.

				ASSAY IN %			
Sample	Collected by	Description	Ni	Cu	S	Fe	
16 Ma 1	HaR	Norite					
2	"	Coarse grained spheroidally weathered olivine gabbro (Scattered sulphide grains).	0,34	0,12	0,53		
3	"	Streaky olivine gabbro.					
4	"	Dunitic peridotite.	0,12	0,028	0,10		
5	"	Streaky olivine gabbro.	0,096	0,031	0,10		
6	EK	Dunitic peridotite.	0,14	0,028	0,10		
7	HaR	Troctolite intrusive into banded gabbro.	0,14	0,037	0,14		
8	"	Fine grained peridotite (pipe like intrusion).	0,27	0,033	0,14		
9	"	Po-disseminated troctolite from minor shear zone.	0,31	0,10	0,52		
10	"	Po-disseminated troctolite.	0,22	0,068	0,30		
11	"	Coarse ophitic gabbro, po-diss. (Local boulder).	0,21	0,10	0,71		
12	"	Leucocratic gabbro.	0,064	0,048	0,38		
13	"	Po-disseminated troctolite	0,35	0,19	1,3		
14	"	Fine grained troctolite.	0,15	0,046	0,54		
15	"	Sulphide diss. rusty leucocratic gabbro.	0,29	0,12	0,86		
16	"	Po-disseminated troctolite.					
17	"	Fine grained po-dissemination in homogenous gabbro.					
18	"	Minor "po-enrichment" in mafic portion of troctolite.					

Sample	Collected by	Description	ASSAY IN %			
			Ni	Cu	S	Fe
16 Ma 19	HaR	Foliated barren troctolite.				
20	"	Fine grained peridotite.				
21	"	Barren mafic troctolite.	0,28	<0,05	0,4	9,4
22	FE	Rather coarse olivine gabbro with scattered sulph. grains.				
23	"	Uneven po-dissemination in olivine gabbro.	0,35	0,07	0,4	7,4
24	"	Homogenous leucogabbro (scattered sulphides).				
25	"	Po-disseminated peridotite.	0,22	<0,05	0,1	9,4
26	"	Barren peridotite.	0,15	<0,05	<0,1	8,4
27	"	Po-disseminated troctolite.				
28	"	Troctolite with scattered po/cp grains.				
29	"	Po-disseminated peridotite.	0,19	<0,05	<0,1	8,4
30	"	Faint po-diss. ultramafic band in gabbro.				
31	"	Mafic band in gabbro.				
32	"	Peridotite belt in banded gabbro.				
33	"	Norite (Hernes).				
34	"	Peridotite (Hernes).				
35	"	Fine grained po-diss. peridotite.				

Assay results show encouraging Ni-content in a number of the samples (e.g. > 0,3% in 2, 9, 13 and 23), whereas the Cu-content as a rule is lower (always < 0,2%).

Rather discouraging is the generally low sulphur content (< 1%), indicating that most of the nickel is tied in silicates and not in the sulphide phase. Sample 16 Ma 13 represents a positive exception (0,54% Ni+Cu, 1,3% S), slightly suggesting that enrichment of Ni-sulphide might occur within the complex after all. This sample is presently being investigated in polished section.

GEOPHYSICS.

Some cursory notes on the geophysical information on Magerøy.

Gravity: A gravimetric survey over Magerøy was carried out by student Willy Jan Lønne during the summer 1971. Lønne reported his results in his "Hovedfagsoppgave" (thesis) at the University of Bergen, Seismic dept. As the figures 3-4 show, a positive Bouguer as well as a positive residual anomaly occur on the Kamøyvaer peninsula i.e. the NE part of the gabbro complex.

The form and deepness of the complex, as interpreted by Lønne, is shown on fig. 5.

Magnetics: Preliminary results from a regional aeromagnetic survey (NGU) shows a positive anomaly in the Risfjord area. Fig. 6 shows the anomaly as reported by Lønne.

It could in this connection be noted that the observed po-mineralized troctolites are clearly magnetic.

CONCLUSIONS AND RECOMMENDATIONS.

