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Experimental Constraints On The Origin Of Podiform Chromitites

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The finding of micro-diamond, coesite inclusions and coesite and clinopyroxene exsolution lamellae within magnesiochromite crystals suggests that podiform chromitites in the Luobusa ophiolite, Tibet originated in the deep mantle. In order to investigate the stability field of magnesiochromite and the origin of the coesite and clinopyroxene exsolution lamellae, we undertook a number of experiments in the magnesiochromite+SiO2 system at temperatures of 1000-1600oC and pressures 5-15 GPa. The experimental results show that: 1) magnesiochromite is transformed into a new phase (Fe, Mg)2(Al, Cr)2O5 with a modified ludwigite structure at pressures >14 GPa and a temperature of 1600oC; 2) Si solubility in the magnesiochromite increases slightly with increasing pressure and temperature, reaching a maximum of 2.44 wt%. and then decreasing significantly in the new phase; 3)There is a negative correlation between Si and Cr+Al and no correlation between Si and Mg+Fe. Thus, Si4+ and Ca2+ substitution in chromite may be simultaneously controlled by 2X3+↔Ca2++Si4+ (X: Al, Cr) and 4X3+↔3Si4++Δ (X: Al, Cr; Δ: vacancy). We propose that podiform chromitites with these characteristics formed at the top of the mantle transition zone (12-14GPa) where Si, Ca and Mg are incorporated into chromite with a CF structure. The coesite and clinopyroxene lamellae formed by exsolution as the chromitites were transported to shallow mantle levels. The diamonds and other UHP minerals were preserved as inclusions in magnesiochromite grains. The chromitites and their host peridotites were preserved as ophiolites in suprasubduction zones where they underwent some modification by slab-generated melts.

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