Supplement of Biogeosciences, 15, 5715–5731, 2018
https://doi.org/10.5194/bg-15-5715-2018-supplement

Biogeosciences Open Access EGU

Supplement of

On the formation of hydrothermal vents and cold seeps in the Guaymas Basin, Gulf of California

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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}Th/^{232}Th activity ratio of the leachate remaining residues by total dissolution (for details refer to notes in supplementary table S5).

Addition XRD analyses

Representative aliquots of the authigenic carbonate were analyzed for semi-quantitative analyses and mineral identification applying x-ray diffraction (XRD) by using a Philips X-ray diffractometer PW 1710. Note, 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. Resulting spectra were analyzed with the software XPowder (XPowder, Spain).

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 halflives 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

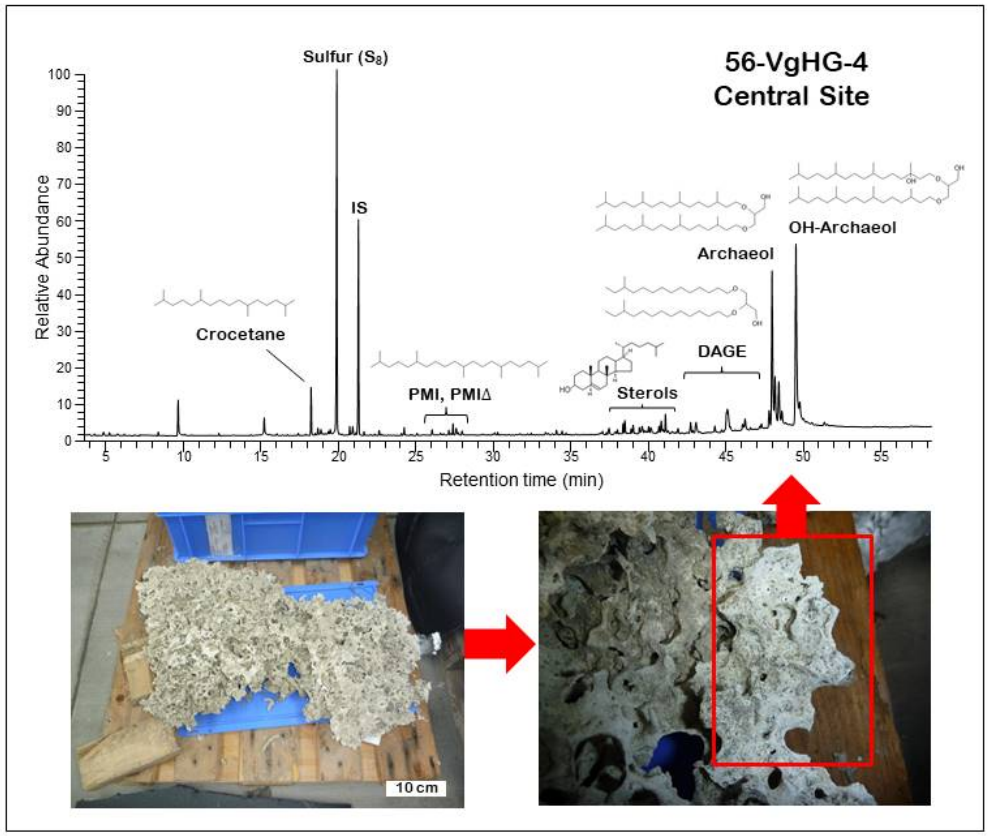

Fig. S1. Total ion current chromatogram of the total lipid extract extracted from *seep carbonate 56-VgHG-4 (Central Site)*. Compounds were analyzed as trimethylsilyl (TMS-) derivatives. Structures are provided for representative compounds. PMI = 2,6,10,15,19-pentamethylicosane; PMIΔ = unsaturated derivatives 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.

