

FOR FALCONBRIDGE NIKKELVERK A/S
A/S SULFIDMALM

Ground follow-up investigations
at the Ruvvačokka grid, Masi, 1975

By

E. Kreivi
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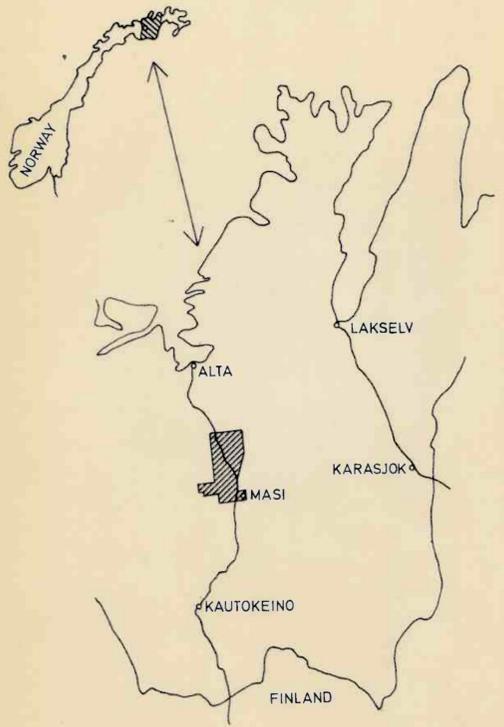
Summary and
Conclusions

1. SUMMARY AND CONCLUSIONS

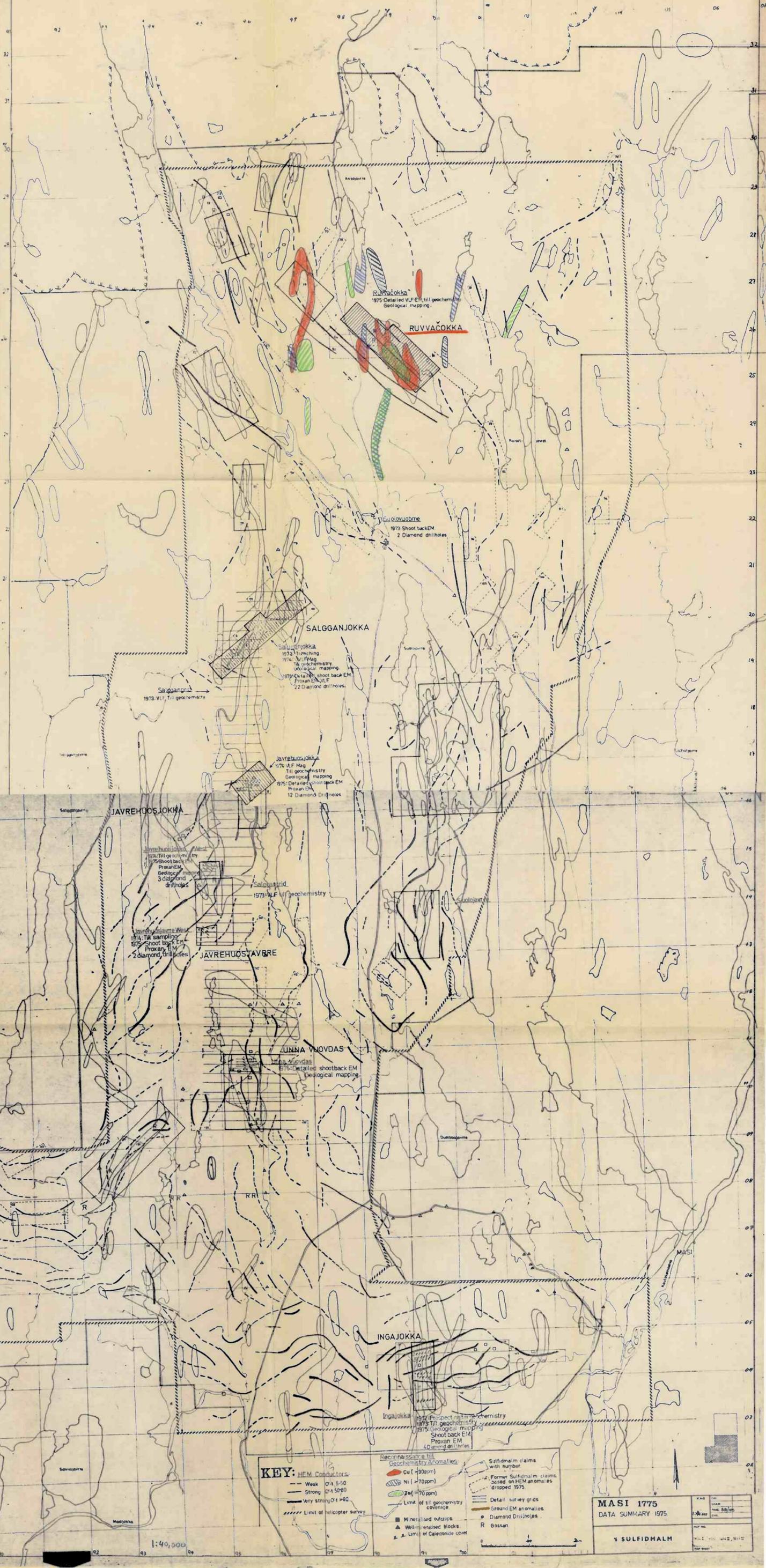
The Ruvvačokka grid was sited to follow up promising indications from the 1974 Masi reconnaissance programme, in the form of Cu and Zn till anomalies, associated with strong airborne -EM conductors. Fig.1 shows the location of the Ruvvačokka grid in relation to other targets in the Masi area. Follow-up results for Ruvvačokka are summarized in fig. 2.

