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Geologic structure and petroleum source rocks of the Tukumcari Basin, east-central New Mexico

ABSTRACT

The Tukumcari Basin of east-central New Mexico is an asymmetric structural depression that existed as a depositional basin from the Atokan (Early Pennsylvanian) through the Wolfcampian (Early Permian). The deepest parts of the Tukumcari Basin are in elevator basins along the northern margin of the basin. Depth to Precambrian basement may exceed 10,000 ft in the deepest parts of these elevator basins. On the shelf areas to the south of the elevator basins, depth to Precambrian ranges from 2,000 to 5,000 ft in most places.

Two stratigraphic intervals, the San Andres Formation (Permian: Leonardian) and the Pennsylvanian System have generally been considered as having significant source rocks. Potential source-bearing strata occur at depths of 500 to 2,500 ft in the San Andres and from 5,000 ft to 10,000 ft in the Pennsylvanian.

The San Andres is a poor to marginal source rock throughout the Tukumcari Basin. Potential source facies are dark-gray limestones. Total organic carbon (TOC) levels within San Andres source facies are less than 0.5 percent throughout most of the basin, barely adequate for petroleum generation. Thermal maturity of the San Andres is also insufficient for petroleum generation throughout most of the basin.

Pennsylvanian shales are good to excellent source rocks of gas, oil, and condensate. Source facies are dark-gray to black shales and thin shaly coals. Shales in the elevator basins are thicker and have enhanced TOC levels. Within the elevator basins, the shales have TOC levels in excess of 2 percent in most places and in the 6 to 10 percent range over large areas. Shaly coals, unknown from outside the elevator basins, have TOC levels approaching 50 percent.

Thermal maturity of Pennsylvanian strata is also enhanced within the elevator basins. Throughout the shelf areas, source facies are only marginally mature. Within the elevator basins, however, deeper burial resulted in enhanced thermal maturity and the Pennsylvanian source facies are within the oil and condensate windows.