

U–Th isotope analytic

U–Th isotope systematics were determined in a parallel leachate and sequential dissolution approach on a broad range of samples (6 to 193 mg aliquots of the XRD and light stable isotope samples) in order to combine structural and mineralogical resolution (coating vs. matrix) with the analytical precision of MC-ICP-MS (multi collector - inductively coupled plasma - mass spectrometry). Single and isochron based age determination are deduced according to comparable cold seep case studies published in Bayon et al. (2009) and Liebetrau et al. (2014), respectively (for details refer to notes in supplementary table S5).

The analytical procedures follow Fietzke et al. (2005) and Liebetrau et al. (2014) applying decay constants given by Cheng et al. (2000) as well as the isoplot 3.7 isochron tool (Ludwig, 2008) for activity ratio and age determinations. Whole procedure mean blank values for this specific sample set were measured around 2 (± 1 ; 2SD, n=3) and 6 (± 3 ; 2SD, n=3) pg for ^{232}Th and 15 (± 10 , 2SD, n=3) and 53 pg (± 8 2SD, n=3) for U in leachate and residue dissolution procedures, respectively. The whole procedure ^{230}Th blank was in sub-fg range in all approaches.

A correction for the isotopic composition of incorporated Th of local to regional detrital origin is deduced from the mean $^{230}\text{Th}/^{232}\text{Th}$ activity ratio of the leachate remaining residues by total dissolution (for details refer to notes in supplementary table S5).

Supplementary references

Bayon, G., Henderson, G. M. and Bohn, M.: U–Th stratigraphy of a cold seep carbonate crust, *Chem. Geol.*, 260, 47–56, 2009.

Cheng, H., Edwards, R. L., Hoff, J., Gallup, C. D., Richards, D. A. and Asmerom, Y.: The half-lives of uranium-234 and thorium-230, *Chem. Geol.*, 169, 17–33, 2000.

Fietzke, J., Liebetrau, V., Eisenhauer, A. and Dullo, W.-C.: Determination of Uranium isotope ratios by multi-static MIC-ICP-MS: method and implementation for precise U- and Th series isotope measurements, *J. Anal. Atom. Spectrom.*, 20, 395–401, 2005.

Liebetrau, V., Augustin, N., Kutterolf, S., Schmidt, M., Eisenhauer, A., Garbe-Schönberg, D. and Weinrebe, W.: Cold-seep-driven carbonate deposits at the Central American forearc: contrasting evolution and timing in escarpment and mound settings, *Int J Earth Sci*, 103 (7), 1845–1872, 2014.

Ludwig, K. R.: Isoplot 3.7: A Geochronological Toolkit for Microsoft Excel, *Berkeley Geochronol. Cent. Spec. Publ.*, 4, 2008.

Supplementary figure S1 to chapter 3.7 Authigenic carbonates

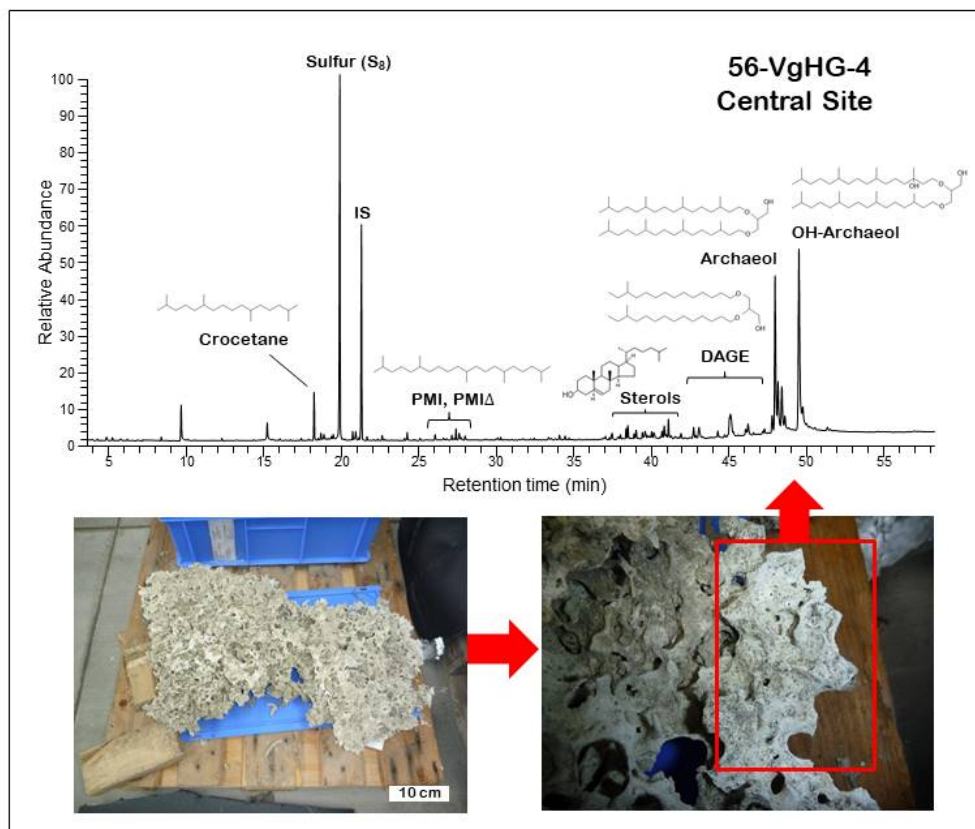


Fig. S1. Total ion current chromatogram of the total lipid extract extracted from *seep carbonate* 56-VgHG-4 (Central Site). Compounds were analyzed as trimethylsilyl (TMS-) derivatives. Structures are provided for representative compounds. PMI = 2,6,10,15,19-pentamethylicosane; PMIΔ = unsaturated derivatives thereof; DAGE = 1,2-dialkylglycerolethers; OH-Archaeol = sn2-hydroxyarchaeol; IS = internal standard. Lower pictures: images of authigenic carbonate recovered from the seafloor at Central Seep.

Supplementary tables

Table S2: Pore fluid data and $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratios of GCs and MUCs sampled in the Guaymas Basin.