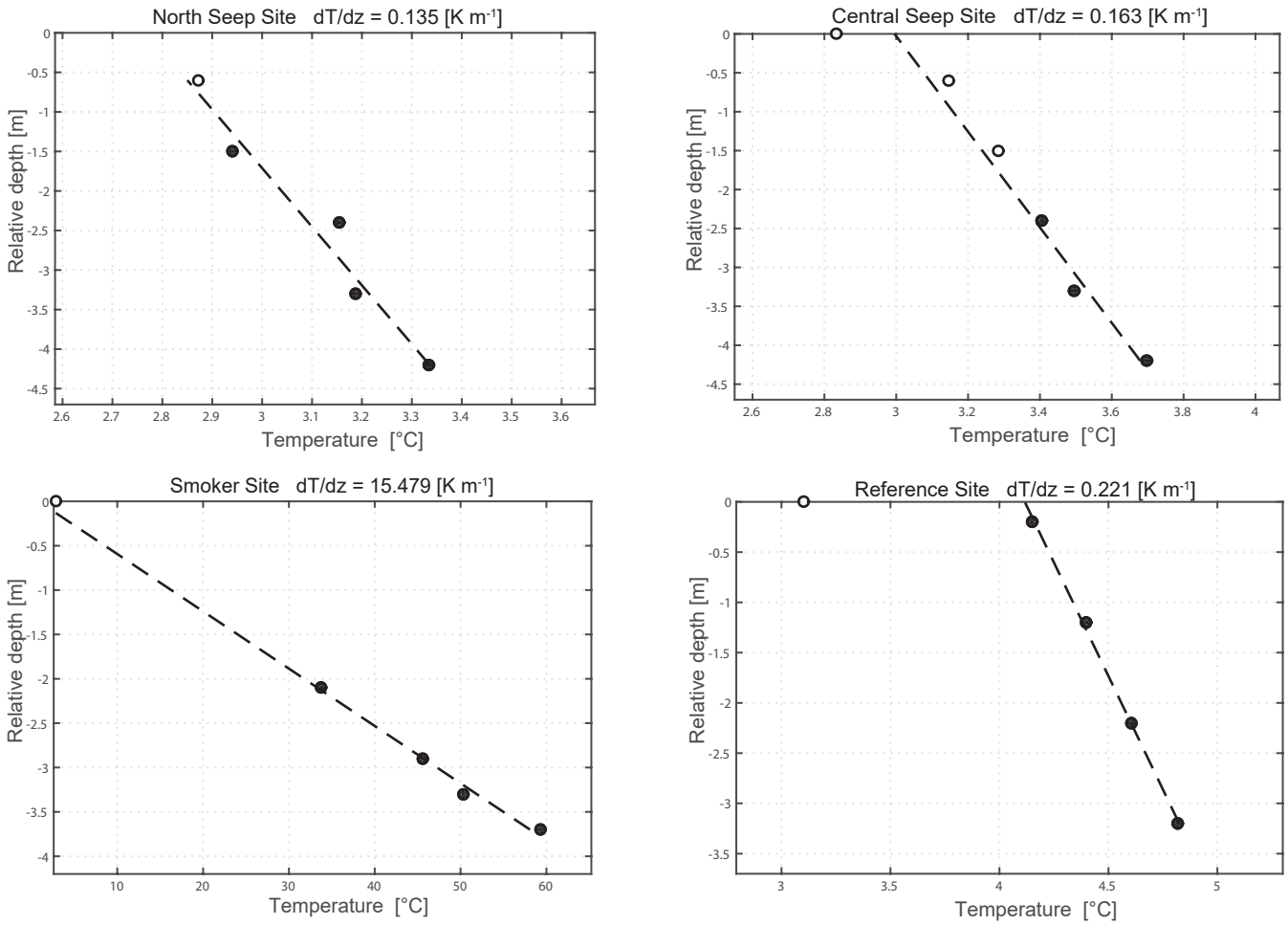

Figure S2: Temperature gradients of temperature measurements for North and Central Seep as well as for Reference Site. One representative example of Smoker Site is shown. Note that black circles represent measurements used to calculate the temperature gradient, while emptycircles were omitted from calculations.

Supplementary tables

Table S1: Pore fluid data of GCs and MUCs sampled in the Guaymas Basin.

Site/ Site name	Depth	TA	TH_2S	Cl	SO_4	Mg	Li	NH_4	Ca	Sr
	(cm)	(meq l^{-1})	(µM)	(mM)	(mM)	(mM)	(µM)	(µM)	(mM)	(µM)
GCs										
St.07 - GC01/	10	6.3	216	561	24.6	53.2	24.6	30	9.6	80.1
North Seep	35	3.4	20	559	27.3	53.1	24.9	32	10.0	85.5
	60	3.0	b.d.l.	560	27.8	53.2	25.0	42	10.2	86.7
	85	3.3	10	567	27.7	52.7	24.9	52	10.0	86.0
	110	5.5	23	553	23.9	52.7	24.8	63	9.5	83.1
	125	7.7	92	560	20.0	52.0	24.7	67	8.4	79.1
	157	21.6	64	567	1.33	49.3	24.0	69	4.0	56.6
	174	23.5	1817	569	1.51	49.7	23.8	57	4.3	56.1
	190	19.9	598	558	1.42	48.7	23.3	89	3.6	48.6
	210	24.3	2121	561	2.34	50.0	23.4	49	4.5	51.8
	230	27.9	2536	559	0.30	49.4	23.1	33	4.2	47.2
	247	23.3	1382	567	0.74	48.9	22.2	94	3.8	43.3
	272	28.5	2530	536	0.11	48.8	22.5	40	3.9	42.0
	294	27.9	1697	545	0.06	49.3	22.6	101	3.2	38.9
St.09 - GC03/	21	2.5	0.0	565	28.8	53.7	25.0	52	10.2	87.6
Central Seep	210	2.6	0.0	566	28.8	53.1	24.7	56	10.1	85.9
	240	2.7	0.0	557	28.8	53.1	24.8	73	10.1	86.3
	265	2.8	1.2	565	28.7	53.1	24.6	84	10.1	86.5
	290	3.0	3.9	568	28.7	53.3	24.7	110	10.1	86.8

	320	2.9	0.0	568	28.6	53.0	24.7	108	10.0	86.1
	360	3.2	6.7	572	28.8	53.2	24.6	109	10.1	86.4
	400	3.1	0.1	565	28.4	53.2	24.7	162	10.1	86.8
	450	3.8	6.2	560	27.5	53.0	24.5	183	10.0	86.4
	500	4.1	52	560	27.1	53.0	24.6	212	9.9	85.9
	545	4.9	78	565	26.8	53.1	24.6	222	9.9	85.9
	590	5.0	39	561	26.2	52.8	24.5	231	9.8	85.2
	625	6.6	127	565	25.3	53.1	24.4	234	9.6	85.3
	660	8.7	107	566	23.8	52.9	24.3	n.d.	9.2	84.0
St.09 - GC13/	20	2.8	14	561	28.4	53.8	24.4	46	10.3	87.7
Central Seep	70	2.7	5	556	28.2	53.3	24.3	55	10.2	87.2
	100	2.7	11	551	28.0	53.5	24.1	45	10.2	87.4
	130	2.6	2	549	27.9	53.2	24.3	48	10.2	87.4
	160	2.8	3	552	28.0	53.1	24.3	78	10.1	86.8
	200	2.9	b.d.l.	550	27.9	53.1	24.3	101	10.1	86.3
	230	3.1	0.5	558	27.9	53.2	24.1	140	10.1	86.5
	260	3.3	13	557	27.8	53.3	24.3	134	10.1	86.8
	305	3.4	77	556	27.8	53.1	24.3	172	10.1	86.4
	340	3.4	84	560	28.0	53.5	24.1	225	10.1	87.5
	365	3.5	113	557	27.8	53.1	24.0	179	10.1	86.2
	400	3.9	160	555	27.4	53.0	24.3	219	10.0	86.3
	415	4.4	423	557	27.3	52.6	24.8	319	10.1	87.6
	430	4.6	480	558	27.2	53.5	24.6	685	10.1	87.4
	445	4.7	n.d.	555	26.9	52.9	24.5	n.d.	10.1	87.3
	470	5.1	n.d.	550	26.7	53.2	24.7	n.d.	9.9	86.5
St.72 - GC15/	7	23.3	7336	552	11.5	52.8	24.2	117	7.3	58.0
Central Seep	22	22.5	6693	551	13.0	52.5	24.1	96	8.2	67.7
	30	23.1	7271	552	11.8	52.7	24.2	91	7.9	64.2

