

ROUGH DRAFT

To: A/S Sydvaranger OSLO
From: R.I.McPherson KAUTOKEINO
Date: September 1974
Subject: SUOVRARAPAT - Finnmarksvidda

→ Heitkin

1. GENERAL STATEMENT

A considerable body of N.G.U. data, mostly dated 1958-62 deals extensively with the Suovrarapat project on West Finnmarksvidda. Most text is in Norwegian consequently this report mainly evaluates maps, drill sections and other graphic data, and the summaries in English of geology and geochemistry.

The writer flew in to Suovrarapat with L.-E.Fjellström and camped for five days on the prospect, later walking out to Bidjovagge. All of N.G.U.'s old drill sites were easily relocated and each numbered: 500A and B, 492A, 1-59 to 10-59 inclusive. The geology was briefly examined using N.G.U. maps and Fjellström checked the distribution of mineralised float.

The map grid used by N.G.U. in their survey was marked on the ground by stakes. This grid covers an area 5000 to 9000 metres east and 4000 to 12000 metres north of a base station at Bidjovagge. Some of these stakes, engraved with their intercepts, were ~~located~~ found but the general impression is that many are now missing - the grid was laid about 16 years ago.

Following this visit to the area the data has been studied and summarized: see three maps attached this report. Enlargements at 1:10,000 of air photos became available in late August (south part of area) and in early September (north part of area).

2. EVALUATION

All ~~ed~~ data has been summarily plotted onto the two magnetic maps: 1962 - GM 374-02/03 - scale 1:4,000 attached to this report.

2.1 GEOLOGY

N.G.U. maps: GM Rapport Nr.252 1960: scale 1:4,000
GM 374-01 1963: scale 1:10,000

Their mapping suggests an intrusive and submarine semi-volcanic pile exposing crystalline amphibolites or diabase toward the base of the succession, overlain by stratified volcanoclastics interbedded with or intruded by

sheeted amphibolites, and then succeeded by metasomatically altered carbonates, argillite and volcanic breccia. Graphite schist, "fels", carbonate, and "intrusive" albite-carbonate (leuco-diabase ?) are mapped at various other horizons within this sequence.

Mapping suggests a thin and possibly discontinuous lowermost sedimentary horizon to contain the lithologies "albittfels" and graphite shale, interlayered with, or possibly directly overlying the mafic intrusives at the base of the exposed succession. The account in English of the geology (1962) suggests that most of the amphibolites are petrographically ophitic and therefore intrusive rather than extrusive.

The "fels" discussed above is brecciated and mineralised by pyrite, pyrrhotite and chalcopryrite, and by subordinate bornite, chalcocite and malachite. "Graphite" either overlies or is contained within the fels.

← Geophysical, soil and float surveys indicate one or more successively higher horizons to contain a similar association of mineralised rocks.

N.G.U. report the regional metamorphic overprint as chlorite rank. The writer infers this is lower chlorite rank.

The impression gained from seeing the rocks in the field is that the coarsest crystalline mafic lithology is mappable as a fine grain gabbro (grovkrystallinsk grønnstein of map Nr.252 ?). Bedded finely tuffaceous volcanoclastics are very finely and remarkably laminated. No scour or current bedding structures were seen which indicates the sequence was deposited below wave base, although the general association of lithologies suggests a shallow water, possibly shelf environment. Some of the finely laminated - weathering beds contain euhedral porphyroblastic feldspars with "albitised" - red⁴ colour in a dense mafic matrix: ~~ee~~ albitised volcanic muds ? Other beds contain concentrations of euhedral magnetite. In several localities the rocks are ~~dense, compact, etc~~ densely fine grain and contain small feldspar laths; the texture is rather trachytic suggesting volcanic flows.

Quartzitic sand and silt wackes were located still higher in the sequence, and in one outcrop an angular fragment of chert was found embedded in a ~~stone~~ thin colloidal band of silica and buried by successively overlapping silt laminae. This, and graded bedding determined at two localities in laminated tuffs indicate the succession to be stratigraphically right way up.

Rocks variously described as albittfels or as albittkarbonat - this usage seems to differ between various maps and reports - or as other carbonate lithologies should be looked at more closely. This writer's impression, both from the Suovrarapat study and Bidjovagge, is that an ~~attempt should be made to separate the~~

attempt should be made to separate the albite-carbonate assemblage, *sensu stricto*, from other mineralogies which may more closely relate to quartzite or limestone. Bottles of 1:10 Normal HCl would be useful in this field mapping :

This problem is again referred to in the following section:

2.2 - Prospecting. In two localities mapped respectively as albitt fels and albitt karbonat intrusive, the general appearance of the rocks gave the impression of quartz keratophyre. Sheets of carbonate cut or ramify through greenstones and were probably submarine calcite dikes. They are common enough in pillow lava assemblages.

