MAPTEK™ Vulcan™

STRUCTURAL COAL MODEL

Drillholes are not the only source of data for interpreting the structure of a deposit and making decisions about mining.

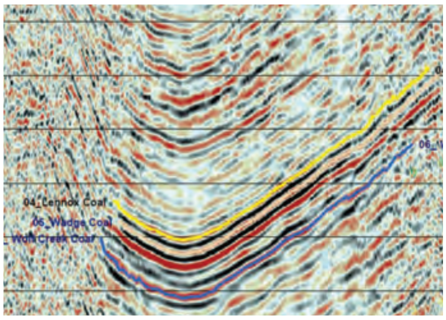
Despite the steep beds behind, the drillhole showed flat lying strata from the core samples

Many engineers prefer drillholes as the most reliable source since they are tangible points on a map and can be statistically reproduced. However, a lot more data can be profitably used by geologists making good interpretations and trusting their judgement. All sources, including seismic, mine workings, croplines and geological interpretations should be considered, but only trustworthy ones should be used in the final plan.

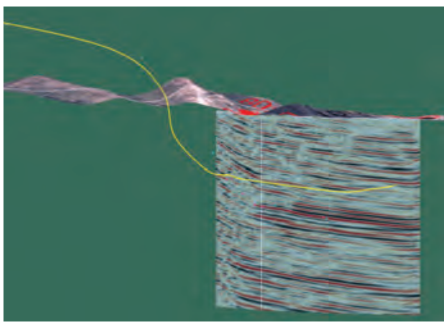
An underground coal mine in Routt County, Colorado has complex structures with asymmetrical folding affecting mine planning. Variations in slope from near zero to greater than 20 degrees across a short distance had led to the logical assumption of a thrust fault between the open pit and underground mine which might affect the extent of underground mining.

A road-cut showed evidence of near-vertical beds, which suggested a different interpretation than faulting. More evidence needed to be gathered. Drilling, which provides invaluable information for quality, coal thickness, and roof and floor properties, is not a very cost effective way of ascertaining structure, especially in terrains such as this.

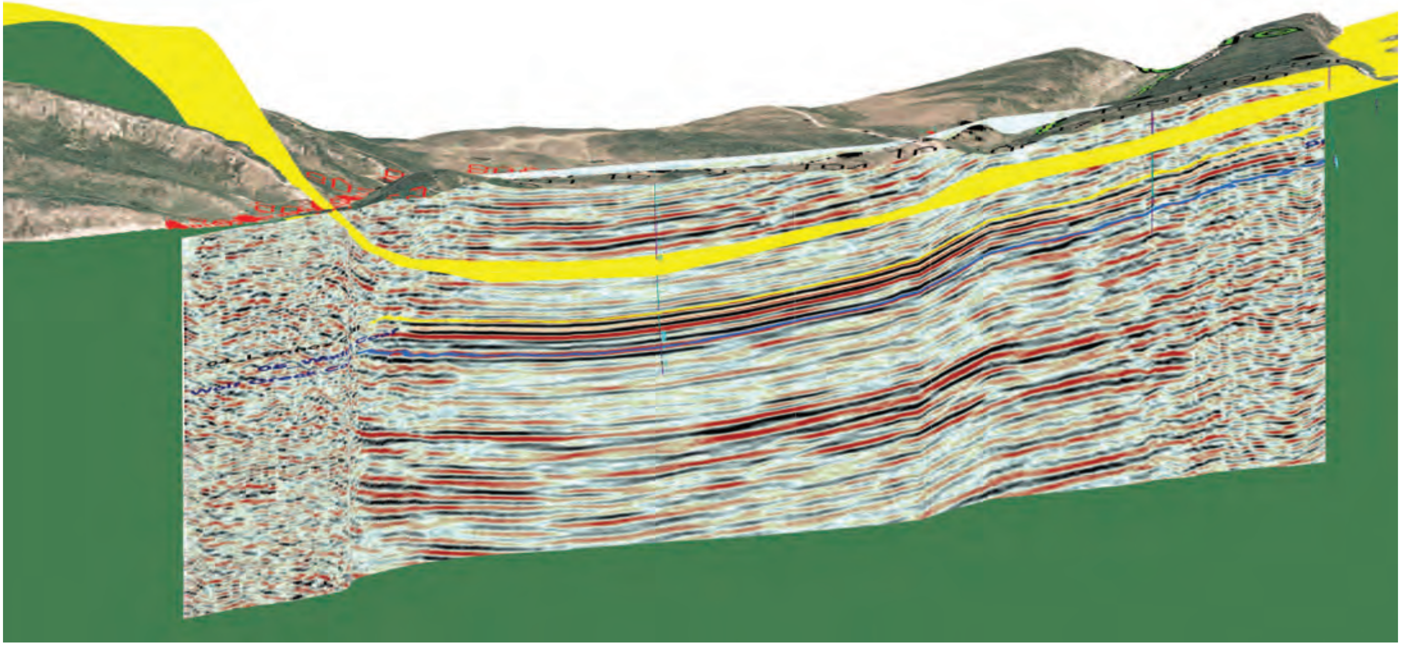
THE NEW SUBSURFACE MODEL ALLOWED THE UNDERGROUND PLANNERS TO DEVELOP THEIR PANELS FARTHER TO THE WEST THAN PREVIOUSLY PROJECTED BECAUSE THE MILDER SLOPES EXTENDED FARTHER THAN THE PREVIOUS MODELLING HAD INDICATED.



Seismic data proved very useful, establishing a tight L-shaped fold rather than a thrust fault



In section view, and using the geophysical points as a guide, it is now possible to make a template curve to accurately reflect the folding



Seismic, while better for structure, can still have interpretation issues. The vertical scale is time, not depth, plus scaling, vertical exaggeration, and curves/bends in the shot line from access and permit problems make it difficult to truly visualise the simple 2D representation.

In 2008, the Maptek Vulcan™ 3D environment was used in a 'medium-tech' but innovative way to provide a simple representation of the seismic data in 3D space. The images were 'registered' across a vertical triangulation to transform time to depth. Although not exact, it was enough to visualise the character of the structure. A major sandstone marker bed provided subsurface and surface control. A grid model was produced honouring the drilling, seismic and cropline data.

The new subsurface model allowed the underground planners to develop their panels farther to the west than previously projected because the milder slopes extended farther than the previous modelling had indicated.

Maptek's in-development 'high-tech' exploration product, Eureka, has much to contribute for seismic work. Raw SEG Y files can be read directly and displayed in the real XY plane with a Z axis in time units. Once the seismic data is converted to depth via sonic logs or another process, you can use the 'smart line' options which are familiar to I-Site users who track geologic lineations.

Cropline interpretations, made from an orthophoto image draped onto topography, were combined with the geophysical data to make a template curve of the folding.

In parallel cross-sections, this curve, drillholes and the croplines were used to make modelling points for the seam structures, especially where erosion complicated the true structure.

The horizon information was augmented by data from the Colorado State Survey which had wells with a complete stratigraphic column.

With the effects of erosion removed, the character of the folding took shape, and the cropline interpretations could be refined.

Drillholes, spad elevations from mine surveys, seismic lines, croplines, and interpreted points were all used to produce a realistic structural model, which showed the coal continuing much farther than previously thought. Subsequent mining confirmed the model's accuracy.

Until mining is finished, you will never have all the data. Models must be continually refined – low, medium or high-tech ways can all contribute. Geologists estimate the extent and amount of coal before mining and engineers determine the best way to mine. Simulations are only as good as the models – geologists and engineers must work together for the best outcomes

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