TWIN MINING CORPORATION

COMBINED MAGNETIC AND ELECTROMAGNETIC HELICOPTER SURVEY

ARCTIC BAY, BAFFIN ISLAND

FINAL REPORT

NTS Map Sheets: 58A/15-16, 58D/01-02-08 and 48C/04-05

Fugro SIAL Airborne Surveys Inc.
project number 01-H02-02

July 2001

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1.0 INTRODUCTION

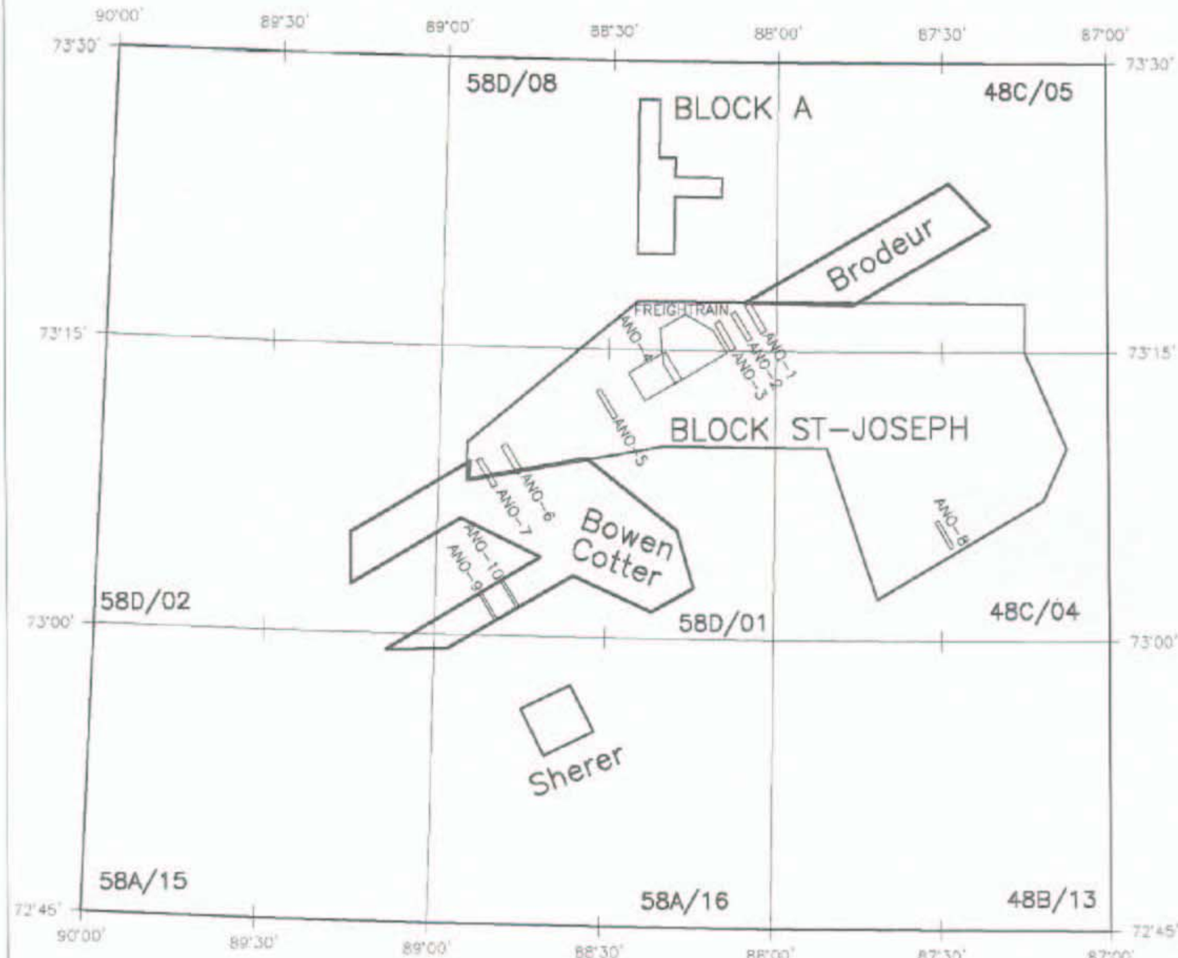
The following report describes the specifications and results of a helicopter high-resolution magnetic and electromagnetic survey that was flown on Baffin Island for the mining company **TWIN MINING CORPORATION.** The survey area was located between 70 and 100 km from Arctic Bay, and required 6641 line-km.

The survey was performed by **Fugro SIAL Airborne Surveys Inc.** (FSAS) from April 4th through May 15th, 2001. Pre-flight tests were performed on site from March 26th trough April 4th, 2001.

The primary goal of this project was to provide high quality digitally recorded and processed geophysical data in order to assist geological mapping and to indicate structures potentially favourable to the presence of kimberlite.

The major areas shown on figure 1 were flown with a line spacing of 250 metres; the control lines were flown perpendicular to the survey lines with a spacing of 2000 and 2500 metres. Smaller inner areas located over magnetic anomalies were detailed with a narrowed line spacing of 50 or 100 metres (see table 2). The nominal survey height was 60 metres above the surface of the ground.

Preliminary magnetic and EM anomaly maps were available daily on site. Final maps and digital data on CD-ROM were delivered to **TWIN MINING CORPORATION** in three batch on June 27th, July 4th and July 30th, 2001.



TWIN MINING CORPORATION

HELICOPTER BORNE SURVEY – ARCTIC BAY AREA

FIGURE 1: LOCATION MAP

5610, Chemin Bois-Franc
St-Laurent, Qué.
Canada H4S 1A9

Phone: +1(514) 339 2999
Fax : +1(514) 339 2997
Email : aem@sialgeo.com

FUGRO SIAL
AIRBORNE SURVEYS

2.0 MANAGEMENT OF SURVEY

Mr. Mouhamed Moussaoui, from **FSAS** carried out co-ordination and general management of the project**.** The **TWIN MINING** Scientific Authority was Mr. Richard Roy. Mr. Roy worked closely with **FSAS** to ensure that the work was carried out according to contract specifications.

The survey and office crews consisted of the following permanent employees of **FSAS**:

Table 1 : Field and Office Crew

POSITION	NAME
Project Manager	Mouhamed Moussaoui, P.Eng.
Electronic Engineer	Neil Punstell
Field Geophysicist & data processing	Ms. My Phuong Vo
Field Operator & Electronic Technician	Mr. Olivier Ayotte
Pilot	Mr. François Hébert Mr. Philip Leynaert
Office Data Processing	Ms. My Phuong Vo Mr. Michel Duguay
Autocad/Drafting	Mr. Albert Sayed Ms. Sylvie Robillard
Data Interpretation	Dr. Marc-Alex Data Vallée, Geophysicist Mr. Camille St-Hilaire, M.Sc.A, Geophysicist
Final Report	Mr. Camille St-Hilaire, M.Sc.A, Geophysicist

3.0 SURVEY AREA

The survey area, shown on Figure 1, is located between 70 and 100 km to the West of Arctic Bay, Baffin Island, and covers portions of the 58A/15-16, 58D/01-02-08 and 48C/04-05 NTS map sheets. A total of 6641 line-km was flown. Table 2 present the specifications of each survey block.The topographic relief in the survey area presented no significant challenge in meeting altitude specifications.

Table 2 : Survey Blocks

BLOCK	NTS MAPS	TIE-LINE SPACING (m.)	TIE-LINE DIRECTION	LINE SPACING (m.)	LINE DIRECTION
St-Joseph	48C/04-05 58D/01-08	2500	330^o	250	60^o
Bowen Cotter	58A/15-16 58D/01-02	2500	330^o	250	60^o
Brodeur	58D/08 48C/05	2500	330^o	250	60^o
Sherer	58A/16	4500	330^o	250	60^o
A	58D/08	2000	90^o	200	0^o
Freightrain	58D/01-08	100	330o 60o	100	60^o 330^o
ANO-1	58D/08	250	60^o	100	330^o
ANO-2	58D/08	250	60^o	100	330^o
ANO-3	58D/08	250	60^o	100	330^o
ANO-4	58D/01	250	60^o	100	330^o
ANO-5	58D/01	250	60^o	100	330^o
ANO-6	58D/01	250	60^o	100	330^o
ANO-7	58D/01	250	60^o	100	330^o
ANO-8	48C/04	250	60^o	50	330^o
ANO-9	58D/01	250	60^o	50	330^o
ANO-10	58D/01	250	60^o	50	330^o

4.0 SURVEY EQUIPMENT

All the instrumentation used during the survey met the contractual specifications and was installed in the helicopter by Neil Punstell and Olivier Ayotte, two qualified electronic engineers working for **FSAS**.

4.1 Helicopter

An Astar AS350-BA helicopter (registration C-GOVH) rented from Canadian Helicopter was used. The helicopter carried the magnetometer and the electromagnetic (with two coil configurations and five frequencies) systems. Average flying speed was 110 km/h. At this speed, and with a recording rate of 10 times per second for the magnetic and electromagnetic systems, the distance between samples along survey lines was typically 3 metres.

4.2 Digital and Analog Acquisition System

A RMS DAS-8/DGR-33A data logging system, an on-board graphical display data-acquisition system and a graphic recorder were used. This system:

- Accepted digital data from the magnetometer sensor and In-Phase and Quadrature components of all five EM coil-pairs, radar and barometric altimeter data, time and raw GPS positions

- Produced a hard-copy graphic record (analog) of both coarse and fine scales data from the magnetometer, In-Phase and Quadrature components of all five EM coil-pairs, radar altimeter, time and fiducial. One-second intervals were indicated on the analogs by means of short tics and fiducial number printed at 10-second intervals

- Produced a digital machine-readable record of raw data on an external hard disk.

The analog records were of sufficient resolution to enable visual checks to be made of system performance. The chart speed of the analog recorder was 1.2 mm/sec.

The data acquisition system was synchronised to GPS time through a one-second GPS pulse. Synchronisation was checked at the end of each day flight.

4.3 Airborne Magnetometer

The magnetometer sensor was mounted in the EM bird, which was towed 30 metres under the helicopter for a ground clearance of 30 metres.

Airborne magnetometer:	Geometrics G822A Cesium Vapour split beam installed in the EM bird
Sensor static resolution:	better than 0.1 nT
In-flight sensitivity:	±0.001 nT
Resolution:	±0.005 nT
Absolute accuracy:	±10 nT
Dynamic range:	20 000 - 100 000 nT
In-flight noise envelope:	< 0.01 nT
Sampling rate:	ten (10) readings per second or approximately 3 metres at average helicopter speed of 110 km/s.

4.4 Electromagnetic System

The electromagnetic system used for this survey has 5 frequencies and was mounted in a rigid kevlar Bird of 8 meters length. Its specifications were:

Model:	SYGHEM-5 (Bird Phoenix)
Manufacturer:	FSAS
Frequencies:	933 Hz, vertical coaxial coils
	866 Hz, horizontal copl. coils
	4 310 Hz, vertical coaxial coils
	4 167 Hz, horizontal copl. coils
	35 088 Hz, horizontal copl. coils
Tx-Rx Separation:	5.82 meters
Noise envelope:	1 ppm
Sampling rate:	10 per second
Time-constant:	0.1 second

Ten (10) EM channels of In-Phase and Quadrature values, along with monitors for atmospheric (sferic) and power-line noise, were sampled ten times per second.
The helicopter mean terrain clearance (averaged over any 2-km distance) was 60 metres. Under conditions of zero airspeed, the exact distance between the horizontal axis of the Bird and the location of the radar altimeter was 30 metres. In flight conditions, the tow cable made an angle of 5^{o} to 8^{o} with the vertical, reducing the distance to 29.9 to 29.7 metres between the horizontal axis of the Bird and the radar altimeter (bird terrain clearance of 30.1 to 30.3 metres).

4.5 Radar altimeter

A radar altimeter recorded the clearance between the ground and the helicopter, while differential GPS measured the altitude of the helicopter. The altimeter was interfaced to the data acquisition system with an output repetition rate of ten per second. The radar altimeter recording was in both digital and analog form.

Radar altimeter:	Terra Tra 3000
Range:	20-2500 ft
Resolution:	4 mV/foot
Accuracy:	1% over flat terrain; 3% in the range of 0 to 300 feet
Sensitivity:	better than 10 feet
Sampling rate:	10 per second

4.6 Navigation and Flight Path Recovery Systems

4.6.1 Video Camera

A Panasonic TC21554/NC colour-video-camera with audio capability recorded in NTSC format the flight-path terrain beneath the helicopter. This camera, with an automatic iris and wide-angle lens, ensured perfect exposures with no operator adjustment. In level flight, the viewing angle of the camera was lest than 2 degrees from the vertical.

The video camera recorded both video and data, which were stored alphanumerically in the top portion of each frame. The data included flight line number, fiducial, time and GPS generated X-Y

UTM co-ordinates. Data and video were available for review immediately after each flight with no further processing.

4.6.2 GPS

In flight positioning was sampled at a rate of 1 hertz using a TRIMBLE-4000SE real-time differential GPS receiver system, in conjunction with a OMNI-Star satellite-link and a PICODAS PNAV-4001 navigation console. The system enables data to be positioned to an absolute accuracy better than 5 metres. At least, 4 satellites were monitored at all times during the survey.

4.6.3 Pilot Guidance

In conjunction with the GPS, a PICODAS PNAV 4001 navigation interface provided in-flight navigation control (X-Y guidance).

4.7 Base Station Magnetometer

Breakwater's mining camp, Nanisivik., in a magnetically clean environment, away from any sources of electromagnetic interference or excessive magnetic gradients. A digital record of the variation of the earth's magnetic field was continually recorded. The airborne and digital base station magnetometers were synchronised with an accuracy better than 1.0 second. During the survey, it was found that diurnal was sometime higher than the cut-off required by the contract specifications and fifteen flight line needed to be reflown. The base station magnetometer technical specifications were:

Base station magnetometer:	Scintrex SC-2
Sensor static resolution:	better than 0.1 nT
Sensitivity:	±0.001 nT
Dynamic range:	20,000 - 95,000 nT
Noise envelope:	less than 0.1 nT
Recording interval:	2.0 seconds

4.8 Field Data Plotting and Verification System

4.8.1 Hardware

The digital data were verified on a daily basis with an in-field processing system to ensure that proper digital recording has taken place and to prevent unnecessary re-flights. The field processing system consisted of one Pentium-PC with a high-resolution screen, a Zip tape drive, a CD-Writer, a Cannon BJ-4000 colour bubble-jet printer and a video player. An Internet access, including e-mail address, helped to maintain good communications with the main office and the scientific authority.

4.8.2 Software

The computer was equipped with custom and commercial software capable of providing preliminary compilation through initial contours in addition to profile plots required to confirm the validity of data collected on each flight. The software package included Geosoft, Oasis and Nortech HPM differential processing software.

5.0 OPERATIONS

Mobilisation of equipment and personnel from Ottawa to Nanisivik started on March 23rd, 2001. Base installation, pre-survey calibrations and tests were carried out from Mars 26th to April 4th, 2001. Survey flying commenced on April 4th and ended on May 15th, 2001.

The survey base was established at the Breakwater's Mining Camp, Nanisivik.

6.0 TESTS AND CALIBRATIONS

6.1 Altimeter Calibration

Prior to the beginning of the survey, pre-survey calibrations were performed for the radar altimeter, determined from flights at altitudes of 60, 90, 120, 150, 180, 210, 240, 270, 300, 400 and 500 metres above the airstrip at Nanisivik.

A low-pass filter of 6 seconds was applied on the radar altimeter data.

6.2 Magnetic survey

Lag tests, to determine the time difference between the magnetometer and positioning devices, were performed by flying in two directions, at the nominal survey height, over a sheet steel building that provided an anomaly sufficient to determine the system lag (+0.6 sec.) in relation to the GPS positioning data.

PICODAS/GPS synchronisation was achieved by the PICODAS acquisition software. This software uses the 1-pps transmission from the Trimble or OMNI-Star consoles that contains the GPS time. Upon reception of the GPS signal, the corresponding PICODAS system time was logged. GPS and PICODAS were recorded as data fields in the raw PICODAS file at a rate of 1 per second.

6.3 EM Survey

Calibration of the EM system was performed prior to survey commencement at the Nanisivik airstrip. The Bird was rotated 90^{o} about its longitudinal axis to minimise coupling with the ground and placed on a stand 90 cm above ground. This rotation effectively converted the horizontal coplanar coil geometry into a vertical coplanar configuration. Calibration was done with an external Q-coil (which produces a signal of known amplitude) positioned near the Rx-coils end of the Bird. The Q-coil was accurately and rigidly positioned with respect to the Rx-coils by means of a jig attached to the Bird.

After this calibration, there was no need to adjust the external calibration coil. However, the EM system was calibrated regularly during flight. An internal coil (bucking coil) was used about 3 to 4 times per hour during survey flights for instrumental drift corrections.

