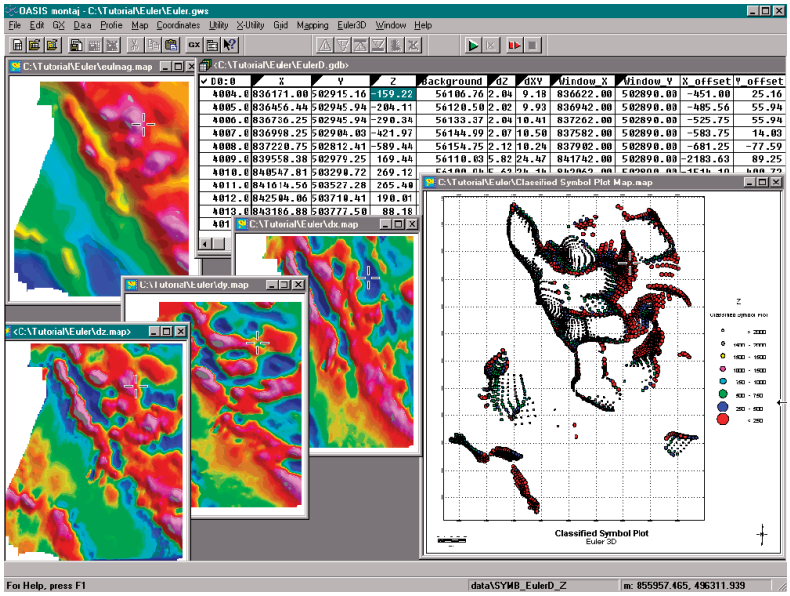
GEOSOFT

Grav/Mag Interpretation

Oasis montaj Extension developed by Geosoft

The montaj™ Grav/Mag Interpretation extension includes Euler 3D Deconvolution processing routines to automatically locate and determine depth for gridded magnetic and gravity data.

Euler 3D automates 3D geologic interpretation by delineating magnetic and gravimetric boundaries and calculating source depths.



The extension also includes the Keating Magnetic Correlation Coefficients function used in Kimberlite Exploration. This tool uses a simple pattern recognition technique to locate magnetic anomalies that resemble the response of a vertical cylinder model typical of Kimberlite pipes. A Source Edge Detection™ (SED) function is included for locating edges (e.g. geological contacts) or peaks from potential field data by analyzing the local gradients.

The Source Parameter Imaging™ (SPI) function automatically calculates the depth of magnetic sources from a gridded magnetic dataset. The depths are displayed as a grid and are based on source parameters of the following source models: contacts (faults), thin sheets (dikes) or horizontal cylinders.

Perform specialized processing using:

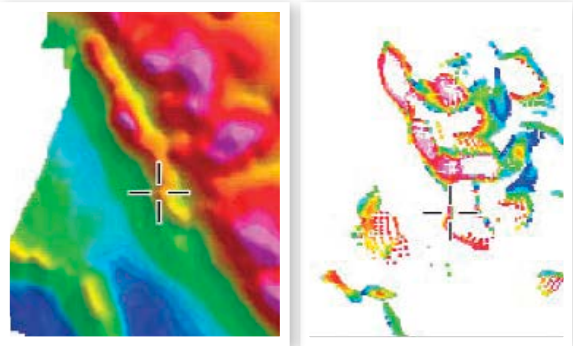
- Keating Magnetic Correlation Coefficients function for locating magnetic anomalies that resemble the response of modeled Kimberlite pipes,
- SED function for locating edges (i.e. geological contacts) or peaks from potential field data by analyzing the local gradients,
- SPI function for quickly and easily calculating the depth of magnetic sources,

Use Grav/Mag Interpretation to:

- Locate and determine depth rapidly for large amounts of area data,
- Apply FFT and convolution grid enhancement and processing routines to calculate X and Y derivative grids (MAGMAP 2D FFT is required to calculate Z derivative grids),
- Display Total Field and Derivative grids for analysis,
- Analyze grids (perform Euler source inversion),
- Choose a structural index (any real value between 0.0 and 3.0),
- Display solutions in Oasis montaj database and search large areas for similar targets,
- Perform and display solution statistics,
- Display/Plot database solutions,
- Window and plot solutions (based on location uncertainty and offset) to extract the solutions you consider relevant and remove erroneous solutions.

