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1. Data Report: Phosphorus Concentrations and Geochemistry in Blake Nose Sediments from Leg 171B[1]

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INTRODUCTION

Quantifying phosphorus (P) concentrations in marine sediments is necessary for constraining the oceanic record of phosphorus burial and helps to constrain P sedimentary geochemistry. To understand P geochemistry in the sediments, we must determine the geochemical forms of P as well as the transformations occurring between these P components with depth and age. Although several records now exist of P geochemistry in the western and eastern equatorial Pacific (Filippelli and Delaney, 1995, 1996), the western equatorial Atlantic (Delaney and Anderson, 1997), the California Current (Delaney and Anderson, in press), and the Benguela Current (Anderson et al., in press), most of these are Neogene records. Relatively little data exist from sediments of the Paleogene or Cretaceous, time periods when carbon isotope records indicate major carbon shifts and when the nature of P geochemistry has not been well constrained. Samples from several sites at various water depths, oceanographic regions, and ages are needed to understand how P geochemistry and burial in sediments reflect ocean history.

We determined P geochemistry and reactive P concentrations in Atlantic sediments of Eocene to Cretaceous age. These are the first records of P geochemistry with good age control from this period. Blake Nose sites are ideal for investigating P geochemistry, as the sediments are shallowly buried at a range of water depths and sedimentation rates. We determined P concentrations and geochemistry, along with calcium carbonate contents, in mid-Cretaceous to upper Eocene sediments drilled on Blake Nose (Ocean Drilling Program Leg 171B) in a depth transect of

[1]Faul, K.L., and Delaney, M.L., 2000. Data report: Phosphorus concentrations and geochemistry in Blake Nose sediments from Leg 171B. *In* Kroon, D., Norris, R.D., and Klaus, A. (Eds.), *Proc. ODP, Sci. Results,* 171B, 1–10 [Online]. Available from World Wide Web: <http://www-odp.tamu.edu/publications/171B_SR/VOLUME/CHAPTERS/SR171B01.PDF>. [Cited YYYY-MM-DD]
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four sites (Sites 1052, 1051, 1050, and 1049; water depths: 1345, 1983, 2300, and 2656 m, respectively).

METHODS

We used a four-step sequential extraction procedure (Delaney and Anderson, 1997; Anderson and Delaney, 2000) modified from an earlier five-step P extraction procedure (Ruttenberg, 1992) to determine P concentrations in four components: oxide-associated P (sorbed to oxides or oxide coatings), authigenic P (presumably authigenic carbonate fluoroapatite), detrital P (terrestrial silicates and detrital apatite), and organic P.

Before determining P concentrations, we freeze-dried and crushed splits of 10-cm^3 samples. Replicate samples (~0.1 g) were weighed and run. After extracting the four components of P into known volumes of extractants, we used a LaChat Quick Chem 8000 automated spectrophotometric flow injection analysis system to measure the P concentrations. Results are reported as the means ± 1 σ (sample standard deviation). Total reactive P is calculated as the sum of oxide-associated P, authigenic P, and organic P. Total P is calculated as the sum of total reactive P and detrital P. Average detection limits are defined as three times the standard deviation of replicate measures of a low-concentration-solution standard and are expressed as equivalent concentration in a sedimentary sample. These limits were typically 0.5 µmol P/g for oxide-associated P, 0.3 µmol P/g for authigenic P, 0.1 µmol P/g for detrital P, and 0.2 µmol P/g for organic P. P concentrations were well above the detection limit for authigenic P but were often at or two to four times the detection limit for the other components. We assessed long-term analytical reproducibility by analyzing a consistency standard of a mixture of samples from all sites drilled on Blake Nose; this consistency standard was measured in each run. The long-term mean P concentrations ± 1 σ for the consistency standard were 1.28 µmol P/g ± 1.53 µmol P/g for oxide-associated P, 9.54 µmol P/g ± 1.13 µmol P/g for authigenic P, 0.63 µmol P/g for detrital P ± 0.91 µmol P/g, and 0.53 µmol P/g for organic P ± 0.15 µmol P/g. The primary P component of this consistency standard was authigenic P, with a relative standard deviation of 12%. The relative errors on the long-term means of the consistency standard were high for the components that constitute small fractions of total P: up to 120% for oxide-associated P, up to 146% for detrital P, and 28% for organic P.

We measured the weight percentage of calcium carbonate ($CaCO_3$) using a UIC, Inc., Coulometrics Model 5012 CO_2 coulometer. Relative standard deviations on the means for multiple determinations of a pure $CaCO_3$ standard and samples run in duplicate within a given analytical run were <1%. The detection limit for weight percentage $CaCO_3$ depends on sample size; for normal sample sizes of 5–10 mg, the detection limit is 0.5–1.0 wt%.

RESULTS

Concentrations of each of the four components of P, total reactive (the biologically active component, defined as the sum of oxide-associated, authigenic, and organic P), total P, and weight percentage $CaCO_3$ for the four sites are shown in Tables **T1, T2, T3,** and **T4.** Total reactive

P background concentrations in the sediments range from 4 to 20 µmol P/g sediment and resemble those at other Atlantic open-ocean sites (e.g., Ceara Rise), but peak values are higher (up to ~60 µmol P/g sediment), especially for Site 1050. At other oceanic sites, the more labile phases of P (oxide associated and organic) are transformed to authigenic P with increasing age and depth (Delaney and Anderson, 1997). Most P in Blake Nose sediments is authigenic: 82% ± 9% (Site 1049), 86% ± 9% (Site 1050), 89% ± 6% (Site 1051), and 88% ± 9% (Site 1052). Authigenic P also typically increases with depth. The amounts of P in the other reactive sedimentary components are relatively small. Oxide-associated P constitutes ~8% of total P for Site 1049 samples, ~6% for Site 1050 samples, ~4% for Site 1051 samples, and ~1% for Site 1052 samples. Typically, oxide-associated P decreases with depth. Organic P constitutes ~6% of total P for Site 1049 samples, ~4% for Site 1050 samples, ~4% for Site 1051 samples, and ~5% for Site 1052 samples. The detrital fraction also makes up a small percentage of the total P in Blake Nose sediments: 4% for Site 1049, 3% for Site 1050, 2% for Site 1051, and 6% for Site 1052. Organic P and detrital P concentrations are typically highest in the deepest, oldest sediments. Total reactive P concentrations do not correlate with weight percentage $CaCO_3$ (ranging from 11% to 94%), a major sedimentary component in Blake Nose sediments.