Graphite and graphitic rocks variously described as graphite "schist" or graphite "shales" are puzzling. Without prior knowledge of the carbon content and with the exception of the readily recognisable crystalline graphite exposed at Bidjovage, much of this material is mappable as a dark argillitic mudstone .

This assemblage is curious in so far as graphite or carbon-bearing mud seems to be closely associated with the mineralisation. A possible explanation for the presence of carbon in rocks assumed to generally pre-date the palaeontological record may be found in the metallization of "fels" rock close to or in contact with carbonaceous rock: a volcanic exhalative source is most likely for the metals and some sulphur, with the attendant growth of sulphur-fixing biogenic organisms a possibility in volcanically warmed ~~seawater~~ seas. A possible alternative explanation may relate to the ~~small~~ quantity of CO₂ which may have been volcanically exhaled at this geologically early stage in crustal development.

It seems likely that brecciation of fels rock is post-depositional and brought about by the mobility of graphite and carbonaceous shale, most likely at the onset of regional metamorphism, with sulphide subsequently and locally remobilised as fracture-fill during the peak of metamorphism.

2.2 PROSPECTING

N.G.U. maps GM 374-0 (two sheets).

The distribution of albite-fels, mostly as float, has been plotted onto the attached maps and colour-coded (red) where mineralised. The addition of other lithologies would have made the maps too complicated. A better system would be to adapt overlays for various classes of data.

One criticism of the float/outcrop register maps is that graphite float cannot be distinguished from outcrop. Furthermore some clusters of float triangles are not colour-coded. Evidently float greenstone carrying calcite, quartz and chalcopryrite is widely but thinly scattered over the area and a cluster of greenstone float north of Cuovca-javrret carries bornite and chalcocite.

These maps distinguish between albite-fels and albite-carbonate (see key) which appears most confusing to this writer, particularly as the photocopy of a geological report on Suovrarapat by N.G.U. (1962) in English distinguishes between "quartzite fels" and "albite-carbonate" rocks. Mathiesen's map of the Bidjovagge area clearly only defines "albite fels". Even the use of "fels" would appear obscure !

2.3 GEOPHYSICS

The extent of both the magnetometer and electromagnetic surveys is adequate. Anomalous magnetic areas are coloured green and S.P. anomalies in purple, thus duplicating the colour coding of Mathiesen's map of the Bidjovagge area.

Evidently the S.P. survey was limited to the area drilled by N.G.U. and should be extended away, north and south along the track of the major E.M. anomaly. The coincidence of S.P. and stronger E.M. anomalies over graphite is self-evident and analogous with Bidjovagge. The magnetometer survey could be further related to geology by differentiating in field mapping between magnetic and non-magnetic amphibolite and diabase - again, see Mathiesen's map of Bidjovagge.

2.4 GEOCHEMISTRY - SOIL SURVEY

Total population contains 525 soil samples. A histogram for Cu is strongly leptokurtic about the 10 to 30 ppm range, and the 50 percentile for the total population was roughly computed at 140-149 ppm for 437 samples, and therefore appeared too strongly skewed.

Cut-off was selected at the 400-409 ppm range, reducing the population to 411 samples. The residue of assays, considered erratic, total 14 and range 480 upwards to 1350 ppm.

Weighted percentiles are very approximately computed at:

50 percentile:	99 ppm
68 percentile:	149 ppm
97.5 percentile:	349 ppm

Accompanying maps clearly show the disposition of geochemical anomalies entrained northward from the projected E-W arc of subcropping mineralisation.

The geochemical survey did not extend over the area of close spaced E.M. and S.P. anomalies to the south-east (8,400 E, 8,600 N).

2.5 DRILLING

Assays and logs are available for 13 holes drilled on the arc of coincident E.M.-S.P. anomalies. Drill holes containing significant mineralisation include 500A (discovery hole), 6-59, 4-59, 9-59, and 10-59.

All of these are closely located against the flanks or at the ends of the S.P. anomalies, and at least three, probably four are ~~related~~ located on the track of rather weaker than stronger E.M. anomalies, clearly indicative of the E.M. and S.P. response to graphite.

Further study should be made of the drill logs, and particularly of the cores if still stored at N.G.U.

