

Hydrogen production through olivine alteration

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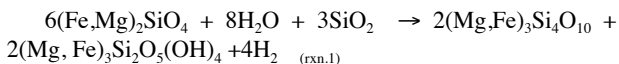
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Here time-dependent interactions of solid, liquid, and gaseous phases with respect to olivine hydrolysis in a 20 mM HCO₃ solution at 30, 50 and 70°C for 315 days is investigated experimentally [1]. Within the first two months, amorphous talc-like and carbonate phases precipitated; however, no inhibition of olivine dissolution is observed at any temperature based on surface chemistry analyses. High-resolution surface analyses confirm that the precipitates grew as spheroids or vertically to form topographic highs allowing further dissolution of the free olivine surfaces and exposing potential catalysts. Despite no magnetite (Fe₃O₄) detected, H₂ increased with time in the 70°C experiments, indicating an alternative coupled route for Fe oxidation and H₂ production. Spectrophotometry analyses show that aqueous Fe(II) is largely converted to Fe(III) potentially integrating into other phases such as serpentine and talc thus, providing a viable pathway for H₂ production, according to rxn.1.



No increase in H₂ production was observed in the 30 and 50°C experiments supporting observations that incorporation of Fe(II) into carbonates occurred faster than the intertwined processes of olivine hydrolysis and Fe(III) oxidation. Overall, carbonate formation is confirmed to be a major influence related to H₂ production in low-temperature serpentinization systems.

[1] Neubeck, A., *et al* accepted. *Planet. Sp. Sci.*