The use of 3D seismic to optimise mine plans at the structurally complex Blackwater Mine

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ABSTRACT

Blackwater Mine is in the central-southern Bowen Basin, immediately south of the township of Blackwater on the Capricorn Highway. The current open cut operation extracts coal from three main seams, designated Top, Middle and Lower, in the Late Permian Rangal Coal Measures cropping out on the eastern flank of the Comet Ridge.

Complex geological structures, dominated by E-W normal faults and N-S reverse faults, have significant detrimental effects on coal mining operations.

Historical exploration before 2010 involved various types of drilling only to understand structure, coal quality and washability. Hence, although combined with limited pit mapping and observation, unknown structures were still often encountered during excavations and led to mining surprises. In 2010 BHP completed 200-line km of closely spaced 2D seismic to capture gross and detailed structures followed by fit for purpose structural drilling to confirm major structures in the northern part of the mine.

In 2018 a high density 9.2 km2 3D seismic survey was completed in the southern part of the mine. Subsequently, a 17.2 km2 survey was completed in 2020 to cover the northern active mining area. It allowed geoscientists to successfully map unknown major faults and seam splits, which can potentially impact the mineability of the area. It is important to note, that faults interpreted using modern high-density 3D data can be interpreted with dramatically higher confidence in the fault dip and azimuth orientation in comparison to the legacy 2D data. Along with subsequent drilling, pit mapping and structural interpretation, the outcome will be very beneficial to mine planning and operations.

This paper provides information on the recent successful 3D seismic campaign at Blackwater with emphasis on interpretation. In detail, the paper presents three case studies on how the seismic interpretation outputs can be incorporated into a structural model to improve geological knowledge, facilitate geotechnical assessment, and support safe and efficient coal mining in a large and structurally complex open cut mine.