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Geophysical survey at South Pasvik march 1993.

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Soumen Malmi Oy SMOY Mikkola, Pekka	18.03 1993	Sulfidmalm Falconbridge

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Råstofftype	**Emneord**	
Malm/metall	Ni Cu	

Sammendrag

This report describes the geophysical survey (Mag and Max-Min EM) carried out on behalf of A/S Sulfidmalm (the Client) by Soumen Malmi Oy (SMOY) at South Pasvik.

In every three grid there are few anomalies which are typical for schists (long, narrow, conductive and partly veakly magnetized). There are also a number of anomalies caused by magnetized, non-conductive rock types. Both of these rock types may be insignificant for the prospecting.

In adition there is one anomaly both in grid A and C, probably related to a faulted or fractured zone. The anomaly situtaing in the grid A, may represent a mineralization related to a mafic formation. It is possible that both anomalies are caused by graphite and sulphides ina fracture.

It could be possible to specify possible mafic formations in the above areas with a gravity survey.

(Tolkningskart med mulig mineraliseringer, ligger som bilag bakerst).

A/S SULFIDMALM

GEOPHYSICAL SURVEY AT SOUTH PASVIK, NORWAY MARCH 1993

SMOY

GEOPHYSICAL SURVEY AT SOUTH PASVIK, NORWAY - MARCH 1993

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ORIGINAL
+ 1 h. rapp mars 1993

GEOPHYSICAL SURVEY AT SOUTH PASVIK, NORWAY - MARCH 1993

INTRODUCTION

This report describes the geophysical survey carried out on behalf of A/S Sulfidmalm (the Client) by Suomen Malmi Oy (Smoy).

The work was carried out according to the agreement dated February 12, 1993. The survey plan was made by the Client. The interpretations were made by Turo Ahokas , GX Consulting according to a sub-contract.All the data is delivered to the Client as various maps and on the IBM-type diskettes using Geosoft format.

A. FIELD SURVEY AND DATA PRESENTATION

1. Survey area

The survey area is located in South Pasvik, Finnmark Fylke, Sör-Varanger Kommun, Norway. The size of the whole area is approx. 3.5 x 6 squarekilometres.

Totally 10.3 linekilometres of baselines, 2.70 kms of rapid base lines and 13 GPS points were measured to locate survey grids on the survey area.

2. Surveying

Surveying and staking of the base lines were carried out using a theodolite and an electro-optical tachometer. The corner points of the grids A, B and C were located using a Trimble GPS navigator (App. 5.). The accuracy of the GPS points is +- 5 m.

3. Magnetic Survey

A standard procedure for the magnetic total field survey was applied. The station spacing was 10 metres. The survey direction was either E-W or N-S (App. 3.1-3.4). Spacing of the survey lines was either 100 metres or 50 metres.

Two Scintrex MP-2 proton magnetometers were used, the other one as a base station. The magnetometers were provided with Rautaruukki KTP-84 data loggers.

The readings were taken with a resolution of 1 nT. The base station data was recorded once a minute. The survey readings were corrected according to the variations of the base station readings line by line.

The absolute corrected accuracy of the survey results is assumably within ±5 nT. The relative accuracy is better than 5 nT.

4. EM-Survey

The EM-measurements were made using Max-Min I equipment in the HLEM mode with a coil separation of 100 metres. Three frequencies (110 Hz, 440 Hz and 1760 Hz) were used. The station separation was 20 metres.

5. Magnetic Maps

The results are presented as profile maps using the slightly smoothened data (3 points' moving average) and as isoanomaly maps. The smoothing was done in order to reduce the magnetic noise originated in the very surface of the ground (individual boulders, etc.).

The isoanomaly maps were processed to illustrate the continuities of the anomalies. Upward continuation (10 metres) was used as the smoothing method.

6. EM-Maps

The EM-results are presented only as profile maps and without any smoothing. There are two types of profile maps: In-phase and out-of-phase stacked profiles and combined frequencies with all in-phase data in one map and, respectively, all out-of-phase data in one map.

B. INTERPRETATION

1. General

A systematic magnetic and Horizontal Loop EM (HLEM) interpretation was made for each grid A, B and C.

No geological background information on the area was at hand, when the interpretation was made. Hence the interpretation presented here bases on the results of the geophysical survey only, and the references to the underlying geology and bedrock base on the view of the interpreter.

The quality of the magnetic data was good enough even for the interpretation of weak anomalies. In the HLEM-data, some influence of conductive overburden can be seen. This has, however, no influence on the qualitative interpretation carried out.

2. Interpretation Methods

The interpretation of the magnetic data is made by interpreting a number of profiles using two- and three-dimensional models, with the Toolkit-software. The profiles shown in Appendices were selected from the most comprehensive places of the survey areas on the ground of prospecting, and if necessary,

systemically from a wider area. In addition, tens of profiles were interpreted in order to form a picture of the geological structure of the area.

With regard to prospecting, such factors like anomaly shape, several HLEM-anomalies in the same places and the picture of possible geological structures obtained from the survey data, were decisive in selecting anomalies to be interpreted.

The interpretation of the HLEM-data was made using the values obtained at the frequency of 1,760 Hz, because they proved most usable. The interpretations were made profile by profile and on the basis of the anomaly shape and the in-phase/out-of-phase ratio.

The results were combined to an interpretation map, in which the locations and widths of the conductors as well as a rough estimate of the conductivity are presented.

As for the dips of the conductors, only estimates are presented in the text, not absolute values (it is difficult to make a precise interpretation of anomalies which are caused by several parallel, narrow conductors).

3. Interpretation of the Grid A

The magnetic measurements (Map in Appendix 1) indicate that there is a spherical, fairly weak anomaly in the area, which can be interpreted as being caused by amafic formation, or by a complex pattern of strongly faulted, narrow, magnetized zones (= schists ?). The magnetic interpretation map is shown in Appendix 6.

A NE-SW -striking faulted or fractured zone crosses the interpreted structure, related to magnetic mineralization (Appendix 6), which is conductive, too (HLEM-interpretation map in Appendix 7).

In case it is a mafic formation, the possible sulphide mineralization related to the above fracture zone, is ore-critical. But it may be only a pattern of e.g. pyrrhotite (and graphite ?) in the fracture.

On the other parts of the area only weak conductivity appears, together with weak magnetism, possibly caused by impregnated pyrrhotite.

There are two interpretation profiles shown in Appendices 8 and 9, both of them being in a very unfavourable direction with respect to the above sulphide mineralization. Hence they are not very comprehensive.

4. Interpretation of the Grid B

The magnetic map (Appendix 11) shows most clearly a spherical anomaly situating in the middle of the area. It appears that there is no conductor related to this anomaly (Appendix 10,

HLEM-interpretation map). According to the interpretations the formation in question is strongly magnetized and possibly rather small in depth dimension. Because of lacking HLEM- anomaly, a sulphide mineralization is not probable (it may be a magnetic anomaly caused by magnetite). The interpretations of profile 4,400 E which is crossing the formation, are shown in Appendices 11 and 12.

According to the interpretations, there are some schist zones (= black schists ?) situating to the north and to the south of the above formation.

Dips are to north and they may be clearly more gentle than presented in the interpretation profiles.

In the area there are no anomalies which would appear interesting as prospecting targets.

5. Interpretation of the Grid C

The survey data indicates that the area quite clearly contains magnetized formations. A weak HLEM-anomaly is related to some of them.

Dips are to west, except for the northernmost part of the area.

In the northern part, the geological strike turns eastwards and at the same time direction of the dips
northwards.

HLEM-anomalies becoming positive is partly caused by the eastern strike (survey line is along the conductors), and this makes the interpretation of the conductors impossible.

In the southern part of the area there is, between profiles 71,000 N - 71,300 N, a stronger magnetized anomaly (Appendix 1), which seems to be related to a NW - SE -striking faulted or fractured zone which is weakly visible also on the HLEM-interpretation map in Appendix 13. It may be caused by a concentration of magnetic minerals in the above mentioned fracture zone, especially as the source of both magnetic and HLEM-anomalies seems to consist of several narrow, parallel zones (see profile interpretations in Appendices 14 and 15).

In other parts of the sub-area there are no anomalies which would appear significant as prospecting targets.

6. Summary

In every three grid there are anomalies which are typical for schists (long, narrow, conductive and partly weakly magnetized). There are also a number of anomalies caused by magnetized, non-conductive rock types. Both of these rock types may be insignificant for prospecting.

In addition, there is one anomaly both in the grid A and C, probably related to a faulted or fractured zone. The anomaly situating in the grid A may represent a minerilization related to

a mafic formation. It is also possible that both anomalies are caused by graphite and sulphides in a fracture.

It could be possible to specify possible mafic formations in the above areas with a gravity survey.

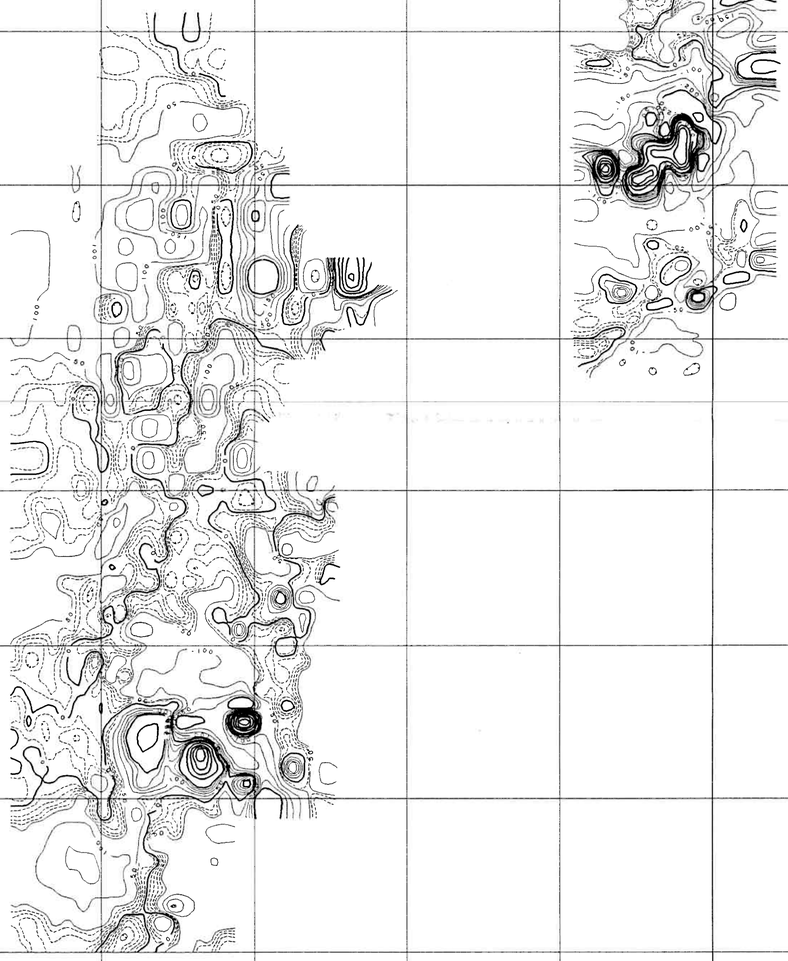
Espoo, March 18, 1993

SUOMEN MALMI OY

Pekka Mikkola

1500 E 2000 E 2500 E 3000 E 3500 E 4000 E 4500 E 5000 E 5500 E 6000 E 6500 E 7000 E 7500 E 8000 E

74500 N
74000 N
73500 N
73000 N
72500 N
72000 N
71500 N
71000 N
70500 N
70000 N



Appendix 1.1

10 nT
50 nT
250 nT

A/S SULFIDMALM

South Pasvik

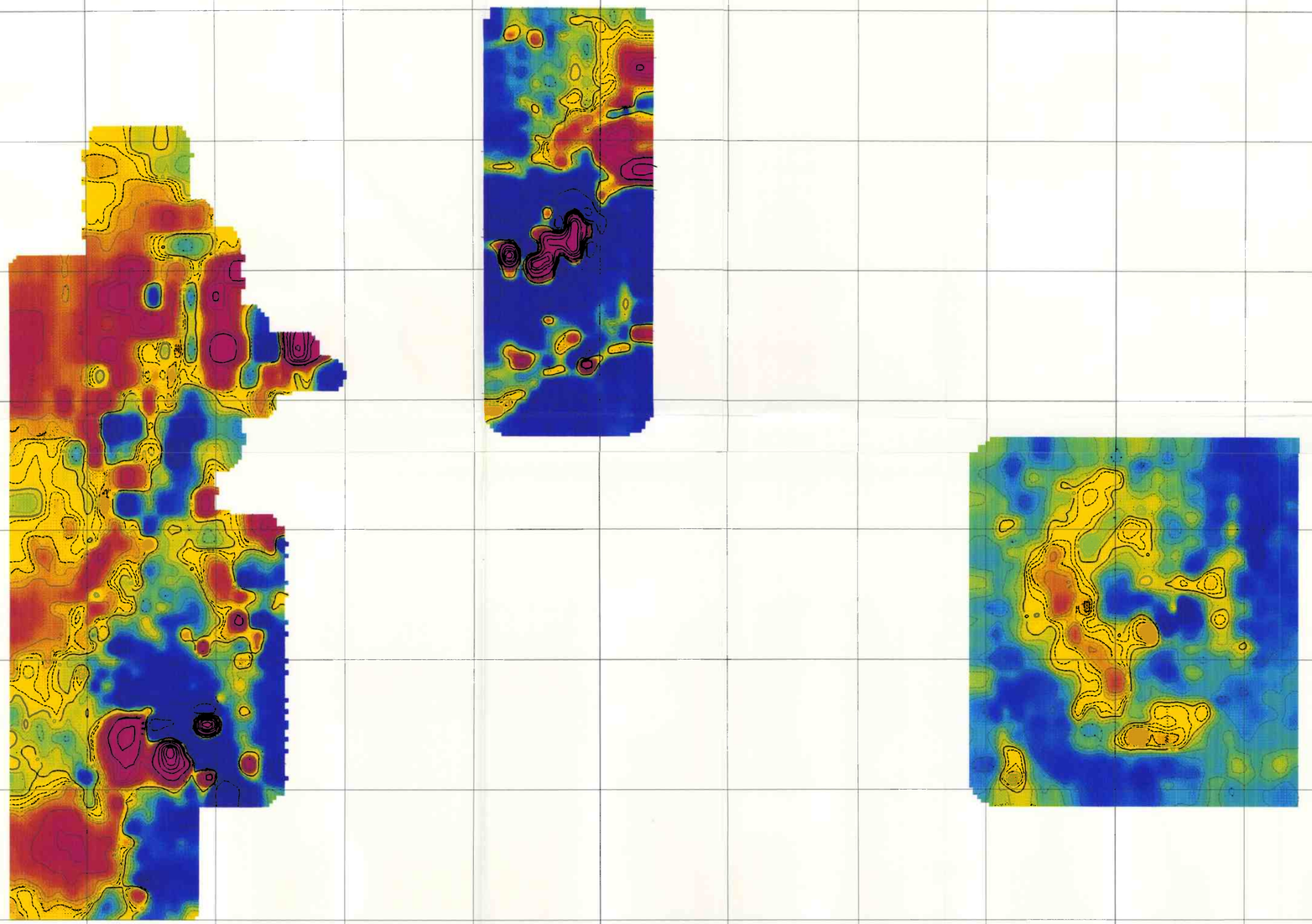
Magnetic Map Total Field
Grid = 10 m x 50 m

SMOY
SUOMEN MALMI OY

Arto Julkunen

1500 E 2000 E 2500 E 3000 E 3500 E 4000 E 4500 E 5000 E 5500 E 6000 E 6500 E 7000 E 7500 E 8000 E

74500 N
74000 N
73500 N
73000 N
72500 N
72000 N
71500 N
71000 N
70500 N
70000 N



Appendix 1.2.

