

Aeromagnetic Modelling - Nelson Bay Deposit 2010

Summary

Magnetic modelling of aeromagnetic survey data covering the Nelson Bay deposit has been carried out. The focus has been on determination of magnetic source depths, which we assume is depth to the top of the magnetite body. Tesla Airborne Geoscience Pty Ltd were contracted to fly a semi-regional airborne survey covering the area of interest in 1996. The Arthur-Pieman aeromagnetic/radiometric survey was flown along east west lines with 200 m line spacing at a nominal flight height of 90 m, using a Cessna 210 platform.

Remanent magnetization (and anisotropy of magnetic susceptibility?) has a major influence on magnetic anomaly shapes and significantly complicated modelling, resulting in ambiguity in source dip estimation. Magnetic profiles have been inverted using a single tabular body using the Geosoft Magmod3 software. This provides a quick estimate of body parameters but is limited to a single anomaly. Modelling/inversion has been carried out with and without remanence. Results including remanence are listed in Table 1. Susceptibility values are in cgs units. Source depths should be viewed with caution, as estimates of remanence are not consistent from profile to profile.

Magnetic source depths for the main northern body range from 28.4 to 218 m with depths increasing rapidly to the north. Line 100910 appears to be unusually shallow and had the highest magnetic susceptibility. The critical question is whether the increased source depth to the north is due to plunge, increased cover or deep oxidation.

Magnetic source depths for the southern body are relatively shallow but calculated susceptibility values are low compared to the main northern body, which may tend to downgrade this body. Line 100980 has the highest amplitude on the southern anomaly but calculated susceptibility is still low compared to the northern body.

The low susceptibility value for line 100910 (the highest amplitude anomaly on the western body) compared to the northern body and the limited strike extent tend to downgrade this body.

Modelling/inversion of selected anomalies indicates significant variation along the strike length of the deposit. Some profiles require the addition of a deeper body below the shallow iron deposit. Depth extent estimates are also variable with some anomalies indicating limited depth extent but others indicating an infinite depth tabular body.

Overall I suggest it might be worth drilling an additional hole to the north on line 100890 for the northern body but the southern and western bodies are unlikely to contribute significantly to the viability of the project.

As a first step, a comprehensive phased program of integrating the magnetic data with surface mapping is recommended. This should be supported by susceptibility measurements on drill core.

A petrography study and some rock magnetic property measurements are recommended to help understand the nature of the Iron Deposit and subsequent alteration. Measurements of remanent magnetization on drill core would help resolve the ambiguity in dip determination. This could be followed by further analysis of magnetic profile data to help to classify magnetic anomalies.

Consideration should be given to a low level cropduster aeromagnetic survey as an alternative to additional ground magnetic surveys.

Magnetic Modelling

For discrete anomalies, inversion programs can provide quick solutions without the need to prepare complex input model data. In more complex situations, multi-body forward modelling and inversion are necessary. Interference from adjacent anomalies limits the effectiveness of modelling and inversion as the information on the flanks of anomalies is critical for determining depth extent.

Modelling problems are often intrinsic, reflecting the following problems:

1. Fundamental ambiguity of potential field interpretation,
2. The insensitivity of magnetic data to depth extent,
3. The poor accuracy of magnetic source depth determination for certain combination of depth/width
4. The use of simple geometric models such as the dipping tabular body.

In many cases, forward models based on drilling results and using simple models fail to match the observed magnetic profiles in both anomaly shape and amplitude. The most likely explanation is that the source geometry is more complex than the simple model used with irregular shapes and variable magnetization likely. It would be possible to produce more realistic models using a cell-based approach but this would be time consuming

In the absence of any constraints, source widths are likely to be only approximate. Magnetic anomaly amplitude is proportional to the product of magnetization (susceptibility) and source width, so without constraints from mapping or drilling, it is not possible to determine either uniquely.

The magnetic expression of rocks is complex and successful interpretation requires a good understanding of the rock and mineral magnetism processes involved and the dependence of magnetic anomaly amplitude and shape on formation dip.

The three types of rock magnetism are:

- ⇒ Isotropic magnetic susceptibility
- ⇒ Anisotropic magnetic susceptibility
- ⇒ Remanent magnetisation

The resultant magnetisation is complex and amplitudes and anomaly shapes are strongly influenced by dip.

