



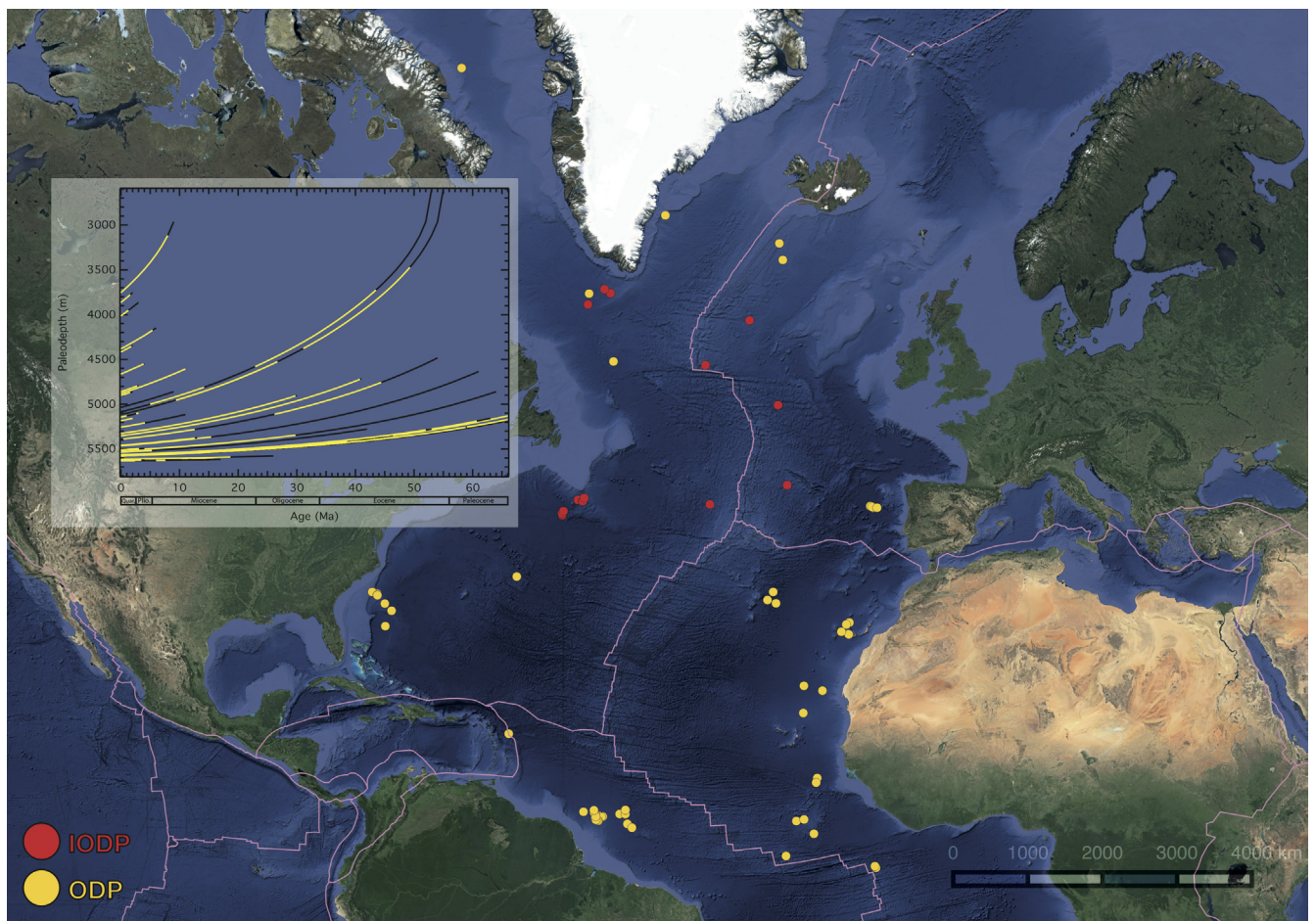
Stockholm
University

Bachelor Thesis

Degree Project in
Marine Geology 30 hp

Cenozoic history of North Atlantic deep sea carbonate preservation

Marcus Länje



Stockholm 2015

Department of Geological Sciences
Stockholm University
SE-106 91 Stockholm

Degree Project in Marine Geology 30 hp
Cenozoic history of North Atlantic deep sea carbonate preservation

Marcus Länje

Abstract

Carbonate preservation in the oceans occurs at a depth called the carbonate compensation depth (CCD). The CCD is where the input rate of carbonate from the surface of the ocean is balanced by the dissolution rate. Factors controlling the CCD are the CO₂ in the atmosphere, weathering, and productivity in the surface water, the depth of the lysocline and deep water currents (and their ocean circulation). Two previous studies have investigated the variation of the CCD through geologic time, one in the equatorial Pacific (Pälike et al., 2012) and the other compiled results from the Pacific, Atlantic and Indian Oceans (Van Andel, 1975).

The project consisted of compiling a database of sediment lithologies for many more sites in the Atlantic since the compilation by Van Andel, 1975, and together with a subsidence model of the ocean crust the systematic variations of CCD could be investigated. The results show that the CCD varies both spatially and temporally in accordance with previous studies. The reconstruction of the CCD needs further analysis, and possibly data from the oldest drilling program, the Deep Sea Drilling Project (DSDP).

One result that is very important is that this study includes a total of 91 sites in the Atlantic Ocean, far more than in any of the other two studies. Future work can build upon the already started database of sediment lithologies.

Keywords

Carbonate compensation depth, CCD, IODP, ODP, DSDP, Atlantic Ocean, subsidence modeling, Cenozoic, database of sediment lithologies, Google Earth.

Contents

1 Introduction	3
1.1 Thesis objectives	3
1.2 The Carbonate Compensation Depth (CCD)	3
1.3 Existing work on Pacific and global compilations of the CCD	4
2 Methods and materials.....	6
2.1 Determination of the age at the top and base of a lithologic unit	8
2.2 Classification of sediments.....	9
2.3 Subsidence modeling.....	10
3 Results	12
4 Discussion	15
5 Conclusions.....	15
6 Future work.....	15
Acknowledgement.....	15
References	16
Appendix 1 and 2	17

1 Introduction

The preservation of carbonate sediments in the deep sea varies significantly both spatially and over geological time related to changes in carbon cycling, weathering and climate. The ocean controls involve supply of biogenic carbonate sediments from the surface and the structure and chemistry of water masses, all of which are reflected in the carbonate compensation depth (CCD). The depth of the CCD has been carefully reconstructed in the Pacific Ocean (Pälike et al., 2012), but less well studied in the Atlantic. The most recent study in the Atlantic was done by Van Andel, 1975. The project started with a compilation of a database of the sediment lithologies and ages of sediments within Integrated Ocean Drilling Program (IODP) and Ocean Drilling Program (ODP). This data was combined with a subsidence model that can predict paleowater depths based upon sediment thickness and crustal age. These two datasets can then help to investigate whether systematic variations in the depth the CCD have occurred in the Atlantic during the Cenozoic. Two questions to be answered in the thesis are the following: At which geological time can preserved calcium carbonate be found in the sediments? Is it possible to reconstruct the CCD level in the Atlantic for the Cenozoic?

1.1 Thesis objectives

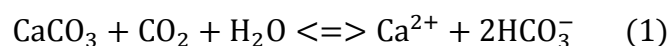
- Attain experience in compiling and handling large geological databases.
- Develop expertise in sediment classification.
- Gain experience working with numerical subsidence modeling.
- Acquire in-depth understanding of the factors controlling CCD changes through geologic time.
- Interpret lithological changes in the framework of existing Cenozoic ocean climate theory.

The compiled geological database could in a future perspective be used in Google Earth for making information about sediment types instantly available by looking at a specific site and borehole.

1.2 The Carbonate Compensation Depth (CCD)

The CCD is the oceanic depth at which the rate of dissolution balances the downward flux of carbonate rain from calcifying organisms; below this depth the dissolution rate exceeds the input rate of carbonate from above. The CCD is one of three horizons in the ocean, above this depth lies the lysocline, followed by the calcite saturation horizon.

The dissolution and precipitation of the calcium carbonate (CaCO_3) is described by the following reaction (e.g. Boudreau, 2013).



In the above reaction one can see that the dissolution of CaCO_3 is controlled by the amount of carbon dioxide (CO_2) present in the ocean, and this CO_2 (natural

and anthropogenic) comes from the atmosphere. Reaction (1) proceeds to right when there's enough supply of CO₂ to react with CaCO₃.

Factors controlling the carbonate compensation depth are productivity in the surface water (e.g. Van Andel et al., 1979), the depth of the lysocline (where dissolution of calcite is first noticed), carbon dioxide in the atmosphere, and weathering (e.g., Coxall et al., 2015; Pälike et al., 2012), and ocean circulation. The deep water current, the North Atlantic Deep Water, coming from the North Atlantic, is ventilated (well oxygenated), cold and more saline than the surface waters flowing northwards, sinks and flows as western boundary current along east margins of North America and South America (e.g. Schmitter et al., 2013). The CCD is also dependent on pressure and temperature, where the solubility of calcite (a polymorph of calcium carbonate, aragonite is another polymorph) increases with pressure and decreases with temperature. The calcite compensation depth is important because the depth give information about past atmospheric concentration of CO₂ and climate (Pälike et al., 2012).

1.3 Existing work on Pacific and global compilations of the CCD

The two most recent studies about the CCD depth have been published, is a compilation by Pälike et al., 2012, who reconstructed the Cenozoic CCD in the equatorial Pacific Ocean and Van Andel, et al., 1975, who made a global compilation of the CCD in the Pacific Ocean, Atlantic Ocean and in the Indian Ocean. The number of drill sites included in this thesis are far greater than the previous two studies.

Pälike et al. 2012 reconstructed the CCD in the equatorial Pacific Ocean through the Cenozoic, Figure 1. In this figure so called subsidence plots are plotted, that gives information about how the ocean crust has subsided since it was formed, and where the individual curves have colored marking where carbonates are present. The boundary between the carbonate and non-carbonate in each curve is the CCD level at that geologic time.

In Figure 1 there are events in the geologic time that have been marked with arrows either going up and down. The PETM (The Paleocene Eocene Thermal Maximum) event at about 55 Ma was a drastic event where the concentration of atmospheric CO₂ and ocean temperatures rose very rapidly over a time period of less than 10 ky (Zachos et al., 2001; Zachos et al., 2004). This event can be seen very clearly in the sediments from the ODP Leg 208, Site 1262-1267 at Walvis Ridge in the South Atlantic, as a very rapid CCD shoaling because of, most probably, massive release of CO₂ from methane hydrates in the bottom. The MECO (the Middle Eocene Climatic Optimum) was also an event where the CCD shoaled for almost 1km.

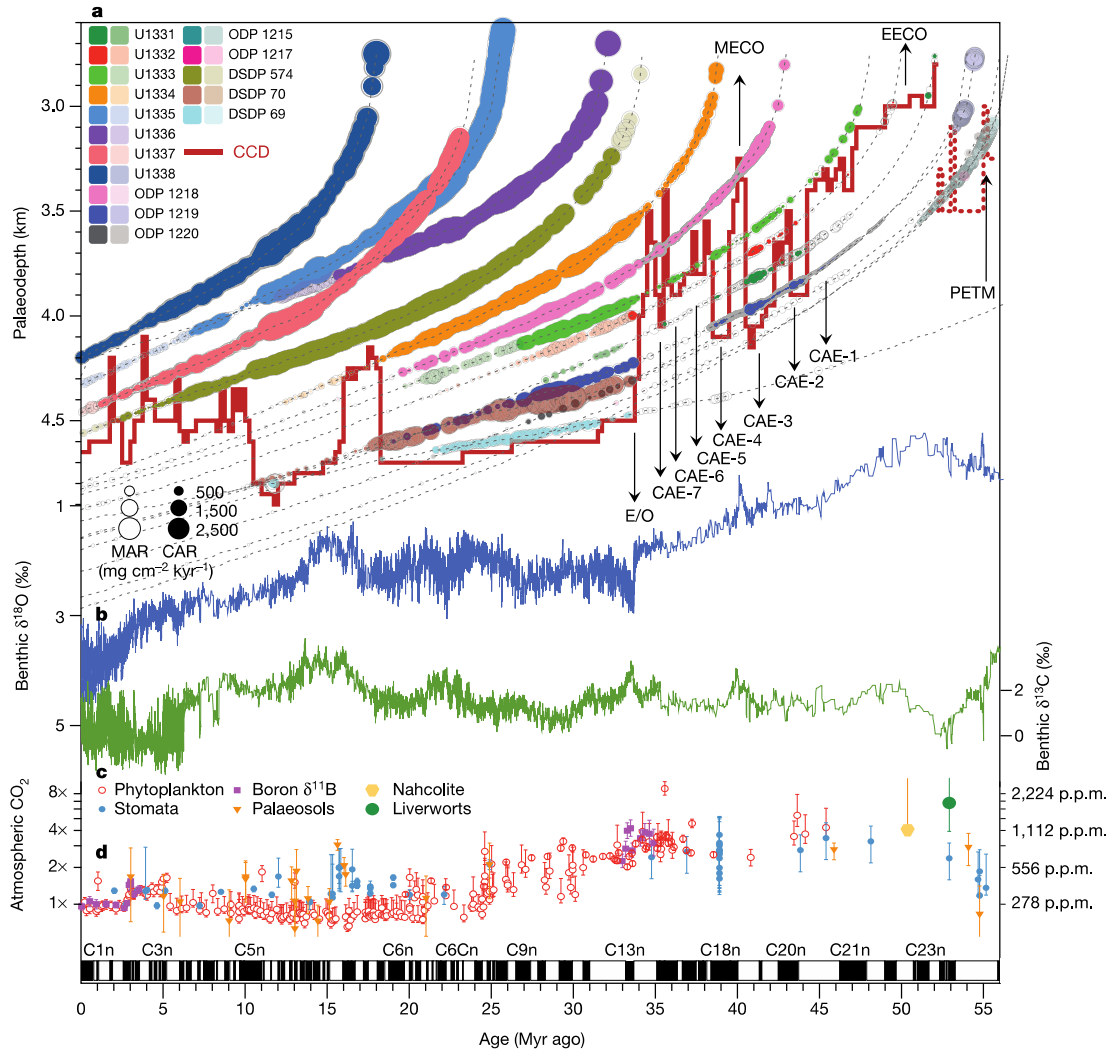


Figure 1. A Cenozoic CCD record in the equatorial Pacific Ocean showing the reconstruction of the CCD and carbonate accumulation rate compared to $\delta^{18}O$ and $\delta^{13}C$ values. The solid red line indicates the position of the CCD in the equatorial Pacific (Pälike et al. 2012).

The above figure reveals both spatially and temporally that the CCD has varied through geologic time in the equatorial Pacific and at present time the CCD is approximately at a depth of 4.6 km.

Van Andel, 1975 compiled a global CCD for the Pacific, the Atlantic and the Indian Ocean, see Figure 2.

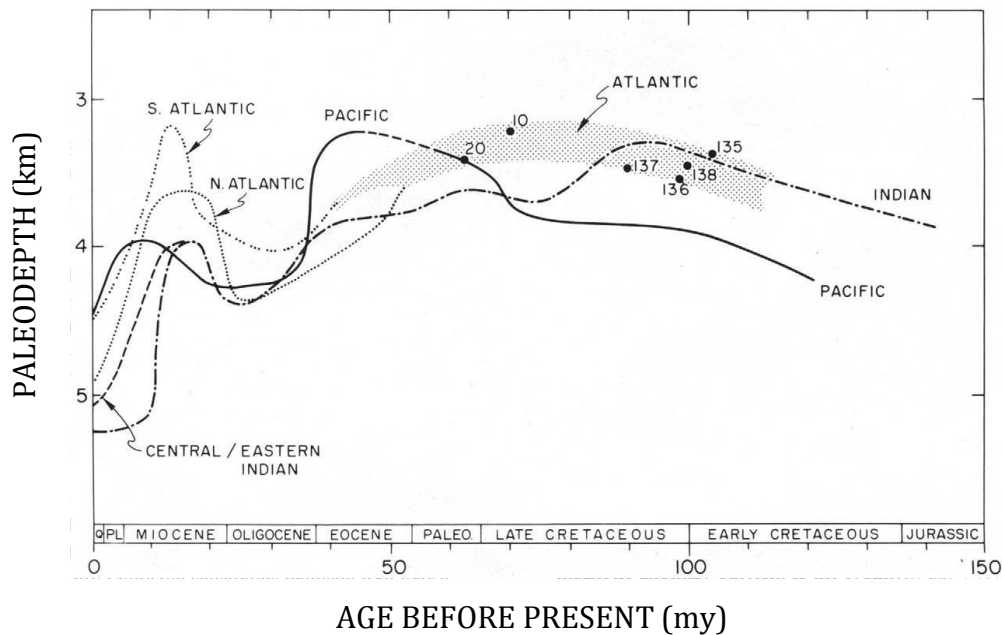


Figure 2. Composite of CCD curves for the Atlantic, Pacific and Indian Oceans. After Van Andel, 1975. A shaded zone shows the CCD during the Cretaceous.

Figure 2 above show that there are similarities and differences between these three oceans as stated by Van Andel, 1975. The data for the Atlantic is based on the Initial Report for the Deep Sea Drilling Project (DSDP) 14

2 Methods and materials

The project started with finding suitable drill site locations from the Integrated Ocean Drilling Program (IODP), Ocean Drilling Program (ODP) and Deep Sea Drilling Program (DSDP) and in that order, since the IODP drill sites are the most recent ones. The website for the Integrated Ocean Drilling Program provides three kinds of KML (Keyhole Markup Language) files: The Drilled Holes, The Proposed Sites, and The Scheduled Expeditions. For this thesis the Drilled Sites file was used, and it's a borehole map with all the locations of drilled holes for all the three programs, and to be used in the software Google Earth that is available from Google for no charge. Links to the related expedition publications are revealed when clicking with the mouse on a borehole location.

The National Oceanic and Atmospheric Administration (NOAA) provides a search engine on their website where information about the expeditions from all three programs can be retrieved (NOAA, 2015). By setting restrictions on the latitudes in their search engine, information about the leg, site, holes, latitude, longitude and water depth at each site in the Atlantic Ocean was retrieved. This information was then used to edit the Drilled Holes file so it only contained the drilled holes in the Atlantic Ocean. The editing of the KML file (the removal of expeditions not in the Atlantic Ocean) was done using a text editor since the KML format itself is based on the XML standard. Below, Figure 3, is an overview of the selected locations.

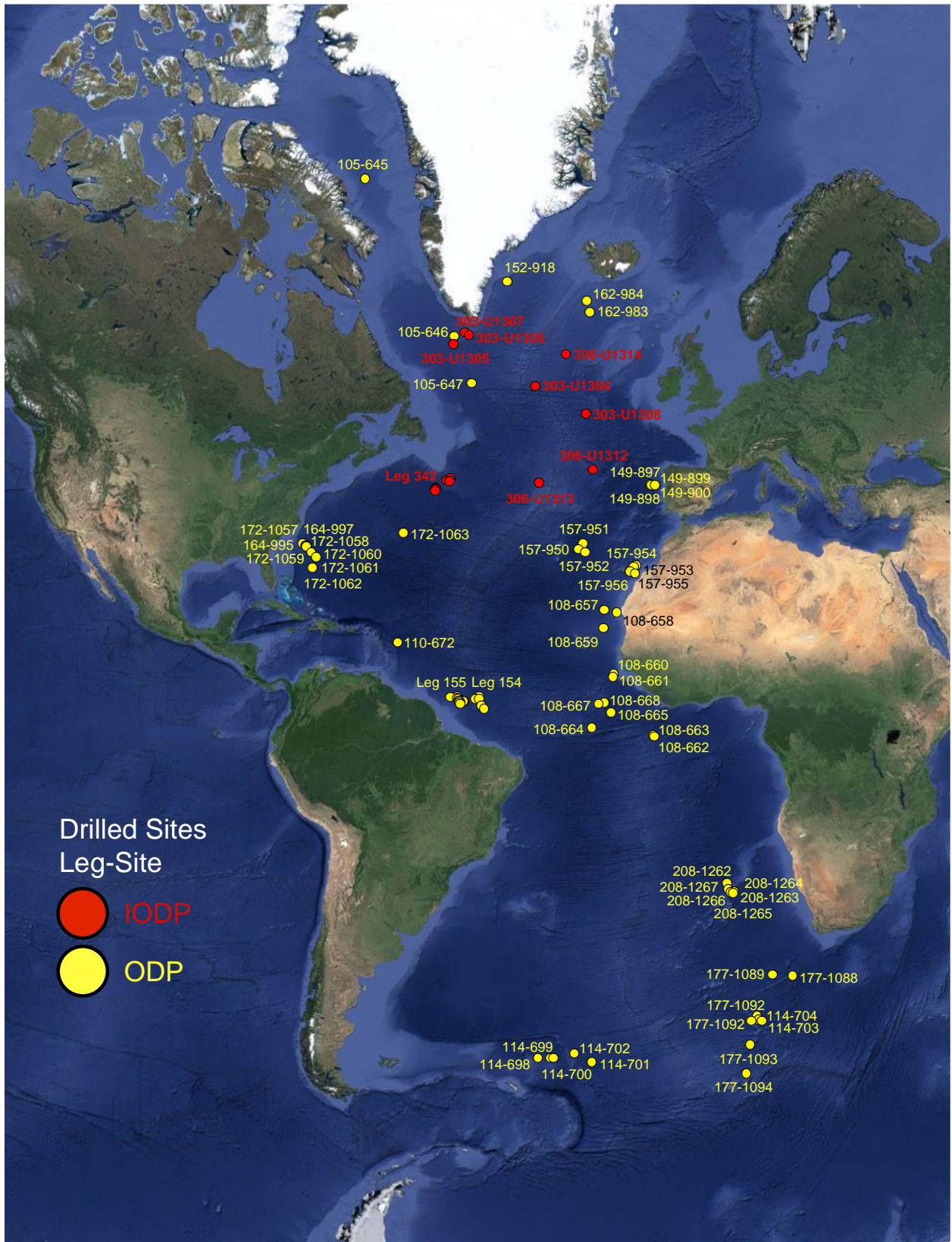


Figure 3. A map of the Atlantic Ocean with all the chosen legs and sites from IODP and ODP. The map was created online at HamsterMap.com (<http://www.hamstermap.com>), using the latitudes and longitudes for each location that were retrieved using the search engine on the NOAA website.

