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Petroleum Potential and Lithostratigraphy of the Rough Creek Graben, Illinois Basin

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The Rough Creek graben is a narrow structural low in southern Illinois and western Kentucky that trends east-southeast to west-northwest. The graben is approximately 150 miles long and 30 miles wide, and is filled with 32,000 feet of sediment. It is bounded on the north by the Rough Creek and Cottage Grove faults, and on the south by the Reelfoot rift and the Pennyrile fault zone. The overlying strata form a sag that has sometimes been called the Moorman Trough of the Illinois Basin. The Rough Creek graben originated as a transtensional basin associated with strike-slip faulting along Rough Creek and Cottage Grove faults in Late Precambrian time, approximately 1.2 BYA. The structure is aligned with the Rome trough to the east, and terminates the north end of the Reelfoot rift, a large aulacogen. The Rough Creek graben experienced active and rapid subsidence and sedimentation throughout latest Precambrian time and into the Cambrian. The graben experienced later compression and relaxation during the Pennsylvanian and Permian associated with Appalachian tectonics.

The Rough Creek graben is filled with probable Precambrian and Cambrian strata of variable lithology. Three significant sequences are present in the basin, and only the uppermost unit has been penetrated by drilling. Initial basin fill appears to be a thick sequence of Precambrian clastics that are likely dominated by terrestrial alluvial fan and fluvial coarse clastics. The second sequence may have been deposited in the initial marine incursion into the graben during latest Precambrian time and may contain shallow marine clastics and carbonates and lacustrine deposits. The third sequence has been penetrated by several

exploratory wells and is composed of marine carbonates and clastics in the central portion of the graben, rimmed by coarse clastics deposited in fan deltas, and interbedded with volcanoclastics. Clean carbonate lithologies in this sequence offer some fracture and preserved matrix porosity and are associated with some gas shows. Limited framework-grain dissolution creates some porosity in the sandstones. Porosity is primarily destroyed by mechanical compaction and chert and clay cementation within the lithic sandstones. Good quality source rocks have not been encountered within the graben fill in the existing wells. The more basinal portions of Sequence 2 or 3 may contain marine or lacustrine shales with source potential. Maturation indicators suggest that the graben is mature or overmature for gas generation. The Rough Creek graben is mantled by a Paleozoic section typical of the southern Illinois Basin and has a thick section of sediments that is still untouched by petroleum exploration.



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