Geological mapping showed the area to be underlain by basic volcanics, in part pillow-lavas, interlayered with sedimentary horizons consisting of greywacke, chert and graphite schist. Mineralization (pyrite with minor chalcopyrite) was found at two locations, in both graphitic and cherty sediments. Detailed surveys revealed very strong till anomalies, with maximum values of 8500 ppm Zn, 3000 ppm Pb and 2870 ppm Cu, associated with VLF-indicated conductive zones. Unfortunately the only usable VLF transmitter (BOF) is almost perpendicular to the strike of the Ruvvačokka conductors and conductor definition using this technique is poor.

The geochemical indications for the Ruvvačokka are very promising and this is a high priority drilling target. The grid will be covered with a Crone Shootback EM survey in March 1976, in preparation for drill testing of the anomalies in late summer 1976.



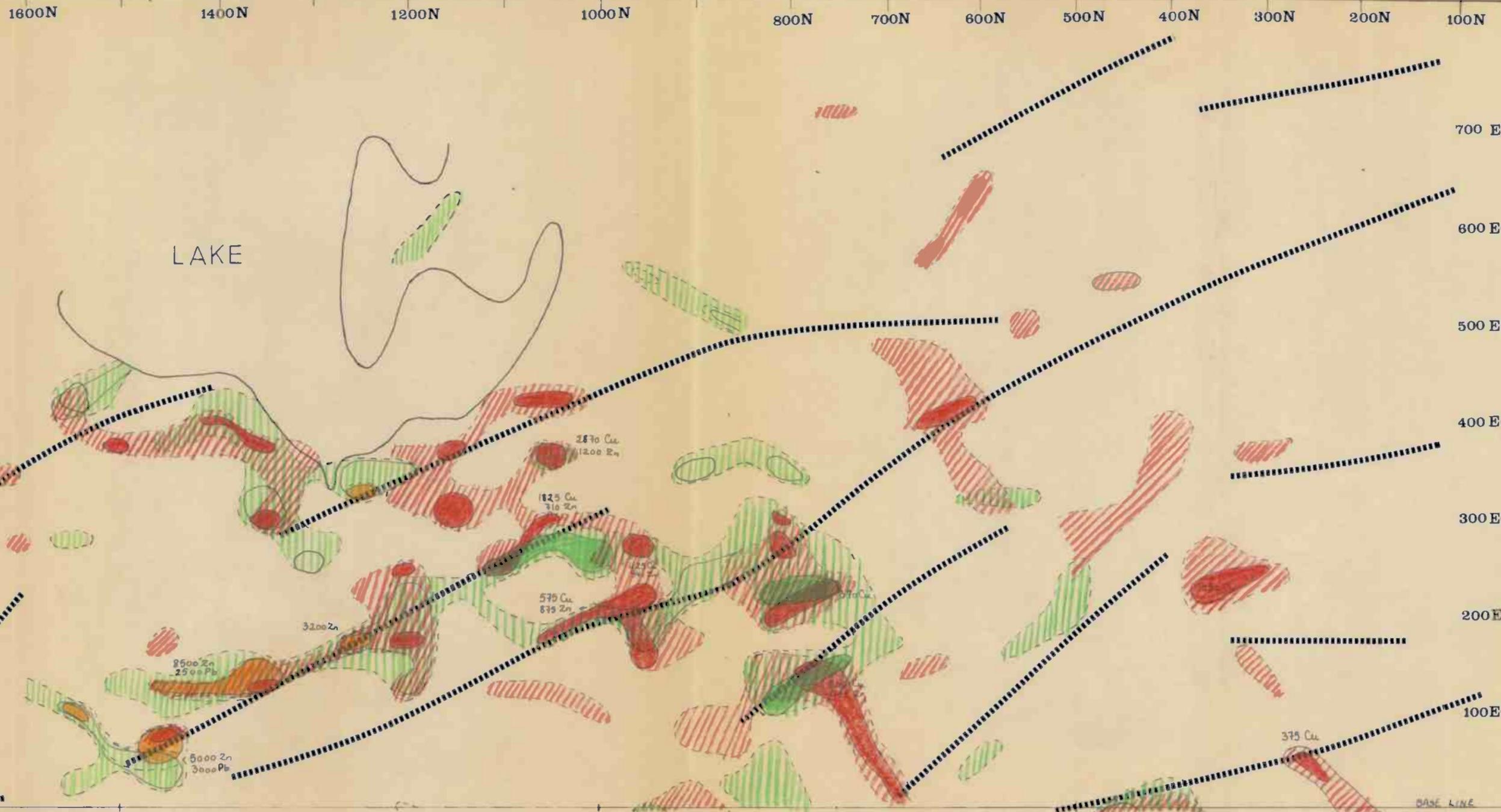
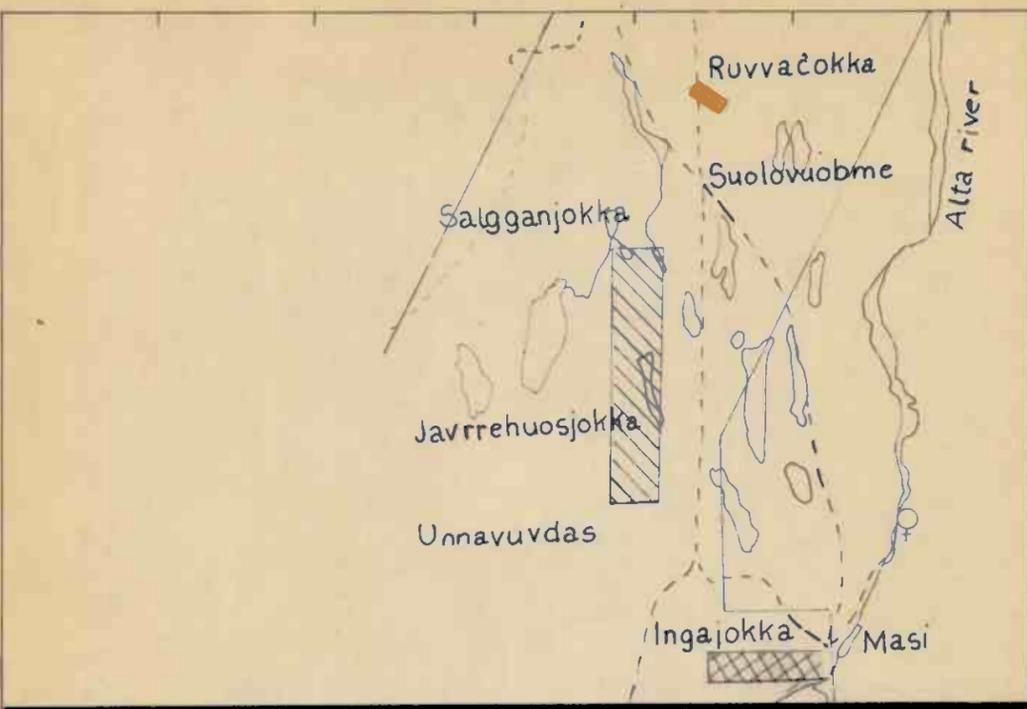
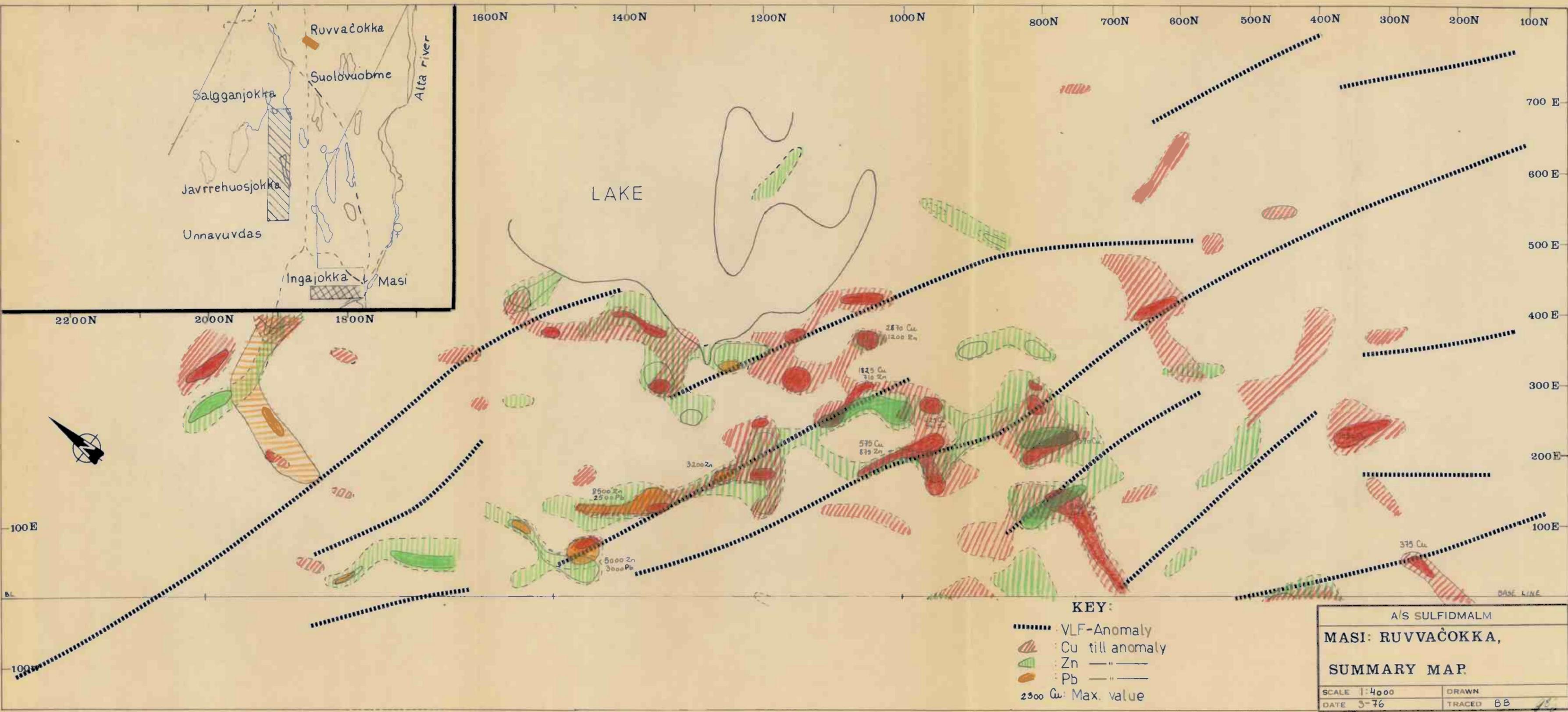
(UNDERSÖKT 1975) Investigated 1975.
 (PLANLAGT UNDERSÖKT 1976) Planned investigation 1976.



