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Geophysical Groundsurvey in the Telemark district

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Geophysical Groundsurvey in the Telemark district.

Bleka

by

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November 7th 1997

Contents

Abstract.

A geophysical groundsurvey was carried out in the late summer of 1997 in the Hjartdal/Svartdal and Nissedal areas in Telemark, Norway. The instrument used was a Proton-magnetometer capable of measuring the total magnetic field of the Earth.

The primary objective in the Hjartdal/Svartdal area was the locating of a gold-copper-bismuth bearing vein deposit hosted in amphibolite. Due to a high content of magnetite in the wallalteration associated with the vein mineralisation, the main trend of the vein was located successfully.

The outstanding ability of the Proton-magnetometer to map near-surface geology was tested and proved in the Nissedal area. Although interpretation of magnetic data should be done with great care, as the Proton-magnetometer reacts primarily to the magnetite content and not a specific rocktype, individual geological strata can be recognised from the magnetic profiles and used as a guidance.

1.Introduction.

This report evaluates magnetic data from a geophysical groundsurvey that was carried out in the summer '97 in the Hjartdal/Svartdal- and Nissedal areas, Norway fig. 1. These two areas will be described in more detail in chapter 3 and chapter 4, respectively.

The objective of the investigations in the Hjartdal/Svartdal area was to locate the gold-copper-bismuth bearing quartz-ankerite veins of the area as grounds for further development of the concession, including the planning of core-drilling. There has previously been an active mine in the area, The Bleka Mine. It exploited high-grade gold, 30-40 g/t, from a single mineralised vein, but had to close down in the beginning of the century due to a lacking economy, cf. ref. 4.

In 1964 the NGU, Norges Geologiske Undersøkelse, did a number of aeromagnetic surveys and produced, among others, an aeromagnetic map of the Nissedal area.. This map shows a large, > 51.500 nT, triangular shaped anomaly over a small area called Kleivaasen. Resent geological mapping and interpretation done by Mr.T. Thomsen Final Year geology student at Aarhus University, cannot explain the anomaly, on the contrary, the rocktypes appears to have susceptibilities below average.

The main aim of the geophysical investigations on Kleivaasen was therefore to produce a feasible explanation for the large aeromagnetic anomaly.

The instrument used in these surveys was a G856AX Proton-magnetometer, capable only of measuring the total magnetic field of the Earth. As this model of proton-magnetometers can store a limited amount of data, 1000 measurements, a small software package called MagLoc was used to extract the data from the Proton-magnetometer to a labtop computer. A 'basestation' reading was taken every morning and evening, to correct the data collected during the day for variations in the Earth's magnetic field.

The 'raw' data as imported by MagLoc is stored on the enclosed 1.44Mb in ASCII format as 'name'.gnt. Also included on the floppy is a small text file explaining the relevant 'name'.gnt file and the corrected data. The corrected data is presented as single profiles in ASCII format.

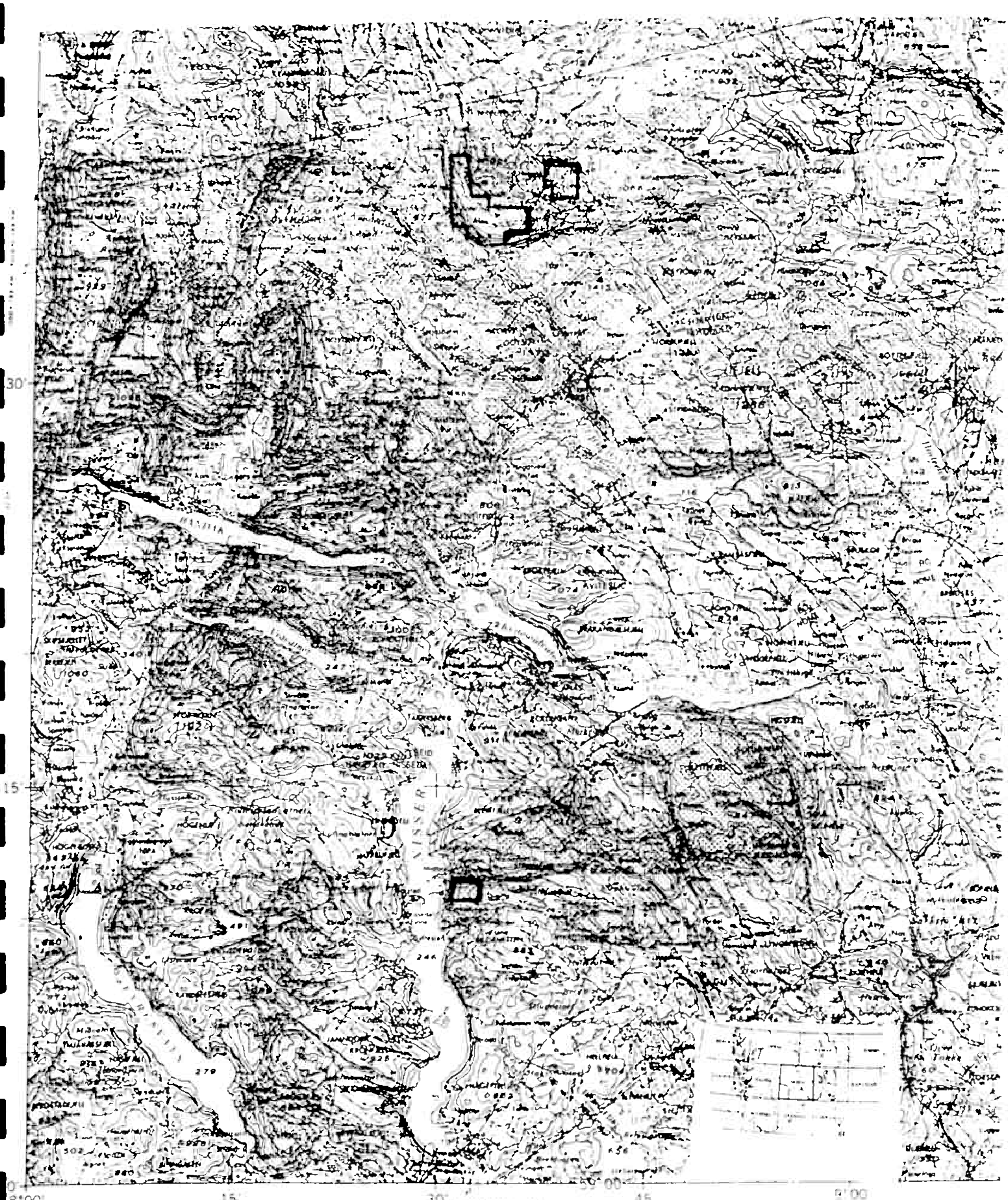


Fig. 1. Map over Telemarken, Norway

2.Previous Work.

Since the Bleka Mine closed in 1916 there has been several investigations in the area. Two of the more recent which will be mentioned here is a geophysical groundsurvey conducted by Jens P Larsen from 1989 *[ref.3]* and a geological exploration project from 1984 conducted for Norsk Hydro A/S *[ref.2]*.

2.1.'Gold Exploration in The Bleka Fold Area, Telemark'

The 1984 geological exploration project took its starting point around the Bleka Mine, 59°35'54" N and 8°33'30"E, - and Espelid, 59°36'90"N and 8°31'14"E, areas, *[fig.2]*. It comprises a significant amount of information regarding the geological and structural nature of the veinsystems.

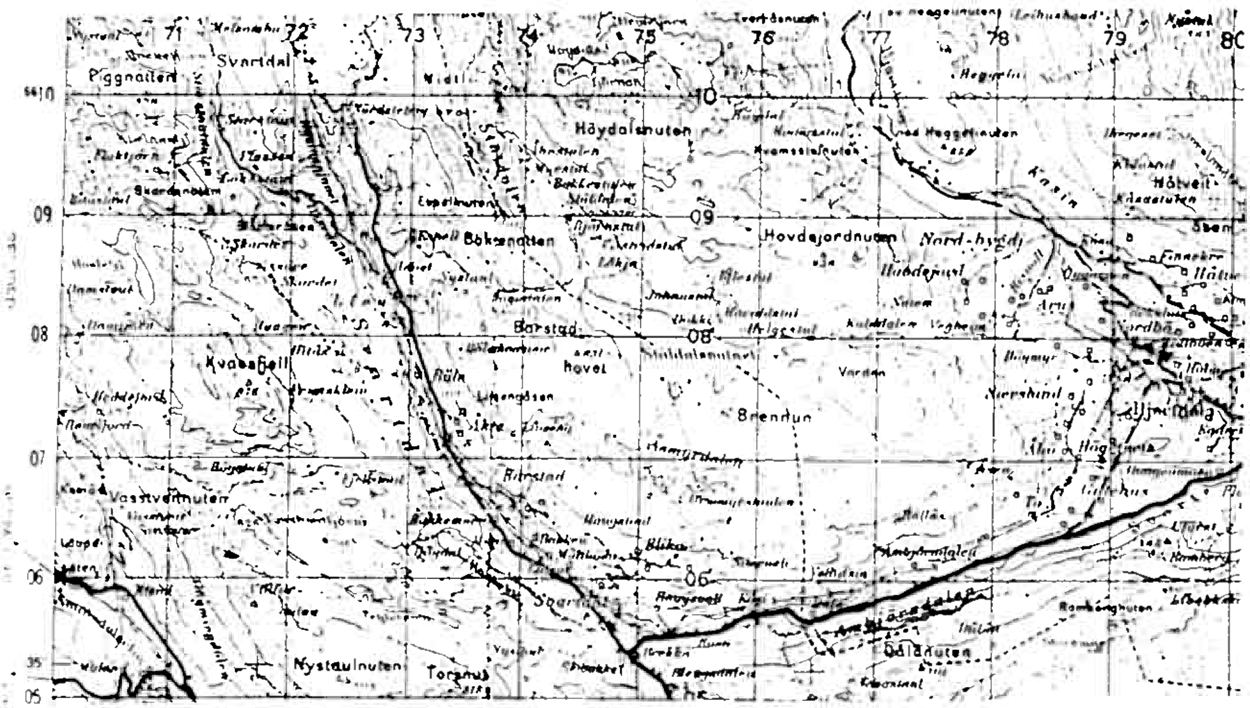


Fig.2. Hjartdal Svartdal, Norway. 1:50000.

In summary, the Bleka Main Vein System, cf. fig.3, was found to be a quartz-tourmaline-ankerite vein with ore minerals constituting approximately 1%. The general orientation of the Vein System is 72° and the strike approximately, ~85° N. After 300 metres the vein shows a abrupt shift in orientation which is taken as a convergence of two en echelon fractures *[ref.2.]*.

The proposed structure of the Vein System is supported by the structural lineaments of the region which shows fractures with a prominent NE/SW and NW/SE orientation.

The Espelid area is located ca 3 kilometres north of the Bleka Mine. The mineralised veins in this area are smaller and more numerous than in the Bleka area. This is interpreted as part of a major vein swarm system with a general 68°/70° orientation. The veins tend to show a greater variation in strike than in the Bleka Mine area, varying from 40° N to 90° N, cf fig.4.

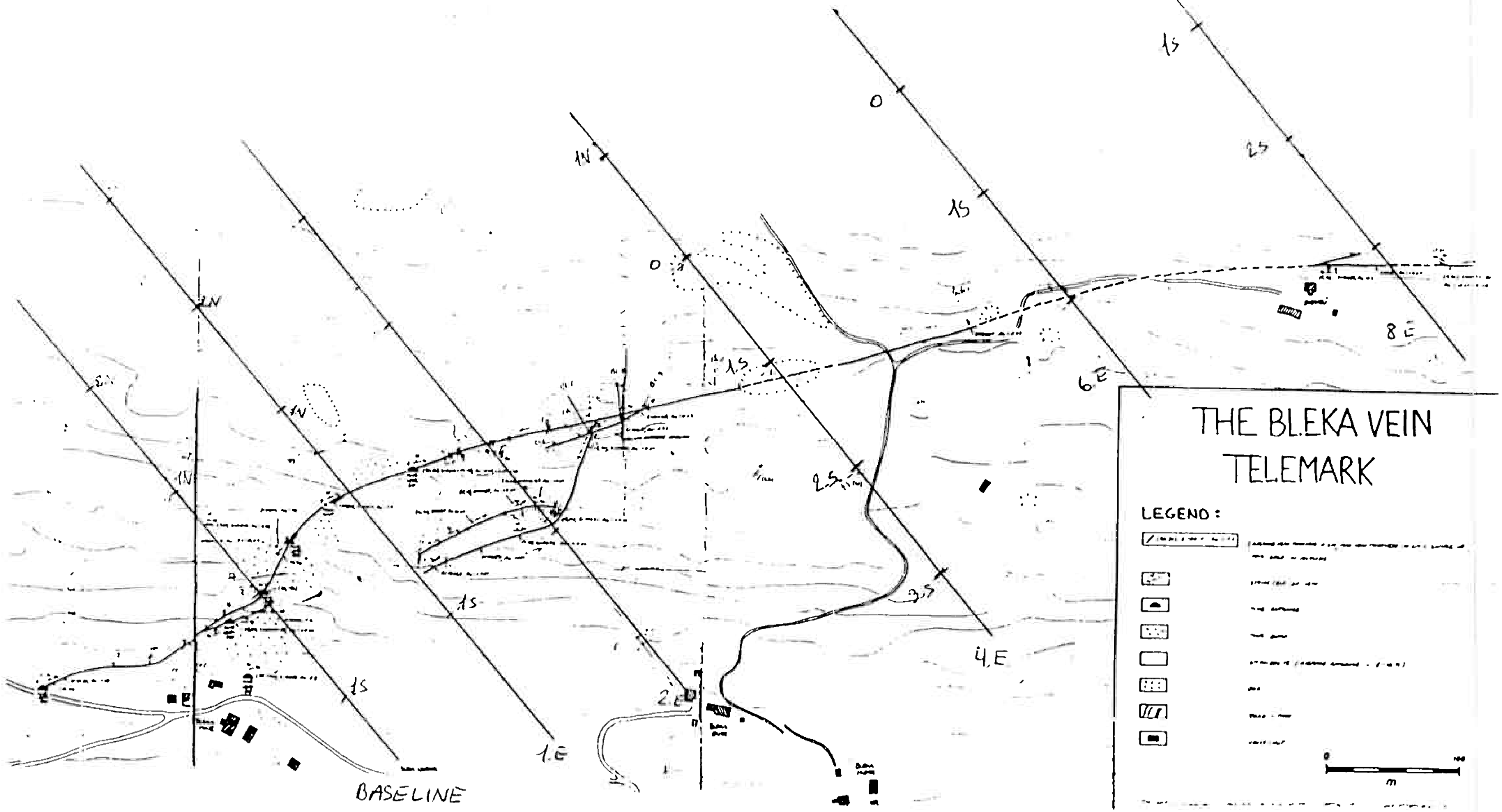


fig.3. Bleka Main Vein System.

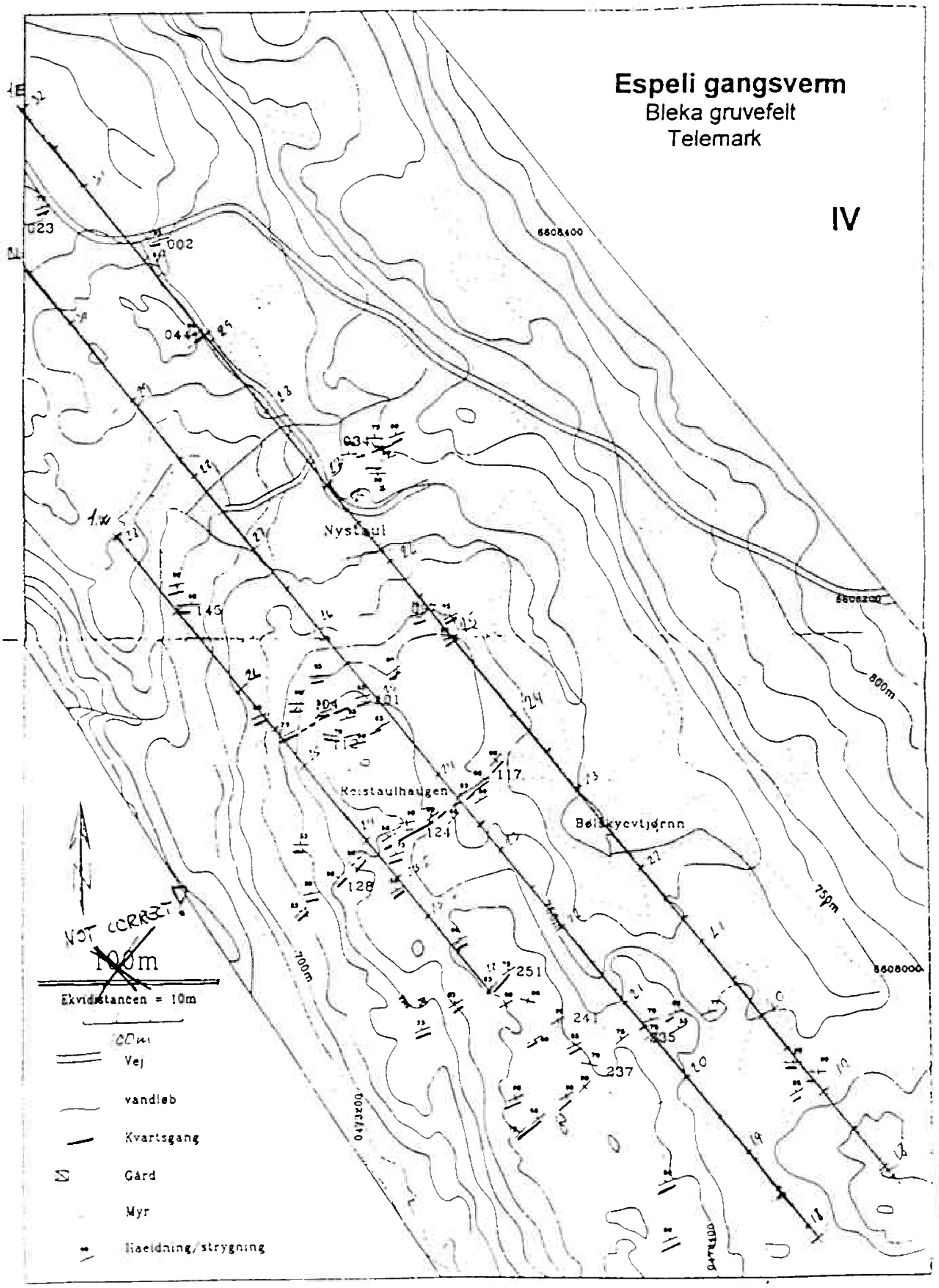


fig.4. The Espelid Vein Swarm.

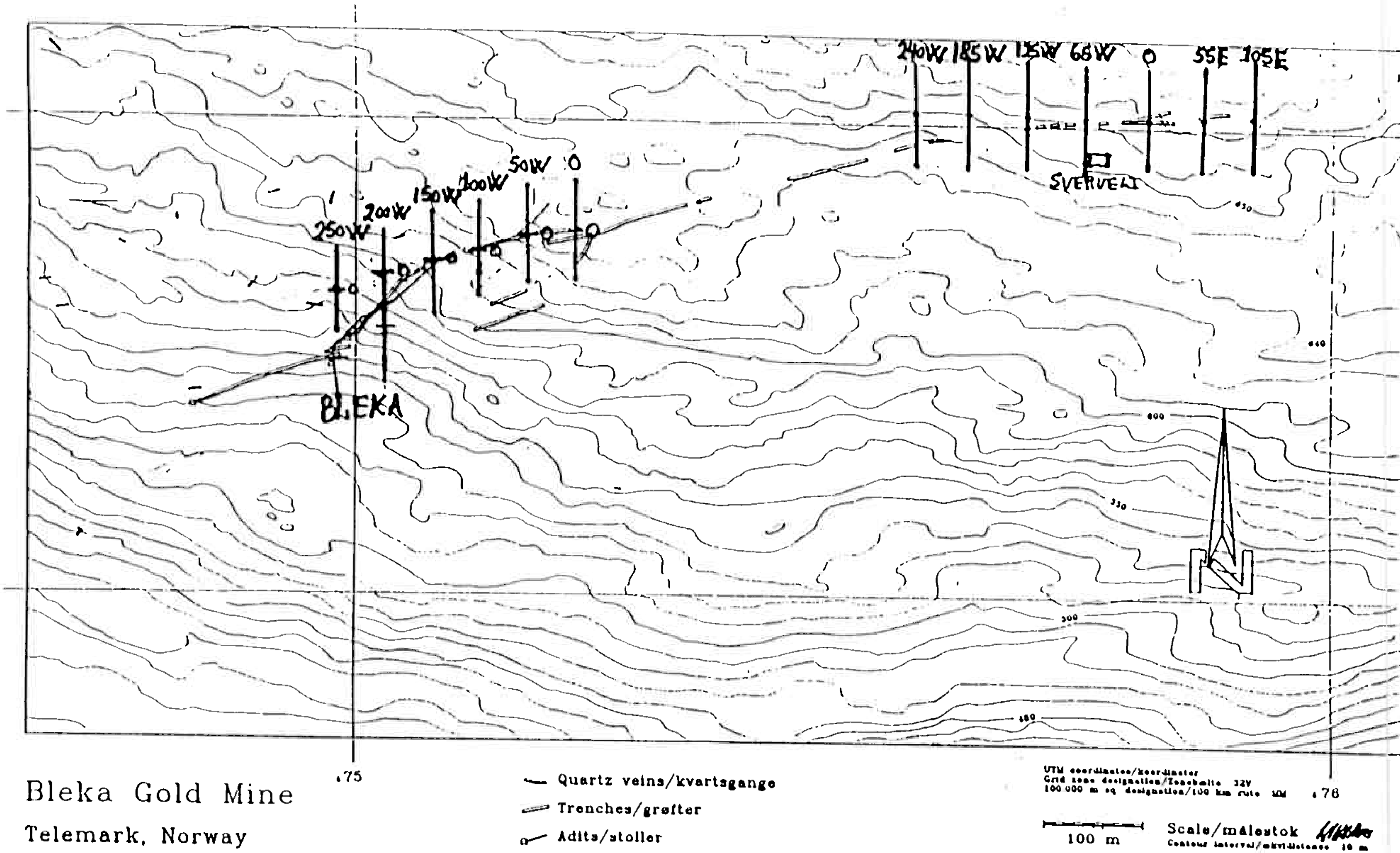


Fig. 5. Position of the magnetic profiles recorded 1989 by Jens P. Larsen.

2.2. 'Geofysisk feltarbejde i Hjartdal, Telemarken'

In the summer/autumn of 1989 Jens.P.Larsen from Aarhus University carried out a geophysical groundsurvey in the Bleka-, Sverveli- and Gjuv area. A large variety of instruments and methods were applied of which the magnetic method proved to be the most adequate.

Six profiles were recorded in the area around the Bleka mine, fig. 5 and seven profiles around Sverveli. The magnetic fields around the Bleka Mine was measured using both a top and a bottom sensor. The difference in the two responses provides a rough estimation of the depth extend of the anomaly causing the magnetic anomaly. The contrast in the response from the two sensors in the Bleka Mine area is very small and implies that the anomaly extends to a considerable depth.

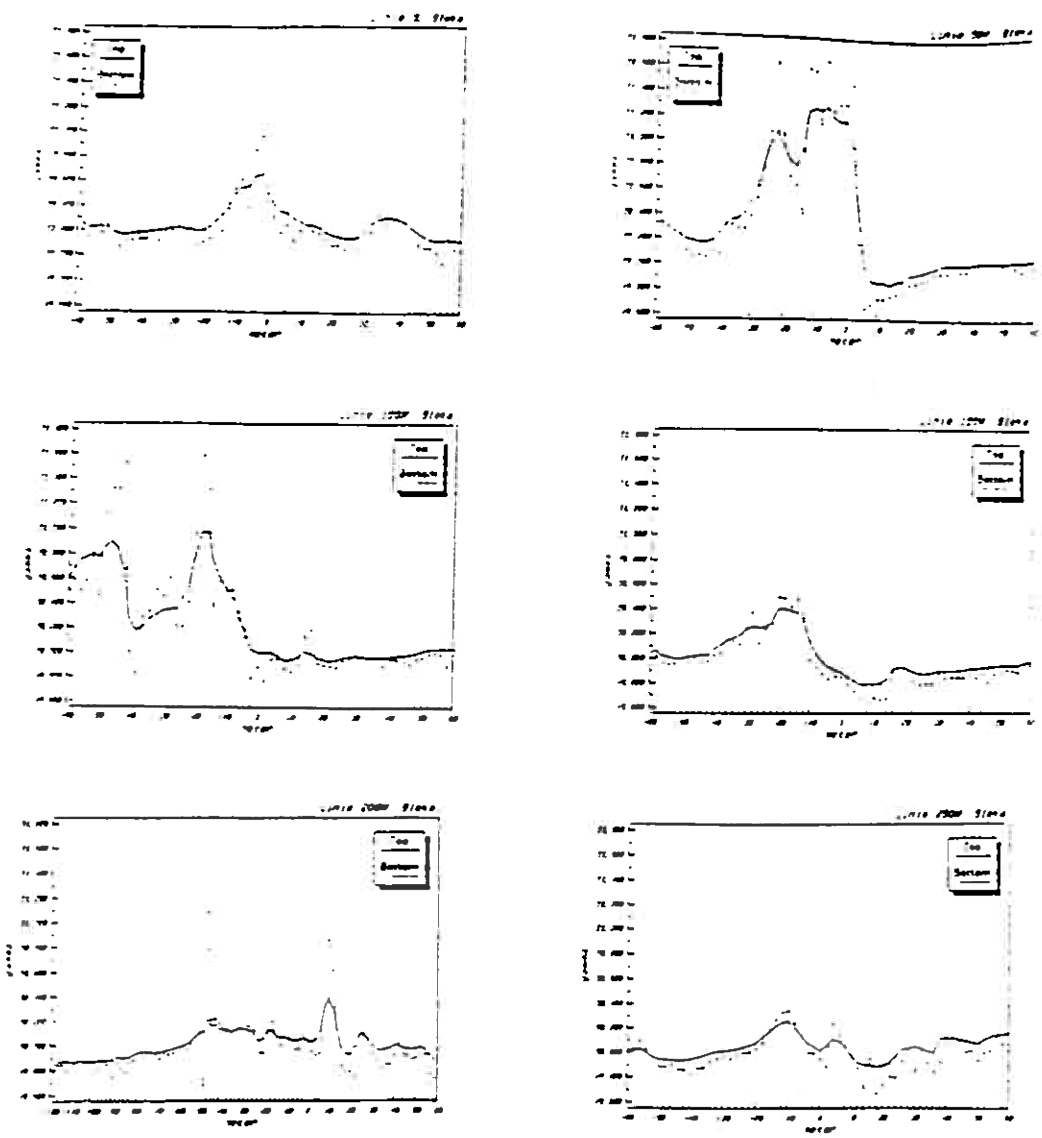


Fig. 6. The six magnetic profiles around the Bleka Mine. 1989.

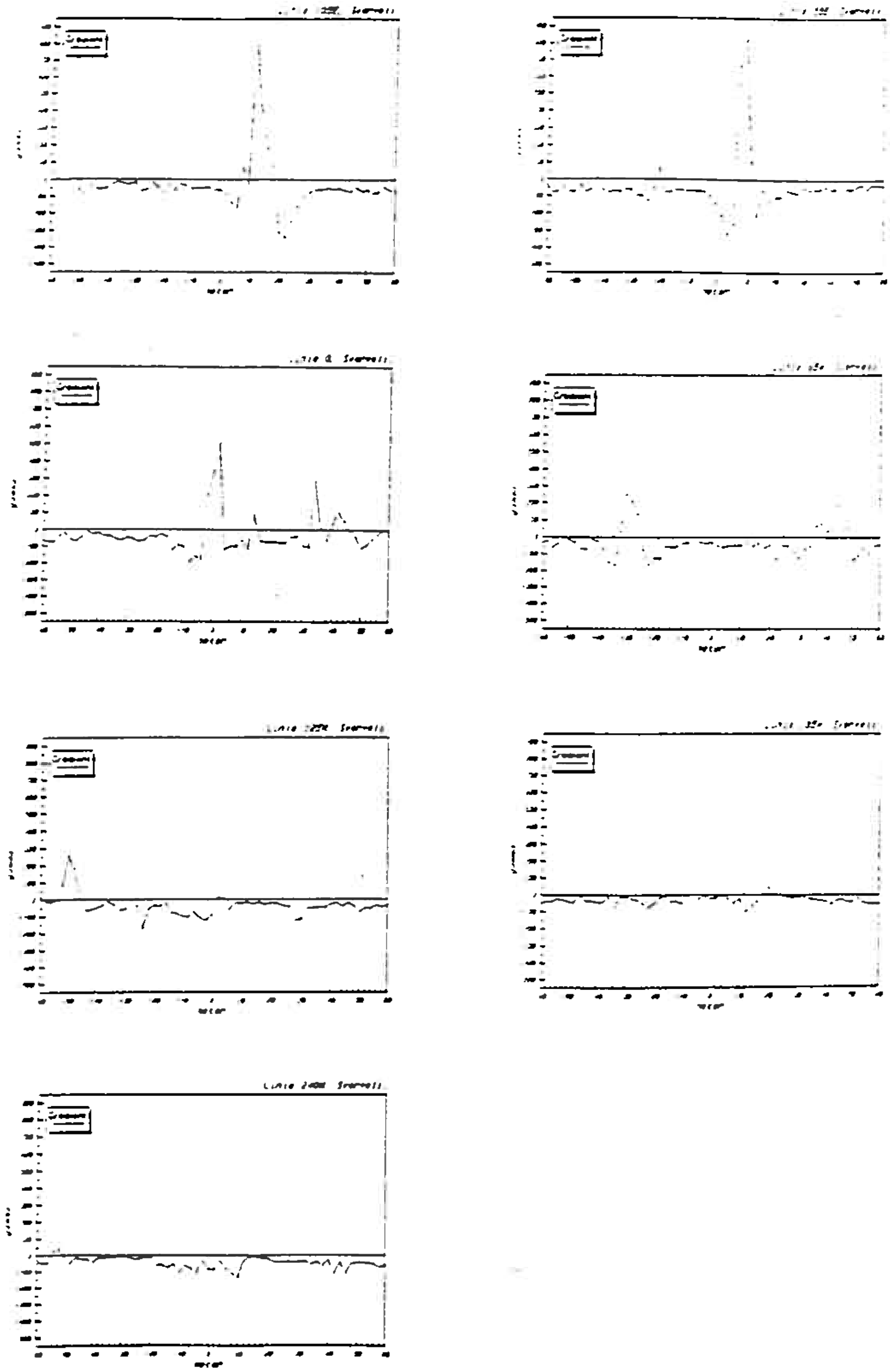


Fig. 7. The seven magnetic profiles recorded around Sverveli. 1989.

3.Hjartdal/Svartdal.

The mineral concession area in Bleka covers approximately 15 km^2 and consists of two separate locations: The Bleka/Espelid- and Bisminuten area, fig. 8. The lithology in both areas is mainly amphibolite of the Midproterozoic Seljord Group, central Telemark.

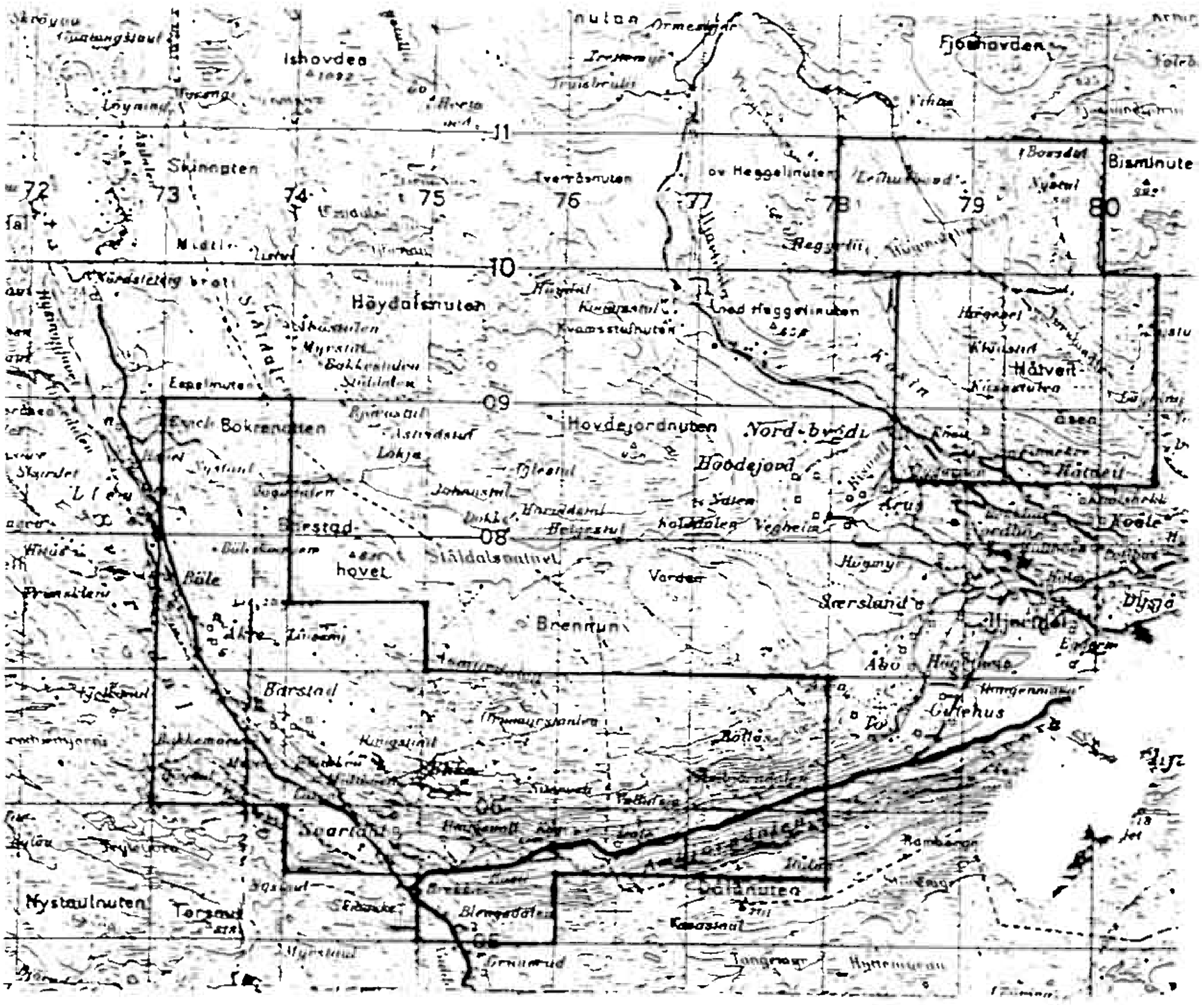


Fig.8. The two concession areas in Hjartdal Svartdal : Bleka Espelid and Bisminuten. (1:50000).

