Geophysical Society of Pittsburgh

Proudly Presents Tuesday, February 18, 2020
At Cefalo's Restaurant, Carnegie, PA

Uses of DAS Seismic Data for Reservoir Management

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Tom Bratton, Tom Bratton LLC and APEX Petroleum Engineering
David Langton, Devon

Distributed Acoustic Sensing (DAS) systems are fiber optic borehole seismic recording systems. Development of DAS technology has been rapid and fruitful during the past three to four years. During that time DAS recording systems have gone from being an interesting R & D project to being an important tool for reservoir geophysics. The primary positive attributes of DAS systems are: receiver station spacing of 3-15 ft, repeatable broad bandwidth recording, and simultaneous recording of thousands of data channels over the entire vertical and horizontal length of a borehole. DAS systems can be used both in passive mode for microseismic, low-frequency strain, and acoustic emissions analysis and with active seismic sources including Vibroseis, dynamite, and borehole seismic sources.

A straightforward example of active-source DAS data is shown in the zero-offset VSP in Figure 1. The figure shows a relatively unprocessed zero-offset VSP shot recorded on DAS fiber in the vertical section of a borehole. The down-going first arrivals are easily seen as the first significant waveform sloping downward and to the right. Up-going reflections originate at the line of first arrivals and slope downward and to the left. By any measure this is high quality zero-offset VSP data and was recorded with a single surface seismic shot. The data produced a high quality corridor stack that tied well with surface seismic data. Figure 2 shows a seismic reflection image generated from data recorded with surface Vibroseis sources and a DAS fiber deployed on the outside of casing in a horizontal borehole. The reflection image shows reflectors directly below the horizontal well in which a DAS fiber was deployed outside the well casing.
Trace spacing of the image is 6.6 ft and has a maximum usable frequency above 100 Hz. The data in Figure 2 was recorded prior to fracing and production of the horizontal well. A second repeated survey produced a time lapse reflection image that showed significant changes in reflection coefficients and interval velocities as a result of fracing and production.

Rock mechanics analysis is crucial to understanding the dynamic response of rock properties to fracturing, stress, and pore pressure changes related to production. Time lapse DAS reflection images show more detailed changes in reservoir properties than are generally seen in surface seismic data due to the high spatial resolution of DAS images and generally higher frequency than surface seismic data. Combining rock mechanics analysis with time lapse DAS images can provide reservoir production details to engineers that may not be available from other cost-effective sources. Relatively inexpensive DAS data acquisition makes time lapse imaging a viable method of reservoir surveillance for the lifetime of a field.

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.

