

Meter-scale chemical interaction between pyroxenite-derived melts and mantle peridotites in the Northern Apennine ophiolites (Italy)

G. BORGHINI^{1,2,3}, E. RAMPONE¹, A. ZANETTI⁴, C. CLASS²,
A. CIPRIANI^{2,5}, A.W. HOFMANN^{2,5},
S.L. GOLDSTEIN² AND M. GODARD⁶

¹DISTAV, Università di Genova, 16132 Genova,

Italy (correspondence: giulio.borghini@unige.it)

²LDEO, Columbia University, Palisades NY 10964, USA

³Dip. Scienze Terra, via Botticelli 23, 20133 Milano, Italy

⁴CNR-IGG, Sez Pavia, via Ferrata 1, I-27100 Pavia, Italy

⁵DSCG, Università di Modena e Reggio Emilia, Italy

⁶MPI für Chemie, P.O. Box 3060, 55020 Mainz, Germany

⁷UMR CNRS, Université Montpellier 2, Montpellier, France

Mantle peridotites from the Northern Apennine ophiolites are characterized by the occurrence of cm-thick pyroxenite layers originated by rather deep segregation of MORB-type melts. Our recent work documents that during the pyroxenite emplacement portions of the country peridotite have been significantly modified in their modal, chemical and isotopic compositions by reaction with melts percolating from pyroxenite veins [1]. Here we report the results of detailed bulk and mineral major and trace element profiles carried out through pyroxenite-peridotite boundaries to investigate the physico-chemical parameters governing the melt-rock reaction process. Relative to the peridotites far (> 2 m) from the pyroxenite veins, wall-rock peridotites show i) modal orthopyroxene enrichment at the expense of olivine, ii) higher Al, Ca, Si contents and slightly lower Mg# iii) Al-richer spinel and lower-Mg# pyroxenes. Moreover, clinopyroxenes in the wall-rock peridotites have LREE-depleted patterns and initial $\epsilon\text{Nd}(430 \text{ Ma}) = +4.7\text{--}+7.6$, pointing to a reaction with an enriched tholeiitic silica-saturated melt. Along the pyroxenite-peridotite traverses, clinopyroxenes record a trace element gradient: at the pyroxenite-peridotite contact they have the lowest MREE-HREE abundances, with lower Sm/Nd ratios than the distal pyroxenite-free peridotites. The overall REE abundances progressively increase away from the pyroxenite-peridotite boundary up to about 20 cm as a result of percolative reactive flow at decreasing melt mass. Beyond 20 cm from the contact, the HREE content decreases with distance from the pyroxenite, while the LREEs remain at nearly constant level, pointing to a more efficient chemical buffering of the host peridotite on the HREE composition of the percolating melt through ion exchange chromatographic-type processes.

[1] Borghini *et al.* (2013), *Geology*, in review.

How do organic molecules affect interactions of water with environmental sorbents?

M. BORISOVER

Institute of Soil, Water and Environmental Sciences, ARO,
The Volcani Center, Bet Dagan, Israel;
correspondence: vwmichel@volcani.agri.gov.il

Water is the integral component of environmental phases and interfaces (e.g., in soils and sediments) and affects their structure and reactivity. Sorption interactions of water with environmental phases can be probed by their response to sorption of organic molecules. Such a test examines a sorbent hydration in a local microenvironment specific for a given probe. However, the direct measurement of the response of water-sorbent interactions to the presence of organic molecules at environmentally relevant conditions is difficult, due to typically low organic sorbate concentrations. Therefore, the use of the model-free thermodynamic approach [1] is proposed which allows determining the effect of organic compounds on sorbent-water interactions from the equilibrium sorption isotherms of organic molecules measured at varying water activities. The analysis included the data on (1) organic vapor sorption on such important soil components as minerals (i.e., quartz, clays, metal oxides) and organic matter (OM), and (2) the liquid phase sorption on the model soil OM. The amount of water *expelled* from a sorbent or *co-sorbed*, per an organic molecule sorbed, was obtained for different extents of sorbent hydrations. The water-expelling effect of organic molecules on minerals was analyzed by using Linear Free Energy Relationship (LFER). The LFER analysis suggested (i) the significance of organic sorbate polarizability associated with n - and π - electrons in driving water into the sorbent phase and (ii) the control of water driving-out effect by molecular size, H-bond acidity and basicity of sorbates. As distinct from minerals, water interactions with strongly hydrated OM phases (i.e., at water activities approaching one) become enhanced upon sorption of multiple organic sorbates containing oxygen, nitrogen or sulfur atoms. This OM hydration enhancement may involve several water molecules per a sorbed organic molecule and seems to be cooperative, which may need to be incorporated into models of organic compound sorption by soils and sediments. Importantly, this effect of the OM hydration enhancement suggests that a pre-hydration of OM does not necessarily create the OM configuration appropriate for further accommodation of other molecules.

[1] Borisover (2012) *Adsorption*, DOI 10.1007/s10450-012-9446-7).