Influence of Composition on the Evolution of Reservoirs and Seals in Carbonate Mounds of the Frisco Limestone, Hunton Group, Oklahoma

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Devonian carbonate mounds in the Frisco Limestone are important oil- and gas-bearing reservoirs in a number of oil and gas fields producing from the Hunton Group in Oklahoma. Though these limestone reservoirs have produced large volumes of petroleum, little is known about the evolution of their pore networks. The lone Frisco Formation outcrop in Pontotoc County, Oklahoma and several cores of the Frisco from producing oil and gas fields were analyzed to establish the composition and fabric of mound lithofacies and determine the post-depositional modifications that influenced reservoir and seal formation. The preservation and evolution of porosity in mound rocks was controlled by depositional facies. Bryozoan content strongly influenced diagenesis of Frisco limestones. Packstones and grainstones containing more than 25% bryozoan fragments evolved into reservoirs, whereas pelmatozoan-rich grainstones with <20% bryozoan grains were cemented by early syntaxial calcite cement to become intraformational seals. Primary porosity preserved in the zooecia of bryozoa provided conduits for corrosive fluids to dissolve grains and generate moldic pores. Facies within and proximal to the Frisco mound complexes include (1) mud-rich bafflestone within mound-core regions, (2) thinly interbedded skeletal packstones/grainstones and wackestones of flanking facies and (3) capping grainstone formed across the tops of mounds. Porosity preferentially developed in bryozoan-rich beds in flanking facies containing lesser amounts of carbonate mud. These beds are recognized on wireline log by higher porosity values, filtercake accumulation and microresistivity separation. Intervening calcite-cemented pelmatozoan-rich beds exhibit lower porosity and fail to show positive microresistvitiy separation indicative of permeable zones.