Rock Property Database System for British Columbia

Sharon Parsons[1], John McGaughey[1], Tom Lane[2]

[1]Mira Geoscience, 310 Victoria Avenue, Suite 309, Westmount (Montreal), QC, H3Z 2M9
[2]Camiro Exploration Division,PO Box 70684, Junction Gardens Post Office, 2938 Dundas St. West,Toronto, ON, M6P 4E7

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Camiro Project #: 06E02

Project Timeframe: Oct. 2006 - Nov. 2007

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.

Project Motivation

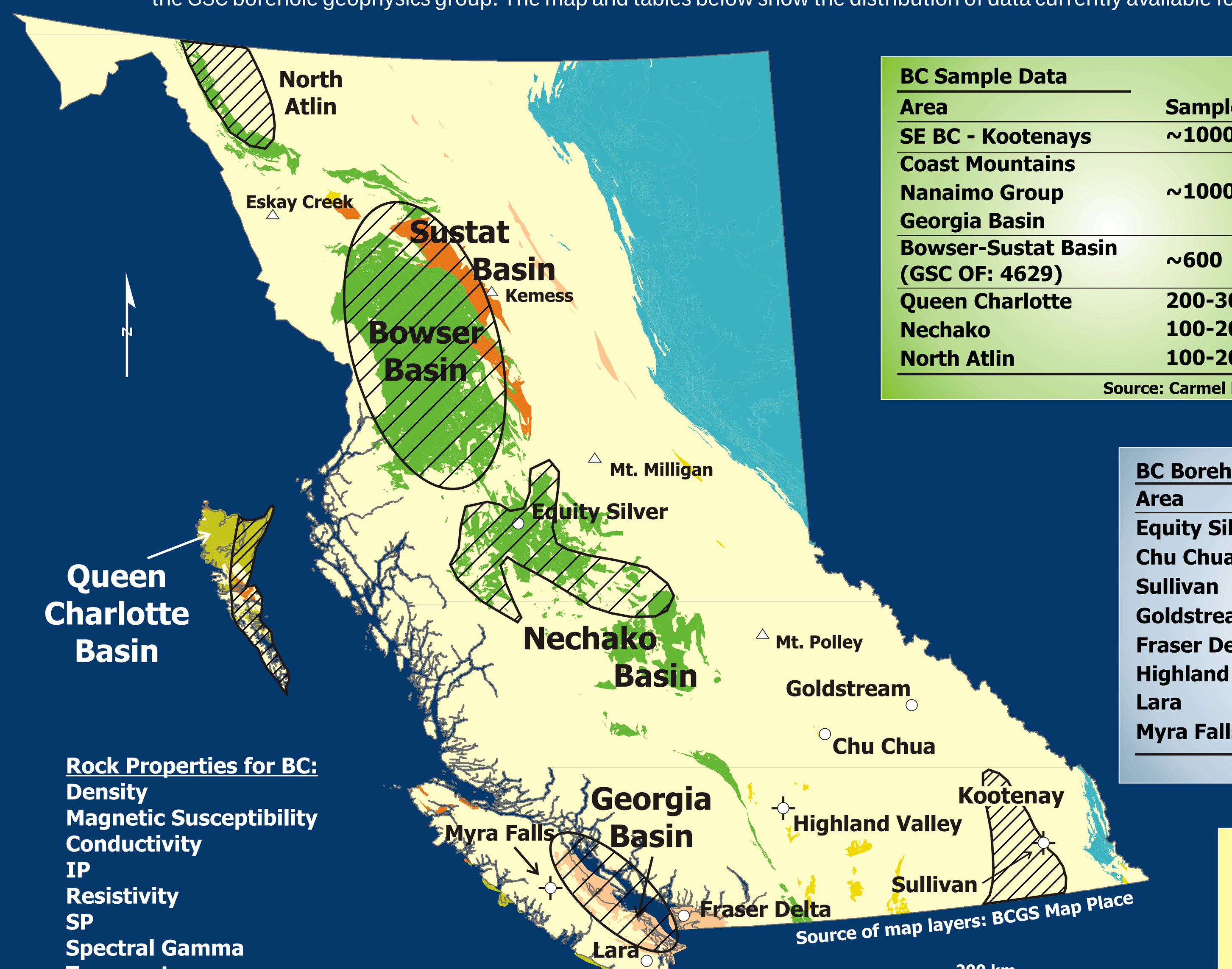
Decade's worth of rock property data exist for BC, however this data is in various hardcopy and digital formats making it difficult to amalgamate. In addition, most data are archived at numerous locations throughout the industry, academic institutions, and government agencies. One of the objectives of this project is to bring together all available data for BC into standard digitized formats on a common integration platform.

