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SVI Pro 2010 The gen next 3D seismic analysis tool

New seismic technologies for exploration and development of fracture plays

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Full azimuth decomposition, imaging, and analysis provides confidence in sweet spot determination

In spite of the current price volatility, unconventional plays represent sources of huge opportunity for oil and gas companies and the global oil and gas economy. Gas plays in naturally occurring fractured shale formations in North America (e.g. Bakken, Barnett, Haynesville, Woodford, and Marcellus) have achieved large visibility within this distinctive class of unconventional plays as technology (hydraulic fracturing, microseismic monitoring, converted wave 3D/3C and multi-azimuth seismic acquisition) has been applied with measurable success, return on investment, and opportunities for significant improvement.

Natural fractures in shale plays can be the source of sweet spots. It is well known that naturally occurring vertical fractures can give rise to anisotropic behavior in seismic data and, if detected, can be used to obtain measurements and models of stress direction and intensity. Traditional approaches to obtain this information rely on segmenting or "sectoring" of the seismic data based on surface (acquisition) azimuth. Although genuine in objective, surface azimuthal sectoring can be geologically biased, inherently impractical (one survey and project becomes many) and resolution-challenged as upfront sectoring and stacking can compromise or even destroy useful directional information.

To compensate for these deficiencies, Paradigm has developed Paradigm EarthStudy 360[™], a full azimuth decomposition, imaging, characterization, and analysis system. The breakthrough with this approach is achieved



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through the breakdown (decomposition) of the seismic wavefield into full azimuth image gathers that carry both reflection data and directional (orientation) data. The decomposition of the seismic data is carried out in depth and in the local angle domain, the natural domain for constructing true subsurface full azimuth image gathers. These new data structures (full azimuth

reflection and directional gathers) can be used to drive inversion processes (amplitude versus angle versus azimuth, and velocity inversion for anisotropic parameters) that produce attribute volumes, maps, and models suitable for making stress orientation and intensity determinations.

As a system, EarthStudy 360 becomes a unique blend of high performance computing, data observation and interaction, data inversion and analysis, and data interpretation, modeling, and correlation. EarthStudy 360 has tremendous potential to change the industry's approach to using the seismic method for this class of unconventional plays, from seismic data acquisition through seismic data interpretation. It is clear that the decision making process for exploration and developmental well planning can be fundamentally influenced by this unbiased, data-driven approach to full azimuth decomposition and imaging, and it is all carried out in the depth domain. dewjournal.com

about the author



Duane Dopkin is a geophysicist and Senior Vice President of Technology for Paradigm. With over twenty years of experience in managing software portfolios that advance the sciences of subsurface imaging and hydrocarbon detection, he has helped drive and align these technologies to meet the dynamic economies and needs of the oil and gas industry.

Prior to joining Paradigm, he worked at Digicon, Inc. and CogniSeis Development, Inc. where he directed geoscientists in special project groups tasked with the development and application of software for seismic processing, imaging, characterization, and interpretation. His current responsibilities combine product management with research and development to ensure the delivery of high end applications, solutions, and workflows to the oil and gas industry.

Dopkin holds a Bachelor of Science degree in Geosciences from The Pennsylvania State University and a Master of Science degree in Geosciences from The University of Houston at Clear Lake. He is a member of the Society of Exploration Geophysicists (SEG) and has published numerous articles on the integration of geoscience disciplines to improve hydrocarbon detection and recovery. He is a regular speaker and participant at professional seminars.