Bergvesenet

Postboks 3021, 7002 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
BV 1225			Trondheim	**Åpen**
Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
USB	NH 411/68			

Tittel

Preliminary report on field-work in Tvedstrand-Laget District

Forfatter	Dato	Bedrift
M. J. Ryan	1970	Norsk Hydro A/S

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Tvedestrand	Aust-Agder	Østlandske	16122	

Fagområde	Dokument type	Forekomster
Geologi Geofysikk		Høgåsen nikkelgruve
Råstofftype	**Emneord**	
Malm/metall		

Sammendrag

Rapporten inneholder Ryans geologiske rapport samt endel kart fra geofysiske målinger utført i Høgåsen-feltet. Ryan gir i sin rapport følgende konklusjon:

The most interesting area in this district would appear to be the Østeravatnet - Royvatn - Skuggevik area where there may exist a structural control / gabbro intrusion relationship.
The probability of finding economic concentrations of sulphides at or near the surface appears low, but the area ought to be considered for detailed geological mapping and geophysical investigations as it would provide a useful case history.

Jnr. 523/1977. ØB.

Norsk Hydro a.s

1237

Porsgrunn Fabrikker

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3901 Porsgrunn, Norway
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Werner Winsnes
25/4 77

Bergmesteren i Østlandske
bergdistrikt
Postboks 7581, Skillebekk
OSLO 2

Deres ref.	Deres brev av	Vår ref.	Dato
		J. Hejna:ek	4.4.1977

Statens malmanvisninger i
Tvedestrand kommune.

Avtale mellom Den norske Stat v/Industridepartementet og Norsk Hydro a.s (tidligere Aktieselskabet Rjukanfos) om opsjon på Statens nikkelmalmanvisninger ved Høgåsen nikkelmalmgruve, Tvedestrand.

Etter denne avtale hadde Hydro leiet av Staten 14 malmanvisninger i Tvedestrand herred. Staten var ifølge avtale uten ansvar for påvisningen av funnpunktene. I den utstrekning funnpunktene kunne påvises, skulle disse avmerkes på synlig og varig måte og innplottes på kart. Tross iherdig leting har man ikke - i alle fall ikke med tilstrekkelig sikkerhet - funnet anvisningene/funnpunktene, og disse er derfor ikke varig merket i terrenget.

Hydros undersøkelse av Høgåsen malmfelt startet med oppfølging og komplettering av de geofysiske undersøkelser som Geofysisk Malmleting (GM), Trondheim gjennomførte vinteren 1946/47. Det henvises til G.M.'s "Rapport over forsøksmålinger II Høgåsen nikkelgrube", datert 5.7.1947. Rapporten finnes både på NGU og hos bergmesteren.

Hydro målte i 1969 med sitt bærbare EM Gun 55/88 instrument noen profiler over selve Høgåsen-gruben. Resultatene man fikk ved denne målingen, var sammenfallende med de resultater GM fikk i 1947. Vårt instrument, med kabellengde på 40 m, registrerte bare til ca. 30 m dyp, og rakk da sannsynligvis

til mindre dybde enn instrumentet/utstyret som GM brukte.

Sommeren 1970 har Dr. M. J. Ryan kartlagt for Hydros regning området Tvedestrand - Laget. Vedlagt følger hans rapport
./. "Preliminary report on field-work in Tvedestrand - Laget distrikt".

Hydro kompletterte sine geofysiske målinger fra 1969 med nye elektromagnetiske og magnetiske målinger syd, sydvest og sydøst for Høgåsen gruben i 1970/71.
./. Vedlagt følger kart 5F 66842 c og 5F 66843 c, hvor også elektromagnetiske målinger utført på isen over Østeråvatnet er inntegnet.
./. På kartet 5F 70490 er tegnet magnetiske målinger (målt med GM magnetometer type 59 A) over samme området.
./. Elektromagnetiske og magnetiske målinger målt sydøst for Østeråvatnet og nord for Røyvatn er tegnet på kart 5F 69819, 5F 69820 og 5F 69821. Samtlige kart følger vedlagt.

Etter avtale med Industridepartementet skulle Hydro etter avtalens utløp sende til bergmesteren rapport om de undersøkelser som ble foretatt i forbindelse med denne kontrakt og de resultater den har gitt, med kart over det område som er undersøkt. På kartet skulle røskinger, diamantborhull, åpningsdrifter o.l. være tegnet inn.

Vi vil opplyse at Hydro ikke har utført noen form for undersøkelsesboring og heller ikke noen røskingsarbeider på Høgåsen-feltet.

Skulle Industridepartementet trenge flere opplysninger i forbindelse med leieavtalen, ber vi Dem vennligst kontakte overing. Jan Hejna, Norsk Hydro, Porsgrunn.

Vi vil benytte anledningen til å takke Industridepartementet for avtalen.

Med hilsen
Norsk Hydro a.s

Jan Hejna

Bilag.

PRELIMINARY REPORT ON FIELD-WORK IN

and

TVEDESTRAND-LAGET DISTRICT.

Order No. T.65078/HK.

Summer of 1970.

Project 411/68. Account 210.04.

H.J. Ryan.

TVEDESTRAND - LAGET DISTRICT

Introduction

For the prospecting in this southern region it was intended that geological maps covering Interesseomrader 1 and 3 would be available. The 1:15,000 geological map of the country around Tvedestrand obtained from Dr. Field covered anomalies 3699, 2774 and part of 2810 in Interesseomrade 1 and copies of 1:15,000 field-slips of the basic igneous complex north of Laget (part of anomali 3349) were provided by Dr. Starmer (see Map III). For the other areas, the 1:100,000 geological map by Touret (1967) was the only coverage. This meant that in Interesseomrade 3 and in the anomalies of Interesseomrade 1 not mentioned above, some time was spent trying to add detail to the Touret map.