	36	13.1	3310	552	19.9	53.3	24.6	74	9.0	75.4
	47	10.7	1733	552	21.9	53.2	24.4	73	9.1	76.1
St.51 - GC09/	10	2.8	b.d.l.	557	28.4	55.4	24.4	67	10.3	88.7
Smoker Site	30	2.7	b.d.l.	554	28.2	54.3	23.9	73	10.2	86.7
	50	2.7	b.d.l.	554	28.1	54.6	23.9	95	10.3	87.0
	70	2.8	b.d.l.	555	28.2	55.6	24.0	95	10.5	88.6
	93	3.0	b.d.l.	554	28.1	54.8	23.5	124	10.3	87.0
	110	2.9	b.d.l.	552	27.9	54.9	22.9	92	10.3	86.7
	130	3.0	b.d.l.	549	27.8	55.8	22.9	146	10.5	88.9
	150	3.1	b.d.l.	552	27.8	55.2	22.7	129	10.4	86.4
	170	3.1	b.d.l.	553	27.9	55.1	22.5	175	10.3	86.8
	193	3.2	b.d.l.	551	27.8	55.4	22.7	196	10.3	87.2
	210	3.3	b.d.l.	560	28.2	55.6	22.3	170	10.4	87.5
	230	3.4	9.4	558	28.0	56.7	22.4	185	10.7	89.2
	250	3.4	3.6	556	28.0	56.0	22.6	215	10.5	88.4
	270	3.6	6.9	559	28.0	56.3	22.8	217	10.6	88.6
	290	3.6	1.9	563	28.2	55.4	22.9	237	10.5	87.7
	306	3.5	2.5	n.d.	n.d.	55.6	22.6	250	10.6	88.5
	320	3.5	1.6	557	27.9	57.2	22.2	230	11.0	90.9
	340	3.6	b.d.l.	575	29.2	57.4	22.5	231	11.1	91.0
	355	3.5	b.d.l.	551	27.4	56.9	21.5	269	11.0	90.3
	370	3.4	b.d.l.	549	27.5	56.8	22.9	249	11.0	91.2
	390	3.6	b.d.l.	560	27.9	56.8	24.0	257	11.2	92.7
	400	3.4	b.d.l.	554	27.5	57.4	24.7	242	11.4	94.3
	410	3.4	b.d.l.	559	27.1	56.4	28.4	342	11.4	95.6
	420	3.0	b.d.l.	568	27.6	57.5	29.8	388	11.5	95.6
	435	3.2	b.d.l.	557	26.6	54.4	31.5	396	11.2	90.1
	450	2.8	b.d.l.	560	26.4	52.7	33.5	437	11.0	79.6
	460	2.7	b.d.l.	558	26.4	52.7	33.3	424	10.8	88.1

	470	2.8	b.d.l.	562	26.3	54.8	33.7	346	11.1	94.8
St.58 - GC10/	20	3.6	b.d.l.	559	28.5	54.3	23.7	262	10.2	86.8
Smoker Site	45	n.d.	b.d.l.	549	27.7	54.3	23.5	n.d.	10.2	87.4
	70	3.4	1.3	564	28.7	55.3	23.4	259	10.5	88.1
	120	3.4	0.2	563	28.5	54.9	23.5	295	10.3	87.2
	145	n.d.	b.d.l.	531	26.6	55.0	23.4	n.d.	10.4	88.0
	170	3.3	b.d.l.	558	28.1	55.5	23.4	304	10.4	87.9
	210	3.2	b.d.l.	563	28.4	53.4	22.9	312	10.1	84.9
	225	n.d.	b.d.l.	566	28.4	54.4	23.9	n.d.	10.4	87.8
	240	3.1	0.8	563	28.2	55.8	24.0	281	10.4	88.7
	255	n.d.	b.d.l.	567	28.4	54.6	23.9	n.d.	10.5	88.1
	270	3.1	b.d.l.	566	28.3	55.6	24.1	266	10.4	87.9
	285	n.d.	b.d.l.	554	27.5	55.2	24.7	n.d.	10.5	89.2
	310	3.0	0.2	566	28.3	56.1	24.4	223	10.5	88.8
	325	n.d.	b.d.l.	568	28.3	54.9	24.8	n.d.	10.5	90.1
	340	2.9	2.7	564	28.1	56.3	25.0	213	10.6	89.7
	355	n.d.	b.d.l.	570	28.2	55.4	25.2	n.d.	10.7	90.1
	370	3.0	1.9	568	28.1	56.5	25.0	181	10.8	90.7
	385	n.d.	b.d.l.	567	27.9	56.4	25.0	n.d.	11.0	92.3
	410	2.8	2.2	569	28.1	56.2	25.7	164	11.0	91.9
	430	2.7	2.3	569	28.0	55.5	26.7	165	11.1	92.2
	450	2.7	1.7	568	27.9	57.4	26.0	133	11.6	94.8
	470	2.8	2.4	565	27.9	56.2	26.9	90	11.5	93.6
St.47 - GC07/	5	3.1	37	564	26.0	52.8	22.9	478	10.6	88.2
Slope Site	10	2.6	17	566	26.7	53.0	23.4	404	10.4	87.6
	15	7.0	25	567	26.4	52.7	20.5	457	9.5	87.2
	20	7.0	24	568	26.2	52.6	23.0	465	10.5	88.0
	25	10.1	268	569	24.7	52.8	23.0	769	10.5	87.9

