Verifiable Predictions of Fractured Reservoir Attributes

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Networks of natural, opening-mode fractures are examples of seismically transparent deformation that can have a significant impact on fluid flow. Both geostatistical and geomechanical approaches have been used to characterize natural fractures, but only geomechanical models can be truly predictive, particularly for exploration purposes. The modeling goal is to incorporate as much relevant physics as possible in order to capture the range of property variation for a given locality and geologic history. Models to date typically make the relatively simple assumptions of elastic behavior and time-invariant properties, even though the diagenetic and burial history for many rocks implies changing mechanical properties that may take on different rheologic characters at different stages of lithification. Fracture modelers often assume rock has a diagenetic history up to the time of fracturing, fracturing occurs under conditions of relatively constant properties, and then additional diagenesis may occur after fracturing to plug up the flow pathways. We present evidence that contemporaneous with propagation of fractures significant diagenetic changes in the rock can fundamentally alter the outcome of the fracturing event itself. We also show that uinderstanding links between mechanical and chemical processes can help overcome limitations of conventional fracture sampling permitting model prdictions to be verified.