

## **Diffraction Imaging Case Study – Slipping Through the Cracks**

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### **Abstract**

Volumetric attributes, such as Coherence and Curvature, have been the standard tools for the interpreting geophysicist when it comes to direct discontinuity detection. We examine the methodology of Pre-stack Migration Diffraction Imaging (DI) and provide three depositional Western Canadian Sedimentary Basin case studies to compare the three techniques.

Although hydraulic stimulation techniques have been around for 60+ years, it has only been in the last decade that a shale production revolution has taken hold of North American energy development. The recent rise in the development of large gas and oil rich shale basins through stimulation has led to unparalleled growth in North American unconventional hydrocarbon production. In the United States 1995 shale, gas provided 1.5% of total gas production, 2005 provided 4.2%, 2010 provided 22.8%, and it is estimated that by 2020 41.5% of gas production will be from shale gas basins (US Energy Information Administration, 2012). As the industry embraces production successes, unmapped and un-resolved faults have created issues such as loss of circulation pressure and loss of hydraulic fluid volumes. Mapping of up-hole fault systems is gaining importance.

### **References Cited**

Born, M., and E. Wolf, 1959, Principles of optics; Pergamon Press.

Chen, J., and G.T. Schuster, 1999, Resolution limits of migrated images: Geophysics, Vol. 64, 1046-1053.

Hagedoorn, J.G. 1954, A process of seismic reflection interpretation: Geophysical Prospecting, 2, 85-127.

Khaidukov, V., Landa, E., and Moser, T.J., 2004, Diffraction imaging by focusing-defocusing: An outlook on seismic super resolution; Geophysics, Vol. 69, No. 6, 1478-1490.

Krey, T., 1952, The significance of diffraction in the investigation of faults: Geophysics, 17, 843-858.

Landa, E., V. Shtivelman, and B. Gelchinsky, 1987, A method for detection of diffracted waves on common-offset sections: Geophysical Prospecting, 35, 359-374.

Moser, T.J., 2011, Edge and Tip Diffraction Imaging in Three Dimensions; 73rd EAGE Conference & Exhibition.

Sheriff, R.E., 1997, Seismic Resolution a Key Element; AAPG December Explorer.

US Energy Information Administration. Annual Energy Outlook 2013 Early Release. December 5, 2012.  
[http://www.eia.gov/energy\\_in\\_brief/data/natgas\\_production\\_AEO2013ER.xlsx](http://www.eia.gov/energy_in_brief/data/natgas_production_AEO2013ER.xlsx).