Data report: pore water nitrate and silicate concentrations for Expedition 320/321 Pacific Equatorial Age Transect[1]

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Chapter contents

[1]Kordesch, W.E.C., and Delaney, M.L., 2013. Data report: pore water nitrate and silicate concentrations for Expedition 320/321 Pacific Equatorial Age Transect. *In* Pälike, H., Lyle, M., Nishi, H., Raffi, I., Gamage, K., Klaus, A., and the Expedition 320/321 Scientists, *Proc. IODP,* 320/321: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.proc.320321.210.2013
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Abstract

Concentrations of dissolved nitrate and silicate were determined in pore water samples from all eight sites (U1331–U1338) of the Pacific Equatorial Age Transect, Integrated Ocean Drilling Program (IODP) Expedition 320/321. Nitrate measurements were not made shipboard, and they are useful in assessing the extent of suboxic diagenesis evident in these sites. Dissolved silicate concentrations were remeasured in this study because two different analytical techniques were used shipboard during Expeditions 320/321, and comparisons indicated issues with analytical consistency. Nitrate and silicate were measured simultaneously in pore water samples squeezed from whole rounds and obtained by Rhizon sampling using an automated colorimetric technique with flow injection analysis. Profiles of nitrate concentrations at Sites U1331–U1333 show the least variability with depth (~50–80 µM). Sites U1334–U1336 exhibit pronounced depletions (from ~300 to 0 µM at Site U1334, from ~150 to 1 µM at Site U1335, and from ~75 to 10 µM at Site U1336), whereas nitrate concentrations increase with depth at Sites U1337 and U1338 (to 64 and 198 µM, respectively). Silicate concentrations at Site U1331 reach ~1180 µM at ~8 meters below seafloor, whereas profiles at other sites generally increase with depth (from 550 to 1200 µM at Site U1332, from 700 to 1200 µM at Site U1333, from 800 to 1350 µM at Site U1334, from 870 to 1960 µM at Site U1337, and from 730 to 1560 µM at Site U1338). At Sites U1335 and U1336, silicate varies 800–1220 and 760–1100 µM, respectively.

Introduction

During Integrated Ocean Drilling Program (IODP) Expedition 320/321, pore water samples were obtained from eight sites (U1331–U1338; Table **T1**) in the equatorial Pacific. These expeditions were the first after the extensive refit and laboratory updating for the R/V *JOIDES Resolution* completed in early 2009. Pore water measurements previously done with long-established techniques using an ultraviolet-visible light spectrophotometer (Gieskes et al., 1991) were to be carried out with newly adapted techniques using a discrete analyzer (see the **"Methods"** chapter [Expedition 320/321 Scientists, 2010a]). These techniques had not been thoroughly vetted before the expeditions, the module needed for nitrate measurements was not present/working during

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Expedition 320, and the discrete analyzer failed entirely before Expedition 321. As a result, nitrate measurements were not made shipboard, and silicate measurements were made using two different analytical techniques. To address these gaps, we report the concentrations of dissolved nitrate and silicate measured at a shore-based facility from archived splits of pore water samples obtained by whole-round squeezing and from Rhizon sampling.

The quantification of nitrate concentrations complements shipboard pore water measurements of dissolved manganese, iron, and sulfate (see the **"Expedition 320/321 summary"** chapter [Pälike et al., 2010b]) in the characterization of diagenetic processes involving organic carbon. Our shore-based measurements of dissolved silicate were prompted by inconsistencies (up to ~200 µM) (Expedition 320/321 Scientists, 2010a) between repeated shipboard analyses of reference samples caused by the use of two different analytical techniques during Expeditions 320 and 321. Expedition 320 used an OI Analytical discrete analyzer (DA3500) spectrophotometer, which failed before Expedition 321, and inductively coupled plasma–atomic emission spectroscopy was used in its place (Expedition 320/321 Scientists, 2010a). For analytical continuity, we measured all archived pore water samples using an automated coulometric technique in a flow injection analysis system (Lachat QuickChem 8000 FIA).

Measurements were made on two archived pore water sample types: whole round and Rhizon. Whole-round samples are hydraulically squeezed from 5–10 cm long whole-round sediment specimens and are a routine part of geochemical measurements on IODP expeditions. Whole-round sample resolution is generally one sample per section for all sites. Rhizon sampling uses plastic syringes to pull pore water through thin tubes inserted directly into core liners. This type of sampling was adapted for measurement of pore water in sediment during IODP Expedition 302 (Dickens et al., 2007) and provides a nondestructive method to obtain higher resolution sampling. Sites U1331, U1334, U1337, and U1338 include Rhizon samples (up to every 10 cm at Sites U1331 and U1338 and every ~1 m at other sites) across zones where pronounced chemical gradients and sediment color changes occur.

Methods and materials

Archived pore water whole-round and Rhizon samples collected during Expedition 320/321 were analyzed simultaneously for dissolved nitrate and silicate concentrations. Samples were filtered and sealed in glass ampules during Expedition 320/321. Ampules were opened on the day of analysis. Samples and standards were diluted with glass-distilled water (6:1 for nitrate and 20:1 for silicate), and constituents were measured using an automated coulometric technique in a flow injection analysis system (Lachat QuickChem 8000 FIA) using standard methods (Parsons et al., 1984; Strickland and Parsons, 1968). When sample size was limited, measurements of nitrate were prioritized.

Standards were made from a stock solution of potassium nitrate, sodium fluorosilicate, and glass-distilled water. A consistency standard (a mixture of sodium nitrate, sodium fluorosilicate, and sodium chloride dissolved in glass-distilled water and kept under refrigeration) was processed and analyzed with each batch of samples for long-term calibration and quality control purposes. Analytical error on the consistency standard analyzed in multiple replicates (n = 57) over the course of several months was 48.6 ± 3.4 µM for nitrate and 722 ± 12 µM for silicate (Table **T2**). Detection limits, determined from replicates (n = 10) of the glass-distilled water used for dilution and run as samples were 0.7 ± 0.2 µM for nitrate and 1 ± 0.4 µM for silicate (Table **T2**).