The lithologic unit intervals (top and base) in meters below sea floor (mbsf), and the lithologic descriptions for all the drilled holes were found in the expedition publications: Initial Reports (for ODP), The Proceedings of the Integrated Ocean Drilling Program, and then recorded in a lithologic database using Excel, see appendix 1 and 2 for the database. The main focus on for the subsidence curves (see section 2.3 Subsidence modeling) are sediments such as nannofossil ooze, foraminifera-bearing nannofossil ooze, clayey nannofossil ooze and so on,

2.1 Determination of the age at the top and base of a lithologic unit

The expedition publications for each site usually contain an age-depth model, those sites who did not have an age-model or where linear fits to the data were missing or where there were too many uncertainties about the ages were discarded. These models have fitted straight lines that give information about the sedimentary rate at different depths in a hole.

Each age-depth model was digitized using a software called WebPlotDigitizer (Rohatgi, 2015), an application developed in HTML5 and available online on the Internet, in order to determine the age at a certain depth in a bore hole.

An image of the age-depth plot is loaded in the interface of WebPlotDigitizer and the x- and y-axis are aligned, that is, the user marks the two points on each axis of the image where the values (age, depth) are known, and inputs these values into the software after having marked the image.

Two points at each straight lines were then added to the image, and the corresponding values (age, depth) were exported to a file in the format “Comma Separated Values” (CSV).

The CSV file was imported in Excel and by using the built-in functions, the slope and intercept were calculated for a straight line. The top and base (in mbsf) of each lithologic unit was then inserted in the correct interval where a calculated slope and y-intercept had been calculated, see Figure 4.

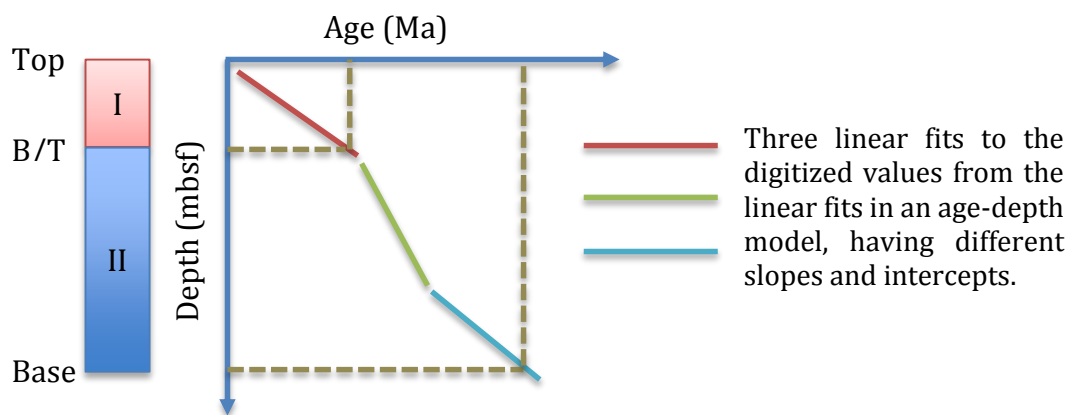


Figure 4. Determination of the age at the top (T) and the base (B) of each lithologic unit in a core. The precision of the calculated age (using the linear fits) have been set to one decimal (example 10.245 Ma ~ 10.2 Ma).

The ages for the top and the base for each lithologic unit are then used as markers when plotting the subsidence curves for the ocean crust (if these intervals contain calcium carbonate).

2.2 Classification of sediments

The sediment classification scheme used in the IODP and ODP programs in for all the sites studied in this thesis is based on a new sediment classification scheme by Mazullo et al., 1987, included as an appendix in a handbook for shipboard sedimentologists (Mazullo et al., 1987). The classification scheme is descriptive and classifies the textures and compositions of the sediments instead of using a genetic classification. Two basic sediment types are defined: granular and chemical sediment. Granular sediment contains discrete grains of either organic or inorganic origins deposited by organic or physical processes, see Table 1 for an overview.

Table 1. Overview of the granular-sediment classification scheme. Modified from Mazullo et al., 1987.

Sediment class	Composition	Major modifiers	Principal names	Minor modifiers
Pelagic (PEL) Fine-grained organic debris of microfauna and microflora (e.g. radiolarians, nannofossils) and associated organisms.	>60% PEL and NER grains. <40% SIL and VOL grains Higher proportion of PEL than NER grains.	1. Composition of PEL and NER grains present in major amounts. 2. Texture of clastic grains in major amounts.	1. ooze 2. chalk 3. limestone 4. radiolarite 5. diatomite 6. spiculite 7. chert Describes composition and degree of consolidation.	1. Composition of PEL and NER grains present in minor amounts. 2. Texture of clastic grains in minor amounts.
Neritic (NER) Coarse-grained calcareous skeletal (e.g., shell fragments), and non-skeletal debris (e.g., ooids, peloids), and fine-grained calcareous grains of non-pelagic origin (e.g., micrite)	>60% PEL and NER grains <40% SIL and VOL grains. Higher proportion of NER than PEL grains.	1. Composition of NER and PEL grains present in major amounts. 2. Texture of clastic grains in major amounts.	1. boundstone 2. grainstone 3. packstone 4. wackestone 5. mudstone 6. floatstone 7. rudstone Describes texture and fabric.	1. Composition of NER and PEL grains present in minor amounts. 2. Texture of clastic grains in minor amounts.
Siliciclastic (SIL) Mineral and rock fragments derived from igneous, sedimentary, and metamorphic rocks.	>60% SIL and VOL grains. <40% PEL and NER grains. Higher proportion of SIL than VOL grains.	1. Composition of all grains present in major amounts. 2. Grain fabric (gravels only). Optional 3. Grain shape 4. Sediment color.	1. gravel 2. sand 3. silt 4. clay (etc.) Describes texture.	1. Composition of all grains present in minor amounts. 2. Texture and composition of SIL grains present as matrix (for coarse-grained clastic sediments).
Volcaniclastic (VOL) Rock fragments and minerals derived from volcanic sources.	>60% SIL and VOL grains. <40% PEL and NER grains. Higher proportion of VOL than SIL grains.	1. Composition of all VOL present in major amounts. 2. Composition of all PEL and NER grains present in major amounts. 3. Texture of SIL grains present in major amounts.	1. breccia 2. lapilli 3. ash/tuff Describes texture.	1. Composition of all VOL present in minor amounts. 2. Composition of NER and PEL grains present in minor amounts. 3. Texture of SIL grains present in minor amounts.
Mixed	40-60% SIL and VOL grains. 40-60% PEL and NER grains	1. Composition of all PEL and NER grains present in major amounts. 2. Texture of clastic grains present in major amounts.	1. mixed sediments Describes degree of consolidation.	1. Composition of NER and PEL grains present in minor amounts. 2. Texture of clastic grains in minor amounts.

The chemical sediments are composed by minerals that have been formed inorganic processes such as precipitation from solution or colloidal suspension, deposition of insoluble precipitates, or recrystallization of detrital evaporates and siliceous, calcareous, or carbonaceous biogenic debris. Coal, gypsum and halite are examples of chemical sediments.

2.3 Subsidence modeling

The subsidence model (i.e. how the ocean crust depth change over time) consists of two mathematical equations (Stein & Stein 1992), and are expressed as follows,

$$\begin{aligned}d(t) &= 2600 + 365t^{1/2}, & t < 20 \text{ Myr} \quad (2) \\d(t) &= 5651 - 2473e^{-0.0278t}, & t \geq 20 \text{ Myr} \quad (3),\end{aligned}$$

where $d(t)$ = the depth of the ocean crust in meters, at time t (in Myr).

The model is based on variations on sea-floor depth and heat flow of the oceanic lithosphere, since the bathymetry is dependent on the temperature integrated over depth and heat flow on the temperature gradient at the sea floor (Stein & Stein 1992). The expressions above are only for the depth, which is the focus for this thesis.

The model assumes that both depth and heat flow reflect the thermal structure of the oceanic lithosphere. As the authors state, this is an approximation, as plate model are the simplest models and describes general variations in depth and heat flow.

In order to use the subsidence model the age of the ocean crust must be determined. The age of the ocean crust is usually not given in the expedition publications, and instead the age was approximated using a KMZ file for use in Google Earth, see Figure 5, having three overlays (contour and rainbow isochrones for the age of the ocean lithosphere, isochrones for the age of the continental lithosphere, and tectonic boundaries). The file was made using GMT (Geological Mapping Tools) from the University of Hawaii, the Agegrid data for the ocean lithosphere is available from EarthByte.org and the Agegrid data for the continental lithosphere provided by Nikolai Shapiro, and the tectonic boundaries data from the USGS earthquakes KML file (Florian, 2012).

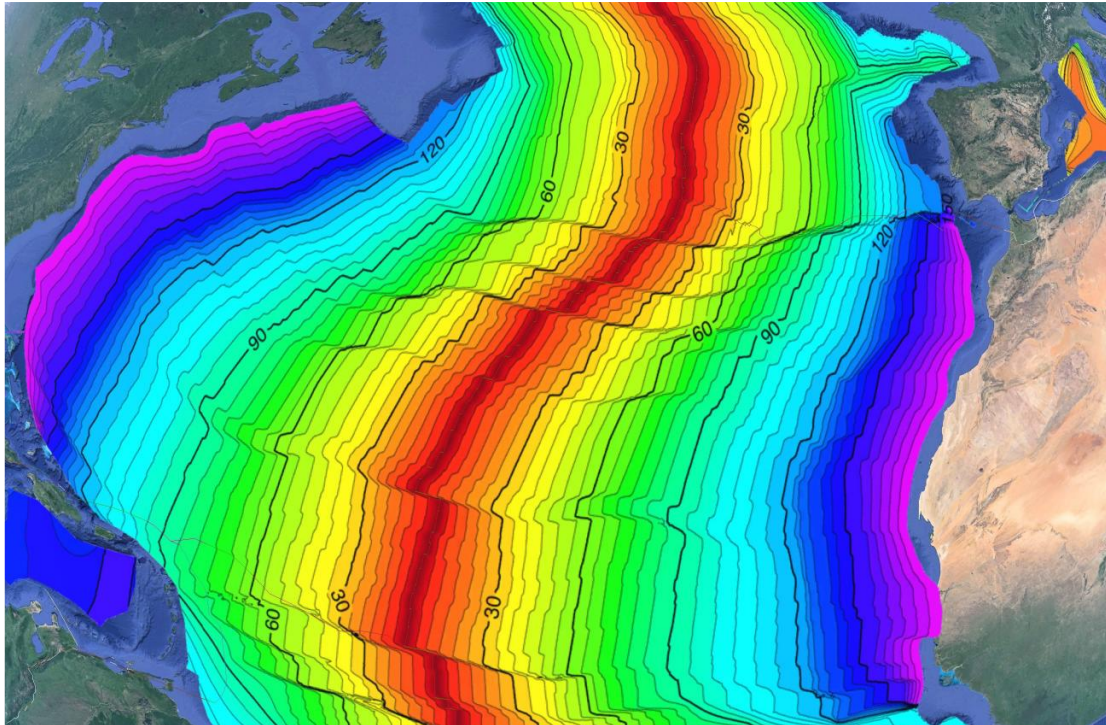


Figure 5. The age of the ocean crust for a part of the North Atlantic Ocean (as viewed in Google Earth). The numbers show the isochrones for the age of the ocean crust in Myr, each interval between the isochrones is 5 Myr.

At the time the ocean crust was formed the depth of the ocean crust, according to the formula, is 2600 meters ($t = 0$ Ma). When the crust moves away from the mid-ocean ridges the depth of the newly formed ocean crust (at $t = 0$ Ma) increases and moves away from the mid-ocean ridge.

If the age of ocean crust (from our perspective) at a site has been approximated to be 25 million years old, then this corresponds to an age of 0 million years (from the perspective of the newly formed ocean crust). When time is equal to 0 Myr (present time), 25 million years have passed since the ocean crust formed. As long as the difference between the birth age to a time t is less than 20 Myr (million years), then equation (2) is used to calculate the depth of the ocean crust, and when the difference is equal to or more than 20 Myr, then equation (3) is used to calculate the depth. This calculation has been done for every site using Excel.

The subsidence data for all the sites were then plotted. Together with this data each site is also accompanied with a data column that contains information about whether calcium carbonate is present or not at different depths (1 = calcium carbonate, 0 = no calcium carbonate). This extra information instructs the graphing software to colorize each graph (with respect to the age of the crust) in yellow when calcium carbonate is present in the sediment. The plotted subsidence curves have not been adjusted to the thickness of the sediments above the ocean lithosphere.

3 Results

The database with the lithologic descriptions, the intervals (top and base in mbsf) for the lithologic units, and approximated ages of the ocean crust, and the corresponding ages for the top and base for the lithologic units can be found in appendix 1.

The following figures (Figure 6-7) presents the results of the subsidence curves for sites in the North Atlantic Ocean from the lithologic database. Some sites have been removed because of the age of retrieved sediment with respect to the age of the ocean crust at these sites, see Table 2.

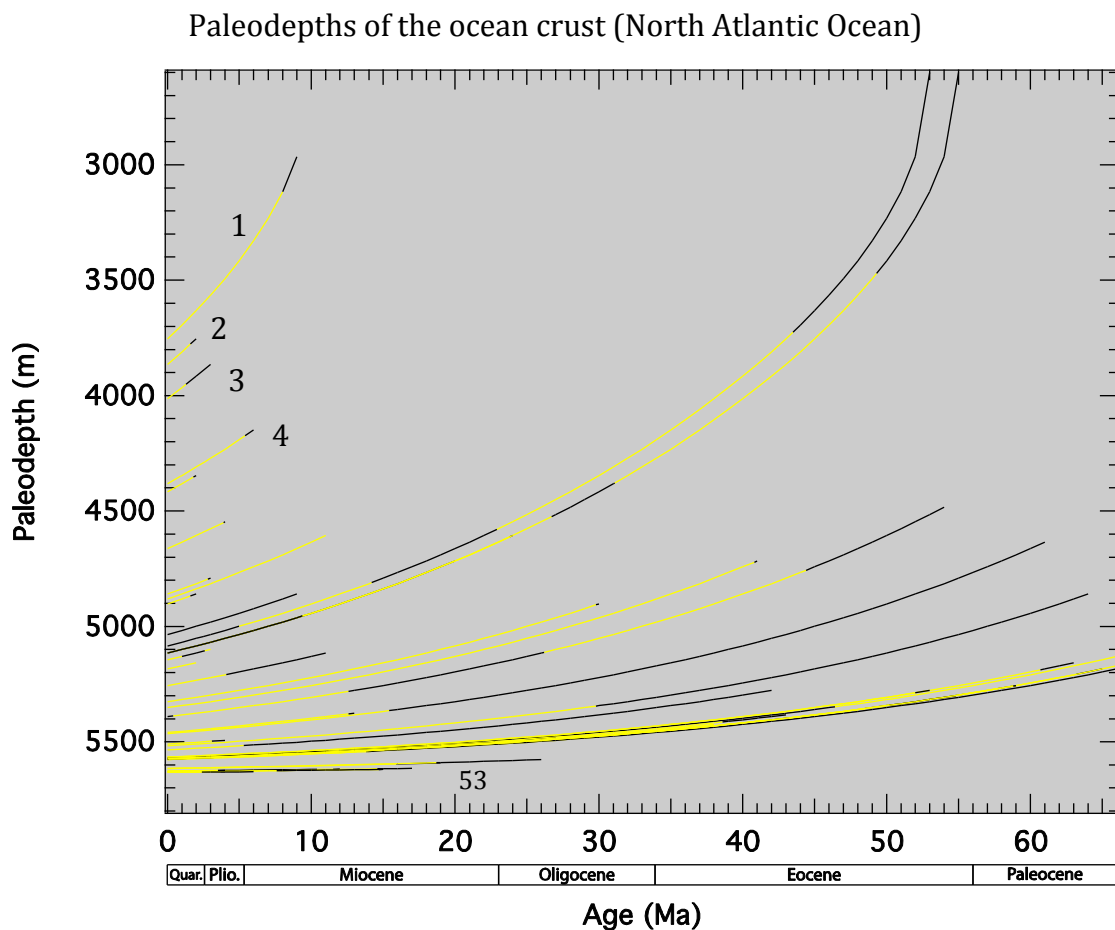


Figure 5. The subsidence curves for the North Atlantic Ocean from the programs ODP and IODP. Yellow areas of each curve are intervals in the sediment at that site where calcium carbonate is present, the boundary between yellow and black parts of each curve represents the CCD. The numbers in the graph corresponds to the numbers in Table 2 below, and the corresponding site. Due to the numerous curves, where some curves overlap each other, every number is not shown in above plot. The length of each curve represents the age of the oldest base recovered in that specific hole.

The sites are in the order from the top left corner (youngest ocean crust) to the lower right corner (oldest ocean crust) as follows in Table 2.

Table 2. Corresponding sites to the numbers (from top left corner to the lower right) in the Figure 5. Cells in the table marked in grey have been removed from the graph due to ages of the sediments in relation to the age of the ocean crust. North Atlantic Ocean.

No.	Leg	Site	Numerical age (Ma)		No.	Leg	Site	Numerical age (Ma)	
			Crust	Sediment				Crust	Sediment
1	105	645	55	19,9	24	157	950	93	61,5
2	105	646	50	9,5	25	157	951	92	12,6
3	105	647	53	56,2	26	157	952	99	13,3
4	108	657	153	18,5	27	157	953	169	17,4
5	108	658	174	3,7	28	157	954	167	11,5
6	108	659	152	26,0	29	157	955	172	14,7
7	108	660	110	42,2	30	157	956	172	14,9
8	108	661	105	63,8	31	162	983	25	1,8
9	108	664	10	8,6	32	162	984	15	2,9
10	108	665	66	10,7	33	164	995	177	6,13
11	108	667	55	23,8	34	164	997	177	6,42
12	108	668	60	2,0	47	172	1057	178	1,2
13	110	672	81	54,2	48	172	1058	176	1,5
14	149	897	125	65,1	49	172	1059	176	0,5
15	149	898	126	29,9	50	172	1060	169	0,9
16	149	899	126	131,9	35	172	1061	163	3,39
17	149	900	128	53,4	36	172	1062	166	4,27
18	152	918	55	60,6	37	172	1063	103	3,5
19	154	925	76	40,8	38	303	U1304	12	1,7
20	154	926	73	29,8	39	303	U1305	43	1,7
21	154	927	72	16,4	40	303	U1306	55	2,0
22	154	928	68	31,5	41	303	U1307	57	3,4
23	154	929	68	55,1	42	303	U1308	33	4,3
24	155	930	87	0,040	43	306	U1312	42	11,0
25	155	931	82	0,492	44	306	U1313	24	6,1
26	155	932	84	0,060	45	342	U1403	122	75,8
27	155	933	83	0,504	46	342	U1404	123	43,4
28	155	935	82	0,397	47	342	U1405	124	26,5
29	155	936	83	0,379	48	342	U1406	125	59,4
30	155	937	93	0,035	49	342	U1407	125	111,7
31	155	938	92	0,050	50	342	U1408	125	58,8
32	155	939	91	0,023	51	342	U1409	121	62,7
33	155	940	87	0,023	52	342	U1410	121	53,4
34	155	942	95	0,150	53	342	U1411	124	38,0
35	155	944	87	0,115					

Figure 6, below, shows the subsidence curves for the sites to the west of the mid-ocean ridge of the North Atlantic Ocean.

