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**A discussion on seismic reservoir characterization of tight reservoir: Scope to further research combining fiber optics****Arijit Chattopadhyay, Misfera Al-Qahtani and Rachid Sablit**

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In North Kuwait, Najmah Formation hosts fractured tight carbonates and organic-rich kerogen layer, with average thickness of about 50 feet at average depth of 14000 feet below surface, characterized by low porosity and ultra-low permeability. This unit is overlain by alternating Gotnia salts and anhydrite layers. Destructive interference of coherent noise in 3D seismic affects the consistency of seismic reservoir characterization within Najmah interval, requires attenuation to exploit seismic data. Application of model-based interbed multiple attenuation reduces coherent noise interference, improves imaging and characterization of the Najmah formation.

Integration of rock physics modeling, full-azimuth P-wave seismic analysis and pre-stack simultaneous seismic inversion reveals that pore geometry can affect seismic anisotropy. In fractured tight carbonates, low  $V_p/V_s$  ratio correlates with relatively porous intervals, low pore aspect ratio and high brittleness index / higher fracture density. Higher organic richness of Najmah kerogen correlates with lower acoustic impedance. Azimuthal seismic analysis highlights existence of multi-azimuth fracture sets within Najmah interval and fast interval velocity coincides with direction of maximum horizontal stress. Combination of brittleness index and fast velocity azimuth can help identifying “sweet spots” within

Najmah formation.

Distributed Acoustic Sensing (DAS) fiber optics cable can acquire 1D and 3D borehole seismic. S/N ratio of raw DAS data is lower than geophone data and DAS is sensitive only to the axial deformation of fiber optic cable. This has downgraded DAS to a 1C geophone. DAS data can be acquired continuously throughout length and life of well, in contrast to geophones. Smart downhole deployment of helically wound DAS can enhance permanent monitoring and reservoir characterization by cross-well tomographic imaging and recording of microseismic events in tight reservoirs like Najmah Formation. Pragmatic use of fiber optics has potential to illuminate fracture systems, identifying the coherent noises of subsurface in evaluation unconventional reservoirs around the world.

**Speaker Biography**

Arijit Chattopadhyay has completed his M.Sc. at the age of 25 years from Indian Institute of Technology, Bombay, India. He is working in R&D Programmes Team of KOC, Kuwait. He has several publications and US Patent in recent years. He is a fellow of Geological Society of London and has over 14 years of global experience in E&P industry collaborative research in reputed academic institutions in India and USA.

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