Camiro Project Deliverables:

1. A copy of the original input data from all parties organized into a consistent and manageable folder structure.
2. Copies of summary data compilations in digital format:
   (i) general information metadata table
   (ii) statistical summary table of rock property data.
3. A report describing the process of data entry and calculation of the statistical summary tables, including a location map of all samples in digital format.
4. The original data provided for the project will be populated into RPDS at Mira Geoscience and will remain available for the duration of the project. Data statistics may subsequently be made publicly available through a web query interface.
5. All data produced from this project will be provided for integration into the BC Ministry of Energy and Mines' Geofile and MAP PLACE websites.
6. A Workshop at project end for geoscience and industry users on how to access, use, and apply the database to exploation problems.

BC Data Distribution

Data are being compiled from numerous government sources, and we also welcome data from industry sources. Primary data sources are rock properties measured on laboratory samples from the BC government and GSC, and in-situ measurements made in drillholes by the GSC borehole geophysics group. The map and tables below show the distribution of data currently available for the project.



BC Sample Data

Area	Sample Count
SE BC - Kootenays	~1000
Coast Mountains	
Nanaimo Group	~1000
Georgia Basin	
Bowser-Sustat Basin (GSC OF: 4629)	~600
Queen Charlotte	200-300
Nechako	100-200
North Atlin	100-200

Source: Carmel Lowe (GSC)

BC Borehole Data

Area	Hole Count
Equity Silver	3
Chu Chua	1
Sullivan	1
Goldstream	2
Fraser Delta	9
Highland Valley	3
Lara	1
Myra Falls	12

Source: J. Mwenifumbo (GSC)

Map Symbols
- Sample data
- Borehole data
- Well log data
- Other major deposits

Albers Equal Area Conic Projection
North American Datum 1983

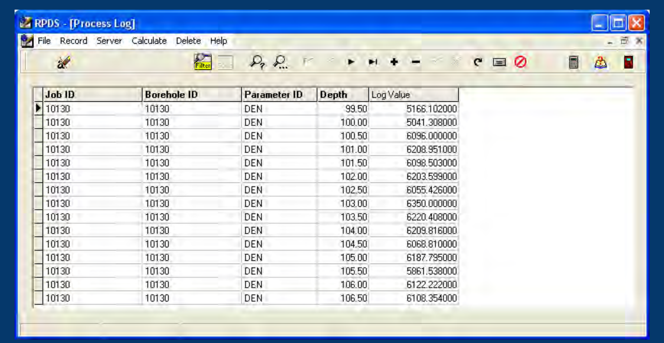
Rock Properties for BC:
Density
Magnetic Susceptibility
Conductivity
IP
Resistivity
SP
Spectral Gamma
Temperature
Acoustic Velocity

Data Compilation Platform: RPDS

Our strategy is to compile the various rock property data for BC into "RPDS" (Rock Property Database System), a database application developed over the last 8 years by a consortium of industry and government agencies, and managed by Mira Geoscience. RPDS is designed to store, manage and query geophysical, geochemical and geotechnical rock property data and metadata in correlation with geological information. RPDS provides a traceable archive of all data handled in the project as well as mechanisms for data quality assessment, editing, and meta-classification. The BC data will be added to the existing archive of greater than 5 million rock property data in RPDS. The figures below illustrate some of the functionality of the database.

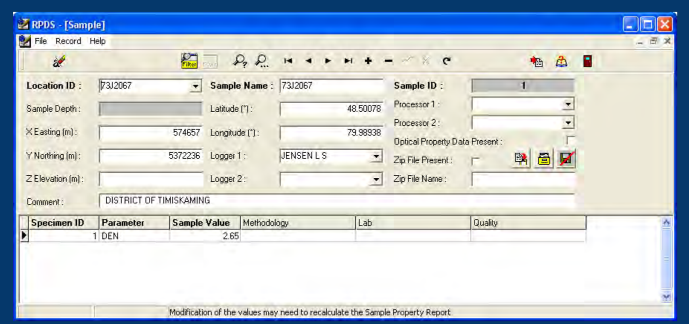
Process Log Table

The storage of wireline data in RPDS is based on the concept of logging runs. The Process Log Table contains the calibrated and processed logging run data for each borehole per job. This data is considered the "live data" in RPDS and is used for calculating the population statistics. The Process Log stores the physical property log values from various depths along the borehole. Since the depth intervals for each measurement vary per logging run, it is important to normalize these values to a constant depth interval in order to correlate each of the parameters for different logging runs. This is performed in the Forced Interval Table.



