

Supplementary Table S1: Stable C and O isotope compilation of pedogenic calcite in the Cedar Mountain Formation

Formation, member, reference	$\delta^{18}\text{O}$ (VPDB)	$\delta^{13}\text{C}$ (VPDB)	Material
CMF, Poison Strip [37]	-8.8	-3.5	Oncoid calcite
	-8.8	-3.4	Oncoid calcite
	-8.8	-3.6	Oncoid calcite
	-11.0	-8.3	Oncoid calcite
	-10.5	-6.1	Oncoid calcite
	-8.7	-3.9	Oncoid calcite
	-8.7	-3.8	Oncoid calcite
	-8.8	-3.7	Oncoid calcite
	-9.5	-4.1	Oncoid calcite
	-8.9	-3.9	Oncoid calcite
	-8.8	-3.9	Oncoid calcite
	-8.8	-3.8	Oncoid calcite
	-8.5	-3.3	Oncoid calcite
	-8.4	-3.2	Oncoid calcite
	-8.5	-3.5	Oncoid calcite
CMF, Ruby Ranch [40]	-8.4	-6.3	Micrite
	-8.4	-6.4	Micrite
	-8.4	-6.3	Micrite
	-8.5	-7	Micrite
	-8.5	-7.2	Micrite
	-8.4	-7.5	Micrite
	-8.4	-6.5	Micrite
	-8.5	-6.4	Micrite
	-8.5	-6.6	Micrite
	-8.6	-6.5	Micrite
	-8.6	-6	Micrite
	-8.6	-5.1	Micrite
	-8.8	-4.8	Micrite
	-8.8	-5	Micrite
	-8.9	-5	Zone 1 cement
	-9	-5.1	Zone 1 cement
	-9.1	-5.2	Zone 1 cement
	-9.2	-5.2	Zone 1 cement
	-9.5	-5.5	Zone 1 cement
	-9.7	-5.3	Zone 1 cement
	-10	-5.3	Zone 1 cement
	-10.1	-5.3	Zone 1 cement
	-10.2	-5.4	Zone 1 cement
	-10.1	-5.5	Zone 1 cement
	-9.8	-5.8	Intergranular sparite
	-10.2	-5.8	Intergranular sparite
	-10.2	-5.8	Intergranular sparite
	-10.3	-6	Intergranular sparite
	-10.1	-6.2	Vein calcite
	-11.5	-5.2	Zone 2 cement
	-12	-5.3	Zone 2 cement
	-13.1	-6.3	Zone 2 cement
	-13.5	-6.3	Zone 2 cement
	-13.6	-6.3	Zone 2 cement
	-14.1	-6.4	Zone 2 cement
	-14.4	-6.2	Zone 2 cement
	-14.6	-6.2	Zone 2 cement