The general geology of this area appears to be very similar to that of Bamble. A deeper level of the Metamorphic belt is probably represented, with charnockitic rocks (Arendalites) outcropping along the coast.

Interesseomrade 3

Touret's map shows this area to be composed of NE/NNE-striking "undifferentiated Bamble migmatites, graphite paragneiss, quartzites - more or less feldspathic, Bamble granitoids, amphibolite and orthoamphibolite (traces of ophitic texture under the microscope)". Beeson (personal communication) reported that the area was made up dominantly of granitic gneiss and amphibolite.

The present work confirmed that the area consists of migmatitic granitic gneiss - occasionally with sillimanite, and garnetiferous amphibolite - occasionally grading into massive amphibolite/metagabbro. Thin, rusty biotite (± graphite, pyrite) schists occur in the gneisses. 1-2 m. dolerite dykes trend 160-180° and contain pyrite.

Basic igneous rocks, which might account for the high Ni, Co, Cu anomalies in the area, were not seen. Chalcopyrite occurs as a very minor accessory mineral in a pegmatite in amphibolite about 1 km. NW of Östebö; pegmatites in granitic gneiss occasionally contain pyrite. The marked valley feature about 1.2 km. NE of Sandvatn (aerial photograph C13, 965) shows mylonitic gneisses with sillimanite and graphite and minor chalcopyrite, pyrite and arsenopyrite (orthorhombic crystals). Rusty amphibolites may contain disseminated pyrrhotite and pyrite - but these are few and form only thin 2 - 3 M. wide rust zones.

Humus anomaly 3716 is, according to Touret's map, from the NE end of a zone of orthoamphibolite within amphibolite. The present work showed the area to consist of mixed migmatitic gneiss and amphibolite - the only obvious sulphide-bearing rock being a 160°-trend dolerite dyke.

Interesseomrade 1

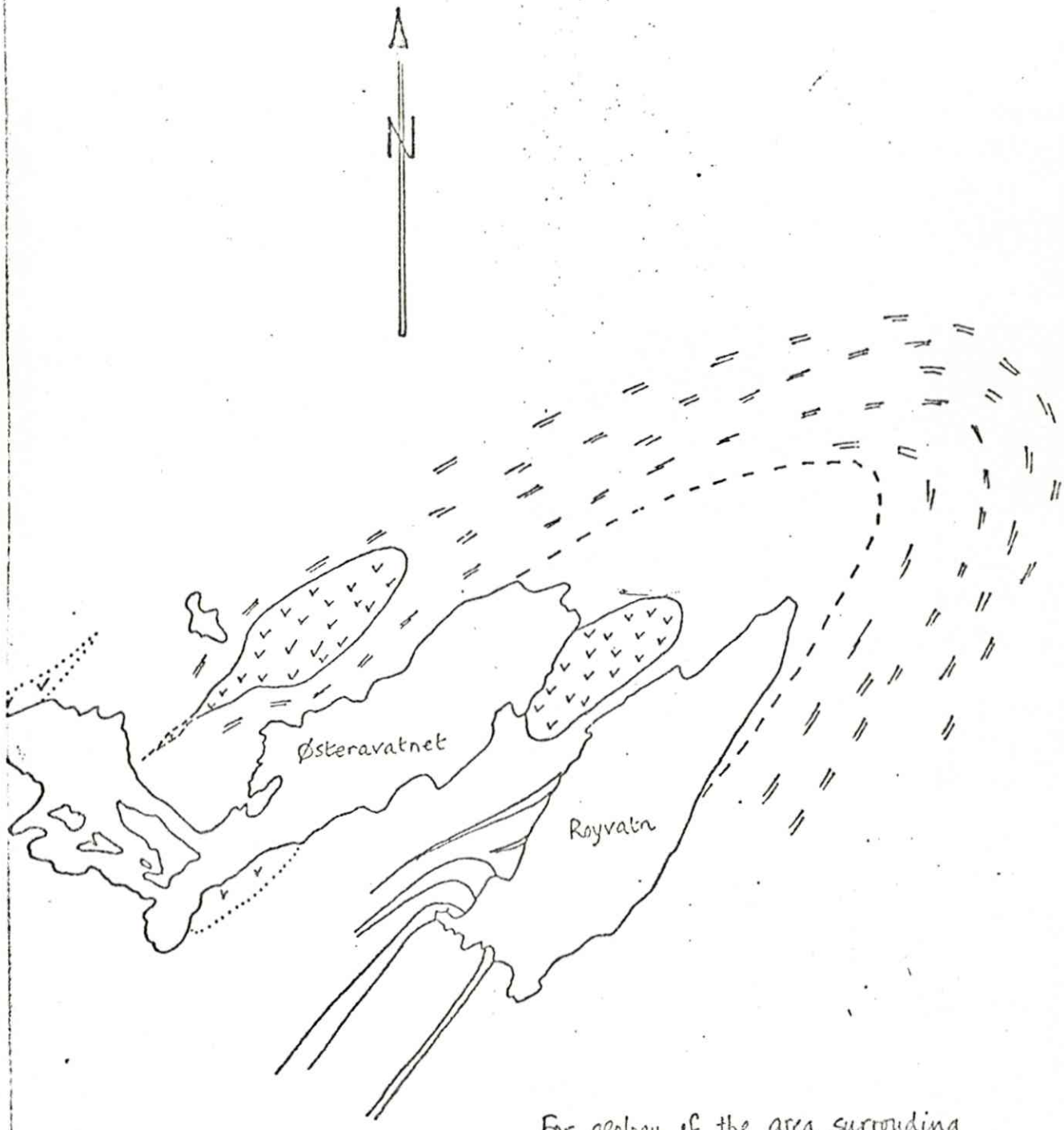
The geochemical anomaly areas of the southwestern part Interesseomrade 1 do not appear to correlate with any known basic igneous rocks. Remarkably, the Østeravatn-Royvatn-Skuggevik (west of Tvedestrandfjord) region, which contains sulphide bearing gabbroic rocks and the Högasen Ni-Cu deposits, does not form an anomaly area. Since Field's 1:15,000 map has been drawn up from road, coast and inland traversing, photointerpretation and the incorporation of undergraduate mapping projects (i.e. detailed reconnaissance type mapping) there may be more of significance to add to what is already

