

Mapping Concretions in the Clearwater Formation

Tammy Willmer*, Osum Oil Sands Corporation, Calgary, Alberta, Canada

twillmer@osumcorp.com

and

Garrett Quinn, Osum Oil Sands Corporation, Calgary, Alberta, Canada

The Lower Cretaceous Clearwater Formation is host to exploitable bitumen near Cold Lake, Alberta. The 32.5 sq. km. study area in Township 65-66, Range 1-2W4 is part of Osum Oil Sands' Taiga Project. Calcite cemented sands or concretions are common in four stratigraphic intervals, particularly at the facies transition near the base of the SAGD interval. The objective of this study is to identify the occurrence of concretions within and between the delineation wells and to recommend horizontal well placements that maximize resource and minimize the impact of concretions. The data includes core and logs from 47 wells and a 2009 high resolution 3D seismic survey. One hundred fifty-seven concretions occur in the 47 wells. The concretions range in thickness from 4 cm to 1.88 m; the average thickness is 55 cm. While they appear to be randomly distributed in 3 of 4 stratigraphic intervals, most of the wells (31 of 47; 66%) intersected a concretion within two meters of the facies transition at the base of the SAGD interval.

Wells with dipole data were used to create a cross-plot template of density vs. μ -rho to correlate the well logs and seismic. A model-based, pre-stack inversion was run creating μ -rho and density volumes. These volumes were cross-plotted against one another to highlight the rock properties of the cemented sands. The cross-plot zone consistent with concretions was extracted as a geo-body for further integration with the geological and geophysical data. The resulting geo-body highlights high density, high rigidity areas that correspond to the base SAGD interval where concretions are most common. At this contact, the seismic was able to predict the absence or presence of the concretions with more than 70% accuracy. However, more randomly distributed concretions elsewhere in the stratigraphy, even concretions greater than one meter in thickness, were not detected in the pre-stack seismic inversion. The higher degree of predictability of concretions at the base of the SAGD interval suggest that in this case spatial interference may be as important as temporal interference, explaining the enhanced seismic response for concretions that are interpreted to be laterally extensive and lack of response for presumably more localized features. The geophysical and geological interpretation that the features at the base of the SAGD interval have considerable extent implies that optimizing bitumen recovery will likely require well placement above this zone.