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12. Data Report: Early–Mid-Pleistocene Oxygen Isotope Stratigraphy from the Atlantic Sector of the Southern Ocean: ODP Leg 177 Sites 1094 and 1091[1]

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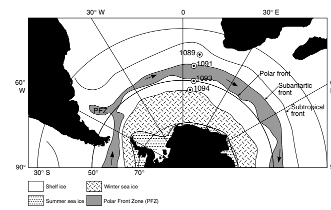
INTRODUCTION

Ocean Drilling Program (ODP) cores permit us to extend the study of millennial-scale climate variability beyond the time period that is generally accessible for piston cores (i.e., the last glacial cycle). ODP Leg 177 provided for the first time continuous high sedimentation rate cores along a north-south transect from 41°to 53°S across the main subdivisions of the Southern Ocean (Fig. F1) (Shipboard Scientific Party, 1999). The main purpose of this drilling was to investigate the Pleistocene and Holocene paleoceanographic history of this region, documented in the sedimentary records. ODP Sites 1094, 1093, 1091, and 1089 accumulated throughout the Pleistocene at rates >10 cm/k.y. and are the most detailed Pleistocene climatic records ever retrieved from the Southern Ocean. These sections provide a unique opportunity to fill an important gap in the knowledge of the paleoclimatic evolution of the high southern latitude regions.

The composite sections at each site were generated shipboard using magnetic susceptibility, gamma ray attenuation (GRA) density, and reflectance data to correlate the drill holes and splice together an optimal (complete and undisturbed) record of the sedimentary sequence at each site. A preliminary magnetic polarity stratigraphy was generated on the "archive" halves of the core sections from each hole, using the ship-

F1. Location of Sites 1091, 1093, and 1094, p. 7.



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board pass-through magnetometer after demagnetization at a single peak alternating field (Shipboard Scientific Party, 1999).

During July 1998, we sampled core sections spanning the mid-Pleistocene interval (0.65–1.2 Ma) from Sites 1094, 1093, and 1091 at the ODP Bremen Core Repository and have since then analyzed the stable isotopic ratios of foraminifers in samples from Sites 1094 and 1091. Our goals for these studies are to establish detailed chronology for the mid-Pleistocene Southern Ocean records from Leg 177 using high-resolution stable isotope analyses, and furthermore, to trace the evolution of millennial-scale variability in proxy records from older glacial and interglacial periods characterized by higher-frequency variation. Here, we report on our stratigraphic results to date and describe the laboratory methods employed for sample preparation and stable isotope analysis. Furthermore, we provide tab-delimited text files of the age models.

MATERIAL AND METHODS

Sample Preparation

Approximately 2400 20-cm^3 samples were taken from the composite sections at Sites 1094 and 1091 at 5-cm intervals and at Site 1093 at 10-cm intervals. Prior to sample preparation, we removed 1 cm^3 from each sample to provide material for subsequent weight percent $CaCO_3$ measurements. The samples were then dried at 70°C for 24 hr to obtain the dry bulk weight per sample. After weighing, each sample was soaked in distilled water and left for 12 hr on a shaking table to desegregate. The samples were then cleaned carefully with a brush and wet sieved into three fractions (>63, >150, and >500 µm) and the <63-µm fraction was collected in a 2-L beaker to settle for up to 7 days. Following this, each coarse fraction was dried, weighed, and transferred to a sample glass. The fine fractions (<63 µm) were dried, transferred into Ziplock bags, and shipped to Weslayan University for subsequent analyses by ODP Leg 177 shipboard scientist S. O'Conell.

Stable Isotopes

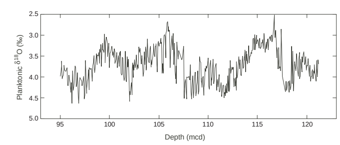
Stable isotope analyses were conducted at the Department of Geology at the University of Bergen. The planktonic foraminiferal isotopic analyses were performed on 12 to 14 individual tests of *Neoglobo-quadrina pachyderma* (sinistral), selected from the >150- to 250-µm size fraction. Prior to analyses, all foraminiferal shells were soaked in 15% H_2O_2 for 15 min to remove organic matter and the H_2O_2 was removed using a syringe. Following this, all shells were cracked open to release potential sediment fillings and ultrasonically rinsed for 1 min in methanol to remove the fine-grained particles. The methanol was removed using a syringe, and the samples were allowed to evaporate to dryness in a drying cabinet. The foraminifer shells were then loaded into individual reaction glasses, and each sample was reacted with three drops of H_3PO_4 using a MAT Carbo Kiel III automated preparation line. Isotope ratios were measured on a Finnigan MAT 252 mass spectrometer. The data are reported as $\delta^{18}O$ vs. the Vee Pee Dee belemnite (VPDB) standard after calibration with NBS-19 standard (Coplen, 1995). Analytical precision of the system as defined by replicate measurements of carbonate standards is ±0.06‰ for $\delta^{13}C$ and ±0.07‰ for $\delta^{18}O$.

RESULTS

Site 1094 Stable Isotope Stratigraphy

Site 1094 (53°10.81′S, 5°7.82′E; 2807-m water depth) is located in a small sedimentary basin north of Bouvet Øya south of the present day position of the Antarctic Polar Front (Fig. F1). The interval from 95.0 to 121.19 meters composite depth (mcd) was sampled continuously (nominally at 5-cm intervals) at Site 1094 for stable isotopic analyses and subsequent lithic counts. Beyond 121.19 mcd there is not a composite spliced section available. The abundance of *N. pachyderma* (sinistral) allowed the planktonic record to be acquired at a 5-cm (~357 yr) resolution, whereas the relative scarcity of benthic foraminifers rendered it impossible to construct a benthic stable isotope record from this site with only 20-cm^3-sized samples. The $\delta^{18}O$ record from Site 1094 is plotted vs. depth in Figure F2. The abundance of planktonic foraminifers remained fairly constant throughout the studied interval, with only minor gaps that do not influence the continuity of the isotope record. Of the 522 samples analyzed, only 28 were barren of planktonic foraminifers (Table T1).

F2. Site 1094 planktonic $\delta^{18}O$ record, p. 8.



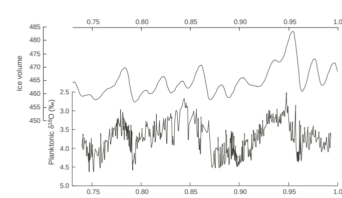
T1. Planktonic $\delta^{18}O$, Site 1094, p. 13.

Site 1094 Age Model

The Matuyama/Brunhes (780 ka) and top Jaramillo (990 ka) paleomagnetic boundaries initially defined the age control for the mid-Pleistocene interval at Site 1094 (Channell and Stoner, in press.). In this study, we have refined this chronology by tuning the $\delta^{18}O$ signal at Site 1094 to the ice volume simulation model of Imbrie and Imbrie (1980). We chose the latter as our tuning target because it has proved to be a powerful target for the late Pleistocene (Bassinot et al., 1994; Martinson et al., 1987) as well as for the early and mid-Pleistocene (Channell and Kleiven, 2000; Shackleton et al., 1990). Our procedure was to match the $\delta^{18}O$ record from Site 1094 to the target using linear interpolation between tie points (Table T2). This procedure was fairly straightforward because precession-related oscillations are well expressed in the $\delta^{18}O$ record of Site 1094. When assigning the tie points, we gave the glacial–interglacial transitions higher priority than the centers of glacial or interglacial intervals. We assumed constant sedimentation rates between tie points, resulting in a change in sedimentation rate more or less abruptly at these points. This assumption may be realistic when the tie points correspond to glacial–interglacial transitions, when environmental changes might be expected to effect the sedimentation rates. Moreover, assigning tie points at high-amplitude transitions is probably more accurate than the designation of any particular peak or trough in intervals displaying considerable high-frequency, low-amplitude variability. In Figure F3, we have plotted our new Site 1094 $\delta^{18}O$ record vs. the Ice Volume Model on their common age scale. Based on our correlation, we conclude that our $\delta^{18}O$ record spans the time interval from 740 to 993 ka.

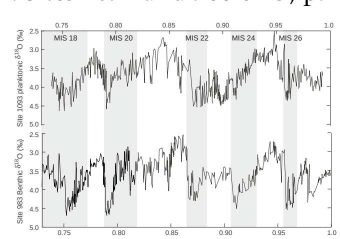
T2. Age model, Site 1094, p. 16.

F3. Site 1094 $\delta^{18}O$ with ice volume simulation model, p. 9.



In Figure F4, we have plotted our new Site 1094 planktonic $\delta^{18}O$ record vs. the mid Pleistocene benthic $\delta^{18}O$ record from North Atlantic Site 983 (Channell and Kleiven, 2000; Kleiven et al., in press) as comparison. Oxygen isotopic Stages 18 through 26 can easily be identified in the Site 1094 $\delta^{18}O$ record by matching to the benthic $\delta^{18}O$ record from Site 983. Orbital variability in $\delta^{18}O$ is clearly present in the Site

F4. Sites 1094 and 983 $\delta^{18}O$, p. 10.



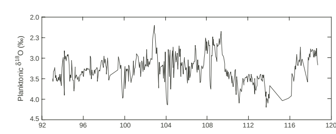
1094 record, indicating that Milankovitch-forced ice volume changes are controlling the large-scale fluctuations. Superimposed on this glacial–interglacial $\delta^{18}O$ signal is large suborbital-scale variability. It is interesting to note that many of the same high-resolution features are common and well defined in the records from both the South and North Atlantic. Significant millennial-scale variability, with pacing indistinguishable from that of the last glacial cycle, characterize all observed climate states during the mid-Pleistocene interval from these sites, suggesting that suborbital variability has been a fundamental part of the climate system in both regions. Further paleoceanographic interpretation of the oxygen isotope results and lithic proxy records from Site 1094 are presented in Kleiven and Jansen, (submitted [N1]).

Site 1091 Stable Isotope Stratigraphy

Site 1091 (47°5.68′S, 5°55.12′E; 4363-m water depth) is located in the Polar Front Zone (PFZ) on the western flank of the Meteor Rise, ~2° north of the present-day Polar Front (Fig. F1). Site 1091 lies well north of the present day Antarctic PFZ, but during the course of glacial cycles, the lithology of the site alternates between calcareous (interglacial) and diatomaceous (glacial) ooze. The sedimentation rates vary between ~10 to ~30 cm/k.y. At Site 1091 there is a continuous spliced section down to 234 mcd (~1.7 Ma). For our study, we sampled the interval from 93.03 to 158.01 mcd continuously at 5-cm intervals at Site 1091 for stable isotopic analyses and subsequent lithic counts.

As for Site 1094, benthic foraminifers at Site 1091 were to absent to scarce for analyses and we have focused on obtaining a continuous isotope signal based on the abundance of the polar planktonic foraminifers *N. pachyderma* (sinistral) selected from the >150- to 250-µm size fraction. The $\delta^{18}O$ record from Site 1091 is plotted vs. depth in Figure F5. The abundance of planktonic foraminifers has remained fairly constant back to 119 mcd, which is as far as we have analyzed at this site to date. There are, however, some intervals barren of foraminifers from 98.6 to 99.4, 114.1 to 115.8, and 117.2 to 117.7 mcd, which have led to minor gaps in our record (Table T3).