The gold-bismuth mineralisation in Bleka is found in a single quartz-ankerite vein structure, The Bleka Main Vein, and was exploited in the late 19th century. The Espelid vein swarm is thought to be an outer halo to a deeper gold mineralisation and may be associated with the same system as the Bleka Main Vein, *cf. ref. 2.*

While the vein itself is non-magnetic, earlier geophysical surveys in the area show a significant magnetic response from the bleached alteration zone along the vein structure, cf. fig.6. p.7.
The objective of the geophysical investigation around the Bleka Mine Area has therefore been mapping the continuation of the Main Vein east of Sverveli, cf. fig.3 p.4.

The favourable conditions seen in the Bleka area are also present in the Bisminuten area : Quartz veins hosted in Amphibolite. The presence of a significant amount of gold in streamsamples taken from the area also suggests the possibility of a similar mineralisation.

Because of a severe lack of time, only a rough grid was laid out and measured in this area.

The geophysical data was collected during a 3 week groundsurvey, from August 8th to August 21st 1997. The measurements were taken every 10 metres along 20 profiles in the Bleka area, fig. 9 and 10 profiles in the Bisminuten area, fig. 10. The spacing between the individual profiles in the Bleka area vary between 100 and 200 metres depending on the need for higher resolution, i.e.tighter grid, and time. The 10 profiles in the Bisminuten area were placed with a 250 metres interval, which proved to be too much for a correlation of the measured anomalies.

3.1.Results and interpretation.

All the recorded magnetic intensity profiles can be found on the enclosed 1.44Mb floppy disk or in appendix B and C.

3.1.1 Bisminuten. Fig 10

The magnetic intensity of the anomalies is higher in this area compared to the ones measured in the Bleka area.

Unfortunately does the 250 metres interval between the individual profiles a correlation virtually impossible. The few very high-intensity anomalies, ~51.000 nT, are in general produced by rhyolite, which is uninteresting in conjunction with the quartz-vein mineralisation. An example of such a lithology boundary-anomaly can be seen on profile 9.5N appendix. C. p55, where the surrounding rock is amphibolite.

Two interesting anomalies can be seen on profile 2N, 800m and 4.5N, 700m, c.f. p.54. The magnetic intensity is approximately 51.000nT and the hostrock appears to be amphibolite.

3.1.2 The Bleka Mine Area. Fig 9

The regional magnetic intensity in the Bleka area remains constant at approximately 50200 nT, which is characteristic for the amphibolite host rock. The magnetised alteration zones around the mineralised veins show a susceptibility contrast of about 100-400 nT, but the magnetic signature of the Main Vein is far from constant. It is almost entirely gone 100 metres West of Sverveli (profile 6.E, cf. p.17) but can clearly be distinguished 100 metres East of Svereli on profile 8.E, cf. p.18. This variation is in agreement with the results obtained by Jens P Larsen in 1989 (compare 6.E. with 240W and 8E. with 105E., fig.7. p.8).

Fig 9

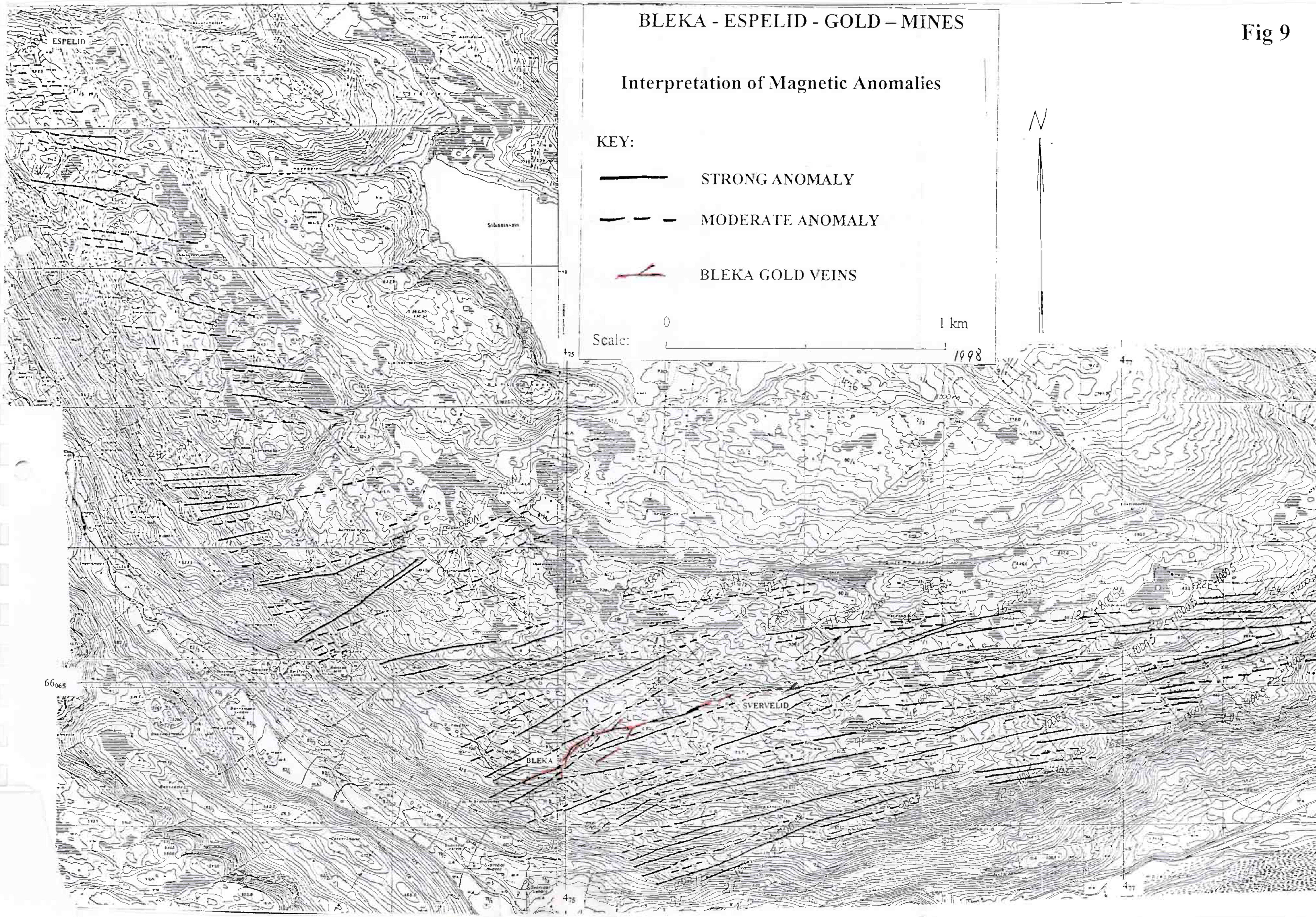

BLEKA - ESPELID - GOLD – MINES
Interpretation of Magnetic Anomalies
KEY:
STRONG ANOMALY
MODERATE ANOMALY
BLEKA GOLD VEINS
Scale:
0
1 km
1998
N
ESPELID
SVERVELID
BLEKA

Fig 10


1998
BISMINUTEN GOLD VEINS
TELEMARK, NORWAY
Interpretation of Magnetic Anomalies
Key:
STRONG ANOMALY
MODERATE ANOMALY
Scale:
0
0.5 km
Bisminuten
66₁₀
66₀₉
4₇₉
4₈₀

Fig 10

As the intensity of the magnetic field was measured using only one sensor, the information gained from the graphs is somewhat limited. This implies that the speculations regarding number, strike and depth of the anomalies interpreted below, can only rely on the shapes of the anomalies and a guess. Still, several trends can be deduced from the following magnetic profiles.

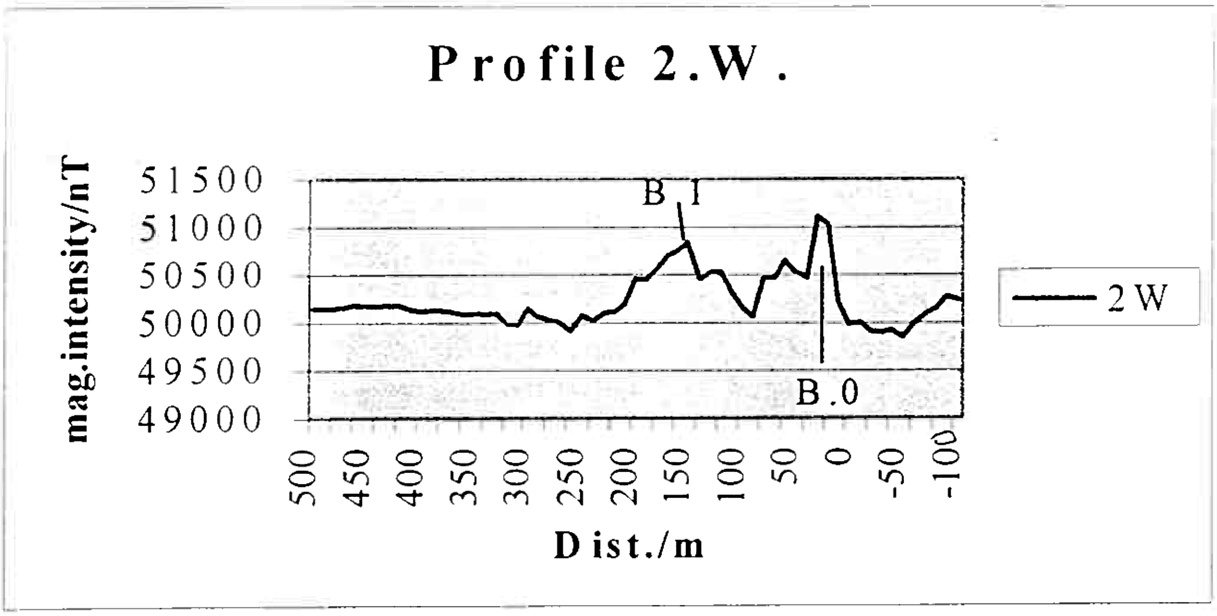


Fig.11. Section of 2W (from -10 to 500)

The first profile in the Bleka Area showing the Main Vein, B.0, is 2.W. The profile is located 25 metres SW of adit E (530 m). Both B.1. and B.0 seem to consist of at least two closely spaced anomalies. The strike could be almost vertical, especially in the case of. B.0.

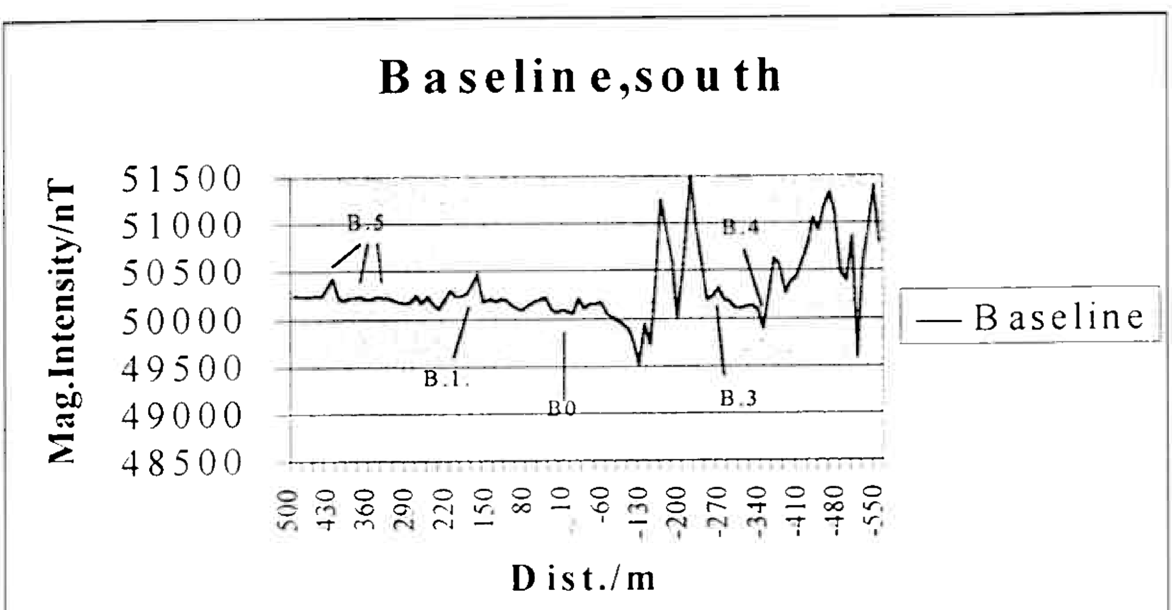


Fig. 12. Southern section of Baseline (from -500 to 500).

The two magnetic anomalies recognised on 2W reappear on Baseline, although in a different shape. B.1. has been reduced from 50800 nT to only ca. 50300-50500 nT and shows two distinct anomalies. B.0 is given by a small negative anomaly ~ -100nT. The pronounced drop in intensity must reflect the position of B.0 on Baseline, which is just in front of adit B where vast amounts of vein- and vein associated material have been removed. The two very large anomalies on the left hand side of B.3 is a powerline and a tinroof shed. Good conductors as these mask the anomalies and usually makes the interpretation useless. B.4. is a cluster of very high intensity anomalies probably due to some structural feature, faults etc., as the anomalies associated with the wallrock alterations are smaller, in general. B.5. consists of 3 small anomalies that appear to share some similarities to the ones seen at Espelid Vein Swarm, cf. fig.32 p.28.

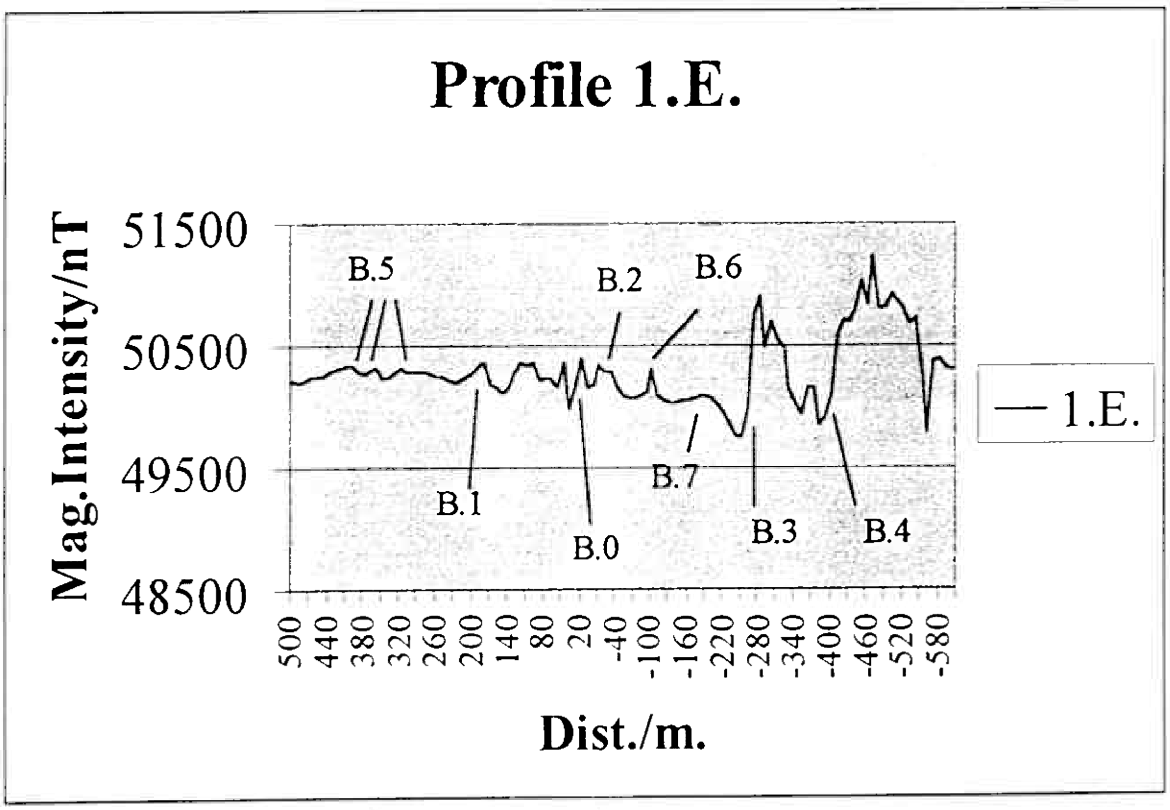


Fig. 14. Section of profile 1.E. (from -580 to 500).

The more asymmetrical shape of anomaly B.0 probably reflects a change in dip from almost vertical to a dip between 70°-60°. This change in dip along the Main Vein has also been recorded by Hydro A/S in 1984, where the dip changes from 75° to 55° across profile 1.E. B.2. is a generally smaller anomaly that runs parallel to the Main Vein Anomaly, B.0, and coincides with the parallel system of mineralised veins mapped by Hydro A/S in 1984, cf. fig. 3 p.4.
Although B.2. doesn't seem to terminate but continues along side B.0 beyond Sverveli.

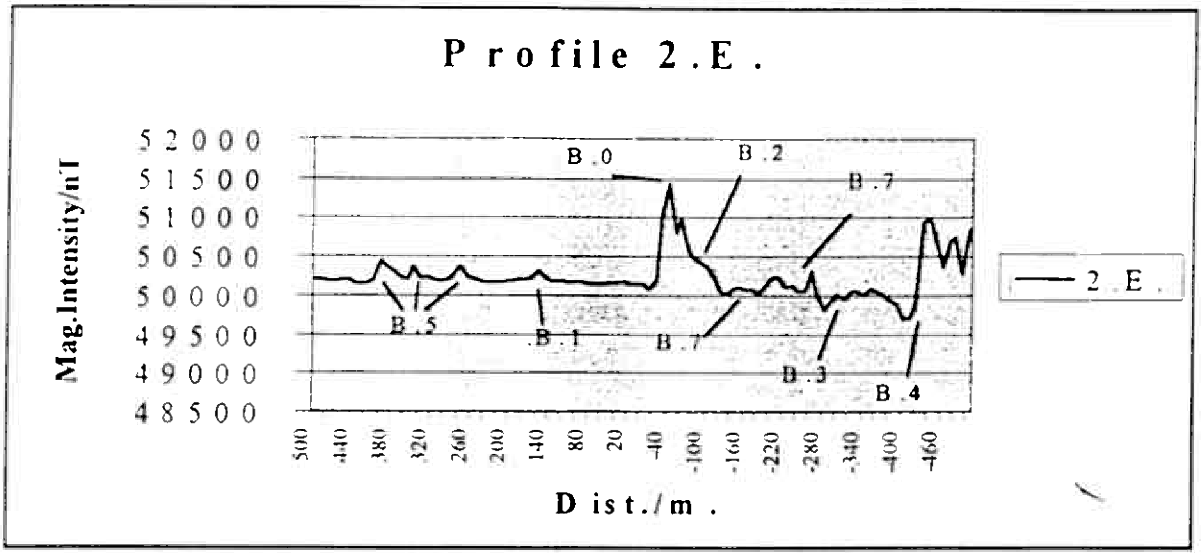


Fig. 14. Section of 2.E. (from -500 to 500).

The distribution of several smaller anomalies around the Bleka Main Vein contribute to the total anomaly and is clearly reflected in the widening of the base of B.0. The small anomaly between B.0 and B.2 is probably a similar 'sidevein'. This 'sidevein' anomaly will hereafter be referred to as B.2. as it is a very typical feature of the Bleka Main Vein.

Following the more spike-like shape of the Main Vein anomaly, B.0., it appears to have regained its near-vertical dip. The anomaly B.7 now appears with two distinct anomalies and at a more shallow depth than on profile 1.E.

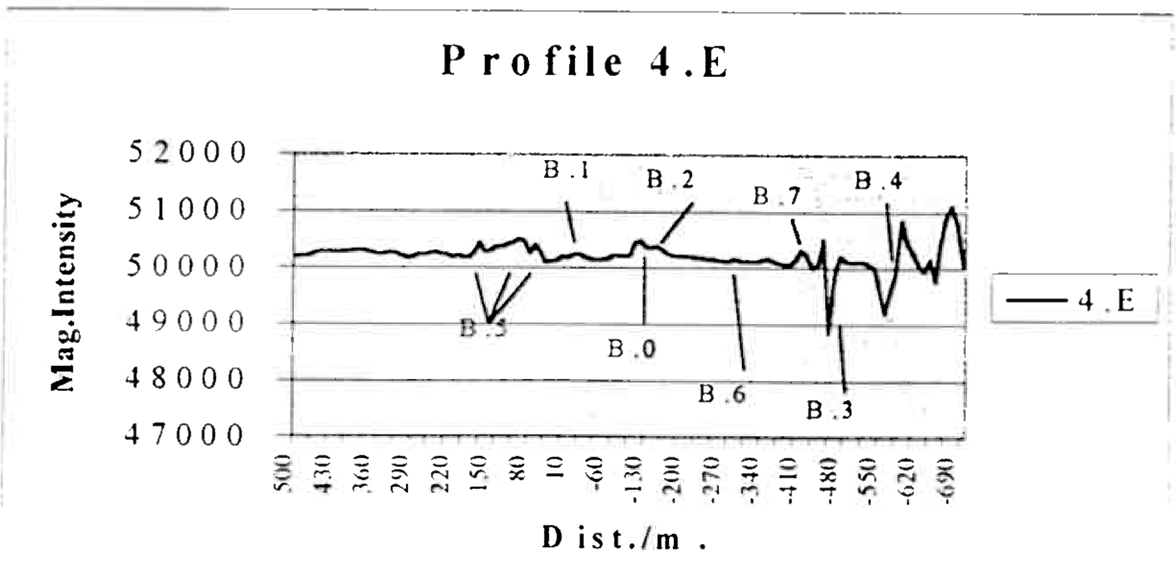


Fig. 15. section of profile 4.E. (from -700 to 500).

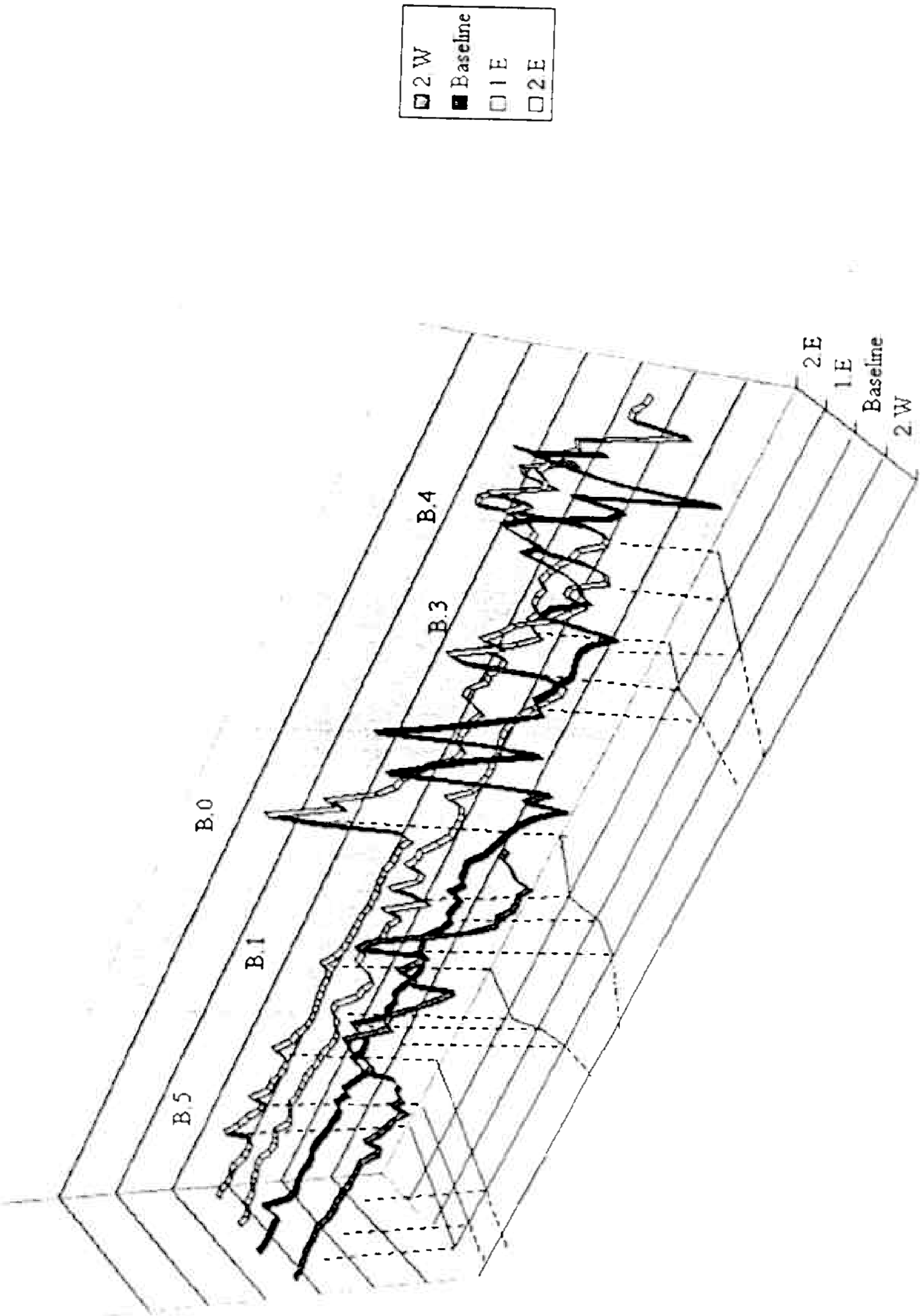


Fig. 16. sketch of the main trends interpreted (2.W - 2.E).

There is a general decrease in magnetic intensity of the interpreted anomalies through the profiles 2W to 4 E, but it is still possible to identify the Main Vein anomaly, B.0, although it has diminished in intensity from 51400 nT to just below 50500 nT. The anomaly, B.2, starts to segregate from the Main Vein anomaly, B.0.

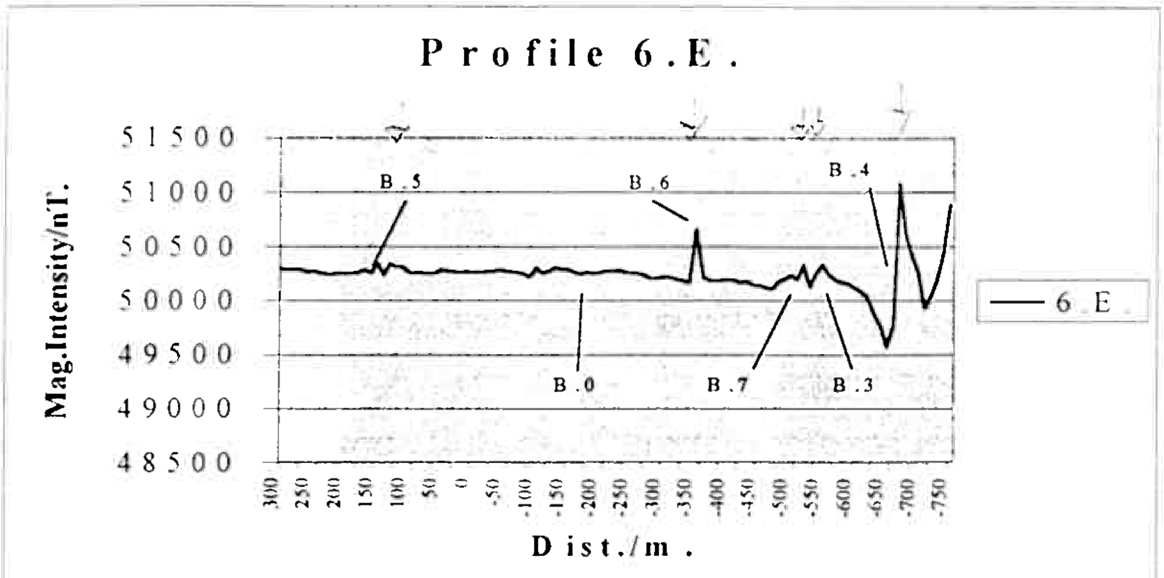


Fig. 17. Section of profile 6.E. (from -750 to 300).

The most striking feature of this profile is the lack of a magnetic signature for the Main Vein anomaly, B.0. and confirms the results presented by Jens P.Larsen in 1989, cf. fig. 7 p.8. 185W. Identification of B.0 relies 100% on the geological mapping of the Bleka Main Vein. As no outcrops have been recorded on the geological map, the position of B.0 is somewhat uncertain. If the position indicated on profile 6.E is correct, the vein appears to be displaced ca.20-30 metres north compared to the position given on the map, cf. fig.3 p.4. The resulting structure would be similar to the change in orientation recorded between Baseline and profile 1.E, just on a smaller scale. The hypothesis of such an en echelon structure can be supported by the trend of anomalies B.3, B.4, B.6 and B.7 cf. fig. 30.p.26.

The B.1 magnetic anomaly can't be identified with certainty based solely on this magnetic intensity profile.

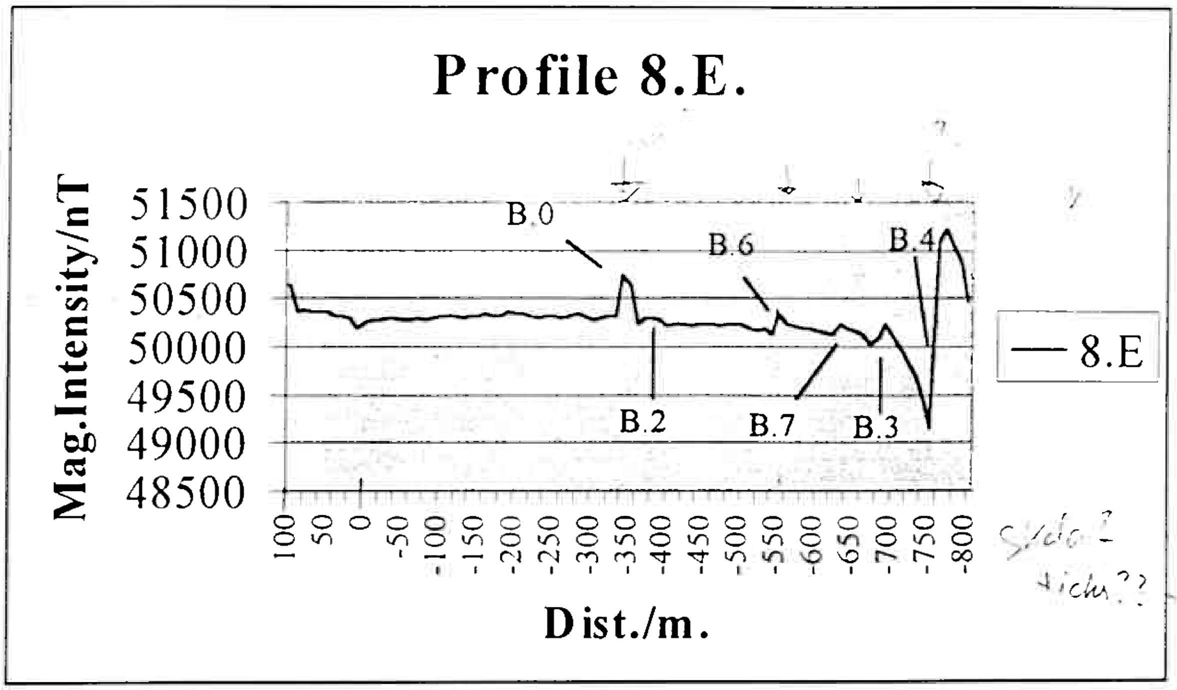


fig. 18. Section of profile 8.E. (from -800 to 100).

Anomaly B.0 reappear with an intensity of ca.50800 nT and B.2. can be identified.

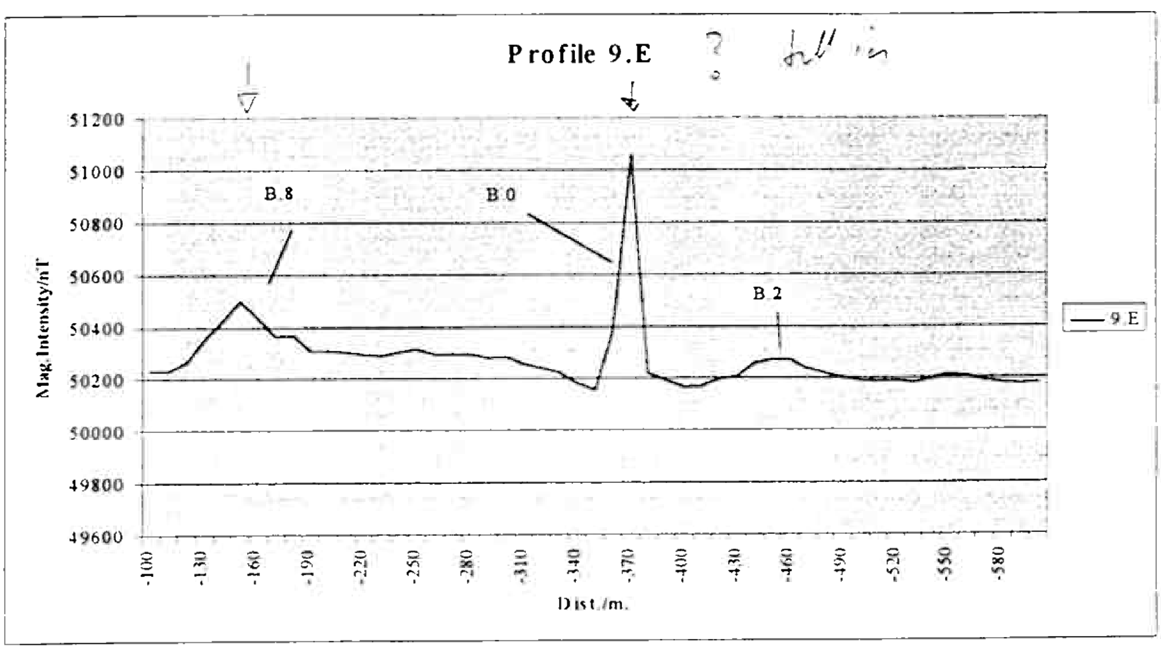


Fig. 19. Profile 9.E. (from -100 to -600).

The profiles 9.E, 11.E and 13.E are all 'fill-in'-profiles measured the last day in the Bleka area. Because of the supposed en echelon structure of the Main Vein these profiles are essential in correlation of the Main Vein anomaly from profile 8.E to 14E.