30	10.1	285	558	24.3	52.7	21.9	648	10.5	88.0
35	10.3	339	561	24.1	52.7	22.1	718	10.4	88.6
40	11.4	426	561	23.5	52.8	22.1	772	10.4	87.9
45	13.2	543	560	22.6	53.2	21.9	840	10.4	88.7
50	13.1	653	565	22.6	52.9	21.4	840	10.3	88.2
60	14.2	764	564	23.8	52.9	21.4	1000	10.2	88.7
70	15.4	951	564	21.0	52.8	21.3	1059	10.1	87.6
80	16.2	1139	566	20.8	52.7	20.9	1072	10.0	87.8
90	17.4	1220	564	19.9	52.8	20.7	1212	9.9	88.1
100	18.7	1383	564	19.0	52.8	20.7	1251	9.9	87.4
120	19.6	1512	568	18.4	53.0	20.5	1007	9.8	87.6
140	21.8	1880	567	18.4	52.7	20.4	1297	9.3	87.6
160	25.5	2377	561	17.0	53.3	20.0	1370	9.1	88.5
180	27.5	2602	563	14.8	52.9	19.7	1630	8.7	87.4
200	28.8	2880	565	13.0	52.9	19.5	1916	8.5	87.6
230	31.9	3452	569	12.0	53.3	19.3	2162	8.1	89.2
260	36.0	4036	561	10.1	52.4	18.7	2276	7.5	87.4
290	38.2	4428	565	5.14	53.0	18.7	2872	7.2	88.1
320	42.4	5142	564	2.84	52.9	18.2	2812	6.6	87.9
350	44.5	5199	564	0.96	52.6	17.8	3242	6.0	87.5
380	45.8	5292	564	0.71	53.2	17.6	4310	5.6	88.0
410	46.9	5053	562	0.73	53.1	17.6	3386	5.3	87.2
440	48.2	4765	567	0.66	53.7	17.6	4206	5.2	87.2
470	50.4	4488	566	0.67	54.0	17.6	4182	5.0	87.4
500	50.2	4857	570	0.58	54.6	17.6	3568	4.8	87.3
530	50.9	4547	566	0.58	54.6	17.8	4442	4.6	86.0
560	53.1	4329	572	0.54	55.2	17.8	4846	4.5	86.3
590	54.1	3861	572	0.65	55.2	17.8	4696	4.3	85.2
620	56.8	3465	571	0.54	56.2	18.0	5268	4.2	85.8
650	58.5	2870	570	0.62	56.5	18.0	6002	4.1	84.8

	680	62.4	2622	569	0.54	57.3	18.1	6918	3.9	85.4
	710	62.9	2243	578	0.46	58.4	18.4	7346	3.9	85.8
	740	65.1	2132	572	0.38	58.2	18.4	7486	3.7	85.2
MUCs										
St.33 - MUC11/	0.0	2.5	2.9	558	28.4	53.9	24.6	1.0	10.4	87.3
North Seep	0.5	3.0	62	554	27.9	53.4	24.6	7.5	10.3	87.6
	1.5	3.0	49	556	28.1	53.2	24.6	14	10.3	86.5
	2.5	3.8	367	565	28.1	53.5	24.8	11	10.3	87.0
	3.5	4.8	906	563	27.2	53.6	24.8	12	10.2	86.3
	4.5	6.9	1661	567	25.8	53.1	24.6	11	9.9	83.2
	6.0	9.1	2162	570	24.2	53.1	24.6	13	9.7	81.1
	8.0	9.3	2170	571	24.1	52.7	24.6	14	9.6	81.0
	10.0	16.6	4554	570	18.7	52.4	24.4	13	8.9	75.1
	12.5	20.6	5472	569	16.1	52.2	24.3	13	8.4	71.7
	15.5	28.4	5988	574	9.79	51.9	24.2	17	7.5	64.4
	18.5	26.9	4649	569	10.6	51.5	24.0	19	7.5	65.2
	22.0	30.5	4992	573	8.24	51.4	24.0	18	7.2	64.1
St.23 - MUC5/	0.0	2.5	b.d.l.	560	28.6	55.3	25.3	0.3	10.6	90.6
Ring Seep	0.5	2.7	b.d.l.	556	28.3	53.5	24.7	0.2	10.3	87.3
	1.5	2.9	b.d.l.	552	28.1	53.7	24.9	5.6	10.3	87.3
	2.5	2.9	b.d.l.	565	29.4	53.2	24.9	16	10.2	87.5
	3.5	2.9	b.d.l.	557	28.3	53.5	25.0	19	10.3	88.4
	4.5	2.9	b.d.l.	562	28.6	53.5	25.1	n.d.	10.3	87.9
	5.5	2.9	b.d.l.	557	28.2	53.3	25.1	28	10.3	87.9
	7.0	2.9	b.d.l.	561	28.2	53.3	25.0	26	10.3	88.0
	9.0	2.9	b.d.l.	563	28.4	53.7	25.4	29	10.4	88.7
	11.0	2.9	0.54	566	28.4	53.4	25.3	25	10.3	88.2

	13.0	2.9	7.61	563	28.3	53.3	25.2	27	10.3	88.0
	15.5	2.9	44	563	28.3	53.3	25.4	n.d.	10.3	87.6
	18.5	3.0	66	561	28.0	53.4	25.7	n.d.	10.3	87.8
	22.0	3.1	105	566	28.2	53.1	25.9	47	10.3	87.9
St.15 - MUC02/	0.0	2.4	b.d.l.	566	28.7	54.3	24.7	0.0	10.4	88.8
Reference Site	0.5	2.6	b.d.l.	561	28.4	53.5	26.2	1.0	10.3	88.1
	1.5	2.6	b.d.l.	560	28.4	53.6	26.2	0.0	10.3	87.4
	2.5	2.7	b.d.l.	565	28.7	53.4	25.5	0.0	10.3	87.0
	3.5	2.7	b.d.l.	562	28.5	53.6	25.2	0.0	10.3	87.5
	4.5	2.7	b.d.l.	565	28.8	53.2	24.6	0.4	10.2	87.4
	5.5	2.7	b.d.l.	565	28.6	53.3	24.7	1.3	10.3	87.4
	7.0	2.7	b.d.l.	557	28.3	53.0	24.4	3.6	10.2	87.4
	9.0	2.7	b.d.l.	558	28.4	53.1	24.5	6.7	10.2	86.9
	11.0	2.8	b.d.l.	554	28.0	53.3	24.4	8.0	10.2	87.1
	13.0	2.7	b.d.l.	560	28.5	53.3	24.5	10	10.3	87.4
	15.5	2.8	b.d.l.	559	28.4	53.4	24.5	15	10.3	87.6
	18.5	2.9	b.d.l.	560	28.2	53.4	24.3	22	10.3	88.0
	22.0	2.9	4.9	557	28.1	53.3	24.4	31	10.3	87.7
	26.0	3.0	23	557	28.1	53.2	24.2	42	10.2	88.1
	30.0	3.2	11	555	27.9	53.3	24.3	53	10.3	87.9
St.22 - MUC04/	0.0	2.6	13	574	29.4	54.1	24.6	0.0	10.3	88.2
Central Seep	0.5	3.1	n.d.	554	28.0	53.6	24.7	4.9	10.3	87.1
	1.5	3.5	54	557	27.9	53.3	24.5	8.4	10.2	86.8
	2.5	3.5	106	560	27.9	53.2	24.5	11	10.2	87.0
	3.5	3.9	276	555	27.4	53.2	24.4	11	10.1	86.7
	4.5	4.5	502	556	27.2	53.2	24.4	25	10.1	87.1
	5.5	5.3	839	558	26.8	52.9	24.3	28	10.0	85.9
	7.0	6.0	1134	557	26.2	53.3	24.3	35	10.1	86.6

