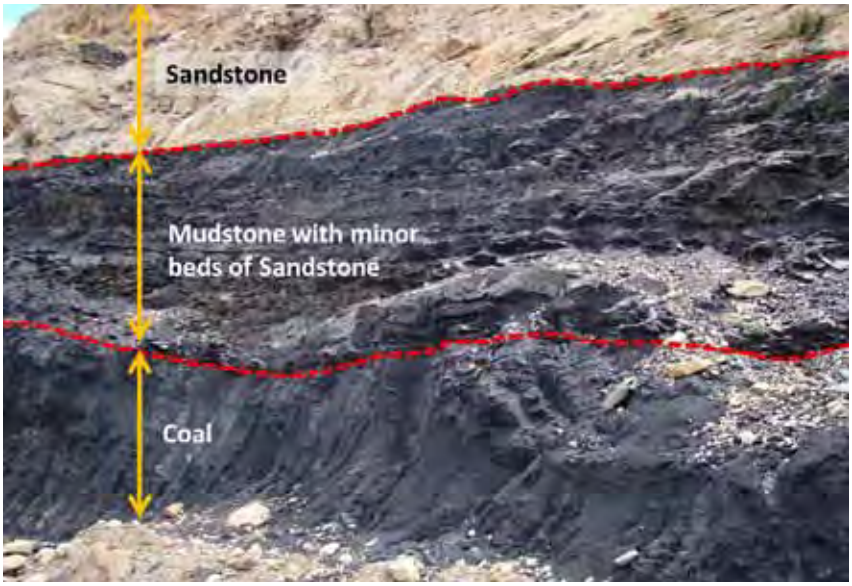
MAPTEK™ Vulcan™

FINDING THE DIRT COAL DIVIDE

Stockton Mine produces almost 2 mtpa of low ash semi-hard coking coal for export. Determining an accurate top of coal boundary is important for efficient mine planning.



Coal is black but black is not always coal! Modelling the structures to identify the margins between black coal and black mudstones allows the right equipment to be employed to strip the overburden

Stockton's product coal is a blend from multiple pits and the wash plant. Since 2009 the mine has been operated by an alliance between Downer EDI Mining NZ and Solid Energy New Zealand. Stockton has used Maptek Vulcan™ for 15 years.

The principal coal seam is up to 15 metres thick in the centre of the deposit and less than 3 metres thick in daughter splits at the margins.

Overburden and interburden lithologies form an ash continuum, grading from sandstones to mudstones to high ash coal, and into coal with very little ash. Lithologies can change laterally within a few metres from sandstone to mudstone. Bedding thickness ranges from decimetres to metres. While the upper overburden is mostly sandstone, the coal roof can be a mix of sandstone and mudstone and high ash coal.

The overburden is up to 50 metres thick. Pre-stripping is done with large machinery to within a metre above the coal. Final preparation is done with smaller machinery. When overburden turns 'black', a mine geologist must determine whether it is coal or mudstone, as operations strive to avoid wasting coal. Occurrences of thick black mudstone slow the stripping operation.

With the current resource, the 'easy' coal has mostly been mined. As mining moves into the margins occurrences of thick black mudstones on top of the coal become more common.

The issue in 2009 was whether the thick black mudstones can be predicted and thereby incorporated into the mine plan prior to stripping. The resource model had no information about the burden lithologies.

The bulk of the data used came from exploration diamond drilling. Downhole geophysics was not available at the time. Chip logging from some coal quality drilling could also be used.

Lava scripts were set up to identify the top of the significantly thick black lithology overlaying the coal. Results are written direct to a design layer

Previous attempts to model lithology using grids and cross-sectional wire-framing had failed because of the sparse data. A new approach was required. With a classic block model surfaces are used to code blocks, but we didn't have these surfaces. Our 'reverse' model solution involved block modelling the lithologies as populations and then turning those populations into surfaces.

The concept is to estimate the probability of a block being a particular lithology; sandstone, mudstone, hi-carb mudstone or coal. A 'top of black' surface can then be created and incorporated into existing models.

Two data 'streams' are available from drilling data; explicitly logged lithologies, and lithologies derived from ash analyses.

Using Vulcan, samples are composited to an Isis database, indicators are assigned, then estimated into a block model. Vulcan's unfolding (projection method) is excellent for this process.

The final block model (3 million blocks) of burden lithologies has limited appeal to mine planning where surfaces are preferred. A 'top of black' surface is required, that being seam roof or overlying mudstone.

A Lava script was written, incorporating several options. The Lava script burrows down each stack of blocks, evaluating lithology and 'grade of black' to determine 'top of black'.

The new geology model proved useful in predicting occurrences of thick black material on top of the coal. A good model can't be built on poor data, however. The need for more data on burden lithologies was recognised, and then implemented in subsequent drilling programs.

Thanks to Peter Manning
Geologist, Southern Geo Logic

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The lithology at Stockton is a continuum of sandstone, mudstone, high ash coal and coal

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