

Regional Geology and Reservoir Potential of the Schrader Bluff, Prince Creek, and Sagwon Member of the Sagavanirktok Formation (Late Cretaceous-Early Tertiary), Sagavanirktok Quadrangle, North Slope, Alaska

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A collaborative project between FEX-Talisman and University of Alaska-Fairbanks graduate students investigated surface exposures of the Schrader Bluff (SB), Prince Creek (PC), and Sagavanirktok (SAG) formations along the Toolik, Ivishak and Sagavanirktok rivers, North Slope, Alaska. Goals included (i) defining the distribution and reservoir quality of Late Cretaceous to Early Tertiary Brookian sandstones, (ii) identifying sandbody/floodplain geometries, and (iii) assessing the hydrocarbon potential of the Brooks Range frontal foothills.

Results indicate that the shallow-marine SB along the Toolik and Ivishak Rivers contains repeated coarsening-upward successions (~5-20 m thick) composed of basal marine mudstone coarsening to hummocky or swaley cross-stratified sandstone at the top. Petrographic analyses of hydrocarbon-saturated samples from the Ivishak River show that porosities/permeabilities are reduced by compaction and cementation, resulting in poor reservoir potential in this region.

In contrast, a structurally complex succession of the continental PC along the Ivishak River south of the Echooka #1 well fines-upward from a basal sandy conglomerate to fine-grained sandstone, siltstone, carbonaceous shale, and coal at the top. Additional exposures of the PC along the Sagavanirktok River at Sagwon Bluffs (~200 m thick) and along the east side of the Toolik River (~175 m thick) are remarkably similar to each other. At both localities the PC is composed of coarse-to fine-grained sandstone, organic siltstone, organic mudstone, carbonaceous shale, and coal. Meandering sheet sandstones up to 6 m thick and hundreds of meters wide and ribbon-form sandbodies up to 15 m thick and hundreds of meters wide are isolated from each other by organic floodplain facies and display a low degree of channel interconnectedness. The reservoir characteristics of PC sandstones at all localities are exceptional with porosities of 18%-30% and permeabilities locally in excess of 1 darcy.

A regional unconformity at the base of the Sagwon Member of the SAG at Sagwon bluffs and along the Ivishak River signals a change from water-saturated deltas dominated by meandering rivers, crevasse splays, lakes, swamps, and mires during PC time to that of an extensive conglomerate-rich braidplain during SAG time. The Sagwon Member of the SAG contains medium-to coarse-grained sandbodies encased in pebble-to-boulder conglomerate along with infrequently exposed finer-grained floodplain deposits. Due to the conglomeratic nature of the Sagwon Member and friability of the sandstones, representative core plugs were difficult to extract from field samples. Based on typical facies and thin section analyses the Sagwon Member of the SAG is believed to be an excellent reservoir.

Outcrops at Sagwon Bluffs and along the Ivishak River are extensively oil stained. Geochemical analyses of oil-saturated samples from the SB along the Ivishak River, from the SB from the Ivishak #1 and Susie #1 well cores and from the PC at Sagwon Bluffs indicate that all oils are related and that reservoirs were charged from marine source rocks. Oils are typed to the Pebble Shale/Hue Shale/HRZ, have early-mid oil window maturities, low sulfur, high gravity, and are not biodegraded (with the exception of the Sagwon Bluffs samples). The combination of pervasive light oil charge and good porosities/permeabilities in several reservoir intervals suggests that this lightly-drilled area may warrant future hydrocarbon exploration.