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Approaching equilibrium: The evolution of CO_2 in a porous medium YOSSI COHEN, DANIEL H. ROTHMAN, Lorenz Center and the Department of Earth Atmospheric and Planetary Sciences, MIT, Cambridge, MA, USA — Understanding the microscopic mechanisms of mineral weathering rates has motivated studies of dissolution and precipitation for decades. Many applications, including the global carbon cycle and sub- surface carbon dioxide sequestration justify the importance of a full comprehension of the mechanism. The injection of carbon dioxide into a porous medium drives the system into far-from-equilibrium conditions where forces, surface phenomena, and other processes become crucial for the long-term stability of the system. A complete physical picture able to predict the pattern formation and the structure developing within the porous medium is lacking and cannot be associated only with empirical kinetic laws. Here we propose a theoretical model that couples transport, reaction, and the intricate geometry of the rock. The model concerns the different time scales when the system is far from equilibrium and when approaching a steady state. We use analytical theory and numerical simulations to study the short and the long term behavior of the carbon dioxide as it dissolves and precipitates in a fluid-rock system.

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