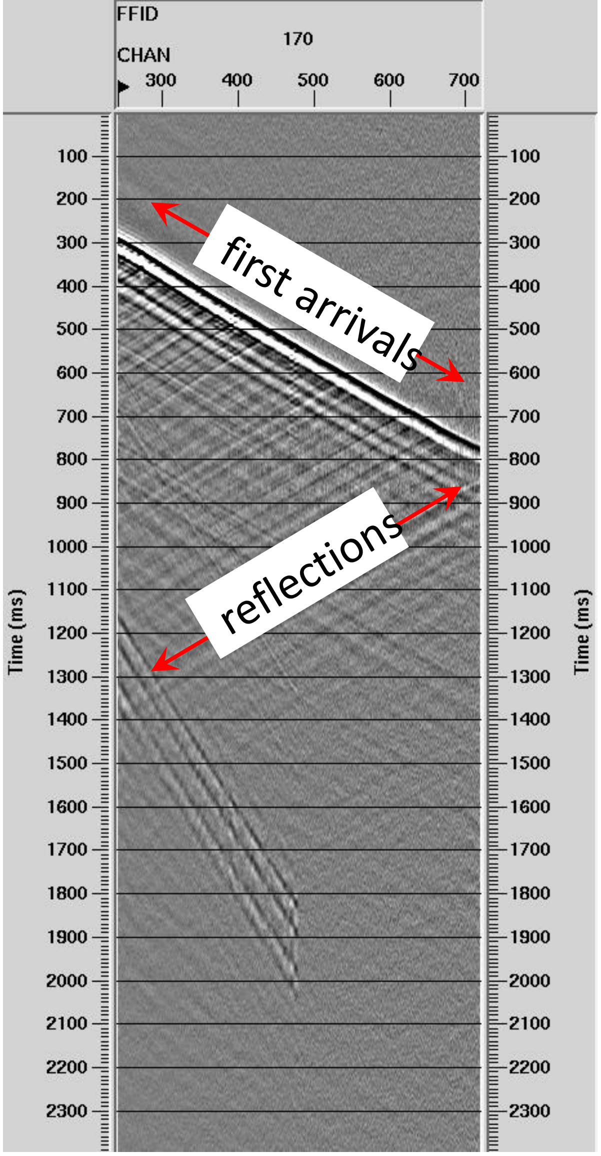


Figure 1. Zero-offset VSP recorded on vertical DAS fiber with one surface seismic shot. A single surface-Vibroseis sweep was used to record this zero-offset VSP in a vertical well with a DAS fiber deployed on the outside of casing. Down-going first arrivals slope downward and to the right while up-going reflections start at the first arrivals and slope downward and to the left.

Brief Biography for speaker, Mr. Brian Fuller

Brian holds BS (Western Washington University), MS (U of Wyoming), and PhD (U of Wyoming) degrees in Geophysics. He has over 30 years' experience in the oil and gas industry including successful oil exploration, software and technology development, and service company work. He has a long term professional interest in borehole seismology and is currently focused on further developing and commercializing seismic reflection imaging using horizontal DAS cables to measure reservoir properties for reservoir and frac engineering uses. Brian has been part of two SEG Best Paper awards, both related to microseismic technology. He currently holds the position of Vice President of Reservoir Geoscience at Sterling Seismic & Reservoir Services in Littleton, Colorado and lives in the Denver area.

