Walker Creek Revisited: Reinterpretation of Diagenesis of Smackover Formation, Walker Creek Field, Arkansas

Recent petrographic, trace element, isotopic, and fluid inclusion work has necessitated a major revision of the diagenetic model for the Smackover Formation at Walker Creek field, southern Arkansas. Prior studies concluded that all diagenetic changes occurred within a few tens of feet of the earth's surface. This investigation has shown that near surface diagenesis is confined to very minor marine cementation. The equant calcspar and baroque dolomite cementation occurred much later at temperatures between 60 and 120°C during the initial stages of hydrocarbon migration in the deep subsurface.

Earlier workers also concluded that the equant cementation is unrelated to depositional facies. They attributed the layered permeable and impermeable zones to permeability preservation in a meteoric vadose zone and occlusion in a meteoric phreatic zone. Because the equant cement is of a late origin, it can no longer be attributed to a meteoric zone.

The equant cement does occur in all depositional facies, but the effect of this cement upon the permeability of the rock is related to the original depositional facies. Permeability has been preserved in the coarser grained ooid and ooid-intraclast grainstones. This may be related to the size of the pore throats; cementation could block the pore throats completely in the finer grained material only. The coarser rock remained permeable and was made more permeable by late stage dissolution.

This new-found relation of permeability and original depositional facies has several implications regarding future hydrocarbon exploration in the southern Arkansas-northern Lousiana area.

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Stratigraphic, Sedimentologic, and Diagenetic Framework for Jurassic Cotton Valley Terryville Massive Sandstone Complex, Northern Louisiana

With deregulation and the subsequent rise in gas prices and development of modern evaluation and completion techniques, the "tight gas sands" of the Cotton Valley Terryville massive sandstone complex have become an intriguing play. This study establishes a generalized stratigraphic framework which allows regional correlation of individual productive horizons in the Terryville from east Texas to east Louisiana. It also proposes a sedimentologic sequence for deposition and a diagenetic sequence for reservoir rock modification.

The Terryville is an extensive complex of marine-dominated, massively bedded, predominantly fine-grained, quartz sandstones. It lies stratigraphically between the underlying Bossier shale and the overlying Knowles limestone and downdip from the time-equivalent Hico shale and Schuler Formation.

A series of four prograding marine-dominated, coalescing, deltaic complexes are proposed as the depositional systems for placing the Terryville sands on the stable Jurassic shelf. In this model, fluctuating sea levels and longshore drift spread the sands over a belt 40 to 50-mi (64 to 80 km) wide.

Burial diagenesis modified the porosity and, in the southeastern part of the area, created overpressuring in the Terryville sandstones. Subsequent structural movement in certain areas created large fractured reservoirs. Production from the tight gas sands is controlled by distinctive sedimentary and diagenetic effects which divide the area into two subareas: the normally pressured and the overpressured Terryville. Utilization of these concepts should result in a higher degree of success in economically developing the tight gas sands of the Cotton Valley Terryville.

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Structural Control of Lower Vicksburg (Oligocene) Turbidite Channel Sandstones, McAllen Ranch Field, Texas

Lower Vicksburg sandstones at McAllen Ranch field produce gas from depths of 9,300 to 15,000 ft (2,800 to 4,500 m). The sandstones have an ordered sequence of sedimentary structures and a systematic variation in composition and texture, which indicate deposition of the sands by turbidity flow. Structure at McAllen Ranch is a large, asymmetrical, southeast-plunging, anticlinal nose bounded on the west by a major growth fault. This structure is cut by numerous, smaller, growth and antithetic faults. To the west of the field is a Jackson shale uplift. Structural movement was active during deposition and controlled depositional patterns and facies distribution of the sandstones.

Three distinct facies were determined from examination of cores. Facies 1 has thick, stacked sequences of massive and laminated sandstones with very little shale. Facies 2 sandstones are separated by thin siltstones and shales and are thinner than the sandstones in facies 1. Facies 3 has considerably more silt and shale than either facies 1 or 2. Facies and net sand isopach maps for an upper sandstone, the "M," and a lower sandstone, the "V," indicate that these sandstones were deposited in turbidite channel environments.

The Jackson shale uplift west of the field controlled deposition of the "V' sandstone. The "V" sandstone was deposited in strike-trending channels that were diverted around the shale uplift. Anomalous thinning of the sandstone down the center of the field indicates the early presence of an axial, structural high. Deposition of the "M" sandstone was controlled by the axial high and by faulting. Two major, dip-trending channels were formed on either flank of the structure. Minor, strike-trending channels were developed later along the downthrown side of faults.

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Eruption of Mount St. Helens

Numerous small seismic events on March 20, 1980, indicated the reawakening of Mount St. Helens in southwest Washington State following a 125-year dormancy. A phreatic eruption one week later began a 62-day period of steam and ash venting, and periodic snow and ash avalanches. In early April, a bulge was detected growing about 5 ft (1.5 m) per day on the north side of the mountain. By mid-May, the bulge had swollen an estimated 250 ft (76 m) from the original mountainside. Residents of the valley below were warned of possible debris and mudflows caused by failure of the bulging mountain flank.

At 8:32 a.m. Sunday morning, May 18, 1980, a 5.0-magnitude earthquake caused the bulging north flank of Mount St. Helens to slide into the valley below, uncovering a gas-charged magma chamber. The resulting catastrophic explosion ripped away the remaining north flank and destroyed approximately 125-sq mi (325 sq km) of conifer forest in a 130° arc north of the mountain. The debris flow that resulted from the failure of the bulging north flank flowed down the North Fork of the Toutle River filling the valley with hundreds of feet of debris. Subsequent mudflows continued down the valley, ultimately emptying into the Columbia River after