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## Reservoir Characterization of the Hartselle Sandstone in the Vicinity of Gorgas Power Plant, Walker County, Alabama, Using Amplitude Variation with Offset (AVO)

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### ABSTRACT

The Black Warrior Basin (BWB) contains prolific oil and gas reservoirs, which have been well characterized to the west of two major coal-fired power plants in Alabama. The Mississippian Hartselle Sandstone of the BWB is a major oil sand resource in the United States. A stratigraphic test well, drilled at the William C. Gorgas Power Plant, Walker County, Alabama, revealed light crude oil (40°API) in the Hartselle Sandstone at 729.9 m (2601.3 ft) below ground surface. Two 5 mile, 2D Vibroseis seismic reflection lines (line 101 and 201), which intersect near the stratigraphic test well, exhibit classic amplitude variation with offset (AVO) responses along the Hartselle Sandstone unit. Using an AVO intercept-gradient analysis along the target horizon (Hartselle Sandstone) across the seismic reflection profiles, the lateral extent of the hydrocarbon resource was mapped up to 1.3 km (0.8 miles) from the test well. The Hartselle Sandstone in the Gorgas area is considered a tight oil sand prospect and is higher impedance than the overlying limestone. The AVO analysis results show a pattern of positive amplitude decreasing with larger offsets consistent with a class I AVO anomaly, typical of high impedance hydrocarbon-saturated sands. The hydrocarbon zone within the Hartselle Sandstone extends a distance of 594 m (1949 ft) along line 101 and a distance of 1284 m (4213 ft) along line 201. These distances were used to estimate the areal extent of the hydrocarbons along each seismic reflection line, which averages 0.2 km<sup>2</sup> (50 ac) for line 101 and 0.5 km<sup>2</sup> (146 ac) for line 201. In addition to this areal extent estimation, volumetric and risking analysis indicates that the Hartselle Sandstone in the Gorgas area has a large resource potential, with an estimated total volume of hydrocarbons in place ranging from 0.1 to 5.6 million barrels of oil.

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