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Mechanical Stratigraphic Controls on Natural Fracture Spacing and Penetration

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ABSTRACT

Fine-grained low permeability sedimentary rocks, such as shale and mudrock, have drawn attention as unconventional hydrocarbon reservoirs. Fracturing – both natural and induced – is extremely important for increasing permeability in otherwise low-permeability rock. We analyze natural extension fracture networks within a complete measured outcrop section of the Ernst Member of the Boquillas Formation in Big Bend National Park, west Texas. Results of bed-center, dip-parallel scanline surveys demonstrate nearly identical fracture strikes and slight variation in dip between mudrock, chalk, and limestone beds. Fracture spacing tends to increase proportional to bed thickness in limestone and chalk beds; however, dramatic differences in fracture spacing are observed in mudrock. A direct relationship is observed between fracture spacing/thickness ratio and rock competence. Vertical fracture penetrations measured from the middle of chalk and limestone beds generally extend to and often beyond bed boundaries into the vertically adjacent mudrock beds. In contrast, fractures in the mudrock beds rarely penetrate