Petrogenesis of hoegbomite-baring spinel-corundum rocks from the Palghat-Cauvery Shear Zone system, southern India

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The hoegbomite-baring rocks occur in corundum-, sapphirine-, and spinel-bearing Mg-Al-rich layers within layered mafic to ultramafic rocks at Paramati locality, Southern India. The rocks are composed dominantly of plagioclase, spinel, and corundum as well as hoegbomite. It occurs as an accessory mineral around rim or along the grain boundary of spinels. It is characterized by moderate Ti content (4.9-5.4 wt.% TiO_2) and XMg (= Mg/(Fe+Mg) = 0.51-0.52) compared to that reported by Tsunogae and Santosh (2005). Cr_2O_3 and MnO contents of the mineral are negligible (less that 0.22 and 0.17 wt.%, respectively). Spinel shows XMg of 0.55, which is nearly consistent with that of hoegbomite. Its Cr_2O_3 and ZnO contents are very low (less that 0.24 and 0.01 wt.%, respectively). Composition of corundum is close to the ideal chemistry (Al_2O_3), although it contains small amounts of Fe_2O_3 and TiO_2 (up to 0.45 and 0.21 wt.%, respectively). Plagioclase is compositionally close to pure anorthite as An99.

Hoegbomite with moderate XMg and high Ti content as well as close association with spinel is consistent with the previous reports of the mineral as a retrograde phase replacing spinel. Although Koshimoto et al. (2004) estimated peak metamorphic temperature of 930-950 ^oC and inferred clockwise P-T history from this locality, the formation of hoegbomite can be regarded to be below the peak temperature because of its occurrence as a retrograde phase. Razakamanana et al. (2000) examined spinel-hoegbomite association from Madagascar and inferred hoegbomite formation from Ti-bearing spinel. The textural characteristics of our hoegbomite-bearing rock are consistent with the progress of the following reaction; Ti-spinel + H_2O to Ti-free spinel + hoegbomite, and limited migration of hoegbomite to the edge of spinel grains. Although this model might be contrasting with the formation of Ti-free hoegbomite + corundum + magnetite association by hydration and oxidation of spinel (Tsunogae and Santosh, 2005), both the hoegbomite localities are within the Palghat-Cauvery Shear Zone System. The formation of hoegbomite during retrograde metamorphism in this region is therefore probably related to the infiltration of hydrous (or locally oxidized) fluids along the Palghat-Cauvery Shear Zone System. Our fluid inclusion study of corundum indicates the preserve of CO_2-rich fluid during the growth of the mineral. Although we failed to identify H_2O-rich fluid inclusions, H_2O-bearing fluid might have been present at the formation stage of hoegbomite.