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Shallow burial alteration of dolomite and limestone clumped isotope geochemistry

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Geology of the Sample Site

Andros Island, the largest island on the Great Bahama Bank, sits atop more than six kilometers of nearly 100% carbonate rock. The 4442-meter-long Andros Number 1 well was drilled into north-central Andros Island by the Stafford and Bahamas Oil companies in 1947. The core is now housed by the Florida State Geological Survey in Tallahassee, FL. The core spans the Pleistocene through the Early Cretaceous according to approximate microfossil dating and correlation with the stratigraphy of Florida (Spencer, 1967).

The core material was discussed by Illing (1954) and Spencer (1967) and petrographically and geochemically described by Goodell and Garman (1969; Fig. DR1). The foraminifera and bivalve fossils, occasional reefal debris, and common pelletal muds found in the core support the interpretation of marine deposition for the entire sedimentary sequence. Some faulting and uplift occurred within the Great Bahama Bank during the Early Cretaceous, however, it is likely that the burial history of all samples from the Andros core follows an essentially linear increasing depth and temperature trend (Elberli and Ginsburg 1987). While it is true that periods of erosion are observed in core sediments, their magnitude is likely minor and no tectonic uplifts are known to have occurred (Goodell and Garman, 1969; Elberli and Ginsburg, 1987).

Today, deposits on the interior of the Great Bahama Bank are generally oolitic and coralgal sands in higher-energy areas that grade into pelletal muds (Illing 1954). Most of this modern material is aragonitic, but early diagenesis has resulted in no aragonite present below ~35 m depth (Goodell and Garman, 1969; Beach, 1993). All material studied from this core is 100% carbonate, but the mineralogy varies from calcite to dolomite.

Offshore cores analyzed by Melim et al. (2002) indicate a shift from aragonite-dominated mud to mature microsparitic limestone and complete alteration by marine pore fluids within 100 – 150 m of sea level. Recrystallization of material at ~250 m depth indicates complete dolomitization and a degree of diagenetic stabilization relatively soon after deposition, consistent with diagenetic models (Beach 1993; Whitaker et al. 1994; Melim et al. 2001; Melim et al. 2002). Marine waters have been shown to flow consistently through the upper ~400 m of the Great Bahama Bank (from the center of the platform outward) and are likely agents of lithification as well as dolomitization (e.g. Whitaker et al. 1994).

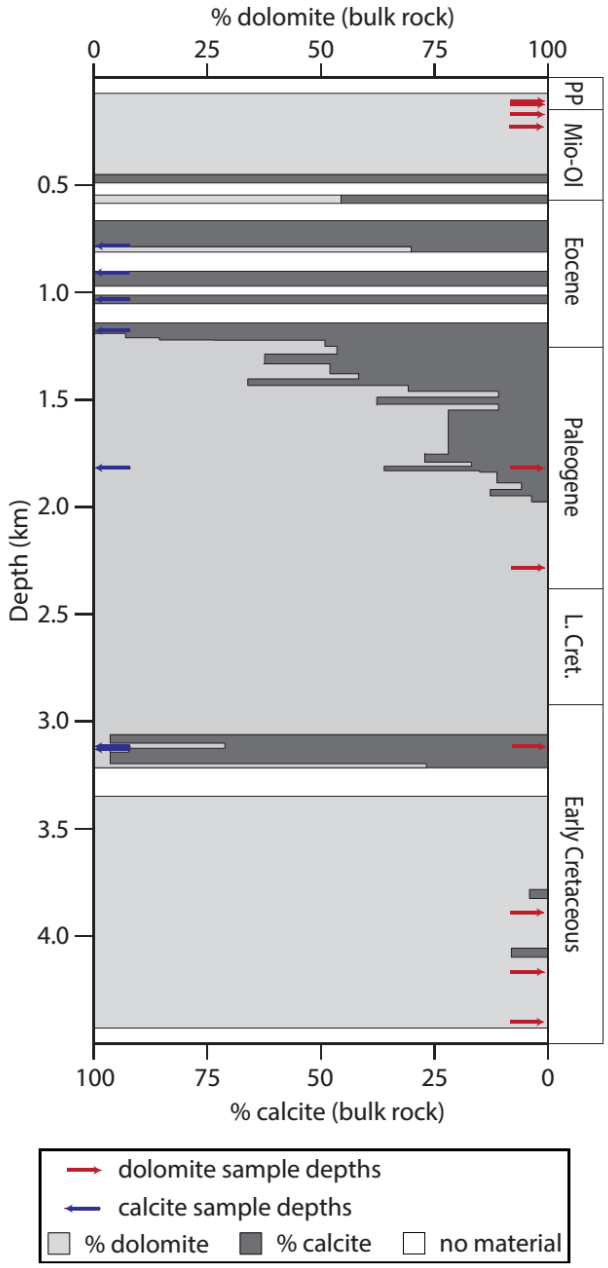

Figure DR1. Mineralogy of all Andros Island #1 core material, via XRD analyses of this study and Goodell and Garmin (1969). Dolomite and calcite sample depths are indicated with squares and circles, respectively. All samples analyzed were >80% pure dolomite or calcite, as indicated by XRD. PP = Plio-Pleistocene; Mio-Ol = Miocene-Oligocene.

Sample Characterization

Samples taken from the core's uppermost layers are entirely micritic dolomite mud with no visible grains. By 250m depth, dolomite is entirely recrystallized with microspar, which is the likely result of near-surface diagenesis and lithification as described above. Foraminifera, bivalve, and coral fragments are still visible within the entirely recrystallized micritic matrix. From ~450 m to 3500 m depth, limestone beds are interbedded with dolomites, with both commonly preserving pellet traces and fossil outlines. Specifically in sample AC7 at 3240 m depth, calcitic algal grains are encased in a dolomite rhomb matrix. Such preservation further

suggests that dolomitization above this depth was not the result of deep burial fluids but instead early diagenesis.

Samples below 3500 m depth are largely homogenous, showing microcrystalline dolomite rhombs with little variation. These near-uniform microcrystalline rocks with no apparent preservation of original features mark a petrographic transition between relatively unaltered near-surface material and material that may have been wholly recrystallized at depth. Rare 10 µm-scale fractures are filled with additional dolomite rhombs; these were too small to independently sample and thus were avoided for isotopic analysis. Minor calcite fractions indicated in Figure DR1 (Goodell and Garman 1969) were not observed in our coarser analysis. These deep, massive dolomites, could be in part a result of thermally driven Kohout circulation.

XRD results agreed with high resolution XRD and XRF analyses conducted by Goodell and Garman (1969; Fig. DR1, Fig. DR2). Eleven samples analyzed were 100% calcite or dolomite. Specific mineralogies are indicated below (Table DR1) Porosity roughly decreases downcore but is qualitatively highly variable. Sr concentrations are consistently below 200 ppm throughout the entire core, except for a specific interval between ~800 and ~1200 m where concentrations are ~400 ppm (Goodell and Garman, 1969).

Table DR1. Mineralogies calculated from XRD for each sample. Error is ~5%. Letters (d or c) indicate dominant mineralogy.

