Society of Independent Professional Earth Scientists
Houston Chapter
Newsletter
December 2012

December SIPES Luncheon

High Resolution Diffraction Imaging of Small Scale Fractures in the Eagle Ford Unconventional Shale Play

A.M. Popovici, *I. Sturzu, I. Musat, N. Tanushev; Z-Terra Inc., and T.J. Moser; Moser Geophysical Services*

December Hospitality Sponsor
WESTERLY EXPLORATION, INC.

Date: **Thursday, Dec. 13**
Place: **Petroleum Club**
800 Bell St.
Time: **Social 11:15**
Lunch 11:45

Registration deadline is Tues, Dec 11

IN THIS ISSUE

Abstract

In the year 2000, shale gas represented just 1 percent of American natural gas supplies. Today, it is 30 percent and the percentage keeps increasing. The technology to drill and fracture the shale formations is now exported to the rest of the world, increasing the national oil and gas reserves in many other countries. The thickness of the shale formations is often just a few hundred feet, so new high-resolution technologies are needed to visualize the structure and the natural fracture distribution and orientation in these thin shale layers. Diffraction imaging can be used to complement the structural images produced by conventional processing - by generating an additional image volume of high resolution unconformities - such as small scale faults and fractures, pinch-outs, or salt flanks.

High resolution imaging of the small scale fractures in shale reservoirs improves production and recovery efficiency, reduces field development cost and decreases the environmental impact of developing the field by using fewer wells to optimally produce the reservoir. This technology is not yet deployed in the industry and is a fundamental advance in high resolution 3-D prestack data imaging of complex geological structures. Current diffraction imaging research has identified a new approach to image small scale faults, pinch-outs, salt flanks, reflector unconformities, in general any small scattering objects, by using diffraction imaging as a complement to the structural images produced by reflection imaging (Shitvelman and Keydar 2004, Taner, Fomel and Landa 2006, Fomel, Landa and Taner 2006, Khaidukov, Landa and Moser 2004, Moser and Howard 2008, Moser 2009, Klokov et all. 2010, Klokov, Baina and Landa 2011, Dell and Gajewski 2011).

Diffraction imaging can be used as a complement to the structural images produced by conventional processing, to image and visualize the structure and the natural fracture distribution and orientation in thin shale layers. Diffraction imaging is simply the process of using diffractions to focus and image the structural elements that produced diffraction surfaces. Since diffractors are, by definition, smaller than the wavelength of seismic waves, diffraction imaging provides super-resolution information, which consists of image details that are beyond the classical Rayleigh limit of half a seismic wavelength. The goal of diffraction imaging is to provide interpreters with an additional 3-D or 4-D volume to fill in the small, but potentially crucial, structural details.

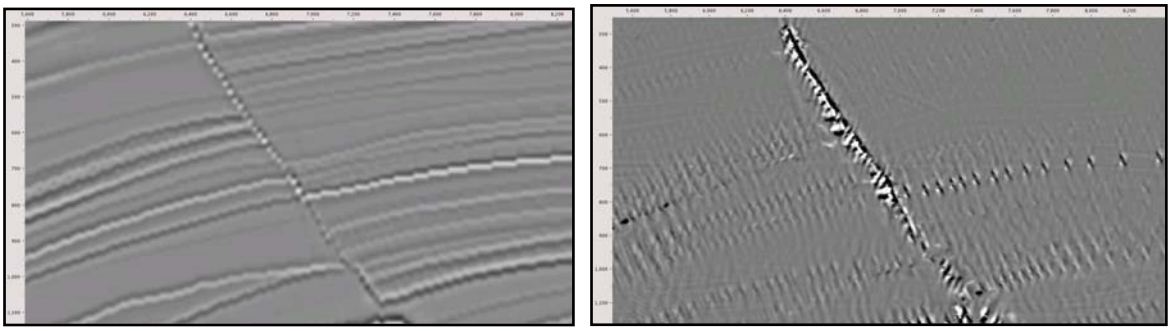
(Continued on page 2)

Luncheon registration deadline is Noon, Tuesday Dec 11

$30 for Members and Affiliates,
$35 for guests and non-members. An additional $5 for late/walk-ups.
***No-shows will be billed*.**
Call, fax, or e-mail your reservation to the SIPES-Houston Office.
You can sign up online at www.sipeshouston.org, but payment is still required at the luncheon or by mail.

