Emerging and Future Trends in Seismic Attributes

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Summary

Seismic attributes extract information from seismic reflection data that can be used for both quantitative and qualitative interpretation. Some attributes such as seismic amplitude, envelope, RMS amplitude, spectral magnitude, acoustic impedance, elastic impedance, and AVO measures are directly sensitive to changes in seismic impedance. Other attributes such as peak-to-trough thickness, peak frequency, and bandwidth are sensitive to layer thicknesses. Both of these classes of attributes can be quantitatively correlated to well control using multivariate analysis, geostatistics, or neural networks. Seismic attributes such as coherence, Sobel filter edge detectors, amplitude gradients, dip-azimuth, curvature, and Gray-level co-occurrence matrix texture attributes provide images that allow interpreters to qualitatively use geologic models of structural deformation, seismic stratigraphy, and seismic geomorphology, to infer the presence of fractures or the likelihood of encountering sand-prone facies.

It is therefore no surprise that research workers at major oil companies, geoscience contractors and universities continue not only to develop new seismic attributes and improve workflows using well-established attributes but also to minimize seismic artifacts and calibrate the attribute expression of geologic features that were previously unrecognized or overlooked. There has virtually been an explosion in seismic attributes in the last several years, and interpreters use them routinely and successfully.

Three years ago, we were asked to provide a historical perspective on seismic attributes to celebrate the 75th anniversary of the Society of Exploration Geophysicists (Chopra and Marfurt, 2005). The goal of our contribution for a talk on seismic attributes at this Convention is to update readers on the progress made since that time. As in 2005, we will focus more on attributes used in mapping structure and stratigraphy, leaving attributes used in lithologic estimation and the direct detection of hydrocarbons to experts in those fields.