Acquisition and Processing of a Detailed Aeromagnetic Survey Glass Buttes, Oregon

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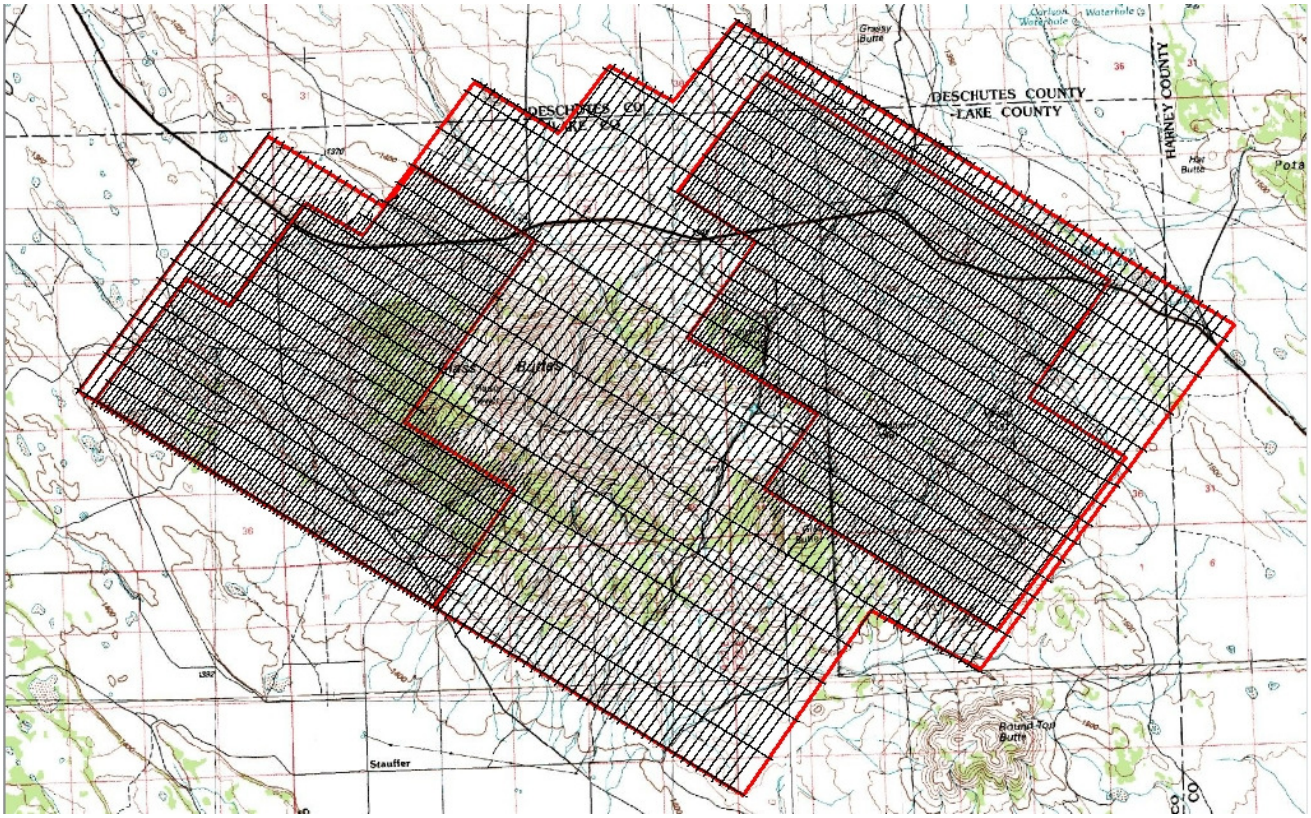
Summary

Using an ultra-light aircraft, a high-resolution aeromagnetic survey was carried out over Ormat Nevada's Glass Buttes project area in Oregon.

Location Maps – Survey Line Locations



Northeast-southwest primary survey lines were spaced at 200-meter intervals with northwest-southeast tie-lines spaced at 1000 meters. In the southwest and northeast corner two additional areas inside the main survey were flown with line spacing at exactly half of the original line spacing. Average terrain clearance was 223 meters from the sensor.

A total of 1,352 line-miles of aeromagnetic data were acquired. Survey operations were completed on May 25, 2010. Processed survey data including a total magnetic intensity map were transmitted to Ormat Nevada Inc. on May 27, 2010.

