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The Permian Basin Petroleum Systems, Simpson-Ellenburger and Woodford-San Andres—New Insights for Exploring a Mature Petroleum Province

Two major petroleum systems evolved in the Permian Basin of west Texas and southeastern New Mexico: the Simpson-Ellenburger (~5 Gboe) and the Woodford-San Andres (~25 Gboe).

The Simpson-Ellenburger petroleum system consists of over 90 oil fields and over 50 gas fields. Oil fields are on the Central Basin Platform and Eastern Shelf and produce from the Early Ordovician Ellenburger Formation at an average depth of 11,000 and 8,500 ft, respectively. The source rock for this petroleum system is the Middle-Late Ordovician Simpson Group. Reservoir rocks for these fields are karsted and fractured dolostone that contain oil with an average API gravity of 45° and a sulfur content of 0.2 wt. %. The most prolific Ellenburger gas fields are in the adjacent Delaware and Val Verde basins where these same reservoir rocks are at average depth of 17,000 ft. Gas in these fields was originally oil expelled from the Simpson Group at a shallower depth which, after greater burial, was thermally cracked to gas.

The Woodford-San Andres petroleum system consists predominately of oil fields whose reservoir rocks span Mississippian-Late Permian. The Late Permian San Andres Formation is the dominant reservoir rock containing greater than 50% of the original in-place oil. Source rock for this petroleum system is the Late Devonian-Early Mississippian Woodford Shale. Most of the reservoir rocks are complex, restricted-platform carbonates that contain oil with an average API gravity of 37° and a sulfur content of 0.8 wt. %.

Mapping these petroleum systems in space and time provides a more robust and predictive framework for exploration and development.

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