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Coexisting chromian omphacite and diopside in tremolite schist from the Chugoku Mountains, SW Japan: The effect of Cr on the omphacite-diopside immiscibility gap

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ABSTRACT

Chromian clinopyroxenes with exsolution textures were found in high-pressure (HP) tremolite schist from the Osayama serpentinite melange in the Chugoku Mountains, Southwestern Japan. Chromian omphacite [jadeite $(Jd)_{23.3–41.4}$ diopside $(Di)_{46.7–60.7}$ kosmochlor $(Ko)_{4.5–19.6}$ aegirine $(Ae)_{<7.0}$] with up to 6.6 wt% Cr_2O_3 occurs as neoblastic crystals in a foliated tremolite-rich matrix, or as pseudomorphs after relict chromian spinel, and contains irregular-shaped thin lamellae of chromian diopside ($Jd_{3.8–18.2}Di_{72.5–93.6}Ko_{1.1–13.9}Ae_{<3.4}$). Chromian omphacite contains roughly constant jadeite plus kosmochlor components at 38.2–51.6 mol%; this is equivalent to the jadeite component of ordered *P*2/*n* omphacite. Systematic analyses of coexisting chromian pyroxenes yield a clear immiscibility gap between "omphacite" and "diopside." The compositional gap becomes much narrower with increasing Ko component; addition of only 10 mol% Ko component narrows the omphacite-diopside gap by an order of magnitude. Such an effect is similar to, but more effective than, the introduction of Fe^{3+} on the omphacite-diopside immiscibility gap.

Chromian pyroxenes replacing relict chromian spinel are associated with other chromian silicates including phengite, chlorite, and pumpellyite. The wide compositional gap of chromian pyroxenes and the presence of chromian pumpellyite and Si-rich chromian phengite indicate $T < 300–400$ °C and $P > 0.8$ GPa. This *P-T* estimate is consistent with parageneses of minerals in the host serpentinite. The variation of Cr content in chromian silicates reflects the extent of Cr ↔ Al substitution, and may be related to a chemical heterogeneity of the Cr-bearing fluid.