# Interpreting Fractures Through 3-D Seismic Discontinuity Attributes and their Visualization

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Characterization of fractures is essentially the understanding of fracture patterns, so that appropriate ways can be devised for effectively draining out fractured reservoirs. Surface seismic data has long been used for detecting faults and large fractures, but recent developments in seismic attribute analysis have shown promise in identifying groups of closely spaced fractures or interconnected fracture networks. The coherence attribute has been used for detection of faults and fractures over the last several years. However, volume curvature attributes have shown promise in helping us with fracture characterization. In addition to faults and fractures, stratigraphic features such as levees and bars and diagenetic features such a karst collapse and hydrothermally-altered dolomites also appear to be well-defined on curvature displays. Multi-spectral curvature estimates extended to volumetric calculations can yield both long and short wavelength curvature images, allowing an interpreter to enhance geologic features having different scales.

3D visualization as well as 3D volume rendering of seismic data is also an efficient way of displaying structural or stratigraphic hydrocarbon traps in their true three-dimensional perspective, allowing interpreters to comprehend the complex geometric inter-relations of horizons with faults and deviated well penetrations. This can be done rapidly providing insight about the details on the shapes, and highlighting depositional features such as channels and buildups.

The interpretation on curvature displays needs to be calibrated with log data and a promising way is to interpret the lineaments in a fractured zone in a localized area and then transform them into a rose diagram which may be compared with similar rose diagrams obtained from image logs to gain confidence in the seismic-to-well calibration. Alternatively, 3D rose diagrams can be generated as a volume using either the ridge or the valley shape attribute in combination with the azimuth of minimum curvature attribute. Once a favorable match is obtained, the interpretation of fault/fracture orientations and the thicknesses over which they extend can be used with greater confidence for more quantitative reservoir analysis. We illustrate all such applications through examples from real seismic data volumes from Alberta, Canada.