Using Seismic Attributes to Delineate Fractures

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Open natural fractures can enhance reservoir permeability resulting in improved productivity and recovery efficiency. Healed natural fractures can be reactivated during hydraulic fracture jobs, often resulting in a suboptimum fracture network, and even propagating through what would otherwise be a good fracture barrier. Natural fractures are a function of the reservoir thickness, rigidity, and tectonic deformation style. Fracture prediction from surface seismic data can be either direct or indirect. Typically, individual fractures fall well below seismic resolution. Nevertheless, fractures sweet spots (and/or the coupled stress regime that opens microfractures or control hydraulically-induced fractures) can be detected using pre-stack attributes such velocity versus azimuth and amplitude versus azimuth attributes. Alternatively, we can use post-stack seismic attributes to map faults, folds, and flexures, develop a tectonic deformation hypothesis, and test this hypothesis against well control, allowing us to infer spatial locations where fracture density should be high. In this paper we focus on this latter work flow, illustrating the information content available in properly analyzed surface seismic poststack attribute volumes.