4. Data Report: Utilizing Color Reflectance Analysis as a Carbonate Concentration Proxy[1]

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INTRODUCTION

Color reflectance data (400–700 nm) are routinely collected aboard the *JOIDES Resolution* and have been used to estimate the carbonate concentration in sediments (Balsam et al., 1997; Mix et al., 1995). A good summary of the recent usage of color reflectance data to estimate fractions of various minerals is published in Balsam et al. (1999).

The purpose of this paper is to present models estimating the carbonate fraction for each site cored during Leg 181. These models ("Appendix A," p. 6) were constructed using data collected aboard ship during Leg 181 (hereafter referred to as "shipboard data") and supplementary data collected at the Ocean Drilling Program Gulf Coast Repository (ODP GCR) after the cruise (hereafter referred to as "laboratory data"). Each model is contained in a separate table and includes predicted carbonate fractions with corresponding depth values in meters composite depth (mcd) (Carter, McCave, Richter, Carter, et al., 1999). Graphic depictions for each model are included in "Appendix B," p. 7.

METHODS AND MATERIALS

Leg 181 was the maiden voyage for the automated system now used to collect color reflectance data. At the first site of Leg 181, Site 1119, the Minolta spectrophotometer did not consistently make good contact with core material, which resulted in poor data quality data for Site 1119 and left the shipboard color reflectance data unusable. Adjustments were made in the settings of the spectrophotometer before data

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were collected at subsequent sites, and therefore data quality for the re-
maining cores is better (Carter, McCave, Richter, Carter, et al., 1999).
Color reflectance data (laboratory data) were collected on cores from
Hole 1119C at the ODP GCR with a Minolta CM-2002 spectrophotome-
ter. This is the same model instrument used aboard ship. The software
package used in the data collection process was provided by the manu-
facturer. A barium sulfate standard was used. Cores were covered with
Glad plastic wrap before taking measurements to protect the optical
components of the instrument from moisture and scratches and to
avoid sample contamination. A glass slide was used to scrape mold
growth from core surfaces. Measurements were taken on cores by care-
ful visual inspection to ensure good contact with the core material and
avoid confounders such as cracks, large shell fragments, pebbles, and
pyrite oxidation halos.

Figure F1 is a comparative display of the ranges of color reflectance
data (all wavelengths combined) for each hole. The maximum, 75th
quartile, median, 25th quartile, and minimum values are displayed in a
box and whisker format. There are obvious problems with the data.
Cores from Site 1120 show out-of-range values for Holes 1120B and
1120C (reflectance >100%). A comparison with the measured carbonate
summary statistics (Table T1) shows that these values are significantly
higher at Site 1120 than at the other sites. These problematic data were
not discarded because no other color reflectance data from this site are
available. Because the measured carbonate values for Site 1120 are
higher than those from other sites and because the range of color reflec-
tance values is similar to data from other cores, we utilized these data to
construct the model for Site 1120. Interquartile range values for color
reflectance data from Site 1120 are similar to those of other cores recov-
ered during this leg, which suggests the possibility that they preserve
some of the variance in the data set, even though absolute values are
not reliable.

Models to estimate carbonate concentrations were generated using
the statistics package produced by the SAS Institute, Inc., and are regres-
sion models. Models for Sites 1124 and 1125, and Holes 1119C and
1123A used the following model form:

$$Y = \beta_0 + \beta_1 FD_1 + \beta_2 FD_2 + \ldots + \beta_{30} FD_{30}.$$

The model for Site 1121 has the form

$$Y = \beta_0 + \beta_1 R_1 + \beta_2 FD_4 + \beta_3 FD_7 + \beta_4 FD_{21} + \beta_5 FD_{30}.$$

The model for Site 1120 has the form

$$Y = \beta_0 + \beta_1 R_1 + \beta_2 FD_2 + \beta_3 FD_7 + \beta_4 FD_{21} + \beta_5 FD_{27}.$$
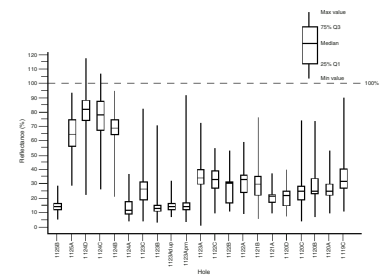
Models for Sites 1122 and 1123 (all shipboard data) are of the form

$$Y = \beta_0 + \beta_1 R_1 + \beta_2 FD_1 + \beta_3 FD_2 + \ldots + \beta_{30} FD_{30}.$$

For all these models,

    Y = the dependent variable, predicted carbonate fraction.
    β_i = the coefficient (model parameter) estimated in the modeling
           process.

F1. Ranges of color reflectance
data, p. 10.

T1. Measured carbonate summary
statistics, p. 11.

R_1 = the raw reflectance value at 400 nm wavelength.
FD_i = the first derivative value calculated using two successive reflectance values (such as FD_1 calculated from R_1 [400 nm] and R_2 [410 nm]).

Development of the models proceeded empirically. The choice of first derivative transformation of the reflectance data was suggested by the work of Deaton and Balsam (1991) and the collective experience of the authors. The data were analyzed to minimize the covariance problem that is inherent in reflectance data. Variables were selected based on this study and various combinations of the least covariant factors were tried in order to choose empirically the most effective regression model. Adding the first untransformed reflectance variable (R_1 = 400 nm) helped increase the R^2 value for some of the models. An indication of how well each model describes the data can be ascertained by inspecting Table T2. Models that have low enough R^2 values (<50%) to be of questionable value as prediction tools are the models for Sites 1122 and 1123. Several of the models account well for most of the variation in the data—namely, the models for Sites 1121 and 1125 and for Hole 1119C. Plots of measured carbonate vs. predicted carbonate fraction can be examined for every model in "Appendix C," p. 8. Model parameter estimates for every model are also included in "Appendix D," p. 9.

In an effort to get an indication of the relative data quality between shipboard data and laboratory data, some cores from Hole 1123A were also measured in the laboratory after the cruise. Figure F1 shows that the data range for laboratory data is not significantly different from that of the shipboard data. However, the R^2 values for the models are significantly different. The model generated using the laboratory data is significantly better than that using the shipboard data. Both models use the same variables, the same model structure, and the same depth range over the cores. This suggests that there may be a problem with the shipboard data in this interval, making it more noisy, masking the true variance of the data, and hindering the ability of the model to reflect the true variability of the data.

T2. Carbonate prediction model statistics, p. 12.

CONCLUSIONS

Shipboard color reflectance data contain some unresolved problems; however, most data can be used with caution. Shipboard color reflectance data from Site 1119 are not usable. The carbonate prediction model fit is good at Sites 1120, 1121, 1124, and 1125 (shipboard data) and Holes 1119C and 1123A (laboratory data). Models for Sites 1122 and 1123 (excluding the model from laboratory data) are of questionable usefulness but are included for comparison and completeness.

ACKNOWLEDGMENTS

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APPENDIX A

Models for Leg 181 Data: Carbonate Fraction Predictions

Models were developed to estimate the carbonate fraction for each site of Leg 181. Each of the following ASCII tables contains predicted carbonate fractions with the corresponding depth values in meters composite depth (mcd): Table **ATA1** contains data for Hole 1119C; Table **ATA2** contains data for Site 1120; Table **ATA3** contains data for Site 1121; Table **ATA4** contains data for Site 1122; Table **ATA5** contains data for Site 1123; Table **ATA6** contains laboratory data for Hole 1123A; Table **ATA7** contains shipboard data for Hole 1123A; Table **ATA8** contains data for Site 1124; and Table **ATA9** contains data for Site 1125.

ATA1. Carbonate fraction prediction model, Hole 1119C, p. 33.

ATA2. Carbonate fraction prediction model, Site 1120, p. 34.

ATA3. Carbonate fraction prediction model, Site 1121, p. 35.

ATA4. Carbonate fraction prediction model, Site 1122, p. 36.

ATA5. Carbonate fraction prediction model, Site 1123, p. 37.

ATA6. Carbonate fraction prediction model, Hole 1123A (laboratory data), p. 38.

ATA7. Carbonate fraction prediction model, Hole 1123A (shipboard data), p. 39.

ATA8. Carbonate fraction prediction model, Site 1124, p. 40.

ATA9. Carbonate fraction prediction model, Site 1125, p. 41.

APPENDIX B

Plots of Model Predictions: Carbonate Fraction

The Leg 181 models for carbonate fractions were plotted. For results of the plots, see Figures **AFB1, AFB2, AFB3, AFB4, AFB5, AFB6,** and **AFB7.**

AFB1. Model-predicted carbonate fraction, Hole 1119C, p. 13.
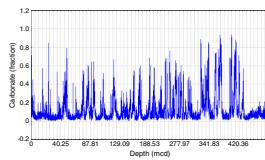
AFB2. Model-predicted carbonate fraction, Site 1120, p. 14.
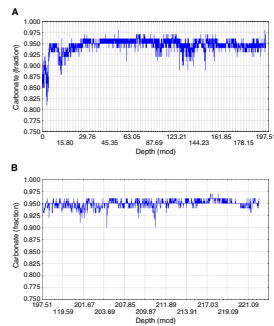
AFB3. Model-predicted carbonate fraction, Site 1121, p. 15.
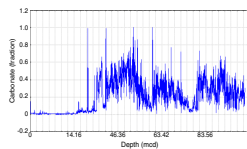
AFB4. Model-predicted carbonate fraction, Site 1122, p. 16.
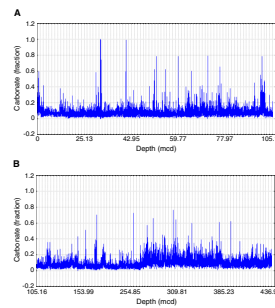
AFB5. Model-predicted carbonate fraction, Hole 1123A (laboratory and shipboard data) and Site 1123 (laboratory and shipboard data), p. 18.
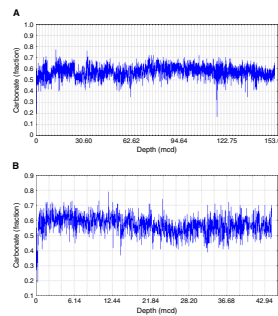
AFB6. Model-predicted carbonate fraction, Site 1124 (laboratory and shipboard data), p. 21.
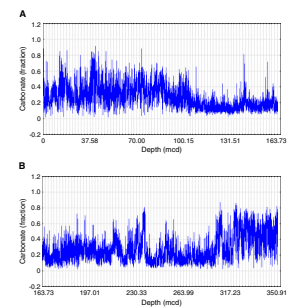
AFB7. Model-predicted carbonate fraction, Site 1125 (shipboard data), p. 23.
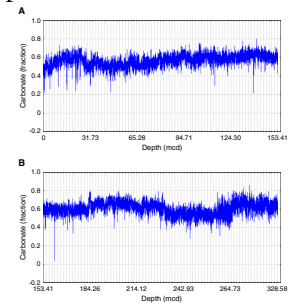
APPENDIX C

Plots of Measured Carbonate Values vs. Predicted Values (Model Evaluation)

The carbonate fraction prediction models were evaluated by comparing the plots of the Leg 198 predicted carbonate fraction values were to the measured carbonate fraction values. For results of the comparisons, see Figures **AFC1, AFC2, AFC3, AFC4, AFC5, AFC6,** and **AFC7.**

AFC1. Model-predicted carbonate fraction vs. measured carbonate fraction, Hole 1119C, p. 25.
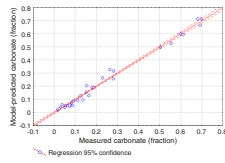
AFC2. Model-predicted carbonate fraction vs. measured carbonate fraction, Site 1120, p. 26.
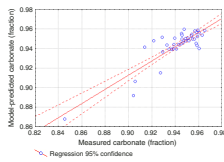
AFC3. Model-predicted carbonate fraction vs. measured carbonate fraction, Site 1121, p. 27.
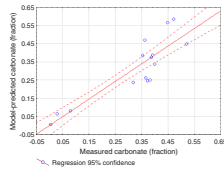
AFC4. Model-predicted carbonate fraction vs. measured carbonate fraction, Site 1122, p. 28.
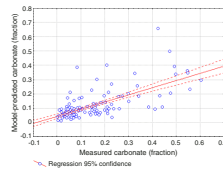
AFC5. Model-predicted carbonate fraction vs. measured carbonate fraction, Hole 1123A and Site 1123, p. 29.
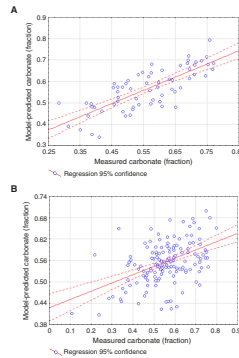
AFC6. Model-predicted carbonate fraction vs. measured carbonate fraction, Site 1124, p. 31.
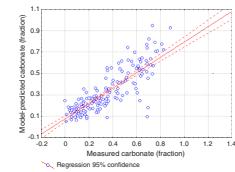
AFC7. Model-predicted carbonate fraction vs. measured carbonate fraction, Site 1125, p. 32.
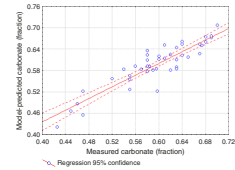
APPENDIX D

Model Parameter Estimates

Carbonate model parameters were estimated for Leg 198. Each of the following tables contains the carbonate model parameter estimates for the designated site or hole: Table ATD1 contains carbonate model parameter estimates for Site 1119C (laboratory reflectance data); Table ATD2 contains carbonate model parameter estimates for Site 1120; Table ATD3 contains carbonate model parameter estimates for Site 1121; Table ATD4 contains carbonate model parameter estimates for Site 1122; Table ATD5 contains carbonate model parameter estimates for Site 1123; Table ATD6 contains carbonate model parameter estimates for Hole 1123A (laboratory reflectance data); Table ATD7 contains carbonate model parameter estimates for Hole 1123A (shipboard reflectance data); Table ATD8 contains carbonate model parameter estimates for Site 1124; and Table ATD9 contains carbonate model parameter estimates for Site 1125.

