# High-Resolution Rock Strength and the Implications for Reservoir Geomechanics in the Cenomanian-Age Buda Formation, Dimmit County, Texas

Christopher K. Zahm[1], Robert G. Loucks[1], and Bruce G. Gates[2]

[1]Bureau of Economic Geology, Jackson School of Geosciences, University of Texas at Austin, University Station, Box X, Austin, Texas 78713–8924, U.S.A.

[2]Ageron Energy, LLC, San Antonio, Texas 78729, U.S.A.

## ABSTRACT

The Buda Formation is a productive, naturally fractured reservoir unit in South Texas that has undergone a resurgence in development using horizontal wells and hydraulic stimulation to produce from low-porosity zones. A rich dataset that includes core, dipole sonic logs, and formation microresistivity (FMI) image logs within the Buda interval was collected for the McKnight 1305H in Dimmit County, Texas. Unconfined compressive strength (UCS) values are high in the Buda Formation in this well with a mean value of 89.5 MPa (~13,900 psi) compared to other stratigraphic formations in this well (e.g., Austin Chalk Group, Eagle Ford Group, and Del Rio Formation). However, the key issue within the Buda is that UCS values vary between the two predominant lithofacies—lime wackestone and argillaceous mudstones. Mean of all measured UCS values within the lime wackestone lithofacies is 93.9 MPa (~13,600 psi) with a standard deviation of 17.9 MPa (~2600 psi) compared to argillaceous mudstone that has a mean UCS of 86.0 MPa (~12,400 psi) with a standard deviation of 19.5 MPa (~2800 psi). There are also a few thin, limited bentonite beds that have UCS values of 10–30 MPa (~1500–4400 psi). Measured UCS in core shows a correlation between UCS, porosity, and other rock mechanics data. Observation of drilling-induced tensile fractures and borehole breakouts in FMI logs are used to determine a 052° azimuth (N52°E) of horizontal maximum stress (SHmax). These observations, combined with knowledge of the UCS of the Buda enable the construction of a stress polygon that is used to determine that the McKnight well lies within the strike-slip (SS) stress state regime where the SHmax is greater than the overburden stress (Sv), which in turn is greater than the minimum horizontal stress (Shmin). This is likely related to loca-

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tion of the McKnight well, which is drilled along an antiformal feature associated with the Chittim Anticline that formed during the Laramide Orogeny approximately 30 Ma.

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