Survey Equipment

Aircraft

Moyes-Bailey Dragonfly Aircraft Reg. No. N914CS

Geometrics 823A Magnetometer (Primary magnetic sensor)

- Recording interval: 0.1 sec
- Sensitivity: 0.01 nT
- Maximum accepted noise level: 0.25 nT peak-to-peak

Applied Physics Fluxgate Magnetometer (Compensation magnetic sensor)

- Freeflight Systems TRA 3000 Radar Altimeter
- Recording interval: 0.1 sec
- Digital recording resolution, 0.25 ft

Trimble AgGPS 150 Guidance System

- Recording interval: 0.2 sec

Panasonic Toughbook Laptop computer with digital data acquisition system

Ground Base Station

Geometrics 856AX Magnetometer (Base Station)

- Recording interval: 0.5 seconds
- Time synchronized to airborne system
- Recording resolution: 0.1 nT

Survey aircraft - magnetic sensor is mounted on the right wing.

Production Summary

The Glass Buttes Project, consisting of 1,352 line-miles, was flown in two time segments: March 19 – March 23, 2010 and May 6 – May 26, 2010 due to inclement weather in March. Sixteen sorties were flown. Joe Nance was the survey pilot and Michael Hobbs was the data acquisition technician. No data were acquired during marginal weather.

The base station magnetometer monitored diurnal magnetic fluctuations during all flights. Space weather during the survey was minor.

Flight 1, March 19: K=0
Flight 2, March 19: K=0
Flight 3, March 23: K=0
Flight 4, March 23: K=0
Flight 5, May 6: K=2
Flight 6, May 6: K=2
Flight 7, May 7: K=2
Flight 8, May 9: K=0
Flight 9, May 12: K=1
Flight 10, May 13: K=1
Flight 11, May 13: K=1
Flight 12, May 14: K=1
Flight 13, May 21: K=2
Flight 14, May 23: K=0
Flight 15, May 24: K=0
Flight 16, May 25: K=0

From NOAA Space Weather Prediction Center: http://www.swpc.noaa.gov/info/Kindex.html

DATA PROCESSING

A. Flight Path Recovery

The DGPS navigation vertical and horizontal coordinate outputs were recorded as latitude, longitude, and elevation using the WGS84 geographic coordinate system. Mapping parameters for processed digital and mapped data are as follows:

Projection:	UTM
Zone:	10
Datum:	NAD 27

A speed check on the location data was completed, and the line location with the derived aircraft speed information was mapped for editing. After editing, the GPS data were accepted for the final flight path map production.

B. Magnetic Data

1. Data Received

Each day during the survey, digital magnetic data from the airborne acquisition systems were received by FTP. The data were read and converted to a line location file.

2. Data Editing

a. Profile plots of the magnetic data for each line were inspected for noisy or missing data.

b. The data quality was considered good, and no filters were applied.

c. No deculturing of the data was attempted.

3. I.G.R.F.

The International Geomagnetic Reference Field (2010), updated to the dates of the survey, was calculated and applied to the dataset.

4. External Field Correction

The base magnetometer produced a record of the variations in the external magnetic field, including diurnal variations. These data were inspected and compared with the observed magnetic data trace. The observed variations in the external field, corrected for the I.G.R.F. values for the location of the base station, were hi-cut filtered to remove noise and subtracted from the observed magnetic data. Longer wavelength external field variations are addressed in the leveling process.

5. *Leveling*

   Mis-ties at line intersections were calculated and adjusted to minimize mis-tie errors. Initial leveling adjustments were completed using a DC level adjustment to compensate for long wavelength diurnal effects. The average intersection mis-tie before DC adjustment was 20.21 nT; after DC adjustment, the average mis-tie was 4.74 nT. After final leveling, the average mis-tie was 1.73 nT.

6. *Reduction to the Pole*

   Reduction to the Pole calculates the field that would be observed if the survey area were located at the north magnetic pole. This transformation shifts the magnetic anomalies more nearly over the causative bodies. The Reduced-to-the-Pole grid used an inclination of 66.62 degrees and a declination of 15.35 degrees.

III. DELIVERABLES

The following were delivered as part of the project:

A. Maps as PDF on CD ROM

- Glass_tmi.pdf: Total Magnetic Intensity Map.
- Glass_rtp.pdf: Reduced To Pole (TMI) Map.
- Glass_hg.pdf: Horizontal Gradient (RTP) Map.
- Glass_tilt.pdf: Tilt Derivative (RTP) Map.
- Glass_hgtilt.pdf: HG of the Tilt Derivative Map

B. Digital Data

- Glass_tmi.xyz: Total Magnetic Intensity Grid in XYZ Grid Format
- Glass_rtp.xyz: Reduced To Pole (TMI) Grid in XYZ Grid Format
- Glass_hg.xyz: Horizontal Gradient (RTP) Grid in XYZ Grid Format
- Glass_tilt.xyz: Tilt Derivative (RTP) Grid in XYZ Grid Format
- Glass_hgtilt.xyz: HG of the Tilt Derivative Grid in XYZ Grid Format
- Glass.dat: Survey line data in ASCII Format

