Role of melt injection and mixing in formation of Archean chromitite in anorthosites: Evidence from the Sittampundi anorthosite complex, southern India

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Chromitite and anorthosite interlayers occur in many layered intrusions and the Archean anorthosite complexes. The Neoarchean Sittampundi anorthosite complex in southern India is composed of white anorthosite, dark anorthosite, minor gabbro and pyroxenes granulite. Plenty of chromitite layers are hosted in anorthositic rocks, in sharp contact with each other. Coarse-grained amphibole and plagioclase in the chromitites are also surrounded by interstitial Cr-spinel and amphibole to form embayment textures along their rims. Besides, REE patterns of the coarse-grained amphibole and $^{87}Sr/^{86}Sr$ isotope values of plagioclase in chromitites and that in hosting anorthosite are similar, implying that coarse silicate minerals in the chromitites were captured from the anorthosite host. In contrast, High-Mg# orthopyroxene megacrysts are present in chromitite but absent in anorthositic rocks. These orthopyroxenes are commonly optically continuous, but are crosscut and surrounded by interstitial Cr-spinel and amphibole in their core and rim, respectively. The absence of orthopyroxene in anorthosite indicates that orthopyroxene was probably formed earlier in the deeper magma chamber(s), and partially remelted when it entered the extant magma chamber. Such relationships strongly suggest that Cr-spinel was saturated through the mixing of an anorthositic mush with a replenished (more primitive) magma. The addition of Cr_2O_3 from the replenished magma (especially from the orthopyroxene xenocrysts) and SiO_2 from the anorthositic crystal mush would have pushed for the Cr-spinel saturation and triggered chromitite formation. The high Al feature of Cr-spinel is likely to be a function of plagioclase remelting, which increased the amount of Al^{3+} in the mixed magma.