known of this area. It may be that a structural geology-gabbro formation relationship can be established for the area east, southeast and south of Tvedestrand. Large NE-SW trending synformal folds occur around Østeravatn-Royvatn and to the east of Sagesund. It is probable that the complementary antiform (assuming the synforms are of the same age) is sheared out by the Dypvaag-Sagesund fault and a second fault on the western side of Tvedestrandfjord. With the old Ni-Cu mine at Högasen, known sulphide-bearing basic igneous rocks elsewhere and known large structures, some time was spent examining the contacts etc. of basic bodies at Högasen, Royvatn and Skuggevik even though the area was outside the specific geochemical anomaly areas of Interesseomrade 1. A consideration ought to be given to further detailed geological and geophysical work.

Østeravatnet-Royvatn-Skuggevik Area:

Fig. 2 is a sketch of the Østerorvatnet-Røyvatn area showing the location of the two sulphide-bearing gabbros. The contacts of both bodies were traced and they turn out to be positioned slightly differently to those shown on Field's map. At Högasen the surrounding granitic gneisses dip steeply south and at the northeastern margin of the gabbro strike more or less at right angles to the contact. To the southwest, the gabbro becomes a thin, streaked, 'pinch and swell' type layer. There is little or no sulphide (except along the central part of the southeastern side where it has been mined). Contact rocks vary from biotite-rich gabbro to coarse grained dark metagabbro and biotite amphibolite.

The body between the two lakes shows signs of differentiation. Coarse, dark green peridotite and sulphides occur along the western lakeside margin (see Field's map). At the southwestern contact the border zone shows three facies: garnetiferous amphibolite - medium grained pale greyish-green



For geology of the area surrounding the gabbros, see Field's map.

FIG. 2.

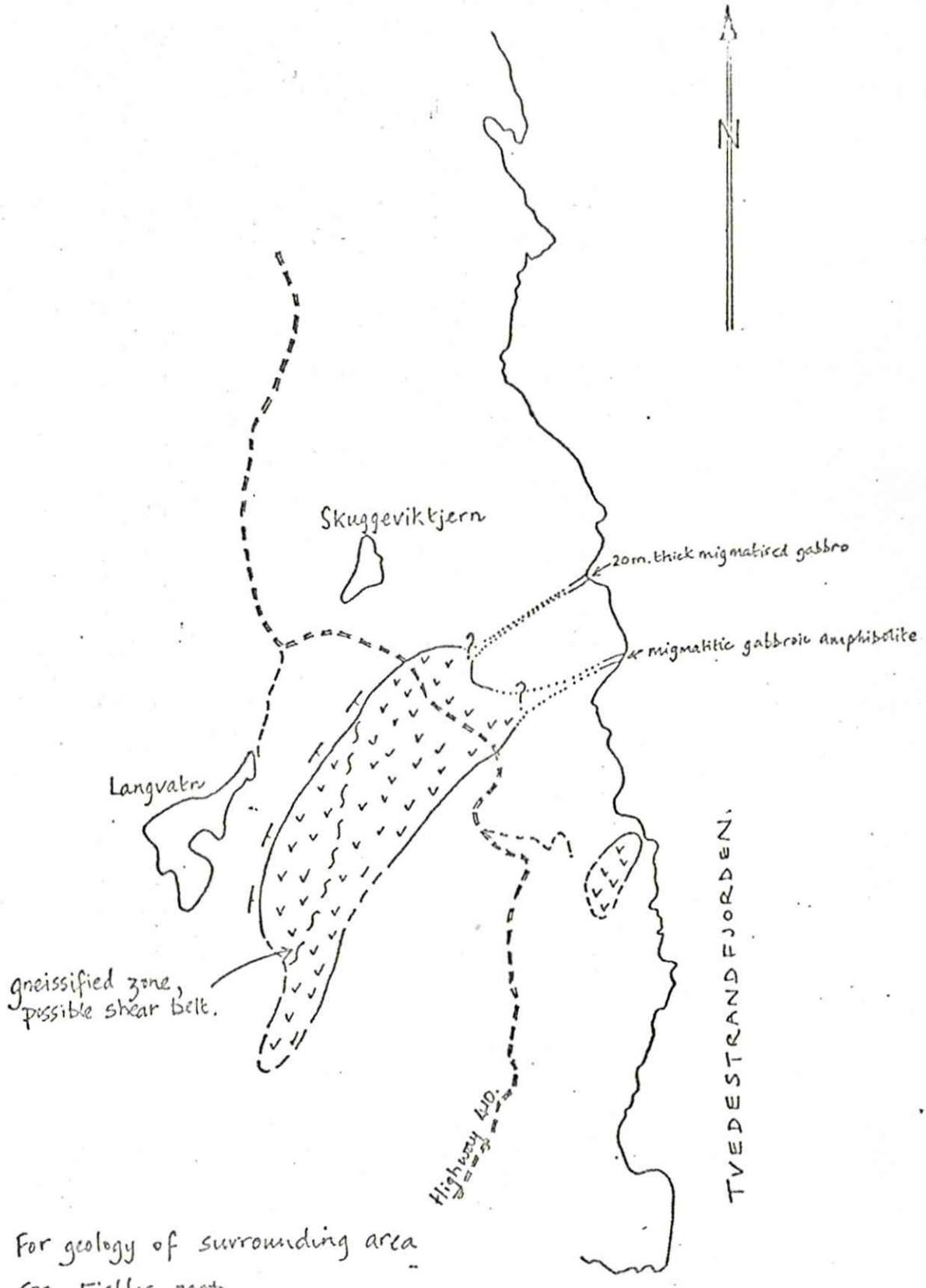
"dolerite" - coarse grained, dark coloured gabbro with blebs of pyrrhotite, chalcopyrite and ?graphite. The amphibolitised margin may be very thin or absent; the country rocks, consisting of biotite schist and gneiss (sometimes rusty and with graphite) and biotite-garnet gneiss dip beneath the gabbro. Near the northern contact a small trial 'scherp' shows disseminated pyrrhotite-chalcopyrite.

