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Sammendrag Several copper anomalies were found near Langtjernet at the eastern end of Sanddølafeltet during the regional stream sediment survey in 1973 (NGU oppdrag nr. 177, Grongprosjektet, kartblad Andorsjøen 1823 I). This locality lies mostly within the Sanddøla trondjemite but includes the contact with a greenstone unit. Some samples were subsequently analysed for molybdenum and several were found to be anomalous. This led G. Gale and R. Kvien to conclude "we interpret the Cu - Mo mineralisation occurring near the roof of an intruded trondjemite as a porphyry Mo type of deposit" (NGU Rapport nr. 1189, page 21). This preliminary report is to briefly describe the field work and record some of the results which may have a bearing on which areas of Grongfeltet merit claiming of mineral rights. The final report will be ready early in 1975.				

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"Follow-up of copper and molybdenum geochemical anomalies in the southern part of Grongfeltet: - Field work and analytical results for Cu and Mo".

Rapporten konkluderer med at det kan være muligheter for funn av lavprosentlige kobber/molybdenforekomster i det sydlige Grongfelt. Sikring av bergrettighetene før "Grongloven" løper ut bør overveies. Et kopi av det foreløpige resultatkart er allerede oversendt Viggo Wiik, som vi har forstått vil kunne forestå det praktiske arbeid i forbindelse med eventuell utlegging av mutingspunkter.

Vi ber om å bli holdt underrettet om de videre skritt Styringsgruppen finner å ta.

Med hilsen
KJEMISK AVDELING

Aslak Kvalheim
direktør

David Sm
geokjemik

Oppdrag:

GRONGPROSJEKTET

NGU Rapport nr. 1289 - Preliminary Report

Follow-up of copper and molybdenum geochemical
anomalies in the southern part of Grongfeltet: -

- Field work and analytical results for Cu and Mo.

October 1974.

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Norges geologiske undersøkelse

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TEGNINGER

- 1289-01 The Fremstfjellet and Amøbetjernet Areas.
1289-02 The Eastern Part of the Trondhjemite.

1. INTRODUCTION

Several copper anomalies were found near Langtjernet at the eastern end of Sanddølafeltet during the regional stream sediment survey in 1973 (NGU oppdrag nr. 1177, Grongprosjektet, kartblad Andorsjøen 1823 I). This locality lies mostly within the Sanddøla trondhemite but includes the contact with a greenstone unit. Some samples were subsequently analysed for molybdenum and several were found to be anomalous. This led G. Gale and R. Kvien to conclude "we interpret the Cu - Mo mineralisation occurring near the roof of an intruded trondhemite as a porphyry Mo type of deposit" (NGU Rapport nr. 1189, page 21).

The author's task in 1974, as part of the Trondhemitt-prosjektet, was to confirm and accurately locate the anomalous streams, to examine outcrops partly in conjunction with G. Gale, and to carry out a pilot project of rock sampling.

This preliminary report is to briefly describe the field work and record some of the results which may have a bearing on which areas of Grongfeltet merit claiming of mineral rights. The final report will be ready early in 1975.

2. FIELD WORK

282 stream sediment samples were systematically collected from an area (Fremstfjell-prosjektet) delineated by reference to the distribution of Cu + Mo, Cu and doubtful Mo anomalies found during the 1973 regional survey. All sample sites were marked with wooden stakes (tegning 1289-01).

115 rock samples, of which 55 are for chemical analysis and 60 for petrological studies, were collected from a smaller area defined by the larger stream sediment anomalies and known mineralisation from 1973. These samples were not collected at regular intervals, but from scattered mineralised and unmineralised outcrops as a pilot project in order to assist planning of a possible future detailed systematic rock sampling project (tegning nr. 1289-01).

20 soil samples and 4 rock samples were collected around a chalcopyrite - pyrite occurrence within the trondhemite found by G. Gale at a prospect at the side of a lake, henceforth referred to as Amøbetjernet, which is 0.5 km south of the Fremstfjellet area (tegning 1289-01).

35 stream sediments and 12 rock samples were collected during a few reconnaissance traverses through the central parts of the trondhemite intrusion between Kolitjernet and Nesåelva (tegning 1289-02).

396 stream sediment samples were collected by T. Sjørdal to the north - east of Fremstfjellet (the 1974 regional survey, NGU oppdrag 1276).

