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16. DATA REPORT: CARBONATE AND ORGANIC CARBON CONTENTS OF SEDIMENTS FROM SITES 1143 AND 1146 IN THE SOUTH CHINA SEA[1]

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INTRODUCTION

The goal during Ocean Drilling Program Leg 184 was to reconstruct the long-term paleoenvironmental variability of the South China Sea (SCS) and the adjacent Asian continent. In the paleoceanographic proxies, the amounts of inorganic and organic carbon that have accumulated in sediment are fundamental measurements of paleoproductivity (e.g., Meyers, 1997). These proxy indicators are mainly controlled by surface water productivity and/or sediment preservation. In this report, we augmented shipboard data with coarse-fraction contents (weight percentage of particles >63 µm) from Sites 1143 and 1146. In addition, we compared the data from these two sites to determine the differences in paleoenvironment between the southern and northern parts of the SCS.

Site 1143 (9°21.72′N, 113°17.11′E; water depth = 2772 m), located within the Nansha area on the southern margin of the SCS, records the depositional history of 9 m.y. Site 1146 (19°27.40′N, 116°16.37′E; water depth = 2092 m) on the mid-continental slope in the northern part of the SCS documents a time interval of 18 m.y. Both sites lie above the modern lysocline (~3000 m). Sediment and squeeze cake samples were collected at a frequency of one per section from three advanced piston corer/extended core barrel holes at the two sites (Table T1).

T1. Coarse fraction, $CaCO_3$, and TOC, p. 9.

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[1] Wang, L.-W., and Lin, H.-L., 2004. Data report: Carbonate and organic carbon contents of sediments from Sites 1143 and 1146 in the South China Sea. *In* Prell, W.L., Wang, P., Blum, P., Rea, D.K., and Clemens, S.C. (Eds.), *Proc. ODP, Sci. Results,* 184, 1–9 [Online]. Available from World Wide Web: <http://www-odp.tamu.edu/publications/184_SR/VOLUME/CHAPTERS/207.PDF>. [Cited YYYY-MM-DD]

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METHODS

Subsamples were divided for coarse-fraction and geochemical analyses. For the coarse fraction, weighed freeze-dried samples were soaked in deionized distilled water and then washed through 63-µm sieves. The >63-µm fraction residue was collected, dried, and weighed. The weight of the >63-µm fraction divided by the weight of the original sample gives the coarse fraction in weight percentage (wt%). In the analyses of calcium carbonate and total organic carbon (TOC) concentrations, dried bulk sediment was first ground to a powder and then two weighed samples (~0.1 g) were measured using a LECO CS-244 carbon/sulfur analyzer. One of the two weighed samples was directly measured for total carbon (TC) content. The procedure involves heating the sample at 850°C and measuring the combustion products by infrared energy detector. The other sample was digested with 2.4-N HCl to remove carbonates. The carbonate-free residue was washed thoroughly with deionized distilled water and dried, and then the residual carbon was measured. This value represents the TOC content of the sediment. The difference between the two carbon measurements (TC – TOC) gives the total inorganic carbon (TIC) content. $CaCO_3$ concentration is calculated by

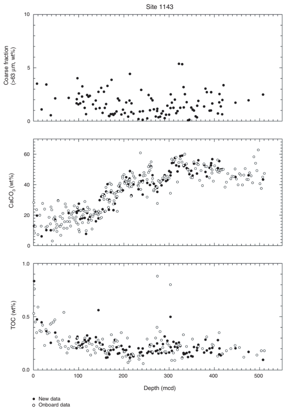
$$\mathrm{CaCO_3\ (wt\%) = TIC\ (wt\%)/12 \times 100}$$

assuming all inorganic carbon is present as calcite or aragonite. Precision of the analyses is better than 0.04% and 0.10% for working standard (bulk sediments from the SCS) and sediment samples, respectively (Table T1). The method used here is different from that used on board the *JOIDES Resolution* but yields comparable results.