Both the igneous bodies mentioned above appear to be within the northwestern limb of the synform which, from Field's map, has an axial plane trace running through Røyvatn, more or less parallel with the northwestern shore. The intrusions seem to be younger than the fold. The position of the gabbros north and east of Sagesund (reported to be lacking sulphides) would appear to lend weight to the idea of structural control over gabbro emplacement.

Fig. 3 is a sketch of the Skuggevik area showing the position of the two gabbro masses. The small southern mass contains pyrrhotite and water from a well on the southern margin smells of H_2S. The larger body is complex and the relationship with the two "legs" of migmatised metagabbro that outcrop at the sea coast is obscured by the dense forest between there and highway 410. West of the road Field shows three separate masses, two of them containing pyroxenite. Recent mapping by an undergraduate from Nottingham suggests that the three masses are one, split by a mylonitic, gneissified zone. This northern gabbro apparently contains patches with minor sulphides within it but none were seen during the present work which concentrated mainly on the margins.

Anomaly 3699

This area is made up of amphibolite and metasediments - quartz - sillimanite - phlogopite schists and quartz-cordierite gneiss (see Field's



For geology of surrounding area see Field's map.

FIG. 3

map). Possibly the high Ni and Cu values are associated with the amphibolites.

Anomalies 2774 and 92

These two anomaly areas are developed on migmatitic granitic gneiss and quartz-sillimanite-phlogopite schist. There are no prominent basic igneous or metamorphic rocks - the problem of the very high Cu value remains unsolved.

Anomaly 2810

Amphibolite, quartzite, granitic gneiss and quartz-sillimanite-phlogopite schist make up the area. The humus Ni and Cu anomalies are from a gneissic area, apparently without thick amphibolites; the stream sediment Ni anomaly could be due to the proximity of amphibolite.

Anomaly 2783

This area consists mainly of metasedimentary rocks, some of which contain minor pyrite and chalcopyrite. The road adjacent to Hofsdalsvatnet shows rusty biotite-graphite-garnet schist and gneiss with occasional chalcopyrite. 350 m. NNW of Rönningen to the east of the road (on a lake not marked on the 1:50,000 map) a 5-8 m. wide rust zone occurs in mixed biotite gneiss and schist with quartz-cordierite-sillimanite lenses. The whale-back feature west of Myra is formed of massive garnet-hornblende gneiss and hornblende granite strikes NE along the southern part of the area. The high humus Cu anomaly may be associated with a rust zone similar to those mentioned above.

