

SEISMIC DIRECT HYDROCARBON INDICATORS IN OIL AND GAS EXPLORATION

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Seismic data analysis, interpretation and integration is one of the building blocks throughout field life cycle-from exploration to decommissioning a field. Understanding the ability and limitation of seismic data is the first critical step in integration it with geology. Seismic is used in many steps of subsurface description process, structural and stratigraphic interpretation, saturation change and pressure prediction, etc.

Historically, seismic served only as a tool to identify the geometries of potential traps. As an acquisition and processing technology evolved, the quality of imaging of subsurface improved. This resulted in better delineation of reservoir geometries, faults, etc. and integration with geology. The seismic amplitudes carry a lot of information about fluid and rock properties in the subsurface. The improvement in seismic acquisition and processing enabled to compute many derivatives of recorded signals such as incidence angle stacks, intercept, and gradient data. It is crucial to understand acoustic properties of reservoirs and overlaying seals which enable geoscientist to differentiate true fluid effect from minerology, multiples, or tuning effect.

Seismic is the main tool in predicting the presence of hydrocarbons within a trap during exploration period. There are 3 products derived from seismic analysis which formulates the Direct Hydrocarbon Indicator term:

- Cross-cutting reflector
- Amplitude shut-off with structural conformance
- Amplitude versus Angle (Offset) anomaly

Each prospect is unique in terms of the ability of having the DHI's mentioned above. This is heavily dependent on the acoustic properties of reservoir and non-reservoir units and quality of seismic. The quality of seismic includes the acquisition parameters and processing methodology, which is crucial in setting correct expectations from the seismic data analysis.

Cross-cutting reflector and clear amplitude shut-off with structural conformance are the most reliable DHI's that every explorer is looking for.

AVA anomalies are relatively less reliable and requires direct calibration to a well. Generally, DHI's need to be fully integrated with the geological model to understand their significance.