Paleoenvironmental reconstruction and geocellular reservoir model of a heterogeneous, tidally influenced reservoir analogue: The Neslen Formation near Harley Dome, Book Cliffs, Utah

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ABSTRACT

Deposits of deep-time coastal systems that record the interaction between fluvial, wave, and tidal processes, commonly contain complex ichnology and can be reservoir analogues. These typically low net/gross reservoirs contain highly variable vertical and lateral sandstone-shale distribution that juxtapose a variety of sandbody geometries. Herein we describe a high-resolution, multiproxy sedimentologic, ichnologic, architectural, and geocellular modelling study of the transition between the upper Sego and Neslen formations (fms). We identify common facies, interpret paleoenvironments, quantify sandbody geometries, and model a highly heterogeneous reservoir.

Four composite measured sections containing the transition from the upper Sego to Neslen formation were recorded near Harley Dome in the Book Cliffs, Utah. Sandbodies comprise inclined heterolithic stratification, lateral accretion surfaces, internal scours, and varying degrees of bioturbation. Sandbodies are separated from each other by muddier intervals containing paleosols with rhizoliths, siltstone, and coal. The ichnologic suite includes *Arenicolites, Asterosoma, Chondrites, Conichnus, Cylindrichnus, Diplocraterion, Lockeia, Macaronichnus, Ophiomorpha, Palaeophycus, Planolites, Schaubcylindrichnus, Siphonichns, Skolithos, Thalassinoides, Teredolites, Teichichnus,* and *Rhizocorallium*. By combining sedimentologic, ichnologic, and architectural data, we interpret paleoenvironments of the basal Neslen formation at Harley Dome to include tidal channels, tidal flat, bays, heterolithic distributary channels, floodplains, and deltas. A spatiotemporal evolutionary paleoenvironmental model was developed for the shallow marine to continental transition.

Wells were developed from a combination of outcrop measurements and outcrop acquired gamma ray data. These pseudo wells were combined with wireline logs from nearby wells, high-resolution 2D and 3D imagery, and observed sandbody-shale geometries to produce a 3D geocellular reservoir model utilizing object-based & multi-point geostatistical modelling techniques. We aim to evaluate the applicability of these different modelling techniques from results produced by an optimized workflow that includes the integration of paleoenvironmental reconstruction data and well data with the goal of providing a geologically accurate output for this ancient heterogeneous coastal system to be used as a reservoir analogue.

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