

Regional Stratigraphy and Depositional Characteristics of the Pennsylvanian Prue Sandstone, Lincoln County, Oklahoma

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Abstract

The Pennsylvanian Prue Sandstone in northeastern Oklahoma has been interpreted to represent fluvial and deltaic deposits that formed across a gently dipping shelf margin. The Prue Sandstone appears to be primarily sourced from the northeast with depositional trends to the southwest. The Prue Sandstone commonly includes moderately well-sorted and fine-grained sandstones that are light brown in color. Facies include sandstones with interbedded mudstones and shale exhibiting bioturbation, sandstones displaying localized wavy and planar laminations, and dark shales. Few studies have documented the stratigraphy and depositional characteristics of the Prue Sandstone across Lincoln County, Oklahoma. This study provides additional insight into the Prue stratigraphy, depositional characteristics, and the regional interpretation of the fluvial and deltaic deposits and associated oil and gas reservoirs in the area.

To evaluate the regional stratigraphy, various subsurface maps were generated to illustrate the spatial variability of the Prue Sandstone across Lincoln County. In the 990 mi² (1593 km²) study area, logs from 1600 wells were used for subsurface correlation and to generate geological maps. Most wells commonly have gamma-ray, spontaneous-potential, neutron-porosity, bulk-density, and resistivity logs. Two wells with Prue core spanning selected intervals were also analyzed.

The Prue Sandstone is bounded at the top by the Oswego Limestone and at the base by the Verdigris Limestone. The Oswego and Verdigris limestones are easily recognized on well logs and form excellent stratigraphic markers given their spatial continuity. The interpreted formation tops were used to generate structure and isopach maps of the Prue Sandstone. Sandstone intervals within the Prue were identified to produce net sandstone and sandstone percentage maps. Well logs were used to identify and map intervals of sandstone that exhibit porosity values greater than 12%. Subsurface maps combined with well-log

signatures, core descriptions, and production data were used to further define the Prue Sandstone depositional and reservoir characteristics.

Prue Sandstone structure maps illustrate the gradual southwesterly dip across the study area. Faults, such as the northeast to southwest trending Wilzetta Fault, display noticeable effects to structure and net-sandstone maps. Isopach and net-sandstone maps of the interval reveal thickness trends that are oriented from northeast to southwest and are consistent with a sediment source from the northeast. The Prue interval thickness ranges from 20 – 160 ft (6 – 48.7 m) and increases to the southeast. Prue net sandstone thickness ranges from 0 – 116 ft (35.4 m) and displays similar trends as the isopach. Two prominent northwest to southeast trending faults are interpreted to impact the patterns of deposition, resulting in significant spatial variability of the sandstone. The integration and analysis of subsurface maps, cross sections, and well-log signatures illustrates the spatial variability of the Prue stratigraphy and depositional characteristics.

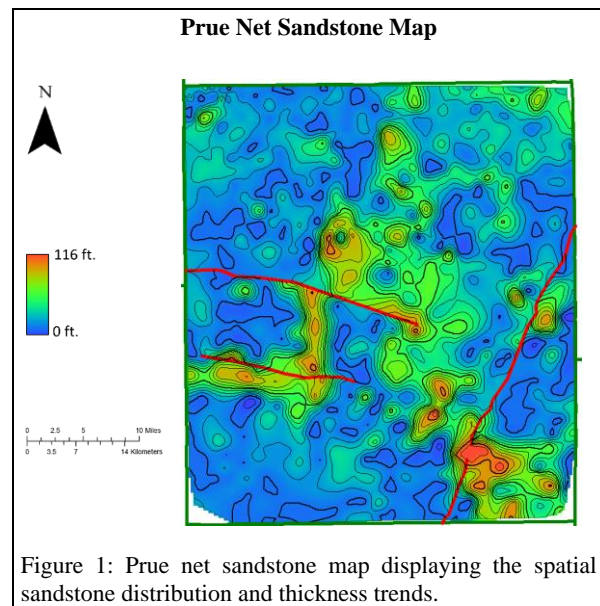


Figure 1: Prue net sandstone map displaying the spatial sandstone distribution and thickness trends.