KEY:

<p>HEM Conductivity</p> <p>Weak 0.1-5.00</p> <p>Strong 0.1-50.00</p> <p>Very strong 0.1-80.0</p> <p>Limit of helicopter survey</p>	<p>Reconnaissance till geochemistry anomalies</p> <p>Cu (>30ppm)</p> <p>Ni (>70ppm)</p> <p>Zn (>70ppm)</p> <p>Limit of till geochemistry coverage</p> <p>Mineralised outcrops</p> <p>Well mineralised blocks</p> <p>Limit of Caledonide cover</p>	<p>Sulfidmalm claims with number</p> <p>Former Sulfidmalm claims based on HEM anomalies dropped 1975</p> <p>Detail survey grids</p> <p>Ground EM anomalies</p> <p>Diamond drillholes</p> <p>R Bossan</p>
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MASI 1775
 DATA SUMMARY 1975
 1 SULFIDMALM



KEY:

- VLF-Anomaly
- ▨ Cu till anomaly
- ▨ Zn
- ▨ Pb
- 2300 Cu Max. value

A/S SULFIDMALM	
MASI: RUVVAČOKKA,	
SUMMARY MAP	
SCALE 1:4000	DRAWN
DATE 3-76	TRACED BB

Geological mapping

2. GEOLOGICAL MAPPING (by Tuomo Alapieti, Kalle Taipala)

This report covers detailed geological mapping of the Ruvvačokka grid, 4 km north of Suolovuobme. The report is divided into 3 sections, a) Petrography; b) Tectonics and c) Summary. Fieldwork was carried out during the period Sept. 1-15 1975. Original mapping was on a scale of 1:1000, using as reference the existing geophysical grid.

2a) Petrography (for locations see fig. 3)

Location 1/TA. A wide, quite inhomogeneous greenschist/greenstone outcrop. The rocktypes change indistinctly to other types. Usually they are bedded and quite strongly folded. On the northern part of the outcrop the rock is almost a chlorite schist. To the south of the chlorite schist the amphibole appears and the rock is a typical greenstone. Further south plagioclase (albite) appears and the rock becomes more amphibolitic (albite-epidote-amphibolite). The local decrease in metamorphic grade on the northern side of the outcrop is possibly caused by a narrow shear zone. The rock material of this outcrop has been mainly spilitic tuff with lavamaterial (traces of lava-flows are still visible). The sample 1/TA represents the more amphibolitic variety.