Site/ Site name	Depth	Alkalinity	H ₂ S	Chlorid	Sulfate	Mg	Li	NH ₄ ⁺	Ca	Sr
	(cm)	(meq l ⁻¹)	(μM)	(mmol)	(mmol)	(mmol)	(μmol)	(μmol)	(mmol)	(μmol)
Gravity corer										
St.07 - GC01/ North Seep	10	6.3	216	561.20	24.60	53.2	24.6	30	9.6	80.1
	35	3.4	20	559.27	27.28	53.1	24.9	32	10.0	85.5
	60	3.0	-	559.84	27.80	53.2	25.0	42	10.2	86.7
	85	3.3	10	566.92	27.68	52.7	24.9	52	10.0	86.0
	110	5.5	23	553.00	23.93	52.7	24.8	63	9.5	83.1
	125	7.7	92	559.64	19.96	52.0	24.7	67	8.4	79.1
	157	21.6	64	567.46	1.33	49.3	24.0	69	4.0	56.6
	174	23.5	1817	568.85	1.51	49.7	23.8	57	4.3	56.1
	190	19.9	598	557.77	1.42	48.7	23.3	89	3.6	48.6
	210	24.3	2121	561.05	2.34	50.0	23.4	49	4.5	51.8
	230	27.9	2536	558.86	0.30	49.4	23.1	33	4.2	47.2
	247	23.3	1382	567.07	0.74	48.9	22.2	94	3.8	43.3
	272	28.5	2530	536.37	0.11	48.8	22.5	40	3.9	42.0
	294	27.9	1697	544.58	0.06	49.3	22.6	101	3.2	38.9
St.09 - GC03/ Central Seep	21	2.5	0.0	564.78	28.82	53.7	25.0	52	10.2	87.6
	210	2.6	0.0	566.46	28.85	53.1	24.7	56	10.1	85.9
	240	2.7	0.0	556.63	28.80	53.1	24.8	73	10.1	86.3
	265	2.8	1.2	564.82	28.68	53.1	24.6	84	10.1	86.5
	290	3.0	3.9	567.80	28.75	53.3	24.7	110	10.1	86.8
	320	2.9	0.0	567.72	28.60	53.0	24.7	108	10.0	86.1
	360	3.2	6.7	572.08	28.83	53.2	24.6	109	10.1	86.4
	400	3.1	0.1	564.98	28.36	53.2	24.7	162	10.1	86.8
	450	3.8	6.2	559.52	27.46	53.0	24.5	183	10.0	86.4
	500	4.1	52	559.99	27.11	53.0	24.6	212	9.9	85.9
	545	4.9	78	565.32	26.78	53.1	24.6	222	9.9	85.9

	590	5.0	39	561.12	26.15	52.8	24.5	231	9.8	85.2
	625	6.6	127	565.39	25.35	53.1	24.4	234	9.6	85.3
	660	8.7	107	566.02	23.82	52.9	24.3	-	9.2	84.0
St.09 - GC13/ Central Seep	20	2.8	14	560.91	28.42	53.8	24.4	46	10.3	87.7
	70	2.7	5	555.69	28.22	53.3	24.3	55	10.2	87.2
	100	2.7	11	551.16	28.03	53.5	24.1	45	10.2	87.4
	130	2.6	2	548.93	27.88	53.2	24.3	48	10.2	87.4
	160	2.8	3	552.13	28.00	53.1	24.3	78	10.1	86.8
	200	2.9	-	550.42	27.87	53.1	24.3	101	10.1	86.3
	230	3.1	0.5	558.03	27.94	53.2	24.1	140	10.1	86.5
	260	3.3	13	557.02	27.83	53.3	24.3	134	10.1	86.8
	305	3.4	77	556.45	27.77	53.1	24.3	172	10.1	86.4
	340	3.4	84	560.29	28.01	53.5	24.1	225	10.1	87.5
	365	3.5	113	556.71	27.80	53.1	24.0	179	10.1	86.2
	400	3.9	160	555.46	27.37	53.0	24.3	219	10.0	86.3
	415	4.4	423	556.93	27.32	52.6	24.8	319	10.1	87.6
	430	4.6	480	557.53	27.21	53.5	24.6	685	10.1	87.4
	445	4.7	-	555.47	26.95	52.9	24.5	-	10.1	87.3
	470	5.1	-	550.19	26.71	53.2	24.7	-	9.9	86.5
St.72 - GC15/ Central Seep	7	23.3	7336	551.90	11.45	52.8	24.2	117	7.3	58.0
	22	22.5	6693	550.95	12.99	52.5	24.1	96	8.2	67.7
	30	23.1	7271	552.37	11.81	52.7	24.2	91	7.9	64.2
	36	13.1	3310	551.78	19.95	53.3	24.6	74	9.0	75.4
	47	10.7	1733	552.29	21.90	53.2	24.4	73	9.1	76.1
St.51 - GC09/ Smoker Site	10	2.8	0	557.35	28.43	55.4	24.4	67	10.3	88.7
	30	2.7	0	554.39	28.25	54.3	23.9	73	10.2	86.7
	50	2.7	0	553.55	28.12	54.6	23.9	95	10.3	87.0
	70	2.8	0	554.64	28.18	55.6	24.0	95	10.5	88.6
	93	3.0	0	553.85	28.07	54.8	23.5	124	10.3	87.0
	110	2.9	0	552.27	27.90	54.9	22.9	92	10.3	86.7
	130	3.0	0	549.30	27.85	55.8	22.9	146	10.5	88.9
	150	3.1	0	552.39	27.83	55.2	22.7	129	10.4	86.4

170	3.1	0	553.27	27.91	55.1	22.5	175	10.3	86.8
193	3.2	0	550.86	27.78	55.4	22.7	196	10.3	87.2
210	3.3	0.1	559.84	28.18	55.6	22.3	170	10.4	87.5
230	3.4	9.4	557.75	27.99	56.7	22.4	185	10.7	89.2
250	3.4	3.6	555.77	28.01	56.0	22.6	215	10.5	88.4
270	3.6	6.9	558.75	28.03	56.3	22.8	217	10.6	88.6
290	3.6	1.9	563.19	28.21	55.4	22.9	237	10.5	87.7
306	3.5	2.5	-	-	55.6	22.6	250	10.6	88.5
320	3.5	1.6	557.25	27.88	57.2	22.2	230	11.0	90.9
340	3.6	0	575.02	29.23	57.4	22.5	231	11.1	91.0
355	3.5	0	550.96	27.42	56.9	21.5	269	11.0	90.3
370	3.4	0	548.62	27.45	56.8	22.9	249	11.0	91.2
390	3.6	0	560.22	27.91	56.8	24.0	257	11.2	92.7
400	3.4	0	553.76	27.55	57.4	24.7	242	11.4	94.3
410	3.4	0	559.37	27.14	56.4	28.4	342	11.4	95.6
420	3.0	0	567.50	27.57	57.5	29.8	388	11.5	95.6
435	3.2	0	556.69	26.63	54.4	31.5	396	11.2	90.1
450	2.8	0	560.04	26.42	52.7	33.5	437	11.0	79.6
460	2.7	0	557.76	26.38	52.7	33.3	424	10.8	88.1
470	2.8	0	562.25	26.30	54.8	33.7	346	11.1	94.8

St.58 - GC10/
Smoker Site

20	3.6	0.0	558.87	28.51	54.3	23.7	262	10.2	86.8
45			548.98	27.73	54.3	23.5		10.2	87.4
70	3.4	1.3	563.78	28.74	55.3	23.4	259	10.5	88.1
120	3.4	0.2	563.36	28.47	54.9	23.5	295	10.3	87.2
145			530.87	26.59	55.0	23.4		10.4	88.0
170	3.3	0.1	558.27	28.15	55.5	23.4	304	10.4	87.9
210	3.2	0.0	563.31	28.35	53.4	22.9	312	10.1	84.9
225			565.51	28.41	54.4	23.9		10.4	87.8
240	3.1	0.8	562.87	28.20	55.8	24.0	281	10.4	88.7
255			566.58	28.35	54.6	23.9		10.5	88.1
270	3.1	0.0	565.66	28.31	55.6	24.1	266	10.4	87.9
285			554.12	27.45	55.2	24.7		10.5	89.2
310	3.0	0.2	566.21	28.34	56.1	24.4	223	10.5	88.8
325			568.19	28.33	54.9	24.8		10.5	90.1

