Reservoir Porosity Characterization for a Carbon Sequestration Target: Citronelle Field, Alabama

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The Citronelle Field, located in the Mobile County area of Alabama, has been a longstanding (since 1955) oil and gas producing basin (537MMbbl oil in place, 169MMbbl oil produced) and more recently, a carbon sequestration target. Located overtop of a salt-cored anticline, main production in the Citronelle Field is from the Donovan Sand of the Cretaceous Rodessa Formation. Overall, the Donovan Sand is characterized by discontinuous fine- to medium-grained fluvial sandstone, with inclusions of pebble-sized mud rip-up clasts as well as some feldspathic grains, interbedded with mottled to fissile mudstone. The Donovan Sand is currently being injected with supercritical-CO_2 in hopes of enhancing oil recovery as well as serving as a pilot for long-term geologic carbon sequestration. Estimated enhancement of reserves is approximately 20%. Porosity and sedimentary lithofacies distribution within the Donovan Sand is highly variable, ranging from ~0.5%- ~11% porosity with an average of about 6%. Due to this heterogeneity, it becomes imperative to better understand the reservoir's overall geology. Core studies, thin section analyses, and a fluid saturation index test from the Donovan Sand have been completed, allowing for higher resolution reservoir characterization. The lower porosity portions of the reservoir are areas of concern for pore space filling and degradation of EOR and sequestration capacity due to mineral precipitation from supersaturated supercritical-CO_2. However, there is also potential for creation of secondary pore space by dissolution of minerals within the sandstone. This would hypothetically increase carbon storage capacity within the reservoir as well as allow greater mobility of the fluid through the rock, enhancing EOR production. The exact dynamics of these reactions are not yet known, however we are able to postulate that there is some possible clogging of the reservoir, as evidenced by a decrease in the rate of fluid injection.