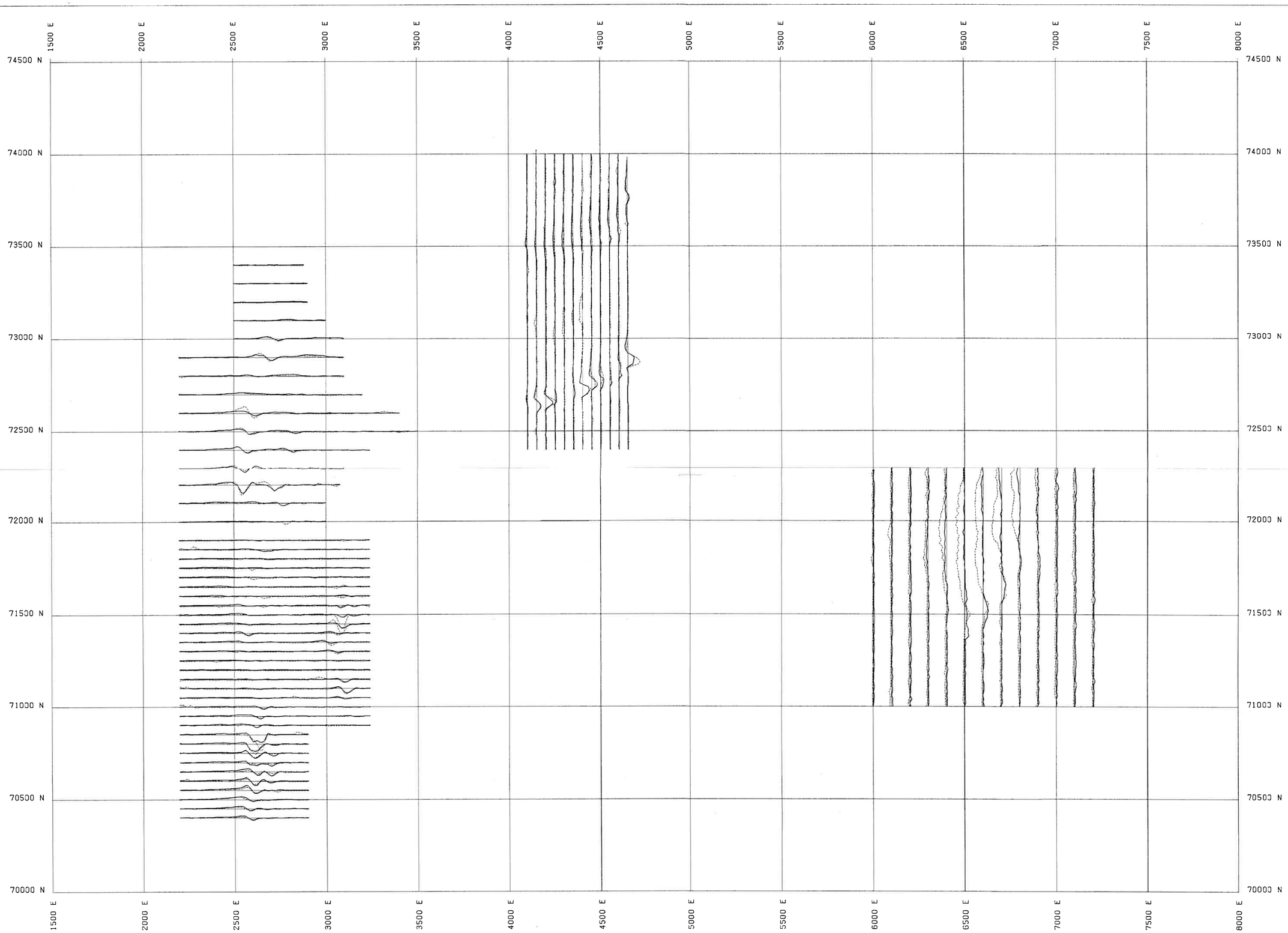
A/S SULFIDMALM

South Pasvik

Magnetic Map Total Field
Grid = 10 m x 59 m
Smoothing: Upward Continiation 10 m

SMOY
SUOMEN MALMI OY

Arto Julkunen 13059310



Appendix 2.1

A/S SULFIDMALM

South Pasvik

Coil Separation = 100 m
EM-measurement (Max-Min)
1 cm = 50 %, '+' = left/up

Stacked EM

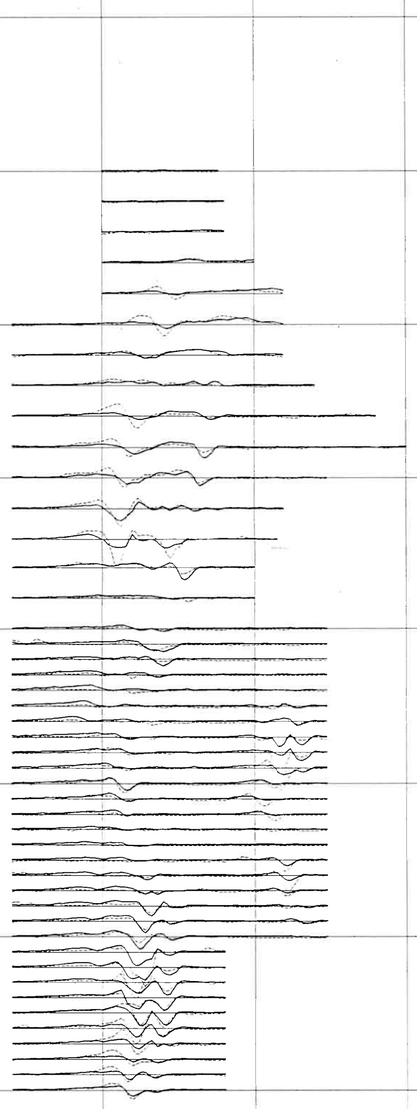
f = 110 Hz
– – – – – = Re
——— = Inn

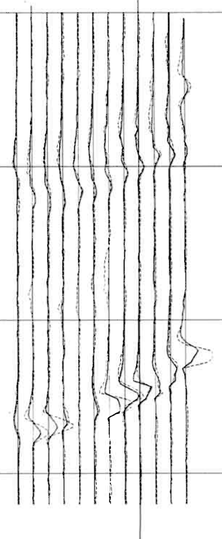
13059311 Arto Julkunen

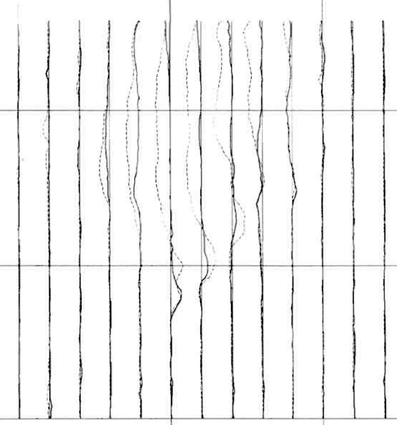
SMOY
SUOMEN VALMI OY

1500 E 2000 E 2500 E 3000 E 3500 E 4000 E 4500 E 5000 E 5500 E 6000 E 6500 E 7000 E 7500 E 8000 E

74500 N
74000 N
73500 N
73000 N
72500 N
72000 N
71500 N
71000 N
70500 N
70000 N







Appendix 2.2

Bilag til rapport
BV 4010

A/S SULFIDMALM

South Pasvik

Coil Separation = 100 m
EM-measurement (Max-Min)
1 cm = 50 %, '+' = left/up
Stacked EM