340	2.9	2.7	564.46	28.09	56.3	25.0	213	10.6	89.7
355			570.13	28.22	55.4	25.2		10.7	90.1
370	3.0	1.9	568.13	28.14	56.5	25.0	181	10.8	90.7
385			566.77	27.94	56.4	25.0		11.0	92.3
410	2.8	2.2	569.41	28.13	56.2	25.7	164	11.0	91.9
430	2.7	2.3	568.78	28.03	55.5	26.7	165	11.1	92.2
450	2.7	1.7	567.68	27.87	57.4	26.0	133	11.6	94.8
470	2.8	2.4	565.27	27.89	56.2	26.9	90	11.5	93.6

St.47 - GC07/
Slope Site

5	3.1	37	564.45	26.04	52.8	22.9	478	10.6	88.2
10	2.6	17	566.14	26.68	53.0	23.4	404	10.4	87.6
15	7.0	25	567.30	26.37	52.7	20.5	457	9.5	87.2
20	7.0	24	568.30	26.18	52.6	23.0	465	10.5	88.0
25	10.1	268	568.70	24.67	52.8	23.0	769	10.5	87.9
30	10.1	285	558.26	24.31	52.7	21.9	648	10.5	88.0
35	10.3	339	561.14	24.12	52.7	22.1	718	10.4	88.6
40	11.4	426	560.88	23.54	52.8	22.1	772	10.4	87.9
45	13.2	543	559.69	22.64	53.2	21.9	840	10.4	88.7
50	13.1	653	565.28	22.62	52.9	21.4	840	10.3	88.2
60	14.2	764	564.40	23.76	52.9	21.4	1000	10.2	88.7
70	15.4	951	563.90	21.04	52.8	21.3	1059	10.1	87.6
80	16.2	1139	566.22	20.76	52.7	20.9	1072	10.0	87.8
90	17.4	1220	564.44	19.86	52.8	20.7	1212	9.9	88.1
100	18.7	1383	564.18	18.99	52.8	20.7	1251	9.9	87.4
120	19.6	1512	568.29	18.42	53.0	20.5	1007	9.8	87.6
140	21.8	1880	566.71	18.36	52.7	20.4	1297	9.3	87.6
160	25.5	2377	561.37	16.99	53.3	20.0	1370	9.1	88.5
180	27.5	2602	562.67	14.79	52.9	19.7	1630	8.7	87.4
200	28.8	2880	564.65	13.01	52.9	19.5	1916	8.5	87.6
230	31.9	3452	569.38	12.04	53.3	19.3	2162	8.1	89.2
260	36.0	4036	561.33	10.13	52.4	18.7	2276	7.5	87.4
290	38.2	4428	565.43	5.14	53.0	18.7	2872	7.2	88.1
320	42.4	5142	564.36	2.84	52.9	18.2	2812	6.6	87.9
350	44.5	5199	563.55	0.96	52.6	17.8	3242	6.0	87.5
380	45.8	5292	563.94	0.71	53.2	17.6	4310	5.6	88.0

410	46.9	5053	562.02	0.73	53.1	17.6	3386	5.3	87.2
440	48.2	4765	567.11	0.66	53.7	17.6	4206	5.2	87.2
470	50.4	4488	565.69	0.67	54.0	17.6	4182	5.0	87.4
500	50.2	4857	570.03	0.58	54.6	17.6	3568	4.8	87.3
530	50.9	4547	566.38	0.58	54.6	17.8	4442	4.6	86.0
560	53.1	4329	572.02	0.54	55.2	17.8	4846	4.5	86.3
590	54.1	3861	571.52	0.65	55.2	17.8	4696	4.3	85.2
620	56.8	3465	571.08	0.54	56.2	18.0	5268	4.2	85.8
650	58.5	2870	570.41	0.62	56.5	18.0	6002	4.1	84.8
680	62.4	2622	569.27	0.54	57.3	18.1	6918	3.9	85.4
710	62.9	2243	578.43	0.46	58.4	18.4	7346	3.9	85.8
740	65.1	2132	571.82	0.38	58.2	18.4	7486	3.7	85.2

Multicorer

St.33 - MUC11/ North Seep	0.0	2.5	2.9	557.77	28.36	53.9	24.6	1.0	10.4	87.3
	0.5	3.0	62	553.72	27.89	53.4	24.6	7.5	10.3	87.6
	1.5	3.0	49	555.94	28.12	53.2	24.6	14	10.3	86.5
	2.5	3.8	367	564.58	28.08	53.5	24.8	11	10.3	87.0
	3.5	4.8	906	562.64	27.20	53.6	24.8	12	10.2	86.3
	4.5	6.9	1661	567.19	25.79	53.1	24.6	11	9.9	83.2
	6.0	9.1	2162	569.90	24.23	53.1	24.6	13	9.7	81.1
	8.0	9.3	2170	570.94	24.14	52.7	24.6	14	9.6	81.0
	10.0	16.6	4554	569.94	18.69	52.4	24.4	13	8.9	75.1
	12.5	20.6	5472	568.90	16.08	52.2	24.3	13	8.4	71.7
	15.5	28.4	5988	573.54	9.79	51.9	24.2	17	7.5	64.4
	18.5	26.9	4649	569.07	10.58	51.5	24.0	19	7.5	65.2
	22.0	30.5	4992	573.17	8.24	51.4	24.0	18	7.2	64.1
St.23 - MUC5/ Ring Seep	0.0	2.5	-	560.44	28.63	55.3	25.3	0.3	10.6	90.6
	0.5	2.7	-	556.32	28.34	53.5	24.7	0.2	10.3	87.3
	1.5	2.9	-	552.20	28.07	53.7	24.9	5.6	10.3	87.3
	2.5	2.9	-	565.10	29.39	53.2	24.9	16	10.2	87.5
	3.5	2.9	-	557.33	28.33	53.5	25.0	19	10.3	88.4
	4.5	2.9	-	562.23	28.56	53.5	25.1	-	10.3	87.9

5.5	2.9	-	557.42	28.15	53.3	25.1	28	10.3	87.9
7.0	2.9	-	561.39	28.25	53.3	25.0	26	10.3	88.0
9.0	2.9	-	563.16	28.39	53.7	25.4	29	10.4	88.7
11.0	2.9	0.54	566.15	28.45	53.4	25.3	25	10.3	88.2
13.0	2.9	7.61	563.25	28.30	53.3	25.2	27	10.3	88.0
15.5	2.9	44	563.45	28.31	53.3	25.4	-	10.3	87.6
18.5	3.0	66	561.46	28.04	53.4	25.7	-	10.3	87.8
22.0	3.1	105	565.70	28.17	53.1	25.9	47	10.3	87.9

St.15 -
MUC02/
Reference
Site

0.0	2.4	-	566.07	28.67	54.3	24.7	0.0	10.4	88.8
0.5	2.6	-	560.71	28.39	53.5	26.2	1.0	10.3	88.1
1.5	2.6	-	559.80	28.38	53.6	26.2	0.0	10.3	87.4
2.5	2.7	-	565.01	28.71	53.4	25.5	0.0	10.3	87.0
3.5	2.7	-	561.94	28.47	53.6	25.2	0.0	10.3	87.5
4.5	2.7	-	565.17	28.77	53.2	24.6	0.4	10.2	87.4
5.5	2.7	-	564.54	28.64	53.3	24.7	1.3	10.3	87.4
7.0	2.7	-	557.38	28.35	53.0	24.4	3.6	10.2	87.4
9.0	2.7	-	557.64	28.37	53.1	24.5	6.7	10.2	86.9
11.0	2.8	-	553.57	28.04	53.3	24.4	8.0	10.2	87.1
13.0	2.7	-	560.07	28.48	53.3	24.5	10	10.3	87.4
15.5	2.8	-	559.17	28.42	53.4	24.5	15	10.3	87.6
18.5	2.9	-	559.53	28.22	53.4	24.3	22	10.3	88.0
22.0	2.9	4.9	556.55	28.11	53.3	24.4	31	10.3	87.7
26.0	3.0	23	556.81	28.14	53.2	24.2	42	10.2	88.1
30.0	3.2	11	555.33	27.91	53.3	24.3	53	10.3	87.9