	9.0	8.0	1844	559	25.4	53.1	24.2	49	10.0	85.3
	11.0	8.8	2080	561	24.8	53.1	24.1	36	10.0	85.2
	13.0	10.4	2621	558	24.2	53.2	24.2	43	9.9	84.9
	15.5	10.4	2700	559	24.2	53.3	24.3	44	10.0	84.9
	18.5	12.4	3546	558	22.8	53.0	24.4	33	9.9	83.6
	22.0	13.2	3299	557	22.2	53.0	24.4	28	9.9	83.0
	26.0	14.4	3810	560	21.5	53.2	24.5	21	9.9	82.7
St.65 - MUC15/	0.0	2.4	b.d.l.	546	28.0	54.6	24.4	0.3	10.4	89.5
Smoker Site	0.5	2.4	b.d.l.	540	27.7	53.7	25.3	0.1	10.3	88.0
	1.5	2.7	b.d.l.	541	27.6	53.7	24.7	0.0	10.3	87.7
	2.5	2.7	b.d.l.	546	28.0	53.3	24.6	0.5	10.3	87.3
	3.5	2.8	b.d.l.	544	27.8	53.2	24.5	1.5	10.2	87.1
	4.5	2.8	b.d.l.	544	27.8	53.1	24.5	4.4	10.2	86.8
	5.5	2.8	b.d.l.	548	28.1	53.0	24.4	6.6	10.2	87.1
	7.0	2.9	b.d.l.	549	28.1	53.1	24.4	14	10.2	87.3
	9.0	2.9	b.d.l.	550	28.1	52.9	24.0	18	10.3	87.0
	11.0	3.1	b.d.l.	545	27.8	53.2	23.9	31	10.2	87.9
	13.0	3.1	b.d.l.	548	28.0	53.4	24.3	27	10.2	87.6
	15.5	3.1	b.d.l.	547	27.9	52.9	23.9	37	10.1	87.1
	18.5	3.1	b.d.l.	552	28.2	54.7	24.8	36	10.7	90.0
	22.0	3.0	b.d.l.	536	27.3	52.8	23.9	39	10.1	86.4
	26.0	3.0	b.d.l.	543	27.6	53.5	24.2	41	10.2	87.8
	30.0	3.0	b.d.l.	541	27.5	53.3	24.3	37	10.2	87.6
St.66 - MUC16/	0.0	2.4	b.d.l.	546	27.9	54.4	24.6	0.0	10.4	88.9
Smoker Site	0.5	2.6	b.d.l.	557	28.5	53.5	24.2	5.0	10.3	87.5
	1.5	2.7	b.d.l.	551	28.2	53.7	24.3	10	10.3	88.2
	2.5	2.9	b.d.l.	549	28.0	53.5	24.2	16	10.3	87.7
	3.5	2.9	b.d.l.	548	28.0	53.5	24.4	17	10.3	88.1

4.5	3.0	b.d.l.	557	28.4	53.6	24.3	20	10.3	88.1
5.5	3.1	b.d.l.	547	27.8	53.5	24.4	20	10.3	87.7
7.0	3.1	b.d.l.	548	28.9	53.4	24.3	21	10.3	87.6
9.0	3.0	b.d.l.	547	27.8	53.8	24.5	22	10.4	87.9
11.0	2.9	b.d.l.	555	28.2	53.5	24.2	22	10.3	87.7
13.0	2.9	b.d.l.	548	27.9	53.5	24.1	22	10.3	87.8
15.5	3.0	b.d.l.	549	27.9	53.6	24.2	20	10.4	87.4
18.5	3.0	b.d.l.	555	28.3	53.7	24.2	20	10.5	88.2

Abbreviations: b.d.l., below detection limit; n.d., not determined

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

Site/ Site name	Depth (cm)	$^{87}Sr/^{86}Sr$ Aliquot 1	2 SEM	$^{87}Sr/^{86}Sr$ Aliquot 2*	2 SEM	$^{87}Sr/^{86}Sr$ Aliquot 3*	2 SEM	$^{87}Sr/^{86}Sr$ Aliquot 4*	2 SEM	Mean $^{87}Sr/^{86}Sr$**
GCs										
St.07 - GC01/	10	0.709178	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
North Seep	174	0.709160	9.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	272	0.709169	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	294	0.709161	9.E-06	0.709146	9.E-06	n.d.	n.a.	n.d.	n.a.	0.709153
St.09 - GC03/	21	0.709183	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
Central Seep	660	0.709174	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
St.51 - GC09/	10	0.709176	8.E-06	0.709179	7.E-06	n.d.	n.a.	n.d.	n.a.	0.709178
Smoker Site	320	0.709170	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	400	0.709133	9.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	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	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	470	0.708990	9.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
St.58 - GC10/	20	0.709168	7E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
Smoker Site	450	0.709150	6E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
MUCs										
St.33 - MUC11/	0.0	0.709162	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
North Seep	0.5	0.709169	7.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	22.0	0.709178	7.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
St.23 - MUC5/	0.0	0.709191	8.E-06	0.709189	7.E-06	n.d.	n.a.	n.d.	n.a.	0.709190
Ring Seep	0.5	0.709173	7.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	9.0	0.709170	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	22.0	0.709150	6.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
St.15 - MUC02/	0.0	0.709187	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
Reference Site	0.5	0.709181	9.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	30.0	0.709176	7.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
St.22 - MUC04/	0.0	0.709173	6.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
Central Seep	0.5	0.709185	7.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.
	26.0	0.709170	8.E-06	n.d.	n.a.	n.d.	n.a.	n.d.	n.a.	n.a.