F5. Site 1091 planktonic $\delta^{18}O$ record, p. 11.

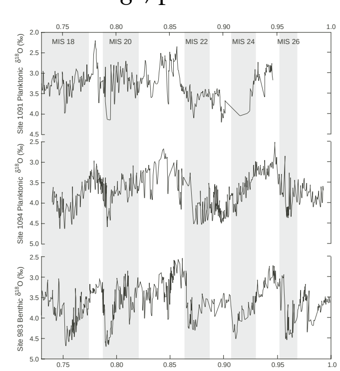


T3. Planktonic $\delta^{18}O$, Site 1091, p. 17.

Site 1091 Age Model

We have not yet constructed a final age model for our Site 1091 interval, as work on these sections is still in progress. However, to make a correlation between our results at Sites 1094 and 1091, we have tied the $\delta^{18}O$ record from Site 1091 from 93.03 to 119 mcd to that of Site 1094 using the AnalySeries program (Paillard et al., 1996). In Figure F6, we have plotted the $\delta^{18}O$ records from Site 1094 and 1091 on their common age scale together with the benthic $\delta^{18}O$ record from Site 983. Based on this correlation, we conclude that our record from site 1091 spans the interval from 750 to 950 ka (marine isotope Stages 18–25).

F6. Site 1091 and 1094 $\delta^{18}O$ records vs. age, p. 12.



Site 1093

Site 1093 (49°58.60′S, 5°51.92′E) lies just beneath the present Antarctic PFZ, at the northern edge of the modern diatomaceous ooze belt (Fig. F1). At Site 1093 there is a continuous spliced section down to 255 mcd. For our study, we sampled the interval from 190 to 255 mcd continuously at 10-cm intervals for stable isotopic analyses and subsequent lithic counts. We have so far analyzed the first 12-mcd section of our interval and have found every sample to be barren of planktonic or benthic foraminifers. Based on shipboard data (Shipboard Scientific Party, 1999) we know that our interval begins in a cool interval at the MIS 17/18 transition and remains cold until the MIS 18/19 transition. In recent work by Hodell et al. (**Chap. 9,** this volume), they find that Site 1093 is barren of foraminifers in every cold (glacial) interval for the last 600 k.y. We believe that this pattern continues into the mid-Pleistocene and hope to be able to obtain stable isotope measurements as we move into the warmer interglacial intervals of MIS 19 and MIS 21.

ACKNOWLEDGMENTS

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Figure F1. Location of Ocean Drilling Program Sites 1091, 1093, and 1094 with the mean position of the Polar, Subantarctic, and Subtropical frontal zones and the summer and winter sea ice cover (redrawn from Shipboard Scientific Party, 1999).

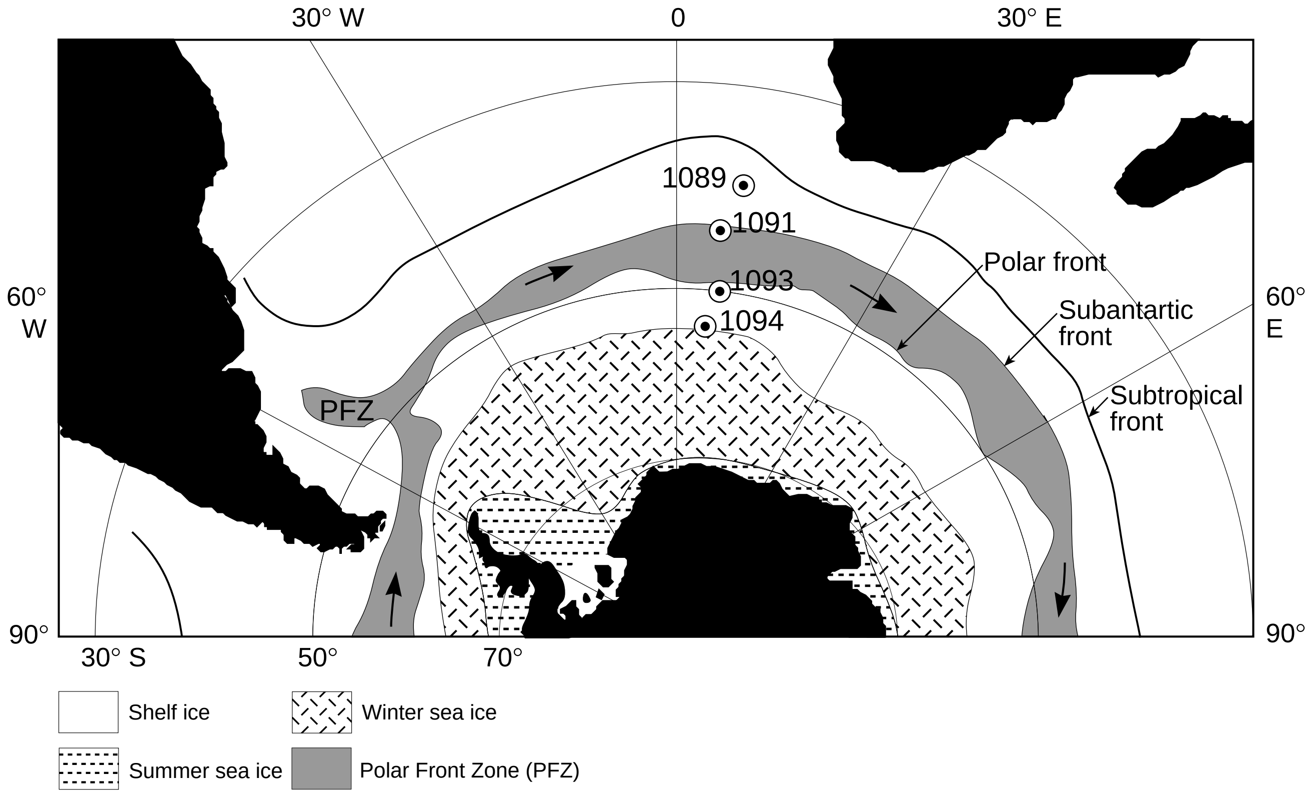

Figure F2. The Site 1094 planktonic $\delta^{18}O$ record plotted vs. depth. Oxygen isotope data were obtained from the planktonic foraminifer *N. Pachyderma* (sinistral).

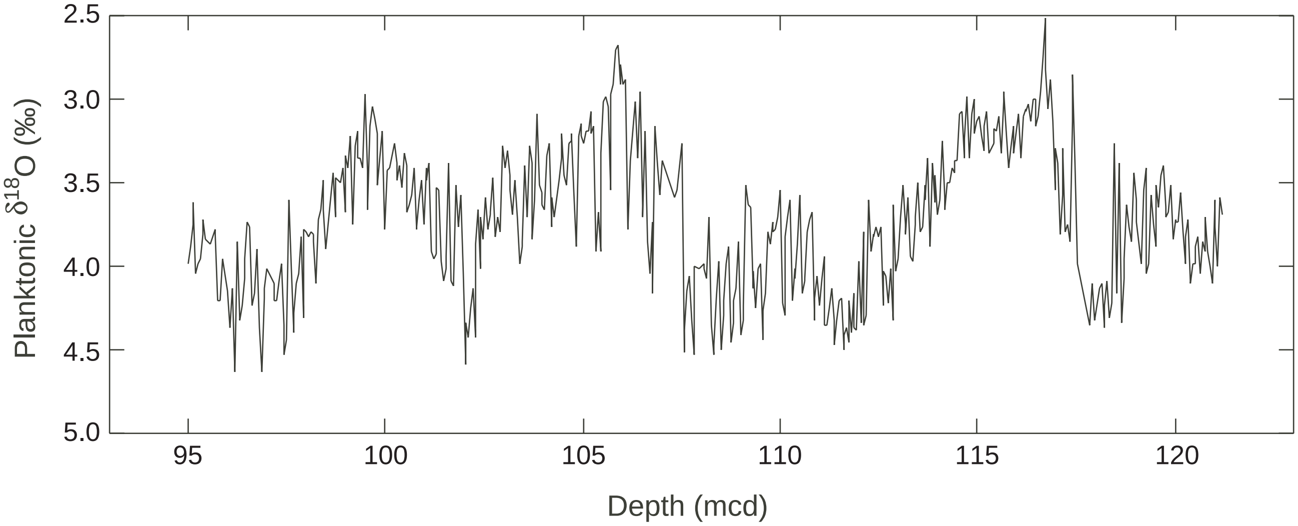

Figure F3. Correlation of the Site 1094 planktonic $\delta^{18}O$ record to the Imbrie and Imbrie (1980) ice volume simulation model that has been used as a tuning target to construct the age-model for Site 1094.

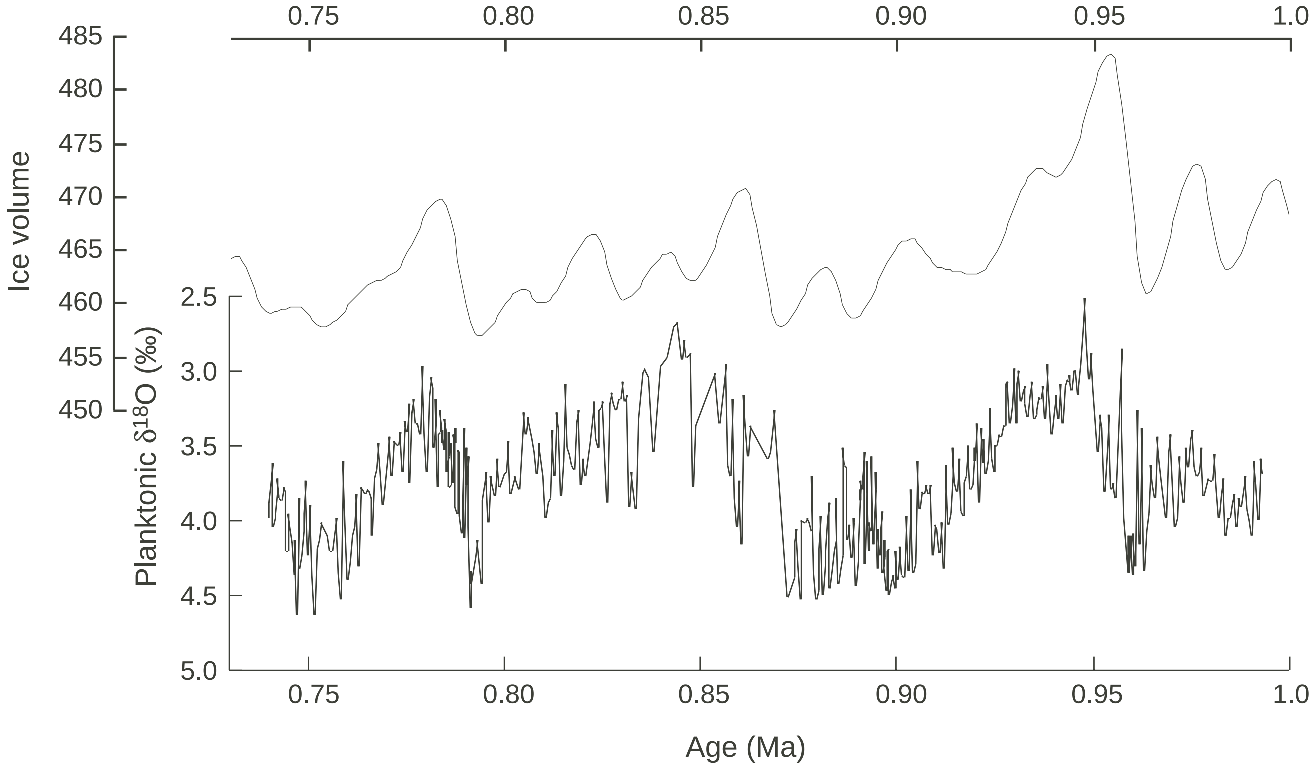

Figure F4. Comparison of the Site 1094 δ¹⁸O record to the benthic δ¹⁸O record from ODP Site 983. All marine isotope stages (MISs) from MIS 18 to MIS 26 are identified in the Site 1094 record. Glacial isotope stages are shaded and labeled.