The system drift, due to thermal changes, was monitored by watching the chart recorder. Each flight, field procedures included flying to an altitude outside of the ground influence for in-flight zero levelling calibrations.

6.4 Radar Altimeter

Accuracy of the radar altimeter was regularly tested by hovering with the 30 metres tow cable fully extended down to the Bird on the ground, and comparing the radar value with the length of the tow cable.

7.0 QUALITY CONTROL

All flight records, the differentially corrected GPS and the ground station records were merged into a single GEOSOFT-OASIS database on a flight by flight basis. Profiles were examined in detail, on the analog records and mainly using OASIS scrolling and zooming capabilities. The main concerns were the speed check of GPS data, diurnal activity, altimeter data (mainly radar, Z-GPS jumps), magnetic and EM profiles.

7.1 GPS

The velocity and acceleration of the aircraft were calculated for the entire flight as a check on the flight path. Any errors were corrected. Gradient grids were also used to assess GPS quality. Plots of the flight path were produced on a daily basis to inspect the quality of the coverage.

Before demobilisation, to be sure that data were of good quality, a final check was carried out. Control line magnetic data were gridded separately and the result compared to the survey line grid.

7.2 Magnetic survey

Quality control procedures for the magnetic survey were:

1) Application of a de-spiking filter. This filter only affects discrete spikes
2) Visual inspection of magnetic profiles and flight path plots
3) Application of lag
4) Preliminary calculation of the intersections between the traverses and control lines
5) Preliminary colour maps

The base station level was determined and continuously updated by averaging all the observations collected during the course of the survey. At the end of the survey, the average value of the main base station was subtracted from magnetic readings.

OASIS profiles and **FSAS**'s software were then used to compare the degree of diurnal activity with the contract tolerance.

After having been merged in the main OASIS database, the base station magnetometer data were carefully inspected in order to remove any cultural noise and spikes. A low-pass filter was applied to remove small amplitude noise.

GEOSOFT line gridding (minimum curvature) software was used in the field. Colour maps of the total field, as well as its derivatives and shadow, were regularly produced in the field, with flight path overlay, in order to evaluate data quality.

7.3 EM Survey

For the electromagnetic data, only a visual inspection of the EM analog records and a quick interpretation of the EM anomalies were done in the field.

8.0 FINAL PROCESSING

Final compilation was completed at **FSAS**'s head office, Montreal, under the supervision of Mr. Mouhamed Moussaoui. Other personnel assigned to this project were Ms. My Phuong Vo, Geophysicist (Magnetic data processing), Mr. Michel Duguay (EM data processing), Mr. Albert Sayegh (AutoCad/Drafting) and Ms. Sylvie Robillard (AutoCad/Drafting). All field-processing steps were exhaustively verified and updated before proceeding further.

8.1 Magnetic data

8.1.1 Data Processing

For the magnetic survey the steps to be completed at this stage were:

- Complete verification of the different field (X-Y, GPS time, radar altimeter, Z-GPS)
- Complete visual verification of the magnetic profile (de-spike, filtering of the low noise, residual calculation
- Lag removed (0.6 sec)
- Diurnal correction
- Intersection levelling of the total field
- Production of the deliverable items (maps and archives files).

After long wavelength diurnals were removed, the final levelling of the total magnetic field was done by intersection analysis. First, all the intersection differences were calculated and examined. A statistical levelling was done on each control line by subtracting a second order curve. Secondly, any residual difference between control line/traverse-line was applied on each traverse-line to produce identical values for the intersections.

The magnetic values were then reduced to a regular X-Y grid, using GEOSOFT MONTAJ random gridding (minimum curvature) software.

The final grid was contoured using the GEOSOFT contouring routines. Hierarchies of contour intervals were defined, each with its own dropout density, pen weight, and periodic annotation.

A colour contour map of the final total field magnetic intensity gridded data set was produced. Pseudo equal area colour intervals were utilised wherein smaller increments were applied around the mean data values and increasingly larger increments were applied towards the minimum and maximum data values. This resulted in a better resolution of anomalies in the mid-range of the data. Such anomalies can become obscured when linear colour intervals are used.

8.1.2 Magnetic Interpretation and Results

More than 14 small round-shaped anomalous zones, which could possibly indicate the presence of plutonic intrusive bodies (kimberlite), have been mapped. The half-slope method was used to estimate the sources depths (Peters, L.J., 1949. A direct Approach to Magnetic Interpretation and Its Practical Application. Geophysics, vol. 14, no. 3, pp. 290-320). This method is widely applied and quite effective. For each anomaly, the estimated distances between the magnetic sensor and the magnetic source are presented in appendix B. The radar altimeter readings were then subtracted from these values to obtain the source depths.

Appendix C presents the magnetic profiles obtained on each anomaly. When an anomaly was clearly observed on more than one line, the profile of each line has been drawn (exemple: Jackson anomaly, which corresponds to Freightrain). The best profile was then selected to estimate the source depth (example: profile N30W for the Jackson anomaly). To help to define the point of maximum slope along the selected profiles, the first derivative were calculated.

FSAS used also more sophisticated interpretation tools to evaluate depth extensions of the magnetic sources. 2.5-D Interpretation Software, as Magix XL, were used and results indicate that for each magnetic anomaly, the depth extensions must be higher than 30 metres.

8.2 Electromagnetic Data

The processing of the electromagnetic data has been done with **FSAS** software and needed 8 different steps:

1- Manually removes the spikes or strange values caused by sferic or other sources
2- Remove general and random noises with a triangular filter of thirteen points
3- Remove the low frequency and small amplitude noises with a triangular filter of sixty-one points
4- Restore the original amplitude of each anomaly by manually moving back the initial anomaly amplitude
5- Level each profile by using automatically and/or manually the null and calibration data
6- Plot the profiles
7- Calculate the apparent resistivity using an homogeneous half space model
8- Gridding of the apparent resistivity data

8.2.1 EM Interpretation

The EM anomalies maps represent a compilation and an interpretation (location and conductance, i.e. conductivity-thickness product) of all the EM anomalies detected. Appendix A summarises, in a tabular format, the results of this compilation.

An EM survey allows to detect three types of electric conductors. Each type is described hereafter:

8.2.1.1 TYPE 1 (Bedrock conductors)

Most of the time, the EM anomalies line up from line to line to draw the conductor axis. When a conductor is made up of EM anomalies characterised by well-defined and narrow negative In-Phase and quadrature components, this type of conductor is often related to massive sulphide and/or graphite mineralised beds. Under such circumstances, the quantitative interpretation (conductance and depth) of each anomaly is done by assuming a vertical tabular model. This choice is justified because this model is the best one to represent narrow conductors, typical of sulphur and graphical mineralisation.

8.2.1.2 TYPE 2 (Superficial conductors)

This type of conductor is characterised by a series of wide and flared EM anomalies, more or lest aligned from line to line and with low In-Phase and quadrature components. The calculated conductances are generally weak (limited to a few Siemens). This type of anomaly results from horizontal and superficial conductors, as alluvial and lake deposits, glacial cover, some lithological units and conductive overburden. In this case, the interpretation is done with a homogeneous half-space model. Since these conductors are horizontal, the maximum EM coupling is obtained with the horizontal coplanar configurations (886, 4 167 and 35 088 Hz), which give the best representation of this type of conductors.

8.2.1.3 TYPE 3 (Positive In-Phase conductors)

This third type of conductor consists in a positive In-Phase component without quadrature response. These EM anomalies are associated with highly magnetic lithologies and mineralisation with a magnetic susceptibility so high that it affects the In-Phase component. This type of anomalies cannot be considered as "true" conductors but, when they can be, a negative response on the quadrature component is obtained and the conductor is classified as type 1.

8.2.2 Calculation of the Apparent Resistivity

The apparent resistivity maps were calculated with a routine written in FORTRAN by Zbinek Dvorak. The method is presented in a paper written in 1978 by Douglas C. Fraser, which use mathematical equation developed in 1967 by F.C. Frischknecht. The model, named "**Pseudo–Layer Half–Space Model**", uses the amplitude and phase of the secondary magnetic field to yield apparent resistivity. The amplitude is defined as:

$$\text{Amplitude} = (\text{in-phase}^2 + \text{quadrature}^2)^{1/2}$$

With this model, the altitude of the EM Bird does not enter in the calculations and the apparent resistivity values are not affected by altitude errors, which is an advantage over other models.

8.2.3 EM Results

No type 1 and type 3 conductors were observed. On the other hand, some wide and flared type 2 EM anomalies have been outlined. All these anomalies are located along the hydrographic network and their calculated conductances are so low that they represent superficial conductors. One high conductive area located on the St-Joseph block corresponds to a salted water plan.

No EM responds directly related to the magnetic anomalies were observed.

9.0 DELIVERIES

All final products required by the technical specifications of the contract were delivered in three batch on June 27th, July 4th and July 30th, 2001. M. Albert Sayegh and Ms. Sylvie Robillard prepared all CAD map layouts and digital mapping files.

9.1 Map Products

All maps were made at a scale of 1:20 000 using the North American Datum 1927 with the following parameters:

- Central Meridian 87°W
- Zone: 16
- Spheroid Clarke 1866
- Projection UTM
- False Easting 500 000 metres
- False Northing 0 metres

- Datum NAD 27

Four black & white paper-prints of the following final maps were produced:

- Total-Magnetic-Field contours
- Vertical-Magnetic-Gradient contours
- EM Anomaly map
- EM Profiles (frequency 933 Hz)
- EM Profiles (frequencies 4 310 and 4 167 Hz)
- EM Profiles (frequency 35 088 Hz)

Four paper-prints of the following final maps were produced in full colour:

- Total-Magnetic-Field contours
- Vertical-Magnetic-Gradient contours
- EM-Resistivity Contours for the frequency 4167 Hz
- EM-Resistivity Contours for the frequency 35 088 Hz

All the digital files of these map products, suitable for plotting on an HP 750 ink jet plotter were delivered. All geophysical, positional and ancillary digital data were provided in standard formats (e.g. ASCII and/Geosoft profile archives) on CD ROM. Positional data were provided in latitudes and longitudes and UTM NAD 27.

Note that for the ANO-8 block, the Total Field and Vertical Magnetic gradient maps are presented in appendix D at a scale of 1:20 000.

9.2 Digital Data Products

Four copies of a two CD-ROM containing the digital profile and Grid (Geosoft Format) archives were produced. All digital data are georeferenced to the standard UTM-system for the area.

9.3 Miscellaneous Items

The following miscellaneous items were finally produced:

- Analogue records
- Flight path videocassettes
- This technical project report in four copies
- EM Anomaly List (Annexe A)

10.0 CONCLUSIONS

All airborne and ground-based records were of excellent quality.

It was found that even though diurnal was within specifications, diurnal subtraction was not adequate to level the data and, in fact, good intersections were required to produce a reliable final data set.

Data were acquired in good diurnal conditions. Fifteen flight line needed to be reflown due to excessive diurnal activity. The remaining diurnal levelling error, that does not affect map and calculated gradient quality, is however estimated to be in the 1-3 nT range.

GPS results proved to be of high quality and very few intersection displacements were required.

The main causes of down-time were the bad weather (50% of the working period were lost due to poor visibility, fog, blowing snow, strong wind, white out, low ceiling) and diurnal activity.

On May 4th 2001, the operator reported a technical problem on the frequency 886 Hz (coplanar). Twin Mining representatives were immediately informed and Mrs. Dallas Davis and Richard Roy agreed to continue the survey in order not to delay the work progress.

It is hoped that the information presented in this report and on the accompanying maps will be useful both in planning subsequent exploration efforts and in the interpretation of related exploration data.

Respectfully Submitted,

Camille St-Hilaire, M.Sc.A.
Senior Geophysicist

APPENDIX A

EM ANOMALY LIST

EM ANOMALY LIST

LEGEND

CODE:	**0 :**	**EM Anomaly (Type 1)**
	1 :	**Positive In-Phase (Type 3)**
	2 :	**EM Conductor associated to positive In-phase (negative quadrature)**

TWIN MINING CORPORATION
EM ANOMALY LIST
BLOCK ST-JOSEPH (fr: 4310 Hz)

LINE	FID	UTMX (m)	UTMY (m)	INP. (ppm)	QUAD. (ppm)	COND. (s)	DEPTH (m)	CODE
-32112	1844.9	494585.1	8118056.0	-0.8	-5.6	0.1	0	0
-32112	1947.5	493098.2	8114525.0	-1.9	-13.7	0.1	0	0
-30901	3525.3	453703.1	8130690.0	-9.2	-8.3	1.8	4	2
-30901	3534.1	453532.9	8130985.0	-10.6	-7.1	2.5	18	2
404	3181.8	452398.0	8131314.5	-3.8	-8.4	0.5	21	2
404	3192.6	452150.3	8131154.0	-27.2	-12.8	3.8	7	2
404	3197.8	452019.7	8131064.5	-29.2	-12.0	7.5	20	2
404	3208.1	451724.1	8130879.0	-10.2	-17.9	0.8	6	2
503	3440.5	452005.2	8130725.0	-20.5	-24.7	1.8	12	2
503	3462.0	452563.3	8131076.0	-14.6	-15.3	1.8	15	2
503	3468.0	452723.7	8131167.5	-4.1	-11.2	0.4	15	2
604	3907.1	452338.2	8130741.5	-27.9	-13.6	3.8	13	2
604	3912.7	452245.7	8130668.5	-19.7	-18.3	1.8	10	2
703	4419.1	452701.2	8130610.0	-4.0	-7.1	0.6	21	2
703	4441.9	453361.6	8130984.0	-21.4	-15.4	2.5	18	2
804	4844.6	453579.6	8130861.5	-19.6	-11.0	4.4	25	2
804	4854.2	453321.7	8130682.0	-14.1	-12.6	1.8	17	2
903	5548.1	453747.3	8130613.5	-7.9	-13.4	0.6	0	2
903	5554.1	453921.7	8130713.0	-12.3	-11.9	1.8	28	2
903	5568.9	454359.1	8130969.5	-6.5	-8.4	0.9	18	2
1004	5953.7	454849.1	8130956.0	-21.9	-19.8	1.8	10	2
1004	5960.9	454616.9	8130827.0	-29.5	-14.5	3.8	22	2
1004	5978.1	454059.4	8130553.0	-3.7	-10.3	0.4	18	2
1113	480.1	454446.1	8130439.5	-1.1	-7.1	0.1	0	2
1113	489.7	454669.9	8130567.5	-2.4	-7.2	0.2	26	2
1113	506.9	455131.9	8130839.5	-16.0	-17.9	1.1	10	2
1113	526.1	455667.0	8131145.0	-9.4	-17.6	0.5	0	2
1204	1288.2	441491.9	8122685.0	-11.3	-13.1	0.9	0	2
1304	6578.8	441596.3	8122462.0	-6.0	-14.5	0.5	0	2
8403	4733.0	473335.9	8120288.0	0.5	-6.2	0.0	0	0
8504	6096.7	473372.7	8120005.5	0.7	-6.1	0.0	0	0
11203	6798.8	475806.7	8113627.5	-1.2	-5.9	0.1	0	0
11504	1595.8	476196.0	8112966.5	-1.6	-6.8	0.2	5	0
13103	2531.4	479495.7	8110263.5	-1.7	-6.0	0.3	30	0
13103	2885.2	491647.8	8117248.5	-0.9	-5.2	0.1	0	0
13204	3515.9	483427.3	8112229.5	-1.6	-10.5	0.1	10	0
13204	3661.0	478193.6	8109228.5	-2.7	-8.4	0.3	23	0
13303	4332.8	494367.1	8118232.5	-3.5	-15.3	0.3	0	0
13404	4478.2	494504.7	8118062.5	-1.6	-9.9	0.1	7	0
14303	2638.1	493065.0	8114621.0	-2.0	-10.4	0.1	8	0
14404	1564.1	493252.6	8114461.0	-1.9	-9.4	0.2	12	0
14503	933.8	480187.7	8106620.5	-2.0	-7.8	0.2	5	0
14614	700.4	480197.6	8106333.0	-1.6	-11.3	0.1	3	0

TWIN MINING CORPORATION
EM ANOMALY LIST
BLOCK BOWEN (fr: 4310 Hz)