Paleodepths of the ocean crust (South Atlantic Ocean)

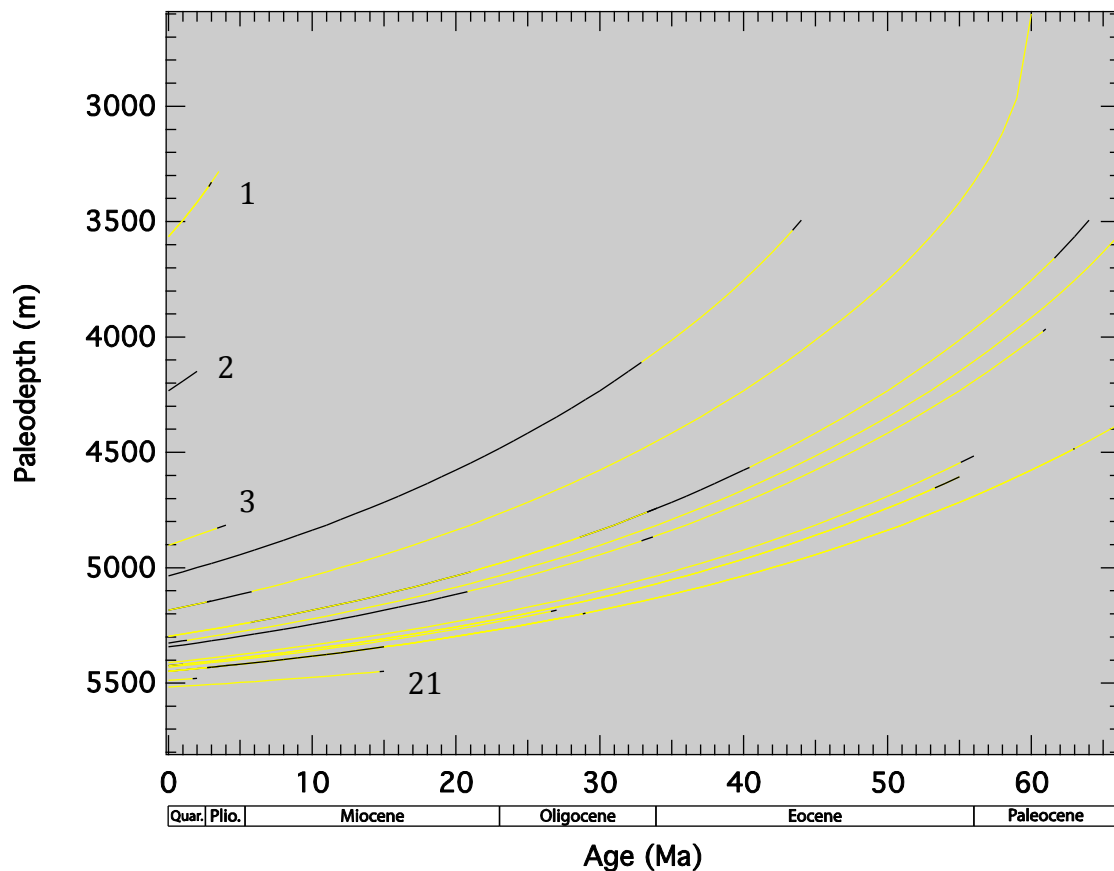


Figure 6. The subsidence curves for the South Atlantic Ocean from the programs ODP. Yellow areas of each curve are intervals in the sediment at that site where calcium carbonate is present, the boundary between yellow and black parts of each curve represents the CCD. The number in the plot corresponds to the number in Table 3 below, and the corresponding site. Due to the numerous curves, where some curves overlap each other, every number is not shown in above plot. The length of the curve is represents the age of the oldest base recovered at specific Hole.

Table 3. Corresponding sites to the numbers (from top left corner to the lower right) in the Figure 6. South Atlantic Ocean.

No.	Leg	Site	Numerical age (Ma)		No.	Leg	Site	Numerical age (Ma)	
			Crust	Sediment				Crust	Sediment
1	108	662	7	3,7	12	208	1266	84	56,1
2	108	663	7	2,9	13	208	1263	86	55,0
3	177	1094	20	1,6	14	208	1265	86	54,8
4	177	1093	43	4,0	15	208	1264	87	26,7
5	114	701	50	43,4	16	114	698	90	92,3
6	114	702	60	61,6	17	114	703	90	62,9
7	177	1091	60	2,7	18	114	704	90	28,8
8	208	1262	70	64,4	19	177	1092	90	15,2
9	208	1267	70	33,4	20	177	1089	98	2,2
10	114	700	73	88,3	21	177	1088	105	14,7
11	114	699	75	60,8					

4 Discussion

Data from 74 sites (of a total of 91 sites) from the IODP and ODP has been presented and to answer at what geologic time the carbonates starts to become present in the sediment is difficult to say. What is clear is that the CCD has fluctuated both spatially and temporally over geologic time. Figure 5, and Figure 6 resembles the plots by Pälike et al., 2012 but I have not managed to reconstruct the CCD over geologic time. Site 897, and Site 900 show for instance calcium carbonate present below 5000 meters depth in Eocene and Paleocene, but the reason for this uncertainty is that almost all sites showing carbonates at these epochs lie also in the boundary between the continental and oceanic crust, so even if there are carbonates, this carbonate could come have terrestrial origin, instead of being pelagic.

5 Conclusions

Subsistence models of the ocean crust is possible to do for the Atlantic Ocean, but it is very dependent on correct ages of the ocean crust. Locations at the continental/oceanic crust boundary are causes of concern.

The CCD in the Atlantic Ocean has varied spatially and temporally through the Cenozoic, but it proved difficult to reconstruct the CCD in the Atlantic Ocean.

6 Future work

The compiled database of sediment lithologies includes more drilling sites than previous compilations in the past. Future work could improve this database even further by looking at all the drill sites in the Atlantic Ocean with the Deep Sea Drilling Project (DSDP). Furthermore, the idea of making the lithology descriptions available from within Google Earth is also something to look more closely at.

Acknowledgement

I would like to thank Matt O'Regan and Helen Coxall, the supervisors for this project at the Department of Geological Sciences at Stockholm University, for their constructive input and encouragements throughout the study.

References

- Boudreau, B.P., Middelburg, J.J. & Meysman, F.J.R., 2010. Carbonate compensation dynamics. *Geophysical Research Letters*, 37(3).
- Boudreau, B.P., 2013. Carbonate dissolution rates at the deep ocean floor. *Geophysical Research Letters*, 40(4), pp.744–748.
- Coxall, H.K. et al., 2005. Rapid stepwise onset of Antarctic glaciation and deeper calcite compensation in the Pacific Ocean. *Nature*, 433(7021), pp.53–57.
- Emelyanov, E.M.E., 2005. Calcium Carbonate Compensation Depth (CCD). In *The Barrier Zones in the Ocean SE - 20*. Springer Berlin Heidelberg, pp. 345–361.
- Florian [florian@auxotectonics.com], 2012. Age of the Earth's Lithosphere for Google Earth [online] Available at: <<http://nachon.free.fr/GE/Welcome.html>> [Accessed 15 February 2015]
- Hönisch, B. et al., 2012. The Geological Record of Ocean Acidification. *Science*, 335(6072), pp.1058–1063.
- Mazzullo, J. M., Meyer, A., and Kidd, R., 1987. New sediment classification scheme for the Ocean Drilling Program. In Mazzullo, J., and Graham, A. G. (Eds.), *Handbook for Shipboard Sedimentologists*. ODP Tech. Note, 8:45-67
doi:10.2973/odp.tn.8.1988
- NOAA, 2015. Curators of Marine and Lacustrine Geological Samples Consortium: Index to Marine and Lacustrine Geological Samples (IMLGS). National Geophysical Data Center, NOAA.
doi:10.7289/V5H41PB8 [February 2, 2015]
- Pälike, H. et al., 2012. A Cenozoic record of the equatorial Pacific carbonate compensation depth. *Nature*, 488(7413), pp.609–614.
- Rohatgi, A., 2015. WebPlotDigitizer - Web based tool to extract numerical data from plots, images and maps. [online] Available at: <<http://arohatgi.info/WebPlotDigitizer/>> [Accessed 26 February 2015]
- Schmittner, A., Chiang, J.C.H. & Hemming, S.R., 2013. Introduction : The Ocean's Meridional Overturning Circulation. In A. Schmittner, J. C. H. Chiang, & S. R. Hemming, eds. *Ocean Circulation: Mechanisms and Impacts - Past and Future Changes of Meridional Overturning*. John Wiley & Sons, Inc., pp. 1–4.
- Stein, C.A. & Stein, S., 1992. A model for the global variation in oceanic depth and heat flow with lithospheric age. *Nature*, 359(6391), pp.123–129.
- Van Andel, T.H., 1975. Mesozoic/cenozoic calcite compensation depth and the global distribution of calcareous sediments. *Earth and Planetary Science Letters*, 26(2), pp.187–194.
- Zachos, J. et al., 2001. Trends, Rhythms, and Aberrations in Global Climate 65 Ma to Present. *Science*, 292, pp.686–693.
- Zachos, J.C. et al., 2005. Rapid acidification of the ocean during the Paleocene-Eocene thermal maximum. *Science*, 308(5728), pp.1611–5.

Appendix 1 and 2

The appendix contain a print out of the database of the sediment lithologies. This database is also available in digital form in an Excel file. The digital version also contain the coordinates and water depth at each site.

References for the sediment lithology database (in order of presentation).

Integrated Ocean Drilling Program (IODP)

Channell, J.E.T., Kanamatsu, T., Sato, T., Stein, R., Alvarez Zarikian, C.A., Malone, M.J., and the Expedition 303/306 Scientists. *Proceedings of the Integrated Ocean Drilling Program, Volume 303/306.*

doi:10.2204/iodp.proc.303306.104.2006

Norris, R.D., Wilson, P.A., Blum, P., and the Expedition 342 Scientists, 2014. *Proceedings of the Integrated Ocean Drilling Program, Volume 342.*

doi:10.2204/iodp.proc.342.103.2014

Ocean Drilling Program (ODP)

Srivastava, S. P., Arthur, M., Clement, B., et al., 1987. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 105.*

doi:10.2973/odp.proc.ir.105.1987

Ruddiman, W., Sarnthein, M., Baldauf, J., et al., 1988. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 108.*

doi:10.2973/odp.proc.ir.108.1988

Masle, A., Moore, J. C , et al., 1988. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 110.*

doi:10.2973/odp.proc.ir.110.1988

Ciesielski, P. R, Kristoffersen, Y., et al., 1988. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 114.*

doi:10.2973/odp.proc.ir.114.1988

Sawyer, D.S., Whitmarsh, R.B., Klaus, A., et al., 1994. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 149.*

doi:10.2973/odp.proc.ir.149.1994

Larsen, H.C., Saunders, A.D., Clift, P.D., et al., 1994. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 152.*

doi:10.2973/odp.proc.ir.152.1994

Curry, W.B., Shackleton, N.J., Richter, C, et al., 1995. *Proceedings of the Ocean Drilling Program, Initial Reports Volume 154.*

doi:10.2973/odp.proc.ir.154.1995

Hood, R.D., Piper, D.J.W., Klaus, A., et al., 1995. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 155.
doi:10.2973/odp.proc.ir.155.1995

Schmincke, H.-U., Weaver, P.P.E., Firth, J.V., et al., 1995. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 157.
doi:10.2973/odp.proc.ir.157.1995

Jansen, E., Raymo, M.E., Blum, P., et al., 1996. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 162.
doi:10.2973/odp.proc.ir.162.1996

Paull, C.K., Matsumoto, R., Wallace, P.J., et al., 1996. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 164.
doi:10.2973/odp.proc.ir.164.1996

Keigwin, L.D., Rio, D., Acton, G.D., et al., 1998. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 172.
doi:10.2973/odp.proc.ir.172.1998

Gersonde, R., Hodell, D.A., Blum, P., et al., 1999. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 177.
doi:10.2973/odp.proc.ir.177.1999

Zachos, J.C., Kroon, D., Blum, P., et al., 2004. *Proceedings of the Ocean Drilling Program, Initial Reports* Volume 208.
doi:10.2973/odp.proc.ir.208.2004

Furter information about digital files used in this thesis

The database with the sediment lithologies and the two files for use within Google Earth: the borehole file (KML file) that was modified to contain only drill sites in the Atlantic, the age of the lithosphere file (KMZ file) are available on an accompanying CD.

The references above also apply to the running file that contain the lithological summaries and age-depth models for each site. This file is also available on the accompanying CD.

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
303	U1304	A	0	239,46	1	nannofossil ooze and diatom ooze	Holocene-late Pliocene	12	0,0	1,6	
303	U1304	B	0	242,45	1	nannofossil ooze and diatom ooze	Holocene-late Pliocene	12	0,0	1,6	
303	U1304	C	0	69,38	1	nannofossil ooze and diatom ooze	Holocene-late Pliocene	12	0,0	0,4	
303	U1304	D	52	243,74	1	nannofossil ooze and diatom ooze	Holocene-late Pliocene	12	0,3	1,7	
303	U1305	A	0	280,00	1	silty clay, silty clay with nannofossils, nannofossil silty clay, silty clay nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	43	0,0	1,6	
303	U1305	B	0	265,30	1	silty clay, silty clay with nannofossils, nannofossil silty clay, silty clay nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	43	0,0	1,5	
303	U1305	C	0	287,90	1	silty clay, silty clay with nannofossils, nannofossil silty clay, silty clay nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	43	0,0	1,7	
303	U1306	A	0	307,00	1	silty clay and silty clay with diatoms	Holocene-late Pliocene	55	0,0	2,0	
303	U1306	B	0	315,90	1	silty clay and silty clay with diatoms	Holocene-late Pliocene	55	0,0	2,0	
303	U1306	C	0	267,60	1	silty clay and silty clay with diatoms	Holocene-late Pliocene	55	0,0	1,7	
303	U1306	D	0	179,50	1	silty clay and silty clay with diatoms	Holocene-late Pliocene	55	0,0	1,1	
303	U1307	A	0	46,60	1	silty clay with foraminifers, foraminifer silty clay, foraminifer sandy clay, silty clay foraminifer ooze, foraminifer ooze, nannofossil ooze, silty clay nannofossil ooze with foraminifers, and nannofossil silty clay	Holocene-early Pleistocene	57	0,0	1,0	
303	U1307	B	0	45,10	1	silty clay with foraminifers, foraminifer silty clay, foraminifer sandy clay, silty clay foraminifer ooze, foraminifer ooze, nannofossil ooze, silty clay nannofossil ooze with foraminifers, and nannofossil silty clay	Holocene-early Pleistocene	57	0,0	1,0	
303	U1307	A	46,6	125,70	2	silty clay	early Pleistocene-late Pliocene	57	1,0	2,6	
303	U1307	B	45,1	124,80	2	silty clay	early Pleistocene-late Pliocene	57	1,0	2,6	
303	U1307	A	125,7	162,60	3	silty clay, silty clay with nannofossils, silty clay nannofossil ooze, silty clay nannofossil ooze with diatoms, and nannofossil silty clay	late Pliocene	57	2,6	3,4	
303	U1307	B	124,8	154,60	3	silty clay, silty clay with nannofossils, silty clay nannofossil ooze, silty clay nannofossil ooze with diatoms, and nannofossil silty clay	late Pliocene	57	2,6	3,2	
303	U1308	A	0,00	187,90	1	nannofossil ooze, foraminifer nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	33	0,0	2,5	
303	U1308	B	0,00	174,30	1	nannofossil ooze, foraminifer nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	33	0,0	2,3	

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
303	U1308	C	0,00	179,50	1	nannofossil ooze, foraminifer nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	33	0,0	2,3	
303	U1308	E	0,00	180,95	1	nannofossil ooze, foraminifer nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	33	0,0	2,4	
303	U1308	F	0,00	178,43	1	nannofossil ooze, foraminifer nannofossil ooze, and nannofossil ooze with silty clay	Holocene-late Pliocene	33	0,0	2,3	
303	U1308	A	187,90	239,20	2 2A	nannofossil ooze, nannofossil ooze with silty clay, and silty clay nannofossil ooze	late Pliocene	33	2,5	3,1	
303	U1308	B	184,50	198,30	2 2A	nannofossil ooze, nannofossil ooze with silty clay, and silty clay nannofossil ooze	late Pliocene	33	2,4	2,6	
303	U1308	C	176,30	238,00	2 2A	nannofossil ooze, nannofossil ooze with silty clay, and silty clay nannofossil ooze	late Pliocene	33	2,3	3,0	
303	U1308	E	180,95	200,90	2 2A	nannofossil ooze, nannofossil ooze with silty clay, and silty clay nannofossil ooze	late Pliocene	33	2,4	2,6	
303	U1308	F	178,43	226,80	2 2A	nannofossil ooze	late Pliocene	33	2,3	2,9	
303	U1308	A	255,60	341,10	2 2B	nannofossil ooze	late Pliocene-late Miocene	33	3,3	4,3	
303	U1308	C	238,00	279,90	2 2B	nannofossil ooze	late Pliocene-late Miocene	33	3,0	3,5	
306	U1313	C	0	41,08	1 1A	nannofossil silty clay, silty clay nannofossil ooze, nannofossil ooze with clay, nannofossil ooze, and subordinate intervals of silty clay nannofossil ooze with diatoms and nannofossil ooze with diatoms and clay	Holocene-early Pleistocene	24	0,0	0,9	
306	U1313	D	0	39,7	1 1A	nannofossil silty clay, silty clay nannofossil ooze, nannofossil ooze with clay, nannofossil ooze, and subordinate intervals of silty clay nannofossil ooze with diatoms and nannofossil ooze with diatoms and clay	Holocene-early Pleistocene	24	0,0	0,9	
306	U1313	A	41	111,86	1 1B	nannofossil ooze, nannofossil ooze with clay, and silty clay nannofossil ooze	early Pleistocene-late Pliocene	24	0,9	2,6	
306	U1313	B	39,38	111,28	1 1B	nannofossil ooze, nannofossil ooze with clay, and silty clay nannofossil ooze	early Pleistocene-late Pliocene	24	0,9	2,6	
306	U1313	C	41,08	112	1 1B	nannofossil ooze, nannofossil ooze with clay, and silty clay nannofossil ooze	early Pleistocene-late Pliocene	24	0,9	2,6	
306	U1313	D	39,7	113,14	1 1B	nannofossil ooze, nannofossil ooze with clay, and silty clay nannofossil ooze	early Pleistocene-late Pliocene	24	0,9	2,7	
306	U1313	A	111,86	308,64	2	nannofossil ooze	late Pliocene-latest Miocene	24	2,6	6,1	

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
306	U1313	B	111,28	300,67	2	nannofossil ooze	late Pliocene-latest Miocene	24	2,6	6,0	
306	U1313	C	112	293,45	2	nannofossil ooze	late Pliocene-latest Miocene	24	2,6	6,0	
306	U1313	D	113,14	152,34	2	nannofossil ooze	late Pliocene-latest Miocene	24	2,7	3,6	
306	U1314	A	0	257,58	1	nannofossil- and clay-rich sediments having varying proportions of diatoms and foraminifers	Holocene-late Pliocene	41	0,0	2,9	
306	U1314	B	0	279,91	1	nannofossil- and clay-rich sediments having varying proportions of diatoms and foraminifers	Holocene-late Pliocene	41	0,0	3,1	
306	U1314	C	0	208,18	1	nannofossil- and clay-rich sediments having varying proportions of diatoms and foraminifers	Holocene-late Pliocene	41	0,0	2,4	
342	U1403	A	0	3	1	clay with nannofossils	Pleistocene	122	0,0	2,0	
342	U1403	B	0	3	1	clay with nannofossils	Pleistocene	122	0,0	2,0	
342	U1403	A	3	72,3	2	clay	middle Eocene	122	2,0	43,1	
342	U1403	B	3	70,64	2	clay	middle Eocene	122	2,0	42,8	
342	U1403	A	72,3	119,14	3	radiolarian clay	middle Eocene	122	43,1	46,4	
342	U1403	B	70,64	120,4	3	radiolarian clay	middle Eocene	122	42,8	46,5	
342	U1403	A	119,14	147,8	4	nannofossil ooze with clay and radiolarians	early Eocene	122	46,4	50,5	
342	U1403	B	120,4	145,4	4	nannofossil ooze with clay and radiolarians	early Eocene	122	46,5	50,0	
342	U1403	A	147,8	220,62	5 5a	nannofossil ooze with clay	early Eocene-Paleocene	122	50,5	66,8	
342	U1403	B	145,5	217,07	5 5a	nannofossil ooze with clay	early Eocene-Paleocene	122	50,1	65,6	
342	U1403	A	220,62	242,3	5 5b	nannofossil chalk with foraminifers and clay	Maastrichtian-Campanian	122	66,8	69,5	
342	U1403	B	217,07	261,76	5 5b	nannofossil chalk with foraminifers and clay	Maastrichtian-Campanian	122	65,6	75,8	
342	U1404	B	0	2,33	1	foraminiferal sand and nannofossil ooze	Pleistocene-Pliocene	123	2,7	3,4	
342	U1404	A	0	22,32	2 2a	clay and silty clay	Miocene	123	2,7	9,3	
342	U1404	B	2,4	24,4	2 2a	clay and silty clay	Miocene	123	3,4	9,9	
342	U1404	A	33,2	200,6	2 2b	biosiliceous clay, biosiliceous ooze with clay, and biosiliceous clay with calcareous fossils	Oligocene-Miocene	123	12,5	32,8	