3. FREMSTFJELL-PROSJEKTET - Detailed Stream Sediment Survey

Cu and Mo show a host of anomalies. 20 of the 282 samples have a Cu content exceeding 580 ppm which is the maximum found last year in this area. The 1974 maximum is 1850 ppm Cu (sample number 64). Mo, however, provides the most interesting results since 38 samples have an Mo content exceeding 176 ppm (last years maximum), and they range up to 1780 ppm Mo (sample number 55) (tegning 1289-01). Background values for Mo in stream sediments are usually less than 5 ppm.

Many of these samples were, however, taken from very small streams with a high organic content and low silt content in the sampling material which probably tends to concentrate heavy metals. Preliminary results from a separate study on the -180μ fractions indicate concentration of Cu and Mo by a factor of approximately 2.5 in organic-rich fractions over normal stream sediments and a similar factor of about 2.5 in normal stream sediments over silt-rich fractions. The thin overburden in this area of extensive outcrop may also be a factor causing metal contents higher than is usual.

The Fremstfjellet results will be statistically processed with regard to stream order and Fe, Mn and organic content but even after correction it is expected that the highest anomalies will have Cu and Mo contents respectively about 30 and 100 times background values.

4. FREMSTFJELL-PROSJEKTET - Reconnaissance Rock Sampling.

This year G. Gale found more Mo-mineralised rock within and along strike of the zone of molybdenite - chalcopyrite - pyrite - bearing fine-grained porphyritic trondhjemite indicated by his mapping in 1973. Also he found molybdenite veining in the vicinity of one of the Cu + Mo stream sediment anomalies of 1973 at the head of Smaltjernet. In addition several new Mo- or Cu-mineralised outcrops were found mostly within the same zone by the present author.

Molybdenite occurs in narrow veins often less than 1 mm thick but occasionally up to 6 mm thick. None of the veins were found to intersect. The rock type is always pyritised trondhjemite or silicified pyritised altered trondhjemite - greenstone contact rock.

Preliminary spectrographic analyses of a chalcopyrite-bearing chip (specimen 3083, tegning 1289-01) from a pyritised zone at the north-western limit of the area indicated $> 3\ 000$ ppm Cu, 300 ppm Co, 300 ppm Ni, 100 ppm V and 10 ppm Mo. The host rock is probably a very altered block of greenstone within the trondhjemite. A malachite-bearing chip (specimen 3022) from a pyritised zone at the eastern limit of the area yielded 100 ppm Cu, 60 ppm Co, 100 ppm Ni, 100 ppm V and 20 ppm Mo. The original rock type is uncertain, it is probably a very altered greenstone. Otherwise finds of copper were not encouraging.

Chalcopyrite and molybdenite were very rarely found in the same rocks, molybdenite generally being restricted to the trondhjemite and chalcopyrite to the greenstone but both occurring in the very altered contact zone. Thus it is possible that the two Cu + Mo stream sediment anomalies of 1973 were fortuitous and that these elements belong to separate episodes of mineralisation although these were probably genetically related.

5. AMØBETJERN-PROSJEKTET - Preliminary Examination.

Traces of molybdenite were found coexisting with the abundant chalcopyrite and pyrite at this locality. A chip from specimen 3038 gave the following preliminary spectrographic results: $> 3\ 000$ ppm Cu, 1 000 ppm Mo and 100 ppm Ag.

The soil samples (parent material, mean depth to bedrock = 29 cm) gave several results significantly greater than the background values: medians 16 ppm Cu, 2 ppm Mo, maxima 171 ppm Cu, 37 ppm Mo (tegning 1289-01).

The petrography and geochemistry of this mineralised outcrop differs considerably from that of the rocks found within the Fremstfjellet area. Furthermore there is a band of only background value Cu and Mo stream sediments separating them. Hence it is likely that Amøbetjernet represents a different type of mineralisation, for example both Mo and Cu related to the trondhjemite.

6. KOLITJERN - NESÅELV-PROSJEKTET - Reconnaissance Traverses.

Results are not yet available for the rock samples but no mineralisation was observed along the traverse routes.

