Integrated Reservoir Characterization in Pursuit of a Heavy Oil Giant in the Arctic

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Alaska's North Slope is a world-class petroleum basin with some of the largest producing fields in North America. What is not widely known is the vast resource of heavy oil in shallow sands overlying these light oil reservoirs. Development of heavy oil in the Arctic represents a significant departure from conventional light oil developments on the North Slope as well as established heavy oil developments elsewhere in the world. To progress this opportunity, BP has initiated an appraisal program focused on the portion of the heavy oil resource within the Lower Ugnu (M-sand) reservoirs.

The Ugnu M-sands were deposited during the Late Cretaceous and Early Tertiary within a regionally extensive, fluvial-deltaic complex. The M-sand interval varies in thickness from 180 to 225 feet and consists of very high quality, unconsolidated clean sands separated by thinner silty mudstone units. Sand bodies tend to be high net:gross, but with significant lateral variability in thickness and facies type. Some of the interbedded mudstones are laterally continuous and vertically segregate individual hydrocarbon bearing reservoir units.

A regional interpretation of reservoir distribution, continuity, and quality has underpinned appraisal of the Ugnu resource. Integration of log, core, and seismic data has provided the basis for defining reservoir architecture and region-wide depositional models. Regionally extensive single and multi-storey lower delta plain channels and sandsheet complexes have been interpreted from core derived lithofacies integrated with high resolution fully quantitative palynology. Sand deposition in moderate to high sinousity meandering river and distributary channel systems is indicated by image log paleocurrent interpretation and seismic amplitudes. Syn-depositional fault interpretation from 3-D seismic data appears to have influenced Ugnu sand deposition on both local and regional scales. In addition, 3-D seismic attribute analyses has provided a basis for lithology prediction away from well control and a tool to better constrain reservoir connectivity in the absence of production data.

Gaining an understanding of Ugnu reservoir architectures and depositional systems through an integrated reservoir description has informed resource screening, appraisal activity, reservoir performance prediction, and will be critical in the selection of a heavy oil recovery process for one of the northernmost heavy oil accumulations in the world.