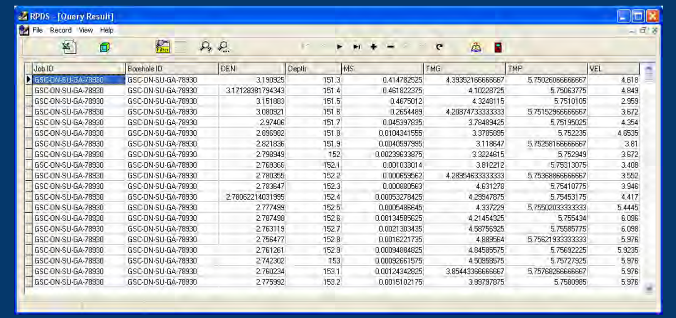
Sample Table

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.



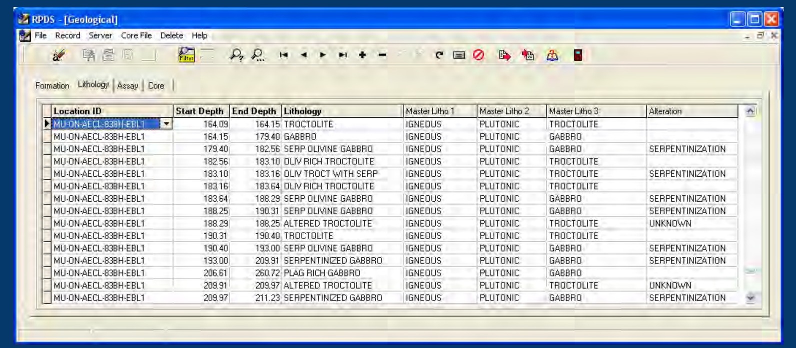
Forced Interval Table

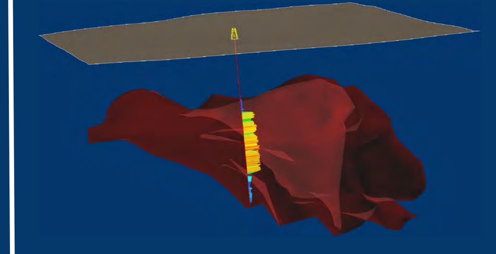
The Forced Interval Table re-calculates the Process Log data for each physical property to a common reference sampling interval of 10cm. Therefore, for each parameter, the average of all data points found in a 10cm interval centered on the "forced interval" is calculated. If no data point is found within that interval, a straight line interpolation method is used.



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.