St.22 -
MUC04/
Central Seep

0.0	2.6	13	573.52	29.41	54.1	24.6	0.0	10.3	88.2
0.5	3.1	-	554.12	27.98	53.6	24.7	4.9	10.3	87.1
1.5	3.5	54	557.10	27.94	53.3	24.5	8.4	10.2	86.8
2.5	3.5	106	559.65	27.94	53.2	24.5	11	10.2	87.0
3.5	3.9	276	554.70	27.39	53.2	24.4	11	10.1	86.7
4.5	4.5	502	556.43	27.19	53.2	24.4	25	10.1	87.1
5.5	5.3	839	558.43	26.76	52.9	24.3	28	10.0	85.9

7.0	6.0	1134	556.85	26.23	53.3	24.3	35	10.1	86.6
9.0	8.0	1844	558.69	25.39	53.1	24.2	49	10.0	85.3
11.0	8.8	2080	561.26	24.84	53.1	24.1	36	10.0	85.2
13.0	10.4	2621	558.09	24.19	53.2	24.2	43	9.9	84.9
15.5	10.4	2700	558.68	24.18	53.3	24.3	44	10.0	84.9
18.5	12.4	3546	558.30	22.78	53.0	24.4	33	9.9	83.6
22.0	13.2	3299	556.63	22.19	53.0	24.4	28	9.9	83.0
26.0	14.4	3810	559.75	21.49	53.2	24.5	21	9.9	82.7

St.65 -
MUC15/
Smoker Site

0.0	2.4	-	545.94	28.01	54.6	24.4	0.3	10.4	89.5
0.5	2.4	-	540.49	27.71	53.7	25.3	0.1	10.3	88.0
1.5	2.7	-	540.79	27.62	53.7	24.7	0.0	10.3	87.7
2.5	2.7	-	546.33	27.96	53.3	24.6	0.5	10.3	87.3
3.5	2.8	-	544.35	27.85	53.2	24.5	1.5	10.2	87.1
4.5	2.8	-	544.22	27.80	53.1	24.5	4.4	10.2	86.8
5.5	2.8	-	547.72	28.06	53.0	24.4	6.6	10.2	87.1
7.0	2.9	-	549.09	28.11	53.1	24.4	14	10.2	87.3
9.0	2.9	-	549.83	28.06	52.9	24.0	18	10.3	87.0
11.0	3.1	-	545.00	27.79	53.2	23.9	31	10.2	87.9
13.0	3.1	-	548.08	27.96	53.4	24.3	27	10.2	87.6
15.5	3.1	-	546.57	27.88	52.9	23.9	37	10.1	87.1
18.5	3.1	-	551.75	28.16	54.7	24.8	36	10.7	90.0
22.0	3.0	-	536.44	27.26	52.8	23.9	39	10.1	86.4
26.0	3.0	-	543.44	27.63	53.5	24.2	41	10.2	87.8
30.0	3.0	-	540.95	27.51	53.3	24.3	37	10.2	87.6

St.66 -
MUC16/
Smoker Site

0.0	2.4	-	546.38	27.90	54.4	24.6	0.0	10.4	88.9
0.5	2.6	-	556.72	28.51	53.5	24.2	5.0	10.3	87.5
1.5	2.7	-	550.64	28.16	53.7	24.3	10	10.3	88.2
2.5	2.9	-	548.63	27.96	53.5	24.2	16	10.3	87.7
3.5	2.9	-	548.41	27.97	53.5	24.4	17	10.3	88.1
4.5	3.0	-	557.13	28.42	53.6	24.3	20	10.3	88.1
5.5	3.1	-	547.23	27.81	53.5	24.4	20	10.3	87.7
7.0	3.1	-	547.90	28.89	53.4	24.3	21	10.3	87.6

9.0	3.0	-	546.83	27.78	53.8	24.5	22	10.4	87.9
11.0	2.9	-	554.58	28.24	53.5	24.2	22	10.3	87.7
13.0	2.9	-	548.24	27.94	53.5	24.1	22	10.3	87.8
15.5	3.0	-	549.17	27.88	53.6	24.2	20	10.4	87.4
18.5	3.0	-	554.67	28.25	53.7	24.2	20	10.5	88.2

St29 -

MUC09/ Slope Site	0.0	2.4	0	557.87	28.53	54.1	24.8	4.7	10.3	88.2
	0.5	2.6	0	553.14	28.21	53.7	24.6	24	10.4	88.7
	1.5	2.8	0	552.55	28.12	53.7	24.5	50	10.5	88.4
	2.5	2.8	0	558.80	28.45	53.4	24.4	68	10.5	88.1
	3.5	2.9	0	556.47	28.31	53.8	24.4	58	10.6	89.5
	4.5	3.2	0	552.99	27.98	53.5	24.3	93	10.6	88.9
	5.5	3.2	0	551.17	28.03	53.8	24.6	73	10.7	89.1
	6.5	3.3	0	553.34	27.98	53.3	24.2	92	10.7	89.0
	7.5	3.7	0	552.56	27.78	53.5	24.1	139	10.9	90.4
	9.0	3.9	0	554.02	27.65	53.6	24.2	183	11.0	89.9
	11.0	4.2	0	553.67	27.42	53.7	24.0	218	11.0	90.5
	13.0	4.8	0	555.66	27.13	53.3	23.8	281	10.9	89.3
	15.0	5.6	0	557.70	26.83	53.4	23.7	320	10.8	89.9
	18.5	6.4	0	556.21	26.41	53.5	23.4	402	10.8	89.6
	20.5	7.1	3.10	551.83	25.69	54.2	23.5	480	10.9	90.6
	23.5	8.4	46	546.85	25.01	53.0	22.8	582	10.6	89.5
	26.5	9.9	103	551.32	24.80	52.9	22.4	606	10.6	88.8
	29.0	10.3	186	555.47	24.64	53.3	22.3	660	10.6	89.4
	30.0	10.7	289	556.17	24.22	53.4	22.4	702	10.6	89.7
	38.0	11.6	368	562.69	24.10	53.2	22.1	767	10.5	89.5

Site/ Site name	Depth	⁸⁷ Sr/ ⁸⁶ Sr	2 SEM	⁸⁷ Sr/ ⁸⁶ Sr	2 SEM	⁸⁷ Sr/ ⁸⁶ Sr	2 SEM	⁸⁷ Sr/ ⁸⁶ Sr	2 SEM	Mean ⁸⁷ Sr/ ⁸⁶ Sr**
	(cm)	Aliquot 1		Aliquot 2*		Aliquot 3*		Aliquot 4*		