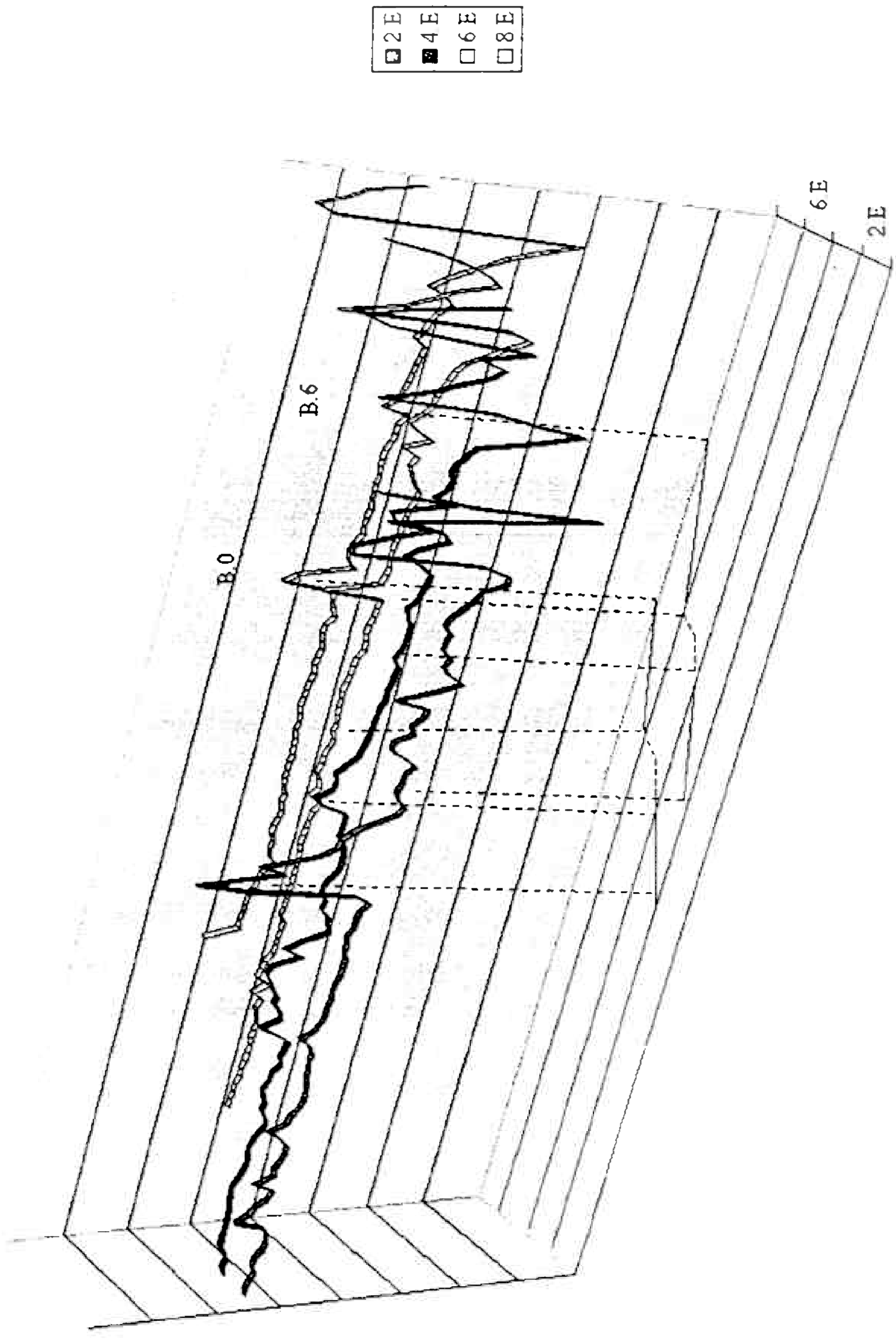


Fig. 9. Sketch of the main trends interpreted (2.E - 8.E).

The Main Vein anomaly, B.0 and B.2 are easily identifiable on profile 9.E and indicate another displacement north. B.8 is a new anomaly that have a trend and signature somewhat like the Main Vein anomaly, B.0 so it may be a vein structure similar to the it.

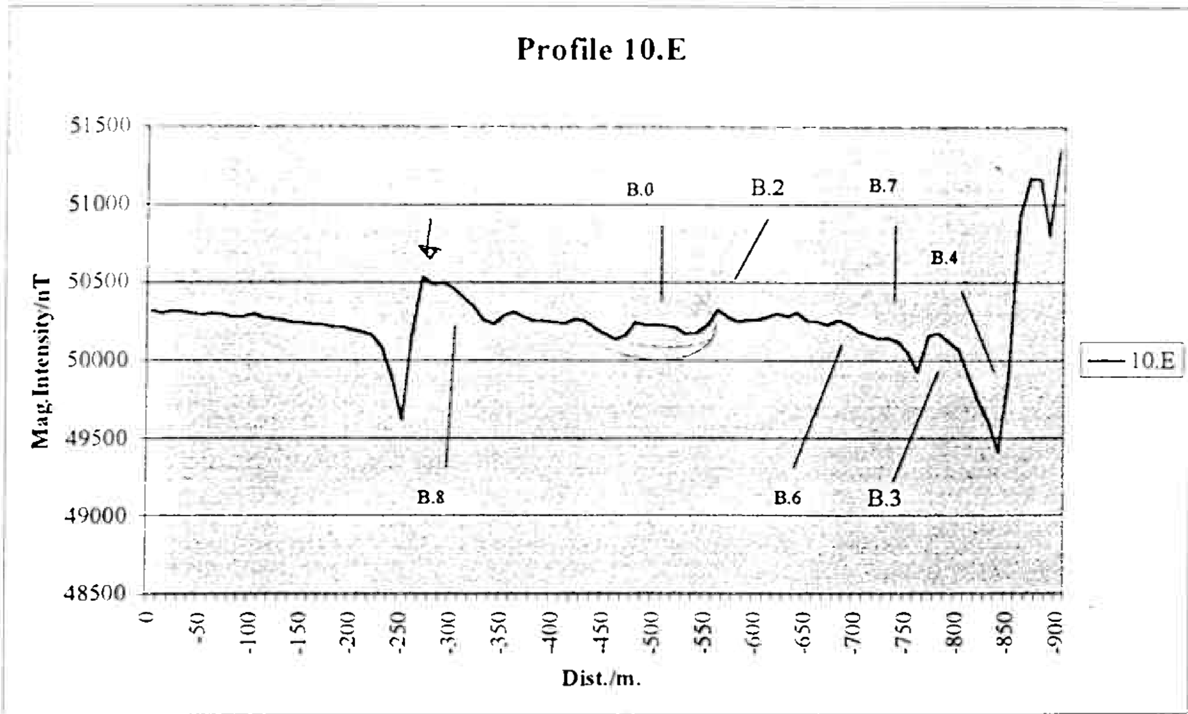


Fig. 21. Profile 10.E (from 0 to -900).

All the anomalies interpreted on profile 8.E can be recognised on this profile, with the exception of the new anomaly B.8. The identification of B.0 is on this profiles primarily based on the presence of the characteristic hollows surrounding the Bleka Main Vein anomaly, cf. fig.20, and anomaly B.2.

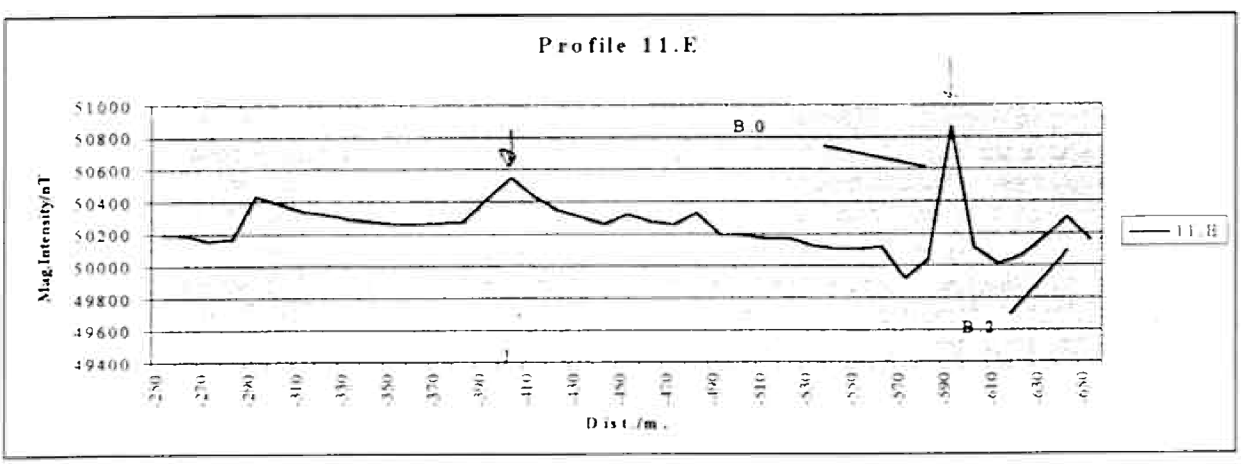


fig.22. Profile 11.E. (from -250 to -650).

Only the Main Vein anomaly, B.0 and the anomaly B.2 can be identified with certainty.

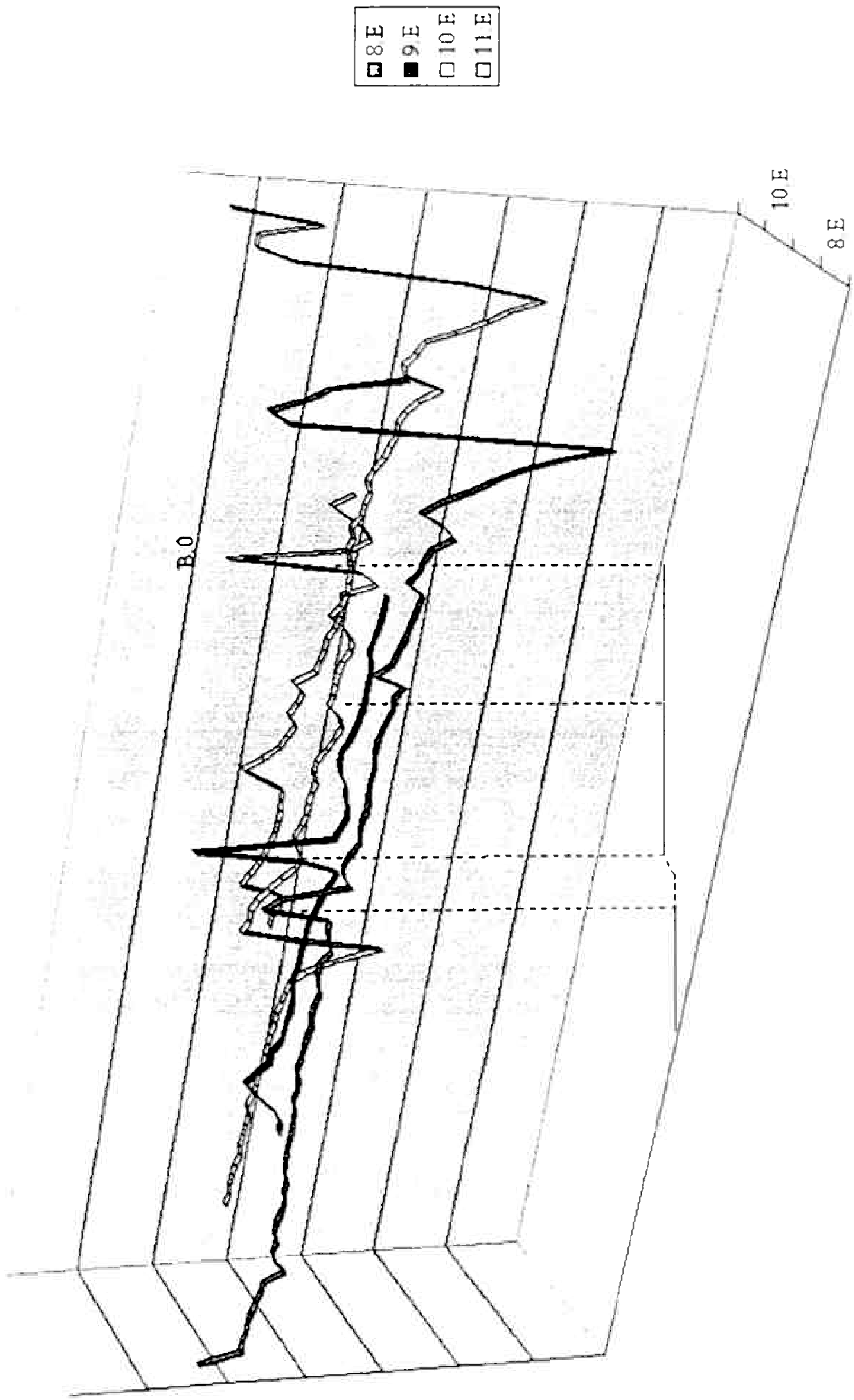


Fig. 23. Stacked profile over 8.E, 9.E, 10.E and 11.E, with the Main Vein sketched.

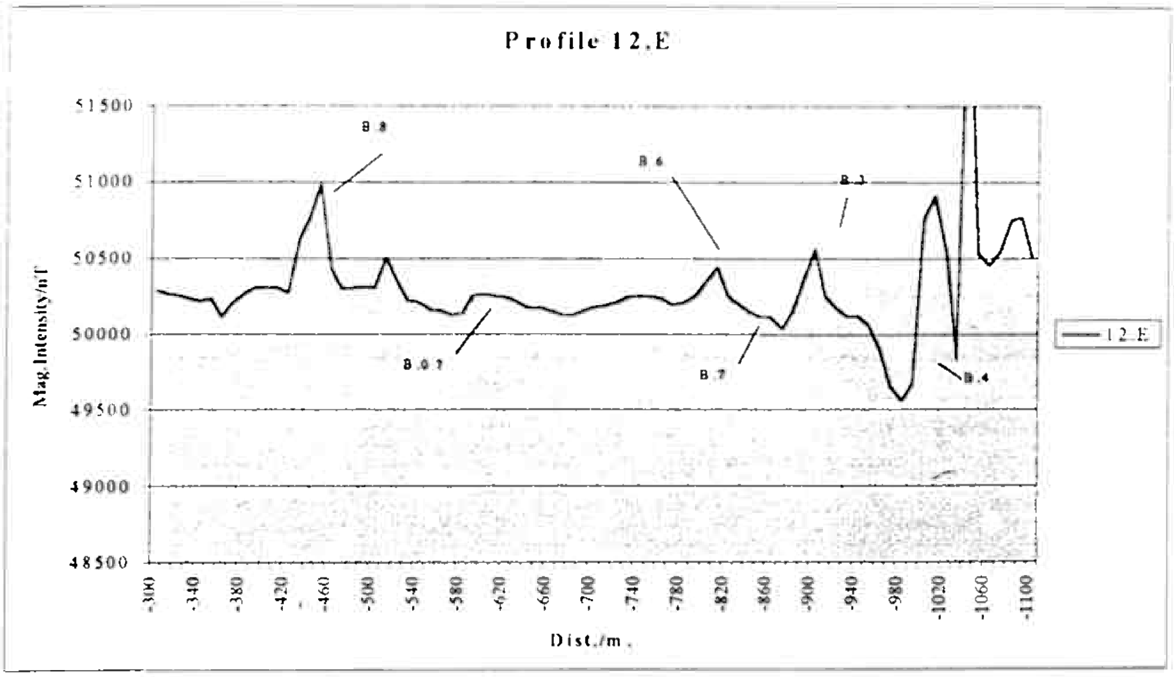


Fig.24. Profile 12.E (from -300 to -1100).

The interpreted location of the Main Vein anomaly, B.0 is very dubious at best and anomaly B.8 appears to have split up into two separate anomalies very much like the main vein.

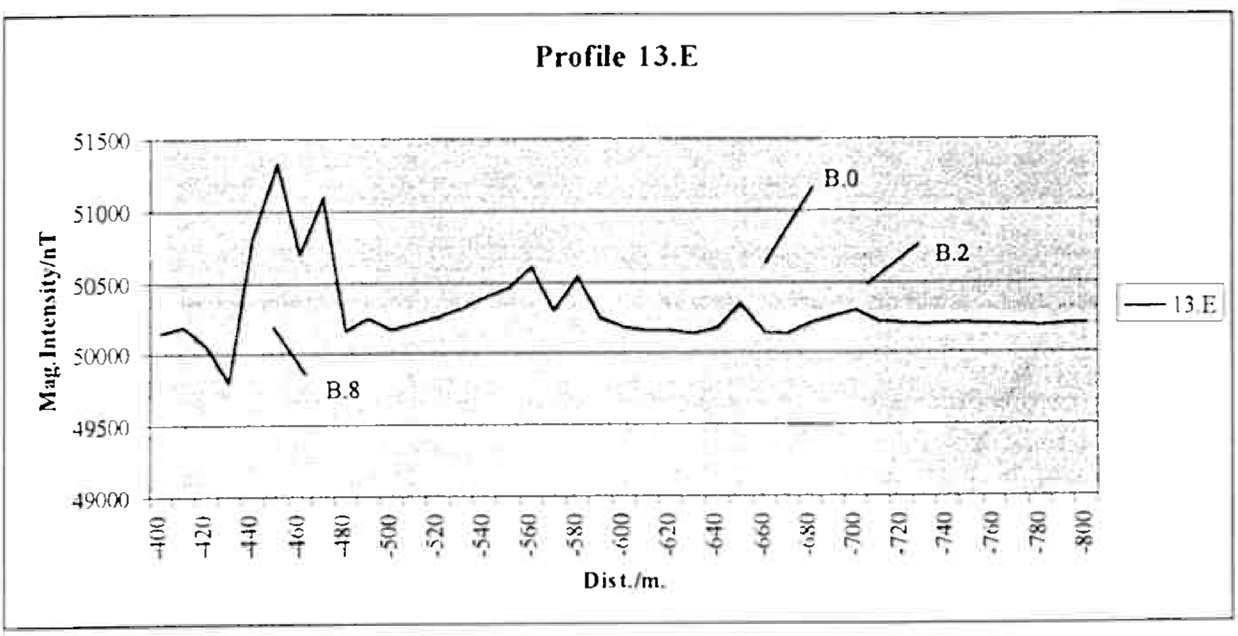


Fig.25. Profile 13.E. (from -400 to -800).

The Main Vein anomaly, B.0 and the smaller B.2 have been interpreted to be located at ca.-650 and -700, respectively. These interpretations together with, although very uncertain, the position of the Main Vein on profile 12.E, indicate another displacement north.

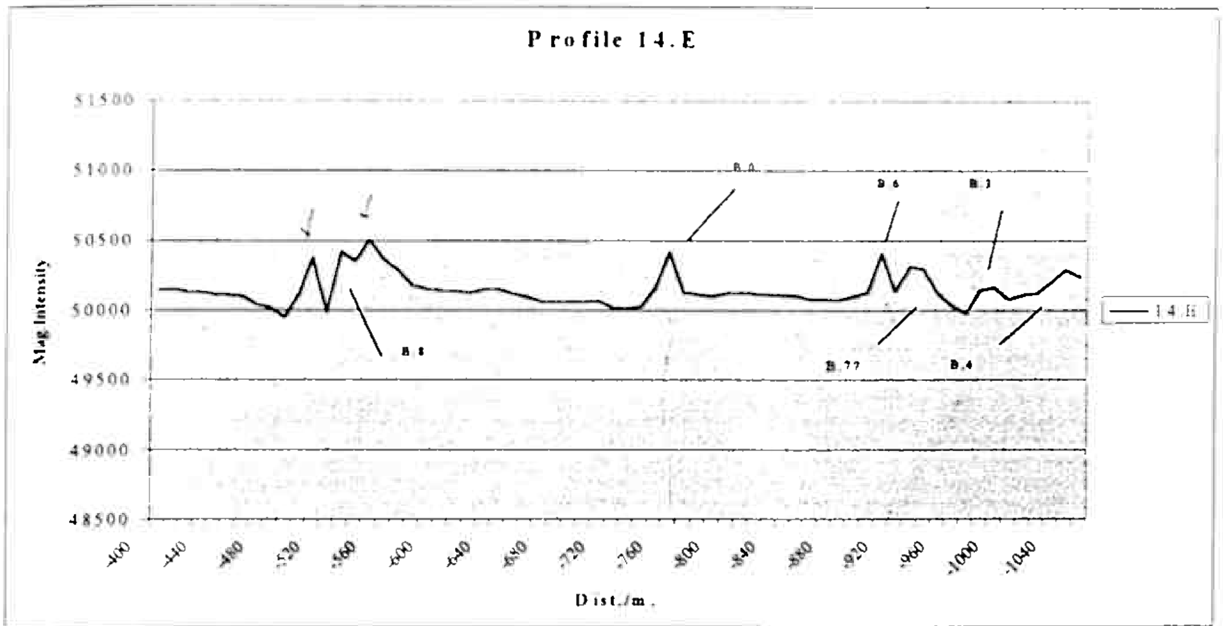


Fig. 26. Northern section of profile 14.E (from -400 to -1050).

After the displacement of the main vein somewhere before or around profile 12.E the anomaly has regained its previous characteristics, i.e. tall narrow spike with hollows at the sides. Anomaly B.4 seems to fade a bit. This could be an indication of a new or different structural system, i.e. new fault systems etc. The negative anomaly to the left of B.8 is another tinroof.

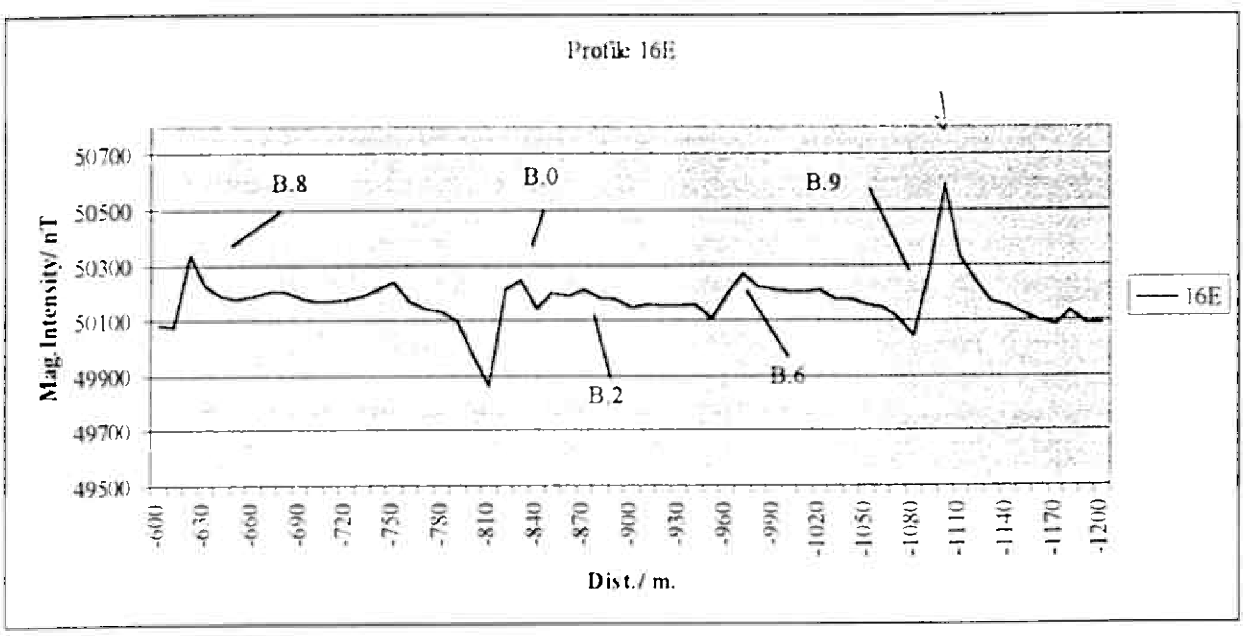


fig. 27. Profile 16E (from -1200 to -600).

Please note that the scale has been changed as a result of the rapidly decreasing magnetic intensity of the anomalies. The large negative response on the left hand side of B.0 is caused by a nearby tinroof and telephonecables. Otherwise the signature of the Main Vein anomaly is the same as seen on fig. 26.

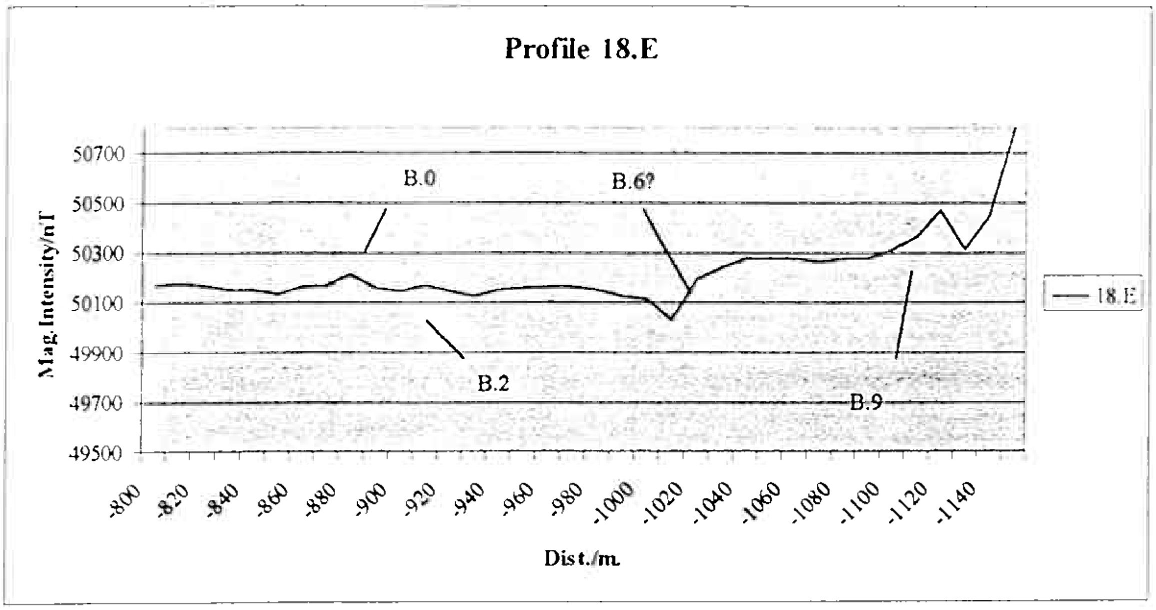


Fig. 28. Profile 18E (from -1300 to -800 metres).

The Main vein anomaly, B.0 is still very weak and the identification of B.6 very uncertain. The sudden rise in magnetic intensity at B.6 could be caused by geological structures or a change in lithology.

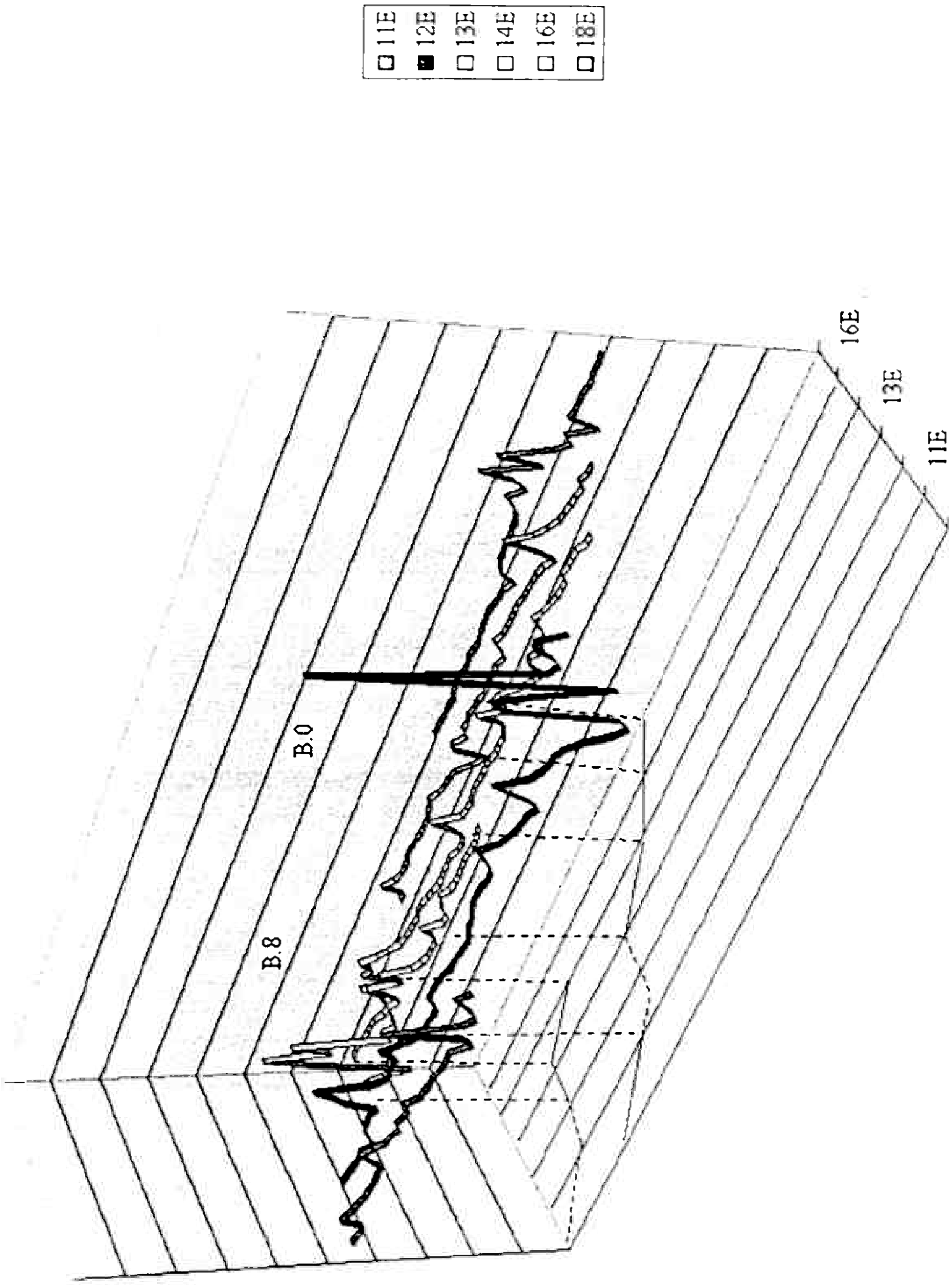


Fig. 29. Stacked profile with the Main Vein sketched (11E - 18E)

3.2.The Espelid-area.

The Espelid-area is located in Svartdal, Northwest of Bleka. Previous geological fieldwork shows an extensive amount of mineralised veins, *cf. fig. 4 p.5.* These seem to be nearly parallel, steep dipping veins, hosted in amphibolite and with an orientation of 230-250°/60-80°. The main part are relatively small, < 0.1m but several larger veins have been recorded.

The magnetic field intensities recorded in this area vary with only ca.100 nT from a background intensity of 50200 nT. This makes an accurate mapping of the small veins difficult, but the main features can still be interpreted.

There seems to be a fine correlation between the geological map, *fig.4*, and the interpreted magnetic anomalies. The punctuated line indicate possible vein trends as interpreted from the magnetic data.

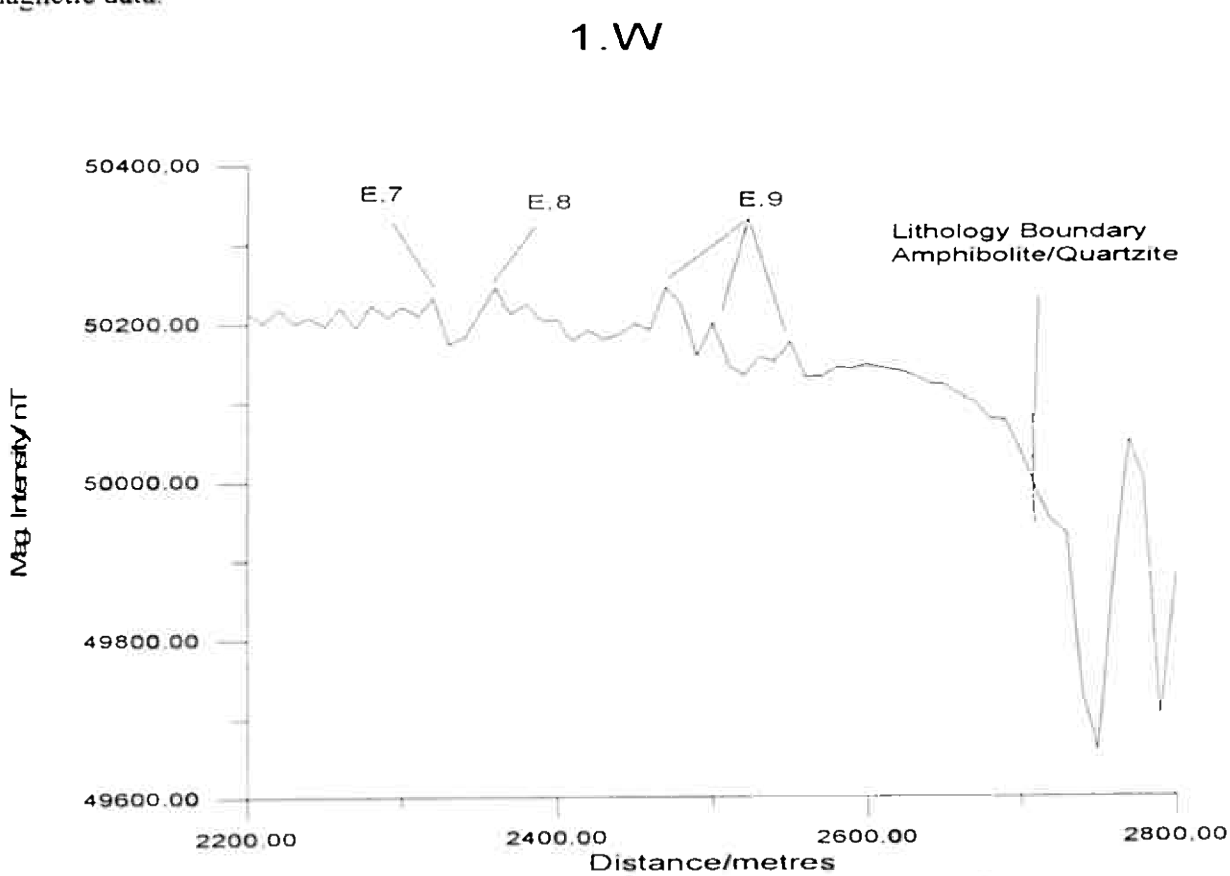


fig. 31. Profile 1W (from 2200 to 2800).

The sharp drop in magnetic intensity at 2700 metres on line 1W must relate to geological structures such as a change of lithology, probably amphibolite/quartzite.