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
342	U1404	B	24,4	203,56	2	2b	biosiliceous clay, biosiliceous ooze with clay, and biosiliceous clay with calcareous fossils	Oligocene-Miocene	123	9,9	33,9
342	U1404	C	16	45,01	2	2b	biosiliceous clay, biosiliceous ooze with clay, and biosiliceous clay with calcareous fossils	Oligocene-Miocene	123	7,4	16,0
342	U1404	A	200,62	226,5	3		clayey/silty nannofossil ooze and nannofossil ooze	Oligocene-late Eocene	123	32,8	38,7
342	U1404	B	203,56	225,11	3		clayey/silty nannofossil ooze and nannofossil ooze	Oligocene-late Eocene	123	33,9	38,6
342	U1404	A	226,5	299,82	4		clay/claystone and radiolarian clay	middle Eocene-late Eocene	123	38,7	43,4
342	U1404	B	225,11	228,75	4		clay/claystone and radiolarian clay	middle Eocene-late Eocene	123	38,6	38,8
342	U1405	A	0	10,7	1	1a	foraminiferal sand and nannofossil ooze	Pleistocene-late Pliocene	124	0,3	5,1
342	U1405	B	0	2,25	1	1a	foraminiferal sand and nannofossil ooze	Pleistocene-late Pliocene	124	0,3	1,3
342	U1405	C	0	4,66	1	1a	foraminiferal sand and nannofossil ooze	Pleistocene-late Pliocene	124	0,3	2,4
342	U1405	A	10,7	17,51	1	1b	clay and silty clay	late Pliocene	124	5,1	8,2
342	U1405	B	2,25	20,74	1	1b	clay and silty clay	late Pliocene	124	1,3	9,7
342	U1405	C	4,66	14,34	1	1b	clay and silty clay	late Pliocene	124	2,4	6,8
342	U1405	A	17,51	140,98	2	2a	clay and biosiliceous ooze	early Miocene	124	8,2	22,8
342	U1405	B	20,74	141,2	2	2a	clay and biosiliceous ooze	early Miocene	124	9,7	22,8
342	U1405	C	14,34	144,54	2	2a	clay and biosiliceous ooze	early Miocene	124	6,8	22,8
342	U1405	A	140,98	207,2	2	2b	clay, biosiliceous ooze, and nannofossil ooze	late Oligocene-early Miocene	124	22,8	23,4
342	U1405	B	141,2	202,2	2	2b	clay, biosiliceous ooze, and nannofossil ooze	late Oligocene-early Miocene	124	22,8	23,3
342	U1405	C	144,54	203,7	2	2b	clay, biosiliceous ooze, and nannofossil ooze	late Oligocene-early Miocene	124	22,8	23,3
342	U1405	A	207,2	307,03	2	2c	clay, biosiliceous ooze, and nannofossil claystone	late Oligocene	124	23,4	26,5
342	U1405	B	202,2	223,3	2	2c	clay, biosiliceous ooze, and nannofossil claystone	late Oligocene	124	23,3	23,7
342	U1405	C	203,7	232,35	2	2c	clay, biosiliceous ooze, and nannofossil claystone	late Oligocene	124	23,3	23,9
342	U1406	A	0	2,61	1		foraminiferal sand and nannofossil ooze	Pleistocene	125	3,8	7,3

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
342	U1406	B	0	2,62	1		foraminiferal sand and nannofossil ooze	Pleistocene	125	3,8	7,3
342	U1406	C	0	1,6	1		foraminiferal sand and nannofossil ooze	Pleistocene	125	3,8	5,9
342	U1406	A	2,61	184,86	2		nannofossil ooze	Oligocene-Miocene	125	7,3	32,1
342	U1406	B	2,62	181,12	2		nannofossil ooze	Oligocene-Miocene	125	7,3	31,6
342	U1406	C	1,6	184,57	2		nannofossil ooze	Oligocene-Miocene	125	5,9	32,0
342	U1406	A	184,86	243,4	3		nannofossil chalk	middle Eocene-early Oligocene	125	32,1	43,2
342	U1406	B	181,12	243,5	3		nannofossil chalk	middle Eocene-early Oligocene	125	31,6	43,3
342	U1406	C	184,57	229,19	3		nannofossil chalk	middle Eocene-early Oligocene	125	32,0	38,9
342	U1406	A	243,4	281,05	4		nannofossil chalk with foraminifers and nannofossil chalk with radiolarians	Paleocene-middle Eocene	125	43,2	59,4
342	U1406	B	243,5	254,83	4		nannofossil chalk with foraminifers and nannofossil chalk with radiolarians	Paleocene-middle Eocene	125	43,3	56,0
342	U1407	A	0	7,75	1		foraminiferal nannofossil ooze, foraminiferal sand, and clay with nannofossils	Pleistocene	125	0,1	14,9
342	U1407	B	0	8,14	1		foraminiferal nannofossil ooze, foraminiferal sand, and clay with nannofossils	Pleistocene	125	0,1	15,6
342	U1407	C	0	7,7	1		foraminiferal nannofossil ooze, foraminiferal sand, and clay with nannofossils	Pleistocene	125	0,1	14,8
342	U1407	A	7,75	15,89	2		clay with nannofossils	early Oligocene	125	14,9	30,4
342	U1407	B	8,14	18,04	2		clay with nannofossils	early Oligocene	125	15,6	44,1
342	U1407	C	10,7	14,63	2		clay with nannofossils	early Oligocene	125	20,5	28,0
342	U1407	A	16,3	83,18	3		nannofossil ooze with foraminifers	middle Eocene	125	31,2	47,4
342	U1407	B	17,9	85,5	3		nannofossil ooze with foraminifers	middle Eocene	125	44,1	48,4
342	U1407	C	14,63	75,86	3		nannofossil ooze with foraminifers	middle Eocene	125	28,0	47,0
342	U1407	A	82,8	102,8	4		nannofossil ooze with foraminifers and nannofossil ooze with radiolarians	early Eocene	125	47,3	51,7
342	U1407	B	85,5	95,01	4		nannofossil ooze with foraminifers and nannofossil ooze with radiolarians	early Eocene	125	48,4	49,4
342	U1407	C	75,86	96,05	4		nannofossil ooze with foraminifers and nannofossil ooze with radiolarians	early Eocene	125	47,0	49,4

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
342	U1407	A	121,9	174,6	5	5a	nannofossil chalk with foraminifers and radiolarians and nannofossil chalk with radiolarians	Paleocene	125	54,3	61,7
342	U1407	B	127	173,59	5	5a	nannofossil chalk with foraminifers and radiolarians and nannofossil chalk with radiolarians	Paleocene	125	56,3	61,6
342	U1407	C	117	176,01	5	5a	nannofossil chalk with foraminifers and radiolarians and nannofossil chalk with radiolarians	Paleocene	125	53,6	61,8
342	U1407	A	174,6	267,3	5	5b	nannofossil chalk and nannofossil chalk with foraminifers	early Paleocene-Albian	125	61,7	102,3
342	U1407	B	173,59	268,66	5	5b	nannofossil chalk and nannofossil chalk with foraminifers	early Paleocene-Albian	125	61,6	102,7
342	U1407	C	176,01	261,79	5	5b	nannofossil chalk and nannofossil chalk with foraminifers	early Paleocene-Albian	125	61,8	100,7
342	U1407	A	266,77	299,18	6		grainstone, pelletal packstone, and framestone	late Albian	125	####	111,7
342	U1407	B	268,66	269,82	6		grainstone, pelletal packstone, and framestone	late Albian	125	####	103,1
342	U1408	A	0	12,22	1		clayey silt, nannofossil foraminiferal ooze, and clay	Pleistocene-Oligocene	125	0,0	10,3
342	U1408	B	0	13,22	1		clayey silt, nannofossil foraminiferal ooze, and clay	Pleistocene-Oligocene	125	0,0	11,2
342	U1408	C	0	12,93	1		clayey silt, nannofossil foraminiferal ooze, and clay	Pleistocene-Oligocene	125	0,0	10,8
342	U1408	A	12,22	22,22	2		silty clay, silty clay with nannofossils, and nannofossil clay with silt	Miocene-Oligocene	125	10,3	22,4
342	U1408	B	13,22	23,72	2		silty clay, silty clay with nannofossils, and nannofossil clay with silt	Miocene-Oligocene	125	11,2	24,3
342	U1408	C	12,93	23,37	2		silty clay, silty clay with nannofossils, and nannofossil clay with silt	Miocene-Oligocene	125	10,8	23,8
342	U1408	A	22,22	224,64	3		nannofossil clay/claystone and nannofossil ooze	Oligocene-middle Eocene	125	22,4	49,7
342	U1408	B	23,72	213,7	3		nannofossil clay/claystone and nannofossil ooze	Oligocene-middle Eocene	125	24,3	45,7
342	U1408	C	23,37	179,96	3		nannofossil clay/claystone and nannofossil ooze	Oligocene-middle Eocene	125	23,8	44,6
342	U1408	A	224,64	246,64	4		nannofossil chalk (with radiolarians) and chert	early Eocene-late Paleocene	125	49,7	58,8
342	U1409	A	0	17,61	1		nannofossil ooze to nannofossil foraminiferal ooze, diatomaceous nannofossil ooze, silty clay with nannofossils or foraminifers, and muddy sand with foraminifers	Pleistocene-late Pliocene	121	0,0	25,1
342	U1409	B	0	18,52	1		nannofossil ooze to nannofossil foraminiferal ooze, diatomaceous nannofossil ooze, silty clay with nannofossils or foraminifers, and muddy sand with foraminifers	Pleistocene-late Pliocene	121	0,0	25,3

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
342	U1409	C	0	15,99	1	nannofossil ooze to nannofossil foraminiferal ooze, diatomaceous nannofossil ooze, silty clay with nannofossils or foraminifers, and muddy sand with foraminifers	Pleistocene-late Pliocene	121	0,0	24,8	
342	U1409	A	17,61	33,19	2	barren interval-early silty clay to nannofossil clay	Oligocene	121	25,1	32,0	
342	U1409	B	18,52	37,32	2	barren interval-early silty clay to nannofossil clay	Oligocene	121	25,3	41,0	
342	U1409	C	15,99	37,14	2	barren interval-early silty clay to nannofossil clay	Oligocene	121	24,8	41,0	
342	U1409	A	33,19	101,09	3	nannofossil clay interbedded with nannofossil ooze	middle Eocene	121	32,0	47,4	
342	U1409	B	37,32	102,69	3	nannofossil clay interbedded with nannofossil ooze	middle Eocene	121	41,0	47,7	
342	U1409	C	37,14	100,57	3	nannofossil clay interbedded with nannofossil ooze	middle Eocene	121	41,0	47,3	
342	U1409	A	101,09	126,13	4 4a	nannofossil ooze with foraminifers and/or radiolarians, radiolarian nannofossil ooze with foraminifers, and nannofossil ooze	early Eocene	121	47,4	51,0	
342	U1409	B	103,3	122,5	4 4a	nannofossil ooze with foraminifers and/or radiolarians, radiolarian nannofossil ooze with foraminifers, and nannofossil ooze	early Eocene	121	47,8	50,8	
342	U1409	C	100,57	124,23	4 4a	nannofossil ooze with foraminifers and/or radiolarians, radiolarian nannofossil ooze with foraminifers, and nannofossil ooze	early Eocene	121	47,3	50,9	
342	U1409	A	126,1	155,02	4 4b	clayey nannofossil ooze, nannofossil ooze with foraminifers or radiolarians, chert, nannofossil claystone, siliceous nannofossil limestone, and nannofossil chalk	early Eocene-late Paleocene	121	51,0	55,9	
342	U1409	B	122,5	158,73	4 4b	clayey nannofossil ooze, nannofossil ooze with foraminifers or radiolarians, chert, nannofossil claystone, siliceous nannofossil limestone, and nannofossil chalk	early Eocene-late Paleocene	121	50,8	57,2	
342	U1409	C	124,2	160,47	4 4b	clayey nannofossil ooze, nannofossil ooze with foraminifers or radiolarians, chert, nannofossil claystone, siliceous nannofossil limestone, and nannofossil chalk	early Eocene-late Paleocene	121	50,9	57,8	
342	U1409	A	155,02	200,47	4 4c	nannofossil chalk with radiolarians and nannofossil chalk	Paleocene	121	55,9	62,7	
342	U1409	B	158,73	170,57	4 4c	nannofossil chalk with radiolarians and nannofossil chalk	Paleocene	121	57,2	58,8	
342	U1410	A	0	34,35	1	nannofossil ooze to nannofossil foraminiferal ooze, silty clay with nannofossils or foraminifers, clay, and muddy foraminiferal sand	Pleistocene	121	0,0	7,0	
342	U1410	B	0	34,15	1	nannofossil ooze to nannofossil foraminiferal ooze, silty clay with nannofossils or foraminifers, clay, and muddy foraminiferal sand	Pleistocene	121	0,0	6,6	
342	U1410	C	0	32,67	1	nannofossil ooze to nannofossil foraminiferal ooze, silty clay with nannofossils or foraminifers, clay, and muddy foraminiferal sand	Pleistocene	121	0,0	4,3	

Appendix 1: Sediment lithologies - Integrated Ocean Drilling Program / International Ocean Discovery Program (IODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
342	U1410	A	34,35	64,17	2		clay, clay with nannofossils, and nannofossil clay	late Miocene-Oligocene	121	7,0	32,0
342	U1410	B	34,15	63,27	2		clay, clay with nannofossils, and nannofossil clay	late Miocene-Oligocene	121	6,6	31,2
342	U1410	C	32,67	63,54	2		clay, clay with nannofossils, and nannofossil clay	late Miocene-Oligocene	121	4,3	31,5
342	U1410	A	64,17	211,5	3		nannofossil clay, clayey nannofossil ooze, and nannofossil ooze	middle Eocene	121	32,0	46,7
342	U1410	B	63,27	216,27	3		nannofossil clay, clayey nannofossil ooze, and nannofossil ooze	middle Eocene	121	31,2	47,1
342	U1410	C	63,54	214,22	3		nannofossil clay, clayey nannofossil ooze, and nannofossil ooze	middle Eocene	121	31,5	46,9
342	U1410	A	211,5	245,07	4	4a	nannofossil chalk with foraminifers and/or radiolarians	early Eocene	121	46,7	50,9
342	U1410	B	225,49	244,25	4	4a	nannofossil chalk with foraminifers and/or radiolarians	early Eocene	121	48,2	50,8
342	U1410	C	214,22	239,83	4	4a	nannofossil chalk with foraminifers and/or radiolarians	early Eocene	121	46,9	50,2
342	U1410	A	245,07	258,91	4	4b	nannofossil chalk with foraminifers and/or radiolarians and chert	early Eocene	121	50,9	53,4
342	U1410	C	242,8	243,27	4	4b	nannofossil chalk with foraminifers and/or radiolarians and chert	early Eocene	121	50,6	50,6
342	U1411	A	0	9,87	1		nannofossil ooze to nannofossil foraminiferal ooze, silty clay with nannofossils or foraminifers, clay, and muddy foraminiferal sand	Pleistocene	124	0,0	1,1
342	U1411	B	0	14,35	1		nannofossil ooze to nannofossil foraminiferal ooze, silty clay with nannofossils or foraminifers, clay, and muddy foraminiferal sand	Pleistocene	124	0,0	8,9
342	U1411	C	0	9,24	1		nannofossil ooze to nannofossil foraminiferal ooze, silty clay with nannofossils or foraminifers, clay, and muddy foraminiferal sand	Pleistocene	124	0,0	1,0
342	U1411	B	14,35	212,58	2		silty clay, clay with nannofossils and silt, nannofossil clay, and clayey nannofossil ooze	early Miocene-late Eocene	124	8,9	36,4
342	U1411	C	100	214,94	2		silty clay, clay with nannofossils and silt, nannofossil clay, and clayey nannofossil ooze	early Miocene-late Eocene	124	32,0	36,5
342	U1411	B	215,8	254,5	3		clayey nannofossil chalk and clayey nannofossil chalk with foraminifers	late Eocene	124	36,5	38,0
342	U1411	C	214,94	223,58	3		clayey nannofossil chalk and clayey nannofossil chalk with foraminifers	late Eocene	124	36,5	36,8

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
105	645	A	0	71,6	1	1A	Alternating beds of detriticarbonate muddy sand and silty mud, with scattered dropstones to cobble size.	Holocene- Pleistocene	55	0,1	0,6
105	645	B	0	71,6	1	1A	Alternating beds of detriticarbonate muddy sand and silty mud, with scattered dropstones to cobble size.	Holocene- Pleistocene	55	0,1	0,6
105	645	C	0	71,6	1	1A	Alternating beds of detriticarbonate muddy sand and silty mud, with scattered dropstones to cobble size.	Holocene- Pleistocene	55	0,1	0,6
105	645	F	0	71,6	1	1A	Alternating beds of detriticarbonate muddy sand and silty mud, with scattered dropstones to cobble size.	Holocene- Pleistocene	55	0,1	0,6
105	645	G	0	71,6	1	1A	Alternating beds of detriticarbonate muddy sand and silty mud, with scattered dropstones to cobble size.	Holocene- Pleistocene	55	0,1	0,6
105	645	B	71,6	168,1	1	1B	Alternating beds of detriticarbonate silty clay to silty mud, with dropstones to cobble size.	Pleistocene	55	0,6	1,3
105	645	A	168,1	335	2		Noncarbonate silty mud, clayey silt, and silty clay, with dropstones to cobble size.	Early Pleistocene- Pliocene	55	1,3	2,5
105	645	D	168,1	335	2		Noncarbonate silty mud, clayey silt, and silty clay, with dropstones to cobble size.	Early Pleistocene- Pliocene	55	1,3	2,5
105	645	E	168,1	335	2		Noncarbonate silty mud, clayey silt, and silty clay, with dropstones to cobble size.	Early Pleistocene- Pliocene	55	1,3	2,5
105	645	D	335	753,4	3	3A	Poorly sorted muddy sand and sand-bearing silty mud, with scattered, predominantly shale, pebbles in coarser beds.	Pliocene-late Miocene	55	2,5	11,9
105	645	E	335	753,4	3	3A	Poorly sorted muddy sand and sand-bearing silty mud, with scattered, predominantly shale, pebbles in coarser beds.	Pliocene-late Miocene	55	2,5	11,9
105	645	E	753,4	916,8	3	3B	Muddy sandstone and silty mudstone, interbedded with well-laminated carbonate-rich silty claystones.	Late-middle Miocene	55	11,9	15,2
105	645	E	916,8	1147,1	3	3C	Fine- to medium-grained muddy sandstone and silty mudstone. Sandstone occasionally glauconite-bearing.	Middle-early Miocene	55	15,2	19,9
105	646	A	0	188,2	1	1A	Predominantly silty clays and clayey silts with variable amounts of biogenic skeletons to 50%. The most common biogenics are nannofossils, foraminifers, sponge spicules, and diatoms. Thin detriticarbonate and siliciclastic silt and silty clay beds are markers.	Holocene-late Pliocene	50	0,0	2,4
105	646	B	0	188,2	1	1A	Predominantly silty clays and clayey silts with variable amounts of biogenic skeletons to 50%. The most common biogenics are nannofossils, foraminifers, sponge spicules, and diatoms. Thin detriticarbonate and siliciclastic silt and silty clay beds are markers.	Holocene-late Pliocene	50	0,0	2,4
105	646	B	188,2	236,1	1	1B	Poorly sorted, locally granule-bearing muddy sands, and silty muds.	Late Pliocene	50	2,4	2,9