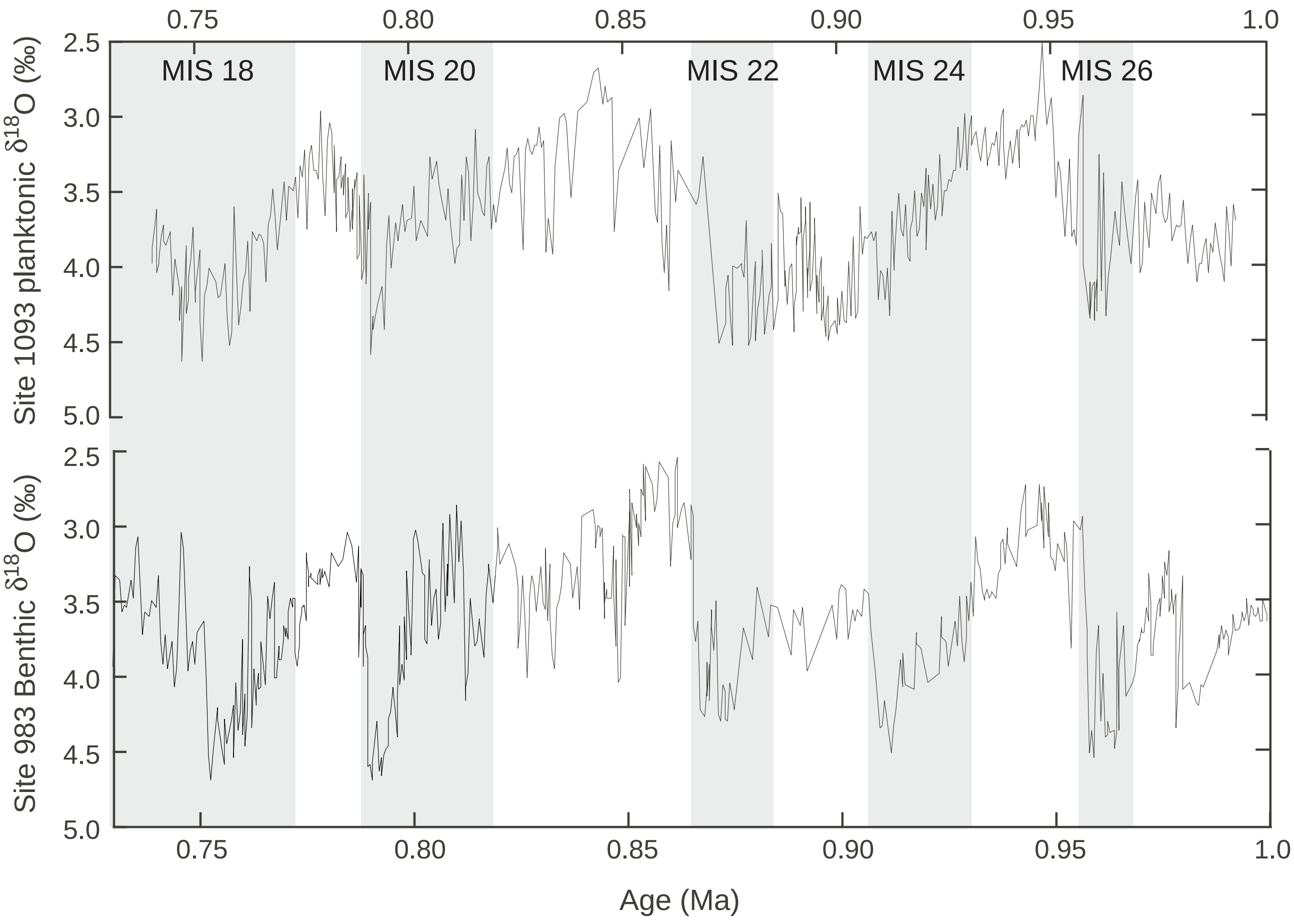

Figure F5. The Site 1091 planktonic $\delta^{18}O$ record plotted vs. depth. Oxygen isotope data were obtained from the planktonic foraminifer *N. Pachyderma* (sinistral).

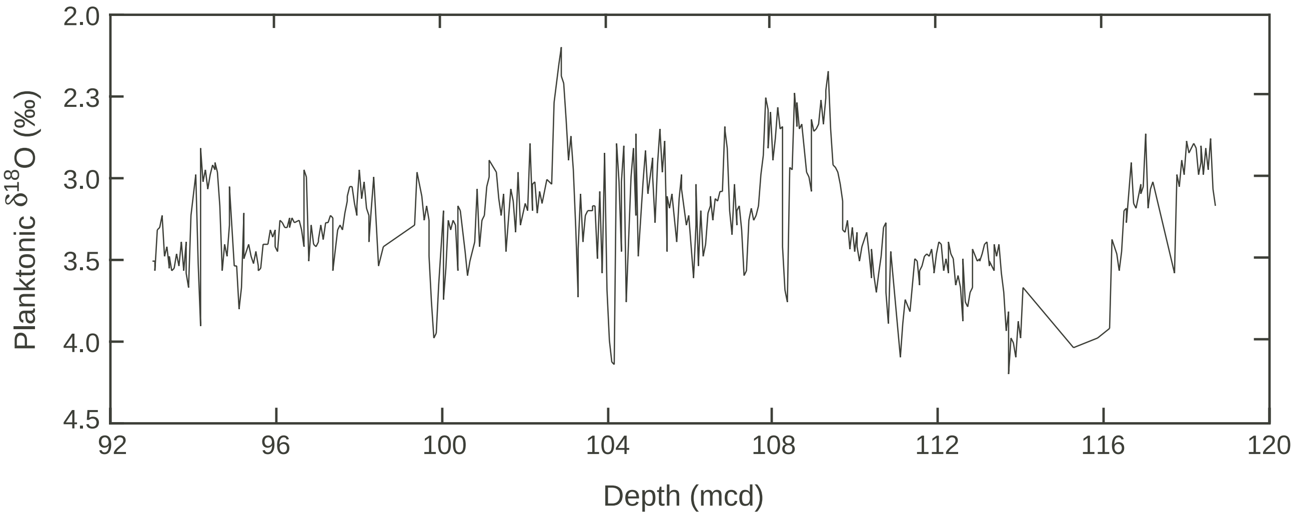

Figure F6. The Site 1091 and 1094 planktonic $\delta^{18}O$ records plotted vs. age after correlation of the Site 1091 $\delta^{18}O$ record to the Site 1094 $\delta^{18}O$ record. Also plotted is the benthic $\delta^{18}O$ record from ODP Site 983 to obtain boundaries for the marine oxygen isotope stages (MISs). Glacial stages are shaded and labeled.

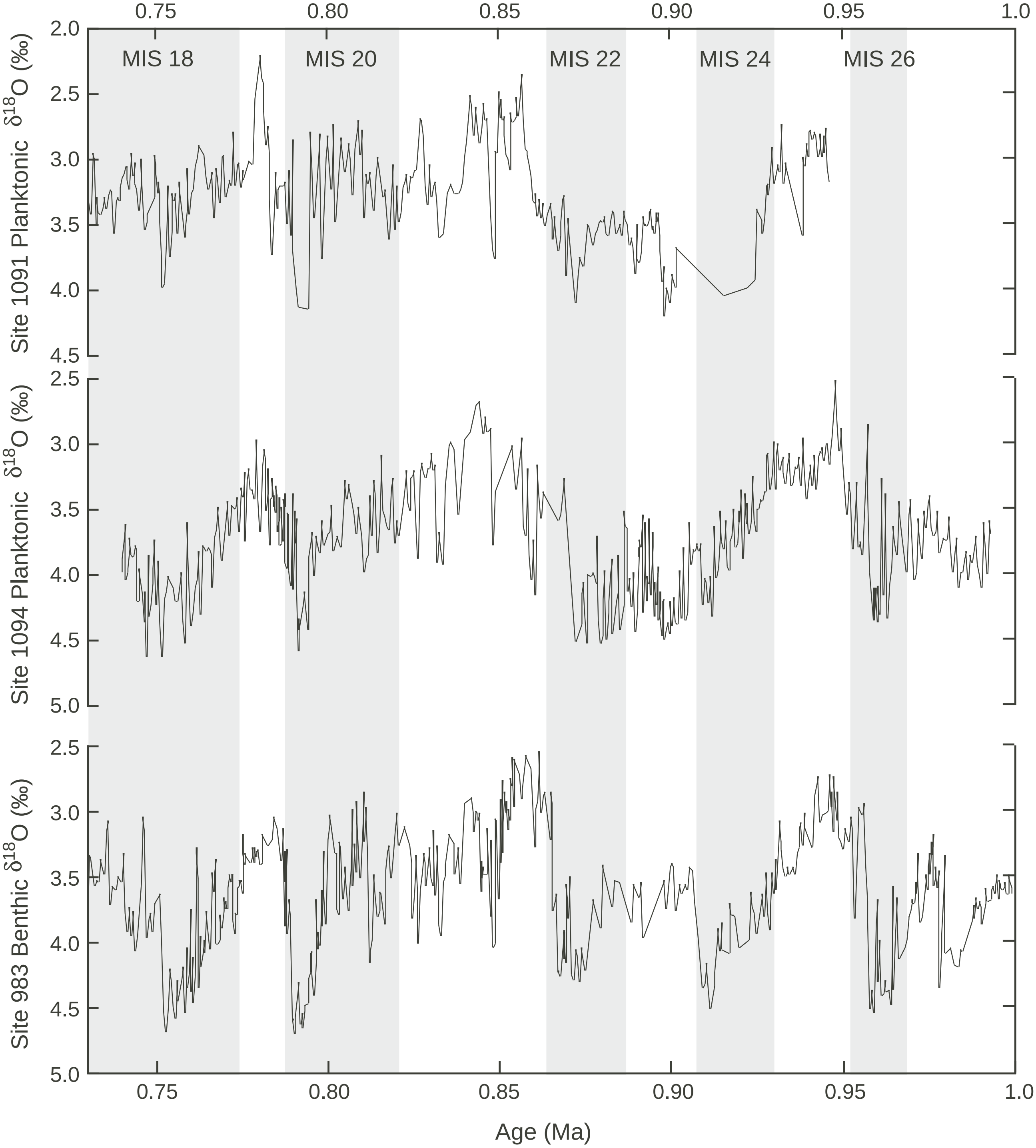

Table T1. $\delta^{18}O$ for the planktonic foraminifer *N. pachyderma* (s), Site 1094. (**See table notes.** Continued on next two pages.)