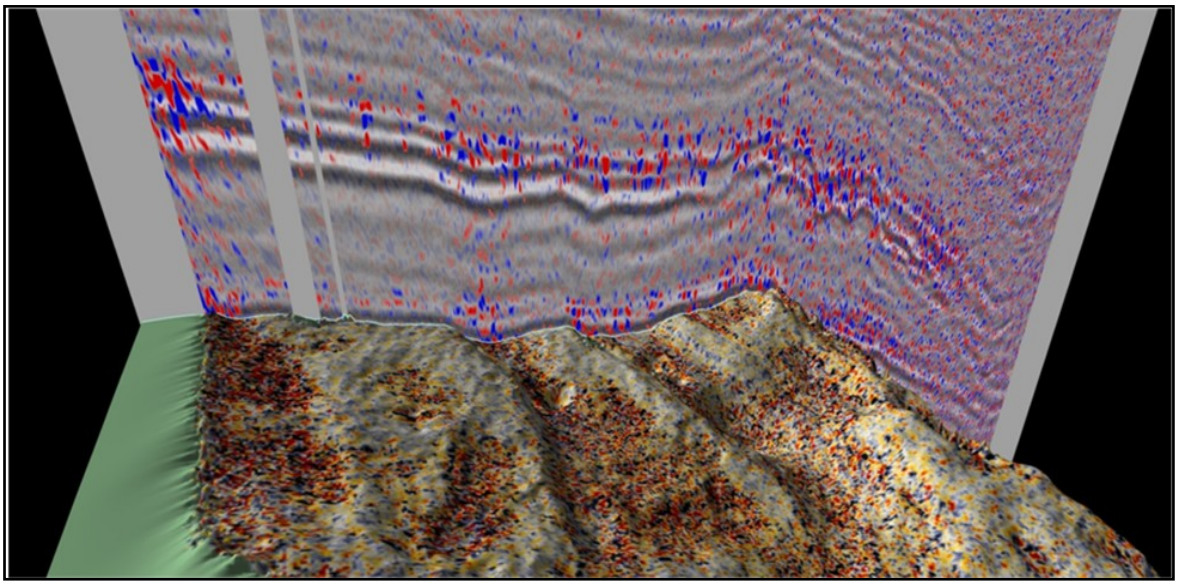
Luncheon, *continued*

(Continued from page 1)



a) b)

Details on a fault from a synthetic model. (a) Kirchhoff migration stack using the exact velocity model (b) Diffraction imaging stack of the same data..



Diffraction imaging along horizon showing the areas with larger fracture density, overlayed on the structrural image. Data courtesy of Marathon and Seitel.

References

Dell, S. and Gajewski, D., 2011 Common-reflection-surface-based workflow for diffraction imaging, *Geophysics*, **76**, 187–195.

Fomel S., Landa E. and Taner M.T. 2006. Post-stack velocity analysis by separation and imaging of seismic diffractions, 76th SEG meeting, New Orleans, Louisiana, USA, Expanded Abstracts, 2559–2563.

Fomel, S., 2002, Applications of plane-wave destruction filters: *Geophysics*, **67**, 1946-1960.

Khaidukov V., Landa E. and Moser T.J. 2004. Diffraction imaging by focusing-defocusing: An outlook on seismic superresolution. *Geophysics* **69**, 1478–1490.

Klokov, A., Baina, R. Landa, E., Thore P. and Tarrass I. 2010, Diffraction imaging for fracture detection: synthetic case study, 80th SEG meeting, Denver, Colorado, USA, Expanded Abstracts, 3354-3358.

(Continued on page 3)

Luncheon, *continued*

(Continued from page 2)

Klokov, A., Baina, R. and Landa, E. 2011, Point and Edge Diffractions in Three Dimensions, 73rd EAGE Conference & Exhibition, Vienna 2011, B023.

Shtivelman V. and Keydar S. 2004. Imaging shallow subsurface inhomogeneities by 3D multipath diffraction summation. *First Break* **23**, 39–42.

T. J. Moser, 2009, Diffraction Imaging in Subsalt Geometries and a New Look at the Scope of Reflectivity, EAGE Subsalt Imaging Workshop: Focus on Azimuth, Cairo, Egypt, Expanded Abstracts.

T.J. Moser and C.B. Howard, 2008, Diffraction imaging in depth, *Geophysical Prospecting* **56**, 627–641

Biography

Alexander Mihai Popovici is Chief Executive Officer and Chairman at Z-Terra Inc., a provider of state-of-the-art geophysical and geological technology, services and software for the upstream oil and gas industry. He holds Ph.D. (1995) and M.Sc. (1991) degrees in geophysics from Stanford University, and an equivalent B.S. (1985) in geophysical and geological engineering from University of Bucharest, Romania. Dr. Popovici is the founder and former CEO of 3DGeo Inc. The company was sold in 2008. 3DGeo grew from 2 employees in Palo Alto CA, to an international corporation with offices in Houston TX, Santa Clara CA, Buenos Aires, Rio de Janeiro, and representation in Beijing and The Hague.

Dr. Popovici's industry experience includes work in the seismic processing research department for Halliburton Geophysical Services in Dallas and Houston, and EM acquisition and processing contracts with the University of Bucharest, Romania. From 1987 to 1988, he was employed at Guzik Technical as a staff engineer for magnetic recording and software development, and was a consultant there until 1993.

He has several patents in the field, over 70 publications in conference proceedings, books, trade journals, and research reports and has given numerous invited talks at conferences, geophysical associations, and geophysical workshops. He has been a member of the SEG Research Committee since 1995, served as Associate Editor (Seismic Mi-

(Continued on page 4)

Luncheon, *continued*

(Continued from page 3)

gration) for Geophysics, and is past Chairman and founding board member of Geoscientists Without Borders, an SEG Foundation program that funds humanitarian applications of geophysics around the world. Currently he serves on the SEG Foundation Development Board and is Vice-Chair of the SEG Trustees Associates.

Popovici is active in the community; he was president of Casa Romana (http://www.casaromana.org), a non-profit organization serving Americans of Romanian origin living in the Bay Area. He was elected to this position in 1997 and built the largest Romanian community center and church on the West Coast. At present he is Honorary Vice Consul of Romania in Houston.

Popovici is director on the board of the Romanian Education Foundation (http://www.roed.org), which he co-founded in 1994, a charitable organization helping foreign students from impoverished families to apply at American and European universities. He is a scuba diving instructor, active fencer (top ten in the U.S. Veteran Division), plays paintball with one of the first established pro teams (The Wild Geese, founded 1985), practices karate, rock climbs, and is working on his private pilot license. ◆