Depth (m)	Sample	% dolomite
122	AC30d	100
125	AC31d	100
206	AC27d	100
259	AC33d	100
499	AC32c	3
735	AC29c	8
880	AC37c	0
1076	AC23c	0
1330	AC26c	0
1859	AC18c	17
1859	AC18d	90
2373	AC15d	89
3236	AC6d	100
3240	AC7c	3
3240	AC7d	99
3825	AC5d	100
4284	AC2d	100
4413	AC1d	100

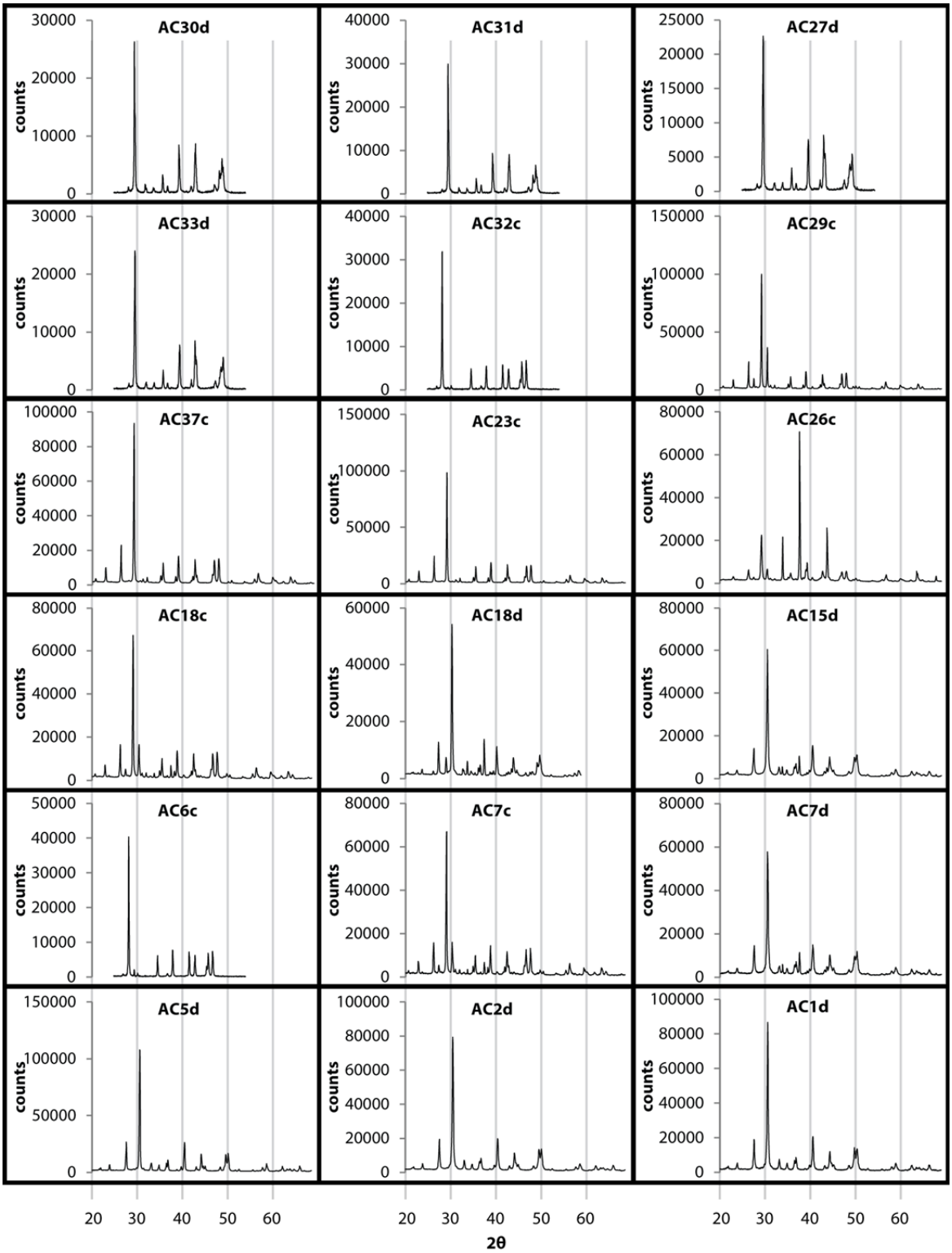

Figure DR2. Raw XRD data for all samples. Organized by sample depth.

Stable and Clumped Isotope Measurements

Carbonate samples were measured for their stable and clumped isotopic composition. All stable isotope work was conducted at the University of Michigan Stable Isotope Laboratory. Carbonate material was sampled using a mounted Dremel hand drill at lowest speed settings to prevent overheating of a given sample.

CO_2 was extracted from each carbonate sample using an offline sample preparation procedure (see Defliese et al., 2015; based on Huntington et al. 2009). Each ~5 mg aliquot was reacted individually in anhydrous phosphoric acid in a common acid bath at 75° C. Calcites were reacted for 20 minutes and dolomites were reacted for 1 hour or until completion. Residual water vapor was removed from resultant CO_2 via cryogenic procedures under vacuum conditions. To eliminate hydrocarbon and halocarbon contaminants, gas was passed through Porapak™ resin held at -15° C for 10 minutes (AC sample numbers 5, 6, 23, 29, 33, 37) or at -30° C for 15 minutes (all other samples; Petersen et al. in review). Volume of CO_2 before and after this process was monitored to ensure quantitative collection of all sample gas. Clean CO_2 was then transferred to a Thermo Scientific MAT 253 Stable Isotope Ratio Mass Spectrometer for Δ_{47} analysis, where masses 44 through 49 were measured for 60-80 cycles. As described by Dennis et al. (2011), heated CO_2 with stochastic isotopologue distributions and CO_2 equilibrated with water at 25° C were used to monitor machine conditions and establish the absolute reference frame.

$\delta^{18}O$ and $\delta^{13}C$ measurements are a byproduct of clumped isotope analysis but have lower multi-replicate precision than when measured using the Kiel method, at least in part because much more heterogeneous material (>4 mg) is incorporated into each replicate measurement. For those samples passed through the cold (-30° C) Porapak™, corrections of +0.36 for $\delta^{18}O$ and +0.10 for $\delta^{13}C$ were applied to account for measured method-specific fractionation effects (Petersen et al. in review). All clumped $\delta^{18}O$ values were then corrected for acid fractionation via Kim and O'Neil (1997) (calcites) or Rosenbaum and Shepard (1986) (dolomites). The isotopic composition of the fluid from which the carbonates precipitated was calculated using the fractionation factor of Kim and O'Neil (1997) for calcite and Horita (2014) for dolomite (Table DR1). All carbonate $\delta^{18}O$ and $\delta^{13}C$ values are reported relative to the Vienna Pee Dee Belemnite standard (VPDB), and all $\delta^{18}O$ water values ($\delta^{18}O_w$) are reported relative to the Vienna Standard Mean Ocean Water standard (VSMOW).

Table DR2. Summary of isotopic data for all samples.

Depth (m)	Sample	$\delta^{13}C$ (‰ VPDB)[1]	$\delta^{18}O$ (‰ VPDB)[1]	Δ^{47} (‰ ARF)[2]	Defliese et al. Δ^{47} °C[3]	$\delta^{18}O_{H2O}$[4] (‰ VSMOW)	Ghosh et al. Δ^{47} °C[5]
122	AC30d	1.88 ± 0.05	1.64 ± 0.14	0.6811 ± 0.0162	30.6° ± 6.3°	1.0 ± 1.3	31.4 ± 7.2
125	AC31d	1.83 ± 0.02	1.45 ± 0.08	0.6754 ± 0.0069	32.3° ± 2.7°	1.3 ± 0.6	32.7 ± 3.1
206	AC27d	3.13 ± 0.15	2.30 ± 0.19	0.6856 ± 0.0034	28.4° ± 1.3°	1.3 ± 0.4	30.4 ± 1.5
259	AC33d	2.32 ± 0.02	2.38 ± 0.10	0.6903 ± 0.0031	26.6° ± 1.1°	1.0 ± 0.3	29.4 ± 1.3
499	AC32c	-0.18 ± 0.02	-2.33 ± 0.08	0.6845 ± 0.0057	28.8° ± 2.1°	0.5 ± 0.4	30.6 ± 2.5
735	AC29c	-0.35 ± 0.07	-2.44 ± 0.18	0.6938 ± 0.0089	25.5° ± 3.2°	-0.3 ± 0.5	28.6 ± 3.8
880	AC37c	2.00 ± 0.04	-0.57 ± 0.03	0.6899 ± 0.0069	26.9° ± 2.5°	1.9 ± 0.5	29.4 ± 3.0
1076	AC23c	2.52 ± 0.03	-0.89 ± 0.03	0.6895 ± 0.0058	27.0° ± 2.1°	1.6 ± 0.4	29.5 ± 2.5
1330	AC26c	0.13 ± 0.07	-0.30 ± 0.14	0.6543 ± 0.0061	40.8° ± 2.6°	4.8 ± 0.3	37.5 ± 2.9
1859	AC18c	-1.33 ± 0.06	-3.16 ± 0.05	0.6618 ± 0.0036	37.6° ± 1.5°	1.4 ± 0.2	35.8 ± 1.7
1859	AC18d	2.10 ± 0.01	0.97 ± 0.02	0.6519 ± 0.0040	41.7° ± 1.7°	2.8 ± 0.3	38.1 ± 1.9
2373	AC15d	1.52 ± 0.06	0.62 ± 0.21	0.6337 ± 0.0106	50.0° ± 4.9°	4.0 ± 1.1	42.5 ± 5.2
3236	AC6c	1.54 ± 0.09	-3.89 ± 0.22	0.6614 ± 0.0024	37.7° ± 1.0°	0.7 ± 0.4	35.9 ± 1.1
3240	AC7c	2.12 ± 0.07	-3.14 ± 0.10	0.6402 ± 0.0092	47.0° ± 4.1°	3.0 ± 0.6	40.9 ± 4.5
3240	AC7d	2.33 ± 0.07	1.45 ± 0.19	0.6337 ± 0.0104	49.9° ± 4.8°	3.4 ± 0.9	42.5 ± 5.1
3825	AC5d	0.98 ± 0.04	0.04 ± 0.11	0.5996 ± 0.0179	68.0° ± 10.1°	6.4 ± 1.6	51.3 ± 9.6
4284	AC2d	3.85 ± 0.05	0.83 ± 0.05	0.6425 ± 0.0045	45.7° ± 1.9°	3.5 ± 0.4	40.3 ± 2.2
4413	AC1d	2.53 ± 0.08	-0.91 ± 0.18	0.6096 ± 0.0088	61.5° ± 4.4°	4.6 ± 0.7	48.6 ± 4.6