Gravity corer

St.07 - GC01/	10	0.709178	8.E-06							
North Seep	174	0.709160	9.E-06							

	272	0.709169	8.E-06							
	294	0.709161	9.E-06	0.709146	9.E-06					0.709153
St.09 - GC03/ Central Seep	21	0.709183	8.E-06							
	660	0.709174	8.E-06							
St.51 - GC09/ Smoker Site	10	0.709176	8.E-06	0.709179	7.E-06					0.709178
	320	0.709170	8.E-06							
	400	0.709133	9.E-06							
	410	0.709069	5.E-06	0.709074	8.E-06	0.709072***	5.E-06	0.709076	7.E-06	0.709073
	450	0.708949	7.E-06							
	470	0.708990	9.E-06							
St.58 - GC10/ Smoker Site	20	0.709168	7E-06							
	450	0.709150	6E-06							

Multicorer

St.33 - MUC11/ North Seep	0.0	0.709162	8.E-06							
	0.5	0.709169	7.E-06							
	22.0	0.709178	7.E-06							
St.23 - MUC5/ Ring Seep	0.0	0.709191	8.E-06	0.709189	7.E-06					0.709190
	0.5	0.709173	7.E-06							
	9.0	0.709170	8.E-06							
	22.0	0.709150	6.E-06							
St.15 - MUC02/ Reference Site	0.0	0.709187	8.E-06							
	0.5	0.709181	9.E-06							
	30.0	0.709176	7.E-06							
St.22 - MUC04/	0.0	0.709173	6.E-06							

Central Seep	0.5	0.709185	7.E-06
	26.0	0.709170	8.E-06

*Aliquot refers to repetition of whole sample preparation procedure (probing (500 instead of 1000ng), purification, measurement) besides otherwise noted

**Mean of individual aliquot measurements in similar depths

***Aliquot only remeasured

Table S3: Guaymas Basin hydrocarbons, carbon isotope results of methane and ethane as well as hydrogen isotope results are shown for GCs, MUCs, and the hydrothermal plume. Note hydrothermal plume hydrocarbons and carbon isotope results from Berndt et al. (2016).

Site/ Site name	depth (cm)	Methane (C1) (μmol)	Ethane (C2) (μmol)	Propane (C3) (μmol)	C1/ (C2+C3)	$\delta^{13}\text{C}_{\text{Methane}}$ (‰)	$\delta^{13}\text{C}_{\text{Ethane}}$ (‰)	$\delta\text{D}_{\text{Methane}}$ (‰)
Gravity corer								
St.07 - GC01/ North Seep	44	6.3	0.23	0.16	16	-47.0	-	-
	94	20	0.12	0.07	105	-53.4	-	-
	144	450	0.78	0.11	509	-77.2	-27.4	-
	194	6863	0.33	0.15	14265	-60.9	-26.1	-190
	244	2004	0.16	0.18	6045	-60.6	-	-
	294	13954	-	0.14	101266	-58.4	-28.7	-196
Gashydrate	265	497283	-	-	-	-58.9	-	-198
	265	710604	-	-	-	-58.7	-	-196
	265	330618	-	-	-	-58.1	-	-197
	265	414102	-	-	-	-57.9	-	-196
St.09 - GC13/ Central Seep	20	7.7	0.08	0.05	59	-40.5	-	-
	70	20	0.18	0.12	66	-51.1	-	-
	120	6.0	0.07	0.04	53	-50.7	-	-
	170	10	0.13	0.07	50	-52.0	-	-
	220	14	0.20	0.08	53	-48.2	-	-
	270	8.8	0.12	0.04	54	-39.2	-	-
	320	3.8	0.13	0.06	20	-26.5	-	-
	370	5.2	0.17	0.07	21	-34.6	-	-

	420	5.4	0.27	0.07	16	-45.9	-	-
	470	7.2	0.24	0.03	27	-50.2	-	-
St.72 - GC15/ Central Seep	7	1458	8.66	0.03	168	-53.9	-29.3	
	27	1276	9.07	0.03	140	-54.5	-28.9	
	42	448	1.81	0.04	243	-57.2	-26.8	
St.14 - GC05/ Graben Site	210	9.2	0.08	0.05	67	-66.1	-	-
	260	9.7	0.08	0.05	78	-66.5	-	-
	310	10.3	0.07	0.04	92	-66.6	-	-
	360	9.9	0.08	0.05	79	-66.4	-	-
	410	7.9	0.07	0.05	67	-65.0	-	-
	460	9.0	0.06	0.03	110	-69.6	-	-
	510	3.0	0.05	0.03	41	-58.6	-	-
	560	2.1	0.04	0.03	29	-49.8	-	-
	610	2.2	0.06	0.05	21	-69.6	-	-
	660	2.0	0.05	0.03	24	-70.5	-	-
St.51 - GC09/ Smoker Site	20	0.78	0.11	0.06	5	-	-	-
	70	0.83	0.11	0.06	5	-	-	-
	120	0.78	0.07	0.04	7	-	-	-
	170	0.83	0.07	0.04	8	-	-	-
	220	0.76	0.04	0.03	11	-	-	-
	270	0.98	0.06	0.04	10	-	-	-
	320	0.99	0.05	0.03	13	-	-	-
	370	1.4	0.11	0.08	7	-	-	-
	420	2.2	0.09	0.13	10	-	-	-
	470	1.6	0.05	0.05	15	-	-	-
St.58 - GC10/ Smoker Site	20	2.0	0.07	0.05	16	-	-	-
	70	1.7	0.08	0.05	13	-	-	-
	120	1.6	0.10	0.05	11	-	-	-
	170	1.5	0.08	0.06	11	-	-	-
	220	1.2	0.04	0.04	16	-	-	-

	270	1.0	0.07	0.05	8	-	-	-
	320	1.03	0.08	0.05	8	-	-	-
	370	0.82	0.06	0.03	9	-	-	-
	420	0.82	0.05	0.04	9	-	-	-
	470	0.79	0.08	0.04	7	-44.2	-	-
St.47 - GC07/ Slope Site	100	85	0.45	0.059	167	-79.5	-	-
	150	329	0.42	0.045	836	-88.2	-	-
	200	2272	0.27	0.045	7282	-87.7	-	-
	250	3688	0.16	0.059	16550	-86.7	-	-
	300	5651	0.16	0.059	25357	-84.1	-	-
	350	6773	0.15	0.074	30392	-85.0	-	-
	400	6959	0.15	0.074	31229	-81.0	-	-
	450	8100	0.15	0.075	36111	-81.1	-	-
	500	9518	0.15	0.074	42711	-78.3	-	-
	550	9880	0.15	0.015	60060	-76.9	-	-
	600	6049	0.15	0.015	35979	-75.5	-	-
	650	5183	0.17	0.060	22852	-76.2	-	-196
	700	7225	0.29	0.093	19432	-75.3	-	-195
	750	5567	0.17	0.111	16758	-73.0	-	-
	800	2998	0.19	0.081	11587	-72.2	-	-
	850	3468	0.18	0.095	14596	-71	-	-
	900	5594	0.14	0.146	28793	-71	-	-192
	950	2668	0.29	0.131	6264	-76	-	-
	1000	14129	0.38	0.131	107565	-67	-	-193

Multicorer

St.33 - MUC11/ North Seep	0.5	3	0.029	0.029	55	-67.8	-	-
	1.5	5	0.030	0.030	81	-70.6	-	-
	2.5	42	0.076	0.046	349	-76.0	-	-
	3.5	77	0.138	0.046	417	-75.3	-	-
	5	234	0.354	0.046	583	-76.4	-38.3	-
	7	265	0.361	0.031	674	-77.6	-38.1	-
	9	386	0.577	0.048	617	-77.5	-35.6	-
	11	703	0.807	0.048	822	-79.5	-	-
	13	897	0.965	0.067	870	-76.5	-	-

