

Automatic solids modelling

Maptek™ Vulcan™ Implicit Modelling tools were used to create a valid geological model for short term planning at Quebrada Blanca Mine in Chile.

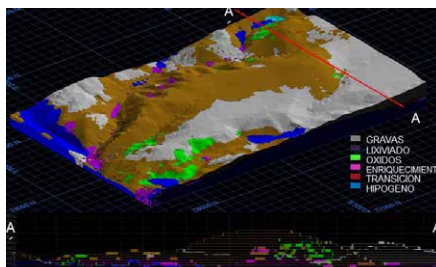
The Teck Quebrada Blanca open pit copper mine is 4400m above sea level, 240km southeast of Iquique in the Tarapaca region of Chile. Teck has 13 mines in Canada, the US, Chile and Peru, and actively explores for copper, zinc and gold across the globe.

The challenge

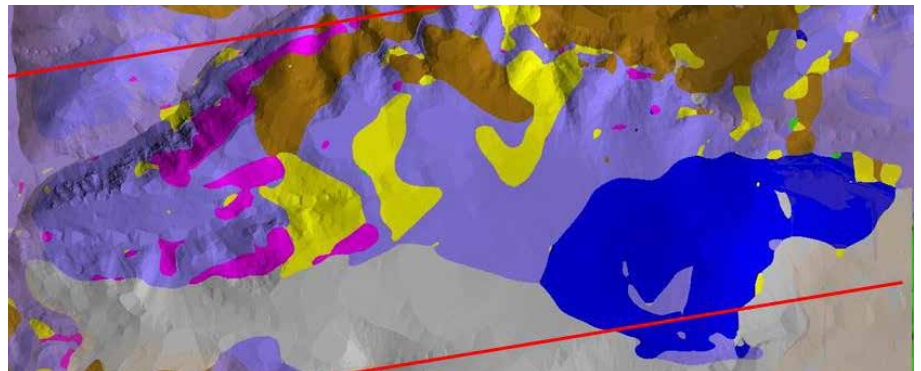
Teck needed to quickly and easily generate a geological model of the supergene zone for short term planning. Staff understood the geology of the deposit extremely well, but were less experienced in technical modelling.

Maptek™ was asked to provide expertise in mapping and geological interpretation, with particular attention to lithological concepts and structural controls. The data to model included bench maps, blastholes, reverse circulation (RC) and diamond drillholes (DDH).

Maptek realised not all of this geological data had been used in the October 2013 long term model. Quebrada Blanca had a conceptual model of the hypogene area of the deposit, which differed in some respects from the supergene zone.



Geological model of the mineralised area



Solid model showing lithology and cross-section lines

Maptek™ Vulcan™ has several tools for manually building solid models. The aim was to test the new implicit modelling tools in Vulcan 10 to automatically produce solid models directly from the database.

The project focused on the life-of-mine supergene interpretation phase with a medium term block model. The user-defined variables were lithology, alteration and mineralised zones.

Initially, only blasthole data was used for the geological interpretation. Not all holes were fully mapped so DDH and RC drilling data was included, along with the blastholes and structural information.

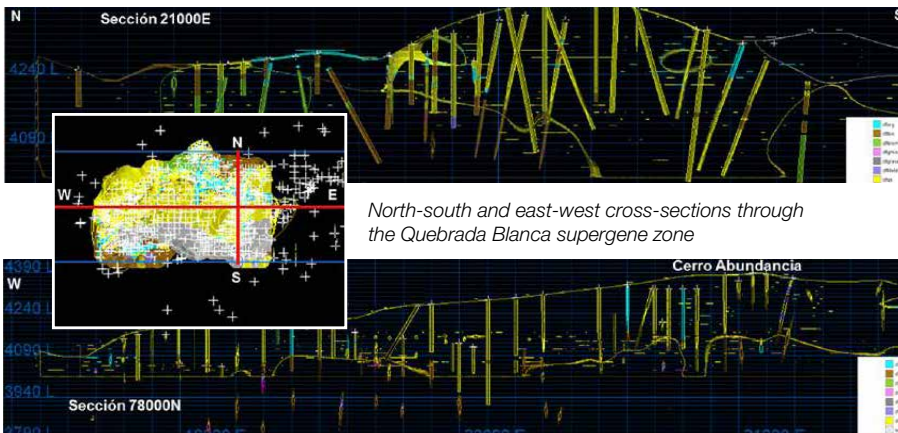
Considerations in the interpretation included mapped structures and the effects of mapping carried out in different periods. Blastholes and drillholes were displayed differently to weight data for ranking the interpretation.