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Prepared for Shree Minerals

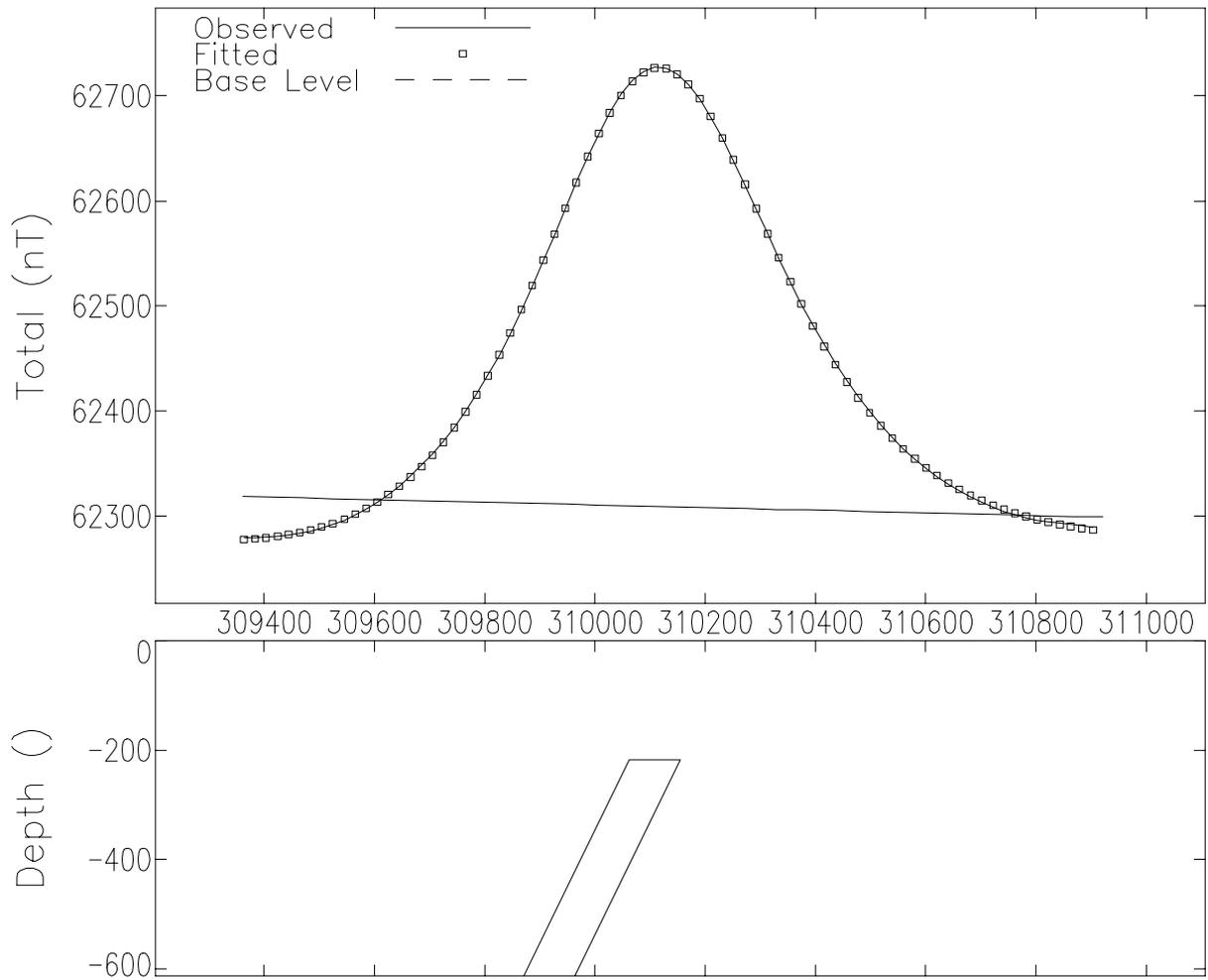
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100881L 01



MODEL PARAMETERS:

Model Type		Tabular2
Depth	F	218
Half Width	F	46.4
Half Length	X	770
Offset	X	0
Dip	F	116 deg
Thickness	F	519
Susceptibility	F	0.00513 emu
Remnance Ratio	F	4.464201
Remnance Incl	F	-34 deg
Remnance Decl	X	0 deg
Main Position	F	310107.9
Cross Position	X	5442982
Base Level	F	62309.19 nT
Base Slope	F	-.0125044 nT/
Base Curvature	X	0 nT/2