Results

Concentrations of dissolved nitrate and silicate for all eight Expedition 320/321 sites are provided in Tables **T3, T4, T5, T6, T7, T8, T9,** and **T10** and Figures **F1** and **F2.** Depths are plotted in core depth below seafloor, method A (meters below seafloor [mbsf] in text and figures), for all sites.

The profile of dissolved nitrate concentrations from our measurements on whole-round and Rhizon samples at Site U1331 shows a slight decrease with depth, starting at ~70 µM at 2.95 mbsf and decreasing to an average of ~55 µM at depths greater than 22 mbsf. At Site U1332, concentrations remain between ~55 and 45 µM. Nitrate concentrations at Site U1333 range from 50 to 60 µM and increase to 83 µM at 35.95 mbsf. Site U1334 contains the highest nitrate measured at any site, with concentrations in the shallowest sample at ~261 µM followed by a gradual decline from ~44 µM at 6 mbsf to ~10 µM at 125 mbsf and a slight increase to ~50 µM at 228 mbsf. Site U1335 follows a similar profile, with high nitrate in the shallowest samples (~153 µM), a sharp decline to near-zero values (54–375 mbsf), and a slight increase at depth (~34 µM). Near-surface concentrations at Site U1336 start at ~75 µM and steadily decrease to ~10 µM by 93 mbsf. At Site U1337, nitrate remains below 30 µM from 7 to 409 mbsf and increases to ~64 µM at ~428 mbsf. Site U1338 also remains low (<75 µM) from 1 to 350

mbsf and increases at 360 mbsf to 200 µM. Deep-water nitrate concentrations from the World Ocean Circulation Experiment Pacific Ocean Atlas in the equatorial Pacific (Line P04; 10°N, –120°W; ~4500 m water depth) proximal to Expedition 320/321 sites are steady at ~36 µM (Talley, 2007).

Profiles of dissolved silicate concentrations from our measurements on whole-round and Rhizon samples at most sites increase with depth. At Site U1331, surface concentrations of ~750 µM at 3 mbsf approach 900 µM at 123 mbsf. Surface concentrations at Site U1332 contain the lowest measured silicate concentrations of ~555 µM at 3 mbsf and approach 1200 µM at 103 mbsf. Profiles of silica at Sites U1333, U1335, and U1336 remain close to ~1000 µM. Silicate at Site U1334 increases from ~900 µM at shallow depths to 1362 µM at 257 mbsf. Silicate at both Sites U1337 and U1338 increases from ~1000 µM to the highest measured values of more than ~1500 µM. Rhizon sampling at Site U1338 also targeted a diatom-rich interval at ~130 mbsf (Section 321-U1333B-14H-5; see the **"Site U1338"** chapter [Expedition 320/321 Scientists, 2010e]) and contains average silicate concentrations of ~1150 µM.

Silicate concentrations measured in this study (including Rhizon samples) are consistently higher than shipboard measurements from Expedition 320/321 (0.67 µM/µM; R^2 = 0.41; n = 380), falling below a 1:1 line (Fig. **F3**). When compared by expedition, our data are on average more similar to shipboard measurements made during Expedition 321 (Sites U1337 and U1338; 0.56 µM/µM; R^2 = 0.40; n = 153) than during Expedition 320 (Sites U1331–U1336; 0.19 µM/µM; R^2 = 0.07; n = 227).

Rhizon samples from a 1.3 m interval at Site U1331 (Section 320-U1331B-1H-6; Table **T3**) were collected to test the feasibility of using the Rhizon sampling procedure during Expedition 320/321. Shipboard measurements and our archived samples show general agreement between whole-round and Rhizon sample concentrations (Table **T3;** Figs. **F1, F2**) (Expedition 320/321 Scientists, 2010b).

Differences in concentrations between whole-round and Rhizon samples at Sites U1331 and U1334 are partially attributed to samples originating from different holes (i.e., whole-round samples at Site U1331 are from Hole U1331A and Rhizon samples are from Hole U1331B; Table **T3**). Additionally, interstitial water sampling from extended core barrel–cored sections may contain contamination from seawater drilling fluid (i.e., Samples 320-U1334C-23X-1, 75 cm, to 23X-3, 75 cm, as well as Site U1337 below 210 mbsf [Section 321-U1337A-23X-3] and Site U1338 below 244 mbsf [Section 321-U1338A-27X-3) (Expedition 320/321 Scientists, 2010c, 2010d, 2010e).