LINE	FID	UTMX (m)	UTMY (m)	INP. (ppm)	QUAD. (ppm)	COND. (s)	DEPTH (m)	CODE
-33601	3109.8	439654.6	8105019.5	-3.3	-15.0	0.2	0	0
-33411	2983.6	427782.6	8108422.0	-1.3	-8.7	0.0	0	2
-33411	3021.0	427532.2	8109882.5	-2.9	-13.9	0.2	0	2
-33411	3030.3	427464.7	8110264.0	-4.2	-15.4	0.3	0	2
-33411	3071.0	427212.0	8111603.0	-11.1	-17.8	0.8	9	2
-33303	2497.4	433119.2	8100252.5	-1.8	-8.6	0.2	9	0
2324	1698.5	427601.6	8111764.5	-1.6	-22.9	0.1	0	2
2324	1709.9	427263.3	8111575.5	-9.1	-33.1	0.4	4	2
2324	1716.8	427045.6	8111460.5	-93.2	-59.1	6.4	0	2
2324	1721.9	426892.6	8111377.5	-116.9	-15.4	64.6	6	2
2423	1900.1	426849.6	8111021.0	-120.2	-54.9	9.6	0	2
2423	1904.9	427000.8	8111129.0	-162.1	-82.3	7.3	0	2
2423	1906.7	427058.0	8111172.5	-148.0	-79.6	7.3	0	2
2423	1915.0	427335.3	8111355.5	-6.7	-19.4	0.4	7	2
2423	1918.0	427440.2	8111409.5	-6.2	-27.6	0.3	5	2
2423	1924.6	427679.4	8111506.0	-3.6	-15.8	0.3	0	2
2524	2684.3	427610.0	8111215.0	-2.2	-14.7	0.1	0	2
2524	2717.0	426812.6	8110747.0	-176.3	-138.8	4.3	5	2
2623	2871.2	426876.9	8110497.5	-200.0	-120.4	5.6	3	2
2623	2891.3	427564.6	8110857.0	-0.4	-10.2	0.0	0	2
2623	2900.0	427861.1	8111047.5	-0.5	-7.2	0.1	0	2
2714	3615.4	427665.6	8110683.5	-0.3	-7.5	0.1	0	2
2714	3632.5	427191.5	8110407.5	-36.4	-51.5	1.8	9	2
2714	3635.8	427098.6	8110351.5	-65.5	-60.1	3.1	10	2
2714	3645.4	426830.6	8110176.5	-82.6	-63.1	4.5	2	2
2813	3700.7	426896.8	8109955.5	-16.2	-25.3	1.1	4	2
2813	3709.1	427182.0	8110073.5	-31.5	-47.2	1.0	6	2
2813	3712.1	427288.9	8110127.0	-29.2	-45.8	1.0	11	2
2813	3728.6	427794.4	8110425.0	-0.2	-5.2	0.1	0	2
2914	4485.0	427842.2	8110161.5	-1.0	-15.5	0.0	0	2
2914	4502.6	427382.4	8109913.5	-4.0	-14.6	0.3	0	2
2914	4514.6	427045.8	8109709.0	-7.9	-26.0	0.4	2	2
2914	4517.6	426963.2	8109655.0	-8.0	-27.0	0.4	3	2
2914	4525.4	426756.4	8109525.5	-5.3	-25.0	0.3	10	2
3013	4675.2	426917.5	8109331.0	-2.8	-12.4	0.3	11	2
3013	4692.3	427547.4	8109694.0	-2.2	-11.5	0.1	5	2
3013	4716.8	428318.6	8110144.0	-2.4	-10.0	0.1	8	2
3114	5495.0	428517.2	8109989.0	-20.8	-29.4	1.0	5	2
3114	5501.9	428301.8	8109861.0	-2.7	-9.9	0.3	14	2
3114	5541.1	427257.3	8109241.0	-1.7	-11.2	0.1	12	2
3114	5554.6	426820.6	8109006.0	-1.3	-10.6	0.0	0	2
3213	5655.5	427380.7	8109081.0	-1.2	-8.8	0.0	0	2
3224	2016.5	428810.7	8109577.0	-2.6	-8.0	0.3	7	2
3224	2047.1	427848.8	8109017.5	-2.1	-6.9	0.2	21	2
3323	2262.2	427721.1	8108658.0	-4.0	-14.0	0.3	0	2
3323	2270.6	428010.0	8108831.0	-6.1	-22.2	0.4	10	2
3424	3225.9	427928.8	8108501.5	-3.3	-11.8	0.3	6	2
3523	3472.6	428135.0	8108343.5	-2.6	-10.2	0.3	0	2

3624	4502.8	428476.4	8108213.5	-4.1	-14.7	0.3	0	2
3723	4783.8	428729.6	8108097.0	-2.1	-5.2	0.3	28	2
7014	5062.3	439788.8	8104957.0	-4.7	-20.5	0.3	6	0
7113	5726.2	440057.8	8104799.5	-2.8	-14.8	0.2	0	0
7313	1400.9	433073.7	8100194.0	-3.1	-21.2	0.1	0	0
7414	2739.8	433220.8	8100010.5	-7.0	-28.0	0.3	4	0
7713	4241.8	435091.8	8100202.0	-1.6	-13.9	0.1	0	0
8513	2483.0	456251.2	8110120.5	-1.6	-7.7	0.2	11	0
10414	1249.6	458817.7	8106139.0	-1.6	-10.1	0.1	4	0

TWIN MINING CORPORATION
EM ANOMALY LIST
BLOCK SHERER (fr: 4310 Hz)

LINE	FID	UTMX (m)	UTMY (m)	INP. (ppm)	QUAD. (ppm)	COND. (s)	DEPTH (m)	CODE
-30251	867.9	447169.1	8096202.0	-1.5	-10.2	0.0	0	0
103	1941.3	446117.9	8095905.5	-1.1	-10.9	0.0	0	0
204	1678.0	447228.1	8096294.5	-3.2	-21.0	0.1	0	0
204	1711.7	446223.8	8095675.0	-0.6	-7.7	0.0	0	0
213	1538.2	447158.8	8096047.5	-1.2	-13.0	0.0	0	0
304	2029.7	447094.2	8095875.0	-0.3	-5.2	0.1	0	0
1003	3254.5	445224.7	8092768.5	-1.2	-10.5	0.0	0	0

TWIN MINING CORPORATION
EM ANOMALY LIST
BLOCK ANO-9 (fr: 4310 Hz)

LINE	FID	UTMX (m)	UTMY (m)	INP. (ppm)	QUAD. (ppm)	COND. (s)	DEPTH (m)	CODE
502	2612.2	439559.1	8104755.0	-0.8	-5.5	0.1	0	0
611	2496.0	439593.4	8104786.5	-0.7	-5.6	0.1	0	0

TWIN MINING CORPORATION
EM ANOMALY LIST
BLOCK A (fr: 4310 Hz)

LINE	FID	UTMX (m)	UTMY (m)	INP. (ppm)	QUAD. (ppm)	COND. (s)	DEPTH (m)	CODE
202	4736.1	454733.1	8145515.0	-0.9	-4.7	0.1	0	0
301	4264.2	454938.3	8146201.0	-2.1	-11.0	0.1	0	0
402	3650.8	455099.8	8151009.5	-1.9	-12.2	0.1	1	0
402	3773.5	455136.6	8146781.0	-1.9	-6.8	0.2	25	0
402	3789.5	455132.3	8146272.5	-0.8	-5.9	0.1	0	0
402	3805.9	455120.8	8145753.5	-3.0	-9.6	0.3	9	0
501	3257.7	455337.5	8146028.5	-1.6	-4.7	0.3	23	0
501	3273.7	455322.8	8146629.5	-1.4	-5.1	0.1	0	0
501	3402.0	455346.7	8150991.5	-3.1	-14.7	0.2	0	0
602	2639.4	455514.1	8150888.0	-2.5	-11.7	0.1	4	0
602	2786.5	455544.7	8146022.0	-12.5	-45.8	0.3	2	0
602	2799.7	455545.7	8145615.0	-1.1	-4.6	0.1	0	0
701	1938.6	455753.8	8145981.0	-13.6	-24.8	1.1	13	0
701	1943.4	455750.4	8146173.0	-8.9	-14.2	0.8	2	0
711	2305.0	455721.3	8146008.0	-11.1	-22.6	0.8	2	0
802	1291.6	455940.5	8152683.5	-1.6	-4.6	0.3	19	0
802	1478.7	455948.9	8146127.0	-7.0	-16.1	0.5	0	0
802	1482.3	455951.2	8146006.0	-12.0	-23.3	0.8	0	0
802	1514.3	455952.7	8144905.0	-0.9	-6.5	0.1	0	0
901	1008.8	456110.9	8144991.0	-0.4	-6.8	0.1	0	0
901	1039.9	456118.5	8146140.0	-7.0	-19.2	0.4	0	0
901	1064.3	456116.1	8147038.0	-1.9	-11.6	0.1	0	0
901	1123.9	456173.4	8149085.5	-0.7	-6.9	0.1	0	0
901	1225.0	456126.2	8152828.0	-1.6	-6.9	0.2	0	0

APPENDIX B

MAGNETIC ANOMALY LIST

MAGNETIC ANOMALIES OBSERVED

Anomaly	Line Numb er	x (Nad 27)	y (Nad 27)	Approxim ate Diameter (metres)	Maximum Amplitude (nT)	Mag sensor to source (metres)	Source Depth (metres)
*Jackson-E	3503	459180.94	8128295.00	120/500	34	25	0
*Jackson-W (Freightrain)	7801	459134.66	8128287.00	100/300	38	29	0
Ano1-E	2804	465652.59	8131993.50	100	2.0	N/A	N/A
	30011	465860.00	8131840.00	100	2.0		
Ano1-W	30112	465829.00	8132077.00	150	1.25		
Ano2-E	3004	463975.81	8130440.00	100	0.35	N/A	N/A
Ano2-W	weak,						
*Ano3-E	3304	463388.34	8129228.50	140	19	47	16
*Ano3-W	26612	463453.22	8129167.50	100	20	38	18
Ano4a-E	2903	457658.97	8127109.00	150	1.1	N/A	N/A
Ano4a-W	20512	457594.59	8127152.00	240	0.6		
Ano4b-E	3004	457007.91	8126407.50	90	5.5	N/A	N/A
Ano4b-W	19612	456951.94	8126415.00	300	4.0		
Ano4c	17702	455550.00	8125030.00	613	7.0		
Ano4d	17001	454143.78	8126117.50	633	5.0		
*Ano5-E	2703	451203.25	8123978.00	600	12.41	290	250
*Ano5-W	13301	451141.69	8123945.95	300	12		
Ano6-E	2804	442204.19	8118490.00	300	4.63	N/A	N/A
Ano6-W	2901	442126.91	8118679.00	169	4.00		
Ano7-E	2804	439856.16	8117129.00	130	2	N/A	N/A
Ano7-W	301	439742.34	8117210.20	300	2		
*Ano8a	401	484210.34	8110407.50	50	2	50	22
*Ano8b	201	484096.34	8110398.50	52	4	60	29
*Ano9-E	7214	439736.00	8104340.50	30	16	21	0
*Ano9-W	***						
*Ano10-E	7614	442354.25	8104685.50	60	5	29	0
*Ano10-W	412	442438.63	8104644.00	52	6	30	0
*Sherer-A	204	443672.78	8094195.50	75	17	50	15
*Sherer-B	304	443654.59	8093905.50	75	17	54	15

LEGEND

*** » Flight lines are crooked and do not pass directly on the anomaly .
* » Important anomalies
N/A » Anomalies are so small in amplitude that it is impossible to derive their depth estimate using Peters (1949) method
-E » Means lines are flown at N60^{o}E
-W » Means lines are flown at N30^{o}W

Notes :

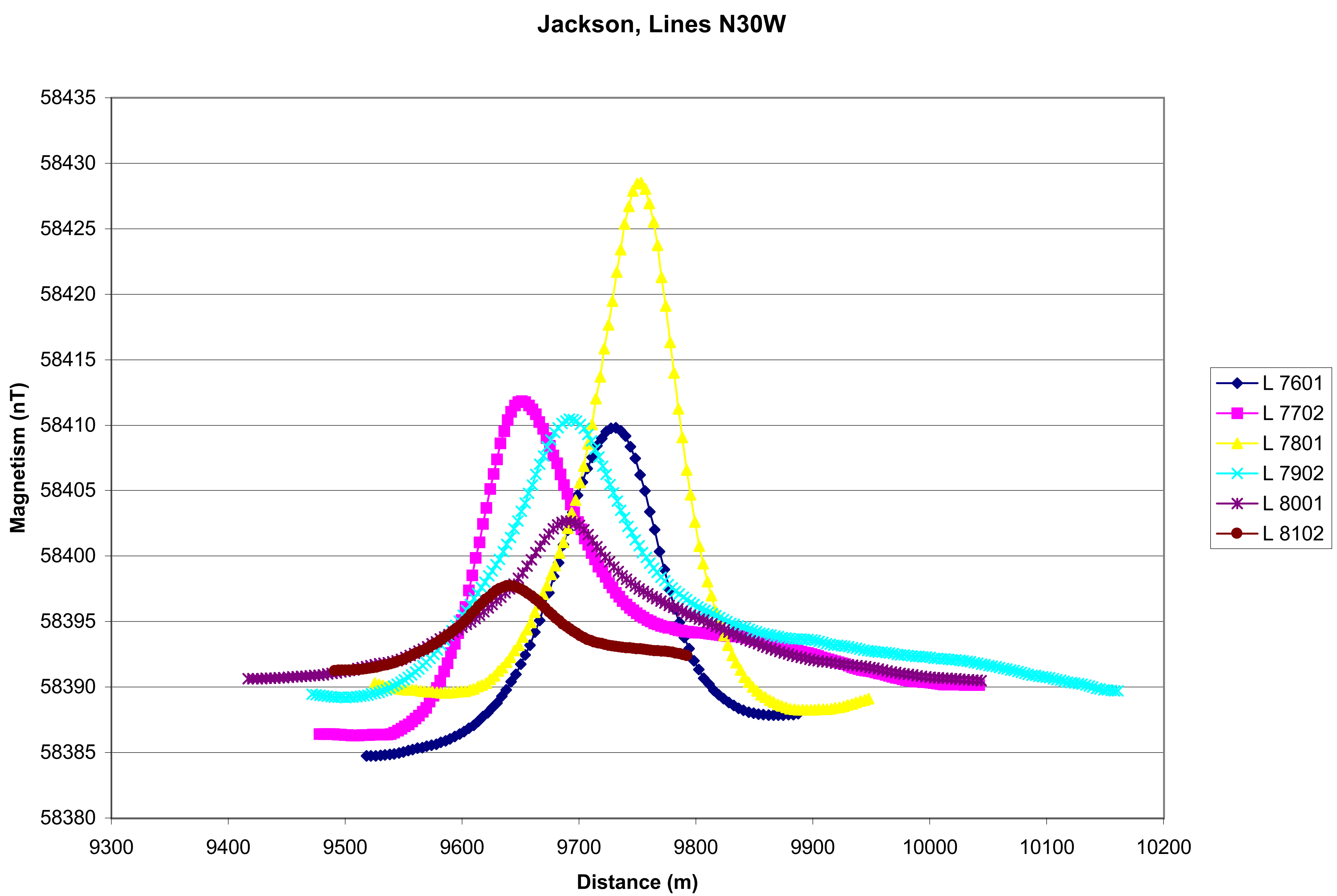
- Average altitude of the magnetic sensor was 30 metres above the ground. Consider a margin error of ±5 metres on the distance of magnetic sensor to source displayed in the table above. Depth estimation where obtained using Peters half slope method (Peters, L.J., 1949. The direct approach to magnetic interpretation and its practical application. Geophysics, vol. 14, p.290-320).

- The whole Jackson anomaly has a diameter which ranges from 300 – 500 m .