[1]Conventional isotopic data as measured in clumped isotope analyses. All uncertainties are one standard error.
[2]Δ_{47} values are reported in the absolute reference frame of Dennis et al. (2011).
[3]Δ_{47} temperatures via the Defliese et al. (2015) all 75° C data calibration.
[4]Water $\delta^{18}O$ calculated from clumped isotope temperatures (Defliese et al. (2015) calibration) and carbonate $\delta^{18}O$, via fractionation factors of Kim and O'Neil (1997) for calcite and Horita (2014) for dolomite.
[5]Δ_{47} temperatures via the Ghosh et al. (2006) calibration. These data are not used for interpretation because this temperature – Δ_{47} relationship differs from calibration data produced in the laboratory where the above analyses were conducted (see text and Defliese et al. 2015).

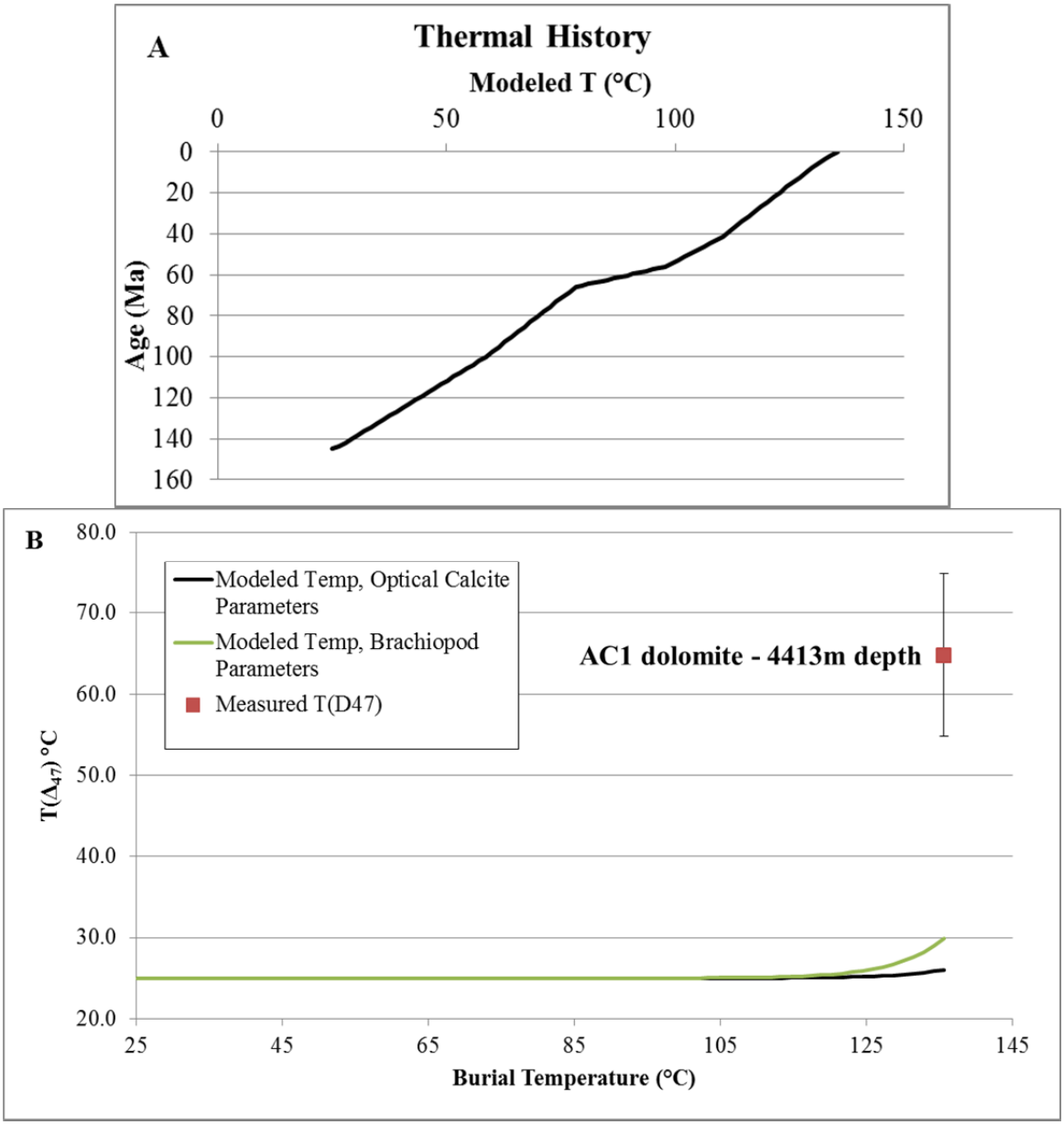

Figure DR3. A) Temperature change over time for the lower most sample (AC1, 4413 m depth) given a ~30° C/km geothermal gradient (hotter than measurements indicate) and a burial model based on stratigraphic thickness for each epoch. B) Passey and Henkes (2012) model output given the conditions outlined in (A). Under this hotter-than-measured geothermal scenario, the Stolper and Eiler (2015) model would predict similar temperature change to that observed, though much less change (<10 °C) would be predicted under the measured geothermal range. The Stolper and Eiler (2015) model would predict essentially no Δ_{47} change for all other samples. Fundamentally, far less or no Δ47 alteration is predicted by these models for all samples. This means that either solid-state alteration in fine-grained carbonates occurs at colder temperatures than predicted, or that subtle recrystallization is responsible for essentially all observed alteration.

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Rosenbaum, J., and Sheppard, S. M., 1986, An isotopic study of siderites, dolomites and ankerites at high temperatures: Geochimica et Cosmochimica Acta, v. 50, p. 1147–1150, doi:10.1016/0016-7037(86)90396-0.

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Table DR3. Raw clumped isotope data. D47 rfac (Reference Frame and Acid Corrected) is the final Δ_{47} value used for interpretation. This value incorporates an acid fractionation factor of 0.067‰ for a 75°C reaction temperature (Defliese et al. 2015) and is placed into the empirical reference frame of Dennis et al. (2011) via heated and equilibrated gas data run during the listed timeframes ('windows'). Additional data available upon request.

