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Petrology and Petrophysics of the Middle Lance Formation (Upper Cretaceous), American Hunter Old Road Unit No. 1, Sublette County, Wyoming

The American Hunter Old Road Unit no. 1 was drilled as a basin-centered gas well in 1981. It is located 10 miles south of yet to be developed Jonah field. Drill stem test data in the Middle Lance indicated a low permeability formation with probable formation damage.

Core in the Middle and Lower Lance recovered thin to medium bedded, fine to medium sandstone and chert pebble conglomerate, interbedded with silty mudstone and shale. Conglomeratic beds are cross-bedded, massive and graded. Sandstones are massive, trough cross-bedded and ripple laminated, with local rooted zones. Small meandering rivers deposited sandstones and conglomerate. Mudstones are root mottled, homogeneous, and locally carbonaceous, consistent with deposition in overbank, swamp and lacustrine settings.

Sandstones are sublithic to lithic arenite, with cementation by moderate amounts of mixed-layer illite-smectite and quartz, rare siderite, pyrite, ferroan calcite and kaolinite. Porosity consists of moderate to rare mesopores, moderate to common clay-lined intergranular microporosity) and kaolinite-filled natural fractures.

Mean core porosity is 10.4%, mean in situ gas permeability is 0.81 md. "Irreducible" water saturations (S_{wi}) range from 21% to 50%, and closely agree with log-derived saturations, indicating that most of the potential reservoir sandstones are at or near S_{wi} . In situ relative permeability to gas measured at S_{wi} ranges from 46% to 99% of the absolute permeability. The common pore-bridging and pore-filling clay cement is responsible for the low absolute and relative permeabilities, relatively high values of S_{wi} for the lower permeability rocks and moderate to severe susceptibility to formation damage.