Rock Property Database System

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Mira Geoscience

What is the average density of gabbro in Sudbury?

What is the average resistivity of rhyolite in VMS type deposits?

The Rock Property Database System (RPDS) answers these types of questions by bringing together geological and geophysical information on a common integration platform, facilitating the interpretation of rock properties and corresponding geological description across geographic areas.

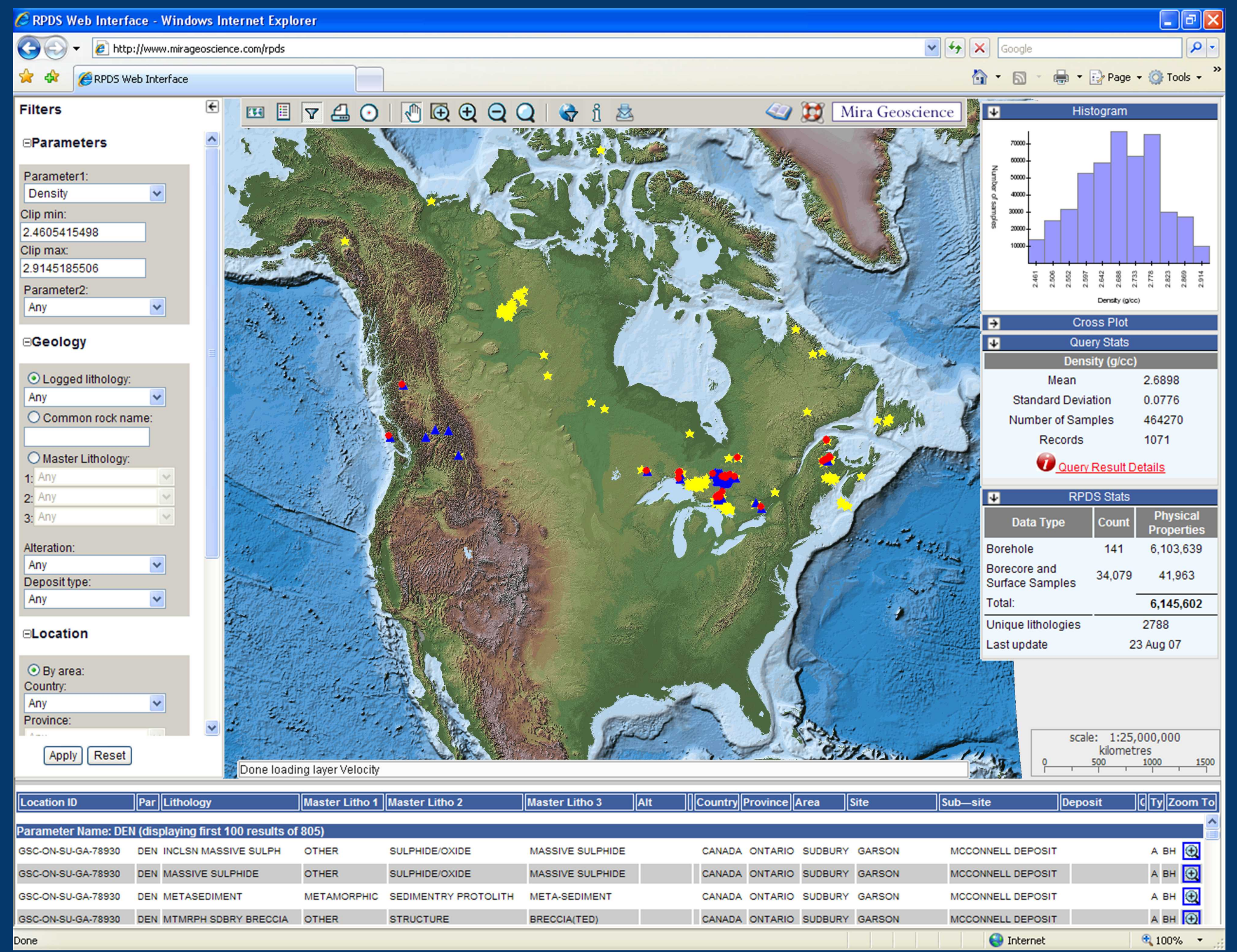
Why Is Rock Property Data Important For Exploration And Discovery?