JUNE 2015 RUN

Samples:

Date	Name	d13C	d18O	d45	d46	d47	d48	d49	D47	D48	D49	window	D47rfac
6/15	AC33d-1	2.38	43.71	5.979	8.435	14.405	17.865	5.619	-0.108	0.908	-17.11	1	0.704
6/15	AC33d-2	2.30	43.40	5.896	8.142	14.035	16.667	5.983	-0.102	0.312	-16.11	1	0.717
6/30	AC33d-3	2.29	43.26	5.877	8.001	13.9	17.588	7.126	-0.078	1.497	-14.7	3	0.722

Transfer Functions:

Window	Start date	end date	SlopeEGL	SlopeETF	IntETF
1	6/12/2015	06/17/15	0.01894	1.039	1.032
2	6/18/2015	06/26/15	0.02128	1.103	1.071
3	6/25/2015	06/29/15	0.02210	1.088	1.074

Equilibrated and Heated Gasses:

DATE	Name	d13C	d18O	d45	d46	d47	d48	D47	D48
6/12/2015	MDIWHG	-41.03	30.67	-35.197	-4.24	-42.074	-9.848	-1.833	-1.398
6/12/2015	CarraraHG	1.91	35.37	5.272	0.389	4.987	-1.516	-0.829	-2.292
6/12/2015	EvapHG	-41.22	41.84	-35.015	6.546	-31.437	12.113	-1.576	-1.01
6/13/2015	2xEVHG	-40.93	58.25	-34.216	22.383	-15.287	48.543	-1.241	3.135
6/15/2015	OoidsHG	4.33	31.43	7.415	-3.415	3.393	-6.361	-0.863	0.46
6/16/2015	MDIWHG	-40.92	26.44	-35.229	-8.322	-45.995	-22.085	-1.861	-5.603
6/12/2015	Heavy25C	4.75	70.96	9.069	34.745	44.632	79.739	0.755	8.445
6/12/2015	MDIW25C	-41.42	30.34	-35.568	-4.558	-41.858	-11.581	-0.896	-2.508
6/13/2015	Evap25C	-41.36	46.03	-35.009	10.582	-26.607	27.543	-0.544	6.135
6/13/2015	2XEV25C	-41.30	72.96	-34.093	36.575	-0.608	84.294	-0.126	9.126
6/14/2015	Heavy25C	4.78	73.43	9.178	37.127	47.077	84.074	0.719	7.848
6/16/2015	MDIW25C	-41.56	29.88	-35.717	-5.005	-42.456	-13.243	-0.92	-3.291
6/17/2015	Evap25C	-41.76	46.20	-35.377	10.745	-26.884	23.939	-0.593	2.283
6/18/2015	2xEVHG	-41.00	53.15	-34.449	17.46	-20.32	37.821	-1.371	2.509
6/19/2015	CarraraHG	2.30	30.46	5.481	-4.355	0.445	-13.102	-0.896	-4.45
6/20/2015	EvapHG	-40.73	41.73	-34.558	6.436	-31.127	12.276	-1.638	-0.63
6/23/2015	EvapHG	-40.99	44.92	-34.696	9.516	-28.297	19.749	-1.577	0.614
6/23/2015	CarraraHG	2.21	37.21	5.607	2.163	7.123	1.922	-0.792	-2.397
6/24/2015	2xEVHG	-41.04	68.37	-33.992	32.152	-5.666	75.201	-1.104	9.258
6/25/2015	OoidsHG	4.23	33.50	7.386	-1.416	5.413	-2.735	-0.794	0.095
6/18/2015	2xEV25C	-41.37	73.02	-34.161	36.635	-0.627	84.626	-0.129	9.317
6/20/2015	Heavy25C	4.75	71.40	9.088	35.172	45.113	81.335	0.79	9.102
6/20/2015	MDIW25C	-41.44	30.58	-35.581	-4.331	-41.782	-12.633	-1.029	-4.026
6/23/2015	Evap25C	-41.46	47.83	-35.046	12.327	-25.076	27.061	-0.628	2.2
6/24/2015	MDIW25C	-41.46	30.71	-35.595	-4.204	-41.68	-12.142	-1.031	-3.784
6/24/2015	2xEV25C	-41.32	71.55	-34.16	35.214	-2.017	83.033	-0.174	10.605
6/25/2015	Evap25C	-41.59	46.48	-35.215	11.016	-26.558	24.323	-0.695	2.122
6/26/2015	Heavy25C	4.94	74.56	9.363	38.22	48.551	90.61	0.9	11.79
6/25/2015	OoidsHG	4.23	33.50	7.386	-1.416	5.413	-2.735	-0.794	0.095
6/27/2015	EvapHG	-41.26	42.89	-35.013	7.551	-30.555	15.535	-1.649	0.37
6/28/2015	MDIWHG	-40.94	29.10	-35.162	-5.753	-43.6	-16.578	-1.969	-5.164
6/29/2015	CarraraHG	2.12	35.55	5.475	0.561	5.356	-1.341	-0.84	-2.461
6/25/2015	Evap25C	-41.59	46.48	-35.215	11.016	-26.558	24.323	-0.695	2.122
6/26/2015	Heavy25C	4.94	74.56	9.363	38.22	48.551	90.61	0.9	11.79
6/27/2015	MDIW25C	-41.54	30.27	-35.691	-4.625	-42.221	-13.492	-1.078	-4.303
6/29/2015	2xEV25C	-41.34	70.04	-34.23	33.762	-3.502	79.666	-0.209	10.295
6/29/2015	Evap25C	-41.76	46.18	-35.379	10.73	-27.028	24.386	-0.724	2.751

JANUARY 2015 RUN

Samples:

Date	Sample Name	d13C (pdb)	d18O (smo	d45	d46	d47	d48	d49	D47	D48	D49	window	D47rfac
1/28	AC6 cal #3 IZW	1.66	35.98	5.05	0.973	5.936	1.848	5.81	-0.232	-0.098	-1.48	1	0.663
1/30	AC29 cal #1 IZW	-0.51	36.74	3.042	1.707	4.566	5.394	6.053	-0.255	1.969	-0.553	1	0.675
1/30	AC37 cal #1 IZW	2.04	39.20	5.519	4.084	9.595	13.578	2.837	-0.136	5.348	-10.98	1	0.668
2/1	AC23 cal #1 IZW	2.53	38.83	5.961	3.729	9.737	12.853	2.992	-0.1	5.342	-10.6	1	0.704
2/1	AC29 cal #2 IZW	-0.26	37.36	3.296	2.306	5.476	3.449	2.379	-0.198	-1.163	-5.641	1	0.713
2/1	AC37 cal #2 IZW	1.87	39.24	5.358	4.125	9.494	7.362	1.533	-0.111	-0.898	-12.18	1	0.698
2/2	AC5 dolo #1 IZW	0.86	41.35	4.478	6.153	10.47	27.19	-11.589	-0.227	14.664	-28.08	1	0.544
2/3	AC37 cal #3 IZW	2.02	39.11	5.495	3.997	9.501	6.698	5.152	-0.119	-1.301	-8.503	1	0.689
2/3	AC 23 cal #2 IZW	2.82	40.33	6.283	5.176	11.573	10.215	1.445	-0.031	-0.162	-15.26	1	0.729
2/7	AC5 dolo #2 IZW	1.05	40.73	4.637	5.556	10.079	16.703	3.918	-0.193	5.499	-11.84	2	0.593
2/7	AC29 cal #3 IZW	-0.27	37.51	3.293	2.449	5.595	5.328	2.393	-0.218	0.421	-5.903	2	0.693
2/9	AC5 dolo #3 IZW	1.02	41.02	4.617	5.841	10.387	17.277	3.441	-0.146	5.496	-12.84	2	0.636
2/10	AC23 cal #3 IZW	2.46	38.74	5.892	3.638	9.55	14.675	1.476	-0.125	7.332	-11.85	2	0.683
2/12	AC5 dolo #4 IZW	0.98	40.98	4.575	5.803	10.296	21.511	3.71	-0.156	9.758	-12.46	3	0.625
2/13	AC37 cal #4 IZW	2.05	39.06	5.522	3.949	9.494	6.821	5.172	-0.106	-1.084	-8.418	3	0.704
2/13	AC23 cal #4 IZW	2.58	38.89	6.012	3.785	9.828	16.832	2.034	-0.117	9.178	-11.71	3	0.682

Transfer Functions:

Window	Start date	end date	SlopeEGL	SlopeETF	IntETF
1	1/26/2015	2/3/2015	0.02503	1.100	1.015
2	2/4/2015	2/11/2015	0.02581	1.096	1.023
3	2/12/2015	2/21/2015	0.02658	1.109	1.035

Equilibrated and Heated Gasses:

