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Meta attributes: A new concept for reservoir characterization and seismic anomaly detection

Fault cubes, salt bodies, sand channel volumes, and gas chimney data extracted from 3-D seismic are rapidly becoming valuable tools for exploration and field development. These seismic anomalies can be highlighted using a new technique that analyzes data with combinations of seismic attributes. Computer algorithms can be developed to search through data volumes looking for specific types of anomalous seismic data using carefully designed criteria or “meta-attributes.” Meta-attributes are an aggregation of a number of seismic attributes combined with the interpreter’s insight through a neural network to detect a particular feature. One of the main features of the meta-attribute concept is combining “artificial intelligence” of neural networks with the “natural intelligence” of an interpreter. This leads to a more comprehensive integration of geological, petrophysical and seismic data. Non-linear interrelationships between data as well as knowledge versus geologic features and reservoir properties are defined implicitly at the natural scale level. Meta attributes extracted from multiple input seismic volumes and derived attributes are used to predict porosity lithology or fluid saturation, as well as for detecting faults, fractures, channel facies or salt bodies. The meta-attribute approach is placed in the historical context, the technology is explained and examples are given.