# Reactive transport of salicylate in a goethite-coated sand column

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## Methodology

The salicylate sorption at oxide/water interface and correlation with the hydrodynamic transport parameters is the main objective of this study. For this purpose, the surface complexation reactions were examined under static and dynamic conditions by conducting batch and column tests, vibrational spectroscopy and modeling approach.

## Results and Discussion

Prior to salicylate sorption experiments, the surface properties of the synthesized Goethite-coated quartz were determined. Sorption isotherm, sorption edges, solid-to-solution ratio effect on sorption were studied and described using macroscopic models and the MINTEQ database incorporated in PHREEQC-2 [1].

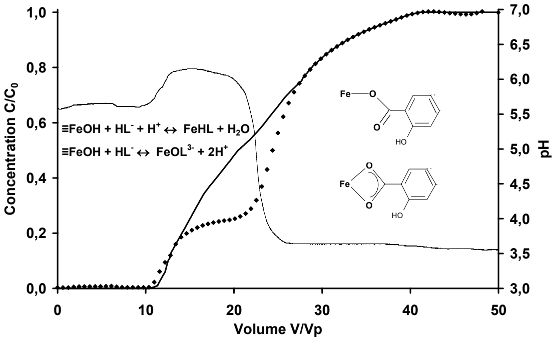

**Figure 1:** Breakthrough curve of salicylate (♦) and modeling results (—); $pH_{outflow}$ (--).

The hydrodynamic parameters of the column were determined by a non-reactive tracer injection and by using the Convection-Dispersion Equation ($\theta = 0.58$ $cm^3/cm^3$; $D = 0.0048$ cm²/min; $\lambda = 125$ µm). Column breakthrough curves displayed two steps at high flow rate (0.3 cm/min). On the basis of spectroscopic observations (Raman and Infrared), the mononuclear salicylate surface complexes (monodentate and/or bidentate) are identical at any height in the column. However, a binuclear monodentate complex is expected in batch. Assuming one type of site and two surface complexation reactions per site, the transport of salicylic acid in a goethite-coated sand column can be described by surface complexation modeling.

[1] Parkhurst D.L. & Appelo C.A.J. (2000) PHREEQC (Version 2)

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# Assessing parent magma compositions and $H_2O$ contents in the central Oregon Cascades

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We analyzed olivine–hosted melt inclusions in mafic tephra deposits from six volcanic centers located in the central Oregon High Cascades by FTIR, LA–ICPMS, and EMP to relate pre–eruptive volatile contents ($H_2O$, $CO_2$, S, Cl) to major and trace element compositions and mineralogy. Host olivine crystals ($Fo_{77-86}$) have $\delta^{18}O = 5.35 \pm 0.2‰$; values typical for mantle–derived magmas. Melt inclusion compositions have 49–54 wt% $SiO_2$ and 4.3–7.2 wt% MgO. Maximum $H_2O$ and $CO_2$ contents range from 1.6–3.8 wt% and 860–1500 ppm, respectively and suggest maximum pressures of inclusion entrapment between 2–4 kbar. Magmatic $H_2O$ concentrations are lower in tholeiitic compositions than in calc–alkaline samples. High incompatible element abundances relative to N–MORB indicate that these magmas formed by melting of an enriched mantle source that was overprinted with even higher abundances of incompatible and fluid mobile elements derived from the underlying subducted slab. Geochemical trends, petrographic observations, and correlations between maximum $H_2O$ contents and major elements suggest that these melts have experienced multiphase crystal fractionation (olivine and plagioclase dominated) during transit from the mantle to the surface. We investigated a variety of models, including equilibrium olivine and plagioclase addition, forward crystallization modeling from whole rock primitive compositions from the Cascades, and least–squares mixing calculations to assess total extents of crystallization. Minimum (olivine–only) and maximum (~50:50 ol+plag) estimates of crystallization range from 11–17% and 31–40%, respectively. After correction for the effects of crystallization, we estimate that the original magmas contained 1.2–2.8 wt% $H_2O$. Batch melting calculations for parental compositions suggest relatively large degrees of melting (15–23%) of an enriched mantle source. Comparison with wet mantle melting models indicate maximum temperatures in the mantle wedge that are near or above the dry peridotite solidus [1]; these temperature and melting estimates suggest that flux–melting may be important beneath the central Oregon High Cascades.

[1] Portnyagin *et al.* (2007) *EPSL* **225**, 53–69.