*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

Abbreviations: n.d., not determined; n.a., not applicable

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) (µM)	Ethane (C2) (µM)	Propane (C3) (µM)	C1/ (C2+C3)	$\delta^{13}C_{Methane}$ (‰)	$\delta^{13}C_{Ethane}$ (‰)	$\delta D_{Methane}$ (‰)
GCs								
St.07 - GC01/	44	6.3	0.23	0.16	16	-47.0	n.d.	n.d.
North Seep	94	20	0.12	0.07	105	-53.4	n.d.	n.d.
	144	450	0.78	0.11	509	-77.2	-27.4	n.d.
	194	6863	0.33	0.15	14265	-60.9	-26.1	-190
	244	2004	0.16	0.18	6045	-60.6	n.d.	n.d.
	294	13954	b.d.l.	0.14	101266	-58.4	-28.7	-196
Gashydrate	265	497283	b.d.l.	b.d.l.	n.a.	-58.9	n.d.	-198
	265	710604	b.d.l.	b.d.l.	n.a.	-58.7	n.d.	-196
	265	330618	b.d.l.	b.d.l.	n.a.	-58.1	n.d.	-197
	265	414102	b.d.l.	b.d.l.	n.a.	-57.9	n.d.	-196
St.09 - GC13/	20	7.7	0.08	0.05	59	-40.5	n.d.	n.d.
Central Seep	70	20	0.18	0.12	66	-51.1	n.d.	n.d.
	120	6.0	0.07	0.04	53	-50.7	n.d.	n.d.
	170	10	0.13	0.07	50	-52.0	n.d.	n.d.
	220	14	0.20	0.08	53	-48.2	n.d.	n.d.
	270	8.8	0.12	0.04	54	-39.2	n.d.	n.d.
	320	3.8	0.13	0.06	20	-26.5	n.d.	n.d.
	370	5.2	0.17	0.07	21	-34.6	n.d.	n.d.
	420	5.4	0.27	0.07	16	-45.9	n.d.	n.d.
	470	7.2	0.24	0.03	27	-50.2	n.d.	n.d.

St.72 - GC15/	7	1458	8.66	0.03	168	-53.9	-29.3	n.d.
Central Seep	27	1276	9.07	0.03	140	-54.5	-28.9	n.d.
	42	448	1.81	0.04	243	-57.2	-26.8	n.d.
St.51 - GC09/	20	0.78	0.11	0.06	5	n.d.	n.d.	n.d.
Smoker Site	70	0.83	0.11	0.06	5	n.d.	n.d.	n.d.
	120	0.78	0.07	0.04	7	n.d.	n.d.	n.d.
	170	0.83	0.07	0.04	8	n.d.	n.d.	n.d.
	220	0.76	0.04	0.03	11	n.d.	n.d.	n.d.
	270	0.98	0.06	0.04	10	n.d.	n.d.	n.d.
	320	0.99	0.05	0.03	13	n.d.	n.d.	n.d.
	370	1.4	0.11	0.08	7	n.d.	n.d.	n.d.
	420	2.2	0.09	0.13	10	n.d.	n.d.	n.d.
	470	1.6	0.05	0.05	15	n.d.	n.d.	n.d.
St.58 - GC10/	20	2.0	0.07	0.05	16	n.d.	n.d.	n.d.
Smoker Site	70	1.7	0.08	0.05	13	n.d.	n.d.	n.d.
	120	1.6	0.10	0.05	11	n.d.	n.d.	n.d.
	170	1.5	0.08	0.06	11	n.d.	n.d.	n.d.
	220	1.2	0.04	0.04	16	n.d.	n.d.	n.d.
	270	1.0	0.07	0.05	8	n.d.	n.d.	n.d.
	320	1.03	0.08	0.05	8	n.d.	n.d.	n.d.
	370	0.82	0.06	0.03	9	n.d.	n.d.	n.d.
	420	0.82	0.05	0.04	9	n.d.	n.d.	n.d.
	470	0.79	0.08	0.04	7	n.d.	n.d.	n.d.
St.47 - GC07/	100	85	0.45	0.059	167	-79.5	n.d.	n.d.
Slope Site	150	329	0.42	0.045	836	-88.2	n.d.	n.d.
	200	2272	0.27	0.045	7282	-87.7	n.d.	n.d.
	250	3688	0.16	0.059	16550	-86.7	n.d.	n.d.

	300	5651	0.16	0.059	25357	-84.1	n.d.	n.d.
	350	6773	0.15	0.074	30392	-85.0	n.d.	n.d.
	400	6959	0.15	0.074	31229	-81.0	n.d.	n.d.
	450	8100	0.15	0.075	36111	-81.1	n.d.	n.d.
	500	9518	0.15	0.074	42711	-78.3	n.d.	n.d.
	550	9880	0.15	0.015	60060	-76.9	n.d.	n.d.
	600	6049	0.15	0.015	35979	-75.5	n.d.	n.d.
	650	5183	0.17	0.060	22852	-76.2	n.d.	-196
	700	7225	0.29	0.093	19432	-75.3	n.d.	-195
	750	5567	0.17	0.111	16758	-73.0	n.d.	n.d.
	800	2998	0.19	0.081	11587	-72.2	n.d.	n.d.
	850	3468	0.18	0.095	14596	-71.1	n.d.	n.d.
	900	5594	0.14	0.146	28793	-70.5	n.d.	-192
	950	2668	0.29	0.131	6264	-76.0	n.d.	n.d.
	1000	14129	0.38	0.131	107565	-66.6	n.d.	-193
MUCs								
St.33 - MUC11/	0.5	3	0.029	0.029	55	-67.8	n.d.	n.d.
North Seep	1.5	5	0.030	0.030	81	-70.6	n.d.	n.d.
	2.5	42	0.076	0.046	349	-76.0	n.d.	n.d.
	3.5	77	0.138	0.046	417	-75.3	n.d.	n.d.
	5	234	0.354	0.046	583	-76.4	-38.3	n.d.
	7	265	0.361	0.031	674	-77.6	-38.1	n.d.
	9	386	0.577	0.048	617	-77.5	-35.6	n.d.
	11	703	0.807	0.048	822	-79.5	n.d.	n.d.
	13	897	0.965	0.067	870	-76.5	n.d.	n.d.
	15	954	1.014	0.086	868	-79.3	n.d.	n.d.
	17	882	0.917	0.076	888	-77.0	n.d.	n.d.
	19	830	0.996	0.087	766	-75.4	n.d.	n.d.

