



Figure S1.

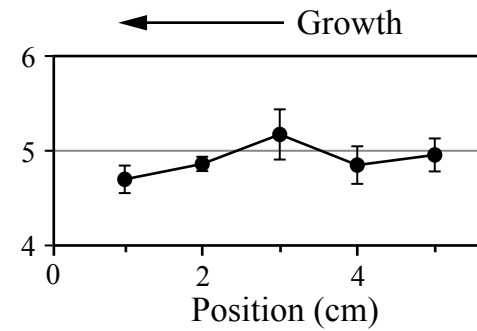
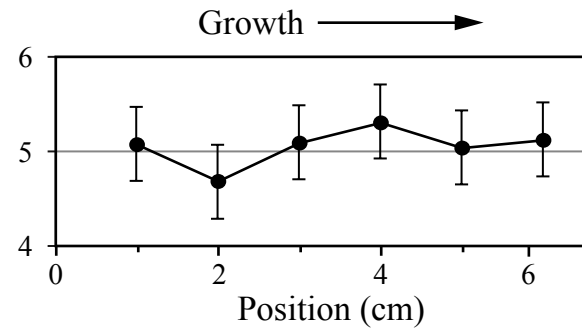
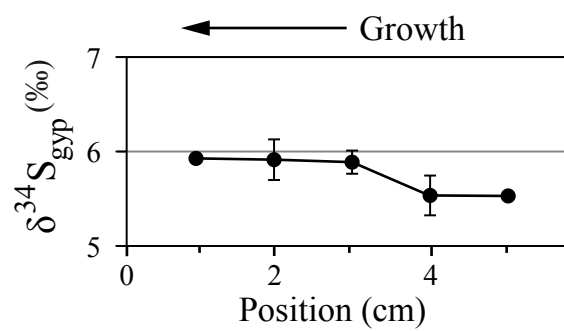
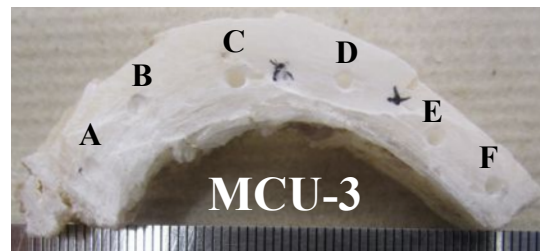


Figure S2.