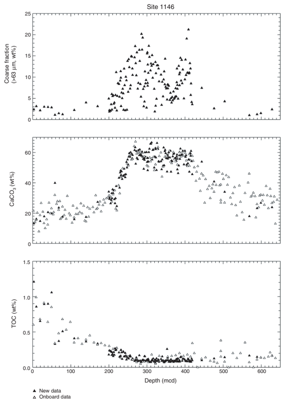
RESULTS

The coarse fraction of most Site 1143 sediment samples is <5 wt%, with only two values above this range (Fig. F1). No obvious trend is observed within the data set. Site 1143 $CaCO_3$ concentrations vary between 59.02 and 6.03 wt%. The sediment contents of $CaCO_3$ are higher below 300 meters composite depth (mcd) than above but gradually decrease from ~60 wt% at 310 mcd to the minimum at 18 mcd. The variability pattern of $CaCO_3$ is generally different from that of the coarse fraction. Most of the TOC concentrations are <0.5 wt%, with only three values considerably greater. The increasing trend from 200 mcd to coretop sediments mirrors that of $CaCO_3$, suggesting that the $CaCO_3$ concentrations reflect varying amounts of noncarbonate hemipelagic sediment input (e.g., clastics and admixed volcanic ash) (Wang, Prell, Blum, et al., 2000).

F1. Coarse fraction, $CaCO_3$, and TOC, Site 1143, p. 5.



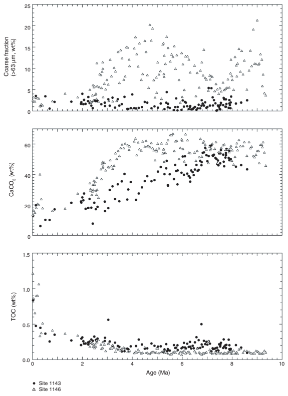
F2. Coarse fraction, $CaCO_3$, and TOC, Site 1146, p. 6.



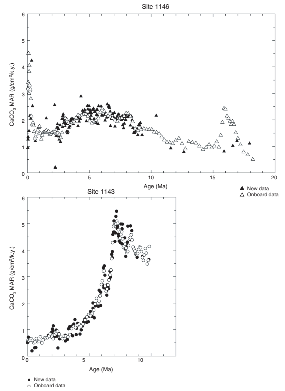
Site 1146 coarse fractions range between 21.21 and 1.02 wt% (Fig. F2). In general, the values are lower for sections below 420 mcd and in the upper 200 m. It cannot be ruled out that this is an artifact resulting from the different sampling resolutions along the core for this study. The concentrations of $CaCO_3$ at Site 1146 vary between 28 and 18 wt% below 570 mcd and then increase gradually to reach a plateau of ~60 wt% at ~415 mcd. $CaCO_3$ contents remain high uphole to ~255 mcd and then decline to a minimum at the top of the sediment core, with the exception of the peak between 255 and ~415 mcd. With few exceptions, the downcore record of coarse fraction mimics that of $CaCO_3$ at Site 1146, implying that the carbonate shells of microfossils are the major contributors for the sand fraction in core sediments. Site 1146 TOC values are consistently <0.3 wt% from ~200 mcd downhole to the bottom of the core. A progressive increase in TOC occurs between 200 and 60 mcd, followed by a rapid increase to the maximum of 1.21 wt% at the top of the core.

A tentative comparison between the time series of these two records was made according to preliminary age models based on the biostratigraphy and paleomagnetism measured on board (Fig. **F3**) (Wang, Prell, Blum, et al., 2000). Because this study yielded only seven data points older than 10 Ma for Site 1146 and Site 1143 has a depositional history of only 9 m.y., we compare coarse fraction, $CaCO_3$, and TOC between the two sites for the last 10 m.y., as shown in Figure **F3.** In general, the coarse fraction and $CaCO_3$ from Site 1146 are higher than those of Site 1143 for sediments older than Quaternary. The Site 1143 $CaCO_3$ begins to decrease gradually at 7 Ma, yet at Site 1146 it remains constant until 4 Ma and then decreases rapidly until ~1 Ma (Fig. **F3**). Of special interest is the fact that although the $CaCO_3$ contents are similar in the upper Miocene sections of these two sites, the accumulation rate of $CaCO_3$ at Site 1143 is almost twice as high as that at Site 1146 (Fig. **F4**). The high accumulation rate of $CaCO_3$ at Site 1143 during the late Miocene reflects an increased sedimentation rate, which has been ascribed to the redeposition of adjacent sediments (Wang, Prell, Blum, et al., 2000). Whether this is the signature of the "biogenic bloom" recorded in the equatorial Pacific regime (e.g., Berger et al., 1993; Farrell et al., 1995) has yet to be confirmed. Furthermore, in contrast to the steadily decreasing $CaCO_3$ accumulation rates at Site 1143 since 7 Ma (Fig. **F4**), $CaCO_3$ accumulation rates at Site 1146 remain within a relatively narrow range throughout the record.