Anomalies 2963 and 189

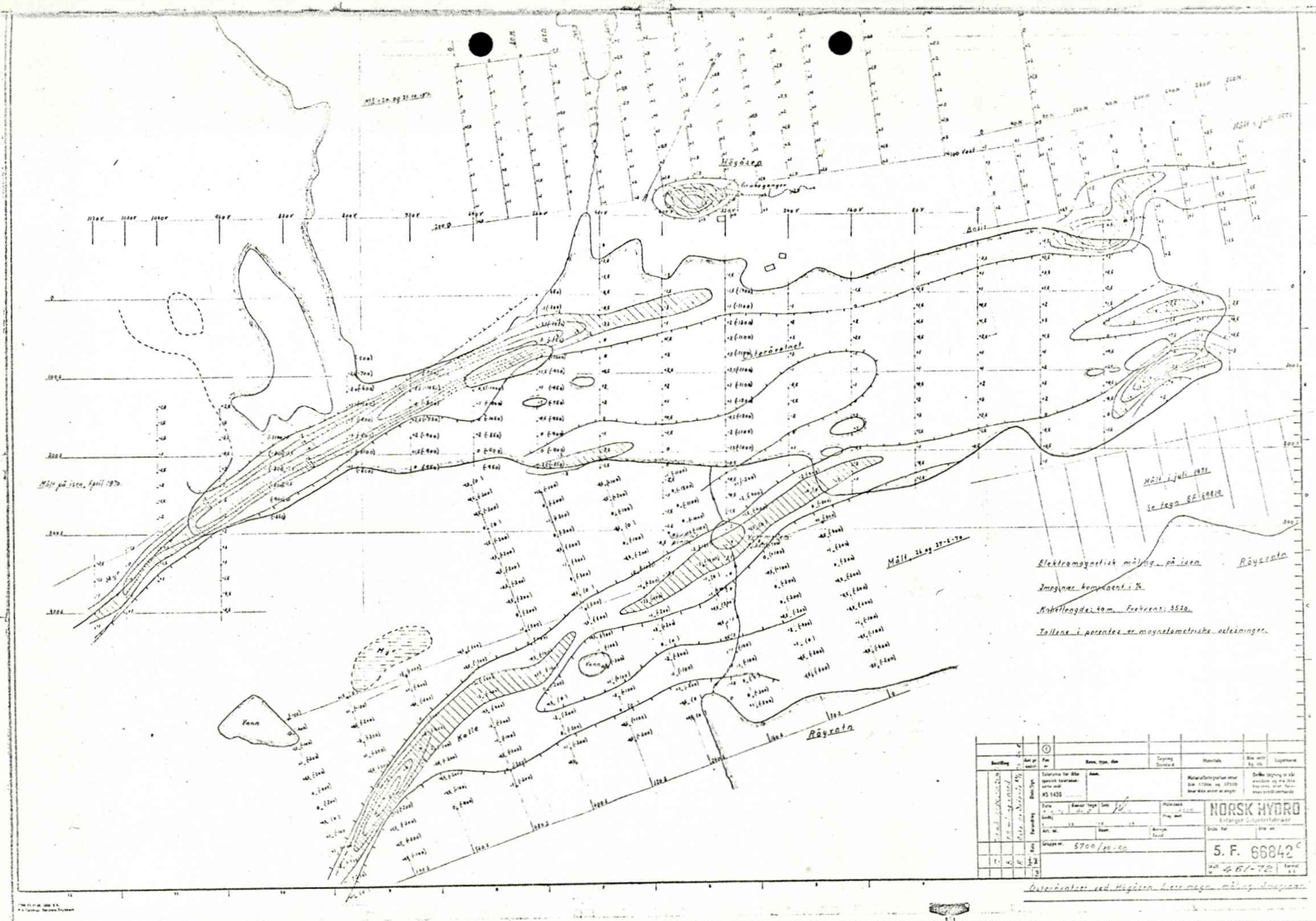
The area northwest of Lundevatnet and Songevatnet, judging from the excellent exposures in the E 18 cuttings and reports from Starmer, consists chiefly of migmatitic gneisses and amphibolite. Southeast of Lundevatnet, Högfjell (looking like a typical gabbro hill of the Risør-Sondeled district) consists of mixed biotite gneiss, biotite-graphite schist (? rusty due to weathered sulphides) and garnetiferous amphibolite which may contain rusty, cross-cutting veinlets with minor pyrrhotite.

Anomaly 3349

Two days were spent on the large basic mass north of Laget traversing the outer contact and inner junction against metasediments using field-slips from Dr. Starmer. Virtually the whole complex has less sulphide than the normal foliated, banded etc. amphibolites of the region. Only a very coarse-grained, hornblende-rich facies shows conspicuous sulphide (and apatite) and even then the amount of sulphide is no more than that of a minor accessory mineral.

c) Tvedestrand-Laget District

The most interesting area in this district would appear to be the Østeravatnet-Royvatn-Skuggevik area where there may exist a structural control/gabbro intrusion relationship. The probability of finding economic concentrations of sulphides at or near the surface appears low, but the area ought to be considered for detailed geological mapping and geophysical investigation as it could provide a useful case history.



Högåsen
Österåvatnet
Målt på isen April 1970.
Målt i juli 1971
Se tegn. 5F 69810
Målt 26 og 27-5-70
Røyvatn
Vann
Myr
Kolle
Basalt
Elektromagnetisk måling på isen
Imaginær komponent i %
Kabellengde: 40 m. Frekvens: 3520.
Tallene i parentes er magnetometriske avlesninger.
NORSK HYDRO
5. F. 66842
5700/40-50
461-72

