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Diopside and coesite lamellae within Cr-spinel from the Podiform Chromitite in the Luobusa Ophiolite, Tibet

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Previous works have suggested melt-rock interactions are significant for the podiform chromitite genesis especially in supra-subduction zone setting under shallow condition (e.g. Zhou et al., 1996, Arai, 1997). But recently, the podiform chromitites in the Luobusa ophiolite have received much attention because unusual mineral assemblages such as diamond, coesite and unusual metal phases have been reported from the heavy mineral separation (Bai et al., 1993, 2000, Robinson et al. 2002, Yang et al., 2001). In this study, we discovered numerous needles within Cr-spinel of podiform chromitite. They are several micrometers wide and several tens micrometers long. Their texture is very similar to that of exsolution lamellae within UHP garnet (e.g. Haggerty and Sautter 1990; Ye et al., 2000). To investigate them, we conducted Analytical Transmission Electron Microscopy (ATEM) analysis at Tokyo Institute of Technology. EDS analysis showed that most needles have diopside composition. And rod-shaped SiO2 phases were also observed. Electron diffraction pattern of SiO2 phase can be indexed only by coesite with monoclinic structure. The relationships between diopside and Cr-spinel and between coesite and Cr-spinel are [100]sp // [103]di and [011]sp // [010]di, [100]sp // [012]coe and [110]sp // [100]coe respectively. These parallel orientation suggest that diopside and coesite were formed as exsolution lamellae from Cr-spinel. Exsolution lamellae indicate diopside and SiO2 component were dissolved to Cr-spinel. But experimental and mineralogical works have shown that CaO and SiO2 are not incorporated to spinel under the ordinary condition. But the occurrence of coesite directly indicates that the exsolution lamellae was generated under the UHP condition over 3 GPa. So they suggest Cr-spinels were originated from the much higher pressure and/or higher temperature condition than previously assumed.