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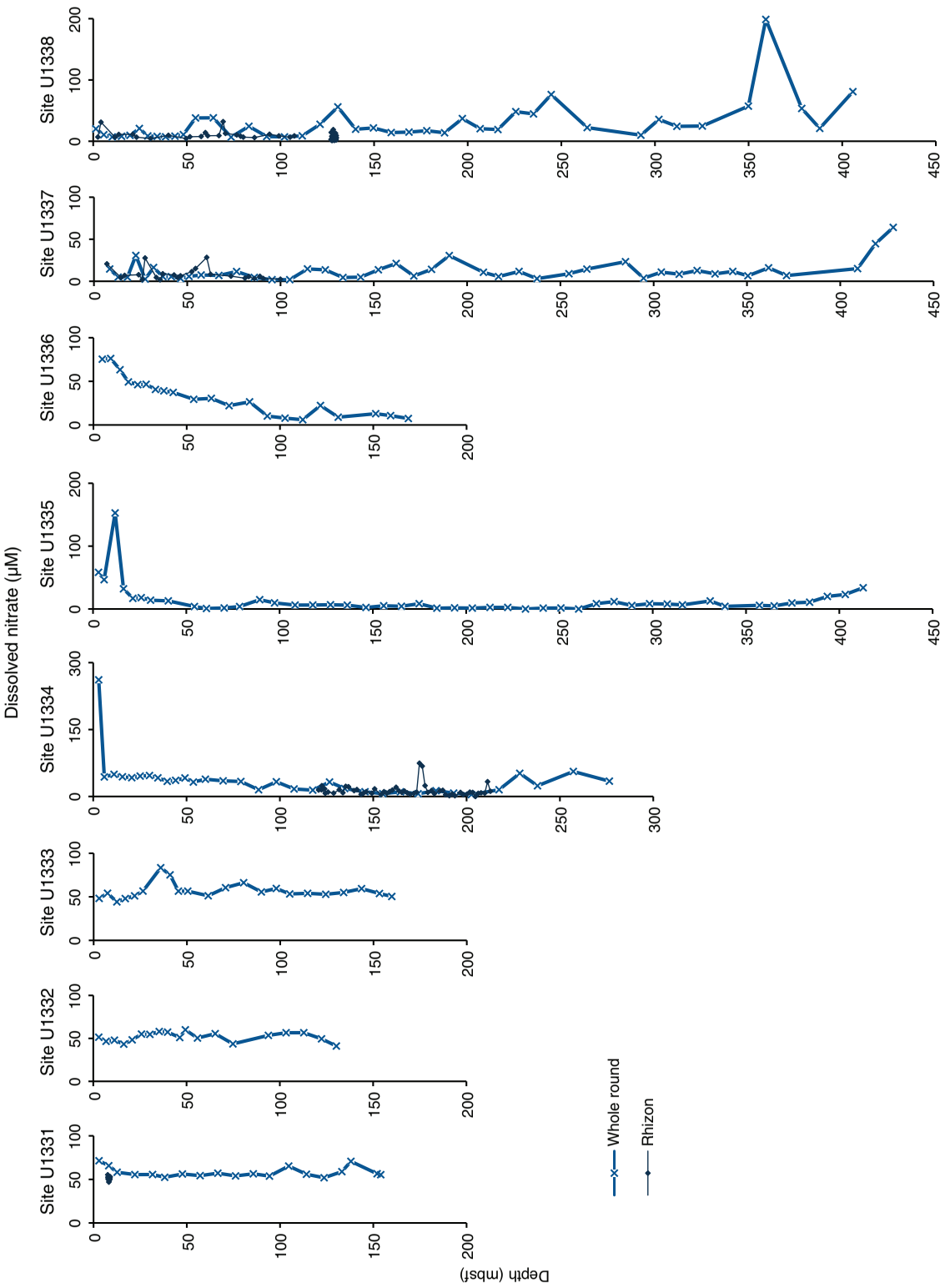

Figure F1. Plots of pore water concentrations of dissolved nitrate vs. depth, Sites U1331–U1338.

Figure F2. Plots of pore water concentrations of dissolved silicate vs. depth, Sites U1331–U1338.

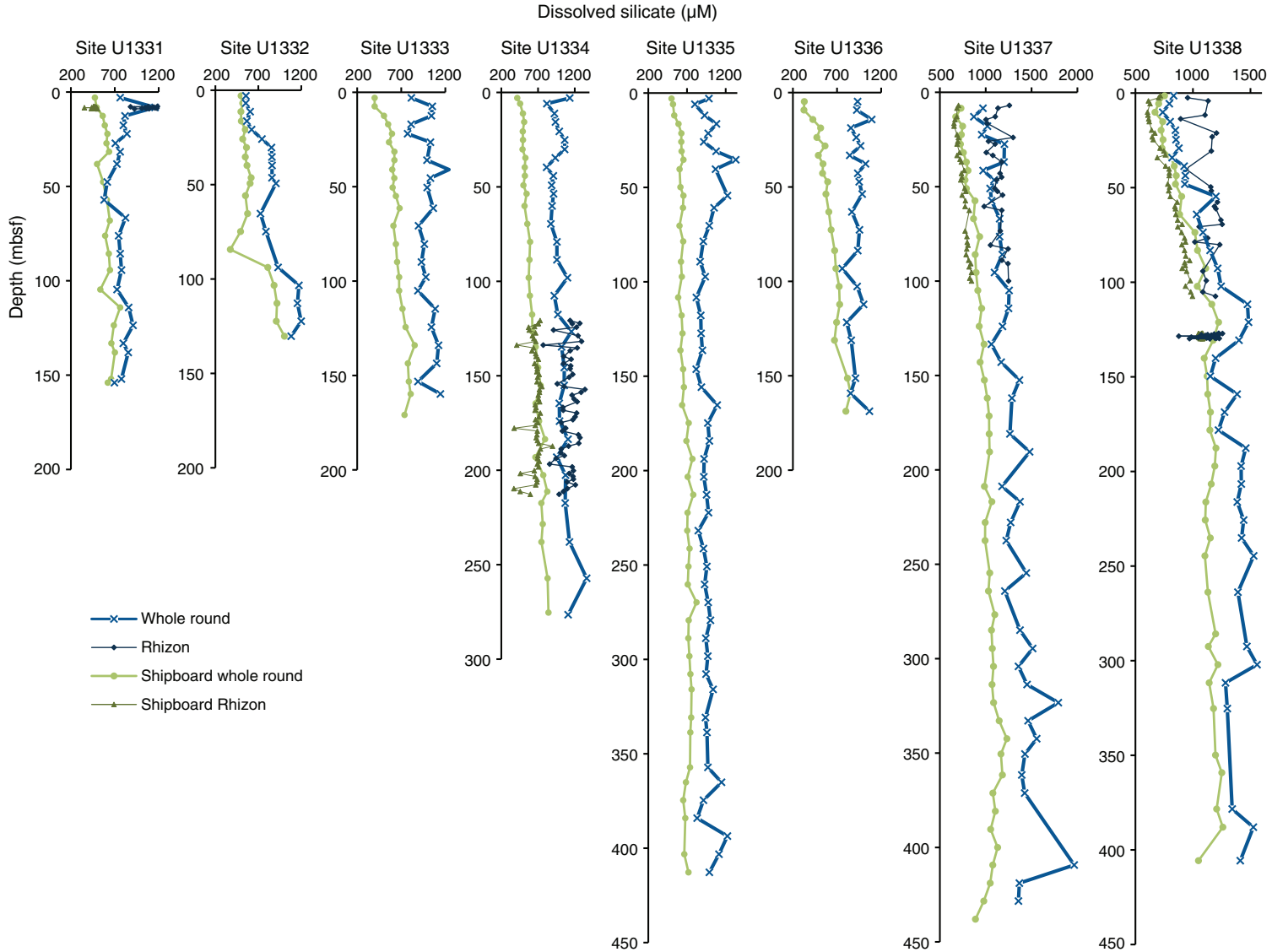

Figure F3. Comparison plot of dissolved silicate data measured during Expedition 320/321 vs. measurements made in this study. Solid lines are linear regressions for Expeditions 320 ($y = 0.19x + 441$; $R^2 = 0.07$; $n = 227$) and 321 ($y = 0.56x + 272$; $R^2 = 0.40$; $n = 153$). Linear regression for all data is $y = 0.67x + 42$ ($R^2 = 0.41$; $n = 380$). Dotted line is 1:1.