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Table T1. Concentrations of phosphorus components, Site 1049.

Core, section, interval (cm)	Depth (mbsf)	$CaCO_3$ (wt%)	Phosphorus concentrations (µmol P/g sediment)											
			Oxide associated		Authigenic		Detrital		Organic		Total reactive		Total	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
171B-1049A-														
3H-4, 78-81	25.88	78.7	1.60	0.10	8.61	0.39	0.61	0.54	0.68	0.08	10.89	0.41	11.50	0.68
3H-4, 78-81	25.88	78.7	BDL	BDL	8.15	0.12	0.49	0.07	0.39	0.01	8.54	0.12	9.03	0.13
4H-4, 77-79	35.37	70.3	1.43	0.37	8.52	0.26	0.45	0.33	0.82	0.11	10.77	0.46	11.22	0.57
4H-7, 40-42	39.51	66.2	BDL	BDL	6.22	1.48	0.11	0.02	0.34	0.08	6.56	1.48	6.67	1.49
4H-7, 40-42	39.51	66.2	1.08	0.06	7.26	0.32	0.16	0.02	0.35	0.01	8.69	0.32	8.85	0.32
5H-4, 77-79	44.87	63.4	1.22	0.27	7.45	0.02	0.11	0.02	0.79	0.11	9.46	0.29	9.57	0.29
5H-4, 77-79	44.87	63.4	BDL	BDL	7.84	0.21	0.27	0.11	0.45	0.02	8.29	0.21	8.56	0.23
6H-3, 77-79	52.87	66.7	1.80	0.14	7.40	0.06	0.21	0.15	0.72	0.09	9.92	0.18	10.13	0.24
7H-1, 79-81	59.39	80.9	0.67	0.10	13.68	0.12	0.43	0.20	0.52	0.10	14.88	0.19	15.30	0.27
7H-1, 79-81	59.39	80.9	BDL	BDL	12.89	0.38	0.39	0.01	0.29	0.03	13.18	0.38	13.57	0.38
9H-4, 78-80	67.18	69.3	1.83	0.02	9.10	0.26	0.23	0.09	0.58	0.10	11.50	0.28	11.73	0.29
10X-1, 64-66	70.04	66.8	1.61	0.24	8.71	0.24	0.21	0.01	0.73	0.10	11.06	0.35	11.26	0.35
10X-1, 64-66	70.04	66.8	BDL	BDL	8.83	0.09	0.33	0.04	0.36	0.02	9.19	0.09	9.52	0.10
12X-1, 60-62	86.70	64.5	2.24	0.67	11.39	0.63	0.23	0.03	0.32	0.02	13.95	0.92	14.18	0.92
13H-2, 72-74	97.92	34.6	2.15	0.16	23.13	0.21	1.00	0.01	1.51	0.06	26.78	0.28	27.78	0.28
16X-2, 57-59	117.07	66.1	2.18	0.70	14.97	0.42	0.38	0.05	0.38	0.02	17.53	0.82	17.91	0.82
16X-4, 77-79	120.27	75.3	0.57	0.11	15.45	0.39	0.31	0.01	0.93	0.05	16.95	0.41	17.26	0.41
16X-4, 77-79	120.27	75.3	BDL	BDL	14.28	0.42	0.37	0.05	0.64	0.00	14.92	0.42	15.29	0.42
18X-3, 60-62	137.90	68.9	1.50	0.66	7.94	0.17	0.22	0.03	0.64	0.05	10.07	0.68	10.29	0.69
18X-3, 60-62	137.90	68.9	1.07	0.01	8.06	0.21	0.28	0.06	0.34	0.02	9.46	0.21	9.75	0.22
18X-4, 81-83	139.61	92.4	1.00	0.03	5.36	0.32	1.21	0.34	0.51	0.09	6.87	0.34	8.08	0.48
19X-4, 79-81	149.19	69.5	1.61	0.18	7.19	0.43	1.42	0.31	1.27	0.04	10.07	0.47	11.49	0.56
19X-4, 79-81	149.19	69.5	BDL	BDL	6.91	0.08	1.09	0.07	0.91	0.03	7.82	0.09	8.91	0.11
20X-4, 41-43	158.41	34.0	2.32	0.21	7.97	0.06	0.65	0.01	1.94	0.15	12.23	0.27	12.88	0.27
21X-3, 78-80	166.88	68.3	1.34	0.29	14.67	1.45	0.63	0.04	1.16	0.05	17.16	1.48	17.79	1.48
21X-3, 78-80	166.88	68.3	BDL	BDL	12.97	0.25	0.71	0.06	0.69	0.06	13.66	0.26	14.37	0.27

Notes: SD = standard deviation. BDL = below detection limit.

Table T2. Concentrations of phosphorus components, Site 1050. (See table notes. Continued on next page.)