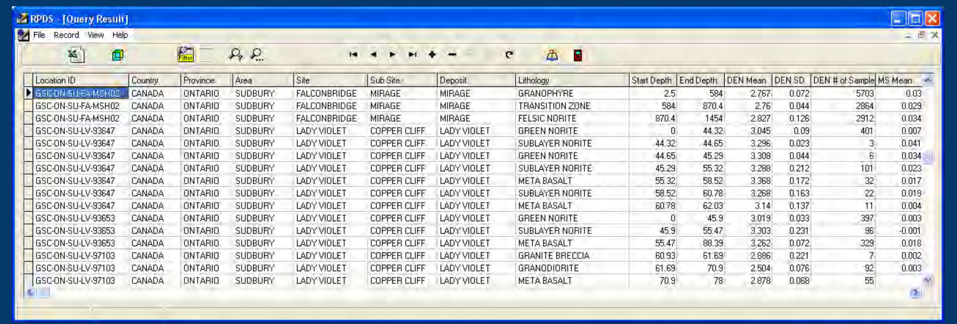


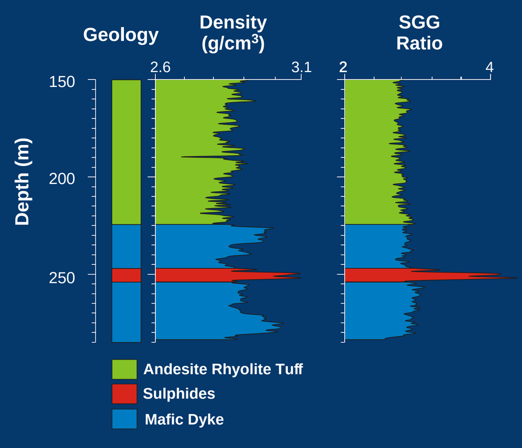


RPDS exports rock properties as Gocad well objects

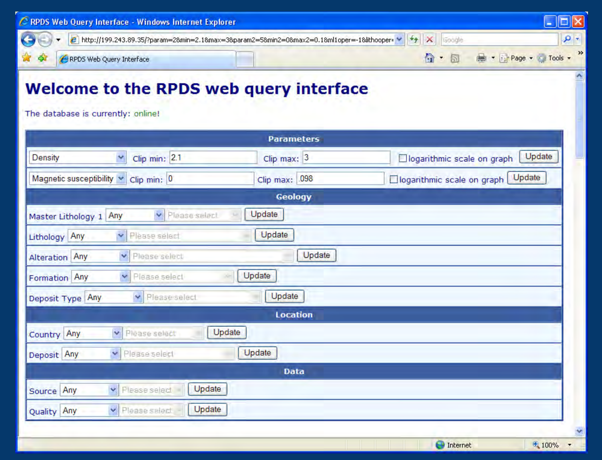
Physical/Sample Properties Table

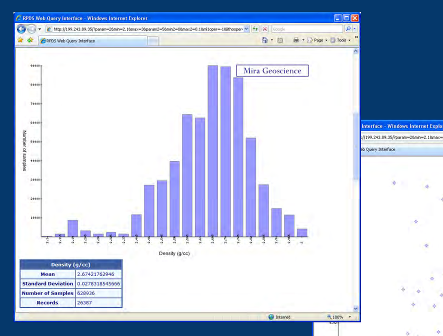
The Physical/Sample Properties Table is a composite table where logging run data taken from the Forced Interval Table and surface sample data taken from the Sample Table are correlated with geological information and where population statistics of physical properties as a function of geological classification 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 formation/lithology combination encountered in the borehole per geographic area.

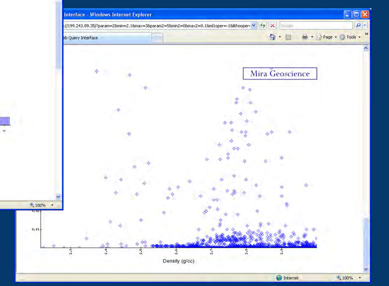


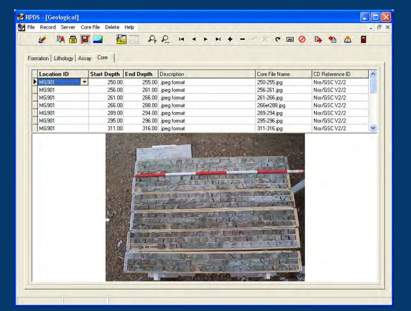


RPDS stores digital files









RPDS stores field/corelog photos

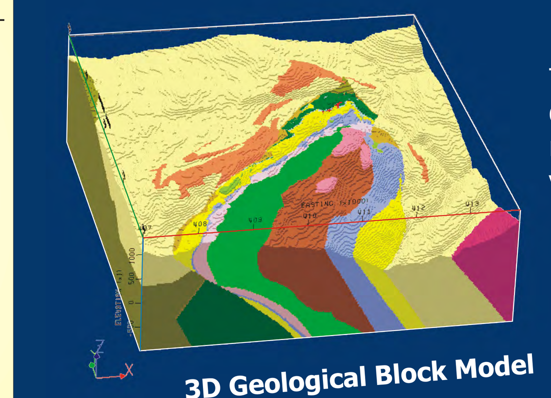
Web Query Interface

The web interface is a publicly assessable prototype web-based query tool available at: www.mirageoscience.com/rpds. It communicates with the Physical/Sample Properties table through an intermediate Regional Properties Table to provide rapid query results on population statistics, including histograms and multiparameter cross-plots. Some typical queries might include:

"What is the average density of Paleozoic basalt in the Abitibi greenstone belt?"
"What is the correlation between velocity and fracture frequency for Sudbury granites?"

Application: Eskay Creek, Northwest BC

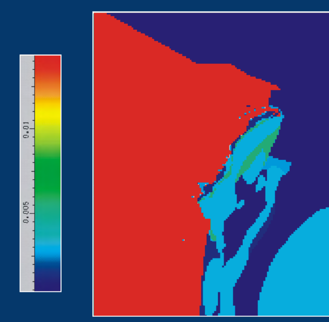
Rock Unit	Susceptibility Values 10-3 SI units
Betty Creek Andesite	3.14
Hanging Wall Andesite	14.193
Bowser Sandstone	0.628
Bowser Conglomerates	0.691
Mt Dilworth Dacite	3.14
Mafic Dyke	7.285
Hanging Wall Mudstone	2.638
Contact Mudstone	2.638
Eskay Porphyry	3.14
Rhyolite	1.256
Upper Betty Creek Sediments	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