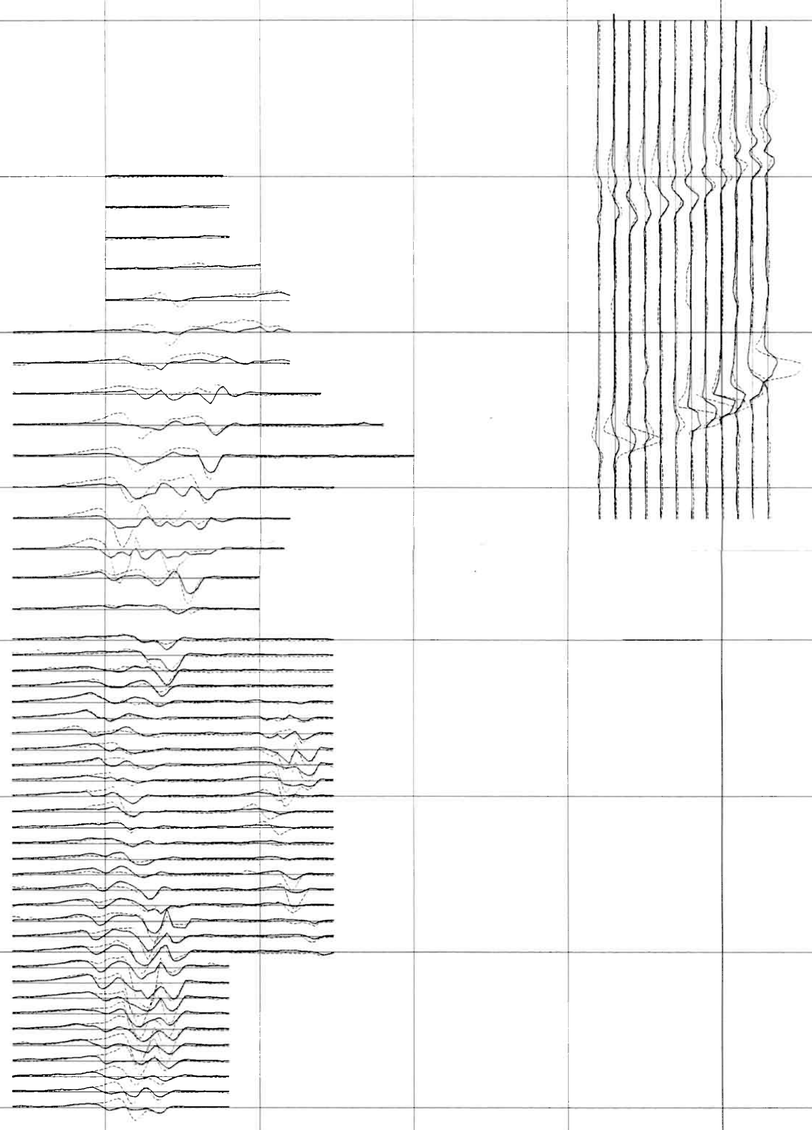
f = 440 Hz
– – – – – = Re
——— = Im

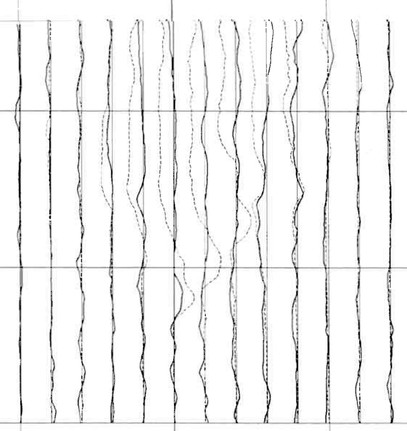
13059312 Arto Julkunen

SMOY
SUOMEN VALMI OY

1500 E 2000 E 2500 E 3000 E 3500 E 4000 E 4500 E 5000 E 5500 E 6000 E 6500 E 7000 E 7500 E 8000 E

74500 N
74000 N
73500 N
73000 N
72500 N
72000 N
71500 N
71000 N
70500 N
70000 N





Appendix 2.3

A/S SULFIDVALM

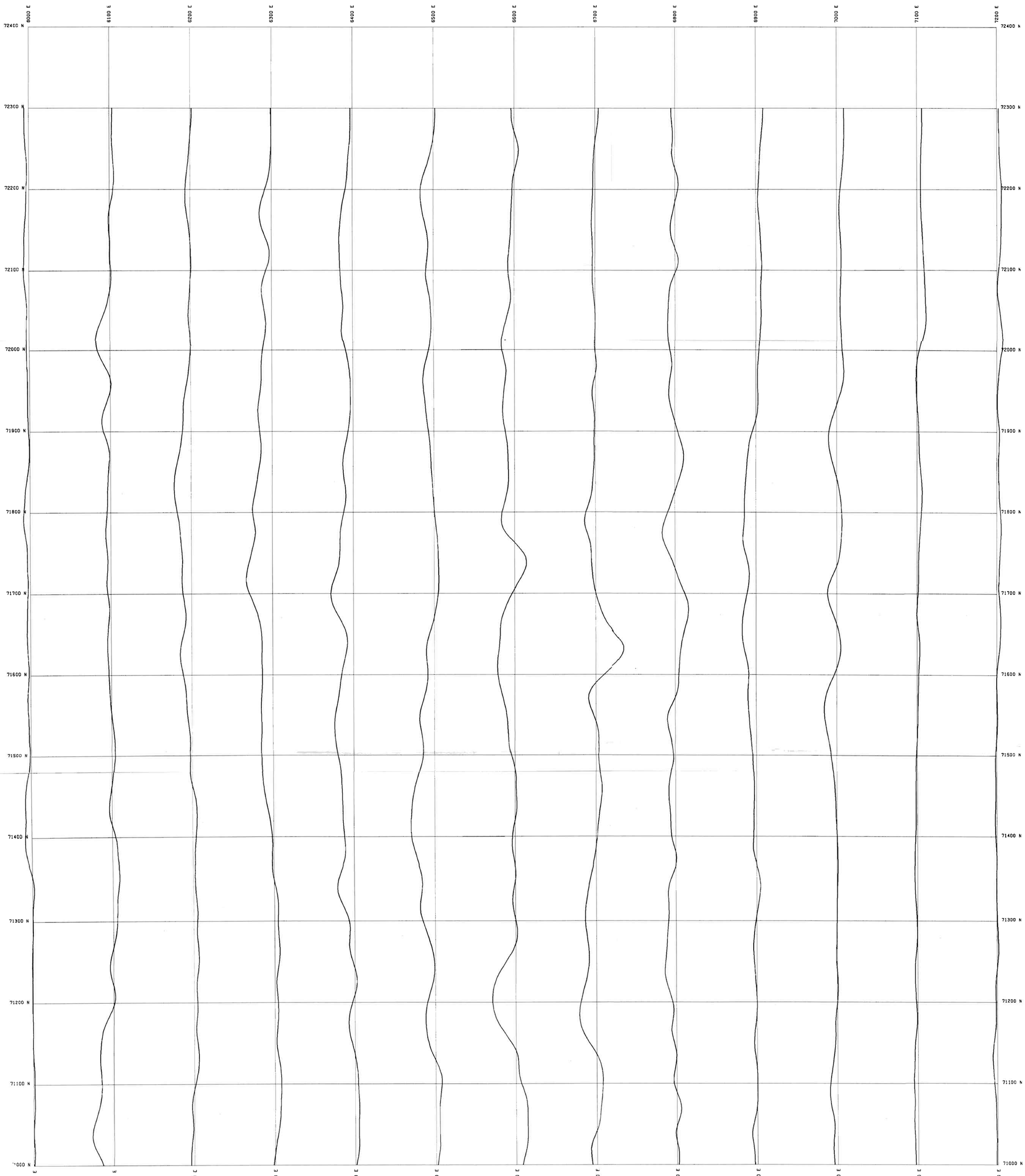
South Pasvik

Coil Separation = 100 m
EM-measurement (Max-Min)
1 cm = 50 %, '+' = left/up
Stacked EM

f = 1760 Hz
– – – – – = Re
——— = Im

13059313 Arto Juikunen

SUOMEN VALMI OY



Appendix 3.1

A/S SULFIDMALM

South Pasvik
Grid A

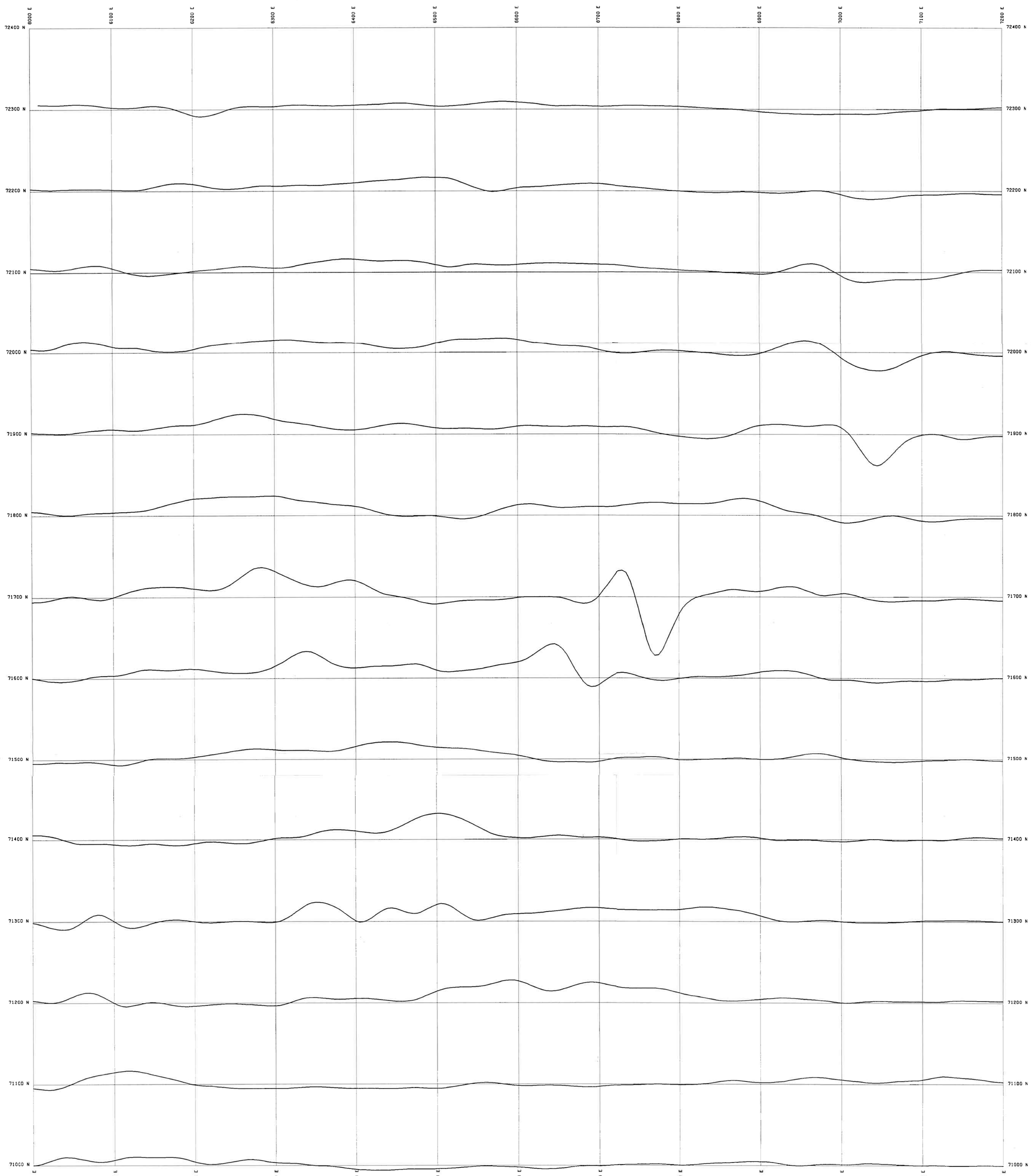
Magnetic Profiles Total Field

1 cm = 100 nT, '+' = left/up

Base Field = 53200 nT

Arto Julkunen SUOMEN MALMI OY

1:2000



Appendix 3.2

A/S SULFIDMALM

South Pasvik
Grid A

Magnetic Profiles Total Field

1 cm = 100 nT, "+" = left/up

Base Field = 53200 nT

13059314 Arto Julkunen SUOMEN MALMI OY

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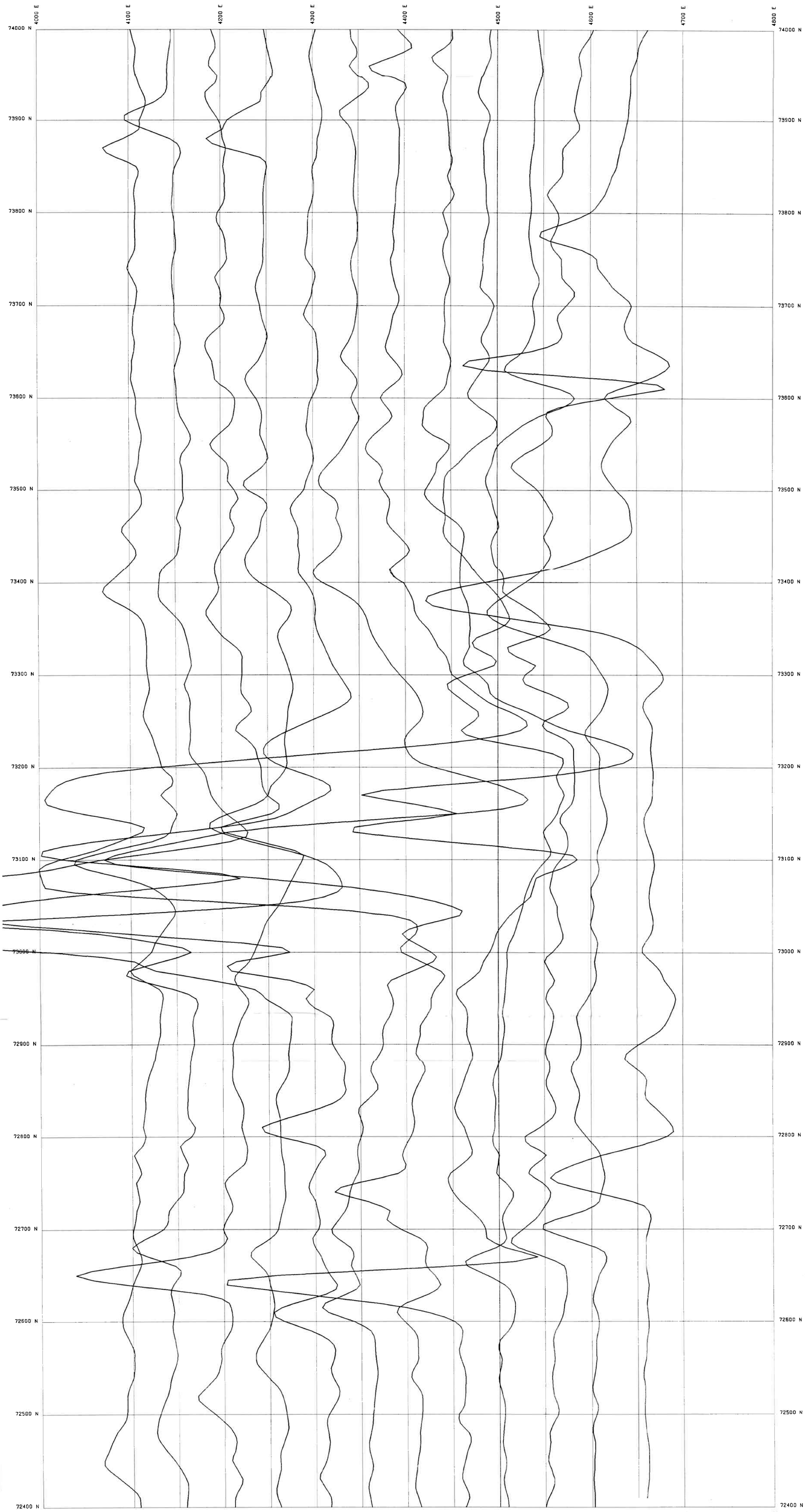


