

Relict chromian spinels in serpentinites of the Yuli belt, eastern Taiwan: compositional characteristics and geologic implications

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Ultramafic rocks are important for deciphering geodynamic evolution of orogenic belts. The Yuli metamorphic belt has been the most crucial topic in regional tectonics of eastern Taiwan in recent years (Tsai et al., 2013; Brown et al., 2015; Keyser et al., 2016; Chen et al., 2017). Four major serpentinite-bearing tectonic blocks crop out in Fengtien, Wanjung, Juisui, and Chinshuichi areas in this elongated metamorphic belt. High-pressure (HP) rocks of unusual bulk compositions occur in some of the blocks and have been well characterized and dated. However, serpentinites are surprisingly not studied in detail yet. We investigated serpentinites in the Juisui and Chinshuichi areas. Metasomatic zones commonly occur between serpentinites and surrounding metasediments. We discovered chromian spinel (Cr-spinel) relics in some of the serpentinite samples, which consist mainly of antigorite and magnetite, with secondary chrysotile and calcite. The relict reddish-brown Cr-spinel is replaced by opaque ferritchromite and magnetite. Cr-spinel compositions are characterized by different groups of Cr# [= Cr/(Cr + Al) atomic ratio], Mg# [= Mg/(Mg + Fe²⁺) atomic ratio] and TiO₂ content. Type I Cr-spinel shows moderate Cr# (0.48-0.58), relatively high Mg# (near 0.7), and very low TiO₂ (< 0.02 wt.%), whereas Type II shows high Cr# (up to 0.8) and relatively low Mg# (< 0.6), but relatively high TiO₂ (0.02-0.28 wt.%). We tentatively interpret that Type I might be of abyssal peridotite protolith origin and Type II of forearc (mantle wedge) origin. Therefore, serpentinites from the Yuli belt are likely of multiple origins in terms of protolith tectonic setting. They might have been incorporated into a subduction channel (or accretionary prism) and mixed with pelitic and psammitic sediments before metamorphism and serpentinitization.

Keywords: serpentinite, tectonic setting, Cr-spinel, subduction, forearc, Yuli belt