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# Understanding the influence of small scale geological heterogeneity on capillary trapping of CO2 using engineered beadpacks

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During geologic CO2 sequestration, most of the storage domain far from the injection sites is likely to be dominated by buoyancy and capillary forces. Under such flow regimes, small scale geological heterogeneities have been shown to dampen plume migration rates and cause trapping beneath capillary barriers. To understand the impact of such heterogeneities on CO2 trapping processes experimentally, many core-scale and lab scale flow studies have been conducted. Reservoir cores are limited by the scale of investigation possible and most lab experiments are conducted in macroheterogeneous media constructed by arranging homogeneous units to represent heterogeneity. However, most natural sedimentary facies display heterogeneity at a hierarchy of scales, and heterogeneity at the mesoscale (mm to decimeters) goes unrepresented in laboratory experiments due to the difficulty in reproducibility.

This work presents results from buoyancy driven migration experiments conducted at the meter scale using glass beads packed in a quasi 2D glass cell and complementary reduced physics simulations. We demonstrate a novel automated technique to build beadpacks with 2D heterogeneous sedimentary features in a reproducible manner. A fluid pair that mimics the phase density and viscosity contrasts, and interfacial tension of CO2-Brine at reservoir pressures and temperatures is employed for the flow experiments. Light transmission technique is used for visualization, and to calibrate and quantify saturation of the trapped non-wetting fluid during the experiments. Invasion Percolation is used to simulate the buoyancy driven flow. With the ability to generate different types of heterogeneous structures in a reproducible manner, and by comparing experiments and simulations, a systematic investigation of the effect of heterogeneity on capillary trapping becomes possible.

## References

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**Primary author:** KRISHNAMURTHY, Prasanna (The University of Texas at Austin)

**Co-authors:** Dr TREVISAN, Luca (Karlsruhe Institute of Technology); Dr MECKEL, Timothy (Bureau of Economic Geology, The University of Texas at Austin); Dr DICARLO, David (The University of Texas at Austin)

**Presenter:** KRISHNAMURTHY, Prasanna (The University of Texas at Austin)

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