Appendix 3.3

A/S SULFIDMALM

South Pasvik
Grid B

Magnetic Profiles Total Field

1 cm = 100 nT, '+' = left/up

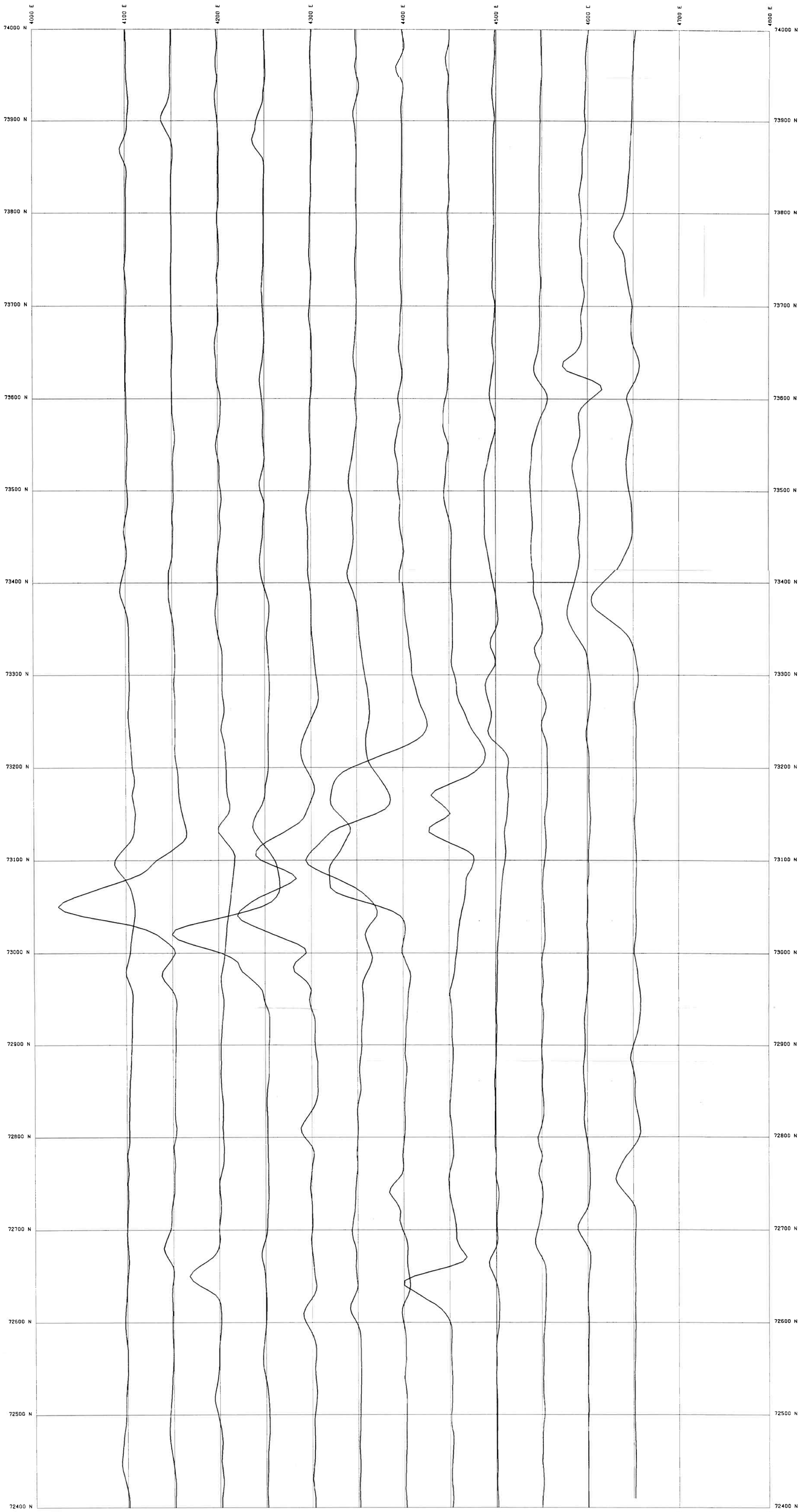
Base Field = 53200 nT

Smoothing: 3 Points Average

Arto Julkunen

SUOMEN MALMI OY

1:2000



Appendix 3.3 b

A/S SULFIDMALM

South Pasvik
Grid B

Magnetic Profiles Total Field

1 cm = 500 nT, '+' = left/up

Base Field = 53200 nT

Smoothing: 3 Points Average

1402502 Arto Julkunen

SUOMEN MALMI OY

1:2000

Appendix 3.4

A/S SULFIDMALM

South Pasvik
Grid C

Magnetic Profiles Total Field

1 cm = 100 nT, '+' = left/up

Base Field = 53200 nT

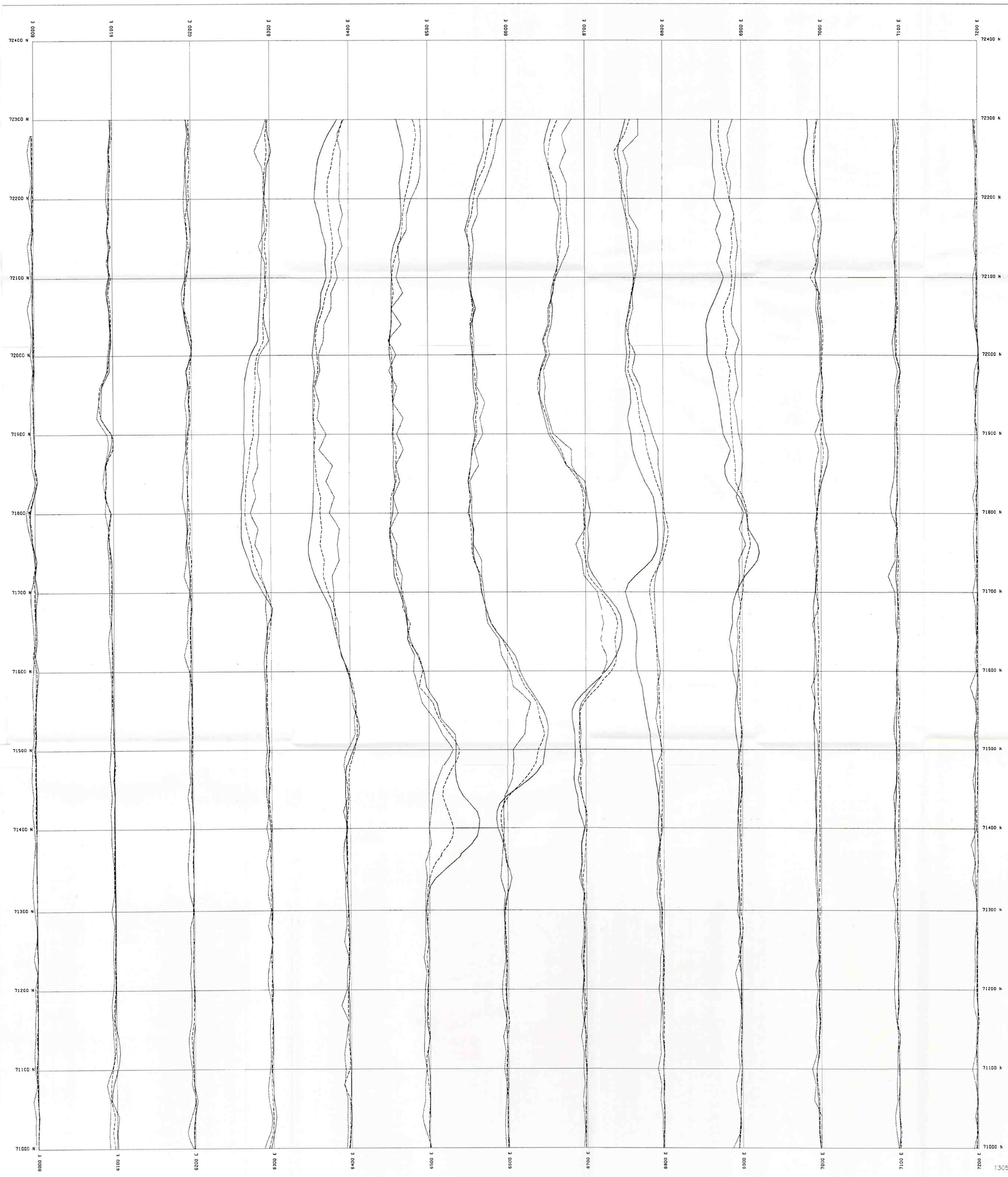
Smoothing: 3 Points Average

SMOY
SUOMEN MALMI OY

Arto Julkunen
13059315

1:2000

Appendix 3.4



Appendix 4.1

A/S SULFIDMALM

South Pasvik
Grid A

EM-Measurement (Max-Min)
Combined Frequencies
1 cm = 10 %, "+"=up/left

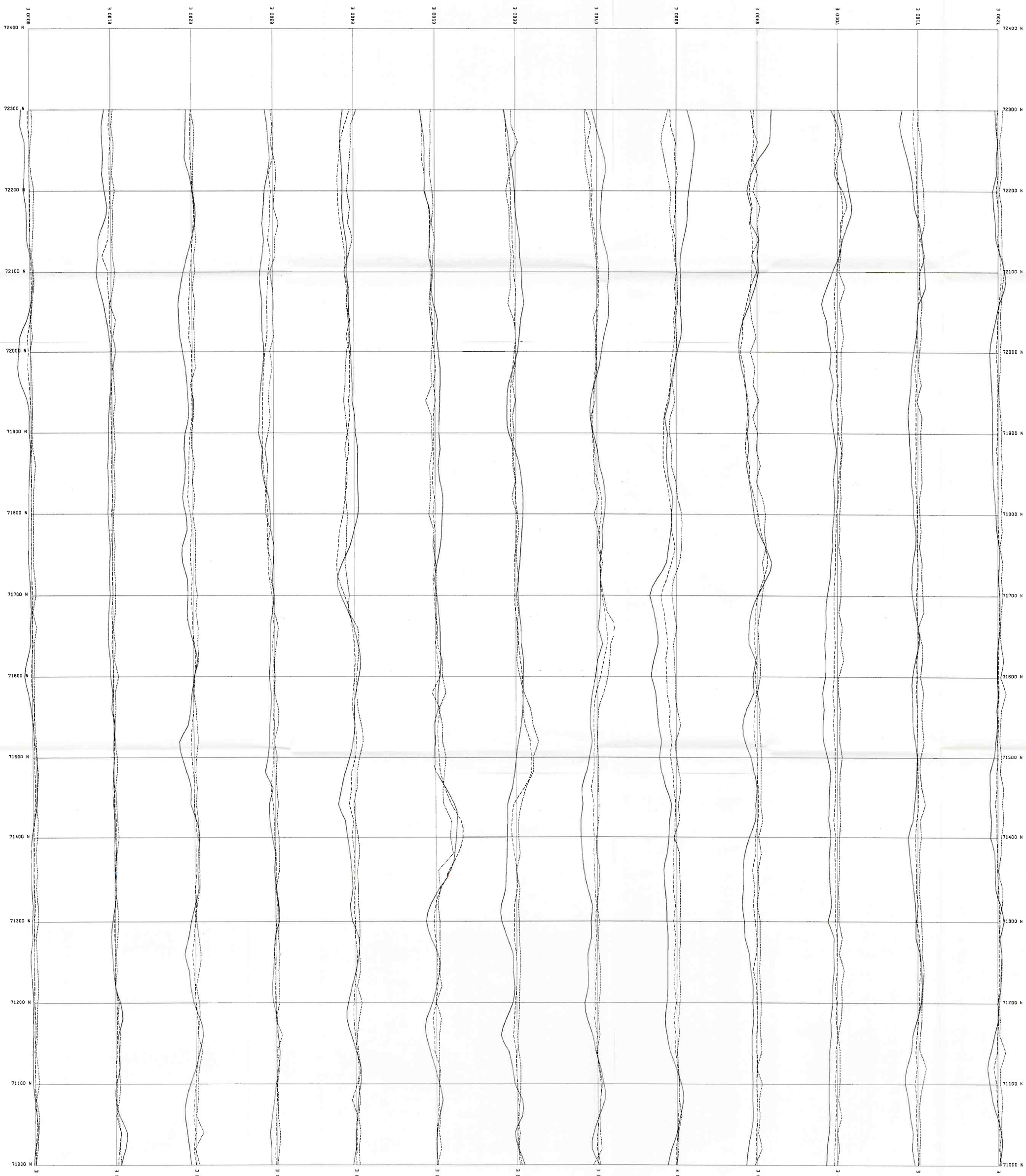
------ = 110 Hz
— — — = 440 Hz
——— = 1760 Hz

Työn nr rapport
HY 4010

13059341 Arto Julkunen SUOMEN MALMI OY

SMOY

1:2000



Appendix 4.2

A/S SULFIDMALM

South Pasvik
Grid A

EM-Measurement (Max-Min)
Combined Frequencies
1 cm = 10%, 1" = 10 %
------ = 110 Hz
– – – – = 440 Hz
——— = 1760 Hz

14059342 Arto Julkunen SUOMEN MALMI OY

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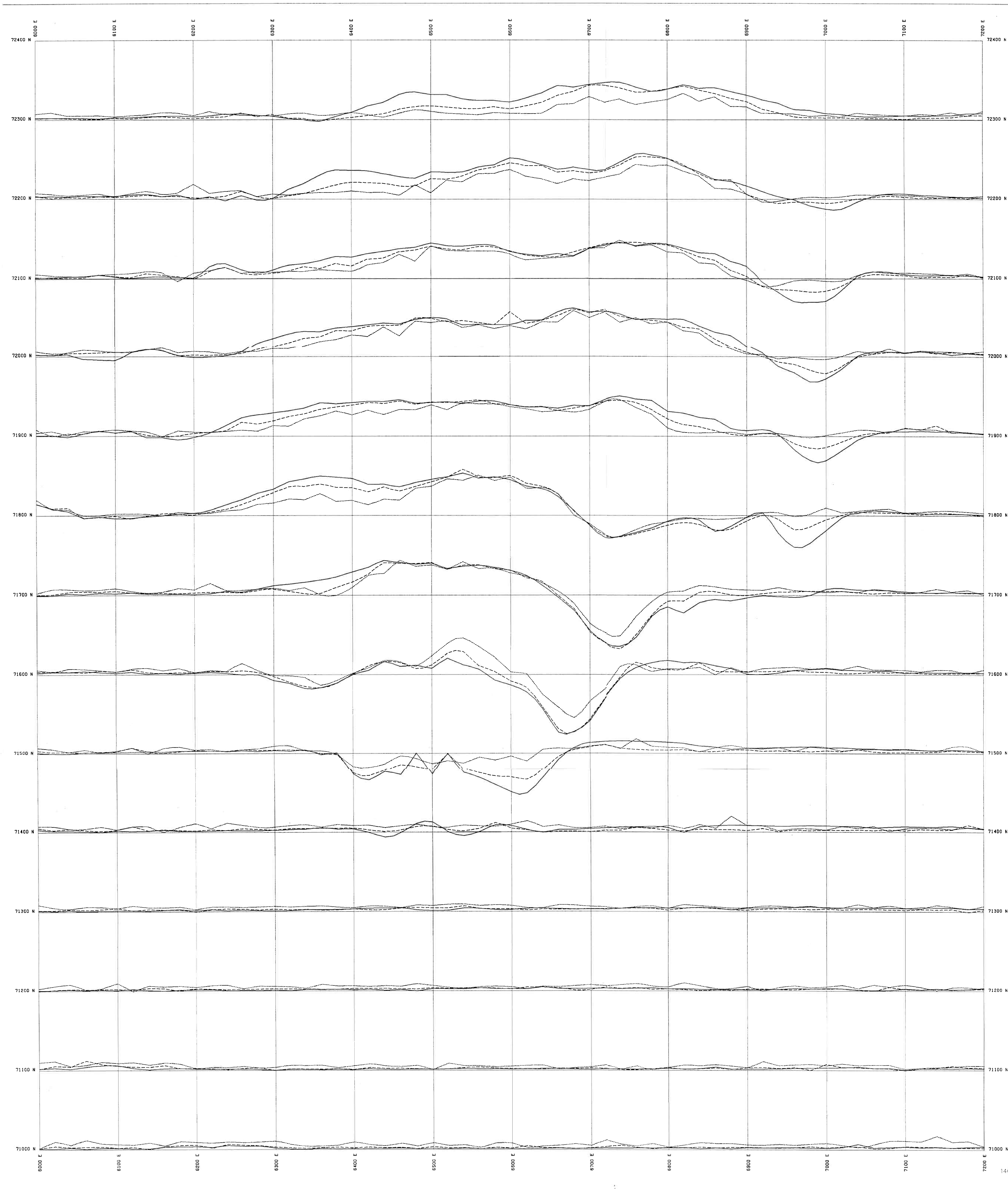