Figure F1. Comparative display of the ranges of color reflectance data (all wavelengths combined for each hole). Dup = shipboard data, prn = laboratory data.
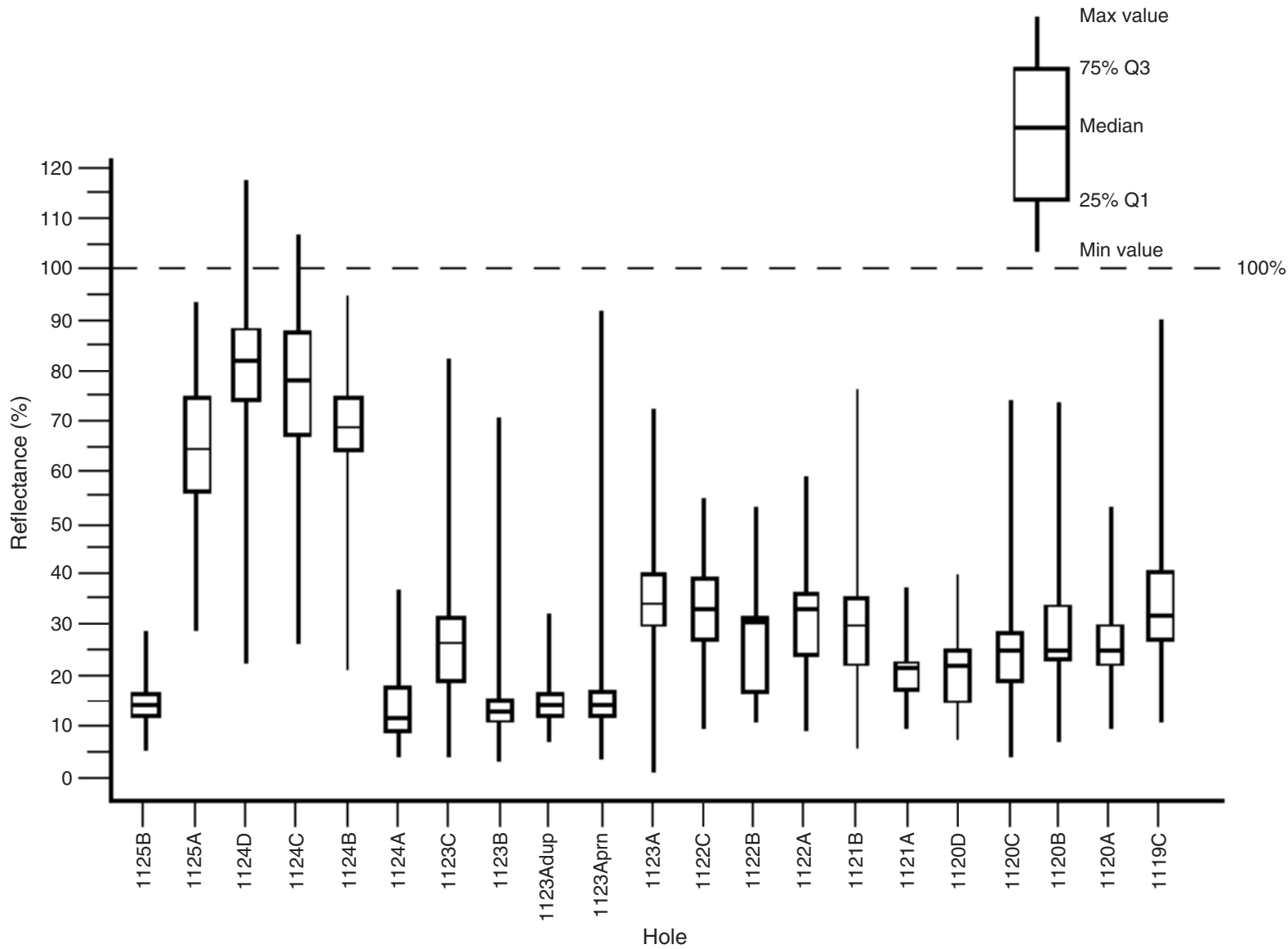
Table T1. Measured carbonate summary statistics by site.

Site	100% maximum	Mean	0% minimum	Range	Carbonate N
1119	72.66	15.40861	0.48	72.18	74
1120	98.73	94.59521	84.52	14.21	73
1121	52.02	22.89152	0.38	51.64	33
1122	76.41	13.25076	0.07	76.34	236
1123	84.3	58.27108	10.93	73.37	912
1124	88.28	34.98078	0	88.28	373
1125	71	59.72153	23	48	144

Note: N = number of samples with measured carbonate (total).

Table T2. Carbonate prediction model statistics.

Site/Hole	Root mean squared error	R^2	Coefficient of variation	Reflectance N	Carbonate N	Variables N	Model variables	Data source
1119C	0.36437	0.9714	–17.52781	2922	74	30	all 30 fdv	Lab
1120	0.19376	0.6609	6.78812	12184	73	5	r1, fd2, fd7, fd21, fd27	Ship
1121	0.48677	0.9606	–24.46203	3602	33	5	r1,fd4,fd7,fd21,fd30	Ship
1122	0.97357	0.4473	–41.56004	20967	236	31	r1, fd1-fd30	Ship
1123	0.45273	0.2895	157.96569	41844	912	31	r1, fd1-fd30	Ship
1123A	0.43911	0.6097	151.1393	833	280	30	all 30 fdv	Lab
1123A	0.49232	0.2191	212.54304	1868	337	30	all 30 fdv	Ship
1124	0.79314	0.6592	–94.62303	27721	374	30	all 30 fdv	Ship
1125	0.20555	0.8166	50.9898	23412	144	30	all 30 fdv	Ship

Notes: N = number of samples with measured reflectance, number of samples with measured carbonate (total), and number of variables used to construct models. fd = first derivative value for the interval 400–410 nm, fdv = first derivative value, r1 = reflectance measurement for 400 nm.

Figure AFB1. Model-predicted carbonate fraction for Hole 1119C (laboratory data).
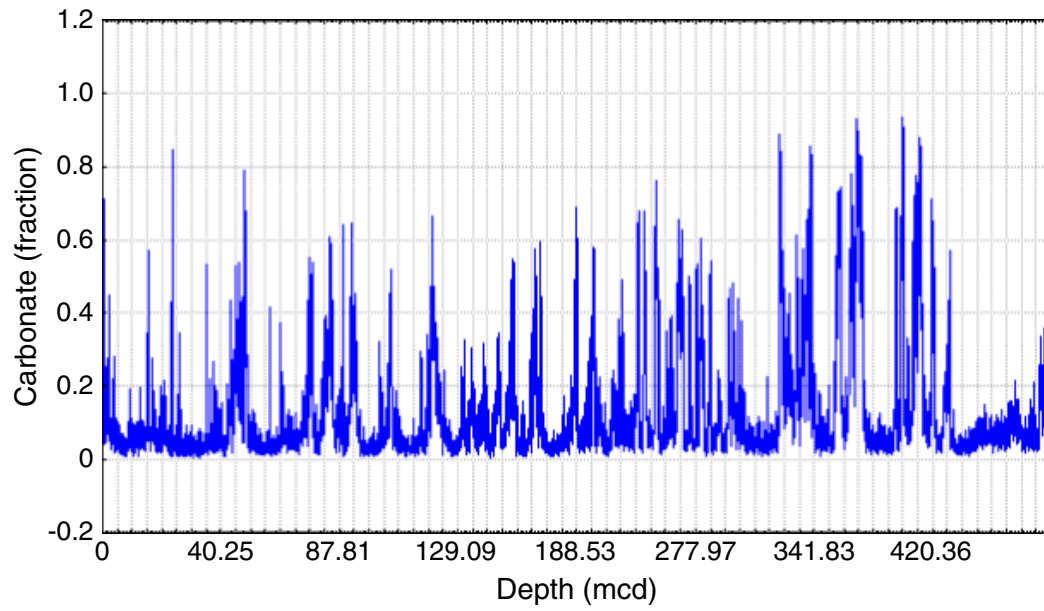
Figure AFB2. A. Model-predicted carbonate fraction for Site 1120, cases 2–8001 (shipboard data). **B.** Model-predicted carbonate fraction for Site 1120 (shipboard data), cases 8002–9054.
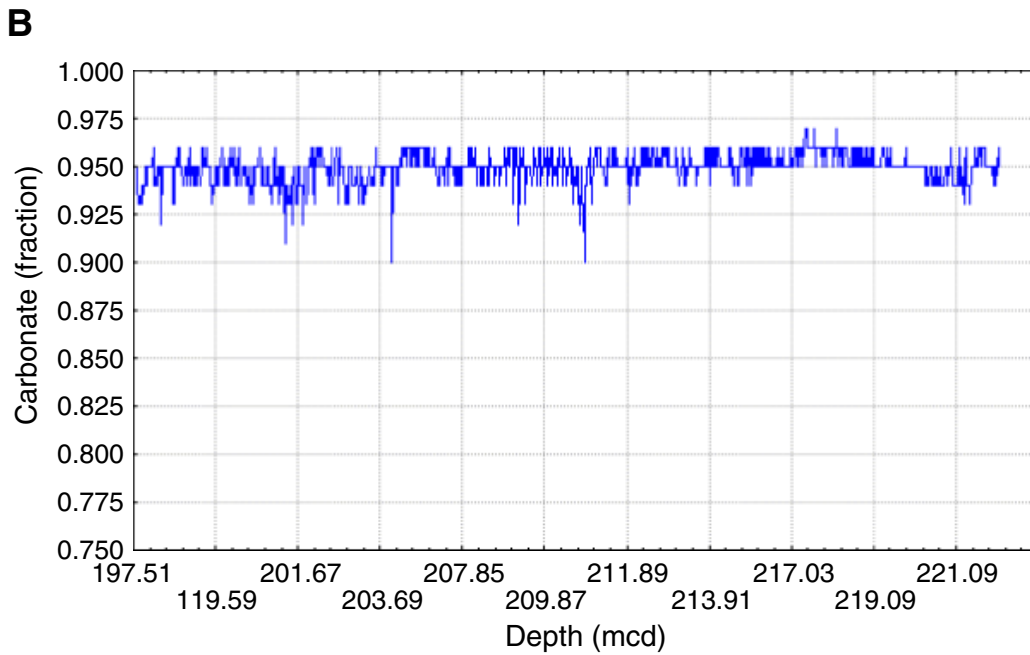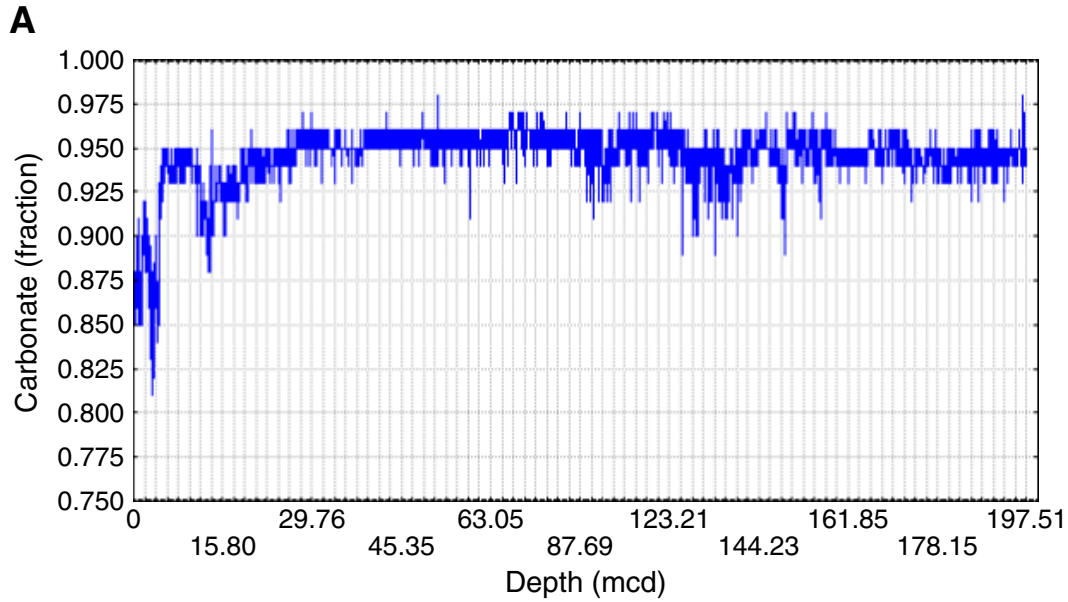
Figure AFB3. Model-predicted carbonate fraction for Site 1121 (shipboard data), cases 2–8001.
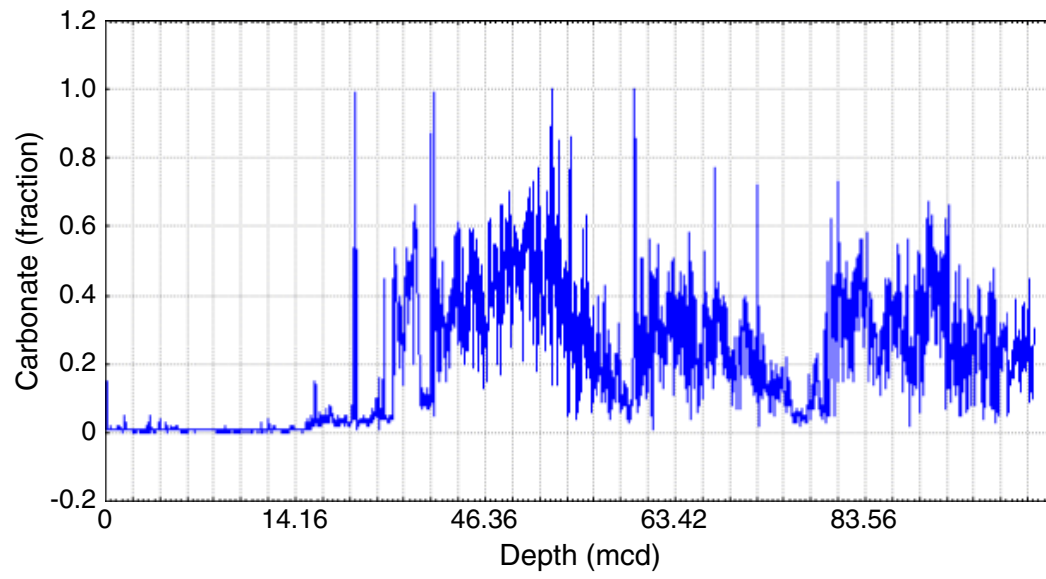
Figure AFB4. A. Model-predicted carbonate fraction for Site 1122 (shipboard data), cases 2–8001. **B.** Model-predicted carbonate fraction for Site 1122, cases 8002–16001. (Continued on next page.)