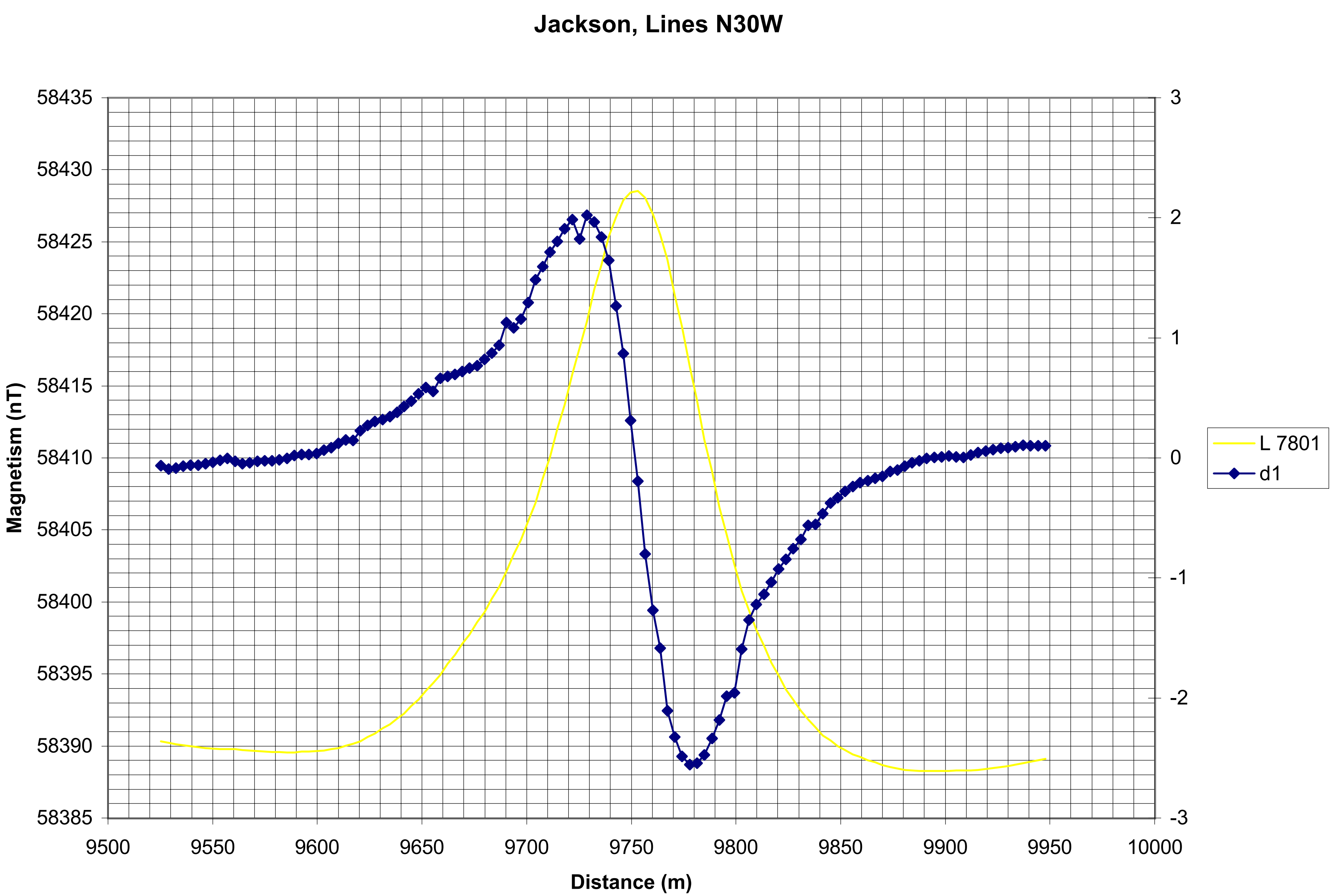
- Jackson anomaly and Ano1 to Ano8 are located on the St-Joseph block.. Ano9 and Ano10 are located on the Bowen block.

APPENDIX C

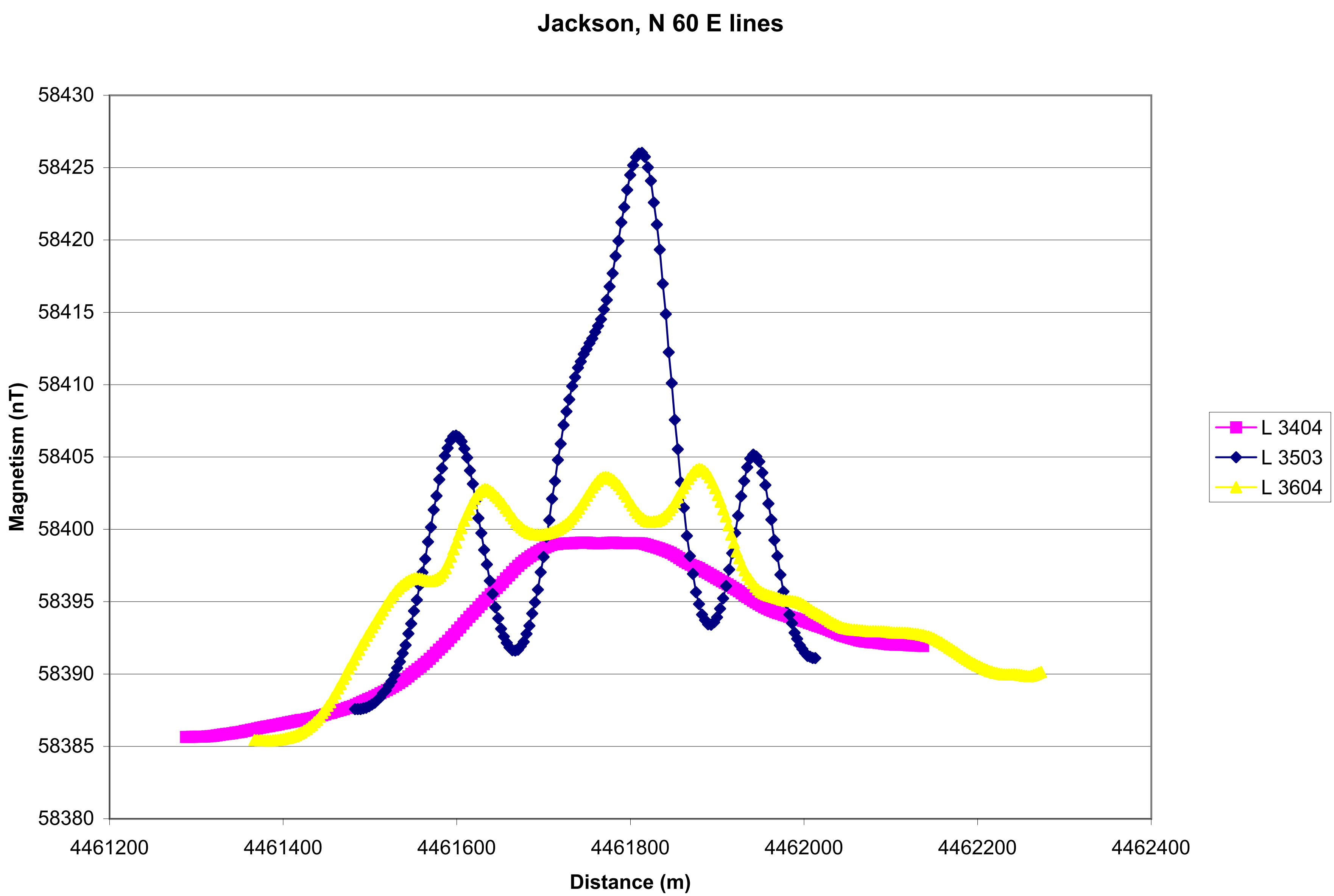
MAGNETIC ANOMALY PROFILES



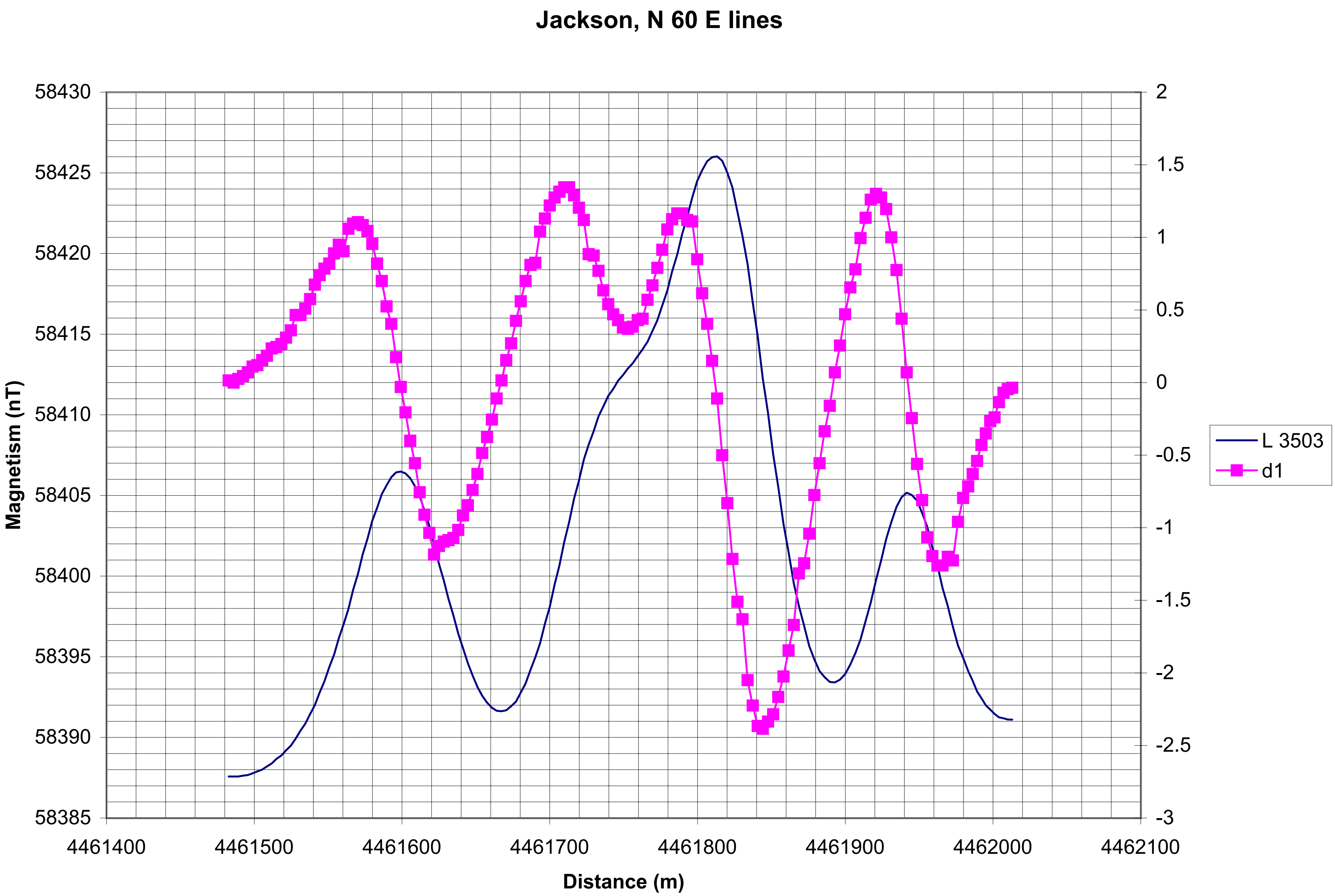
Jackson, Lines N30W
58435
58430
58425
58420
58415
58410
58405
58400
58395
58390
58385
58380
Magnetism (nT)
9300
9400
9500
9600
9700
9800
9900
10000
10100
10200
Distance (m)
L 7601
L 7702
L 7801
L 7902
L 8001
L 8102

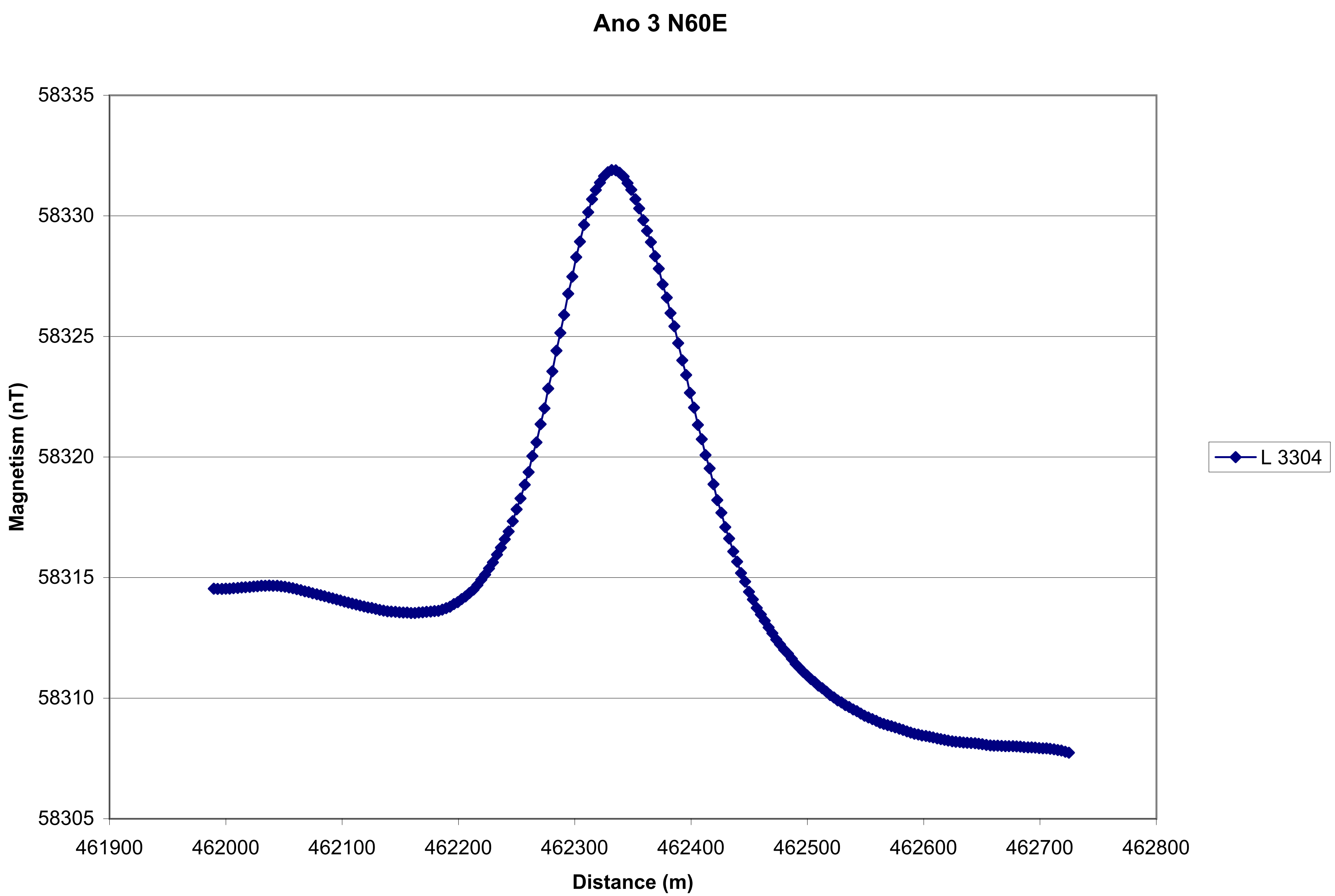


Jackson, Lines N30W
Magnetism (nT)
58435
58430
58425
58420
58415
58410
58405
58400
58395
58390
58385
3
2
1
0
-1
-2
-3
9500
9550
9600
9650
9700
9750
9800
9850
9900
9950
10000
Distance (m)
L 7801
d1

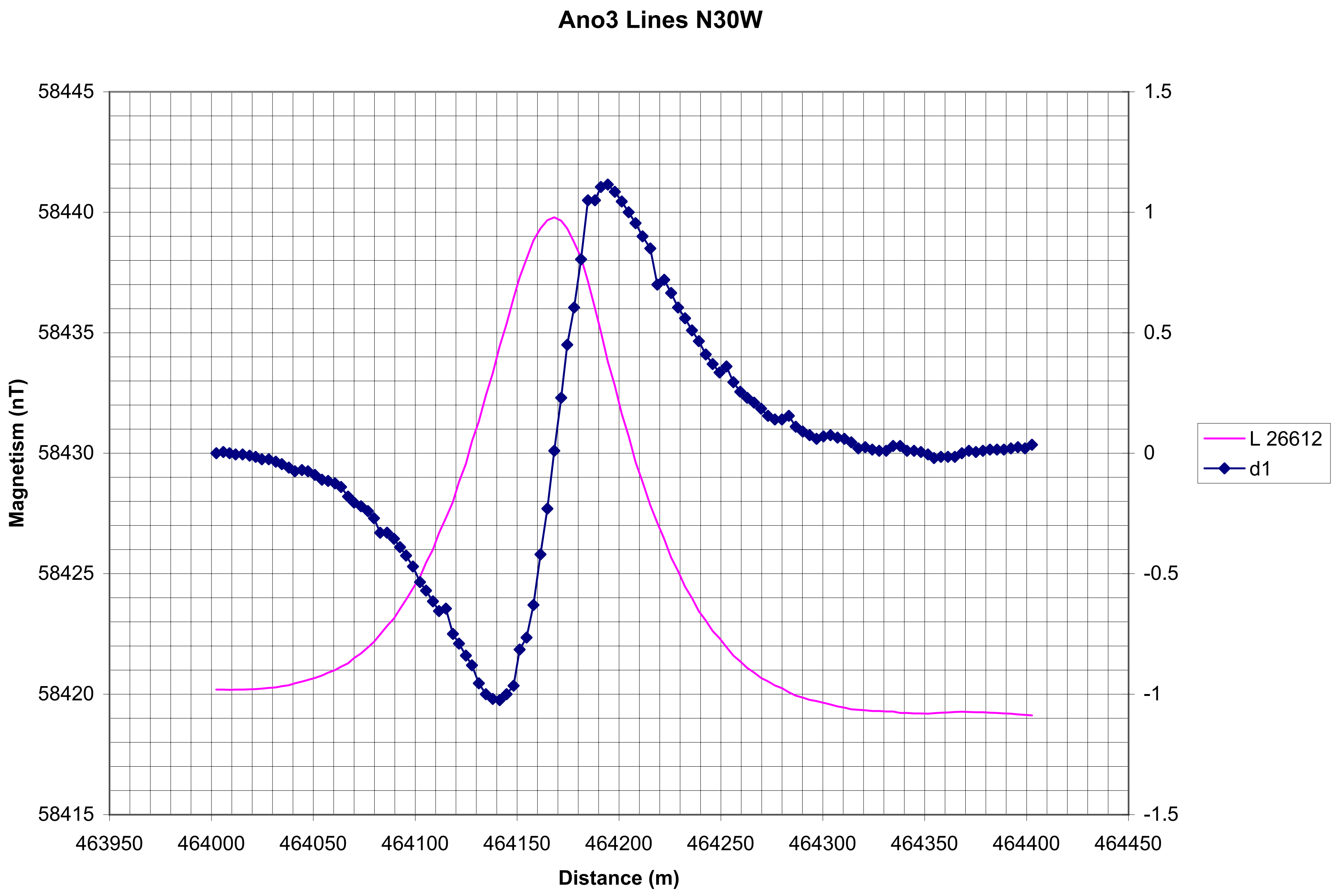


Jackson, N 60 E lines
58430
58425
58420
58415
58410
58405
58400
58395
58390
58385
58380
Magnetism (nT)
4461200
4461400
4461600
4461800
4462000
4462200
4462400
Distance (m)
L 3404
L 3503
L 3604

