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Lithostratigraphic Correlation and Reservoir Characterization of the Permian Age Cutoff Formation; Guadalupe Mountains, West Texas

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The Leonardian-Guadalupian age Cutoff Formation has recently become a topic of interest in the energy industry due to its association with organic rich siltstones and sandstones of the Bone Spring play in the Delaware Basin of West Texas. Ongoing research in outcrop exposures of the Guadalupe Mountains and wireline logs is being conducted in order to refine the lithostratigraphic correlation and tight-hydrocarbon reservoir characterization of the Cutoff Formation.
The Cutoff Formation is a ~600 ft (~183 meters) section of carbonate facies and siliciclastic rich facies deposited on the shelf margin, slope ,and basin of a distally steepened ramp. Logging of over 2390 ft (728 meters) of measured section allows for the recognition of 8 facies types. Carbonate facies include: wackestones – packstones, grainstones-rudstones, breccias, floatstones, and silty mudstones-wackstones. Siliciclastic facies include: black-green siltstones, radiolarian siltstones, and coarse siltstones-very fine sandstones.

Facies identified in the Cutoff Formation have been assigned to three lithostratigraphic units based upon their position relative to the Leonardian-Guadalupian boundary (LGB). The LGB is defined at an erosional surface within the Cutoff Formation that stretches from the proximal slope to the basin floor. The Lower Cutoff Formation is truncated by the LGB and is comprised of alternating packages of carbonate facies and siliciclastic facies. The Lower Cutoff Formation is divided into 8 subunits. The Middle Cutoff Formation consists of breccias and coarse quartz siltstones-very fine sandstones that onlap the LGB. The Upper Cutoff Formation is Guadalupian in age and is composed of carbonate facies. The Upper Cutoff Formation is divided into 3 subunits.

There is tight oil potential within siliciclastic facies of the Lower and Middle Cutoff units. Reservoir facies within the Lower Cutoff formation are radiolarian siltstones. Porosity in this facies is moldic, interparticle, and intraparticle porosity associated with radiolarian tests. Radiolarian siltstones are interbedded with black-green siltstones. Within the Middle Cutoff Formation, coarse siltstones-very fine sandstones contain intergranular porosity. This facies is interbedded with silty breccias.

This study provides evidence that the current depositional model for the Cutoff Formation and time equivalent deposits within the Delaware Basin need to be revisited. First, the identification of two new carbonate subunits within the Lower Cutoff Formation suggests that there must be a broader carbonate factory on the Leonardian shelf than previously conceived. Second, truncation of Leonardian age units at the global stratotype boundary for the Leonardian and Guadalupian epochs may alter stratigraphic correlations to units in other parts of the basin (i.e. Glass Mountains, Southern Delaware Basin). Finally,

the discovery of a repeating pattern of carbonate and siliciclastic facies in the Lower Cutoff Formation provides evidence that long term sedimentologic and eustatic processes may have contributed to the deposition of tight-hydrocarbon facies around the Delaware Basin during late Leonardian time.

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