An example of CO_2 sequestration: Direct nano-scale observations of brucite [Mg(OH)2] dissolution

CHRISTINE V. PUTNIS[1], JÖRN-ERIK HÖVELMANN[2], ENCARNI RUIZ-AGUDO[3] AND HÅKON AUSTRHEIM[4]

[1]Institut für Mineralogie, University of Münster, Corrensstrasse 24, 48149 Münster, Germany
[2]Fachbereich Geowissenschaften, Universität Bremen, Postfach 330440, 28334 Bremen, Germany
[3]Department of Mineralogy and Petrology, University of Granada, Fuentenueva s/n 18071 Granada, Spain
[4]Department of Geosciences, University of Oslo, PO box 1047 Blindern, 0316 Oslo, Norway

The dissolution and carbonation of brucite on (001) cleavage surfaces was investigated in a series of *in situ* and *ex situ* Atomic Force Microscopy (AFM) experiments at varying pH (2- 12), temperature (23-40°C), aqueous $NaHCO_3$ concentration (10-5-1 M), and PCO_2 (0-1 atm).

Dissolution rates increased with decreasing pH and increasing $NaHCO_3$ concentration.

Simultaneously with dissolution of brucite, the growth of a Mg-carbonate phase (probably dypingite) was directly observed. In $NaHCO_3$ solutions (pH 7.2 - 9.3), precipitation of Mg-carbonates was limited. Enhanced precipitation was, however, observed in acidified $NaHCO_3$ solutions (pH 5, DIC $\approx$ 25.5 mM) and in solutions that were equilibrated under a CO_2 atmosphere (pH 4, DIC $\approx$ 25.2 mM). Nucleation predominantly occurred in areas of high dissolution, such as deep step edges, suggesting that the carbonation reaction is locally diffusion-transport controlled within a fluid-mineral boundary layer and is the result of interface-coupled dissolution-precipitation. More extensive particle growth was also observed after *ex situ* experiments lasting for several hours. This AFM study contributes to an improved understanding of the mechanism of aqueous brucite carbonation at low temperature and PCO_2 conditions and has implications for carbonation reactions in general.

Different styles of metasomatism in lithospheric mantle beneath Central Europe

JACEK PUZIEWICZ[1], MAGDALENA MATUSIAK-MAŁEK[1], THEODOROS NTAFLOS[2] AND MICHEL GRÉGOIRE[3]

[1]University of Wroclaw, Poland, jacek.puziewicz@ing.uni.wroc.pl
[2]University of Vienna, Austria
[3]University Tolouse III, France

The lithospheric mantle beneath Central Europe (SE Germany, SW Poland, W Czechia) was sampled by many eruption of alkaline lavas forming the Central European Volcanic Province. The volcanic activity was concentrated in the Eger (Ohře) Rift in the western part of Czechia and its surroundings. The investigated mantle xenoliths show that this lithospheric mantle is mostly harzburgitic and widely affected by cryptic metasomatism.

The study of Księginki xenolith suites (mantle peridotites and pyroxenites) shows that the lithospheric mantle beneath the Eger Rift was – at least in places – extensively chemically rejuvenated and thermally homogenised by alkaline lavas on their way to the surface. The xenoliths representing the mantle located outside the rift evidence significant variability. The "Fe-metasomatism", leading to slight decrease of Mg/(Mg+Fe) ratios in olivine, ortho- and clinopyroxene is common in lithospheric mantle located outside the Rift. This metasomatism is usually melt-induced and probably related to Cenozoic alkaline magmas moving pervasively through the harzburgites. The metasomatic events caused by CO_2-bearing silicate melt or by different agents were also deciphered in the region. A metasomatic high-Mg and very low Al clinopyroxene occurring in strongly depleted harzburgites was recently discovered in some localities. Its REE patterns as well as major element composition suggest that it might have originated from fluids generated in a supra-subduction (Alpine orogeny related?) setting. This demonstrates that the Central European lithospheric mantle recorded not only young metasomatic events related to Cenozoic rifting and alkaline melts.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.16