Ti-rich garnet core in spinel in a kimberlite: evidence for metasomatic origin

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EPMA data are obtained from the P-5 kimberlite from the Wajrakarur field in the Eastern Dharwar craton of southern India (EDC). The studied sample consists of xenocrysts and xenoliths set in a variable grain size groundmass of olivine (with two textures: rounded-anhedral and subhedral-euhedral), phlogopite, perovskite, spinel, pyroxene, spinel and spinel containing Ti-garnet core. Ti-rich garnet associated with spinel is a rare occurrence in kimberlites.

Two types of spinel have been identified (a) fine grained (<80 μm) and compositionally non titaniferous, and (b) large macrocrysts (>100 μm) having replacement cores having distinctly Ti-rich (TiO_2 up to 28.51 wt %) compositions. Spinel is an abundant phase varying from <20 to >300 μm in size, mostly subhedral to euhedral in shape. Pipe-5 has atoll- and necklace-textured spinels in addition to the euhedral groundmass spinels. Apart from individual grains in ground mass spinel there are also spinel intergrowths with perovskite (no apparent reaction texture observed), and sieve-like intergrowths. The composition of groundmass spinel is extensively used as petrogenetic indicator mineral (Roeder and Schulze 2008). Ti-garnets contain significant Ti (21.25-28.51wt.% TiO_2), Ca (15.45-27.69 wt.% CaO), Fe (2.62-24.46 wt.% FeO) and low Cr (0.08-1.52 wt.% Cr_2O_3) and low Al (1.40-3.87 wt.% Al_2O_3). Ti- garnets and their paragenetic relationships to spinel are considered here as vital petrogenetic indicators of metasomatic fluids (Dongre et al., 2016; Cheng et al., 2014), and textural association with spinel shows that Ti-garnet formed when early crystallizing spinel interacted with residual melt during magma crystallization.

References:

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