Rock properties represent a quantitative link between geology and geophysics. Geophysical data is responsive only to physical rock properties. Through cross-correlation we can assign physical property values to geological units and use this information to characterize the rock property environment of specific ore deposits. Proper characterization of the physical property environment of ore deposits leads directly to significant exploration benefits through improved geophysical survey design, forward modelling, inversion, and interpretation. Advances in data acquisition and interpretation will yield higher quality drillhole targets.

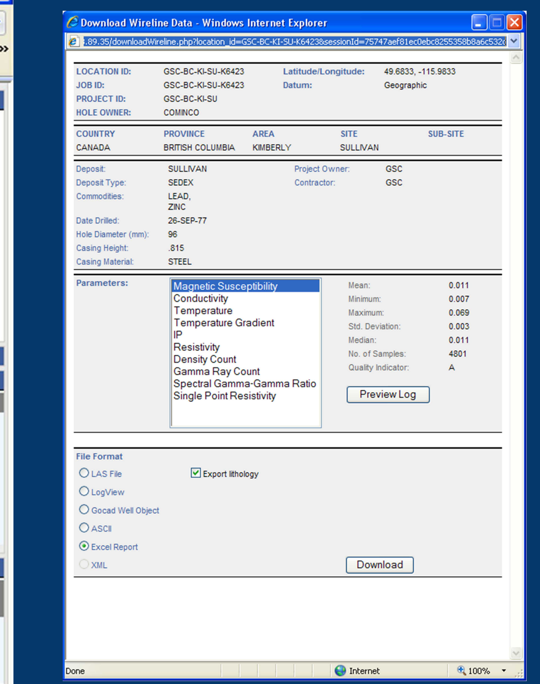
Motivation

Decade's worth of rock property data exist throughout the industry, academic institutions, and government geological surveys. The data, for the most part, reside in reports, papers, electronic spreadsheets on the computers of individual workers, old floppy disks, etc. One of the objectives of RPDS is to provide a single repository for rock property data, as opposed to many disparate sources, thus allowing large-scale aggregation of data and in-depth analysis of rock property relationships.

