TRACE ELEMENT AND ISOTOPIC FINGERPRINTS IN CLINOPYROXENES FROM THE OCEANIC LITHOSPHERE BENEATH KERGUELEN ISLANDS (INDIAN OCEAN)

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Abstract
Some mantle xenoliths from the Kerguelen Islands contain clinopyroxenes in harzburgites from the Table de l'Oiseau locality that show clear cores but spongy rims, associated with secondary Ca-rich magnesian olivines, reacted spongy primary Cr-rich spinels and secondary chromites. One sample shows reaction zones around primary Cr-rich spinel that contain abundant apatite, Na-plagioclase, K-rich glass and secondary clinopyroxenes. The composition of primary olivine, orthopyroxene and spinel indicate partial melting extraction (ca 15-18%) prior to development of reaction rims in clinopyroxene, spinel or reaction zones around spinel. Shortly before eruption, these xenoliths were metasomatised by small volumes of melt with a high Mg/Fe ratio, enriched in CaO, Na_2O (K_2O), P_2O_5, but Al_2O_3- and H_2O-poor. This melt was also highly enriched in Sr, LREE, MREE (Sr=366-482 ppm, La/Yb= 47-130), but not in Rb, Ba, Th, U and HFSE. This melt is inferred to be an evolved silicate-bearing melt containing some CO2 rather than being carbonate-dominant. We report the in-situ $^{87}Sr/^{86}Sr$ of 18 clinopyroxene clear cores analysed in situ by LAM-MC-ICPMS on thick sections. The $^{87}Sr/^{86}Sr$ isotopic compositions show a very large range from 0.70395 to 0.70454 and very distinct from that of the host basanite ($^{87}Sr/^{86}Sr$ = 0.704223 ± 21). Although the trace-element compositions of clinopyroxene are homogeneous within one sample, some Sr isotopic ratios have remained unequilibrated. Clinopyroxenes with unradiogenic Sr isotopes may represent either the composition of the residual oceanic lithosphere after MORB extraction and before metasomatism or the signature of an old metasomatism by melts with MORB-like compositions. The more radiogenic compositions (ca ~ 0.7044) are likely to represent the isotopic composition of the metasomatic agent and are similar to basalts erupted 25-30Ma ago on the archipelago. Either this indicates that the age of the metasomatism is 25-30 Ma old, or that more recent melts originating from the Kerguelen plume are significantly less radiogenic in Sr than previously thought.