Bergvesenet

Postboks 3021, N-7441 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
5295				

Kommer fra arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Grong Gruber AS		Grong Gruber a.s.		

Tittel

REPORT ON FIELD-WORK IN THE FREMSTFJELL - NESÅPIGGEN - GAIZERVATN AREA, JULI - AUGUST 1983

Forfatter	Dato	År	Bedrift (oppdragsgiver og/eller oppdragstaker)
M.J. Ryan, P.J.F. Davis, J.L. Enderby and S.P. Swatton		1983	

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
	Nord-Trøndelag			Grong

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Geologi		Grongfeltet

Råstoffgruppe	Råstofftype

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Innhold:
Continued detailed investigation of the Fremstfjell area
Reconnaissance of the Nesåpiggen - Reinsjoen area
A brief reconnaissance of areas of mineralisation in the Gaizervatn area reported by D. Cawthera i 1982

REPORT ON FIELD-WORK IN THE FREMSTFJELL-NESÅPIGGEN-GAIZERVATN AREA

July-August 1983

M.J. Ryan, P.J.F. Davis, J.L. Enderby and S.P. Swatton

Introduction

Approximately five weeks were spent in the Grong District during the period July 17 - August 23. The main objectives were:

(a) continued detailed investigation of the Fremstfjell area;

(b) reconnaissance of the Nesåpiggen-Reinsjoen area;

(c) a brief reconnaissance of areas of mineralisation in the Gaizervatn area reported by D. Cawthera in 1982.

A. Continued investigation at Fremstfjell

The aims here were:

i) to attempt to map zones of mineralisation and alteration;

ii) to check on a possible extension of the mineralisation to the north-west;

iii) to quantify further the ore potential;

iv) to decide on the structural level of the Fremstfjell mineralisation.

Trenching:

Because of problems with drilling and blasting, the proposed 200 m of trench and 200 trench chip samples were not achieved. However, two new trenches were completed and sampled successfully: Trench 2 of 1980 was extended northwards to Nedrebekken and a new Trench 7 was blasted from Bore-Hole 2 northwards to Smaltjern.

Trench 2 (1983) represents a northward extension of approximately 56 m and contains the following, from south to north:

0 - 1 m	medium/dark coloured, pyrite-rich quartz diorite containing epidote spots and veins and a network of pink/cream coloured feldspar veinlets
1 - 2 m	pyrite-rich, foliated green diorite (? greenstone) with pink leucogranite streaks and veins, very weak Mo
2 - 6 m	overburden
6 - 7 m	metagabbro, pyrite-rich and epidotised, quartz-veined
7 - 8 m	gabbro passing into greenschist with quartz-Mo veins
8 - 9 m	mixed schistose green and pink leucogranite and schistose granodiorite; pyrite-rich and with quartz-Mo veins
9 - 10 m	pale green, pyritised, sericitic leucogranite
10 - 12 m	(from 9.75 m) rich Mo and quartz-Mo veins in leucogranite, with minor green Cu
12 - 13 m	leucogranite with fine-grained Mo
13 - 16 m	Pyritiferous metagabbro/greenstone mixed with leucogranite sheets intrusive along the schistosity

16 - 24 m diorite/gabbro shot through by leucogranite veins and quartz-Mo; heavily pyritised and epidotised; Mo-mineralised throughout by quartz-Mo veins and dry "Mo-paint"

24-34.5 m as above, very heavily pyritised but with very weak Mo

34.5-37 overburden

37 - 44 m grey and pink leucogranite with quartz-Mo-pyrite veins

44 - 48 m rotten, schistose rock, very deeply weathered or unexposed

48-48.5 m schistose greenstone

48.5-56 m pinkish-cream coloured, massive leucogranite with quartz-pyrite veins and weak Mo (51-54 m, badly exposed due to deep weathering in schistose zone.)