DATE	Name	d13C	d18O	d45	d46	d47	d48	D47	D48
26-Jan	MDIWHG	-41.36	25.22	-47.792	-25.59	7.945	-2.094	-6.812	67.592
26-Jan	CarraraHG1	2.06	35.21	5.057	-3.896	3.459	-0.743	-4.354	-2.737
26-Jan	CarraraHG2	2.11	35.17	5.066	-2.204	2.236	-0.751	-2.601	-3.942
26-Jan	2xEVHG1	-41.15	63.47	-10.447	63.008	1.107	-1.134	7.018	-14.782
27-Jan	2xEVHG2	-41.35	63.24	-10.897	65.083	0.295	-1.161	9.424	-14.942
28-Jan	EvapHG	-41.07	35.47	-37.556	-2.789	8.741	-1.817	-3.568	47.079
29-Jan	CarraraHG	2.13	37.04	6.921	2.405	3.033	-0.758	-1.601	-6.756
31-Jan	MDIWHG	-41.26	26.66	-46.322	-22.814	6.912	-2.081	-6.774	63.395
1-Feb	2xEVHG	-41.31	61.93	-12.17	59.389	3.808	-1.228	6.518	-9.07
2-Feb	OoidsHG	4.54	37.03	9.348	2.105	3.937	-0.662	-1.889	-8.225
3-Feb	MDIWHG	-41.21	28.94	-44.079	-17.453	6.959	-2.031	-5.729	58.699
27-Jan	Evap25C	-41.26	47.36	-25.409	25.022	3.606	-0.709	1.119	18.429
27-Jan	MDIW25C1	-41.38	30.55	-41.839	-16.86	8.831	-1.112	-8.233	57.543
27-Jan	2xEV25C1	-41.32	70.39	-3.068	81.246	-4.199	-0.134	11.113	-32.456
27-Jan	MDIW25C2	-41.49	29.87	-42.58	-14.297	6.061	-1.108	-4.337	56.146
27-Jan	2xEV25C2	-41.31	70.51	-2.996	82.182	-0.903	-0.175	11.767	-29.467
28-Jan	2xEV25C	-41.47	70.13	-3.505	82.29	-0.306	-0.174	12.579	-28.05
30-Jan	Evap25C	-41.30	47.21	-25.614	26.272	4.745	-0.734	2.627	19.919
31-Jan	MDIW25C	-41.40	30.65	-41.778	-12.907	7.356	-1.137	-4.451	55.797
1-Feb	2xEV25C	-41.30	70.53	-2.986	81.675	-0.323	-0.193	11.26	-28.947
2-Feb	MDIW25C	-41.36	30.03	-42.336	-14.116	6.682	-1.145	-4.472	56.321
4-Feb	CarraraHG	1.96	37.57	7.299	2.012	3.581	-0.738	-3.002	-7.055
4-Feb	CarraraHG	2.15	37.74	7.68	1.125	9.065	-0.704	-4.206	-2.138
7-Feb	EvapHG	-41.21	43.68	-29.79	17.667	2.992	-1.688	0.938	24.928
8-Feb	2xEVHG	-41.36	66.82	-7.42	74.362	-0.763	-1.064	11.403	-22.566
9-Feb	CarraraHG	2.05	38.09	7.942	0.387	7.342	-0.696	-5.617	-4.423
11-Feb	OoidsHG	4.53	38.09	10.426	1.154	7.736	-0.622	-4.863	-6.489
11-Feb	2XEVHG	-41.19	67.27	-6.896	72.911	8.161	-1.139	9.19	-14.843
4-Feb	Evap25C	-41.37	46.87	-26.008	24.686	4.814	-0.738	1.714	20.719
5-Feb	2xEV25C	-41.36	70.46	-3.078	82.456	0.418	-0.161	12.124	-28.041
8-Feb	MDIW25C	-41.37	30.69	-41.76	-11.458	7.337	-1.186	-3.07	55.661
9-Feb	Evap25C	-41.18	47.35	-25.398	25.331	6.956	-0.768	1.434	21.76
10-Feb	2xEV25C	-41.26	71.06	-2.404	83.858	-0.191	-0.165	12.287	-29.837
11-Feb	MDIW25C	-41.29	30.76	-41.567	-15.978	14.365	-1.136	-7.758	62.796
12-Feb	MDIWHG	-41.41	29.33	-43.958	-17.178	7.756	-2.094	-6.212	58.945
13-Feb	CarraraHG	2.06	37.38	7.232	2.583	1.837	-0.716	-2.072	-8.519
15-Feb	EVAPHG	-41.31	44.64	-28.954	15.011	12.547	-1.658	-3.508	32.902
16-Feb	CarraraHG	2.08	36.76	6.632	1.293	3.044	-0.712	-2.153	-6.141
18-Feb	2XEVHG	-41.27	62.95	-11.141	62.736	3.499	-1.202	7.755	-11.319
19-Feb	CarraraHG	2.00	37.56	7.331	3.53	2.084	-0.732	-1.473	-8.554
21-Feb	OoidsHG	4.61	37.78	10.172	3.526	3.387	-0.649	-1.913	-10.268
12-Feb	Evap25C	-41.31	71.54	-1.988	85.129	0.895	-0.158	12.563	-29.61
12-Feb	2xEV25C	-41.46	70.66	-2.997	83.409	0.568	-0.175	12.631	-28.167
14-Feb	MDIW25C	-41.29	30.19	-42.177	-15.417	8.711	-1.208	-6.098	58.041
15-Feb	Evap25C	-41.38	46.96	-25.962	26.593	3.13	-0.774	3.411	18.839
16-Feb	2xEV25C	-41.12	70.33	-2.978	81.657	2.933	-0.184	11.614	-25.615
19-Feb	EVAP25C	-41.41	46.65	-26.264	25.65	2.064	-0.748	3.085	18.397
20-Feb	MDIW25C	-41.24	31.03	-41.367	-11.976	6.898	-1.248	-4.243	54.36
21-Feb	2xEV25C	-41.28	71.43	-2.079	83.981	2.622	-0.169	11.707	-27.756

SEPTEMBER 2014 RUN

Samples:

Date	Sample	d13C	d18O	d45	d46	d47	d48	d49	D47	D48	D49	window	D47 rfac
09/18/14	Andros32 cal #1 IZW	-0.28	36.86	3.25471	1.81814	4.93015	4.59587	1.99231	-0.2201	0.95284	-5.029	1	0.6740
09/18/14	Andros6 cal #1 IZW	1.21	34.78	4.57567	-0.1823	4.29144	-0.3992	-59.37	-0.2463	-0.0347	-63.6	1	0.6656
09/22/14	Andros26 cal #1 IZW	-0.15	38.71	3.4399	3.60673	6.9355	9.57592	76.048	-0.1717	2.33261	64.557	2	0.6665
09/23/14	Andros32 cal #2 IZW	-0.32	36.87	3.21894	1.82818	4.88042	4.38551	1.95358	-0.2426	0.72318	-5.05	2	0.6818
09/23/14	Andros6 cal #2 IZW	1.50	35.93	4.88333	0.9247	5.67956	8.6928	21.7641	-0.2694	6.82995	14.632	2	0.6295
09/27/14	Andros15 dolo #1 IZW	1.31	40.93	4.87426	5.75285	10.6035	15.7691	2.64684	-0.1101	4.18205	-13.72	3	0.6584
09/27/14	Andros6 cal #3 IZW	1.56	35.62	4.92984	0.62858	5.44727	1.6576	-67.392	-0.2571	0.39959	-73.41	3	0.6557
09/29/14	Andros 32 cal #3 IZW	-0.24	37.17	3.30047	2.12046	5.27391	5.14725	-111.49	-0.2219	0.89806	-118.3	3	0.6977
09/29/14	Andros 27 dolo #1 IZW	3.25	43.29	6.76805	8.03298	14.9824	20.776	-103.82	0.04394	4.57187	-124.1	3	0.6915
09/29/14	Andros 2 dolo #1 IZW	3.63	41.59	7.06648	6.39086	13.5764	16.8138	-31.479	-0.044	3.94074	-50.68	3	0.6405
10/02/14	Andros 26 cal#2 IZW	0.26	39.04	3.82837	3.92489	7.61916	11.0658	-11.945	-0.204	3.17563	-23.51	3	0.6476
10/02/14	Andro2 dolo#2 IZW	3.78	41.53	7.20723	6.33718	13.6842	17.3174	-94.911	-0.0292	4.54515	-112.9	3	0.6528
10/02/14	Andros27 dolo VER2 #1 IZW	2.66	42.53	6.19745	7.30212	13.6234	18.9362	-51.526	0.00227	4.21689	-71.13	3	0.6877
10/03/14	Andros15 dolo #2 IZW	1.56	41.81	5.14189	6.60492	11.737	17.7904	2.33076	-0.0969	4.47766	-15.95	4	0.6225
10/03/14	Andros 27 dolo ver2 #2 IZW	3.17	43.23	6.6946	7.97544	14.8489	20.5571	-66.44	0.04381	4.47111	-87.42	4	0.6777
10/04/14	Andros 15 dolo #3 IZW	1.31	40.74	4.87422	5.57263	10.4277	16.2938	-13.067	-0.1079	5.0609	-28.8	4	0.6489
10/04/14	Andros 18 dolo #1 IZW	-1.30	35.96	2.26907	0.95191	2.96487	1.92487	-90.193	-0.3129	0.02013	-94.08	4	0.6529
10/07/14	Andros2 dolo #3 IZW	3.85	41.35	7.26731	6.16864	13.5746	14.7825	-135.44	-0.0341	2.37777	-152.4	4	0.6342
10/07/14	Andros 18 dolo #2 IZW	-1.47	36.16	2.11657	1.13929	3.00593	1.6772	-148.79	-0.2992	-0.6013	-152.6	4	0.6658
10/07/14	Andros 26 cal #3 IZW	-0.01	38.83	3.57361	3.72774	7.17042	12.8972	102.793	-0.1945	5.38765	90.602	4	0.6536
10/07/14	Andros18 cal #2 IZW	1.99	41.57	5.5307	6.37544	11.9452	18.6575	-4.5618	-0.0657	5.79188	-22.68	4	0.6486
10/09/14	AC18 cal #3 IZW	1.99	41.67	5.54033	6.46474	12.0699	16.0067	-56.82	-0.0396	2.99659	-74.16	4.1	0.6456