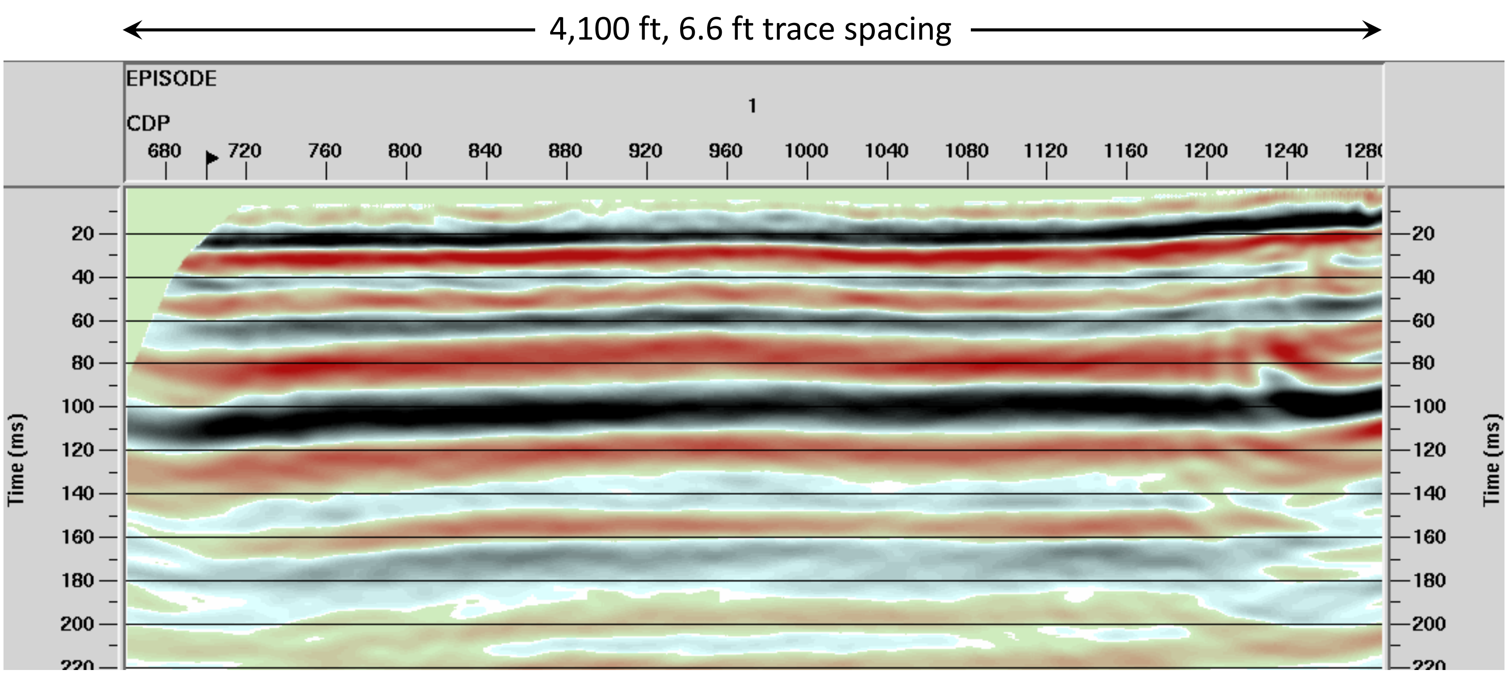


Figure 2. Seismic reflection image of a reservoir immediately below a horizontal DAS cable. This reflection image shows reflectors directly below a horizontal well in which a DAS cable was permanently deployed. Two-way time in milliseconds is relative to a flat datum 5 ft above the highest part of the toe-up horizontal wellbore. The field data was recorded with surface Vibroseis sources and a DAS fiber. Trace spacing of the image is 6.6 ft and the maximum usable frequency is greater than 100 Hz. The horizontal length of the image is about 4,100 ft.

Tuesday February 18, 2020

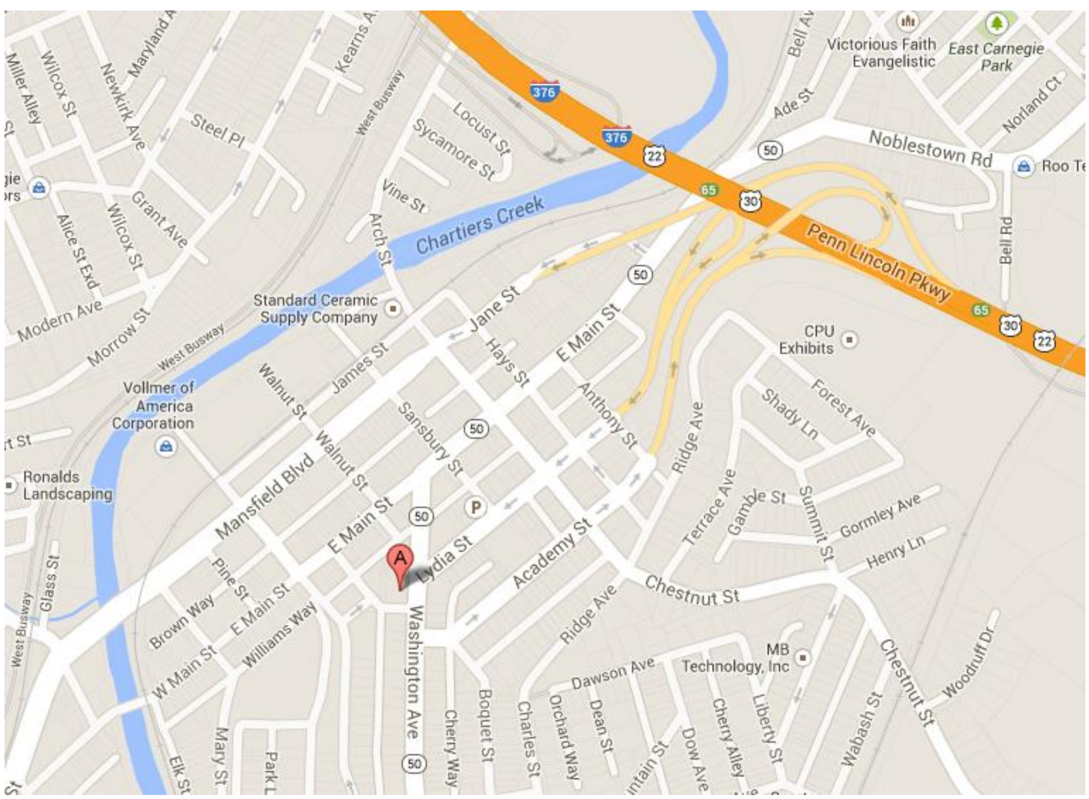
Agenda:

11:30 hours—Registration,
12:00 (noon)--Luncheon has been served, attendees seated and talk begins,
13:00 (1PM) hours—Talk completed and meeting ends.

To receive a CEU certificate from this lecture please contact Bill Harbert

This months lecture will be held at :

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



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