F3. Comparisons of coarse fraction, $CaCO_3$, and TOC, p. 7.



F4. Mass accumulation rates of $CaCO_3$, p. 8.



Site 1146 TOC concentrations are lower than those from Site 1143 (Fig. **F3**) except for the interval after ~2 Ma. Nevertheless, the variation patterns are similar, with consistently low values prior to ~4 Ma and then increasing values to the present.

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Farrell, J.W., Raffi, I., Janecek, T.C., Murray, D.W., Levitan, M., Dadey, K.A., Emeis, K. C., Lyle, M., Flores, J.-A., and Hovan, S., 1995. Late Neogene sedimentation patterns in the eastern equatorial Pacific. *In* Pisias, N.G., Mayer, L.A., Janecek, T.R., Palmer-Julson, A., and van Andel, T.H. (Eds.), *Proc. ODP, Sci. Results,* 138: College Station, TX (Ocean Drilling Program), 717–756.

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Figure F1. Coarse fraction, $CaCO_3$, and TOC in sediment samples from Site 1143. Onboard data are from Wang, Prell, Blum, et al., 2000.

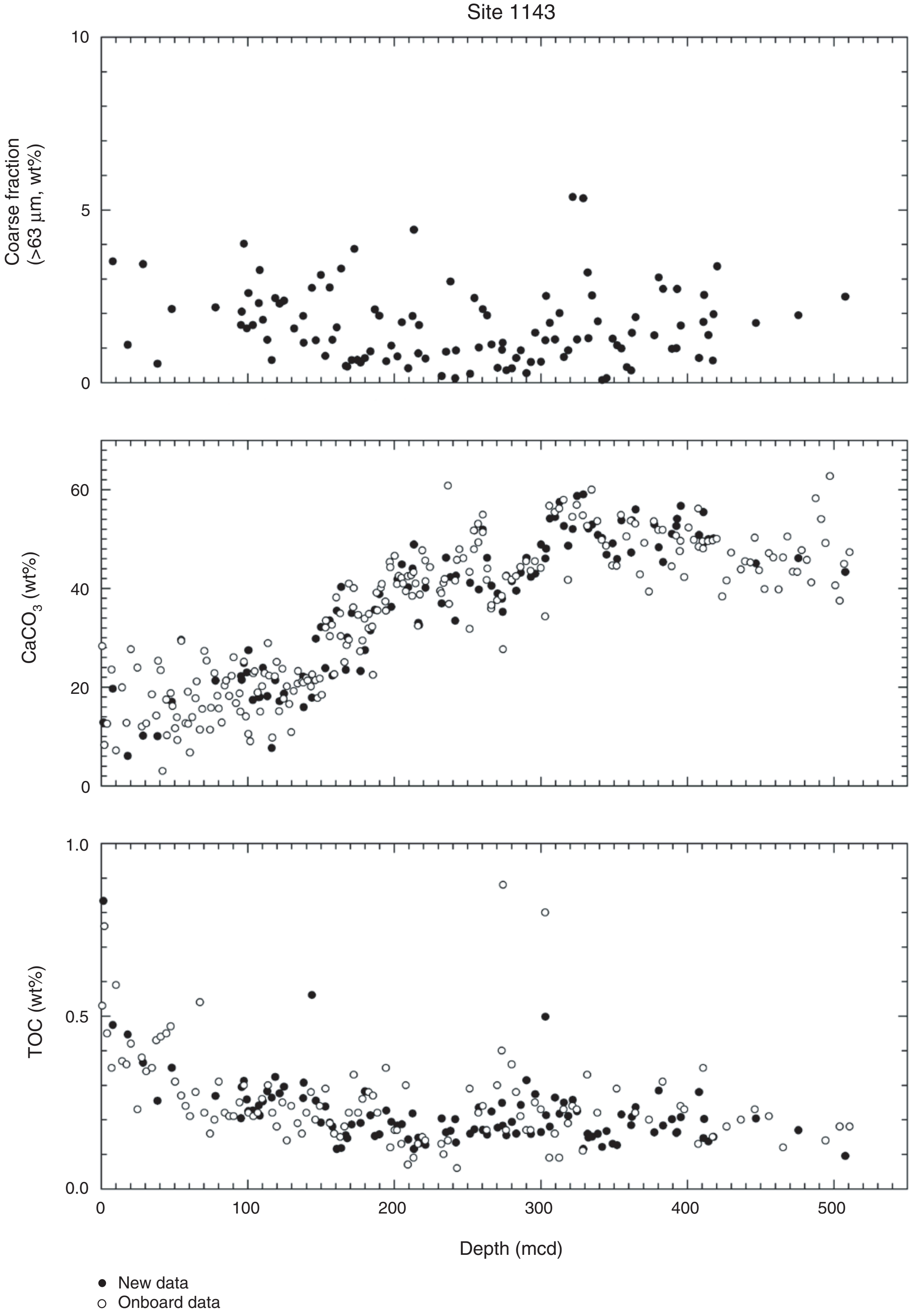

Figure F2. Coarse fraction, $CaCO_3$, and TOC in sediment samples from Site 1146. Onboard data are from Wang, Prell, Blum, et al., 2000.

