

Table S1. $\delta^{13}\text{C}$, $\delta^{18}\text{O}$, and $^{87}\text{Sr}/^{86}\text{Sr}$ values of the Sobcha travertines and their calculated $\delta^{13}\text{C}_{\text{mother-CO}_2}$ (i.e., $\delta^{13}\text{C}$ of mother CO_2). $\delta^{13}\text{C}_{\text{mother-CO}_2}$ was evaluated using the equation from Panichi and Tongiorgi [84].

Sample ID	$\delta^{13}\text{C}$ (V-PDB ‰)	$\delta^{18}\text{O}$ (V-PDB ‰)	$^{87}\text{Sr}/^{86}\text{Sr}$	$\delta^{13}\text{C}_{\text{mother-CO}_2}$
1	3.9	−26.5	0.712752	−5.8
2	3.9	−26.6	0.712876	−5.8
3	3.9	−26.6	0.712686	−5.8
4	3.8	−26.4	0.712812	−5.9
5	3.8	−26.7	0.712717	−5.9
6	4.0	−26.0	0.712714	−5.7
7	4.0	−26.3	0.712759	−5.7
8	3.8	−26.6	0.712859	−6.0
9	3.9	−26.2	0.712813	−5.8
10	3.9	−26.7	0.712824	−5.8
11	3.8	−26.3	0.712784	−6.0
12	4.5	−23.8	0.712696	−5.1
13	4.0	−25.8	0.712951	−5.7
14	3.7	−26.3	0.712823	−6.1
15	3.8	−25.8	0.712783	−5.9
16	4.3	−25.3	0.712662	−5.4
17	4.1	−26.0	0.712649	−5.6
18	4.0	−26.1	0.712610	−5.8
19	4.9	−23.7	0.712737	−4.6
20	4.3	−25.0	0.712712	−5.4
21	4.5	−23.7	0.712458	−5.1
22	4.1	−25.1	0.712733	−5.6

23	4.3	−24.4	0.712707	−5.4
24	4.1	−25.3	0.712825	−5.5
25	4.0	−25.3	0.712708	−5.7
26	4.0	−25.1	0.712769	−5.7
27	4.0	−25.3	0.712646	−5.7
28	4.3	−24.1	0.712643	−5.3
29	3.4	−25.1	0.712732	−6.5
30	3.7	−24.9	0.712677	−6.0

Table S2. U-Th dating results of the Sobcha travertines.

Sample ID	²³⁸ U (ppb)	²³² Th (ppt)	²³⁰ Th/ ²³² Th (atomic ratio 10 ^{−6})	δ ²³⁴ U* (measured)	²³⁰ Th/ ²³⁸ U (activity ratio)	²³⁰ Th age (yr) (uncorrected)	²³⁰ Th age (yr) (corrected)	δ ²³⁴ U _{initial} ** (corrected)	²³⁰ Th age (yr BP)*** (corrected)
1	331.8 ±0.5	12576 ±252	68.1 ±1.4	847.4 ±2.4	0.1566 ±0.0004	9594 ±30	9003 ±420	869 ±3	8981 ±420
21	729.1 ±1.6	100135 ±2013	17.0 ±0.3	837.4 ±3.0	0.1417 ±0.0005	8699 ±35	6524 ±1542	853 ±5	6502 ±1542
30	403.2 ±0.6	23009 ±461	17.0 ±0.3	833.8 ±2.5	0.0452 ±0.0003	2714 ±16	1807 ±642	838 ±3	1785 ±642

* $\delta^{234}\text{U} = ([^{234}\text{U}/^{238}\text{U}]_{\text{activity}} - 1) \cdot 1000$.

** $\delta^{234}\text{U}_{\text{initial}} = \delta^{234}\text{U}_{\text{measured}} \cdot e^{\lambda^{234}T}$.

***B.P. stands for "Before Present", "Present" is 2000 A.D.

The initial ²³⁰Th/²³²Th atomic ratio are corrected with a crustal average of 4.4, the range of change is 50%, i.e. $4.4 \pm 2.2 \cdot 10^{-6}$.

Table S3. Concentrations ($\mu\text{g g}^{-1}$) of trace elements in the travertine samples from Sobcha.

