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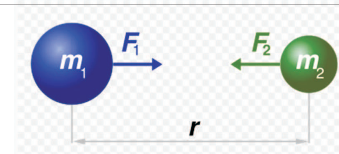
Surface geophysics ◆ *Airborne geophysics* ◆ *Well logging* ◆ *Map creation and GIS* ◆ *Geology* ◆ *License areas*

Electrical method ◆ *Gamma-ray methods* ◆ *Radon exploration*
Magnetic method ◆ **Gravity method** ◆ *Elektromagnetic method*

GRAVITATION

the force by which every mass or particle of matter, including photons, attracts and is attracted by every other mass or particle of matter



$$F_1 = F_2 = G\frac{m_1 \times m_2}{r^2}$$

distance between the point masses: where:
F is the magnitude of the gravitational force between the two point masses,
G is the gravitational constant,
m1 is the mass of the first point mass,
m2 is the mass of the second point mass,
r is the distance between the two point masses.

LAND GRAVITY SURVEYS

Gravity measurements define anomalous density within the Earth; in most cases, ground-based gravimeters are used to precisely measure variations in the gravity field at different points. Gravity anomalies are computed by subtracting a regional field from the measured field, which result in gravitational anomalies that correlate with source body density variations. Positive gravity anomalies are associated with shallow high density bodies, whereas gravity lows are associated with shallow low density bodies. Thus, deposits of high-density chromite, hematite, and barite yield gravity highs, whereas deposits of low-density halite, weathered kimberlite, and diatomaceous earth yield gravity lows. The gravity method also enables a prediction of the total anomalous mass (ore tonnage) responsible for an anomaly.

The positional accuracy requirements of a gravity survey have, in the past, required a heavy survey effort. Modern GPS techniques can achieve the required accuracy in a matter of seconds.

In gravity surveying, the interest is in the variation of gravity over the surface of the Earth, which is used to map the variations in rock density. For these small variations convenient gravity units are used, namely milligals or mm/s2, where

1 milligal = 10^{-3} Gals = 10^{-5} m/s^2 and 1 Gal = 10^{-2} m/s^2

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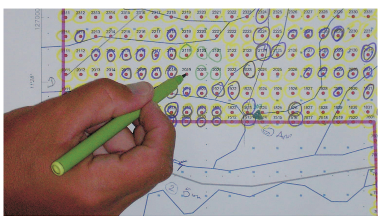
Gravity & GPS Measurements

The gravity and GPS stations are set up usually on a grid. The grid line spacing usually depend on the objectives of the survey. The survey is usually performed in "daily" loops, closed on the appropriate Base Station with a maximum closure error of 0.05 mGal. Gravity drift and tidal corrections are performed at the conclusion of each survey day.
A "loop" is the basic component of any gravity control survey. A loop consists of a sequence of gravity observations, which begins on a gravity control point (base station) and ends on a gravity control point.
The elevations (Z) and the instrument heights (at each station the height of the gravity meter above the ground will be accurately measured) will be measured and recorded by the operator along with the gravity readings. A certain number of gravity/magnetic/GPS station measurements (about 5%) are repeated to ensure data quality.
Gravity observations typically comprise a minimum of 3 separate readings using a LaCoste & Romberg gravity meter, or a 120-sample mean using a Scintrex CG-3 or CG-3M. Using a LaCoste & Romberg instrument, readings will continue until agreement between two consecutive readings is 5-microgals or better.
Using a Scintrex instrument the standard deviation of repeat readings is 7.5 microgals or better. Data acquisition will cease following significant seismic events and/or during bad weather, heavy rain and wind speeds in excess of 20 mph, which may produce micro-seismic noise.

Data Quality Control and Preliminary Data Processing

Data quality control includes the following procedures:
- Quality Control of gravity data accuracy
- Quality Control of gravity station locations
- Quality Control of GPS data quality
- Quality Control of Bouguer Anomaly Accuracy



Gravity data accuracy is controlled by making repeat readings on selected stations from within the survey grid using any or all of the following methods:
- With the same gravity meter in an independent loop on more than one day.
- With two gravity meters in an independent loop on the same day
- With the same gravity meter in the same loop on the same day.

Absolute Gravity

$$ga = gB1 + (rH - rB1)\ \ (t - tB1)d$$

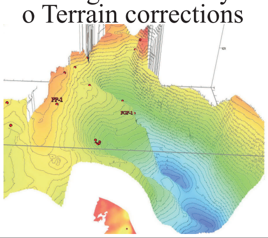
ga absolute gravity in milligals
gB1 base 1 absolute G in milligals
rh instrument height corrected
rB1 base 1 reading
t reading time
tB1 base 1 reading time
d drift from section 4 above, in milligals/hour

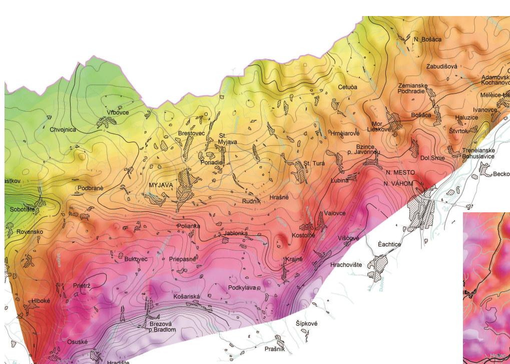
Final Data Processing, Interpretation and Reporting

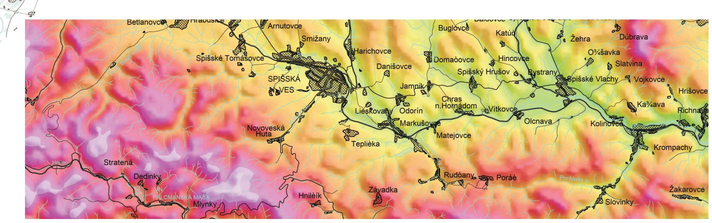
The following steps are undertaken to process the gravity and GPS data:
- Importation of raw gravity data into the data base
- Application of the basic reduction and corrections
- Merging with the GPS positional data
- Gridding and contouring
- Corrections include:
  - o Instrument scale factor
  - o Tidal correction
  - o Instrument height
  - o Drift Correction
  - o Absolute gravity
  - o Latitude correction
  - o Free-air anomaly
  - o Bouguer anomaly
  - o Terrain corrections

Final Products:

Gravity Station Location Map (ST)
Digital Terrain Model Map (ELEV)
Free Air Anomaly Map (FA)
Bouguer Anomaly Map (BA)
Terrain Corrections Map (TC)
Complete Bouguer Anomaly (CBA) Map
First Vertical Derivative Map (VD), calculated from CBA







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