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	$\delta^{18}O$ vs. VPDB
177-1094A-			
11-2, 60–62	92.2	95	3.98
11-2,. 65–67	92.25	95.05	3.88
11-2, 70–72	92.3	95.1	3.75
11-2, 75–77	92.35	95.15	3.62
11-2, 80–82	92.4	95.2	4.05
11-2, 85–87	92.45	95.25	3.98
11-2, 90–92	92.5	95.3	3.96
11-2, 95–97	92.55	95.35	3.81
11-2, 100–102	92.6	95.4	3.72
11-2, 105–107	92.65	95.45	3.84
11-2, 110–112	92.7	95.5	3.86
11-2, 115–117	92.75	95.55	3.87
11-2, 120–122	92.8	95.6	
11-2, 125–127	92.85	95.65	3.78
11-2, 130–132	92.9	95.7	3.81
11-2, 135–137	92.95	95.75	4.2
11-2, 140–142	93	95.8	4.2
11-3, 145–147	93.05	95.85	3.96
11-3, 0–2	93.1	95.9	
11-3, 5–7	93.15	95.95	
11-3, 10–12	93.2	96	4.15
11-3, 15–17	93.25	96.05	4.37
11-3, 20–22	93.3	96.1	4.14
11-3, 25–27	93.35	96.15	4.64
11-3, 30–32	93.4	96.2	
11-3, 35–37	93.45	96.25	3.86
11-3, 40–42	93.5	96.3	4.32
11-3, 45–47	93.55	96.35	4.23
11-3, 50–52	93.6	96.4	4.08
11-3, 55–57	93.65	96.45	3.95
11-3, 60–62	93.7	96.5	3.74
11-3, 65–67	93.75	96.55	3.76
11-3 70–72	93.8	96.6	4.24
11-3, 75–77	93.85	96.65	4.17
11-3, 80–82	93.9	96.7	
11-3, 85–87	93.95	96.75	3.9
11-3, 90–92	94	96.8	4.37
11-3, 95–97	94.05	96.85	4.64
11-3, 100–102	94.1	96.9	4.19
11-3, 105–107	94.15	96.95	4.14
11-3, 110–112	94.2	97	4.01
11-3, 115–117	94.25	97.05	4.05
11-3, 120–122	94.3	97.1	
11-3, 125–127	94.35	97.15	4.11
11-3, 130–132	94.4	97.2	4.21
11-3, 135–137	94.45	97.25	4.2
11-3, 140–142	94.5	97.3	4.09
11-4, 145–147	94.55	97.35	3.99
11-4, 0–2	94.6	97.4	4.35
11-4, 5–7	94.65	97.45	4.53
11-4, 10–12	94.7	97.5	4.44
11-4, 15–17	94.75	97.55	3.6
11-4, 20–22	94.8	97.6	4.01
11-4, 25–27	94.85	97.65	4.4
11-4, 30–32	94.9	97.7	4.28
11-4, 35–37	94.95	97.75	4.1
11-4, 40–42	95	97.8	4.05
11-4, 45–47	95.05	97.85	3.83
11-4, 50–52	95.1	97.9	4.31
11-4, 55–57	95.15	97.95	3.78
11-4, 60–62	95.2	98	3.8
11-4, 65–67	95.25	98.05	3.83
11-4, 70–72	95.3	98.1	3.79
11-4, 75–77	95.35	98.15	3.81
11-4, 80–82	95.4	98.2	3.85
11-4, 85–87	95.45	98.25	4.11
11-4, 90–92	95.5	98.3	3.72
11-4, 95–97	95.55	98.35	3.66
11-4, 100–102	95.6	98.4	3.49
11-4, 105–107	95.65	98.45	3.67
11-4, 110–112	95.7	98.5	3.9
11-4, 115–117	95.75	98.55	
11-4, 120–122	95.8	98.6	
11-4, 125–127	95.85	98.65	3.44
11-4, 130–132	95.9	98.7	3.7
11-4, 135–137	95.95	98.75	3.47
11-4, 140–142	96	98.8	3.48
11-5, 145–147	96.05	98.85	3.5
11-5, 5–2	96.1	98.9	3.41
177-1094D-			
9-1, 130–132	96.4	98.96	3.68
9-1, 135–137	96.45	99.01	3.34
9-1, 140–142	96.5	99.06	3.41
9-1, 145–147	96.55	99.11	3.22
9-2, 0–2	96.6	99.16	3.75
9-2, 5–7	96.65	99.21	3.28
9-2, 10–12	96.7	99.26	3.19
9-2, 15–17	96.75	99.31	3.36
9-2, 20–22	96.8	99.36	3.36
9-2, 25–27	96.85	99.41	3.42
9-2, 30–32	96.9	99.46	2.97
9-2, 35–37	96.95	99.51	3.43
9-2, 40–42	97	99.56	3.67
9-2, 45–47	97.05	99.61	3.17
9-2, 50–52	97.1	99.66	3.05
9-2, 55–57	97.15	99.71	3.12
9-2, 60–62	97.2	99.76	3.21
9-2, 65–67	97.25	99.81	3.51
9-2, 70–72	97.3	99.86	3.36
9-2, 75–77	97.35	99.91	3.19
9-2, 80–82	97.4	99.96	3.78
9-2, 85–87	97.45	100.01	3.44
9-2, 90–92	97.5	100.06	3.43
9-2, 95–97	97.55	100.11	3.41
9-2, 100–102	97.6	100.16	
9-2, 105–107	97.65	100.21	3.27
9-2, 110–112	97.7	100.26	3.39
9-2, 115–117	97.75	100.31	3.48
9-2, 120–122	97.8	100.36	3.4
9-2, 125–127	97.85	100.41	3.53
9-2, 130–132	97.9	100.46	3.32
9-2, 135–137	97.95	100.51	3.4
9-2, 140–142	98	100.56	3.68
9-2, 145–147	98.05	100.61	3.63
9-3, 0–2	98.1	100.66	3.57
9-3, 5–7	98.15	100.71	3.41
9-3, 10–12	98.2	100.76	3.78
9-3, 15–17	98.25	100.81	3.76
9-3, 20–22	98.3	100.86	3.6
9-3, 25–27	98.35	100.91	3.49
9-3, 30–32	98.4	100.96	3.75
9-3, 35–37	98.45	101.01	3.42
9-3, 40–42	98.5	101.06	3.49
9-3, 45–47	98.55	101.11	3.38
9-3, 50–52	98.6	101.16	3.91
9-3, 55–57	98.65	101.21	3.96
9-3, 60–62	98.7	101.26	3.93
9-3, 65–67	98.75	101.31	3.53
9-3, 70–72	98.8	101.36	3.54
9-3, 75–77	98.85	101.41	3.97
9-3, 80–82	98.9	101.46	4.09
9-3, 85–87	98.95	101.51	4.02
9-3, 90–92	99	101.56	3.94
9-3, 95–97	99.05	101.61	3.39
9-3, 100–102	99.1	101.66	4.09
9-3, 105–107	99.15	101.71	4.12
9-3, 110–112	99.2	101.76	3.52
9-3, 115–117	99.25	101.81	
9-3, 120–122	99.3	101.86	3.76
9-3, 125–127	99.35	101.91	3.57
9-3, 130–132	99.4	101.96	4.04
9-3, 135–137	99.45	102.01	4.59
9-3, 140–142	99.5	102.06	4.34
9-3, 145–147	99.55	102.11	4.43
9-4, 0–2	99.6	102.16	4.25
9-4, 5–7	99.65	102.21	4.14
9-4, 10–12	99.7	102.26	4.43
177-1094A-			
12-1, 110–113	100.7	102.28	3.87
12-1, 115–117	100.75	102.33	3.67
12-1, 120–122	100.8	102.38	4.02
12-1, 125–127	100.85	102.43	3.71
12-1, 130–132	100.9	102.48	3.84
12-1, 135–137	100.95	102.53	3.59
12-1, 140–142	101	102.58	3.78
12-1, 145–147	101.05	102.63	3.69
12-2, 0–2	101.1	102.68	3.68
12-2, 5–7	101.15	102.73	3.47
12-2, 10–12	101.2	102.78	3.83
12-2, 15–17	101.25	102.83	3.7
12-2, 20–22	101.3	102.88	
12-2, 25–27	101.35	102.93	3.8
12-2, 30–32	101.4	102.98	3.28
12-2, 35–37	101.45	103.03	3.42
12-2, 40–42	101.5	103.08	3.31
12-2, 45–47	101.55	103.13	3.46
12-2, 50–52	101.6	103.18	3.54
12-2, 55–57	101.65	103.23	3.69
12-2, 60–62	101.7	103.28	3.48
12-2, 65–67	101.75	103.33	3.71
12-2, 70–72	101.8	103.38	3.98
12-2, 75–77	101.85	103.43	3.88
12-2, 80–82	101.9	103.48	3.86
12-2, 85–87	101.95	103.53	3.4
12-2, 90–92	102	103.58	3.7
12-2, 95–97	102.05	103.63	3.28
12-2, 100–102	102.1	103.68	3.38
12-2, 105–107	102.15	103.73	3.84
12-2, 110–112	102.2	103.78	3.6
12-2, 115–117	102.25	103.83	3.09
12-2, 120–122	102.3	103.88	3.52
12-2, 125–127	102.35	103.93	3.56
12-2, 130–132	102.4	103.98	3.64
12-2, 135–137	102.45	104.03	3.66
12-2, 140–142	102.5	104.08	3.34
12-2, 145–147	102.55	104.13	3.27
12-3, 0–2	102.6	104.18	3.76
12-3, 5–7	102.65	104.23	3.59
12-3, 10–12	102.7	104.28	3.71
12-3, 15–17	102.75	104.33	
12-3, 20–22	102.8	104.38	3.48
12-3, 25–27	102.85	104.43	3.35
12-3, 30–32	102.9	104.48	3.21
12-3, 35–37	102.95	104.53	3.45
12-3, 40–42	103	104.58	3.52
12-3, 45–47	103.05	104.63	3.27
12-3, 50–52	103.1	104.68	3.25
12-3, 55–57	103.15	104.73	3.21
12-3, 60–62	103.2	104.78	3.56
12-3, 65–67	103.25	104.83	3.89
12-3, 70–72	103.3	104.88	3.22
12-3, 75–77	103.35	104.93	3.15
12-3, 80–82	103.4	104.98	3.22

