

Implications for mantle heterogeneity and diamond preservation derived from Rosário-6 kimberlite, South of Brazil

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The Rosário-6 is a non-diamondiferous hypabyssal kimberlite located above the Rio de la Plata craton and near the south-eastern edge of the Paraná Basin, in southern Brazil. Petrographically, it is an inequigranular, macrocrystal kimberlite, fresh and the groundmass exhibits a microporphyritic texture and round megacrysts of olivine, which are derived from disaggregated mantle xenoliths. Olivine is also present as macrocrysts, microphenocrysts and in the groundmass together with phlogopite and apatite. These microphenocrysts are immersed in a groundmass of olivine, monticellite, phlogopite, CaTiO₃-perovskite, apatite, Mg-chromite and Mg-ulvöspinel, and melilite. A mesostasis assemblage of phlogopite, melilite, soda melilite, akermanite and calcium carbonate is segregated from the groundmass. Its geochemical signature is similar to those of transitional kimberlites of Kaapvaal Craton, South Africa, and the U/Pb ages of ~ 128 Ma on perovskite reveal that Rosário-6 kimberlite post-dates the main pulse of volcanism in the Paraná-Etendeka Large Igneous Province (LIP). The high Ti content of some minerals, such as Mg-chromite, Mg-ulvöspinel, phlogopite and melilite, and the presence of perovskite suggest a Ti-rich source. Crystallization temperature, pressure and oxygen fugacity (fO_2) conditions were estimated using different methods, in order to determine the potential of Rosário-6 to preserve diamonds. The petrographic, geochemical and isotopic data indicate that the Rosário-6 kimberlite source is a depleted mantle metasomatized by H₂O-rich fluids, CO₂-rich and silicate melts derived from the recycling of an ancient subducted oceanic plate (eclogite) before the South Atlantic opening. Although several authors indicate the influence of Tristan da Cunha plume for the generation of alkaline magmatism associated to the Paraná-Etendeka LIP, our data demonstrates that Tristan da Cunha plume has no chemical contribution to the generation of Rosário-6 kimberlite, except by its thermal influence.