Core, section, interval (cm)	Depth (mbsf)	$CaCO_3$ (wt%)	Phosphorus concentrations (µmol P/g sediment)											
			Oxide associated		Authigenic		Detrital		Organic		Total reactive		Total	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
171B-1050A-														
1X-4, 77-79	5.27	75.5	1.96	0.46	7.40	0.54	0.19	0.02	0.80	0.14	10.16	0.72	10.35	0.72
2H-4, 77-79	15.37	72.2	1.10	0.76	7.45	1.20	0.15	0.04	0.73	0.11	9.29	1.42	9.44	1.43
2H-4, 77-79	15.37	72.2	1.98	0.67	6.32	0.42	0.19	0.05	0.38	0.00	8.67	0.79	8.86	0.79
3H-4, 77-79	24.87	72.1	1.38	0.20	6.75	0.63	0.20	0.01	1.04	0.33	9.17	0.74	9.37	0.74
4H-4, 78-80	34.38	66.9	BDL	BDL	7.32	0.07	0.11	0.01	0.28	0.01	7.59	0.07	7.70	0.07
5H-4, 77-79	43.87	72.9	BDL	BDL	8.51	0.51	0.09	0.01	0.26	0.05	8.77	0.51	8.86	0.51
6H-3, 78-80	51.88	67.7	2.48	1.30	5.76	2.21	0.09	0.03	0.24	0.11	8.48	2.57	8.57	2.57
6H-7, 10-12	57.21	70.2	BDL	BDL	8.54	0.01	0.08	0.02	0.28	0.01	8.82	0.01	8.89	0.03
7H-4, 78-80	62.88	67.2	BDL	BDL	7.59	1.38	0.19	0.03	0.51	0.13	8.10	1.38	8.29	1.38
8H-4, 78-80	72.38	64.2	BDL	BDL	8.10	0.19	0.15	0.02	0.49	0.13	8.59	0.23	8.75	0.23
9H-4, 78-80	81.45	69.5	1.27	0.36	8.32	1.26	0.15	0.04	0.53	0.23	10.12	1.33	10.27	1.34
10H-4, 78-80	91.38	67.2	1.67	0.18	8.14	1.03	0.16	0.03	0.52	0.23	10.32	1.07	10.48	1.07
11X-4, 121-123	101.31	69.1	1.35	0.12	9.41	2.37	0.15	0.04	0.28	0.04	11.04	2.37	11.20	2.37
12X-1, 78-80	105.98	75.6	1.64	0.40	9.71	2.60	0.13	0.02	0.28	0.05	11.63	2.63	11.76	2.63
13X-4, 79-80	120.09	78.0	BDL	BDL	8.83	0.99	0.18	0.05	0.33	0.08	9.15	1.00	9.33	1.00
14X-4, 72-74	129.62	77.5	BDL	BDL	9.74	1.18	0.18	0.03	0.31	0.06	10.05	1.18	10.23	1.18
15X-4, 70-73	139.20	80.8	BDL	BDL	11.09	2.12	0.21	0.05	0.42	0.17	11.51	2.13	11.72	2.13
16X-4, 79-81	148.89	76.3	BDL	BDL	7.07	0.58	0.13	0.03	0.38	0.13	7.45	0.59	7.58	0.59
18X-4, 75-77	168.05	48.8	1.32	0.16	5.33	1.01	0.18	0.04	0.37	0.26	7.02	1.05	7.20	1.05
20X-4, 77-79	187.27	56.9	1.28	0.14	8.34	1.74	0.17	0.03	0.34	0.25	9.96	1.76	10.13	1.76
21X-3, 70-72	193.31	47.0	BDL	BDL	7.01	0.17	0.16	0.03	0.60	0.05	7.61	0.18	7.76	0.18
21X-3, 70-72	193.31	47.0	BDL	BDL	7.68	0.97	0.19	0.03	0.36	0.04	8.03	0.97	8.22	0.97
22X-2, 82-84	201.52	55.0	BDL	BDL	8.39	2.43	0.20	0.03	0.26	0.17	8.65	2.44	8.86	2.44
23X-4, 79-81	214.09	57.3	1.20	0.13	11.10	0.15	0.22	0.01	0.70	0.04	13.00	0.20	13.23	0.20
24X-5, 64-66	225.04	52.8	1.09	0.10	11.50	0.05	0.20	0.00	0.60	0.02	13.20	0.11	13.40	0.11
27X-4, 77-78	246.97	60.9	1.10	0.10	9.34	0.10	0.33	0.01	0.47	0.02	10.92	0.14	11.24	0.14
28X-3, 84-86	251.14	57.7	BDL	BDL	8.96	0.12	0.30	0.01	0.58	0.03	9.54	0.12	9.84	0.12
29X-4, 70-72	262.10	66.8	BDL	BDL	8.46	0.04	0.46	0.08	0.43	0.00	8.89	0.04	9.35	0.09
30X-4, 72-74	271.72	52.8	0.90	0.05	8.29	0.12	0.24	0.01	0.57	0.02	9.76	0.13	10.00	0.13
31X-5, 80-81	281.76	48.9	BDL	BDL	15.45	0.35	0.40	0.02	0.75	0.00	16.19	0.35	16.59	0.35
32X-1, 72-74	286.42	54.8	BDL	BDL	18.80	0.20	0.66	0.06	0.74	0.01	19.54	0.20	20.20	0.21
