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Fluid exsolution during the formation of podiform chromitites: Case study from the Luobusa ophiolite, southern Tibet

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Podiform chromitites occur typically in harzburgites near the petrological Moho in ophiolite sections, and are economically significant. Hydrous fluids may have played an important role in the formation of podiform chromitites, although unambiguous evidence for the involvement of such fluids is rare. Here we present results of the Ni, Co, Mn, and Zn contents of olivines and chromites in representative samples from the Luobusa ophiolite, southern Tibet, considering that these elements exhibit different geochemical behaviour in melts and hydrous fluids. In harzburgites, the olivines exhibit a limited range in terms of contents of these elements, whereas the chromites display a considerable variation. From the dunite lenses to the dunite envelopes, and to the chromitites, both olivine and chromite exhibit significant decreases in Co, Mn and Zn contents, and increases in Ni contents. These features cannot be fully explained by subsolidus re-equilibration, partial melting, fractional crystallization, ore melt–rock reactions. Olivine relicts in chromite indicate the dissolution of pre-existing olivine in dunitic channels. The olivine dissolution may have been due to the water-rich nature of the parental melts of the chromitites. These observations, together with structure features of chromitites, suggest that, during the formation of podiform chromitites, chromite crystallization was accompanied by olivine dissolution and exsolution of a hydrous fluid phase. This resulted in the preferential transfer of Ni into the melt and olivine relicts, and Co, Mn, and Zn into the fluid phase. As such, the chromite and olivine in the chromitites became Ni-rich and Co-, Mn-, and Zn-poor, which led to Ni–Co decoupling.