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Microbially Enhanced Carbonate Mineralization and the Geologic Containment of CO_2

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Geologic sequestration of CO_2 involves injection into deep underground formations including oil beds, un-minable coal seams, and saline aquifers with temperature and pressure conditions such that CO_2 will likely be in the supercritical state. Supercritical CO_2 injection into the receiving formation will result in elevated pressure in the region surrounding the point of injection, and may result in an upward hydrodynamic pressure gradient and associated “leakage” of supercritical to gaseous CO_2. Therefore mechanisms to reduce leakage and to mineralize CO_2 in a solid form are extremely advantageous for the long-term geologic containment of CO_2.

This paper will focus on microbially-based strategies for controlling leakage and sequestrating supercritical CO_2 during geologic injection. We will examine the concept of using engineered microbial barriers (Cunningham et al., in review; Mitchell et al., in review) which are capable of precipitating calcium carbonate (Mitchell and Ferris, 2005; 2006) under high-pressure subsurface conditions. These “biomineralization barriers” may provide a method for plugging preferential flow pathways in the vicinity of CO_2 injection, thereby reducing the potential for unwanted upward migration of CO_2, as well as mineralizing injected CO_2. A summary of experiments investigating biofilm and associated calcium carbonate formation in porous media using a unique high pressure (8.9 MPa), moderate temperature ($\geq$ 32 °C) flow reactor will be presented, and the potential for biomineralization enhanced CO_2 sequestration discussed.

Mitchell, A.C., Ferris, F.G. (2005) *Geochim. Cosmochim. Acta* **69**, 4199-4210.

Mitchell, A.C., Ferris, F.G. (2006) *Geomicrobiol. J.* **23**, 213-226.

Cunningham, A, Phillips, A, Heibert, R, Gerlach, R, Spangler, L, Mitchell, A.C. (in review) *International Journal of Greenhouse Gas Control.*

Mitchell, A.C., Phillips, A Kaszuba, J, Hamilton, M, Cunningham, A, Gerlach, R (in review) *Journal of Supercritical Fluids.*

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