GEOGULF2021
AUSTIN
October 27–29, 2021

Analysis of the Subsurface of the Tuscaloosa Group, Southwestern Alabama, for Carbon Sequestration Purposes

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ABSTRACT

It has been suggested that the Tuscaloosa Group, southwest Alabama, qualifies as a near-limitless reservoir for storing CO_2 because of its composition, porosity, permeability, and depth. In this project, the Upper Cretaceous Tuscaloosa Group of southwestern Alabama subsurface is the geological unit analyzed for carbon sequestration purposes. The Tuscaloosa Group has an overall subsurface thickness of 183–369 m on the west of Alabama and an approximate porosity of 25%. An essential part of this study was to observe and explore how the injected CO_2 fluid interacts with porous rocks, specifically with the mineral glauconite, what type of pore occurring cement develops, and how it changes the porosity of the rocks. Samples from the drill core Julian F. McGowin No. 1, were collected for observing lithological changes, sedimentary structures, textures, vertical changes in grain size and mineralogy, and measuring porous thickness. Petrographic thin sections and core observations show evidence of glauconite throughout most of the core. XRD results show the mineralogical bulk composition of primary quartz, muscovite, K–feldspar, authigenic glauconite, and clay minerals such as kaolinite and illite. A total of six electronic logs were correlated to determine if the depositional environment affected sandstone distribution and better understand the shales that could serve local seals. An experimental plan for a hydrothermal experiment was made using brine data collected from Alabama's Geological Survey. Upper Cretaceous brine is composed chiefly of Na–Ca–Cl, with high concentrations of Mg. This part of the experiment took place inside a rocking autoclave, and the software Geochemist's Workbench was used to analyze the reaction path. Two sets of experiments ran together to understand better the interactions and minor reactions between supercritical CO_2 and sandstones from the Tuscaloosa Group, southwest Alabama. Based on observations made so far, the supercritical CO_2 fluid will not negatively affect the glauconitic sands.

Lopez-Rivera, N., A. Uddin, and D. King, 2021, Analysis of the subsurface of the Tuscaloosa Group, southwestern Alabama, for carbon sequestration purposes: GeoGulf Transactions, v. 71, p. 447.

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