2.6 STRUCTURE and AIR PHOTO INTERPRETATION

Structure has been interpreted as a broad anticline plunging gently south. The breadth of this structure is indicated by the trend of the major E.M. anomaly which tracks south along the ~~west~~^{east} flank from the Salggejokka River and then arcs across the crest of this apparent fold.

If this were a simple fold structure the E.M. anomaly should then track north from Cuovcajavrret along the west flank. Instead the anomaly turns abruptly south under the northernmost lake and curves away to the south-south-east.

Analysis of air photos and magnetic maps suggests that the folding is in response to rather complex faulting, especially ~~to~~^{to} the west, and is not so simple a structure as previously thought. If this is correct, then the area previously drilled is bounded on the west by a belt of one or more faults tracking north-north-east under Cuovcajavrret. The structure must be broadly controlled by this belt and more locally modified by at least several north-west trending faults.

Detailed mapping is needed to clarify this structure.

3. GENERAL CONCLUSIONS

3.1 TARGET CONCEPT

The Bidjovagge area provides the ~~structural~~ conceptual structural situation applicable to Suovrarapat. Mathiesen's map of Bidjovagge shows ore bodies to be frequently located beyond the ends of the graphite shale beds or stringers, and perhaps less frequently located on the flanks of these beds.

These situations correspond to the edges of S.P. anomalies and to either the weaker "tails" of the E.M. anomalies which track over graphite beds, or to short rather weak E.M. anomalies which run semi-parallel but independent from the stronger anomalies, controlled by graphite.

Drillhole data from Suovrarapat supports this concept.

3.2 Structure is more complex than previously thought and if the case presented in this report is close to accurate ~~then~~ then the E.M. anomaly should be investigated to the south under the Cuovca lakes, and north towards the Salggajokka.

A second but probably minor area of S.P., E.M. anomalies and "fels" float centred about 8,300 E 8,400 N should also be investigated.

3.3 Existing geological maps are inadequate if further work is contemplated in this area. The existing map grid was laid down in the order of 14 to 16 years ago and is no longer adequate.

3.4 An S.P. survey is required over the tracks of all important E.M. anomalies in the area.

3.5 Several potential drill targets are already available in three areas:

(a) north of drillhole 3-59, broadly within the area about 7,400-7,600 E and 9,100-9,400 N.

(b) over the geochemical and E.M. anomaly centred about 7,900 E and 9,400 N.

(c) under the northernmost of the Cuovca lakes, about 6,400 E and 9,000 N, or possibly further east, about 6,500 E and 8,950 N.

4. RECOMMENDATIONS

The following work programme is recommended for 1975.

4.1 An all-weather track sufficient for a four wheel drive vehicle be opened-up from Bidjovagge into Cuovcjavrret lake in May 1975, following approximately the line of the existing old track. A decision on this recommendation is urgent and the river crossings and marshes about the Njille-ädno should be inspected to see if this is feasible.

The alternative is transportation by float plane to Cuol'bmajav'ri about 6 kms from the area.

4.2 A four berth hut be erected at the site of the old hut - this to contain

space for a plotting table. To commence May 1975.

4.3 Detailed outcrop mapping over a wide area, employing geologist and two geological assistants, to commence June 1975.

Following materials are required:

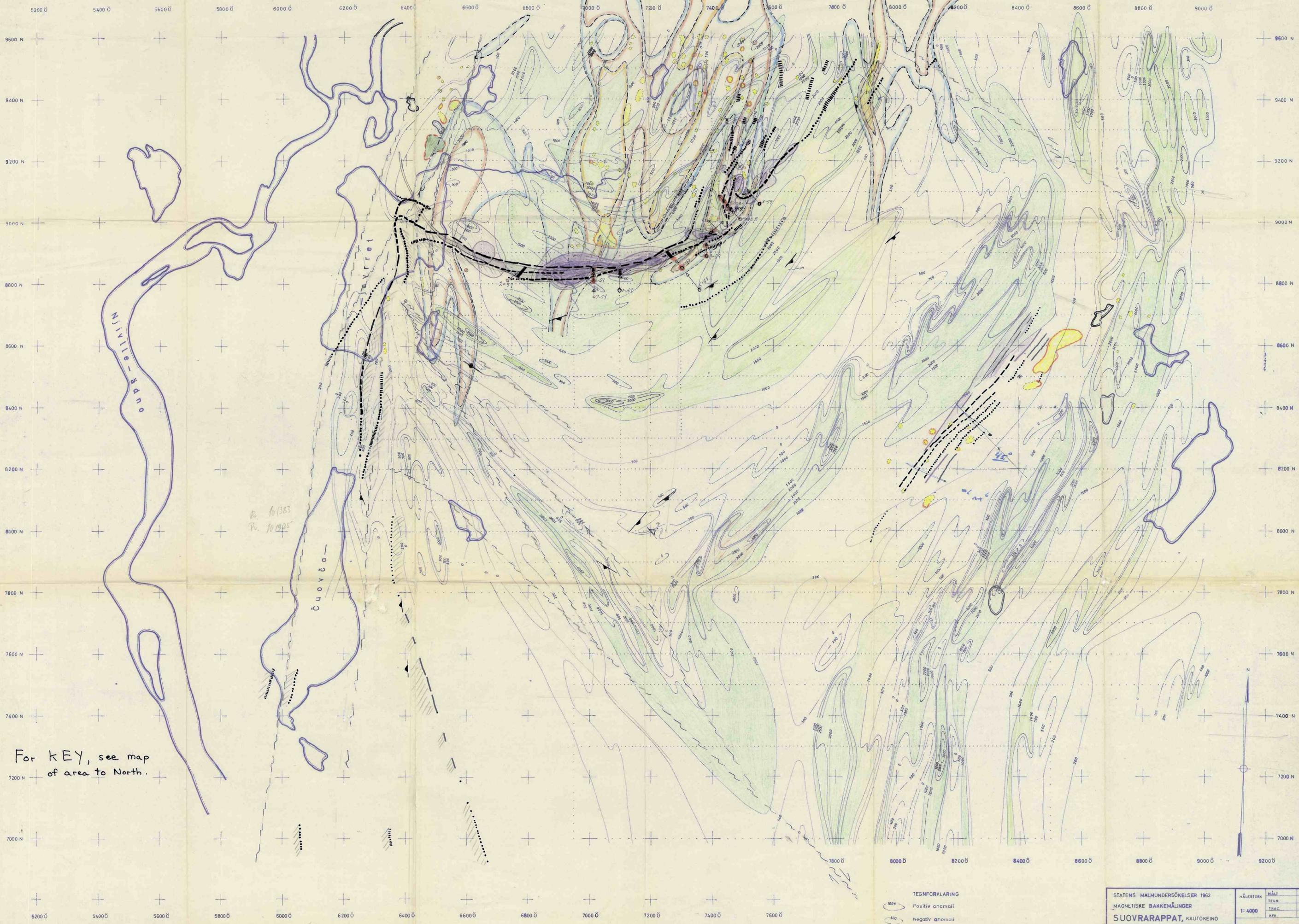
- (a) One set of contact air photo prints of the whole area.
- (b) Sufficient sets of photo enlargements at 1:5,000 scale to cover all field personnel working independently.
- (c) Stable base transparency film and tracing paper.
- (d) Requisite draughting materials.

4.4 S.P. survey to be made over the tracks of E.M. anomalies, to more closely define drill targets. To commence mid-July 1975.

4.5 Exploratory drilling programme, to commence September 1975 or earlier if all other data complete and available for appraisal. Then possibly to continue again in spring 1976.

4.6 The programme outlined follows a tight schedule and will require:

- (a) Complete costing and organising during winter 1974-5.
- (b) The continuous presence of all geological personnel throughout the summer months.