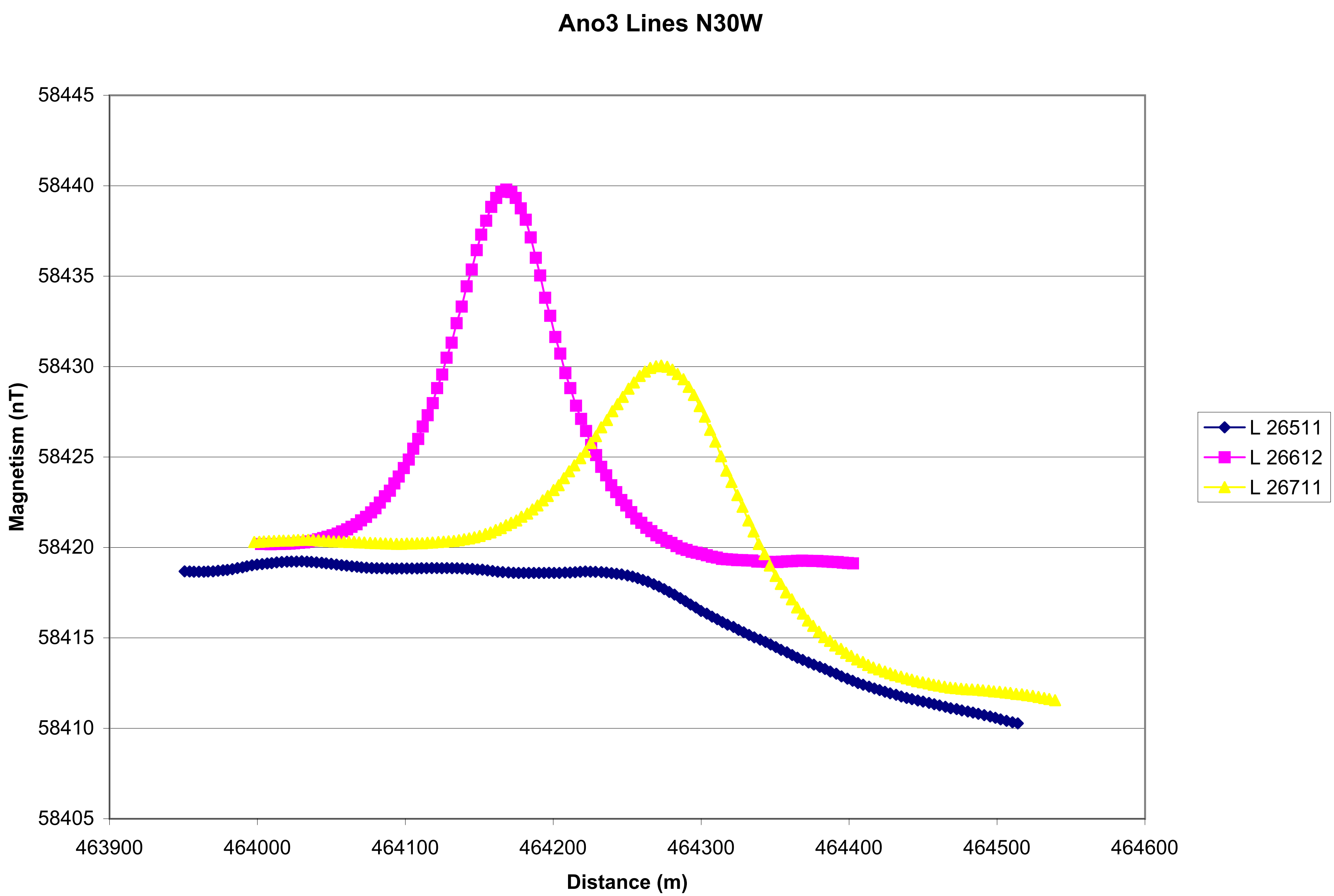

Jackson, N 60 E lines
Magnetism (nT)
Distance (m)
58430
58425
58420
58415
58410
58405
58400
58395
58390
58385
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
4461400
4461500
4461600
4461700
4461800
4461900
4462000
4462100
L 3503
d1



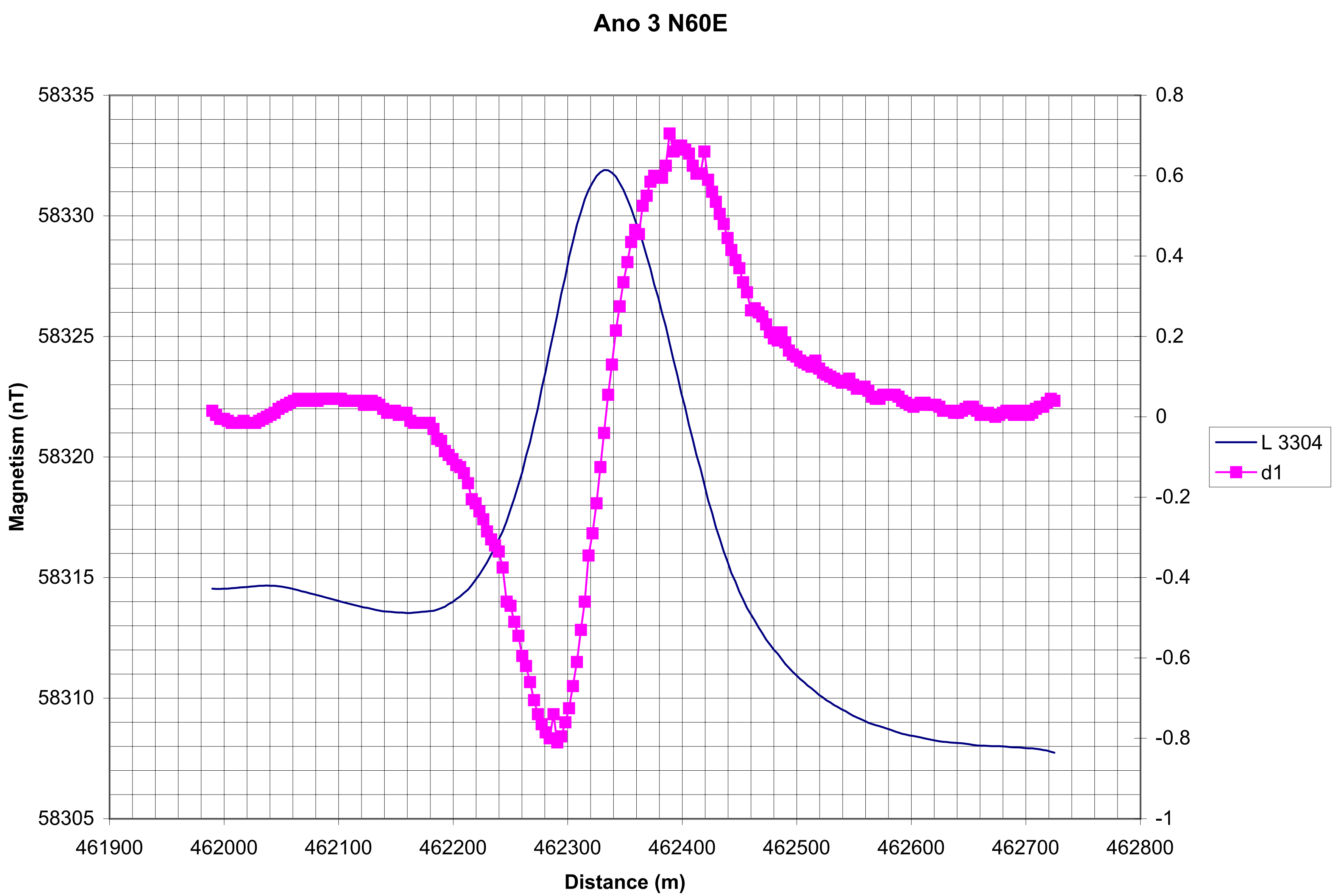
Ano 3 N60E
58335
58330
58325
58320
58315
58310
58305
Magnetism (nT)
461900
462000
462100
462200
462300
462400
462500
462600
462700
462800
Distance (m)
L 3304



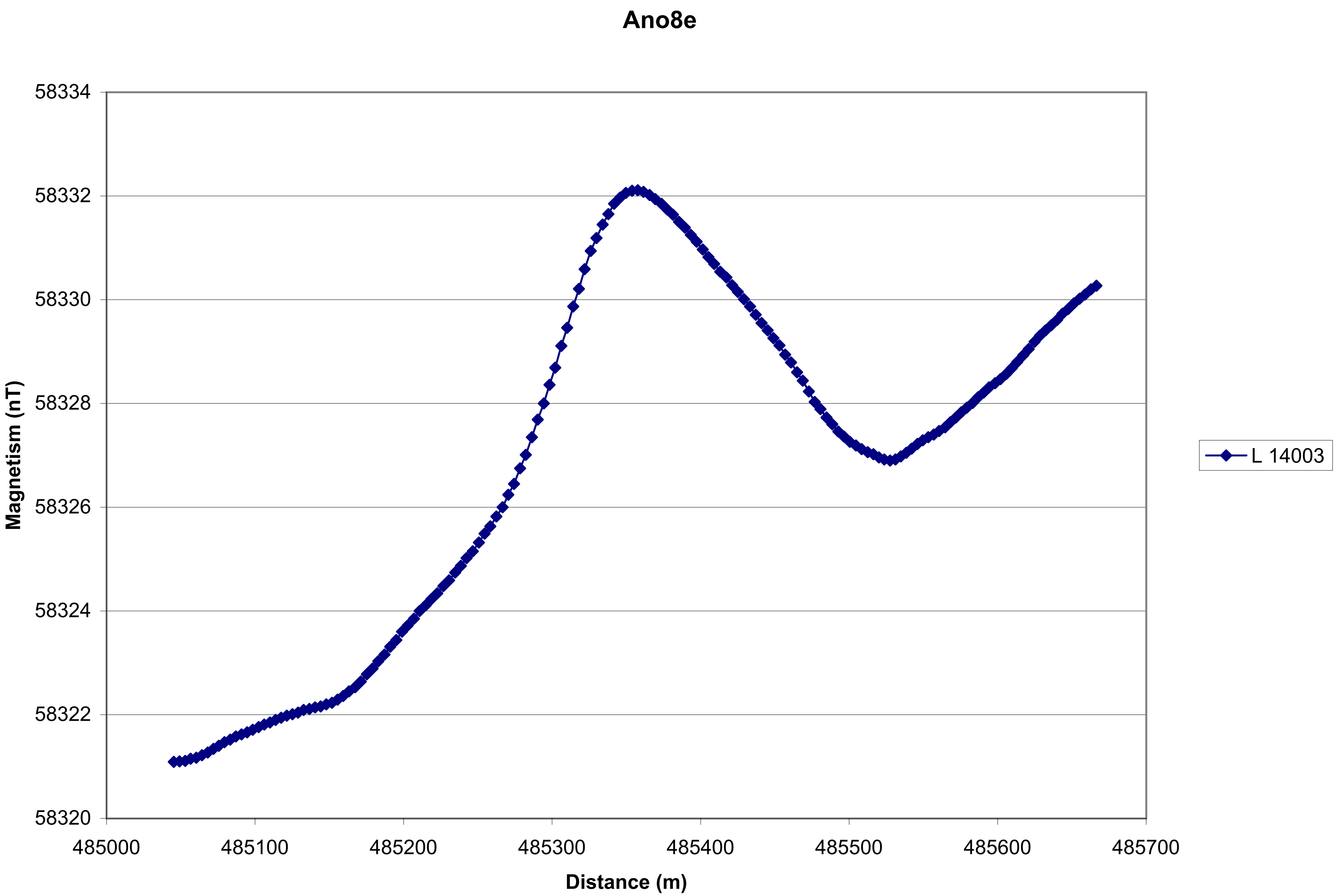
Ano3 Lines N30W
Magnetism (nT)
58445
58440
58435
58430
58425
58420
58415
1.5
1
0.5
0
-0.5
-1
-1.5
463950
464000
464050
464100
464150
464200
464250
464300
464350
464400
464450
Distance (m)
L 26612
d1