3D Euler Processing

Geosoft's Euler 3D™ processing routines automatically locate and determine depth for gridded magnetic and gravity data. Euler 3D automates 3D geologic interpretation by delineating magnetic and gravimetric boundaries and calculating source depths. The Euler 3D Deconvolution method does not assume any particular geologic model, the deconvolution can be applied and interpreted even when particular models, such as prisms or dykes, cannot properly represent the geology.



Depth estimates are often used to delineate geologic structures that produce a magnetic or gravity anomaly. In oil and gas exploration, this is equivalent to determining the maximum thickness of the sedimentary section.

Geosoft's Euler 3D requires data to be processed and gridded prior to analysis – vertical derivative (dz), and horizontal derivative (dx & dy) grids are required. (Geosoft also offers a montaj MAGMAP extension, which may be used to create the prerequisite vertical and horizontal derivative grids.)

The location and depth of gravity and magnetic sources can be determined using the Euler 3D deconvolution system. It is designed to guide the user through data preparation, processing, analysis and visualization. It can also:

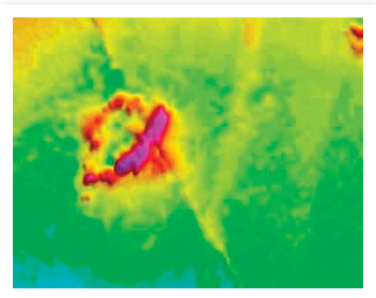
- Choose a structural index (any real value between 0.0 and 3.0),
- Adjust the depth tolerance and window source distance,
- Adjust the data window size and easily calculate the depth of magnetic sources.

Keating Magnetic Correlation Coefficients

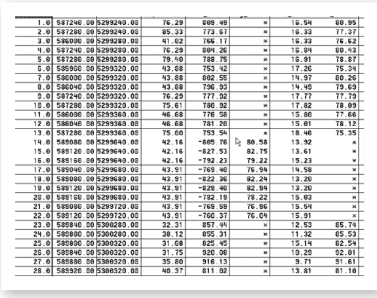
The Keating Magnetic Correlation Coefficients Tool for Kimberlite Exploration, utilizes a simple pattern recognition technique to locate magnetic anomalies that resemble the response of modelled Kimberlite pipes.

Keating's method utilizes a simple pattern recognition technique to locate magnetic anomalies that resemble the response of a modelled kimberlite pipe. The magnetic response of a vertically dipping cylinder is computed in grid form. The model parameters that may be adjusted include the depth, radius and magnetic intensity as a "moving window".

The correlation between modelled and observed data is computed at each grid node using a firstorder regression and archived. The correlation coefficients that exceed a specific threshold (e.g., 75%) are retained for comparison to the magnetic and other exploration data.

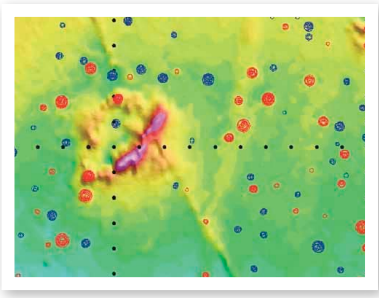


Original grid



1.0	587240.00	5299240.00	76.29	808.48		×	16.54	80.95
2.0	587280.00	5299240.00	85.33	773.67		×	16.33	77.37
3.0	586000.00	5299280.00	41.02	766.17		×	16.33	76.62
4.0	587240.00	5299280.00	76.29	804.26		×	16.84	80.42
5.0	587280.00	5299280.00	79.40	788.75		×	16.91	78.87
6.0	586960.00	5299320.00	43.68	753.42		×	17.26	75.34
7.0	586000.00	5299320.00	43.68	802.55		×	14.97	80.26
8.0	586040.00	5299320.00	43.68	796.03		×	14.45	79.60
9.0	587240.00	5299320.00	76.29	777.32		×	17.77	77.79
10.0	587280.00	5299320.00	75.61	786.32		×	17.82	78.69
11.0	586000.00	5299360.00	46.68	776.58		×	15.80	77.66
12.0	586040.00	5299360.00	46.68	781.20		×	15.81	78.12
13.0	587280.00	5299360.00	75.00	753.54		×	18.46	75.35
14.0	585080.00	5299640.00	42.16	-805.76	Δz	80.58	13.92	×
15.0	585120.00	5299640.00	42.16	-827.53		82.75	13.61	×
16.0	585160.00	5299640.00	42.16	-792.23		79.22	15.23	×
17.0	585040.00	5299680.00	43.91	-769.40		76.94	14.58	×
18.0	585080.00	5299680.00	43.91	-822.36		82.24	13.20	×
19.0	585120.00	5299680.00	43.91	-828.46		82.94	13.20	×
20.0	585160.00	5299680.00	43.91	-782.19		78.22	15.03	×
21.0	585080.00	5299720.00	43.51	-769.59		76.96	15.54	×
22.0	585120.00	5299720.00	43.51	-760.37		76.04	15.91	×
23.0	585040.00	5300280.00	32.31	857.44		×	12.53	85.74
24.0	585080.00	5300280.00	38.12	855.31		×	11.32	85.53
25.0	585000.00	5300320.00	31.68	825.45		×	15.14	82.54
26.0	585040.00	5300320.00	31.75	920.06		×	10.20	92.01
27.0	585880.00	5300320.00	35.80	918.13		×	9.71	91.81
28.0	585920.00	5300320.00	40.37	811.02		×	13.81	81.10