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
105	646	B	236,4	766,7	2	Predominantly silty clay (claystone), clay (claystone), and clayey silt (siltstone), with layers containing as much as 50%-60% nannofossils - typically much less. Rare glauconite in burrows. Rare micritic limestone beds in lower part.	Late Pliocene-late Miocene	50	2,9	9,5	
105	647	A	0	116	1	Interbedded silty clays, clayey silts, and clayey muds with scattered granules and pebbles. Biogenic carbonate, 0%-40%. Detrital carbonate, as much as 75%.	Holocene-late Pliocene	53	0,0	2,5	
105	647	B	0	116	1	Interbedded silty clays, clayey silts, and clayey muds with scattered granules and pebbles. Biogenic carbonate, 0%-40%. Detrital carbonate, as much as 75%.	Holocene-late Pliocene	53	0,0	2,5	
105	647	A	116	119	2 2A	Silty clay underlain by nannofossil clay	Late Miocene	53	2,5	14,2	
105	647	A	119	135,4	2 2B	Silty clay and clay with iron-manganese-phosphate nodules.	Early Miocene	53	14,2	22,9	
105	647	A	135,4	212,3	3 3A	Nannofossil clay (claystone) and nannofossil ooze (chalk).	Early Oligocene	53	22,9	34,4	
105	647	A	212,3	241,1	3 3B	Clayey diatomite, clayey nannofossil diatomite, and nannofossil diatomaceous claystone.	Early Oligocene	53	34,4	35,2	
105	647	A	241,1	530,3	3 3C	Nannofossil claystone	Middle Eocene-early Oligocene	53	35,2	43,5	
105	647	A	530,3	699	4	Claystone	Middle-early Eocene	53	43,5	56,2	
108	657	A	0	13,6	1 1A	Nannofossil ooze with minor amounts of foraminifers, quartz silt, clay, and sponge spicules.	Holocene-early Pliocene	153	0,0	0,5	
108	657	B	0	14,8	1 1A	Nannofossil ooze with minor amounts of foraminifers, quartz silt, clay, and sponge spicules.	Holocene-early Pliocene	153	0,0	0,6	
108	657	A	13,6	26,2	1 1B	Clayey nannofossil ooze, which consists of nannofossils, clay minerals, and minor amounts of quartz, foraminifers, diatoms, sponge spicules, and shell debris and has high content (1%-2.2%) of organic carbon.	Holocene-early Pliocene	153	0,5	1,0	
108	657	B	14,8	27,5	1 1B	Clayey nannofossil ooze, which consists of nannofossils, clay minerals, and minor amounts of quartz, foraminifers, diatoms, sponge spicules, and shell debris and has high content (1%-2.2%) of organic carbon.	Holocene-early Pliocene	153	0,6	1,1	
108	657	A	26,2	96,5	1 1C	Nannofossil ooze that contains minor amounts of foraminifers, quartz silt, clay, and sponge spicules.	Holocene-early Pliocene	153	1,0	3,7	
108	657	B	27,5	97,3	1 1C	Nannofossil ooze that contains minor amounts of foraminifers, quartz silt, clay, and sponge spicules.	Holocene-early Pliocene	153	1,1	3,8	
108	657	A	96,5	124,5	1 1D	Nannofossil ooze of similar composition and lithology to the sediment in Subunits 1A, 1C, and 1E but contains lesser amounts of sand, silty sand, and silt beds.	Holocene-early Pliocene	153	3,7	4,0	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
108	657	B	97,3	120	1	1D	Nannofossil ooze of similar composition and lithology to the sediment in Subunits 1A, 1C, and 1E but contains lesser amounts of sand, silty sand, and silt beds.	Holocene-early Pliocene	153	3,8	3,8
108	657	A	124,5	146,2	1	1E	Nannofossil ooze that contains minor amounts of foraminifers, quartz silt, clay, and sponge spicules.	Holocene-early Pliocene	153	4,0	6,3
108	657	B	120	145,2	1	1E	Nannofossil ooze that contains minor amounts of foraminifers, quartz silt, clay, and sponge spicules.	Holocene-early Pliocene	153	3,8	6,2
108	657	A	146,2	178,2	2		Silty clay and nannofossil-bearing clay, with minor amounts of silty sand and sand, and is characterized by low (2%-30%) concentrations of organic carbon.	Late Miocene	153	6,3	18,5
108	657	B	145,2	166,1	2		Silty clay and nannofossil-bearing clay, with minor amounts of silty sand and sand, and is characterized by low (2%-30%) concentrations of organic carbon.	Late Miocene	153	6,2	13,3
108	658	A	0	34,2	1	1A	Nannofossil ooze with minor amounts of quartz and feldspar silt, foraminifers, and siliceous biogenic debris. Carbonate content (35%-53%).	Holocene-middle Pleistocene	174	0,0	0,2
108	658	B	0	30,8	1	1A	Nannofossil ooze with minor amounts of quartz and feldspar silt, foraminifers, and siliceous biogenic debris. Carbonate content (35%-53%).	Holocene-middle Pleistocene	174	0,0	0,2
108	658	A	34,2	91,2	1	1B	Nannofossil ooze and lesser amounts of diatom ooze, diatom nannofossil ooze, and nannofossil diatom ooze. Carbonate content (28%-69%).	Holocene-middle Pleistocene	174	0,2	0,6
108	658	B	30,8	87,8	1	1B	Nannofossil ooze and lesser amounts of diatom ooze, diatom nannofossil ooze, and nannofossil diatom ooze. Carbonate content (28%-69%).	Holocene-middle Pleistocene	174	0,2	0,6
108	658	A	91,2	233,9	2		Nannofossil ooze, mixed sediment, and siliciclastic sediment. Carbonate content (19%-50%)	Late Pliocene	174	0,6	3,1
108	658	B	87,8	163,8	2		Nannofossil ooze, mixed sediment, and siliciclastic sediment. Carbonate content (19%-50%)	Late Pliocene	174	0,6	2,4
108	658	A	233,9	300,4	3		Nannofossil and nannofossil-bearing silt, clay, or mud, and nannofossil ooze. Carbonate content (10%-45%).	Late-early Pliocene	174	3,1	3,7
108	659	A	0	55,3	1	1A	Nannofossil ooze to foraminifer-bearing nannofossil ooze, and foraminifer-nannofossil ooze. Carbonate content (41%-83%). Traces of volcanic glass and pyrite(?) is scattered throughout the entire subunit.	Holocene-early Pliocene	152	0,0	1,8

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
108	659	B	0	54,1	1	1A	Nannofossil ooze to foraminifer-bearing nannofossil ooze, and foraminifer-nannofossil ooze. Carbonate content (41%-83%). Traces of volcanic glass and pyrite(?) Is scattered throughout the entire subunit.	Holocene-early Pliocene	152	0,0	1,7
108	659	C	0	38	1	1A	Nannofossil ooze to foraminifer-bearing nannofossil ooze, and foraminifer-nannofossil ooze. Carbonate content (41%-83%). Traces of volcanic glass and pyrite(?) Is scattered throughout the entire subunit.	Holocene-early Pliocene	152	0,0	1,2
108	659	A	55,3	159,8	1	1B	Nannofossil ooze and foraminifer-bearing and/or silt-bearing nannofossil ooze. Carbonate content (36%-90%). Traces of volcanic glass and pyrite(?) observable.	Holocene-early Pliocene	152	1,8	6,2
108	659	B	54,1	164,1	1	1B	Nannofossil ooze and foraminifer-bearing and/or silt-bearing nannofossil ooze. Carbonate content (36%-90%). Traces of volcanic glass and pyrite(?) observable.	Holocene-early Pliocene	152	1,7	6,6
108	659	C	100	119	1	1B	Nannofossil ooze and foraminifer-bearing and/or silt-bearing nannofossil ooze. Carbonate content (36%-90%). Traces of volcanic glass and pyrite(?) observable.	Holocene-early Pliocene	152	3,3	3,9
108	659	A	178,8	203,3	2	2A	Nannofossil ooze to silt-bearing to silty nannofossil ooze. Carbonate content (20%-70%).	Miocene	152	7,8	11,8
108	659	B	164,1	198,7	2	2A	Nannofossil ooze to silt-bearing to silty nannofossil ooze. Carbonate content (20%-70%).	Miocene	152	6,6	10,7
108	659	C	177	196	2	2A	Nannofossil ooze to silt-bearing to silty nannofossil ooze. Carbonate content (20%-70%).	Miocene	152	7,6	10,1
108	659	A	203,3	273,8	2	2B	Nannofossil ooze to silt-bearing to silty nannofossil ooze. Carbonate content (10%-70%). Volcanic ash layer at 233 mbsf.	Miocene	152	11,8	26,0
108	659	B	198,7	202,1	2	2B	Nannofossil ooze to silt-bearing to silty nannofossil ooze. Carbonate content (10%-70%).	Miocene	152	10,7	11,5
108	660	B	0	70,2	1		Silty clay, nannofossil ooze, with lesser amounts muddy nannofossil ooze, nannofossil silty clay.	Holocene-early Pliocene	110	0,0	3,8
108	660	A	0	20,8	1	1A	Beds of silty clay that grade upward into thinner beds of muddy nannofossil ooze or nannofossil silty clay. Carbonate content (0%-49%).	Holocene-early Pliocene	110	0,0	0,8
108	660	A	20,8	58,8	1	1B	Interbedded silty clay, muddy nannofossil ooze, and nannofossil ooze, which commonly are massive to moderately bioturbated. Carbonate content (0%-40%).	Holocene-early Pliocene	110	0,8	3,1
108	660	A	58,8	75	1	1C	Interbedded silty clay and nannofossil ooze.	Pliocene	110	3,1	5,3
108	660	A	75	115,8	2		Clay	Miocene(?)	110	5,3	22,0

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
108	660	B	70,2	116,5	2	Clay	Miocene(?)	110	3,8	22,3	
108	660	A	115,8	164,9	3	Radiolarian ooze with trace amounts of sponge spicules and diatoms, less than 0.15% organic carbon, and variable amounts of pyrite.	Middle Eocene	110	22,0	42,2	
108	660	B	116,5	148,8	3	Radiolarian ooze with trace amounts of sponge spicules and diatoms, less than 0.15% organic carbon, and variable amounts of pyrite.	Middle Eocene	110	22,3	35,6	
108	661	A	0	20,6	1 1A	Muddy nannofossil ooze and nannofossil-bearing and nannofossil silty clay.	Pleistocene-latest Miocene	105	0,0	1,2	
108	661	B	0	15,2	1 1A	Muddy nannofossil ooze and nannofossil-bearing and nannofossil silty clay.	Pleistocene-latest Miocene	105	0,0	0,9	
108	661	A	20,6	72,55	1 1B	Nannofossil ooze, muddy nannofossil ooze, and silty clay. Carbonate content (up to 80%).	Pleistocene-latest Miocene	105	1,2	6,6	
108	661	B	15,2	81,7	1 1B	Nannofossil ooze, muddy nannofossil ooze, and silty clay. Carbonate content (up to 80%).	Pleistocene-latest Miocene	105	0,9	8,9	
108	661	A	72,55	90,8	2	Silty clay and nannofossil ooze. Carbonate content (0%-50%).	Latest Miocene and possibly older	105	6,6	11,2	
108	661	A	90,8	163,1	3 3A	Silty clay, nannofossil ooze, and nannofossil clay.	Late Cretaceous and possibly younger	105	11,2	29,8	
108	661	A	163,1	296,1	3 3B	Clay and claystone. Carbonate content (extremely low, approaching 0%).	Late Cretaceous and possibly younger	105	29,8	63,8	
108	662	A	0	26,2	1 1A	Foraminifer-nannofossil and nannofossil oozes with minor (10%-25%) amounts of clay, diatoms, radiolarians, and sponge spicules. Siliceous nannofossil ooze interbedded with pelagic carbonates. Carbonate content (60%-90%).	Pleistocene	7	0,0	0,5	
108	662	B	0	19	1 1A	Foraminifer-nannofossil and nannofossil oozes with minor (10%-25%) amounts of clay, diatoms, radiolarians, and sponge spicules. Carbonate content (60%-90%).	Pleistocene	7	0,0	0,4	
108	662	A	26,2	96,2	1 1B	Foraminifer-nannofossil and nannofossil oozes with minor (10%-25%) amounts of clay, diatoms, radiolarians and sponge spicules. Carbonate content (80%-90%).	Pleistocene	7	0,5	1,3	
108	662	B	36,2	100,7	1 1B	Foraminifer-nannofossil and nannofossil oozes with minor (10%-25%) amounts of clay, diatoms, radiolarians and sponge spicules. Carbonate content (80%-90%).	Pleistocene	7	0,6	1,4	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
108	662	A	96,2	154,64	1	1C	Nannofossil ooze, with minor amounts of clay, diatoms, radiolarians, sponge spicules, and foraminifers. Siliceous nannofossil ooze interbedded with nannofossil ooze. Carbonate content (75%-90%).	Pleistocene-late Pliocene	7	1,3	2,6
108	662	B	100,7	151,2	1	1C	Nannofossil ooze, with minor amounts of clay, diatoms, radiolarians, sponge spicules, and foraminifers. Carbonate content (75%-90%).	Pleistocene-late Pliocene	7	1,4	2,5
108	662	A	154,64	203	1	1D	Nannofossil and foraminifer-nannofossil oozes, with minor (0%-10%) amounts of clay, radiolarians, and diatoms. Carbonate content (85%-90%).	Pliocene	7	2,6	3,7
108	662	B	151,2	188,2	1	1D	Nannofossil and foraminifer-nannofossil oozes, with minor (0%-10%) amounts of clay, radiolarians, and diatoms. Carbonate content (85%-90%).	Pliocene	7	2,5	3,4
108	663	A	0	147,2	1		Nannofossil ooze and foraminifer-nannofossil oozes. A muddy, siliceous-nannofossil ooze is also scattered in the upper 100 m of the section. Carbonate content (75% top-90% base).	Pleistocene-late Pliocene	7	0,0	2,8
108	663	B	0	152	1		Nannofossil ooze and foraminifer-nannofossil oozes. A muddy, siliceous-nannofossil ooze is also scattered in the upper 100 m of the section. Carbonate content (75% top-90% base).	Pleistocene-late Pliocene	7	0,0	2,9
108	664	A	19,4	28,9	1	1A	Clay- and foraminifer-bearing nannofossil ooze interbedded with foraminifer-nannofossil and muddy nannofossil oozes. Nannofossil ooze interrupted by scattered sandy foraminifer turbidites or contourites, ranging from 2-10 cm thick. Carbonate content (60%-90%).	Pleistocene	10	0,6	0,8
108	664	B	0	52,7	1	1A	Clay- and foraminifer-bearing nannofossil ooze interbedded with foraminifer-nannofossil and muddy nannofossil oozes. Nannofossil ooze interrupted by scattered sandy foraminifer turbidites or contourites, ranging from 2-10 cm thick. Carbonate content (60%-90%).	Pleistocene	10	0,0	1,2
108	664	C	0	49,1	1	1A	Clay- and foraminifer-bearing nannofossil ooze interbedded with foraminifer-nannofossil and muddy nannofossil oozes. Nannofossil ooze interrupted by scattered sandy foraminifer turbidites or contourites, ranging from 2-10 cm thick. Carbonate content (60%-90%).	Pleistocene	10	0,0	1,2

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
108	664	D	0	51,1	1	1A	Clay- and foraminifer-bearing nannofossil ooze interbedded with foraminifer-nannofossil and muddy nannofossil oozes. Nannofossil ooze interrupted by scattered sandy foraminifer turbidites or contourites, ranging from 2-10 cm thick. Carbonate content (60%-90%).	Pleistocene	10	0,0	1,2
108	664	B	52,7	247	1	1B	Mud and foraminifer-bearing nannofossil oozes. Muddy nannofossil and foraminifer-nannofossil oozes are scattered. Carbonate content (85%-90%).	Pleistocene-Pliocene	10	1,2	7,3
108	664	C	49,1	61,2	1	1B	Mud and foraminifer-bearing nannofossil oozes. Muddy nannofossil and foraminifer-nannofossil oozes are scattered. Carbonate content (85%-90%).	Pleistocene	10	1,2	2,3
108	664	D	51,1	296,8	1	1B	Mud and foraminifer-bearing nannofossil oozes. Muddy nannofossil and foraminifer-nannofossil oozes are scattered. Carbonate content (85%-90%).	Pleistocene-late Miocene	10	1,2	8,6
108	665	A	0	69,4	1	1	Nannofossil and foraminifer-nannofossil oozes. Muddy nannofossil, siliceous nannofossil, and diatom oozes are scattered in the upper section. Carbonate content (30%-80%).	Holocene-early Pliocene	66	0,0	3,8
108	665	B	0	72,5	1	1	Nannofossil and foraminifer-nannofossil oozes. Muddy nannofossil, siliceous nannofossil, and diatom oozes are scattered in the upper section. Carbonate content (30%-80%).	Holocene-early Pliocene	66	0,0	4,4
108	665	A	69,4	97,9	2	2	Silt-bearing clay generally barren of microfossils.	Early Pliocene	66	3,8	10,7
108	665	B	72,5	82	2	2	Silt-bearing clay generally barren of microfossils.	Early Pliocene	66	4,4	6,8
108	667	A	0	20,3	1	1	Foraminifer-nannofossil ooze; clay-bearing, foraminifer-nannofossil ooze; and foraminifer-bearing, and muddy nannofossil ooze. Carbonate content (20%-80%).	Pleistocene (0-1.5 Ma)	55	0,0	1,5
108	667	B	0	19	1	1	Foraminifer-nannofossil ooze; clay-bearing, foraminifer-nannofossil ooze; and foraminifer-bearing, and muddy nannofossil ooze. Carbonate content (20%-80%).	Pleistocene (0-1.5 Ma)	55	0,0	1,4
108	667	A	20,3	66,5	2	2	Clay-bearing, foraminifer-bearing nanno-fossil ooze and foraminifer-nannofossil ooze. Carbonate content (60%-80%).	Early Pleistocene-early Pliocene (1.5-4 Ma)	55	1,5	4,0
108	667	B	19	78,1	2	2	Clay-bearing, foraminifer-bearing nanno-fossil ooze and foraminifer-nannofossil ooze. Carbonate content (60%-80%).	Early Pleistocene-early Pliocene (1.5-4 Ma)	55	1,4	4,6
108	667	A	66,5	124,3	3	3	Foraminifer-nannofossil ooze; clay-bearing, foraminifer-bearing nannofossil ooze; and clay-bearing nannofossil ooze interbedded with muddy nannofossil ooze. Carbonate content (70%-80%).	Early Pliocene-Late Miocene	55	4,0	8,8

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
108	667	B	78,1	122,9	3	Foraminifer-nannofossil ooze; clay-bearing, foraminifer-bearing nannofossil ooze; and clay-bearing nannofossil ooze interbedded with muddy nannofossil ooze. Carbonate content (70%-80%).	Early Pliocene-Late Miocene	55	4,6	8,6	
108	667	A	124,3	148,3	4	Slump deposit with a extremely distorted mixture of sediments similar in lithology to Unit III. Blocks and pebbles of nannofossil silty clay.	Late Miocene	55	8,8	12,0	
108	667	B	122,9	139,6	4	Slump deposit with a extremely distorted mixture of sediments similar in lithology to Unit III. Blocks and pebbles of nannofossil silty clay.	Late Miocene	55	8,6	10,8	
108	667	A	148,3	198,8	5	Mud-bearing nannofossil ooze; foraminifer-bearing, clayey nannofossil ooze; and foraminifer-bearing nannofossil ooze interbedded with nannofossil-bearing silty clay. Carbonate content (less than 20% to greater than 80%).	Middle Miocene	55	13,9	16,1	
108	667	A	198,8	376,5	6	Silt-bearing, clay-bearing nannofossil ooze; muddy nannofossil ooze; and clayey nannofossil chalk interbedded with silt-bearing, siliceous-bearing, clay-bearing, nannofossil ooze; nannofossil-bearing, siliceous-bearing claystone; and silt-bearing siliceous clay. Carbonate content (~0% to greater than 80%).	Middle Miocene-late Oligocene	55	16,1	23,8	
108	668	A	0	8,8	1	Foraminifer-bearing, muddy nannofossil ooze; mud-bearing, foraminifer-bearing nannofossil ooze; and muddy foraminifer-nannofossil ooze.	Late Pleistocene	60	0,0	0,5	
108	668	B	0	31,2	1	Foraminifer-bearing, muddy nannofossil ooze; mud-bearing, foraminifer-bearing nannofossil ooze; and muddy foraminifer-nannofossil ooze.	Holocene-Late Pliocene	60	0,0	2,0	
110	672	A	0	123,3	1	Calcareous clay and mud; common ash layers; traces of biogenic silica; Calcium carbonate content: 5%-65%	Early Pleistocene-late Miocene (upper part)	81	0,4	6,5	
110	672	A	123,3	170,8	2 2A	Mudstone and claystone; few ash layers; Calcium carbonate content: 0%-15%	Late Miocene (lower part) and indeterminant	81	6,5	12,6	
110	672	A	170,8	208,8	2 2B	Claystone and siliceous claystone; common ash layers; Calcium carbonate content: 0%	Indeterminant and early Miocene	81	12,6	19,8	
110	672	A	208,8	227,8	2 2C	Claystone and mudstone with laminated silt intervals; Calcium carbonate content: 0%	Indeterminant	81	19,8	26,2	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
110	672	A	227,8	332,3	3	Interbedded claystone, calcareous mudstone, and marl; frequent thin quartz silt laminae; Calcium carbonate content: 0%-65%	Late Oligocene (lower part) to early Oligocene	81	26,2	36,6	
110	672	A	332,3	455,8	4	Interbedded claystone, laminated calcareous mudstone, micritic limestone and calcarenite; glauconitic sand layers; Calcium carbonate content: 0%-90%	Early Oligocene/late Eocene to middle Eocene	81	36,6	44,4	
110	672	A	455,8	493,8	5	Siliceous (radiolarian) claystone; shaly in lower part; Calcium carbonate content: <10%	Middle Eocene (lowermost)-early Eocene	81	44,4	54,2	
114	698	A	0	4,25	1	Ice-rafted detritus (gravel)	Pliocene?	90	0,0	4,8	
114	698	A	4,25	42	2 2A	Nannofossil ooze	Early middle-early Eocene	90	4,8	53,8	
114	698	A	42	146,5	2 2B	Nannofossil chalk	Early Eocene-late Maestrichtian	90	53,8	73,3	
114	698	A	146,5	190,5	2 2C	Limestone	Late Cretaceous	90	73,3	83,0	
114	698	A	200	200,15	3 3A	Sandy mud	Late Cretaceous or older	90	84,9	84,9	
114	698	A	209,5	219,28	3 3B	Basalt	Late Cretaceous or older	90	86,8	88,8	
114	698	A	219,28	237	3 3C	Hematite-rich claystone	Late Cretaceous or older	90	88,8	92,3	
114	699	A	0	85,7	1	Siliceous and siliceous clayey oozes	Quarternary-early Miocene	75	0,0	20,8	
114	699	A	85,7	142	2 2A	Nannofossil diatom ooze and diatom mud	Early Miocene-late Oligocene	75	20,8	26,5	
114	699	A	142	233,6	2 2B	Nannofossil siliceous ooze	Early Oligocene-late Oligocene	75	26,5	32,9	
114	699	A	233,6	235,6	3	Gravel	Early Oligocene	75	32,9	33,1	
114	699	A	243,1	335,4	4	Siliceous nannofossil ooze and nannofossil ooze	Early Oligocene-middle/late Eocene	75	33,7	38,0	
114	699	A	335,4	375,2	5 5A	Nannofossil chalk	Middle/late Eocene	75	38,0	46,1	
114	699	A	382,6	487,9	5 5B	Nannofossil chalk	Middle Eocene-early Eocene	75	46,7	54,2	
114	699	A	496,6	516,3	6	Claystone and nannofossil chalk	Late Paleocene	75	56,2	60,8	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
114	700 B		0	26	1		Diatom ooze	Quarternary-late Pliocene	73	0,0	1,3
114	700 B		26,4	45,4	2		Nannofossil ooze	Middle Eocene	73	1,3	44,2
114	700 B		45,4	168,9	3	3A	Nannofossil chalk	Middle to early Eocene	73	44,2	52,7
114	700 B		168,9	228,5	3	3B	Micritic nannofossil chalk	Early Eocene	73	52,7	56,9
114	700 B		228,5	319	4		Micritic, indurated nannofossil chalk	Late Paleocene-early Paleocene	73	56,9	64,3
114	700 B		319	359	5	5A	Homogenous micritic nannofossil-bearing limestone	Early Paleocene-Maestrichtian	73	64,3	71,2
114	700 B		359	441,5	5	5B	Alternating micritic limestone alternating with clay-bearing/clayey micritic limestone.	Maestrichtian-Campanian	73	71,2	74,9
114	700 B		441,5	489	5	5C	Ash-bearing alternating micritic limestone alternating with clay-bearing/clayey micritic limestone and/or ash layers.	Campanian, Santonian, and Turonian	73	74,9	88,3
114	701 A		0	74,8	1	1A	Alternating horizons of ash-bearing diatom ooze, mud-bearing diatom ooze, muddy diatom ooze, and diatom ooze.	Quarternary-Late Pliocene	50	0,0	3,2
114	701 B		70	147,5	1	1A	Alternating horizons of ash-bearing diatom ooze, mud-bearing diatom ooze, clay-bearing diatom ooze, and diatom ooze.	Late early Pliocene-late Miocene	50	2,5	5,9
114	701 B		147,5	174,76	1	1B	Monospecific assemblage of a tropical to temperate diatom, <i>Bruniopsis mirabilis</i> .	Late Miocene	50	5,9	6,3
114	701 B		174,76	183,71	1	1C	Moderately to well-sorted sand and gravel of varying lithologies, including quartz, volcanic glass, agglutinated benthic foraminifers, biotite, metapelites, iron-coated schists, pumice, and mud clasts.	Late Miocene	50	6,3	6,4
114	701 B		183,71	203	1	1D	Diatom ooze and clay-bearing diatom ooze.	Late Miocene	50	6,4	8,9
114	701 C		0	145,5	1	1A	Diatom ooze, mud-bearing diatom ooze, muddy diatom ooze, and ash-bearing diatom ooze.	Quarternary-Late Miocene	50	0,0	5,8
114	701 C		145,5	160,9	1	1B	Diatom ooze dominated by <i>Bruniopsis mirabilis</i> .	Late Miocene	50	5,8	6,4
114	701 C		160,9	167,96	1	1C	Sand/gravel consisting of quartz, volcanic glass, agglutinated benthic foraminifers, biotite, metapelites, iron-coated schists, pumice, and mud clasts.	Late Miocene	50	6,4	6,6
114	701 C		167,96	243,8	1	1D	Clay- or mud-bearing diatom ooze.	Late-middle Miocene	50	6,6	12,6
114	701 C		243,8	395,15	2	2A	Diatom-bearing mud/clay, siliceous-bearing mud/clay, and siliceous mud/clay. Throughout the subunit, fine-grained terrigenous clays dominate over biogenic siliceous components.	Middle-early Miocene	50	12,6	32,9

