Progressive silica depletion during experimental serpentinization of peridotite mantle xenoliths

Y. M. PORTELLA[1,2*], R. V. CONCEIÇÃO[1], T. A. SIQUEIRA[3], D. G. CEDEÑO[1], R. S. IGLESIAS[3]

[1] Programa de Pós-Graduação em Geociências (PPGGEO), UFRGS, Porto Alegre, Brazil (*correspondence: ymportella@gmail.com; rommulo.conceicao@ufrgs.br; daniel.grings@ufrgs.br)

[2] E&P, Petrobras S.A., Rio de Janeiro, Brazil

[3] Instituto do Petróleo e dos Recursos Naturais, PUC-RS, Porto Alegre, Brazil (tiago.siqueira@pucrs.br; rodrigo.iglesias@pucrs.br)

In the past few years serpentinization reactions have been the focus of many experimental studies aimed mostly at hydrogen and methane production [1–3]. However, such studies have only marginally approached aqueous silica release into the derived fluids, and results are ambiguous. In order to estimate silica depletion during progressive serpentinization, replicate batch experiments of powdered peridotite mantle xenoliths with seawater-salinity brines were conducted at 230°C and 13.5 MPa in different run-times. Water to rock mass ratio (W/R) was kept constant, in agreement with lower range estimates of serpentinization in the Mid-Atlantic ridge [4].

X-ray fluorescence (XRF) and diffraction (XRD) of the products indicates that bulk rock SiO_2 concentration drops continously from 44.44 to 41.67 wt%, while lizardite precipitates. XRD analyses also suggests that lizardite is the main secondary phase and that no detectable amounts of magnetite or brucite were formed. Under 6 weeks of reaction, silica depletion reaches -6.2% of the original silica content, at an average rate of approximately -0.157% $[SiO_2].day^{-1}$.

Our results differ from those of [2,3] which reported an initial increase in aqueous silica that was followed by a progressive concentration decrease in the reacted fluid. Bulk rock XRF analysis of the reacted powder implies that SiO_2 depletion in the serpentinized peridotite must be acompanied by progressive increase in aqueous silica concentration in the fluid until saturation. Likewise, XRD analyses indicates that lizardite is the dominant serpentine polymorph, coherent with low temperature (<300°C) serpentinites [5].

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