Facies Analysis and Seismic Inversion of the Grosmont Formation

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The Grosmont Formation is an Upper Devonian fractured and karsted carbonate reservoir currently producing in a SAGD pilot project. In preparation for a commercial application in the Saleski area of Northern Alberta we have described and characterized the reservoir observed in 18 delineation wells tied to a high-resolution 34.2 km^2 seismic inversion volume. This allows us to map porosity and optimize thermal development.

The Grosmont Formation is subdivided by age into four members A to D. The upper two members C and D comprise the main reservoir of original limestone that has been dolomitized, karsted, and mechanically fractured. Twenty depositional and diagenetic facies are identified that represent deposition in a low-energy, shallow-water ramp environment, and are packaged in shallowing-upwards cycles. Typical facies include argillaceous bioclastic dolofloatstone to dolowackestone, bioclastic and peloidal dolorudstone and microbially-laminated dolomudstone. Overprinting diagenetic facies include an unconsolidated bitumen-saturated dolomite, and a range of breccia types with brittle to plastically-deformed clasts.

These Grosmont facies are laterally continuous in the Saleski area. Individual beds can be correlated across the study area, and distinctive facies are often on the order of 20 cm to a few meters in thickness. These stratigraphic zones are commonly thinner than the nominal seismic resolution of 4 to 5 metres. Core-to-log calibration has been used to create facies associations that have similar porosity. The variation in porosity between facies associations provides sufficient impedance contrast to be resolvable with seismic data. The inverted density volume demonstrates that the facies associations are laterally continuous except where interrupted by collapse dolines. This model defines two reservoirs for the proposed commercial development: a reservoir in Grosmont C with average net pay thickness of 19 meters; and a reservoir in the D with average net pay thickness of 17 meters, where net pay is defined as density porosity greater than 12% and resistivity greater than 100 ohm-m.