Location 2/TA. Several small outcrops on the top of the hill. The rock types are basic volcanics similar to the obs. 1/TA. More coarse grained amphibolitic varieties are quite common. Lava-flows (sometimes with pillow structures) are often visible. The rock is often strongly folded.

Location 3/TA. A poorly exposed, wide outcrop north of the previous volcanic area. On the southern part of this locality the volcanic material diminishes rapidly and the rock is greywacke with a little volcanic material. Below the greywacke there is strongly foliated quartzose, sometimes rusty rock sometimes also containing graphite (sample 3/TA-A). This rock looks like re-crystallized chert (jasper) and resembles jaspilites from Finnish Lappland. Below the chert there is again a narrow greywacke bed, but this greywacke does not contain any volcanic material and it is very strongly sheared in the direction of bedding (see sample 3/TA-B). Below the greywacke bed there is a strongly weathered graphite-bearing schist (samples 3/TA-C, 3/TA-D). This graphite schist contains a little sulphides (mostly fine grained, disseminated pyrite).

4/TA. The rock types are as in the previous observation, but the upper greywacke is quite carbonate-bearing.

5/TA. A tuffaceous greywacke with thin (5 cm) limestone (=carbonate-rich) intercalations.

6/TA. An about 5 m thick graphite schist-bed between chert-beds. The upper chert on graphite schist contains plenty of graphite and is often rusted. The graphite schist contains sometimes massive pyrite and a few grains chalcopryrite (6/TA-B). Quartzose intercalations (cherts) are also sulphide-bearing (py + a little cp, see sample 6/TA-C).

7/TA. An old quarry. The rock is mostly very graphite-rich containing about 80% graphite, the remainder being quartz and pyrite. Sometimes quartzose material is very common, sometimes also pyrite (see sample 7/TA). The pyrite-bearing rock is usually brecciated, but graphite-rich varieties are often sheared in the direction of bedding.

8/TA. The biggest chert outcrop on the mapped area. "Chert" is just the fieldname of this quartzose rock type given before microscope study (see also 3/TA). The rock is usually very foliated and quartz is the main mineral. Often the rock is weathered and rusted probably containing carbonate and/or feldspar, in which case the weathered rock resembles wet salt. Often the rock is graphite-bearing, and this property points to some kind of metasomatic origin or to siliceous volcanic emanations erupted under the sea. This event is possibly associated with the inorganic formation of graphite schist by reducing CO_2 . This quartzose rock also has a few similar features to the acid spilitic volcanics of the Salganjokka-area, but any connection between these two rock types seems to be very improbable.

9/TA. The contact between the graphite schist/chert and mica schist. The graphite schist is quite quartz-bearing and also contains some py. The content of graphite is not very great. The mica schist is quite fine grained and very strongly folded containing graphite close to the contact zone. Away from the contact the amount of carbon diminishes and the grain-size of the mica schist increases. This mica schist looks like some kind of metaturbidite, but tectonic movements have destroyed any original sedimentary-characters.

To the south of the contact the graphite schist changes quite rapidly to chert without any distinct contact. The sample 9/TA represents graphite-bearing micaschists.

10/TA. A magnetite- and garnet- (almandine-?) bearing intercalation in the volcanic material. This rock type resembles "Garben Schiefer" because of radial amphibole grains (sample 10/TA).

