

Distribution and Abundance of Potentially Reactive Minerals With Geologic CO₂ Sequestration in the Mount Simon - Eau Claire Sedimentary System

Brenda B. Bowen¹, Raul Ochoa¹, Nathan Wilkens¹, Ryan Neufelder¹, Richard Lahann², James Brophy³, Cristian Medina^{2,3}, and John Rupp²

¹Purdue University, Department of Earth and Atmospheric Science, West Lafayette, IN 47907, bbowen@purdue.edu

²Indiana Geological Survey, Bloomington, IN 47405

³Indiana University, Department of Geological Sciences, Bloomington, IN 47405

The ability to predict how carbon dioxide (CO₂) will behave in the subsurface relies, in part, on a detailed understanding of the mineralogical, geochemical, and petrophysical properties of the formations that make up the reservoir and seal on macro- to microscopic scales. As CO₂ dissolves in the formation brines, fluid pH can drop from near neutral to below 4, leading to dissolution of some mineral phases (e.g., feldspar, iron oxide, carbonate) and precipitation of subsequent secondary minerals. The consequences of these reactions can have both positive and/or negative effects on the reservoir and seal. For instance, these reactions can alter porosity and permeability, and can also provide important ions that could help to facilitate the trapping of CO₂ over geologic time scales. New analyses of the Mount Simon Sandstone and the Eau Claire Formation, the respective reservoir and seal for ongoing CO₂ sequestration demonstrations in the Midwest, have been aimed at identifying the types, abundance, and distribution of potentially reactive minerals within these units. In addition to abundant detrital and authigenic quartz and feldspar, these formations contain micas, variable clay minerals, iron oxides, carbonates, sulfates, pyrite, etc. Using a combination of petrographic techniques (including cathodoluminescence and scanning electron microscopy), together with mineralogy (via x-ray diffraction and short wave infrared reflectance spectroscopy), and geochemical analyses (including major oxide, trace element, and isotope geochemistry), we evaluate sedimentologic and diagenetic controls on the distribution of potentially reactive phases, leading towards predictive models of where in the basin they are more likely to occur.