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
114	701	C	395,15	452,8	2	2B	Nannofossil ooze, siliceous ooze, and clay.	Late Eocene to early Oligocene	50	32,9	39,9
114	701	C	452,8	481,3	3		White to light brownish gray indurated nannofossil chalk with intermittent dark brown staining of carbonate, probably by iron manganese oxides.	Middle Eocene	50	39,9	43,4
114	701	C	481,3	481,47	4		Highly-altered amygdaloidal olivine basalt, dark blue gray in color, that represents oceanic crustal basement or possibly an interbedded sill.	?	50	43,4	43,4
114	702	A	0	6,65	1	1A	Diatom mud.	Quaternary-late Miocene	60	0,0	6,3
114	702	A	6,65	22,15	1	1B	Nannofossil-diatom ooze	Late Miocene	60	6,3	9,5
114	702	A	22,15	33,1	2	2A	Nannofossil ooze	Late Miocene	60	9,5	39,6
114	702	B	0	6,15	1	1A	Diatom mud	Quaternary-late Miocene	60	0,0	5,8
114	702	B	6,15	21,1	1	1B	Nannofossil-diatom ooze	Late Miocene	60	5,8	9,5
114	702	B	21,1	32,8	2	2A	Nannofossil ooze	Late Miocene-late Eocene	60	9,5	39,5
114	702	B	32,8	202,45	2	2B	Nannofossil chalk	Late Eocene-early Eocene	60	39,5	53,9
114	702	B	202,45	294,3	2	2C	Indurated nannofossil chalk	Early Eocene-late Paleocene	60	53,9	61,6
114	703	A	0	71,4	1	1A	Siliceous foraminifer-bearing nannofossil ooze	Quaternary-Latest early Oligocene	90	0,0	30,8
114	703	A	71,4	162,4	1	1B	Foraminifer-bearing nannofossil ooze	Latest early Oligocene-latest middle Eocene	90	30,8	40,4
114	703	A	162,4	228,9	1	1C	Nannofossil ooze with mass flow deposits	Middle Eocene	90	40,4	44,8
114	703	A	228,9	365,9	1	1D	Nannofossil chalk with mass flow deposits	Middle Eocene(?)	90	44,8	62,9
114	703	A	364	365,65	2		Porphyritic basalt or basaltic andesite	?	90	62,6	62,9
114	704	A	0	102,2	1	1A	Diatom ooze to calcareous-bearing diatom ooze, calcareous diatom ooze, diatom calcareous ooze, calcareous ooze, and nannofossil ooze.	Pleistocene-Latest Pliocene	90	0,0	1,7
114	704	B	0	101,7	1	1A	Diatom-foraminifer ooze, calcareous diatom ooze, calcareous siliceous ooze, and diatom ooze. Minor lithologies include nannofossil ooze and spots of pure diatom ooze (i.e., "diatom cotton")	Pleistocene-latest Pliocene	90	0,0	1,7

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
114	704	A	102,2	178,2	1	1B	Calcareous ooze, including siliceous calcareous ooze, siliceous-bearing calcareous ooze, and siliceous-bearing nannofossil ooze.	Late Pliocene	90	1,7	3,0
114	704	B	101,7	175,7	1	1B	Siliceous-bearing calcareous ooze, siliceous calcareous ooze, and siliceous-bearing nannofossil ooze.	Late Pliocene	90	1,7	2,9
114	704	A	178,2	222,2	1	1C1	Diatom-bearing calcareous ooze	Early late Pliocene-early Pliocene	90	3,0	5,2
114	704	B	175,7	219	1	1C1	Siliceous-bearing calcareous ooze and siliceous calcareous ooze.	Early late Pliocene-early Pliocene	90	2,9	4,9
114	704	A	222,2	254,2	1	1C2	Siliceous calcareous ooze to diatom-bearing nannofossil ooze.	Early Pliocene-late Miocene	90	5,2	5,9
114	704	B	219	251,7	1	1C2	Ash-bearing clayey diatom ooze.	Early late Pliocene-latest Miocene	90	4,9	5,9
114	704	B	251,7	451,2	1	1D	Nannofossil ooze. Mean carbonate content is about 80%.	Latest Miocene-latest early Miocene	90	5,9	16,5
114	704	B	451,2	491,2	2	2A	Nannofossil chalk and micrite-bearing nannofossil chalk.	Late early Miocene	90	16,5	17,7
114	704	B	491,2	671,7	2	2B	Indurated micritic nannofossil chalk.	Late Early Miocene-early Oligocene	90	17,7	28,8
149	897	A	0	55,2	1		Nannofossil ooze, nannofossil clay, silty clay to clayey silt, silt and fine sand.	Pleistocene-early Pliocene	125	0,0	1,5
149	897	C	0	292	1		Nannofossil ooze, nannofossil clay, silty clay to clayey silt, silt and fine sand.	Pleistocene-early Pliocene	125	0,0	4,1
149	897	C	292	301,2	2	2A	Nannofossil claystone, claystone, nannofossil silty claystone, siltstone and sandstone	Early Pliocene-late Miocene	125	4,1	7,8
149	897	C	301,2	359,8	2	2B	Nannofossil chalk, calcareous claystone, claystone, silty claystone to clayey siltstone, siltstone and sandstone	Late Miocene-early Miocene	125	7,8	24,6
149	897	C	359,8	619,7	2	2C	Nannofossil chalk, claystone, silty claystone to clayey siltstone, siltstone and sandstone	Early Miocene-middle Eocene	125	24,6	48,2
149	897	D	596	622,9	2	2C	Nannofossil chalk, claystone, silty claystone to clayey siltstone, siltstone and sandstone	Early Miocene-middle Eocene	125	43,6	48,9
149	897	C	619,7	639,4	3	3A	Claystone	Uncertain	125	48,2	52,7
149	897	D	622,9	645,2	3	3A	Claystone	Uncertain	125	48,9	54,0

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
149	897	C	639,4	648,7	3	3B	Clayey conglomerate, clayey sandstone, and sandy silty claystone	Uncertain	125	52,7	54,8
149	897	D	645,2	655,2	3	3B	Clayey conglomerate, clayey sandstone, and sandy silty claystone	Uncertain	125	54,0	56,3
149	897	C	648,7	677,5	4		63% basement lithologies, 37% sedimentary (sandstone, dolomite, limestone, and calcareous claystone)	Late Aptian-Hauterivian	125	54,8	61,3
149	897	D	655,2	693,8	4		63% basement lithologies, 37% sedimentary (sandstone, dolomite, limestone, and calcareous claystone)	Late Aptian-Hauterivian	125	56,3	65,1
149	898	A	0	163,35	1		Nannofossil ooze, nannofossil clay, clay, silty clay to clayey silt, silt and fine sand.	Pleistocene-Middle Miocene	126	0,0	12,2
149	898	A	163,35	172,17	2	2A	Nannofossil ooze, nannofossil clay, clay, and silty clay to clayey silt	Middle Miocene	126	12,2	13,5
149	898	A	172,17	339,72	2	2B	Nannofossil chalk, nannofossil claystone, claystone, silty claystone to clayey siltstone, siltstone and sandstone	Middle Miocene-late Oligocene	126	13,5	29,9
149	899	A	81,5*	131,65	1		Nannofossil ooze, nannofossil clay, clay, silty clay to clayey silt, silt and fine sand	Pliocene	126	2,1	3,4
149	899	A	131,65	206,6	2	2A	Nannofossil ooze, nannofossil clay, clay, silty clay, silt and sand	Early Pliocene-middle Miocene	126	3,4	13,8
149	899	A	206,6	228,6	2	2B	Calcareous claystone, claystone, silty claystone to clayey siltstone, siltstone and sandstone	Middle Miocene-late Eocene	126	13,8	17,7
149	899	B	230,5	360,6	2	2B	Calcareous claystone, claystone, silty claystone to clayey siltstone, siltstone and sandstone	Middle Miocene-late Eocene	126	18,1	38,0
149	899	B	360,6	364,6	3	3A	Claystone	Late Eocene	126	38,0	66,7
149	899	B	364,6	369,9	3	3B	Clayey conglomerate, clayey sandstone, and sandy silty claystone	Late Cretaceous	126	66,7	69,5
149	899	B	369,9	484,2	4	4A	Calcareous claystone, claystone, serpentinite breccia, and basalt clasts	Pre-Late Cretaceous-early Aptian	126	69,5	121,4
149	899	B	484,2	557,92	4	4B	Serpentinite, gabbro, siltstone, and claystone	Early Aptian-Barremian	126	121,4	131,9
149	900	A	0	67,2	1	1A	Nannofossil ooze, nannofossil clay, clay, silt and fine sand	Pleistocene-late Pliocene	128	0,0	2,5
149	900	A	67,2	96	1	1B	Nannofossil ooze, nannofossil clay, and clay	Late Pliocene-late Miocene	128	2,5	5,6
149	900	A	96	181,5	1	1C	Nannofossil ooze, nannofossil clay, clay, silt and fine sand	Late Miocene-late early Miocene	128	5,6	14,8

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
149	900	A	181,5	234,3	2	2A	Nannofossil chalk, nannofossil claystone, claystone, silty claystone to clayey siltstone, siltstone and fine sandstone	Early Miocene	128	14,8	19,8
149	900	A	234,3	748,9	2	2B	Nannofossil chalk, nannofossil claystone, claystone, calcareous silty claystone to clayey siltstone, silty claystone to clayey siltstone, silt and fine sandstone	Early Miocene-Paleocene	128	19,8	53,4
152	918	A	0	71,1	1	1A	Interbedded, soupy, fining-upward ferromagnesian-foraminifer sand with firmer silt, clay; ice-rafted debris (IRD)	Holocene-Pleistocene	55	0,0	1,7
152	918	B	0	71,1	1	1A	Interbedded, soupy, fining-upward ferromagnesian-foraminifer sand with firmer silt, clay; ice-rafted debris (IRD)	Holocene-Pleistocene	55	0,0	1,7
152	918	C	0	71,1	1	1A	Interbedded, soupy, fining-upward ferromagnesian-foraminifer sand with firmer silt, clay; ice-rafted debris (IRD)	Holocene-Pleistocene	55	0,0	1,7
152	918	A	71,1	236	1	1B	Interbedded turbidites with silt, fossils and IRD	Pliocene	55	1,7	2,9
152	918	A	236	317,8	1	1C	Silt enriched in IRD (diamicton)	Pliocene	55	2,9	3,4
152	918	A	317,8	543,6	1	1D	Silt with IRD	Early Pliocene-late Miocene	55	3,4	6,8
152	918	D	317,8	543,6	1	1D	Silt with IRD	Early Pliocene-late Miocene	55	3,4	6,8
152	918	D	543,6	600	1	1E	Silt	Late Miocene	55	6,8	9,4
152	918	D	600	806,5	2		Nannofossil chalk, silt, silt with nannofossils, micritic hardgrounds	Late Miocene-early Miocene	55	9,4	18,8
152	918	D	806,5	1011,6	3	3A	Turbiditic sands interbedded with silt and nannofossil chalk	Early Miocene-late Oligocene	55	18,8	26,7
152	918	D	1011,6	1108,2	3	3B	Coarse, massive siliciclastic turbidites	Late Oligocene	55	26,7	31,1
152	918	D	1108,2	1157,9	4		Volcanic silt, nannofossil chalk	Middle Eocene	55	31,1	49,3
152	918	D	1157,9	1189,4	5		Volcanic silt, clay and glauconitic sandstone	Early Eocene	55	49,3	57,0
152	918	D	1189,4	1204,4	6		Highly weathered lava flows	Unknown	55	57,0	60,6
154	925	A	0	30	1	1A	Nannofossil clay with foraminifers alternating with clayey nannofossil ooze with foraminifers. Carbonate content: 34%	Holocene-early Pliocene	76	0,0	1,0
154	925	B	0	30	1	1A	Nannofossil clay with foraminifers alternating with clayey nannofossil ooze with foraminifers. Carbonate content: 34%	Holocene-early Pliocene	76	0,0	1,0
154	925	C	0	30	1	1A	Nannofossil clay with foraminifers alternating with clayey nannofossil ooze with foraminifers. Carbonate content: 34%	Holocene-early Pliocene	76	0,0	1,0
154	925	D	0	30	1	1A	Nannofossil clay with foraminifers alternating with clayey nannofossil ooze with foraminifers. Carbonate content: 34%	Holocene-early Pliocene	76	0,0	1,0
154	925	E	0	30	1	1A	Nannofossil clay with foraminifers alternating with clayey nannofossil ooze with foraminifers. Carbonate content: 34%	Holocene-early Pliocene	76	0,0	1,0

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	925	A	30	135	1	1B	Nannofossil ooze with varying amounts of foraminifers and a steadily increasing clay content toward the top of the subunit. Carbonate content: 61%	Holocene-early Pliocene	76	1,0	4,6
154	925	B	30	135	1	1B	Nannofossil ooze with varying amounts of foraminifers and a steadily increasing clay content toward the top of the subunit. Carbonate content: 61%	Holocene-early Pliocene	76	1,0	4,6
154	925	C	30	135	1	1B	Nannofossil ooze with varying amounts of foraminifers and a steadily increasing clay content toward the top of the subunit. Carbonate content: 61%	Holocene-early Pliocene	76	1,0	4,6
154	925	D	30	135	1	1B	Nannofossil ooze with varying amounts of foraminifers and a steadily increasing clay content toward the top of the subunit. Carbonate content: 61%	Holocene-early Pliocene	76	1,0	4,6
154	925	E	30	135	1	1B	Nannofossil ooze with varying amounts of foraminifers and a steadily increasing clay content toward the top of the subunit. Carbonate content: 61%	Holocene-early Pliocene	76	1,0	4,6
154	925	A	135	210	2	2A	Nannofossil ooze with clay alternating with clayey nannofossil ooze. Carbonate content: 71%	Early Pliocene-middle Miocene	76	4,6	7,2
154	925	B	135	210	2	2A	Nannofossil ooze with clay alternating with clayey nannofossil ooze. Carbonate content: 71%	Early Pliocene-middle Miocene	76	4,6	7,2
154	925	C	135	210	2	2A	Nannofossil ooze with clay alternating with clayey nannofossil ooze. Carbonate content: 71%	Early Pliocene-middle Miocene	76	4,6	7,2
154	925	D	135	210	2	2A	Nannofossil ooze with clay alternating with clayey nannofossil ooze. Carbonate content: 71%	Early Pliocene-middle Miocene	76	4,6	7,2
154	925	A	210	260	2	2B	Nannofossil ooze. Carbonate content: 77%	Early Pliocene-middle Miocene	76	7,2	9,0
154	925	B	210	260	2	2B	Nannofossil ooze. Carbonate content: 77%	Early Pliocene-middle Miocene	76	7,2	9,0
154	925	C	210	260	2	2B	Nannofossil ooze. Carbonate content: 77%	Early Pliocene-middle Miocene	76	7,2	9,0
154	925	D	210	260	2	2B	Nannofossil ooze. Carbonate content: 77%	Early Pliocene-middle Miocene	76	7,2	9,0
154	925	A	260	290	2	2C	Nannofossil ooze with distinct bands of nannofossil ooze with clay. Carbonate content: 66%	Early Pliocene-middle Miocene	76	9,0	10,3
154	925	B	260	290	2	2C	Nannofossil ooze with distinct bands of nannofossil ooze with clay. Carbonate content: 66%	Early Pliocene-middle Miocene	76	9,0	10,3
154	925	C	260	290	2	2C	Nannofossil ooze with distinct bands of nannofossil ooze with clay. Carbonate content: 66%	Early Pliocene-middle Miocene	76	9,0	10,3

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	925	D	260	290	2	2C	Nannofossil ooze with distinct bands of nannofossil ooze with clay. Carbonate content: 66%	Early Pliocene-middle Miocene	76	9,0	10,3
154	925	A	290	700	3	3A	Upper section include nannofossil chalks with foraminifers and foraminifer nannofossil chalks to nannofossil chalks with clay and foraminifer nannofossil chalks with clay. Lower section include nannofossil chalks and nannofossil chalks with clay and foraminifers to nannofossil chalks with clay and clayey nannofossil chalks. Carbonate content: 70%	Middle Miocene-early Eocene	76	10,3	30,5
154	925	B	290	700	3	3A	Upper section include nannofossil chalks with foraminifers and foraminifer nannofossil chalks to nannofossil chalks with clay and foraminifer nannofossil chalks with clay. Lower section include nannofossil chalks and nannofossil chalks with clay and foraminifers to nannofossil chalks with clay and clayey nannofossil chalks. Carbonate content: 70%	Middle Miocene-early Eocene	76	10,3	30,5
154	925	C	290	700	3	3A	Upper section include nannofossil chalks with foraminifers and foraminifer nannofossil chalks to nannofossil chalks with clay and foraminifer nannofossil chalks with clay. Lower section include nannofossil chalks and nannofossil chalks with clay and foraminifers to nannofossil chalks with clay and clayey nannofossil chalks. Carbonate content: 70%	Middle Miocene-early Eocene	76	10,3	30,5
154	925	D	290	700	3	3A	Upper section include nannofossil chalks with foraminifers and foraminifer nannofossil chalks to nannofossil chalks with clay and foraminifer nannofossil chalks with clay. Lower section include nannofossil chalks and nannofossil chalks with clay and foraminifers to nannofossil chalks with clay and clayey nannofossil chalks. Carbonate content: 70%	Middle Miocene-early Eocene	76	10,3	30,5
154	925	A	700	930	3	3B	Limestone lithologies that vary similarly on meter scales to the chalk lithologies of Subunit IIIA. Carbonate content: 64%	Middle Miocene-early Eocene	76	30,5	40,8
154	925	B	700	930	3	3B	Limestone lithologies that vary similarly on meter scales to the chalk lithologies of Subunit IIIA. Carbonate content: 64%	Middle Miocene-early Eocene	76	30,5	40,8
154	925	C	700	930	3	3B	Limestone lithologies that vary similarly on meter scales to the chalk lithologies of Subunit IIIA. Carbonate content: 64%	Middle Miocene-early Eocene	76	30,5	40,8
154	925	D	700	930	3	3B	Limestone lithologies that vary similarly on meter scales to the chalk lithologies of Subunit IIIA. Carbonate content: 64%	Middle Miocene-early Eocene	76	30,5	40,8
154	926	A	0	30	1	1A	Alternating beds of nannofossil clay with foraminifers, and clay with nannofossils. Carbonate content: 30%	Holocene-early Pliocene	73	0,0	1,1
154	926	B	0	30	1	1A	Alternating beds of nannofossil clay with foraminifers, and clay with nannofossils. Carbonate content: 30%	Holocene-early Pliocene	73	0,0	1,1