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

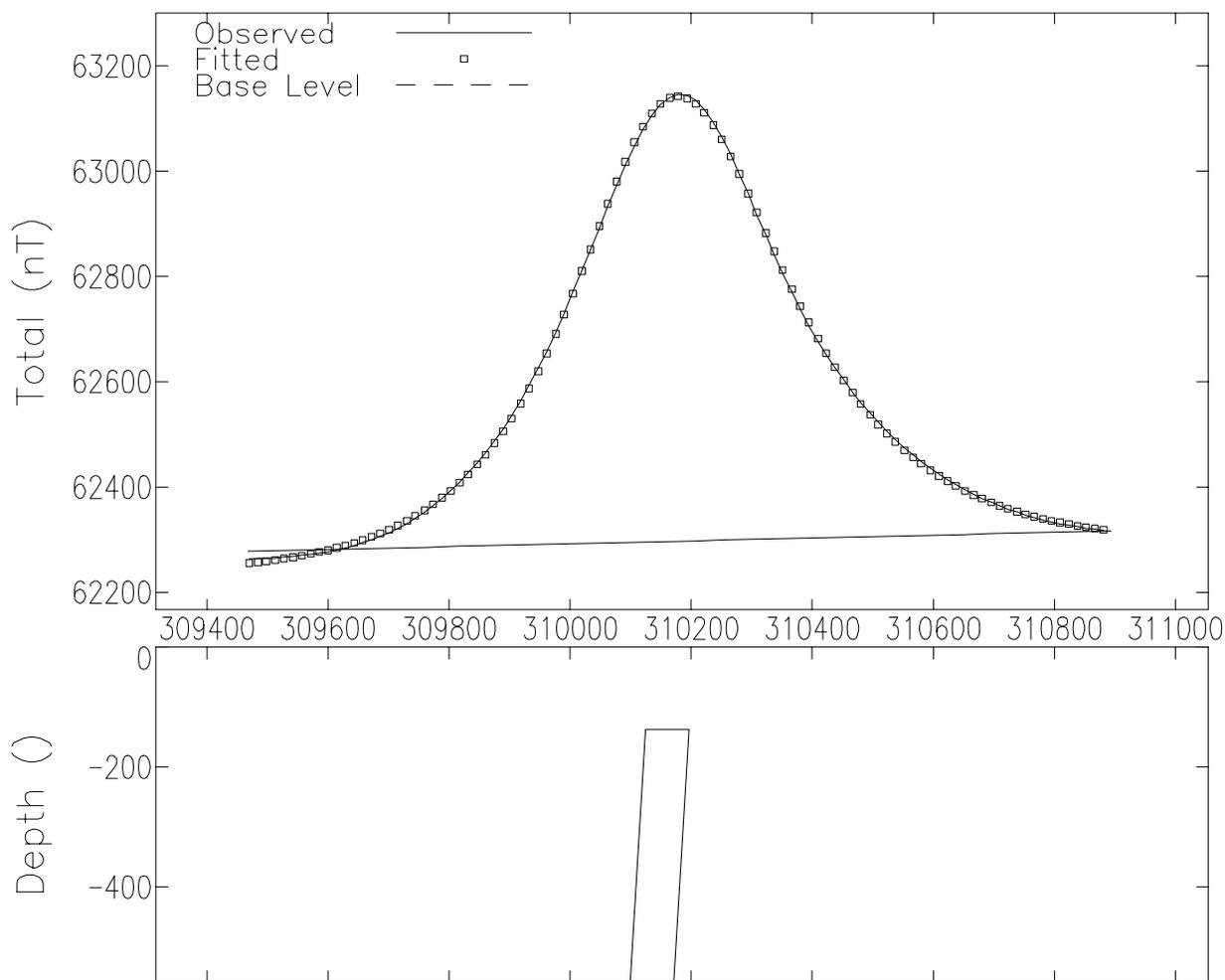
Field Strength	62000 nT
Inclination	-72 deg
Declination	0 deg

COORDINATES:

Sensor Height	80
Strike Perp	70 deg
Line Direction	90 deg
Main Direction	90 deg
Main Offset	
Cross Direction	0 deg
Cross Offset	

Figure 1 Magmod3 inversion line 100881, northern body

100890L 01



MODEL PARAMETERS:

Model Type		Tabular2
Depth	F	137
Half Width	F	36.4
Half Length	X	706
Offset	X	0
Dip	F	93 deg
Thickness	F	912
Susceptibility	F	0.00786 emu
Remnance Ratio	F	2.462347
Remnance Incl	F	-71 deg
Remnance Decl	X	0 deg
Main Position	F	310160.3
Cross Position	X	5442783
Base Level	F	62296.43 nT
Base Slope	F	.0271388 nT/
Base Curvature	X	0 nT/2

(F-fitted, X-fixed, L-limit)

GEOMAGNETIC FIELD:

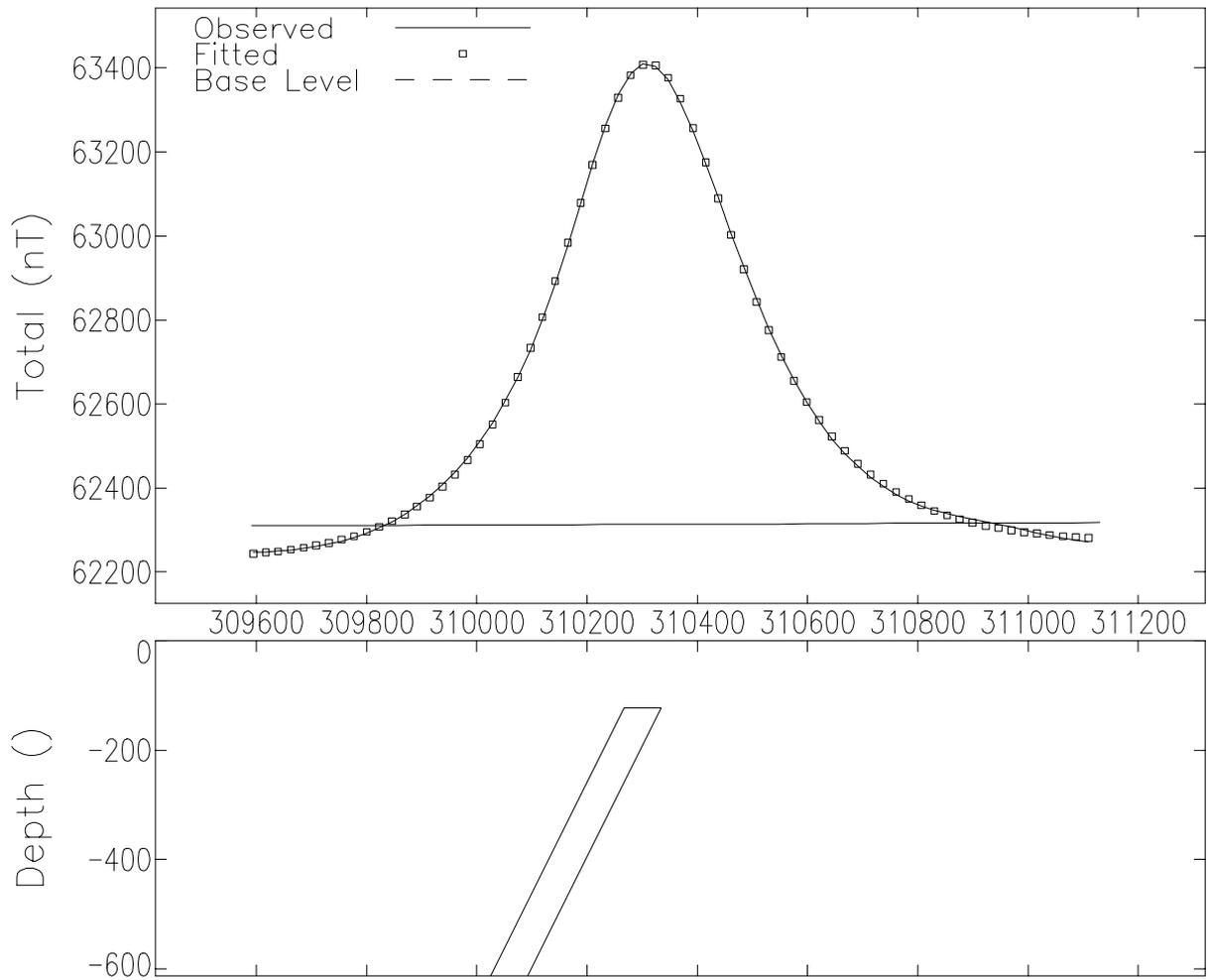
Field Strength	62000 nT
Inclination	-72 deg
Declination	0 deg