	-14.9	-6	Zone 2 cement
	-15.1	-6.1	Zone 2 cement
	-15.6	-5	Zone 2 cement
	-16.2	-6.2	Zone 2 cement
	-16.8	-6.2	Zone 2 cement
	-16.9	-6	Zone 2 cement
	-17	-6	Zone 2 cement
	-17.1	-5.8	Luminescent cement
	-17.2	-5.9	Luminescent cement
	-17.3	-5.9	Luminescent cement
	-16.8	-6	Luminescent cement
	-16.8	-6.2	Luminescent cement
	-16.9	-6.4	Luminescent cement
	-17.1	-6.4	Luminescent cement
	-17	-6.5	Luminescent cement
	-17.1	-6.2	Luminescent cement
	-17.2	-6.3	Luminescent cement
	-17.4	-6.8	Luminescent cement
	-17.8	-6.7	Luminescent cement
CMF, Ruby Ranch, [22]	-13.5	-5.8	Microfacies 1
	-13.9	-6.3	Microfacies 1
	-7.8	-5.5	Microfacies 2
	-7.7	-5.3	Microfacies 2
	-7.9	-5.6	Microfacies 2
	-7.9	-5.4	Microfacies 2
	-8.1	-5.5	Microfacies 2
	-7.8	-5.6	Microfacies 2
	-7.9	-5.5	Microfacies 2
	-7.3	-4.7	Microfacies 3
	-7.1	-4.6	Microfacies 3
	-7.3	-4.9	Microfacies 3
	-7.6	-4.8	Microfacies 3
	-11	-5.9	Microfacies 4 (spar)
	-3.3	-1.7	Microfacies 4
	-3.5	-2.9	Microfacies 4
	-5.6	-3.6	Microfacies 4
	-6.7	-5	Microfacies 4 (spar)
	-3.7	-4.4	Microfacies 4
	-3.2	-3.8	Microfacies 4
	-9.5	-5.8	Microfacies 5
	-9.1	-6.1	Microfacies 5
	-8.3	-5.9	Microfacies 5
	-8.6	-5.1	Microfacies 5
	-7.5	-5.3	Microfacies 5
	-7.4	-5.5	Microfacies 5
	-8.6	-5	Microfacies 5
	-8.9	-5.2	Microfacies 5
	-8.8	-5.2	Microfacies 5

Supplementary Table S2: Isotope Dilution data for U-Pb

sample	weight (mg)	U (ppm)	Pb (ppm)	$^{238}\text{U}/^{206}\text{Pb}$	2 σ % uncert	$^{207}\text{Pb}/^{206}\text{Pb}$	2 σ % uncert	$^{204}\text{Pb}/^{206}\text{Pb}$	2 σ % uncert	$^{208}\text{Pb}/^{204}\text{Pb}$
RRR1	2.49	592	44.4	28.20	1.2	0.43107	0.04	0.02599	0.09	38.277
RRR2	10.05	185	7.04	40.26	1.2	0.24569	0.06	0.01335	0.15	38.771
RRR3	6.09	114	27.3	11.99	1.1	0.67007	0.04	0.04233	0.08	38.048

RRR4	18.96	135	3.88	45.11	1.5	0.17367	0.21	0.00850	0.32	38.505
RRR5	10.43	265	6.73	47.20	1.1	0.14178	0.07	0.00635	0.17	38.510