33X-4, 77-79	294.17		BDL	BDL	11.96	0.08	0.53	0.04	0.59	0.00	12.55	0.08	13.08	0.09
34X-3, 77-79	299.07	58.6	BDL	BDL	14.18	0.29	0.69	0.05	0.56	0.01	14.74	0.29	15.43	0.29
34X-3, 77-79	299.07	58.6	0.99	0.14	16.37	0.29	BDL	BDL	BDL	BDL	17.36	0.32	17.36	0.32
35X-5, 60-63	311.50	33.2	BDL	BDL	18.90	0.20	0.84	0.03	0.92	0.01	19.82	0.20	20.66	0.20
35X-5, 60-63	311.50	33.2	BDL	BDL	21.39	0.94	0.97	0.04	BDL	BDL	21.39	0.94	22.37	0.94
36X-3, 49-51	317.99	37.7	BDL	BDL	19.13	0.10	0.69	0.04	0.87	0.01	20.01	0.11	20.20	0.11
36X-3, 49-51	317.99	37.7	1.18	0.17	21.18	0.35	0.79	0.04	BDL	BDL	22.36	0.39	23.15	0.39
171B-1050C-														
2R-3, 80-83	330.90	43.7	BDL	BDL	23.35	0.25	0.50	0.04	0.68	0.01	24.04	0.25	24.54	0.25
2R-3, 80-83	330.90	43.7	0.91	0.16	25.47	0.70	BDL	BDL	BDL	BDL	26.38	0.72	26.38	0.72
3R-3, 79-81	340.49	45.4	BDL	BDL	31.00	0.23	0.88	0.04	0.91	0.01	31.91	0.23	32.80	0.23
3R-3, 79-81	340.49	45.4	0.94	0.11	33.01	1.47	1.03	0.04	BDL	BDL	33.95	1.47	34.97	1.48
4R-3, 20-22	349.50	31.0	2.46	0.81	23.10	0.03	1.02	0.04	0.94	0.01	26.50	0.81	27.52	0.81
4R-3, 20-22	349.50	31.0	1.38	0.11	27.39	1.06	0.90	0.02	BDL	BDL	28.77	1.07	29.66	1.07
5R-3, 12-14	359.02	38.0	4.50	0.67	55.99	0.93	1.68	0.25	0.77	0.04	61.25	1.14	62.93	1.17
5R-3, 12-14	359.02	38.0	1.75	1.56	58.67	2.48	1.40	0.12	BDL	BDL	60.42	2.93	61.82	2.93
6R-3, 32-35	368.82	66.4	BDL	BDL	20.07	0.05	1.21	0.02	0.54	0.06	20.61	0.08	21.82	0.08
6R-3, 32-35	368.82	66.4	1.30	0.44	22.22	0.59	1.24	0.02	BDL	BDL	23.52	0.74	24.76	0.74
7R-1, 74-77	375.94	69.9	2.71	0.76	13.84	0.06	2.59	2.07	0.43	0.05	16.99	0.76	19.58	2.21
7R-1, 74-77	375.94	69.9	1.15	0.13	15.71	0.14	BDL	BDL	BDL	BDL	16.87	0.19	16.87	0.19
8R-3, 69-72	388.59	55.4	BDL	BDL	14.61	0.15	0.68	0.18	0.90	0.03	15.51	0.15	16.19	0.23
8R-3, 69-72	388.59	55.4	0.55	0.10	17.10	0.52	BDL	BDL	BDL	BDL	17.66	0.53	17.66	0.53
8R-4, 50-52	389.40	57.7	BDL	BDL	16.56	0.88	0.37	0.04	0.44	0.03	17.00	0.88	17.37	0.88
8R-4, 50-52	389.40	57.7	BDL	BDL	17.11	0.53	0.43	0.06	0.35	0.04	17.46	0.53	17.89	0.53
13R-3, 73-76	427.03	74.3	1.57	0.33	10.58	0.12	0.49	0.01	0.83	0.04	12.97	0.35	13.46	0.35
13R-3, 73-76	427.03	74.3	1.11	0.09	12.69	0.31	BDL	BDL	BDL	BDL	13.80	0.32	13.80	0.32
15R-3, 77-79	446.37	81.9	1.24	0.23	5.37	2.30	0.56	0.26	0.41	0.23	7.02	2.33	7.58	2.34
15R-7, 40-42	452.01	77.5	2.13	0.79	9.97	1.24	0.26	0.04	0.42	0.02	12.52	1.47	12.78	1.47
19R-1, 135-138	482.35	93.7	0.71	0.16	4.31	1.05	0.59	0.01	0.20	0.01	5.22	1.06	5.81	1.06
21R-2, 49-51	502.19	79.2	1.17	0.06	8.11	0.10	0.71	0.20	0.44	0.01	9.72	0.11	10.43	0.23
22R-1, 42-43	510.22	83.1	1.87	1.20	10.98	0.78	0.76	0.04	0.37	0.01	13.22	1.44	13.98	1.44
23R-1, 90-92	520.30	81.1	1.55	0.75	9.52	0.05	0.59	0.02	0.39	0.00	11.46	0.75	12.05	0.75
24R-1, 40-473	529.50	46.3	1.94	0.93	10.10	0.05	0.50	0.08	1.15	0.04	13.19	0.93	13.68	0.94
25R-3, 67-70	542.37	63.7	1.31	0.35	14.84	0.17	0.57	0.02	0.90	0.02	17.05	0.39	17.63	0.40

