New evidence for LREE depleted mantle in the Mesoarchean

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This report presents the REE and the Nd isotope composition of selected samples of the Alto da Varginha metakomatiite suite, which outcrops in the southern sector of the Quadrilátero Ferrífero region, southern São Francisco craton, Brazil. The main outcrop constitutes a superb exposition in an old quarry (Choell Quarry) containing delicate pseudomorphs of spinifex and cumulate textures (UTMN 7720778 and UTME 636265 coordinates). However, no vestige of the primary mineralogy was found, and the metakomatiites are made of variable proportions of serpentine, chlorite, tremolite and iron oxides. Three distinct samples were measured for their REE content by the ICP-MS method, one at the CRPG lab (Nancy, France) and the others at the ACME lab (Canada). The more complete results were obtained in the sample from the CRPG lab. This sample shows only 2.61 ppm of the sum of the REE, and a pronounced LREE depletion in the chondrite-normalized REE pattern (REE_N), with La/Yb_N = 0.24, La/Sm_N = 0.76 and Gd/Yb_N = 0.54, being the La_N = 0.31, Gd_N = 0.82 and Yb_N = 1.51. This same REE pattern was also obtained in the other two samples – although with less precision in the La and Ce content, showing Pr/Yb_N = 0.21–0.22, Sm/Yb_N = 0.30–0.42 and Gd/Yb_N = 0.64–0.61, being the Pr_N = 0.36–0.44, Gd_N = 1.11–1.21 and Yb_N = 1.73–1.98. The Nd isotope composition for these two latter samples – measured at the Geochronology Laboratory, Brasília University, Brazil, revealed respectively a $^{147}Sm/^{144}Nd$ ratio of 0.2866 and 0.2773, and a $^{143}Nd/^{144}Nd$ ratio of 0.514558 and 0.514446, with the episolon Nd (0) value of +37.46 and +35.65, and the T_{DM} model age of 3.09 and 3.26 Ga. Assuming the hypothetic age of 3.1 Ga for the magma crystallization, the calculated episolon Nd(t) is +1.5 and +3.1. We concluded that the origin of these metakomatiites is related to portions of the mantle under the southern São Francisco craton which were highly LREE depleted during the Mesoarchean.