	15	954	1.014	0.086	868	-79.3	-	-
	17	882	0.917	0.076	888	-77.0	-	-
	19	830	0.996	0.087	766	-75.4	-	-
	22	762	1.167	0.103	600	-71.4	-	-
	26	522	0.672	0.076	698	-70.8	-	-
St.23 - MUC5/ Ring Seep	0.5	2	0.044	0.029	28	-44.8	-	-
	1.5	3	0.045	0.045	35	-44.8	-	-
	2.5	5	0.045	0.090	35	-51.7	-	-
	3.5	6	0.030	0.030	104	-51.0	-	-
	5	7	0.045	0.030	86	-49.7	-	-
	7	13	0.046	0.030	166	-49.5	-	-
	9	36	0.062	0.046	332	-49.9	-	-
	11	16	0.031	0.031	254	-48.1	-	-
	13	10	0.083	0.083	62	-55.1	-	-
	15	14	0.182	0.017	72	-56.2	-	-
	17	13	0.153	0.089	53	-57.7	-	-
	19	18	0.233	0.167	44	-57.2	-	-
	22	17	0.136	0.102	70	-55.1	-	-
St.15 - MUC02/ Reference	0.5	0.45	0.010	0.015	18	-	-	-
	1.5	0.49	0.014	0.012	19	-	-	-
	2.5	0.48	0.017	0.016	14	-	-	-
	3.5	0.59	0.019	0.018	16	-	-	-
	5	0.51	0.026	0.019	11	-	-	-
	7	0.55	0.033	0.026	9	-	-	-
	9	0.52	0.022	0.017	14	-	-	-
	11	0.52	0.023	0.016	14	-	-	-
	13	0.63	0.027	0.018	14	-	-	-
	15	0.68	0.039	0.040	9	-	-	-
	17	0.69	0.051	0.033	8	-	-	-
	19	0.73	0.046	0.036	9	-	-	-
	22	0.78	0.084	0.051	6	-	-	-
	26	0.89	0.034	0.025	15	-	-	-
	30	1.09	0.047	0.031	14	-	-	-

	34	1.10	0.044	0.028	15	-	-	-
	38	1.21	0.047	0.025	17	-	-	-
St.22 - MUC04/ Central Seep	0.5	69	0.123	0.022	477	-57.3	-	-
	1.5	84	0.152	0.073	373	-57.1	-	-
	2.5	127	0.216	0.023	531	-57.5	-	-
	3.5	494	0.795	0.047	587	-57.6	-36.0	-
	5	632	0.999	0.038	610	-56.4	-35.3	-
	7	1409	2.131	0.036	650	-56.2	-35.3	-122
	9	1871	3.110	0.031	596	-57.2	-35.1	-113
	11	1514	2.804	0.027	535	-57.5	-33.9	-114
	13	2121	3.623	0.043	578	-57.5	-37.7	-119
	15	2582	3.960	0.138	630	-58.1	-36.6	-
	17	2296	3.773	0.046	601	-57.3	-35.7	-117
	19	2106	3.256	-	647	-57.0	-37.0	-
	22	2461	5.115	0.094	472	-55.2	-34.2	-97
	26	1621	3.543	0.098	445	-55.8	-29.6	-
	30	925	2.200	0.122	398	-54.7	-32.4	-
	34	196	0.642	0.122	257	-54.7	-35.1	-
	38	55	0.183	0.046	238	-43.7	-	-
St.65 - MUC15/ Smoker Site	0.5	1.04	0.060	0.060	9	-	-	-
	1.5	0.47	0.015	0.000	31	-	-	-
	2.5	1.33	0.077	0.077	9	-	-	-
	3.5	1.46	0.078	0.062	10	-	-	-
	5	1.62	0.079	0.047	13	-	-	-
	7	1.74	0.079	0.048	14	-34.0	-	-
	9	1.89	0.080	0.064	13	-35.9	-	-
	11	1.85	0.080	0.064	13	-68.6	-	-
	13	2.13	0.064	0.048	19	-48.6	-	-
	15	2.77	0.079	0.111	15	-57.5	-	-
	17	2.63	0.065	0.049	23	-64.8	-	-
	19	3.16	0.08	0.07	21	-67.2	-	-
	22	2.96	0.09	0.05	21	-67.0	-	-
	26	2.41	0.07	0.07	17	-64.3	-	-

	30	1.50	0.08	0.05	12	-	-	-
	34	1.16	0.10	0.09	6	-	-	-
St.66 - MUC16/ Smoker Site	0.5	0.86	0.030	0.0302	14	-	-	-
	1.5	1.71	0.046	0.0305	22	-	-	-
	2.5	1.58	0.032	0.0322	25	-	-	-
	3.5	1.81	0.034	0.0335	27	-	-	-
	5	1.56	0.035	0.0346	23	-31.48	-	-
	7	1.83	0.035	0.0355	26	-	-	-
	9	1.00	0.036	0.0357	14	-	-	-
	11	1.50	0.037	0.0371	20	-	-	-
	13	1.32	0.051	0.0509	13	-	-	-
	15	1.42	0.051	0.0514	14	-	-	-
	17	1.57	0.067	0.0665	12	-	-	-
St.43 - MUC14/ Slope Site	0.5	0.60	0.01	-	40	-	-	-
	1.5	0.92	0.03	0.02	20	-	-	-
	2.5	0.81	0.03	0.02	16	-	-	-
	3.5	0.86	0.04	0.02	16	-	-	-
	5	0.97	0.05	0.02	14	-	-	-
	7	0.85	0.05	0.02	12	-	-	-
	9	0.94	0.05	0.02	13	-	-	-
	11	2.01	0.06	0.03	23	-62.3	-	-
	13	2.56	0.06	0.02	32	-47.9	-	-
	15	3.27	0.04	0.02	53	-75.3	-	-
	17	3.88	0.07	0.03	39	-71.8	-	-
	19	4.36	0.07	0.03	45	-72.8	-	-
	22	5.51	0.07	0.03	55	-75.8	-	-
	26	6.22	0.08	0.04	54	-67.4	-	-
	30	6.68	0.10	0.04	48	-69.9	-	-
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VCTD								
St.52 - NIBo6/	67	0.172	0.023	0.023	344	-36.8	-	-113
St.52 - NIBo9/	27	0.059	0.008	0.008	401	-36.9	-	-111
St.52 - NIBo11/	19	0.043	0.006	0.006	384	-14.9	-	-98
St.52 - NIBo12/	401	1.009	0.129	0.129	352	-37.4	-	-108

Table S4: Water column data (temperature, salinity, turbidity, and methane concentrations) above North, Central, Ring Seeps and Slope, Graben, and Smoker Sites.