Appendix 4.3

A/S SULFIDMALM

South Pasvik
Grid A

EM-Measurement (Max-Min)
Combined Frequencies
1cm = 10 %,

------ = 110 Hz
— — — = 440 Hz
———— = 1760 Hz

14059343 Arto Julkunen

SMOY
SUOMEN MALMI OY

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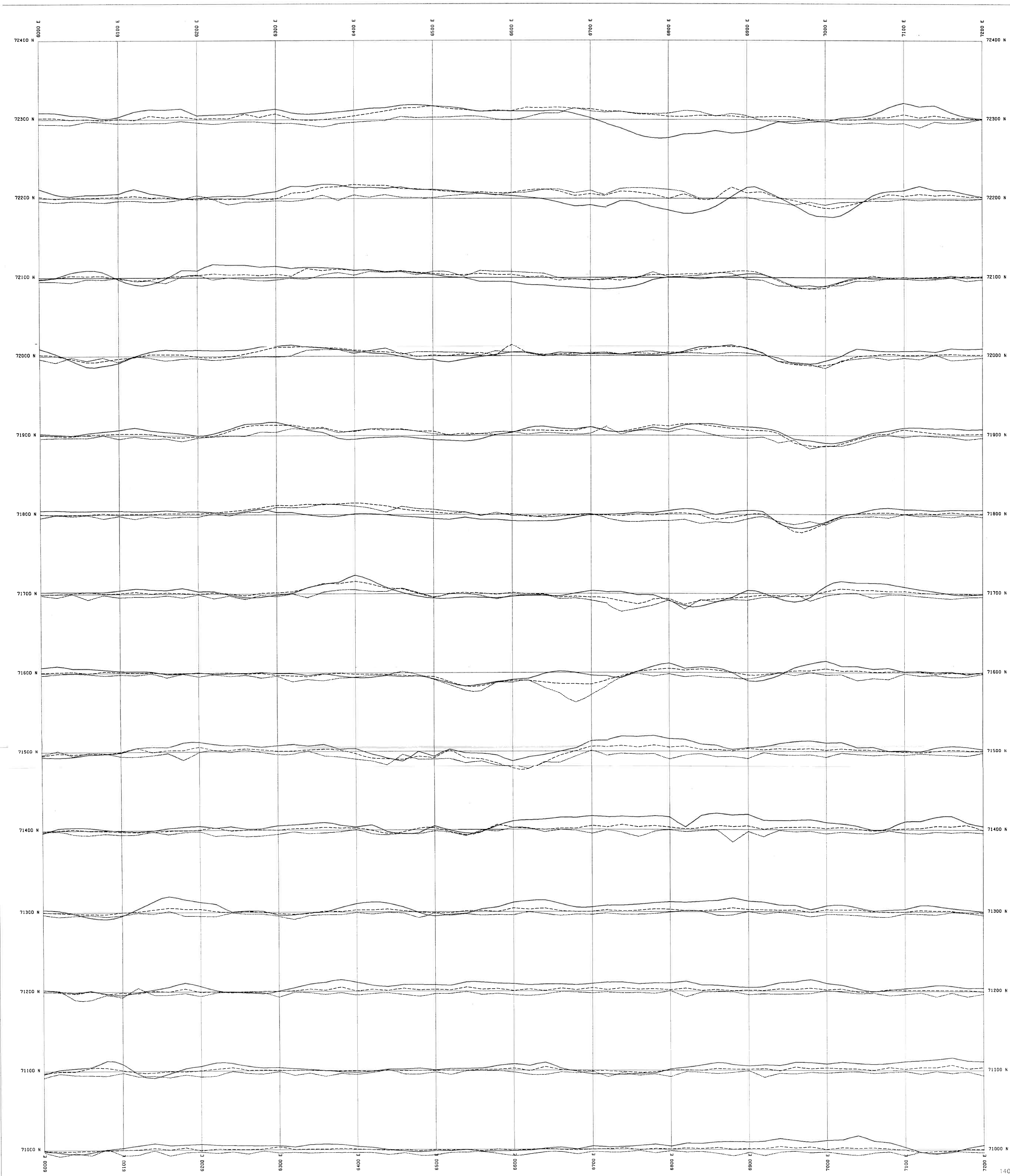

Appendix 4.4

A/S SULFIDMALM

South Pasvik
Grid A

EM-Measurement (Max-Min)
Combined Frequencies Im
1 cm = 10%, '–' = ut / left

- - - - - - = 110 Hz
— — — — = 440 Hz
———— = 1760 Hz

14059344 Arto Julkunen

SMOY
SUOMEN MALMI OY

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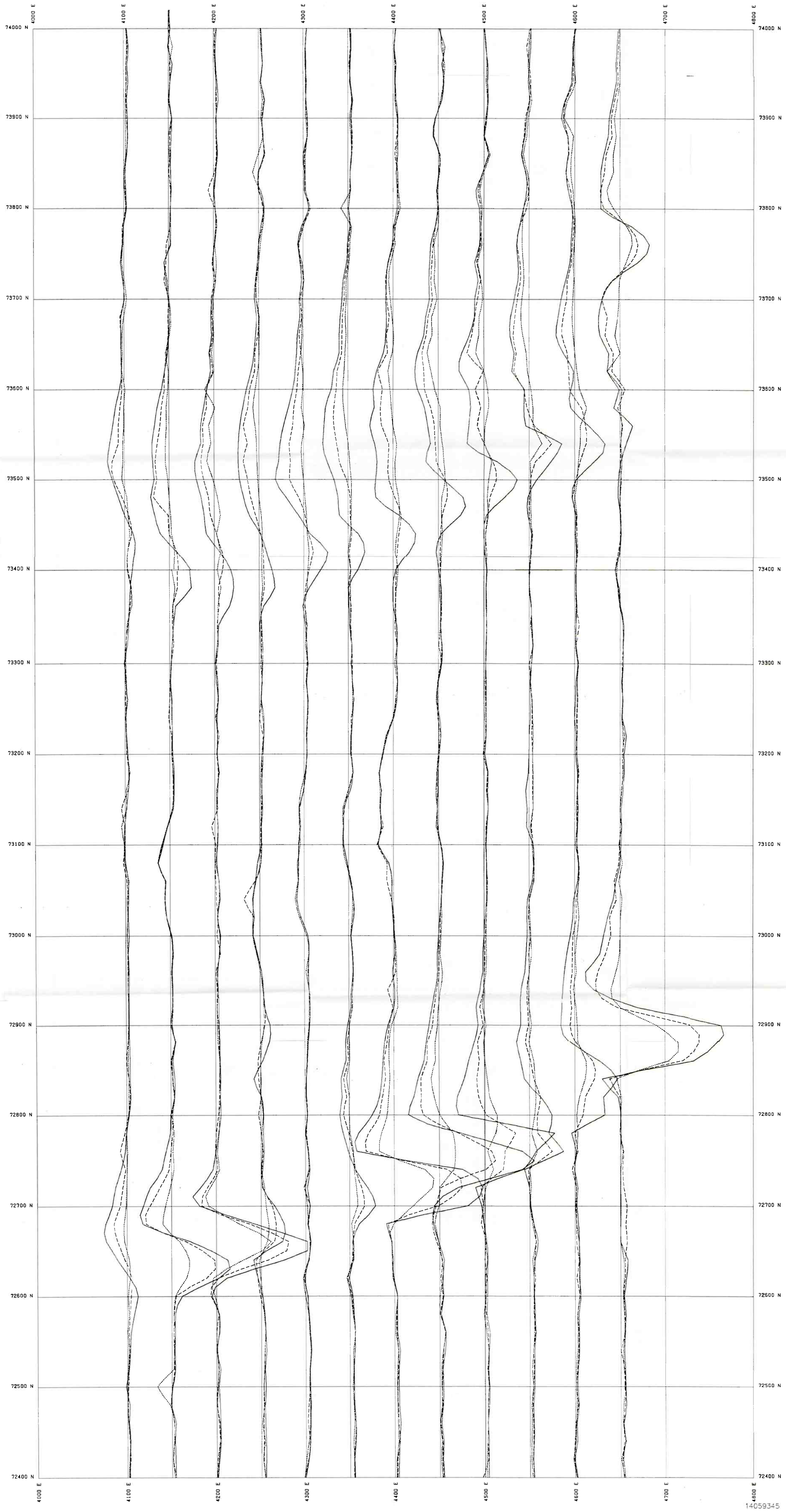


Appendix 4.5

A/S SULFIDMALM

South Pasvik
Grid B

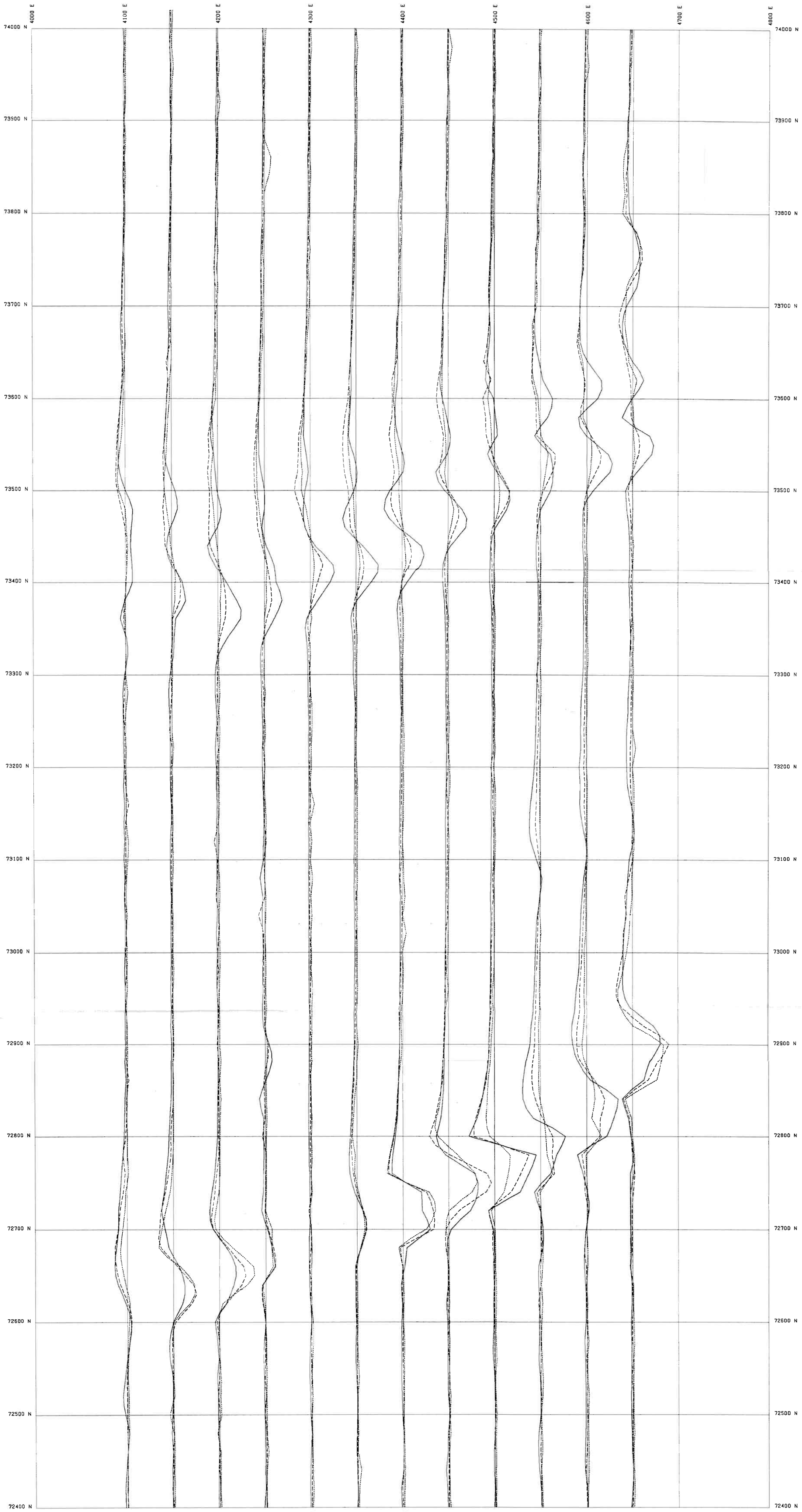
EM–Measurement (Max–Min)
Combined Frequencies Re
1 cm = 10 %. '+'=up/left