- (1) New geological information and orientation visits has shown large masses of ultramafic rocks within the Magerøy gabbro complex. These rocks are especially abundant in the W and NW parts of the complex.
- (2) Geology, sulphide prospecting and geophysical information has initially narrowed down the target to the Kamøyvaer area.
- (3) Reconnaissance prospecting revealed irregular occurrences of disseminated po (-cp) mineralization, particularly within troctolitic rocks.

Several of the collected rock samples contain appreciable amounts of nickel ($>0,3\%$), whereas the copper content as a rule is low ($<0,2\%$). The generally low sulphur content ($<1\%$) is discouraging, suggesting silicate nickel.

- (4) Despite the not too exciting prospecting results including the somewhat discouraging assay results, the Magerøy complex still have some merit for further work.

The existence of sulphides within ultramafics and particularly the type represented by sample 16 Ma 13, gives a moderate Ni-potential to the Kamøyvaer area. This is accentuated by excellent location and access conditions, close to roads and the sea.

- (5) As a low priority follow-up program the following is suggested:
 - a) Ground geophysics by the use of VLF-EM and Mag. methods. Approx. 25 line km's in a 200 x 20 m grid.
 - b) Detailed geological mapping dictated by results from a).

OT Rømer

List of reports, memos

- GEUL (1958) : Preliminary report on the geology of eastern Magerøy. (Unpublished NGU-report).
- REITAN (1960) : Magerøy. NGU 212 a pp 55-57.
- FØYN (1967) : Stratigraphical consequence of the discovery of Silurian fossils on Magerøy. (NGU 247 pp 208-222.
- LØNNE (1972) : En gravimetrisk/magnetisk undersøkelse av Magerøy og de nærmeste omgivelser. Unpublished thesis, Univ. i Bergen.
- ROSENQVIST 14.4.72 : Orientation visit to Magerøy (Memo).
- " 29.5.72 : New geophysical/geological info on Magerøy (Memo).
- CURRY 31.5.72 : Preliminary report on the Magerøy gabbro. (Memo incl. geol. map).
- ENGBERG 21.7.72 : Rapport over prospektering på Magerøy. (Memo).
- CURRY 5.9.72. : Notes on the geology of Magerøy gabbro complex (Memo).
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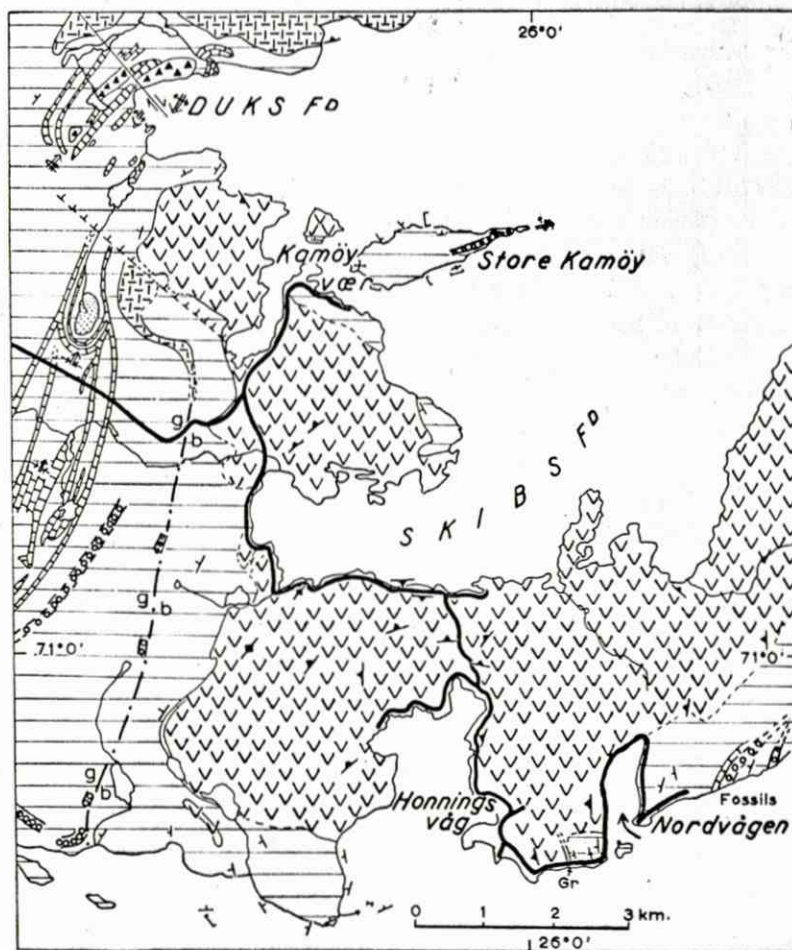
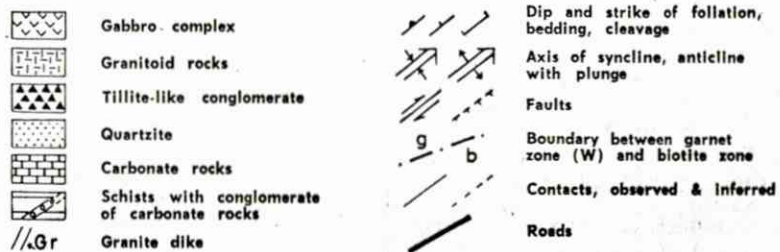
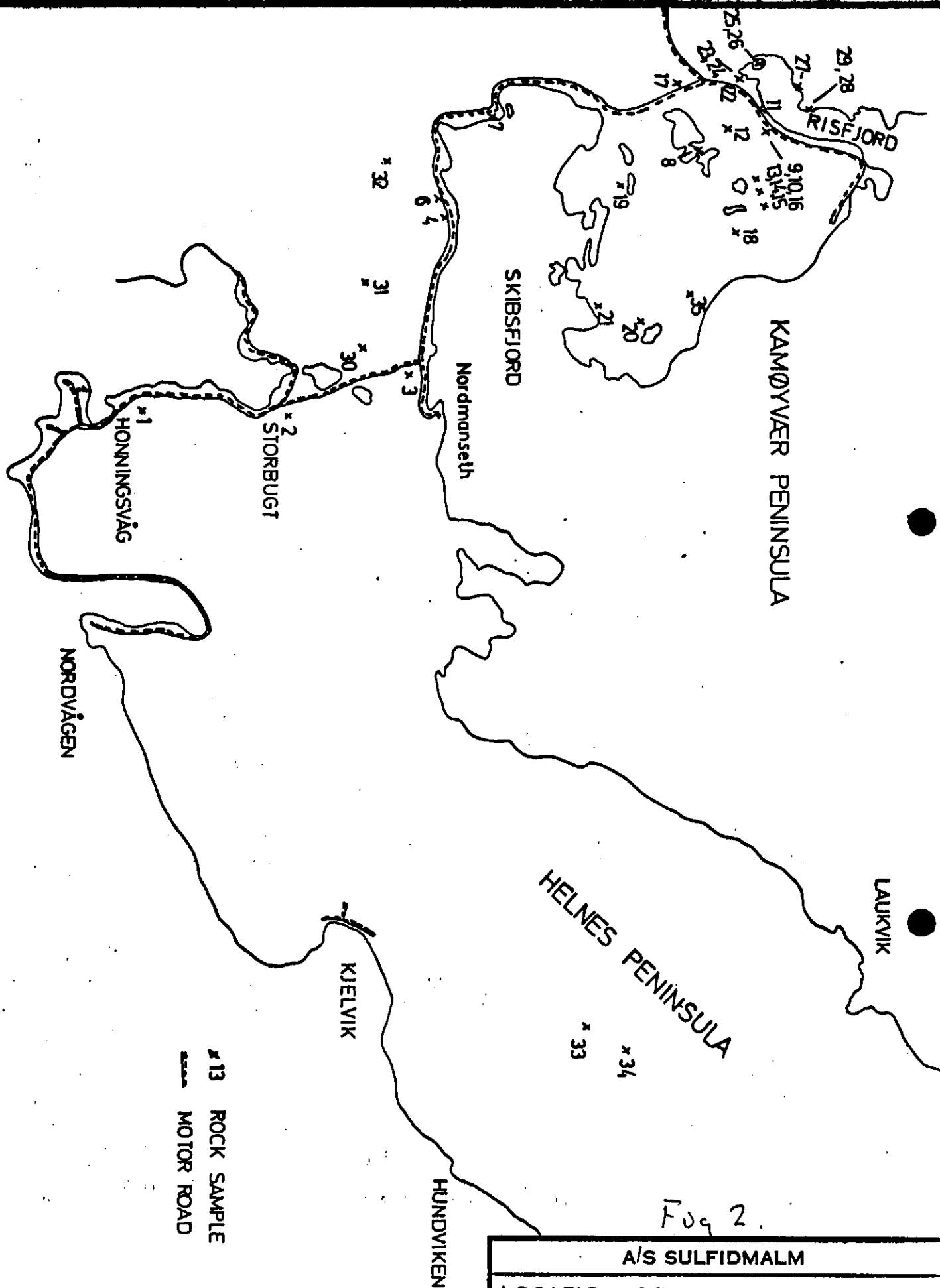


