



GLOSSARY

The following definitions are designed for potential field interpretations performed by GeoPotential

Ambiguity

An inherent characteristic of gravity and magnetic fields which states that for any given gravity or magnetic anomaly a range of density or susceptibility distributions can cause the same anomaly. Consequently, to compensate for this non-unique characteristic, it is necessary to introduce independent geological and/or geophysical constraints into the interpretations of gravity and magnetic anomalies.

Bouguer Correction

The correction applied to gravity readings to remove an assumed slab of material between the station elevation and sea level in land gravity surveys. In marine gravity surveys, the correction "fills in" the lack of a slab of material between sea level and the ocean bottom.

Bouguer Gravity Field

The gravity field obtained after the latitude, elevation, Bouguer and terrain corrections have been applied to the gravity data. The Bouguer gravity field is often divided into the Simple Bouguer gravity field before applying terrain corrections and the Final Bouguer gravity field after applying terrain corrections.

The Bouguer gravity field is the gravity anomaly field usually analyzed in gravity interpretations. The gravity anomalies observed in this field are caused by density contrasts within the crust and sub-crust of the Earth.

A final Bouguer gravity field which has been accurately corrected for is not equivalent to gravity measured at the sea-level surface of the Earth. The sub-sea level mass inhomogeneities are still being observed from the original station elevations.

Curie Point Isotherm

The isotherm in the Earth's crust where the temperature is too high for rocks to remain magnetic. The Curie point is about 600 degrees C for most rocks and usually occurs at a depth of about 20 Km.

The Curie point isotherm is often used to define the bottom of intrabasement magnetic bodies.

Declination

The angle of azimuth between the Earth's geographic pole and the Earth's magnetic pole.

Density

Density is mass per unit volume and is expressed in gm/cm^3 . Densities are usually measured as either saturated bulk densities or grain densities. For gravity interpretations, the bulk rock densities are of interest since these are the densities responsible for the measured gravity fields.

Bulk rock densities have been shown to vary as a function of geologic age, lithology and depth of burial.

Rock densities typically range from 1.9 gm/cm^3 to 2.8 gm/cm^3 .

Density Contrast

The relative density (σ) between two or more rocks. Density contrasts can be either positive or negative. For example if Rock A = 2.60 gm/cm^3 and Rock B = 2.70 gm/cm^3 then the density contrast of Rock A relative to Rock B is -0.10 gm/cm^3 . Conversely the relative density contrast of Rock B relative to Rock A is $+0.10 \text{ gm/cm}^3$.

In gravity interpretations the anomalies being studied are caused by density contrasts within the Earth's crust and sub-crust.

Density-Depth Function

The relationship between the changes in density with a change in depth. In many areas of the world the increase in density with a change in depth has been shown to be primarily a function of compaction. However age, lithology and porosity also may influence the relationship.

The relationship is important in gravity modeling because a gravity anomaly may be caused by a gradational change in density rather than a well-defined density contrast, such as may occur at a fault.

Density Model

A model of the geology in which lithologic layers are replaced by equi-density layers. The equi-density layers may or may not correspond to geological formations.

Direct Modeling

Given a density or susceptibility model and computing the theoretical gravity or magnetic fields from the model.

Elevation Correction

The sum of the free-air and Bouguer corrections

Free-air Gravity Field

The gravity field obtained after the latitude and free-air corrections have been applied to the gravity data.

The free-air gravity field is occasionally analyzed in lieu of the Bouguer gravity field for gravity interpretations. The gravity anomalies observed in this field are caused by density variations within the crust and sub-crust of the Earth.

Free-air Correction

The correction applied to gravity readings to correct for the change in gravity due to the change in elevation of the gravity station and a reference elevation (usually sea level). The change in gravity with elevation is caused by the change in distance from the center of mass of the Earth.

Gardner's Equation

An empirically derived equation that describes the relationship between bulk densities and acoustic velocities of rocks.

The equation was derived for rocks of Western North America and Alaska. However, experience has shown the equation to hold for many other areas of the world. The greatest variation from the equation occurs for lower density rocks, especially salt, shales, quaternary alluvium, and volcanoclastics.

Gamma

The older common unit of magnetic field intensity. Equal to 1 nanoTeslas or 1×10^{-15} oersteds or 114×10^{-3} ampere-turns/meter.

High Density Basement

The location within the geologic column of an area where the deepest major density contrast occurs. The rocks above the major density contrast are usually younger sedimentary and/or volcanic rocks typically having densities ranging from approximately 1.9 gm/cm^3 to 2.7 gm/cm^3 . The rocks below the major density contrast are usually older sedimentary, volcanic and/or crystalline rocks typically having densities ranging from 2.6 to 2.8 gm/cm^3 . In practice, the location of high density basement can be complicated by structural variations (e.g. thrusting of high density basement over lower density rocks) and by lateral density variations within a formation. High density basement may or may not be equivalent to crystalline or magnetic basement.

Inclination

The dip of the Earth's magnetic field. The inclination varies from 0 degrees (horizontal) at the magnetic Equator to +90 degrees (vertical into the Earth) at the magnetic North Pole and -90 degrees (vertical out of the Earth) at the magnetic South Pole.

Intrabasement Body

A body for which the depth to the top of the body is less than the vertical thickness of the body. Usually used in the context of magnetic analysis.

Inverse Modeling

Given an observed gravity or magnetic field and computing a density or susceptibility model necessary to satisfy the observed field.