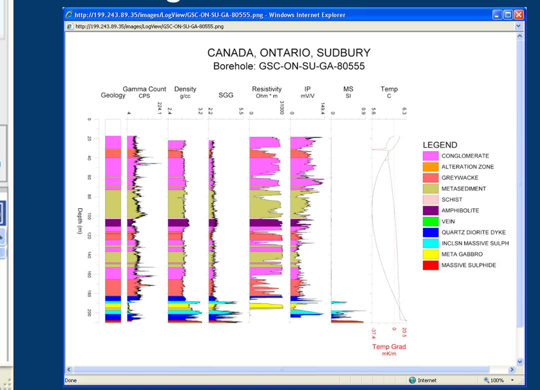
RPDS Front-End: The Web Interface



Download Data Window

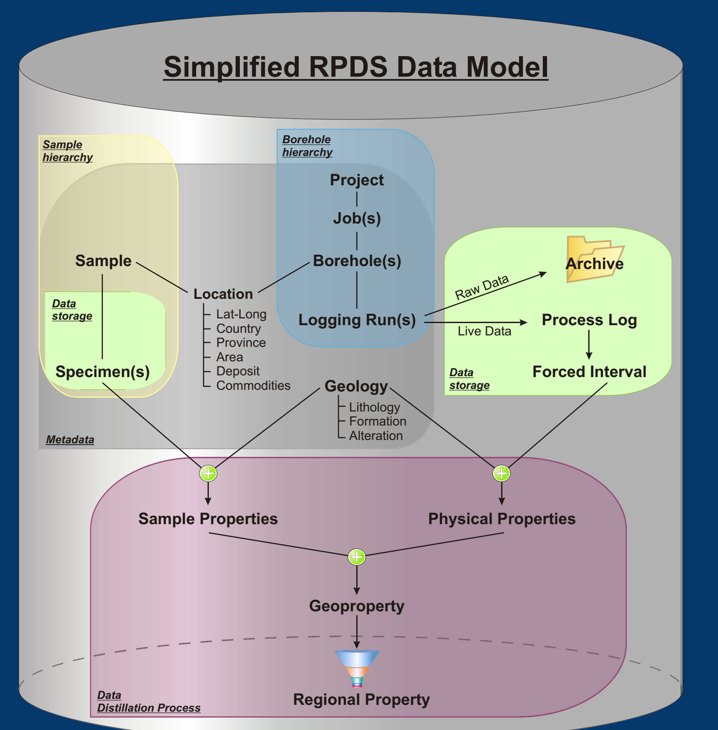


Log View Plot Preview



www.mirageoscience.com/rpds

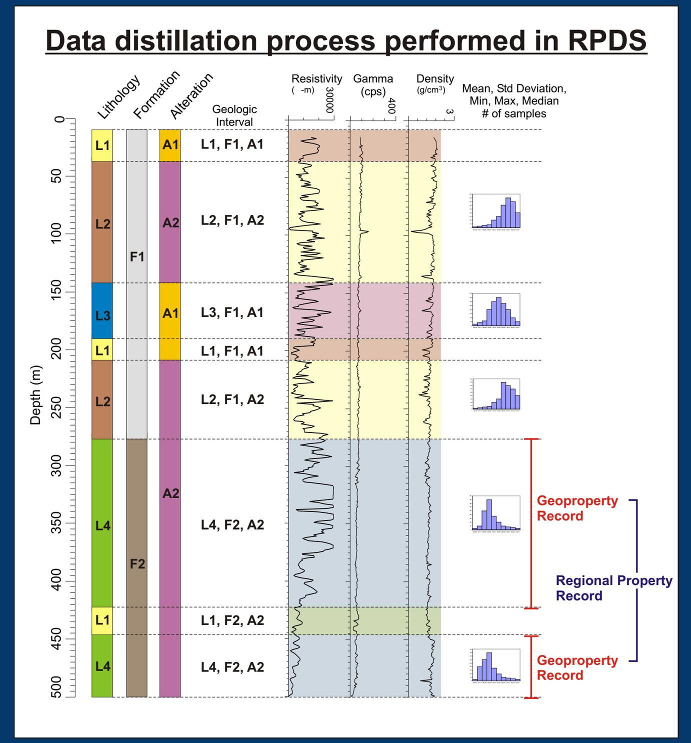
RPDS Data Model



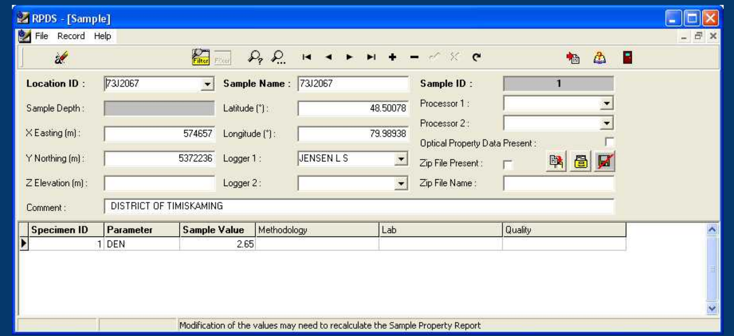
RPDS is an Oracle-based relational data management system for borehole and surface sample rock property data. It is designed to store, manage and query physical, geochemical and geotechnical property data and metadata in correlation with geological information.

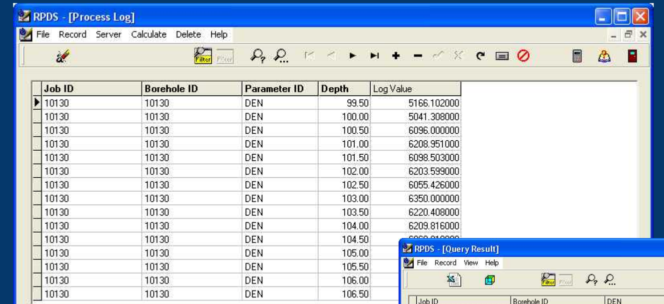
The schematic diagram to the right shows the data distillation process performed in RPDS. A "geologic interval" is defined, representing a combination of the lithology, formation, and alteration information at depth along a borehole. Population statistics for that interval are calculated for all physical property parameters measured in the hole. These statistics are combined for similar "geologic intervals" across multiple boreholes and are amalgamated with sample data possessing the same combination of geologic information in similar geographic areas.

The diagram to the left shows the highly simplified data model illustrating relationships between the key database tables. The specific tables which contribute to the calculation of population statistics are described in the flowchart below.