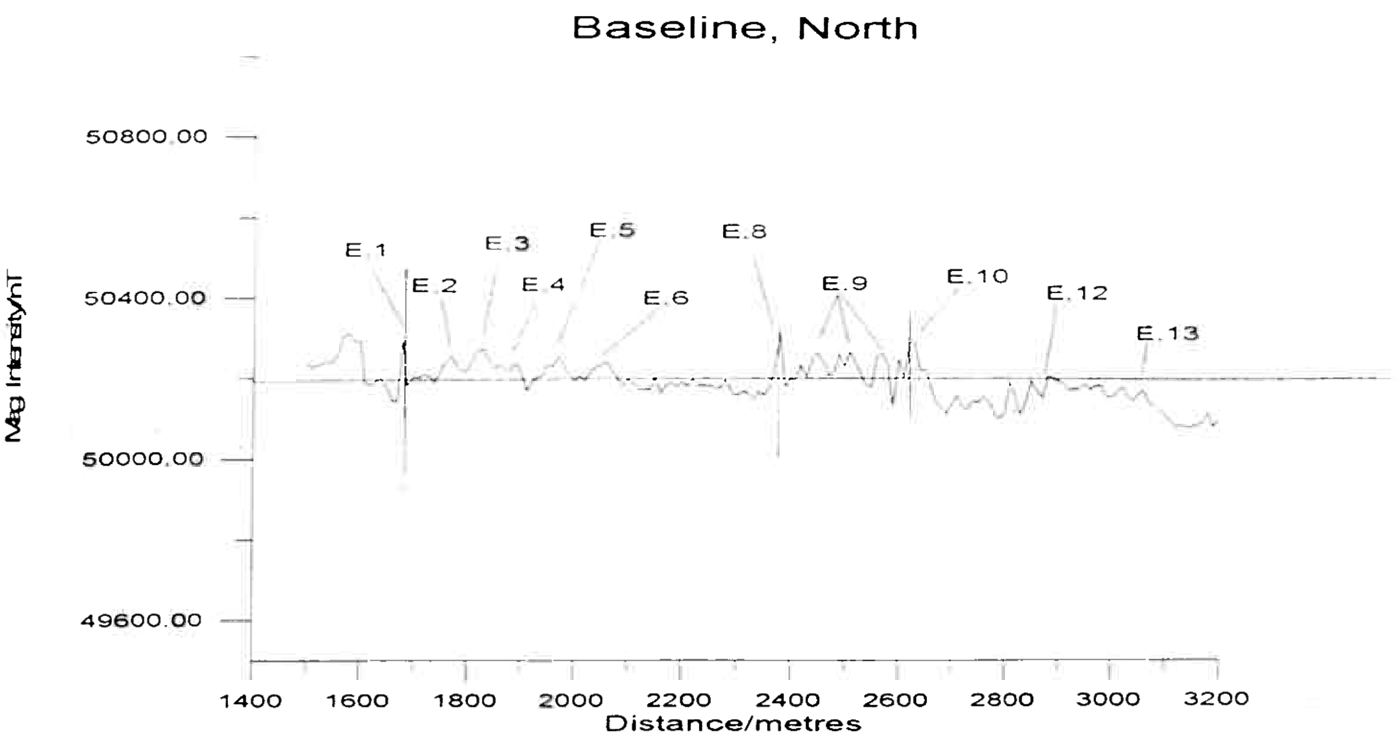


Fig.32. Baseline (from 1500 to 3200).

Anomalies E.8 and the three small anomalies called E.9 are still identifiable, though anomaly E.7 is gone or very uncertain. It might be the very small anomaly seen at 2260 metres.
The anomalies E1 through E5 have not been recognised in the field but are not doubt part of a vein swarm similar to the one seen at E.8 through E.10 that has been mapped.

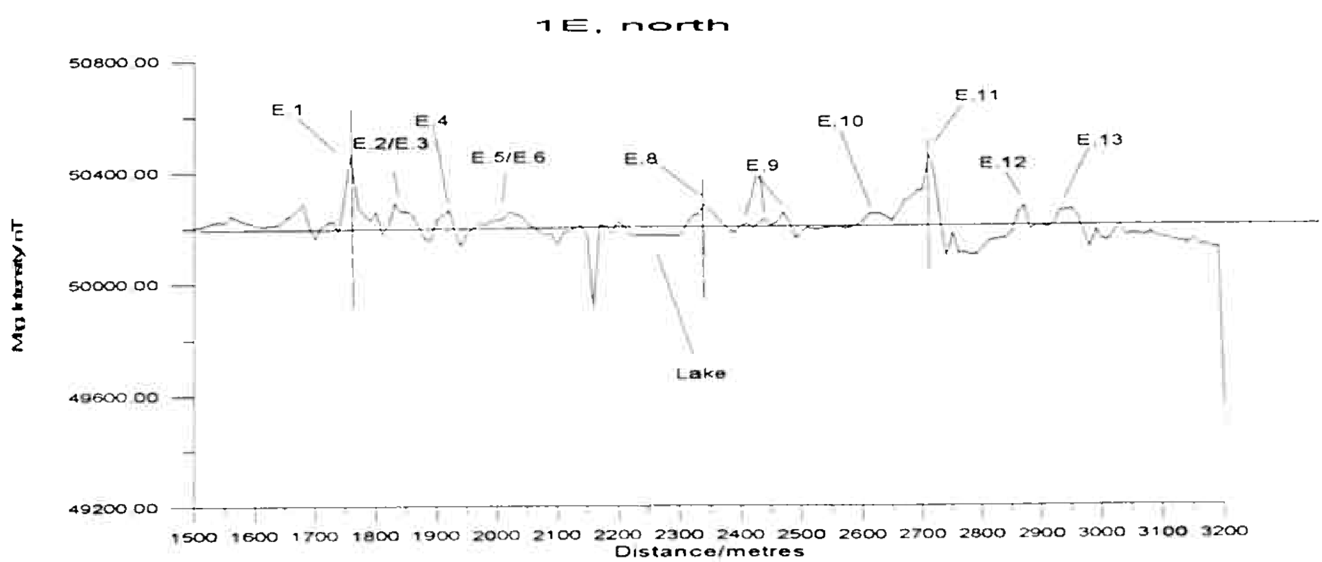


fig.33. Northern part of profile 1.E. (from 1500 to 3200).

The anomalies E.4 and E.5 is now so close that they appear as one anomaly. E.5 and E.6 also seem to converge, although the width of the anomaly indicate that they have a more shallow dip than E4/E5. This is in acceptance with the geological map where dips between 77° and 55° have been measured for the veins constituting anomaly E.5 and E.6.

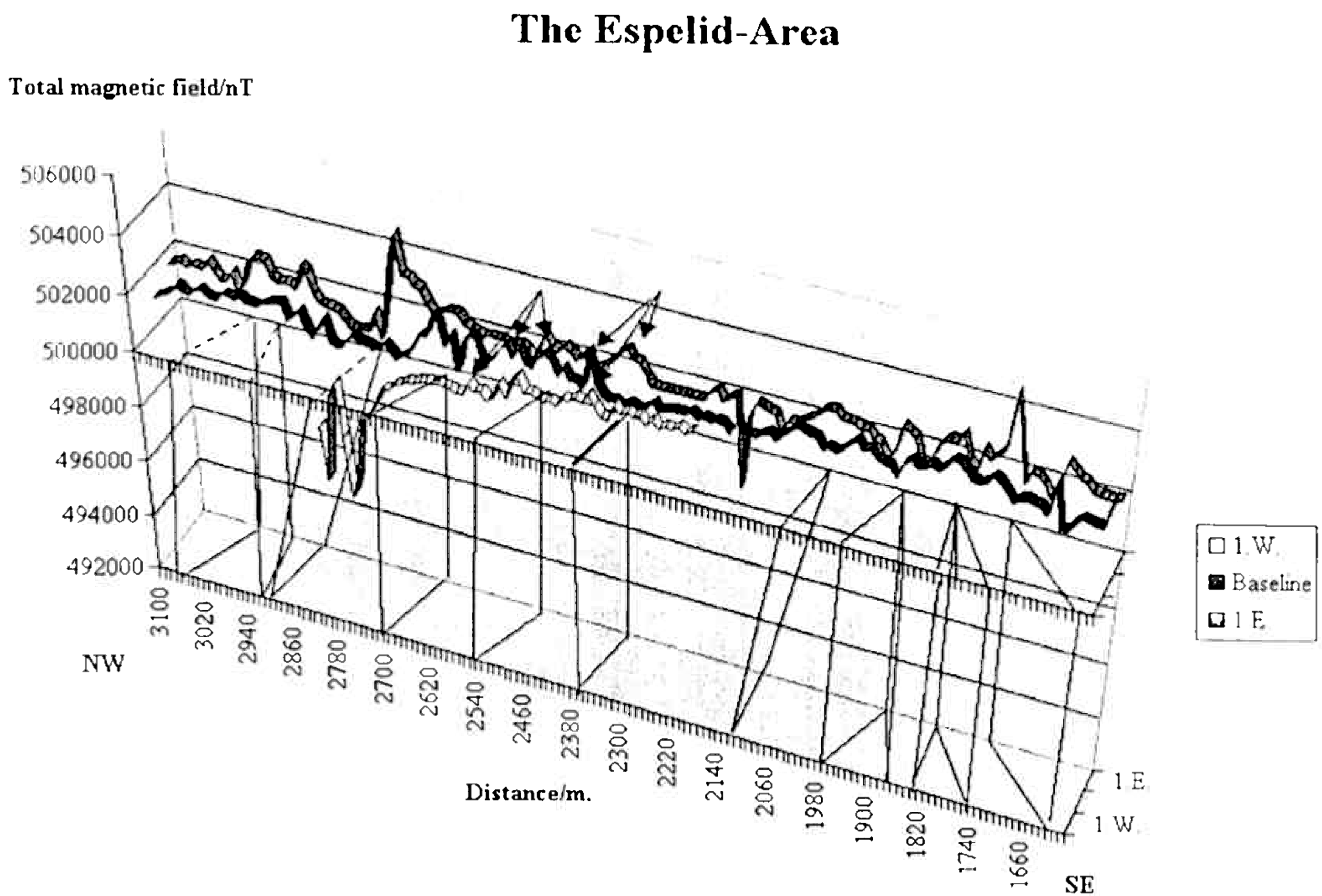


Fig. 34. Stacked profile with the main vein trends. (1.W - 1.E)

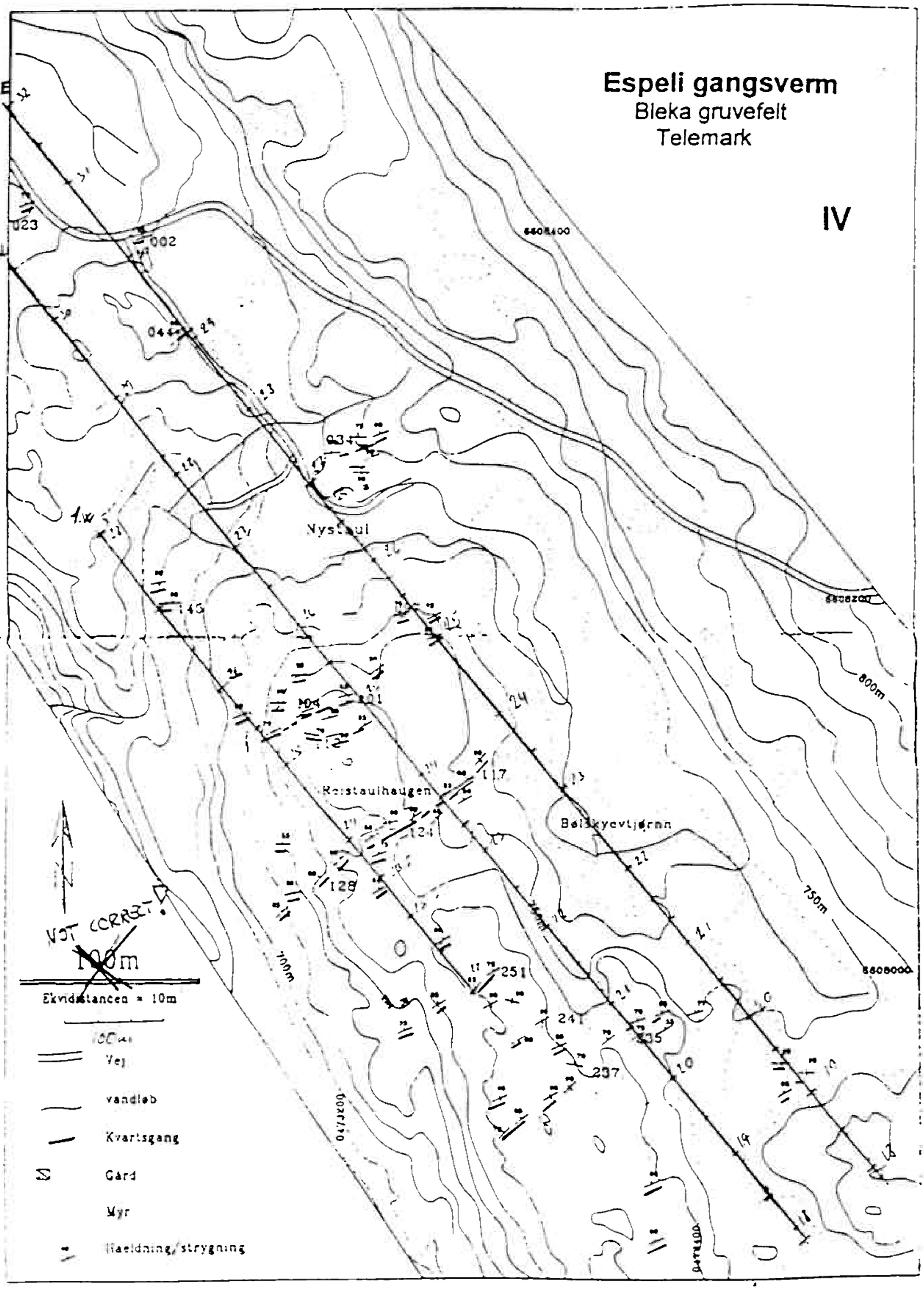


Fig. 35 . Orientation of vein swarms in the Espelid area as interpreted from the magnetic data.

5. Conclusion.

After almost 5 weeks geophysical groundsurvey using a Proton-magnetometer in different areas and all kinds of weather, its ability to map the near-surface geology is very convincing. Mapping a single magnetised structure such as the Bleka Main Vein in an, almost, homogenous hostrock is of course optimal.

It is also useful in supporting geological interpretations were no outcrops can be mapped and measured. Still, a joint interpretation of magnetic and geological data should be done with great care, as the Proton-magnetometer respond primarily to the magnetite content and not necessarily a change in lithology.

The magnetic data from the area around the Bleka Mine and further eastward indicate that the Main Vein is offset in an en echelon structure, cf. fig. 30. Another example of such a distribution of ore zones is the Corinthia deposit in the Southern Cross greenstone belt, fig.48. c.f. ref.

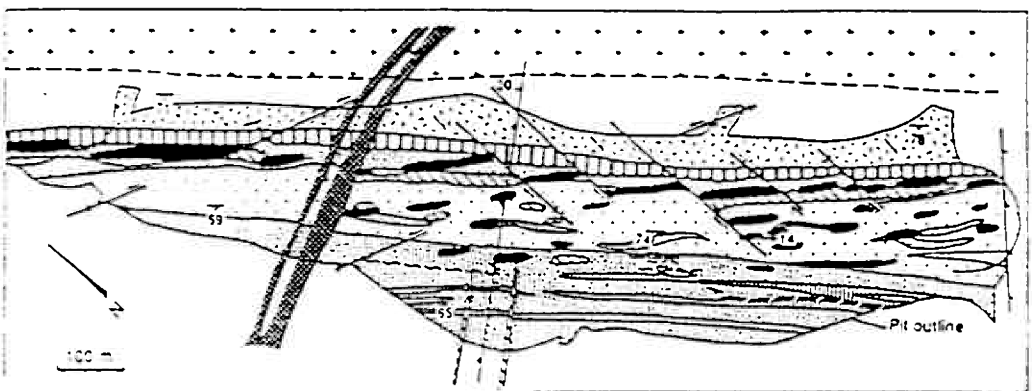


Fig.48. The Corinthia deposit. [ref.5]..

The size of the elongated anomalies produced by the high content of magnetite in the wallrock alterations is approximately 200 X 20m and with a geometry that corresponds to a left-lateral shear, cf. fig. 30 p.26.. The location of the Bleka Main Vein East of profile 18E is uncertain, but several rocksamples with a high content of sulphides was taken from the area just North of profile 20E-24E. Sulphides such as Arsenopyrite, Pyrrhotite, Chalcopyrite etc. is a characteristic group of minerals in alterationzones associated with vein deposits.

The Espelid Vein Swarm was mapped successfully using the Proton-Magnetometer. In addition to the vein swarm already mapped a new group of anomalies with a similar magnetic signature was identified just 700 metres South of Nystaul, cf. fig. 34 p.30.

Although two bands of high-intensity anomalies, the 'pegmatite' with an approximate East-West orientation and some Fine-grained volcanic rocks with an North-South orientation, cf. fig.47 p.38, were identified, the magnetic intensity data from the groundsurvey in Nissedal, Kleivaasen, is inconclusive. A closer analysis of the magnetic data in conjunction with the geology of the Kleivaasen area might provide a clue as to the structure and origin of these high-magnetite rocks.

6. References.

1 Dobrin, Milton B., Savit, Carl H.: 'Introduction to geophysical prospecting'. 4th. edition p.633 - 749. McGraw-Hill Book Co. 1988. Singapore.

2. Harpøth, O., Gregersen J.L.: 'Gold Exploration in the Bleka fold area, Telemark'. 1984. Exploration report for Norsk Hydro A/S.

3. Larsen, Jens P.: 'Geofysisk feltarbejde i Hjartdal, Telemarken'. 1989. Geophysical groundsurvey report.

4. Nordic Minerals A/S : 'Bleka Gold Project'. 1996.

5. Ridley, John R., Groves, David I., Hageman, Steffen G.: 'Exploration and deposit models for gold deposits in amphibolite/granulite facies terrains'. Results of research carried out as MERIWA Project No. M154. Report No.142/I.

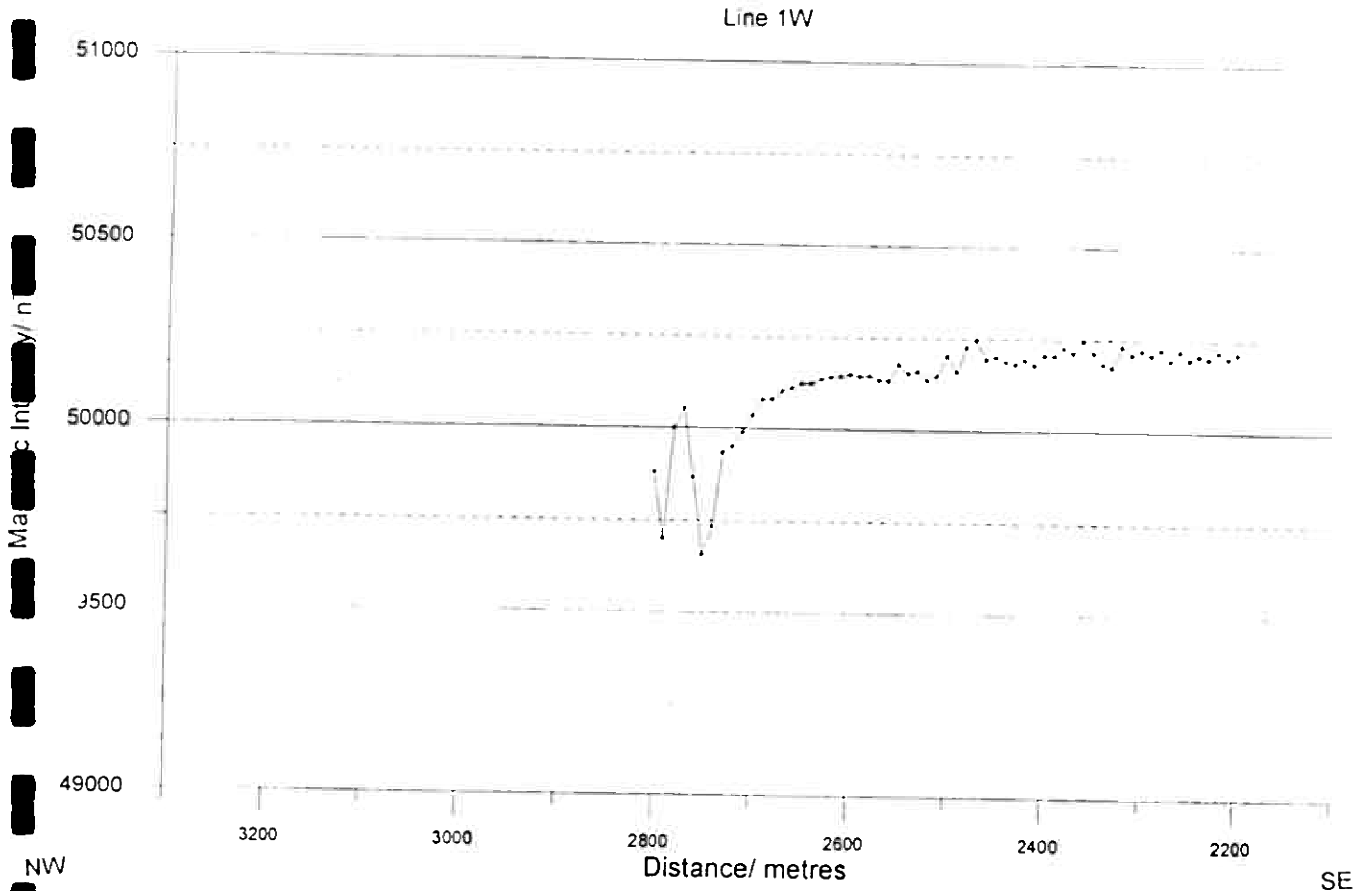
6. Telford, W.M., Geldart, L.P., Sheriff, R.E.: 'Applied Geophysics'. 2nd. Edition p.62 - 135. Cambridge University Press 1990, Cambridge.

7.1 Appendix A.

7.2 Appendix B.
Bleka and Espelid.

Surveylines in the Svartdal/Hjartdal area, Telemark.

Lines	Extent	Total/metres	No. of stations
4W	17.4N - 8.0N	940	95
2W	22N - 1.0S	2300	231
1W	28N - 22N	600	61
Baseline	32N - 5.5S	3750	376
1E	32N - 6.0S	3800	381
2E	9.0N - 6.5S	1550	156
4E	9.0N - 7.0S	1600	161
6E	3.0N - 8.5S	1150	116
8E	1.0N - 9.0S	1000	101
9E	1.0S - 6.0S	500	51
10E	0.0 - 9.0S	900	91
11E	2.5S - 6.5S	400	41
12E	3.0S - 11S	800	81
13E	4.0S - 8.0S	400	41
14E	4.0S - 11.5S	750	76
16E	6.0S - 12S	600	61
18E	8.0S - 13S	500	51
20E	10S - 13S	300	31
22E	10S - 14S	400	41
24E	12S - 13.5S	150	16
		22390	2259


Line 1W
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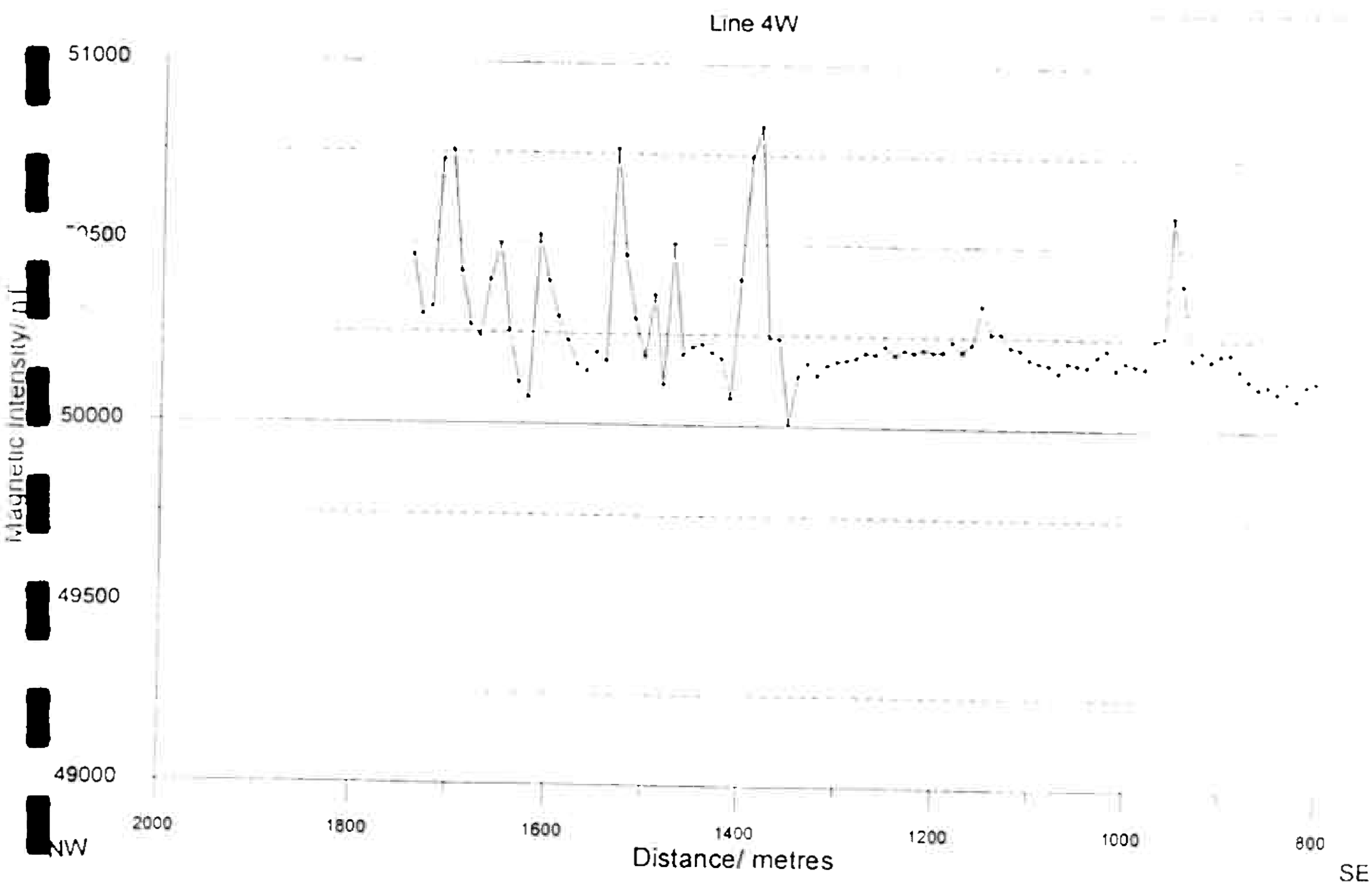
50500
50000
49000
Magnetic Intensity/ nT
3200
3000
2800
2600
2400
2200
NW
Distance/ metres
SE


Line 4W
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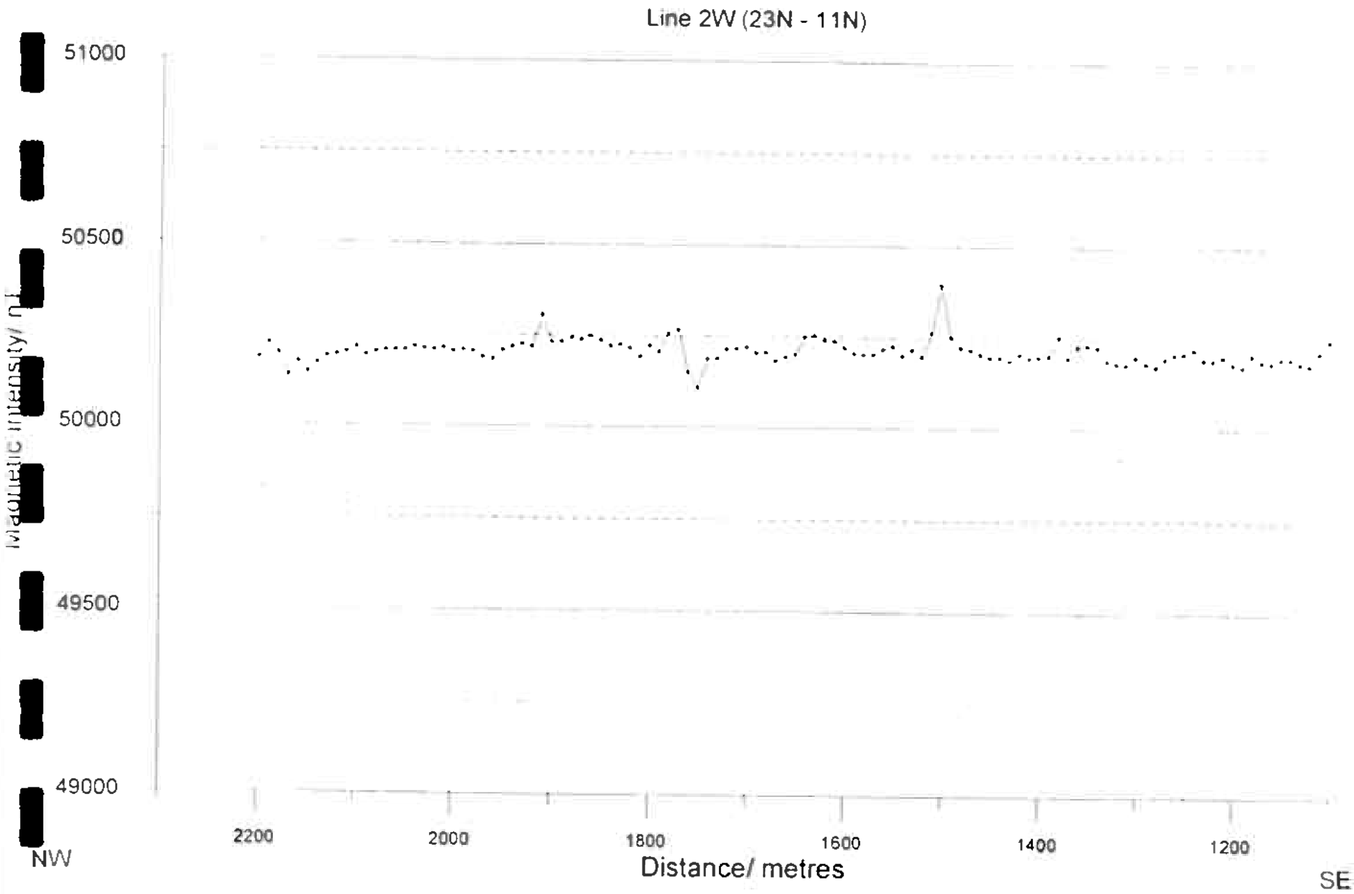
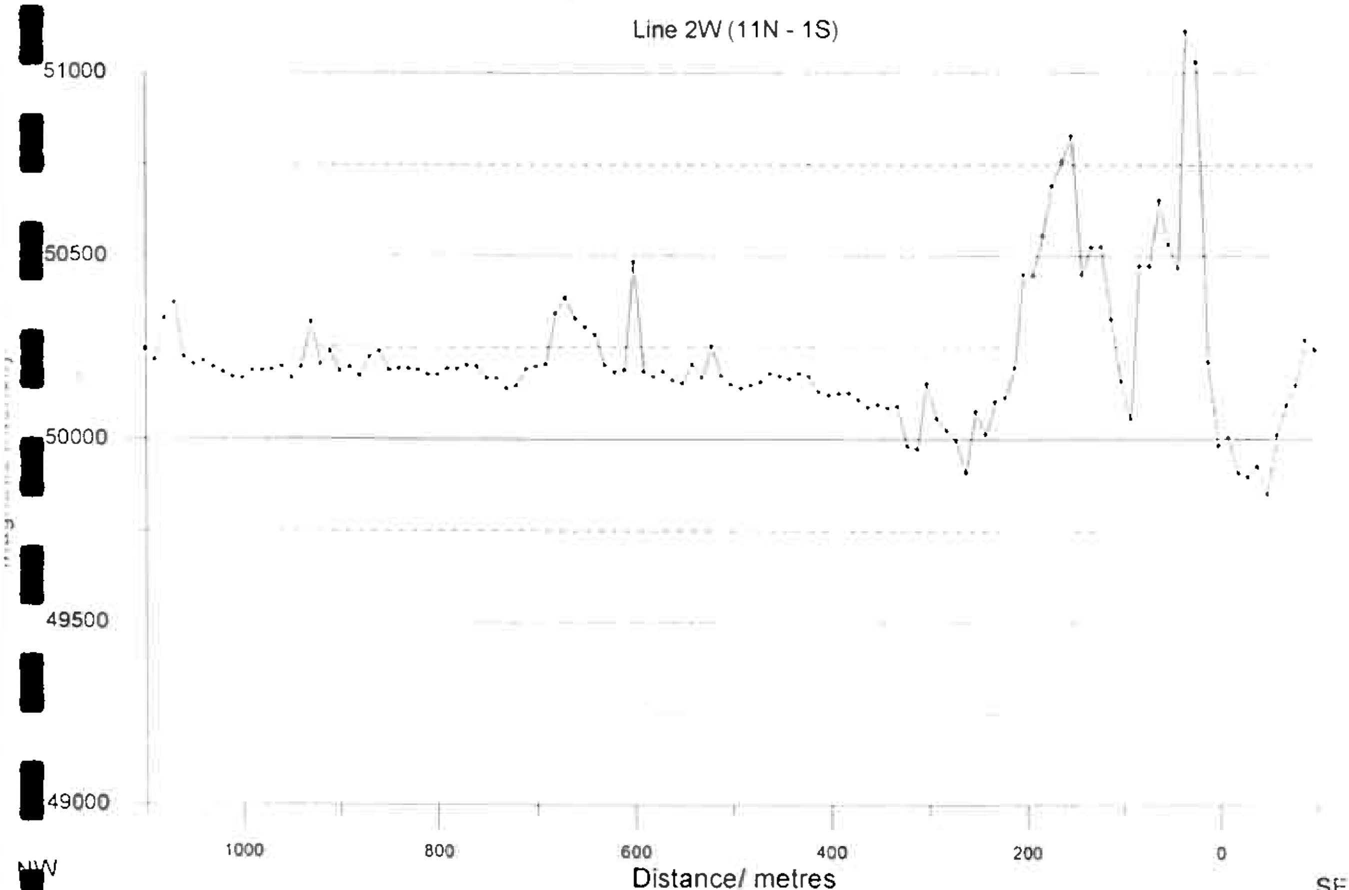
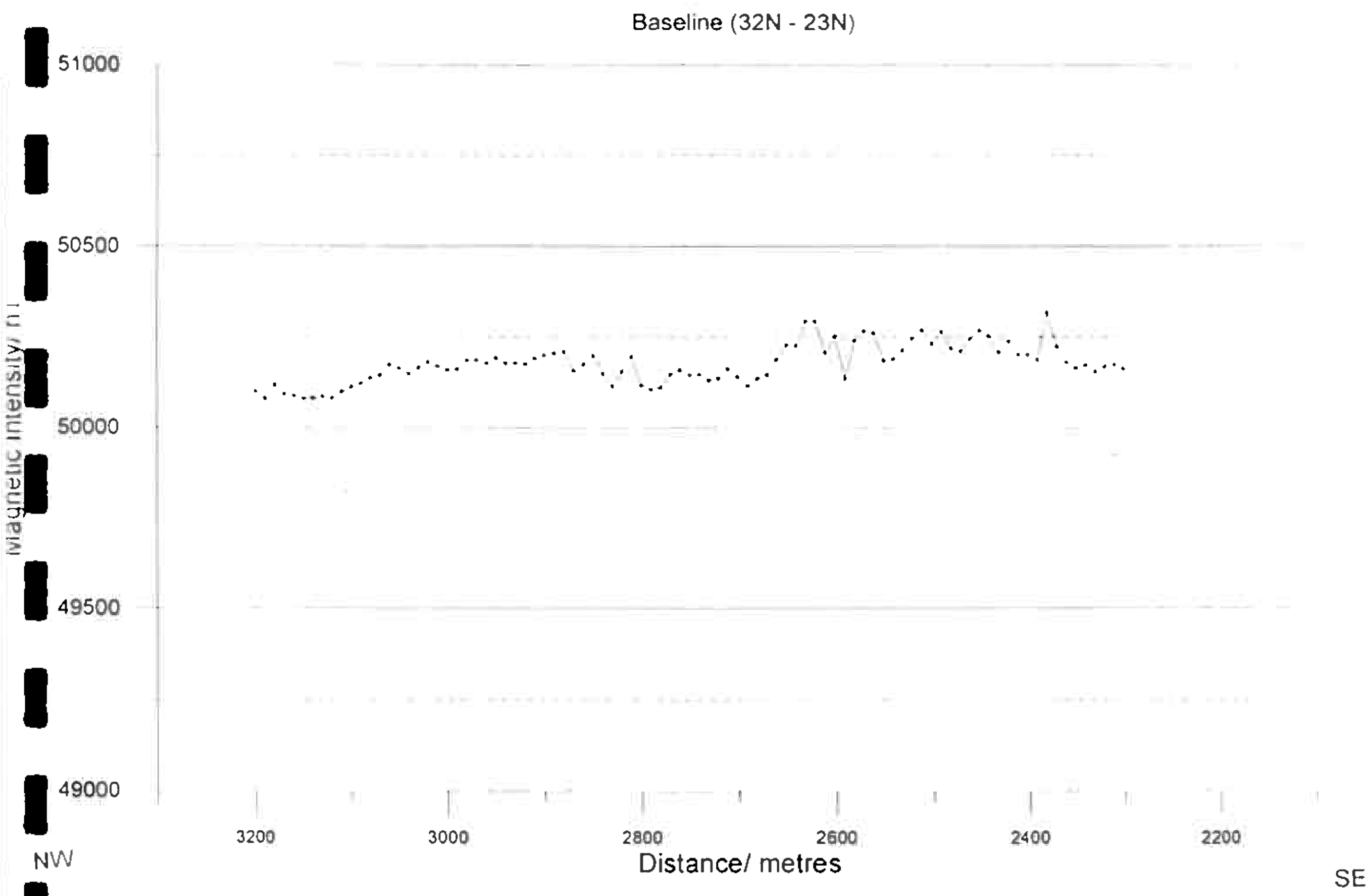
50000
49500
49000
2000
1800
1600
1400
1200
1000
800
NW
Distance/ metres
SE



