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A Geologist's Guide To Explaining Natural Fracture Phenomena with Fracture Mechanics

by
Jon Olson - Univ. of Texas, Austin - AAPG Distinguished Lecturer

ABSTRACT

This is a review talk designed to introduce a geologic audience to the concepts of fracture mechanics and how they can be applied to make conceptual and quantitative interpretations of natural fracture phenomena. Examples are driven by outcrop and core observations and explained conceptually with simple analytical equations from fracture mechanics. More complex fracture relationships are briefly treated using numerical model results. The talk focuses on opening mode fractures (joints, veins, dikes) and how fracture mechanics can be used to predict their geometric attributes.

Examples include the relationship between in situ stress anisotropy and propagation paths, theoretical predictions of fracture length, spacing and aperture versus length distributions, the role of subcritical (stress corrosion) cracking on fracture clustering, and the concept of natural hydraulic fracturing. The influence of simultaneous diagenesis and fracture growth will also be discussed in the context of preserved fracture aperture (e.g., how does a fracture stay open when the driving stress is gone?).