EARTH SCIENCES DIVISION

# DISTINGUISHED SCIENTIST SEMINAR SERIES

Friday, December 11th, 10:30 AM-12:00 PM
B50 Auditorium
Lawrence Berkeley National Laboratory

## Enhanced, *in situ* mineral carbonation in peridotite for $CO_2$ capture and storage

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## ABSTRACT

The rate of natural carbonation of tectonically exposed mantle peridotite during weathering and low-temperature alteration can be enhanced to develop a significant sink for atmospheric $CO_2$. Natural carbonation of peridotite in the Samail ophiolite, an uplifted slice of oceanic crust and upper mantle in the Sultanate of Oman, is surprisingly rapid. Carbonate veins in mantle peridotite in Oman have an average $^{14}C$ age of ~26,000 years, and are not 30 to 95 million years old as previously believed. These data and reconnaissance mapping show that ~$10^4$ to $10^5$ tons per year of atmospheric $CO_2$ are converted to solid carbonate minerals via peridotite weathering in Oman. Peridotite carbonation can be accelerated via drilling, hydraulic fracture, input of purified $CO_2$ at elevated pressure, and–particularly– increased temperature at depth. After an initial heating step, $CO_2$ pumped at 25 or 30°C can be heated by exothermic carbonation reactions that sustain high temperature and rapid reaction rates at depth with little expenditure of energy. *In situ* carbonation of peridotite could consume more than 1 billion tons of $CO_2$ per year in Oman alone, affording a low-cost, safe, and permanent method to capture and store atmospheric $CO_2$.

## BIOSKETCH

Peter Kelemen is Arthur D. Storke Professor of Geochemistry at Columbia University, where he moved in 2004 after 17 years at the Woods Hole Oceanographic Institution. He graduated from Dartmouth College in 1980, and received his MSc and PhD (1987) from the University of Washington in Seattle. He married Rachel Cox in 1987, and they have two children, Sara 15 and Lucy 11. Kelemen's research focused for many years on chemical and physical processes during reactive transport of magma in the Earth's mantle and lower crust ("the plumbing system of volcanoes"), and how this affects the composition and structure of oceanic, volcanic arc, and continental crust. In recent years, he has also been studying the evolution of continental upper mantle, the role of density instabilities on crustal evolution, the deeper parts of earthquakes, and reactive transport of low-temperature fluid through mantle peridotites. In addition to his research work, Kelemen was a founding partner of Dihedral Exploration, consultants specializing in "extreme terrain mineral exploration" in BC, Alaska, and Greenland from 1980-1992, and has taken part in several mountaineering expeditions in Peru, India, and Pakistan.

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