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	$CaCO_3$ (wt%)	Phosphorus concentrations (µmol P/g sediment)											
			Oxide associated		Authigenic		Detrital		Organic		Total reactive		Total	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
27R-1, 80-82	558.80	40.8	BDL	BDL	8.63	0.04	0.87	0.07	1.12	0.02	9.74	0.05	10.62	0.09
28R-3, 63-65	571.23	40.4	BDL	BDL	8.88	0.11	1.08	0.07	1.16	0.05	10.04	0.12	11.12	0.14
29R-3, 92-95	581.12	53.8	BDL	BDL	7.20	0.12	1.13	0.03	0.92	0.01	8.12	0.12	9.25	0.12
30R-4, 76-78	592.06	25.2	0.68	0.18	7.63	0.09	1.99	0.39	2.17	1.02	10.47	1.04	12.46	1.11
31R-4, 75-78	601.65	29.4	BDL	BDL	7.26	0.11	1.08	0.01	1.16	0.01	8.42	0.11	9.50	0.11

Notes: SD = standard deviation. BDL = below detection limit. Blank cells = quantity undetermined.

Table T3. Concentrations of phosphorus components, Site 1051. (See table notes. Continued on next page.)

Core, section, interval (cm)	Depth (mbsf)	$CaCO_3$ (wt%)	Phosphorus concentrations (µmol P/g sediment)											
			Oxide associated		Authigenic		Detrital		Organic		Total reactive		Total	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
171B-1051A-														
2H-4, 78-80	11.08	73.0	1.52	0.26	6.59	0.47	0.27	0.06	0.40	0.07	8.51	0.54	8.78	0.55
3H-4, 78-80	20.58	74.2	1.54	0.37	5.87	0.14	0.17	0.00	0.38	0.02	7.79	0.40	7.95	0.40
4H-4, 78-80	30.08	71.2	0.95	0.19	6.05	0.04	0.19	0.01	0.45	0.02	7.45	0.20	7.64	0.20
5H-4, 78-80	39.58	79.8	1.67	0.84	5.26	0.06	0.17	0.03	0.36	0.01	7.30	0.85	7.47	0.85
6H-4, 78-80	49.08	80.1	BDL	BDL	5.61	0.05	0.23	0.08	0.27	0.02	5.88	0.05	6.11	0.10
7H-4, 77-79	58.57	79.5	BDL	BDL	5.37	0.43	0.19	0.08	0.26	0.01	5.63	0.43	5.83	0.44
8H-4, 78-80	66.87	75.8	0.39	0.06	5.09	0.05	0.14	0.05	0.32	0.02	5.80	0.08	5.94	0.10
9H-4, 79-81	77.59	75.1	0.64	0.11	6.03	0.24	0.21	0.02	0.30	0.01	6.97	0.26	7.18	0.26
10H-4, 78-80	87.08	76.8	0.81	0.36	5.39	0.28	0.14	0.01	0.26	0.01	6.46	0.46	6.60	0.46
11H-4, 78-80	96.58	76.8	0.58	0.07	6.03	0.09	0.15	0.01	0.28	0.02	6.89	0.12	7.04	0.12
12H-4, 78-80	106.08	81.9	BDL	BDL	5.82	0.16	0.17	0.05	0.05	0.05	5.86	0.17	6.03	0.17
13H-4, 78-80	115.58	81.2	1.02	0.22	9.87	4.19	0.63	0.30	0.05	0.05	10.95	4.20	11.57	4.21
14H-4, 78-80	125.08	81.2	0.61	0.16	6.19	0.09	0.18	0.06	0.24	0.01	7.04	0.18	7.22	0.19
15H-4, 78-80	134.58	81.7	0.54	0.16	5.53	0.24	0.13	0.01	0.25	0.01	6.32	0.29	6.45	0.29
16H-4, 78-80	144.08	79.9	0.80	0.14	7.96	0.08	0.18	0.03	0.32	0.01	9.08	0.16	9.26	0.16
17X-4, 63-65	153.43	83.5	BDL	BDL	5.25	0.11	0.16	0.01	0.25	0.01	5.50	0.11	5.66	0.11
18X-4, 77-79	163.47	81.6	BDL	BDL	5.82	0.23	0.17	0.03	0.26	0.02	6.09	0.23	6.26	0.23
19X-4, 60-62	172.90	81.8	BDL	BDL	5.47	0.04	0.11	0.01	0.25	0.01	5.72	0.05	5.83	0.05
20X-4, 56-58	182.46	75.3	BDL	BDL	5.13	0.22	0.18	0.05	0.33	0.01	5.46	0.22	5.64	0.23
21X-4, 75-77	192.25	74.9	BDL	BDL	6.17	0.04	0.14	0.01	0.39	0.02	6.56	0.04	6.70	0.04
22X-4, 107-109	202.17	65.6	BDL	BDL	4.83	0.07	0.17	0.00	0.51	0.02	5.34	0.08	5.51	0.08
23X-4, 74-76	211.44	70.6	1.17	0.76	4.23	2.48	0.08	0.06	0.29	0.15	5.68	2.60	5.76	2.60
24X-4, 78-80	221.08	70.3	0.77	0.57	6.09	1.41	0.13	0.03	0.37	0.08	7.22	1.53	7.36	1.53
25X-4, 77-79	230.67	68.7	0.48	0.19	6.43	0.12	0.11	0.01	0.35	0.01	7.26	0.22	7.37	0.22
26X-4, 78-80	240.28	75.5	0.54	0.08	7.43	0.34	0.22	0.04	0.41	0.03	8.38	0.35	8.60	0.35
26X-7, 40-42	243.91	65.2	1.69	0.43	7.28	0.78	0.14	0.01	0.35	0.01	9.32	0.89	9.46	0.89