Anomaly Database

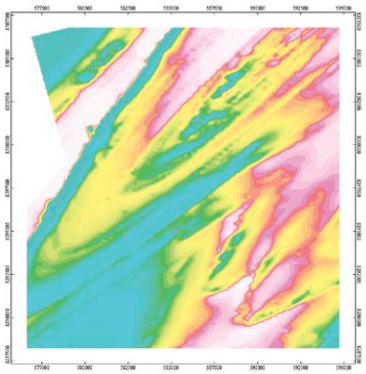


Combined Grid

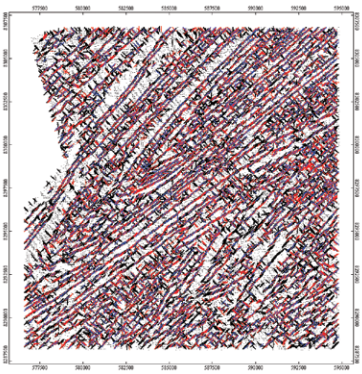
Source Edge Detection

The Source Edge Detection (SED) function locates edges (i.e. geological contacts) or peaks from potential field data by analyzing the local gradients. The SED function estimates the location of abrupt lateral changes in magnetization or mass density of upper crustal rocks. Its procedure is to identify maxima on a grid of horizontal gradient magnitudes.

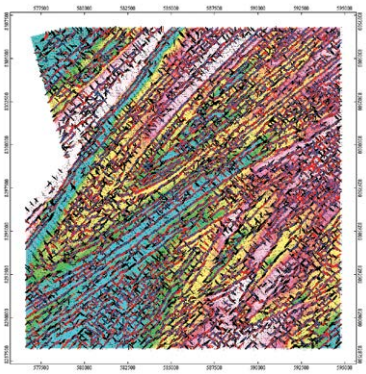
Using the technique of Cordell and Grauch (1982, 1987) a database of source edge locations are derived from a grid of total magnetic field or gravity. A map is produced with ⊥ symbols representing locations and gradient directions of potentaial field anomalies. You can distinguish between gradients that are in 1, 2, 3, or 4 directions.



Gridded Magnetic Survey Data



Location and gradient direction of potential field anomalies

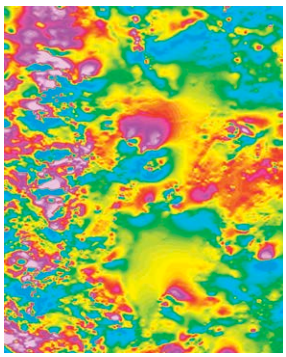


Integrated magnetic survey data and location and gradient direction of potential field anomalies

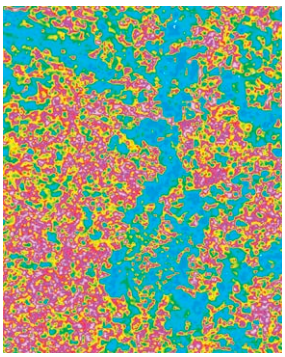
Source Parameter Imaging

The Source Parameter Imaging (SPI) function is a quick, easy, and powerful method for calculating the depth of magnetic sources. Its accuracy has been shown to be +/- 20% in tests on real data sets with drillhole control. This accuracy is similar to that of Euler deconvolution, however SPI has the advantage that it produces a more complete set of coherent solution points and is easier to use.

(The Source Parameter Imaging and SPI are trademarks of Fugro Airborne Surveys)



Original Grid



SPI Depth
magenta=shallow, blue=deep

Key Functionality

- Gravity processing and reduction functions
- Terrain Algorithm and Corrections

*The montaj Grav/Mag Interpretation extension requires Geosoft's Oasis montaj.