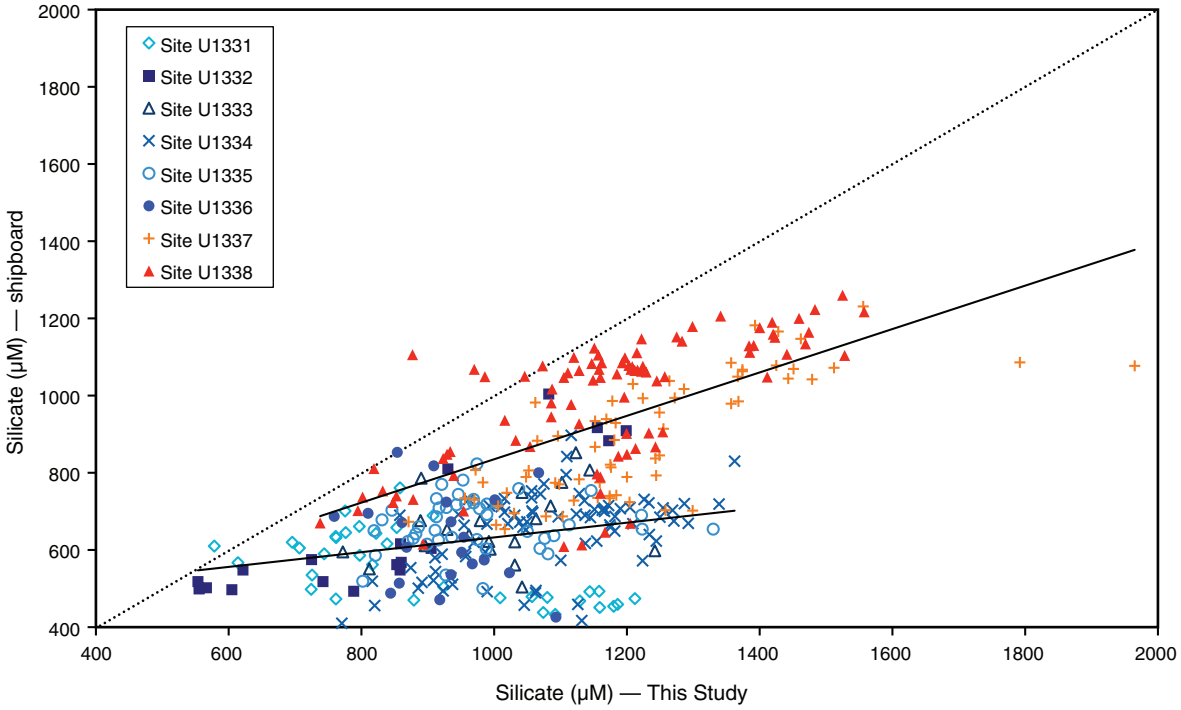

Table T1. Equatorial Pacific site information, Expedition 320/321.

Site	Holes with whole-round samples	Holes with Rhizon samples	Water depth (mbsl)	Latitude	Longitude	Crustal age (Ma)
U1331	A, B	B	5116	12°04.088′N	142°09.696′W	53
U1332	A		4924	11°54.709′N	141°02.742′W	50
U1333	A		4853	10°30.995′N	138°25.172′W	46
U1334	A	B, C	4799	7°59.998′N	131°58.393′W	38
U1335	A, B		4327	5°18.734′N	126°116.994′W	26
U1336	B		4286	7°42.073′N	128°15.252′W	~33*
U1337	A	A	4463	3°50.006′N	123°12.355′W	24
U1338	A, B	A, B	4200	2°30.468′N	117°58.162′W	18

* = drilling did not reach basement; crustal age unknown. From Pälike et al. (2010).

Table T2. Analytical figures of merit.

	Pore water concentration (μM)	
	NO_3^-	$H_4SiO_4^0$
Detection limits	0.7 ± 0.2	1 ± 0.4
Reproducibility (consistency standard replicates)	48.6 ± 3.4	722 ± 12

Detection limits are defined as three times the standard deviation of replicate measures of a blank of the same matrix as each sample, expressed in equivalent concentration for a typical sample size.

Table T3. Pore water concentrations, Site U1331.

Sample type	Core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	320-U1331A-				
Whole round	1H-2, 145–150	2.95	2.95	762	71.4
	2H-2, 145–150	8.15	9.65	1158	65.7
	2H-5, 145–150	12.65	14.15	817	58.2
	3H-2, 145–150	17.65	20.56	797	—
	3H-5, 145–150	22.15	25.06	839	55.5
	4H-2, 145–150	27.15	30.41	707	—
	4H-5, 145–150	31.65	34.91	761	55.6
	5H-3, 145–150	38.15	43.74	724	52.4
	6H-3, 145–150	47.65	55.15	614	56.2
	7H-3, 145–150	57.15	66.2	578	54.3
	8H-3, 145–150	66.65	77.96	822	57.1
	9H-3, 145–150	76.15	86.6	744	54.0
	10H-3, 145–150	85.65	94.17	762	56.4
	11H-3, 145–150	94.33	105.34	776	53.8
	12H-3, 145–150	104.65	117.87	726	65.3
	13H-3, 145–150	114.15	129.21	858	55.9
	14H-3, 145–150	123.62	139.8	908	51.9
	15H-3, 140–150	138.00	154.67	775	70.7
	17X-3, 145–150	152.05	167.12	853	56.5
	320-U1331B-				
Rhizon	1H-6, 10	7.61	8.46	1186	55.3
	1H-6, 20	7.71	8.56	1080	52.6
	1H-6, 30	7.81	8.66	879	50.3
	1H-6, 40	7.91	8.76	1212	51.7
	1H-6, 50	8.01	8.86	1144	51.9
	1H-6, 60	8.11	8.96	1129	50.6
	1H-6, 70	8.21	9.06	1074	46.9
	1H-6, 80	8.31	9.16	1048	48.0
	1H-6, 90	8.41	9.26	1159	50.5
	1H-6, 100	8.51	9.36	1180	51.4
	1H-6, 110	8.61	9.46	1009	50.0
	1H-6, 120	8.71	9.56	1057	49.9
	1H-6, 130	8.81	9.66	1092	51.9
	1H-6, 140	8.91	9.76	924	53.1
	15H-3, 145–150	133.15	149.33	797	58.9
	17H-1, 140–150	154.00	169.56	696	55.4