A
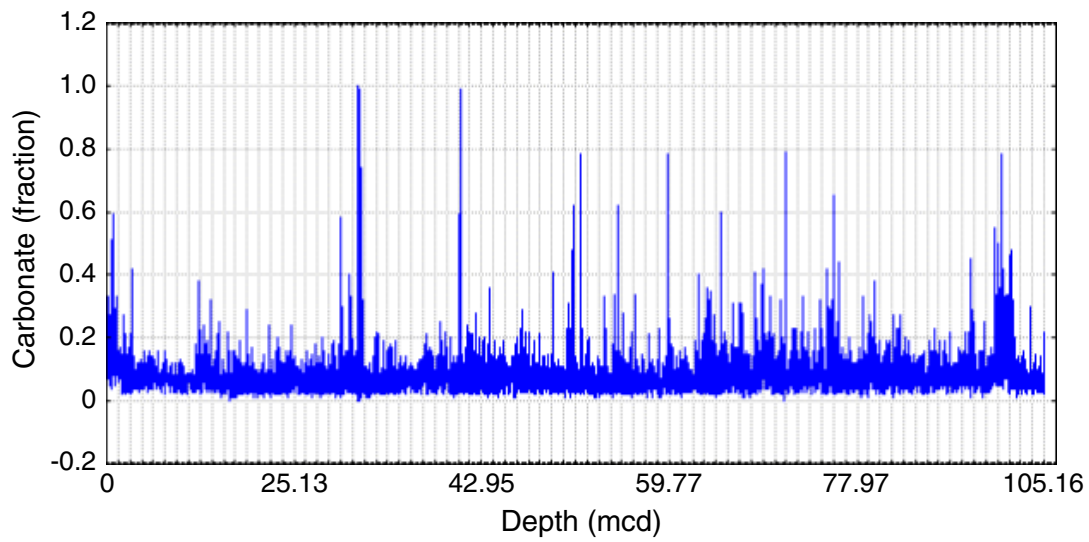
B
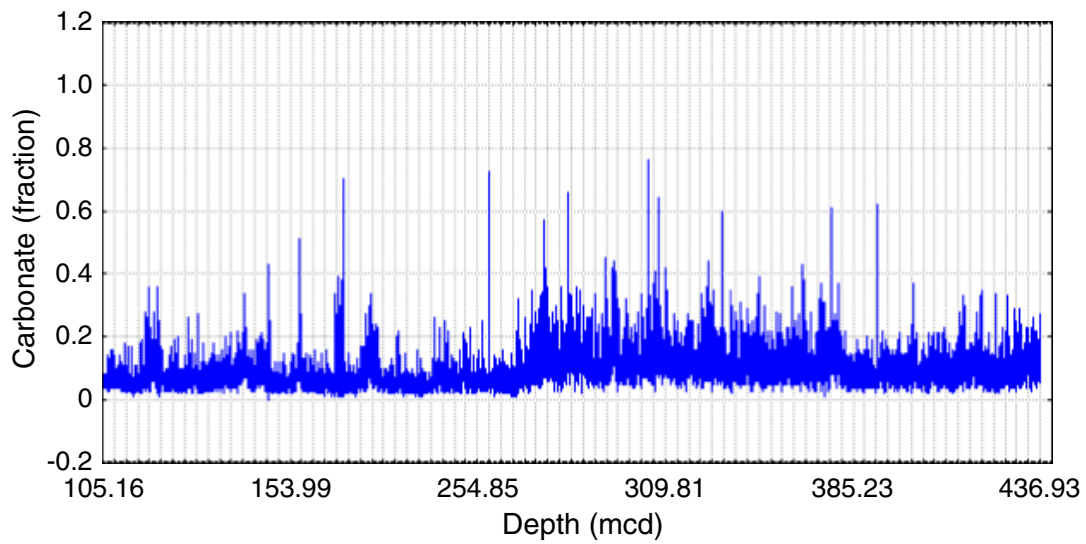
Figure AFB4 (continued). C. Model-predicted carbonate fraction for Site 1122, cases 16002–19224.

C
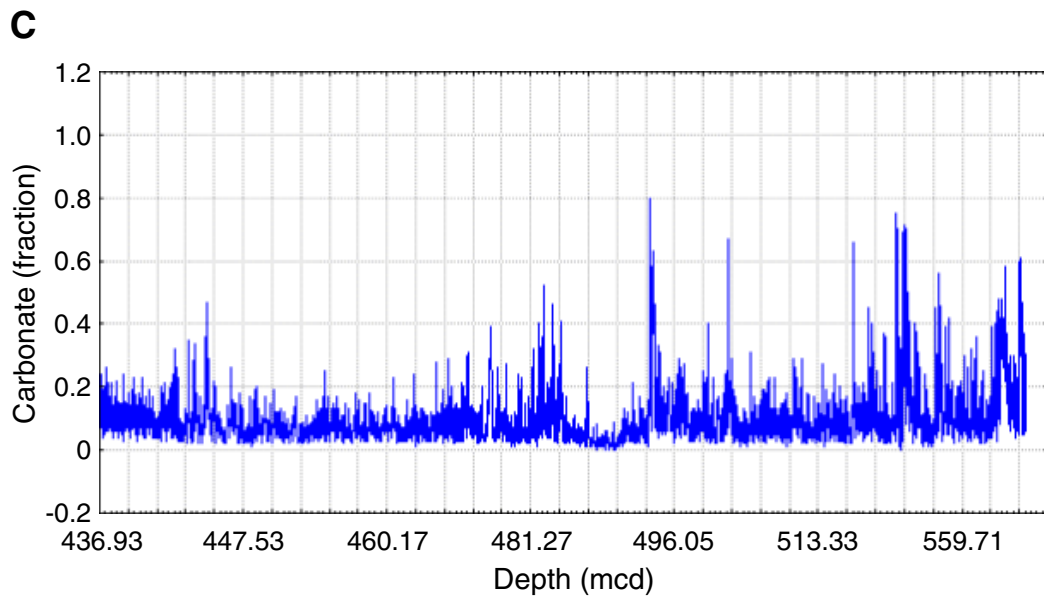
Figure AFB5. A. Model-predicted carbonate fraction for Hole 1123A (laboratory data), cases 2–8001. **B.** Model-predicted carbonate fraction for Hole 1123A (shipboard data). Mcd = meters composite depth. (Continued on next two pages.)

A
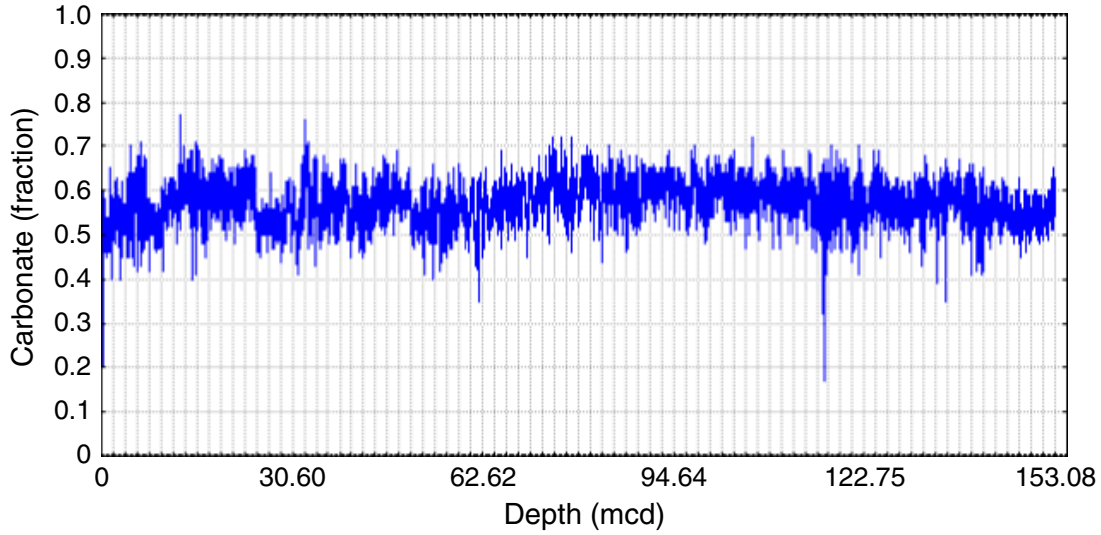
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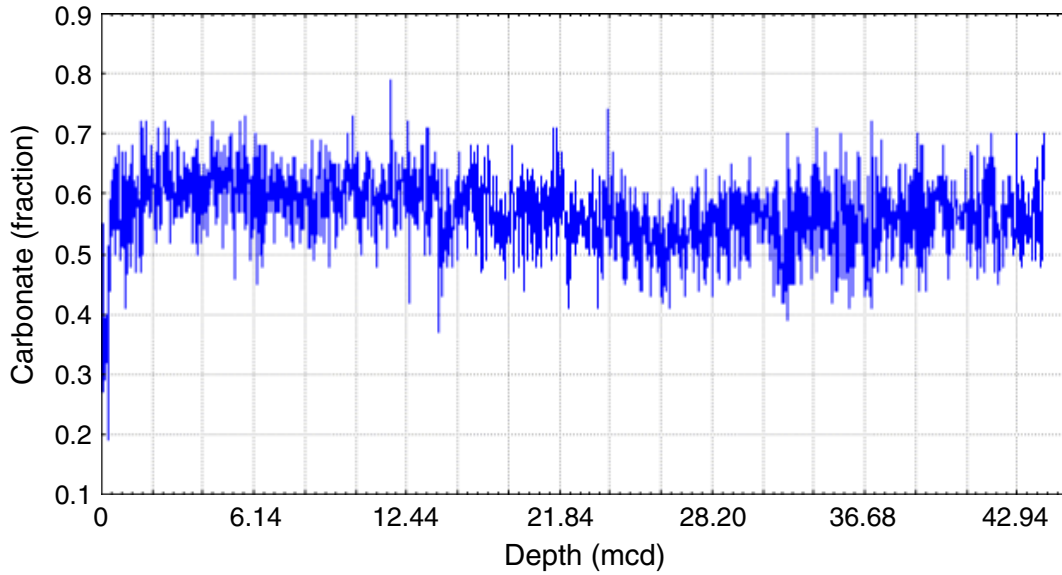
Figure AFB5 (continued). C. Model-predicted carbonate fraction for Site 1123 (shipboard data), cases 2–8001. **D.** Model-predicted carbonate fraction for Site 1123 (shipboard data), cases 8002–16001. (Continued on next page.)