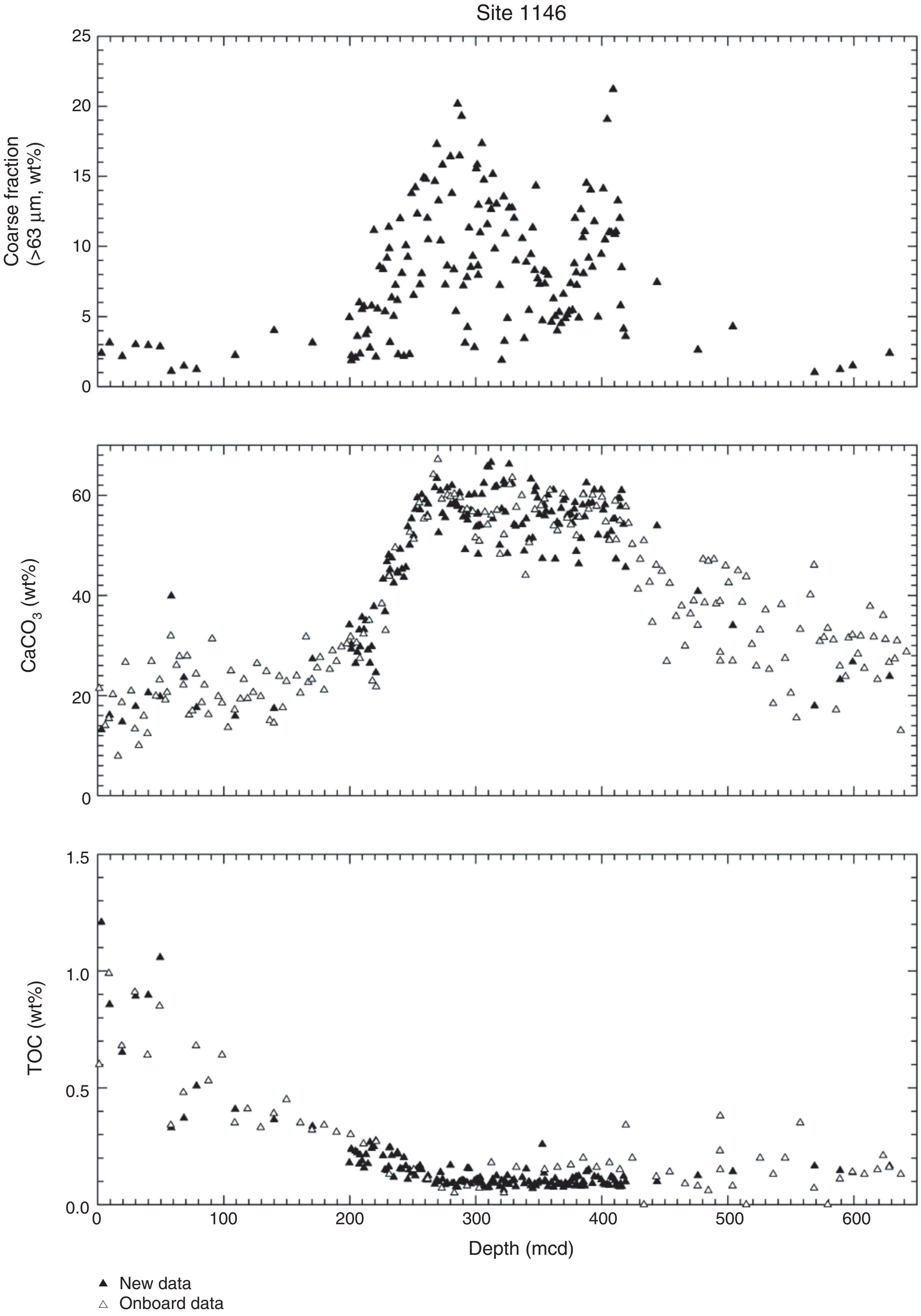

Figure F3. Comparisons of coarse fraction, $CaCO_3$, and TOC between sediment samples from Sites 1143 and 1146. Ages of individual samples were estimated based on control points from Wang, Prell, Blum, et al., 2000.