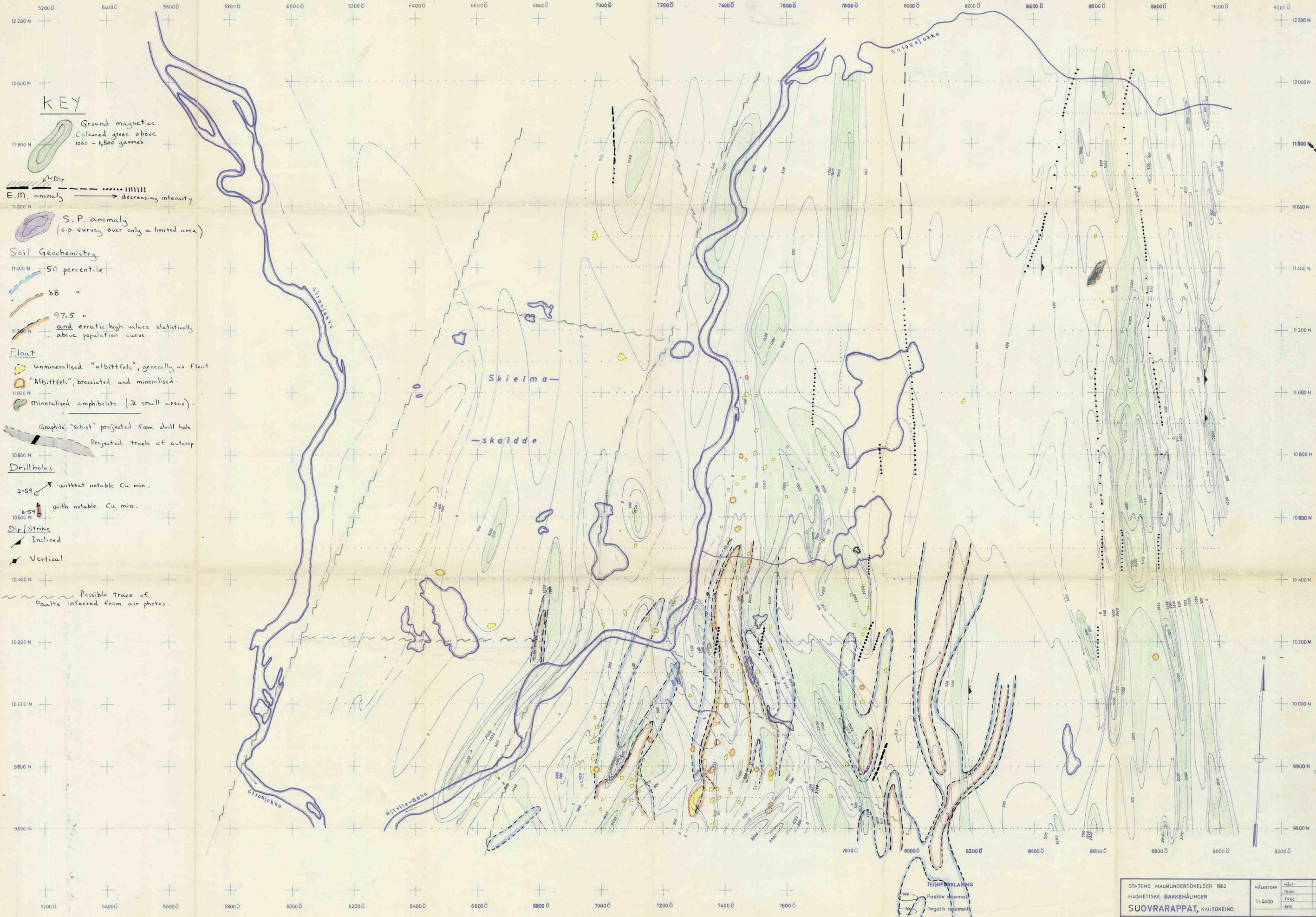


For KEY, see map
of area to North.

R. 10/1983
P. 10/1985

- TEGNFORKLARING
- 1000 Positiv anomali
 - 500 Negativ anomali
 - Målepunkter

STATENS MALUNDERSØKELSER 1962		MÅLESTORR	MÅLT
MAGNETISKE BAKKEMÅLINGER		1:4000	TEGN.
SUOVRARAPPAT, KAUTOKEINO		ISAC	KFR.
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM		TEGNING NR. GM374-02	KÅRTBLAD (AMS) 1833 IV



KEY

- Ground magnetics
Coloured green above
1000 - 1500 gammas
- E.M. anomaly
Dip
decreasing intensity
- S.P. anomaly
(s.p. survey over only a limited area)
- Soil Geochemistry
50 percentile
68 "
97.5 "
and erratic high values statistically
above population curve.
- Float
Unmineralised "albitfels", generally as float
"Albitfels", brecciated and mineralised.
Mineralised amphibolite (2 small areas).
- Graphite "schist" projected from drill hole
Projected track of outcrop
- Drillholes
2-59 without notable Cu min.
6-59 with notable Cu min.
- Dip Strike
Inclined
Vertical
- Possible trace of
Faults inferred from air photos.

TEGNFORKLARING
 1000
 Positiv anomal
 Negativ anomal
 Målepunkter

STATENS MALMUNDERSØKELSER 1962		MÅLSTOKK	MÅLT
MAGNETISKE BAKEMÅLINGER		1:4000	TEGN.
SUOVRARAPPAT, KAUTOKEINO			TRAC
NORGES GEOLOGISKE UNDERSØKELSE TRONDHEIM			KFR
		TEGNING NR.	KARTBLAD (ANS)
		GM374-03	1833 IV