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(Article begins on next page)

Are the glasses in mantle xenoliths witness of the metasomatic agent composition?

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Glass veins and pockets in mantle xenoliths are often considered as indicators of the composition of metasomatic agents affecting the mantle. Here we demonstrate that infiltration of, and reaction with, the host basalt may produce glassy veins and pockets whose composition encompasses that of different potential metasomatic agents. The xenoliths studied are 4-19 cm large, equigranular, spinel-facies harzburgites and lherzolites from the Patagonia lithospheric mantle. A reaction rim occurs at the contact with the basalt. Peridotite orthopyroxene is in reaction with the basalt and a glassy pocket (up to 600 μm in diameter) is thereby formed. New crystals of euhedral olivine ($Fo = 84$) and Ti-oxides crystallise in the glass pocket close to the basalt, while euhedral crystals of clinopyroxene ($mg\# = 85-89$) and olivine crystallise close to orthopyroxene. The reaction-crystallisation processes induce dramatic compositional variations in the glass pocket from phonotephryte to trachyte. Trace element concentration and patterns and the element anomalies are controlled by the reaction-crystallisation process. Orthopyroxene dissolution has mainly a dilution effect, whereas clinopyroxene crystallisation and the crystallisation of Ti oxides (and apatite) largely controls the trace element fractionation and element anomalies. The largest trace element variations are documented in the veins. The studied glasses obviously do not represent metasomatic agents that affected the lithospheric mantle, but the large compositional variations they document encompass those of glasses quoted in literature (Wulff-Pedersen et al., 1996; Coltorti et al., 2000) and believed to represent metasomatic agents, thus suggesting caution in drawing inferences on mantle processes and components from glass pockets and veins in xenoliths.

References

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Surface chemistry of a gram-negative bacterium

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Many geochemical processes are microbially mediated; surface complexation of ions, dissolution of minerals, redox reactions, etc. These processes involve interfacial reactions with bacterial surfaces. The surfaces of bacteria, containing carboxylic, phosphate, hydroxyl and ammonium groups, have a pH-dependent surface charge. Therefore the acid-base characteristics of the bacterial surface play a dominant role in the interfacial reactions. Models and techniques, developed to investigate the acid-base properties of mineral surfaces, have been applied to bacterial surfaces. The aim of our study was to evaluate the applicability of acid-base titrations to bacterial surfaces.

Acid-base titrations were performed to study the surface chemistry of *Shewanella putrefaciens*, a facultative anaerobe gram-negative bacterium. Because living cells may adjust to stress conditions (pH, electrolyte concentration, etc.) protons can be consumed or produced by processes other than protonation/ deprotonation of surface functional groups. Therefore we performed pH-stat experiments and followed the change in buffer capacity of the aqueous phase over time. Our results indicate that, depending on pH, weak organic acids were present in the solution. Additionally a constant hydroxide consumption was observed above pH 7. A possible explanation is that the bacteria actively pump protons into the solution, in response to a pH increase of the medium. By quantifying the different irreversible acid-base reactions, titration curves were obtained representative of surface reactions only. These titration curves, combined with electrophoresis experiments, enabled us to characterize the point of zero charge, the surface charge density, the surface functional groups and the electrostatic effects.