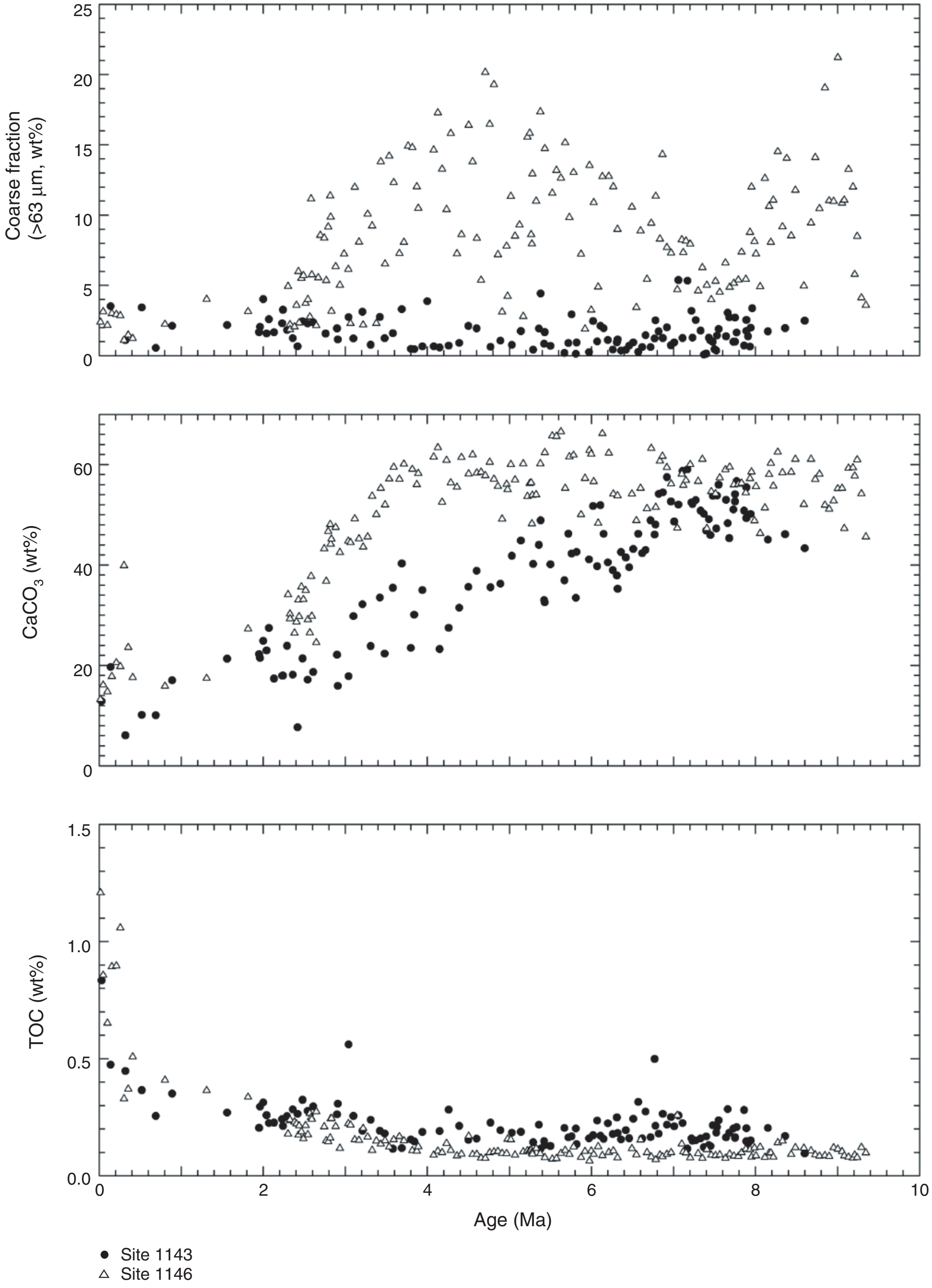

Figure F4. Mass accumulation rates of $CaCO_3$ from Sites 1143 and 1146. Onboard data are from Wang, Prell, Blum, et al., 2000.