Line 2W (23N - 11N)
51000
50500
50000
49500
49000
Magnetic intensity/ nT
2200
2000
1800
1600
1400
1200
NW
Distance/ metres
SE



Line 2W (11N - 1S)
51000
50500
50000
49500
49000
1000
800
600
400
200
0
NW
Distance/ metres
SE


Baseline (32N - 23N)
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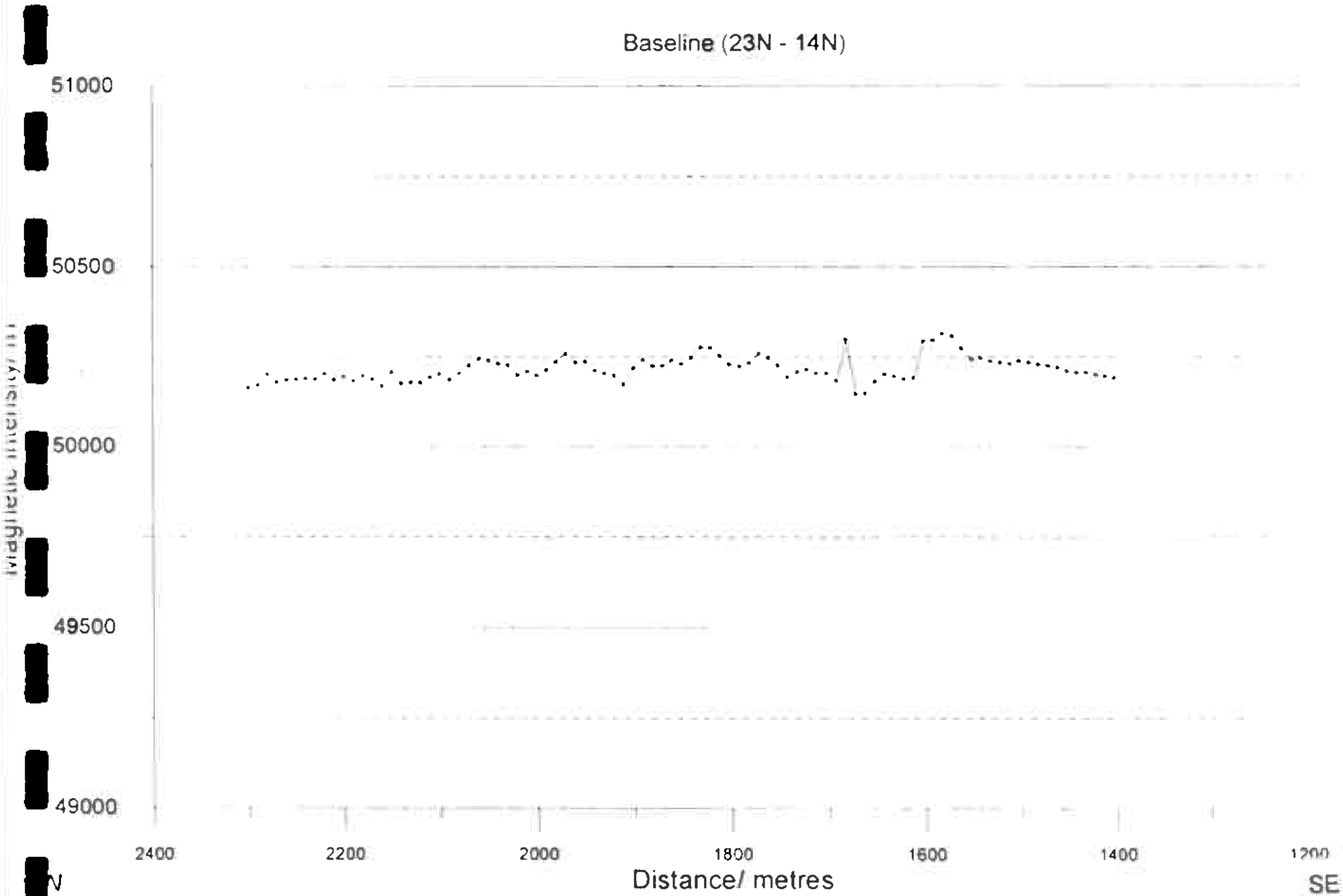
50000
49500
49000
Magnetic intensity/ nT
3200
3000
2800
2600
2400
2200
NW
Distance/ metres
SE


Baseline (23N - 14N)
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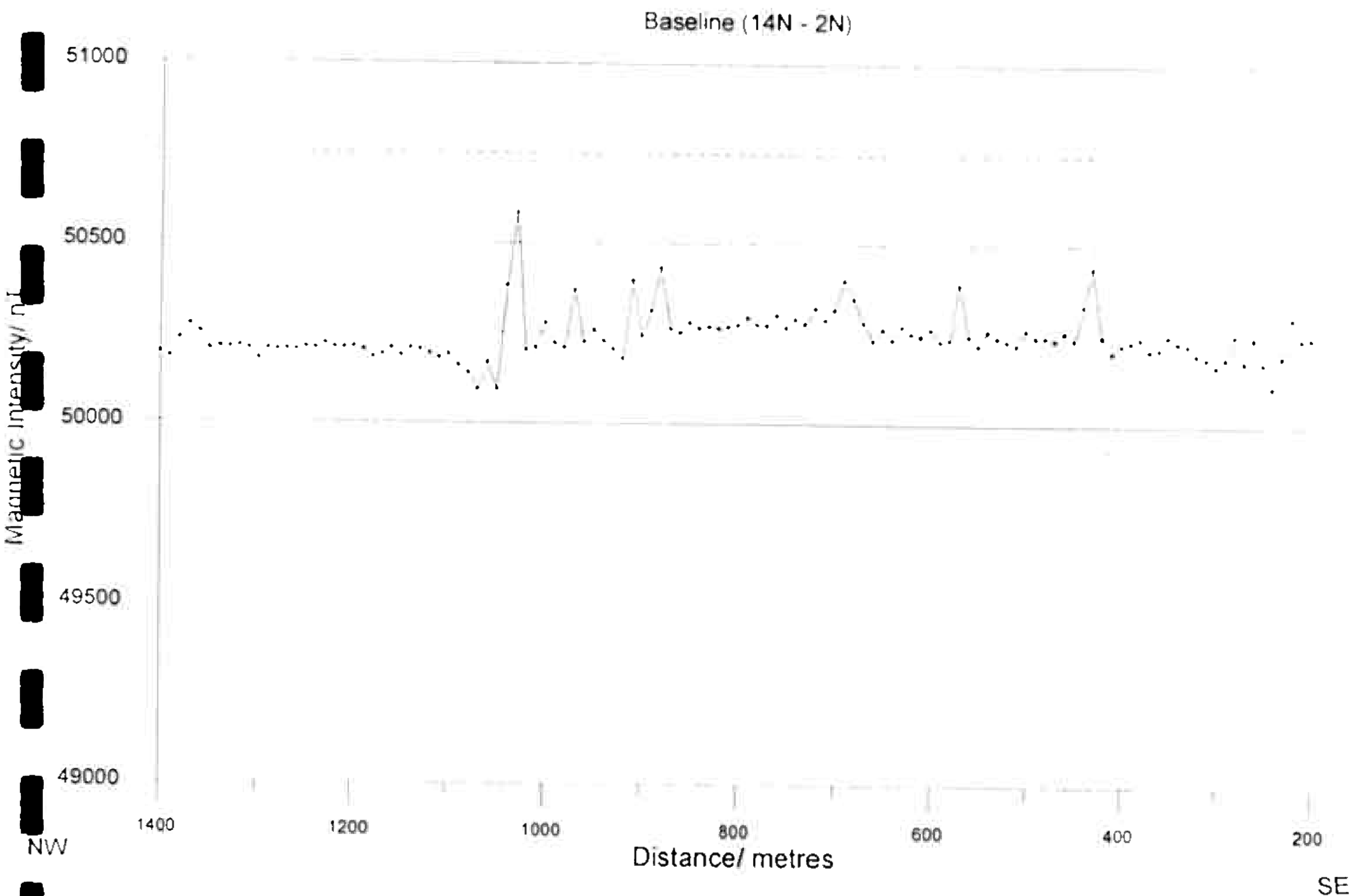
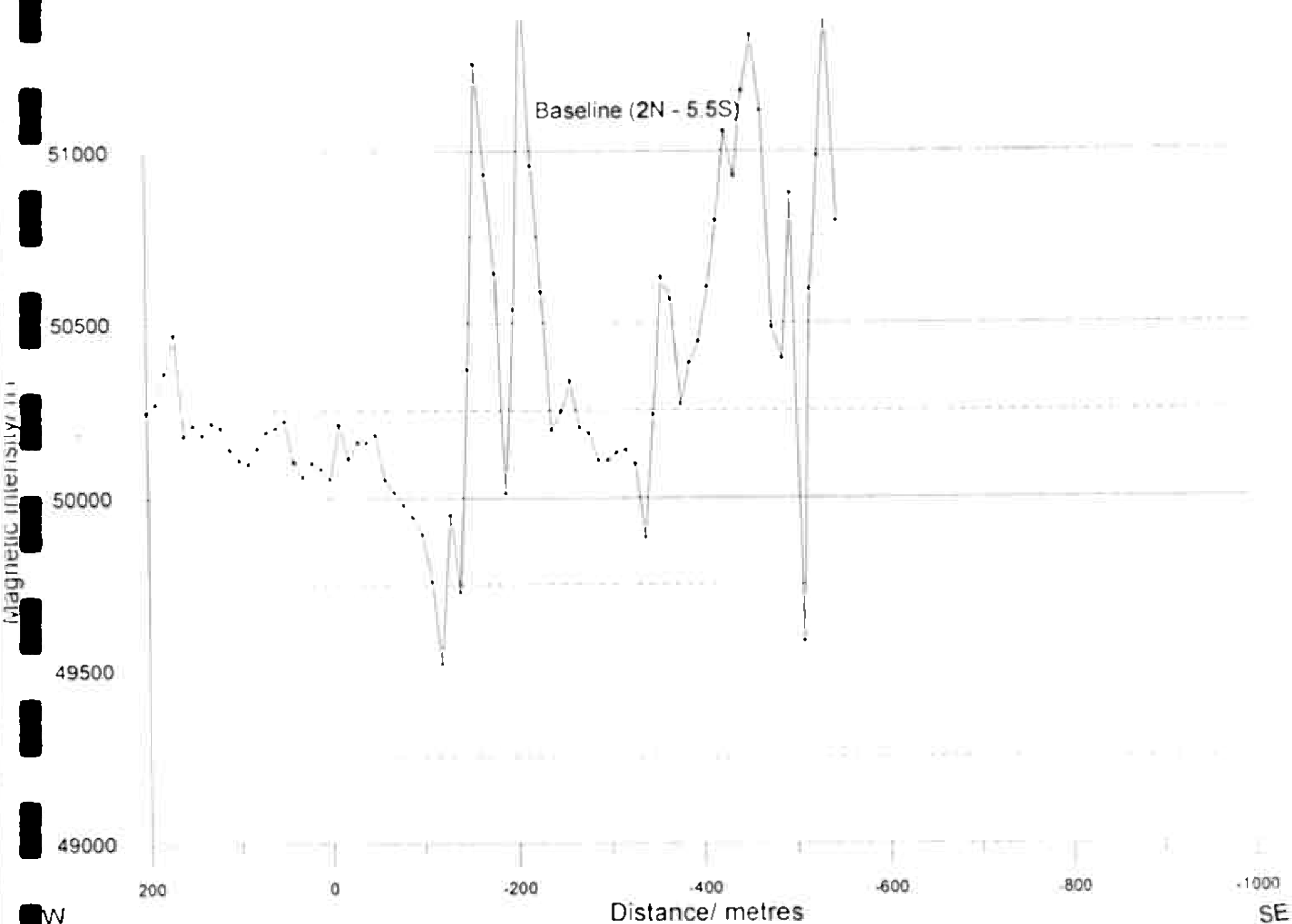
50000
49500
49000
2400
2200
2000
1800
1600
1400
1200
Distance/ metres
SE


Baseline (14N - 2N)
Magnetic Intensity/ nT
51000
50500
50000
49500
49000
1400
1200
1000
800
600
400
200
NW
Distance/ metres
SE


Baseline (2N - 5.5S)
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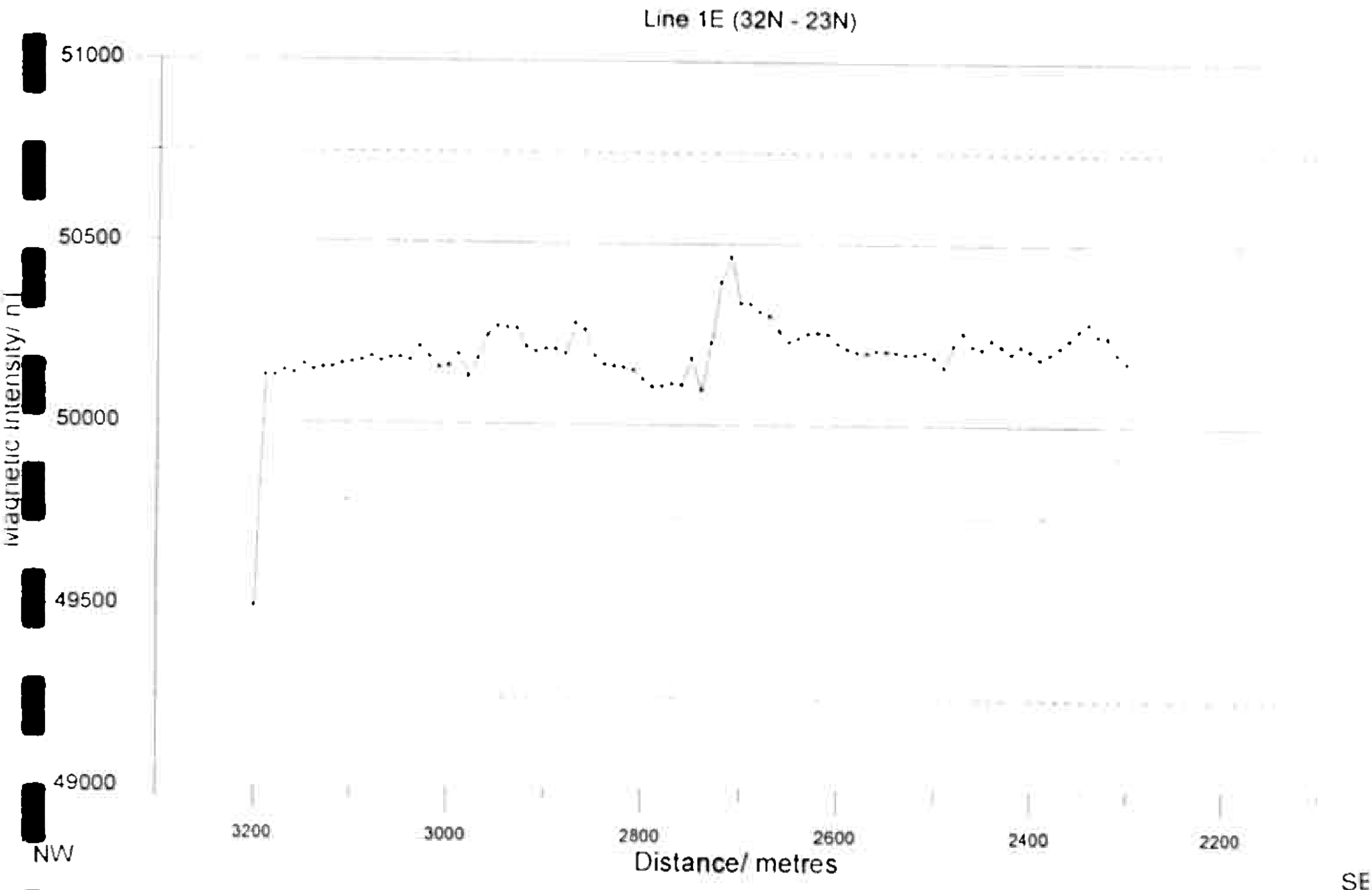
50000
49500
49000
200
0
-200
-400
-600
-800
-1000
Distance/ metres
SE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Magnetic intensity/ nT
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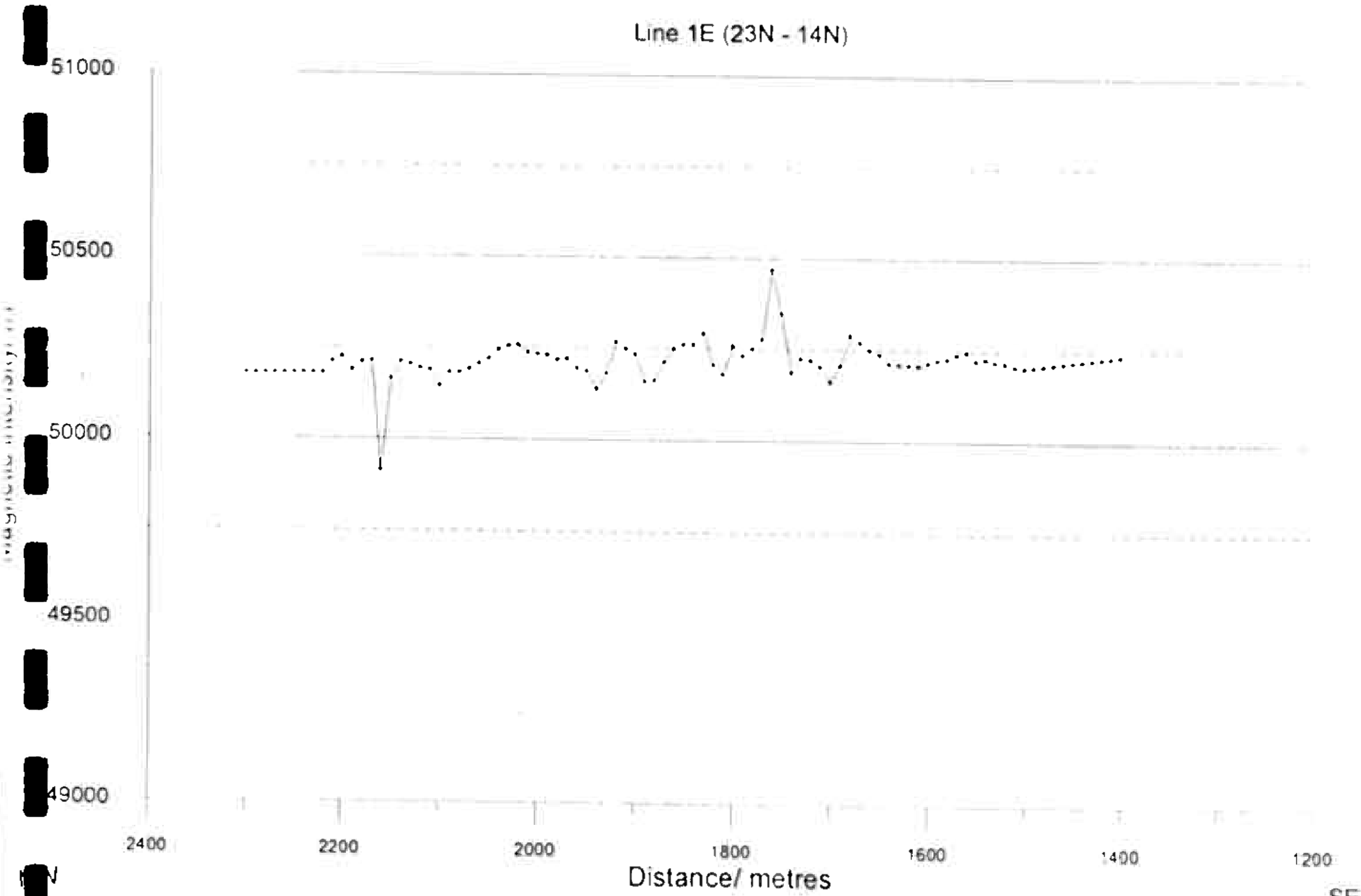
50000
49500
49000
3200
3000
2800
2600
2400
2200
NW
Distance/ metres
SE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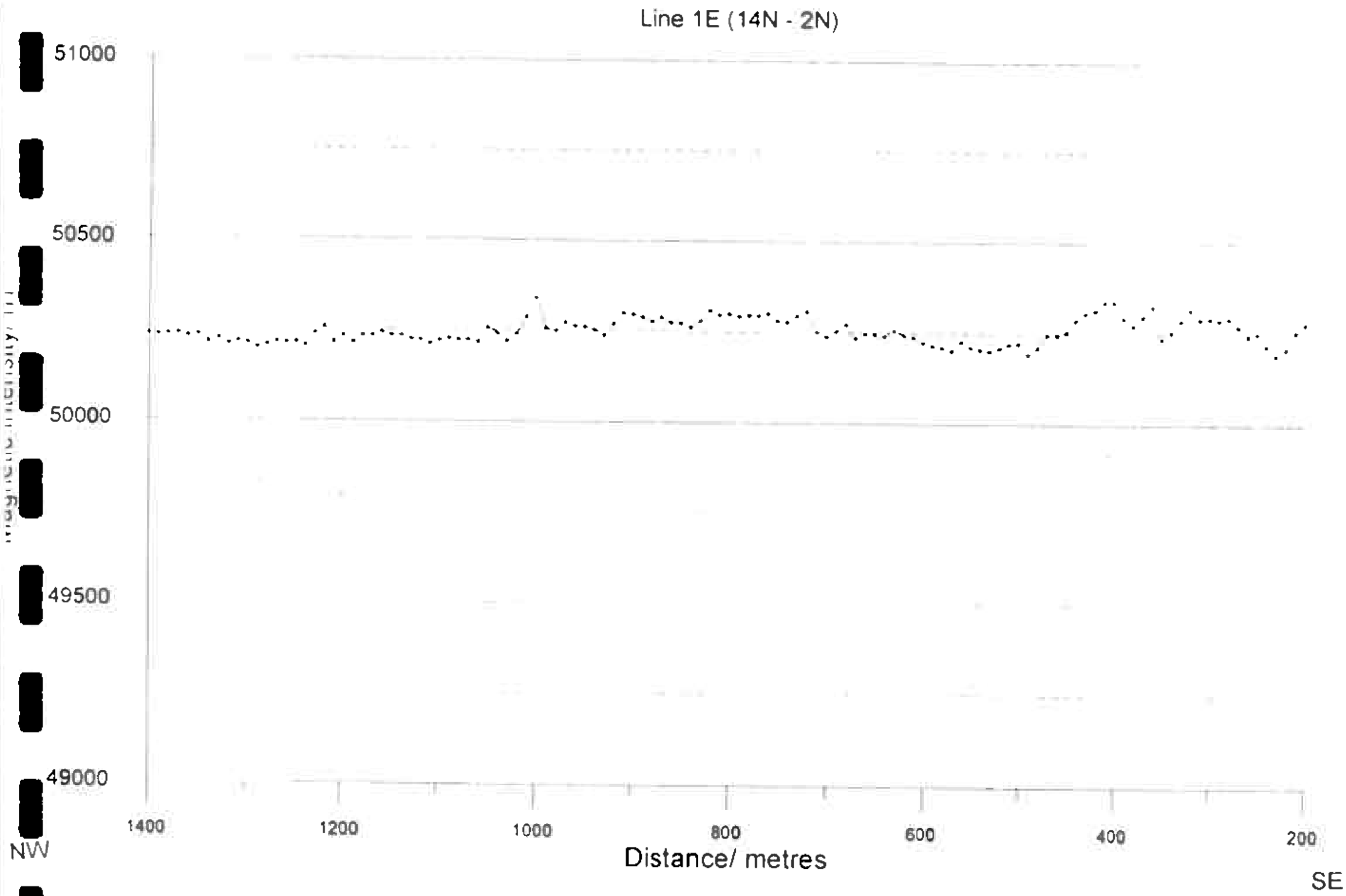
50000
49500
49000
2400
2200
2000
1800
1600
1400
1200
Distance/ metres
SE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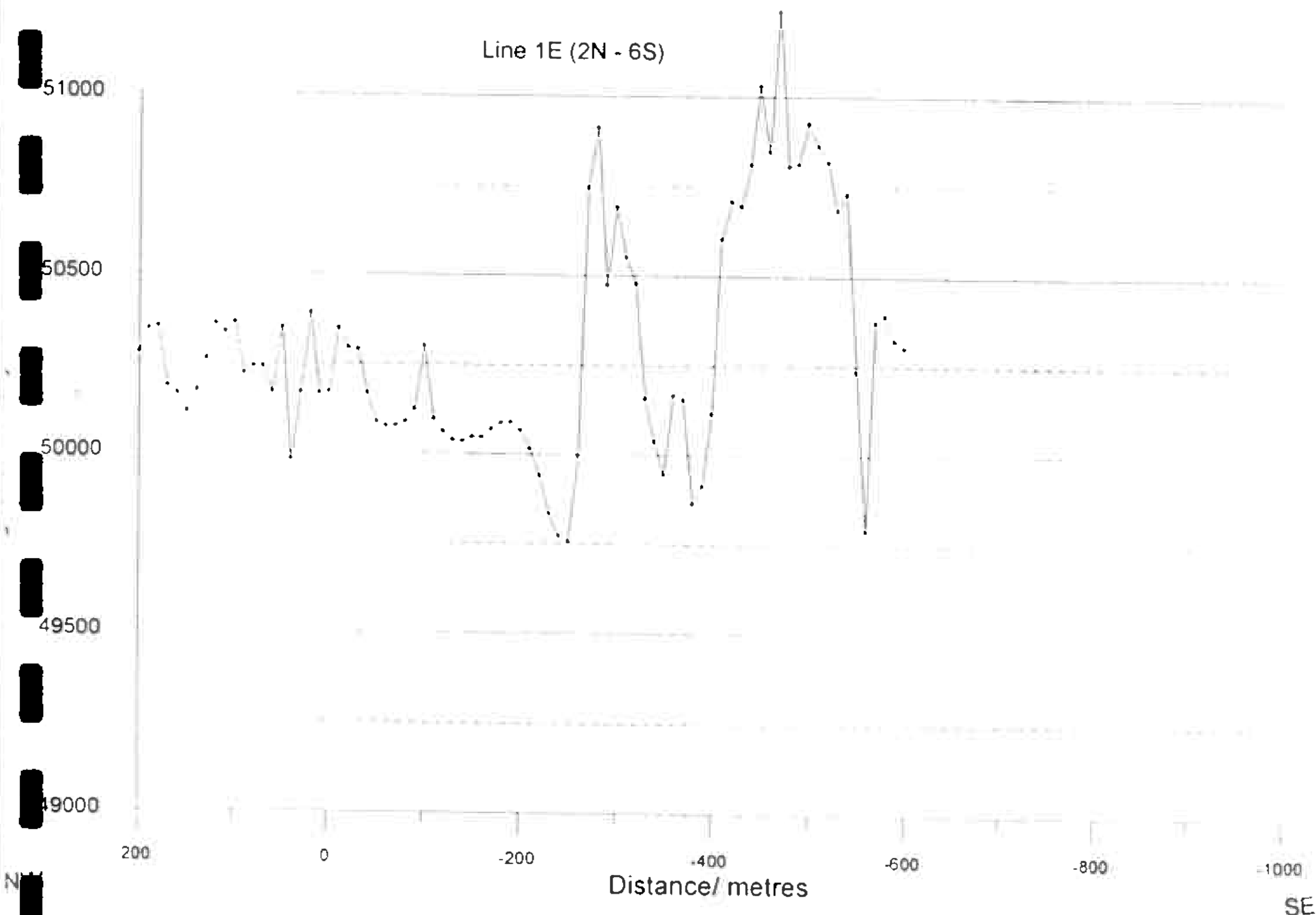
50000
49500
49000
1400
1200
1000
800
600
400
200
NW
Distance/ metres
SE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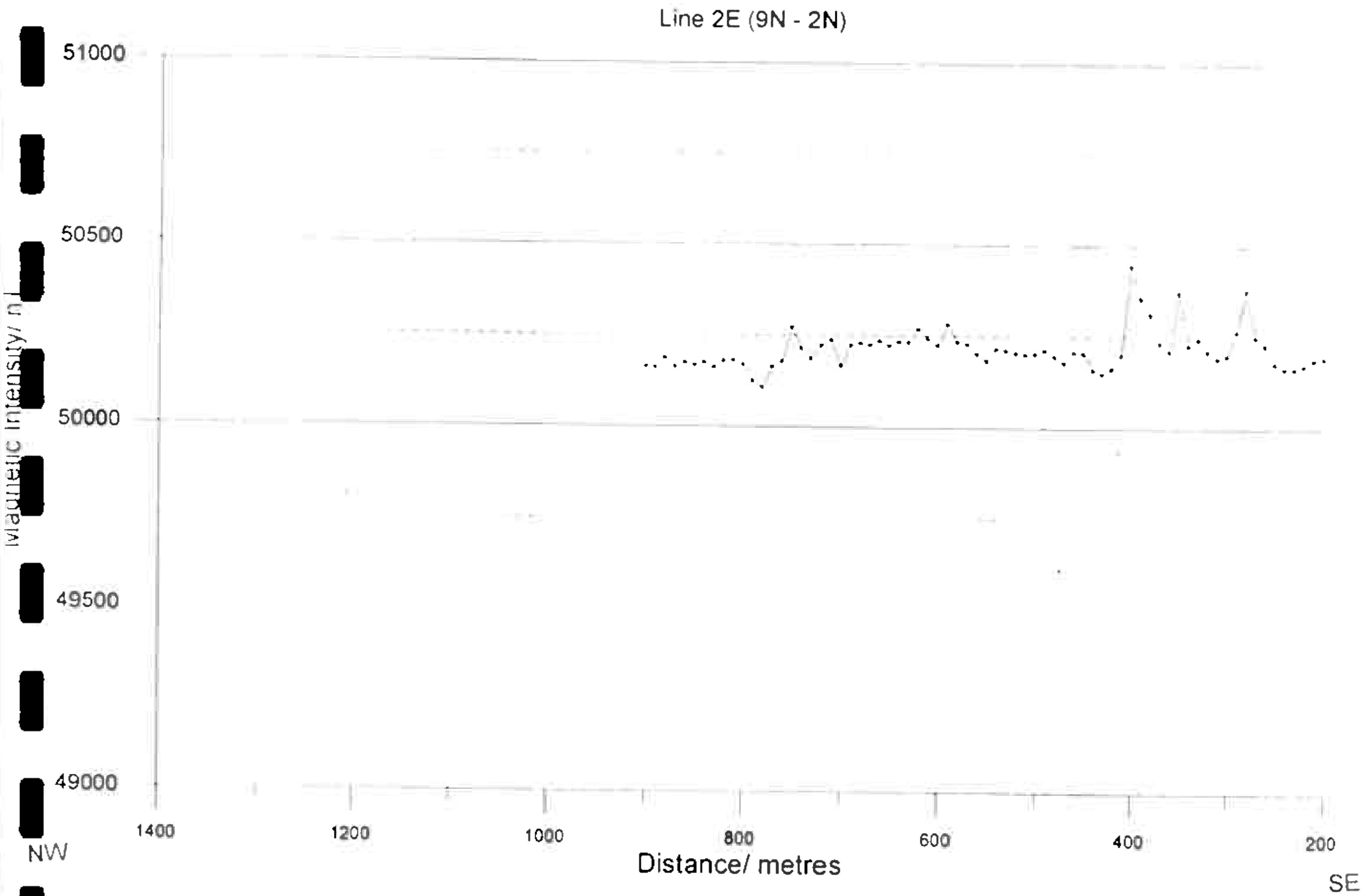
49500
200
0
-200
-400
-600
-800
-1000
Distance/ metres
SE