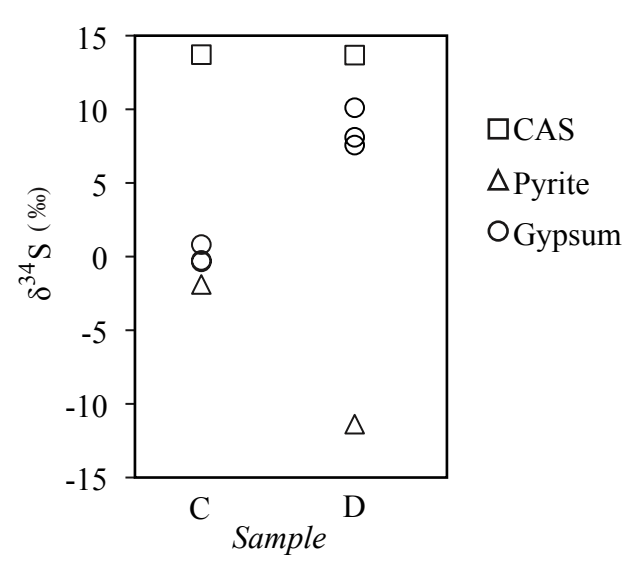


Figure S3

Table S1. Geochemical and stratigraphic information for gypsum sample locations

Location	Ridge	Formation	Member	Sub-unit	n	$\delta^{34}\text{S}_{\text{gyp}}$	σ
1	Mammoth	Ste. Genevieve	Joppa	J1	8	5.6	0.5
2	Mammoth	Ste. Genevieve	Joppa	J1	9	6.8	0.7
3	Mammoth	Ste. Genevieve	Joppa	J1	10	10.0	1.1
4	Mammoth	Ste. Genevieve	Joppa	J1	10	8.1	0.7
5	Mammoth	Ste. Genevieve	Joppa	J2	9	1.5	3.6
6	Mammoth	Ste. Genevieve	Joppa	J2	9	-2.0	3.1
7	Mammoth	Ste. Genevieve	Joppa	J1	10	4.1	1.6
8	Mammoth	Ste. Genevieve	Joppa	J1	10	6.5	1.7
9	Mammoth	Ste. Genevieve	Joppa	J1	10	6.0	1.5
10	Mammoth	Ste. Genevieve	Karnak	N/A	3	-1.8	1.5
11	Flint	Girkin	Levias/Paoli*	L2 & P1	6	-10.8	1.1
12	Flint	Girkin	Paoli	P2	9	-5.6	0.7

*Levias on wall, Paoli on ceiling, samples taken from floor and could have fallen from either. n = number of samples at location, $\delta^{34}\text{S}_{\text{gyp}}$ is average of all samples at location, σ = standard deviation for all samples at location

Table S2. Geochemical and geologic information for whole rock samples

Sample ID	Location	Formation	Member	Sub-unit	Lithology	CAS (ppm)	Pyrite (ppm)	$\delta^{34}\text{S}_{\text{CAS}}$	$\delta^{34}\text{S}_{\text{pyr}}$	$\delta^{34}\text{S}_{\text{gyp}}$
1	Surface	Girkin	ND		Limestone	839	<10	15.20		
2	Surface	Girkin	ND		Limestone	136	98	17.25		
3	Surface	Big Clifty	ND		Sandstone	NP	<10		4.39	
4	Surface	Hardinsburg	ND		Sandstone	NP	<10		17.38	
5	Surface	Caseyville	ND		Conglomerate	NP	<10		9.14	
6	Surface	Unknown (Haney?)	ND		Limestone	132	12	14.58		
7	Surface	Fraileys	ND		Shale	NP	<10			
8	Surface	Big Clifty	ND		Sandstone	NP	<10			
9	Surface	Big Clifty	ND		Sandstone	NP	<10			
10	Surface	Girkin	ND		Limestone	523	239	16.92	-40.71	
11	Surface	Unknown	ND		Limestone (Oolitic)	360	<10	17.01	-15.23	
12	Surface	Ste. Genevieve	ND		Limestone	58	186	16.72	14.44	
13	Surface	Girkin	ND		Limestone	218	<10	16.79	-15.40	
14	Surface	Big Clifty	ND		Sandstone	NP	<10		15.18	
15	Surface	Ste. Genevieve	ND		Limestone	723	<10	15.48	1.17	
16	Surface	Fraileys	ND		Shale	NP	<10		-2.20	
A	Subsurface	Ste. Genevieve	Joppa	J1	Limestone	422	<10	13.30	-11.38	
B	Subsurface	Ste. Genevieve	Joppa	J1	Limestone	457	<10	12.61	-10.43	
C	Subsurface	Ste. Genevieve	Joppa	J1	Limestone	426	21	13.72	-7.02	0.07
D	Subsurface	Ste. Genevieve	Joppa	J1	Limestone	1218	<10	13.32	-1.89	8.59

$\delta^{34}\text{S}_{\text{gyp}}$ refers to gypsum crusts. NP = no precipitate. Only siliciclastic samples failed to yield a precipitate. Pyrite samples with <10 ppm yielded a precipitate, but mass of precipitate was below gravimetric detection limits. Stratigraphic formation could not be confidently identified for samples 6 and 11; these were therefore not included in interpretations.

Table S3. Geochemical and stratigraphic information for water samples.

Sample ID	Location	Formation	Filtered?	ZnAcetate?	[SO ₄ ²⁻] ppm	δ ³⁴ S _{SO4}
W1	Pool	Ste. Genevieve	Y	N	282	-7.71
W2	Sulfur seep	Ste. Genevieve	Y	N	535	-4.50
W2	Sulfur seep	Ste. Genevieve	Y	Y	ND	-4.18
W2	Sulfur seep	Ste. Genevieve	N	Y	ND	-4.34

Pool is located below ~8m drop. Filter mesh size was 0.2μm. ND = Not determined.