# Sr isotopic insights into the formation of Paleoarchean barite

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Paleoarchean barites are important targets for stuyding the earliest environments and emergence of microbial metabolisms on Earth. However, the origin and formation of these rare stratiform sulfate deposits remains poorly understood. Sulfur isotope data suggest that sulfate was derived from seawater [1], but the source of Ba and geological setting in which the barites precipitated are less well constrained.

Here, we present Sr isotope data from four Paleoarchean barite deposits from the Barberton Greenstone Belt in South Africa and Swaziland, with ages ranging from 3.52 Ga (Londozi) to *ca*. 3.4 Ga (Vergelegen), 3.26 Ga (Stentor) and 3.23-3.26 Ga (Barite Valley). Barite has extremely low $^{87}Rr/^{86}Sr$ due to crystallographic exclusion of Rb and therefore very limited *in situ* radiogenic growth of $^{87}Sr$, so that measured $^{87}Sr/^{86}Sr$ ratios reflect the source of Sr during initial barite precipitation. We demonstrate that all barite deposits show a relative large range in $^{87}Sr/^{86}Sr$ that appears to be of primary origin and not related to metamorphic grade. The lowest $^{87}Sr/^{86}Sr$-values for individual deposits define a strong correlation with age ($R^2$ = 0.98) and increase from 3.5 to 3.2 Ga following a slope that is significantly steeper than the upper mantle curve. These results suggest the presence of a temporally homogeneous reservoir with higher Rb/Sr-values than the Paleoarchean mantle, and argues against a simple genetic model with mixing of mantle-derived Ba with seawater $SO_4^{2-}$. The highest $^{87}Sr/^{86}Sr$-values exceed ratios inferred for Paleoarchean seawater but are close to values suggested for continental crust at 3.5 Ga [2]. In addition, Sr-isotope ratios are correlated with atmospherically-derived sulfur isotopic variations, showing decreasing magnitudes of $\Delta^{33}S$ with increasing $^{87}Sr/^{86}Sr$ and possibly demonstrating coupling of surface and deep processes during the formation of Paleoarchean barite.

[1] Roerdink et al (2012) *Earth Planet. Sci. Lett.* **331-332** (177-186) [2] McCulloch (1994) *Earth Planet. Sci. Lett.* **126** (**1-13**)