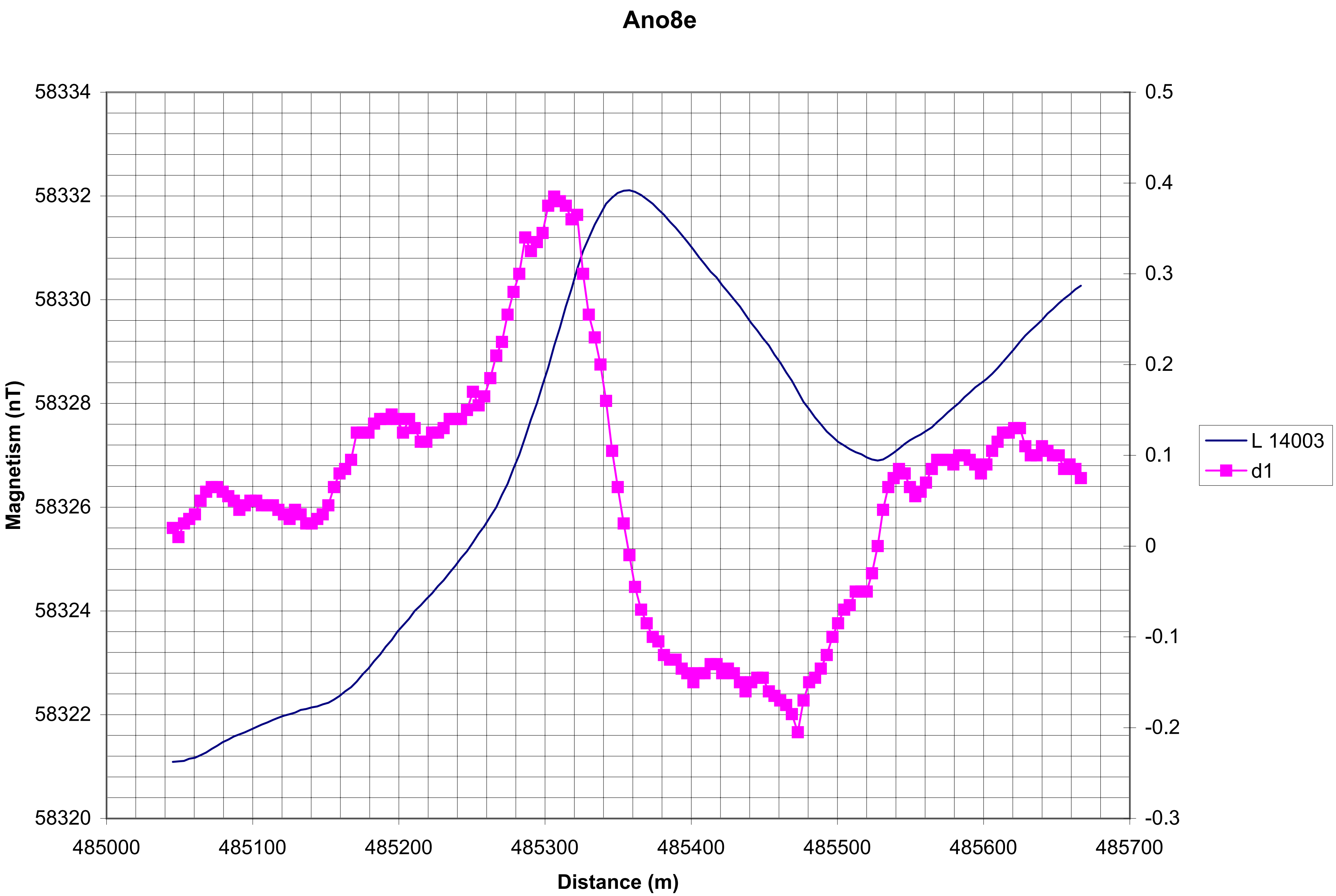


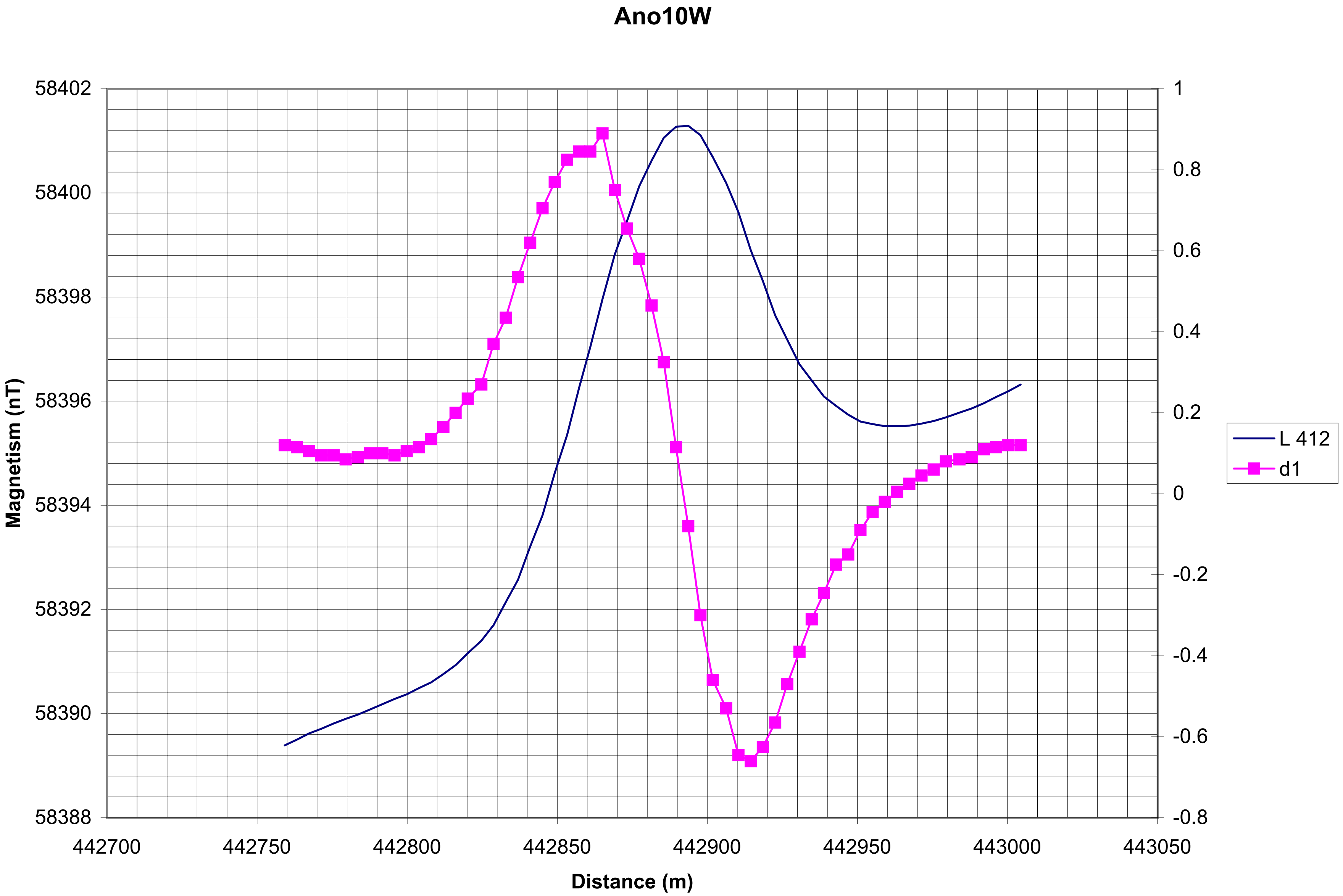
Ano3 Lines N30W
58445
58440
58435
58430
58425
58420
58415
58410
58405
Magnetism (nT)
463900
464000
464100
464200
464300
464400
464500
464600
Distance (m)
L 26511
L 26612
L 26711



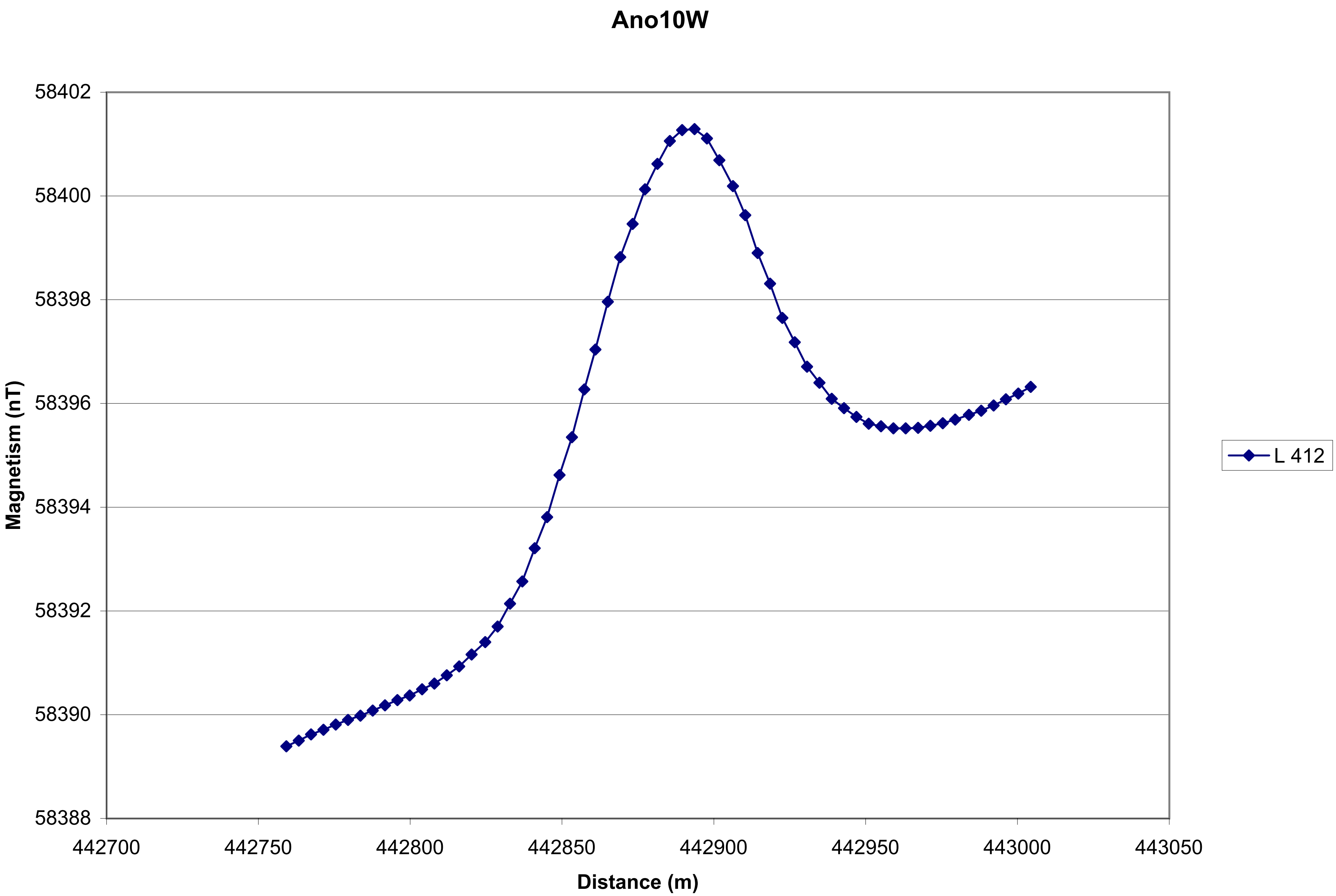
Ano 3 N60E
Magnetism (nT)
58335
58330
58325
58320
58315
58310
58305
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
461900
462000
462100
462200
462300
462400
462500
462600
462700
462800
Distance (m)
L 3304
d1

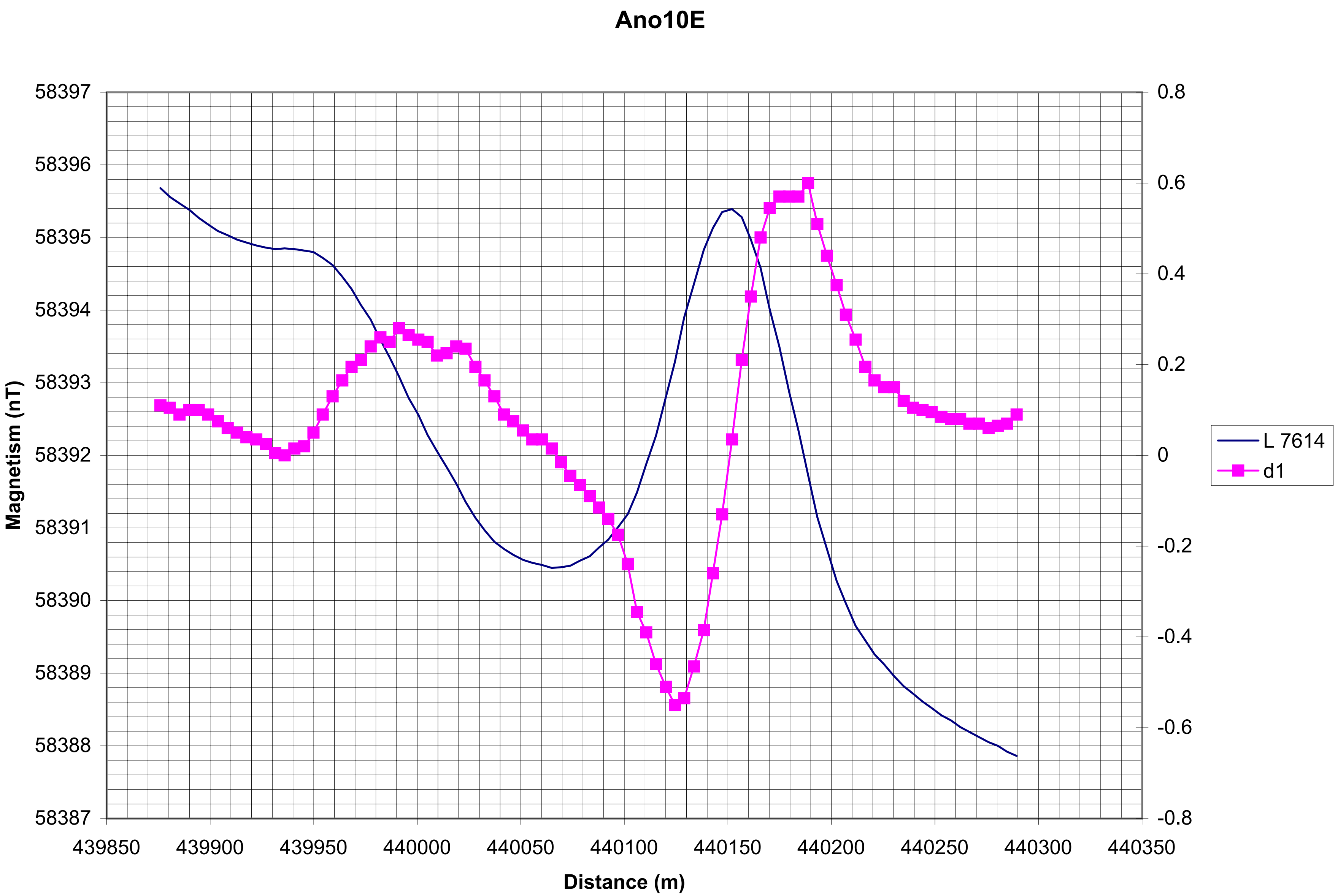

Ano8e
58334
58332
58330
58328
58326
58324
58322
58320
Magnetism (nT)
485000
485100
485200
485300
485400
485500
485600
485700
Distance (m)
L 14003


Ano8e
Magnetism (nT)
58334
58332
58330
58328
58326
58324
58322
58320
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
485000
485100
485200
485300
485400
485500
485600
485700
Distance (m)
L 14003
d1

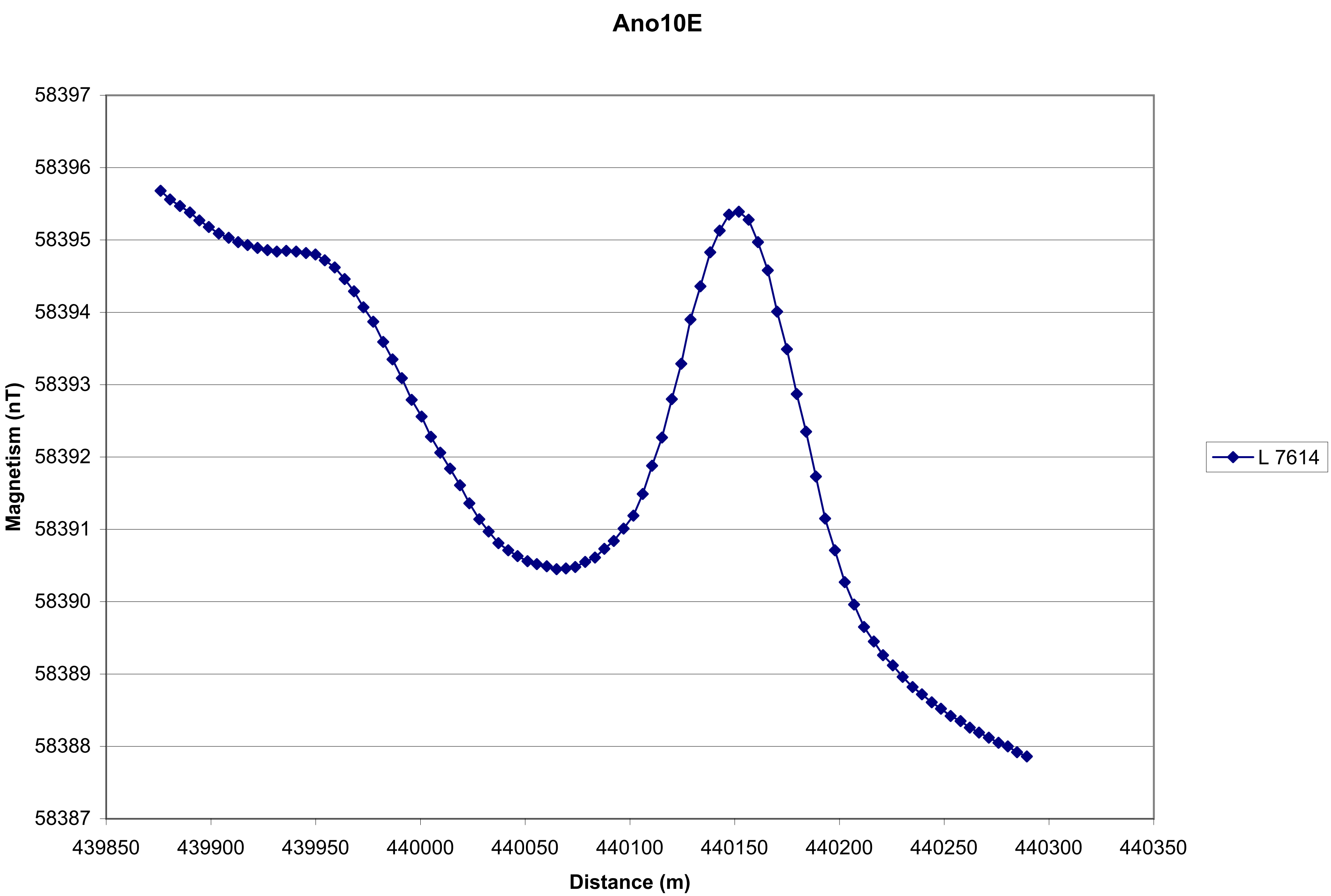


Ano10W
58402
58400
58398
58396
58394
58392
58390
58388
Magnetism (nT)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
442700
442750
442800
442850
442900
442950
443000
443050
Distance (m)
L 412
d1

