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# Estimation of tectonic effect accelerating carbonate accumulation rate through numerical simulation of $^{87}Sr/^{86}Sr_{carbonate}$ proxy

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A quantitative estimation of terrestrial weathering (TW) flux was undertaken, premised on the assumption that variations in continental carbonate accumulation rates during the Early Paleozoic stemmed from shifts in TW flux driven by local tectonic events. To address this, a novel numerical Sr-reservoir box-model simulation method was developed and implemented, leveraging the $^{87}Sr/^{86}Sr$ isotopic proxy in carbonates. This model was constructed using the Sr-budget framework of restricted seawater (RSW). Numerical simulations were conducted using these parameter sets for various $^{87}Sr/^{86}Sr_{TW}$ values. From this, the minimum $F(Sr)_{TW}/F(Sr)_{SW}$ ratios, along with the maximum $F(Sr)_{TW}$ and $F(Sr)_{SW}$ values needed to reach the observed $^{87}Sr/^{86}Sr_{RSW}$ targets, were successfully identified. This method was applied to the carbonate successions in the Cathaysia terrane during the Cambro-Ordovician period, marked by the break-up of the Gondwana supercontinent and the subsequent opening of the Paleo-Tethys Sea. The studied units exhibited notably high $^{87}Sr/^{86}Sr_{carbonate}$ values (up to 0.7386) and rapid accumulation rates (up to 94.1 m/Ma). Numerical simulation results suggest that the elevated $^{87}Sr/^{86}Sr_{carbonate}$ value (0.7386) at 472.2 Ma likely arose from a sharp increase in TW flux, estimated to be 10.2 to 13.5 times higher than modern maximum flux levels ($F(Sr)_{TW}$ = 34 Gmol $yr^{-1}$). This intensified TW would have increased the saturation index (SI, Ω) of carbonate minerals, thereby accelerating both carbonatization processes and carbonate accumulation rate. The newly developed RSW Sr-reservoir box-model simulation demonstrates significant potential as a tool for quantitatively assessing the impact of tectonic events on geochemical fluxes.