Training Students to Analyze Spatial and Temporal Heterogeneities in Reservoir and Seal Petrology, Mineralogy, and Geochemistry: Implications for CO_2 Sequestration Prediction, Simulation, and Monitoring

Background

Increased attention is being placed on research into technologies that capture and store carbon dioxide (CO_2). Carbon capture and storage (CCS) technologies offer great potential for reducing CO_2 emissions and, in turn, mitigating global climate change without adversely influencing energy use or hindering economic growth.

Deploying these technologies in commercial-scale applications requires a significantly expanded workforce trained in various CCS specialties that are currently underrepresented in the United States. Education and training activities are needed to develop a future generation of geologists, scientists, and engineers who possess the skills required for implementing and deploying CCS technologies.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) has selected 43 projects to receive more than $12.7 million in funding, the majority of which is provided by the American Recovery and Reinvestment Act (ARRA) of 2009, to conduct geologic sequestration training and support fundamental research projects for graduate and undergraduate students throughout the United States. These projects will include such critical topics as simulation and risk assessment; monitoring, verification, and accounting (MVA); geological related analytical tools; methods to interpret geophysical models; well completion and integrity for long-term CO_2 storage; and CO_2 capture.

Project Description

DOE is partnering with Purdue University to conduct training and research to determine the depositional and diagenetic characteristics of reservoirs and seals; the low-permeability formations located above CO_2 injection target formations that prevent the upward migration of CO_2 into more shallow formations or from escaping into the atmosphere. Depositional characteristics help to determine where the sediment was deposited and lithified, such as a beach, lake, or dune. Diagenetic characteristics, such as compaction and cementation, illustrate the physical,

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PARTNERS

None

PROJECT DURATION

Start Date
12/01/2009

End Date
11/30/2012

COST

Total Project Value
$303,362

DOE/Non-DOE Share
$299,920/$3,442

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chemical, and biological changes that take place in sediments as they become consolidated into rocks. This project will also explore methods for predicting changes in the mineralogy (chemical composition) and texture that occur when rocks are exposed to CO_2-saturated brines.

During the project, graduate students will conduct original scientific research into topics related to the lithological, textural, and compositional variability in formations that are being analyzed as possible CO_2 sequestration reservoirs and seals. The students will focus primarily on analyzing core samples and geophysical well-logs of the Mount Simon Sandstone and overlying Eau Claire Formation seal.

The students will work with samples directly tied to ongoing DOE Regional Partnership CO_2 sequestration projects to:

- Quantify the mineralogy, geochemistry, and texture of reservoir and seal units.
- Explore new methods of petrographic image analysis for rapid and quantitative assessment of mineralogy, focusing on the minerals that are in contact with pore space.
- Investigate changes in reservoir mineralogy and texture in samples that have been experimentally exposed to CO_2-saturated brines and compare the observed changes with modeled reactions.

Goals/Objectives

The objective of this project is to train graduate students in the use of geological tools that are essential to reservoir characterization and geologic sequestration. This effort will focus on training students through curriculum and research using advanced petrological, mineralogical, and geochemical methods; core analysis; and geophysical well-log interpretation.

Benefits

This project will improve scientific understanding of the depositional and diagenetic characteristics of regional reservoirs and seals as well as those related to specific sequestration projects. An added benefit of this project is producing a trained workforce with the skills and competencies in geology, geophysics, and geochemistry needed for the implementation of large-scale CCS projects.

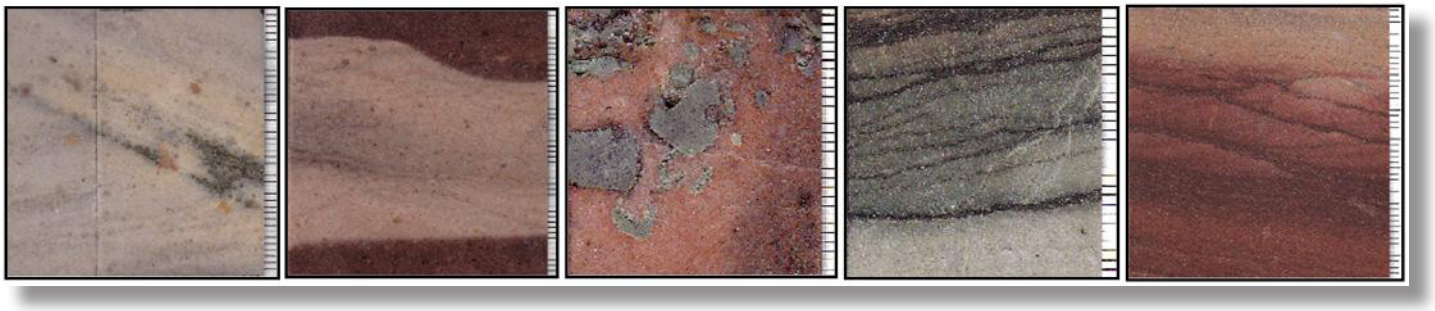

Figure 1. Examples of Mt. Simon Sandstone (a potential CO_2 sink) illustrating its textural and compositional variability.