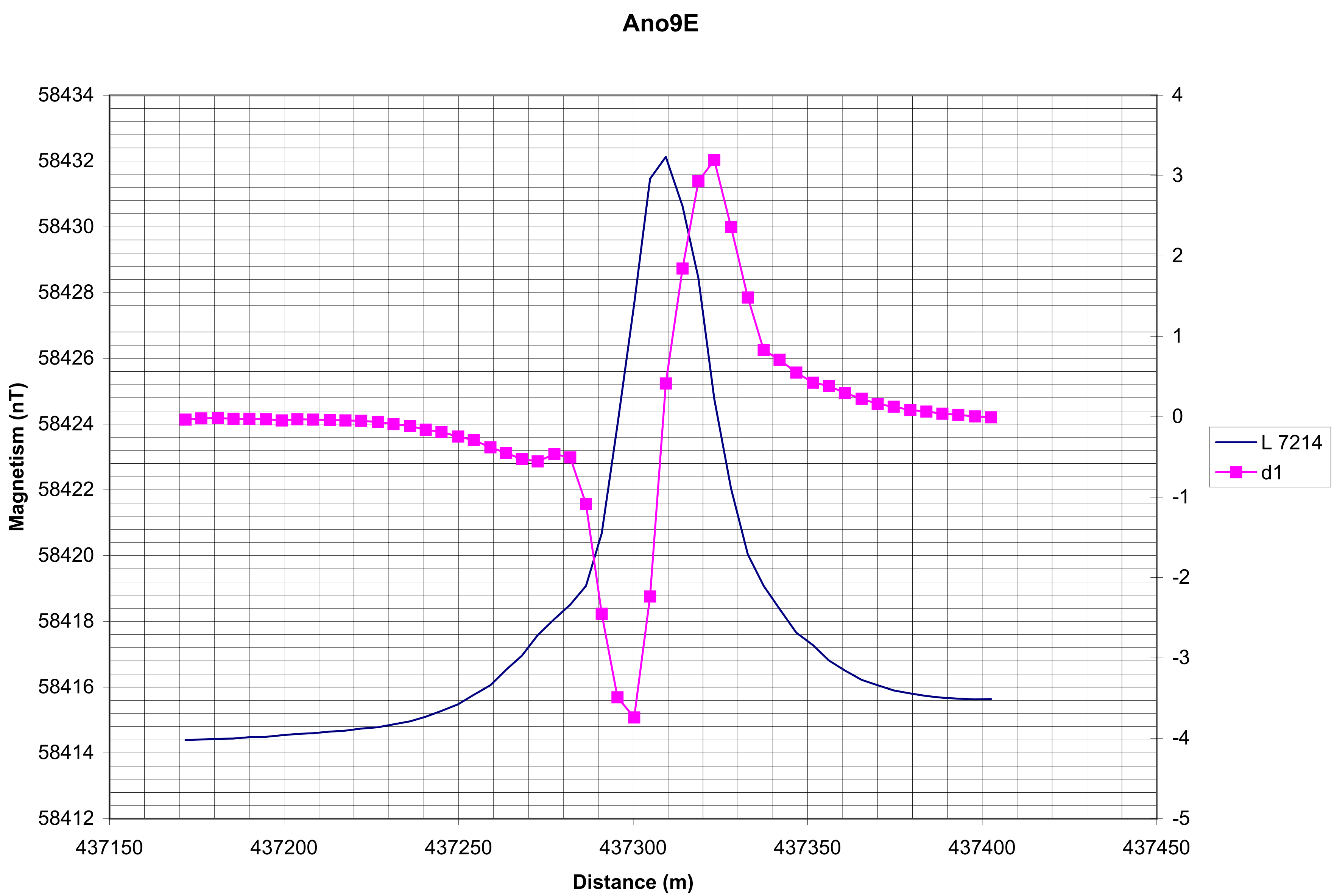

Ano10W
58402
58400
58398
58396
58394
58392
58390
58388
Magnetism (nT)
442700
442750
442800
442850
442900
442950
443000
443050
Distance (m)
L 412


Ano10E
58397
58396
58395
58394
58393
58392
58391
58390
58389
58388
58387
Magnetism (nT)
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
439850
439900
439950
440000
440050
440100
440150
440200
440250
440300
440350
Distance (m)
L 7614
d1

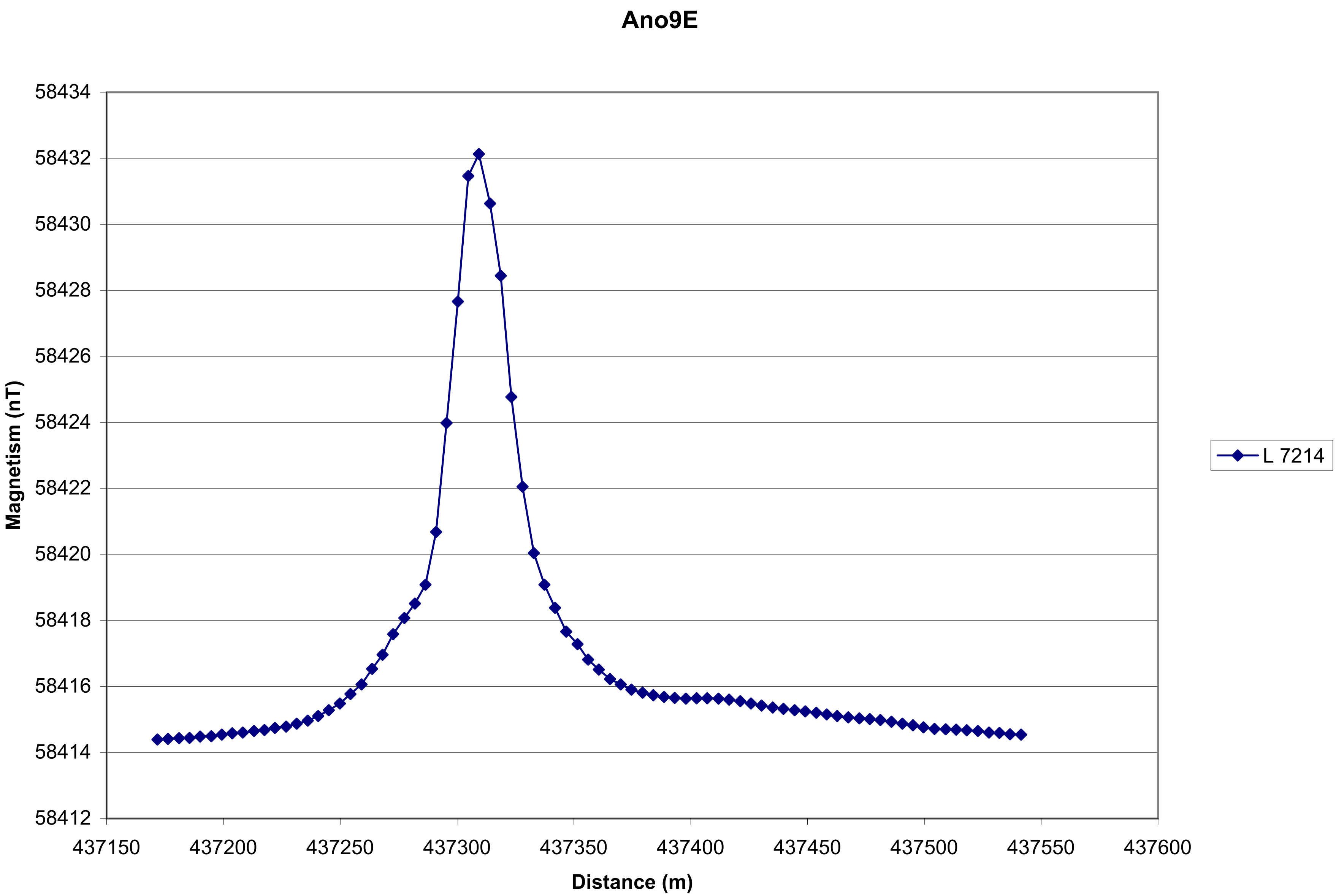
Ano10E

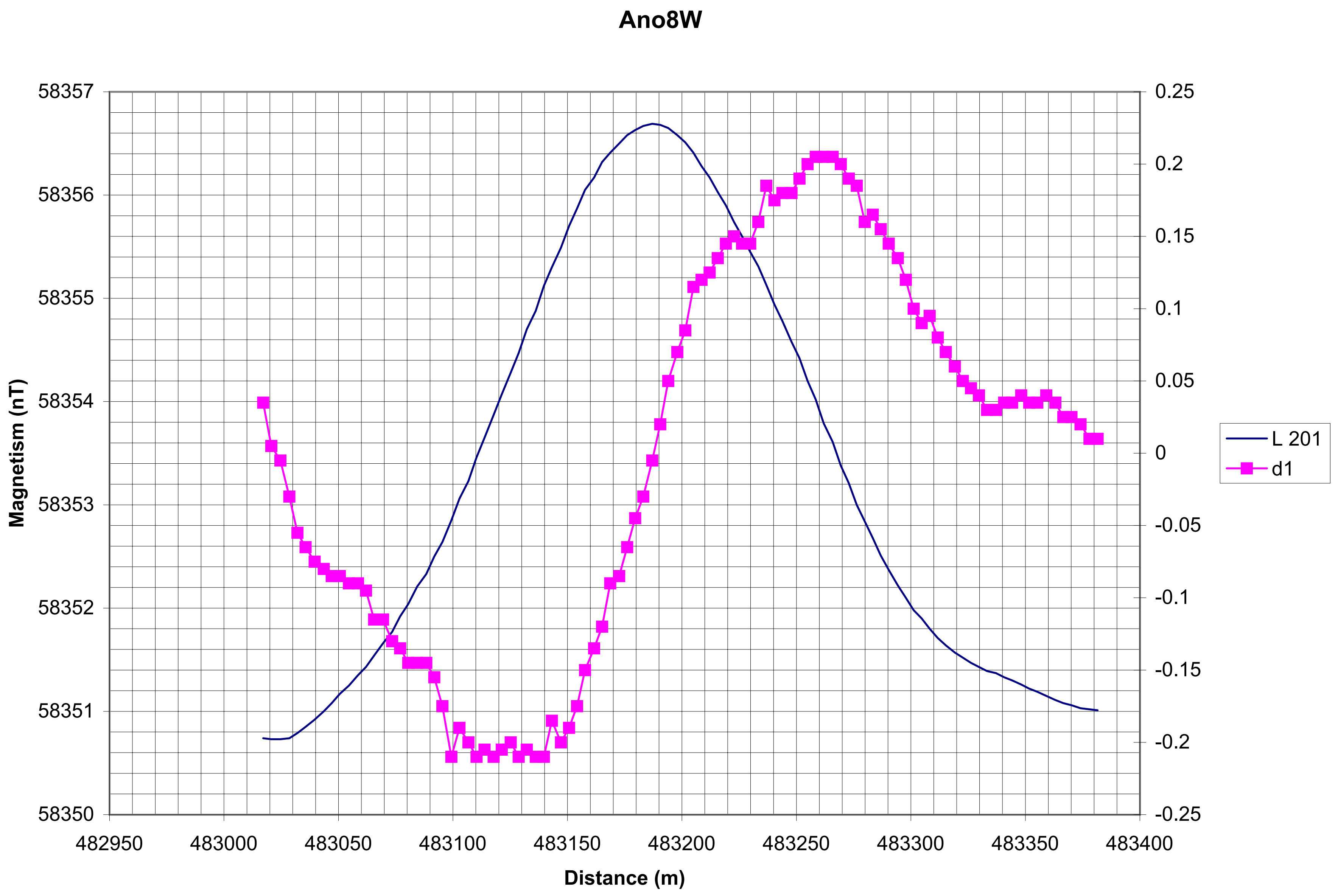


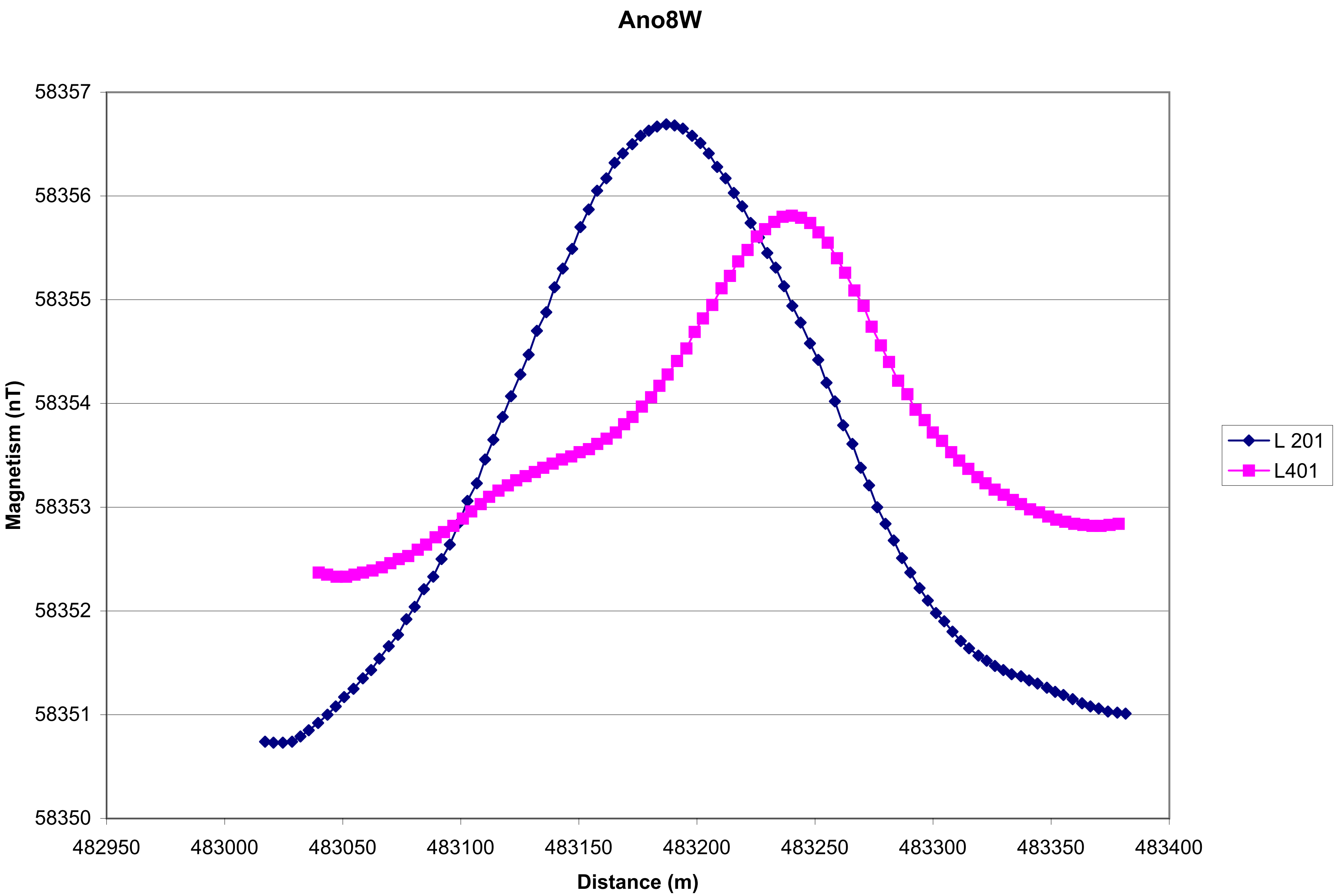
Ano10E
Magnetism (nT)
58397
58396
58395
58394
58393
58392
58391
58390
58389
58388
58387
439850
439900
439950
440000
440050
440100
440150
440200
440250
440300
440350
Distance (m)
L 7614