------ = 110 Hz
— — — = 440 Hz
——— = 1760 Hz

14059345 Arto Julkunen

SUOMEN MALMI OY

1:2000



Appendix 4.6

A/S SULFIDMALM

South Pasvik
Grid B

EM–Measurement (Max–Min)
Combined Frequencies
1 cm = 10 %, '+'=up/left lm

------ = 110 Hz
— — — — = 440 Hz
———— = 1760 Hz

14059346 Arto Julkunen

SUOMEN MALMI OY

1:2000

Appendix 4.7

A/S SULFIDMALM

South Pasvik
Grid C

EM–Measurement (Max–Min)
Combined Frequencies Re
1 cm = 10 %, '+'=up/left

- - - - - - = 110 Hz
— — — — = 440 Hz
———— = 1760 Hz

SMOY SUOMEN MALMI OY

Arto Julkunen
14059347

1:2000

Appendix 4.8

A/S SULFIDMALM

South Pasvik
Grid C

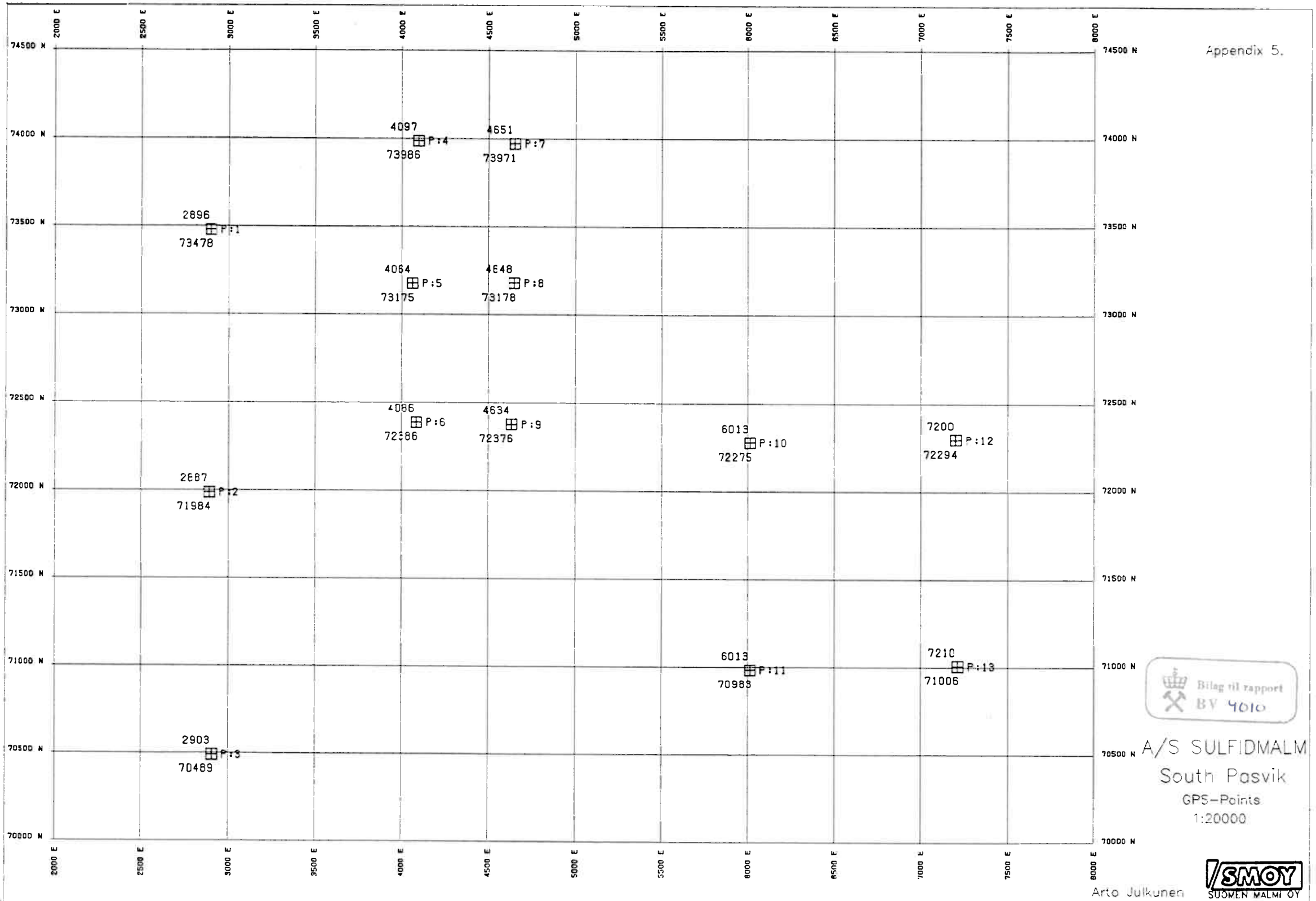
EM-Measurement (Max-Min)
Combined Frequencies Im
1 cm = 10 %, '+'=up/left

------ = 110 Hz
— — — = 440 Hz
——— = 1760 Hz

SMOY
SUOMEN MALMI OY
Arto Julkunen
14059348
1:2000

Appendix 4.8

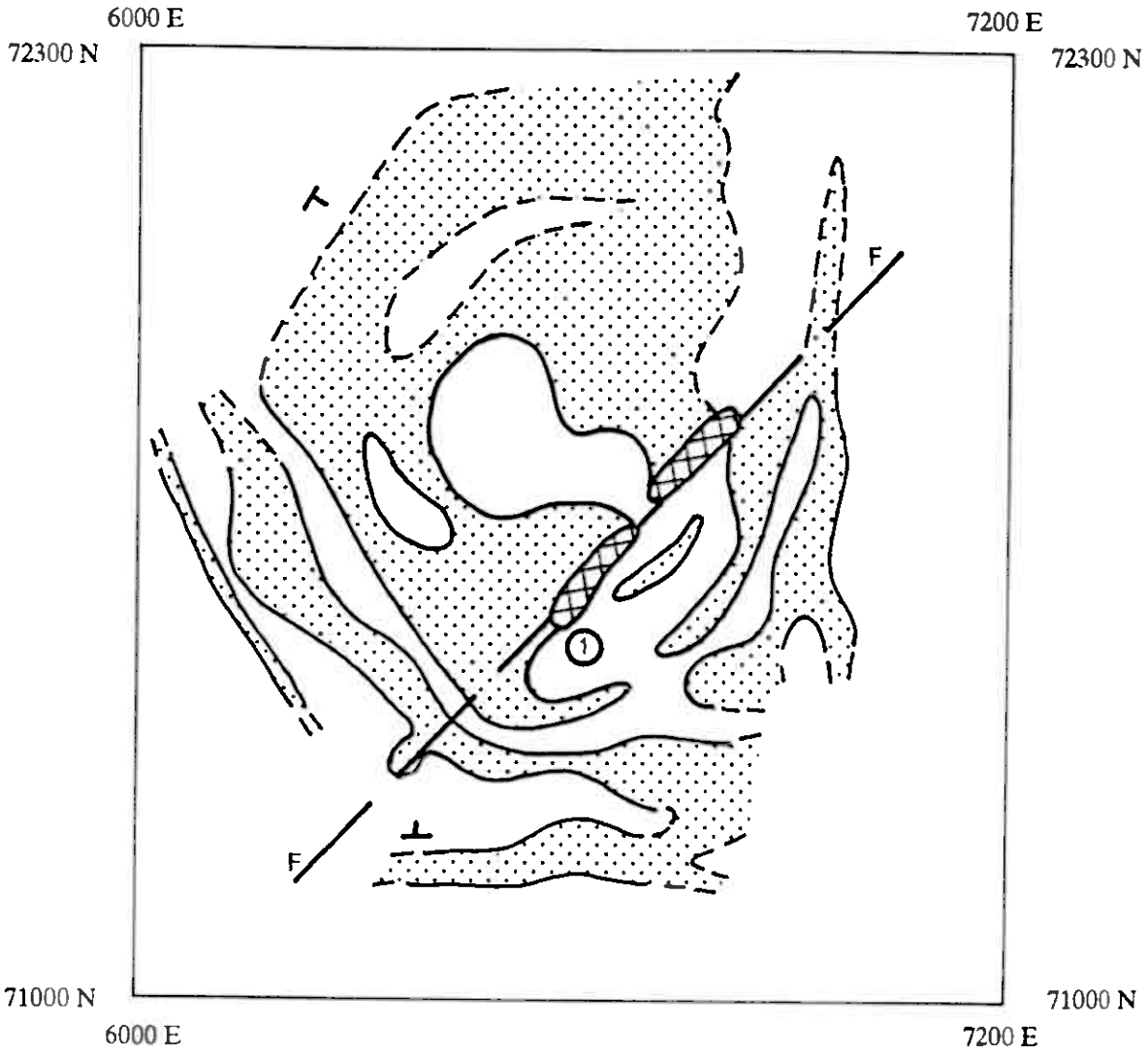
Appendix 5.



A/S SULFIDMALM
South Pasvik
GPS-Points
1:20000

Arto Julkunen

SMOY
SUOMEN MALMI OY



LEGEND

Weakly magnetized rocks

Magnetic "mineralization"

