Bossier - Haynesville: Developing Mechanically Layered Shale Gas Plays

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Shale gas plays are emerging as significant contributors to global gas reserves. However, their ultra-low matrix permeabilities limit productivity unless connected natural fractures exist, hydraulic fracturing creates new efficient fracture systems, or a combination of both. Play success thus depends on identification of fractures or, efficiently hydraulically fracturable zones of the resource (i.e., sweet spots).

In an attempt to understand productivity variations in the Bossier-Haynesville shale in northwestern Louisiana, USA, we interpreted 20 cores, 10 image logs, micro-seismic data, and present-day stress. Observations are compared to the Barnett and Marcellus shales.

Three fracture categories -associated with over-pressures or tectonics - are interpreted: pre-compaction, early diagenetic, and post-consolidation fractures. The majority are carbonate filled although other cements are also observed. Our observations indicate that fracture distribution in the Bossier-Haynesville system is controlled not only by the tectonic/basin history, but also by mechanical layering. Slight variations in rock stiffness, corresponding to changes in clay, silt, carbonate, and organic carbon content, influence fracture density and could lead to variable spacing-length relations. A layered fractured/ non- fractured shale system could be problematic for play development if the less fractured layers are organic rich whereas the highly fractured layers are lean. Depending upon the resource's stress profile and chosen horizontal well placement, a layered system can reduce frac efficiency by dissipating frac energy, or enhance it by increasing the stimulated fracture surface area as it connects with reactivated natural fractures. These considerations are critical to the successful development of mechanically-layered shale gas plays.