The ^{142}Nd record of Hadean zircons

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^{146}Sm-^{142}Nd systematics were investigated in Hadean zircons to assess the potential of this system as a record of early Earth evolution. 790 zircons with >90% concordant ^{207}Pb/^{206}Pb ages from 3.95 to 4.19 Ga were selected from 32,000 surveyed grains from the Jack Hills quartzite (W. Australia). Zircons were leached in HNO_3 and dissolved at 200°C in HF using a metal-jacketed Teflon bomb. 10% of the solution was spiked using a mixed ^{149}Sm-^{150}Nd tracer while the remaining fraction was prepared for ^{142,143}Nd/^{144}Nd analysis. Purification of Nd from Ce was ensured by three successive elutions using an HDEHP column. Spiked Sm and Nd fractions were separated using a miniaturized HDEHP column. The yield was 90-95%. Sm and Nd blanks were 10-30 pg (1-3 pg for isotope dilution chemistry). The main fraction yielded 75 ng Nd which was analyzed in a single run using a Triton mass spectrometer. The sample yielded a long-lived (3 h), intense (^{142}Nd=10^{11} A) beam allowing determination of ^{142}Nd/^{144}Nd ratio with a precision of ±10 ppm ($2\sigma_m$). ^{142}Ce/^{142}Nd and ^{144}Sm/^{144}Nd were less than 10 ppm and 1 ppm respectively. No ^{142}Nd anomaly was detected at the ±10 ppm level (Table 1). Although in situ decay of ^{146}Sm in ca. 4.1 Ga zircons could produce ^{142}Nd excesses of ~25 ppm, initial ^{176}Hf/^{177}Hf results on individual zircons of similar age yielded both positive and negative ε_{Hf} values. Thus the bulk sample may have simply averaged out grains with ^{142}Nd excesses and deficits. However, the highly negative initial ε^{143}Nd (Table 1) suggests that the zircons were not closed systems for Sm-Nd since crystallization, possibly due to exchange with the host rock during metamorphism of the quartzite. The poor preservation of the Nd isotope record suggests that analysis of composited zircons is a problematic method with which to evaluate the Nd isotope evolution of early Earth.

Table 1. Sm-Nd systematics of Jack Hills zircons

[Nd] (ppm)	^{147}Sm/^{144}Nd	$\varepsilon^{143}Nd_0$	$\varepsilon^{143}Nd_{4.1Ga}$	$100*\varepsilon^{142}$Nd (ppm)
9.2	0.5891	45.4	-164.3	8.3±10.2