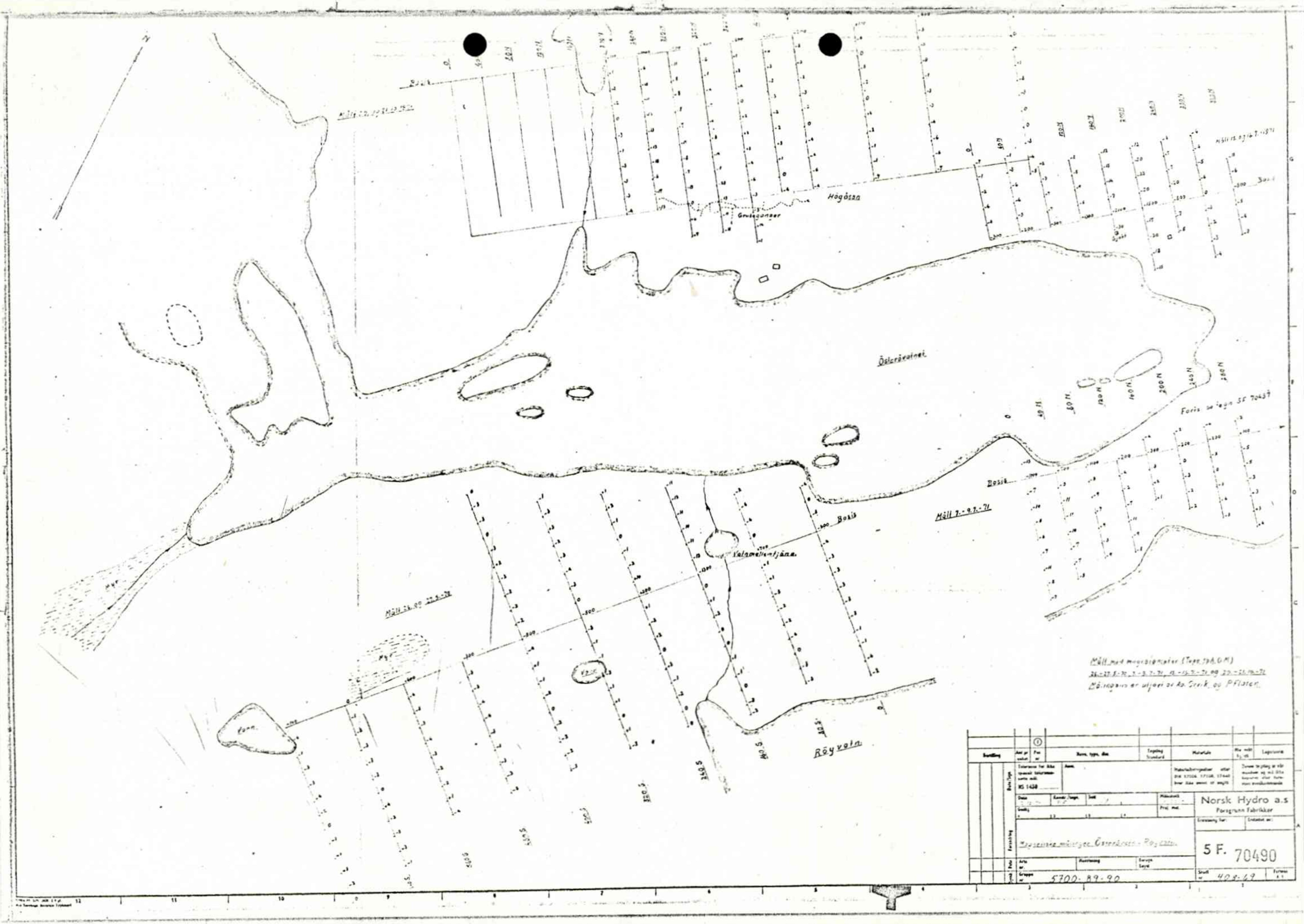
NORSK HYDRO

Gruppe nr. 5700/40-40

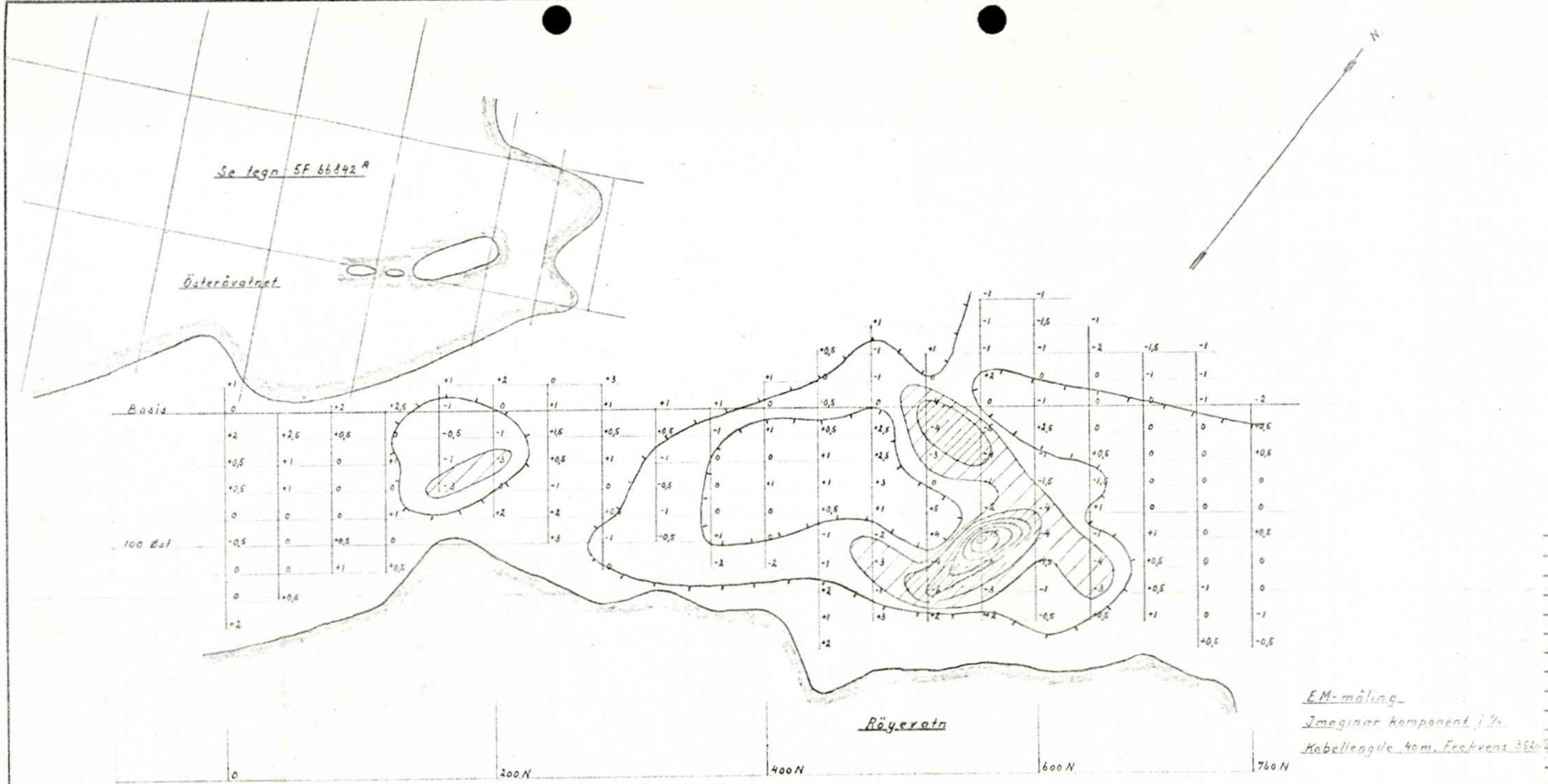
5. F. 66843c

461-73

Österövatnet ved Högåsen. Elektromagn. måling. Reell.