Trench 7 runs northwards from just west of Bore-Hole no. 2 towards Smaltjern and was blasted using 75 shot-holes - see accompanying sketch by Steve Swatton. From south to north it showed:

0 - 5 m pale green coloured leucogranite/ epodotised granodiorite shot through by white quartz veins and pink feldspar; strongly pyritised with quartz, quartz-Mo, quartz-pyrite-chalcopyrite (and green secondary Cu)

5 - 10 m overburden

10 - 13 m as in 0 - 5 m, but with no Mo

13 - 15 m overburden

16 - 20 m darker green epidotised granodiorite with pink feldspar, white quartz veins

20-22.5 m overburden

22.5-34 m bright green and yellow coloured epidotised granodiorite

34 - 36 m overburden

36 - 40 m paler (? intermediate) version of the previous bright green granodiorite and pale green epidotised leucogranite; dark greenish-black chlorite conspicuous at 40 m mark; Mo and Cu

40 - 52 m green and greenish-yellow coloured, epidotised granodiorite, weakly foliated, with pegmatitic veins of white quartz-pink feldspar

52 - 65 m granodiorite and schistose granodiorite with rich Mo mineralisation about 53 - 55 m; veins of leucogranite and dark greenish-black chlorite.

Trench 7 illustrates one of the problems encountered in the mapping - namely, the apparent gradational nature of the contact between granodiorite and leucogranite. The rock types in the 0 - 5, 10 - 13, 16 - 20, 22.5 - 34, 36 - 40 and 40 - 52 m sections - admittedly not a continuously exposed section - apparently pass gradually into one another. Also, it can be seen that most of the trench contains little or no visible Mo, except for the three mineralised zones at shot holes 1 - 5, 24 - 31 and 50 - 56.

Discussion of trench sample analyses

Trench 2/83 averages 646 ppm Mo and 852 ppm Cu (these figures include the sample 1 figures of 12805 ppm Mo and 123 ppm Cu - but not the Mo zone samples I, II and III).

The sample 1 figure of 12805 Mo would appear to be anomalous, see field description of trench 2/83. Samples 8 and 9, with 2685 and 1584 ppm Mo respectively, are from the Mo-rich zone between 9.75 and 12.00 m of the new trench. Because of the

way the trench was blasted, extra sampling of this zone was done, see Mo zone samples, and the high values confirmed.

The relatively high Cu values in samples 2 - 35 reflect the large amount of metagabbro/greenstone in the trench, heavily pyritised and epidotised. Chalcopyrite was not particularly abundant or obvious and the copper may well be in the form of cupriferous pyrite. The lower Cu values in the northern third of the trench correlate with the leucogranite there.

Tr. 7/83 averages 122 ppm Mo and 331 ppm Cu. Mo and Cu are noticeably abundant in only three short sections of this 65 m long trench, namely 0 - 5 m, shot-holes 27, 28 and 32 (about the 38 m mark) and at shot-holes 52 - 58 (especially in the 53 - 55 m zone).

Obviously the overall Mo and Cu values are disappointing, probably indicating that the trench is running near to the western limit of Mo-Cu mineralisation in the Nedrebekken-Smaltjern segment of the area.

i) Mineralisation and alteration

The attempt at mapping zones of mineralisation and alteration was partially successful, although the difficulties produced by deeply weathered, or flat or rounded outcrops limit the extent to which this can be done.

As can be seen from the enclosed map, a central zone of molybdenite-chalcopyrite-pyrite is surrounded by a zone of molybdenite-pyrite with pyrite in a wider zone outside the molybdenite. Perhaps the zonation is not as clear-cut as stated above : the occurrence of copper seems to be very patchy and irregular, possibly due to it being related in some way to greenstone xenoliths and rafts within the granodiorite/leucogranite complex.

Accurate mapping of any alteration pattern is very difficult to do. Pinkish coloured feldspar (presumed to be K-feldspar in the field) more-or-less coincides with the molybdenite-bearing area, with epidote-bearing rocks overlapping the above and occurring outside the main moly-copper zones. Phyllic alteration and silicification appear to be related to schistosity zones but sericitised rocks also occur frequently throughout the main moly-minineralised area. Really, no regular, clear-cut alteration pattern has emerged, e.g. trenches 3 and 2 contain mixed K-feldspathised, sericitised and epidotised rocks but trench 7, which cuts near the western margin of the main moly-mineralised zone, shows chiefly epidotisation and chlorite veining with subordinate K-feldspathisation.

ii) Possibility of an extension of the mineralisation to the north-west

The Mo-mineralised leucogranite zone north of Smaltjern extends westwards as a thin sheet, or series of sheets, for about 400 m. Weak Mo and leucogranite were founed as far west as the western-most NNW-SSE trending linear feature, here supposed to be a dextral tear fault. This zone would appear to be no larger than in the Bore Hole 1/Trench 1 section.