— = no data.

Table T4. Pore water concentrations, Site U1332.

Sample type	Core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	320-U1332A-				
Whole round	1H-2, 145–150	2.95	2.95	555	51.4
	2H-2, 145–150	6.85	7.16	554	46.6
	2H-5, 145–150	11.35	11.66	605	47.9
	3H-2, 145–150	16.35	17.00	566	43.3
	3H-5, 145–150	20.85	21.50	622	48.3
	4H-2, 145–150	25.85	28.50	742	55.0
	4H-5, 145–150	30.35	33.00	853	54.7
	5H-2, 145–150	35.35	40.50	858	58.0
	5H-5, 145–150	39.85	45.00	860	57.3
	6H-3, 145–150	46.35	52.00	859	51.0
	6H-5, 145–150	49.35	55.00	905	60.0
	7H-3, 145–150	55.85	63.75	—	50.4
	8H-3, 145–150	65.35	72.85	725	55.5
	9H-3, 145–150	74.85	77.63	788	43.6
	11H-3, 145–150	93.85	97.17	930	53.5
	12H-3, 145–150	103.35	109.37	1173	56.6
	13H-3, 145–150	112.85	120.62	1155	56.6
	14H-3, 145–150	122.35	133.87	1199	49.5
	15X-3, 140–150	130.30	142.82	1082	41.1

— = no data.

Table T5. Pore water concentrations, Site U1333.

Sample type	Core, section, interval (cm)	Depth (mbsf)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	320-U1333A-			
Whole round	1H-2, 145–150	2.95	815	48.2
	1H-5, 145–150	7.45	1052	54.1
	2H-2, 145–150	12.45	1042	44.2
	2H-5, 145–150	16.95	812	48.0
	3H-2, 145–150	21.95	772	51.1
	3H-5, 145–150	26.45	1031	56.6
	4H-5, 145–150	35.95	992	83.4
	5H-2, 145–150	40.95	1242	75.2
	5H-5, 145–150	45.45	1031	56.5
	6H-2, 145–150	50.45	994	56.5
	7H-3, 140–150	61.40	1063	51.2
	8H-3, 140–150	70.70	896	60.5
	9H-3, 140–150	80.40	962	66.2
	10H-3, 140–150	89.90	929	55.6
	11X-2, 140–150	97.90	979	59.6
	12X-3, 140–150	105.10	889	53.3
	13X-3, 140–150	114.70	1085	54.0
	14X-3, 140–150	124.40	1042	52.9
	15X-3, 140–150	134.00	1123	55.0
	16X-3, 140–150	143.60	1102	59.4
	17X-3, 140–150	153.20	890	53.8
	18X-1, 140–150	159.80	1144	50.4

Table T6. Pore water concentrations, Site U1334. (Continued on next page.)

Sample type	Hole, core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	320-U1334A-				
Whole round	1H-2, 145–150	2.95	2.95	1132	261.5
	1H-4, 145–150	5.95	5.95	820	43.8
	2H-2, 145–150	11.15	12.02	923	49.6
	2H-5, 145–150	15.65	16.52	937	44.1
	3H-2, 145–150	20.65	22.62	989	42.1
	3H-5, 145–150	25.15	27.12	1063	45.7
	4H-2, 145–150	30.15	33.63	1062	47.0
	4H-5, 145–150	34.65	38.13	935	41.7
	5H-2, 145–150	39.65	44.42	816	33.9
	5H-5, 145–150	44.15	48.92	908	36.2
	6H-2, 145–150	49.15	56.08	886	41.5
	6H-5, 145–150	53.65	60.58	912	32.3
	7H-3, 140–150	60.10	67.52	891	38.7
	8H-3, 140–150	69.60	78.66	874	35.0
	9H-3, 140–150	79.10	90.32	957	33.5
	10H-3, 140–150	88.60	99.91	957	15.0
	11H-3, 140–150	98.10	111.02	1100	33.0
	12H-3, 140–150	107.60	121.75	922	16.8
	13H-4, 140–150	117.60	133.04	970	14.2
	14H-3, 140–150	126.60	143.53	1155	32.4
	15H-3, 140–150	134.70	153.56	1021	17.8
	16H-3, 140–150	145.60	166.16	1057	10.5
	17H-3, 140–150	155.10	178.32	1056	6.2
	18H-3, 140–150	164.60	188.70	989	10.3
	19H-3, 140–150	174.02	200.44	993	6.1
	20H-3, 140–150	183.60	210.58	1108	12.9
	21H-3, 140–150	193.10	223.10	955	7.6
	22H-3, 140–150	202.60	245.30	1075	4.2
	24X-2, 140–150	217.40	264.30	1070	15.1
	25X-3, 140–150	228.50	275.90	—	51.9
	26X-3, 140–150	238.00	285.71	1128	23.9
	28X-3, 140–150	257.20	306.11	1362	56.0
	30X-3, 140–150	276.50	327.47	1109	34.3
	320-U1334B-				
Rhizon	13H-5, 75	122.45	141.44	1166	24.2
	13H-6, 75	123.95	142.94	—	17.2
	320-U1334C-				
	13H-5, 75	120.75	145.88	1136	14.4
	13H-6, 75	122.25	147.38	1269	15.1
	14H-1, 79	124.29	151.35	1224	7.1
	14H-2, 79	125.79	152.85	911	9.9
	14H-4, 79	128.79	155.85	1244	7.5
	14H-6, 79	131.79	158.85	1292	15.2
	15H-1, 75	133.75	161.98	770	8.3
	15H-2, 75	135.25	163.48	1234	22.7
	15H-3, 75	136.75	164.98	1137	21.8
	15H-5, 75	139.75	167.98	1049	13.1
	15H-6, 75	141.25	169.48	1151	15.6
	16H-1, 100	143.50	173.19	1048	4.7
	16H-2, 75	144.75	174.44	1145	7.3
	16H-3, 75	146.25	175.94	1137	10.6
	16H-5, 75	149.25	178.94	1172	7.1
	16H-6, 75	150.75	180.44	1124	17.0
	17H-2, 75	154.25	184.60	962	4.0
	17H-3, 75	155.75	186.10	1056	10.7
	17H-4, 75	157.25	187.60	1339	7.3
	17H-5, 75	158.75	189.10	1286	10.9
	17H-6, 75	160.25	190.60	1163	14.3
	18H-1, 75	162.25	193.69	1190	20.6
	18H-2, 75	163.75	195.19	1233	12.5
	18H-3, 75	165.25	196.69	—	9.3
	18H-4, 75	166.75	198.19	1038	12.0
	18H-5, 75	168.25	199.69	1043	8.0
	18H-6, 75	169.75	201.19	1226	4.9
	19H-1, 75	171.75	204.27	1205	6.8
	19H-2, 75	173.25	205.77	1174	9.6
	19H-3, 75	174.75	207.27	1015	74.6