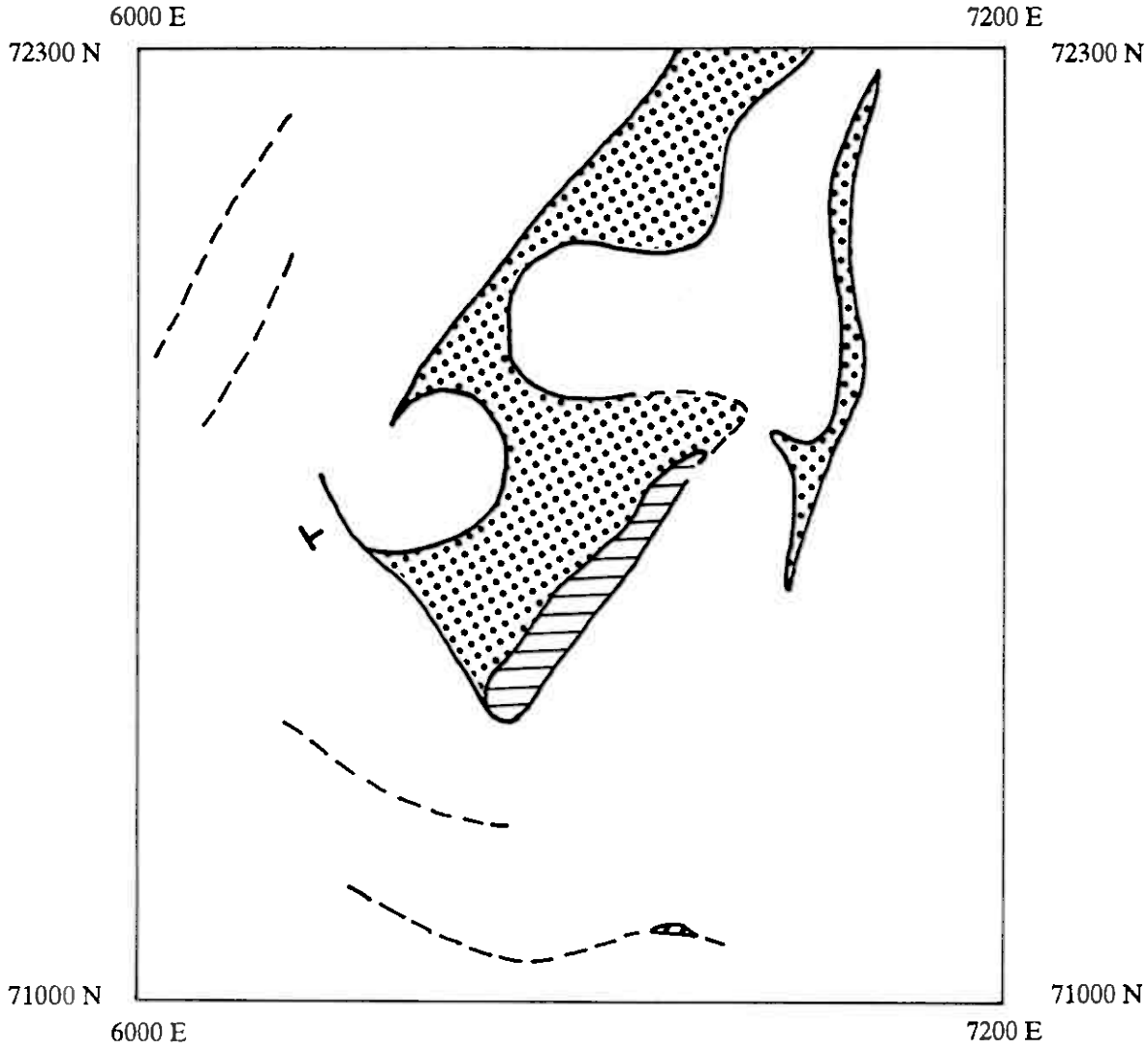
Possible fault or fractured zone

Interpreted direction of dip

SUOMEN MALMI OY

PASVIK A
Magnetic interpretation map
1 : 10 000

SMOY/TA 5.93



LEGEND

Weak, narrow conductor

Weakly conductive area

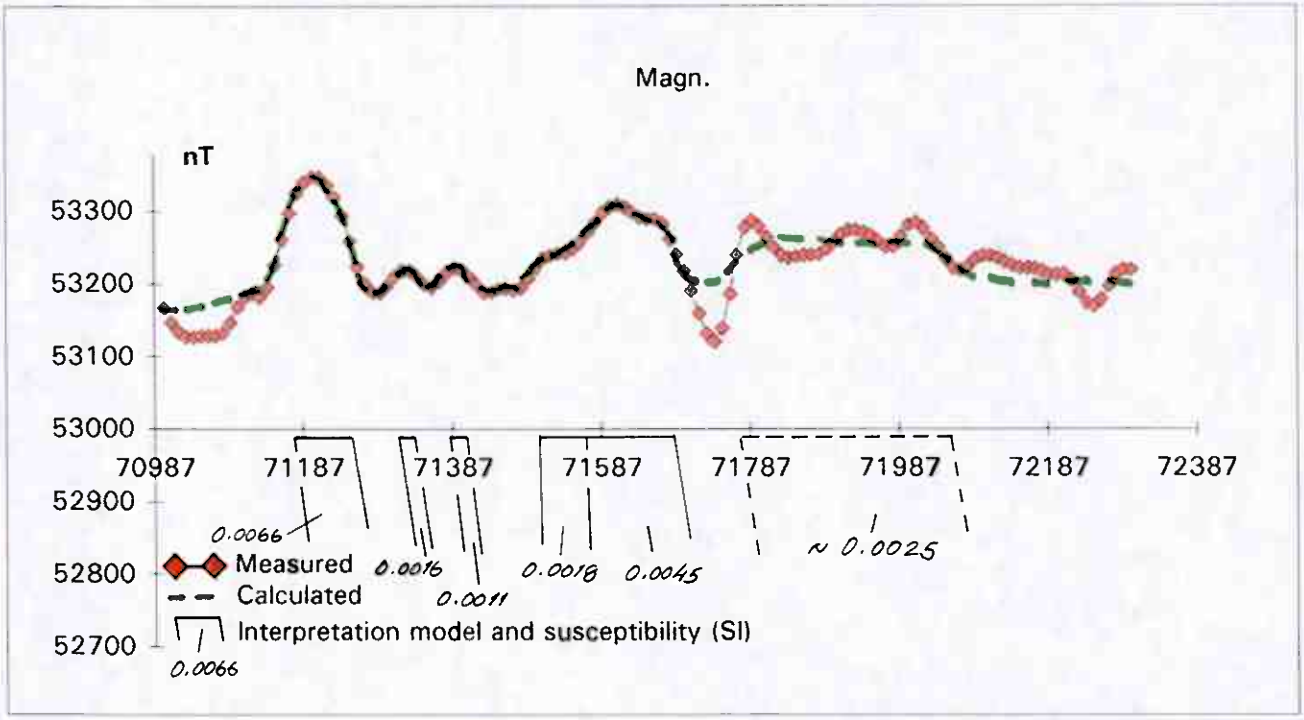
Conductor

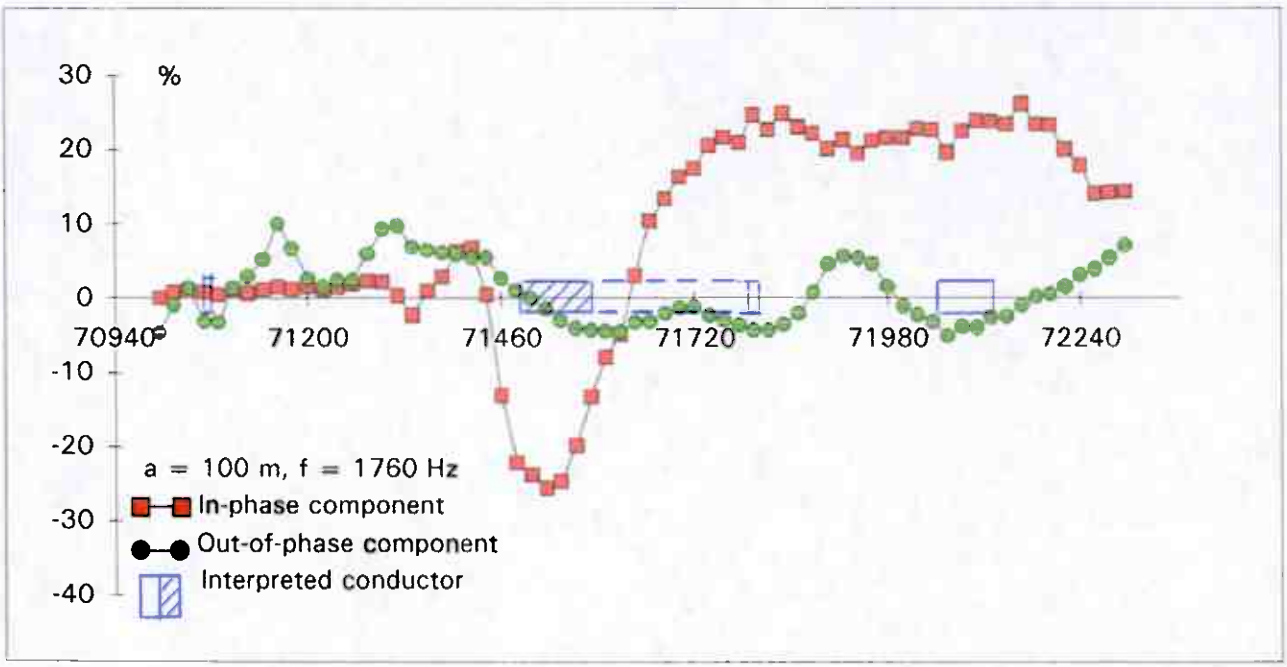
Interpreted direction of dip

SUOMEN MALMI OY

PASVIK A
Slingram interpretation map
1 : 10 000

SMOY / TA 5.93



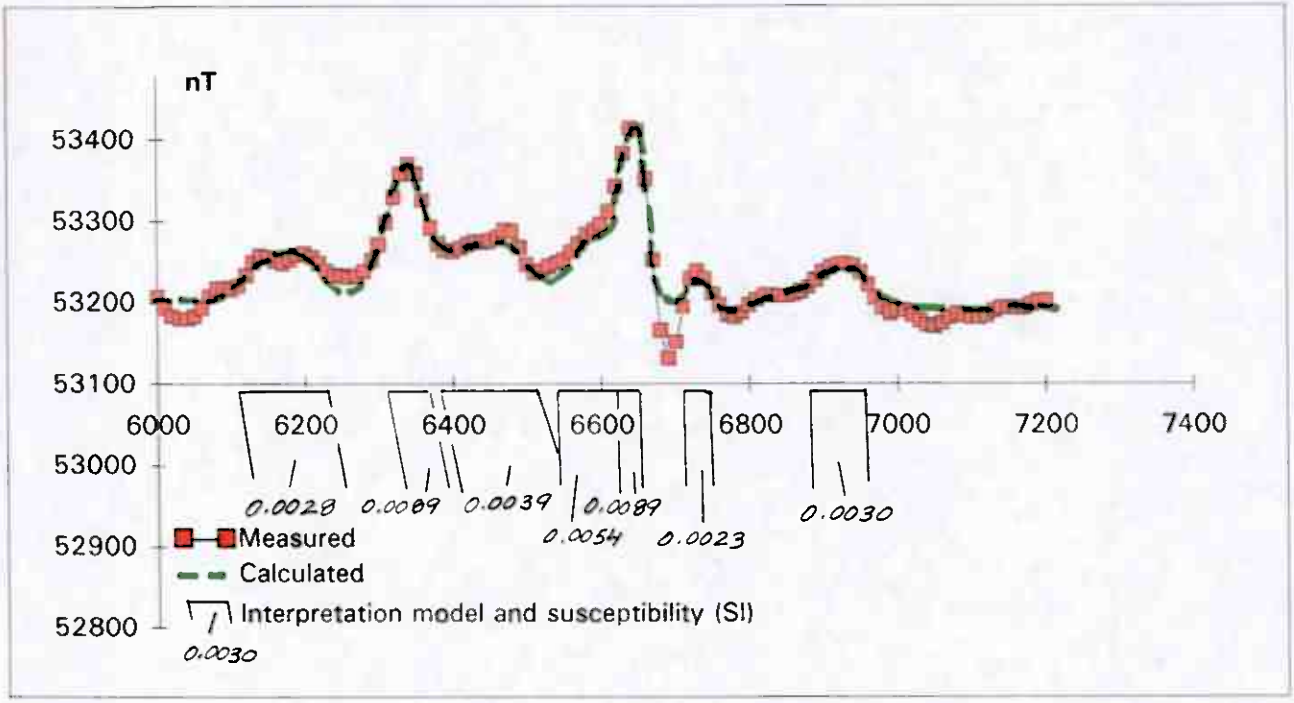


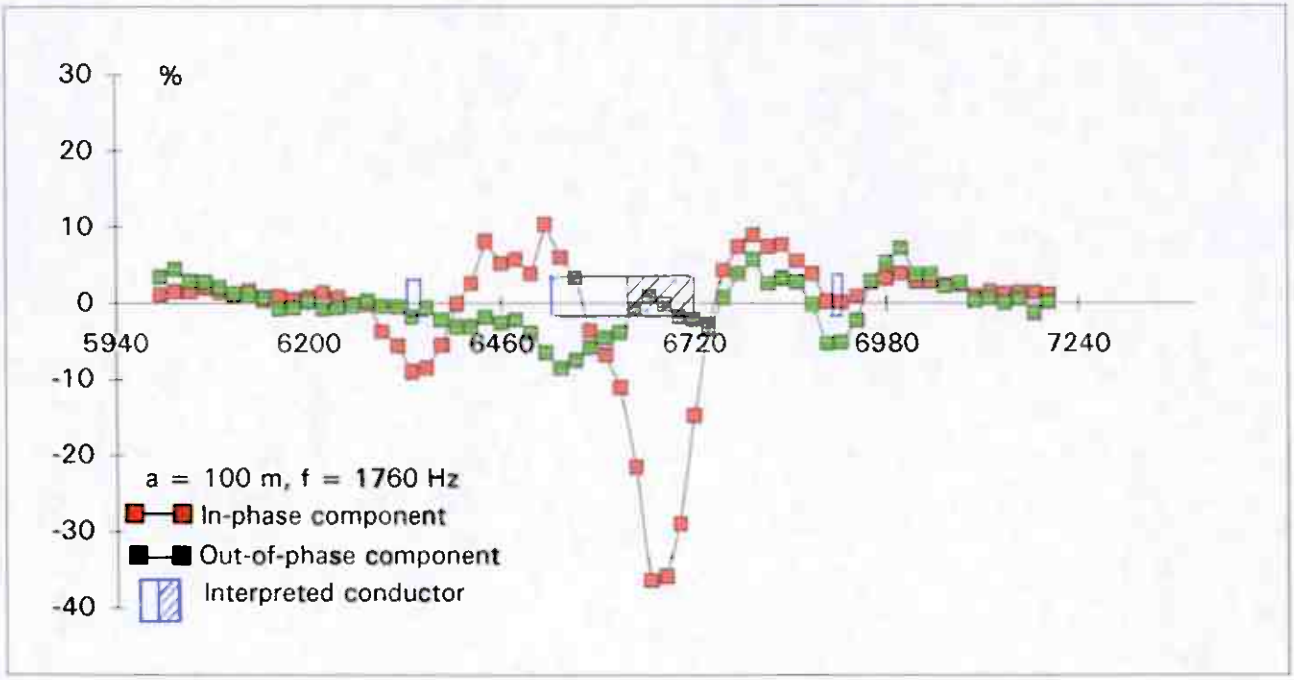
Scale 1:1000

Pasvik A

Profile 6600 E

Magnetic and SL interperations



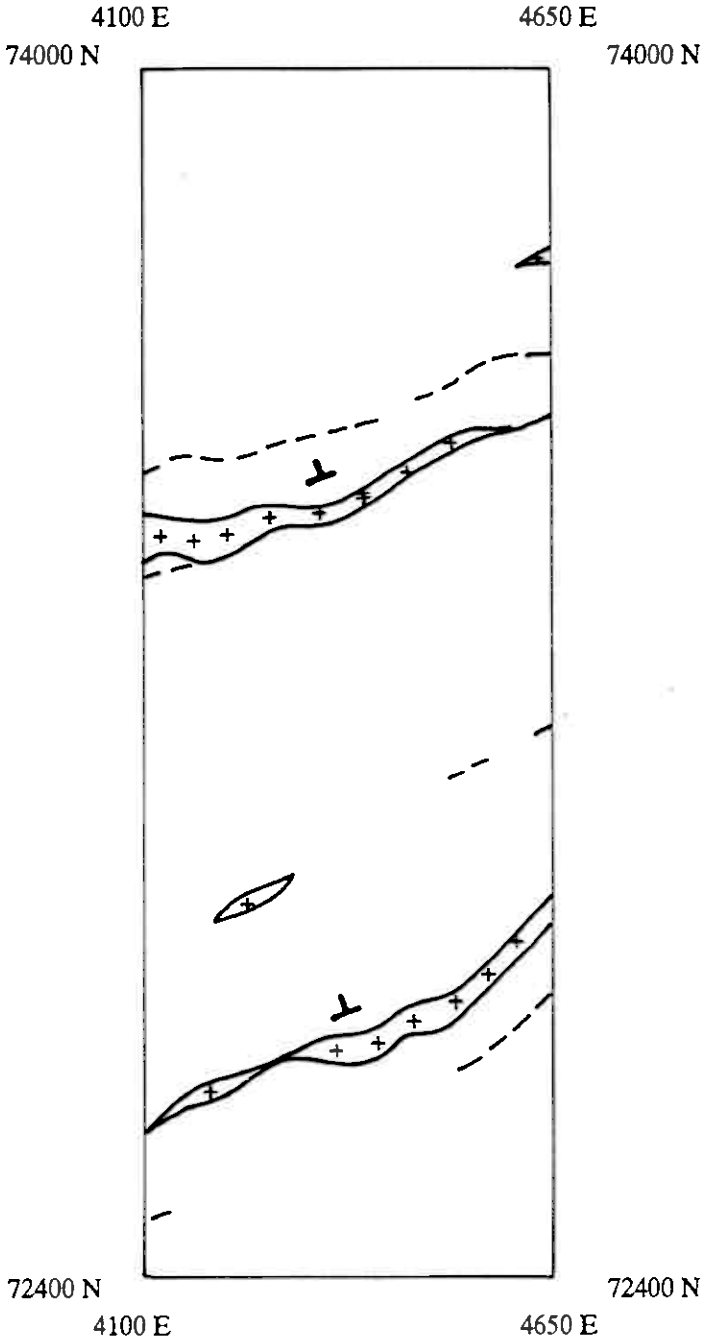


Scala 1 : 10000

Pasvik A