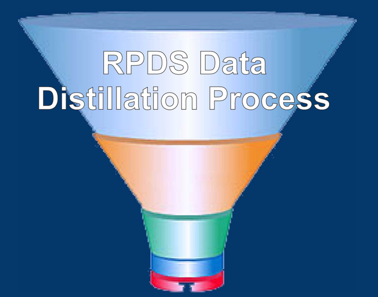


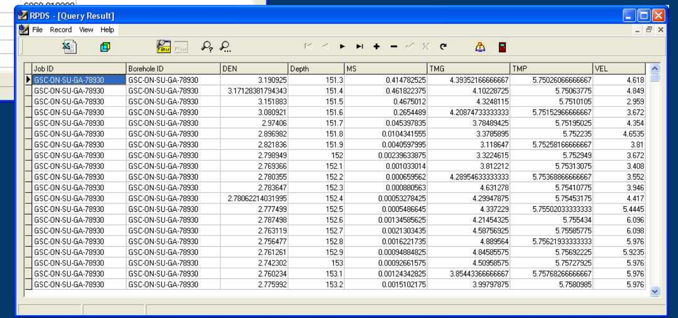
Sample Table
The Sample Table contains physical property data and associated metadata from both borehole core samples ("borecore") originating from known boreholes and depths, and surface samples of varying origin and assumed not to originate from boreholes.





Process Log Table
The Process Log Table contains the calibrated and processed logging run data for each borehole. This data is considered the "live data" in RPDS and is used for calculating the population statistics.

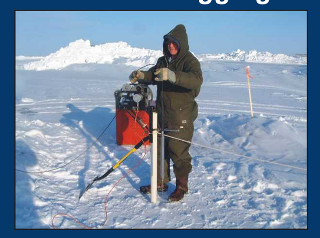




Forced Interval Table
The Forced Interval Table re-calculates the Process Log data for each physical property to a common reference sampling interval

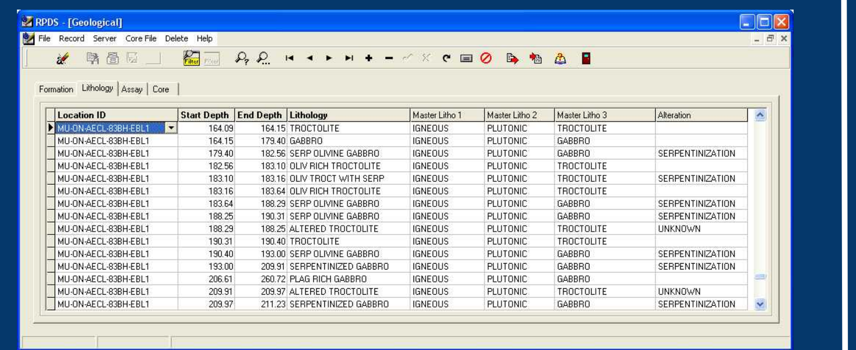
Borecore Samples

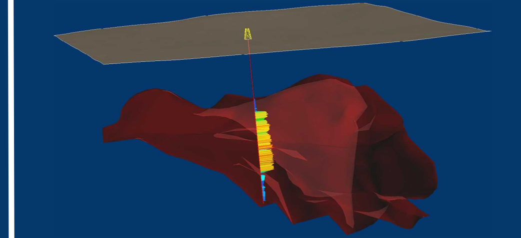
Wireline Logging



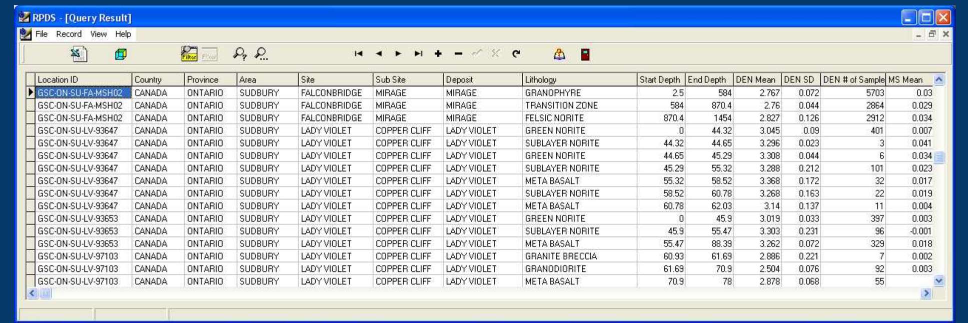
Images courtesy of the GSC

Geological Table
The Geological Table contains all geological information for boreholes and for surface samples. This includes information on lithology, alteration, formation, geologic-age, assay analyses, and core photos.