Table T6 (continued).

Sample type	Hole, core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	19H-4, 75	176.25	208.77	—	68.0
	19H-5, 75	177.75	210.27	1077	24.2
	19H-6, 75	179.25	211.77	1031	9.1
	20H-1, 75	181.25	215.02	1250	13.3
	20H-2, 75	182.75	216.52	1271	6.4
	20H-4, 75	185.75	219.52	1254	12.8
	20H-5, 75	187.25	221.02	1116	13.8
	20H-6, 75	188.75	222.52	1015	3.9
	21H-1, 75	190.75	224.95	1011	1.8
	21H-2, 75	192.25	226.45	1058	5.6
	21H-3, 75	193.75	227.95	946	1.7
	21H-5, 75	196.75	230.95	858	9.1
	21H-6, 75	198.25	232.45	1165	4.1
	22H-1, 75	200.25	236.05	1182	5.2
	22H-2, 75	201.75	237.55	1126	9.7
	22H-3, 75	203.25	239.05	1175	9.0
	22H-4, 75	204.75	240.55	1182	0.0
	22H-5, 75	206.25	242.05	1096	7.0
	22H-6, 75	207.75	243.55	1209	8.1
	23X-1, 75	209.75	250.68	1100	7.5
	23X-2, 75	211.25	252.18	1045	33.2
	23X-3, 75	212.75	253.68	987	11.7

— = no data.

Table T7. Pore water concentrations, Site U1335.

Sample type	Hole, core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	320-U1335A-				
Whole round	1H-2, 145–150	2.95	3.09	983	58.3
	1H-4, 145–150	5.95	6.09	802	46.6
	2H-2, 145–150	11.85	12.86	927	152.8
	2H-5, 145–150	16.35	17.36	1081	32.1
	3H-2, 145–150	21.35	22.66	974	16.9
	3H-5, 145–150	25.85	27.16	916	18.0
	4H-2, 145–150	30.85	33.89	1076	14.0
	4H-5, 145–150	35.35	38.39	1330	—
	5H-2, 145–150	40.35	45.52	1069	12.9
	6H-5, 145–150	54.35	60.34	1223	3.9
	7H-3, 140–150	60.80	67.89	1050	0.8
	8H-3, 140–150	70.30	79.49	988	1.6
	9H-3, 145–150	78.58	89.94	911	3.9
	10H-3, 145–150	89.35	100.40	870	14.8
	11H-2, 140–150	97.30	110.16	936	9.7
	12H-3, 140–150	108.30	122.39	821	6.2
	13H-3, 140–150	117.80	131.04	878	6.3
	14H-3, 140–150	127.30	142.60	882	6.7
	15H-3, 140–150	136.30	152.65	899	6.1
	16H-3, 140–150	146.30	162.65	819	2.4
	17H-3, 140–150	155.80	175.80	886	5.1
	18H-3, 140–150	165.30	185.77	1090	4.3
	19H-3, 140–150	174.80	196.11	969	8.4
	20H-3, 140–150	184.30	207.03	989	1.3
	21H-3, 140–150	193.80	217.92	921	1.8
	22H-3, 140–150	203.30	229.28	917	1.4
	23H-3, 140–150	212.80	241.22	953	2.5
	24H-3, 140–150	222.30	253.93	978	2.5
	25H-3, 140–150	231.80	264.57	846	0.0
	26H-3, 140–150	241.30	275.94	913	1.4
	27H-3, 140–150	250.80	287.74	957	1.6
	28H-3, 140–150	260.30	298.08	928	0.0
	29H-3, 140–150	269.80	309.29	974	8.5
	30H-3, 140–150	279.30	319.86	1003	11.7
	31H-3, 140–150	288.80	331.43	943	5.5
	32H-3, 140–150	298.30	342.26	969	8.4
	33H-3, 140–150	307.80	353.54	946	7.9
	34H-3, 140–150	315.90	364.32	1037	6.5
	39X-3, 140–150	365.10	417.10	1146	4.9
	40X-3, 140–150	374.60	426.60	913	9.6
	41X-3, 140–150	384.10	436.10	831	10.8
	42X-3, 140–150	393.60	445.60	1222	20.0
	43X-3, 140–150	403.20	455.20	1113	23.1
	44X-3, 140–150	412.80	464.80	989	33.8
	320-U1335B-				
	36H-3, 140–150	330.80	382.65	939	12.8
	37H-2, 140–150	338.70	392.95	958	4.2
	39H-3, 140–150	357.20	411.45	970	5.8

— = no data.