Line 2E (9N - 2N)
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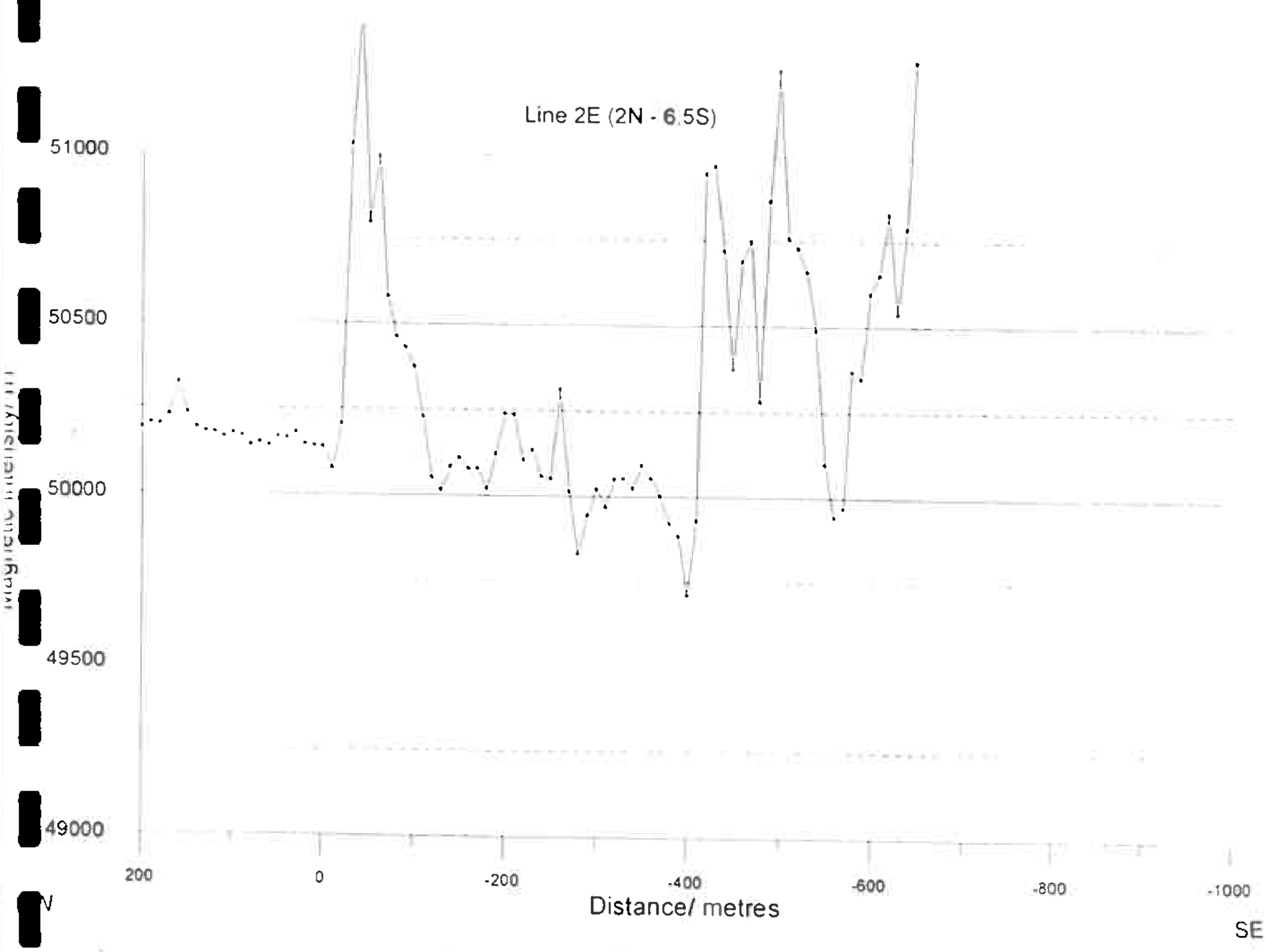
50500
50000
49500
49000
Magnetic Intensity/ nT
1400
1200
1000
800
600
400
200
NW
Distance/ metres
SE


Line 2E (2N - 6.5S)
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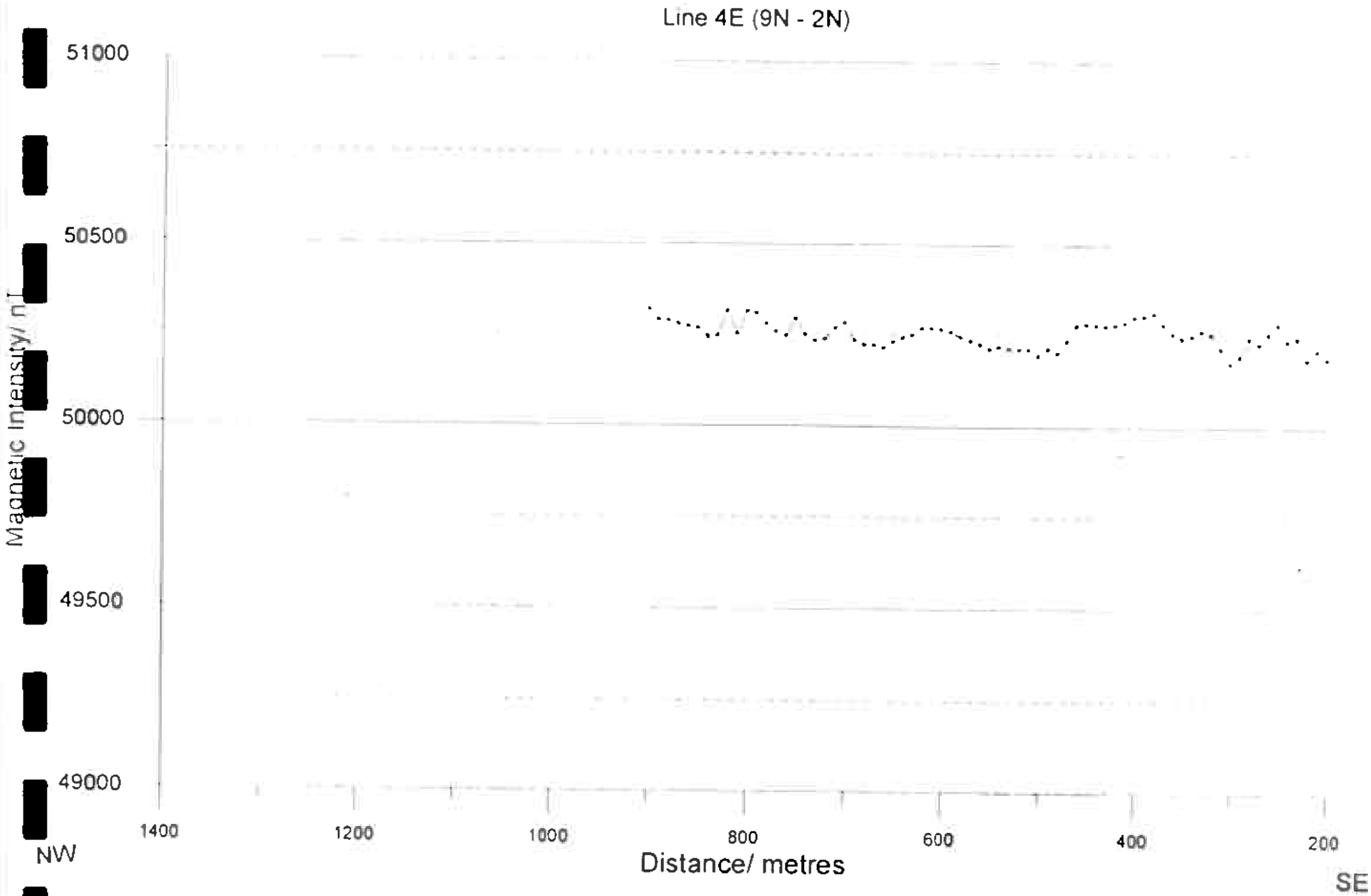
50500
50000
49500
49000
200
0
-200
-400
-600
-800
-1000
Distance/ metres
SE



Line 4E (9N - 2N)
Magnetic Intensity/ nT
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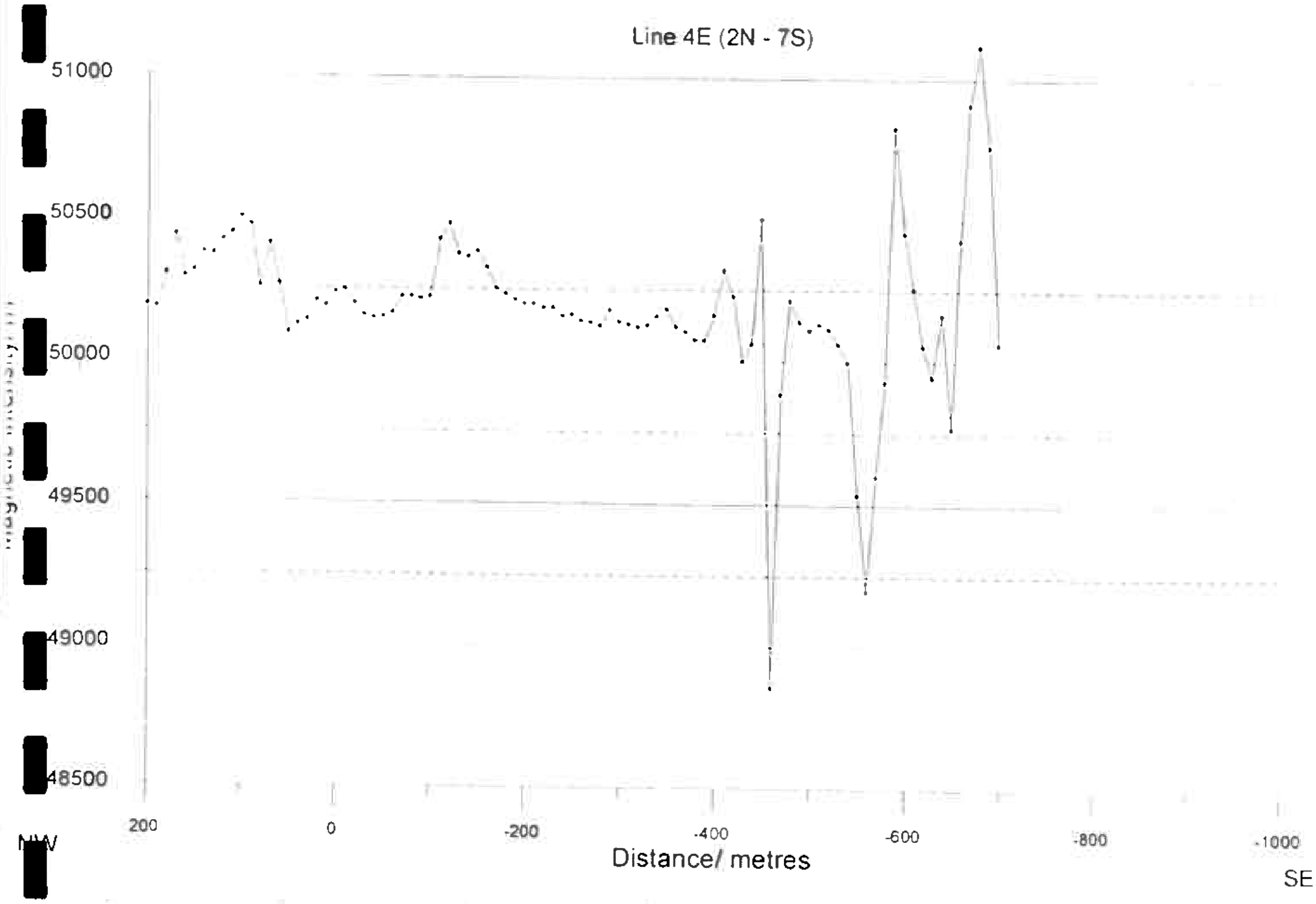
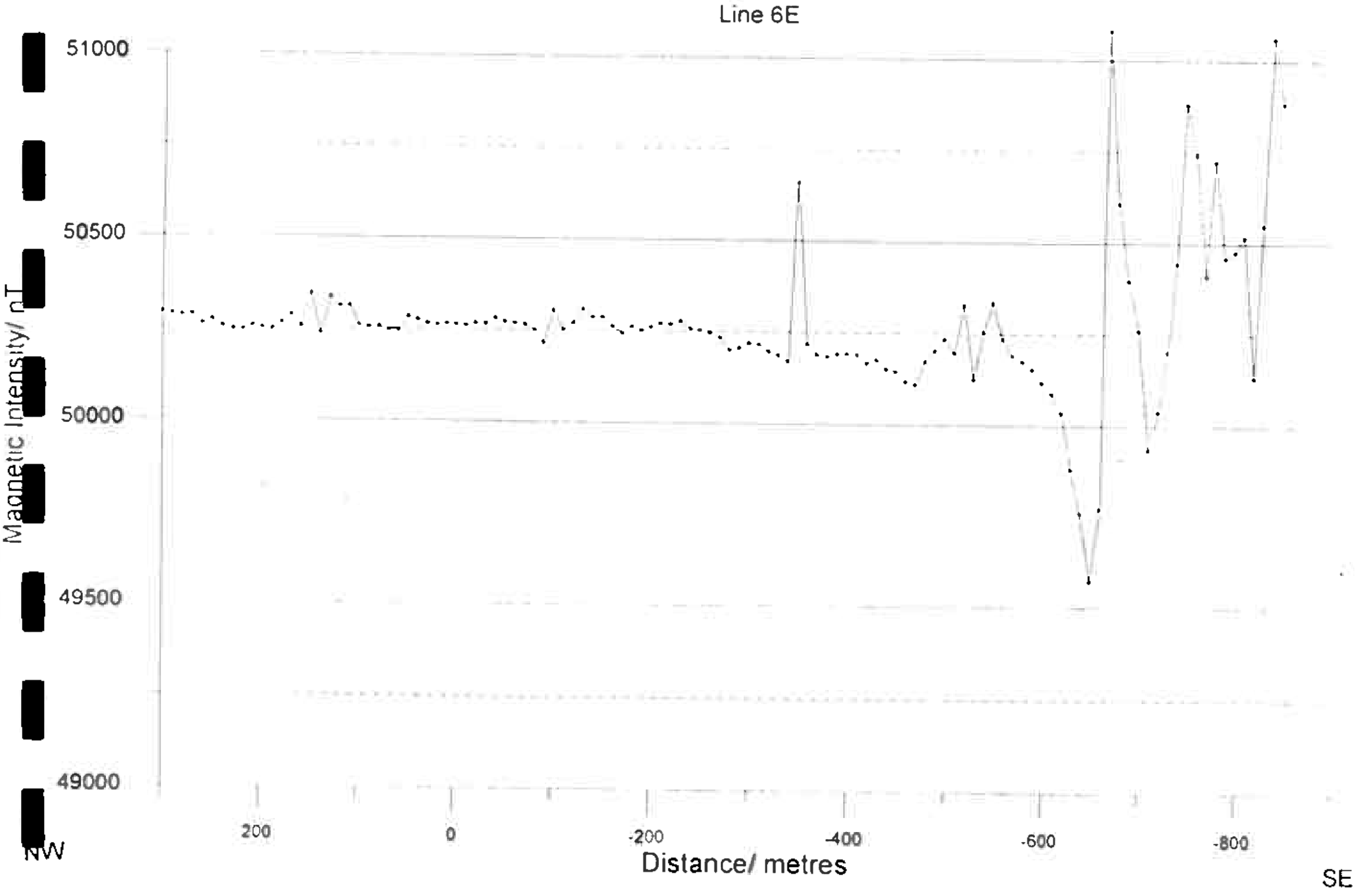
50500
50000
49500
49000
1400
1200
1000
800
600
400
200
NW
Distance/ metres
SE



Line 4E (2N - 7S)
51000
50500
50000
49500
49000
48500
200
0
-200
-400
-600
-800
-1000
NW
Distance/ metres
SE



Line 6E
Magnetic Intensity/ nT
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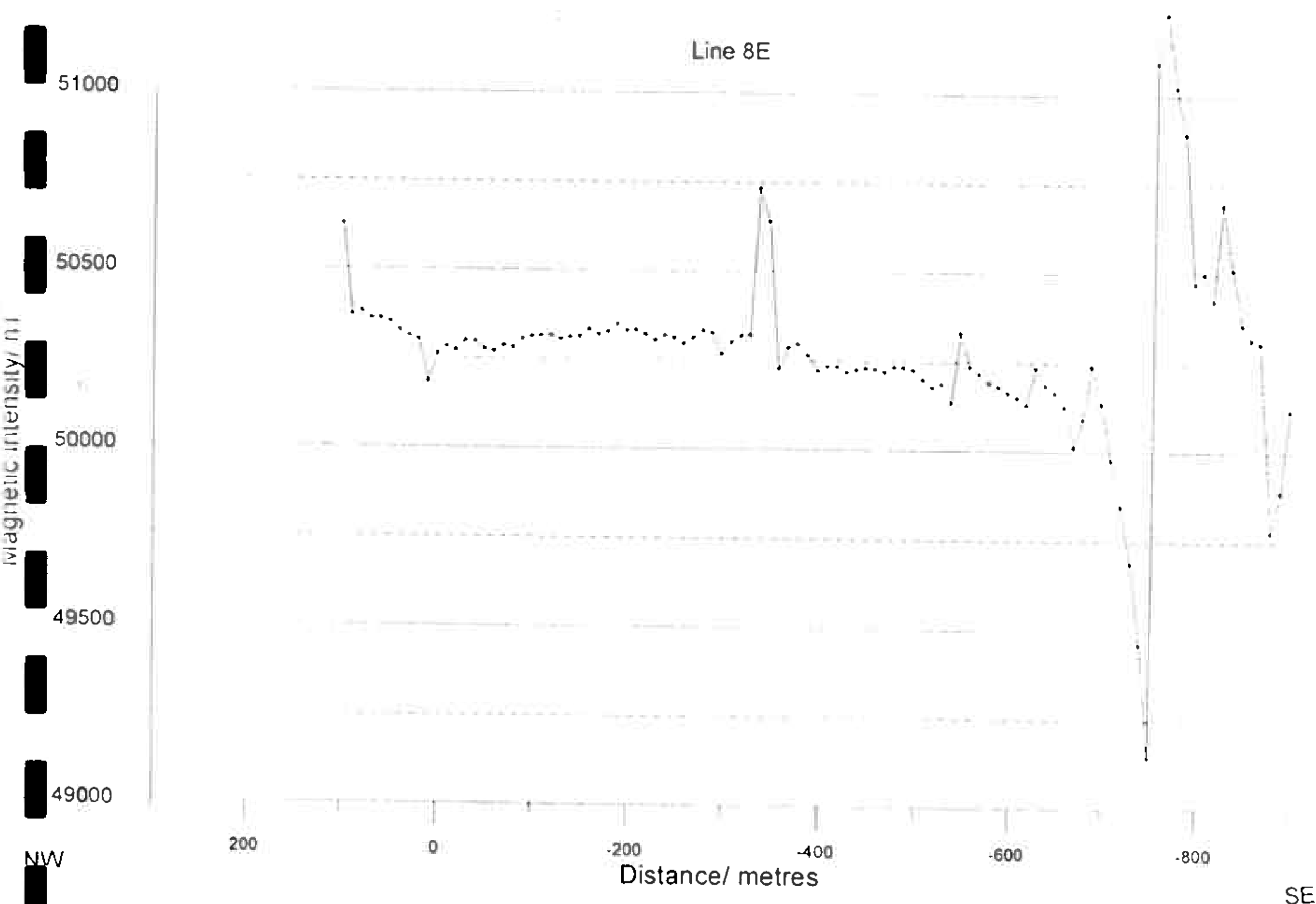
49500
49000
200
0
-200
-400
-600
-800
NW
Distance/ metres
SE



Line 8E
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50000
49500
49000
200
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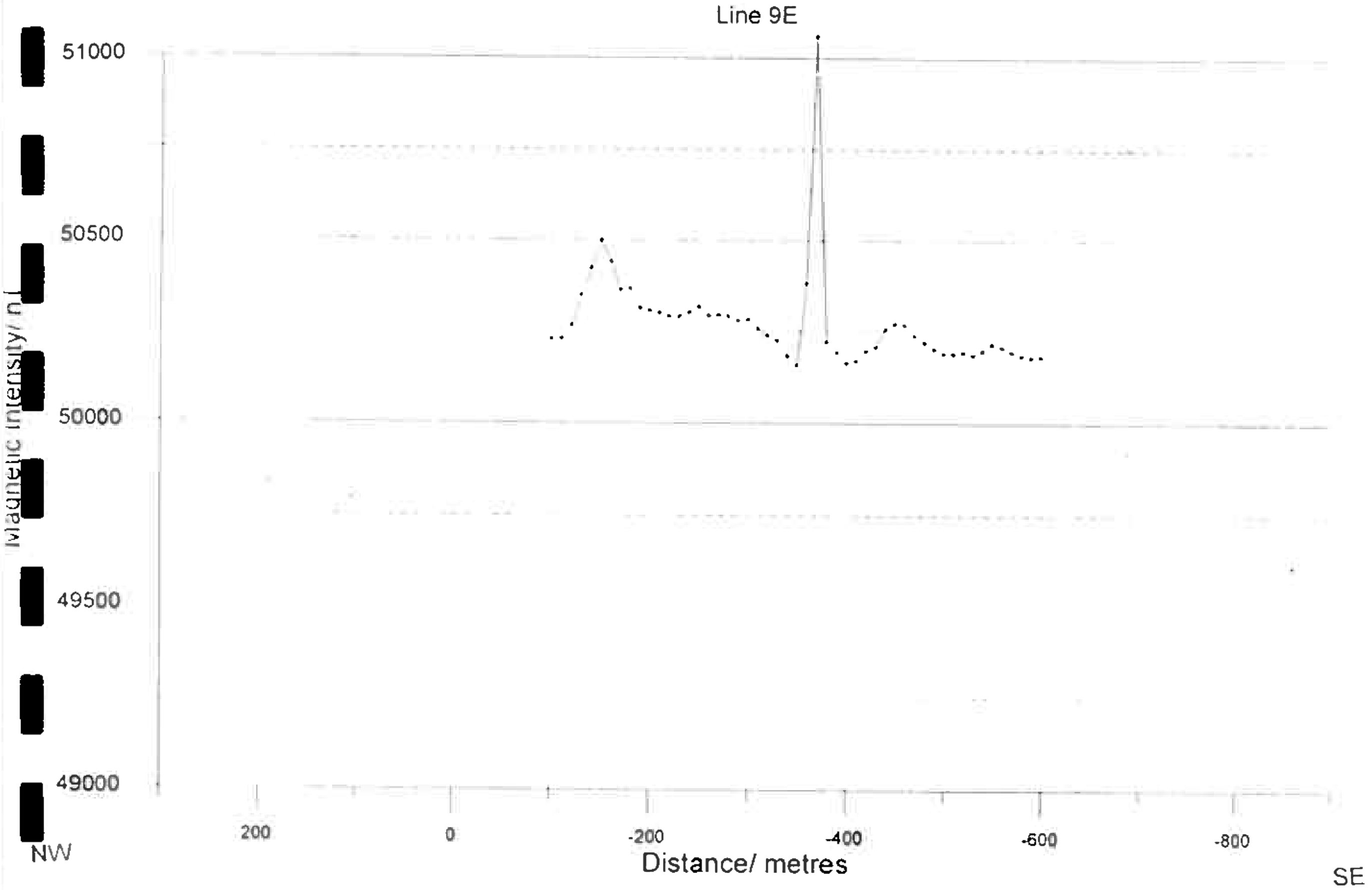
-200
-400
-600
-800
NW
Distance/ metres
SE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50000
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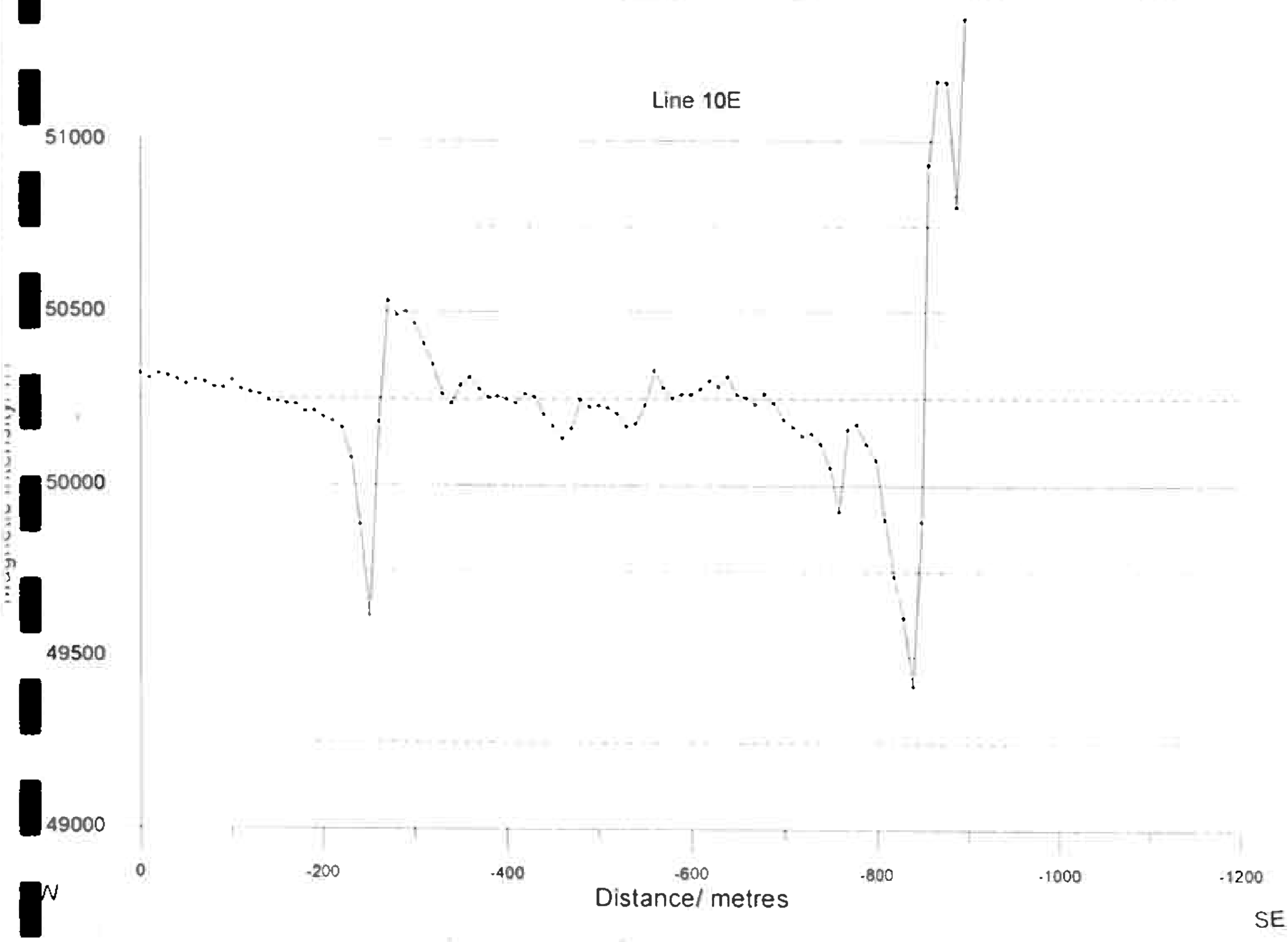
49000
Magnetic Intensity/ nT
200
0
-200
-400
-600
-800
NW
Distance/ metres
SE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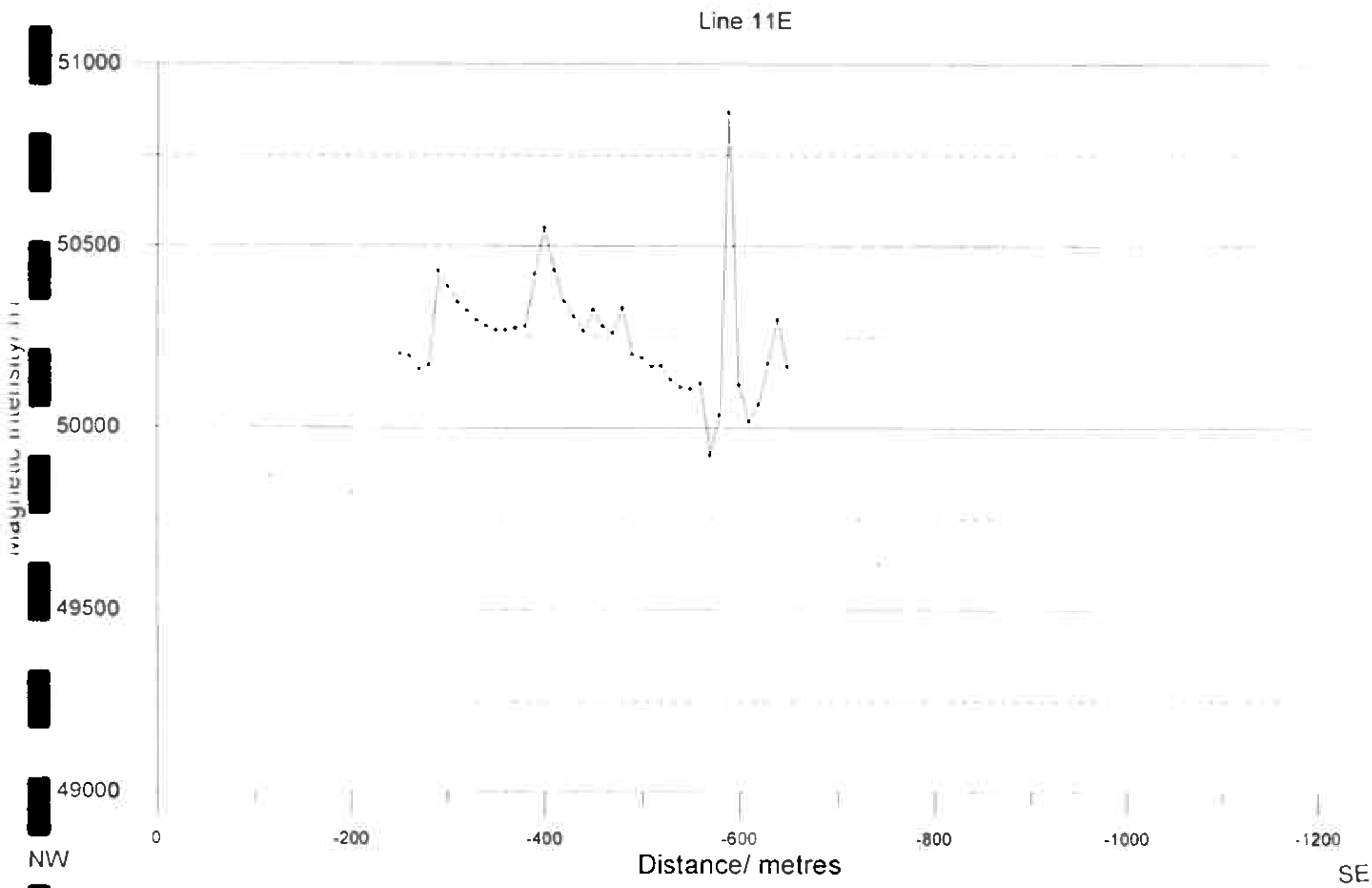
50000
49500
49000
0
-200
-400
-600
-800
-1000
-1200
Distance/ metres
SE


