

## **Fracture Analysis and Geological Characterization of a "Leaky" CO<sub>2</sub> System in the Rocky Mountain Foreland**

Treadway, Whitney <sup>\*1</sup>; Lageson, David R. <sup>1</sup>; Lynn, Helen B. <sup>1</sup> (1) Earth Sciences, Montana State University, Bozeman, MT.

Anthropogenic CO<sub>2</sub> in the atmosphere is a great concern relative to global warming. Currently, research is being done on carbon sequestration. Carbon sequestration, or the capture and storage of CO<sub>2</sub>, can be conducted in a variety of ways. One promising approach is geologic carbon sequestration, the storage of CO<sub>2</sub> in subsurface geologic formations. Before geologic carbon sequestration can be done safely and effectively, it is necessary to completely understand the nature of the storage sites. This includes geologic characterization of the reservoir and seal rock formations, structure of the trapping mechanism(s), and analysis of fracture patterns and fluid migration patterns. Reservoir formations must be porous enough to adequately store large volumes of CO<sub>2</sub>. Overlying seal formations must be impermeable to CO<sub>2</sub> migration upwards towards the surface. Fracture networks can lead to CO<sub>2</sub> leakage at the surface, even when the reservoir and seal rocks are adequate. Understanding the fractures in and around the storage site is important. Laramide uplifts in the Rocky Mountain foreland have been suggested for potential carbon storage sites. The Thermopolis Anticline in the southern Bighorn Basin, WY is one of these Laramide uplifts and is the target field area for this project. Two main research objectives for this project are as follows: 1) determine dominant fracture orientations compared to the trend of the anticline, and 2) determine fluid migration pathways and whether or not CO<sub>2</sub> has traveled through these pathways. It is hypothesized that the crest of the anticline is highly fractured by fractures parallel and perpendicular to the hinge line which has allowed fluid to flow up through the stratigraphic section to the surface. Fracture stations were located throughout the field area and in seven different formations. Stations contained between fifteen and fifty fractures measured. For each fracture measured, data was collected on the orientation, length, aperture, spacing to the next similar fracture, vein fill present, and material of vein fill. Samples of vein fill material of measured fractures were collected. Orientation data were plotted on stereonet and rose diagrams. Plots were combined and separated based on location on the anticline and formation. Detailed lab analyses were conducted on the vein material samples. These analyses included preliminary petrographic work on hand samples and thin sections, carbon and oxygen isotope analysis to determine origin of fluid e.g. meteoric, and fluid inclusion analysis to determine temperature of original fluid. Differences between vein material and possible CO<sub>2</sub> migration patterns can be inferred based on the results of these analyses.