Eolian Architecture of Sandstone Reservoirs in the Covenant Field, Sevier County, Utah

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The lower Jurassic Navajo Sandstone and the sandstone of the middle Jurassic White Throne Member of the Temple Cap Formation compose the primary reservoirs at Covenant Field in the central Utah thrust belt. Analysis of the stratigraphic and structural features identified from resistivity-image logs along with core and standard electric logs permitted the definition of dune architecture and permeability anisotropy caused by crossbedding within the eolian reservoir units.

Sandstone bodies in these units are dominated by barchanoid dune types and commonly lack inter-dune deposits. Paleo-wind transport directions were calculated for the White Throne and Navajo sandstones. These directions are southwest and southsoutheast, respectively, giving the two sandstones unique paleowind- transport directions. Therefore, maximum permeability directions within each reservoir are different and must be considered for optimum well placement. Tri-axial permeability measurements indicate a horizontal to vertical permeability anisotropy ratio of 2.4 in the White Throne and 2.7 in the Navajo. The average width of individual dunes was estimated by examining the preserved dune-set thicknesses in each sandstone. Average calculated dune widths for the White Throne and Navajo are 1,650 ft and 2,200 ft, respectively. Drainage ellipses were constructed using the paleo-wind-transport directions, permeability-anisotropy ratios, and estimated dune sizes. The validity of the drainage ellipses is supported by well interference identified from production data.

Rocks previously known as the “Upper Navajo” at Covenant Field have recently been assigned to the White Throne Member of the Temple Cap Formation based on regional outcrop studies, subsurface correlations, palynology, and radiometric dating. This assignment is supported by comparing the calculated paleo-windtransport directions for the White Throne and Navajo sandstones at Covenant Field to measured Jurassic outcrop sections. The distinct lithologic and diagenetic attributes of each horizon also suggests they were deposited in different environments.