Site/ Site name	Latitude (N)	Longitude (W)	Depth (m)	Temperature (°C)	Salinity (‰)	Turbidity (ml/l)	CH ₄ (nM)
VCTD01	27.50594	-111.68014	1718	2.9	34.6	0.6	5.7
Ring Seep	27.50478	-111.67956	1578	3.0	34.6	0.6	28
	27.50434	-111.67932	1477	3.2	34.6	0.6	1.1
	27.5033	-111.67878	1276	3.6	34.6	0.4	1.1
	27.50218	-111.6782	1084	4.1	34.6	0.3	2.3
	27.50144	-111.67784	888	5.1	34.5	0.1	3.2
	27.50104	-111.6777	699	6.9	34.5	0.0	
	27.5011	-111.67768	699	6.9	34.5	0.0	1.1
	27.50116	-111.6776	504	8.7	34.6	0.1	1.8
	27.50118	-111.67758	304	11	34.8	0.4	4.3
	27.5011	-111.67764	103	16	35.0	1.5	6.3
	27.50116	-111.6776	61	20	35.2	3.3	5.9
VCTD02	27.43584	-111.50468	1847	2.8	34.6	0.9	2.6
Central Seep	27.4358	-111.50462	1754	2.9	34.6	0.7	3.4
	27.4358	-111.50462	1604	3.0	34.6	0.6	2.1
	27.43584	-111.50464	1404	3.4	34.6	0.5	1.7
	27.43588	-111.50454	1154	3.9	34.6	0.3	6.6
	27.43592	-111.50452	903	5.1	34.5	0.1	1.8
	27.43588	-111.50456	704	6.4	34.5	0.0	1.5
	27.4358	-111.50462	503	8.2	34.6	0.1	1.6
	27.43578	-111.5046	302	12	34.8	0.3	2.5
	27.43582	-111.50462	98	16	35.0	2.0	6.5
	27.43582	-111.50462	12	25	34.9	4.5	5.6
VCTD03	27.55462	-111.54802	1826	2.9	34.6	0.7	12

North Seep	27.554	-111.54796	1825	2.9	34.6	0.7	11
	27.55363	-111.54796	1825	2.9	34.6	0.7	14
	27.55424	-111.5473	1827	2.9	34.6	0.7	8.8
	27.55464	-111.54686	1825	2.9	34.6	0.7	11
	27.5547	-111.54742	1825	2.9	34.6	0.7	12
	27.55468	-111.5482	1821	2.9	34.6	0.7	4.7
	27.55466	-111.54878	1818	2.9	34.6	0.7	3.4
	27.55466	-111.54912	1817	2.9	34.6	0.7	4.3
	27.55527	-111.54854	1823	2.9	34.6	0.7	5.7
	27.55578	-111.54806	1824	2.9	34.6	0.7	7.6
VCTD06	27.41288	-111.38718	1003	4.5	34.5	0.2	4.3
Smoker Site	27.41278	-111.3871	1304	3.6	34.6	0.4	2.0
	27.41276	-111.38708	1604	3.0	34.6	0.6	414
	27.4128	-111.38716	1773	3.6	34.6	0.6	3618
	27.41282	-111.38714	1773	2.9	34.6	0.6	
	27.41204	-111.38728	1781	3.0	34.6	0.6	7091
	27.41202	-111.38728	1781	3.0	34.6	0.6	
	27.41034	-111.38836	1798	2.9	34.6	0.6	275
	27.41034	-111.38836	1797	2.9	34.6	0.6	
	27.40984	-111.38864	1794	2.9	34.6	0.6	341
	27.40982	-111.38864	1794	2.9	34.6	0.6	
VCTD07 Slope Site	27.70688	-111.2278	652	6.7	34.5	0.0	24
	27.70684	-111.22772	661	6.2	34.5	0.0	17
	27.7068	-111.22766	568	7.5	34.6	0.0	8.5
	27.7068	-111.22766	568	7.5	34.6	0.0	
	27.70676	-111.22758	468	8.7	34.6	0.1	5.2
	27.70678	-111.22758	319	11	34.8	0.3	
	27.70678	-111.22762	319	12	34.8	0.3	3.3
	27.70682	-111.22762	168	15	35.0	1.6	4.2
	27.7068	-111.2275	58	22	35.0	3.4	6.4
	27.7068	-111.2275	8	30	35.0	4.4	3.3
27.7068	-111.2275	8	30	35.0	4.4		

VCTD10	27.41402	-111.3864	1605	3.0	34.6	0.6	773
Smoker Site	27.41292	-111.38692	1752	2.9	34.6	0.7	537
	27.41149	-111.38764	1755	2.9	34.6	0.6	577
	27.41128	-111.38774	1751	3.0	34.6	0.7	1060
	27.41056	-111.38812	1749	3.3	34.6	0.7	7669
	27.40864	-111.38908	1744	3.0	34.6	0.7	2911
	27.41338	-111.38672	1691	2.9	34.6	0.7	290
	27.41242	-111.38718	1592	3.0	34.6	0.6	623
	27.41168	-111.38756	1589	3.0	34.6	0.6	672
	27.41062	-111.38809	1585	3.0	34.6	0.6	846
	27.40934	-111.38874	1582	3.0	34.6	0.6	1010
CTD01	27.30388	-111.5024	1998	2.8	34.6	0.9	
Graben Site	27.30388	-111.5024	1999	2.8	34.6	0.9	
	27.30388	-111.5024	1998	2.8	34.6	0.9	19
	27.30388	-111.5024	1999	2.8	34.6	0.9	
	27.30388	-111.5024	1998	2.8	34.6	0.9	
	27.3038	-111.50236	1804	2.9	34.6	0.7	
	27.3038	-111.50234	1804	2.9	34.6	0.7	
	27.3038	-111.50234	1804	2.9	34.6	0.7	2.4
	27.3038	-111.50234	1804	2.9	34.6	0.7	
	27.3038	-111.50234	1804	2.9	34.6	0.7	
	27.30386	-111.50246	1003	4.6	34.5	0.2	
	27.30386	-111.50246	1003	4.6	34.5	0.2	
	27.30386	-111.50246	1003	4.6	34.5	0.2	3.2
	27.30386	-111.50246	1003	4.6	34.5	0.2	
	27.3038	-111.5024	103	16	35.0	1.8	5.0
	27.3038	-111.5024	103	16	35.0	1.8	
	27.3038	-111.5024	103	16	35.0	1.8	
	27.3038	-111.5024	103	16	35.0	1.8	
	27.3038	-111.5024	103	16	35.0	1.8	
	27.30372	-111.50236	13	29	35.2	4.3	
	27.30372	-111.50238	13	29	35.2	4.3	
	27.30374	-111.50238	13	29	35.2	4.3	3.3

27.30374 -111.50238 13 29 35.2 4.3

Table S5: U-Th isotope systematics, $^{87}\text{Sr}/^{86}\text{Sr}$ isotope ratio signatures, light stable isotope data and XRD mineral identification of authigenic carbonates recovered at "Central-Site" sediment surface (SO241, St. 56, VgHG-4, 1843 m water depth) applying methods as described in this paper and Berndt et al. (2014).

