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## Keys to Success in Shale Play Development

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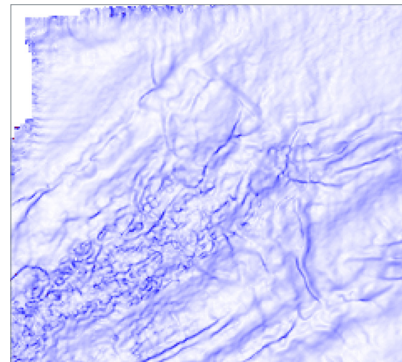
Despite the abundance of shale reserves throughout the world, successful exploitation of these resource plays presents a unique set of challenges for the geoscientist. Shale deposits are known to have significant variation in geology, geochemistry and geo-mechanical properties from one basin to another, and often within the same play. Accurately interpreting the lateral extent, variance in thickness to delineate the most promising zones is critical to assessing the economics of the acreage. Production comes mainly from targeting sweet spots in the reservoir that are characterized by clusters of natural fractures. Evaluating the density and structural orientation of the fracture systems is another critical factor. Detailed reservoir characterization based on all available data is an essential component of successful shale play exploration and development.

Speed in decision-making is the key to success and a source of competitive advantage for many companies that have been successful in the shale plays. With depressed gas prices and narrow economics, drilling efficiency is a key imperative for all operators. Geoscientists have to quickly incorporate new information into their interpretation model and feed the intelligence back to the operations team at the well site. Operational efficiency is therefore the second key component to successful shale play exploration and development.

Due to lateral variations and isolated fracture networks, production from shale reservoirs can vary significantly over short distances. Among other techniques, geoscientists analyze post-stack geometric seismic attributes such as curvature to delineate fracture trends with the highest potential for production. Curvature attributes may be co-blended with other attributes such as amplitude and dip of maximum similarity to provide a higher-definition understanding of the reservoir. For post-stack attribute analysis of shale plays, determination of the optimal frequency with which to analyze the reservoir is critical. The frequency band which best resolves the zone of interest can be identified by applying spectral decomposition

to the post stack seismic data, or by analyzing frequency gathers. Subsequent calculation of the geometric attributes on this seismic volume will provide the most detailed understanding of the reservoir character.

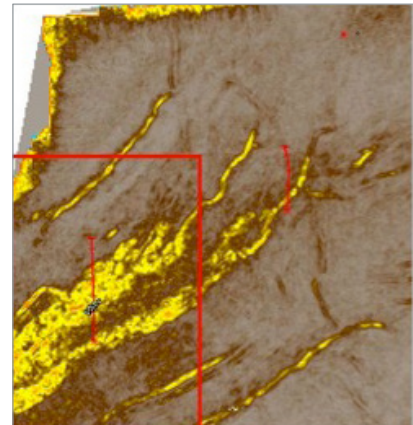
IHS Kingdom provides the integrated post-stack seismic processing, analysis tools and attribute generation capabilities required to get the most out of existing data for accurate reservoir characterization.



Left: Smoothed dip of maximum similarity highlights detailed faults and fracture zones in the Eagle Ford shale formation

*Seismic data courtesy of Global Geophysical Services*

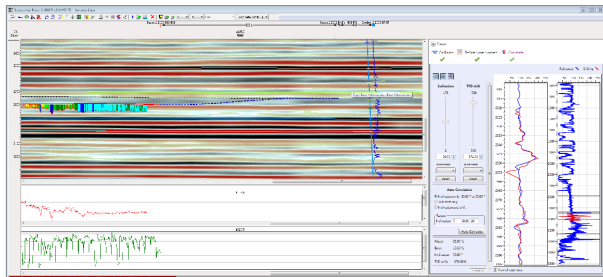
Right: Analysis of geometric seismic attributes reveals regional fault and fracture trends



Due to the fast pace of operations, drilling teams have to incorporate knowledge of the reservoir in quick time. These operations require input from (1) engineers for field planning, well design, and real-time geosteering corrections, (2) geologists for well target identification, correlation of acquired LWD data, and geosteering correction input, and (3) geophysicists for correlation of observed drilling and geologic information with the seismic data.

Kingdom's Geosteering module provides an integrated well planning tool that allows geoscientists to pick targets in the zone of interest using geologic data overlain on seismic data, which provides the inter-well structural information required for accurate well planning. This set of targets is easily handed to drilling engineers for detailed well planning.

During the drilling of the well, LWD data is captured and relayed to the team in real/near-time. This acquired LAS and directional survey information is required to determine where the bit is in the zone of interest and for making any necessary corrections to the well path to keep it in the optimal section of the zone. Kingdom's Geosteering capabilities allow geoscientists and engineers to work together in near-real time to keep the well on track. This allows the geoscientist to quickly analyze the position of the borehole relative to the original well plan and the updated structural interpretation. Necessary corrections can then be passed to the drilling engineers and the rig so that the bit can be geo-steered back into the optimal position.

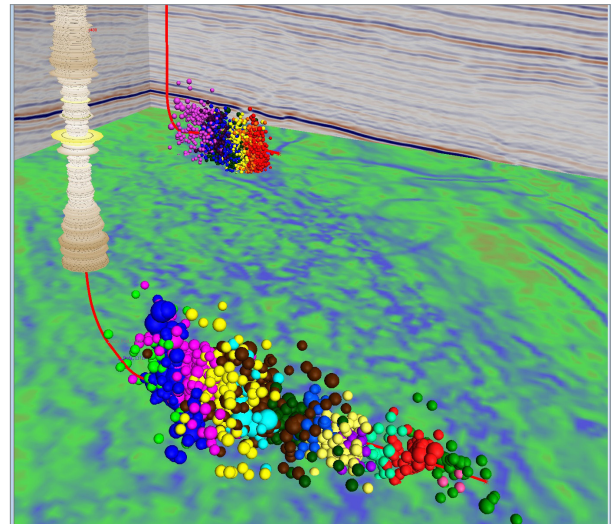


Integrated geosteering optimizes horizontal well drilling accuracy

Wells are stimulated by hydraulic fracturing, and monitored using microseismic technology. By analyzing the mapped locations of the fracture-induced seismic events, engineers can accurately assess the stimulated rock volume resulting from treatment. They can then interpret the event data to infer fracture orientation, and use the information to optimize their next frac job.

Kingdom provides comprehensive capabilities to load, visualize and analyze microseismic data. Using Kingdom's microseismic interpretation capabilities, geoscientists can:

- Define fracture patterns and geometries
- Determine volumetrics on fractured rock
- Assess the effectiveness of fracture jobs



3-D visualization of multiple seismic attributes and microseismic events enables analysis of the true spatial distribution of the fracture patterns

By providing an integrated, collaborative set of tools, built in collaboration with E&P companies engaged in shale play development, Kingdom enables asset teams to combine all available data from each discipline and work together in real/near-time decision-making processes. The result is full utilization of knowledge and data to understand the character of the reservoir and to maximize operational efficiency in field development.



For more information

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