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Modification of the High-Pressure-Type Chromites into the Low-Pressure-Type: Petrological Investigation of the Podiform Chromitites in the Luobusa Ophiolite, Tibet

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The podiform chromitites in the Luobusa ophiolite, Southern Tibet, have received much attention because of the presence of ultrahigh-pressure minerals, such as micro-diamonds (Bai et al., 1993; Yang et al., 2007; Xu et al., 2009), coesite (Yang et al., 2007) and highly reduced metal phases (Bai et al., 2000; Robinson et al., 2004). The occurrence of diamonds, stable over 150 km deep in the mantle, suggests that the podiform chromitite in the Luobusa have a deep mantle origin (Yang et al., 2007). We have reported unusual silicate exsolution lamellae (coesite, clinopyroxene and $MgSiO_3$ phase) in chromite of the podiform chromitites in the Luobusa ophiolite (Yamamoto et al., 2009). These silicate exsolutions in chromites are restricted only in the nodular- and massive-type chromites, and disseminated-type chromites have no exsolutions. Thus, chromites of the podiform chromitite in the Luobusa are classified into two types; (1) high-pressure type with abundant silicate-exsolution and (2) low-pressure type with no silicate-exsolutions. Significantly, dunitic orbicular-type chromitite consist of both high-pressure type (centered-nodular chromite surrounded by coarse-grained olivine) and low-pressure type (disseminated chromites scattered in the interstitial part of the olivine matrix). Petrographical investigation shows that nodular-type chromites with abundant silicate-exsolutions are gradually modified into disseminated-type chromites in their morphology and exsolution abundance. The characteristic of the disseminated-type chromite, such as their interstitial distribution, euhedral to subhedral morphology and absence of silicate-exsolutions, suggest their formation under the low-pressure magmatic conditions. Moreover, anhedral clinopyroxene were observed in the interstitial part of the olivine matrix in the dunitic orbicular-type chromitites. Chondrite-normalized REE concentrations of the melt in equilibrium with clinopyroxene are highly depleted in the middle-REE and similar to typical boninitic REE pattern. On the basis of these results, it is suggested that boninitic melts, which percolated through the mantle section, largely recrystallized and/or modified the high-pressure type chromites into the low-pressure type. We conclude that the podiform chromitites at the Luobusa retain evidence of their multi-stage development from ultrahigh-pressure environment to low-pressure magmatic processes.

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