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LETTER

Magnetite-free, yellow lizardite serpentinization of olivine websterite, Canyon Mountain complex, N.E. Oregon

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ABSTRACT

We document an example of serpentinization of olivine and orthopyroxene that produced virtually no magnetite, but instead relatively Fe-rich yellow-colored lizardite (X_{Fe} = 0.08 to 0.17), and the native Fe-Ni-Co metals, awaruite and wairauite. Lizardite's identity was confirmed by micro-Raman spectroscopy, although peaks are broad. Electron microprobe analyses of the lizardite yield a continuous compositional trend of formula contents suggestive of the progressive uptake of Fe^{3+} exclusively on M sites, where it is charge balanced by vacancies. Although these observations are unusual, this secondary mineral assemblage can be explained in terms of the likely intensive variables T, f_{H_2O}, f_{H_2}, and a_{SiO_2} attending the alteration. The absence of magnetite in serpentinization does not signify a lack of oxidation. By forming the hydrated phase-component ferri-lizardite instead of magnetite from the fayalite and ferrosilite components, the yield of hydrogen is reduced by two-thirds. The usual inverse correlation of rock density with magnetic susceptibility is unlikely to be the case in this kind of serpentinization.

Keywords: Serpentinite, ferrian lizardite, olivine-websterite, micro-Raman, hydrogen, magnetic susceptibility