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

	26	0.89	0.034	0.025	15	n.d.	n.d.	n.d.
	30	1.09	0.047	0.031	14	n.d.	n.d.	n.d.
	34	1.10	0.044	0.028	15	n.d.	n.d.	n.d.
	38	1.21	0.047	0.025	17	n.d.	n.d.	n.d.
St.22 - MUC04/	0.5	69	0.123	0.022	477	-57.3	n.d.	n.d.
Central Seep	1.5	84	0.152	0.073	373	-57.1	n.d.	n.d.
	2.5	127	0.216	0.023	531	-57.5	n.d.	n.d.
	3.5	494	0.795	0.047	587	-57.6	-36.0	n.d.
	5	632	0.999	0.038	610	-56.4	-35.3	n.d.
	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	n.d.
	17	2296	3.773	0.046	601	-57.3	-35.7	-117
	19	2106	3.256	-	647	-57.0	-37.0	n.d.
	22	2461	5.115	0.094	472	-55.2	-34.2	-97
	26	1621	3.543	0.098	445	-55.8	-29.6	n.d.
	30	925	2.200	0.122	398	-54.7	-32.4	n.d.
	34	196	0.642	0.122	257	-54.7	-35.1	n.d.
	38	55	0.183	0.046	238	-43.7	n.d.	n.d.
St.65 - MUC15/	0.5	1.04	0.060	0.060	9	n.d.	n.d.	n.d.
Smoker Site	1.5	0.47	0.015	0.000	31	n.d.	n.d.	n.d.
	2.5	1.33	0.077	0.077	9	n.d.	n.d.	n.d.
	3.5	1.46	0.078	0.062	10	n.d.	n.d.	n.d.
	5	1.62	0.079	0.047	13	n.d.	n.d.	n.d.
	7	1.74	0.079	0.048	14	-34.0	n.d.	n.d.
	9	1.89	0.080	0.064	13	-35.9	n.d.	n.d.

	11	1.85	0.080	0.064	13	-68.6	n.d.	n.d.
	13	2.13	0.064	0.048	19	-48.6	n.d.	n.d.
	15	2.77	0.079	0.111	15	-57.5	n.d.	n.d.
	17	2.63	0.065	0.049	23	-64.8	n.d.	n.d.
	19	3.16	0.08	0.07	21	-67.2	n.d.	n.d.
	22	2.96	0.09	0.05	21	-67.0	n.d.	n.d.
	26	2.41	0.07	0.07	17	-64.3	n.d.	n.d.
	30	1.50	0.08	0.05	12	n.d.	n.d.	n.d.
	34	1.16	0.10	0.09	6	n.d.	n.d.	n.d.
St.66 - MUC16/	0.5	0.86	0.030	0.0302	14	n.d.	n.d.	n.d.
Smoker Site	1.5	1.71	0.046	0.0305	22	n.d.	n.d.	n.d.
	2.5	1.58	0.032	0.0322	25	n.d.	n.d.	n.d.
	3.5	1.81	0.034	0.0335	27	n.d.	n.d.	n.d.
	5	1.56	0.035	0.0346	23	-31.5	n.d.	n.d.
	7	1.83	0.035	0.0355	26	n.d.	n.d.	n.d.
	9	1.00	0.036	0.0357	14	n.d.	n.d.	n.d.
	11	1.50	0.037	0.0371	20	n.d.	n.d.	n.d.
	13	1.32	0.051	0.0509	13	n.d.	n.d.	n.d.
	15	1.42	0.051	0.0514	14	n.d.	n.d.	n.d.
	17	1.57	0.067	0.0665	12	n.d.	n.d.	n.d.
VCTD09 (Berndt et al., 2016)*								
St.52 - NIBo6/		*67*	*0.172*	*0.023*	*344*	*-36.8*	n.d.	-113
St.52 - NIBo9/		*27*	*0.059*	*0.008*	*401*	*-36.9*	n.d.	-111
St.52 - NIBo11/		*19*	*0.043*	*0.006*	*384*	*-14.9*	n.d.	-98
St.52 - NIBo12/		*401*	*1.009*	*0.129*	*352*	*-37.4*	n.d.	-108

* Italic numbers from Berndt et al. (2016)

Abbreviations: b.d.l., below detection limit; n.a., not applicable.; n.d., not determined

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

Site/ Site name	Latitude (N)	Longitude (W)	Depth (m)	T (°C)	Salinity (‰)	Turbidity (ml l^{-1})	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	n.d.
	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	n.d.
	27.41204	-111.38728	1781	3.0	34.6	0.6	7091
	27.41202	-111.38728	1781	3.0	34.6	0.6	n.d.
	27.41034	-111.38836	1798	2.9	34.6	0.6	275
	27.41034	-111.38836	1797	2.9	34.6	0.6	n.d.
	27.40984	-111.38864	1794	2.9	34.6	0.6	341
	27.40982	-111.38864	1794	2.9	34.6	0.6	n.d.
VCTD07	27.70688	-111.2278	652	6.7	34.5	0.0	24
Slope Site	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	n.d.
	27.70676	-111.22758	468	8.7	34.6	0.1	5.2

	27.70678	-111.22758	319	11	34.8	0.3	n.d.
	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	n.d.
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	n.d.
Graben Site	27.30388	-111.5024	1999	2.8	34.6	0.9	n.d.
	27.30388	-111.5024	1998	2.8	34.6	0.9	19
	27.30388	-111.5024	1999	2.8	34.6	0.9	n.d.
	27.30388	-111.5024	1998	2.8	34.6	0.9	n.d.
	27.3038	-111.50236	1804	2.9	34.6	0.7	n.d.
	27.3038	-111.50234	1804	2.9	34.6	0.7	n.d.
	27.3038	-111.50234	1804	2.9	34.6	0.7	2.4
	27.3038	-111.50234	1804	2.9	34.6	0.7	n.d.
	27.3038	-111.50234	1804	2.9	34.6	0.7	n.d.
	27.30386	-111.50246	1003	4.6	34.5	0.2	n.d.
	27.30386	-111.50246	1003	4.6	34.5	0.2	n.d.

27.30386	-111.50246	1003	4.6	34.5	0.2	3.2
27.30386	-111.50246	1003	4.6	34.5	0.2	n.d.
27.30386	-111.50246	1003	4.6	34.5	0.2	n.d.
27.3038	-111.5024	103	16	35.0	1.8	5.0
27.3038	-111.5024	103	16	35.0	1.8	n.d.
27.3038	-111.5024	103	16	35.0	1.8	n.d.
27.3038	-111.5024	103	16	35.0	1.8	n.d.
27.3038	-111.5024	103	16	35.0	1.8	n.d.
27.30372	-111.50236	13	29	35.2	4.3	n.d.
27.30372	-111.50238	13	29	35.2	4.3	n.d.
27.30374	-111.50238	13	29	35.2	4.3	3.3
27.30374	-111.50238	13	29	35.2	4.3	n.d.

