Finding the Fractures and Faults in the Mississippian Lime Play: Reservoir Optimization, Fluid Management, and Enhanced Recovery

Lynn Watney
Kansas Geological Society

Abstract

The economics of the Mississippian Lime Play (MLP) strongly depend on water management, more specifically, reducing the water cut during production and finding means to efficiently dispose of the brine. Oil production is dictated to a large degree by the reservoir quality and height above the oil: water contact. However, multiple lithofacies and pore types exist that are laterally discontinuous starting how the sediment accumulated, e.g., lenticular spiculitic biostromes and prograding wedges of strata. Each lithofacies has its own capillary pressure and relative permeability curves usually dictating some water cut in even the best conditions with a large oil column. Lithofacies distribution is also controlled by the local diagenesis, e.g., karst, hydrothermal alternation, and subaerial exposure.

The impacts of fault and fracture systems on well performance are less well understood, but complicate the simple matrix view of the pore system, e.g., when strata are dis-placed, cross stratal fluid flow occurs, and anisotropic enhanced fluid flow is developed in fracture systems. Map-ping faults and fractures, characterizing them as barriers or conduits, establishing their orientation, lengths, timing, and stress regime of the faults are becoming paramount to de-fining the success of continued successful development of the MLP.

The lithofacies, stratigraphy, and structure similarly control the host strata for the disposed brine, the Cambro-Lower Ordovician Arbuckle Group dolomite. This disposal interval is comprised of distinct hydrostratigraphic units, modified by structure, leading to local and regional variations in injectivity and storage defined by barriers and conduits related to stratigraphy and structure. It is important to examine the MLP from the perspective of this entire interval and the relating this to the basement geology to examine root causes of the structure.

The presentation focuses on ongoing research related to identifying and charactering key structural and stratigraphic elements deemed important to refine our models of the MLP in order to optimize oil recovery and brine disposal from both economic and environmental viewpoints.