C
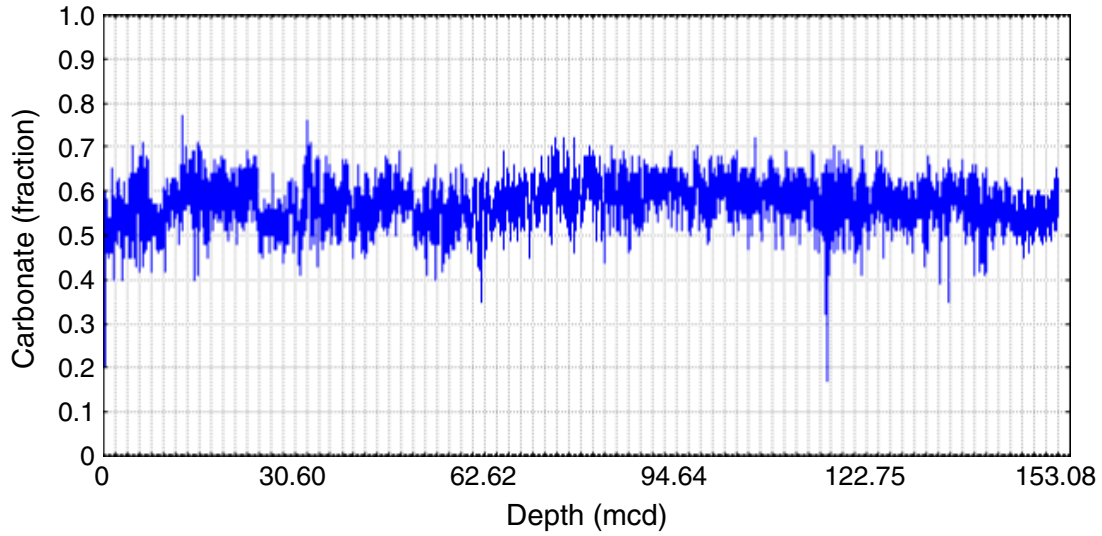
D
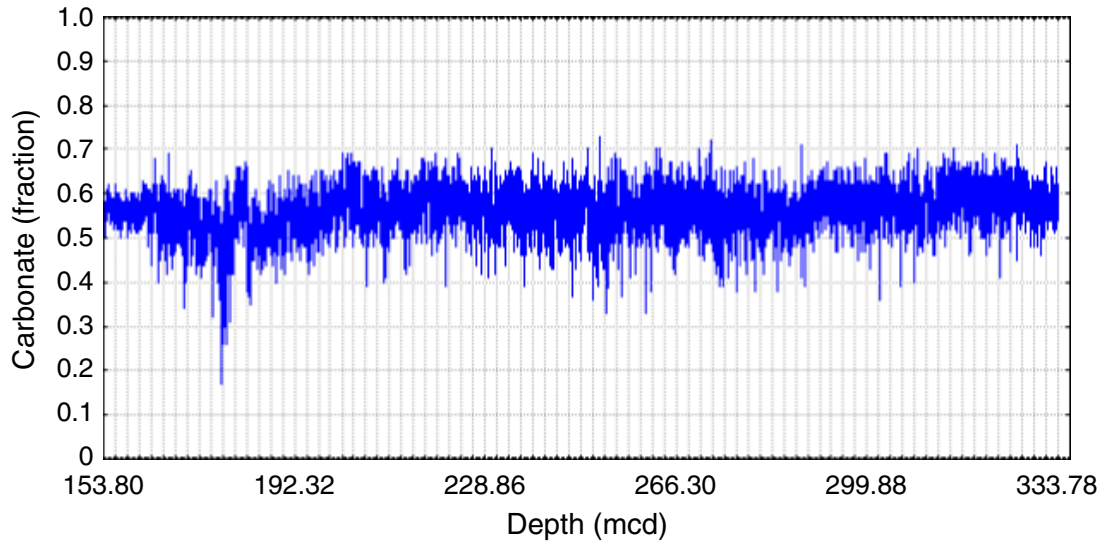
Figure AFB5 (continued). E. Model-predicted carbonate fraction for Site 1123 (shipboard data), cases 16002–24001.