The stream sediment results for Cu are low compared to the Fremstfjellet area (median = 8 ppm, mean = 8.9, maximum = 27 ppm) but some of these values might indicate anomalous streams. Similarly the Mo results are low (median = 1 ppm, mean = 2.4, maximum = 10 ppm) but the higher values are significantly greater than the background distribution and hence are believed to be indicators of further mineralisation.

These anomalies are principally in the streams draining the Kolitjernet and Kolifjellene areas where there are several blocks of greenstone within the trondhemite (tegning 1289-02). The anomaly between Nedre- and Midtre Nesåvatnet is from a river rather than a stream and suggests some Cu and Mo mineralisation close to or at the north-east contact of the trondhemite. Vast unexplored areas lie to the East and West of these reconnaissance traverses.

7. REGIONAL STREAM SEDIMENT SURVEY

The original plan to cover mainly the greenstone area North-East of Langtjernet was extended to include the arkose unit from Langtjernet to Blåmuren, the trondhemite - greenstone contact from Langtjernet to Midtre Nesåvatnet and a few extra sample sites within the 1973 regional survey area (NGU oppdrag 1177). This extension proved profitable since anomalies occur in all areas and most are new indicators of mineralisation.

At this stage arbitrary values of 50 ppm Mo and 100 ppm Cu will be used to indicate anomalies. This yields 53 anomalous samples of which 6 occur within an area of oppdrag 1177 which is also within the Fremstfjellet area.

Along the trondhjemite - greenstone contact there are 8 Mo, 21 Cu and 3 Mo + Cu anomalies which show a clear pattern of Mo on the trondhjemite side and Cu on the greenstone side (tegning 1289-02).

2 Mo anomalies (230 & 240 ppm), which are the highest outside the Fremstfjellet area, occur in a stream at the eastern end of Gaziervannet draining silicic volcanics with intrusions of trondhjemite, according to G. Gale (NGU Rapport 1189, unit 11, pages 13 & 36, tegning 1189-04). This is close to the molybdenite - bearing quartz vein and chalcopyrite-bearing erratic found in 1973 (op. cit. pages 20 & 25).

An adjacent stream shows 2 Mo + Cu anomalies where it flows over unit 11 and unit 4 (trondhjemite), but upstream nearer the summit of Blåmuren there are 2 Mo and 1 Mo + Cu anomalies where it drains only unit 23 (arkose, conglomeratic arkose and conglomerate: fragments derived mainly from medium-grained trondhjemite) (op. cit. pages 14 & 36). All samples in these two streams are anomalous.

8 Cu anomalies (maximum 620 ppm) occur between Gaiz-javre and three kilometres North-East draining mainly trondhjemite (unit 4) but also arkose (unit 23) and greenstone (unit 13).

8. COMMENTS

In 1974 the stream sediment anomalies from 1973 have been confirmed and more accurately located. Since many first order streams were sampled and the overburden is generally thin the location of mineralisation can in many cases be narrowed down to small areas. Several anomalies can be explained by the low grade mineralisation already found. However, many of the new stream sediment anomalies occur in streams or stream systems which were not included in the 1973 regional survey and therefore lie outside the area in which we were especially looking for mineralisation this year. Consequently it is possible that some outcropping mineralisation in the Fremstfjellet area has been overlooked.

Many of the anomalies occur in streams which do not drain the molybdenite-chalcopyrite-pyrite zone or its probable westward extension. Most of the anomalies occur in a wide north-south zone between Korttjernet and Tretjernbekken. Several anomalies occur in streams draining the area to the north-west of the Fremstfjellet area. This unexplored area should be scheduled for a detailed survey in 1975.

Some kind of interrelationship between Cu and Mo is suggested by the observations that only Mo stream sediment anomalies (117 & 118) were found below the chalcopyrite-bearing rock specimen 3083 near Korttjernet and only Cu stream sediment anomalies (43, 44, 45) were found below molybdenite-bearing rock specimens 3044 & 3045 in Brattbekken.

The new regional Mo and Cu stream sediment anomalies North of Langtjernet and those within the detailed Fremstfjellet area lie along a curve parallel to and astride the south-eastern contact of the trondhjemite body with a strong tendency for Mo anomalies to be on the trondhjemite side and Cu anomalies on the greenstone side. The 1974 regional survey shows more Mo anomalies than the 1973 regional survey (only four samples > 50 ppm). It is therefore quite possible that a detailed survey around the new anomalies would yield more and greater anomalies as happened this year.