COORDINATES:

Sensor Height	80
Strike Perp	70 deg
Line Direction	90 deg
Main Direction	90 deg
Main Offset	
Cross Direction	0 deg
Cross Offset	

Figure 2 Magmod3 inversion line 100890, northern body

100900L 01



MODEL PARAMETERS:

Model Type		Tabular2
Depth	F	122
Half Width	F	33.8
Half Length	X	758
Offset	X	0
Dip	F	116 deg
Thickness	F	883
Susceptibility	F	0.0123 emu
Remnance Ratio	F	4.169682
Remnance Incl	F	-26 deg
Remnance Decl	X	0 deg
Main Position	F	310300.4
Cross Position	X	5442588
Base Level	F	62313.53 nT
Base Slope	F	.0050291 nT/
Base Curvature	X	0 nT/2

(F-fitted, X-fixed, L-limit)

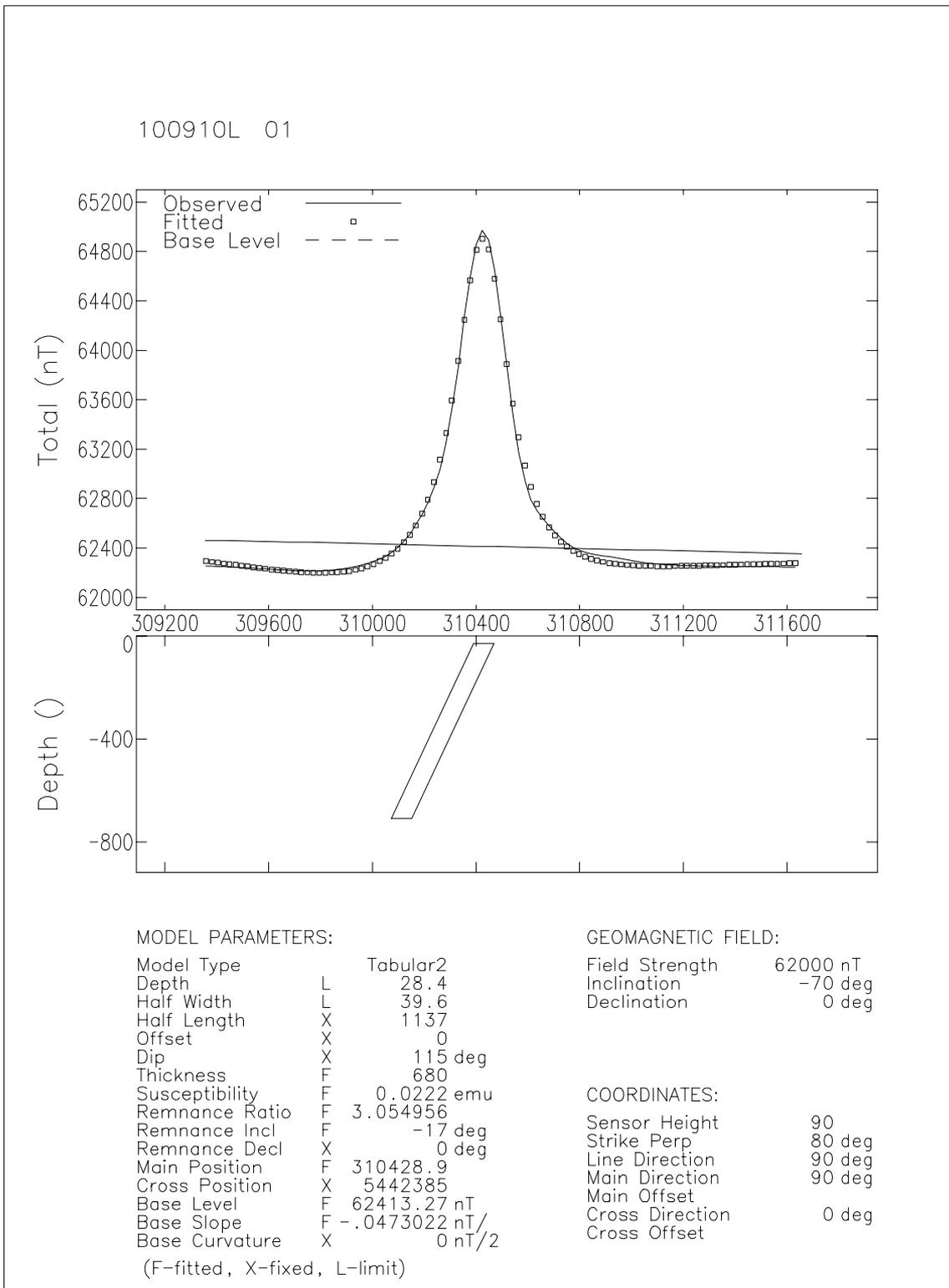
GEOMAGNETIC FIELD:

Field Strength	62000 nT
Inclination	-72 deg
Declination	0 deg

COORDINATES:

Sensor Height	80
Strike Perp	70 deg
Line Direction	90 deg
Main Direction	90 deg
Main Offset	
Cross Direction	0 deg
Cross Offset	

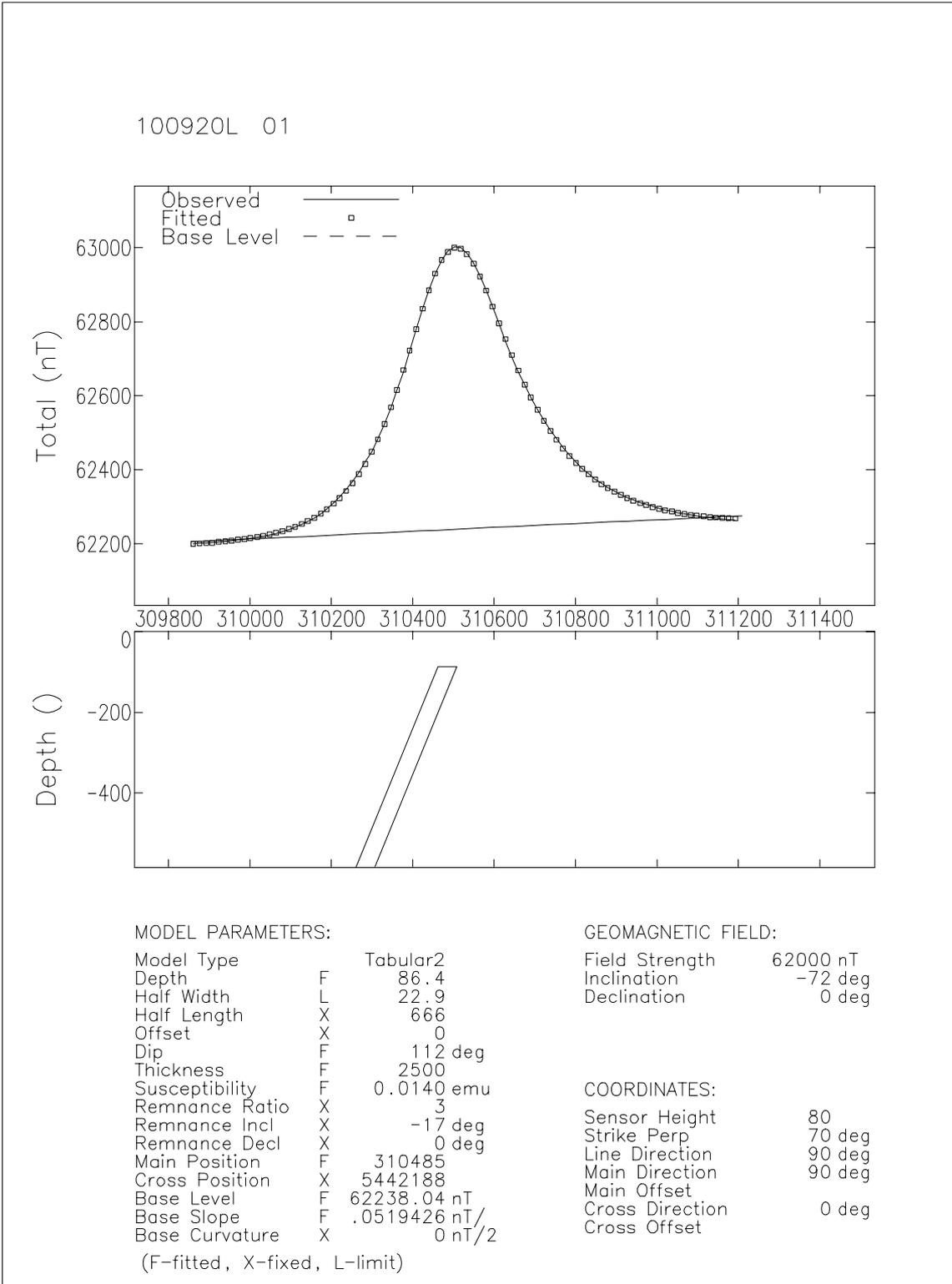
Figure 3 Magmod3 inversion line 100900, northern body