Fig. 1.

Geological map of south-eastern Magerøy by J. J. C. Geul.





Fog 2.

A/S SULFIDMALM	
LOCATION OF ROCK SAMPLES MAGERØY GABBRO W-FINNMARK	
SCALE 1:50 000	DRAWN HøR
DATE 11-72	TRACED BL

REPORT 201-72-16

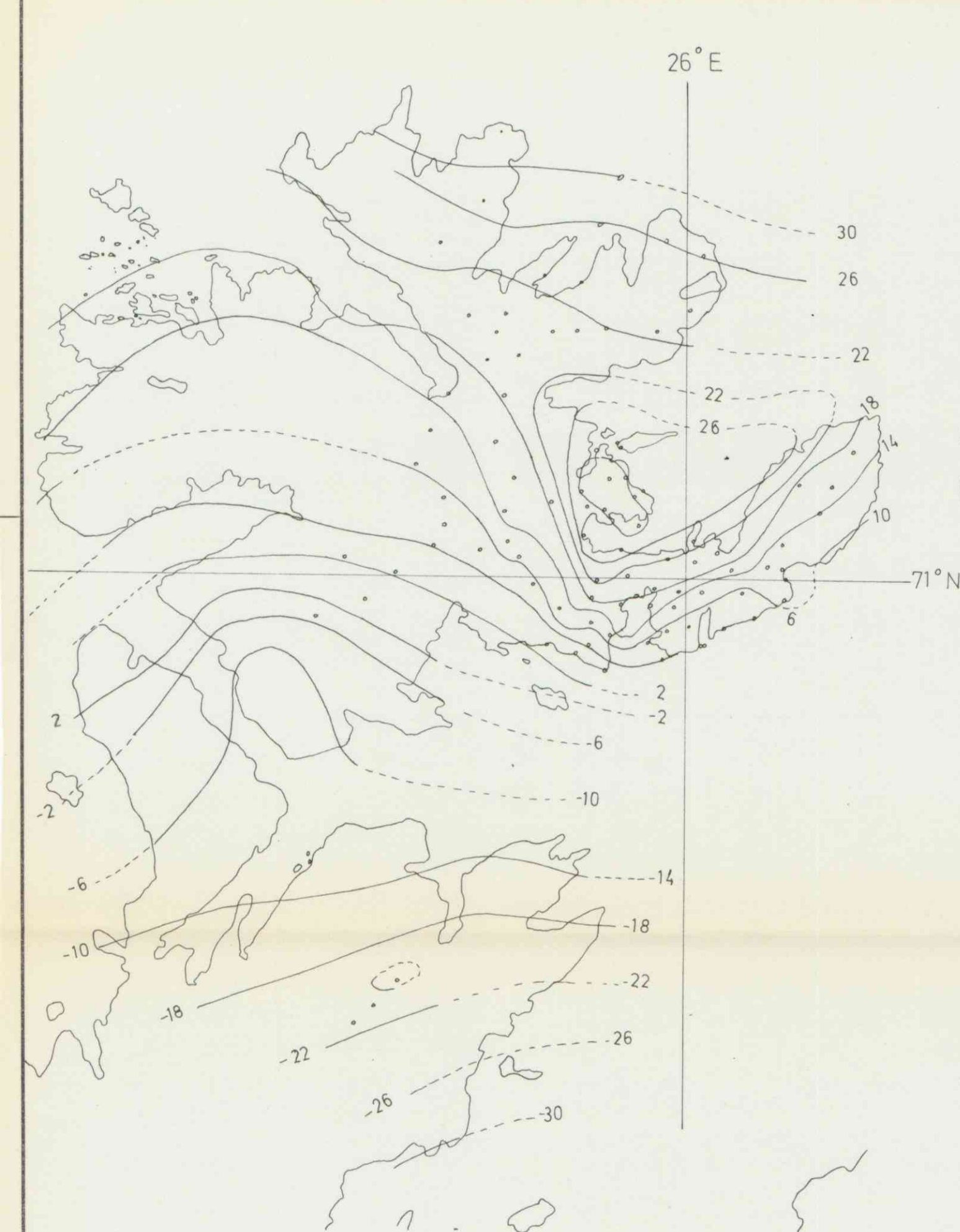


FIG. 3 (1:200 000)
BOUGUER ANOMALIES