North-west of B.H.1, no significant mineralisation nor leucogranite was found. East of lake 711 m near Skarsfjellet, alongside the prominent NNE-SSW linear feature, pale weathering granodiorite, sometimes strongly epidotised and veined by epidote (with K-feldspar in the Λ-shaped wedge between the NNW and NNE features) was prominent.

In the E-W feature that runs between lakes 711 m and 732.5, north-east of Skarsfjellet, thin sheets of leucogranite occur in the northern wall of the shear zone with weak secondary green Cu-mineralisation at one locality. Otherwise there is nothing to suggest an extension to the main mineralised area.

iii) Ore potential

Except for the westerly extension of the Smaltjern mineralisation described in (ii) above, no further increase in the area of mineralisation was discovered. The northward extension to Trench 2 showed Mo-mineralisation over most of the trench, but Trench 7 showed only three narrow zones of Mo-mineralisation.

From the westernmost Mo showing to Bore Hole 9 in the east measures 1300 m; the north-south extent of the main mineralised area (from BH6 to BH3 and south to the trig. point ridge) measures 340-400 m. Even if the actual dimensions of a possible mineralised zone measure only 500 m x 300 m (1640 ft x 980 ft), i.e. from Trench 2 to midway between BH's 7 and 9 x from BH6 to BH3 - the size of main mineralised area compares reasonably well with the classic stockwork molybdenum deposits of North America, e.g.:

	Width (ft)	Thickness (ft)	% Mo
Alice	1600 x 2200 ft	700 + ft	0.12
Endako	1200 x 6000 ft	1000 ft	0.09
Urad	400 x 1000 ft	700 ft	0.25
Henderson	2200 x 3000 ft	1000 ft	0.29
Climax	2200 x 4200 ft	300-800 ft	0.20
Questa	2500 x 4000 ft	700 ft	0.11
Fremstfjell	**1000 x 1650 ft**	**?? 100-700 ft**	**0.035(?)**

Analyses of the Fremstfjell mineralisation

	No. of Samples	ppm Mo	ppm Cu
BH1	15	224	252
BH2	35	248	664
BH3	32	110	325
BH4	69	161	383
BH5	84	374	854
BH6	64	209	228
BH7	20	60	299
BH8	20	148	110
BH9	35	61	642
Average BH 1-9		177	417

	No. of Samples	ppm Mo	ppm Cu
Trench 1/80	11	300	258
2/80	24	152	486
3/80	25	698	277
4/80	3	2072	772
5/80	10	209	362
6/80	3	268	228
2/83	50	403	866
7/83	75	122	331
Average Trenches		528	448
Overall average Bore-Holes + Trenches		353	433

NOTE: The Tr 2/83 Sample 1 12805 ppm Mo and 123 ppm Cu have not been included in the figures above. Also it is worth noting that the sections of core that were analysed were for the most part only those sections that contained visible Mo. If all the core samples had been analysed the Cu values would probably be higher, e.g. the greenstones of the core samples would probably increase the Cu average.

Comments bore-hole and trench sample analyses

There is a large difference between the average bore-hole analyses and those of the trenches. If the 2072 ppm Mo (Trench 4/80) is included the trench samples are, on average, three times more than the bore-holes. Even without that high figure, the trench samples' average is double the bore-holes'. Curiously, the copper values for the two groups of samples are about the same. The discrepancy in Mo-values may reflect poor core splitting or biased chip sampling - or both. (Trench 4/80 was deliberately positioned to sample the rusty, vein-rich outcrops near Nedretjern and high values from those few samples were expected).

If the overall average Mo value of 0.035% reflects accurately the Mo content of the mineralised area (0.02% for the bore-hole samples), then clearly the Mo-mineralisation is uneconomic. Whether or not richer mineralisation lies at depth remains to be seen. Bore-holes 5 and 6 need to be deepened to bottom the mineralisation. A new bore-hole north of bore-hole 6 on the same profile ought to be considered.

iv) Structural level of the Fremstfjell mineralisation

The bore-hole 3-4-5-6 section shows a wedge of mineralisation apparently dipping to the north. The Mo at the bottom of bore-holes 4 and 5, beneath the thick wedge of unmineralised greenstone, may be part of a second, lower wedge of mineralisation or it may mean that the Mo zone has a steep northerly dip. Extending bore-hole 6 would help to define the shape of mineralised zone more closely. As stockwork molybdenum deposits generally tend to be cylindrical or lenticular in shape, originally steeply inclined, one might expect a steep northern contact to the mineralised zone - possible controlled or modified by the faulting along the Smaltjern shear zone.