Table T1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	δ18O vs. VPDB
12-3, 85–87	103.45	105.03	3.26
12-3, 90–92	103.5	105.08	3.19
12-3, 95–97	103.55	105.13	3.19
12-3, 100–102	103.6	105.18	3.07
12-3, 105–107	103.65	105.23	3.21
12-3, 110–112	103.7	105.28	3.16
12-3, 115–117	103.75	105.33	3.91
12-3, 120–122	103.8	105.38	3.68
12-3, 125–127	103.85	105.43	3.92
12-3, 130–132	103.9	105.48	3.33
12-3, 135–137	103.95	105.53	3.01
12-3, 140–142	104	105.58	2.99
12-3, 145–147	104.05	105.63	3.04
12-4, 0–2	104.1	105.68	3.54
12-4, 5–7	104.15	105.73	2.97
12-4, 10–12	104.2	105.78	2.91
12-4, 15–17	104.25	105.83	2.71
12-4, 20–22	104.3	105.88	2.68
12-4, 25–27	104.35	105.93	2.92
12-4, 30–32	104.4	105.98	2.8
12-4, 35–37	104.45	106.03	2.91
12-4, 40–42	104.5	106.08	2.88
12-4, 45–47	104.55	106.13	3.78
12-4, 50–52	104.6	106.18	3.37
12-4, 55–57	104.65	106.23	
12-4, 60–62	104.7	106.28	
12-4, 65–67	104.75	106.33	3.02
12-4, 70–72	104.8	106.38	3.35
12-4, 75–77	104.85	106.43	2.95
12-4, 80–82	104.9	106.48	3.63
12-4, 85–87	104.95	106.53	3.71
12-4, 90–92	105	106.58	3.19
12-4, 95–97	105.05	106.63	3.85
12-4, 100–102	105.1	106.68	4.05
12-4, 105–107	105.15	106.73	3.73
12-4, 110–112	105.2	106.78	4.16
12-4, 115–117	105.25	106.83	3.16
12-4, 120–122	105.3	106.88	3.38
12-4, 125–127	105.35	106.93	3.58
12-4, 130–132	105.4	106.98	3.37
12-5, 0–2	105.6	107.18	
12-5, 5–7	105.65	107.23	
177-1094D-			
10-1, 135–137	105.95	107.29	
10-1, 140–142	106	107.34	3.59
10-1, 145–147	106.05	107.39	3.55
10-2, 0–2	106.1	107.44	
10-2, 5–7	106.15	107.49	3.27
10-2, 10–12	106.2	107.54	4.52
10-2, 15–17	106.25	107.59	4.38
10-2, 20–22	106.3	107.64	4.15
10-2, 25–27	106.35	107.69	4.06
10-2, 30–32	106.4	107.74	4.33
10-2, 35–37	106.45	107.79	4.53
10-2, 40–42	106.5	107.84	4
10-2, 45–47	106.55	107.89	
10-2, 50–52	106.6	107.94	4.01
10-2, 55–57	106.65	107.99	
10-2, 60–62	106.7	108.04	3.99
10-2, 65–67	106.75	108.09	4.02
10-2, 70–72	106.8	108.14	4.07
10-2, 75–77	106.85	108.19	3.7
10-2, 80–82	106.9	108.24	4.35
10-2, 85–87	106.95	108.29	4.53
10-2, 90–92	107	108.34	4.47
10-2, 95–97	107.05	108.39	4.19
10-2, 100–102	107.1	108.44	3.97
10-2, 105–107	107.15	108.49	4.5
10-2, 110–112	107.2	108.54	4.29
10-2, 115–117	107.25	108.59	4.2
10-2, 120–122	107.3	108.64	3.99
10-2, 125–127	107.35	108.69	3.89
10-2, 130–132	107.4	108.74	4.46
10-2, 135–137	107.45	108.79	4.34
10-2, 140–142	107.5	108.84	4.2
10-2, 145–147	107.55	108.89	4.14
10-3, 0–2	107.6	108.94	3.85
10-3, 5–7	107.65	108.99	4.42
10-3, 10–12	107.7	109.04	4.32
10-3, 15–17	107.75	109.09	4.23
10-3, 20–22	107.8	109.14	3.51
10-3, 25–27	107.85	109.19	3.64
10-3, 30–32	107.9	109.24	3.65
10-3, 35–37	107.95	109.29	4.14
10-3, 40–42	108	109.34	4.03
10-3, 45–47	108.05	109.39	4.25
10-3, 50–52	108.1	109.44	4.01
10-3, 55–57	108.15	109.49	3.99
10-3, 60–62	108.2	109.54	4.44
10-3, 65–67	108.25	109.59	4.27
10-3, 70–72	108.3	109.64	4.16
10-3, 75–77	108.35	109.69	3.8
10-3, 80–82	108.4	109.74	3.87
10-3, 85–87	108.45	109.79	3.74
10-3, 90–92	108.5	109.84	3.79
10-3, 95–97	108.55	109.89	3.78
10-3, 100–102	108.6	109.94	3.7
10-3, 105–107	108.65	109.99	3.55
10-3, 110–112	108.7	110.04	4.22
10-3, 115–117	108.75	110.09	4.3
10-3, 120–122	108.8	110.14	3.82
10-3, 125–127	108.85	110.19	3.7
10-3, 130–132	108.9	110.24	3.6
10-3, 135–137	108.95	110.29	4.21
10-3, 140–142	109	110.34	4.01
10-3, 145–147	109.05	110.39	4.07
10-4, 0–2	109.1	110.44	3.87
10-4, 5–7	109.15	110.49	3.57
10-4, 10–12	109.2	110.54	4.16
10-4, 15–17	109.25	110.59	4.09
10-4, 20–22	109.3	110.64	4.08
10-4, 25–27	109.35	110.69	3.79
10-4, 30–32	109.4	110.74	3.72
10-4, 35–37	109.45	110.79	3.68
10-4, 40–42	109.5	110.84	4.32
10-4, 45–47	109.55	110.89	4.19
10-4, 50–52	109.6	110.94	4.06
10-4, 55–57	109.65	110.99	4.24
10-4, 60–62	109.7	111.04	4.07
10-4, 65–67	109.75	111.09	3.94
10-4, 70–72	109.8	111.14	4.36
10-4, 75–77	109.85	111.19	4.36
10-4, 80–82	109.9	111.24	4.25
10-4, 85–87	109.95	111.29	4.13
10-4, 90–92	110	111.34	4.32
10-4, 95–97	110.05	111.39	4.47
10-4, 100–102	110.1	111.44	4.32
10-4, 105–107	110.15	111.49	4.2
10-4, 110–112	110.2	111.54	4.19
10-4, 115–117	110.25	111.59	4.5
10-4, 120–122	110.3	111.64	4.41
10-4, 125–127	110.35	111.69	4.37
177-1094A-			
13-1, 20	109.3	111.74	4.46
177-1094D-			
10-4, 130	110.4	111.75	4.21
177-1094A-			
13-1, 25–27	109.35	111.79	4.4
13-1, 30–32	109.4	111.84	4.17
13-1, 35–37	109.45	111.89	4.37
13-1, 40–42	109.5	111.94	4.38
13-1, 45–47	109.55	111.99	3.97
13-1, 50–52	109.6	112.04	4.34
13-1, 55–57	109.65	112.09	3.8
13-1, 60–62	109.7	112.14	4.35
13-1, 65–67	109.75	112.19	4.3
13-1, 70–72	109.8	112.24	3.61
13-1, 75–77	109.85	112.29	3.92
13-1, 80–82	109.9	112.34	3.81
13-1, 85–87	109.95	112.39	3.82
13-1, 90–92	110	112.44	3.77
13-1, 95–97	110.05	112.49	3.83
13-1, 100–102	110.1	112.54	3.77
13-1, 105–107	110.15	112.59	4.23
13-1, 110–112	110.2	112.64	4.03
13-1, 115–117	110.25	112.69	4.06
13-1, 120–122	110.3	112.74	4.22
13-1, 125–127	110.35	112.79	4.02
13-1, 130–132	110.4	112.84	4.33
13-1, 135–137	110.45	112.89	3.63
13-1, 140–142	110.5	112.94	4.03
13-1, 145–147	110.55	112.99	3.96
13-2, 0–2	110.6	113.04	3.71
13-2, 5–7	110.65	113.09	3.52
13-2, 10–12	110.7	113.14	3.75
13-2, 15–17	110.75	113.19	3.81
13-2, 20–22	110.8	113.24	3.59
13-2, 25–27	110.85	113.29	3.94
13-2, 30–32	110.9	113.34	3.97
13-2, 35–37	110.95	113.39	3.75
13-2, 40–42	111	113.44	3.7
13-2, 45–47	111.05	113.49	3.5
13-2, 50–52	111.1	113.54	3.8
13-2, 55–57	111.15	113.59	3.76
13-2, 60–62	111.2	113.64	3.51
13-2, 65–67	111.25	113.69	3.61
13-2, 70–72	111.3	113.74	3.35
13-2, 75–77	111.35	113.79	3.89
13-2, 80–82	111.4	113.84	3.39
13-2, 85–87	111.45	113.89	3.62
13-2, 90–92	111.5	113.94	3.46
13-2, 95–97	111.55	113.99	3.69
13-2, 100–102	111.6	114.04	3.6
13-2, 105–107	111.65	114.09	3.25
13-2, 110–112	111.7	114.14	3.59
13-2, 115–117	111.75	114.19	3.67
13-2, 120–122	111.8	114.24	3.5
13-2, 125–127	111.85	114.29	3.5
13-2, 130–132	111.9	114.34	3.42
13-2, 135–137	111.95	114.39	3.44
13-2, 140–142	112	114.44	3.37
13-2, 145–147	112.05	114.49	3.37
13-3, 0–2	112.1	114.54	3.09
13-3, 5–7	112.15	114.59	3.08
13-3, 10–12	112.2	114.64	3.35
13-3, 15–17	112.25	114.69	3.24
13-3, 20–22	112.3	114.74	2.98
13-3, 25–27	112.35	114.79	3.36
13-3, 30–32	112.4	114.84	3.09
13-3, 35–37	112.45	114.89	3
13-3, 40–42	112.5	114.94	3.2
13-3, 45–47	112.55	114.99	3.14
13-3, 50–52	112.6	115.04	3.11
13-3, 55–57	112.65	115.09	3.22
13-3, 60–62	112.7	115.14	3.31