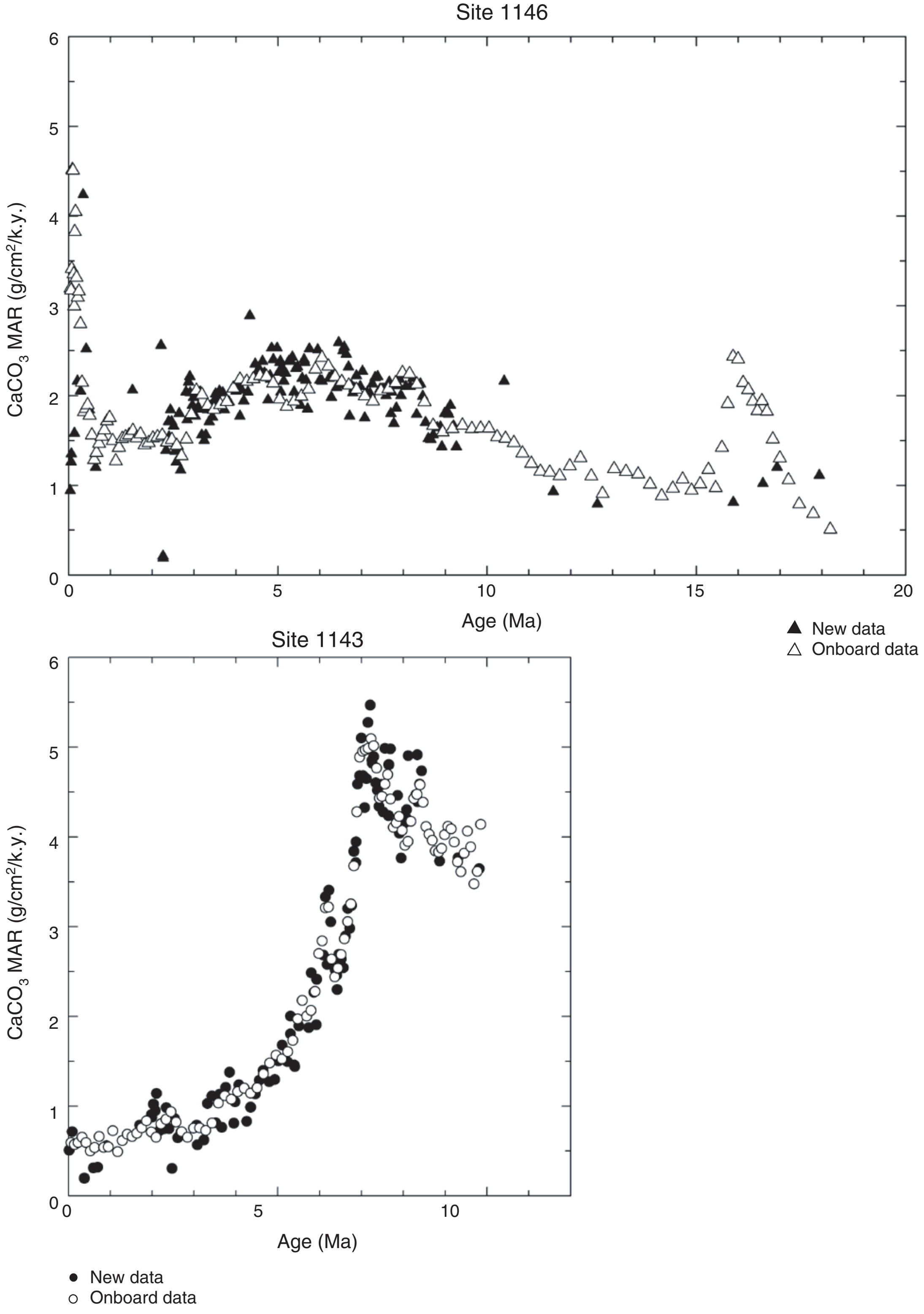

Table T1. Coarse fraction, total carbon, TOC, total inorganic carbon, and $CaCO_3$ in sediment samples, Sites 1143 and 1146.

