Quantifying Rock Characteristics in the San Andres Formation that Promote CO_2 Sequestration, Permian Basin, USA

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Abstract

The San Andres Formation is a conventional carbonate reservoir on the Central Basin Platform, Permian Basin. The San Andres has been a prolific producer of oil and gas, but vertical and lateral heterogeneity within and between fields make reservoir characterization and thus recovery difficult. Carbon dioxide (CO_2) flooding has long been used for enhanced oil recovery operations within the San Andres Formation, and some fields unintentionally sequester large volumes of CO_2. However, the rock characteristics that allow effective CO_2 sequestration (e.g., lateral geological heterogeneity, diagenetic evolution, pore-network dynamics, fluid-rock interactions) are still uncertain. There is a desire to transition these reservoirs into permanent CO_2 sequestration sites due to existing infrastructure and the history of CO_2 injection. Using thin-section data from several fields on the Central Basin Platform, we quantify heterogeneity within pore and pore throat networks using to provide a ranking for transitioning these reservoirs into permanent CO_2 sequestration sites.

We analyzed thin sections using field-emission scanning electron microscopy to document the mineralogy and porosity network at the micron scale. The resulting data documents pore dimensions, pore-lining minerals, and pore-network heterogeneity between different facies and stratigraphic intervals of the San Andres Formation. We integrate this thin section data with existing core-plug porosimetry and field-wide production data to quantify the CO_2 trapping capability of the San Andres Formation, and thus the viability for a particular field to be converted to CO_2 sequestration. This newly collected data can help make informed economic decisions on the future utilization of depleted carbonate petroleum reservoirs, not only in the Permian Basin, but globally.

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