9/28/2017; 8:00AM

Post-stack attribute-based fracture characterization: A case study from the Permian Basin

Joseph P. Dominguez
CGG GeoSoftware

The ability to determine the relative density and orientations of fractures in potential reservoirs has become increasingly important as resource plays are now a major exploration and development focus for energy companies worldwide. This presentation focuses on extracting a relative fracture density attribute and fracture orientations from migrated post-stack 3D seismic data. The results of applying these processes and workflow are presented from a Permian Basin project in the United States.

Detection and mapping of fractures in migrated post-stack 3D seismic data depend on the resolution and signal-to-noise ratio of the data in the seismic volume. A brief discussion of seismic resolution is necessary to understand why detection of fractures is even possible in post-stack seismic volumes.

Because of the subtle nature of the amplitude effects, detection and resolution of fractures in these volumes depends on minimizing the noise in the seismic volume. The smaller the physical effect the interpreter is trying to image or quantify in the seismic data, the greater the degree of attention that must be given to filtering noise from the data. A robust and unique structurally-oriented post-stack coherent and random noise filtering process was applied as part of this fracture detection workflow.

Physically, fractures or fracture swarms scatter some of the seismic energy, creating an amplitude change that can be detected as an indication of fractures. A discontinuity class attribute, Horizon Edge Stacking (HES) (Dorn et al., 2012), was applied to the noise-filtered seismic volume to perform initial fracture im

aging. The HES attribute forms the basis for all subsequent attributes from the Permian Basin project which include the Fracture Density attribute and the extraction of fracture orientations. The post-stack computed fracture orientations are compared with available FMI log data. This post-stack workflow provides extracted seismic information which can positively impact fractured reservoir exploration and development decisions.