Core, section, interval (cm)	Depth (mcd)	Coarse fraction (wt%)	TC (wt%)	Standard deviation (1 σ)	TOC (wt%)	Standard deviation (1 σ)	TIC (wt%)	$CaCO_3$ (wt%)
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1H-1, 145–150*	1.50		2.37	0.02 (4)	0.83	0.09 (3)	1.54	12.81
2H-3, 145–150*	7.80	3.51	2.83	0.09 (3)	0.47	0.03 (3)	2.35	19.62
3H-3, 145–150*	17.98	1.09	1.17	0.02 (3)	0.45	0.02 (3)	0.72	6.03
4H-3, 145–150*	28.52	3.43	1.58	0.05 (5)	0.36	0.02 (3)	1.21	10.11
5H-3, 145–150*	38.42	0.54	1.46		0.25		1.21	10.04
6H-3, 145–150*	48.14	2.13	2.39		0.35		2.04	17.00
9H-3, 145–150*	77.98	2.18	2.82	0.05 (5)	0.27	0.06 (3)	2.55	21.28
12H-3, 145–150*	107.56	2.29	2.39		0.24		2.15	17.90
15H-3, 140–150*	137.73	1.93	2.91	0.02 (3)	0.26	0.01 (2)	2.65	22.10
16H-3, 95–97	146.42	1.22	3.83		0.26		3.57	29.78
18H-3, 140–150*	166.87	0.48	2.97	0.03 (5)	0.15	0.04 (2)	2.81	23.45
18H-4, 95–97	167.88	0.46	3.75		0.15		3.61	30.07
18H-6, 95–97	170.88	0.65	4.38		0.19		4.19	34.96
21H-1, 95–97	194.48	0.62	4.49		0.23		4.26	35.51
21H-3, 140–150*	197.97	1.06	4.54	0.01 (3)	0.19	0.03 (3)	4.35	36.24
22X-1, 95–97	202.06	0.76	5.20		0.18		5.02	41.81
22X-3, 95–97	205.06	1.74	5.57		0.19		5.38	44.83
23X-1, 95–97	209.46	0.41	4.96		0.14		4.82	40.17
23X-3, 95–97	212.46	1.93	5.50		0.22		5.28	43.98
24X-1, 95–97	213.40	4.42	5.98		0.12		5.86	48.85
24X-3, 95–97	216.40	0.85	4.10		0.15		3.96	32.96
24X-3, 140–150*	216.89	1.66	4.03		0.13		3.90	32.52
25X-1, 95–97	221.28	0.69	4.94		0.13		4.81	40.08
26X-1, 95–97	232.32	0.19	4.63		0.20		4.43	36.91
26X-3, 95–97	235.32	0.89	5.71		0.16		5.54	46.20
26X-5, 95–97	238.32	2.92	5.24		0.17	0.02 (2)	5.07	42.26
27X-1, 95–97	241.54	0.12	4.21		0.20		4.01	33.43
27X-1, 140–150*	242.03	0.93	5.24	0.09 (5)	0.13	0.01 (4)	5.11	42.56
28X-1, 95–97	251.68	0.25	5.09		0.16		4.93	41.09
28X-3, 95–97	254.68	2.45	6.38		0.17		6.20	51.70