E
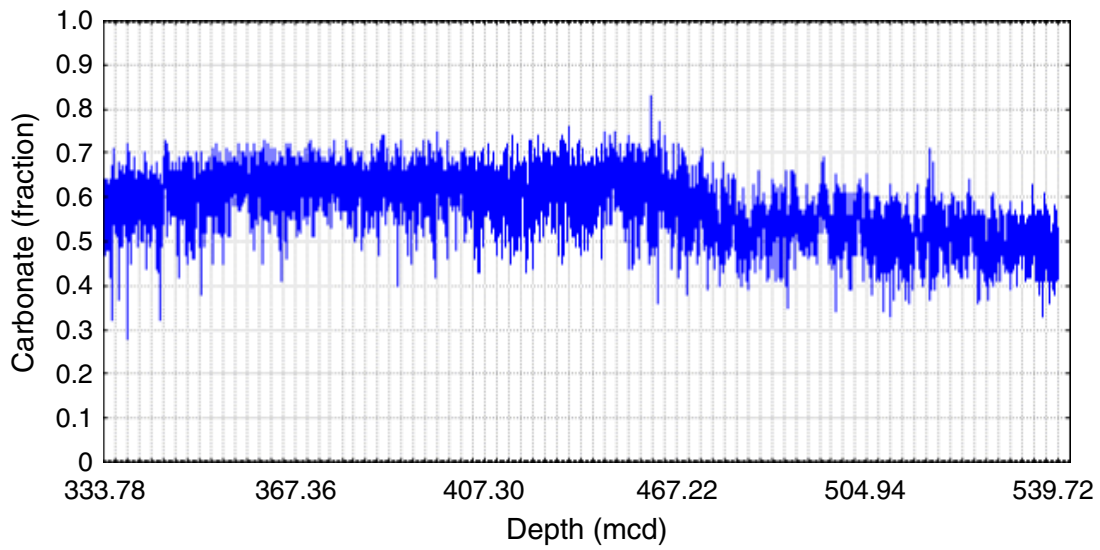
Figure AFB6. A. Model-predicted carbonate fraction for Site 1124 (shipboard data), cases 2–8001. **B.** Model-predicted carbonate fraction for Site 1124 (shipboard data), cases 8002–16001. (Continued on next page.)
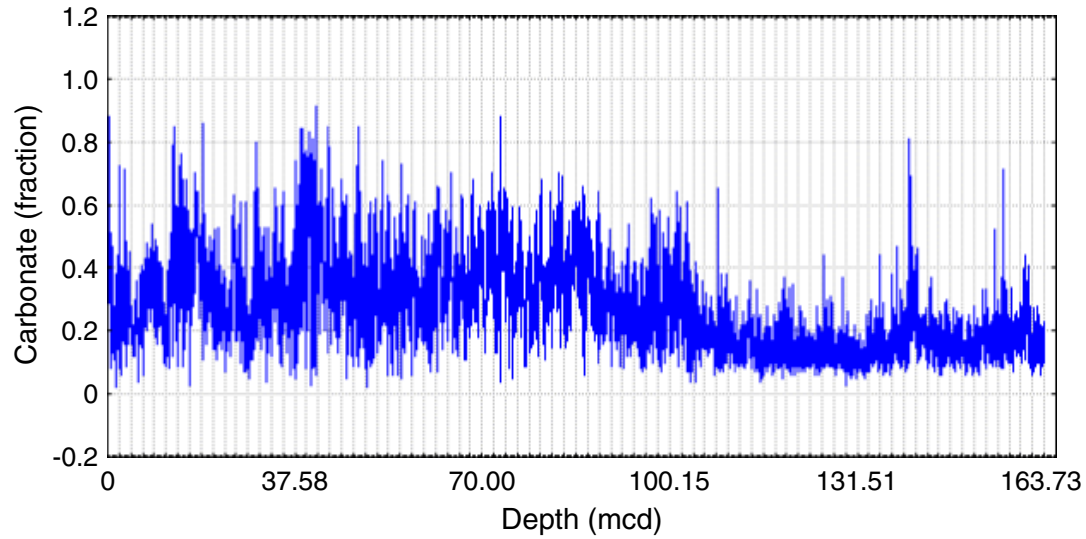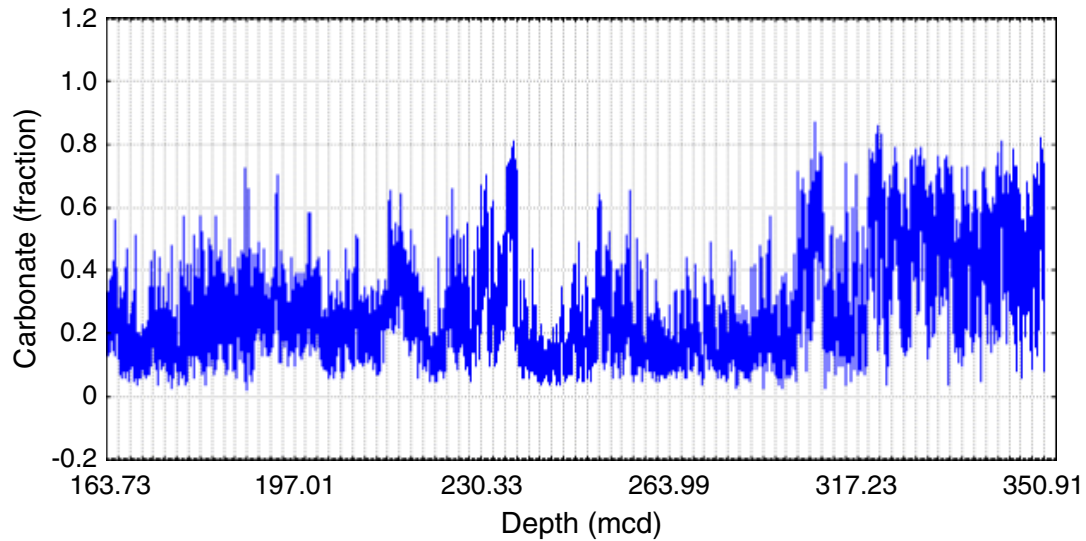
Figure AFB6 (continued). C. Model-predicted carbonate fraction for Site 1124 (shipboard data), cases 16002–22055.
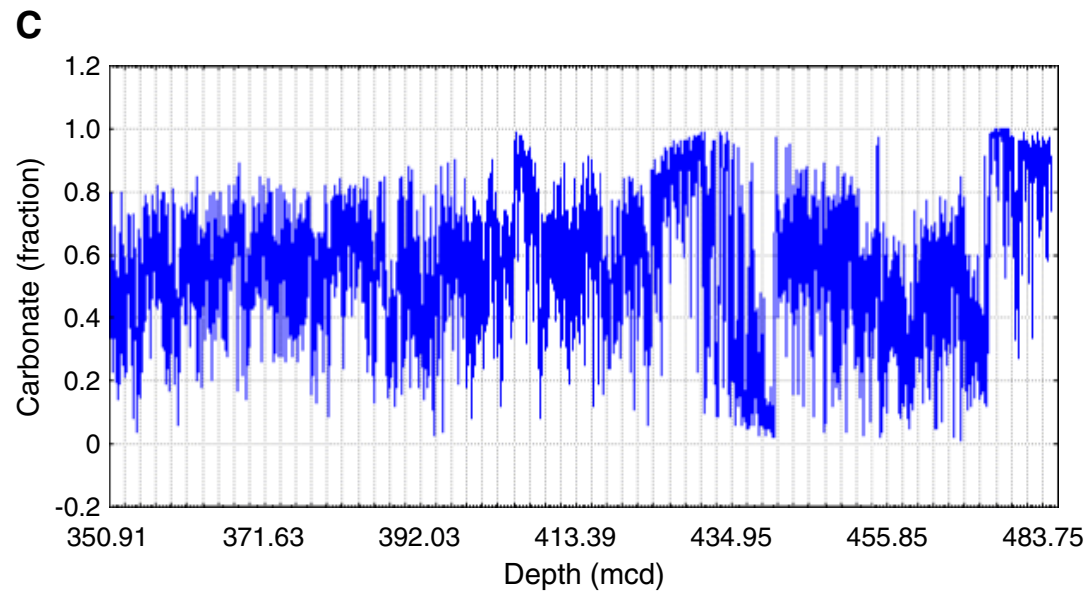
Figure AFB7. A. Model-predicted carbonate fraction for Site 1125 (shipboard data), cases 2–8001. **B.** Model-predicted carbonate fraction for Site 1125 (shipboard data), cases 8002–16001. (Continued on next page.)
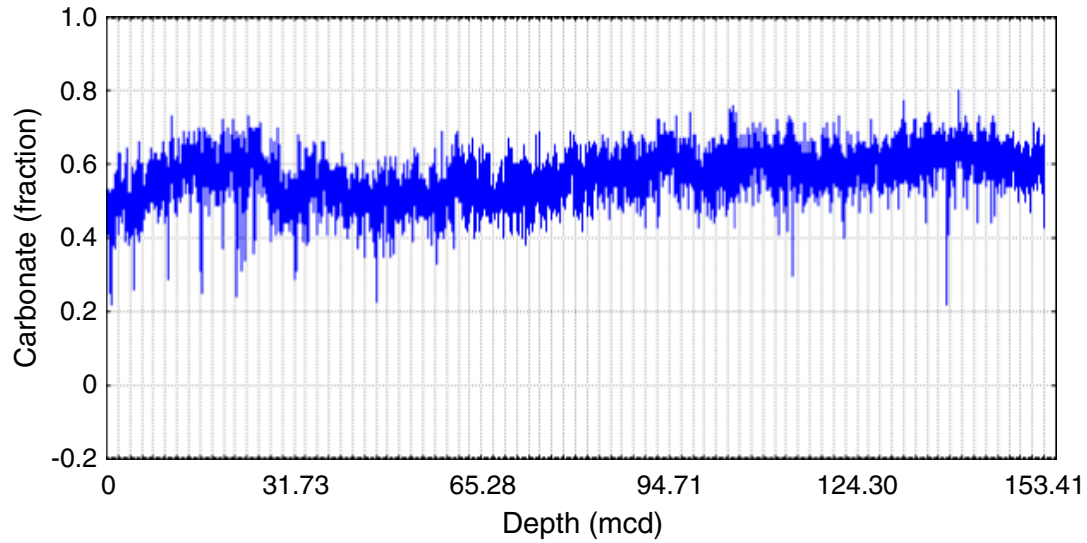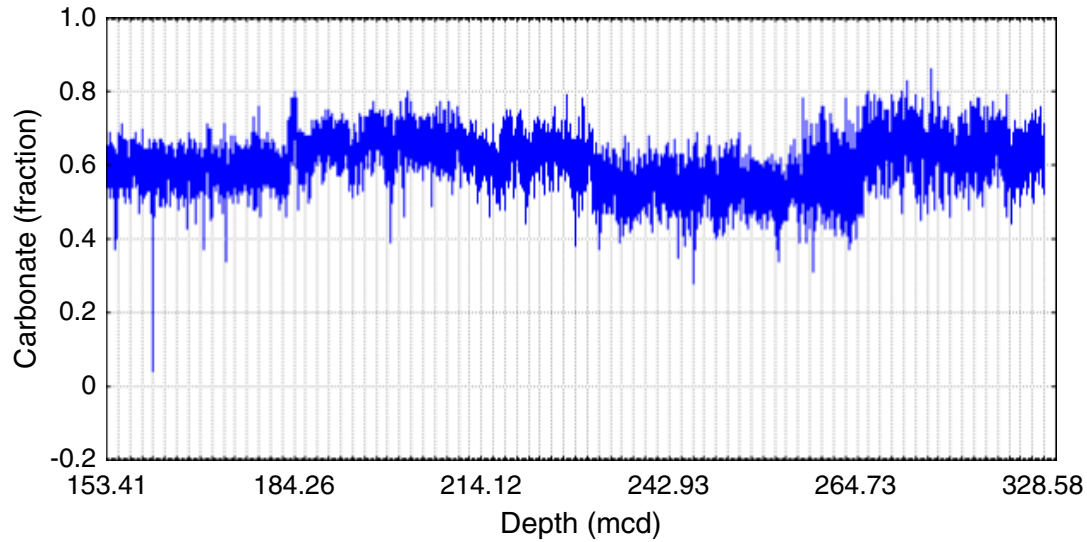
Figure AFB7 (continued). C. Model-predicted carbonate fraction for Site 1125 (shipboard data), cases 16002–21723.
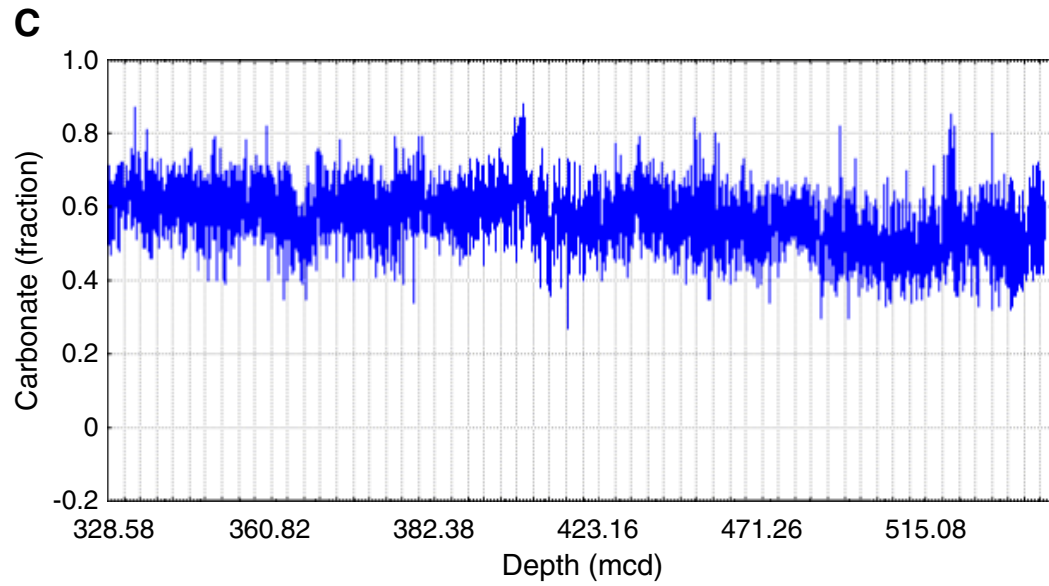
Figure AFC1. Model-predicted carbonate fraction vs. measured carbonate fraction for Hole 1119C. Correlation: $r = 0.99430$.
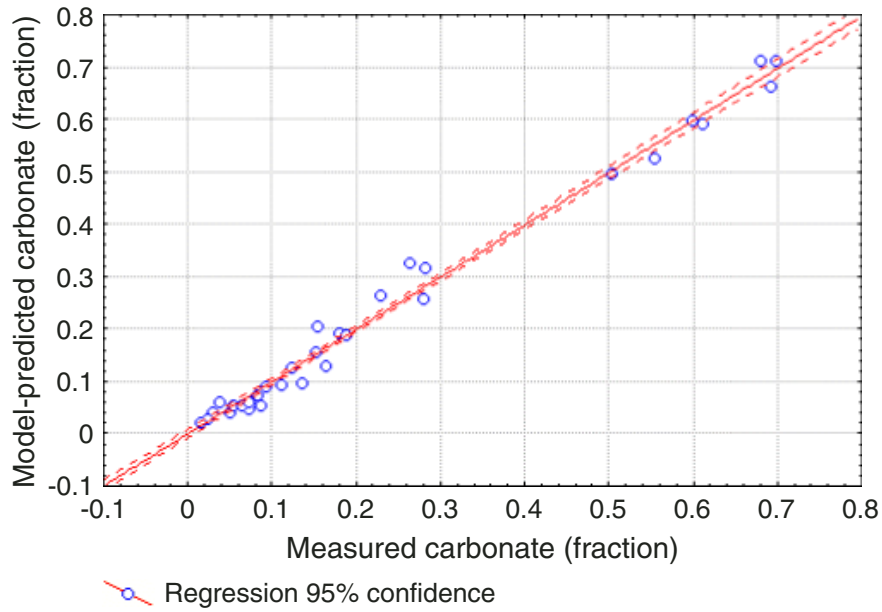
Figure AFC2. Model-predicted carbonate fraction vs. measured carbonate fraction for Site 1120. Correlation: $r = 0.87100$.
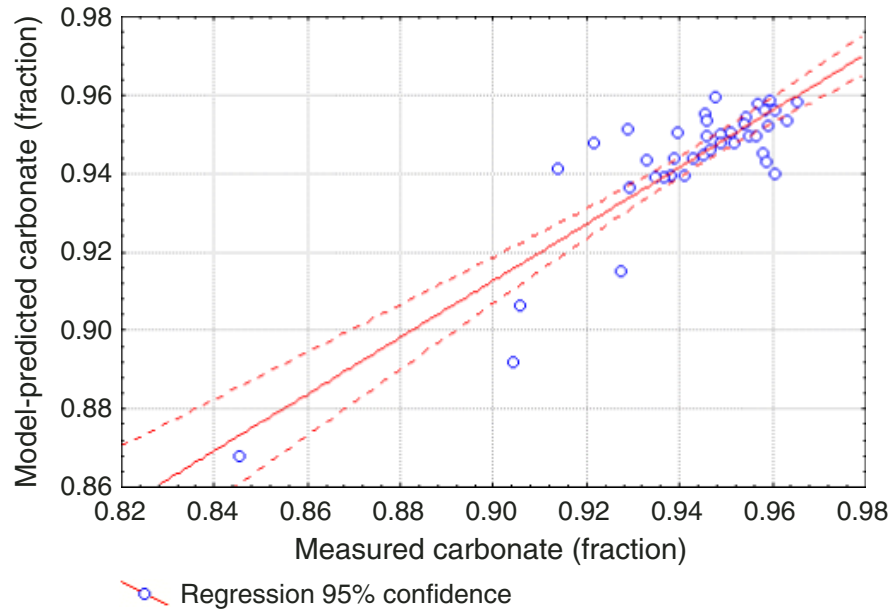
Figure AFC3. Model-predicted carbonate fraction vs. measured carbonate fraction for Site 1121. Correlation: $r = 0.93523$.
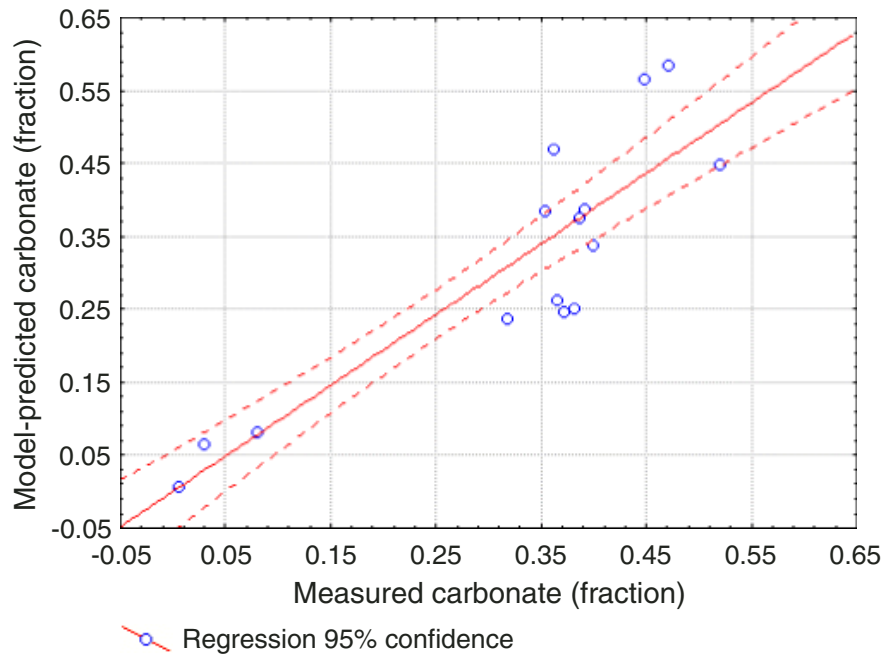
Figure AFC4. Model-predicted carbonate fraction vs. measured carbonate fraction for Site 1122. Correlation: $r = 0.68955$.
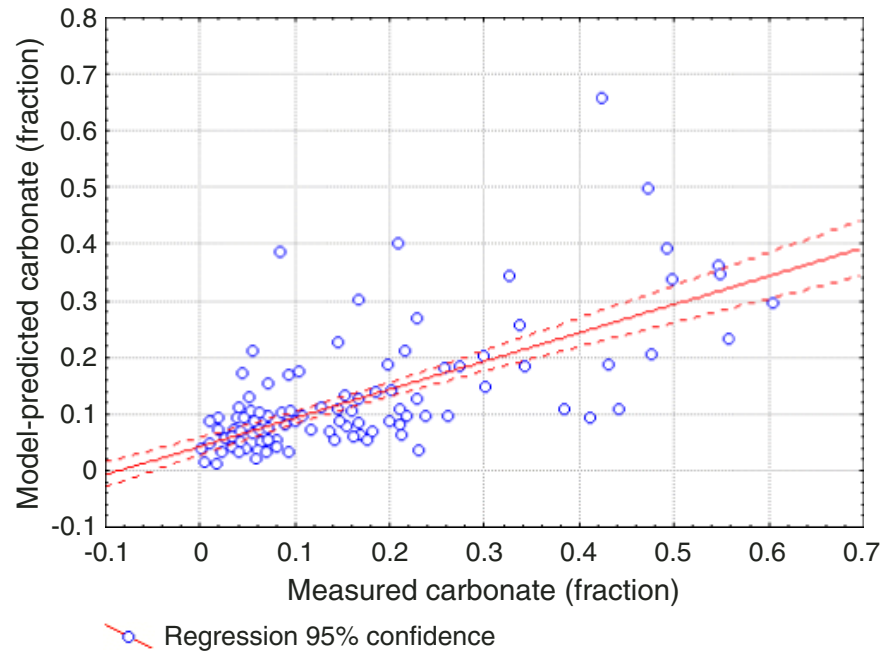
Figure AFC5. A. Model-predicted carbonate fraction vs. measured carbonate fraction for Hole 1123A (laboratory data). Correlation: $r = 0.78046$. **B.** Model-predicted carbonate fraction vs. measured carbonate fraction for Hole 1123A. $r = 0.46702$. (Continued on next page.)
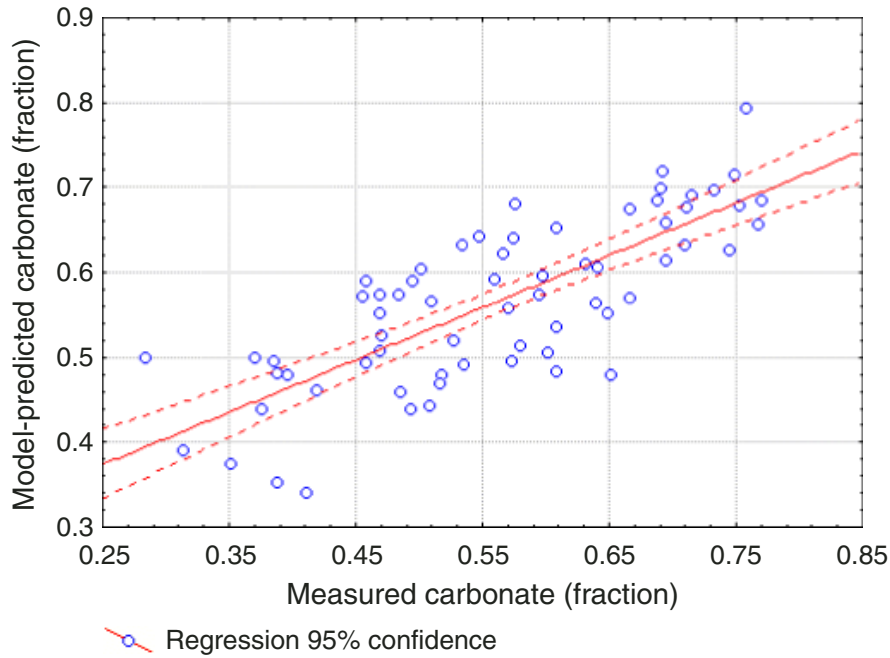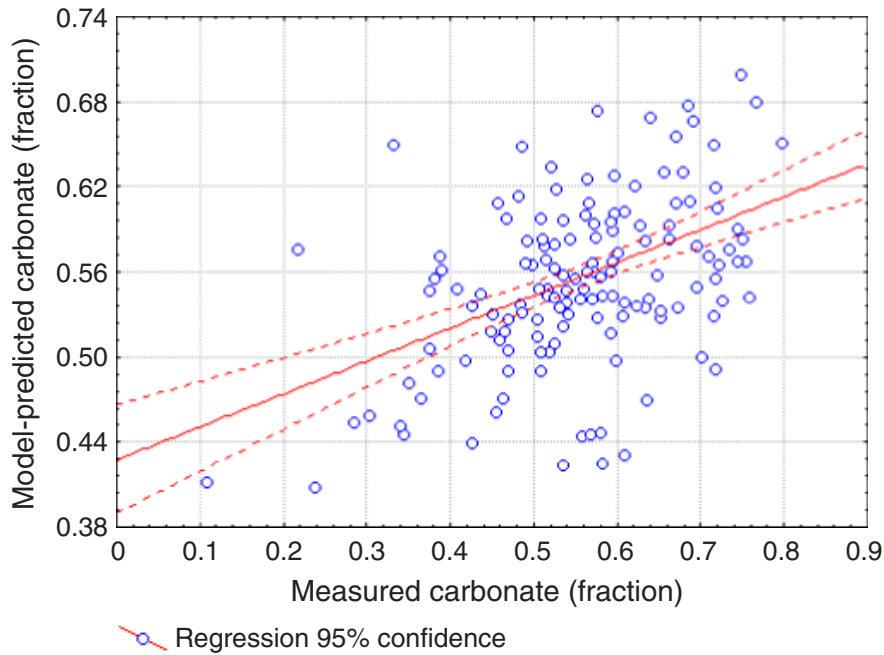
Figure AFC5 (continued). C. Model-predicted carbonate fraction vs. measured carbonate fraction for Site 1123. Correlation: $r = 0.53853$.
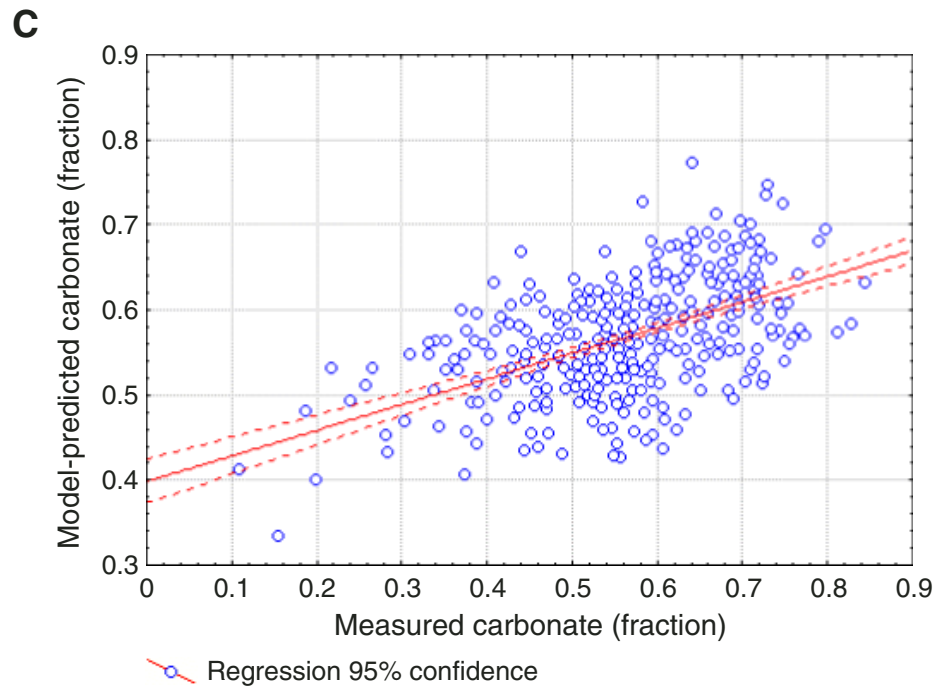
Figure AFC6. Model-predicted carbonate fraction vs. measured carbonate fraction for Site 1124. Correlation: $r = 0.83085$.
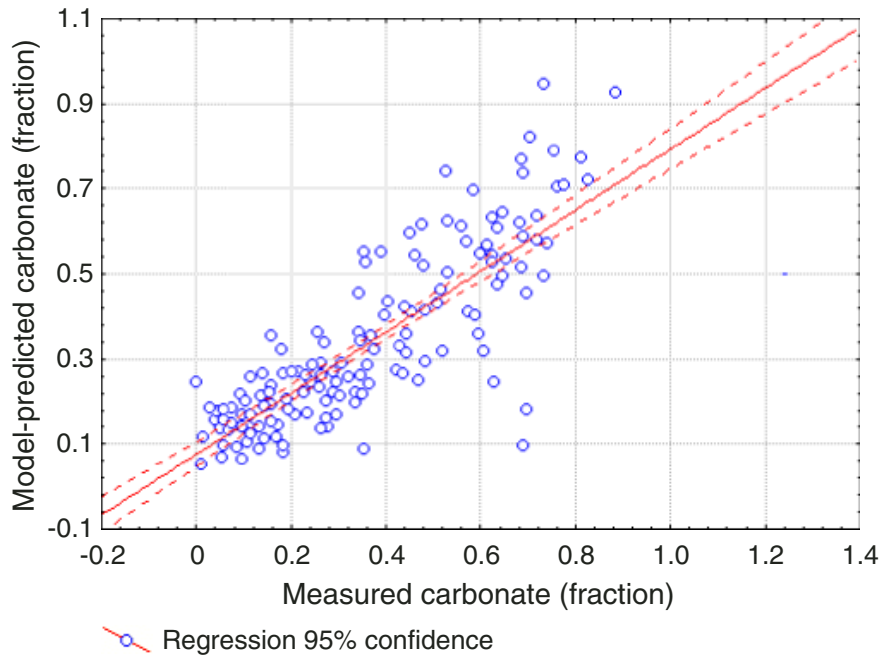
Figure AFC7. Model-predicted carbonate fraction vs. measured carbonate fraction for Site 1125. Correlation: $r = 0.90472$.
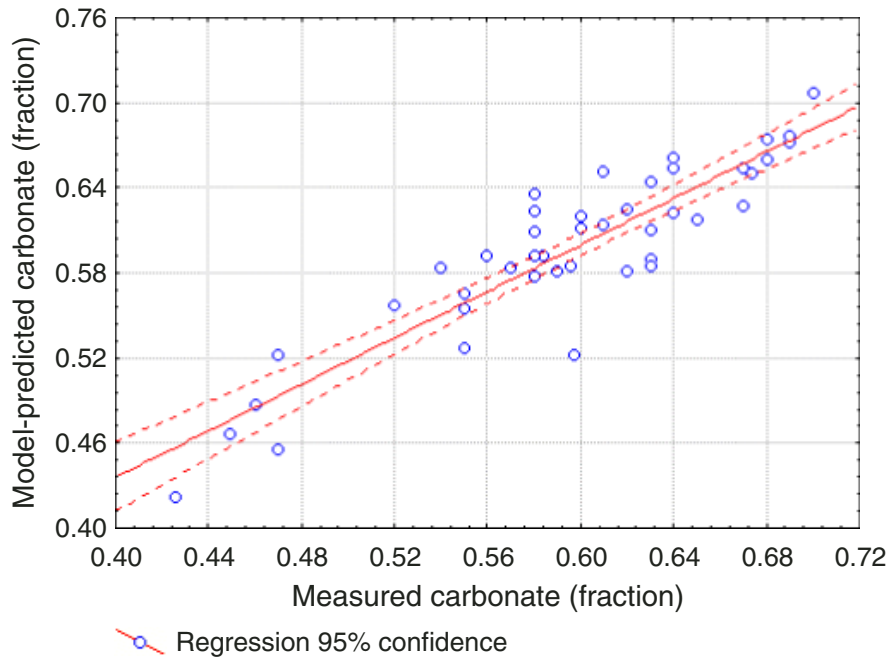
Table ATA1. Carbonate fraction prediction model,
Hole 1119C.

