OREBODY MODELING AND RESOURCE ESTIMATION

SGS is a pioneer in computer-based orebody modeling and resource estimation, providing these services since 1981. We have provided modeling and resource estimation solutions to companies involved in the mining of:
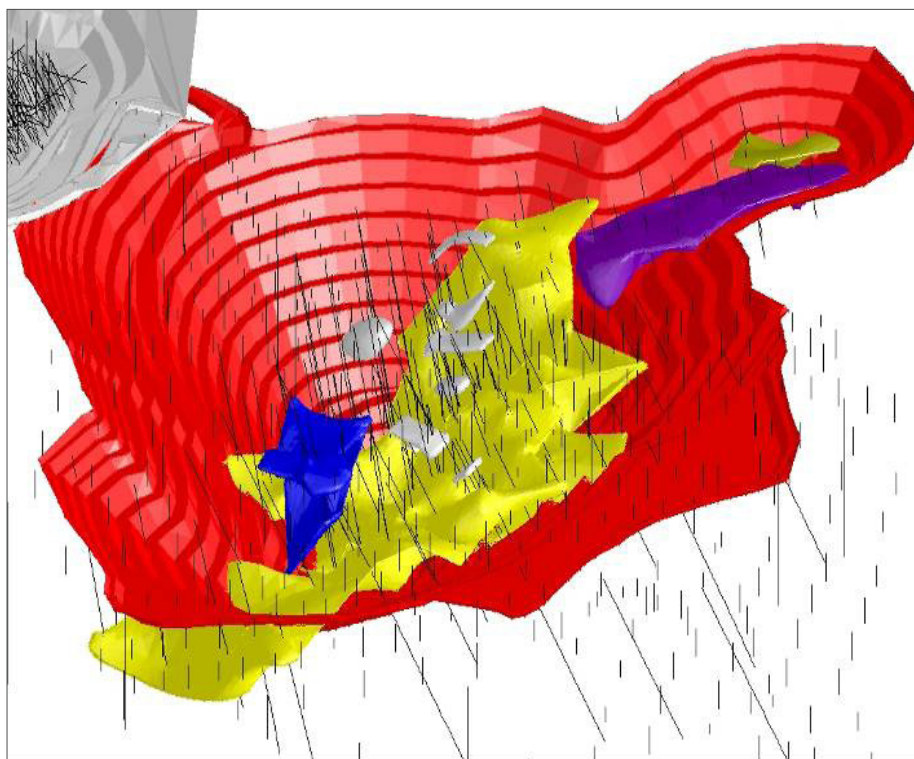
- Gold and precious metals
- Base metals
- Iron ore
- Coal
- Uranium
- Diamonds
- Industrial minerals (bauxite, barite, limestone for cement, salt, sands with titanium bearing minerals, wollastonite, asbestos etc)

Accurate resource estimation by a Qualified Person (QP) is an essential part of due diligence and important to investors and a key part of your commitment to National Instrument 43-101 and JORC. SGS is an experienced leader in geostatistical techniques and will ensure your resource estimations are completed with the utmost accuracy and integrity.

MODELING

At SGS, a typical computer orebody modeling project starts with a critical review of existing drill hole and surface or underground sample data as well as maps and plans with current geological interpretation. Drill hole and/or sample databases are set-up to suit all the quantitative and qualitative information necessary to build a resource model. From there, we can provide you with the following expert services:

- Computer-based 3D orebody modeling
- Sectional, longitudinal, 3D and multi-seam modeling
- Geostatistical analysis, variographic analysis of composite spatial continuity

- Resource estimation using industry standard methods including Inverse Distance interpolation, Kriging and Conditional Simulation (determination of grade values at unobserved points)
- Resource classification with application of the Canadian Institute of Mining and Metallurgy (CIM) code

METHODOLOGY

Generally the first step in any modeling project is to produce a set of drill-hole sections from the drill-hole database. Such sections are first used to check the data in the file and second to draw interpreted geological limits for the different ore or rock types. The next step is to divide those geological zones into blocks and have estimates of tonnage and grade(s) in each block. The shape of blocks and the estimation method vary with the type of deposit being modeled.

In vein-type deposits recognized by drill holes on cross-sections at regular intervals, we typically do a conventional sectional modeling with user-defined and irregular blocks around each mineralized intercept on the sections. With interactive programs like SECTCAD, the complete section modeling of a deposit with moderately complex geology from drill holes on about 15 sections can be completed in less than 2 days.

Vein type or tabular deposits can also be modeled with the polygon method. In that case, the blocks are the polygons of influence automatically generated by programs like POLYCAD around mineralized intercepts.

Disseminated mineralization is often modeled with small cubic or rectangular blocks on a 3D regular grid. Grade in each block is interpolated by distance weighting methods such as inverse distance. With programs like those of the BLKCAD package, it is possible to

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estimate and map thousands of blocks in just a few hours. More sophisticated distance weighting methods involve geostatistics.

Additionally, with automated methods, several different orebody models can be built for the same deposit and results compared. For example, a sub-vertical vein can be modeled on cross-sections or with polygons on a long section. If the vein is thick enough, we can fill the space between modeled walls with small blocks on a regular grid and interpolate grade(s) in each block.

GEOSTATISTICAL RESOURCE ESTIMATION

Geostatistics relies on the assumption that samples in a geologic data set are correlated to each other. Once that correlation is determined, it can be used to predict values between existing data points. The determination of that correlation is referred to as a structural analysis or variogram modeling. Variogram models are based on mathematical functions that approximate the spatial distribution of materials in the ground based on a set of known geologic data points or samples.

SGS offers geostatistical services to aid in ore resource estimation and grade control. We conduct a detailed geostatistical analysis of existing computerized sample data. We then composite drill hole samples in intervals of various length, examine histograms and correlation diagrams of composite grades, calculate and model 2D or 3D variograms and perform various types of kriging (ordinary, lognormal or indicator) of block grades. Specific problems that can be solved with this type of analysis are:

- The determination of a capping value in precious metal deposits with outliers
- The precision of resource estimates and its improvement with fill-in drilling
- The pooling of different sample information (drill hole vs. channel or muck) in the block grade interpolation

In operating mines, a geostatistical analysis of existing grade control information indicates what gains in recovery can be expected with an automated processing method like blast hole kriging and what the parameters of that method (type of transformation, search window, variogram models) should be.

DELIVERABLES

SGS can provide a NI43-101 compliant technical report. Whatever the method used, the final product of a modeling and resource estimation project by SGS is a file with block coordinates and another file with block calculated or estimated tonnage and grade values. Resource reports are produced showing variations with cut-off(s) and confidence if geostatistical interpolation methods have been used, as well as sections and bench maps showing block outlines and values.

At SGS we have earned our leading position by utilizing a variety of people with practical mining and geological experience, world-renowned theoretical knowledge, advanced mathematical techniques, efficient programming algorithms and the latest computer technology. Partner with SGS and let us reduce your financial risks and optimize your business operations.

CONTACT INFORMATION

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WHEN YOU NEED TO BE SURE

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