28X-5, 95–97	257.68	1.01	5.00		0.24		4.77	39.74
29X-1, 95–97	260.38	2.12	6.40	0.02 (2)	0.17	0.01 (2)	6.23	51.88
29X-3, 95–97	263.38	1.94	5.70		0.16		5.54	46.16
29X-5, 95–97	266.38	1.10	5.08		0.22		4.86	40.49
30X-1, 93–95	270.48	0.43	4.85		0.18		4.67	38.92
30X-3, 93–95	273.48	0.95	4.80		0.25		4.55	37.89
30X-3, 140–150*	273.99	1.15	4.41	0.03 (2)	0.18	0.06 (2)	4.23	35.22
30X-5, 94–96	276.49	0.35	5.26		0.15		5.11	42.55
31X-1, 95–97	280.28	0.41	5.17		0.19		4.97	41.44
31X-3, 95–97	283.28	0.71	4.90		0.16		4.74	39.48
31X-5, 96–98	286.29	0.93	5.42		0.24		5.18	43.17
32X-1, 95–97	290.20	0.27	5.86		0.31		5.54	46.17
32X-3, 95–97	293.20	0.59	5.24		0.16	0.04 (3)	5.08	42.32
32X-5, 95–97	296.20	1.44	5.43		0.27	0.03 (3)	5.15	42.95
33X-1, 95–97	300.12	0.60	6.03		0.16		5.86	48.86
33X-3, 94–96	303.11	1.22	6.02		0.50	0.05 (3)	5.52	46.00
33X-3, 140–150*	303.61	2.50	5.98		0.21		5.76	48.02
33X-5, 94–96	306.11	1.72	6.68		0.18		6.50	54.13
34X-1, 95–97	309.72	1.25	6.79		0.26		6.53	54.42
34X-3, 95–97	312.72	2.01	7.11		0.22		6.89	57.45
34X-5, 95–97	315.72	0.74	6.56		0.25		6.31	52.61
35X-1, 95–97	318.70	0.93	6.05		0.21		5.83	48.62
35X-3, 95–97	321.70	5.37	6.50	0.09 (2)	0.26		6.24	51.99
35X-5, 95–97	324.70	1.25	7.27		0.22		7.04	58.70
36X-1, 95–97	328.92	5.33	7.20		0.12		7.08	59.02
36X-3, 95–97	331.92	3.18	6.45		0.16		6.29	52.41
36X-3, 140–150*	332.41	1.28	6.40	0.08 (4)	0.15	0.01 (3)	6.25	52.12
36X-5, 95–97	334.92	2.52	6.50		0.15		6.35	52.89
37X-1, 95–97	338.78	1.77	6.25		0.16		6.09	50.78
37X-3, 95–97	341.78	0.07	6.14		0.12		6.02	50.15

Notes: TC = total carbon, TOC = total organic carbon, TIC = total inorganic carbon. * = squeeze cake samples. TIC = TC – TOC. Number in parentheses = number of analytical replicates. Only a portion of this table appears here. The complete table is available in **ASCII**.