Whilst Fremstfjell has an absence of breccias, multiple porphyries and dykes etc., the mineralised zone contains abundant greenstone rafts and xenoliths, in addition to the gabbro sheets and blocks, which represent a disrupted, early mafic phase of the intrusive granodiorite complex. Assuming that the granodiorite has a normal intrusive relationship with the greenstone cover (when not modified by local faulting), the mineralised area must lie close to the original roof of the granodiorite body.

The gradational nature of the granodiorite - "leucogranite" contact (with grey 'intermediate rock' in , e.g. bore-hole 7) seen in, e.g. trenches 7/83 and 1/80 etc. leads to the conclusion that the "leucogranite" is of metasomatic origin, i.e. an alteration product, produced by K_2O-bearing hydrothermal fluids that accompanied the Mo-mineralisation. Whether a separate, wholly magmatic, granite intrusive phase remains to be discovered at depth has yet to be answered.

The E-W elongation of the Mo-mineralised area parallels the regional foliation and is close to the orientation of the numerous shear zones (e.g. Smaltjern, Nedrebekken) trending 070-075. In many cases the shear zones are silicified and Mo-mineralised and may have exerted some control on the mineralisation. Of the averaged bore-hole Mo values, BH5 and BH2 - lying closest to the Nedrebekken shear zone - show the highest values with the BH4 and BH3 values decreasing away from this central zone, as is the case with BH's, 8 and 7 and BH6 to the north. Also it should be noted that the two central bore-holes 4 and 5 had more or less continuous Mo-mineralisation above the thick greenstone wedge, whereas bore-holes 3 and 6 both had gaps in Mo-mineralised zone. Perhaps 4 and 5 are closest to the centre of the mineralisation. Thus the earlier suggestion of extending bore-holes 4, 5 and 6 by 100, 100 and 250 m respectively, coupled with a new 500 m bore-hole to the north, inclined parallel to the previous holes, should delimit the mineralised zone on that profile.

B. Reconnaissance of the Nesåpiggen-Reinsjöen area

a) The Mo-Cu anomalies between Reinsjöen and Langlöftvatna

The stream which flows from lake 664 m into Reinsjöen follows a shear zone that cuts through very pale coloured granodiorite which is strongly epidotised and feldspathised. No mineralisation was seen in the granodiorite, except for v. minor secondary Cu.

To the north, the peninsula projecting into Reinsjöen, consists of greenstones with patchy rusting due to pyrite and occasional veins of K-feldspar.

Between lake 670 m and Reinsjöen the "normal granodiorite" shows little or no alteration and no significant mineralisation.

The source of the 55 ppm Mo-anomaly was not found.

b) The Mo-anomalies between Reinsjöen and Nesåpiggen

The area south-west of lake 854 (Lievkjesåejtjonne) contains several very weak Mo-mineralisation localities (see sketch map). N3

Five separate Mo showings occur east-north-east of the V-shaped lake. Here the granodiorite is not rusted, nor does it show any unusual alteration that might point to the area containing Mo-mineralisation. The rocks have an E-W jointing and poorly developed spaced cleavage and are cut by E-W trending shear zones. There is no noticeable sericitisation nor silicification. Thin (?) K-feldspar streaks accompany the Mo which was found with pyrite in thin streaky E-W veins, together with (??) arsenopyrite. On the ridge above the Mo-localities occurs an unmetamorphosed lamprophyre dyke, trending 280-300 with a second set of metamorphosed dykes trending 025.

Four more separate showings of very weak Mo were found in the southern anomaly area. Here again, there was nothing unusual in the granodiorite - no alteration or veining visible and no rusting. The Mo occurs as either very small veins along with? K-feldspar or as individual spots up to about 1 mm across.

The source of the 66 ppm Mo anomaly west of lake 854 was not located but presumably it could be due to mineralisation similar to that described above.

