Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Dynamics and mass transport of solutal convection in a closed porous media system BAOLE WEN, DARIA AKHBARI, MARC HESSE, The University of Texas at Austin — Most of the recent studies of CO_2 sequestration are performed in open systems where the constant partial pressure of CO_2 in the vapor phase results in a time-invariant saturated concentration of CO_2 in the brine (C_s). However, in some closed natural CO_2 reservoirs, e.g., Bravo Dome in New Mexico, the continuous dissolution of CO_2 leads to a pressure drop in the gas that is accompanied by a reduction of C_s and thereby affects the dynamics and mass transport of convection in the brine. In this talk, I discuss the characteristics of convective CO_2 dissolution in a closed system. The gas is assumed to be ideal and its solubility given by Henry's law. An analytical solution shows that the diffusive base state is no longer self-similar and that diffusive mass transfer declines rapidly. Scaling analysis reveals that the volume ratio of brine and gas η determines the behavior of the system. DNS show that no constant flux regime exists for $\eta > 0$; nevertheless, the quantity F/C_s^2 remains constant, where F is the dissolution flux. The onset time is only affected by η when the Rayleigh number Ra is small. In this case, the drop in C_s during the initial diffusive regime significantly reduces the effective Ra and therefore delays the onset.

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Date submitted: 01 Aug 2016 Electronic form version 1.4