

VULCAN GEOLOGY MODULES

Tools that allow geologists to access and view drillhole data, define geological zones, accurately model orebodies and deposits, and more.

GEOLOGY TOOLS

Management and validation of drillhole, lithological, and analytical data using Vulcan database or through interfacing to third party databases.

- > 3D display & analysis of drillhole data.
- > Tools for 3D geological interpretation.
- > Powerful compositing tools for both non-stratigraphic and stratigraphic environments.
- > Display and manipulation of downhole geophysical data.
- > Among stratigraphic modelling tools:
 - Single tree-style interface accesses virtually all of Vulcan's grid modelling tools
 - Save Complex Modelling runs as a single specification
 - Use multiple horizon lists, including an enhanced split definition panel which allows for 'Z' splitting
 - Dynamic model extent definition allows preview of grid size prior to modelling
 - Modelling directly from a drillhole database or from existing Mapfiles
 - In-pit survey or mapping data incorporated directly into the interpolation or modelling process
 - Choose your modelling method - thickness stacked or direct structural surface creation
- > Multi-domain Implicit Modelling with no void or overlap between domains.
- > Model grade shell and geology domains.
- > Boolean modelling ensures valid triangulations for mine planning.
- > Calculate strip ratios from user-defined HARP block model variables, limiting a lowest mineable level.

TOOLS TO QUERY AND FILTER THE INFORMATION, ALONG WITH DIFFERENT COMPOSITING OPTIONS.

BLOCK MODELLING

Accurate creation, visualisation and manipulation of complex block models.

- > Based on user-defined block dimensions and sizes.
- > Store and use information in any location of the space via regular cells or sub-cells variables.
- > Inverse distance grade estimation.
- > Creation of customised reports including grade tonnage curves.
- > Dynamic visualisation of single or multiple planes through the block model.
- > Advanced reserve reporting with ability to breakdown by other block variables.
- > Support for a large number of blocks with options to add, delete or modify variables in real time.

FOUNDATION FOR ADVANCED MODULES SUCH AS BASE GEOSTATS, GAUSSIAN SIMULATION, ETC.

BASE GEOSTATISTICS

General tools for the application of geostatistical techniques.

- > Based on GSLIB, provides diverse functions to calculate and model variograms, including 3D variogram maps and interactive modelling.
- > Variogram model autofit.
- > Easily determine three orthogonal directions given a main direction.
- > Indicate different geometric search parameters for each direction, facilitating the creation of directional variograms.
- > Simple kriging, ordinary kriging, indicator kriging and indicator simulation can all be used in estimation.
- > SMU support size analysis and validation.
- > Unfolding module incorporated.
- > Unfolding can be applied to deposits where mineralisation is controlled by a structural surface, which has been modelled.
- > The grade estimation search ellipse, or variography search ellipse, is distorted from the usual regular ellipse to follow folded upper and lower surfaces representing the orebody geometry.
- > The difference between a normal estimation and an unfolded estimation is that the search ellipse is moulded to follow the surfaces used to bound the deposit.
- > Locally Varying Anisotropy (LVA) method for arbitrary search path for grade estimation.

AN IDEAL UPGRADE TO TURN A GEOMODELLER INTO A POWERFUL GEOSTATMODELLER.

GAUSSIAN SIMULATION & CO-KRIGING

All the geostatistical tools widely used in risk analysis, uncertainty assessment and bivariate simultaneous grade estimation.

- > Multi-variable co-kriging and many functions related to the handling of models.
- > Multiple Indicator Simulation and specialised tools to prepare and process the simulation data.
- > Pre and post process tools for simulation include:
 - Normal scores (univariate) and stepwise (bivariate and trivariate) transformations
 - Drift analysis
 - Average variogram
 - Distribution and variogram validation options
- > Among cokriging tools:
 - Automatic calculation and fitting of a Linear Model of regionalisation
 - Simultaneous estimation with two variables

WORKING IN THE VULCAN BLOCK MODEL ENVIRONMENT, ENORMOUS MODELS AND HUNDREDS OF VARIABLES CAN BE HANDLED EFFICIENTLY.

CHANNEL SAMPLING

A special combination of options to streamline the creation and manipulation of underground channel samples.

- > Allows user to create and edit simple locations and directions of channel samples.
- > Samples can be rotated around the orientation and inclination, allowing the user to easily locate the channels that do not have enough survey information.
- > Visualisation of sample grades including weighted averages above user defined cut-offs.

IDEAL IN UNDERGROUND MINES, WHICH REQUIRE A SINGLE ADMINISTRATION OF THE SAMPLES FOR CHANNELS MANUALLY OR BY INTERACTIVE GRAPHICS.