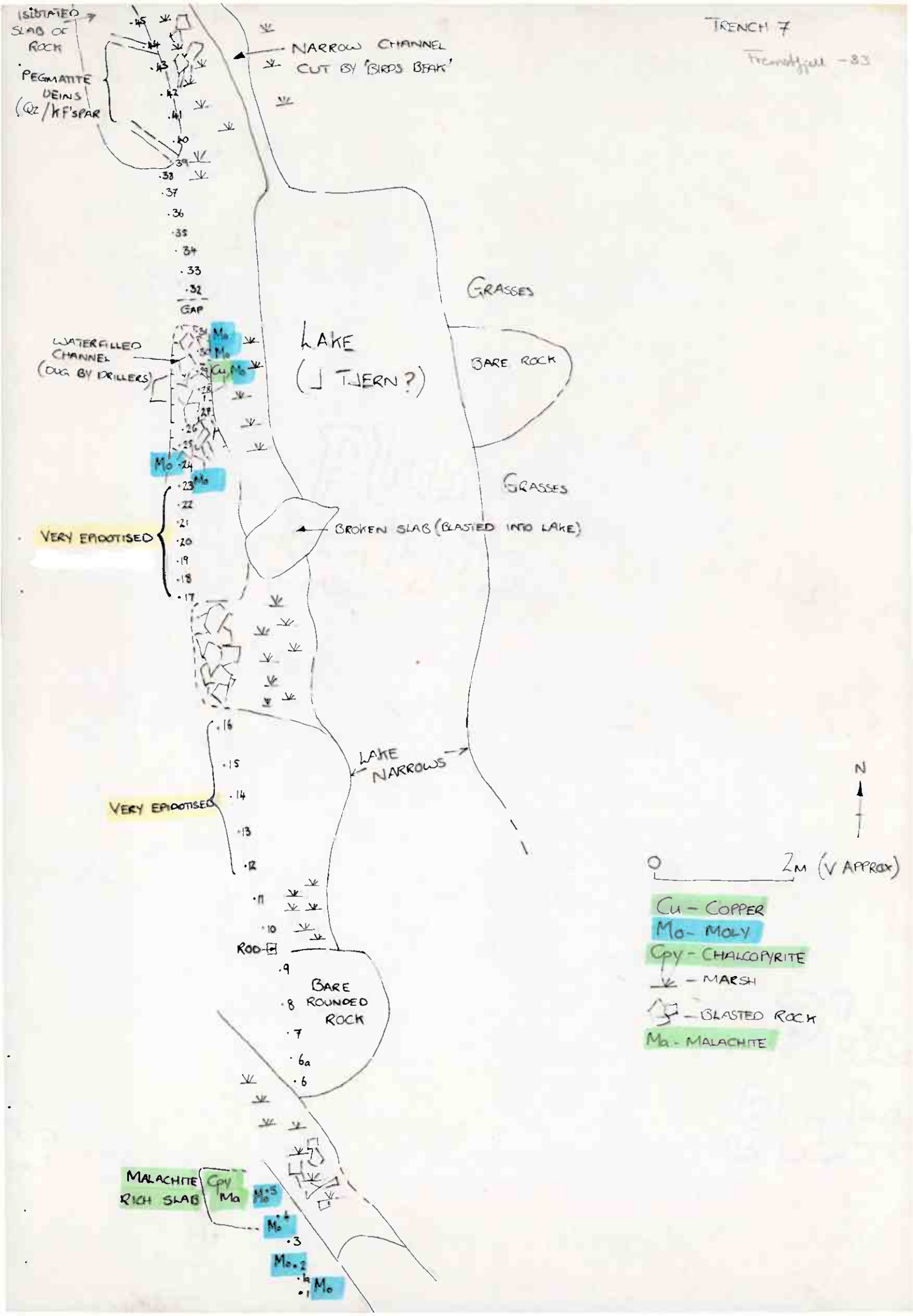
C. Brief reconnaissance of reported mineralisation in the Gaizervatn area

This involved checking out the showings reported by D. Cawthera in 1982 along the shores of the lake embayment one kilometer south of the Gaizerhytte and then traversing ENE along, ribbon-shaped lake 652 to lakes 658 and 664 m and then westwards back to Pervatn.

Nowhere was there more than weakly rusted granodiorite with accessory pyrite, possibly very fine-grained chalcopyrite. The "moly in small veinlets" reported by Cawthera was not found.

