GSCO2
Center for Geologic Storage of CO_2

Geophysics Role in GSCO2 Research Center

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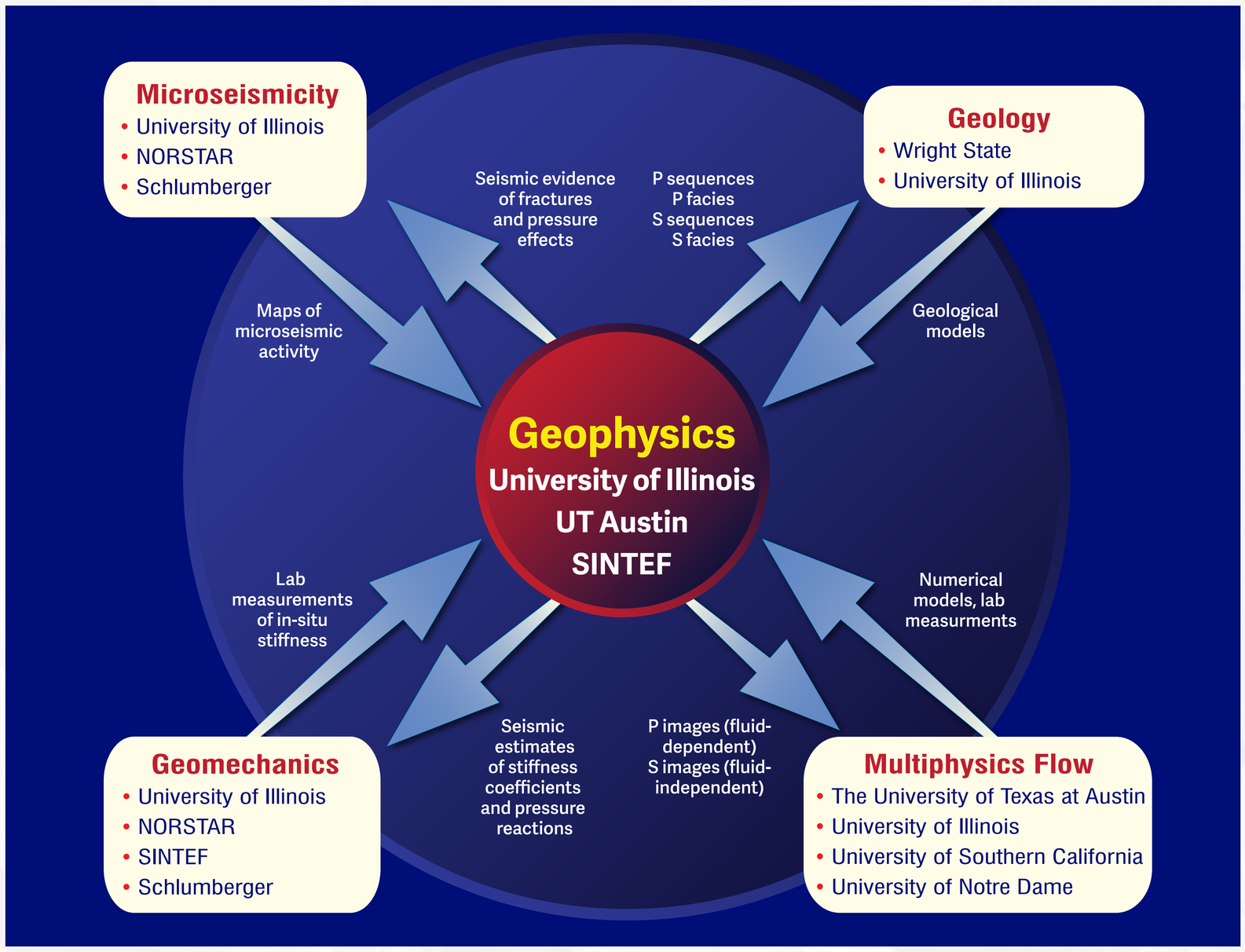
Abstract

Geophysical efforts used to characterize CO_2 storage sites must utilize S-wave seismic data in addition to P-wave data so that geophysical research blends seamlessly with research in geomechanics, geology, reservoir monitoring, rock physics, and multi-physics fluid flow. A fundamental requirement for achieving this integration of geophysical research with all other research themes involved in CO_2 storage dynamics is that the total geological system spanning a CO_2 reservoir and its sealing units must be imaged with full-elastic seismic wavefields. Full-elastic seismic wavefields provide increased sensitivity to rock fabric (geomechanics and rock physics research), better detections of subtle faults and fracture systems (reservoir monitoring and multi-physics fluid flow research), and identification of seismic lithofacies (geology and rock physics research). Laboratory measurements of P-wave and S-wave propagation behavior in real rock samples must be linked to this geophysical research for optimal calibration of the P and S seismic attributes that are used in each of these interlocking connections between geophysical research and companion-theme research.