10/10/14	AC18 dolo#3	-1.52	36.18	2.066	1.16186	2.97806	2.22638	-25.572	-0.2971	-0.0984	-29.93	4.1	0.6667

Transfer Functions:

Window	Start date	end date	SlopeEGL	SlopeETF	IntETF
1	9/15/2014	9/21/2014	0.02929	0.988	0.946
2	9/22/2014	9/24/2014	0.02894	1.037	0.992
3	9/26/2014	10/2/2014	0.02976	1.024	0.993
4	10/1/2014	10/7/2014	0.030514	1.00273	0.96817
4.1	10/2/2014	10/10/2014	0.030564	1.01035	0.97677

Equilibrated and Heated Gasses:

Date	Sample	d13C	d18O	d45	d46	d47	d48	D47	D48
09/09/14	MCB HG	-2.82	23.32	0.41	-11.26	-11.91	-14.71	-1.27	7.86
09/09/14	Mix HG	-3.06	25.14	0.25	-9.50	-10.25	-15.57	-1.17	3.41
09/09/14	Cararra HG	2.06	36.86	5.44	1.83	6.66	8.82	-0.75	5.14
09/09/14	Ooids HG	4.37	37.36	7.62	2.31	9.49	16.86	-0.65	12.17
09/10/14	Mix HG	-3.01	26.57	0.34	-8.11	-8.79	-17.45	-1.17	-1.31
09/10/14	MCB HG	-3.32	20.99	-0.14	-13.50	-14.70	-26.65	-1.30	0.17
09/10/14	MDIW HG	-41.48	28.97	-35.54	-5.88	-44.33	-13.70	-2.19	-1.99
09/11/14	Mix HG	-2.96	22.49	0.25075	-12.055	-12.87	-30.13	-1.2788	-6.3162
09/11/14	Cararra HG	2.12	36.73	5.48899	1.70422	6.60459	5.15915	-0.737	1.74192
09/12/14	Mix HG	-2.93	27.52	0.45926	-7.2001	-7.743	-16.278	-1.137	-1.9577
09/14/14	MCB HG	-3.05	22.31	0.16	-12.23	-13.10	-32.32	-1.25	-8.21
09/15/14	Carrara HG	1.90	37.10	5.29739	2.05792	6.74446	6.35449	-0.7489	2.22529
09/16/14	Cararra HG	2.13	37.61	5.52665	2.55233	7.47522	7.93659	-0.7438	2.81109
09/18/14	Mix HG	-3.06	24.95	0.24375	-9.6768	-10.485	-24.863	-1.2243	-5.713
09/19/14	MCB HG	-3.02	21.82	0.17168	-12.699	-13.609	-31.356	-1.3055	-6.278
09/19/14	MCB HG	-3.02	21.82	0.17	-12.70	-13.61	-31.36	-1.31	-6.28
09/20/14	AAS HG	-41.66	16.41	-36.142	-18.005	-56.782	-46.34	-2.6024	-11.048
09/22/14	MDIW HG	-41.38	26.67	-35.524	-8.10	-46.49	-20.76	-2.28	-4.69
09/23/14	Cararra HG	2.04	33.60	5.31231	-1.3182	3.3354	-3.5347	-0.8357	-0.9023
09/26/14	MDIW HG	-41.29	29.37	-35.348	-5.4986	-43.792	-15.192	-2.2174	-4.272
09/27/14	AAS HG	-41.46	16.96	-35.933	-17.472	-56.066	-44.062	-2.6	-9.7613
09/28/14	Mix HG	-3.33	26.44	0.03982	-8.2465	-9.2547	-21.547	-1.1916	-5.2073
09/27/14	AAS HG	-41.46	16.96	-35.933	-17.472	-56.066	-44.062	-2.6	-9.7613
09/29/14	Carrara 2 HG	2.38	35.20	5.679	0.2233	5.25822	-0.5972	-0.8146	-1.0433
10/01/14	Evap HG	-41.51	39.76	-35.194	4.53448	-33.891	11.1141	-1.9497	2.00604
10/02/14	AAS HG	-41.42	17.18	-35.887	-17.264	-55.886	-45.721	-2.6668	-11.897
10/04/14	Carrara2 HG	3.21	38.77	6.57962	3.6772	9.76823	9.21738	-0.6529	1.83599
10/07/14	Evap HG	-41.35	42.58	-34.95	7.25647	-30.992	18.4578	-1.8737	3.83596
10/09/14	AAS HG	-41.53	17.14	-35.986	-17.299	-55.99	-46.168	-2.6363	-12.292
10/13/14	Carrara2 HG	1.85	34.23	5.149	-0.711	3.814	-2.854	-0.790	-1.435
10/13/14	Carrara2 HG (rerun)	1.84	34.23	5.148	-0.712	3.795	-2.780	-0.807	-1.358
09/09/14	AAS 25C	-41.63	17.02	-36.09	-17.42	-55.16	-35.22	-1.53	-0.70
09/10/14	AAS 25C	-41.31	17.96	-35.76	-16.51	-54.05	-33.31	-1.61	-0.58
09/10/14	Evap 25C	-40.61	47.16	-34.10	11.67	-24.83	35.80	-0.75	12.03
09/10/14	MDIW 25C	-41.64	30.58	-35.63	-4.33	-42.07	-8.09	-1.28	0.55
09/11/14	Evap 25C	-40.62	46.65	-34.13	11.18	-25.35	33.49	-0.76	10.77
09/11/14	MDIW 25C	-41.57	30.67	-35.561	-4.2445	-41.883	-9.7676	-1.2361	-1.308
09/12/14	MDIW 25C	-41.67	30.26	-35.67	-4.6374	-42.371	-9.2133	-1.2397	0.04006
09/12/14	MDIW 25C	-41.49	30.81	-35.483	-4.1113	-41.67	-8.5244	-1.2287	-0.3215
09/14/14	AAS 25 BL	-41.77	15.35	-36.28	-19.028	-56.976	-48.441	-1.6367	-11.169
09/15/14	AAS 25C	-41.60	17.31	-36.054	-17.138	-54.978	-43.085	-1.6541	-9.4225
09/16/14	Evap 25	-40.68	46.97	-34.171	11.4899	-25.106	30.5072	-0.7756	7.22793
09/17/14	Evap 25C	-41.57	46.41	-35.03	10.95	-26.55	28.88	-0.82	6.72
09/19/14	MDIW 25C	-41.52	29.27	-35.56	-5.60	-43.21	-14.26	-1.28	-3.14
09/20/14	AAS 25C	-41.48	17.11	-35.944	-17.328	-55.082	-45.268	-1.6924	-11.301
09/22/14	AAS 25	-41.57	17.38	-36.021	-17.07	-54.90	-45.65	-1.68	-12.21
09/23/14	Evap 25C	-41.53	46.74	-34.977	11.2702	-26.222	29.6596	-0.845	6.83676
09/24/14	AAS 25	-41.58	17.51	-36.03	-16.94	-54.78	-44.18	-1.67	-10.95
09/26/14	AAS 25C	-41.69	17.25	-36.134	-17.199	-55.149	-43.67	-1.6885	-9.9049
09/27/14	Evap 25C	-41.49	47.04	-34.928	11.5597	-25.901	31.6887	-0.8493	8.24367
09/28/14	AAS 25C	-41.45	17.71	-35.896	-16.754	-54.52	-43.932	-1.7238	-11.073
09/29/14	MDIW 25C	-41.41	30.66	-35.413	-4.2485	-41.856	-11.468	-1.3624	-3.0148
09/28/14	AAS 25C	-41.45	17.71	-35.90	-16.75	-54.52	-43.93	-1.72	-11.07
10/03/14	AAS 25	-41.54	17.97	-35.976	-16.503	-54.365	-42.817	-1.7254	-10.424
10/04/14	Evap 25C	-41.43	47.02	-34.879	11.5389	-25.875	30.2906	-0.8561	6.91871
10/07/14	MDIW 25C	-41.46	29.58	-35.497	-5.2957	-42.946	-14.649	-1.3752	-4.1293
10/08/14	AAS 25C	-41.47	17.85	-35.914	-16.615	-54.448	-44.079	-1.7682	-11.505
10/11/14	Evap 25C	-41.56	45.15	-35.065	9.73557	-27.78	25.2014	-0.8609	5.52698