Abbreviations: n.d., not determined

* Italic numbers from Berndt et al. (2016)

Table S5: U-Th isotope systematics, $^{87}Sr/^{86}Sr$ isotope ratio signatures, light stable isotope data and XRD mineral identification of authigenic carbonates recovered at Central-Seep sediment surface (SO241, St. 56, VgHG-4, 1843 m water depth) applying methods as described in this paper and Berndt et al. (2016).

sample ident & code	description	dissolution mode [1]	sample weight [2]	Non-Si fraction [3]	$\delta^{13}C_{(V\text{-}PDB)}$ [8]	$\delta^{18}O_{(V\text{-}PDB)}$ [8]	$^{87}Sr/^{86}Sr$ [9]	XRD mineral analyses (normalized to 100%)
			(mg)	(%)	(‰)	(‰)		
outer rim	white coating							
470-15-I-1a-L	leachate	weak	129.5	91	n.d.	n.d.	0.709178 ± 0.000007	
470-15-I-1b-L	leachate	*weak	102.6	92	n.d.	n.d.	0.709174 ± 0.000006	
470-15-II-L	leachate	medium	132.8	93	n.d.	n.d.	0.709179 ± 0.000006	
470-15-III-L	leachate	strong	143.6	94	n.d.	n.d.	0.709204 ± 0.000006	

470-15	leachates	**mean								0.709184	±	0.000027			
470-15-I-1a-R	residue	total	12.1	n.d.	n.d.			n.d.		0.707915	±	0.000010			
470-15-II-R	residue	total	9.5	n.d.	n.d.			n.d.		0.708274	±	0.000006			
470-15-III-R	residue	total	9.6	n.d.	n.d.			n.d.		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	n.d.			n.d.		0.709176	±	0.000006			
472-15-II-L	leachate	medium	158.4	96	n.d.			n.d.		0.709178	±	0.000007			
472-15-III-L	leachate	strong	192.9	96	n.d.			n.d.		0.709175	±	0.000008			
472-15	leachates	**mean	n.d.	n.d.	n.d.			n.d.		0.709176	±	0.000003			
472-15-I-R	residue	total	6.4	n.d.	n.d.			n.d.		0.708667	±	0.000009			
472-15-II-R	residue	total	6.2	n.d.	n.d.			n.d.		0.708513	±	0.000014			
472-15-III-R	residue	total	7.6	n.d.	n.d.			n.d.		0.708077	±	0.000011			
472-15	bulk	***all			-44.7	±	0.4	3.6	± 0.1						Aragonite (88%), Calcite (12 %)

continued Table S5

sample ident & code	Age[4]		^{238}U conc.		^{232}Th conc.		$\delta^{234}U_{(o)}$ [5]		($^{230}Th/^{232}Th$)		($^{238}U/^{232}Th$)		($^{230}Th/^{234}U$) [6]		$\delta^{234}U_{(t)}$ [7]	
	(kys BP)		(ppm)		(ppb)											
outer rim																
470-15-I-1a-L	*0.17*	*± 0.06*	3.96	± 0.02	60.74	± 0.33	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	± 0.29	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	±	0.24	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	±	0.71	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	n.d.		n.d.	3.67	±	0.02	5822.4	±	32.5	82.8	±	2.7	1.07	±	0.01	1.94	±	0.01	0.1522	±	0.3198	n.d.		n.d.
470-15-II-R	n.d.		n.d.	5.04	±	0.02	8712.3	±	74.3	71.7	±	3.6	1.08	±	0.01	1.78	±	0.02	0.1733	±	0.3445	n.d.		n.d.
470-15-III-R	n.d.		n.d.	3.01	±	0.01	8116.2	±	45.4	55.0	±	2.6	1.05	±	0.01	1.14	±	0.01	0.2540	±	0.5777	n.d.		n.d.
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	±	0.3	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	±	0.2	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	±	0.6	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	n.d.		n.d.	3.93	±	0.02	8154.3	±	44.7	58.4	±	3.9	1.08	±	0.01	1.48	±	0.01	0.2083	±	0.4228	n.d.		n.d.
472-15-II-R	n.d.		n.d.	4.5	±	0.02	8485.3	±	53.3	64.3	±	2.5	1.07	±	0.01	1.64	±	0.01	0.1863	±	0.3800	n.d.		n.d.
472-15-III-R	n.d.		n.d.	1.9	±	0.01	7251.7	±	57.7	-18.5	±	2.2	1.04	±	0.01	0.81	±	0.01	0.3651	±	0.8939	n.d.		n.d.
472-15	0.05	±	0.08																			137.0	±	55.0

Round brackets denote activity ratio. Uncertainties presented on 2 sigma level.
Abbreviations: n.d., not determined

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 leachtes 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 $^{230}Th/^{234}U$ ages calculated (note 6) for different leachates of homgenized 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 resiude 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: *Italics* mark individual ages characterized by high uncertainties at low $^{230}Th/^{232}Th$ ratios and high impact of ^{230}Th correction values.

Note 5: (meas. $^{234}U/^{238}U$ act. ratio -1) * 1000 at time 0 (today)

Note 6: $^{230}Th/^{234}U$ activity ratio corrected for inherited ^{230}Th by application of $^{230}Th/^{232}Th$ activity ratio of 1.066 ± 0.029 (2SD, n=6) as deduced from the mean residue value.

Note 7: ($^{234}U/^{238}U$ act. ratio at zero age -1) * 1000 at time (t = U/Th-age)
Measured $^{234}U/^{238}U$ back-calculated for ^{234}U decay since carbonate precipitation, based on the individual U/Th ingrowth age and half-lives measured by Cheng et al. (2000).
$\delta^{234}U_{(t)}$ of Rosholt-1 isochron approaches based on isoplot 3.75 calculation.

Note 8: Both samples were analysed on three aliquots each (uncertainty is given in 2 SD, n=3).

Note 9: $^{87}Sr/^{86}Sr$ 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).