Latitude Correction

A correction applied to gravity readings to correct for the systematic change of gravity with latitude. The change in gravity with latitude is caused by the change in acceleration due to the Earth's rotation and also to polar flattening.

Magnetic Basement

The location within the geologic column of an area where the deepest major susceptibility contrast occurs. In areas where the crystalline basement is magnetic, the magnetic basement is equivalent to crystalline basement. Shallower susceptibility contrasts (such as occur when volcanic or magnetic sediments are in contrast with non-magnetic rocks) may mask or complicate the interpretation of magnetic basement. Susceptibility variations within magnetic basement are common.

Milligal

The unit of acceleration commonly used with gravity measurements.
1 gal = 1,000 milligal = 10,000 gravity units = 1 cm/sec

Normal Magnetic Field

The large "regional" part of the Earth's magnetic field that is roughly approximated by a polarized sphere. The International Geomagnetic Reference Field (IGRF) is the mathematical model of this field. This "regional" portion of the field is usually removed from the measured field to isolate the more local magnetic anomalies of interest in exploration.

Observed Gravity Field

A Bouguer, free-air, regional or residual gravity field. The term "observed gravity" is used in lieu of the term "raw gravity" (see below).

Observed Magnetic Field

A total magnetic intensity or total magnetic anomaly field.

Potential Field

A field that obeys a certain differential equation known as Laplace's Equation. Gravity and Magnetic fields are both potential fields.

Reduction-to-the-Pole Field

Recomputing a magnetic field so it appears as it would at a magnetic inclination of +90 degrees(i.e. the magnetic North Pole). In practice the reduction-to-the-pole operation removes the asymmetry of magnetic anomalies caused by magnetic inclinations less than 90 degrees. Also the operation places magnetic anomalies directly over their causative bodies making interpretation of the magnetic field easier.

Raw Gravity

Also called measured gravity, or observed gravity. The gravity measured at a gravity station before latitude, free-air, Bouguer or terrain corrections are applied.

Regional Gravity Field

That component of the Bouguer gravity field that is caused by the density contrast between high density basement and the lower density overburden.

Second-Vertical Derivative Field

A gravity or magnetic field for which the second-vertical derivative of the field is computed. Also called second-derivative field.

The second-vertical derivative field is actually a measure of the radius of curvature of the field from which it was computed. Where the curvature of the field is greatest, the vertical derivative is greatest. Where the field has no curvature (i.e. a linear gradient), the second-vertical derivative is zero.

In interpretation applications, the second-vertical derivative field is a means of visually enhancing higher frequency anomalies and trends of the original field.

Semi-infinite

A body or field that is infinite in one dimension and finite in the other two dimensions. In the context of modeling, the bodies and field are infinite normal to the plane of the profile or cross-section.

Suprabasement Body

A body for which the depth to the top of the body is greater than the vertical thickness of the body. Usually used in the context of magnetic analysis.

Susceptibility

A measure of the degree to which a substance may be magnetized. Usually expressed either in cgs units or in ucgs (micro cgs) units (1×10^{-6} cgs = 1 ucgs.). The susceptibility has been shown to be roughly proportional to the amount of magnetite that a rock contains.

Rock susceptibilities typically range from .000 cgs units to .010 cgs units.

Susceptibility Contrast

The relative susceptibility between two or more rocks. Susceptibility contrasts can be either positive or negative. For example if Rock A = .001 cgs and Rock B = .002 cgs, then the susceptibility contrast of Rock A relative to Rock B is -.001 cgs. Conversely, the relative susceptibility contrast of Rock B relative to Rock A is +.001 cgs.

In magnetic interpretations the anomalies being studied are caused by susceptibility contrasts within the Earth's crust and sub-crust.

Susceptibility Model

A model of the geology in which lithologic layers are replaced by equi-susceptibility layers. The equi-susceptibility layers may or may not correspond to geologic formations.

Terrain Correction

The correction applied to simple Bouguer gravity readings to compensate for the fact that the slab used for the Bouguer correction is not a true slab but has irregularities (topography) on its upper surface in land surveys and irregularities (bathymetry) on its lower surface in marine surveys.

Terramagnetic Survey

A land magnetic survey acquired from a vehicle moving across the Earth's surface.

Theoretical Gravity Field

The gravity field calculated from a density model. Also called calculated gravity field.

Also the gravity field computed from a mathematical model of the Earth for use in reductions of gravity measurements.

Theoretical Magnetic Field

The magnetic field calculated field calculated from a susceptibility model. Also called calculated magnetic field.

Three-Dimensional

A map representation of potential fields or geologic structures. Any point can be located by specifying its x,y,z coordinates. These maps usually take the form of contour maps.

Total Magnetic Anomaly Map

The magnetic anomaly field after the Earth's normal magnetic field (IGRF) has been removed from the total magnetic intensity field. Also called: Residual Magnetic Anomaly, Total Magnetic Intensity with Earth's Normal Field Removed, Residual Magnetic Intensity, etc. The magnetic anomalies observed in this field are caused by susceptibility contrasts within the crust and sub-crust of the Earth.

Total Magnetic Intensity

The total intensity of the magnetic field measured on, above, or below the surface of the Earth. When measured on the surface, the data is called land or marine magnetic data. When measured above the surface, the data is called aeromagnetic data.

Two-Dimensional

A profile or cross-sectional representation of potential fields or geologic structures. Any point can be located by specifying its x,z (horizontal, vertical) coordinates.

For two-dimensional modeling, the density and susceptibility models of the geology and the observed gravity and magnetic profiles over the model are assumed to be infinite.