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In-situ major, trace elements and Sr isotopes in clinopyroxenes from the oceanic lithosphere beneath Kerguelen Islands (Indian Ocean)

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Some mantle xenoliths from the Kerguelen Islands, apex of the northern part of the Kerguelen-Heard LIP, have clinopyroxenes that display in-situ major, trace elements and Sr isotopic variations. The harzburgites from Table de l'Oiseau display clinopyroxenes with 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. There is no direct evidence of infiltration of the host lava. The major and minor element composition of primary olivine, orthopyroxene and spinel testify of partial melting extraction (c.a 15-18%) prior to the development of spongy rims in clinopyroxene or spinel. Shortly before eruption, these xenoliths were metasomatised by small volumes of melts with a high Mg/Fe ratio, enriched in CaO, Na2O (K2O), P2O5, but Al2O3- and H2O-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, as recorded by the trace-element compositions of clinopyroxene cores. Petrographical, mineralogical and geochemical data suggest that the metasomatic agent was a silicate-bearing melt that evolved through percolation and reaction with the lithospheric mantle to a melt that has trace-element fingerprints commonly attributed to carbonatite magmas. We report in-situ 87Sr/86Sr

of 18 clinopyroxene clear cores analysed by LA-MC-ICPMS on thick sections. The 87Sr/86Sr isotopic compositions show a very large range from 0.70395 to 0.70454 in the three samples analysed. Sr isotopes are homogeneous in two samples and are associated to either homogeneous or heterogeneous trace-element compositions of the same clinopyroxene grains. However, one sample displays Sr isotopic heterogeneity up to 0.65 per mil, associated to trace-element variations in the same grains. There are important results from this study; 1) Sr isotopic heterogeneities exist in the oceanic lithosphere at the scale of neighbouring grains (cm-mm scale) in a single thick sections, 2) the host basanite has 87Sr/86Sr = 0.704223 +/- 21 and therefore host lava infiltration prior or during transport of the xenoliths cannot explain the large range of 87Sr/86Sr in the clinopyroxenes, 3) Petrographical, mineralogical and geochemical data suggest that the variations in Sr isotopes could have been induced during the last metasomatic event.