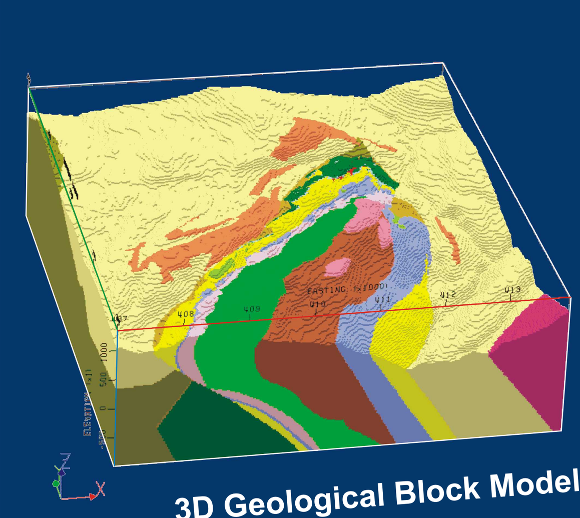
Well Objects Export



Geoproperty Table
The Geoproperty Table is a composite table where logging run data taken from the Forced Interval Table and surface sample data taken from the Sample Table are correlated with geological information and population statistics of physical properties as a function of geological classification are pre-stored for rapid query. This table lists, for each borehole/surface sample, the mean values, standard deviations, and sample counts for physical properties per geological interval encountered in the borehole per geographic area.

Application: Eskay Creek, Northwest BC

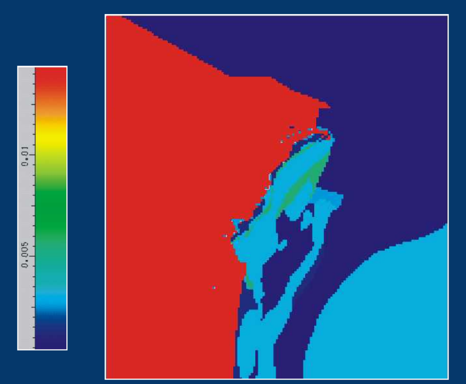
Rock Unit	Susceptibility Values 10-3 SI units
Betty Creek Andesite	3.14
Hanging Wall Andesite	14.193
Bowser Sandstone	0.628
Bowser Conglomerates	0.691
Mt Dilworth Dacite	3.14
Mafic Dyke	7.285
Hanging Wall Mudstone	2.638
Contact Mudstone	2.638
Eskay Porphyry	3.14
Rhyolite	1.256
Upper Betty Creek Sediments	5.526
Unuk River Formation Seds	0.628
Dacite East	3.14
Ore	0.377-0.44
Western Volcanics	14.193



3D Geological Block Model

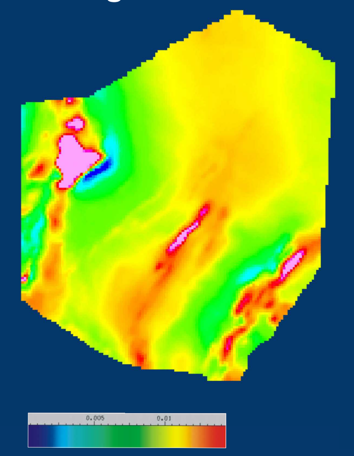
The 3D geological block model shows the spatial distribution of each rock type in the model space. Each rock type can then be assigned physical rock property values, in this case magnetic susceptibility.

Magnetic Reference Model

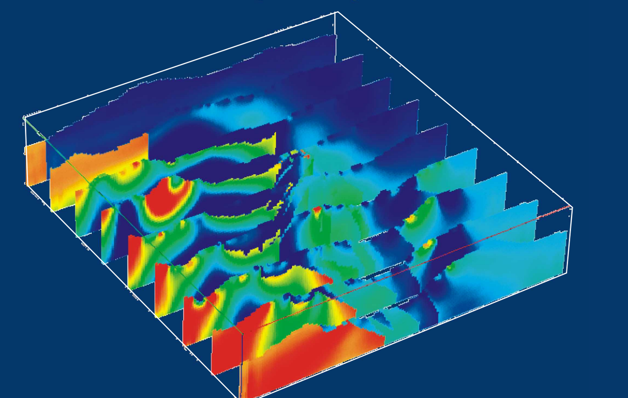


Attributing the 3D geological model with magnetic susceptibility values results in the creation of the magnetic reference model. This model represents our expectation of the 3D magnetic properties of the site, based on geological mapping and physical property data. The 3D magnetic reference model provides tremendous value to an exploration program. It can be used as the basis for forward modelling studies in geophysical survey design, and enables explorationists to quantitatively assess realistic expectations from such surveys. It can also be used to constrain 3D inversions, enforcing solutions that are consistent with geological interpretation, as the example here shows. An archival compilation of rock property data will greatly facilitate our ability to routinely undertake this type of analysis. Jurisdictions that can provide such a compilation will afford a competitive advantage.

