

Revisiting the Shale Gas and Shale Oil Resources of the Paradox Basin, Colorado and Utah

Steven Schamel

GeoX Consulting Inc, Salt Lake City, UT.

Black “shale” intervals within the Hermosa Group (Pennsylvanian), particularly those within the up to 7,000+ ft thick Paradox Formation, are the known source rocks for existing conventional oil and gas production in the Paradox Basin. Additionally, the “shale” intervals themselves now are emerging as reservoirs supporting significant shale-gas and shaleoil production. The synorogenic Hermosa Group was deposited as a series of orbital-forced transgressive-regressive cycles dominated by restricted-basin carbonates and anhydrite. Typically in the Paradox Formation the base of each cycle is a 10 to 150 ft thick transgressive, dark-gray, laminated, organic-carbonrich calcareous/dolomitic mudstone or shaly carbonate. This interval grades upward into intercalated anhydrite, dolostone, and limestone with minor black shale overlain by a thick halite interval deposited during the lowstand, arid-icehouse portion of the glacio-eustatic cycle. The TOC of the black “shale” averages 2- 4 percent and commonly exceeds 10 percent.

Kerogen is dominantly amorphous (algal) with minor terrestrial organic matter. Thermal maturity indicators, R_o and T_{max} , indicate that the “shale” units are in the oil window across nearly all of the central and southwest Paradox Basin. They are in the dry-gas window in a narrow belt along the northeast basin margin and in southwest Colorado, the southeastern terminus of the basin. Wet-gas maturities characterize an intermediate belt that lies just east of the Utah-Colorado state line extending towards Green River, Utah. These levels of thermal maturity are reflected in the types of fluids produced from “shale” units, and in an increase in GOR and the methane content of produced gas towards the northeast. Since the early 1990s, shale oil has been produced from horizontal wells in the Cane Creek Shale (cycle 22) in the south-central basin. In recent years significant gas discoveries have been made in the Gothic Shale (cycle 3) in southwest Colorado, where the thickness of this and the overlying Hovenweep Shale (cycle 2) each exceeds 100 ft. The potential for expansion of shale-gas and shale-oil production from these and other black “shale” units in the Paradox basin is considerable.