Isotopic constraints on Archean mantle from Archean anorthosite complexes

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The geochemical composition of the mantle has changed throughout Earth's history largely due to the extraction of melt to form the continental crust and the recycling of crustal material back into the mantle by subduction. Isotopic analysis of juvenile, mantle-derived material allows us to trace the geochemical changes in the mantle throughout the history of the Earth. Archean anorthosite complexes form from mantle-derived melts that may have had little to no interaction with crust. Isotopic analysis of primary igneous phases preserved in these anorthosite complexes can be used to better define the isotopic signature of the Archean mantle. The Fiskenaesset anorthosite complex, southwest Greenland is the best preserved Archean anorthosite complex and provides a geologic model for other Archean anorthosite complexes. Field and geochemical evidence suggest the Fiskenaesset complex was derived from mantle melt and emplaced into oceanic crust. The Pb isotopic signature of relict igneous plagioclase crystals from the Fiskenaesset complex was determined by LA-MC-ICPMS on 40 µm spots to evaluate the source of the parental magma and processes that contribute to the formation of Archean anorthosite complexes. The 206Pb/204Pb varies from 11.64 – 13.67, 207Pb/204Pb from 12.83 – 15.00, and 208Pb/204Pb from 29.52 – 34.32. µ values range from 7.15 – 8.87. Two-stage Pb model ages for these spot analyses range from 2.5 – 3.1 Ga with a majority of the data points coinciding with a ca. 2.8 Ga metamorphic event. The significance of the few spots with ca. 3.1 Ga Pb model ages cannot be ascertained until a U-Pb crystallization age for the Fiskenaesset complex is determined. If the Fiskenaesset complex crystallized ca. 3.1 Ga, the spot analyses of plagioclase undisturbed by metamorphism indicate that the anorthosite parent magmas were derived from a source more enriched than chondritic mantle.