The geochemical data needs processing and rock analyses and thin section studies have yet to be done; hence it is too early to provide a reasoned estimate of the probability of finding a workable Cu and/or Mo deposit in the areas mentioned. However, there is strong evidence at present to suggest that the area is enriched in Cu and Mo and possibilities for finding porphyry Cu/Mo deposits therefore exist. This is thought sufficient to justify recommendation that mining rights in the area are claimed before expiry of the Grong Law, pending decisions upon the kind of exploration to be carried out in 1975.

Since the south-eastern part of the trondhjemite appears to be a Mo province and the neighbouring greenstone to be a Cu province, it is suggested that at least a belt about 4 km wide along the entire contact from North of

Midtre Nesåvatnet to West of Kolutjernet is claimed (about 70 km²). Also at least the entire eastern part of the trondhjemite mass (East of a N-S line through Gjætingrumpen) should be scheduled for a regional stream sediment survey in early 1975. Several areas merit detailed stream sediment, rock and perhaps, soil surveys.

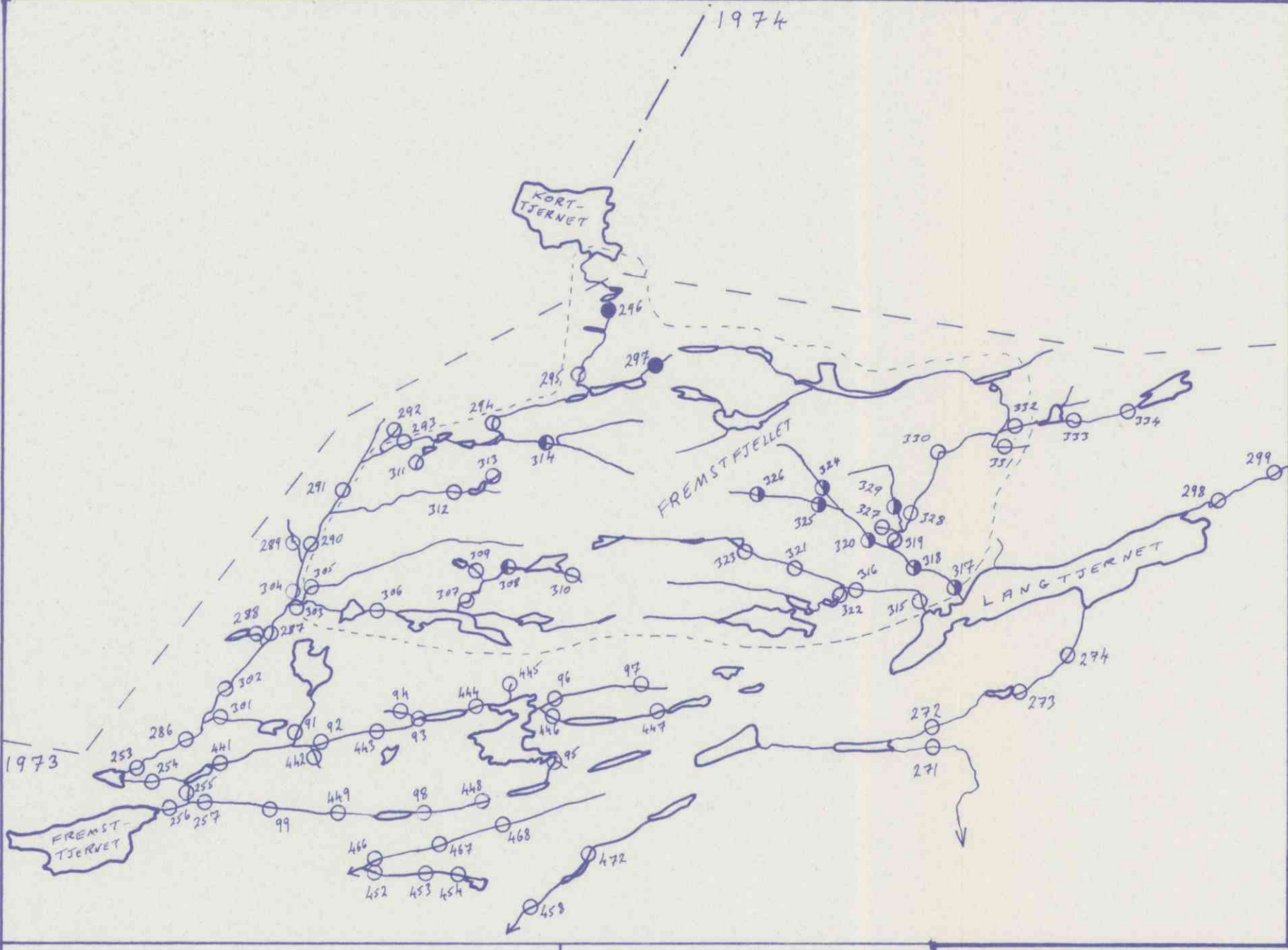
Further it is suggested that the area between Blåmuren and Gaziervannet is claimed since this is especially encouraging for Mo, and perhaps also the area of Cu anomalies to the North-East.