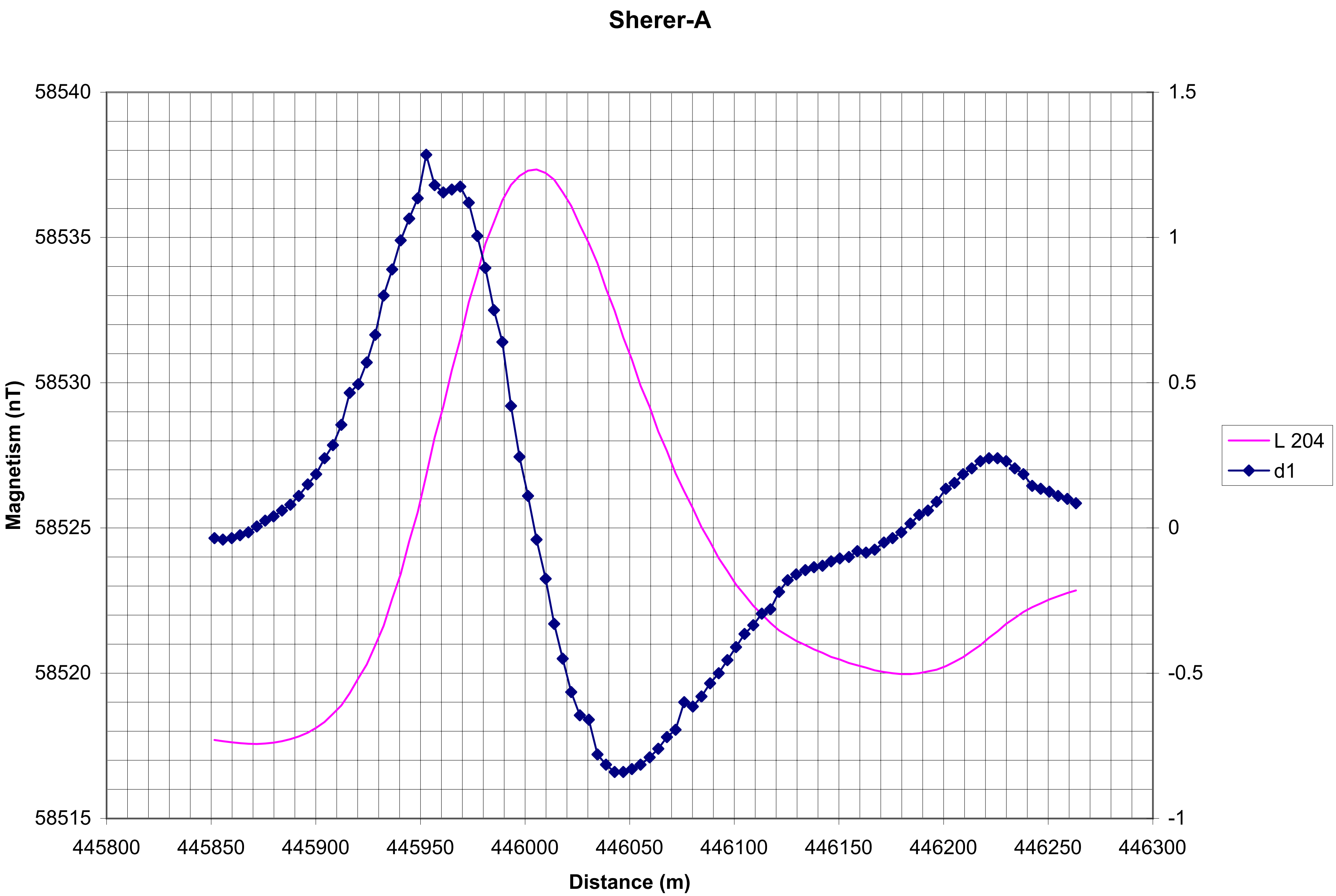
Ano9E
Magnetism (nT)
58434
58432
58430
58428
58426
58424
58422
58420
58418
58416
58414
58412
4
3
2
1
0
-1
-2
-3
-4
-5
437150
437200
437250
437300
437350
437400
437450
Distance (m)
L 7214
d1


Ano9E
58434
58432
58430
58428
58426
58424
58422
58420
58418
58416
58414
58412
Magnetism (nT)
437150
437200
437250
437300
437350
437400
437450
437500
437550
437600
Distance (m)
L 7214

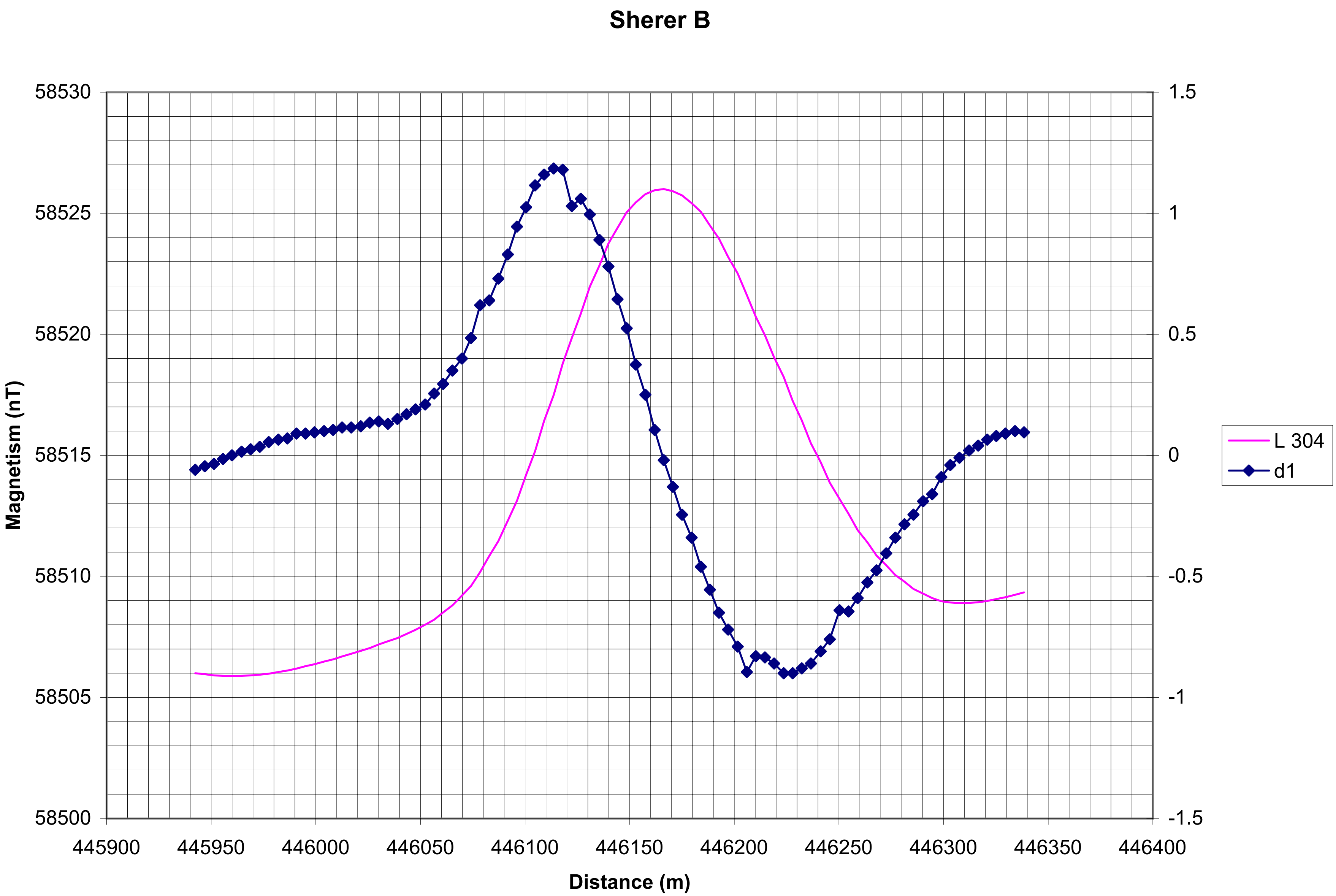

Ano8W
Magnetism (nT)
58357
58356
58355
58354
58353
58352
58351
58350
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
482950
483000
483050
483100
483150
483200
483250
483300
483350
483400
Distance (m)
L 201
d1



Ano8W
58357
58356
58355
58354
58353
58352
58351
58350
Magnetism (nT)
482950
483000
483050
483100
483150
483200
483250
483300
483350
483400
Distance (m)
L 201
L401

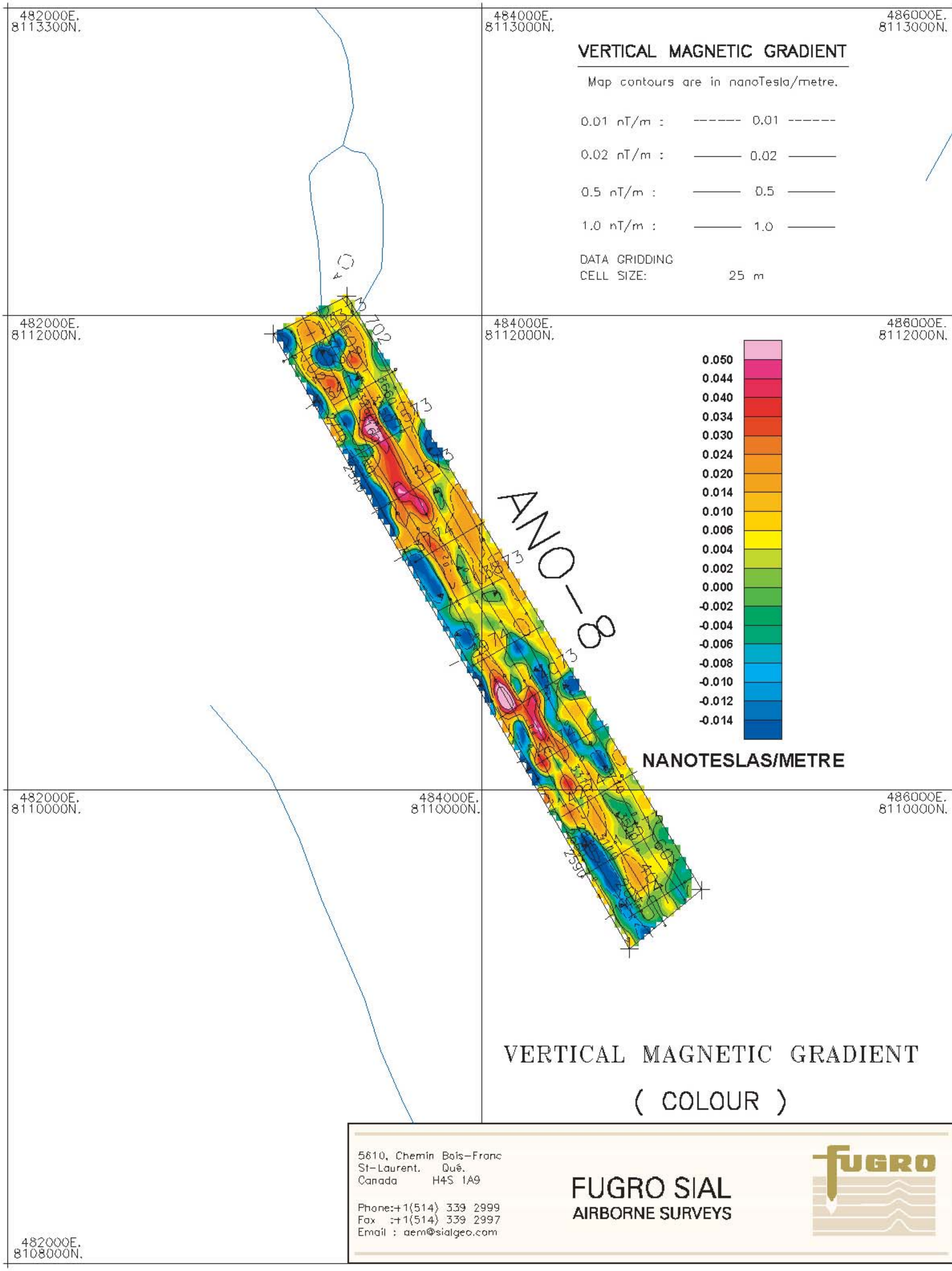


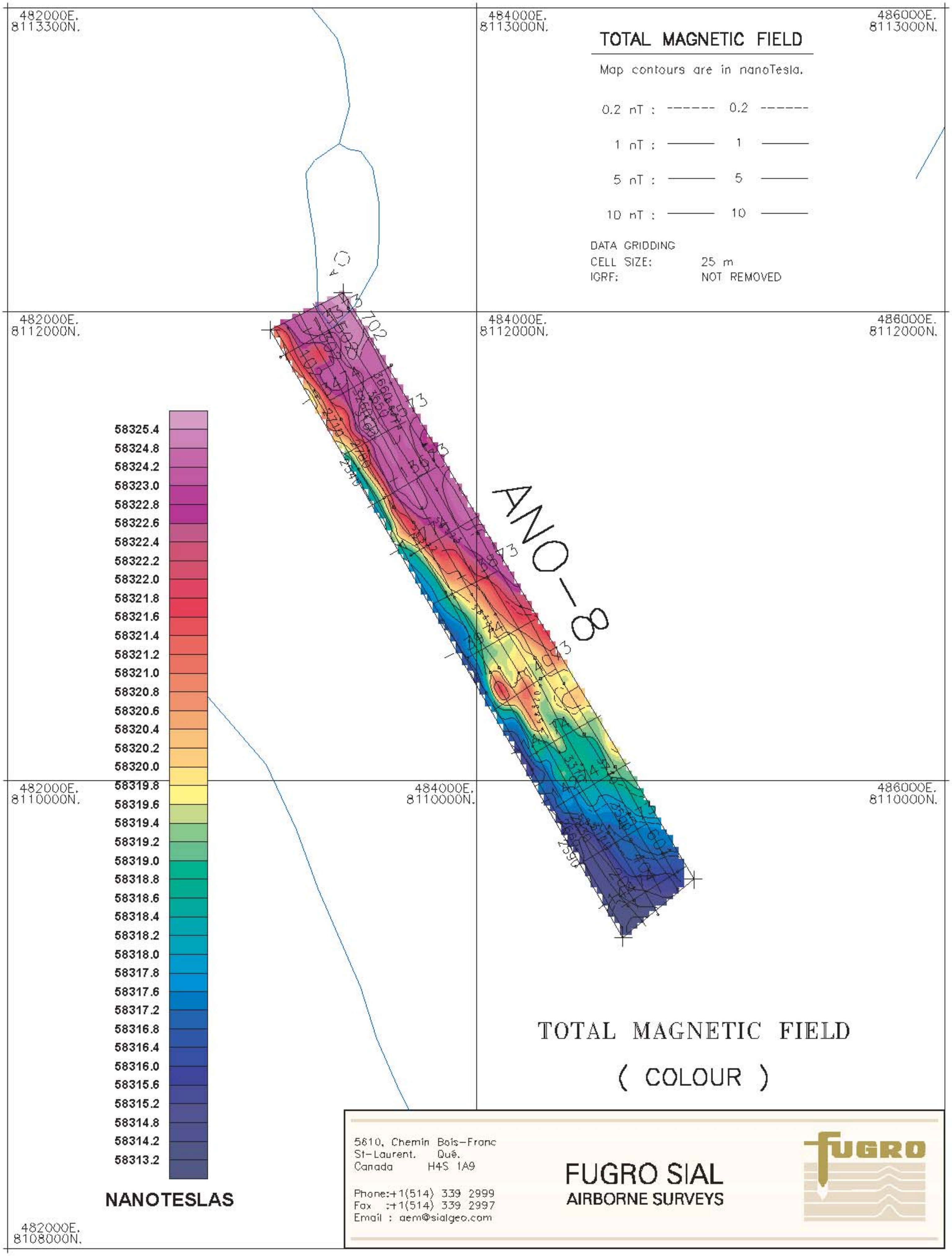
Sherer-A
Magnetism (nT)
58540
58535
58530
58525
58520
58515
1.5
1
0.5
0
-0.5
-1
445800
445850
445900
445950
446000
446050
446100
446150
446200
446250
446300
Distance (m)
L 204
d1


Sherer B
Magnetism (nT)
58530
58525
58520
58515
58510
58505
58500
1.5
1
0.5
0
-0.5
-1
-1.5
445900
445950
446000
446050
446100
446150
446200
446250
446300
446350
446400
Distance (m)
L 304
d1

APPENDIX D

BLOCK ANO-8 MAGNETIC MAPS


482000E. 8113300N.
484000E. 8113000N.
486000E. 8113000N.
VERTICAL MAGNETIC GRADIENT
Map contours are in nanoTesla/metre.
0.01 nT/m : ------ 0.01 ------
0.02 nT/m : ——— 0.02 ———
0.5 nT/m : ——— 0.5 ———
1.0 nT/m : ——— 1.0 ———
DATA GRIDDING
CELL SIZE: 25 m
482000E. 8112000N.
484000E. 8112000N.
486000E. 8112000N.
ANO-8
0.050
0.044
0.040
0.034
0.030
0.024
0.020
0.014
0.010
0.006
0.004
0.002
0.000
-0.002
-0.004
-0.006
-0.008
-0.010
-0.012
-0.014
NANOTESLAS/METRE
482000E. 8110000N.
484000E. 8110000N.
486000E. 8110000N.
482000E. 8108000N.
VERTICAL MAGNETIC GRADIENT
(COLOUR)
5810, Chemin Bois-Franc
St-Laurent, Qué.
Canada H4S 1A9
Phone:+1(514) 339 2999
Fax :+1(514) 339 2997
Email : aem@sialgeo.com
FUGRO SIAL
AIRBORNE SURVEYS
FUGRO



TOTAL MAGNETIC FIELD

(COLOUR)

5810, Chemin Bois-Franc
St-Laurent, Qué.
Canada H4S 1A9

Phone:+1(514) 339 2999
Fax :+1(514) 339 2997
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AIRBORNE SURVEYS