Geosoft MAGMOD-3 Modeling Result

10/06/17

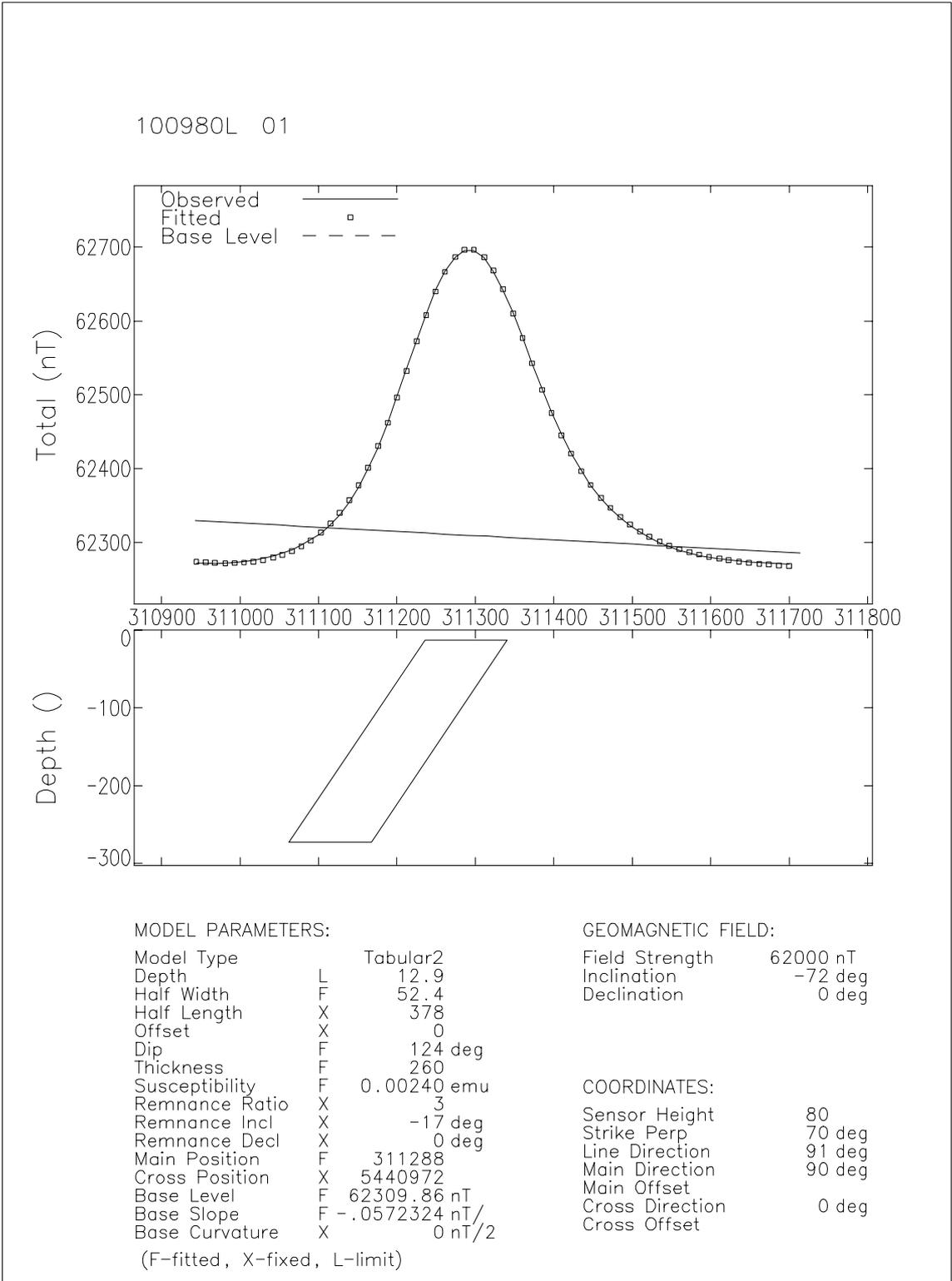
Figure 4 Magmod3 inversion line 100910, northern body



