Plume-subduction events recorded by KS2 kimberlite indicator minerals from Juína, Brazil

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The Cretaceous Juína Kimberlite Province (JKP, 95-92 Ma) is located in the southwest of the Amazonian Craton, northwest of Mato Grosso, Brazil. Here we present new geochemical and isotopic data of garnet (n=187) and zircon (n=25) megacrysts collected from the KS2 kimberlite. The magmatic zircon megacrysts have U-Pb ages of 92.1 ± 0.7 Ma. The chondrite-normalized rare earth element (REE) patterns (LREE<HREE), pronounced by Ce positive anomaly, as well as low trace element contents (e.g. U=7-50 ppm, Th=2-22 ppm, ΣREE=8-77 ppm) coupled with positive Th, U, Ta, Ce and Hf anomalies are typical of mantle-derived zircon megacrysts in kimberlites. The Ti content (5.3-12.9 wt%) of zircon megacrysts yields a temperature range between 689 and 770 °C, suggesting crystallization at relatively shallow depths in the lithospheric mantle (<140 km). Garnet xenocrysts are pyrope with #Mg ranging 63-76, CaO 3.5-6.6 wt%, and Cr_2O_3 0.04-4.1 wt%. They are classified as megacrystic (G1), pyroxenitic (G4), and lherzolitic (G9) garnet. Chondrite-normalized REE concentrations of garnet from different groups have very similar patterns. They show strongly positive-sloped REE pattern with HREE contents between 6.4-15.4 times chondritic and nearly flat to positive slope for MREE and HREE, typical for garnets from fertile (or refertilized) lherzolite xenoliths. The positive correlation between Y and Zr reflects high-temperature metasomatism related to a silicate melt with basaltic composition. The $^3He/^4He$ isotope ratios of garnet samples were obtained by crushing extraction method. The results allow to identify the existence of subduction ($^3He/^4He$ = 1.1-4.0 R_A) and plume ($^3He/^4He$ = 21.4-39.4 R_A) mantle sources. The radiogenic helium component might be related to Mesoproterozoic subduction of oceanic crust during the formation of a mobile belt, which was accreted onto the southern edge of the Amazonian Craton between 1.75 and 1.55 Ga in a continental margin setting. The mantle plume component may indicate the Trindade mantle plume track beneath the Brazilian continent at 95-92 Ma.