AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

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Origin, Conditions, and Timing of Gas Generation in the Lewis Shale, San Juan Basin, New Mexico

The Cretaceous Lewis Shale represents a highly prospective, underdeveloped gas resource in the San Juan Basin, northwestern New Mexico. Petrographic, fluid inclusion, vitrinite reflectance, and Rock-Eval analyses were performed on fractured sandstone, siltstone, and mudstone core samples to better understand the origin, timing, and temperature of Lewis Shale gas generation.

Ultraviolet-fluorescence and petrographic analyses in sandstones reveal hydrocarbon-bearing (blue fluorescing) two-phase (liquid and vapor) fluid inclusions in quartz fracture-fill and syntaxial quartz overgrowth cements. Moreover, in some samples bitumen (non-fluorescing) coats the fracture-fill and syntaxial overgrowth quartz, and oil staining (pale yellow-orange fluorescence) is present on detrital grain surfaces and paragenetically late authigenic kaolinite. The observations are strong evidence for present and past liquid hydrocarbons in the Lewis despite very low oil yields from Lewis reservoirs.

Preliminary homogenization temperatures indicate that quartz overgrowths formed at >150ºC. Notably, the homogenization temperatures come from sandstone having high cement and intergranular volumes (22 and 29 percent, respectively) and little (<7 percent) matrix material as determined from point-counts (counts per section equals 300). Rock-Eval (Tmax ranging from ~ 450º-490ºC) and vitrinite reflectance data (mean Ro=1.58 percent, n=25), indicate that the Lewis has been heated to 173ºC.

High paleotemperatures and the evidence for liquid hydrocarbons indicate that some Lewis Shale gas may have evolved from oil cracking, possibly when the Lewis achieved maximum temperature probably at maximum burial. Maturation of hydrocarbons and the cracking process may have generated overpressures, which would account for the calculated high intergranular volumes.