Table T8. Pore water concentrations, Site U1336.

Sample type	Core, section, interval (cm)	Depth (mbsf)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	320-U1336B-			
Whole round	2H-2, 145–150	4.75	933	75.4
	2H-5, 145–150	9.25	924	76.2
	3H-2, 145–150	14.25	1093	63.3
	3H-5, 145–150	18.75	857	49.3
	4H-2, 145–150	23.75	918	46.2
	4H-5, 145–150	28.25	967	46.6
	5H-2, 145–150	33.25	844	40.7
	5H-5, 145–150	37.75	1023	39.1
	6H-2, 145–150	42.75	935	37.3
	6H-5, 145–150	47.25	951	—
	7H-3, 145–150	53.75	985	29.4
	8H-3, 140–150	63.20	868	30.5
	9H-3, 140–150	72.70	954	22.1
	10H-4, 140–150	83.70	935	26.5
	11H-4, 140–150	93.20	759	10.2
	12H-4, 140–150	102.70	928	7.8
	13H-4, 140–150	112.20	1001	6.0
	14H-4, 140–150	121.70	810	22.3
	15H-4, 140–150	131.20	861	8.9
	18H-4, 140–150	151.30	909	12.9
	19H-3, 140–150	159.30	854	10.7
	20H-3, 140–150	168.80	1067	7.4

— = no data.

Table T9. Pore water concentrations, Site U1337. (Continued on next page.)

Sample type	Core, section, interval (cm)	Depth (mbsf)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	321-U1337A-			
Whole round	2H-2, 145–150	8.45	970	14.6
	2H-5, 145–150	12.95	871	4.9
	3H-2, 145–150	17.95	1019	4.8
	3H-5, 145–150	22.45	956	30.7
	4H-2, 145–150	27.45	1204	2.6
	4H-5, 145–150	31.95	—	16.4
	5H-2, 145–150	36.95	1200	5.5
	5H-5, 145–150	41.45	972	5.5
	6H-2, 145–150	46.45	1092	3.3
	6H-5, 145–150	50.95	1048	5.8
	7H-3, 145–150	57.45	1065	7.5
	8H-3, 145–150	66.95	1152	6.9
	9H-3, 145–150	76.45	1152	11.6
	10H-3, 145–150	85.95	1181	4.6
	11H-3, 145–150	95.45	1096	1.9
	12H-3, 145–150	104.95	1255	1.9
	13H-3, 145–150	114.45	1249	14.7
	14H-3, 150–155	124.00	1183	13.6
	15H-3, 145–150	133.45	1062	4.5
	16H-3, 145–150	142.95	1169	4.9
	17H-3, 145–150	152.45	1368	13.7
	18H-3, 147–152	161.99	1286	21.2
	19H-3, 145–150	171.45	—	6.3
	20H-3, 145–150	180.95	1264	14.2
	21H-3, 145–150	190.45	1479	30.6
	23X-3, 145–150	208.75	1178	10.7
	24X-2, 145–150	216.85	1374	5.6
	25X-3, 145–150	227.85	1272	11.7
	26X-3, 145–150	237.45	1224	3.1
	28X-2, 140–150	254.60	1443	9.0
	29X-2, 140–150	264.20	1209	14.5
	31X-3, 140–150	284.90	1374	23.3
	32X-3, 140–150	294.60	1512	3.7

Table T9 (continued).

Sample type	Core, section, interval (cm)	Depth (mbsf)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	33X-3, 140–150	304.10	1357	10.9
	34X-3, 140–150	313.70	1451	8.4
	35X-3, 140–150	323.30	1792	12.8
	36X-3, 140–150	332.90	1462	8.8
	37X-3, 140–150	342.40	1556	11.7
	38X-2, 140–150	350.50	1428	6.5
	39X-3, 140–150	361.60	1393	16.0
	40X-3, 140–150	371.20	1425	6.8
	44X-3, 140–150	409.30	1965	15.1
	45X-3, 140–150	418.90	1367	44.7
	46X-3, 140–150	428.40	1357	64.1
Rhizon	2H-1, 145–150	6.95	1258	20.7
	2H-2, 140–145	8.40	1134	—
	2H-5, 140–145	12.90	1104	—
	2H-6, 145–150	14.45	1003	4.4
	3H-1, 145–150	16.45	1016	7.0
	3H-6, 145–150	23.95	1299	7.8
	4H-1, 145–150	25.95	1030	2.2
	4H-2, 140–145	27.40	1103	27.7
	4H-5, 140–145	31.90	1006	—
	4H-6, 145–150	33.45	1078	4.5
	5H-1, 145–150	35.45	—	1.8
	5H-2, 140–145	36.90	1174	8.9
	5H-6, 145–150	42.95	1156	7.5
	6H-1, 145–150	44.95	1174	4.5
	6H-2, 140–145	46.40	1120	6.5
	6H-5, 140–145	50.90	1098	—
	6H-6, 145–150	52.45	1128	11.5
	7H-1, 145–150	54.45	1184	15.2
	7H-5, 145–150	60.45	983	28.4
	7H-7, 53–58	62.53	1175	8.3
	9H-1, 145–150	73.45	1159	6.1
	9H-6, 145–150	80.95	1052	3.7
	10H-1, 145–150	82.95	1244	5.6
	10H-3, 145–150	85.95	—	3.1
	10H-5, 145–150	88.95	1176	5.9
	10H-7, 26–31	90.76	1243	3.3
	11H-6, 145–150	99.95	1249	2.5

— = no data.

Table T10. Pore water concentrations, Site U1338. (Continued on next page.)