MARCH 2014 RUN

Date	Sample	d13C	d18O	d45	d46	d47	d48	d49	D47	D48	D49	window	D47 rfac
03/25/14	AC31 dolo #1 IZW	1.93	43.02	5.531	7.769	13.334	19.398	17.818	-0.056	3.742	-3.424	1	0.6764
03/25/14	AC30 dolo #2 IZW	1.88	42.67	5.465	7.436	12.952	18.310	33.605	-0.040	3.333	12.761	1	0.7034
03/25/14	AC30 dolo #1 IZW	1.86	42.83	5.458	7.589	13.095	19.134	-17.222	-0.042	3.839	-37.322	1	0.6984
03/26/14	AC31 dolomite #2 IZW	1.77	41.87	5.343	6.661	12.034	16.461	48.836	-0.063	3.055	29.375	1	0.6932
03/28/14	AC7-A dolo #1 IZW	2.05	40.12	5.542	4.973	10.513	12.496	109.155	-0.122	2.501	91.941	2	0.6371
03/28/14	AC7-A calcite #1 IZW	2.11	36.10	5.464	1.093	6.473	3.323	43.079	-0.242	1.134	34.818	2	0.6141

03/28/14	AC1 deep dolo #1 IZW	2.63	39.35	6.055	4.230	10.263	11.315	77.858	-0.167	2.814	62.099	2	0.5970
03/31/14	AC7-A calcite #2 IZW	2.10	36.47	5.463	1.453	6.876	3.908	128.108	-0.194	0.997	######	3	0.6662
03/31/14	AC 30 dolo #3 IZW	1.03	41.68	4.637	6.481	11.142	17.046	169.537	-0.046	3.991	######	3	0.7129
04/01/14	AC7-A dolo #2 IZW	2.32	40.95	5.826	5.773	11.639	14.505	55.303	-0.082	2.892	36.990	3	0.6538
04/01/14	AC31 dolo #3 IZW	1.88	42.87	5.480	7.626	13.175	19.375	85.818	-0.021	4.003	63.510	3	0.6778
04/01/14	AC1-deep dolo #2 IZW	2.95	40.51	6.396	5.349	11.876	13.743	139.494	-0.017	2.984	######	3	0.7140
04/02/14	AC7-A dolo #3 IZW	2.32	40.61	5.811	5.451	11.281	14.032	33.124	-0.106	3.068	15.852	4	0.6101
04/02/14	AC7-A calcite #3 IZW	1.78	35.94	5.146	0.936	6.013	2.598	-0.322	-0.218	0.724	-7.598	4	0.6396
04/02/14	AC1 deep dolo #3 IZW	2.32	39.39	5.768	4.272	10.047	10.690	25.685	-0.128	2.110	10.912	4	0.6215
04/03/14	AC7-A dolo #4 IZW	1.40	35.97	4.794	0.964	5.766	2.651	137.400	-0.131	0.722	######	4	0.7377
04/03/14	AC7-A calcite #4 IZW	2.09	35.95	5.435	0.952	6.338	3.074	61.424	-0.208	1.166	53.341	4	0.6412
04/03/14	AC31 dolo #4 IZW	1.94	42.93	5.536	7.682	13.300	19.711	80.621	-0.010	4.223	58.242	4	0.6543
04/03/14	AC30 dolo #4 IZW	2.00	42.91	5.587	7.667	13.326	19.505	-50.514	-0.022	4.050	-70.200	4	0.6417
04/04/14	AC1 deepdolo #4 IZW	2.23	39.67	5.697	4.543	10.214	11.068	10.239	-0.155	1.944	-4.764	4	0.5884
04/08/14	AC1 deep dolo #5 IZW	2.55	40.30	6.017	5.149	11.188	13.218	-20.367	-0.114	2.864	-36.386	5	0.6315
04/14/14	AC15 dolo #1 IZW	1.51	41.59	5.088	6.393	11.453	16.955	-15.662	-0.115	4.075	-33.160	6	0.6050
04/14/14	AC26 calcite #1 IZW	-0.13	39.11	3.468	3.990	7.356	10.863	60.532	-0.159	2.844	48.386	6	0.6708
04/15/14	AC26 calcite #2 IZW	0.20	39.66	3.797	4.530	8.215	13.494	62.969	-0.173	4.375	49.320	6	0.6328

Transfer Functions:

Window	Start date	end date	SlopeEGL	SlopeETF	IntETF	
1	3/18/2014	3/25/2014	0.02253	1.083	0.980	
2	3/21/2014	3/28/2014	0.02424	1.008	0.936	
3	3/24/2014	3/31/2014	0.02431	1.021	0.953	
4	4/2/2014	4/8/2014	0.029592	1.37523	1.0026	
5	4/7/2014	4/11/2014	0.028009	2.0919	1.30802	
6	3/26/2015	4/15/2014	0.027038	1.10306	0.97447	*few standards at end of run; used long-term data

Equilibrated and Heated Gasses:

