Geophysical Society of Pittsburgh

Proudly Presents Tuesday, March 1^{th} , 2016
At
Cefalo's Restaurant, Carnegie, PA

P-P Prestack Azimuthal Amplitudes: comparison of P-P azimuth-blind AVA to azimuth-dependent AVA.

Dr. Heloise Bloxsom Lynn

Abstract:.
This continuing case history, introduced at the SEG Annual Meeting 2014, furthered at SEG 2015, culminates with documentation and modeling of azimuthal Amplitude Variation with Angle (AVA) gradients and azimuthal near offset amplitudes, at calibration tiepoints. This carbonate reservoir flows oil with sufficient fracture-density. It is overlain by a clastic section; the thick low-impedance layer directly overlying the carbonate reservoir is a shale. 3D P-P data acquisition was high-fold and full-azimuth. Point accelerometers were used. Data processing was careful relative-amplitude preserving through pre-imaging steps; OVT prestack depth migration with a VTI velocity field; a non-sectored analysis of the azimuthal residual normal moveout to quantify and remove the HTI effect from the traveltimes; followed by azimuth sectoring (four azimuth sectors, $0-180^{o}$), each with four angle stacks. Overlap in azimuth- and in angle-space improved S/N in each of the output 16 SEGY volumes used for azimuthal amplitude analysis.
The Top/Carbonate reflector was mapped and extracted from each of the 16 volumes. Stacking the Top/Carbonate across azimuth yielded azimuth-blind amplitudes, from which Intercept,Gradients were calculated. The crossplots of industry-standard azimuth-blind Intercept,Gradient display typical linearity, indicating that for this Top/Carbonate reflector, the carbonate's VP, VS, and density are linked through rock physics. Modeling using rock physics documents this assertion.
The azimuthal AVA gradients tie calibration data: the azimuth of most negative AVA gradient is fracture parallel. The azimuth of most positive AVA gradient is fracture perpendicular. HTI modeling confirm these statements. The azimuthal AVA gradients display a good fit to the cosine 2q on a bin-by-bin basis (bin size 100 ft x 100 ft) at calibration tiepoints. This industry-expected result is gratifying, but not surprising.
The near-offset (stack of $6-15^{o}$ angles of incidence) azimuthal amplitudes tie calibration data. The azimuth of highest amplitude Top/Carbonate is fracture parallel; the azimuth of dimmest amplitude is fracture-perpendicular. The near-offset amplitudes display an azimuthal cos 2q dependence at known fracture density and fracture azimuth calibration points.
The crossplot of the **azimuth-dependent** (Intercept, Gradient), at **calibration points** of high fracture density and known fracture azimuth, display a line, parallel to the azimuth-blind linear fits (I,G). The azimuthal-VP, -VS, and (possibly) density are clearly linked through rock physics. The change in the azimuthal VP, caused by the azimuthal change in the shear modulus, causes the azimuthal near offset variations. This assertion is shown to successfully model the field data. I employed shear wave splitting in my estimation of azimuthal-VP. Shear modulus m 1 and m 2, correspond to VS1 and VS2, were used (respectively) in the fracture-parallel azimuth and the fracture-perpendicular azimuth to obtain azimuthal-VP. The VP in the fracture perpendicular direction is decreased, due to a decrease in the shear modulus.
I have observed this same type effect (azimuthal near offset amplitudes) in other P-P field data sets around the world during the last 20 years, and in published field datasets. Legacy 3D datasets, with full azimuthal coverage to offsets half of target depth, are candidates for re-processing, **tieing to calibration points**, and re-evaluation. Please inspect your own azimuthal near-offset amplitudes

Biography:
Dr. Heloise Bloxsom Lynn started processing P-P reflection seismic data in 1975, working for Texaco, in Houston, Texas, having completed her BA in Geology-Math, at Bowdoin College, Brunswick, Maine. 1976-1979 found her at Stanford Univ., where she completed her PhD in Geophysics, in Prof. Claerbout and Prof. Thompson's research groups. Since 1980, she has worked in reflection seismology in the oil and gas industry, for Amoco and BP (1980-1984), and Lynn Inc (1984 to today).
In October, 2015, she received the Fessenden Award from SEG, in recognition of her work on the azimuthal anisotropy contained in field data. Below is the SEG citation:
Heloise Lynn *is presented the Reginald Fessenden Award for her 35-year career of translating the anisotropic behavior of seismic waves into practical applications that allow stress fields, fracture systems, and geomechanical properties to be characterized in targeted rock systems. She has described her research findings in many oral presentations and in 47 published papers that collectively create an invaluable knowledge base for scientists, researchers, students, teachers, and exploration geophysicists*

Please RSVP using the PayPal link on the Geophysical Society of Pittsburgh website at: www.thegsp.org
Cost: $35 Members, $40 Non-members ($20 for Students). Meeting Location: 428 Washington Ave, Carnegie, PA 15106 (412) 276-6600. Note the significant detour warning on page 2 of the newsletter.