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Survey Line Data Format

Columns	Format	Description	Units
1-8	A8	Line Name	Alpha
9-20	F12.5	Latitude	Decimal Degrees
21-32	F12.5	Longitude	Decimal Degrees
33-43	F11.1	UTM X	Meters
44-54	F11.1	UTM Y	Meters
55-65	F9.0	Fid	
66-72	F7.1	Radar Altimeter	Feet
73-80	F8.1	GPS Elevation	Feet
81-89	F9.2	Raw Magnetics	nT
90-98	F9.2	Final Magnetics	nT
99-107	F9.2	Diurnal Magnetics	nT

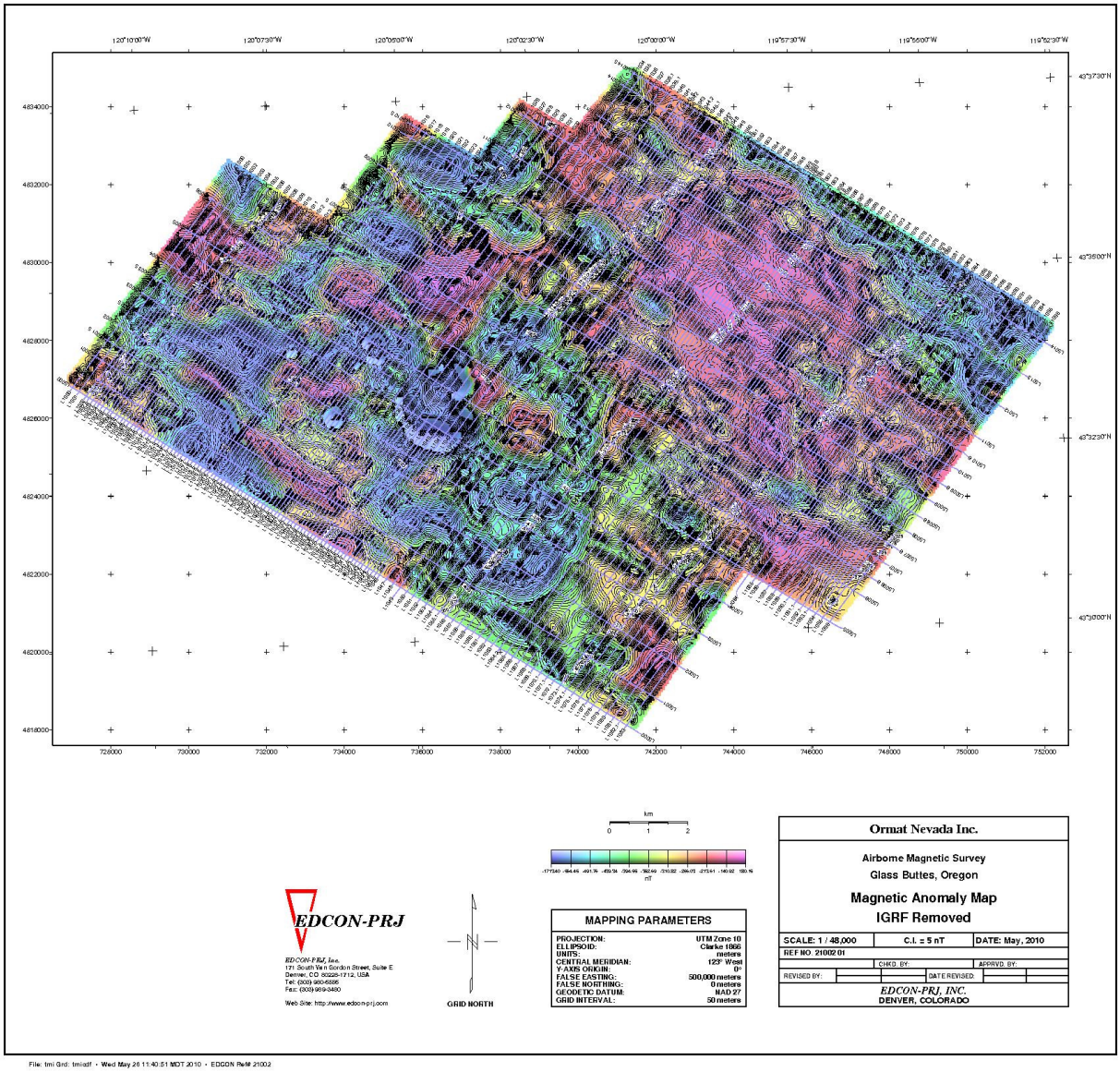

Figure 1: Magnetic Anomaly Map