Profile 71600 N

Magnetic and HLEM interpretations



SUOMEN MALMI OY

LEGEND

Weak, narrow conductor

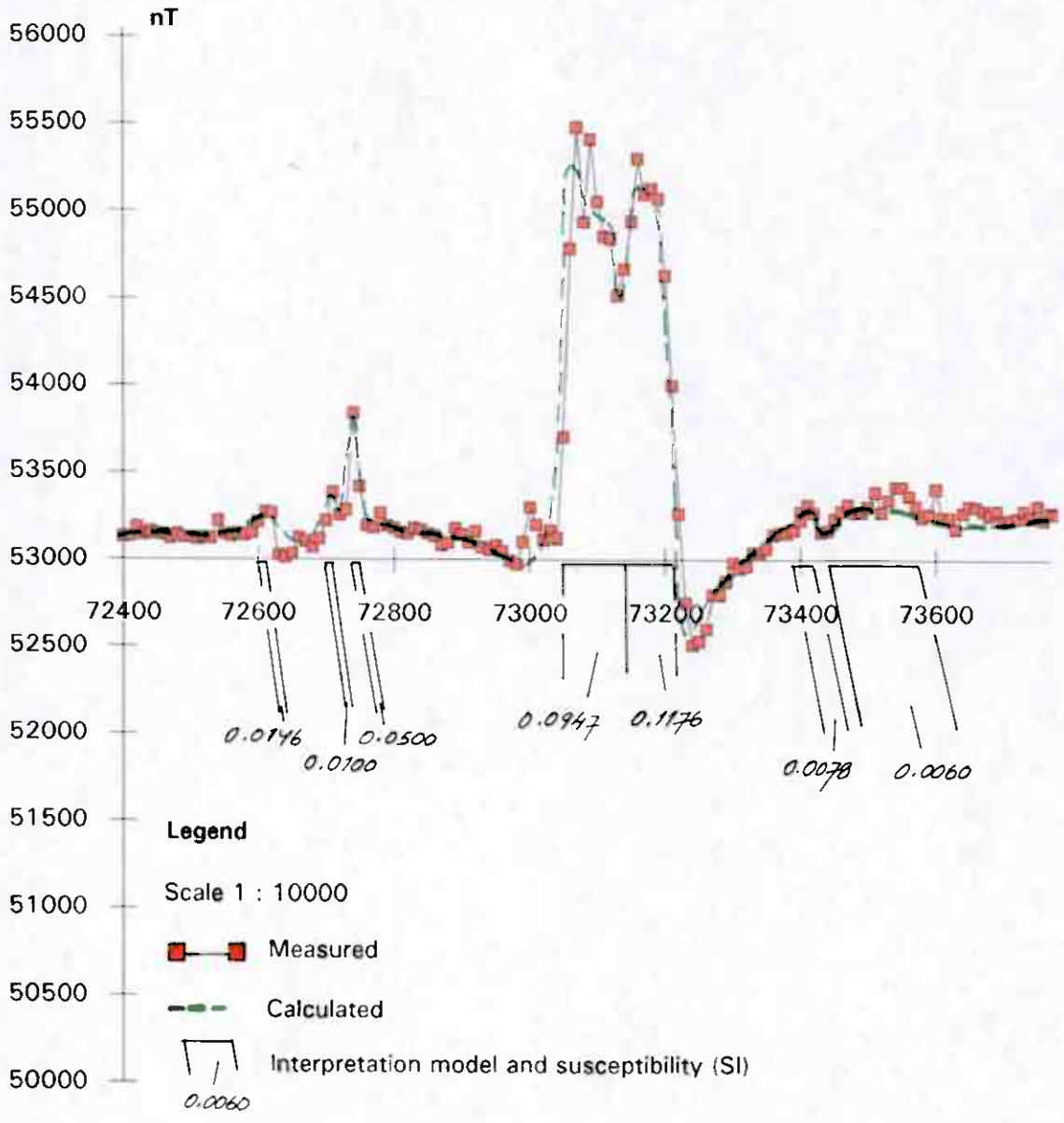
Conductor

Interpreted direction of dip

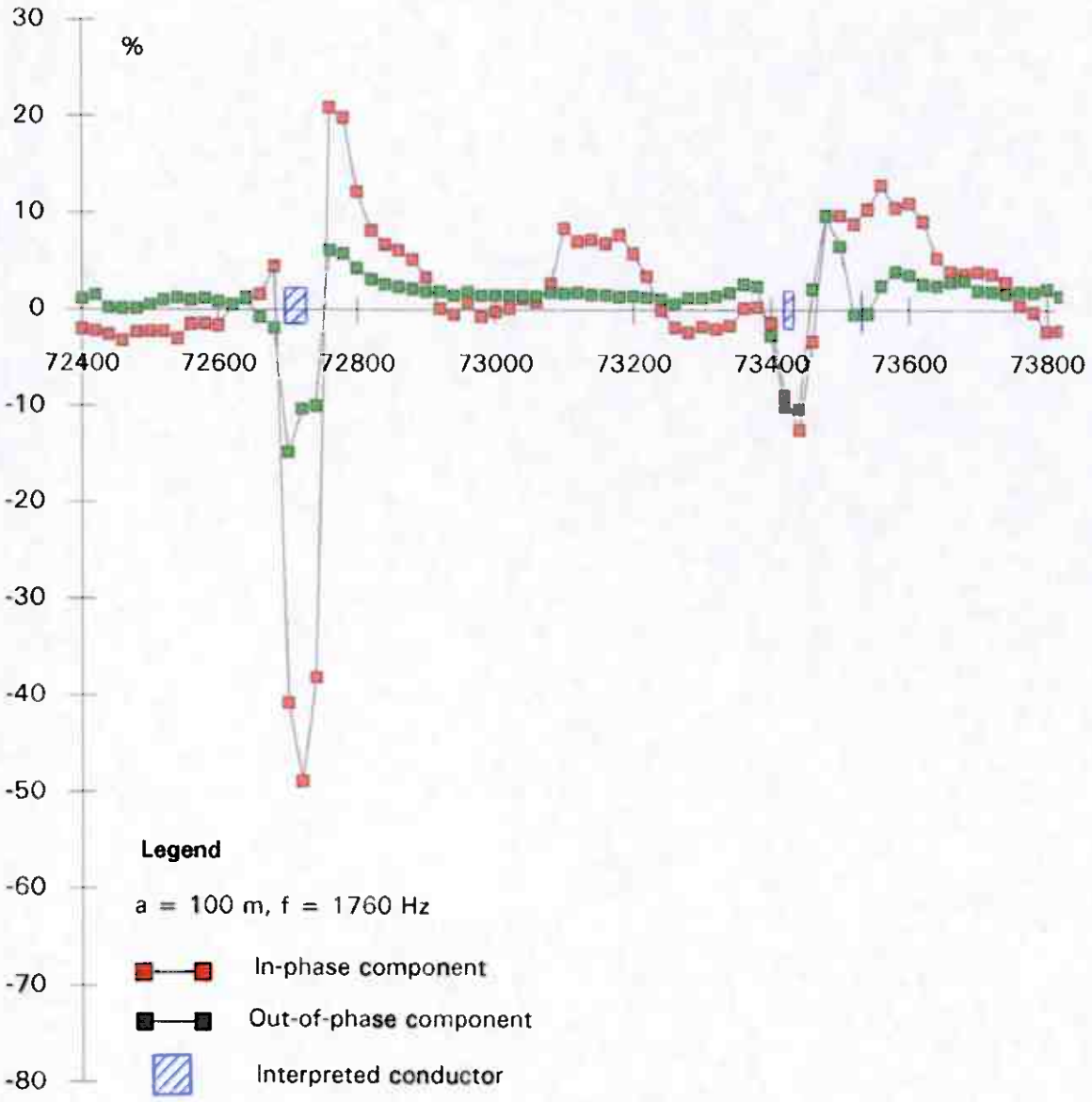
PASVIK B
Slingram interpretation map
1 : 10 000

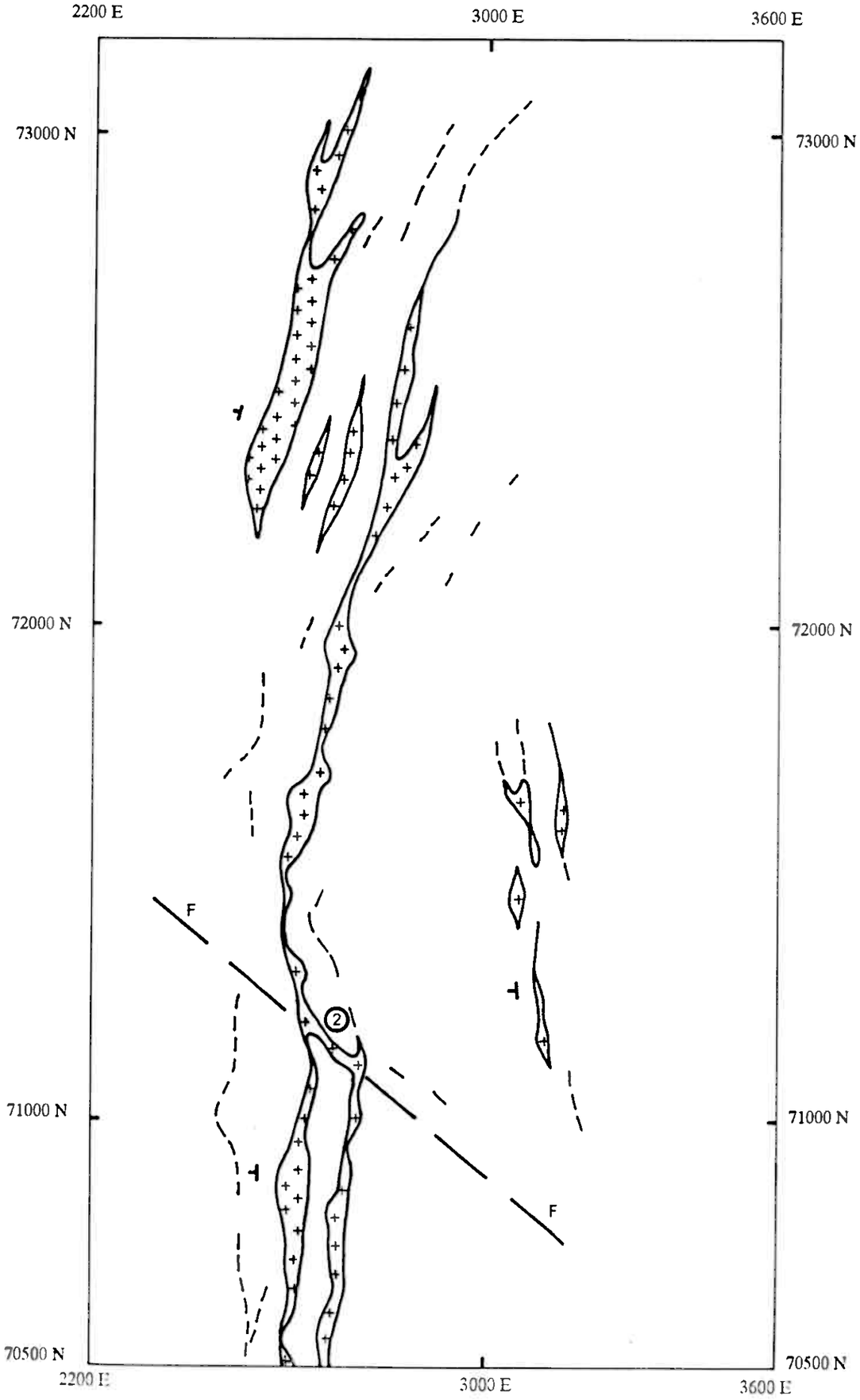
SMOY / TA 5.93

Pasvik B, Magnetic profile 4400E



Pasvik B, HLEM profile 4400E





LEGEND

Weak, narrow conductor

Conductor

F ② Possible mineralization

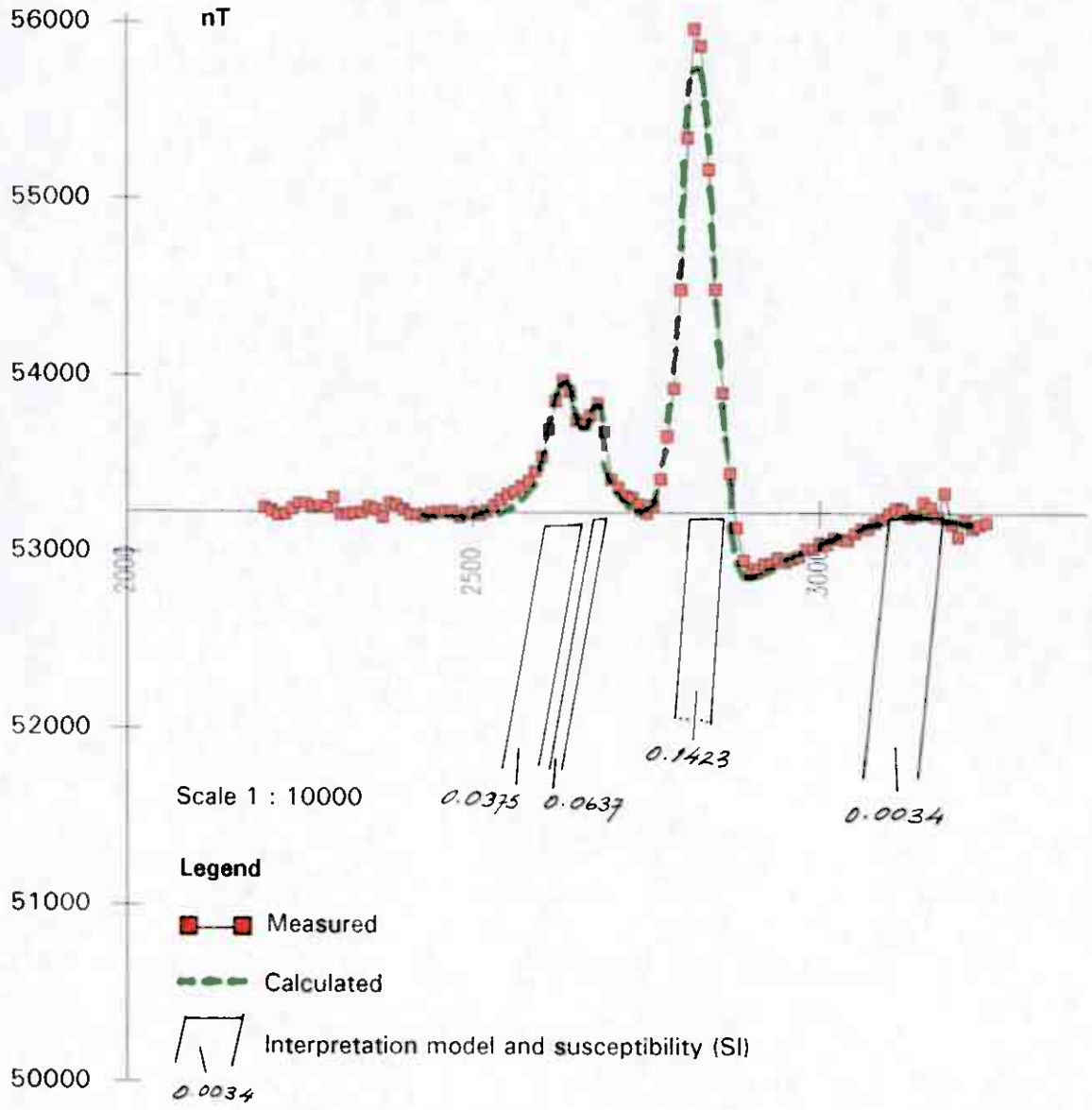
Intepreted direction of dip

SUOMEN MALMI OY

PASVIK C
Slingram interpretation map
1 : 10 000

SMOY / TA 5.93

Pasvik C, Magnetic profile 71150N



Pasvik C, HLEM-profile 71150N