Supplementary Table S3: Laser Ablation data from Stony Brook University

spot	U ppm	2SD	Th ppm	2SD	Pb ppm	2SD	²³⁸ U/ ²⁰⁶ Pb	2 σ % uncert	²⁰⁷ Pb/ ²⁰⁶ Pb	2 σ % uncert	rho
	76.9	10.7	0.47	0.08	3.9	1.1	29.05	14.4	0.3782	22.5	0.51
1	62.3	9.7	0.49	0.09	3.6	1.0	31.16	8.1	0.3858	9.6	0.04
	65.4	10.2	0.44	0.08	3.1	0.7	30.29	11.1	0.4326	16.4	-0.02
	61.5	9.9	0.42	0.07	4.7	1.7	25.78	13.3	0.4375	14.7	0.24
2	56.9	8.8	0.44	0.09	5.7	1.1	23.22	9.7	0.4677	8.5	0.03
3	59.2	9.8	0.46	0.09	3.6	1.0	29.78	6.3	0.3252	10.3	0.17
4	65.4	9.5	0.45	0.08	3.3	0.9	29.92	10.0	0.3119	10.3	0.12
	64.4	9.3	0.47	0.08	4.1	1.5	32.71	8.7	0.4139	22.8	-0.16
	57.1	9.3	0.38	0.08	2.6	0.7	31.70	7.6	0.3650	35.1	-0.05
5	125.0	22.2	0.29	0.05	2.2	0.6	42.00	7.5	0.1866	9.2	0.04
6	58.9	10.0	0.33	0.07	2.2	0.6	34.42	6.8	0.2823	9.6	-0.06
7	135.9	18.3	0.31	0.06	2.1	0.6	43.35	5.7	0.1518	7.3	0.00
	61.9	9.4	0.42	0.08	3.1	1.0	32.26	6.9	0.3317	16.3	-0.61
8	115.2	18.5	0.30	0.06	2.5	0.7	41.41	5.6	0.1810	9.2	-0.15
9	111.6	17.6	0.29	0.05	1.9	0.4	39.51	6.1	0.1877	7.1	-0.06
10	150.4	23.2	0.33	0.06	2.4	0.6	40.89	5.5	0.1684	9.9	0.26
11	153.1	20.5	0.28	0.05	4.4	1.3	41.56	5.7	0.2279	11.1	0.06
	178.5	29.5	0.31	0.06	4.5	2.9	42.25	6.2	0.2057	14.2	-0.56
12	303.2	47.6	0.34	0.05	2.2	0.5	49.15	4.6	0.1344	11.4	0.16
13	335.8	55.3	0.25	0.06	3.5	1.2	45.91	4.4	0.1494	11.8	0.04
14	378.5	62.2	0.21	0.05	1.8	0.6	49.03	3.7	0.0860	5.9	-0.16
15	425.7	65.3	0.22	0.04	2.3	0.5	48.60	6.5	0.0992	9.3	0.15
16	328.1	51.4	0.22	0.04	2.4	0.8	47.46	4.1	0.1247	13.6	0.25
17	368.7	59.9	0.22	0.04	1.2	0.3	48.94	3.9	0.0855	7.8	-0.31
	307.5	51.6	0.23	0.05	1.4	0.3	49.12	3.2	0.1227	25.8	-0.22
18	217.7	32.9	0.23	0.04	3.3	0.9	40.93	5.1	0.1704	7.7	-0.45
19	279.5	46.7	0.24	0.05	1.4	0.4	49.31	4.3	0.0981	7.3	-0.35
20	248.7	46.2	0.20	0.04	2.4	0.8	48.72	3.7	0.1064	11.2	-0.19
21	211.6	32.8	0.24	0.05	3.6	0.4	41.72	4.1	0.2107	7.4	-0.10

Supplementary Table S4: Laser Ablation data from the University of Kansas

spot	U ppm	2SD	Th ppm	2SD	Pb ppm	2SD	²³⁸ U/ ²⁰⁶ Pb	2 σ % uncert	²⁰⁷ Pb/ ²⁰⁶ Pb	2 σ % uncert	rho
1	133.8	1.5	0.1714	0.0041	0.726	0.022	47.9819	8.8	0.0986	1.1	0.1023
2	131.8	1.4	0.1802	0.0049	1.244	0.083	45.2134	8.7	0.1280	3.3	-0.1373
3	67.55	0.66	0.1652	0.0043	0.775	0.03	44.5294	8.7	0.1456	2.0	-0.1116

