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Protoanthophyllite from three metamorphosed serpentinites

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ABSTRACT

This is the first report of a natural Mg-rich protoanthophyllite. It is common in metamorphosed serpentinites from three Japanese ultramafic complexes, and some crystals contain anthophyllite (*Pnma*) lamellae. The Mg/(Mg + Fe) ratios of the Hayachine, Tari-Misaka, and Takase protoanthophyllites are 0.90, 0.92, and 0.91, respectively. The samples have identical optical properties: X = **a**, Y = **b**, Z = **c**, and $2V_x = 64 \pm 5°$. Their space group is *Pnmn* (or *Pn*2*n*), as revealed by systematic extinctions in selected-area electron-diffraction patterns. The protoanthophyllite and anthophyllite have similar compositions and orthorhombic symmetry. They are difficult to distinguish using optical, microanalytical, and powder X-ray diffraction measurements. This problem raises the possibility that some of the published data on geological and synthetic anthophyllite samples may be of misidentified materials, potentially leading to errors in the published stability relations of anthophyllite. We provide a method to identify protoanthophyllite and differentiate it from its polymorphs using selected-area electron diffraction and high-resolution transmission electron microscopy methods.