Table T1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	$\delta^{18}O$ vs. VPDB
13-3, 65–67	112.75	115.19	3.16
13-3, 70–72	112.8	115.24	3.08
13-3, 75–77	112.85	115.29	3.33
13-3, 80–82	112.9	115.34	3.3
13-3, 85–87	112.95	115.39	3.26
13-3, 90–92	113	115.44	3.18
13-3, 95–97	113.05	115.49	3.19
13-3, 100–102	113.1	115.54	3.1
13-3, 105–107	113.15	115.59	3.33
13-3, 110–112	113.2	115.64	3.01
13-3, 115–117	113.25	115.69	2.96
13-3, 120–122	113.3	115.74	3.19
13-3, 125–127	113.35	115.79	3.42
13-3, 130–132	113.4	115.84	3.28
13-3, 135–137	113.45	115.89	3.16
13-3, 140–142	113.5	115.94	3.32
13-3, 145–147	113.55	115.99	
13-4, 0–2	113.6	116.04	3.09
13-4, 5–7	113.65	116.09	3.35
13-4, 10–12	113.7	116.14	3.1
13-4, 15–17	113.75	116.19	3.06
13-4, 20–22	113.8	116.24	3.08
13-4, 25–27	113.85	116.29	3.03
13-4, 30–32	113.9	116.34	3.14
13-4, 35–37	113.95	116.39	3
13-4, 40–42	114	116.44	3
13-4, 45–47	114.05	116.49	3.16
13-4, 50–52	114.1	116.54	3.11
13-4, 55–57	114.15	116.59	2.95
13-4, 60–62	114.2	116.64	2.75
13-4, 65–67	114.25	116.69	2.52
13-4, 70–72	114.3	116.74	2.83
13-4, 75–77	114.35	116.79	3.06
13-4, 80–82	114.4	116.84	2.88
13-4, 85–87	114.45	116.89	3.14
13-4, 90–92	114.5	116.94	3.54
13-4, 95–97	114.55	116.99	3.3
13-4, 100–102	114.6	117.04	3.38
13-4, 105–107	114.65	117.09	3.81
13-4, 110–112	114.7	117.14	3.58
13-5, 0–2	114.74	117.18	3.29
13-5, 5–7	114.79	117.23	3.8
13-5, 10–12	114.84	117.28	3.75
13-5, 15–17	114.89	117.33	3.86
13-5, 20–22	114.94	117.38	3.13
13-5, 25–27	114.99	117.43	2.86
13-5, 0–32	115.04	117.48	3.39
177-1094D-			
11-2, 40–42	116	117.54	3.99
11-2, 45–47	116.05	117.59	
11-2, 50–52	116.1	117.64	
11-2, 55–57	116.15	117.69	
11-2, 60–62	116.2	117.74	
11-2, 65–67	116.25	117.79	
11-2, 70–72	116.3	117.84	4.35
11-2, 75–77	116.35	117.89	4.1
11-2, 80–82	116.4	117.94	4.33
11-2, 85–87	116.45	117.99	
11-2, 90–92	116.5	118.04	
11-2, 95–97	116.55	118.09	4.14
11-2, 100–102	116.6	118.14	4.11
11-2, 105–107	116.65	118.19	4.37
11-2, 110–112	116.7	118.24	4.24
11-2, 115–117	116.75	118.29	4.09
11-2, 120–122	116.8	118.34	4.31
11-2, 125–127	116.85	118.39	4.22
11-2, 130–132	116.9	118.44	
11-2, 135–137	116.95	118.49	3.26
11-2, 140–142	117	118.54	4.16
11-2, 145–147	117.05	118.59	3.38
11-3, 0–2	117.1	118.64	4.34
11-3, 5–7	117.15	118.69	4.07
11-3, 10–12	117.2	118.74	3.96
11-3, 15–17	117.25	118.79	3.64
11-3, 20–22	117.3	118.84	3.77
11-3, 25–27	117.35	118.89	3.86
11-3, 30–32	117.4	118.94	3.44
11-3, 35–37	117.45	118.99	3.6
11-3, 40–42	117.5	119.04	3.74
11-3, 45–47	117.55	119.09	
11-3, 50–52	117.6	119.14	3.98
11-3, 55–57	117.65	119.19	3.54
11-3, 60–62	117.7	119.24	3.42
11-3, 65–67	117.75	119.29	4.05
11-3, 70–72	117.8	119.34	3.98
11-3, 75–77	117.85	119.39	3.58
11-3, 80–82	117.9	119.44	3.75
11-3, 85–87	117.95	119.49	3.88
11-3, 90–92	118	119.54	3.51
11-3, 95–97	118.05	119.59	3.65
11-3, 100–102	118.1	119.64	3.45
11-3, 105–107	118.15	119.69	3.4
11-3, 110–112	118.2	119.74	3.65
11-3, 115–117	118.25	119.79	3.71
11-3, 120–122	118.3	119.84	3.68
11-3, 125–127	118.35	119.89	3.51
11-3, 130–132	118.4	119.94	3.84
11-3, 135–137	118.45	119.99	3.72
11-3, 140–142	118.5	120.04	3.74
11-3, 145–147	118.55	120.09	3.73
11-4, 0–2	118.6	120.14	3.56
11-4, 5–7	118.65	120.19	3.8
11-4, 10–12	118.7	120.24	3.98
11-4, 15–17	118.75	120.29	3.83
11-4, 20–22	118.8	120.34	3.72
11-4, 25–27	118.85	120.39	4.1
11-4, 30–32	118.9	120.44	3.99
11-4, 35–37	118.95	120.49	3.98
11-4, 40–42	119	120.54	3.88
11-4, 45–47	119.05	120.59	3.82
11-4, 50–52	119.1	120.64	4.05
11-4, 55–57	119.15	120.69	3.85
11-4, 60–62	119.2	120.74	3.91
11-4, 65–67	119.25	120.79	3.71
11-4, 70–72	119.3	120.84	3.92
11-4, 75–77	119.35	120.89	4
11-4, 80–82	119.4	120.94	4.1
11-4, 85–87	119.45	120.99	3.61
11-4, 90–92	119.5	121.04	3.77
11-4, 95–97	119.55	121.09	4
11-4, 100–102	119.6	121.14	3.59
11-4, 105–107	119.65	121.19	3.69

Notes: VPDB = Vienna Peedee belmenite standard. This table is also available in **ASCII format.**

Table T2. Age model for the 95- to 121-mcd interval at Site 1094.

Depth (mcd)	Age (Ma)
95.05	0.74374
96.85	0.75264
102.01	0.79159
103.38	0.8113
103.73	0.8155
104.83	0.83315
105.43	0.84888
105.83	0.85674
107.54	0.86638
108.34	0.87197
109.14	0.87877
109.54	0.89013
111.59	0.91178
117.84	0.96041
120.99	0.98901

Table T3. δ18O for the planktonic foraminifer *N. pachyderma* (s), Site 1091. (See table notes. Continued on next two pages.)