4	97.6	1.3	0.1697	0.004	0.826	0.032	46.1118	8.7	0.1223	1.5	-0.0407
5	130.6	1.4	0.1434	0.0033	0.715	0.027	48.2120	8.7	0.0995	1.6	0.0452
6	87.3	1.5	0.1489	0.0048	0.818	0.028	45.7621	8.7	0.1309	1.7	0.0531
7	105.9	2.5	0.1469	0.0037	0.689	0.027	46.3955	8.7	0.1070	1.7	0.4055
8	168.1	1.2	0.1998	0.0053	1.225	0.058	48.0010	8.7	0.1150	2.3	-0.3641
9	176.4	5.2	0.1644	0.0065	2.25	0.23	45.2304	8.7	0.1611	4.7	-0.6530
10	196.8	2.7	0.17	0.0053	0.91	0.048	49.3153	8.7	0.0905	1.0	0.3078
11	286.4	3.1	0.1547	0.0031	0.797	0.024	51.9477	8.7	0.0759	1.2	0.0978
12	191.3	3.4	0.1466	0.0039	0.866	0.035	47.5097	8.7	0.0900	1.4	0.0622
13	66.3	0.83	0.1494	0.0034	0.82	0.031	43.4081	8.7	0.1504	2.3	0.0583
14	101.2	1.6	0.1395	0.0035	0.624	0.015	46.5745	8.8	0.1041	2.2	0.6372
15	109	2.2	0.153	0.0048	0.582	0.02	49.3355	8.7	0.1000	1.8	0.0564
16	85.8	1.6	0.109	0.0042	0.505	0.025	48.6199	8.7	0.1033	2.1	-0.0450
17	55.6	1.7	0.1561	0.0032	0.714	0.027	43.5334	8.7	0.1574	2.1	0.2264
18	57.89	0.87	0.1388	0.0032	0.785	0.026	43.5648	8.7	0.1614	2.1	0.1451
19	79.4	1.6	0.134	0.0031	0.836	0.025	43.1289	8.7	0.1332	1.6	0.3274
20	2.25	0.1	0.0046	0.0011	0.1603	0.0083	26.8166	8.9	0.4330	6.0	-0.1180
21	4.43	0.18	0.0105	0.0019	0.156	0.011	35.6920	9.0	0.2960	4.4	-0.1399
22	3.433	0.093	0.0484	0.0019	0.3179	0.0084	23.3911	8.7	0.4714	1.6	-0.1314
23	1.825	0.039	0.1572	0.0043	0.673	0.016	8.9854	8.8	0.6700	1.5	0.4702
24	3.684	0.04	0.157	0.0038	0.637	0.019	15.8158	8.8	0.5704	1.3	0.2322
25	79.7	1	0.1659	0.0048	0.741	0.029	45.0110	8.8	0.1291	1.8	-0.2485
26	164.4	2.7	0.1649	0.0048	0.797	0.029	47.1017	8.8	0.0919	1.3	0.3541
27	240.9	3.2	0.1517	0.0063	1.159	0.049	45.3323	8.7	0.0902	1.8	0.3662
28	232.9	4	0.166	0.0044	0.774	0.025	51.4823	8.6	0.0817	1.3	0.6963
29	247.1	4.5	0.1601	0.0049	1.17	0.047	48.3278	8.7	0.0918	1.8	0.3014
30	196	2.5	0.1324	0.0041	0.71	0.027	49.9895	8.7	0.0828	1.6	0.0799
31	181.3	2.6	0.1196	0.0026	0.727	0.029	51.7917	8.6	0.0875	2.3	0.1181
32	28.09	0.79	0.1554	0.0065	0.708	0.033	39.4490	8.9	0.2386	2.2	-0.2167
33	46.31	0.93	0.096	0.0032	0.452	0.022	44.9440	9.1	0.1314	2.5	0.3228
34	25.57	0.39	0.1614	0.0048	0.604	0.017	37.9958	8.7	0.2275	2.1	-0.0268
35	22.98	0.38	0.1364	0.0029	0.514	0.015	39.6174	8.7	0.2198	1.1	0.3288
36	21.78	0.43	0.1239	0.0055	0.822	0.044	36.3368	8.7	0.3105	2.1	0.0455
37	7.04	0.22	0.1591	0.0052	0.769	0.019	20.8419	8.8	0.4887	1.3	-0.0420
38	13.84	0.3	0.1572	0.0033	0.673	0.017	31.3441	8.7	0.3445	1.4	0.5407
39	17.31	0.13	0.1677	0.0055	0.924	0.017	31.1579	8.7	0.3704	1.6	0.4988
40	12.03	0.17	0.1416	0.0042	0.979	0.025	25.2035	8.8	0.4433	1.0	0.3888
41	159.7	3.1	0.1253	0.0032	0.563	0.029	49.3355	8.7	0.0820	1.6	-0.1084
42	101	1.3	0.1602	0.0042	0.748	0.022	45.7101	8.7	0.1135	1.4	-0.0134