Sample type	Hole, core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	321-U1338A-				
Whole round	1H-1, 145–150	1.40	1.49	832	20.2
	2H-2, 145–150	5.65	7.13	795	10.6
	2H-5, 145–150	10.15	11.63	738	7.0
	3H-2, 145–150	15.15	17.38	802	8.1
	3H-5, 145–150	19.65	21.88	848	9.6
	4H-2, 145–150	24.65	28.30	853	20.8
	4H-5, 145–150	29.15	32.80	878	8.6
	5H-2, 145–150	34.15	39.90	819	7.9
	5H-5, 145–150	38.65	44.40	923	7.2
	6H-2, 145–150	43.65	49.20	934	8.3
	6H-5, 145–150	48.15	53.70	929	10.8
	7H-3, 145–150	54.65	60.90	1199	38.0
	8H-3, 145–150	64.15	72.20	1032	38.2
	9H-3, 145–150	73.65	83.10	1087	6.7
	10H-3, 145–150	83.15	93.40	1149	24.4
	11H-3, 145–150	92.65	103.70	1215	7.7
	12H-3, 145–150	102.15	114.50	1245	7.0
	13H-3, 145–150	111.65	125.40	1474	8.8
	14H-3, 145–150	121.15	135.10	1483	27.7
	15H-3, 145–150	130.65	145.70	1400	56.0
	16H-3, 145–150	140.15	156.20	1197	19.6
	17H-3, 145–150	149.65	167.70	1151	21.7
	18H-3, 145–150	159.15	178.40	1384	14.2
	19H-3, 145–150	168.65	188.80	1275	14.9
	20H-3, 145–150	178.15	198.90	1222	17.2
	21H-3, 145–150	187.65	209.70	1459	13.8
	22H-3, 145–150	197.15	220.50	1419	37.0
	23H-3, 145–150	206.65	231.30	1420	20.5
	24H-3, 145–150	216.15	242.60	1385	19.1
	25H-3, 146–151	225.68	253.20	1441	48.3
	26H-3, 145–150	235.15	263.10	1423	44.6
	27X-3, 140–150	244.60	272.40	1528	76.2
	29X-3, 140–150	263.80	293.10	1391	22.3
	32X-3, 140–150	292.50	380.00	1469	9.9
	33X-3, 140–150	302.10	392.40	1557	35.6
	34X-3, 140–150	311.70	425.10	1283	24.3
	38X-3, 140–150	349.90	450.80	—	57.3
	29X-3, 140–150	359.20	315.90	—	198.8
	41X-3, 140–150	378.40	358.30	1341	53.5
	42X-3, 140–150	388.00	434.30	1525	21.0
	44X-3, 140–150	405.70	450.80	1411	80.9
	321-U1338B-				
	36H-3, 140–150	325.30	434.30	1299	24.8
	321-U1338A-				
Rhizon	1H-2, 100–105	2.50	2.54	954	6.9
	2H-1, 145–150	4.15	5.63	1132	31.1
	2H-6, 145–150	11.65	13.13	1105	6.7
	3H-1, 145–150	13.65	15.88	893	11.1
	3H-6, 145–150	21.15	23.38	1205	11.3
	4H-1, 145–150	23.15	26.77	1167	6.6
	4H-6, 145–150	30.65	34.27	1160	4.4
	5H-6, 145–150	40.15	45.85	939	9.6
	6H-6, 145–150	49.65	55.21	1155	4.4
	7H-1, 145–150	51.65	57.86	1160	7.3
	7H-5, 145–150	57.65	63.86	1213	7.8
	7H-7, 71–76	59.91	66.12	1187	14.1
	8H-1, 145–150	61.15	69.23	1200	9.0
	8H-5, 145–150	67.15	75.23	1243	9.2
	8H-7, 68–73	69.38	77.46	1254	32.0
	9H-1, 145–150	70.65	80.10	1054	12.8
	9H-5, 145–150	76.65	86.10	1128	10.3
	9H-7, 53–58	78.73	88.18	1016	8.2
	10H-1, 145–150	80.15	90.38	1233	6.7
	10H-5, 145–150	86.15	96.38	—	6.0
	11H-4, 145–150	94.15	105.80	1086	11.4
	12H-1, 145–150	99.15	111.50	1116	8.7
	12H-5, 145–150	105.15	117.50	1086	6.6

Table T10 (continued).

Sample type	Hole, core, section, interval (cm)	Depth (mbsf)	Depth (m CCSF)	$H_4SiO_4^0$ (μM)	NO_3^- (μM)
	12H-7, 72–77	107.42	119.77	1196	8.8
	321-U1338B-				
	14H-4, 90–95	127.00	140.05	1224	2.9
	14H-4, 100–105	127.10	140.15	1257	14.4
	14H-4, 120–125	127.30	140.35	—	3.4
	14H-4, 130–135	127.40	140.45	1185	8.1
	14H-4, 140–145	127.50	140.55	1212	1.2
	14H-5, 10–15	127.70	140.75	1128	1.7
	14H-5, 20–25	127.80	140.85	1073	6.8
	14H-5, 30–35	127.90	140.95	1222	2.6
	14H-5, 40–45	128.00	141.05	1160	5.0
	14H-5, 50–55	128.10	141.15	1208	6.3
	14H-5, 60–65	128.20	141.25	1111	19.0
	14H-5, 70–75	128.30	141.35	1105	2.6
	14H-5, 80–85	128.40	141.45	1158	2.5
	14H-5, 90–95	128.50	141.55	877	5.6
	14H-5, 100–105	128.60	141.65	1216	3.7
	14H-5, 110–115	128.70	141.75	1162	1.4
	14H-5, 120–125	128.80	141.85	1157	2.0
	14H-5, 130–135	128.90	141.95	1203	5.5
	14H-5, 140–145	129.00	142.05	986	5.9
	14H-6, 10–15	129.20	142.25	1046	7.8
	14H-6, 30–35	129.40	142.45	1120	13.1
	14H-6, 40–45	129.50	142.55	1206	3.3
	14H-6, 50–55	129.60	142.65	1193	3.4
	14H-6, 60–65	129.70	142.75	1229	2.1
	14H-6, 70–75	129.80	142.85	970	9.3
	14H-6, 80–85	129.90	142.95	1147	5.6

— = no data.