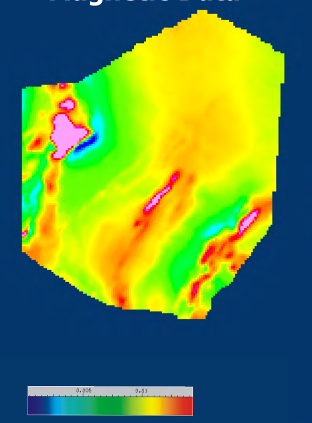
The 3D geological block model shows the spatial distribution of each rock type in the model space. Each rock type can then be assigned physical rock property values, in this case magnetic susceptibility.

Magnetic Reference Model (SI units)

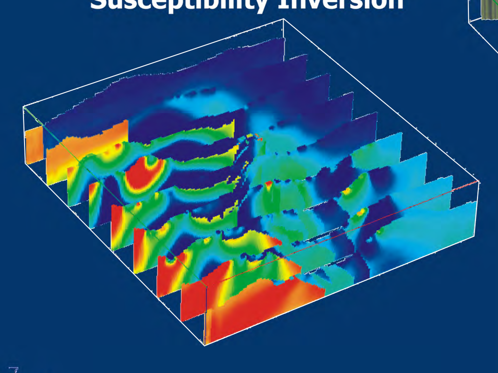


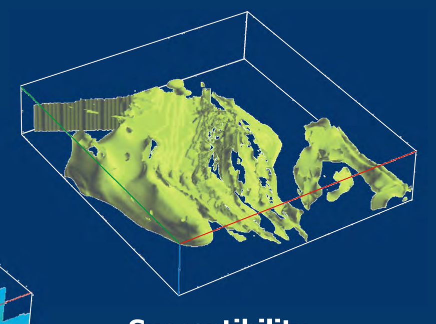
Attributing the 3D geological model with magnetic susceptibility values results in the creation of the magnetic reference model. This model represents our expectation of the 3D magnetic properties of the site, based on geological mapping and physical property data. The 3D magnetic reference model provides 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

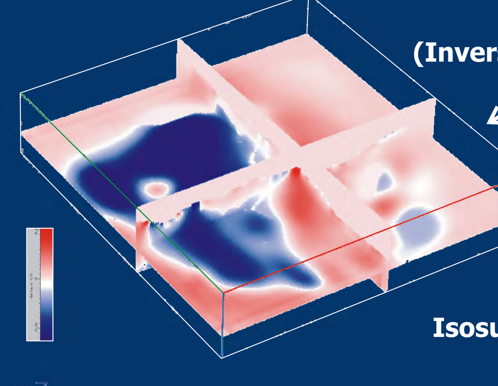




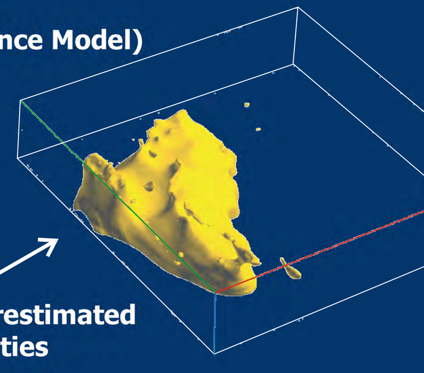
Susceptibility Isosurface

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. The isosurface, shown adjacent, is a 3D contour surface of constant susceptibility in the earth model showing the boundary between high and low susceptibility values at the site.

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.



Delta M (Inversion - Reference Model)



Isosurface of overestimated susceptibilities

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.

Upcoming UBC-GIF Study:

The University of British Columbia Geophysical Inversion Facility (UBC-GIF) will compile a characterization of the rock property environment of BC ore deposits, using data from RPDS, in order to demonstrate the effectiveness of using physical rock property data in exploration models.

In areas with sufficient rock property data, the Group hopes to determine, through forward modeling, the 'detectability' of deposits. These would be based on current acquisition parameters but would also aid in guiding further acquisition strategies if factors are known such as the thickness and composition of overburden or the size or the physical property contrasts of the orebody. In addition, inverse modelling of field data using rock property constraints will be performed in order to provide limits on the spatial distribution of rock units thus improving geological interpretation and targeting. Furthermore, using relationships between physical properties may enable a much more in depth interpretation of more subtle geologic features such as alteration.

The Project hopes to provide practical information of value to the mining industry that can be used and built upon for future targeting purposes.

For more information please visit the Mira Geoscience trade show booth - B28