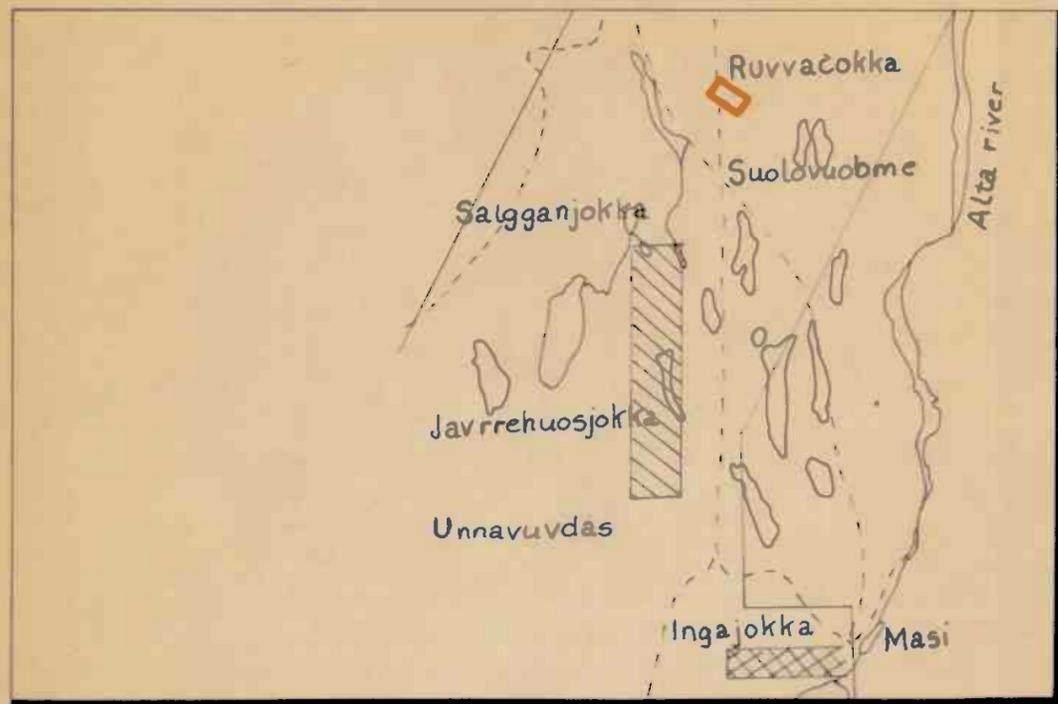
11/TA. A small outcrop, in which the rock is graphite schist containing massive pyrrhotite plus pyrite and a little chalcopyrite (sample 11/TA).

2b. Tectonic Summary.

The tectonic observations, except fracturing, are summarized on fig. 4. Schmidt's equal area net (lower hemisphere) plot. Fold axes and lineations are marked with dots. Beddings and schistositys are plotted on the net and areas of equal pole densities are joined with equidensity curves. These equidensity limits can be found on the diagram. The constructed fold axis for the Ruvva^âokka area is marked with a cross.

Even though the investigated area was small and the number of tectonic measurements was limited, two main directions of plunge of fold axes can be seen. The first one varying from 130/20 to 175/30 (constructed fold axis 173/25). This represents the most common direction on this area. The second one is about 230/15 and might represent the axis of second folding phase, but it could as well be the axis of cross folding of one and the same phase (see also constructed fold axis of the Havgajavrre - Sodnajavrre area, Rpt. 366/75/17). N-S-striking steeply dipping fracturing is possibly the axial plane cleavage (dashed lines on the maps) of the southly plunging anticline. Lineations that can be seen in the chert beds represent the direction of tectonic transport. They are almost at right angles to the areal fold axis. The gentle, varying plunge directions of the lineations are caused by the location at the crest of southly plunging anticline.

Due to the interaction of topography and the gently plunging anticline, geological contacts are often not parallel to the observed bedding strike. Extensions to the ore bearing horizons should be sought along the direction of the fold axis, rather than along the bedding strike direction.



2200N 2000N 1800N

1500N 1300N 1100N 900N 700N 500N 300N 100N

KEY:

- Quartzite, Chert
- Qtz. keratophyre.
- Conglomerate
- Al bite carbonate rock
- Graphitic schist
- Amphibolite
- Gabbroic rock
- Old showing

