Natural Fractures in the New Albany Shale, Illinois Basin, and Their Importance for Shale-Gas Production

Gale, Julia F.[1]; Laubach, Stephen E.[1]; Fidler, Lucas J.[1] (1) Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, Austin, TX.

Success in the New Albany Shale gas play in southern Indiana and western Kentucky, where gas is mostly thermogenic, is partly dependent on understanding how the natural fracture system impacts hydraulic fracture treatments. We consider both the potential for natural fractures to provide permeability enhancement and their potential effects on hydraulic fracture treatment efficiency. We present observations from outcrops in the Illinois Basin in Kentucky and across the Cincinnati Arch into the Appalachian Basin and from cores from Indiana (10 cores) and Kentucky (2 cores) in the Illinois Basin. The structural grain of the two areas - southern Indiana and western Kentucky - is fundamentally different. Southern Indiana is dominated by the Wabash Valley normal fault system, which is currently active and trends approximately N-S. Western Kentucky is dominated by the E-W trending Rough Creek Graben. The major and minor faults and opening-mode fractures in part reflect this difference. The present-day in situ stress must be determined on a site-specific basis. The World Stress Map database suggests a swing in the maximum horizontal stress direction from ENE in southern Indiana to E-W in western Kentucky. The large difference in underlying local structure might have a significant perturbation effect on the far-field stress orientation.

Steep, sealed, or partly sealed fractures, some of which are sheared, are present in several of the cores. They contain both carbonate and quartz cements. These sets are likely to be important either for enhancing permeability or as influences over hydraulic fracture propagation. Compacted, fibrous, quartz-dolomite-bitumen veins are present in the basal Blocher Member in some outcrops. The veins are up to 14 cm wide and mostly < 1 m in height, and commonly contain bitumen in vuggy openings. For completions in the usually-targeted Clegg Creek Member it is unlikely that these large veins will affect production, but they could affect completions in the Selmier Member, where hydraulic fractures could propagate down into the Blocher. Smaller compacted fractures confined to pyrite-rich layers are present in both outcrop and cores throughout the New Albany Shale. They may be related to the large fractures in the Blocher Member, but they are apparently more widespread, and could act as mechanical discontinuities causing hydraulic fractures to deviate.