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Origin of Spinel-Pyroxene Symplectite in Lherzolite Xenoliths from Tallante, Southeast Spain: Evidence for Mantle Diapirism beneath the Betic-Rif Zone

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We found spinel-pyroxene symplectites in lherzolite xenoliths from Tallante, SE Spain, and investigated their petrographical and geochemical signatures. The symplectites are always surrounded by coarser-grained spinel-pyroxene lenticular aggregates. The spinel-pyroxene symplectites are divided into two types, spinel-type (= opx + cpx + sp) and plagioclase-type (= opx + cpx + sp + pl) in mineral assemblage. The petrography and major-element chemistry of bulk symplectites indicate an origin of subsolidus reaction between olivine and garnet (Fig. 1). The bulk spinel-pyroxene symplectites, however, shows a relatively flat REE distribution with slight LREE enrichment, i.e. no trace-element signature of garnet (Fig. 2). It is also different from the Horoman (Japan) spinel-pyroxene symplectite that occasionally preserves the garnet trace-element signature, i.e. depletion of LREE and enrichment of HREE. After depletion by melt extraction and breakdown of garnet by decompression, all the minerals including symplectite constituents have been homogenized in the stability field of spinel to plagioclase lherzolite, with an assistance of some melt, possibly alkaline silicate melt (e.g. Downes 2001). Moreover, some of spine-type symplectite suffered heating by injection of slab-derived melt, and consequently have been transformed to the plagioclase-type symplectite.

The petrological and major-element compositional features of the Tallante spinel-pyroxene symplectite strongly indicate that it had been garnet and was carried from the garnet-lherzolite stability field to spinel- to plagioclase-lherzolite stability field by mantle diapir. The active mantle diapirism possibly occurred in Betic-Rif zone at the Miocene time.

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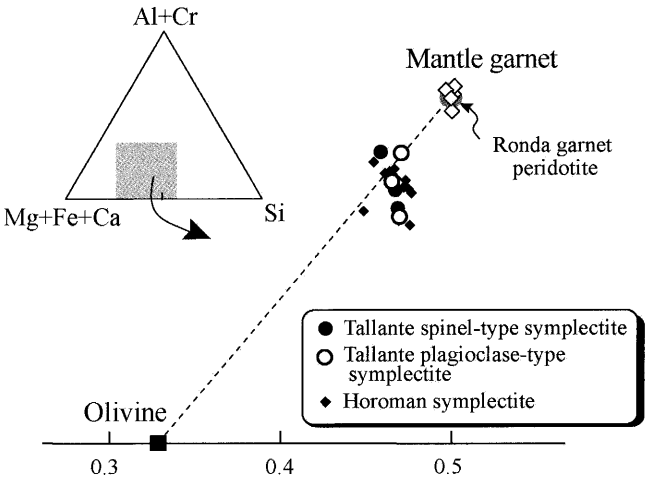

Figure 1 (Al + Cr)-(Mg + Fe + Ca)-Si atomic ratio of the Tallante bulk spinel-pyroxene symplectites. Horoman bulk spinel-pyroxene symplectite (Takahashi and Arai 1989; Morishita and Arai 2003), representative mantle garnets (McDonough and Rudnick 1998) and garnet from the Ronda garnet peridotite (south Spain; Obata 1980) are also shown.

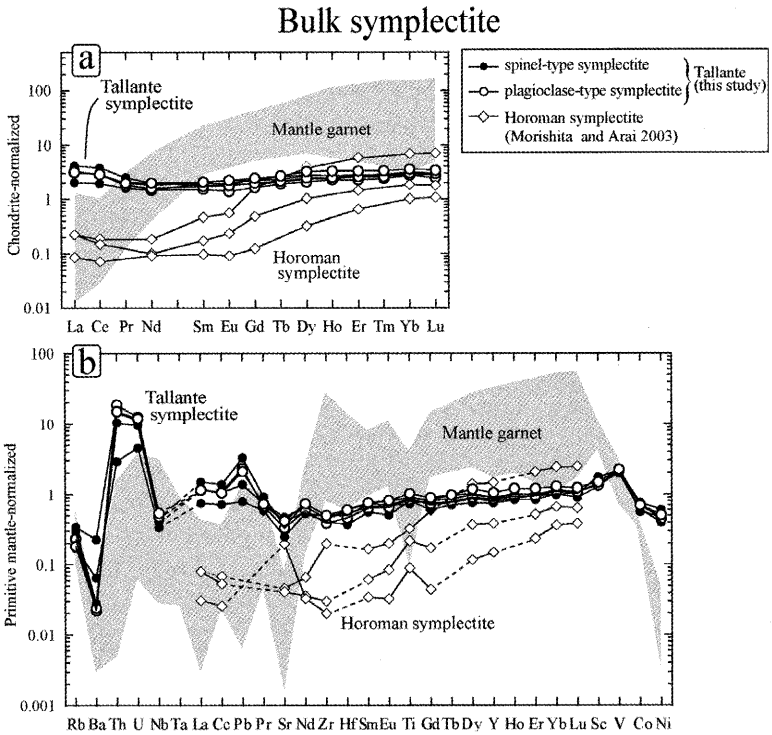

Figure 2 The chondrite (McDonough and Sun 1995)-normalized REE distribution (a) and the primitive mantle (McDonough and Sun 1995)-normalized trace element distribution (b) of Tallante bulk spinel-pyroxene symplectites. REE and trace-element distributions of Horoman bulk spinel-pyroxene symplectite (Morishita and Arai 2003) and garnet form mantle xenoliths (Aulbach et al. 2005; Grégoire et al. 2003; Ionov et al. 2005; Litasov et al. 2000; Stern et al. 1999) are also shown. Note that the REE distribution pattern of bulk symplectite is different between the Tallante and Horoman peridotites.