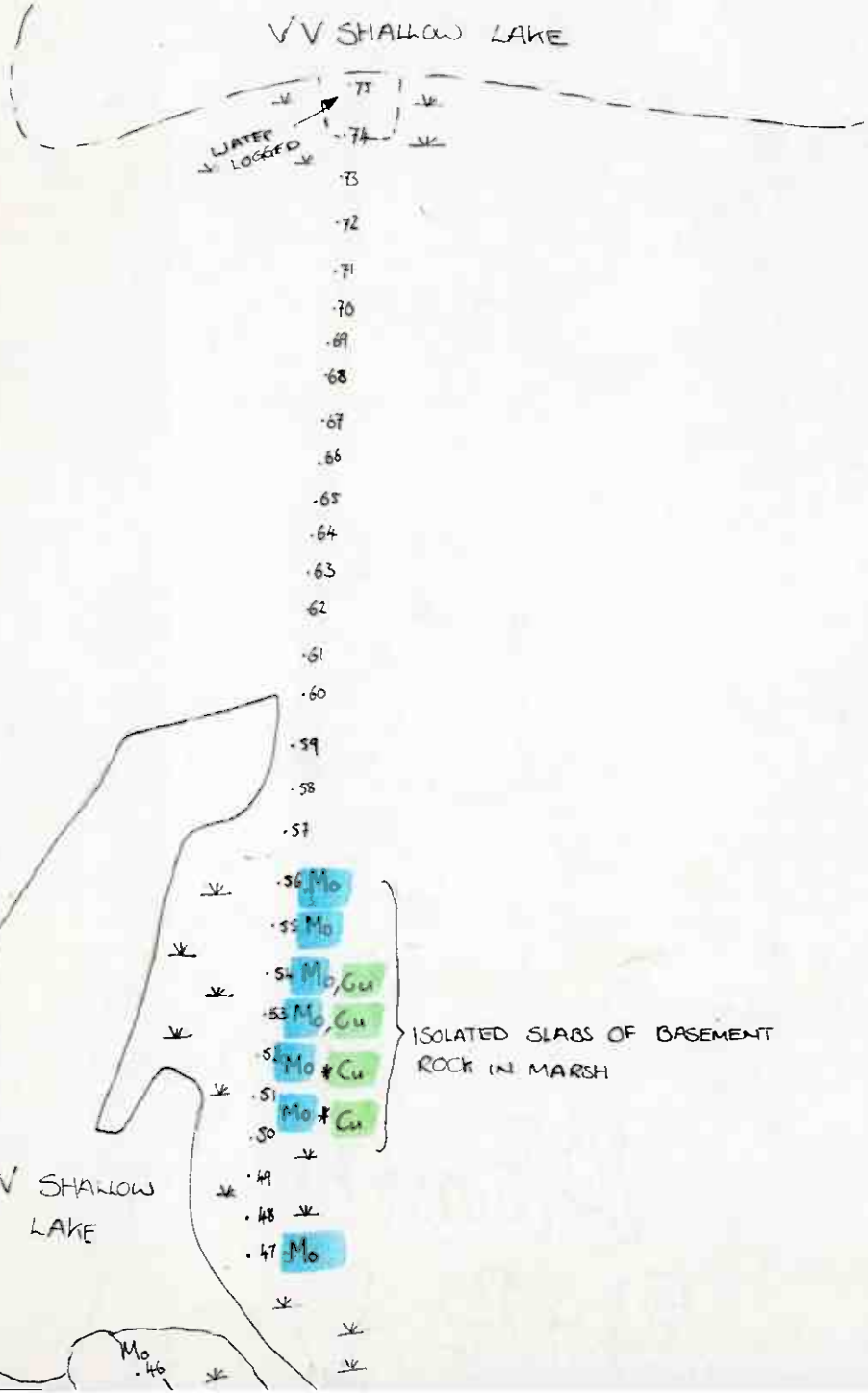
These negative results do not detract from the earlier findings at the southern end of Gaizervatn where thick individual quartz-molybdenite ± pyrite veins cut pyritised granodiorite. However, this area would require drilling, probably deep drilling to evaluate it further.

M.R
20.12.83


TRENCH 7
Fremdlagen -83
ISOLATED SLAB OF ROCK
PEGMATITE VEINS (Qz / K F'SPAR
NARROW CHANNEL CUT BY 'BIRDS BEAK'
GRASSES
LAKE (/ TJERN?)
BARE ROCK
GRASSES
WATERFILLED CHANNEL (DUG BY DRILLERS)
GAP
BROKEN SLAB (BLASTED INTO LAKE)
VERY EPIDOTISED
VERY EPIDOTISED
LAKE NARROWS
ROD
BARE ROUNDED ROCK
MALACHITE RICH SLAB
Cpy
Ma
N
0
2M (V APPROX)
Cu - COPPER
Mo - MOLY
Cpy - CHALCOPYRITE
- MARSH
- BLASTED ROCK
Ma - MALACHITE