GEOTECHNICAL TOOLBOX

Set up and use a structural database to display and calculate geotechnical information.

- > Data can be manually entered or imported from ASCII files, or linked to third party databases.
- > Structures can be displayed in 3D; an equiareal or equiangular stereonet or an orientation rose diagram, dipmeter or tadpole diagrams.
- > Data can be selected directly from a region in the space to perform Stereonet analysis, where several stability tools are available, including friction cone, sliding and toppling faulting.
- > Arbitrary user defined planes, such as proposed slopes with different directions and inclination, can also be entered directly at the stereonet, making it easier to analyse different operational or design scenarios.
- > Support for oriented drillholes.

EASIER TO ANALYZE DIFFERENT OPERATIONAL OR DESIGN SCENARIOS.

GRADE CONTROL

Perform material type/destination classification in open pit blasts and underground.

- > Display blast hole samples and block model estimations along with related Vulcan data such as geological mapping and registered face photos.
- > Material classification boundaries are digitised on the screen using standard Vulcan tools.
- > Solid triangulation models of the blast are used for accurate volume calculations.
- > Once material/grade boundaries have been digitised, the blackout process cuts the blast solid (using tri-boolean methods) into individual solid blocks for the purpose of material classification.
- > Advanced features allow for reblocking and partial reblocking of a blast.
- > Can perform blockouts on block models and/or drill samples if required.
- > Database can be linked to external databases, such as Oracle, SQLServer or Access, using ODBC (Open Data Base Connectivity).
- > Reports summaries of each grade block and totals for each blast.

DATA USED AND CREATED BY THE PROCESS IS STORED IN A VULCAN ISIS DATABASE THAT CAN BE CUSTOMISED TO THE EXACT REQUIREMENTS OF EACH MINE.

MONITORING

View, calculate, manipulate and plot data obtained from monitors on a periodic basis.

- > Time series data from the monitor is imported into the database established for the Monitoring module.
- > The data can be observed over certain time intervals in 3D views or as time series charts. Various derived parameters, such as incremental and cumulative change and rates of change, can be queried and displayed.
- > Colour legends and resizable symbols can be also used to display selected data characteristics.
- > Fully integrated with the other Vulcan modules, so information like geotechnical, geological and civil data can be overlaid and analysed along with the monitors.
- > Models can be built to demonstrate how the monitors change with time. These changes are modelled as points, contours, triangulated surfaces or grids so that they can be used by the Animation module (under View) for powerful 4D visualisation.

LEVELS OF CONTAMINANTS AT DIFFERENT LOCATIONS IN A WATER TABLE, OR THE MEASUREMENTS TAKEN FROM TOTAL STATION SURVEY SYSTEMS CAN BE USED TO MONITOR WALL MOVEMENT IN AN OPEN CUT PIT.



> IMPROVE EFFICIENCY WITH VULCAN

Vulcan software provides the user with the world's best 3D interactive modelling and planning package. It is the total solution of choice for the largest and best mining companies in the world. From geology to mine planning and scheduling, Vulcan delivers functionality, efficiency and improved productivity to Maptek customers worldwide.

COAL WASHABILITY

Storage, manipulation and modelling of coal recovery curves for preparation plants.

- > Converts and queries washability data from relational database source.
- > Produces washability mapfiles for modelling and reporting purposes.
- > Creates a composite washability data source from selected holes, at a chosen size-fraction range, for individual graphical query.
- > Produces Australian Standard wash curves (AS4156.1).
- > Allows wash characteristics determination for required qualities.
- > Combines other wash data with standard gravity separation techniques.

COMPLEX WASHABILITY MODELS SIMPLIFY THE 'WHAT IF' QUESTIONS ASKED OF WASH DATA.

OPTIMISED DIG LIMIT

Maximises the profit for mining of each mining block.

- > Applies optimisation techniques to the available block information to measure the profit of the blocks within the orebody delineation, in comparison to a penalty based on the mining equipment constraints.
- > Mining "digability" for a blast, mining block or bench can be determined using equipment specification curves with penalties applied for mining blast boundaries with acute angles.
- > Simulated annealing to determine the best outcome, balancing mining recovery and grade constraints for each equipment type.
- > Results can be displayed as layers within Vulcan for use in short term planning, as input for grade control, for upload to survey devices, and for field markup of mining benches.

THE OPTIMISATION PROCESS PRODUCES A MINING BOUNDARY FOR USE IN SHORT TERM PLANNING, AS INPUT FOR GRADE CONTROL WHICH MAXIMISES THE ECONOMIC BENEFIT FROM BLAST MATERIAL CLASSIFICATION.