Since Mo stream sediment anomalies commonly occur independently of Cu anomalies, all the samples from the 1973 regional survey West of Langtjernet will now be analysed for Mo. It is recommended that previous surveys in Grongfeltet in the vicinity of trondhjemite are reexamined with a view to analysing samples for Mo.

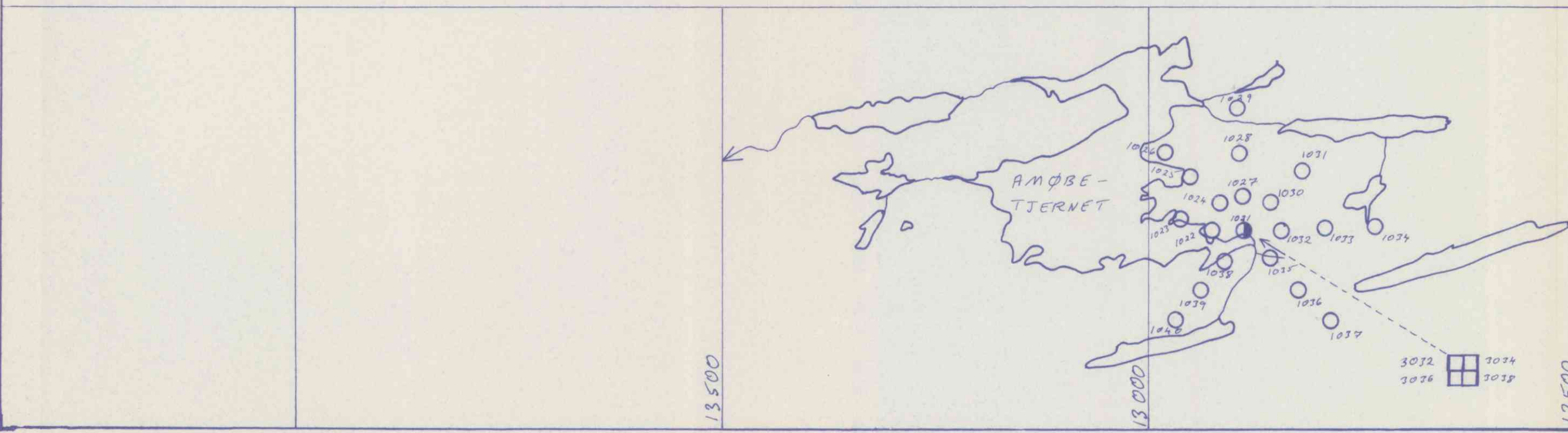
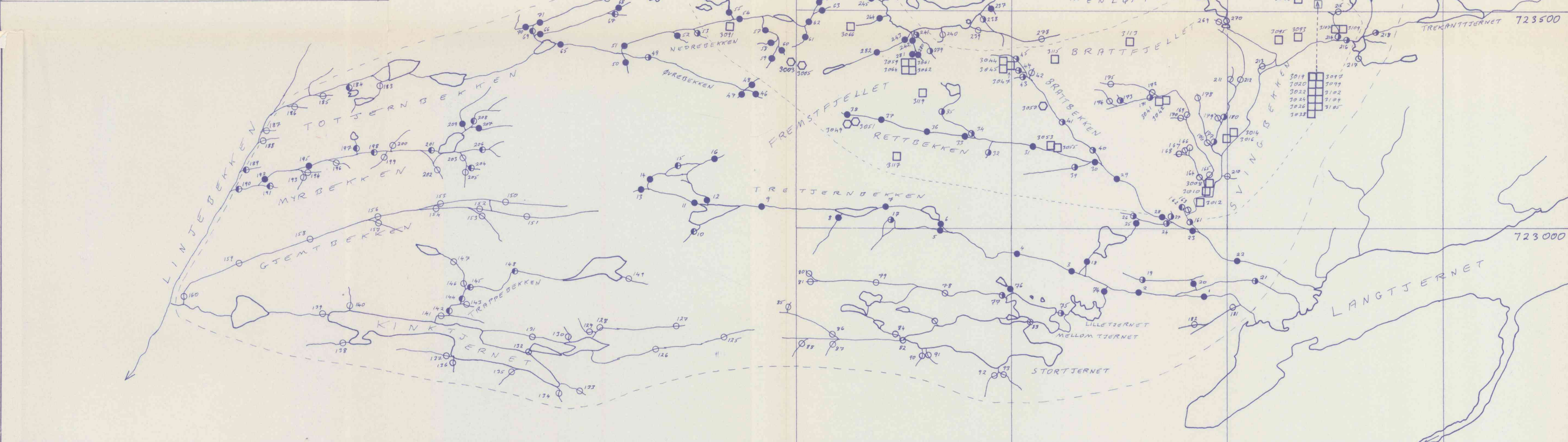
Norges geologiske undersøkelse
Trondheim, 11 October 1974

