Initial $^{87}Sr/^{86}Sr$ ratios of 3.2 Ga barite reveal input of Sr derived from weathering of Archean crust

AARON M. SATKOSKI[1,2]*, BRIAN L. BEARD[1,2], MAX L. COLEMAN[2,3] AND CLARK M. JOHNSON[1,2]

[1]University of Wisconsin-Madison, Madison, Wisconsin, USA (*correspondence: satkoski@wisc.edu)
[2]NASA Astrobiology Insitute, Madison, Wisconsin, USA
[3]NASA Jet Propulsion Laboratory, Caltech, Pasadena, CA

The strontium isotope evolution of seawater through time can be used to infer the balance between mantle and continental inputs into the oceans throughout Earth history. Knowing this balance can aid in deciphering continental growth and global weathering rates. Given preservation issues and secondary alteration of Archean (>2.5 Ga) rocks, the strontium isotope composition of seawater during this time is poorly understood. To better constrain this, we report initial $^{87}Sr/^{86}Sr$ ratios on Archean (3.2 Ga) barite from the Fig Tree Group (in Barite Valley), in the Barberton Greenstone Belt (BGB), South Africa. The studied barite has low $^{87}Rb/^{86}Sr$ ratios (<0.00038) which implies that the correction for in situ radiogenic growth of ^{87}Sr is small. Initial $^{87}Sr/^{86}Sr$ ratios range from 0.70122 – 0.70139, which are higher than the $^{87}Sr/^{86}Sr$ ratio (~0.70062) of the mantle buffered seawater Sr isotope composition at this time. The initial $^{87}Sr/^{86}Sr$ ratios are considered primary and not likely altered given the low metamorphic grade of the BGB and the high Sr concentration in the barite (>2100 ppm). Previous work on barite from the Barite Valley has identified that the barite is a diagenetic, marine type [1]. Modern diagenetic barite has a wide range of Sr isotope ratios, which can vary from seawater due to influence from local sources [2]. The rocks underlying the barite are ultramafic with low $^{87}Sr/^{86}Sr$ ratios precluding these from being the source of the radiogenic Sr. Thus, the high $^{87}Sr/^{86}Sr$ ratios of the barite studied here may reflect a mixture of hydrothermal Sr with a low $^{87}Sr/^{86}Sr$ ratio and seawater Sr with a high $^{87}Sr/^{86}Sr$ ratio derived from weathering of continental crust. Modeling has suggested that continental weathering was negligible prior to 3.0 Ga [3], however, the data reported here suggests that continental input may have been a significant component of seawater 200 m.y. earlier than previously reported.

[1] Bao *et al* (2007) *Geochimica et Cosmochimica Acta* ***71***, 4868-4879. [2] Griffith, E.M. and Paytan, A. (2012) *Sedimentaology* ***59***, 1817-1835. [3] Shields, G.A. (2007) *eEarth* ***2***, 35-42.