Full-Azimuth Imaging in Depth

A Paradigm Geoscience Data Service

Geophysicists ask a lot of their seismic data. For substructure (salt and basalt) reservoir exploration, they seek images to correct complex wave phenomena that can distort reflection positioning and quality to the point where many iterations of velocity model building and seismic migration are required. For mature oil fields, geophysicists seek the maximum resolution from seismic data to uncover evidence of both structural and stratigraphic compartmentalization of reservoirs. Here, preserving dynamic (amplitude) properties of seismic data is important for driving seismic inversion processes or to attribute transformations that emphasize discontinuities or geometric boundaries of depositional features. For fractured reservoirs, geophysicists often rely on directional sampling of the subsurface to create images that can be analyzed, compared and differenced to make inferences regarding fracture orientation and fracture density that define permeability zones and hydrocarbon migration pathways. Here, proper treatment of the full-azimuth sampling is required to measure anisotropy with precision.

Unfortunately, geophysicists often fail to select the optimal imaging solution for their exploration or development objectives. Practical considerations (e.g. project time lines) can dictate the methodology and solution used. To address all of these challenges, Paradigm has implemented a system for the recovery of full-azimuth data in situ (local angle domain) and in depth for generating and extracting high-resolution information about subsurface angle-dependent reflectivity. The system, EarthStudy 360®, enables geophysicists to use all recorded seismic data in a continuous fashion directly in the subsurface local angle domain. This results in two complementary, full-azimuth, common-image angle gather systems that capture both reflectivity and directivity of the subsurface.

The complete set of information from both types of angle gathers has implications for all types of exploration and development assets that use seismic data, including deep water anisotropic regimes, shale resource plays, fractured carbonates, and conventional plays requiring high-resolution velocity models or elastic property determination.

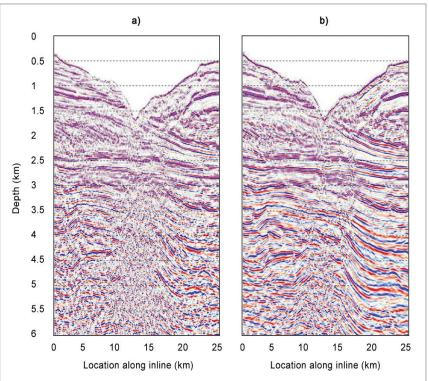
Additionally, the system incorporates a full-azimuth tomography solution to reduce the non-uniqueness of the velocity model and perfect the parameterization of both isotropic and anisotropic velocity models.

Paradigm Full-Azimuth Imaging Solutions

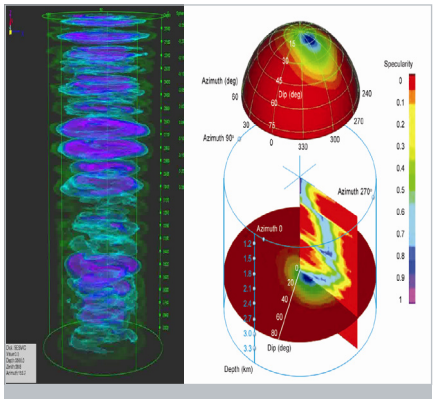
- Specular imaging options to clarify reflectors in low/poor signal to noise or poor illumination area
- Diffraction imaging options to emphasize image feature discontinuities (e.g. faults, edges)
- Optional on-the-fly beam forming for improved imaging
- Multiple attenuation in the directional angle gathers based on dip discrimination
- Precision anisotropic velocity determination with full-azimuth data
- Full-azimuth anisotropic tomography to reduce the non-uniqueness of the velocity model
- Full-azimuth residual moveout and amplitude inversions for fracture and stress determination
- Full-azimuth illumination as an image interpretation asset

Paradigm Full-Azimuth Imaging Advantages

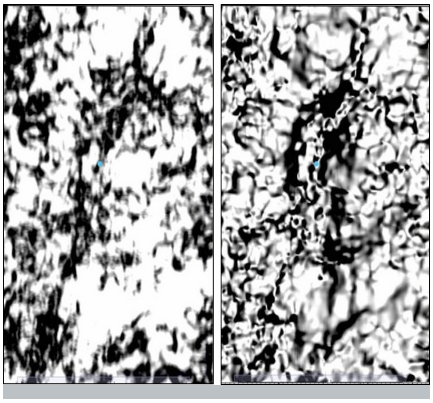
The Paradigm Geoscience Data Services team works with its customers to adapt the industry's only full-azimuth imaging and characterization system to the exploration or development challenge. Our experienced team of geoscientists will work with our customers to discover new subsurface insights from the full-azimuth data perspective, not achievable using conventional imaging methods. With experience in subsalt, fractured carbonates, shale resource plays, development fields, overthrusts and reef regimes, Paradigm will create deliverables that enhance prospecting and development outcomes.



▲ Conventional vs. specular imaging



▲ Full-azimuth reflectivity and directivity



▲ Coherence Cube slice vs. diffraction image slice

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