Origin and redox conditions of Rosário-6 alkaline occurrence, southern Brazil: implications for mantle conditions during Gondwana breakup

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The Rosário-6 alkaline hypabyssal occurrence is situated in the south-eastern edge of the Parana Basin, in the South of Brazil, and erupted concomitant or just after the volcanism of the Paraná-Etendeka Large Igneous Province (LIP). Following the most recent published nomenclature, Rosário-6 occurrence is classified as a kimberlite from a deep mantle source with a distinctive inequigranular texture resulting from the presence of macrocrysts set in a finer-grained matrix. Trace element compositions of olivine, monticellite, spinel, phlogopite, $CaTiO_3$-perovskite and apatite show an enrichment of Nb, Ce, Ta and U, which suggests that Rosário-6 source was enriched by recycled oceanic crust that caused peridotite fertilization by melts derived from former basaltic crust and subducted carbonates. The positive anomalies of Rb, Ba and Sr, the enrichment in LREE, and the negative anomalies of HREE in the Rosário-6 minerals, are indicative of a metasomatism process in the mantle source that could be caused by fluids from recycled oceanic crust. Crystallization temperature, pressure and oxygen fugacity (fO_2) conditions of Rosário-6 mantle source are estimated using different methods from olivine, monticellite, spinel and $CaTiO_3$-perovskite compositions, in order to determine the potential of Rosário-6 to preserve diamonds. Horizontal tomographic images for different depths from P-wave velocity anomalies provide evidence concerning the thickness of the lithosphere in this region and points to a mantle cooling at depths below to 200 km, possibly resulted of an accumulation of oceanic plate slabs from old subductions, which characterizes the Rosário-6 mantle source and the mantle conditions of this region during Gondwana breakup.