Line 11E
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50000
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49000
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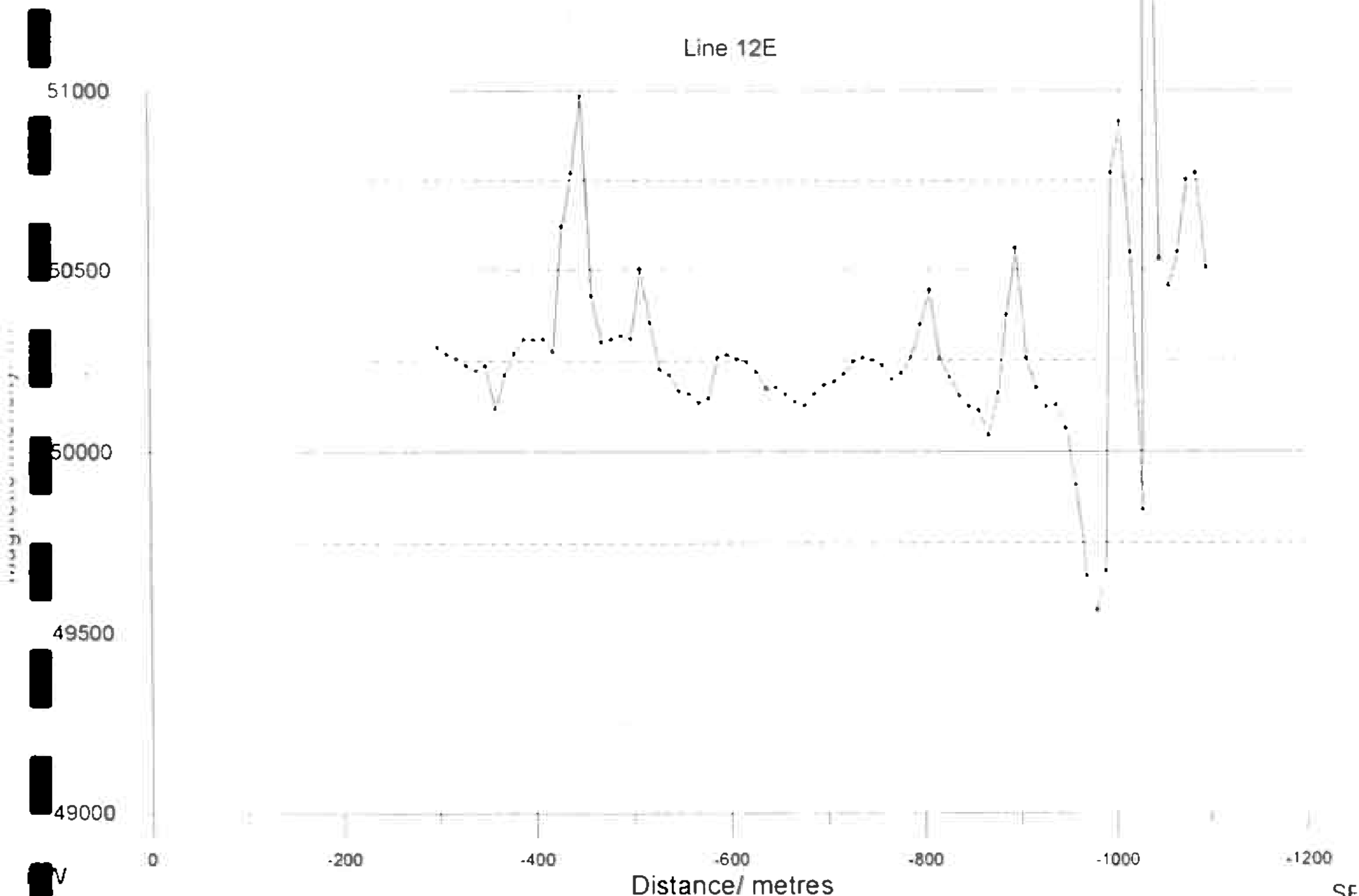
-200
-400
-600
-800
-1000
-1200
NW
Distance/ metres
SE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-600
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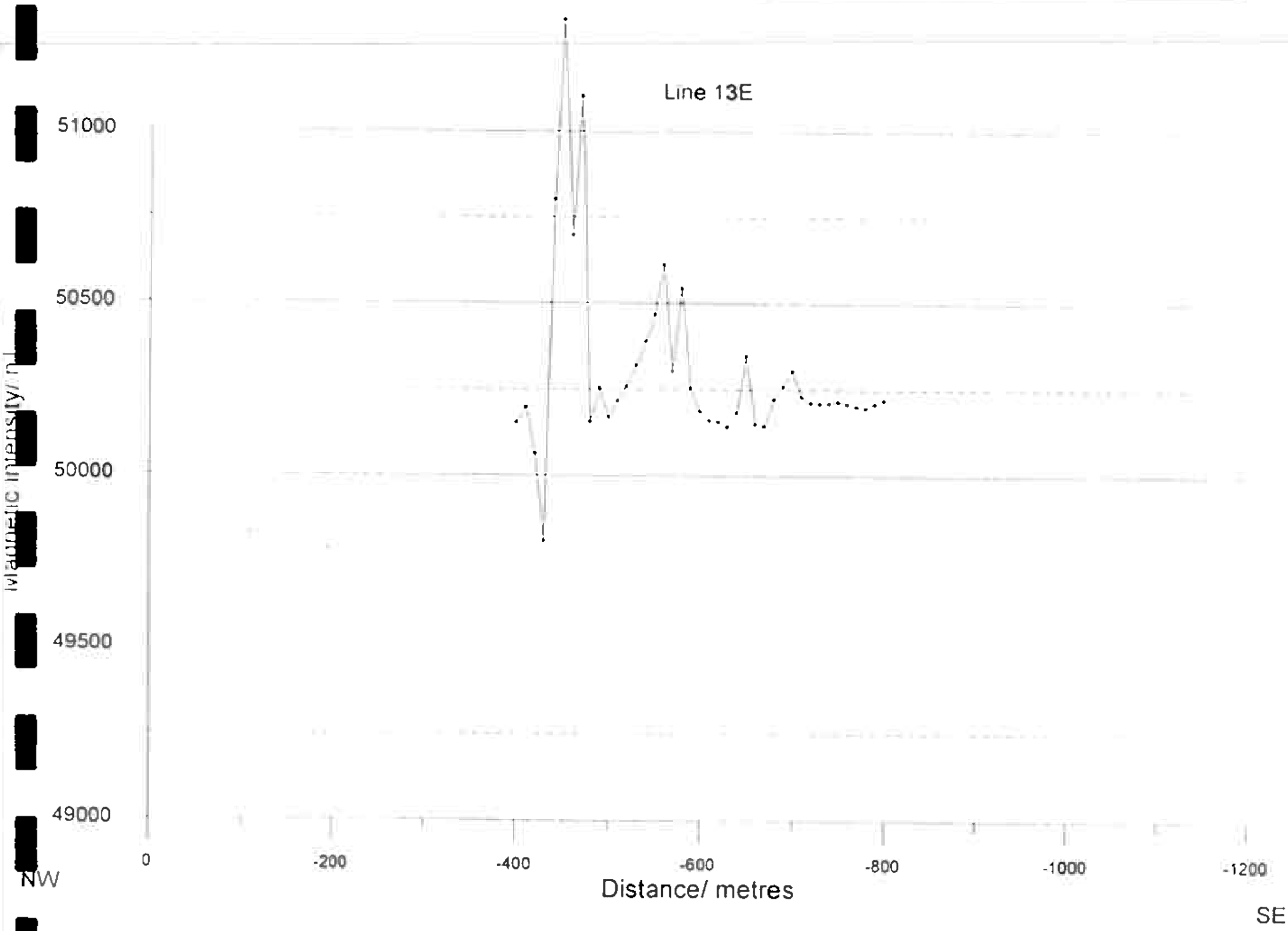
-1000
-1200
Distance/ metres
SE



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49000
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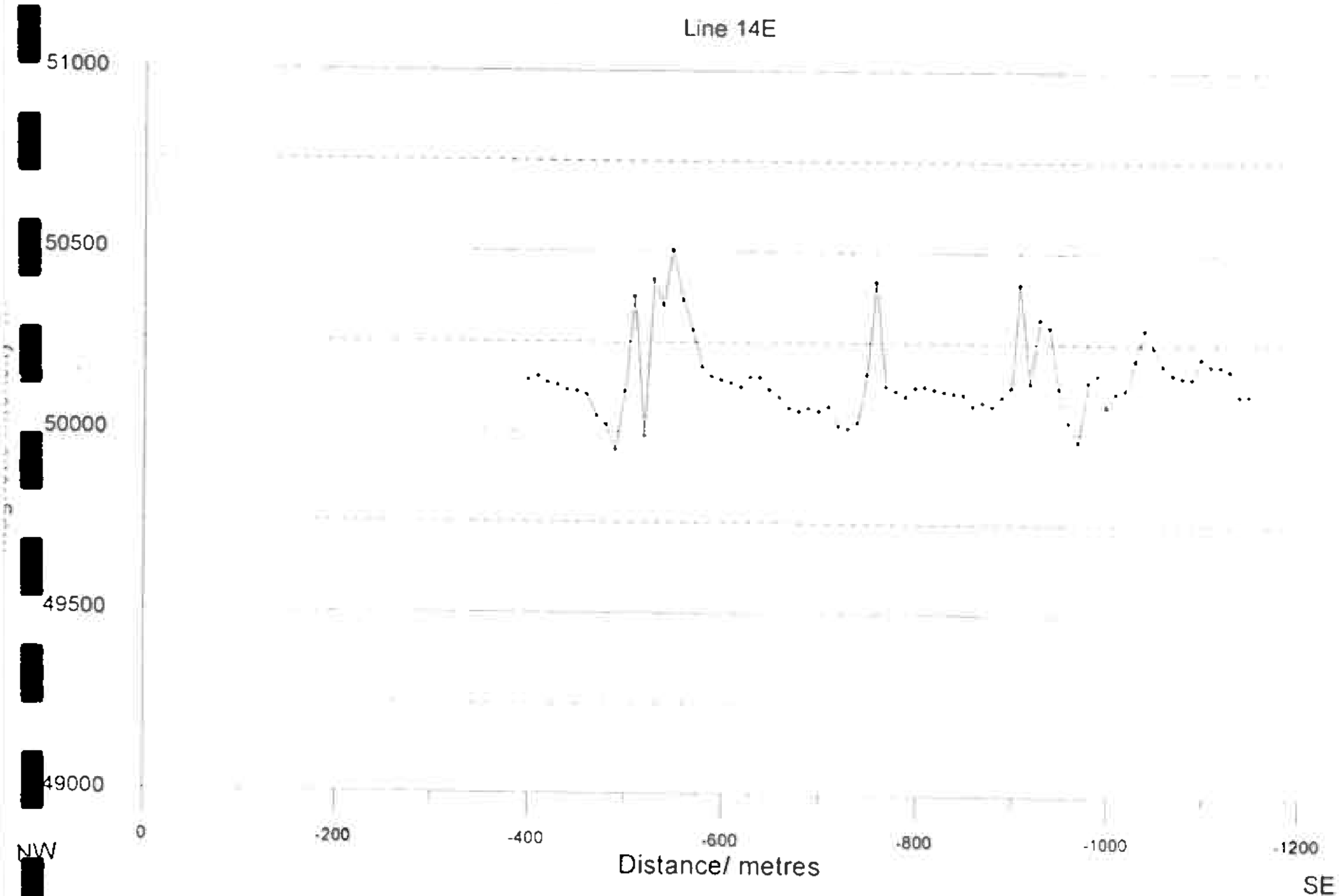
-400
-600
-800
-1000
-1200
NW
Distance/ metres
SE



Line 14E
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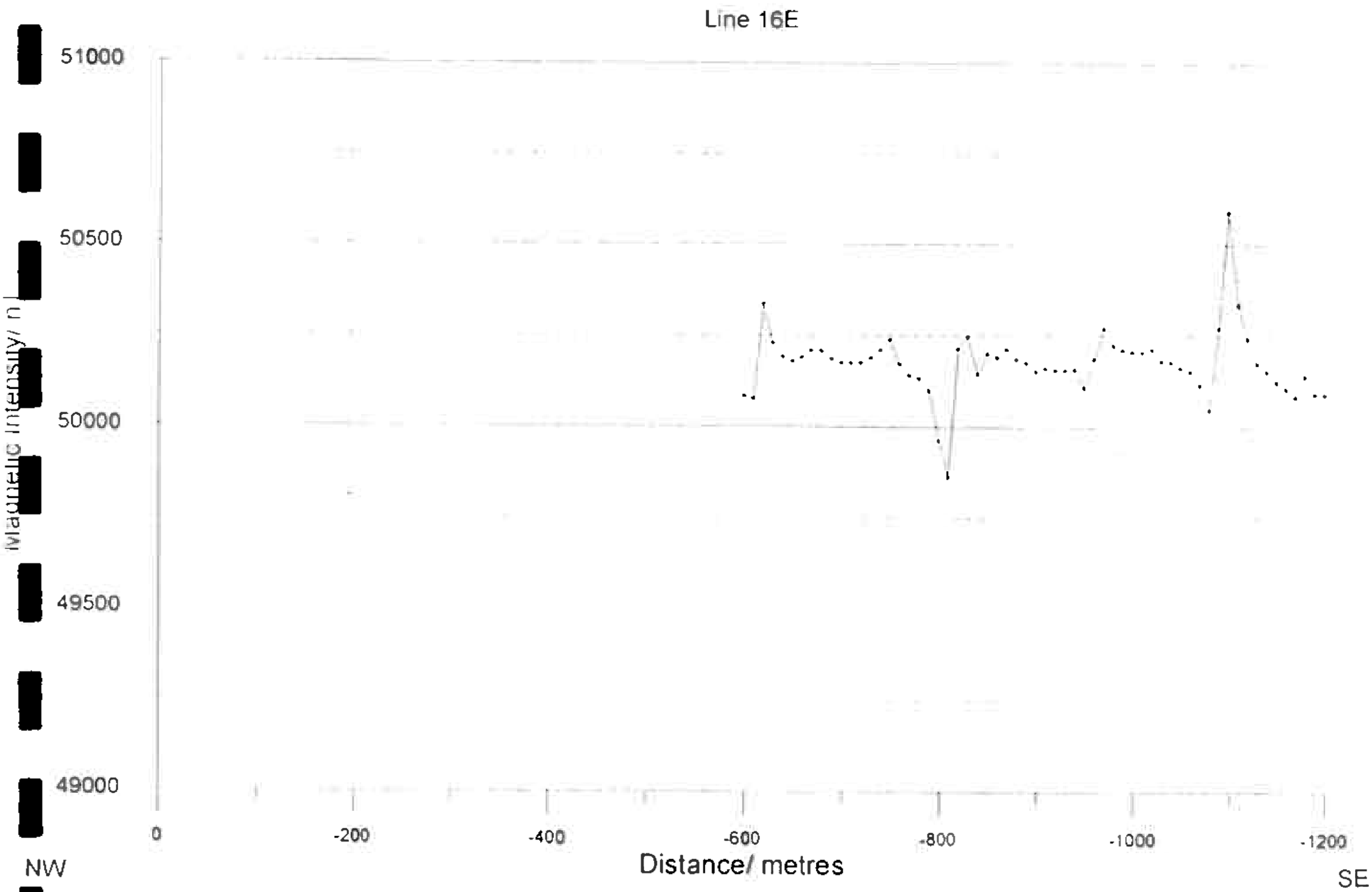
-200
-400
-600
-800
-1000
-1200
NW
Distance/ metres
SE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-600
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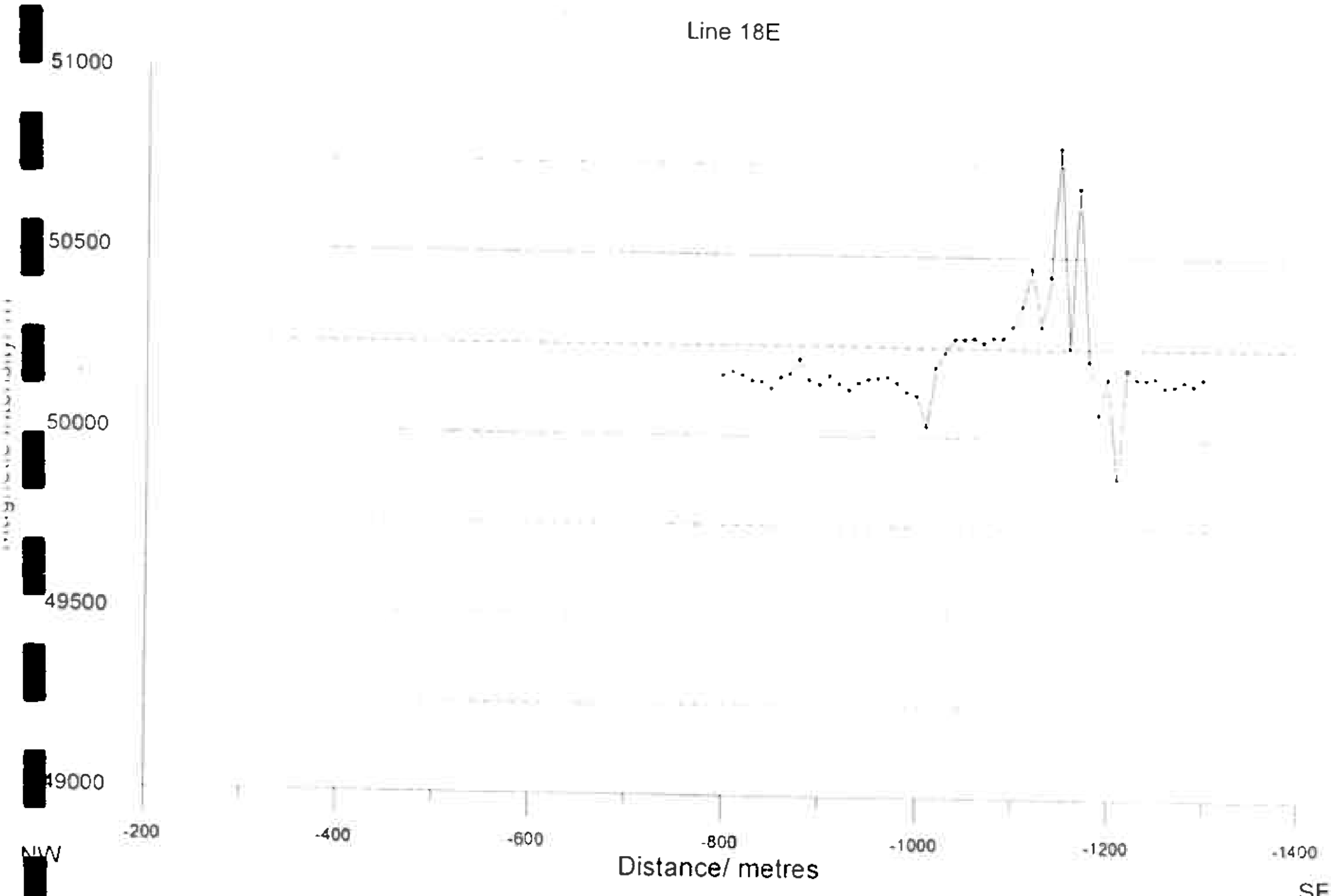
-1200
Distance/ metres
NW
SE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49000
-200
-400
-600
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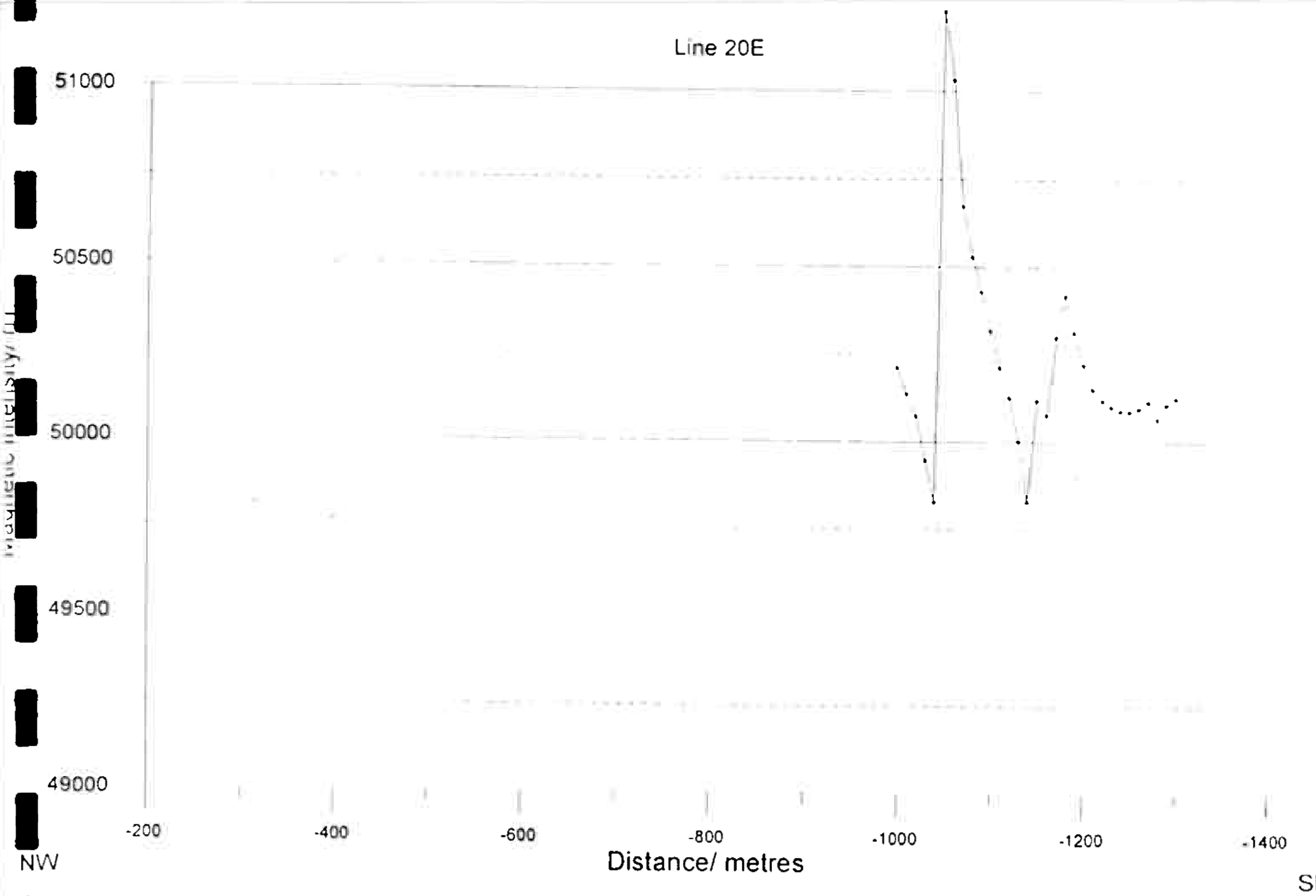
-1200
-1400
Distance/ metres
NW
SE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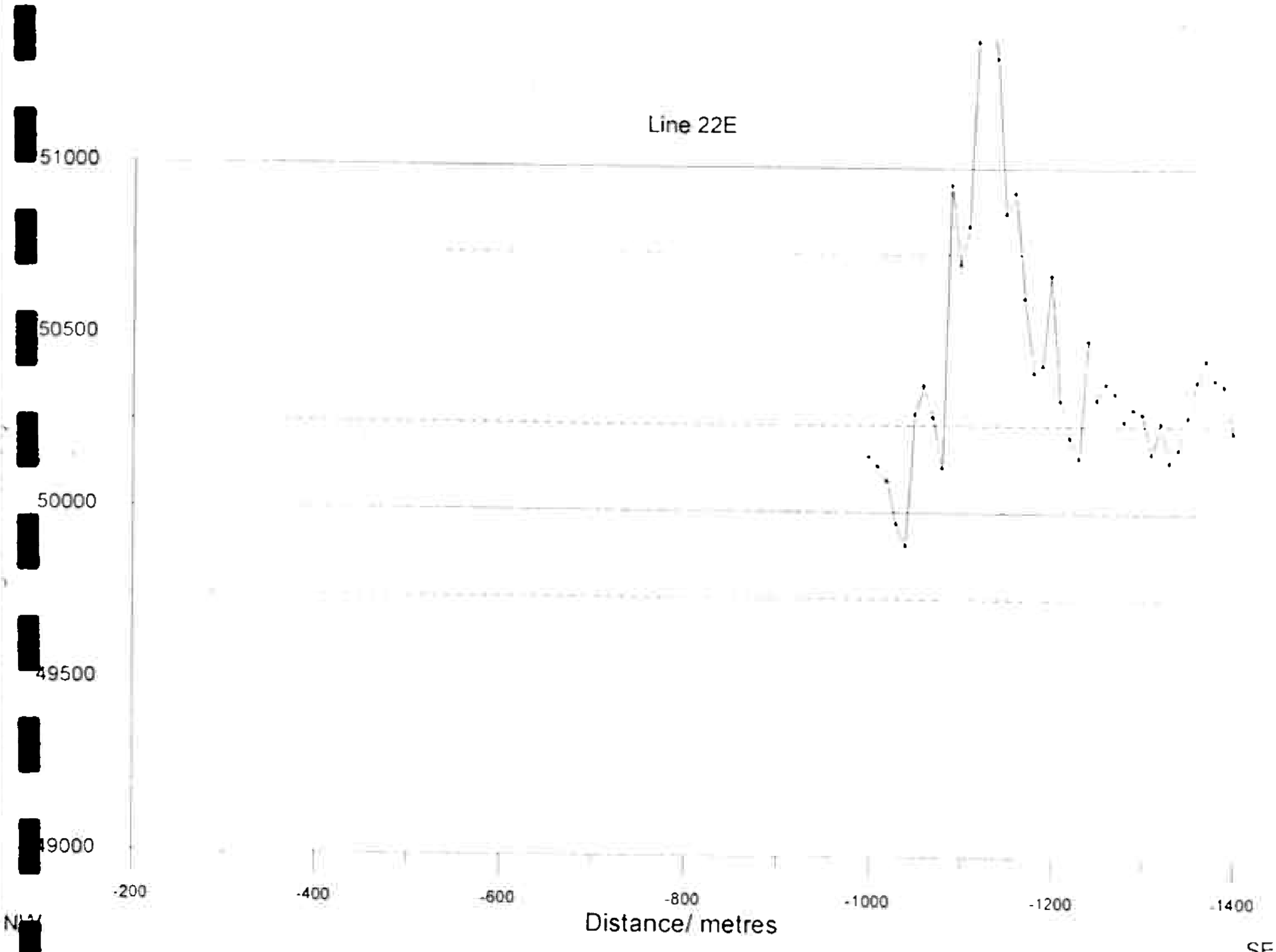
50500
50000
49500
49000
-200
-400
-600
-800
-1000
-1200
-1400
Distance/ metres
NW
SE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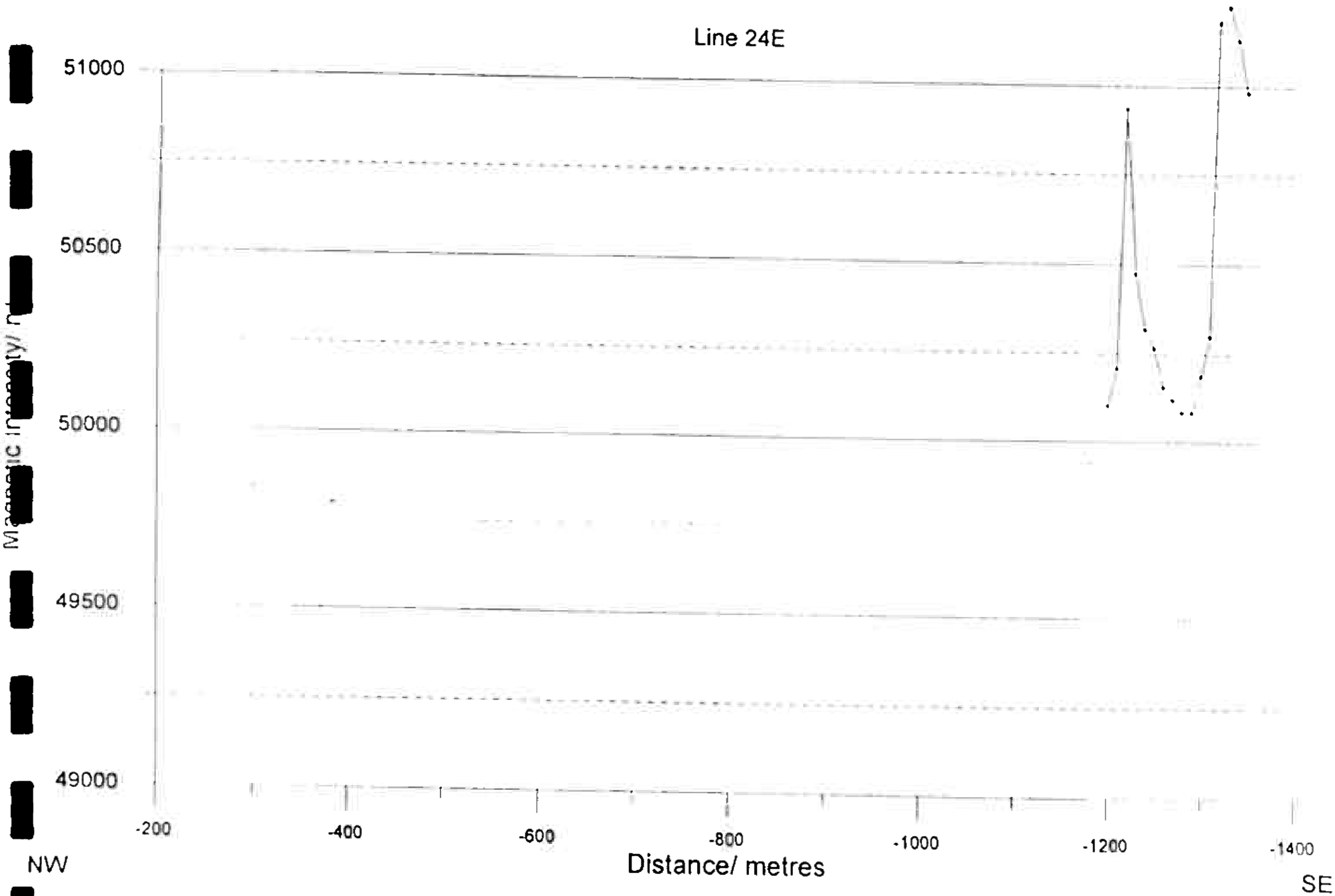
50500
50000
49500
-200
-400
-600
-800
-1000
-1200
-1400
Distance/ metres
SE



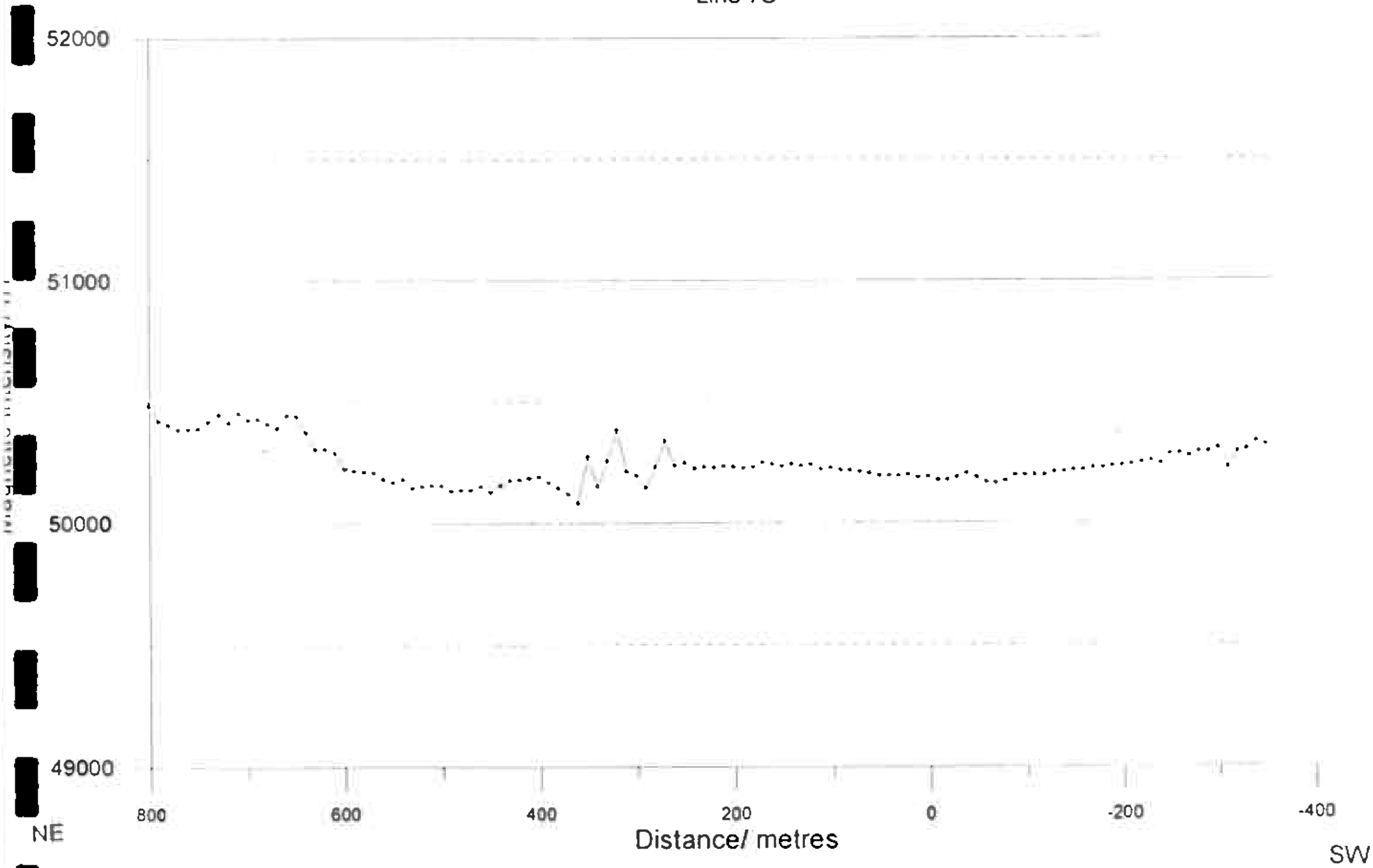
Line 24E
51000
50500
50000
49500
49000
-200
-400
-600
-800
-1000
-1200
-1400
NW
Distance/ metres
SE

Appendix 7.3
The Bisminuten area

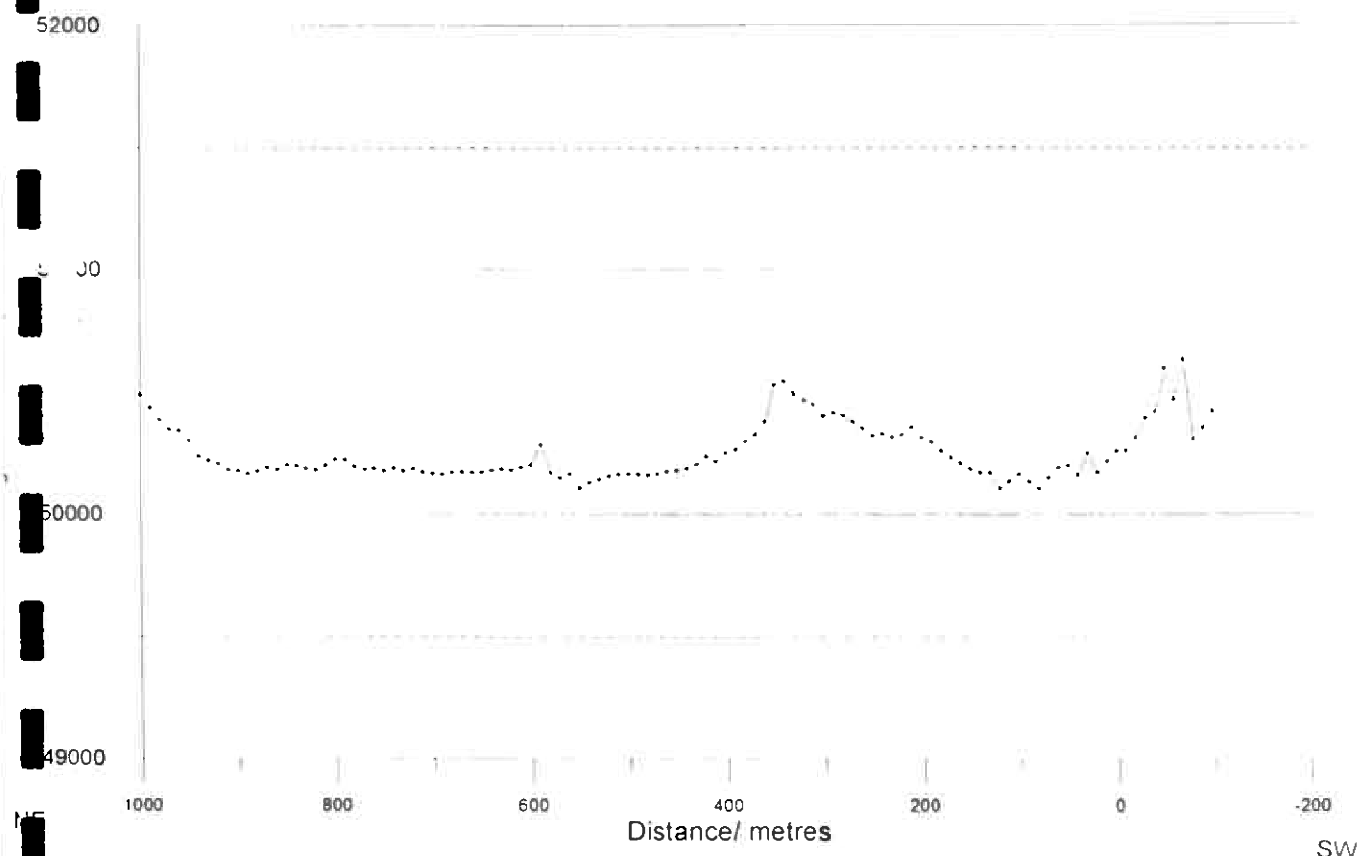
Surveylines in the Bisminuten area, Telemark.

