Lithofacies and Reservoir Assessment for the Thirteen Finger Limestone, Hugoton Embayment, Kansas

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The Atokan Thirteen Finger Limestone is a widely distributed and mappable subsurface unit with a distinct wireline log signature. In the Anadarko basin and Hugoton Embayment of western Oklahoma and Kansas, the Thirteen Finger Limestone is interpreted using log characteristics and bit cuttings as a package of thin interbedded carbonates and radioactive shales that is in sharp contact with the underlying Morrowan shale. The contact between the Thirteen Finger Limestone and overlying Desmoinesian Cherokee Group is more difficult to determine. Fortunately, the complete section of the Thirteen Finger Limestone was cored in the Amoco Rebecca Bounds well drilled in Greeley County, KS. This core, which resides at the Kansas Geological Survey, was examined and sampled to establish stratigraphic boundaries and assess reservoir potential. The base of the Thirteen Finger Limestone was placed at a prominent exposure surface at 5019 feet. Immediately above this surface is a thin coal followed by marine shale and limestone. The top of the Thirteen Finger Limestone was placed at an exposure surface at 4936 feet. The 83 feet of Atokan strata contains limestones (70%) separated by fossiliferous dark gray shale (10%) or black shales (20%) with few macroinvertebrates. Seven prominent flooding surfaces and two hardgrounds help define Atokan high-frequency cycles that consist of dark shale (initial flooding) that transitions upward shallower-water limestone. The dark uranium-rich shales are likely source rocks. Adjacent limestones are dominantly dense wackestones and packstones with average matrix porosity and permeability values of 0.8% and 0.1 md, respectively. However, these limestones contain numerous open- and healed-vertical fractures that may provide the pore network necessary to produce oil and gas.