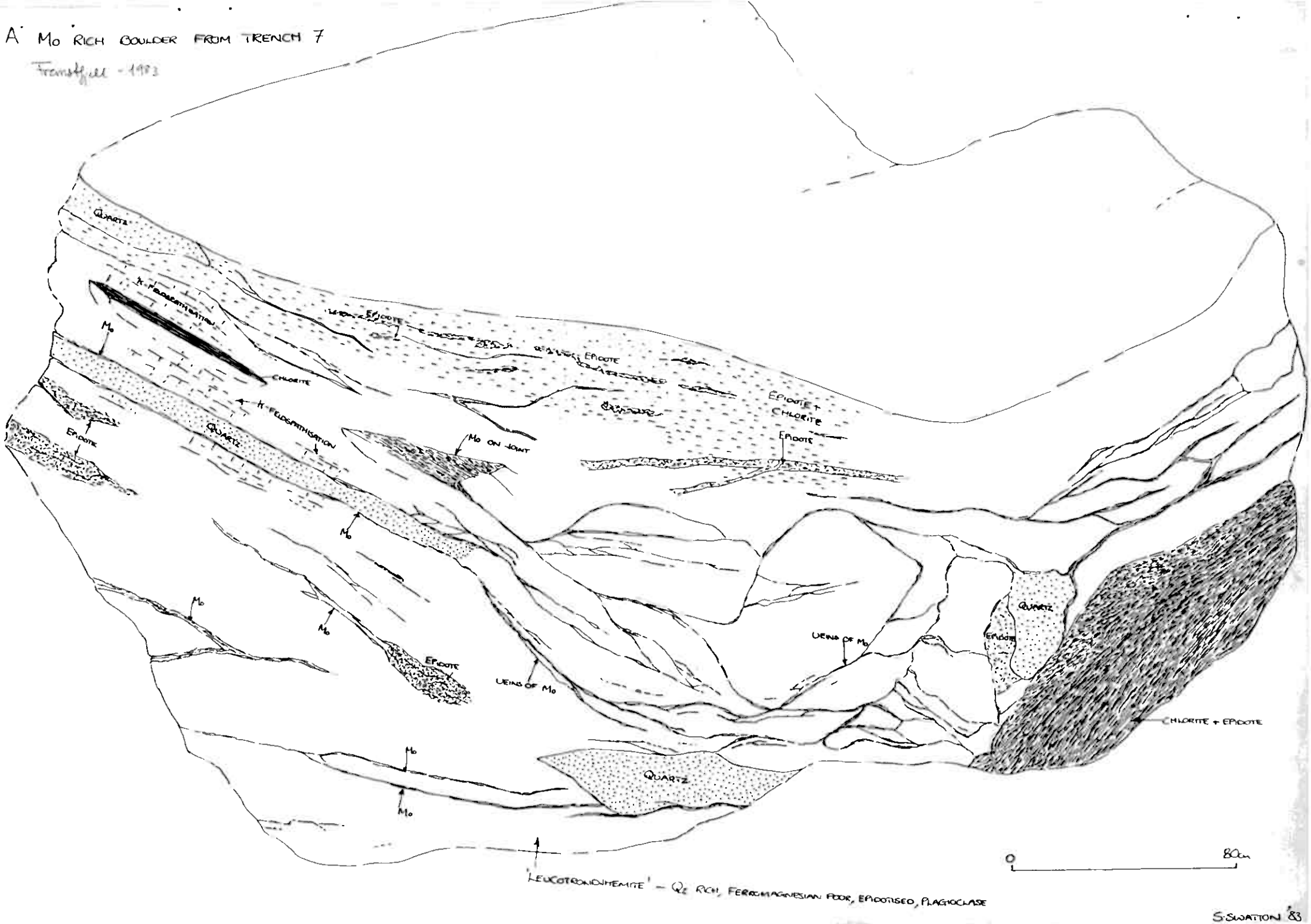
TRENCH 7

Fremstfjell - 83



A Mo RICH BOULDER FROM TRENCH 7

Fremstfjell - 1983



▲ Gabbro sheets, blocks.

G Granodiorite, Diorite

Leucogranite, Leucotrondhjemite

γ Greenstone

Central moly-chalco-pyrite zone

Moly-pyrite zone

Olavtj. 672

732.5

711

617.5

619.5

615.8

641.5

Cyprustj 647

Storfisktj 585