Høgåsen
Basis
Mål 7.-9.7.-71
Røyvatn
Myr
Norsk Hydro a.s
Porsgrunn Fabrikker
NS 1430
5 F. 70490
5700-89-90
408-69



EM-måling

Imaginær komponent i %

Kabellengde 40 m. Frekvens 3520 Hz

Målt i juli 1971 av Flaten

Bestilling	Ant pr enhet	Pos. nr	Navn, type, dim.	Tegning Standard	Materiale	Nto. vekt kg/stk	Lagerrom
		①					

Toleranse for ikke spesielt toleransesatte mål NS 1430

Anm.

Materialbetegnelser etter DIN 17006 og 17100 hvor ikke annet er angitt

Denne tegning er vår eiendom og må ikke kopieres eller forevises uvedkommende

Dato/Sign. — Forandring — Rute — Symbol — Fet.

Dato	Konstr./tegn	Sett	Målestokk
9-9-71	Ro. B.		1:2000

Godkj. 1 | 2 | 3 | 4

Proj. mot

Art. nr. — Navn — Beregn. Beysl.

Gruppe nr. 5700/89-90

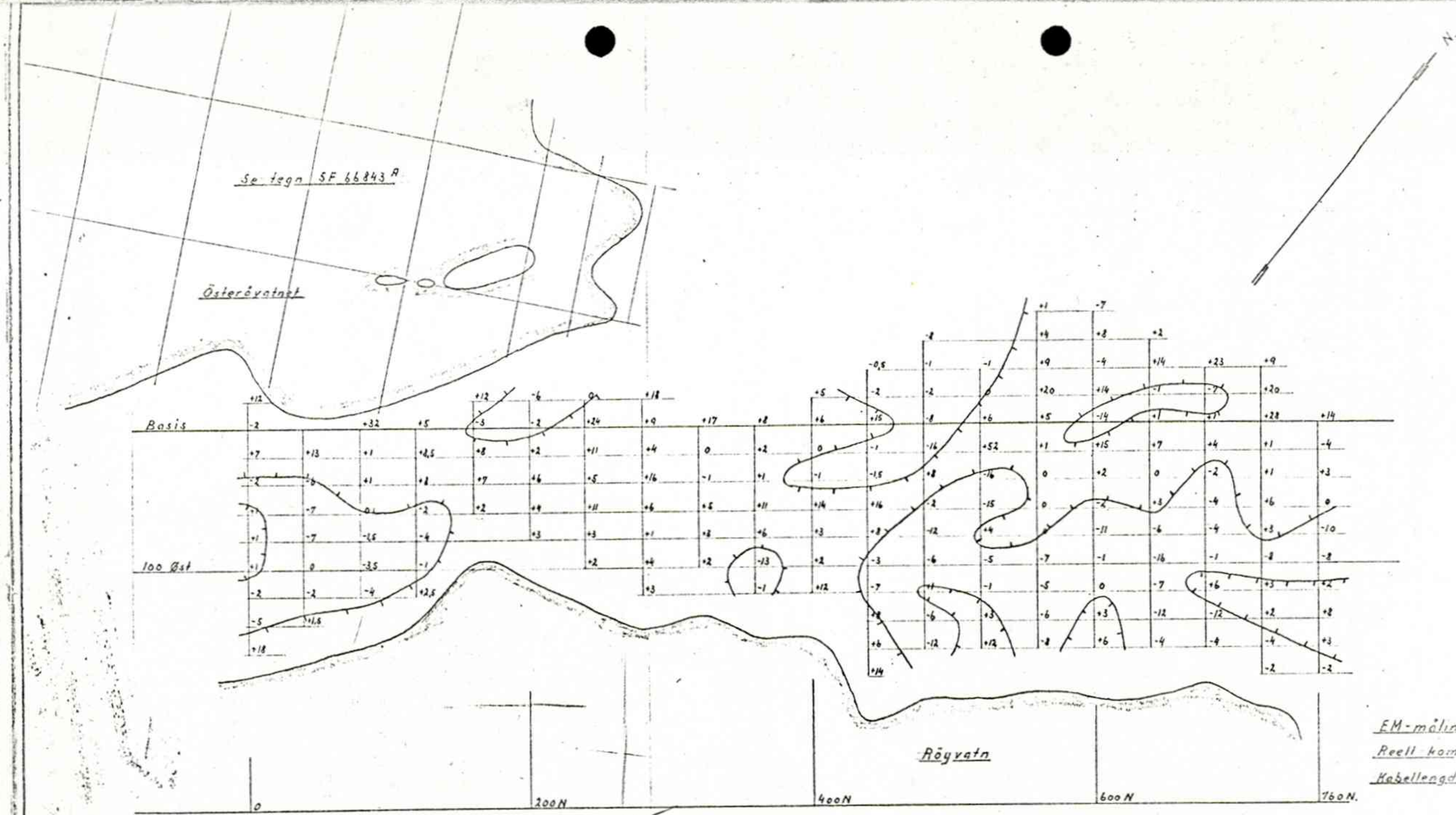
NORSK HYDRO
Eidanger Salpeterfabriker

Erstn. for: — Erst. av:

5. F. 69819

Skuff nr. 495-190 — Format A 2

EM-måling ved Østerâvatn, nordøst. Imaginær.



EM-måling.

