

Supplementary Materials

Table S1. $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of the carbonates.

Sample ID	$\delta^{13}\text{C}$	$\delta^{18}\text{O}$
	‰, VPDB	‰, VPDB
C1	-29.0	2.0
C2	-39.7	5.0
C3	-43.6	4.1
C4	-30.6	5.3
C5	-29.3	1.8
C6	-43.8	4.3
C7	-44.1	4.2
C8	-34.8	2.8
C9-1	-42.0	2.7
C9-2	-40.2	2.1
C10-1	-49.4	4.2
C10-2	-50.3	4.2
C10-3	-50.3	4.2

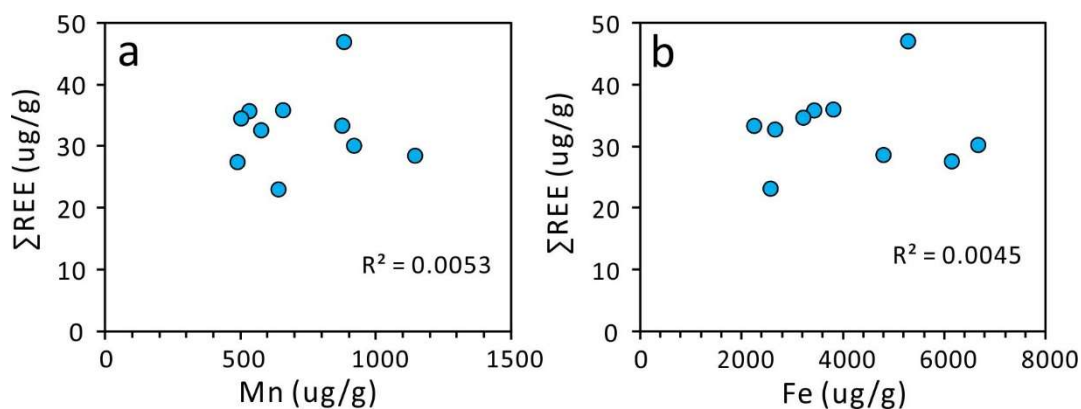


Figure S1. Plot of Mn (a), Fe (b), and rare earth element contents ($\mu\text{g/g}$) of carbonate phase.

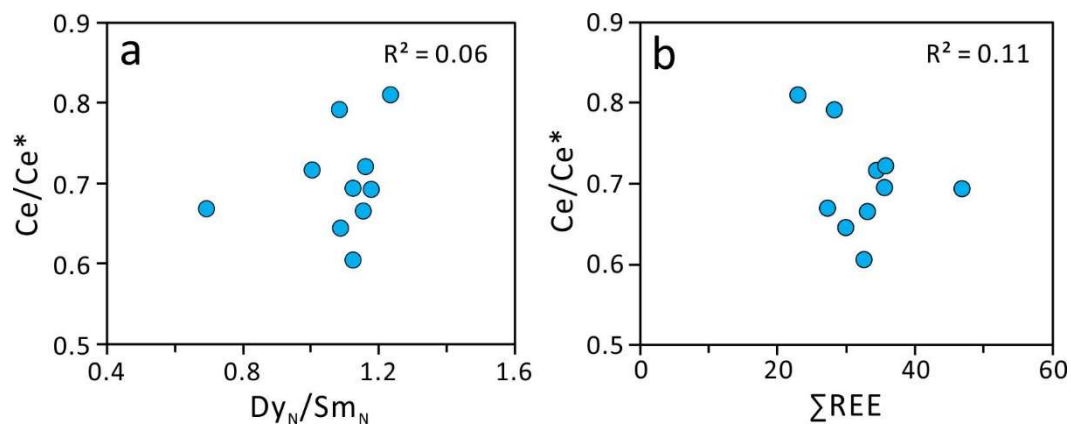


Figure S2. Correlation diagrams between Ce/Ce^* and $\text{Dy}_\text{N}/\text{Sm}_\text{N}$ (a), and total REE (b). Subscript 'N' denotes shale-normalized values.