Magnetic Data

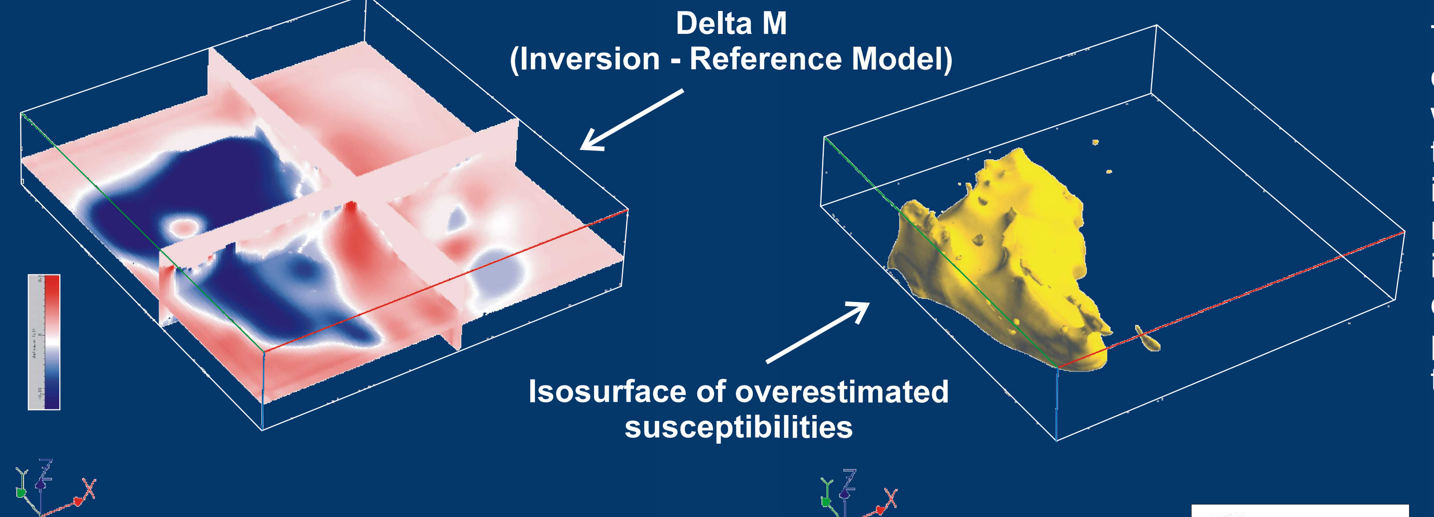


Constrained Susceptibility Inversion



Inversion is a mathematical process that converts geophysical data, such as a magnetic map, to a spatial physical property model of the earth, such as a 3D magnetic susceptibility model. In this case, the magnetic map shown at the far left is converted to the 3D susceptibility model shown here as a series of 2D sections. The 3D susceptibility model is consistent with the magnetic map while remaining as close as possible to the magnetic reference model.

Comparing the inversion model, which is consistent with the magnetic data, to the magnetic reference model illustrates the difference between our expectation of the site based on geological mapping and the demands of the magnetic data. It explicitly shows where the earth has relatively higher or lower susceptibility with respect to our geological interpretation and physical property compilation. That is, it targets anomalies in a significantly more valid and powerful way than by analyzing the magnetic map alone.



The figure at the far left shows zones of relative high and low susceptibility, with respect to the geological data, throughout the 3D model. The isosurface is extracted from that model. Similar isosurfaces generated in this manner may directly yield drillhole targets. The physical rock property compilation is at the heart of this process.

Key contributors to the development of RPDS over the past 10 years:

Ontario · Quantec Geoscience · McMaster University · Xstrata · UBC · Canada · Geoscience BC · CAMIRO Canadian Mining Industry Research Organization