MPS (Multiple Point Statistics) Modeling of a Complex Fluvial System, Ninilchik Field, Cook Inlet, Alaska

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The Ninilchik field has produced approximately 100 BCF of gas from a large, fault-partitioned, doubly-plunging anticline. The reservoir interval is comprised of greater than 6000' of Miocene age inter-bedded sand, silt, mud, and coal deposited in a fluvial environment. No container-based volumetric estimate had previously been done due to the seemingly unpredictable nature of individual sands, and the multiplicity of vertically stacked and poorly constrained gas water contacts. In Fall 2009 a collaborative MPS model was constructed with input from Chevron's Alaska business unit (CNAEP-MCA), and Chevron Energy Technology Company (ETC) sedimentology and geomodeling experts.

Earlier modeling attempts at similar Cook Inlet fields using traditional variogram analysis and SIS facies modeling had been deemed unsatisfactory due to the discontinuous nature of the fluvial sand bodies, and the isolated clustering of well bores which are directionally drilled from separate pads. For these reasons, an MPS approach was taken for facies distributions. The technique is less rigid than object modeling and has predictive facies relationships via the training image(s).

Four litho-facies were defined using log cut-offs to differentiate "sand", "silty sand", "mudstone", and "coal". These litho-facies were then equated to the depositional facies of channel belt, levee, floodplain, and bog respectively.

Training images were constructed in GOCAD for several different combinations of channel belt and levee widths and orientations. The dimensional and orientation interpretations were derived from log correlation, FMI data, and the regional depositional setting and were estimated for each zone. FDM (Facies Distribution Modeling) cubes were built using vertical proportion curves derived from well data alone, as individual facies elements are generally below seismic resolution. Facies models were populated using MPS/FDM modeling in GOCAD.

The resulting facies distributions appear geologically reasonable and honor the well constraints and defined facies relationships.
OGIP volumes were calculated incorporating uncertainty ranges on Sw, PHIE, and GWC's in Petrel over two sets of MPS facies models. The dual MPS models represent amalgamated, and isolated, channel belt end members. The OGIP volumetric ranges will be utilized by the business unit to better quantify and partition the P1-P6 resource base, and as a guide for full-field development planning.