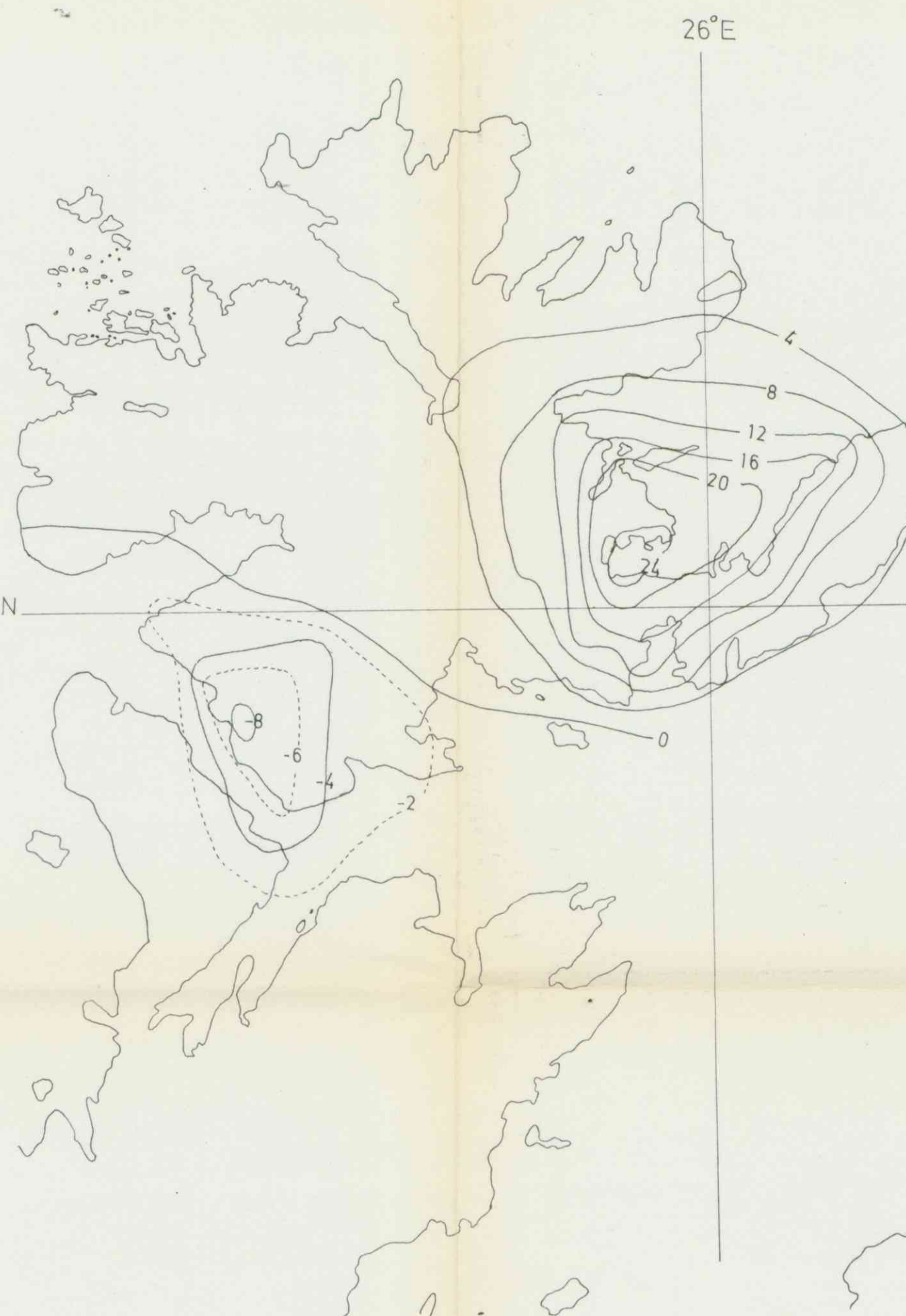


FIG. 4 (1:200 000)
RESIDUAL ANOMALIES

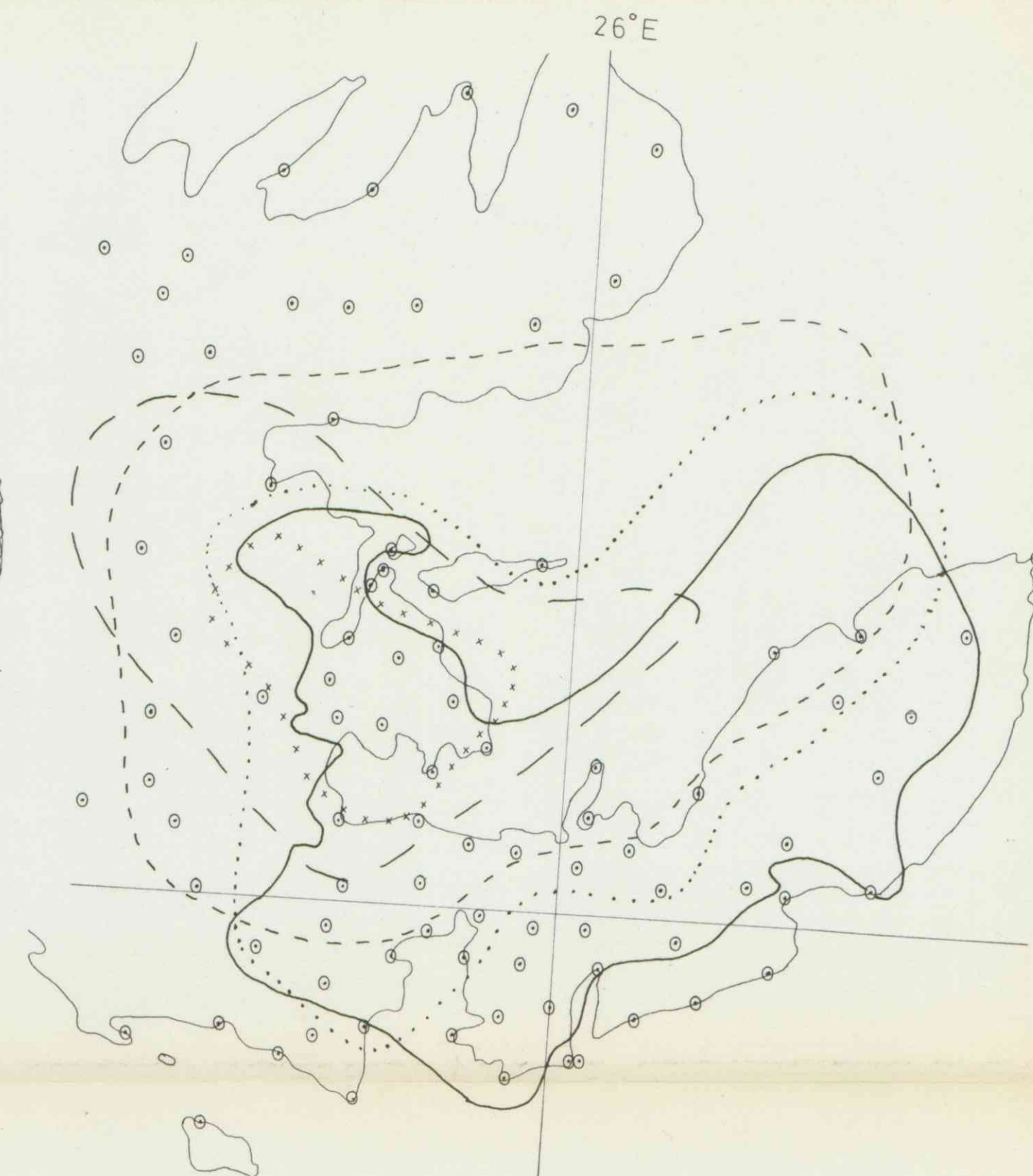


FIG. 5 (1:100 000)

