



A new geochemical model for the Earth's mantle inferred from

^{146}Sm - ^{142}Nd systematics

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The Sm-Nd system is composed of refractory lithophile elements and with its two decay schemes ^{146}Sm - ^{142}Nd ($T_{1/2}=103$ Ma) and ^{147}Sm - ^{143}Nd ($T_{1/2}=106$ Ga), represents one of the most powerful tracers of early silicate differentiation. The difference of 20 ppm in $^{142}\text{Nd}/^{144}\text{Nd}$ ratio, recently measured between most terrestrial rocks and chondrites, suggests that the terrestrial mantle evolved since at least 4.53 Ga with a Sm/Nd ratio closer to that of the depleted MORB mantle (DMM) than a chondritic reservoir (Boyet and Carlson, Science 2005). To minimize the additional increase in the Sm/Nd ratio of the depleted mantle caused by continent formation over Earth history, and hence avoid producing a reservoir with $^{143}\text{Nd}/^{144}\text{Nd}$ higher than observed for terrestrial rocks, the DMM must occupy a much larger mass fraction of the mantle (70-95%) than previously modeled (30-50%). The composition of this early-depleted mantle is estimated by mass balance calculation. The most highly incompatible elements are depleted to about half bulk silicate Earth (BSE) abundances with a smooth BSE normalized incompatible element pattern and a small negative Nb anomaly. Unless, the BSE has non-chondritic abundances of the refractory lithophile elements, the superchondritic $^{142}\text{Nd}/^{144}\text{Nd}$ of terrestrial rocks requires the presence of an enriched component in Earth's mantle formed during an early differentiation event. Although we searched for evidence of this reservoir in specific rocks like Pitcairn basalts (solar-neon enriched EM1 component) or Archean komatiites characterized by radiogenic Os interpreted to reflect a contribution of a very old recycled-mafic crust of (≥ 4.2 Ga), no variation of the $^{142}\text{Nd}/^{144}\text{Nd}$ ratio has been detected outside the analytical uncertainty (< 6 ppm). Therefore, a small reservoir, probably located in the deep mantle may have

survived essentially unperturbed by mantle convection since early Earth differentiation. We will investigate in detail this model with respect to other isotope systematics currently used to trace the chemical evolution of the different silicate components.