26X-7, 40-42	243.91	65.2	BDL	BDL	8.32	2.19	0.15	0.04	0.39	0.02	8.71	2.19	8.86	2.19
29X-4, 84-86	269.14	67.7	BDL	BDL	7.29	0.03	0.16	0.03	0.32	0.00	7.61	0.03	7.77	0.04
30X-3, 58-60	276.98	70.7	0.93	0.26	9.54	0.38	BDL	BDL	BDL	BDL	10.47	0.46	10.47	0.46
31X-3, 55-57	286.55	71.2	BDL	BDL	8.61	0.09	BDL	BDL	BDL	BDL	8.61	0.09	8.61	0.09
32X-3, 73-75	296.33	72.8	0.90	0.09	10.94	1.09	BDL	BDL	BDL	BDL	11.85	1.09	11.85	1.09
33X-4, 84-86	307.54	76.4	0.81	0.10	11.05	0.57	BDL	BDL	BDL	BDL	11.86	0.58	11.86	0.58
36X-4, 81-83	336.41	69.3	1.06	0.15	9.54	0.37	BDL	BDL	BDL	BDL	10.60	0.40	10.60	0.40
37X-4, 72-74	345.92	75.8	0.57	0.32	10.95	0.12	BDL	BDL	BDL	BDL	11.52	0.34	11.52	0.34
38X-3, 81-83	354.21	69.2	0.94	0.17	9.54	1.68	BDL	BDL	BDL	BDL	10.48	1.69	10.48	1.69
39X-4, 116-118	365.76	68.6	0.64	0.32	9.53	0.50	BDL	BDL	BDL	BDL	10.17	0.60	10.17	0.60
40X-4, 86-88	375.06	81.1	0.69	0.22	20.42	0.39	1.01	0.14	BDL	BDL	21.12	0.45	22.13	0.47
41X-1, 38-40	379.68	90.4	0.81	0.33	16.94	0.46	1.59	0.31	BDL	BDL	17.76	0.57	19.35	0.64
42X-4, 77-79	395.17	51.6	1.39	0.09	10.30	0.87	BDL	BDL	BDL	BDL	11.69	0.88	11.69	0.88
43X-4, 81-84	404.81	47.0	BDL	BDL	6.46	0.32	0.28	0.05	0.58	0.03	7.03	0.32	7.32	0.32
44X-4, 80-82	414.40	45.0	BDL	BDL	7.42	0.26	0.30	0.00	0.88	0.05	8.30	0.27	8.60	0.27
45X-4, 79-81	423.99	53.3	0.10	0.02	7.87	0.09	0.33	0.01	0.61	0.01	8.57	0.09	8.90	0.09
45X-7, 19-21	427.90	55.5	BDL	BDL	8.39	0.18	0.14	0.05	0.37	0.01	8.77	0.18	8.91	0.19
45X-7, 19-21	427.90	55.5	BDL	BDL	9.22	1.55	0.13	0.02	0.37	0.02	9.60	1.55	9.73	1.55
46X-4, 77-79	433.57	57.5	BDL	BDL	7.98	0.11	0.31	0.03	0.64	0.01	8.61	0.11	8.92	0.11
47X-4, 76-78	443.16	49.6	0.12	0.05	11.73	0.18	0.36	0.03	1.09	0.03	12.93	0.19	13.29	0.19
48X-4, 71-73	452.71	55.2	0.10	0.03	14.70	0.13	0.39	0.01	0.72	0.04	15.53	0.14	15.92	0.14
49X-2, 50-52	459.10	51.5	0.14	0.02	12.09	0.28	0.36	0.01	0.80	0.03	13.04	0.29	13.40	0.29
50X-4, 78-80	465.48	31.0	0.21	0.02	11.63	0.61	0.36	0.02	1.13	0.02	12.97	0.61	13.33	0.61
51X-4, 78-80	472.08	46.7	0.24	0.01	11.54	0.04	0.45	0.08	1.01	0.07	12.79	0.07	13.24	0.11
52X-4, 75-77	481.75	51.0	0.18	0.01	13.73	0.09	0.63	0.02	0.82	0.07	14.73	0.11	15.35	0.11
53X-4, 77-79	491.37	48.9	0.18	0.03	16.10	0.20	0.69	0.20	0.60	0.40	16.87	0.45	17.56	0.49
54X-4, 68-70	500.88	70.3	0.19	0.02	15.01	0.11	0.37	0.02	0.66	0.03	15.86	0.11	16.23	0.11
56X-4, 75-77	520.15	65.2	0.08	0.01	9.23	0.03	0.34	0.03	0.72	0.03	10.03	0.04	10.37	0.06
57X-4, 77-79	529.77	57.6	0.09	0.02	11.81	0.10	0.35	0.02	1.31	0.09	13.21	0.14	13.56	0.14
58X-3, 76-78	537.86	59.4	0.13	0.01	9.72	0.23	0.34	0.05	1.27	0.04	11.12	0.24	11.46	0.24
59X-3, 78-80	547.48	47.8	0.15	0.01	10.93	0.10	0.41	0.03	1.63	0.11	12.72	0.15	13.13	0.15
60X-1, 69-72	553.99	48.1	0.19	0.05	24.02	8.09	0.52	0.07	1.09	0.12	25.30	8.09	25.82	8.09
61X-4, 18-21	561.08	59.6	0.43	0.03	19.85	0.31	0.61	0.03	1.12	0.05	21.39	0.31	22.00	0.31
62X-5, 73-75	569.63	59.6	0.22	0.02	16.71	0.02	0.56	0.06	1.23	0.04	18.16	0.05	18.72	0.08
63X-3, 91-93	576.41	40.7	0.23	0.02	20.26	0.12	0.69	0.07	1.33	0.18	21.82	0.22	22.51	0.23
64X-5, 55-57	588.65	31.4	0.28	0.06	23.03	0.28	0.77	0.04	1.68	0.04	24.99	0.29	25.76	0.29
65X-4, 5-7	596.35	30.3	0.24	0.02	33.14	0.40	0.73	0.02	1.66	0.08	35.04	0.41	35.78	0.41
66X-3, 81 - 83	605.31	32.6	0.48	0.03	31.99	0.55	0.63	0.01	0.96	0.06	33.44	0.56	34.07	0.56
67X-5, 77 - 79	617.87	38.6	0.51	0.16	32.24	0.15	0.97	0.03	1.18	0.02	33.92	0.22	34.89	0.22