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	δ18O vs. VPDB
177-1091A-			
10-3, 100–102	86.9	93.03	3.52
10-3, 105–107	86.95	93.08	3.52
10-3, 110–112	87	93.13	3.58
10-3, 115–117	87.05	93.18	3.33
10-3, 120–122	87.1	93.23	3.31
10-3, 125–127	87.15	93.28	3.23
10-3, 130–132	87.2	93.33	3.49
10-3, 135–137	87.25	93.38	3.42
10-3, 140–142	87.3	93.43	3.56
10-3, 145–147	87.35	93.48	3.48
10-4, 0–2	87.4	93.53	3.57
10-4, 5–7	87.45	93.58	3.56
10-4, 10–12	87.5	93.63	3.47
10-4, 15–17	87.55	93.68	3.54
10-4, 20–22	87.6	93.73	3.39
10-4, 25–27	87.65	93.78	3.58
10-4, 30–32	87.7	93.83	3.39
10-4, 35–37	87.75	93.88	3.59
10-4, 40–42	87.8	93.93	3.68
10-4, 45–47	87.85	93.98	3.24
10-4, 50–52	87.9	94.03	
10-4, 55–57	87.95	94.08	2.99
10-4, 60–62	88	94.13	3.53
10-4, 65–67	88.05	94.18	3.91
10-4, 70–72	88.1	94.23	2.82
10-4, 75–77	88.15	94.28	3.03
10-4, 80–82	88.2	94.33	2.95
10-4, 85–87	88.25	94.38	3.07
10-4, 90–92	88.3	94.43	2.99
10-4, 95–97	88.35	94.48	2.93
10-4, 100–102	88.4	94.53	2.95
10-4, 105–107	88.45	94.58	2.91
10-4, 110–112	88.5	94.63	2.97
10-4, 115–117	88.55	94.68	3.17
10-4, 120–122	88.6	94.73	3.57
10-4, 125–127	88.65	94.78	3.41
10-4, 130–132	88.7	94.83	3.48
10-4, 135–137	88.75	94.88	3.3
10-4, 140–142	88.8	94.93	3.06
10-5, 0–2	88.9	95.03	3.54
10-5, 5–7	88.95	95.08	3.55
10-5, 10–12	89	95.13	3.81
10-5, 15–17	89.05	95.18	3.67
10-5, 20–22	89.1	95.23	3.22
10--5, 25–27	89.15	95.28	3.5
10-5, 30–32	89.2	95.33	3.46
10-5, 35–37	89.25	95.38	3.41
10-5, 40–42	89.3	95.43	3.48
10-5, 45–47	89.35	95.48	3.53
10-5, 50–52	89.4	95.53	3.45
10-5, 55–57	89.45	95.58	3.54
10-5, 60–62	89.5	95.63	3.57
10-5, 65–67	89.55	95.68	3.56
10-5, 70–72	89.6	95.73	3.41
10-5, 75–77	89.65	95.78	3.41
10-5, 80–82	89.7	95.83	3.41
10-5, 85–87	89.75	95.88	3.33
10-5, 90–92	89.8	95.93	3.37
10-5, 95–97	89.85	95.98	3.32
10-5, 100–102	89.9	96.03	3.43
10-5, 105–107	89.95	96.08	3.45
10-5, 110–112	90	96.13	3.27
10-5, 115–117	90.05	96.18	3.28
10-5, 120–122	90.1	96.23	3.31
10-5, 125–127	90.15	96.28	3.31
10-5, 130–132	90.2	96.33	3.25
10-5, 135–137	90.25	96.38	3.31
10-5, 140–142	90.3	96.43	3.25
10-5, 145–147	90.35	96.48	3.28
10-6, 5–7	90.45	96.58	3.27
10-6, 10–12	90.5	96.63	3.32
10-6, 15–17	90.55	96.68	3.43
10-6, 20–22	90.6	96.73	2.95
10-6, 25–27	90.65	96.78	3
10-6, 30–32	90.7	96.83	3.52
10-6, 33–35	90.73	96.86	3.29
10-6, 40–42	90.8	96.93	3.41
10-6, 45–47	90.85	96.98	3.42
10-6, 50–52	90.9	97.03	3.39
10-6, 55–57	90.95	97.08	3.38
10-6, 60–62	91	97.13	3.3
10-6, 65–67	91.05	97.18	3.38
10-6, 70–72	91.1	97.23	3.28
10-6, 75–77	91.15	97.28	3.28
10-6, 79–82	91.19	97.32	3.23
10-6, 85–87	91.25	97.38	3.25
10-6, 90–92	91.3	97.43	3.57
10-6, 95–97	91.35	97.48	
10-6, 98–101	91.38	97.51	3.33
10-6, 105–107	91.45	97.58	3.29
10-6, 110–112	91.5	97.63	3.33
10-6, 115–117	91.55	97.68	3.22
10-6, 120–122	91.6	97.73	3.15
10-6, 125–127	91.65	97.78	3.12
10-6, 130–132	91.7	97.83	3.06
10-6, 135–137	91.75	97.88	3.06
10-6, 140–142	91.8	97.93	3.16
10-6, 145–147	91.85	97.98	3.23
10-6, 147–149	91.87	98	3.17
177-1091B-			
11-2, 65–67	95.45	98.05	2.96
11-2, 70–72	95.5	98.1	3.13
11-2, 75–77	95.55	98.15	3.03
11-2, 80–82	95.6	98.2	3.19
11-2, 85–87	95.65	98.25	3.24
11-2, 90–92	95.7	98.3	3.4
11-2, 95–97	95.75	98.35	3.19
11-2, 100–102	95.8	98.4	3
11-2, 105–107	95.85	98.45	
11-2, 110–112	95.9	98.5	3.55
11-2, 115–117	95.95	98.55	3.49
11-2, 120–122	96	98.6	3.43
11-2, 125–127	96.05	98.65	
11-2, 130–132	96.1	98.7	
11-2, 135–137	96.15	98.75	
11-2, 140–142	96.2	98.8	
11-2, 145–147	96.25	98.85	
11-3, 0–2	96.3	98.9	
11-3, 5–7	96.35	98.95	
11-3, 10–12	96.4	99	
11-3, 15–17	96.45	99.05	
11-3, 20–22	96.5	99.1	
11-3, 25–27	96.55	99.15	
11-3, 30–32	96.6	99.2	
11-3, 35–37	96.65	99.25	
11-3, 40–42	96.7	99.3	
11-3, 45–47	96.75	99.35	
11-3, 50–52	96.8	99.4	3.29
11-3, 55–57	96.85	99.45	2.97
11-3, 60–62	96.9	99.5	3.05
11-3, 65–67	96.95	99.55	3.12
11-3, 70–72	97	99.6	3.27
11-3, 75–77	97.05	99.65	3.18
11-3, 80–82	97.1	99.7	3.26
11-3, 85–87	97.15	99.75	3.48
11-3, 90–92	97.2	99.8	3.76
11-3, 95–97	97.25	99.85	3.98
11-3, 100–102	97.3	99.9	3.96
11-3, 105–107	97.35	99.95	3.66
11-3, 110–112	97.4	100	
11-3, 115–117	97.45	100.05	3.21
11-3, 120–122	97.5	100.1	3.75
11-3, 125–127	97.55	100.15	3.56
11-3, 130–132	97.6	100.2	3.27
11-3, 135–137	97.65	100.25	3.33
11-3, 140–142	97.7	100.3	3.26
11-3, 145–147	97.75	100.35	3.29
11-4, 0–2	97.8	100.4	3.57
11-4, 5–7	97.85	100.45	3.18
11-4, 10–12	97.9	100.5	3.21
11-4, 15–17	97.95	100.55	
11-4, 20–22	98	100.6	3.46
11-4, 25–27	98.05	100.65	3.6
11-4, 30–32	98.1	100.7	3.52
11-4, 35–37	98.15	100.75	
11-4, 40–42	98.2	100.8	
11-4, 45–47	98.25	100.85	3.39
11-4, 50–52	98.3	100.9	3.08
11-4, 55–57	98.35	100.95	3.43
11-4, 60–62	98.4	101	3.26
11-4, 65–67	98.45	101.05	3.23
11-4, 70–72	98.5	101.1	3.06
11-4, 75–77	98.55	101.15	3
177-1091A-			
11-2, 80–82	94.7	101.2	2.9
11-2, 85–87	94.75	101.25	
11-2, 90–92	94.8	101.3	
11-2, 95–97	94.85	101.35	2.97
11-2, 100–102	94.9	101.4	3.13
11-2, 105–107	94.95	101.45	3.24
11-2, 110–112	95	101.5	
11-2, 115–117	95.05	101.55	3.1
11-2, 120–122	95.1	101.6	3.45
11-2, 125–127	95.15	101.65	
11-2, 130–132	95.2	101.7	3.08
11-2, 135–137	95.25	101.75	3.15
11-2, 140–142	95.3	101.8	3.34
11-2, 145–147	95.35	101.85	2.98
11-3, 0–2	95.4	101.9	2.97
11-3, 5–7	95.45	101.95	3.29
11-3, 10–12	95.5	102	
11-3, 15–17	95.55	102.05	3.16
11-3, 20–22	95.6	102.1	3.2
11-3, 25–27	95.65	102.15	2.79
11-3, 30–32	95.7	102.2	3.2
11-3, 35–37	95.75	102.25	3.04
11-3, 40–42	95.8	102.3	3.03
11-3, 45–47	95.85	102.35	3.22
11-3, 50–52	95.9	102.4	3.09
11-3, 55–57	95.95	102.45	3.16
11-3, 60–62	96	102.5	
11-3, 65–67	96.05	102.55	
11-3, 70–72	96.1	102.6	3.01
11-3, 75–77	96.15	102.65	
11-3, 80–82	96.2	102.7	3.04
11-3, 85–87	96.25	102.75	2.55
11-3, 90–92	96.3	102.8	
11-3, 95–97	96.35	102.85	2.31
11-3, 100–102	96.4	102.9	2.21
11-3, 105–107	96.45	102.95	2.38
11-3, 110–112	96.5	103	2.42

Table T3 (continued).

