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# Geological Carbon Sequestration in the Washita-Fredericksburg Formation, Southeastern U.S.

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Geologic carbon sequestration removes carbon dioxide from the atmosphere and stores it in a subsurface porous formation. The southeastern United States has been suggested to contain large porous formations which could serve as $CO_2$ reservoirs. At a storage facility, $CO_2$ will be injected into the formation where it will dissolve in formation brine, lowering pH and creating conditions favorable for geochemical reactions. This includes mineral dissolution and precipitation reactions that may impact formation properties including porosity and permeability. The rate, extent and impact of geochemical process that may occur need to be considered before injecting $CO_2$ in any formation. In this work, the geochemical reactivity for $CO_2$ sequestration in the sandstones of the Washita-Fredericksburg formation are considered. Petrographic thin sections of formation samples were prepared and analyzed via Scanning Electron Microscopy (SEM) imaging. Backscattered Electron (BSE) and Energy-dispersive Spectroscopy (EDS) images were captured and processed using ImageJ and MATLAB to process images into a mineral map where each phase is depicted as a different color. The mineralogical composition and porosity were calculated via pixel counting in the resulting mineral map. This analysis shows that the dominant mineral phase in the sample is quartz, with clays such as kaolinite acting as a cement between the grains. K-feldspars and muscovite were also observed in the sample, which has a porosity of 22%. The geochemical reactivity of the sample, and extent of mineral dissolution and precipitation following $CO_2$ injection in then considered through reactive transport simulations carried out in CrunchFlow. The greatest extent of reactivity is considered by flowing $CO_2$ acidified bring through the formation, tracking the evolution of ions in solution and the volume fraction of each mineral. Results provide insights on the rate and extent of reactions and potential for changes in formation properties including porosity and permeability.