

## **Chromium oxidation by hydrogen peroxide in serpentinization systems**

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Serpentinization in both terrestrial and marine environments results in basic, reducing and H<sub>2</sub>-rich fluids. Elevated Cr(VI) identified in terrestrial serpentinization-related fluids presents a conundrum as anoxic conditions do not promote Cr(III) oxidation and Cr(VI) formation with Mn oxides is limited at pHs above 8. Serpentinization systems, however, may be capable of producing metastable H<sub>2</sub>O<sub>2</sub>, a Cr(III) oxidizer, due to elevated H<sub>2</sub>. Here we assess H<sub>2</sub>O<sub>2</sub> and chromium oxidation interactions in serpentinization systems, potentially altering the paradigm of O<sub>2</sub>-dependent oxidation. Field results demonstrate that metastable H<sub>2</sub>O<sub>2</sub> and Cr(VI) are present in serpentinization-related fluids. Additionally, laboratory experiments support that H<sub>2</sub>O<sub>2</sub> is an oxidant of Cr(III) in chromite, especially under alkaline conditions. This pathway of Cr(VI) generation may lead to the contamination of waters and has implications regarding chromium isotopic fraction, prebiotic organic synthesis, and microbial functionality.