Calculated dimensions of the gabbro complex

• Stations used in calculations

- Z = 0 km
- Z = 1 km
- Z = 3 km
- - - - Z = 4 km
- xxxxx Z = 6 km

MAGERØY GABBRO COMPLEX
GRAVITY
According to Willy Jan Lønne (1972)

SCALE	OBS.	LØNNE
1:200 000	DRAW.	"
1:100 000	TRAC.	BL -72
	CHK.	HaR -72

1/8 SULFIDMALM

MAP NO.
FIG 3-5
REPORT 201-72-16

MAP SHEET

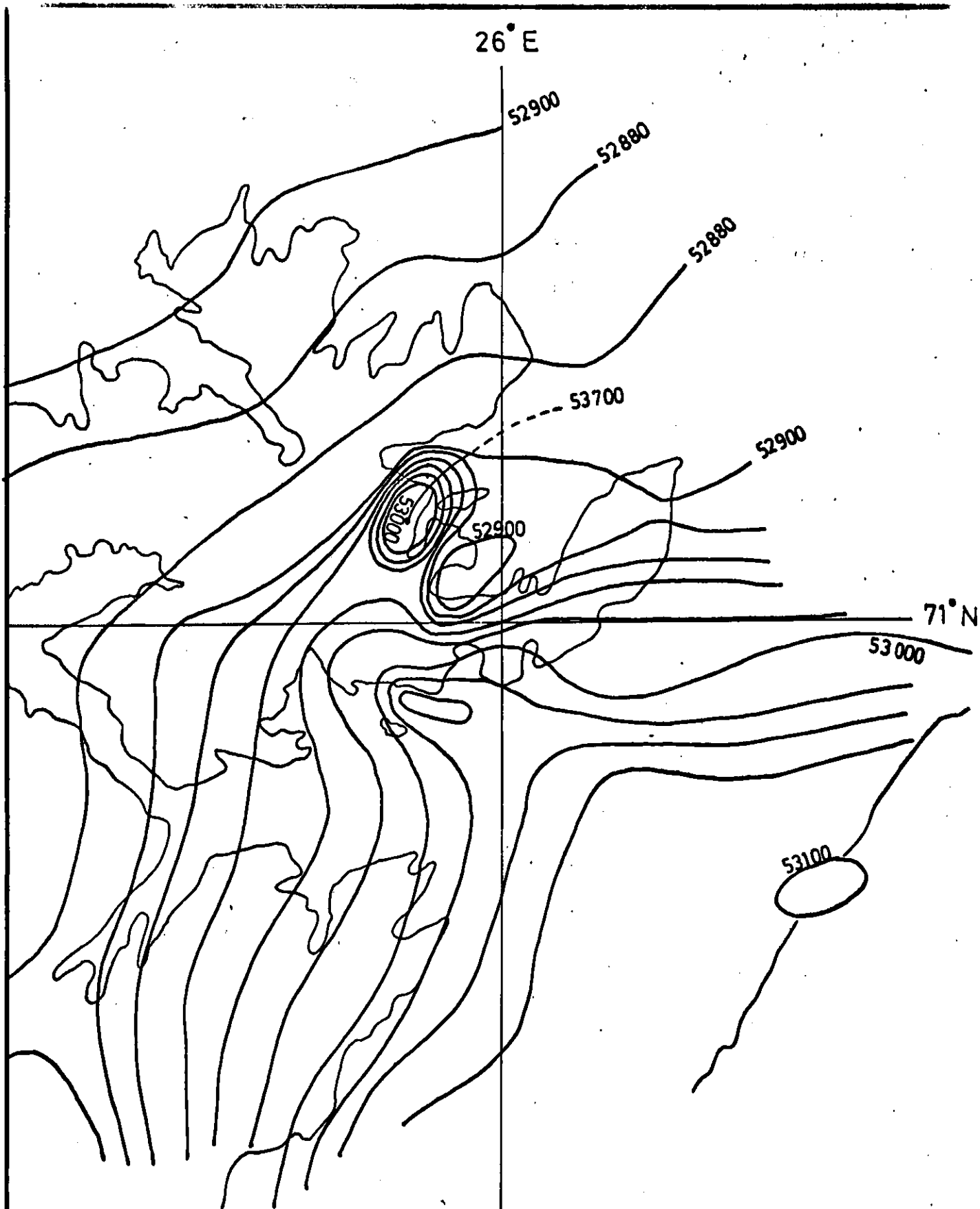


FIG. 6 A/S SULFIDMALM

Magerøy, West-FINNMARK
Aeromagnetic map
(Unpublished data from NGU)

SCALE 1:250 000

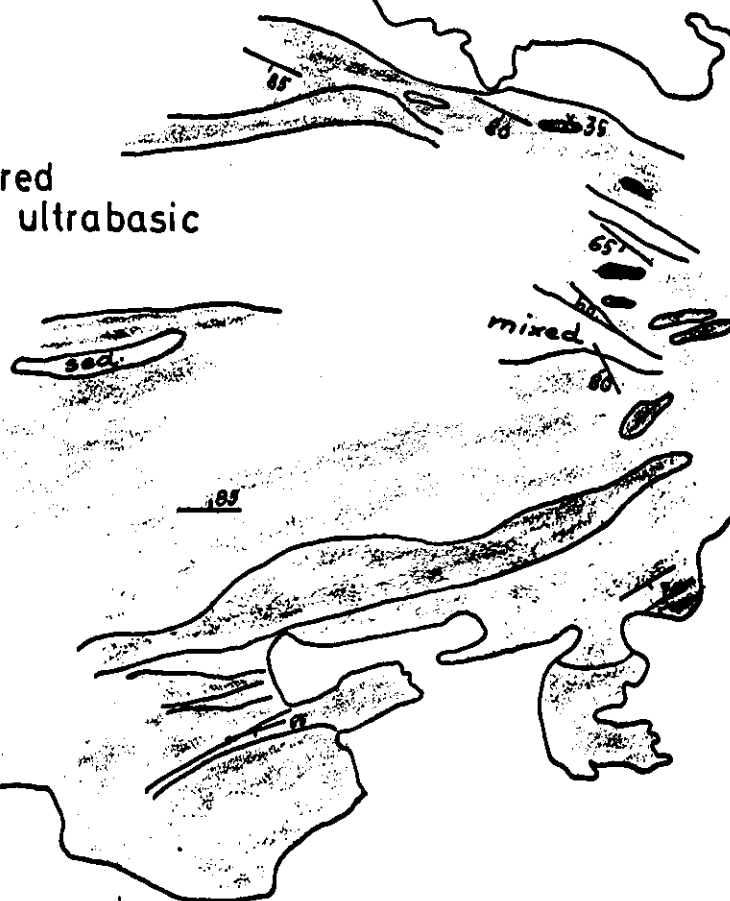
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DATE 11/72

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mixed layered
gabbro and ultrabasic



Ultrabasic



Layered gabbro

MAP 2-201-72-16

A/S SULFIDMALM

Kamøyver halvø, Magerøy
sketch 1 geology

SCALE ca. 1:15000

DRAWN FE 7/72

DATE

TRACED 31 8/72



KEY

- BANDED GABBRO
- HOMOGENEOUS GABBRO
- PERIDOTITE
- NORITE
- PEGMATITE
- GRANITE
- CATALYTIC ZONE
- STRIKE + DIP OF STREAKING
- INTIMATE MIXTURE OF HORNFELS + NORITE ON HELNES HALVØYA
- GREENSCHISTS + HORNFELS AROUND GABBRO COMPLEX

0 100 200 300 400 500m

MAGERØY GABBRO. W-FINMARK PREL. GEOLOGY (JANE CURRY)		Scale 1:15000	Obs. J.C. 20.71
		Draw. E.W.	
		Chk. J.C.	
		Map no. 1-701-72-16	
		Map sheet	

1/2 Sulfidmalm