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Ce-Nd isotopic composition of the continental crust : first data on middle and lower crustal rocks

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The accessibility of the continental crust (CC) sharply decreases with depth. The upper crust is relatively well-known but the geochemical composition of the deepest parts of the crust is harder to estimate. Our recent study combining the measurement of ^{138}La-^{183}Ce and ^{147}Sm-^{143}Nd systematics showed that the upper crust isotopic composition defined by loess measurements plots on the regression line that defines the mantle array [1]. Mass balance estimates for silicate reservoirs predict that (1) the bulk CC is off the εCe-εNd mantle array; (2) the lower crust plots in the lower left quadrant of the εCe-εNd diagram. The aim of this study is to better characterize the CC for the La-Ce systematics.

We analyzed Hf, Nd and Ce isotopic composition of upper to lower crustal rocks from four locations: xenoliths from the French Massif Central; uplifted crust from the Southern Ivrea-Verbano zone (Italy); Paleoproterozoic to Archaean xenoliths from Udachnaya (Siberian craton); and composite samples from the Precambrian Canadian upper crust. Most of the samples are located along mantle arrays in the εCe-εNd and εHf-εNd isotopic plots, except Siberian samples whose isotopic compositions plots well below the εCe-εNd array.

Siberian samples deviate from the mantle array as predicted in the calculations for the lower crust end-member. Such compositions have not been measured so far and contrast with results obtained on the Lu-Hf and Sm-Nd systematics for which all sub-crustal reservoirs plot on the mantle array alignment [2]. The mantle array deviation in εCe-εNd space reflects fractionation of La/Ce relative to Sm/Nd. The La-Ce systematics for Siberian samples has evolved in a closed system since 1.8 Ga that corresponds to large-scale delamination and rejuvenation of the Archean lower lithosphere [3]. A large database from the literature including Archean and post-Archean granulite samples from the lower crust will be used to better understand the parent/daughter fractionation processes through time and discuss the representativeness of our results at global scale.

[1] Israel et al. (2020) EPSL **530**; [2] Vervoort et al. (2000) EPSL **181**; [3] Moyen et al. (2017) EPSL **457**.