sample ident & code	description	dissolution mode ⁽¹⁾	sample weight (mg) ⁽²⁾	repres. non-silic. fract. (%) ⁽³⁾	$\delta^{13}\text{C}$ (V-PDB) ⁽⁴⁾	$\delta^{18}\text{O}$ (V-PDB) ⁽⁴⁾	$^{87}\text{Sr}/^{86}\text{Sr}$ ⁽⁵⁾	XRD mineral analyses (all identified normalized to 100%) ⁽⁶⁾
outer rim	white coating							
470-15-I-1a-L	leachate	weak	129.5	91			0.709178 ± 0.000007	
470-15-I-1b-L	leachate	*weak	102.6	92			0.709174 ± 0.000006	
470-15-II-L	leachate	medium	132.8	93			0.709179 ± 0.000006	
470-15-III-L	leachate	strong	143.6	94			0.709204 ± 0.000006	
470-15	leachates	**mean						
470-15-I-1a-R	residue	total	12.1				0.707915 ± 0.000010	
470-15-II-R	residue	total	9.5				0.708274 ± 0.000006	
470-15-III-R	residue	total	9.6				0.707773 ± 0.000009	
470-15	bulk	***all			-46.6 ± 0.2	3.7 ± 0.3		Aragonite(90%), Calcite (6 %), Quarz (4)
inner core	dark matrix							
472-15-I-L	leachate	weak	146.5	96			0.709176 ± 0.000006	
472-15-II-L	leachate	medium	158.4	96			0.709178 ± 0.000007	
472-15-III-L	leachate	strong	192.9	96			0.709175 ± 0.000008	
472-15	leachates	**mean						
472-15-I-R	residue	total	6.4				0.708667 ± 0.000009	
472-15-II-R	residue	total	6.2				0.708513 ± 0.000014	
472-15-III-R	residue	total	7.6				0.708077 ± 0.000011	
472-15	bulk	***all			-44.7 ± 0.4	3.6 ± 0.1		Aragonite(88%), Calcite (12 %)

sample ident & code	Age (kys BP) ⁽⁷⁾	²³⁸ U conc. (ppm)	²³² Th conc. (ppb)	$\delta^{234}\text{U}_{(o)}$ ⁽⁸⁾	(²³⁰ Th/ ²³² Th)	(²³⁸ U/ ²³² Th)	(²³⁰ Th/ ²³⁴ U) ⁽⁹⁾	$\delta^{234}\text{U}_{(t)}$ ⁽¹⁰⁾
outer rim								
470-15-I-1a-L	0.17 ± 0.06	3.96 ± 0.02	60.74 ± 138.0 ± 4.7	1.42 ± 0.02	199.80 ± 1.52	0.0016 ± 0.0005	138.1 ± 4.8	
470-15-I-1b-L	0.17 ± 0.04	4.28 ± 0.03	56.50 ± 144.7 ± 7.2	1.47 ± 0.02	232.17 ± 2.01	0.0015 ± 0.0004	144.9 ± 7.3	
470-15-II-L	0.12 ± 0.04	4.10 ± 0.03	41.41 ± 138.4 ± 7.4	1.44 ± 0.02	303.94 ± 2.66	0.0011 ± 0.0003	138.5 ± 7.5	
470-15-III-L	0.24 ± 0.14	4.48 ± 0.02	133.64 ± 136.6 ± 5.5	1.32 ± 0.01	102.91 ± 0.75	0.0022 ± 0.0013	136.8 ± 5.7	
470-15	0.17 ± 0.10							
470-15-I-1a-R		3.67 ± 0.02	5822.4 ± 82.8 ± 2.7	1.07 ± 0.01	1.94 ± 0.01	0.1522 ± 0.3198		
470-15-II-R		5.04 ± 0.02	8712.3 ± 71.7 ± 3.6	1.08 ± 0.01	1.78 ± 0.02	0.1733 ± 0.3445		
470-15-III-R		3.01 ± 0.01	8116.2 ± 55.0 ± 2.6	1.05 ± 0.01	1.14 ± 0.01	0.2540 ± 0.5777		
470-15	0.07 ± 0.05						142.0 ± 38.0	
inner core								
472-15-I-L	0.10 ± 0.06	4.06 ± 0.02	54.1 ± 138.8 ± 5.7	1.31 ± 0.01	229.95 ± 1.83	0.0009 ± 0.0006	138.9 ± 5.8	
472-15-II-L	0.11 ± 0.05	3.88 ± 0.02	46.6 ± 139.1 ± 5.2	1.36 ± 0.01	255.93 ± 1.93	0.0010 ± 0.0005	139.2 ± 5.2	
472-15-III-L	0.17 ± 0.13	4.18 ± 0.03	102.9 ± 140.5 ± 7.5	1.28 ± 0.01	124.50 ± 1.10	0.0015 ± 0.0012	140.7 ± 7.7	
472-15	0.13 ± 0.07							
472-15-I-R		3.93 ± 0.02	8154.3 ± 58.4 ± 3.9	1.08 ± 0.01	1.48 ± 0.01	0.2083 ± 0.4228		
472-15-II-R		4.5 ± 0.02	8485.3 ± 64.3 ± 2.5	1.07 ± 0.01	1.64 ± 0.01	0.1863 ± 0.3800		
472-15-III-R		1.9 ± 0.01	7251.7 ± -18.5 ± 2.2	1.04 ± 0.01	0.81 ± 0.01	0.3651 ± 0.8939		
472-15	0.05 ± 0.08						137.0 ± 55.0	

Round brackets denote activity ratio. Uncertainties presented on 2 sigma level.

Note 1: Different dissolution modes conducted for sufficient spread of sub-samples postulated of cogenetic origin and the detrital end-member in order to apply by the isoplot 3.75 software of the Berkeley Geochronology Center, CA, USA for isochron age estimates.

weak = 2 ml 0.8 N HNO₃; medium = 2 ml 4 N HNO₃; strong = 2 ml 13.5 N HNO₃ (all leachates 2 h at RT); total = from individual leachates remaining residues by conc. HF and conc. HNO₃

* Powder sample aliquot introduced for leachate procedure reproducibility.

** Mean of single ²³⁰Th/²³⁴U ages calculated (note 6) for different leachates of homogenized powder sample

aliquots.

*** Ages deduced by Rosholt-1 isochron approach in 3 dimensional projection (note 1) combining all leachates and residues.

Note

2: The sample weight represents the analysed amount dissolved in the individual dissolution mode. Remaining material was 2 x centrifuged, dried down and weighed for residue analyses and recalculation of the dissolved sample weight.

Note

3: The equivalent percentage of the analysed non-silicate fraction represented by the sample weight.

Note

4: Both samples were analysed on three aliquots each (uncertainty is given in 2 SD, n=3).
⁸⁷Sr/⁸⁶Sr isotope ratio according to method described for pore water analyses in this paper (uncertainties are given for individual measurements on 2 SEM level; external reproducibility of NIST-SRM 987 is assumed to be for this data set at 0.000015, n=4).

5: Especially on small sample aliquots of few 10 mg as required in this study relative quantifications are accompanied by large uncertainties. Furthermore, the sensitivity for mineral identification is typically restricted to contents higher than 5% and significant amounts of amorphous material remained not identified.

Note 6: Resulting spectra were analyzed with the software X Powder (X Powder, Spain).

Note 7: *Italics* mark individual ages characterized by high uncertainties at low ²³⁰Th/²³²Th ratios and high impact of ²³⁰Th correction values.

Note

8: (meas. ²³⁴U/²³⁸U act. ratio -1) * 1000 at time 0 (today)
Note 9: ²³⁰Th/²³⁴U activity ratio corrected for inherited ²³⁰Th by application of ²³⁰Th/²³²Th activity ratio of 1.066 ± 0.029 (2SD, n=6) as deduced from the mean residue value.

Note

10: (²³⁴U/²³⁸U act. ratio at zero age -1) * 1000 at time (t = U/Th-age)
Measured ²³⁴U/²³⁸U back-calculated for ²³⁴U decay since carbonate precipitation, based on the individual U/Th ingrowth age and half-lives measured by Cheng et al. (2000).
 $\delta^{234}\text{U}_{(t)}$ of Rosholt-1 isochron approaches based on isoplot 3.75 calculation.