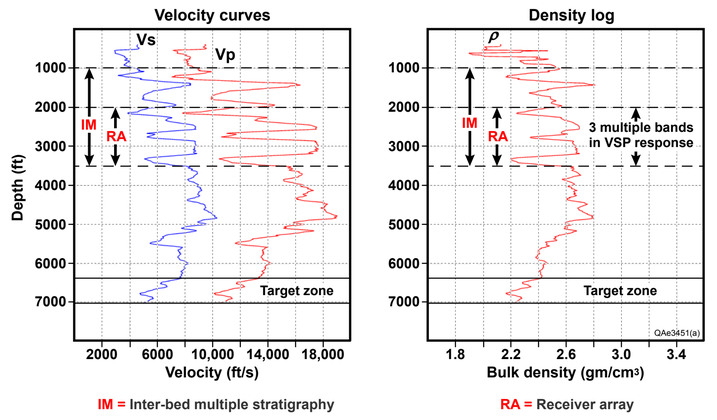
Seismic data should be acquired with 3C geophones to capture the full-elastic seismic wavefields that are needed for integrating geophysical research with all other research themes done at a CO_2 storage site. Data acquisition with 3C sensors ensures that geology is illuminated not just by P-P waves, but also by all possible S-S modes (both fast and slow modes), and all possible converted-wave modes (P-SV and SV-P). The unique basic-research approach in this project is used to demonstrate how S-wave images and S-wave attributes can be created when the seismic data across a CO_2 storage site are recorded by only single component vertical geophones, not by 3C geophones. This simple 1C-sensor approach to acquiring the P-wave and S-wave parameters needed to link geophysical research to its companion research themes has never been used in a CO_2 storage site study.



Status August 2015

Log Data Interpretation

Log data from well GM1 used to construct the seismic propagation medium at the Decatur site.

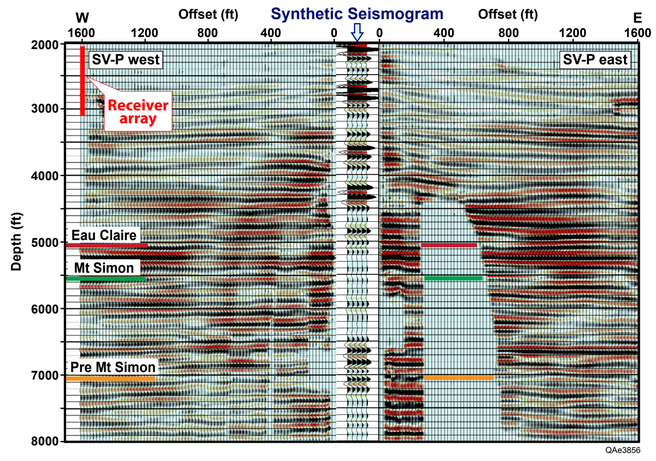


IM = Inter-bed multiple stratigraphy

RA = Receiver array

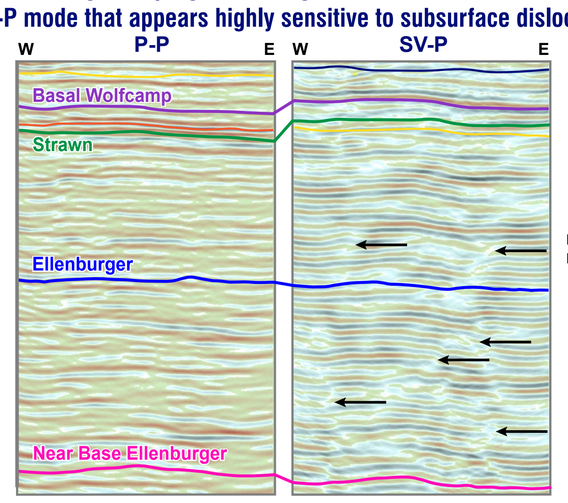
VSP Data Processing

A technology that allows accurate extraction of SV-P and SV-SV modes from vertical seismic profiling data has been developed.



Surface Data Processing

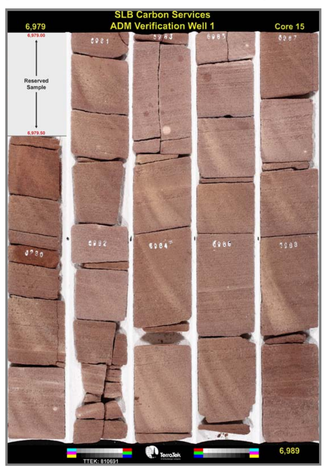
Data processing is in progress. The goal is to obtain a seismic image for SV-P mode that appears highly sensitive to subsurface dislocations.



Fasken Ellenburger Karst example

Lab Measurements On Core Samples

Lab tests (measurement of Vp, Vs, attenuation, and anisotropy for different pressures and saturations) are in progress.



Mt. Simon Sandstone

Basic Research Objective

Expand seismic imaging of CO_2 storage systems from single-mode P-P images to multi-mode P and S images.

Acknowledgments

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