Napa workshop in January:
This abstract proposed for either processing session or the road ahead session

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Mapping Fracture Networks and Fairways Using Microseismics

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During the recent history of recognizing shale gas as a fundamental energy resource in the US, image logs have documented that the permeability structure of these reservoir is dominated by natural fault and fracture systems. Fracture networks consist of all of the fractures in the rock – both man-made in frac jobs and the natural systems that some frac stages intersect. The important fractures in the reservoir are those that are interconnected in natural fracture fairways and carry the pressure from the hydraulic fracturing (frac) point to locations that are at great distance from the well. These fractures make up the primary permeability of the rocks and provide the permeability fairway in the reservoir that controls producibility.

The process for generating images of fracture networks and fairways is described. The processing workflow uses microseismic recordings to compute semblance and coherence volumes. These volumes are combined over large time intervals to accumulate energy from the individual volumes, including energy from events much smaller than those normally detected by hypocenter methods. The seismic emissions that are persistent over time are combined and converted into the fracture network images called TFIs or Tomographic Fracture Images™.

The microseismic energy that is combined to make the fracture images contains the hypocenters that occur during the time interval used in the computation. However, the hypocenter energy is a very small portion of the total energy that is integrated. Das and Zoback, 2011, describe a type of microseismic energy they call "LPLD" or Long Period, Long Duration energy. These energy packets are generated in the same small sub-volume of the earth, have a lower frequency band than hypocenters, and last for much longer periods of time. Occurrences have been documented to last for as long as a few seconds and up to a few minutes. This type of energy is observed in the microseismic trace data and examples will be shown. We believe that the bulk of the microseismic energy that is focused for TFI computation is the LPLD type of energy. Movies of the seismic emissions accumulated over the frac stage are made to show the time sequence of the fracturing process.

A primary objective for the completion engineers assessing frac jobs in shale gas systems is a measurement of the rock volume that has been stimulated to produce gas to the wellbore. The fracture imaging method is used to map the frac job near the perf zone as well as the natural fracture fairways that the frac intersects and allows measurements of the stimulated rock volume (SRV) and distance of fracture propagation.

Reference:

Das, Indrajit and Zoback, Mark D., 2011, Long Period Long Duration Seismic Events During Hydraulic Stimulation of a Shale Gas Reservoir, e-poster, AAPG Annual Convention and Exhibition, Houston, Texas, USA, April 10-13, 2011