Constructing a Neoproterozoic seawater strontium isotope curve

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The strontium isotopic composition of seawater has varied throughout Earth history in response to the balance between Sr isotopic exchange with ocean crust and input of riverine Sr derived from continental weathering. Because of this, seawater $^{87}Sr/^{86}Sr$ highs of the Phanerozoic Eon are interpreted to reflect weathering/erosional events, related to mountain building, while $^{87}Sr/^{86}Sr$ lows are considered to result from low weathering rates due to supercontinent denudation or increased seafloor spreading. Seawater $^{87}Sr/^{86}Sr$ also responds to changes in the isotopic composition of material undergoing weathering with old, continental rocks contributing radiogenic Sr, while the opposite is true for freshly erupted volcanic terrains which are frequently linked to negative excursions in seawater $^{87}Sr/^{86}Sr$. The largest ever increase in seawater $^{87}Sr/^{86}Sr$ took place sometime from approximately 900 Ma to 500 Ma, and was associated with a permanent step shift in baseline $^{87}Sr/^{86}Sr$ composition. The unprecedented size of this increase, its timing and causation remains unconstrained. This study attempts firstly to reconstruct global seawater $^{87}Sr/^{86}Sr$ trends through this increase, using well-preserved carbonate rock samples from the North China craton, calibrated against additional $^{87}Sr/^{86}Sr$ and $\delta^{13}C$ data from Neoproterozoic samples collected from other sections around the world. Other stable isotope systems ($\delta^{13}C$ and $\delta^{18}O$) and trace elements, including REE have been investigated on the same samples to help to identify pristine samples for Sr isotope analysis and help with the interpretation. The newly obtained data from this study, using the excellently preserved early marine calcite cements and some bulk rock samples, confirm that the carbonate strata across the Jiao-Liao-Xu-Huai stratigraphic realm of the North China Craton exhibit the moderately positive δ13C values and low $^{87}Sr/^{86}Sr$ values that are characteristic of the early Neoproterozoic (Tonian). The results help to recreate the global curve by linking negative excursions on the North China Block with the global ~ 800 Ma 'Bitter Springs Anomaly.