Date	Sample	d13C	d18O	d45	d46	d47	d48	D47	D48
03/16/14	Ooids HG	-1.35	34.90	2.19	-0.07	1.32	-0.64	-0.865	-0.50
03/16/14	MIX HG	-3.27	29.69	0.21	-5.10	-5.79	-12.90	-0.99	-2.74
03/16/14	MCB HG IZW	-5.96	22.29	-2.56	-12.26	-15.90	-30.16	-1.25	-5.94
03/16/14	Carerra HG	2.12	38.22	5.54	3.14	8.11	7.19	-0.71	0.90
03/16/14	Carerra HG	2.15	35.65	5.49	0.66	5.55	1.32	-0.76	-0.01
03/17/14	Ooids HG	-1.47	36.19	2.11	1.17	2.51	2.63	-0.83	0.28
03/17/14	Ooids HG	-1.50	36.26	2.1	1.2	2.5	2.7	-0.843	0.2
03/17/14	MCB HG	-5.88	22.44	-2.47	-12.11	-15.64	-29.57	-1.22	-5.63
03/17/14	Cararra HG	2.10	38.24	5.53	3.16	8.12	7.35	-0.71	1.01
03/18/14	Mix HG	-3.44	30.72	0.08743	-4.1121	-4.9342	-10.15	-0.9824	-1.9585
03/19/14	Ooids HG	-1.59	34.03	1.93	-0.91	0.18	-2.56	-0.91	-0.73
03/19/14	MCB HG	-6.00	23.36	-2.56	-11.22	-14.83	-27.55	-1.192	-5.35
03/20/14	Mix HG	-2.84	31.17	0.67	-3.68	-3.83	-8.30	-0.90	-0.99
03/21/14	Cararra HG	2.04	37.67	5.45	2.61	7.48	6.21	-0.720	0.98
03/22/14	Carrara HG	2.00	37.86	5.42	2.79	7.61	6.72	-0.739	1.12
03/23/14	MCB HG	-5.81	24.14	-2.36	-10.47	-13.89	-26.13	-1.21	-5.42
03/24/14	MIX HG	-3.34	29.84	0.15	-4.96	-5.74	-12.78	-1.02	-2.92
03/26/14	Ooids HG	-1.50	36.43	2.10	1.41	2.73	3.28	-0.82	0.46
03/27/14	Carerra HG	2.02	37.55	5.42	2.49	7.30	6.42	-0.75	1.43
03/28/14	carrara HG BL	2.03	37.29	5.43	2.24	7.06	4.42	-0.75	-0.06
03/30/14	Evap HG	-41.28	43.93	-34.84	8.56	-29.42	21.21	-1.64	3.96
03/31/14	MCB HG	-5.91	23.70	-2.47	-10.89	-14.47	-27.80	-1.25	-6.27
04/01/14	MCB HG	-5.92	23.77	-2.47	-10.83	-14.43	-27.47	-1.28	-6.06
04/02/14	MCB HG	-41.60	16.87	-36.06	-17.56	-56.07	-44.30	-2.38	-9.82
04/03/14	Mix HG	-3.87	29.48	-0.35	-5.31	-6.65	-13.81	-1.07	-3.25
04/05/14	MDIW HG	-41.38	28.77	-35.455	-6.0744	-44.308	-15.233	-2.0734	-3.1594
04/06/14	MCB HG BL	-4.50	22.94	-1.1702	-11.62	-13.608	-29.689	-0.9995	-6.7482
04/08/14	Evap HG	-19.52	41.84	-14.56	6.58	-9.54	16.99	-0.88	3.72
04/12/14	MDIW HG	-41.38	29.93	-35.41	-4.96	-43.27	-13.53	-2.15	-3.68
04/14/14	Ooids HG	-1.44	35.25	2.11	0.27	1.54	0.22	-0.90	-0.31
03/17/14	MDIW 25C	-41.42	31.50	-35.39	-3.44	-40.71	-8.04	-0.98	-1.18
03/18/14	MDIW 25C	-41.32	31.28	-35.31	-3.65	-40.82	-8.70	-0.97	-1.41
03/18/14	Evap 25C	-41.54	47.52	-34.96	12.02	-25.28	29.59	-0.63	5.27
03/18/14	AAS 25C	-41.37	17.58	-35.83	-16.88	-54.14	-40.69	-1.27	-7.46
03/19/14	Evap 25C	-41.53	47.51	-34.95	12.01	-25.29	29.37	-0.64	5.10
03/20/14	MDIW 25C	-41.36	31.49	-35.34	-3.46	-40.67	-8.57	-0.99	-1.68
03/21/14	Evap 25C	-41.66	46.41	-35.11	10.94	-26.49	27.43	-0.66	5.30
03/23/14	AAS 25C	-40.99	18.66	-35.44	-15.83	-52.80	-38.88	-1.32	-7.72
03/24/14	EVAP 25	-41.51	45.76	-34.99	10.32	-26.98	26.02	-0.69	5.16
03/26/14	MDIW 25C	-41.43	29.67	-35.47	-5.2111	-42.511	-12.946	-1.0347	-2.5784
03/27/14	Evap 25C	-41.59	46.12	-35.06	10.67	-26.71	26.95	-0.67	5.38
03/28/14	25C AAS	-41.43	17.05	-35.90	-17.39	-54.83	-42.60	-1.41	-8.43
03/30/14	Evap 25C	-41.37	46.53	-34.84	11.06	-26.15	28.03	-0.71	5.66
03/31/14	Evap 25C	-41.45	47.01	-34.89	11.53	-25.77	29.20	-0.72	5.87
04/01/14	MDIW 25C	-41.43	31.14	-35.42	-3.79	-41.18	-9.31	-1.11	-1.76
04/03/14	Evap 25C	-41.39	47.28	-34.83	11.79	-25.46	30.02	-0.73	6.15
04/03/14	AAS 25C	-41.29	17.09	-35.76	-17.35	-54.71	-43.40	-1.47	-9.32
04/05/14	AAS 25	-28.47	20.22	-23.673	-14.3	-39.245	-36.105	-1.2219	-7.9598
04/07/14	AAS 25C	-41.32	30.96	-35.32	-3.96	-41.75	-9.97	-1.64	-2.41

04/11/14	Evap 25C	-41.45	47.33	-34.88	11.83	-25.53	30.68	-0.78	6.71
04/11/14	AAS 25C	-41.41	16.22	-35.91	-18.18	-55.78	-46.86	-1.61	-11.23
04/13/14	Evap 25C	-41.41	47.56	-34.84	12.06	-25.29	31.33	-0.80	6.90
04/14/14	AAS 25C	-41.29	17.19	-35.77	-17.25	-54.75	-44.04	-1.61	-10.19

SAMPLE	d13RAWc	d18ORAWc
AC30 dolo #2 IZW	1.98	43.03
AC30 dolo #1 IZW	1.96	43.19
AC30 dolo #4 IZW	2.10	43.27
AC31 dolo #1 IZW	2.03	43.38
AC31 dolo #3 IZW	1.98	43.23
AC31 dolo #4 IZW	2.04	43.29
AC31 dolomite #2 IZW	1.87	42.23
Andros 27 dolo #1 IZW	3.35	43.65
Andros27 dolo VER2 #1 IZW	2.76	42.89
Andros 27 dolo ver2 #2 IZW	3.27	43.59
Andros 18 cal #1 IZW DOLO	2.13	42.02
Andros18 cal #2 IZW DOLO	2.09	41.93
AC18 cal #3 IZW DOLO	2.09	42.03
Andros15 dolo #1 IZW	1.41	41.29
Andros15 dolo #2 IZW	1.66	42.17
Andros 15 dolo #3 IZW	1.41	41.10
AC15 dolo #1 IZW	1.61	41.95
AC7-A dolo #2 IZW	2.42	41.31
AC7-A dolo #3 IZW	2.42	40.97
AC7-A dolo #1 IZW	2.15	40.48
Andros 2 dolo #1 IZW	3.73	41.95
Andro2 dolo#2 IZW	3.88	41.89
Andros2 dolo #3 IZW	3.95	41.71
AC1 deep dolo #3 IZW	2.42	39.75
AC1 deepdolo #4 IZW	2.33	40.03
AC1 deep dolo #5 IZW	2.65	40.66
AC1 deep dolo #1 IZW	2.73	39.71
Andros 32 cal #3 IZW	-0.14	37.53
Andros32 cal #1 IZW	-0.18	37.22
Andros32 cal #2 IZW	-0.22	37.23
Andros 26 cal#2 IZW	0.36	39.40
Andros 26 cal #3 IZW	0.09	39.19
Andros26 cal #1 IZW	-0.05	39.07
AC26 calcite #1 IZW	-0.03	39.47
AC26 calcite #2 IZW	0.30	40.02
Andros 18 dolo #1 IZW CAL	-1.20	36.32
Andros 18 dolo #2 IZW CAL	-1.37	36.52
(AC18 dolo#3) CAL	-1.42	36.54
Andros6 cal #3 IZW	1.66	35.98
Andros6 cal #1 IZW	1.31	35.14
AC7-A calcite #1 IZW	2.21	36.46
AC7-A calcite #2 IZW	2.20	36.83
AC7-A calcite #3 IZW	1.88	36.30
AC7-A calcite #4 IZW	2.19	36.31

δ18O and δ13C corrections for -30°C Porapak

See Petersen et al. (2015), *RCMS* , for details

*+.1 for δ13C and +.36 for δ18O