HETEROGENEITY IN MISSISSIPPIAN OIL RESERVOIRS, BLACK WARRIOR BASIN, ALABAMA: AN OVERVIEW

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ABSTRACT

Four Mississippian sandstone units produce oil in the Black Warrior basin of Alabama: (1) Lewis; (2) Carter; (3) Millerella; and (4) Gilmer. Reservoir geometries differ for each producing interval,reflecting variation in depositional style during the evolution of a foreland basin. Widespread strike-elongate bodies of Lewis sandstone with complex internal geometry were deposited during descrution of the Fort Payne-Tuscumbia carbonate ramp and represent inception of the foreland basin and initial forebulge migration. Synorogenic Carter sandstone is part of the first major deltaic foreland basin fill and accounts for more than 80 percent of oil production in the basin. More than 95 percent of this production is from a northwest-southeast trending belt of isolated, lensoid, quartzarenitic beach sequences deposited in a destructive shoal-water deltaic complex along the Bangor carbonate-bank margin. *Millerella* sandstone was deposited as transgressive sand patches during the final stages of delta destruction. Gilmer sandstone, in contrast, occurs as imbricate sandstone lenses deposited in a constructive shoal-water delta and is part of the late relaxational basin fill. Interaction of siliciclastic sediment with ancestral and active carbonate ramps was a primary control on facies architecture, and therefore, reservoir heterogeneity.

Patterns of production of injection and reservoir fluids, as well as field- to basin-scale depositional, petrological, petrophysical and geostatistical modeling, reveal microscopic to megasocopic controls on reservoir heterogeneity and hydrocarbon productibility. At a megascopic scale, isolation or continuity of reservoir bodies is a function of depositional topography and the degree of marine reworking of genetically coherent sandstone bodies. These factors result in amalgamated reservoir bodies or in compartments that may remain uncontacted or unconnected during field development. Within producing fields, segmentation of amalgamated sandstone bodies into individual lenses, grain size variations, depositional barriers, and diagenetic baffles further compartmentalize reservoirs, increase tortuosity of fluid flow, and affect sweep efficiency during improved recovery operations.