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	926	C	0	30	1	1A	Alternating beds of nannofossil clay with foraminifers, and clay with nannofossils. Carbonate content: 30%	Holocene-early Pliocene	73	0,0	1,1
154	926	A	30	130	1	1B	Interbedded nannofossil ooze with clay and foraminifers, and nannofossil clay with foraminifers. Carbonate content: gradual increase with depth to about 70%	Holocene-early Pliocene	73	1,1	4,7
154	926	B	30	130	1	1B	Interbedded nannofossil ooze with clay and foraminifers, and nannofossil clay with foraminifers. Carbonate content: gradual increase with depth to about 70%	Holocene-early Pliocene	73	1,1	4,7
154	926	C	30	130	1	1B	Interbedded nannofossil ooze with clay and foraminifers, and nannofossil clay with foraminifers. Carbonate content: gradual increase with depth to about 70%	Holocene-early Pliocene	73	1,1	4,7
154	926	A	130	190	2	2A	Interbedded nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content fluctuates between 50% and 80%	Early Pliocene-middle Miocene	73	4,7	8,1
154	926	B	130	190	2	2A	Interbedded nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content fluctuates between 50% and 80%	Early Pliocene-middle Miocene	73	4,7	8,1
154	926	C	130	190	2	2A	Interbedded nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content fluctuates between 50% and 80%	Early Pliocene-middle Miocene	73	4,7	8,1
154	926	A	190	240	2	2B	Interbedded foraminifer nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content fluctuates between 50% and 80%.	Early Pliocene-middle Miocene	73	8,1	11,9
154	926	B	190	240	2	2B	Interbedded foraminifer nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content fluctuates between 50% and 80%.	Early Pliocene-middle Miocene	73	8,1	11,9
154	926	C	190	240	2	2B	Interbedded foraminifer nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content fluctuates between 50% and 80%.	Early Pliocene-middle Miocene	73	8,1	11,9
154	926	A	240	370	3	3A	Nannofossil chalk with clay to clayey nannofossil chalk. Carbonate content ranges from 60% to 80%.	Middle Miocene-late Oligocene	73	11,9	20,2
154	926	B	240	370	3	3A	Nannofossil chalk with clay to clayey nannofossil chalk. Carbonate content ranges from 60% to 80%.	Middle Miocene-late Oligocene	73	11,9	20,2
154	926	C	240	370	3	3A	Nannofossil chalk with clay to clayey nannofossil chalk. Carbonate content ranges from 60% to 80%.	Middle Miocene-late Oligocene	73	11,9	20,2
154	926	A	370	460	3	3B	Similar lithologies to Subunit IIIA, with the addition of uup to 15% biosiliceous fragments (predominantly radiolarians, with minor amounts of diatoms and silicoflagellates).	Middle Miocene-late Oligocene	73	20,2	23,5
154	926	B	370	460	3	3B	Similar lithologies to Subunit IIIA, with the addition of uup to 15% biosiliceous fragments (predominantly radiolarians, with minor amounts of diatoms and silicoflagellates).	Middle Miocene-late Oligocene	73	20,2	23,5

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	926	C	370	460	3	3B	Similar lithologies to Subunit IIIA, with the addition of up to 15% biosiliceous fragments (predominantly radiolarians, with minor amounts of diatoms and silicoflagellates.	Middle Miocene-late Oligocene	73	20,2	23,5
154	926	A	460	605	3	3C	Similar lithologies to Subunit IIIA, but with a smaller amount of foraminifers in the carbonate-rich layers found in the uppermost subunit.	Middle Miocene-late Oligocene	73	23,5	29,8
154	926	B	460	605	3	3C	Similar lithologies to Subunit IIIA, but with a smaller amount of foraminifers in the carbonate-rich layers found in the uppermost subunit.	Middle Miocene-late Oligocene	73	23,5	29,8
154	926	C	460	605	3	3C	Similar lithologies to Subunit IIIA, but with a smaller amount of foraminifers in the carbonate-rich layers found in the uppermost subunit.	Middle Miocene-late Oligocene	73	23,5	29,8
154	927	A	0	60	1	1A	Alternating beds of foraminifer nannofossil ooze with clay, and clayey nannofossil mixed sediment with iron oxides. Carbonate content: 37%	Holocene-early Pliocene	72	0,0	1,6
154	927	B	0	60	1	1A	Alternating beds of foraminifer nannofossil ooze with clay, and clayey nannofossil mixed sediment with iron oxides. Carbonate content: 37%	Holocene-early Pliocene	72	0,0	1,6
154	927	C	0	60	1	1A	Alternating beds of foraminifer nannofossil ooze with clay, and clayey nannofossil mixed sediment with iron oxides. Carbonate content: 37%	Holocene-early Pliocene	72	0,0	1,6
154	927	A	60	152	1	1B	Nannofossil ooze with clay and foraminifers interbedded with clayey nannofossil ooze. Carbonate content gradually increases downhole from about 40% to 70%.	Holocene-early Pliocene	72	1,6	4,7
154	927	B	60	152	1	1B	Nannofossil ooze with clay and foraminifers interbedded with clayey nannofossil ooze. Carbonate content gradually increases downhole from about 40% to 70%.	Holocene-early Pliocene	72	1,6	4,7
154	927	C	60	152	1	1B	Nannofossil ooze with clay and foraminifers interbedded with clayey nannofossil ooze. Carbonate content gradually increases downhole from about 40% to 70%.	Holocene-early Pliocene	72	1,6	4,7
154	927	A	152	210	2	2A	Nannofossil ooze with foraminifers and clay interbedded with clayey nannofossil ooze. Carbonate content: 69%	Early Pliocene-middle Miocene	72	4,7	7,7
154	927	B	152	210	2	2A	Nannofossil ooze with foraminifers and clay interbedded with clayey nannofossil ooze. Carbonate content: 69%	Early Pliocene-middle Miocene	72	4,7	7,7
154	927	C	152	210	2	2A	Nannofossil ooze with foraminifers and clay interbedded with clayey nannofossil ooze. Carbonate content: 69%	Early Pliocene-middle Miocene	72	4,7	7,7
154	927	A	210	283	2	2B	Interbedded foraminifer nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content: 69%	Early Pliocene-middle Miocene	72	7,7	13,0

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	927	B	210	283	2	2B	Interbedded foraminifer nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content: 69%	Early Pliocene-middle Miocene	72	7,7	13,0
154	927	C	210	283	2	2B	Interbedded foraminifer nannofossil ooze with clay and clayey nannofossil ooze. Carbonate content: 69%	Early Pliocene-middle Miocene	72	7,7	13,0
154	927	A	283	313	3		Nannofossil chalk with foraminifers alternating with clayey nannofossil chalk. Carbonate content varies between 65% and 82%.	Middle Miocene-early Miocene	72	13,0	16,4
154	928	A	0	40	1	1A	Alternating beds of nannofossil clay with iron oxides and nannofossil clayey mixed sediment with foraminifers. Carbonate content: 30%	Holocene-early Pliocene	68	0,0	1,4
154	928	B	0	40	1	1A	Alternating beds of nannofossil clay with iron oxides and nannofossil clayey mixed sediment with foraminifers. Carbonate content: 30%	Holocene-early Pliocene	68	0,0	1,4
154	928	C	0	40	1	1A	Alternating beds of nannofossil clay with iron oxides and nannofossil clayey mixed sediment with foraminifers. Carbonate content: 30%	Holocene-early Pliocene	68	0,0	1,4
154	928	A	40	130	1	1B	Clayey nannofossil mixed sediment with clayey nannofossil ooze. Carbonate content: 47% (increases with depth).	Holocene-early Pliocene	68	1,4	4,8
154	928	B	40	130	1	1B	Clayey nannofossil mixed sediment with clayey nannofossil ooze. Carbonate content: 47% (increases with depth).	Holocene-early Pliocene	68	1,4	4,8
154	928	C	40	130	1	1B	Clayey nannofossil mixed sediment with clayey nannofossil ooze. Carbonate content: 47% (increases with depth).	Holocene-early Pliocene	68	1,4	4,8
154	928	A	130	160	2	2A	Nannofossil ooze with foraminifers and clay interbedded nannofossil clay. Lack of disseminated and nodular pyrite. Carbonate content: 57% (ranging from 10% to 80%).	Early Pliocene-middle Miocene	68	4,8	7,3
154	928	B	130	160	2	2A	Nannofossil ooze with foraminifers and clay interbedded nannofossil clay. Lack of disseminated and nodular pyrite. Carbonate content: 57% (ranging from 10% to 80%).	Early Pliocene-middle Miocene	68	4,8	7,3
154	928	C	130	160	2	2A	Nannofossil ooze with foraminifers and clay interbedded nannofossil clay. Lack of disseminated and nodular pyrite. Carbonate content: 57% (ranging from 10% to 80%).	Early Pliocene-middle Miocene	68	4,8	7,3
154	928	A	160	220	2	2B	Nannofossil ooze with foraminifers and clay interbedded nannofossil clay. Lack of disseminated and nodular pyrite. Clay mineralogy change toward more kaolinite. Carbonate content: 57% (ranging from 10% to 80%).	Early Pliocene-middle Miocene	68	7,3	14,9

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	928	B	160	220	2	2B	Nannofossil ooze with foraminifers and clay interbedded nannofossil clay. Lack of disseminated and nodular pyrite. Clay mineralogy change toward more kaolinite. Carbonate content: 57% (ranging from 10% to 80%).	Early Pliocene-middle Miocene	68	7,3	14,9
154	928	C	160	220	2	2B	Nannofossil ooze with foraminifers and clay interbedded nannofossil clay. Lack of disseminated and nodular pyrite. Clay mineralogy change toward more kaolinite. Carbonate content: 57% (ranging from 10% to 80%).	Early Pliocene-middle Miocene	68	7,3	14,9
154	928	A	223	272	3	3A	Nannofossil chalk with foraminifers and clay alternating with thin beds of clayey nannofossil chalk. Carbonate content: 69%	Late early Miocene	68	15,3	19,7
154	928	B	223	272	3	3A	Nannofossil chalk with foraminifers and clay alternating with thin beds of clayey nannofossil chalk. Carbonate content: 69%	Late early Miocene	68	15,3	19,7
154	928	A	272	350	3	3B	Clayey nannofossil chalk interbedded with nannofossil clay. Lower carbonate content than Subunit IIIA.	Early Miocene	68	19,7	24,1
154	928	B	272	350	3	3B	Clayey nannofossil chalk interbedded with nannofossil clay. Lower carbonate content than Subunit IIIA.	Early Miocene	68	19,7	24,1
154	928	A	350	532	3	3C	Interbedded clayey nannofossil chalk with foraminifers and nannofossil clayey mixed sediment. Carbonate content: 66%	Late to early Oligocene	68	24,1	31,5
154	928	B	350	532	3	3C	Interbedded clayey nannofossil chalk with foraminifers and nannofossil clayey mixed sediment. Carbonate content: 66%	Late to early Oligocene	68	24,1	31,5
154	929	A	0	45	1	1A	Clay with nannofossils alternating with nannofossil clay with foraminifers. Carbonate content: 24%	Holocene-early Pliocene	68	0,0	1,4
154	929	B	0	45	1	1A	Clay with nannofossils alternating with nannofossil clay with foraminifers. Carbonate content: 24%	Holocene-early Pliocene	68	0,0	1,4
154	929	C	0	45	1	1A	Clay with nannofossils alternating with nannofossil clay with foraminifers. Carbonate content: 24%	Holocene-early Pliocene	68	0,0	1,4
154	929	D	0	45	1	1A	Clay with nannofossils alternating with nannofossil clay with foraminifers. Carbonate content: 24%	Holocene-early Pliocene	68	0,0	1,4
154	929	A	45	128	1	1B	Clayey nannofossil ooze with varying amounts of foraminifers and a nannofossil clayey mixed sediment. Carbonate content: 39%	Holocene-early Pliocene	68	1,4	4,4
154	929	B	45	128	1	1B	Clayey nannofossil ooze with varying amounts of foraminifers and a nannofossil clayey mixed sediment. Carbonate content: 39%	Holocene-early Pliocene	68	1,4	4,4
154	929	C	45	128	1	1B	Clayey nannofossil ooze with varying amounts of foraminifers and a nannofossil clayey mixed sediment. Carbonate content: 39%	Holocene-early Pliocene	68	1,4	4,4

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	929	D	45	128	1	1B	Clayey nannofossil ooze with varying amounts of foraminifers and a nannofossil clayey mixed sediment. Carbonate content: 39%	Holocene-early Pliocene	68	1,4	4,4
154	929	A	128	164	2	2A	Clayey nannofossil ooze with foraminifers and nannofossil clay. Carbonate content: 43%	Early Pliocene-early Miocene	68	4,4	6,4
154	929	B	128	164	2	2A	Clayey nannofossil ooze with foraminifers and nannofossil clay. Carbonate content: 43%	Early Pliocene-early Miocene	68	4,4	6,4
154	929	C	128	164	2	2A	Clayey nannofossil ooze with foraminifers and nannofossil clay. Carbonate content: 43%	Early Pliocene-early Miocene	68	4,4	6,4
154	929	A	164	230	2	2B	Clay or claystone and clay with nannofossils or claystone with nannofossils. Carbonate content: <20%	Early Pliocene-early Miocene	68	6,4	13,6
154	929	B	164	230	2	2B	Clay or claystone and clay with nannofossils or claystone with nannofossils. Carbonate content: <20%	Early Pliocene-early Miocene	68	6,4	13,6
154	929	C	164	230	2	2B	Clay or claystone and clay with nannofossils or claystone with nannofossils. Carbonate content: <20%	Early Pliocene-early Miocene	68	6,4	13,6
154	929	A	230	334	3	3A	Claystone alternating with nannofossil clayey mixed sedimentary rock and clayey nannofossil chalk. Carbonate content: 59%	Early Pliocene-early Miocene	68	13,6	23,8
154	929	E	230	334	3	3A	Claystone alternating with nannofossil clayey mixed sedimentary rock and clayey nannofossil chalk. Carbonate content: 59%	Early Pliocene-early Miocene	68	13,6	23,8
154	929	A	334	440	3	3B	Clayey nannofossil chalk alternating with nannofossil claystone. Carbonate content: 67%	Early Pliocene-early Miocene	68	23,8	29,5
154	929	E	334	440	3	3B	Clayey nannofossil chalk alternating with nannofossil claystone. Carbonate content: 67%	Early Pliocene-early Miocene	68	23,8	29,5
154	929	A	440	520	3	3C	Nannofossil chalk and clayey nannofossil mixed sedimentary rock. Carbonate content: 58%	Early Pliocene-early Miocene	68	29,5	33,7
154	929	E	440	520	3	3C	Nannofossil chalk and clayey nannofossil mixed sedimentary rock. Carbonate content: 58%	Early Pliocene-early Miocene	68	29,5	33,7
154	929	A	520	670	3	3D	Clayey nannofossil limestone and clayey nannofossil mixed sedimentary rock. Carbonate content: 56%	Early Pliocene-early Miocene	68	33,7	47,1
154	929	E	520	670	3	3D	Clayey nannofossil limestone and clayey nannofossil mixed sedimentary rock. Carbonate content: 56%	Early Pliocene-early Miocene	68	33,7	47,1
154	929	A	670	735	3	3E	Nannofossil claystone and claystone with nannofossils. Carbonate content: 28%	Early Pliocene-early Miocene	68	47,1	50,0
154	929	E	670	735	3	3E	Nannofossil claystone and claystone with nannofossils. Carbonate content: 28%	Early Pliocene-early Miocene	68	47,1	50,0

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
154	929	A	735	809	3	3F	Clayey nannofossil mixed sedimentary rock with calcareous fragments and, to a lesser extent, clayey nannofossil limestone. Carbonate content: >50%	Early Pliocene-early Miocene	68	50,0	55,1
154	929	E	735	809	3	3F	Clayey nannofossil mixed sedimentary rock with calcareous fragments and, to a lesser extent, clayey nannofossil limestone. Carbonate content: >50%	Early Pliocene-early Miocene	68	50,0	55,1
155	930	B	0	0,55	1		Calcareous clay containing foraminifers and nannofossils from 0 to 0,42 mbsf, overlying a nannofossil- and foraminifer-rich clay at 0,55 mbsf. Carbonate content: Slightly more than 30% in the upper 0,42 m but generally less than 4,5 % below.	Holocene	87	0,000	0,005
155	930	D	0	0,55	1		Calcareous clay containing foraminifers and nannofossils from 0 to 0,42 mbsf, overlying a nannofossil- and foraminifer-rich clay at 0,55 mbsf. Carbonate content: Slightly more than 30% in the upper 0,42 m but generally less than 4,5 % below.	Holocene	87	0,000	0,005
155	930	A	0,55	9,64	2	2A	Silty clay with common black color banding and slight bioturbation and color mottling. Carbonate content: <3%	Holocene-late Pleistocene	87	0,005	0,014
155	930	B	0,55	9,64	2	2A	Silty clay with common black color banding and slight bioturbation and color mottling. Carbonate content: <3%	Holocene-late Pleistocene	87	0,005	0,014
155	930	C	0,55	9,64	2	2A	Silty clay with common black color banding and slight bioturbation and color mottling. Carbonate content: <3%	Holocene-late Pleistocene	87	0,005	0,014
155	930	D	0,55	9,64	2	2A	Silty clay with common black color banding and slight bioturbation and color mottling. Carbonate content: <3%	Holocene-late Pleistocene	87	0,005	0,014
155	930	A	9,64	43	2	2B	Silty clay with thin laminae of silt and beds of silty sand.	Holocene-late Pleistocene	87	0,014	0,019
155	930	B	9,64	43	2	2B	Silty clay with thin laminae of silt and beds of silty sand.	Holocene-late Pleistocene	87	0,014	0,019
155	930	C	9,64	43	2	2B	Silty clay with thin laminae of silt and beds of silty sand.	Holocene-late Pleistocene	87	0,014	0,019
155	930	D	9,64	43	2	2B	Silty clay with thin laminae of silt and beds of silty sand.	Holocene-late Pleistocene	87	0,014	0,019
155	930	A	43	66,65	2	2C	Silty clay.	Holocene-late Pleistocene	87	0,019	0,027
155	930	B	43	66,65	2	2C	Silty clay.	Holocene-late Pleistocene	87	0,019	0,027
155	930	C	43	66,65	2	2C	Silty clay.	Holocene-late Pleistocene	87	0,019	0,027
155	930	D	43	66,65	2	2C	Silty clay.	Holocene-late Pleistocene	87	0,019	0,027

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	930	A	66,65	188,42	2	2D	Silty clay and occurrence of silt laminations and interbedded silt and sand layers.	Holocene-late Pleistocene	87	0,027	0,037
155	930	B	66,65	188,42	2	2D	Silty clay and occurrence of silt laminations and interbedded silt and sand layers.	Holocene-late Pleistocene	87	0,027	0,037
155	930	C	66,65	188,42	2	2D	Silty clay and occurrence of silt laminations and interbedded silt and sand layers.	Holocene-late Pleistocene	87	0,027	0,037
155	930	D	66,65	188,42	2	2D	Silty clay and occurrence of silt laminations and interbedded silt and sand layers.	Holocene-late Pleistocene	87	0,027	0,037
155	930	B	188,42	242,9	3		Sandy mud with subrounded quartz grains up to fine pebble size (5-10 mm) and plant debris (188,42 to 202 mbsf). Laminated clay with faint mottling (202-206,76 mbsf) lies above a 1-m-thick layer of fine sand containing well-rounded mud clasts (1-10 cm in size). Massive clay from 207,13 mbsf to 241,09 mbsf. Muddy sand at the lowermost 1,70 m of this unit.	Late Pleistocene	87	0,037	0,040
155	930	C	188,42	242,9	3		Sandy mud with subrounded quartz grains up to fine pebble size (5-10 mm) and plant debris (188,42 to 202 mbsf). Laminated clay with faint mottling (202-206,76 mbsf) lies above a 1-m-thick layer of fine sand containing well-rounded mud clasts (1-10 cm in size). Massive clay from 207,13 mbsf to 241,09 mbsf. Muddy sand at the lowermost 1,70 m of this unit.	Late Pleistocene	87	0,037	0,040
155	931	A	0	0,57	1		Calcareous clay containing foraminifers and nannofossils. Iron crust interval at 0,53-0,56 mbsf. Carbonate content: 50%	Holocene	82	0,000	0,003
155	931	C	0	0,63	1		Calcareous clay containing foraminifers and nannofossils. Carbonate content: 50%	Holocene	82	0,000	0,004
155	931	A	0,57	6,7	2	2A	Slightly to moderately bioturbated, mottle, and color-banded clay.	Holocene-late Pleistocene	82	0,003	0,020
155	931	A	6,7	27,5	2	2B	Silty clay	Holocene-late Pleistocene	82	0,020	0,027
155	931	B	6,7	27,5	2	2B	Silty clay	Holocene-late Pleistocene	82	0,020	0,027
155	931	A	27,5	199,8	2	2C	Silty clay	Holocene-late Pleistocene	82	0,027	0,048
155	931	B	27,5	199,8	2	2C	Silty clay	Holocene-late Pleistocene	82	0,027	0,048
155	931	B	199,8	349,25	3		Muddy sand, silty clay, and clay	Late Pleistocene	82	0,048	0,430
155	931	B	349,25	349,46	4		Intensively bioturbated foraminifer-nannofossil-rich clay. Carbonate content: Approximately 20%	Middle Pleistocene	82	0,430	0,431