Sample ID	Mn	Sr	Zr	Cu	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	ΣREE
1	675	531	1.14	0.28	0.3	0.64	0.11	0.56	0.25	0.088	0.43	0.081	0.52	0.11	0.33	0.046	0.27	0.041	3.78
2	656	604	2.46	0.55	0.83	1.74	0.23	0.97	0.33	0.11	0.49	0.093	0.59	0.13	0.37	0.052	0.3	0.046	6.28
3	1660	572	3.00	0.49	1.58	3.56	0.66	3.38	1.52	0.54	2.74	0.53	3.38	0.74	2.12	0.29	1.75	0.26	23.05
4	528	634	0.66	0.25	0.057	0.12	0.018	0.087	0.048	0.016	0.06	0.012	0.076	0.015	0.048	0.0078	0.038	0.0062	0.61
5	1270	570	1.79	0.51	0.9	2	0.39	2.01	0.9	0.32	1.63	0.31	1.96	0.42	1.21	0.16	0.99	0.15	13.35
7	1090	526	1.47	0.25	0.57	1.25	0.24	1.22	0.55	0.2	0.99	0.19	1.21	0.26	0.74	0.1	0.6	0.091	8.21
8	688	511	1.11	0.31	0.56	1.18	0.2	0.97	0.42	0.15	0.69	0.13	0.83	0.18	0.51	0.071	0.42	0.061	6.37
9	1140	546	2.00	0.5	1.18	2.56	0.46	2.33	1.02	0.36	1.77	0.33	2.09	0.45	1.28	0.18	1.04	0.15	15.20
10	1280	543	1.96	0.27	0.83	1.81	0.33	1.63	0.75	0.26	1.27	0.24	1.53	0.33	0.94	0.13	0.77	0.11	10.93
14	1220	556	1.53	0.19	0.84	1.85	0.36	1.86	0.83	0.3	1.5	0.28	1.81	0.39	1.11	0.15	0.9	0.14	12.32
15	811	521	0.83	0.19	0.41	0.88	0.16	0.85	0.38	0.14	0.66	0.12	0.78	0.16	0.47	0.065	0.39	0.055	5.52
17	726	573	2.39	0.55	0.88	1.86	0.26	1.1	0.4	0.13	0.62	0.12	0.71	0.15	0.44	0.061	0.36	0.053	7.14
18	804	516	3.24	0.96	1.35	2.8	0.39	1.64	0.59	0.19	0.9	0.17	1.05	0.23	0.65	0.089	0.52	0.079	10.65
19	362	394	3.22	0.62	0.81	1.67	0.19	0.67	0.17	0.038	0.17	0.03	0.18	0.039	0.11	0.017	0.099	0.015	4.21
20	279	399	0.59	0.2	0.14	0.29	0.035	0.14	0.056	0.017	0.072	0.012	0.079	0.016	0.047	0.0086	0.037	0.0062	0.96
22	292	552	0.38	0.75	0.08	0.17	0.023	0.13	0.056	0.025	0.091	0.019	0.12	0.024	0.07	0.012	0.057	0.011	0.89
23	440	326	0.59	0.66	0.22	0.47	0.082	0.43	0.19	0.071	0.33	0.061	0.4	0.085	0.24	0.035	0.2	0.031	2.85
24	524	381	0.70	0.77	0.29	0.6	0.099	0.51	0.21	0.078	0.36	0.069	0.44	0.094	0.26	0.039	0.23	0.035	3.31
26	1010	408	2.40	0.96	1.16	2.39	0.39	1.83	0.76	0.26	1.26	0.23	1.5	0.33	0.94	0.13	0.76	0.12	12.06
29	1060	433	3.13	1.17	1.43	2.91	0.46	2.05	0.78	0.27	1.25	0.23	1.47	0.31	0.91	0.12	0.74	0.11	13.04
PAAS*					38	80	8.9	32	5.6	1.1	4.7	0.77	4.4	1	2.9	0.4	2.8	0.43	

*PAAS = Post-Archean Australian Shale [76]

Table S4. Mn/Sr, enrichment indexes, and elemental anomalies of the studied travertines from Sobcha.

Sample ID	Mn/Sr	(Pr/Yb) _N	(Pr/Tb) _N	(Tb/Yb) _N	(Eu/Eu*) _N
1	1.27	0.13	0.12	1.09	1.35
2	1.09	0.24	0.21	1.13	1.34
3	2.90	0.12	0.11	1.10	1.33
4	0.83	0.15	0.13	1.15	1.39
5	2.23	0.12	0.11	1.14	1.33
7	2.07	0.13	0.11	1.15	1.36
8	1.35	0.15	0.13	1.13	1.39
9	2.09	0.14	0.12	1.15	1.35
10	2.36	0.13	0.12	1.13	1.33
14	2.19	0.13	0.11	1.13	1.36
15	1.56	0.13	0.12	1.12	1.42
17	1.27	0.23	0.19	1.21	1.28
18	1.56	0.24	0.20	1.19	1.28
19	0.92	0.60	0.55	1.10	1.05
20	0.70	0.30	0.25	1.18	1.33
22	0.53	0.13	0.10	1.21	1.68
23	1.35	0.13	0.12	1.11	1.43
24	1.38	0.14	0.12	1.09	1.41
26	2.48	0.16	0.15	1.10	1.34
29	2.45	0.20	0.17	1.13	1.37
average	1.63	0.19	0.16	1.14	1.36