Table T3 (continued).

Core, section, interval (cm)	Depth (mbsf)	$CaCO_3$ (wt%)	Phosphorus concentrations (µmol P/g sediment)											
			Oxide associated		Authigenic		Detrital		Organic		Total reactive		Total	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
68X-2, 99 - 100	623.19	35.5	0.99	0.19	38.31	0.17	1.35	0.02	1.45	0.01	40.76	0.26	42.10	0.26
69X-1, 44 - 46	624.74	40.5	0.44	0.05	33.87	0.48	1.17	0.00	1.41	0.06	35.72	0.49	36.89	0.49
72X-2, 27 - 30	641.77	43.1	0.48	0.08	36.94	0.28	0.94	0.02	0.99	0.03	38.41	0.29	39.34	0.29
73X-1, 82 - 84	642.42	51.1	0.41	0.15	29.73	0.15	0.74	0.01	0.81	0.03	30.96	0.21	31.70	0.21

Notes: SD = standard deviation. BDL = below detection limit.

Table T4. Concentrations of phosphorus components, Site 1052.

Core, section, interval (cm)	Depth (mbsf)	$CaCO_3$ (wt%)	Phosphorus concentrations (µmol P/g sediment)											
			Oxide associated		Authigenic		Detrital		Organic		Total reactive		Total	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
171B-1052A-														
3H-3, 77-79	16.97	79.7	0.57	0.25	6.53	0.08	0.41	0.04	0.42	0.02	7.53	0.26	7.94	0.26
4H-1, 118-120	23.89	72.1	0.35	0.04	10.42	0.20	0.38	0.05	0.60	0.04	11.37	0.21	11.75	0.22
4H-2, 54-56	24.75	79.1	0.32	0.11	10.74	0.06	0.22	0.01	0.43	0.01	11.49	0.13	11.71	0.13
4H-2, 140-142	25.61	75.9	0.22	0.07	8.74	0.36	0.24	0.04	0.61	0.05	9.57	0.37	9.81	0.37
4H-3, 77-79	26.47	68.5	0.55	0.21	5.97	0.08	0.34	0.04	0.52	0.01	7.04	0.22	7.38	0.23
4H-4, 21-23	27.42	74.5	0.26	0.03	9.20	0.11	0.40	0.15	0.45	0.13	9.90	0.18	10.30	0.24
4H-4, 110-112	28.31	76.8	0.38	0.07	10.24	0.98	0.29	0.01	0.64	0.03	11.25	0.98	11.54	0.98
4H-5, 52-54	29.23	75.8	0.23	0.04	12.29	1.14	0.24	0.00	0.53	0.01	13.05	1.14	13.28	1.14
4H-5, 144-146	30.15	75.3	0.23	0.03	9.65	0.35	0.33	0.06	0.57	0.02	10.45	0.35	10.78	0.36
4H-6, 88-90	31.08	72.2	0.20	0.05	8.73	0.07	0.22	0.02	0.63	0.05	9.56	0.10	9.78	0.10
4H-7, 33-35	31.94	77.9	0.24	0.09	9.54	0.31	0.34	0.11	0.51	0.01	10.29	0.33	10.62	0.34
5H-1, 70-72	32.91	75.2	0.22	0.04	8.36	0.33	0.19	0.00	0.53	0.00	9.11	0.33	9.30	0.33
5H-2, 12-14	33.83	71.1	0.20	0.05	9.23	0.27	0.21	0.02	0.59	0.01	10.01	0.28	10.22	0.28
5H-3, 48-50	35.68	81.1	0.47	0.13	5.16	0.12	0.24	0.03	0.33	0.02	5.96	0.18	6.21	0.18
6H-3, 77-79	45.47	79.7	BDL	BDL	5.40	1.17	0.24	0.08	0.28	0.06	5.68	1.17	5.92	1.17
7H-3, 78-80	54.98	81.6	0.73	0.29	5.75	0.47	0.37	0.12	0.26	0.01	6.75	0.55	7.12	0.56
8H-3, 68-70	64.38	81.0	BDL	BDL	4.30	0.07	0.18	0.01	0.31	0.02	4.62	0.08	4.80	0.08
9H-3, 78-80	73.98	81.9	BDL	BDL	4.26	0.36	0.33	0.15	0.24	0.00	4.50	0.36	4.83	0.39
10H-3, 78-80	83.48	81.2	BDL	BDL	4.31	0.13	0.32	0.07	0.24	0.03	4.55	0.13	4.86	0.15
11H-3, 72-74	92.92	82.2	BDL	BDL	4.12	0.18	0.21	0.07	0.24	0.03	4.36	0.18	4.57	0.19
12H-3, 79-81	102.49	78.9	BDL	BDL	4.92	0.10	0.23	0.01	0.23	0.01	5.15	0.10	5.38	0.10
13H-3, 78-80	111.98	82.6	BDL	BDL	4.67	0.10	0.31	0.06	0.22	0.04	4.89	0.11	5.20	0.12
14H-3, 72.5-74.5	121.425	78.9	BDL	BDL	4.42	0.09	0.25	0.05	0.23	0.02	4.65	0.09	4.90	0.10
15H-1, 80-82	128.00	84.2	BDL	BDL	4.26	0.24	0.52	0.36	0.20	0.02	4.45	0.24	4.97	0.43
16X-3, 83-85	133.53	90.8	0.47	0.02	4.10	0.23	0.53	0.07	0.17	0.03	4.74	0.23	5.27	0.24
17X-1, 80-82	136.80	90.9	BDL	BDL	5.07	0.28	0.48	0.20	0.14	0.02	5.21	0.29	5.69	0.35
17X-3, 30-32	139.31	87.9	BDL	BDL	6.13	0.28	0.10	0.01	0.09	0.01	6.22	0.28	6.33	0.28
