DEPLETED MANTLE: THE STORY FROM HF ISOTOPES IN ZIRCON AND BADDELEYITE FROM CARBONATITES

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Here we propose a model for the evolution of depleted mantle based on unpublished Hf isotope data from zircons and baddeleyites from carbonatites from both North and South America and Europe (total of 33 complexes), along with published data of carbonatites from Greenland and Africa. Zircons and baddeleyites were analysed for Hf isotope ratios in the laser ablation mode using a multicollector inductively-coupled plasma mass spectrometry (for analytical details see Bizzarro et al., 2002). The ages of the carbonatite complexes included in this study range from Archean through to the present, reflecting intermittent carbonatite activity over the last 3 billion years. Few Hf isotope ratios have been published for carbonatites in contrast to Sr, Nd and Pb. Our new Hf isotopic data for carbonatites from three continents, along with published data, enable us to assess the evolution of the mantle in terms of Hf isotopes on a global scale and over a considerable part of the Earth’s history. Most of the carbonatites reflect depleted mantle with $\varepsilon_{Hf}(T) \geq 0$. Unpublished values range from +2.7 to +9.9 for the 2.68 Ga Lac Shortt and Dolodau carbonatites (Canada) and +5 to +27 for the 0.38 Ga Kola carbonatites (Russia). Only two carbonatites (South Africa, Greenland) indicate enriched sources. It is worth noting that the Hf data almost mirror the Nd data in isotope evolution diagrams, suggesting a strong coupling of the Lu/Hf and Sm/Nd in the mantle. The data indicate that mantle depletion must have happened very early in the Earth’s history consistent with the findings from Archean silicate rocks. It has been proposed that carbonatite and associated alkaline silicate magmas are generated from mantle plumes, involving deep-seated and, perhaps, primitive components (e.g. FOZO). The existence of depleted mantle over a period of at least 3 Ga implies chem-