Early-formed chemical heterogeneity recorded by ^{142}Nd-^{143}Nd in 3.8-3.0 Ga samples from the Archean Anshan Complex, North China Craton

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The Archean Anshan Complex in the northeastern part of the North China Craton is one of the few areas on Earth where rocks older than 3.8 Ga have been identified, and provides a rare opportunity to determine the relative roles of early planetary processes versus progressive differentiation in shaping the Earth's chemical architecture. We undertook ^{142,143}Nd isotopes and major and trace element analyses on well-dated 3.81–3.0 Ga Anshan samples. The most prominent feature is that their ^{142}Nd isotopes tightly correlate with ^{143}Nd isotopes and incompatible trace elements. These correlations suggest that their generation most likely involved high- and low-μ^{142}Nd end-members. The high-μ^{142}Nd end-member melt had μ^{142}Nd = +15 and $\varepsilon_{(t)}^{143}$Nd(t) = +10 with crust-like incompatible trace element ratios and may have been derived from proto-crust extracted from an early-formed depleted reservoir formed at about 4.5-4.4 Ga. In contrast, the low-μ^{142}Nd end-member melt had μ^{142}Nd = -4 and $\varepsilon_{(t)}^{143}$Nd(t) ≤0 with trace element ratios similar to the average value of komatiites. Furthermore, the estimated composition of the source of the low-μ^{142}Nd end-member melt suggests an early-formed (4.5-4.3 Ga) enriched dense melt, possibly part of the thermo-chemical piles near the core mantle boundary[1]. Thus, the chemical and ^{142,143}Nd isotope heterogeneity of the Anshan Complex preserves information on formation and preservation of early differentiation of the bulk silicate Earth at 4.5–4.3 Ga.

[1] Wang, X.-C., Li, Z.-X. & Li, X.-H. Early differentiation of the bulk silicate Earth as recorded by the oldest mantle reservoir. *Precambrian Research* **238**, 52-60 (2013).