300E
200E
100E
Base Line
100W



LAKE

6/TA

7/TA

8/TA

9/TA

4/TA

3/TA

1/TA

11/TA

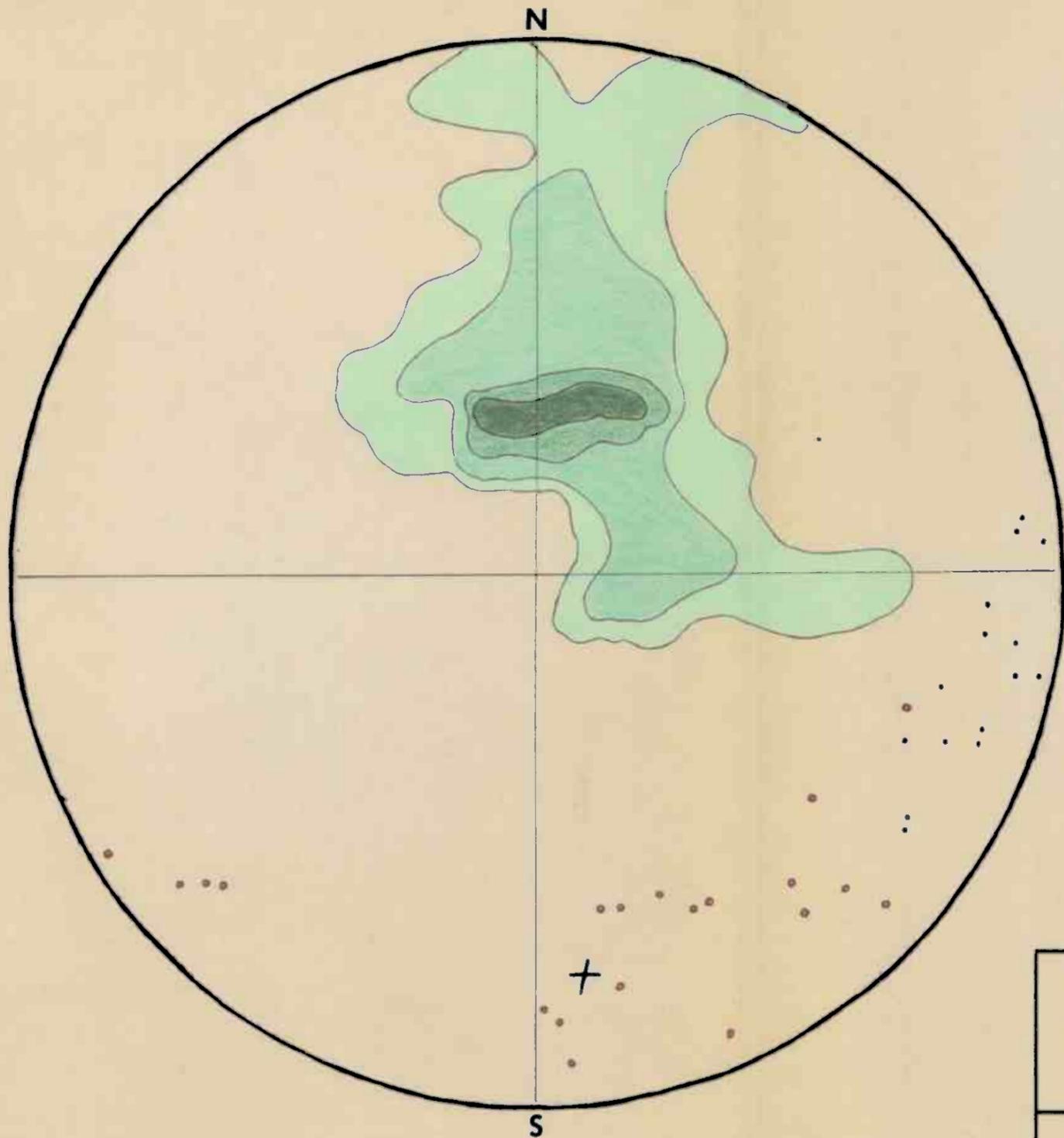
10/TA

700E
600E
500E
400E
300E
200E
100E

A'S SULFIDMALM

RUVVAČOKKA Geology

SCALE 1:4000	DRAWN RBB
DATE 3-78	TRACED BB



KEY:

- Lineation
- X Fold Axis (Constructed)
- Fold Axis
-  Equidensity curves: bedding/schistosity pole plots.

LAMBERT'S PROJECTION Tt-Diagram.

RUVVAČOKKA area Tectonic observations	SCALE	OBS.	
		DRAW. EK	4-76
		TRAC. BB	5-76
		CHK.	
$\frac{1}{5}$ SULFIDMALM	MAP NO.		
	MAP SHEET		

VLFF - survey

3. VLF SURVEY

The Ruvvaçokka grid was covered with a 28 line km VLF survey, using a Crone Radem VLF unit and the Bordeaux France transmitter station. The survey was run along lines 50 m apart, with a reading interval of 25 m. B.O.F. was the only VLF transmitter sending a realable signal at the time the survey was carried out (2/8 - 4/9 1975), but unfortunately the direction to this station is almost perpendicular to the strike of the target conductors at Ruvvaçokka. Occasionally, due to the interaction of relatively flat-lying conductors and incised topography, the local outcrop trace of the conductors is more favourably oriented to the transmitter station and a clear cross-over is obtained. Generally however conductor definition with the VLF is very poor at Ruvvaçokka, and only broad "interference" zones can be outlined. (fig. 5). Frazer values are not presented for this VLF survey.

Till geochemistry

4. TILL GEOCHEMISTRY

The Ruvvačokka grid was covered with shallow (50-70 cm) till sampling on a 25 m x 50 m sampling pattern. A total of 1300 samples were collected. Samples were analysed at the Institute for Atomenergi Lab, Kjeller for Cu, Zn, Pb, Ni, Ag using an HNO_3 hot leach, followed by atomic absorption determination.