March 1st , 2016 Agenda

5:00 pm Social Hour (Beer and Wine) sponsored by

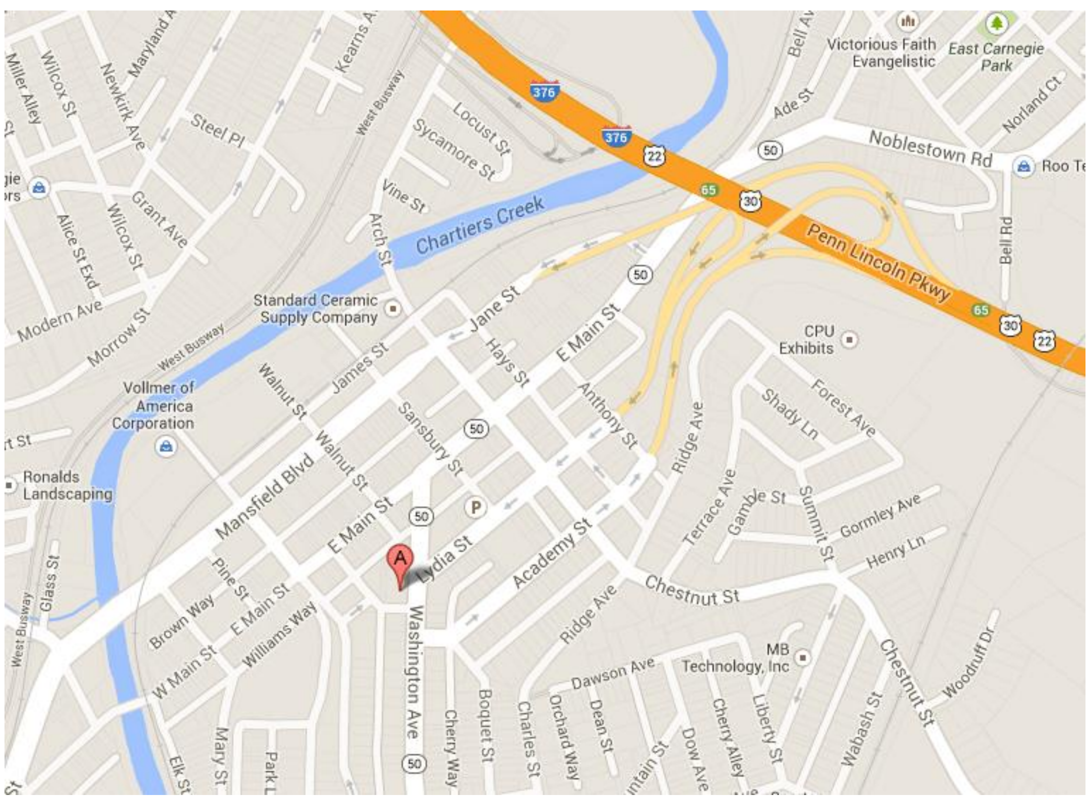
6:00 pm Dinner Buffet

7:00 pm Lecture – Sponsored by

To receive CEU certificate from this lecture please email: mweber@rangeresources.com

This months lecture will be held at :

Cefalo's
Banquet & Event Center
428 Washington Ave.
Carnegie, PA 15106
412.276.6600



We would like to thank our 2015-2016 Corporate Sponsors:

GOLD

SEITEL
THE Onshore Seismic Data Company

EQT
Where energy meets innovation.

Cabot Oil & Gas Corporation

WAMPUM HARDWARE CO.
SINCE 1904

STAR GEOPHYSICS

CGG

~~~~~~

SILVER

BILLMAN GEOLOGIC

Schlumberger

SENECA RESOURCES

~~~~~~

BRONZE

Geokinetics

GEOPHYSICAL PURSUIT, INC.

TESLA
TESLA EXPLORATION INC.

DAWSON®
Dawson Geophysical Company

2015-2016 GSP OFFICERS

President:	Scott Gorham	GorhamS@srcx.com	Seneca Resources
Vice President:	Jianli Yang	yangj@srcx.com	Seneca Resources
Treasurer:	Mandy Thomas	metthomas@slb.com	Schlumberger
Secretary:	Matt Weber	mweber@rangeresources.com	Range Resources
Past President:	Robert Burger	rburger@geotrace.com	Geotrace

Your Dues and Sponsorship in Geophysical Society of Pittsburgh go toward:

- *Outstanding Monthly Lecture Series*
- *SEG Distinguished Lecturers*
- *Annual Scholarship Awards*
- *Annual Golf Outing*
- *Short Courses*

Please contact Scott Gorham (GorhamS@srcx.com) for Sponsorship Opportunities.