Reell komponent i %

Kabellengde 40 m. Frekvens 3520 c/s

Målt i juli 1971 av Flaten

Bestilling	Ant. pr. enhet	Pos. nr.	Navn, type, dim.	Tegning Standard	Materiale	Kto. vekt kg/stk	Lagernorm
		①					

Toleranse for ikke spesielt toleransesatte mål. NS 1430

Anm.

Materialbetegnelser etter DIN 17006 og 17100 hvor ikke annet er angitt

Denne tegning er vår eiendom og må ikke kopieres eller forevises uvedkommende.

Dato: 9-9-71 | Konstr./tegn.: Ao. B. | Sett: | Målestokk: 1:2600 | Proj. met.

Godkj.

Art. nr. | Navn | Beregn. Bevil.

Gruppe nr. 5700/89-90

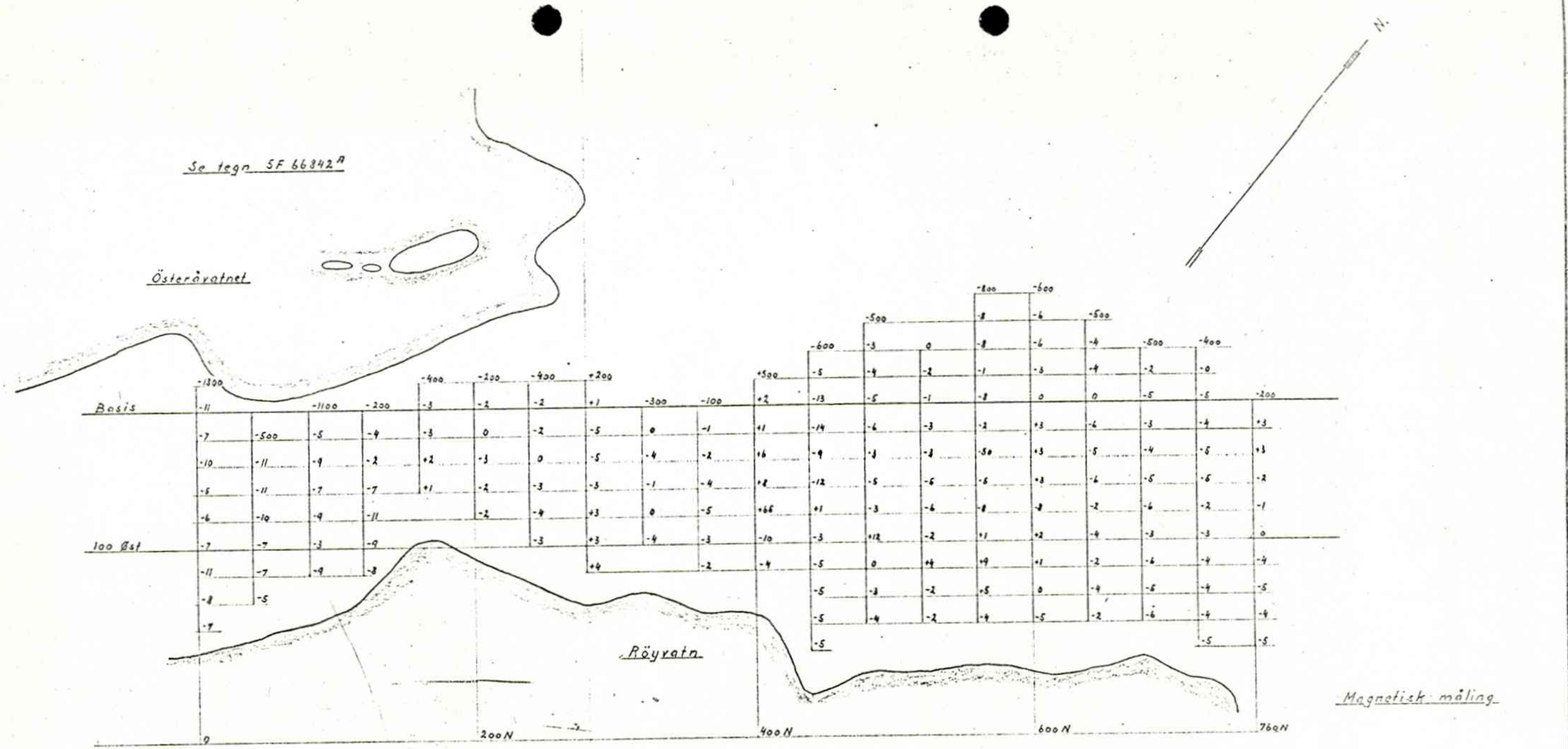
NORSK HYDRO
Eidanger Salpeterfabriker

Erstn. for: | Erst. av:

5. F. 69820

Skuff nr. 495-191 | Format A 2

EM-måling ved Østerøvatnet nordøst. Reell.



Bestilling	Ant pr. enhet	Pos. nr. (1)	Navn, type, dim.	Tegning Standard	Materiale	Nto. vekt kg/stk.	Lagernorm

Toleranse for ikke spesielt toleransesatte mål. NS 1430

Anm.

Materialbetegnelser etter DIN 17006, 17100, 17440 hvor ikke annet er angitt.

Denne tegning er vår eiendom og må ikke kopieres eller forevises uvedkommende.

Dato 13-9-71 | Konstr./tegn. Ar. B. | Sett | Målestokk 1:2000 | Proj. mst. | Godkj.

Norsk Hydro a.s
Porsgrunn Fabrikker

Erstatning for: | Erstattet av:

5 F. 69821

Arts nr. | Henvisning | Beregn. Bøyd.

Gruppe nr. 5700/99-90

Skuff nr. 495-192 | Format A 2

Magnetisk måling ved Österåvatn, nordöst.