Geosoft MAGMOD-3 Modeling Result

10/12/09

Figure 5 Magmod3 inversion line 100920, northern body



Geosoft MAGMOD-3 Modeling Result

10/12/09

Figure 6 Magmod3 inversion line 100980, southern body

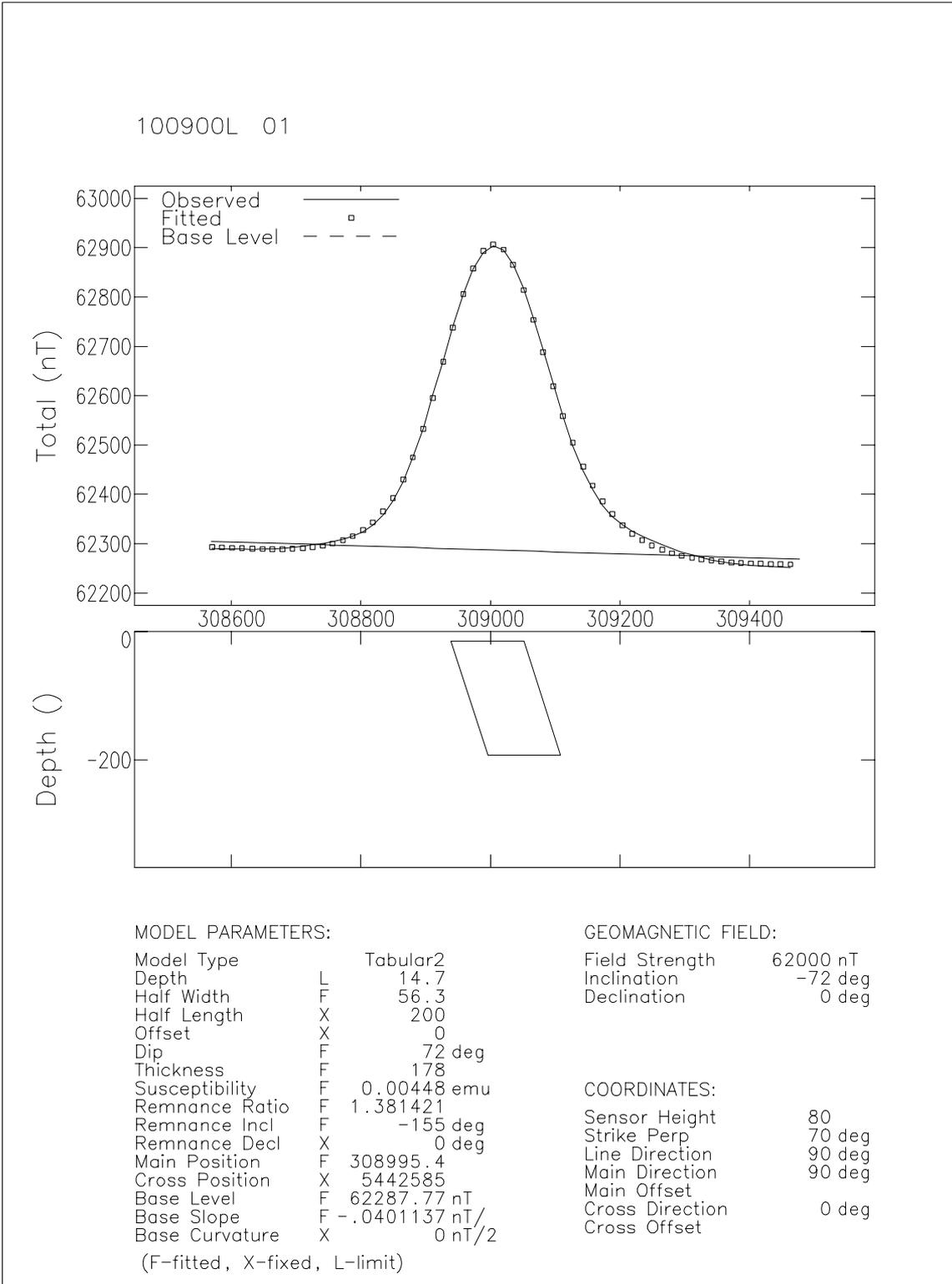


Figure 7 Magmod3 inversion line 100910, western body