Understanding the Pennsylvanian Age Granite Wash Play Fairway Through Log and Core Data: Anadarko Basin, Oklahoma and Texas, U.S.A.

Jesse Koch[1], Thomas P. Bulling[1], Kristy Hanley[1], Kim Koepke[1], and Sara Maloney[1]

[1]BP, L48 Exploration

ABSTRACT

The Pennsylvanian age Granite Wash play covers roughly 4800 square miles in the Texas and Oklahoma panhandle region of the Anadarko Basin and was deposited adjacent to the Wichita uplift. We evaluated 49 cores from across the play fairway to better understand the depositional system and stacking patterns. Core work was coupled with an extensive well log database that allowed for correlation across the area leading to the construction of isopach/facies maps and cross-sections.

Detailed core analysis led to the identification of 31 facies, grouped into seven facies associations (alluvial fans, fluvial channels, estuarine, proximal/distal delta front, prodelta, and offshore). Depositional cycles average 100-300’ thick and generally coarsen upward with smaller, fining upward units occurring within the larger cycle. Each cycle is bound by a marine shale. Porosity and permeability cross plots show three types of reservoirs defined by potential deliverability that span four orders of magnitude of permeability, and a narrow spread on porosity. Regional mapping of the marine shales allowed for the building of isopach maps that define the thickening of the units nearest the Mountain Front, and a pronounced thickening from Texas into Oklahoma that appears to be subsidence related to a deep basement feature. Finer-scale mapping reveals compensational stacking of individual reservoir units that correspond to production trends across the region.

Depositional cycles in the Granite Wash were likely formed from a combination of eustatic and tectonic mechanisms. Sediments shedding from the Wichita uplift interacted with glacially-controlled eustatic cycles. The lower part of a cycle (early HST) consists of a prograding fluvial-deltaic reservoir system. Late HST is represented by a normal regression prior to a sequence boundary. The overlying TST marine shale provides the seal to the reservoir sands and is critical to trapping hydrocarbons. There is a sweet-spot where the reservoir quality of the sandstones is overlain by the marine shale that is required to form the trapping configuration for accumulations outside structural closures. Our work demonstrates the importance of integrating logs and core data to build a detailed subsurface view to predict reservoir performance. This study highlights the complex nature of sedimentary systems deposited near active tectonic uplift during high-frequency eustatic change, which may provide insight into other similar systems globally.