Carbonate fraction prediction	Depth (mcd)
0.8893	0.2
0.5967	0.3
0.6104	0.35
0.7099	0.4
0.4192	0.45
0.502	0.5
0.1568	0.55
0.1839	0.6
0.0706	0.65
0.0831	0.7
0.0427	0.8
0.0447	0.9
0.0898	1
0.0815	1.1
0.0581	1.2
0.1148	1.27
0.0598	1.34
0.1976	1.42
0.2551	1.51
0.1641	1.61
0.143	1.74
0.1627	1.84
0.1123	1.94
0.1044	2.03
0.0496	2.24
0.1854	2.34
0.0854	2.43
0.0723	2.54
0.0796	2.63
0.0889	2.72
0.2784	2.8
0.1719	2.9
0.0884	3
0.1009	3.11
0.1342	3.2
0.0909	3.3
0.1116	3.4
0.074	3.5
0.0691	3.7
0.1305	3.79
0.4488	3.84
0.3315	3.9
0.1073	3.94
0.1733	4
0.0507	4.1
0.1537	4.2
0.076	4.3
0.1725	4.4
0.1142	4.5
0.0541	4.6
0.0545	4.7
0.0275	4.79
0.0311	4.89
0.0294	4.99
0.0512	5.09
0.0347	5.19
0.0298	5.24
0.0303	5.29
0.0466	5.34
0.0982	5.39
0.108	5.44

Note: Only a portion of this table appears here. The complete table
is available in **ASCII**.

Table ATA2. Carbonate fraction prediction model,
Site 1120.

Carbonate fraction prediction	Depth (mcd)
0.87	–0.22
0.85	–0.18
0.83	–0.16
0.9	–0.14
0.87	–0.12
0.88	–0.1
0.86	–0.08
0.87	–0.06
0.88	–0.04
0.88	–0.02
0.86	0
0.87	0.02
0.88	0.04
0.87	0.06
0.86	0.08
0.85	0.1
0.86	0.12
0.86	0.14
0.86	0.16
0.87	0.18
0.88	0.2
0.88	0.22
0.87	0.24
0.87	0.26
0.87	0.28
0.88	0.3
0.88	0.32
0.89	0.34
0.89	0.36
0.89	0.38
0.89	0.4
0.89	0.42
0.86	0.44
0.88	0.46
0.9	0.48
0.9	0.5
0.9	0.52
0.91	0.54
0.91	0.56
0.89	0.58
0.88	0.6
0.88	0.62
0.87	0.64
0.87	0.66
0.87	0.68
0.87	0.7
0.86	0.72
0.86	0.74
0.86	0.76
0.87	0.78
0.85	0.8
0.86	0.82
0.86	0.84
0.88	0.86
0.87	0.88
0.86	0.9
0.86	0.92
0.88	0.94
0.86	0.96
0.86	0.98
0.87	1
0.86	1.02

Note: Only a portion of this table appears here. The complete table
is available in **ASCII**.

Table ATA3. Carbonate fraction prediction model,
Site 1121.

Carbonate fraction prediction	Depth (mcd)
0.02	0.02
0.01	0.04
0.03	0.08
0.15	0.1
0.03	0.12
0.02	0.14
0.01	0.16
0.01	0.18
0.01	0.2
0.01	0.22
0.01	0.24
0.01	0.26
0.01	0.28
0.01	0.3
0.01	0.32
0.01	0.34
0.01	0.36
0.02	0.38
0.01	0.4
0.01	0.42
0.01	0.44
0.01	0.46
0.01	0.48
0.01	0.5
0.01	0.52
0.01	0.54
0.01	0.56
0.01	0.58
0.01	0.6
0.01	0.62
0.01	0.64
0.01	0.66
0.01	0.68
0.01	0.7
0.01	0.72
0.01	0.74
0.01	0.76
0.01	0.78
0.01	0.8
0.01	0.82
0.01	0.84
0.01	0.86
0.01	0.88
0.01	0.9
0.01	0.92
0.02	0.94
0.01	0.96
0.01	0.98
0.01	1
0.01	1.02
0.02	1.04
0.02	1.06
0.01	1.08
0.01	1.1
0.01	1.12
0.01	1.14
0.01	1.16
0.01	1.18
0.01	1.2
0.01	1.22
0.01	1.24
0.01	1.26

Note: Only a portion of this table appears here. The complete table
is available in **ASCII**.