David Smith

David Smith



REGIONAL BERKESEDIMENTER PRØVETAKING for GRONG-PROSJEKTET	
OPDRAG 1177 - 1973	TEGNET FRA FLYFOTO VGS. 357 - 1208 og 1307
OPDRAG 1276 - 1974	MÅLSTOKK 1:20,000



○ BERKESEDIMENTERPRØVE	antall
□ STEINPRØVE - FASTFJELL	50
◇ STEINPRØVE - LØSBLOKK	6
○ JORDPRØVE - UNDERGRUNN	40
--- GRENSEN AV BERKESEDIMENTERPRØVER	
--- GRENSEN AV STEINPRØVER	

DETALJERT GEOKJEMISK PRØVETAKING	
Kart tegnet fra 1:5000 KARTENE	
DM151-1 og DL151-4 NORD-TRØNDERLAG FYLKE	
○ > 50 ppm Mo	METALL
○ > 100 ppm Cu	INNHOOLD

FREMSTFJELL-PROSJEKTET en del av TRONDHEIM-PROSJEKTET en del av GRONG - PROSJEKTET	
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM	

MÅLSTOKK	OBS. DS	1974
	TEGN. DS	1974
1:5000	TRAC.	
TEGNING NR.	KARTBLAD	
1289-01	1823 I	



<p>○ BEKKESEDIMENTERPRØVE antall 35</p> <p>□ STEINPRØVE - FASTFJELL 12</p> <p>--- GRENSEN AV FREMSTFJELL - PROSJEKTET</p> <p>--- GRENSEN AV REGIONAL BEKKESEDIMENTER</p> <p>--- PRØVETAKING med OPPDRAG NUMMER</p>	<p>REKOGNOSERING GEOKJEMISK PRØVETAKING</p> <p>FLYFOTO SERIE W 3401</p> <p>● ≥ 4 ppm Mo</p> <p>○ ≥ 15 ppm Cu</p> <p>○ ≥ 50 ppm Mo</p> <p>⊥ ≥ 100 ppm Cu</p> <p>METALL</p> <p>INNHOOLD</p>	<p>KOLLITJERN-NESÅELV-PROSJEKTET en del av</p> <p>TRONDHEIMITT - PROSJEKTET en del av</p> <p>GRONG - PROSJEKTET</p> <p>NORGES GEOLOGISKE UNDERSØKELSE</p> <p>TRONDHEIM</p>	<p>MÅLESTOKK OBS. D.S. 1974</p> <p>TEGN. D.S. 1974</p> <p>TRAC.</p> <p>1:50,000</p> <p>TEGNING NR. 1289-02</p> <p>KARTBLAD 1824 II</p> <p>1823 I</p>
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