Interpreting polygons

The interpreted polygons were checked for closure, repeated points and dimensions before viewing a preliminary 3D layout of the units. Continuity of the interpreted bodies could be reviewed before a final comparison and validation of the solids was obtained with implicit modelling.

A Vulcan script was used to create synthetic holes, by compositing where samples or composites accurately reflected the shape of the interpreted polygons. The synthetic database inherits the smoothness of the contacts between the interpreted polygons, and a low smoothing level was chosen to accurately represent the data.

The monthly block model for Quebrada Blanca was the basis for modelling. Between 4 and 16 samples were used to provide a more reliable estimate within the mesh composites and result in smoother edged solids.



North-south and east-west cross-sections through the Quebrada Blanca supergene zone

Vulcan 10 implicit modelling

'Our world class Vulcan Implicit Modelling integrates block and automatic solids aspects of 3D modelling in a single tool. Users can combine various methods in a hybrid approach which best suits their deposit and achieves desired planning outcomes,' commented General Manager Maptek South America Marcelo Arancibia.

Defining a geological structure from drillhole data requires many possible alternatives to be evaluated in a short time. Uncertainty modelling allows multiple models of an orebody to be automatically generated from the same drillhole data.

Adding financial information to these scenarios gives greater confidence in assessing the viability of mining and promotes better decisions.

A new radial basis function (RBF) option complements the existing geostatistical estimation technique for implicit modelling.

Implicit modelling allows quick and easy assessment and adjustment of potential models before building. Importantly, the risk can be easily analysed. With integrated RBF, faulting and uncertainty modelling in a single workflow, engineers and geologists can tailor a best fit modelling approach for each scenario.

Implicit modelling using either RBF or the geostatistical technique takes greater advantage of shared structural trends for related domains. Vulcan 10 offers an enhanced smoothing method that still honours the drillhole data. Users can also leverage existing anisotropies.

New methods to create local anisotropies for implicit modelling, grade estimation or simulation allow grade estimation to match the complex folded structures identified through geological modelling.

A simple variogram and a spherical model were selected. The orientation of the units was already implicit in the interpretation. The horizontal search radius was set at 80m, covering the maximum distance between the composites. No estimate was created in areas of sparse data. A vertical radius of 15m was set to coincide with the interpreted spacing of the plans.

Solid modelling with the implicit drillhole database did not require prior interpretation. It did require a drillhole database with previously reviewed sections and compositing data, as well as the definition of preferential directions of ellipsoids for model calculation.

Users could compare the overall consistency between the estimation direct from the drillhole database and that modelled on the interpretations.

Implicit modelling enabled delivery of a block model for resource modelling, featuring valid closed surfaces that honoured all geological contacts.

The modelling process is fully automated in Vulcan 10 using existing databases as inputs.

Advantages

Using Vulcan allowed Quebrada Blanca to produce a model and block solids to confidently prepare realistic resource estimates. Explicit control is provided through polygons. Sections and/or plans can be used in conjunction with the drilling database.

Vulcan produces consistent multi-domain models without crossovers, and with 100% shared boundaries. The 3D solids are generated in minutes and are easy to use, auditable and reproducible. Errors arising from file manipulation are avoided. The speed leads to higher productivity, with more alternatives generated in less time.

Dynamic previews allow Vulcan users to respond quickly to changes, gaining total control over the process. Implicit modelling incorporates geostatistical tools, including ordinary kriging and locally varying anisotropy to accurately account for trends.

A more accurate model of the resource improves planning and thus production at Quebrada Blanca.

Thanks to Teck Quebrada Blanca - Francisco Gonzalez, Geraldine Chavez & Irma Galleguillos, Project Modelling team; Christian Henriquez, Technical Services Manager and René Albornoz, Geology Manager.

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