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Remaining Hydrocarbon Habitat in the Tango Member (Zone 2B) of the Ivishak Formation

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ABSTRACT

Characterizing the remaining hydrocarbon habitat in stratigraphically complex, fluvially-dominated zones within the Ivishak Formation is a key challenge for Area Development Planning in Prudhoe Bay Field. A target interval (Lower Tango) still remains based on the complex nature of the stratigraphy. The re-development of this zone is currently targeted with horizontal wells via coil and to a lesser extent rotary sidetracks to exploit un-swept oil. Sediments of the Tango were deposited in a multi-point sourced, braided river-dominated, coastal plain environment with variable marine influences (Eckelman et al., 1976; Lawton et al., 1987; Atkinson, 1988; Paris, 1988). Lithologically, the Tango is composed of a broad range of clastic sediments, from pure mudstones to coarse pebble conglomerates (Atkinson, 1988). Five genetic depositional elements were interpreted based off of core data in 200 wells from 5 drill sites in Prudhoe Bay using gamma-ray signature, porosity/permeability data, and petrophysical sand flags. Manual interpretation of depositional elements in the Tango from a vertical well results in a one-dimensional subdivision of a fluvial sequence. Multiple geological elements exist interchangeably within a field-wide, non-genetic, layering scheme currently utilized in Greater Prudhoe Bay. Each element interpreted in the Tango represents a unique fluvial process, and exists variably in three dimensions. Furthermore, the lateral extent of the element intersected by the wellbore (i.e. channel margin vs. channel axis) is difficult to constrain spatially, and makes predictability of inter-well depositional architecture difficult to map in detail. Increasing the resolution of mapping by utilizing a stand-alone, vertical sequence of fluvial deposits increases the correlative uncertainty of it's predicted subsurface position. To reconcile these problems, base maps with pie-diagrams at well locations displaying the relative percentage of the interpreted element were combined with 3D geometrical dimensions of elements from field outcrop analogues (Ye, Burns, & Levinson, 2000). This methodology helped establish a predictive model showing the fabric of fluvial element on RDE maps for the respective Tango interval. The maps represent a genetically-influenced, quantitative bias using a 'contouring' methodology utilizing the relative percentage of an element within the base map 'pies' in order to reduce uncertainty. The multi-input mapping schema helped to: 1) construct a 3D architectural framework of the Lower Tango from a combination of both surface and subsurface data; 2) develop high resolution RDE maps (< 1,500 feet); 3) improve the understanding of injector-producer interaction in enhanced oil recovery areas; and 4) improve the overall understanding of the depositional behavior of the Lower Tango in the Eastern portion of Prudhoe Bay.