The till geochemistry data are presented in fig. 6. Sheet 1-7. The following threshold levels were used in interpreting the data:

	Cu	Zn	Pb	Ni	Ag
probably anomalous	120-170	95-127	41- 48	70- 90	0.3
anomalous	170-300	127-250	48-100	90-200	0.4-0.7
strongly anomalous	>300	>250	>100	>200	>0.7

Cu and Zn show very intense linear anomalies, with maximum values of 2870 ppm Cu and 8500 ppm Zn. Pb shows more restricted, but still intense anomalies, with a maximum value of 3000 ppm Pb. The geochemical anomalies are closely associated with the "VLF interference zones", the best indication of conductor locations presently available. The metal distribution pattern also suggests a form of stratigraphic control, with high Pb values in the central anomaly, and copper being more important in the eastern part of the grid. The till geochemistry data have proved very useful in focussing attention on the central portion of the Ruvvačokka follow-up grid.

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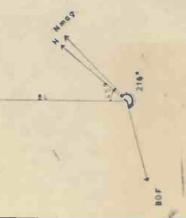
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11/TA. A small outcrop, in which the rock is graphite schist containing massive pyrrhotite plus pyrite and a little chalcopyrite (sample 11/TA).

2b) Tectonics

Location 1/TA-75.

Fold axis:

1. 170/48, 2. 142/18.

Bedding:

179/48, 168/20

(Bedding, fractures and schistosity are given as dip direction)

Fractures:

081/50, 031/84, 274/85

Schistosity:

180/50, 031/84, 025/82

Fold axis 2 represents the areal fold axis (tectonic b-axis) and 1 might be the direction of tectonic a-axis. The fracturing appears only in the coarse grained amphibolitic beds. In the chlorite bearing less competent parts the deformation can be seen as small scale kink folding or kink bands (axial plane 080/90, see fracturing). The rock commonly is very folded and beds even dip northwards on some fold limbs.

Location 2/TA-75

Fold axis:

130/32, 134/10

Bedding:

165/24, 176/34, 178/45

Fractures:

089/88, 070/90, 250/78

Schistosity:

172/62, 175/80 (=bedding plane cleavage)

Very dense fracturing with almost N-S-strike is a possible axial plane cleavage. Folding is still very intense.

Location 3/TA-75

Lineation:

094/15, 099/09

Bedding:

200/34, 174/30

Fractures:

128/88, 205/45, 110/90, 290/84

Schistosity:

191/78, 180/90

The plastic deformation at this place doesn't seem to have been as strong as in the greenstones, which apparently are less competent. Instead of intense folding mylonitization has taken place along the greywacke beds.

It appears that the graphit-schist-chert-greywacke-member was the most resistant part of the lithological series of this area, and that rather than folding it responded to deformation by mylonitization along the greywacke horizons.

Location 4/TA-75

Lineation:

111/14

Bedding:

205/30, 192/42, 211/22, 199/30, 170/24

Fractures:

113/90, 089/86, 110/82

Schistosity:

195/25, 191/65

Fold axis:

052/24 (minor fold), 111/25

Location 5/TA-75

Bedding:

172/22, 188/20

Schistosity:

194/55

(=mylonite zone in greywacke)

186/65

" " " "

Greywacke with carbonate intercalations seems to be most liable to mylonitize.

Locality 6/TA-75

Bedding:

188/42, 195/50

Fracturing:

275/75

Lineation:

102/08

Dense N-S-striking almost vertical fracturing seems to be the most typical tectonic feature of the chert.

Locality 7/TA-75

Bedding:

163/15, 185/20

Fracturing:

285/80, 099/89

Lineation:

086/05

The pure graphite schist is very strongly sheared. Pyrite-graphite schist is not sheared or mylonitized but brecciated.

Locality 8/TA-75

Lineation:

265/10, 264/09

Fracturing:

086/80, 078/85, 258/89

Schistosity:

177/85, 181/84

Locality 9/TA-75

Fold axes:

1. 141/24, 166/35, 169/21, 155/30, 153/30

(small scale flexural folding)

2. 226/16, 228/16, 230/12 (kink bands)

Lineation:

123/18, 125/17, 110/12, 115/15

Bedding:

165/25, 152/30, 140/32, 165/35, 159/39, 160/26

Two cleavages. The older one is a bedding plane cleavage and the younger one appears as kink bands (axial plane 147/42). At some places the younger schistosity appears as quartz-carbonate-filled veins (strike 156/74, -150/xx).

Locality 10/TA-75

Lineation:

232/25, 225/29, 205/35

Bedding:

220/30, 219/25, 204/28

The measurements are not very reliable because of the abundant magnetite.

2b Tectonic summary

2b) Summary

4

X

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Due to the interaction of topography and the gently plunging anticline, geological contacts are often not parallel to the observed bedding strike. Extensions to the ore bearing horizons should be sought along the direction of the fold axis, rather than along the bedding strike direction.