Table ATA4. Carbonate fraction prediction model,
Site 1122.

Carbonate fraction prediction	Depth (mcd)
0.18	0.02
0.6	0.04
0.2	0.06
0.33	0.08
0.18	0.1
0.29	0.12
0.17	0.14
0.14	0.16
0.17	0.18
0.3	0.2
0.1	0.22
0.1	0.24
0.17	0.26
0.32	0.28
0.14	0.3
0.29	0.32
0.33	0.34
0.08	0.36
0.29	0.38
0.08	0.4
0.05	0.42
0.24	0.44
0.23	0.46
0.2	0.48
0.1	0.5
0.27	0.52
0.12	0.54
0.2	0.56
0.09	0.58
0.13	0.6
0.18	0.62
0.14	0.64
0.15	0.66
0.11	0.68
0.08	0.7
0.1	0.72
0.51	0.74
0.05	0.76
0.36	0.78
0.23	0.8
0.11	0.82
0.27	0.84
0.42	0.86
0.47	0.88
0.35	0.9
0.09	0.92
0.04	0.94
0.28	0.96
0.21	0.98
0.14	1
0.08	1.02
0.18	1.04
0.59	1.06
0.27	1.08
0.13	1.1
0.34	1.12
0.48	1.14
0.12	1.16
0.26	1.18
0.14	1.2
0.26	1.22
0.15	1.24

Note: Only a portion of this table appears here. The complete table
is available in **ASCII**.

Table ATA5. Carbonate fraction prediction model,
Site 1123.

Carbonate fraction prediction	Depth (mcd)
0.67	0.02
0.63	0.04
0.62	0.06
0.55	0.08
0.4	0.1
0.49	0.12
0.51	0.14
0.41	0.16
0.37	0.18
0.43	0.2
0.46	0.22
0.32	0.24
0.2	0.26
0.24	0.28
0.46	0.3
0.55	0.32
0.49	0.34
0.57	0.36
0.57	0.38
0.58	0.4
0.6	0.42
0.56	0.44
0.57	0.46
0.58	0.48
0.55	0.5
0.52	0.52
0.52	0.54
0.46	0.56
0.51	0.58
0.5	0.6
0.52	0.62
0.5	0.64
0.5	0.66
0.51	0.68
0.47	0.7
0.5	0.72
0.48	0.74
0.49	0.76
0.52	0.78
0.51	0.8
0.49	0.82
0.51	0.84
0.45	0.86
0.48	0.88
0.5	0.9
0.48	0.92
0.54	0.94
0.5	0.96
0.48	0.98
0.48	1
0.48	1.02
0.5	1.04
0.5	1.06
0.49	1.08
0.48	1.1
0.46	1.12
0.48	1.14
0.5	1.16
0.54	1.18
0.49	1.2
0.47	1.22
0.48	1.24

Note: Only a portion of this table appears here. The complete table
is available in **ASCII**.

Table ATA6. Carbonate fraction prediction model,
Hole 1123A (laboratory data).

Carbonate fraction prediction	Depth (mcd)	Carbonate fraction measured
0.57	—	0.63
0.01	0.03	—
0.01	0.05	—
0.03	0.07	—
0.08	0.09	—
—	0.1	0.56
0.04	0.11	—
0.02	0.13	—
0.02	0.15	—
0.02	0.17	—
0.06	0.19	—
0.06	0.21	—
0.38	0.23	—
0.61	0.25	—
0.51	0.27	—
0.54	0.29	—
0.61	0.31	—
0.39	0.33	—
0.54	0.36	—
0.49	0.38	—
0.58	0.4	—
0.94	0.42	—
0.95	0.44	—
0.91	0.46	—
0.66	0.48	—
0.65	0.5	—
0.65	0.52	—
0.67	0.54	—
0.64	0.56	—
0.63	0.58	—
0.62	0.6	—
0.53	0.62	—
0.56	0.64	—
0.6	0.66	—
0.56	0.68	—
0.62	0.7	—
0.66	0.72	—
0.59	0.74	—
0.6	0.76	—
0.58	0.78	—
0.54	0.8	—
0.6	0.82	—
0.44	0.86	0.38
0.57	0.9	—
0.58	0.94	—
0.53	0.96	—
0.51	1	—
0.61	1.04	—
0.57	1.08	—
0.56	1.12	—
0.57	1.16	—
0.59	1.2	—
0.58	1.24	—
0.56	1.28	—
0.64	1.32	—
0.6	1.36	—
0.58	1.39	—
0.32	1.53	—
0.11	1.55	—
0.05	1.57	—
0.15	1.59	—
0.61	1.63	—
0.59	1.65	—
0.69	1.68	—

Note: Only a portion of this table appears here. The complete table
  is available in **ASCII**.

Table ATA7. Carbonate fraction prediction model, Hole 1123A (shipboard data).

Carbonate fraction prediction	Depth (mcd)
0.69	0.02
0.41	0.04
0.34	0.06
0.27	0.08
0.44	0.1
0.35	0.12
0.29	0.14
0.34	0.16
0.32	0.18
0.39	0.2
0.4	0.22
0.3	0.24
0.27	0.26
0.19	0.28
0.46	0.3
0.57	0.32
0.44	0.34
0.59	0.36
0.53	0.38
0.59	0.4
0.62	0.42
0.6	0.44
0.54	0.46
0.6	0.48
0.62	0.5
0.66	0.52
0.62	0.54
0.5	0.56
0.61	0.58
0.54	0.6
0.62	0.62
0.68	0.64
0.54	0.66
0.54	0.68
0.57	0.7
0.54	0.72
0.53	0.74
0.49	0.76
0.53	0.78
0.63	0.8
0.54	0.82
0.67	0.84
0.51	0.86
0.56	0.88
0.63	0.9
0.45	0.92
0.67	0.94
0.41	0.96
0.52	0.98
0.54	1
0.57	1.02
0.62	1.04
0.52	1.06
0.59	1.08
0.63	1.1
0.48	1.12
0.65	1.14
0.56	1.16
0.52	1.18
0.68	1.2
0.59	1.22
0.57	1.24

Note: Only a portion of this table appears here. The complete table is available in **ASCII**.

Table ATA8. Carbonate fraction prediction model, Site 1124.

Carbonate fraction prediction	Depth (mcd)
0.63	0.02
0.85	0.04
0.62	0.06
0.51	0.08
0.22	0.1
0.39	0.12
0.37	0.14
0.54	0.16
0.76	0.18
0.47	0.2
0.67	0.22
0.73	0.24
0.67	0.26
0.75	0.28
0.76	0.3
0.88	0.32
0.76	0.34
0.61	0.36
0.35	0.38
0.29	0.4
0.51	0.42
0.41	0.44
0.49	0.46
0.11	0.48
0.08	0.5
0.11	0.52
0.25	0.54
0.31	0.56
0.22	0.58
0.25	0.6
0.41	0.62
0.22	0.64
0.29	0.66
0.14	0.68
0.42	0.7
0.37	0.72
0.19	0.74
0.23	0.76
0.18	0.78
0.38	0.8
0.47	0.82
0.19	0.84
0.27	0.86
0.28	0.88
0.16	0.9
0.31	0.92
0.15	0.94
0.29	0.96
0.21	0.98
0.13	1
0.27	1.02
0.21	1.04
0.23	1.06
0.14	1.08
0.14	1.1
0.21	1.12
0.11	1.14
0.28	1.16
0.24	1.18
0.15	1.2
0.19	1.22
0.26	1.24

Note: Only a portion of this table appears here. The complete table is available in **ASCII**.

Table ATA9. Carbonate fraction prediction model, Site 1125.

Carbonate fraction prediction	Depth (mcd)
0.48	0.02
0.52	0.04
0.49	0.06
0.43	0.08
0.46	0.1
0.51	0.12
0.49	0.14
0.47	0.16
0.41	0.18
0.53	0.2
0.44	0.22
0.46	0.24
0.44	0.26
0.41	0.28
0.51	0.3
0.47	0.32
0.53	0.34
0.47	0.36
0.41	0.38
0.43	0.4
0.45	0.42
0.38	0.44
0.4	0.46
0.48	0.48
0.52	0.5
0.42	0.52
0.41	0.54
0.45	0.56
0.45	0.58
0.34	0.6
0.41	0.62
0.33	0.64
0.3	0.66
0.25	0.68
0.41	0.7
0.35	0.72
0.22	0.74
0.3	0.76
0.22	0.78
0.37	0.8
0.44	0.82
0.46	0.84
0.49	0.86
0.38	0.88
0.34	0.9
0.53	0.92
0.39	0.94
0.53	0.96
0.49	0.98
0.53	1
0.38	1.02
0.48	1.04
0.47	1.06
0.48	1.08
0.5	1.1
0.46	1.12
0.47	1.14
0.48	1.16
0.47	1.18
0.48	1.2
0.46	1.22
0.49	1.24

Note: Only a portion of this table appears here. The complete table is available in **ASCII**.

Table ATD1. Carbonate model parameter estimates,
Site 1119C (laboratory reflectance data).

Variable	DF	Parameter estimate	Standard error	t value	Probability $> |t|$
Intercept	1	–2.99843	0.94981	–3.16	0.0055
FD1	1	–0.98097	1.56765	–0.63	0.5393
FD2	1	2.72693	3.78007	0.72	0.4799
FD3	1	3.23423	4.25149	0.76	0.4567
FD4	1	–5.3057	5.092	–1.04	0.3112
FD5	1	5.55867	5.35941	1.04	0.3134
FD6	1	–9.14216	4.74102	–1.93	0.0697
FD7	1	4.52201	7.66529	0.59	0.5626
FD8	1	–9.91156	10.99747	–0.9	0.3794
FD9	1	9.92222	8.07165	1.23	0.2348
FD10	1	–6.57747	6.63406	–0.99	0.3346
FD11	1	13.7145	7.52135	1.82	0.0849
FD12	1	–11.73328	11.11737	–1.06	0.3052
FD13	1	–8.6031	11.90562	–0.72	0.4792
FD14	1	34.98892	16.2556	2.15	0.0452
FD15	1	–43.54069	14.98702	–2.91	0.0094
FD16	1	34.10985	15.85578	2.15	0.0453
FD17	1	–29.81858	14.65664	–2.03	0.0569
FD18	1	19.69968	12.98729	1.52	0.1467
FD19	1	–3.4008	12.46584	–0.27	0.7881
FD20	1	3.99621	10.82892	0.37	0.7164
FD21	1	–12.93237	7.88485	–1.64	0.1183
FD22	1	13.22727	8.89713	1.49	0.1544
FD23	1	–3.6155	7.53423	–0.48	0.6371
FD24	1	3.03142	9.13306	0.33	0.7438
FD25	1	2.5092	8.87236	0.28	0.7805
FD26	1	–6.16231	7.48504	–0.82	0.4211
FD27	1	5.69712	6.54848	0.87	0.3958
FD28	1	–9.50305	5.5104	–1.72	0.1017
FD29	1	8.45407	7.82123	1.08	0.294
FD30	1	–9.08062	7.32659	–1.24	0.2311
FD31	1	4.86389	4.46034	1.09	0.2899

Notes: FD = first derivative of the spectral value, DF = degrees of
freedom. This table is also available in **ASCII**.

Table ATD2. Carbonate model parameter estimates, Site 1120.

Variable	DF	Parameter estimate	Standard error	t value	Probability > $|t|$
Intercept	1	–3.070736	0.36716485	–8.363	0.0001
R1	1	0.009393	0.00257489	3.648	0.0008
FD2	1	0.167758	0.18876931	0.889	0.3795
FD7	1	–0.251446	0.11494365	–2.188	0.0346
FD21	1	0.962151	0.44639092	2.155	0.0372
FD27	1	0.612194	0.32778476	1.868	0.0691

Notes: FD = first derivative of the spectral value, DF = degrees of freedom. This table is also available in ASCII.

Table ATD3. Carbonate model parameter estimates, Site 1121.

Variable	DF	Parameter estimate	Standard error	t value	Probability > $|t|$
Intercept	1	−5.620012	0.42901373	−13.1	0.0001
R1	1	0.16317	0.03494793	4.669	0.0003
FD4	1	1.135263	1.75661072	0.646	0.5279
FD7	1	−0.763586	1.41667175	−0.539	0.5978
FD21	1	−1.828062	1.15902038	−1.577	0.1356
FD30	1	0.220452	1.61975973	0.136	0.8936

Notes: FD = first derivative of the spectral value, DF = degrees of freedom. This table is also available in ASCII.

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Table ATD4. Carbonate model parameter estimates,
Site 1122.

