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Mass-dependent isotopic fractionation of cerium and neodymium in geochemical samples

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We have developed a new analytical method to determine the mass-dependent isotopic fractionations on Ce and Nd in geochemical samples. Mass discrimination effects on Ce and Nd were externally corrected by normalizing 149Sm/147Sm and 153Eu/151Eu, being 0.92124 and 1.0916, respectively based on an exponential law. The reproducibility of the isotopic ratio measurements on 142Ce/140Ce, 146Nd/144Nd and 148Nd/144Nd were 0.008% (2SD, n=25), 0.006% (2SD, n=39) and 0.012% (2SD, n=39), respectively. The present technique was applied to determine the variations of the Ce and Nd isotopic ratios for five geochemical reference materials (igneous rocks, JB-1a and JA-2; sedimentary rocks, JMn-1, JCh-1 and JDo-1). The resulting ratios for two igneous rocks (JB-1a and JA-2) and two sedimentary rocks (JMn-1 and JCh-1) did not vary significantly among the samples, whereas the Ce and Nd isotope ratios for the carbonate samples (JDo-1) were significantly higher than those for igneous and sedimentary rock samples. The 1:1 simple correlation between delta Ce and delta Nd indicates that there were no significant difference in the degree of isotopic fractionation between the Ce and Nd. This suggests that the isotopic fractionation for Ce found in the JDo-1 could be induced by geochemical or physicochemical processes without changing the oxidation status of Ce, since the redox-reaction can produce larger isotopic fractionation than the reactions without changing the oxidation state. The variations in the Ce and Nd isotope ratios for geochemical samples could provide new information concerning the physicochemical processes of the sample formation.

Keywords: isotopic fractionation, cerium, neodymium