18X-3, 79-81	149.49	89.5	BDL	BDL	5.50	0.23	1.57	0.11	0.19	0.03	5.68	0.23	7.25	0.26
19X-3, 84-86	159.14	87.0	BDL	BDL	5.55	0.13	1.07	0.04	0.24	0.01	5.78	0.13	6.85	0.14
171B-1052E-														
5R-1, 24-26	175.44	80.2	BDL	BDL	16.40	0.20	0.58	0.01	0.38	0.01	16.78	0.20	17.36	0.20
8R-1, 97-99	204.97	36.3	BDL	BDL	22.24	0.03	0.89	0.07	1.12	0.01	23.37	0.03	24.25	0.08
9R-2, 28-30	215.39	36.0	BDL	BDL	30.02	0.02	0.79	0.02	0.99	0.01	31.01	0.02	31.80	0.03
10R-3, 75-77	226.95	49.2	BDL	BDL	25.12	0.15	0.72	0.01	0.57	0.01	25.69	0.15	26.41	0.15
12R-3, 69-71	245.88	67.5	0.71	0.10	13.66	0.60	1.96	0.27	0.40	0.01	14.77	0.61	16.72	0.67
13R-3, 47-49	255.47	76.9	BDL	BDL	18.59	0.20	0.61	0.07	0.33	0.02	18.92	0.20	19.53	0.21
14R-1, 78-80	262.48	76.2	BDL	BDL	20.60	1.37	0.53	0.10	0.32	0.01	20.92	1.37	21.45	1.37
15R-1, 73-75	272.03	71.7	BDL	BDL	16.77	0.14	0.60	0.20	0.27	0.04	17.04	0.15	17.64	0.25
16R-3, 78-80	284.68	74.7	BDL	BDL	17.03	0.73	0.61	0.18	0.37	0.01	17.40	0.73	18.00	0.75
16R-6, 70-72	289.11	55.8	BDL	BDL	16.05	0.56	0.39	0.06	0.22	0.02	16.27	0.56	16.66	0.57
16R-6, 70-72	289.11	55.8	BDL	BDL	18.78	5.38	0.45	0.10	0.37	0.01	19.15	5.38	19.60	5.38
17R-3, 78-80	294.15	66.5	BDL	BDL	18.34	0.20	0.40	0.04	0.38	0.02	18.71	0.20	19.12	0.20
20R-3, 72-74	323.02	17.7	BDL	BDL	13.83	0.77	0.45	0.08	0.76	0.03	14.59	0.77	15.03	0.78
21R-3, 127-129	333.17	70.2	BDL	BDL	11.79	0.15	0.32	0.08	0.91	0.06	12.70	0.16	13.02	0.18
22R-4, 66-68	343.76	69.5	BDL	BDL	11.57	1.90	0.52	0.28	0.99	0.16	12.57	1.91	13.09	1.93
23R-3, 55-56	351.85	68.8	BDL	BDL	10.68	0.14	0.44	0.13	1.12	0.06	11.80	0.15	12.24	0.19
24R-3, 101-104	361.91	74.3	BDL	BDL	12.76	0.26	0.46	0.01	0.68	0.01	13.44	0.26	13.90	0.26
25R-1, 59-62	368.09	72.0	BDL	BDL	11.91	0.98	0.65	0.02	0.73	0.01	12.64	0.98	13.29	0.98
25R-1, 90-92	368.41	75.8	BDL	BDL	12.81	0.24	0.23	0.03	0.38	0.03	13.19	0.25	13.42	0.25
25R-1, 90-92	368.41	75.8	BDL	BDL	13.45	2.60	0.26	0.04	0.36	0.01	13.81	2.60	14.08	2.60
26R-4, 89-93	382.49	70.9	BDL	BDL	12.99	0.16	BDL	BDL	0.60	0.01	13.58	0.16	13.58	0.16
28R-1, 80-82	397.10	82.5	BDL	BDL	9.47	0.23	BDL	BDL	0.31	0.01	9.78	0.23	9.78	0.23
29R-3, 74-76	409.64	89.1	BDL	BDL	8.66	0.15	0.48	0.08	BDL	BDL	8.66	0.15	9.14	0.17
30R-3, 63-65	419.13	82.3	BDL	BDL	9.84	0.24	0.46	0.13	0.32	0.00	10.16	0.24	10.62	0.27
31R-3, 79-81	428.89	79.2	BDL	BDL	12.11	0.66	0.31	0.03	0.39	0.02	12.50	0.66	12.81	0.66
33R-1, 138-140	445.68	89.6	BDL	BDL	8.35	0.40	0.32	0.03	0.30	0.07	8.64	0.41	8.97	0.41
34R-1, 61-63	454.51	89.5	BDL	BDL	7.43	0.12	0.29	0.05	BDL	BDL	7.43	0.12	7.72	0.13
35R-3, 92-94	467.52	88.3	BDL	BDL	9.42	0.06	1.93	0.13	0.25	0.01	9.67	0.06	11.60	0.15
47R-4, 51-53	583.01	35.2	BDL	BDL	7.70	0.03	1.91	0.14	0.79	0.05	8.50	0.05	10.41	0.15
51R-1, 136-138	617.96	29.6	BDL	BDL	6.80	0.02	3.26	0.09	0.98	0.05	7.79	0.05	11.04	0.11
52R-3, 110-113	625.80	10.9	BDL	BDL	5.53	0.05	0.30	0.03	1.34	0.00	6.87	0.05	7.17	0.06
53R-5, 133-135	634.53	37.1	0.59	0.27	7.50	0.22	1.74	0.11	0.81	0.01	8.90	0.35	10.63	0.37
54R-3, 44-47	640.24	19.2	0.28	0.02	8.62	0.21	2.60	0.03	0.82	0.02	9.73	0.21	12.33	0.21
55R-6, 2-4	653.92	48.3	0.33	0.08	7.57	0.20	1.43	0.06	0.86	0.01	8.76	0.21	10.19	0.22
57R-3, 135-138	669.46	37.8	0.25	0.09	8.05	0.44	2.48	0.13	0.81	0.03	9.11	0.45	11.58	0.47
58R-3, 57-59.5	678.75	18.5	0.34	0.03	6.09	0.28	2.47	0.16	1.20	0.04	7.63	0.29	10.10	0.33

Notes: SD = standard deviation. BDL = below detection limit.