Variable	DF	Parameter estimate	Standard error	t value	Probability > |t|
Intercept	1	–3.468443	0.34917308	–9.933	0.0001
R1	1	0.083495	0.03199619	2.61	0.0102
FD1	1	–0.135564	1.09738822	–0.124	0.9019
FD2	1	0.385547	1.25895955	0.306	0.7599
FD3	1	2.843244	1.67442428	1.698	0.092
FD4	1	–6.050862	1.93205619	–3.132	0.0022
FD5	1	3.270204	2.08845871	1.566	0.1199
FD6	1	1.546564	2.39147613	0.647	0.519
FD7	1	–1.827609	2.65128781	–0.689	0.4919
FD8	1	6.306459	2.91249788	2.165	0.0323
FD9	1	–0.130816	3.62342379	–0.036	0.9713
FD10	1	–1.997526	3.67184398	–0.544	0.5874
FD11	1	–4.331576	3.61102073	–1.2	0.2326
FD12	1	–0.657204	2.31582148	–0.284	0.777
FD13	1	3.693833	2.74086755	1.348	0.1802
FD14	1	3.766126	2.99810836	1.256	0.2114
FD15	1	0.598826	2.80640415	0.213	0.8314
FD16	1	–2.192557	2.76860924	–0.792	0.4299
FD17	1	–4.819435	3.06717936	–1.571	0.1186
FD18	1	–1.86988	3.03179697	–0.617	0.5385
FD19	1	–2.719279	3.32958889	–0.817	0.4157
FD20	1	4.32702	3.12336881	1.385	0.1684
FD21	1	4.353374	3.04718516	1.429	0.1556
FD22	1	5.845123	3.09968423	1.886	0.0617
FD23	1	3.662064	3.29173707	1.113	0.2681
FD24	1	3.939838	2.92208429	1.348	0.18
FD25	1	2.067159	2.45690793	0.841	0.4017
FD26	1	–5.19903	2.19128415	–2.373	0.0192
FD27	1	–3.364824	1.87781259	–1.792	0.0756
FD28	1	–5.120462	2.73008164	–1.876	0.063
FD29	1	–0.528119	1.9072034	–0.277	0.7823
FD30	1	0.016276	1.66908074	0.01	0.9922

Notes: FD = first derivative of the spectral value, DF = degrees of
freedom. This table is also available in **ASCII**.

Table ATD5. Carbonate model parameter estimates, Site 1123.

Variable	DF	Parameter estimate	Standard error	t value	Probability > |t|
Intercept	1	–0.270424	0.179995	–1.502	0.1338
R1	1	0.034378	0.00715145	4.807	0.0001
FD1	1	0.147009	0.31077197	0.473	0.6364
FD2	1	0.504987	0.38425196	1.314	0.1895
FD3	1	0.42146	0.58730695	0.718	0.4734
FD4	1	–0.868137	0.69533258	–1.249	0.2126
FD5	1	0.851732	0.69010051	1.234	0.2179
FD6	1	–0.398603	0.72015026	–0.553	0.5802
FD7	1	–0.497294	0.94275553	–0.527	0.5982
FD8	1	2.001106	0.88258588	2.267	0.0239
FD9	1	–1.517632	1.01126583	–1.501	0.1342
FD10	1	0.898916	1.20886784	0.744	0.4576
FD11	1	0.757887	1.08772666	0.697	0.4864
FD12	1	–0.319059	0.76216745	–0.419	0.6757
FD13	1	0.040624	0.98258152	0.041	0.967
FD14	1	–0.687926	1.02189399	–0.673	0.5012
FD15	1	–2.819029	0.88760059	–3.176	0.0016
FD16	1	–0.526675	0.74935174	–0.703	0.4826
FD17	1	–0.932751	0.96872366	–0.963	0.3362
FD18	1	0.93326	1.1162914	0.836	0.4036
FD19	1	1.501798	0.95615302	1.571	0.1171
FD20	1	1.753132	1.01384471	1.729	0.0846
FD21	1	1.400305	0.94039255	1.489	0.1373
FD22	1	1.237253	0.94922837	1.303	0.1932
FD23	1	2.186203	0.96462098	2.266	0.024
FD24	1	0.59675	0.80103779	0.745	0.4567
FD25	1	–1.255316	0.70015999	–1.793	0.0738
FD26	1	–1.305811	0.6826952	–1.913	0.0565
FD27	1	–1.425399	0.63202426	–2.255	0.0247
FD28	1	–1.321559	0.64191962	–2.059	0.0402
FD29	1	–0.992825	0.5537088	–1.793	0.0737
FD30	1	0.422484	0.5292249	0.798	0.4252

Notes: FD = first derivative of the spectral value, DF = degrees of freedom. This table is also available in **ASCII**.

Table ATD6. Carbonate model parameter estimates, Hole 1123A (laboratory reflectance data).

Variable	DF	Parameter estimate	Standard error	*t* value	Probability > |t|
Intercept	1	0.397657	0.84062297	0.473	0.6388
FD1	1	–1.221498	1.17201929	–1.042	0.3037
FD2	1	0.99481	1.39209148	0.715	0.4791
FD3	1	0.15499	2.30908722	0.067	0.9468
FD4	1	–1.444551	2.49973134	–0.578	0.5667
FD5	1	0.743232	3.16172009	0.235	0.8154
FD6	1	–1.539407	3.0980059	–0.497	0.622
FD7	1	–2.610672	2.79101746	–0.935	0.3553
FD8	1	–0.004683	3.07132697	–0.002	0.9988
FD9	1	2.880878	3.11523161	0.925	0.3608
FD10	1	1.141798	3.26149783	0.35	0.7282
FD11	1	1.090231	4.0960116	0.266	0.7915
FD12	1	2.68583	4.73281187	0.567	0.5736
FD13	1	–0.367905	5.89596151	–0.062	0.9506
FD14	1	3.946258	5.6831952	0.694	0.4916
FD15	1	–5.103774	4.76727138	–1.071	0.2909
FD16	1	–0.810301	5.59102084	–0.145	0.8855
FD17	1	–4.802781	4.07568571	–1.178	0.2458
FD18	1	–0.531941	4.08093122	–0.13	0.897
FD19	1	–0.249661	4.04838269	–0.062	0.9511
FD20	1	–3.919904	3.85363489	–1.017	0.3153
FD21	1	0.750353	4.07868506	0.184	0.855
FD22	1	–3.457597	3.31511884	–1.043	0.3034
FD23	1	–0.655458	3.58226358	–0.183	0.8558
FD24	1	–2.817448	3.11082491	–0.906	0.3707
FD25	1	3.314245	2.83920737	1.167	0.2502
FD26	1	0.482871	3.03967398	0.159	0.8746
FD27	1	4.516534	2.95377925	1.529	0.1343
FD28	1	0.362925	3.01158018	0.121	0.9047
FD29	1	3.031825	2.49775621	1.214	0.2321
FD30	1	–1.283941	2.27758193	–0.564	0.5762

Notes: FD = first derivative of the spectral value, DF = degrees of freedom. This table is also available in **ASCII**.

Table ATD7. Carbonate model parameter estimates,
Hole 1123A (shipboard reflectance data).

Variable	DF	Parameter estimate	Standard error	t value	Probability > $|t|$
Intercept	1	0.096174	0.29577128	0.325	0.7456
FD1	1	0.120709	0.43741023	0.276	0.783
FD2	1	0.300916	0.63450718	0.474	0.6361
FD3	1	0.649694	0.88053544	0.738	0.4619
FD4	1	–1.922469	1.14770208	–1.675	0.0962
FD5	1	1.180058	1.08041375	1.092	0.2766
FD6	1	0.781749	1.21724002	0.642	0.5218
FD7	1	–1.504981	1.4632074	–1.029	0.3055
FD8	1	2.831768	1.66048252	1.705	0.0904
FD9	1	–1.429901	1.71100763	–0.836	0.4048
FD10	1	–0.432801	2.05420943	–0.211	0.8334
FD11	1	0.925894	1.54548818	0.599	0.5501
FD12	1	–0.493676	1.08875475	–0.453	0.651
FD13	1	1.328391	1.87057004	0.71	0.4788
FD14	1	–3.709336	1.71597415	–2.162	0.0324
FD15	1	0.015332	1.37631024	0.011	0.9911
FD16	1	0.349213	1.40752424	0.248	0.8044
FD17	1	–1.836055	1.77608393	–1.034	0.3031
FD18	1	0.245988	1.81486539	0.136	0.8924
FD19	1	–0.162188	1.66083628	–0.098	0.9223
FD20	1	1.63303	1.74323059	0.937	0.3505
FD21	1	2.033068	1.70997161	1.189	0.2365
FD22	1	0.866931	1.53790022	0.564	0.5739
FD23	1	1.475374	1.496568	0.986	0.326
FD24	1	–2.048453	1.23542738	–1.658	0.0996
FD25	1	0.466575	1.10738094	0.421	0.6742
FD26	1	–0.812477	1.04076368	–0.781	0.4364
FD27	1	–0.658182	0.93611871	–0.703	0.4832
FD28	1	–0.315403	0.95027493	–0.332	0.7405
FD29	1	–0.369535	0.70991543	–0.521	0.6035
FD30	1	0.119638	0.80239094	0.149	0.8817

Notes: FD = first derivative of the spectral value, DF = degrees of
    freedom. This table is also available in **ASCII**.

Table ATD8. Carbonate model parameter estimates, Site 1124.

Variable	DF	Parameter Estimate	Standard Error	t value	Probability $> |t|$
Intercept	1	–3.070736	0.36716485	–8.363	0.0001
FD1	1	–0.778838	0.74158287	–1.05	0.2952
FD2	1	0.351576	0.91793439	0.383	0.7022
FD3	1	1.359917	1.35766851	1.002	0.3181
FD4	1	–0.964937	1.78744175	–0.54	0.5901
FD5	1	4.362448	1.79543135	2.43	0.0163
FD6	1	3.264014	1.81658741	1.797	0.0743
FD7	1	3.189519	2.14711187	1.485	0.1394
FD8	1	–2.017352	2.26028484	–0.893	0.3735
FD9	1	–2.107639	2.53158599	–0.833	0.4064
FD10	1	–8.041198	2.60156451	–3.091	0.0024
FD11	1	–0.052052	2.38323222	–0.022	0.9826
FD12	1	1.536598	1.64428331	0.935	0.3515
FD13	1	3.534009	2.23453252	1.582	0.1158
FD14	1	–0.74144	1.98946557	–0.373	0.7099
FD15	1	4.030173	2.58674006	1.558	0.1213
FD16	1	–4.36457	1.99025894	–2.193	0.0298
FD17	1	–2.977724	1.81793244	–1.638	0.1035
FD18	1	0.829916	2.26907548	0.366	0.715
FD19	1	0.984388	2.31003007	0.426	0.6706
FD20	1	5.654193	2.64363589	2.139	0.034
FD21	1	5.377573	2.3121821	2.326	0.0213
FD22	1	3.341636	2.04371563	1.635	0.1041
FD23	1	0.209657	2.12629549	0.099	0.9216
FD24	1	–0.471768	1.84290502	–0.256	0.7983
FD25	1	–0.365236	1.94388952	–0.188	0.8512
FD26	1	–2.700741	1.59603491	–1.692	0.0926
FD27	1	–2.812718	1.6927878	–1.662	0.0986
FD28	1	–2.59178	1.4100281	–1.838	0.068
FD29	1	–4.158899	1.31412081	–3.165	0.0019
FD30	1	–1.470326	1.2570415	–1.17	0.2439

Notes: FD = first derivative of the spectral value, DF = degrees of freedom. This table is also available in **ASCII**.

Table ATD9. Carbonate model parameter estimates, Site 1125.

Variable	DF	Parameter estimate	Standard error	t value	Probability > |t|
Intercept	1	–0.533222	0.34716475	–1.536	0.1454
FD1	1	–0.008915	0.53909035	–0.017	0.987
FD2	1	–0.95887	0.68953505	–1.391	0.1846
FD3	1	–0.497242	0.87731722	–0.567	0.5792
FD4	1	–0.02663	1.14091026	–0.023	0.9817
FD5	1	0.970385	1.04939154	0.925	0.3698
FD6	1	–0.138252	1.05208208	–0.131	0.8972
FD7	1	2.96633	1.39258388	2.13	0.0501
FD8	1	–3.003108	1.63565197	–1.836	0.0863
FD9	1	1.138776	1.57997197	0.721	0.4821
FD10	1	–1.068847	1.72886105	–0.618	0.5457
FD11	1	1.179204	1.78867083	0.659	0.5197
FD12	1	–0.667715	1.58137318	–0.422	0.6788
FD13	1	–0.437562	1.18243757	–0.37	0.7165
FD14	1	0.472936	1.78633436	0.265	0.7948
FD15	1	–0.976412	1.78999581	–0.545	0.5934
FD16	1	–0.225967	2.09762238	–0.108	0.9156
FD17	1	–1.148753	1.65150713	–0.696	0.4973
FD18	1	–2.481787	1.51318137	–1.64	0.1218
FD19	1	0.355226	1.88324854	0.189	0.8529
FD20	1	0.004327	2.17949542	0.002	0.9984
FD21	1	0.542901	2.02117108	0.269	0.7919
FD22	1	–0.564499	1.4515264	–0.389	0.7028
FD23	1	–2.320998	1.23461516	–1.88	0.0797
FD24	1	–0.747813	1.08050416	–0.692	0.4995
FD25	1	1.300399	0.84504229	1.539	0.1447
FD26	1	0.065563	0.88835153	0.074	0.9421
FD27	1	1.176387	1.10359386	1.066	0.3033
FD28	1	0.508425	0.95661447	0.531	0.6029
FD29	1	0.236891	0.97661569	0.243	0.8116
FD30	1	1.165451	1.21492436	0.959	0.3526

Notes: FD = first derivative of the spectral value, DF = degrees of freedom. This table is also available in **ASCII**.