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	$\delta^{18}O$ vs. VPDB
11-3, 115–117	96.55	103.05	2.64
11-3, 120–122	96.6	103.1	2.9
11-3, 125–127	96.65	103.15	2.75
11-3, 130–132	96.7	103.2	2.96
11-3, 135–137	96.75	103.25	3.31
11-3, 140–142	96.8	103.3	3.74
11-3, 145–147	96.85	103.35	3.44
11-4, 0–2	96.9	103.4	3.1
11-4, 5–7	96.95	103.45	3.39
11-4, 10–12	97	103.5	3.24
11-4, 15–17	97.05	103.55	3.21
11-4, 20–22	97.1	103.6	
11-4, 25–27	97.15	103.65	3.21
11-4, 30–32	97.2	103.7	3.18
11-4, 35–37	97.25	103.75	3.18
11-4, 40–42	97.3	103.8	3.5
11-4, 45–47	97.35	103.85	3.09
11-4, 50–52	97.4	103.9	3.59
11-4, 55–57	97.45	103.95	2.85
11-4, 60–62	97.5	104	3.69
11-4, 65–67	97.55	104.05	
11-4, 70–72	97.6	104.1	4
11-4, 75–77	97.65	104.15	4.13
11-4, 80–82	97.7	104.2	4.15
11-4, 85–87	97.75	104.25	2.79
11-4, 90–92	97.8	104.3	3.03
11-4, 95–97	97.85	104.35	3.46
11-4, 100–102	97.9	104.4	3.03
11-4, 105–107	97.95	104.45	2.81
11-4, 110–112	98	104.5	3.76
11-4, 115–117	98.05	104.55	
11-4, 120–122	98.1	104.6	3
11-4, 125–127	98.15	104.65	2.83
11-4, 130–132	98.2	104.7	3.24
11-4, 135–137	98.25	104.75	2.73
11-4, 140–142	98.3	104.8	3.49
11-5, 0–2	98.4	104.9	3.03
11-5, 5–7	98.45	104.95	2.84
11-5, 10–12	98.5	105	3.1
11-5, 15–17	98.55	105.05	
11-5, 20–22	98.6	105.1	2.88
11-5, 25–27	98.65	105.15	3
11-5, 30–32	98.7	105.2	3.28
11-5, 35–37	98.75	105.25	2.92
11-5, 40–42	98.8	105.3	2.71
11-5, 45–47	98.85	105.35	2.97
11-5, 50–52	98.9	105.4	2.78
11-5, 55–57	98.95	105.45	3.46
11-5, 60–62	99	105.5	3.12
11-5, 65–67	99.05	105.55	3.19
11-5, 70–72	99.1	105.6	3.11
11-5, 75–77	99.15	105.65	
11-5, 80–82	99.2	105.7	3.4
11-5, 85–87	99.25	105.75	3.13
11-5, 90–92	99.3	105.8	2.98
11-5, 95–97	99.35	105.85	3.07
11-5, 100–102	99.4	105.9	
11-5, 105–107	99.5	105.95	3.29
11-5, 110–112	99.55	106	3.23
11-5, 115–117	99.6	106.1	3.62
11-5, 120–122	99.65	106.15	3.3
11-5, 125–127	99.7	106.2	3.04
11-5, 130–132	99.75	106.25	3.54
11-5, 135–137	99.8	106.3	3.21
11-5, 140–142	99.85	106.35	3.49
11-5, 145–147	99.9	106.4	3.41
11-6, 0–2	99.95	106.45	3.22
11-6, 5–7	100	106.5	3.17
11-6, 10–12	100.05	106.55	3.12
11-6, 15–17	100.1	106.6	3.26
11-6, 20–22	100.15	106.65	3.13
11-6, 25–27	100.2	106.7	3.15
11-6, 30–32	100.25	106.75	3.09
11-6, 35–37	100.3	106.8	3.09
11-6, 40–42	100.35	106.85	2.69
11-6, 45–47	100.4	106.9	2.71
11-6, 50–52	100.45	106.95	2.83
11-6, 55–57	100.5	107	3.21
11-6, 60–62	100.55	107.05	3.35
11-6, 65–67	100.6	107.1	3.05
11-6, 70–72	104.35	107.14	3.29
177-1091B-			
12-2, 5–7	104.4	107.19	3.21
12-2, 10–12	104.45	107.24	3.18
12-2, 15–17	104.5	107.29	3.33
12-2, 20–22	104.55	107.34	3.61
12-2, 25–27	104.6	107.39	3.58
12-2, 30–32	104.65	107.44	3.26
12-2, 35–37	104.7	107.49	3.19
12-2, 40–42	104.75	107.54	3.27
12-2, 45–47	104.8	107.59	3.27
12-2, 50–52	104.85	107.64	3.24
12-2, 55–57	104.9	107.69	3.18
12-2, 60–62	104.95	107.74	2.98
12-2, 65–67	105	107.79	2.87
12-2, 70–72	105.05	107.84	2.51
12-2, 75–77	105.1	107.89	2.59
12-2, 80–82	105.15	107.94	2.82
12-2, 85–87	105.2	107.99	2.61
12-2, 90–92	105.25	108.04	2.89
12-2, 95–97	105.3	108.09	2.76
12-2, 100–102	105.35	108.14	2.58
12-2, 105–107	105.4	108.19	2.71
12-2, 110–112	105.45	108.24	2.69
12-2, 115–117	105.5	108.29	3.43
12-2, 120–122	105.55	108.34	3.69
12-2, 125–127	105.6	108.39	3.76
12-2, 130–132	105.65	108.44	2.94
12-2, 135–137	105.7	108.49	2.95
12-2, 140–142	105.75	108.54	2.49
12-2, 145–147	105.8	108.59	2.69
12-3, 0–2	105.85	108.64	2.54
12-3, 5–7	105.9	108.69	2.71
12-3, 10–12	105.95	108.74	2.68
12-3, 15–17	106	108.79	2.83
12-3, 20–22	106.05	108.84	2.97
12-3, 25–27	106.1	108.89	3
12-3, 30–32	106.15	108.94	3.09
12-3, 35–37	106.2	108.99	2.65
12-3, 40–42	106.25	109.04	2.72
12-3, 45–47	106.3	109.09	2.7
12-3, 50–52	106.35	109.14	2.67
12-3, 55–57	106.4	109.19	2.53
12-3, 60–62	106.45	109.24	2.67
12-3, 65–67	106.5	109.29	2.51
12-3, 70–72	106.55	109.34	2.47
12-3, 75–77	106.6	109.39	2.35
12-3, 80–82	106.65	109.44	2.71
12-3, 85–87	106.7	109.49	2.92
12-3, 90–92	106.75	109.54	2.94
12-3, 95–97	106.8	109.59	2.97
12-3, 100–102	106.85	109.64	3.04
12-3, 105–107	106.9	109.69	3.14
12-3, 110–112	106.95	109.74	3.32
12-3, 115–117	107	109.79	3.34
12-3, 120–122	107.05	109.84	3.27
12-3, 125–127	107.1	109.89	3.44
12-3, 130–132	107.15	109.94	3.31
12-3, 135–137	107.2	109.99	3.46
12-3, 140–142	107.25	110.04	3.34
12-3, 145–147	107.3	110.09	3.42
12-4, 0–2	107.35	110.14	3.51
12-4, 5–7	107.4	110.19	3.43
12-4, 10–12	107.45	110.24	3.38
12-4, 15–17	107.5	110.29	3.34
12-4, 20–22	107.55	110.34	3.47
12-4, 25–27	107.6	110.39	3.62
12-4, 30–32	107.65	110.44	3.44
12-4, 35–37	107.7	110.49	3.61
12-4, 40–42	107.75	110.54	3.71
12-4, 45–47	107.8	110.59	3.59
12-4, 50–52	107.85	110.64	3.48
12-4, 55–57	107.9	110.69	3.31
12-4, 60–62	107.95	110.74	3.28
12-4, 65–67	108	110.79	3.71
12-4, 70–72	108.05	110.84	3.9
12-4, 75–77	108.1	110.89	3.46
12-4, 80–82	108.15	110.94	
12-4, 85–87	108.2	110.99	
12-4, 90–92	108.25	111.04	
12-4, 95–97	108.3	111.09	
12-4, 100–102	108.35	111.14	4.1
12-4, 105–107	108.4	111.19	3.9
12-4, 110–112	108.45	111.24	3.75
12-4, 115–117	108.5	111.29	
12-4, 120–122	108.55	111.34	3.82
12-4, 125–127	108.6	111.39	
12-4, 130–132	108.65	111.44	3.5
12-4, 135–137	108.7	111.49	3.51
12-4, 140–142	103.55	111.55	3.66
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12-2, 15–17	103.6	111.6	3.57
12-2, 20–22	103.65	111.65	3.54
12-2, 25–27	103.7	111.7	3.49
12-2, 30–32	103.75	111.75	3.47
12-2, 35–37	103.8	111.8	3.49
12-2, 40–42	103.85	111.85	3.44
12-2, 45–47	103.9	111.9	3.57
12-2, 50–52	103.95	111.95	3.59
12-2, 55–57	104	112	3.47
12-2, 60–62	104.05	112.05	3.4
12-2, 65–67	104.1	112.1	3.41
12-2, 70–72	104.15	112.15	3.57
12-2, 75–77	104.2	112.2	3.5
12-2, 80–82	104.25	112.25	3.59
12-2, 85–87	104.3	112.3	3.4
12-2, 90–92	104.35	112.35	3.47
12-2, 95–97	104.4	112.4	3.5
12-2, 100–102	104.45	112.45	3.66
12-2, 105–107	104.5	112.5	3.61
12-2, 110–112	104.55	112.55	3.67
12-2, 115–117	104.6	112.6	3.88
12-2, 120–122	104.65	112.65	3.5
12-2, 125–127	104.7	112.7	3.76
12-2, 130–132	104.75	112.75	3.79
12-2, 135–137	104.8	112.8	3.71
12-2, 140–142	104.85	112.85	3.67
12-2, 145–147	104.88	112.88	3.44
12-2, 148–150	104.95	112.95	3.51
12-3, 5–7	105	113	3.5
12-3, 10–12	105.05	113.05	3.52
12-3, 15–17	105.1	113.1	3.47
12-3, 20–22	105.15	113.15	3.41
12-3, 25–27	105.2	113.2	3.39
12-3, 30–32	105.25	113.25	3.55
12-3, 35–37	105.27	113.27	3.52
12-3, 37–39	105.35	113.35	3.57

Table T3 (continued).

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	$\delta^{18}O$ vs. VPDB
12-3, 45–47	105.4	113.4	3.41
12-3, 50–52	105.45	113.45	3.48
12-3, 55–57	105.5	113.5	3.41
12-3, 60–62	105.55	113.55	3.59
12-3, 65–67	105.6	113.6	3.71
12-3, 70–72	105.65	113.65	3.94
12-3, 75–77	105.71	113.71	3.82
12-3, 81–83	105.75	113.75	4.2
12-3, 85–87	105.8	113.8	3.98
12-3, 90–92	105.85	113.85	4.01
12-3, 95–97	105.9	113.9	4.1
12-3, 100–102	105.95	113.95	3.88
12-3, 105–107	106.03	114.03	3.99
12-3, 113–115	106.05	114.05	3.68
12-3, 115–117	106.1	114.1	
12-3, 120–122	106.15	114.15	
12-3, 125–127	106.2	114.2	
12-3, 130–132	106.25	114.25	
12-3, 135–137	106.3	114.3	
12-3, 140–142	106.35	114.35	
12-3, 145–147	106.37	114.37	
12-3, 147–149	106.45	114.45	
12-4, 5–7	106.5	114.5	
12-4, 10–12	106.55	114.55	
12-4, 15–17	106.6	114.6	
12-4, 20–22	106.65	114.65	
12-4, 25–27	106.7	114.7	
12-4, 30–32	106.75	114.75	
12-4, 35–37	106.78	114.78	
12-4, 38–40	106.85	114.85	
12-4, 45–47	106.9	114.9	
12-4, 50–52	106.95	114.95	
12-4, 55–57	107	115	
12-4, 60–62	107.05	115.05	
12-4, 65–67	107.1	115.1	
12-4, 70–72	107.15	115.15	
12-4, 75–77	107.21	115.21	
12-4, 81–83	107.25	115.25	
12-4, 85–87	107.3	115.3	4.05
12-4, 90–92	101.8	115.35	
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12-3, 20–22	101.85	115.4	
12-3, 25–27	101.9	115.45	
12-3, 30–32	101.95	115.5	
12-3, 35–37	102	115.55	
12-3, 40–42	102.05	115.6	
12-3, 45–47	102.1	115.65	
12-3, 50–52	102.15	115.7	
12-3, 55–57	102.2	115.75	
12-3, 60–62	102.25	115.8	
12-3, 65–67	102.3	115.85	
12-3, 70–72	102.35	115.9	3.98
12-3, 75–77	102.4	115.95	
12-3, 80–82	102.45	116	
12-3, 85–87	102.5	116.05	
12-3, 90–92	102.55	116.1	
12-3, 95–97	102.6	116.15	3.93
12-3, 100–102	102.65	116.2	3.38
12-3, 105–107	102.7	116.25	
12-3, 110–112	102.75	116.3	
12-3, 115–117	102.8	116.35	3.47
12-3, 120–122	102.85	116.4	3.57
12-3, 125–127	102.9	116.45	3.46
12-3, 130–132	102.95	116.5	3.21
12-3, 135–137	103	116.55	3.19
12-3, 140–142	103.05	116.6	3.28
12-3, 145–147	103.15	116.7	2.91
12-4, 5–7	103.2	116.75	3.16
12-4, 10–12	103.25	116.8	3.19
12-4, 15–17	103.3	116.85	
12-4, 20–22	103.35	116.9	3.04
12-4, 25–27	103.4	116.95	3.11
12-4, 30–32	103.45	117	3.06
12-4, 35–37	103.5	117.05	2.73
12-4, 40–42	103.55	117.1	3.19
12-4, 45–47	103.6	117.15	3.08
12-4, 50–52	103.65	117.2	3.03
12-4, 55–57	103.7	117.25	
12-4, 60–62	103.75	117.3	
12-4, 65–67	103.8	117.35	
12-4, 70–72	103.85	117.4	
12-4, 75–77	103.9	117.45	
12-4, 80–82	103.95	117.5	
12-4, 85–87	104	117.55	
12-4, 90–92	104.05	117.6	
12-4, 95–97	104.1	117.65	
12-4, 100–102	104.15	117.7	
12-4, 105–107	104.2	117.75	3.59
12-4, 110–112	104.25	117.8	2.99
12-4, 115–117	104.3	117.85	3.06
12-4, 120–122	104.35	117.9	2.89
12-4, 125–127	104.4	117.95	2.98
12-4, 130–132	104.45	118	2.79
12-4, 135–137	104.5	118.05	2.78
12-4, 140–142	104.55	118.1	2.86
12-4, 145–147	104.65	118.2	2.79
12-5, 5–7	104.7	118.25	2.83
12-5, 10–12	104.75	118.3	2.99
12-5, 15–17	104.8	118.35	2.91
12-5, 20–22	104.85	118.4	2.81
12-5, 25–27	104.9	118.45	2.98
12-5, 30–32	104.95	118.5	2.82
12-5, 35–37	105	118.55	2.96
12-5, 40–42	105.05	118.6	2.77
12-5, 45–47	105.1	118.65	3.07
12-5, 50–52	105.15	118.7	
12-5, 55–57	105.2	118.75	3.17

Notes: VPDB = Vienna Peedee belmenite standard. This table is also available in **ASCII format.**

CHAPTER NOTE*

N1. Kleiven, H.F., and Jansen, E., submitted. Rapid climate changes in the sub-Polar South Atlantic Ocean curing the mid-Pleistocene (0.74–1.0 Ma). *Geology.*

*Dates reflect file corrections or revisions.