**Mechanical Stratigraphic and Tectonic Controls on Natural Fracturing in the Eagle Ford Formation, South-Central and West Texas**

David A. Ferrill¹, Ronald N. McGinnis¹, Alan P. Morris¹, Kevin J. Smart¹, Kirk D. H. Gulliver¹, Dan Lehrmann², and Mark A. Evans³

¹Space Science and Engineering Division, Southwest Research Institute, 6220 Culebra Rd., San Antonio, Texas 78238
²Geoscience Department, Trinity University, One Trinity Place, San Antonio, Texas 78212
³Department of Geological Sciences, Central Connecticut State University, 1615 Stanley St., New Britain, Connecticut 06050

GCAGS Explore & Discover Article #00195*
Posted October 30, 2017.

*Article based on a full paper published in the GCAGS Transactions (see footnote reference below), which is available as part of the entire 2017 GCAGS Transactions volume via the GCAGS Bookstore at the Bureau of Economic Geology (www.beg.utexas.edu) or as an individual document via AAPG Datapages, Inc. (www.datapages.com), and delivered as an oral presentation at the 67th Annual GCAGS Convention and 64th Annual GCSSEPM Meeting in San Antonio, Texas, November 1–3, 2017.

**ABSTRACT**

The Eagle Ford Formation, like many other self-sourced unconventional reservoirs, is heterolithic and mechanically layered. Detailed analyses of mechanical layering and structural history in the Eagle Ford clearly illustrate the first order control of mechanical layering on nucleation and propagation of brittle deformation features. Analyses of natural exposures along Sycamore Creek near Del Rio, Texas, and at Ernst Tinaja in Big Bend National Park, Texas, document contrasting deformation styles that reflect the different tectonic histories of the two localities. In both cases, early brittle deformation was dominated by shear and hybrid failure (faulting). Early faults at the Ernst Tinaja outcrops are interpreted as resulting from Laramide contractional deformation, whereas the early normal faults at the Sycamore Creek exposure likely formed in response to regional extensional deformation characteristic of the Gulf of Mexico Coastal Plain Province of South Texas. Faults at both locations show dip changes (refraction) related to the mechanical properties of the rock. Opening-mode (extension) fractures developed after faulting in response to regional extension and erosional unroofing. These fractures reflect strong influence of mechanical layering on nucleation, spacing, vertical penetration, and lateral extent of fractures. Systematic extension fracture networks are best developed in chalk and limestone beds—these fractures tend to be bed-restricted, terminating in adjacent mudrock or ash beds. Abutting of extension fractures against faults and occasional occurrence of extension fractures cutting across faults indicate their formation after faulting. These observations provide a foundation for using mechanical stratigraphy and tectonic history to predict fractures in the Eagle Ford and other reservoirs.