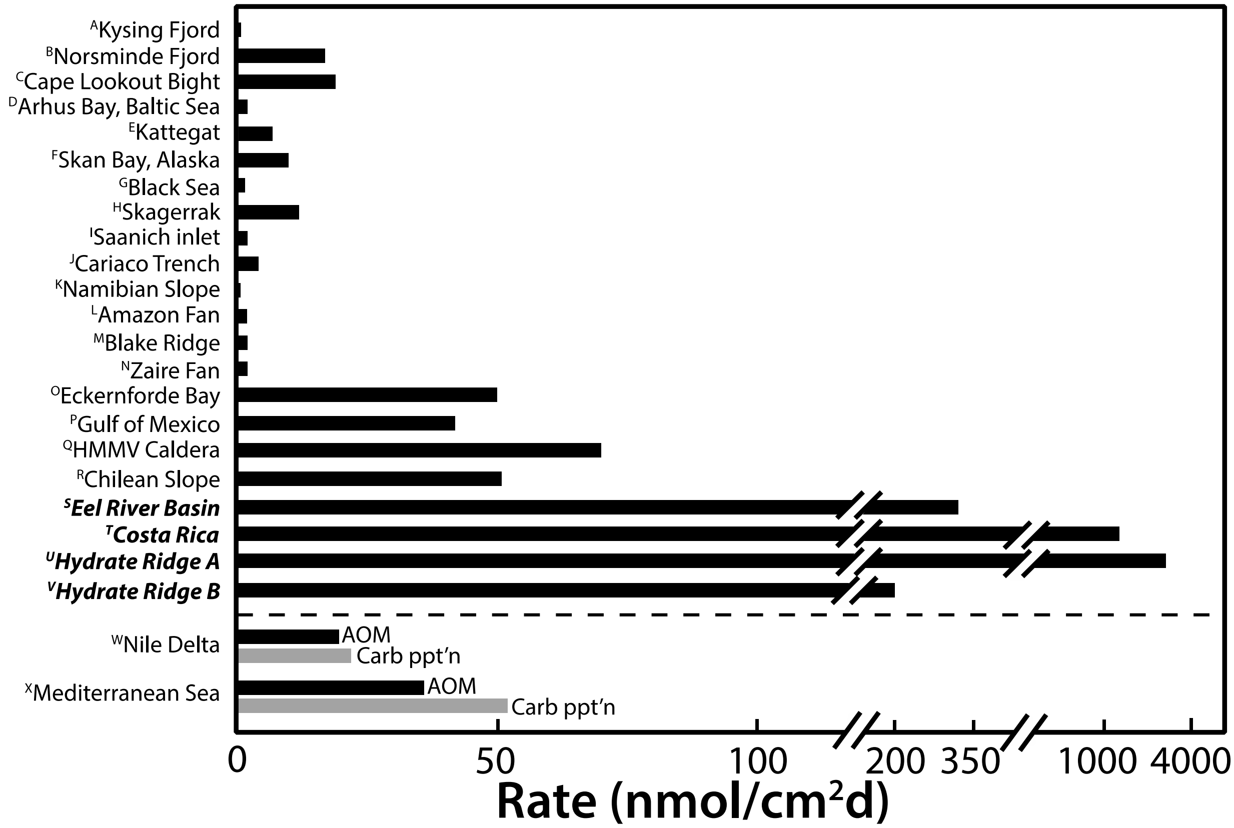

Supplementary Figure 1: AOM and carbonate precipitation rates of modern cold seep systems. Notice that where available, AOM rates overlap with carbonate precipitation rates. This association along with the relatively high AOM rates of Hydrate Ridge, Costa Rica and Eel River Basin suggest that these locations have a high propensity to record disequilibrium clumped isotope signatures. Data references as follows A[1]; B[2]; C[3]; D[4]; E[1]; F[5,6]; G[7]; H[1]; I[8]; J[9]; K[10,11]; L[12]; M[13]; N[14]; O[15]; P[16]; Q[17]; R[18]; S[19]; T[20]; U[21,22]; V[23]; W[24,25]; X[26,27].

Supplementary Table 1

Apparent ancient seep carbonate precipitation temperatures

Notice consistently high temperatures compared to typical bottom waters using both calibrations[28,29].

Sample	phases	temp (°C)	temp (°C)	s.e.
		[28]Tang et al., 2014	[29]Tripati et al., 2015	(°C)
Teepee Buttes				
100-110	micrite	134	97	5
130-140	micrite	193	128	5
190-200	micrite	160	112	7
20-30	micrite	163	113	3
230-240	micrite	207	135	4
250-260	micrite	260	159	6
310-320	micrite	286	169	8
320-2h	micrite	107	81	10
360-370	micrite	181	123	3
40-50	micrite	182	123	4
65-70	micrite	142	102	1
star 230-240	micrite	150	106	4
teepee hrm 210-220	micrite	185	125	5
teepee hrm 400-40	micrite	132	96	3
100-110fc	fibrous cement	178	121	3
190-200fc	fibrous cement	219	141	7
210-220fc	fibrous cement	263	160	9
460-470fc	fibrous cement	196	130	4
711.5 VI S 2	spar			
320-2 PS	peloidal sparite			
704.5 1 PS	peloidal sparite			
711 WI PS	peloidal sparite			
711.5 VI PS 2	peloidal sparite			
711.5 VI PS1	peloidal sparite	113	84	11
HRS 674.6 PS	peloidal sparite			
Quinault Fm				
Sample 1 Quin Fm	micrite	83	66	3
Sample 9 Quin	micrite	46	40	9
Sample 11 Quin Fm	micrite	42	37	2
Pysht Fm				
Sample 4 Pysht	micrite	47	41	7
Sample 5 Pysht	micrite	56	47	10
Panoche Hills				
PTH 04	micrite	28	27	2
PTH-07	micrite	19	20	2
PTH-08	micrite	27	26	8
PTH-18	micrite	31	29	1
PTH-19	micrite	40	35	1
Lincoln Creek Fm				
Sample 8 LC	micrite	46	40	7

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