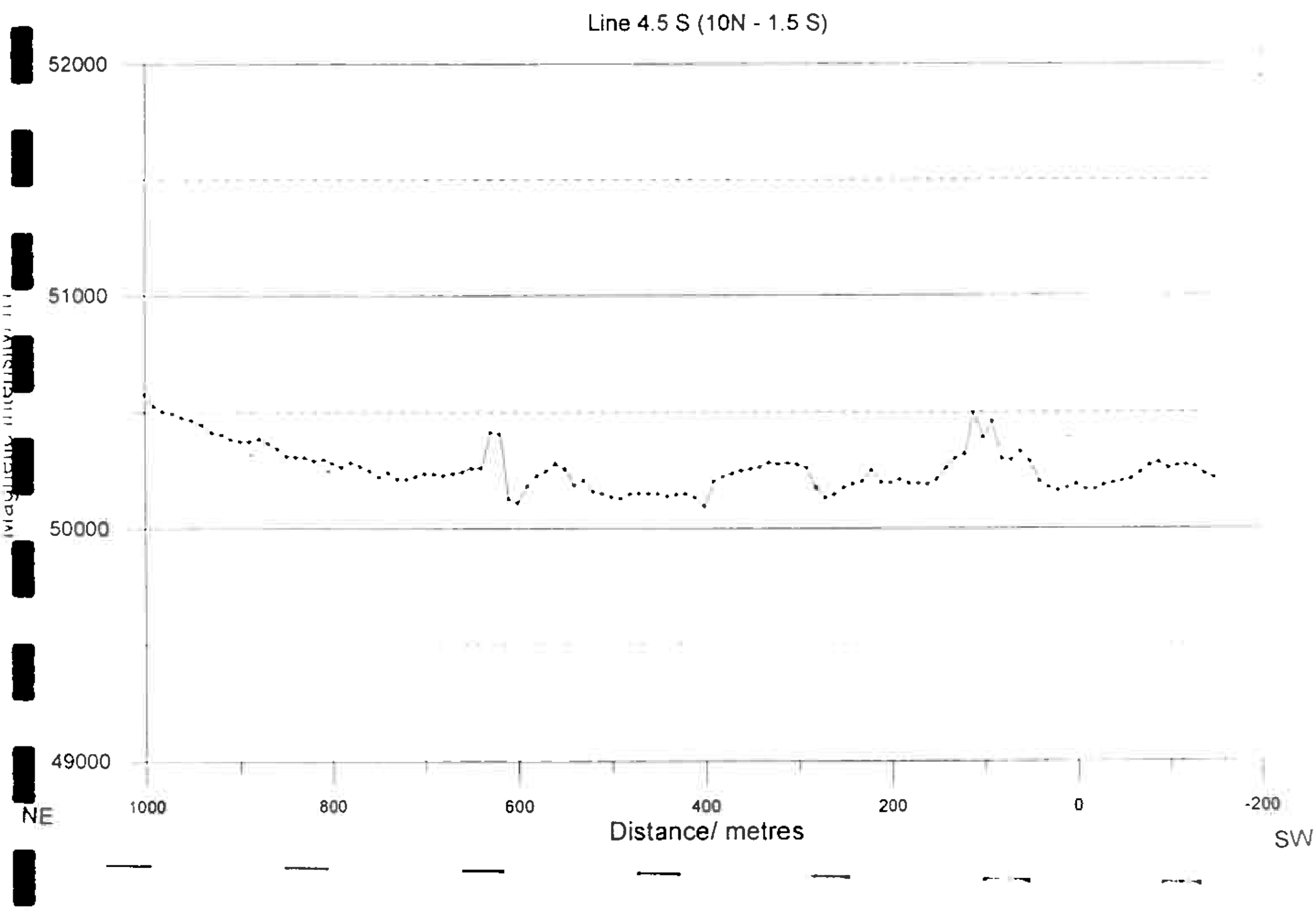
Lines	Extent	Total/metres	No. of stations
7S	8E - 3.5W	1150	116
4.5S	11.5E - 1.5W	1300	131
2S	10E - 1.0W	1100	111
Baseline	10E - 0.0	1000	101
2N	10.5E - 2.0	850	86
4.5N	13E - 4.5 E	850	86
7 N	16E - 4 E	1200	121
9.5N	13E - 0.0	1300	131
12N	9.5E - 1.0E	850	86
14.5N	7E - 0.5W	750	76
		10350	1045

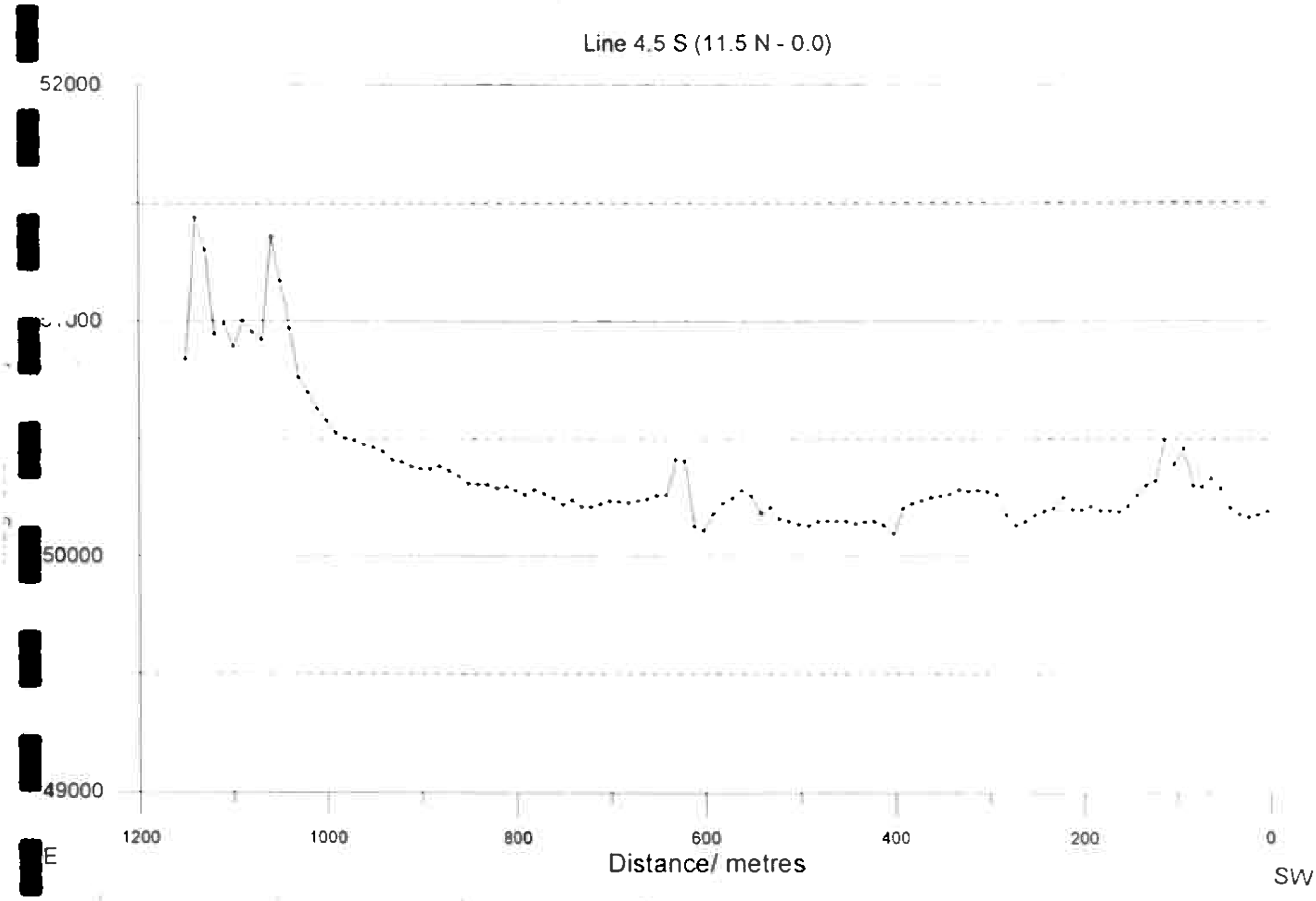
Line 7S

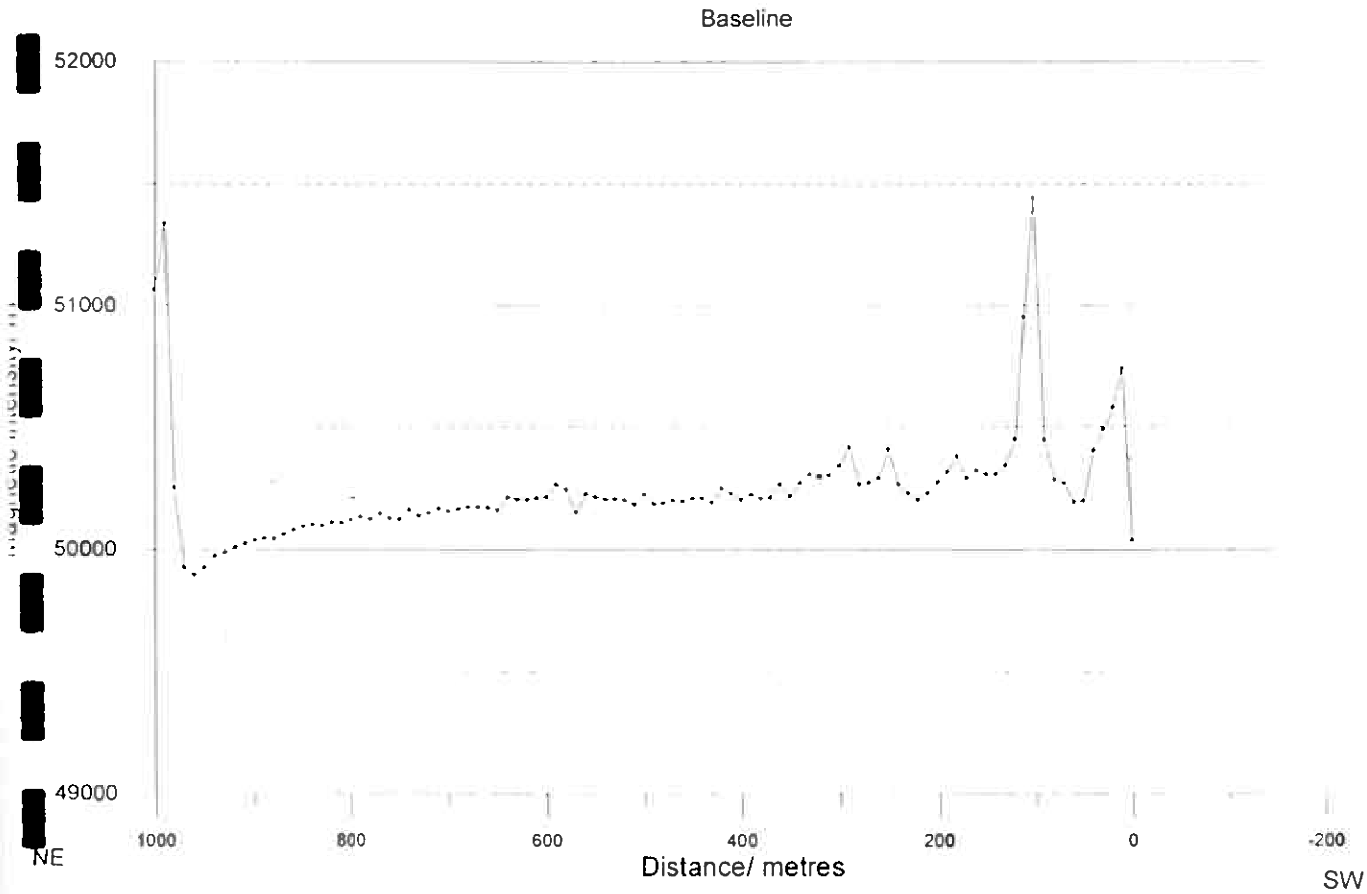


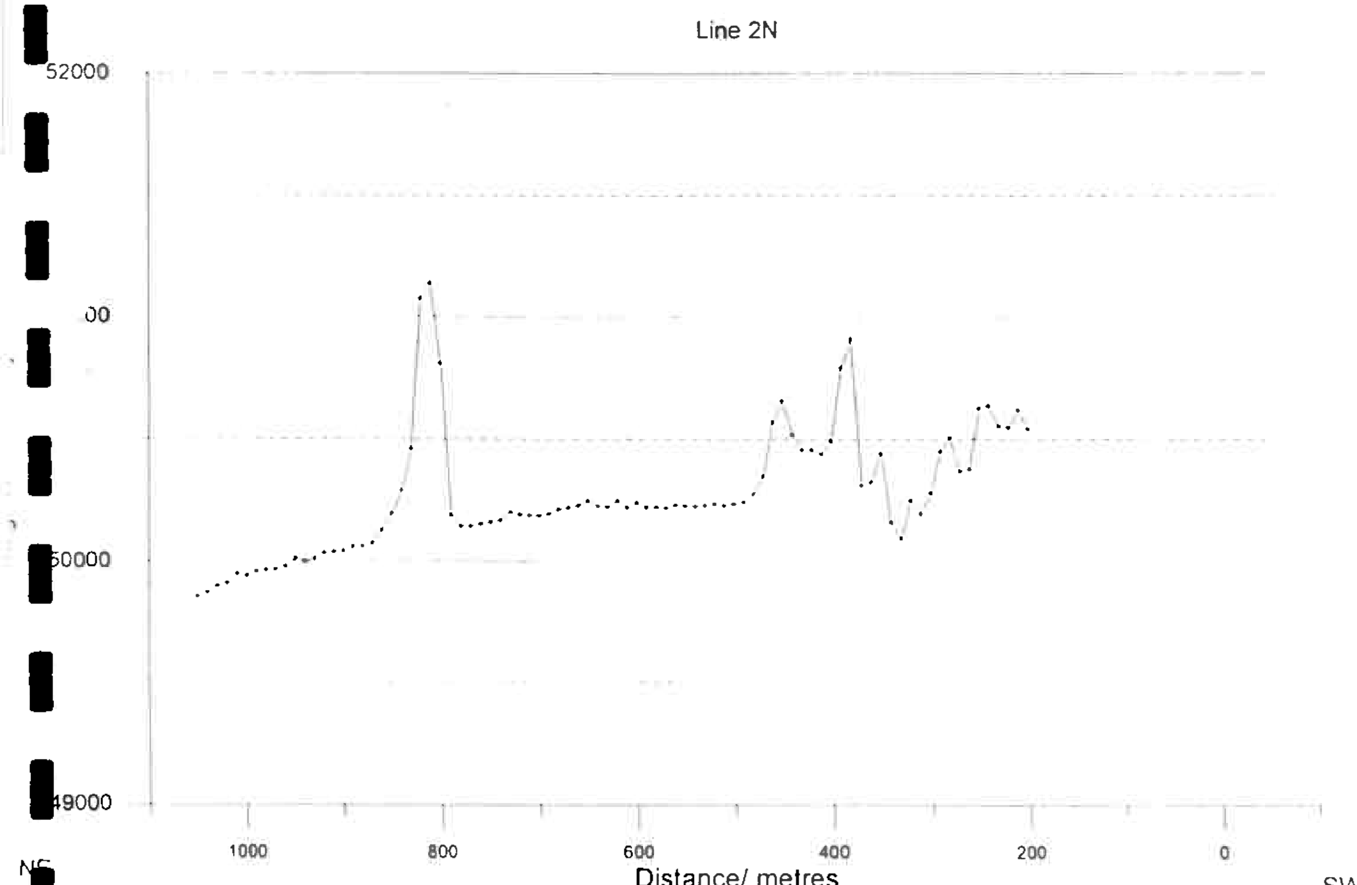
Line 2S

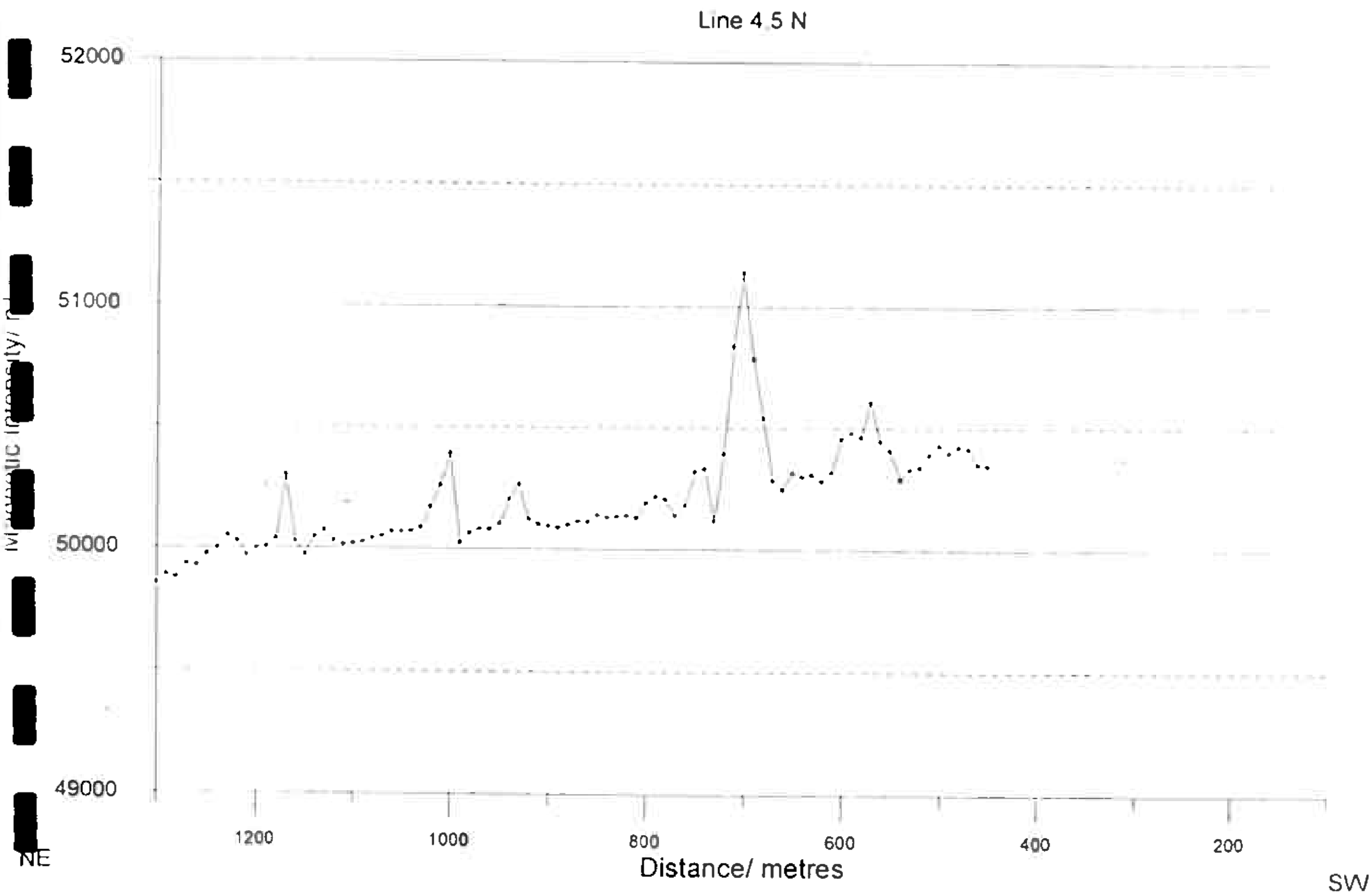


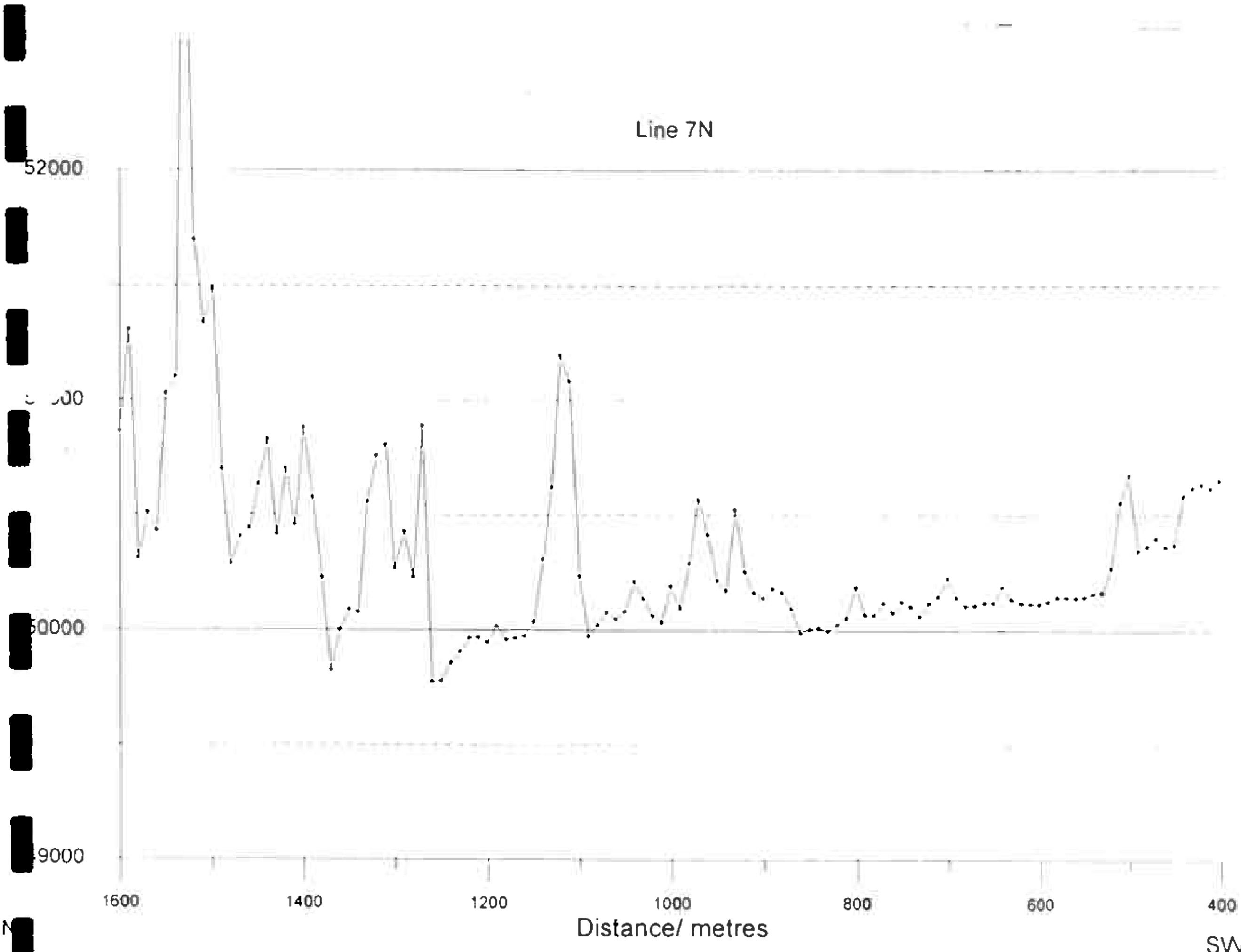

Line 4.5 S (10N - 1.5 S)
52000
51000
50000
49000
1000
800
600
400
200
0
-200
NE
Distance/ metres
SW

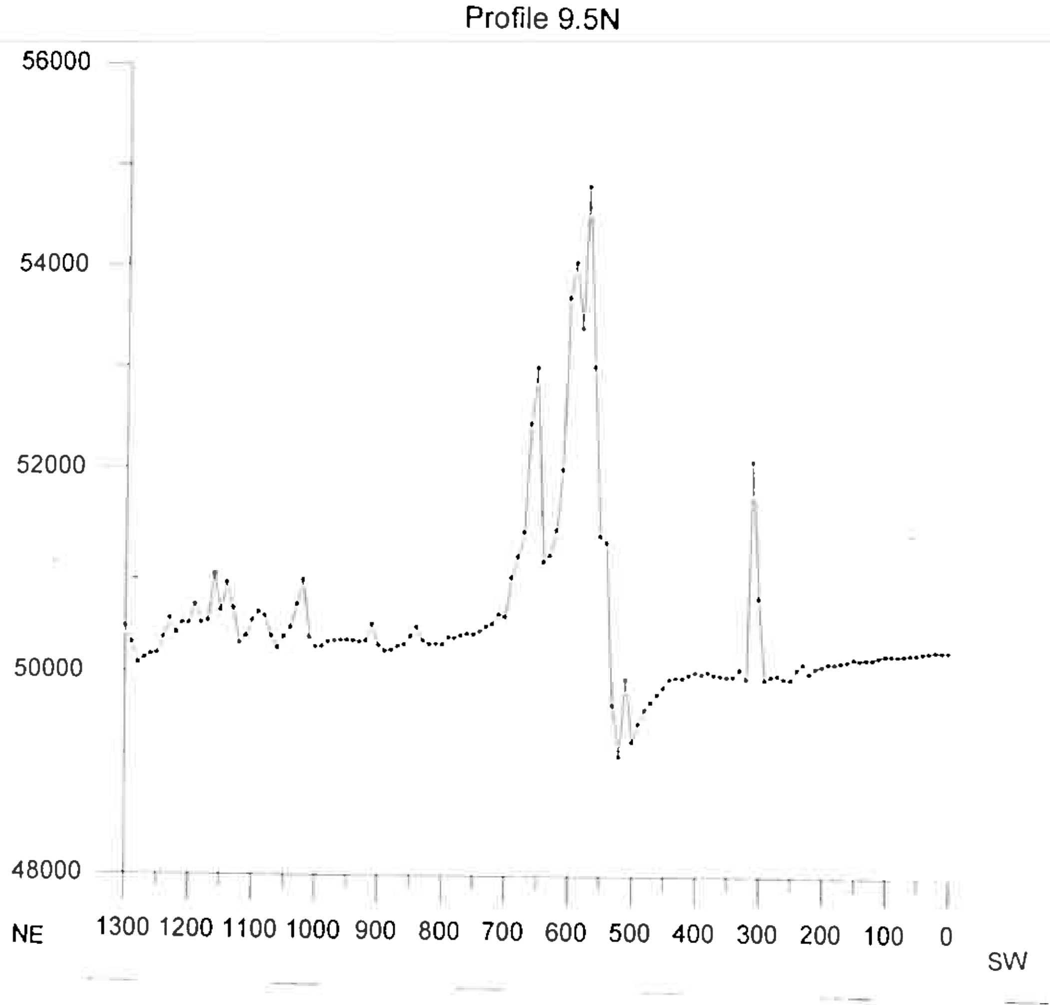

Line 4.5 S (11.5 N - 0.0)
52000
50000
49000
1200
1000
800
600
400
200
0
Distance/ metres
SW

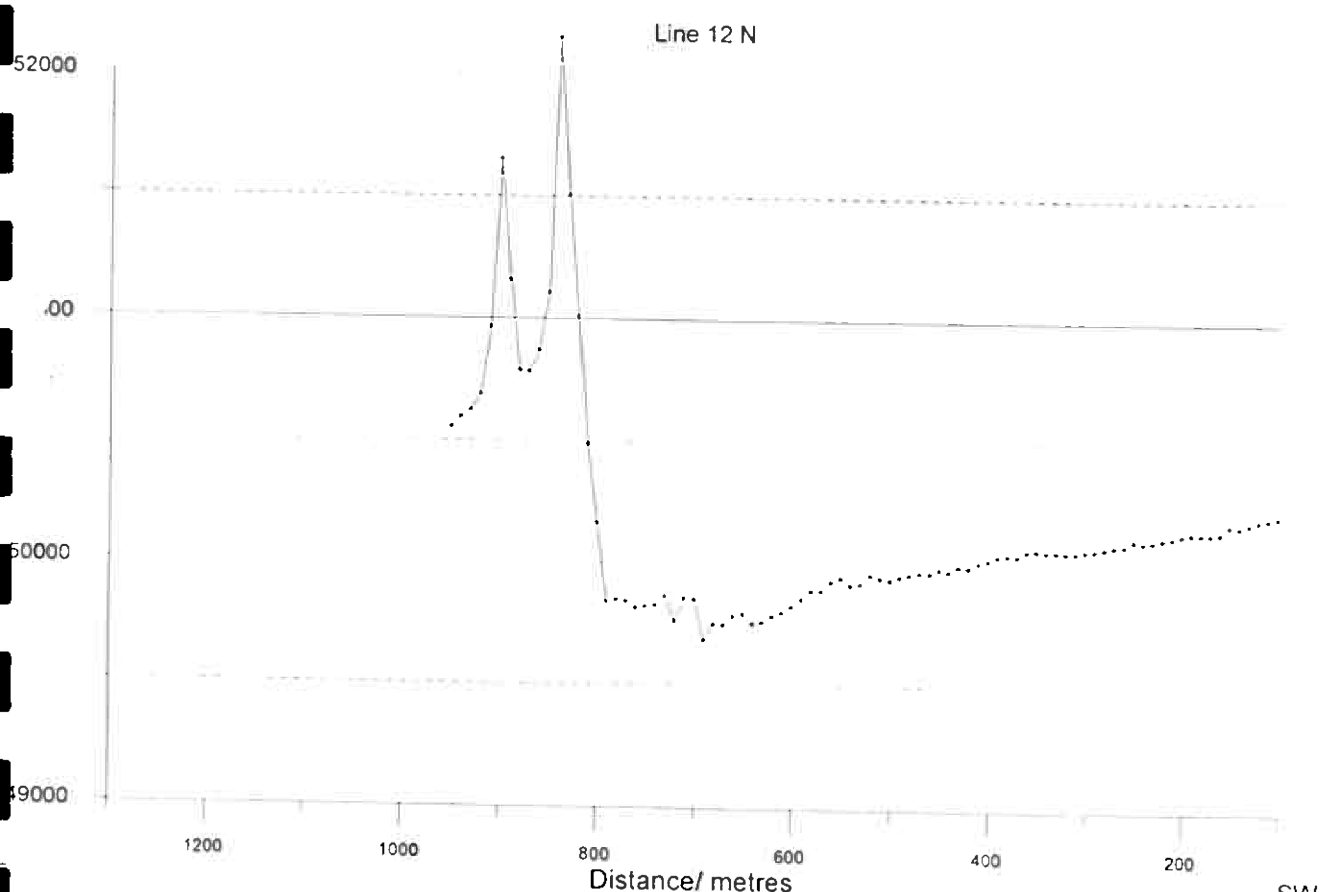

Baseline
52000
51000
50000
49000
1000
800
600
400
200
0
-200
NE
Distance/ metres
SW

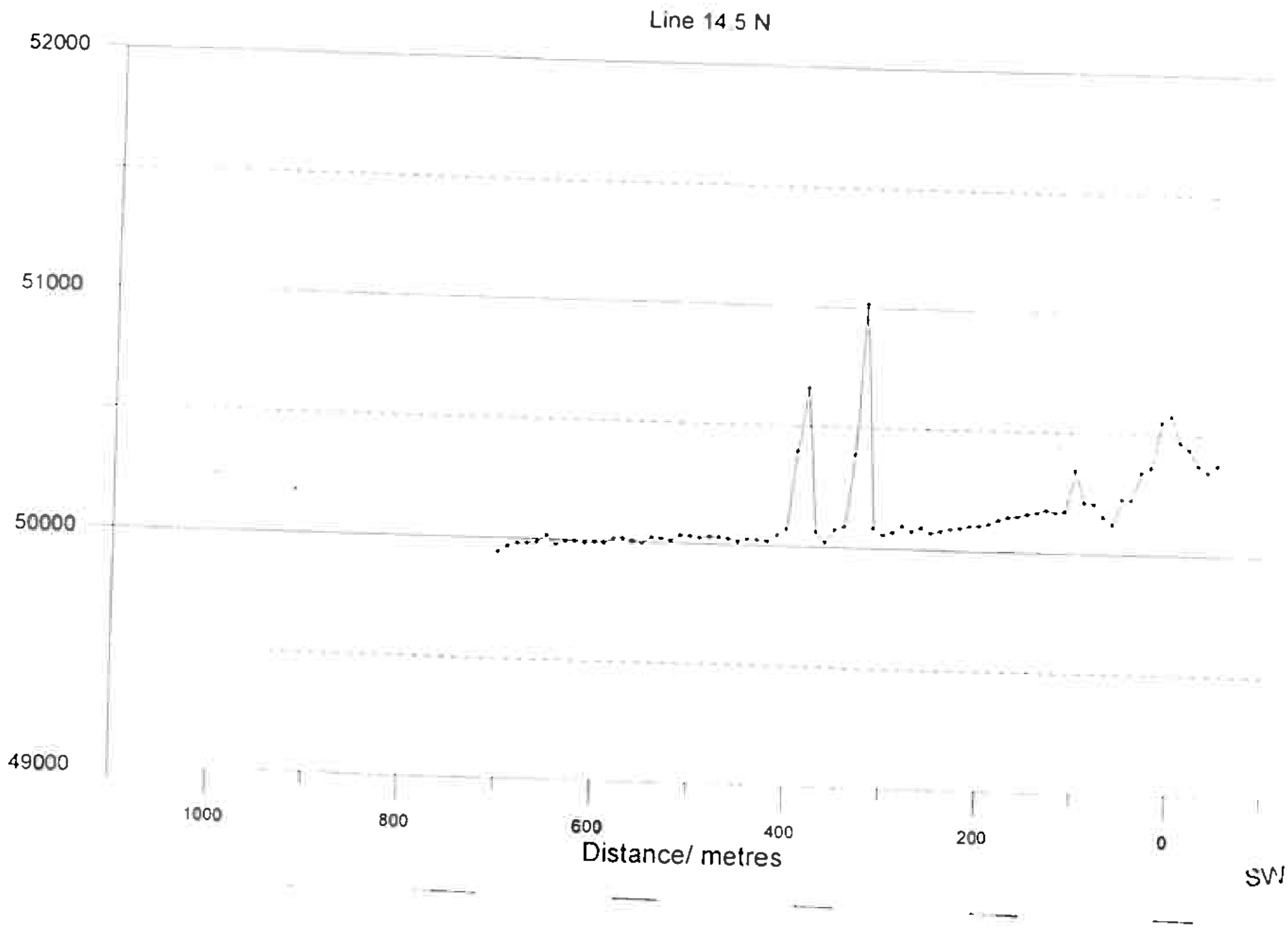

Line 2N
52000
50000
49000
1000
800
600
400
200
0
Distance/ metres
SW


Line 4 5 N
52000
51000
50000
49000
1200
1000
800
600
400
200
NE
Distance/ metres
SW


Line 7N
52000
50000
1600
1400
1200
1000
800
600
400
Distance/ metres
SW


Profile 9.5N
56000
54000
52000
50000
48000
NE
1300 1200 1100 1000 900 800 700 600 500 400 300 200 100 0
SW


Line 12 N
52000
.00
50000
49000
1200
1000
800
600
400
200
Distance/ metres
SW


Line 14.5 N
52000
51000
50000
49000
1000
800
600
400
200
0
Distance/ metres
SW