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	931	B	349,46	360,87	5	5A	Faintly mottled and color banded silty clay	Middle Pleistocene	82	0,431	0,473
155	931	B	360,87	418,1	5	5B	Silty clay containing silt laminae and thin silt beds.	Middle Pleistocene	82	0,473	0,492
155	932	A	0	0,7	1		Calcareous clay with abundant foraminifers and nannofossils, and is moderately bioturbated and slightly color mottled. Carbonate content ranging from 42% (upper 35 cm) to 15% (at the base of the unit).	Holocene	84	0,000	0,004
155	932	B	0	0,7	1		Calcareous clay with abundant foraminifers and nannofossils, and is moderately bioturbated and slightly color mottled. Carbonate content ranging from 42% (upper 35 cm) to 15% (at the base of the unit).	Holocene	84	0,000	0,004
155	932	A	0,7	47	2	2A	Silty clay that grades downhole to silty clay at 25 mbsf.	Holocene-late Pleistocene	84	0,004	0,043
155	932	B	0,7	47	2	2A	Silty clay that grades downhole to silty clay at 25 mbsf.	Holocene-late Pleistocene	84	0,004	0,043
155	932	A	47	168,3	2	2B	Silty clay that grades downhole to clay at approximately 95 mbsf.	Holocene-late Pleistocene	84	0,043	0,060
155	932	B	47	168,3	2	2B	Silty clay that grades downhole to clay at approximately 95 mbsf.	Holocene-late Pleistocene	84	0,043	0,060
155	933	A	0	0,52	1		Nannofossil-foraminifer clay overlying a diagenetic, iron-rich crust marking the base of Unit I. Carbonate content: 33% (near the base of Unit I).	Holocene	83	0,000	0,000
155	933	A	0,52	14,37	2	2A	Clay with distinct black mottles that subtly changes downhole to silty clay with mottles and black color banding by 6,25 mbsf. Carbonate content ranges from 0,3% to 10,6% (average 4,9%).	Holocene-late Pleistocene	83	0,000	0,026
155	933	A	14,37	97,62	2	2B	Silty clay with numerous silt laminae and beds of silt and sand.	Holocene-late Pleistocene	83	0,026	0,049
155	933	A	97,62	167,31	3		Massive silty clay with mud clasts. Recovery relatively incomplete.	Late Pleistocene	83	0,049	0,428
155	933	A	167,31	179,03	4	4A	Silty clay that is moderately bioturbated, mottled, and has small millimeter-scale blebs of hydrotroilite.	Middle Pleistocene	83	0,428	0,487
155	933	A	179,03	249,72	4	4B	Silty clay with numerous silt laminae and fine sand beds.	Middle Pleistocene	83	0,487	0,504
155	935	A	0	0,65	1		Foraminifer-nannofossil-rich clay.	Holocene	82	0,000	0,001
155	935	A	0,65	5,94	2	2A	Slightly to moderately bioturbated, mottled clay.	Holocene-late Pleistocene	82	0,001	0,010

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	935	A	5,94	21,2	2	2B	Silty clay with silt laminae.	Holocene-late Pleistocene	82	0,010	0,017
155	935	A	21,2	43,4	2	2C	Silty clay with silt laminae and thin beds of silt and fine sand.	Holocene-late Pleistocene	82	0,017	0,020
155	935	A	43,4	98,5	2	2D	Silty clay with laminae and 1- to 15-cm-thick beds of silt and fine sand.	Holocene-late Pleistocene	82	0,020	0,024
155	935	A	98,5	151,67	3	3A	Thick beds of well-sorted medium sand, intercalated with silty clay.	Late Pleistocene	82	0,024	0,033
155	935	A	151,67	199,3	3	3B	Clay with laminations and thin beds of silt and fine sand with a massive medium to coarse sand in Core 21X. Intercalated clay, silty clay, and fine sand containing organic detritus (170,40-171,15 mbsf). A moderately bioturbated and mottled silty clay (173,40-178,87 mbsf). Massive, medium to coarse sand containing 1- to 3-cm-diameter clasts of foraminifer-nannofossil-rich and -bearing mud, and a 3-cm-diameter, well-rounded clasts of fine sandstone.	Late Pleistocene	82	0,033	0,041
155	935	A	199,3	276,3	4	4	Thin intervals of contorted beds with a sequence of silty clay. Carbonate-rich clasts (32.7% carbonate) occur at the interval 218,6-225,75 mbsf.	Late Pleistocene	82	0,041	0,215
155	935	A	276,3	286	5	5	Foraminifer-nannofossil-rich and -bearing clay. Carbonate content: 26,8%	Middle Pleistocene	82	0,215	0,232
155	935	A	286	310,32	6	6A	Silty clay with silt laminae.	Middle Pleistocene	82	0,232	0,370
155	935	A	310,32	363	6	6B	Silty clay with laminare and 1- to 3-cm-thick beds of silt and fine sand.	Middle Pleistocene	82	0,370	0,396
155	935	A	363	369,03	6	6C	Silty clay with "wispy" discontinuous laminae and distorted and discontinuous thin beds of silt.	Middle Pleistocene	82	0,396	0,397
155	936	A	0	0,96	1	1	Calcareous clay with abundant foraminifers and nannofossils. Carbonate content: 42% (at 0,27 mbsf) that sharply decreases toward approximately 6% (at 0,75 mbsf).	Holocene Holocene-late	83	0,000	0,002
155	936	A	0,96	6,97	2	2A	Clay that grades downhole to silty clay at 5 mbsf.	Pleistocene	83	0,002	0,010
155	936	A	6,97	72,1	2	2B	Silty clay with occurrence of numerous discrete laminae and beds of silt, below 41 mbsf, by beds of silt to fine sand.	Holocene-late Pleistocene	83	0,010	0,016
155	936	A	72,1	106,3	3	3A	Interbeds of black sandy clay; thin to thick, normally graded sand beds; and thick beds of sand and muddy sand with rare to abundant mud clasts.	Late Pleistocene	83	0,016	0,020
155	936	A	106,3	117	3	3B	Clay with silt laminae and thin beds of silt to fine sand.	Late Pleistocene	83	0,020	0,026

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	936	A	117	154,5	3	3C	Silty clay with graded silt and sand beds.	Late Pleistocene	83	0,026	0,042
155	936	A	154,5	294,16	4		Predominantly silty, commonly sandy, clay.	Late Pleistocene	83	0,042	0,142
155	936	A	294,16	307,35	5	5A	Silty clay with abundant silt laminae and thin to medium beds of silt to fine sand.	Middle Pleistocene	83	0,142	0,171
155	936	A	307,35	377,4	5	5B	Fine to medium sand with zones of high concentrations of organic detritus.	Middle Pleistocene	83	0,171	0,195
155	936	A	377,4	387,52	5	5C	Silty clay with abundant silt and fine sand laminae and beds.	Middle Pleistocene	83	0,195	0,241
155	936	A	387,52	405,69	5	5D	Silty clay to sandy mud of variable lithologies and colors, and mud clasts of various sizes.	Middle Pleistocene	83	0,241	0,305
155	936	A	405,69	415,34	6	6A	Silty clay with rare silt laminae.	Middle Pleistocene	83	0,305	0,354
155	936	A	415,34	426,2	6	6B	Clay to silty clay with numerous silt laminae and common beds of silt to fine sand.	Middle Pleistocene	83	0,354	0,379
155	937	A	0	0,85	1		Nannofossil-foraminifer clay and foraminifer-nannofossil clay, which grades down to nannossil-rich clay or nannofossil-rich silty clay. Carbonate content: 47% (at 0,2 mbsf) to 7,9% (at 0,48 mbsf).	Holocene	93	0,000	0,005
155	937	B	0	0,85	1		Nannofossil-foraminifer clay and foraminifer-nannofossil clay, which grades down to nannossil-rich clay or nannofossil-rich silty clay. Carbonate content: 47% (at 0,2 mbsf) to 7,9% (at 0,48 mbsf).	Holocene	93	0,000	0,005
155	937	C	0	0,85	1		Nannofossil-foraminifer clay and foraminifer-nannofossil clay, which grades down to nannossil-rich clay or nannofossil-rich silty clay. Carbonate content: 47% (at 0,2 mbsf) to 7,9% (at 0,48 mbsf).	Holocene	93	0,000	0,005
155	937	D	0	0,85	1		Nannofossil-foraminifer clay and foraminifer-nannofossil clay, which grades down to nannossil-rich clay or nannofossil-rich silty clay. Carbonate content: 47% (at 0,2 mbsf) to 7,9% (at 0,48 mbsf).	Holocene	93	0,000	0,005
155	937	B	0,85	10,5	2	2A	Terrigenous clay that grades downhole to silty clay.	Holocene-late Pleistocene	93	0,005	0,015
155	937	C	0,85	10,5	2	2A	Terrigenous clay that grades downhole to silty clay.	Holocene-late Pleistocene	93	0,005	0,015
155	937	D	0,85	10,5	2	2A	Terrigenous clay that grades downhole to silty clay.	Holocene-late Pleistocene	93	0,005	0,015
155	937	B	10,5	34,73	2	2B	Homogenous silty clay.	Holocene-late Pleistocene	93	0,015	0,026

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	937	C	10,5	34,73	2	2B	Homogenous silty clay.	Holocene-late Pleistocene	93	0,015	0,026
155	937	D	10,5	34,73	2	2B	Homogenous silty clay.	Holocene-late Pleistocene	93	0,015	0,026
155	937	B	34,73	93,51	2	2C	Faintly mottled silty clay.	Holocene-late Pleistocene	93	0,026	0,030
155	937	C	34,73	93,51	2	2C	Faintly mottled silty clay.	Holocene-late Pleistocene	93	0,026	0,030
155	937	D	34,73	93,51	2	2C	Faintly mottled silty clay.	Holocene-late Pleistocene	93	0,026	0,030
155	937	B	93,51	180,2	2	2D	Faintly mottled silty clay with laminae and beds of silt and very fine sand.	Holocene-late Pleistocene	93	0,030	0,035
155	937	C	93,51	180,2	2	2D	Faintly mottled silty clay with laminae and beds of silt and very fine sand.	Holocene-late Pleistocene	93	0,030	0,035
155	937	D	93,51	180,2	2	2D	Faintly mottled silty clay with laminae and beds of silt and very fine sand.	Holocene-late Pleistocene	93	0,030	0,035
155	938	A	0	0,44	1		Foraminifer-nannofossil clay overlying a diagenetic iron-rich crust. Carbonate content: 33% (at 0.08 mbsf)	Holocene	92	0,000	0,003
155	938	B	0	0,44	1		Foraminifer-nannofossil clay overlying a diagenetic iron-rich crust. Carbonate content: 33% (at 0.08 mbsf)	Holocene	92	0,000	0,003
155	938	A	0,44	10,55	2	2A	Clay with distinct black mottles and burrows.	Holocene-late Pleistocene	92	0,003	0,018
155	938	B	0,44	10,55	2	2A	Clay with distinct black mottles and burrows.	Holocene-late Pleistocene	92	0,003	0,018
155	938	A	10,55	71,84	2	2B	Silty clay with irregularly spaced silt laminae and a few beds that grade from very fine sand at the base.	Holocene-late Pleistocene	92	0,018	0,023
155	938	B	10,55	71,84	2	2B	Silty clay with irregularly spaced silt laminae and a few beds that grade from very fine sand at the base.	Holocene-late Pleistocene	92	0,018	0,023
155	938	A	71,84	117,45	2	2C	Silty clay with numerous silt laminae and beds of silt and very fine sand.	Holocene-late Pleistocene	92	0,023	0,025
155	938	B	71,84	117,45	2	2C	Silty clay with numerous silt laminae and beds of silt and very fine sand.	Holocene-late Pleistocene	92	0,023	0,025
155	938	A	117,45	170,53	2	2D	Silty clay that contains approximately one silt or sandy-silt laminae every two meters.	Holocene-late Pleistocene	92	0,025	0,043
155	938	B	117,45	170,53	2	2D	Silty clay that contains approximately one silt or sandy-silt laminae every two meters.	Holocene-late Pleistocene	92	0,025	0,043
155	938	A	170,53	233,73	2	2E	Laminae and beds of silt.	Holocene-late Pleistocene	92	0,043	0,047

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	938	B	170,53	233,73	2	2E	Laminae and beds of silt.	Holocene-late Pleistocene	92	0,043	0,047
155	938	A	233,73	306,35	2	2F	Silty clay with irregularly spaced laminae and beds of silt.	Holocene-late Pleistocene	92	0,047	0,050
155	938	B	233,73	306,35	2	2F	Silty clay with irregularly spaced laminae and beds of silt.	Holocene-late Pleistocene	92	0,047	0,050
155	939	A	0	0,68	1		Foraminifer-nannofossil clay (0-0.32 mbsf in Hole 939A; 0-0.38 mbsf in Hole 939B; 0-0.20 mbsf in Hole 939C) overlying a iron-rich crust (5 cm thick) that in turn overlies a nannofossil rich clay. Carbonate content decreases sharply below the iron-rich crust (3.6% near the base of Unit I).	Holocene	91	0,000	0,011
155	939	B	0	0,68	1		Foraminifer-nannofossil clay (0-0.32 mbsf in Hole 939A; 0-0.38 mbsf in Hole 939B; 0-0.20 mbsf in Hole 939C) overlying a iron-rich crust (5 cm thick) that in turn overlies a nannofossil rich clay. Carbonate content decreases sharply below the iron-rich crust (3.6% near the base of Unit I).	Holocene	91	0,000	0,011
155	939	C	0	0,6	1		Foraminifer-nannofossil clay (0-0.32 mbsf in Hole 939A; 0-0.38 mbsf in Hole 939B; 0-0.20 mbsf in Hole 939C) overlying a iron-rich crust (5 cm thick) that in turn overlies a nannofossil rich clay. Carbonate content decreases sharply below the iron-rich crust (3.6% near the base of Unit I).	Holocene	91	0,000	0,010
155	939	A	0,68	24,45	2	2A	Clay or silty clay with intense to slight bioturbation and scattered hydrotroilite nodules and bands.	(?)Holocene-late Pleistocene	91	0,011	0,013
155	939	B	0,68	23	2	2A	Clay or silty clay with intense to slight bioturbation and scattered hydrotroilite nodules and bands.	(?)Holocene-late Pleistocene	91	0,011	0,013
155	939	A	24,45	54,48	2	2B	Silty clay with thin laminae and beds of silt.	(?)Holocene-late Pleistocene	91	0,013	0,017
155	939	B	24,45	44,23	2	2B	Silty clay with thin laminae and beds of silt.	(?)Holocene-late Pleistocene	91	0,013	0,015
155	939	A	54,48	78,73	2	2C	Moderately burrowed silty clay and a short interval of color-banded and slightly silty clay alternating with numerous laminae and beds of silt.	(?)Holocene-late Pleistocene	91	0,017	0,020
155	939	B	44,23	66,17	2	2C	Moderately burrowed silty clay and a short interval of color-banded and slightly silty clay alternating with numerous laminae and beds of silt.	(?)Holocene-late Pleistocene	91	0,015	0,018
155	939	A	78,73	102,7	2	2D	Silty clay with greater concentration of silt laminae and beds.	(?)Holocene-late Pleistocene	91	0,020	0,023

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	939	B	66,17	81,5	2	2D	Silty clay with greater concentration of silt laminae and beds.	(?)Holocene-late Pleistocene	91	0,018	0,020
155	939	B	81,5	99,4	2	2E	Structureless silty clay.	(?)Holocene-late Pleistocene	91	0,020	0,023
155	940	A	0	0,24	1		Moderately bioturbated foraminifer-nannofossil clay; four thin, indurated, diagenetic, iron-rich clay horizons.	Holocene	87	0,000	0,001
155	940	A	0,24	9,5	2	2A	Moderately bioturbated, silty clay with black color mottling.	Late Pleistocene	87	0,001	0,010
155	940	A	9,5	31,48	2	2B	Terrigenous silty clay containing silt laminae and thin silt beds.	Late Pleistocene	87	0,010	0,012
155	940	A	31,48	34,39	2	2C	Slightly bioturbated, color-banded silty clay.	Late Pleistocene	87	0,012	0,012
155	940	A	34,39	55,71	2	2D	Terrigenous silty clay with silt laminae and 1- to 3-cm-thick beds of silt and fine sand.	Late Pleistocene	87	0,012	0,013
155	940	A	55,71	60,01	2	2E	Deformed silty clay with truncated laminae and wisps of silt.	Late Pleistocene	87	0,013	0,013
155	940	A	60,01	142,6	2	2F	Terrigenous silty clay with silt laminae and 1- to 3-cm-thick silt beds.	Late Pleistocene	87	0,013	0,017
155	940	A	142,6	210,57	2	2G	Silty clay with silt laminae and less than 4-cm-thick beds of silt and very fine sand.	Late Pleistocene	87	0,017	0,021
155	940	A	210,57	236,14	2	2H	Silty clay with silt laminae and less than 10-cm-thick beds of very fine and fine sand.	Late Pleistocene	87	0,021	0,022
155	940	A	236,14	248,6	2	2J	Silty clay with deformed silt beds and truncated laminae.	Late Pleistocene	87	0,022	0,023
155	942	A	0	0,66	1		Foraminifer-nannofossil clay (0.00-0.41 mbsf) that grades into nannofossil-rich clay (0.41-0.63 mbsf), a faintly laminated, 3-cm-thick interval (0.63-0.66 mbsf) containing diagenetic iron oxyhydroxides.	Holocene	95	0,000	0,006
155	942	B	0	0,81	1		Foraminifer-nannofossil clay (0.00-0.41 mbsf) that grades into nannofossil-rich clay (0.41-0.63 mbsf), a faintly laminated, 3-cm-thick interval (0.63-0.66 mbsf) containing diagenetic iron oxyhydroxides.	Holocene	95	0,000	0,007
155	942	C	0	0,74	1		Foraminifer-nannofossil clay (0.00-0.41 mbsf) that grades into nannofossil-rich clay (0.41-0.63 mbsf), a faintly laminated, 3-cm-thick interval (0.63-0.66 mbsf) containing diagenetic iron oxyhydroxides.	Holocene	95	0,000	0,006
155	942	A	0,66	23,85	2	2A	Clay with distinct black mottles and burrows, grading to silty clay by 4 mbsf.	(?)Holocene-late Pleistocene	95	0,006	0,055
155	942	B	0,66	23,85	2	2A	Clay with distinct black mottles and burrows, grading to silty clay by 4 mbsf.	(?)Holocene-late Pleistocene	95	0,006	0,055
155	942	C	0,66	23,85	2	2A	Clay with distinct black mottles and burrows, grading to silty clay by 4 mbsf.	(?)Holocene-late Pleistocene	95	0,006	0,055

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	942	A	23,85	28,1	2	2B	Silty clay interbedded with sharp-based beds of very fine sand bases and silt tops, and some silt beds and laminae.	(?)Holocene-late Pleistocene	95	0,055	0,080
155	942	B	23,85	28,1	2	2B	Silty clay interbedded with sharp-based beds of very fine sand bases and silt tops, and some silt beds and laminae.	(?)Holocene-late Pleistocene	95	0,055	0,080
155	942	C	23,85	28,1	2	2B	Silty clay interbedded with sharp-based beds of very fine sand bases and silt tops, and some silt beds and laminae.	(?)Holocene-late Pleistocene	95	0,055	0,080
155	942	A	28,1	28,8	3	3A	Foraminifer-nannofossil-rich silty clay. Carbonate content: 14.2%	(?)Holocene-late Pleistocene	95	0,080	0,085
155	942	B	28,1	28,8	3	3A	Foraminifer-nannofossil-rich silty clay. Carbonate content: 14.2%	(?)Holocene-late Pleistocene	95	0,080	0,085
155	942	A	28,8	40,18	3	3B	Bioturbated silty clay, mottled by hydrotroilite, interbedded with silt laminae and beds of silt and very fine sand.	(?)Holocene-late Pleistocene	95	0,085	0,102
155	942	B	28,8	40,18	3	3B	Bioturbated silty clay, mottled by hydrotroilite, interbedded with silt laminae and beds of silt and very fine sand.	(?)Holocene-late Pleistocene	95	0,085	0,102
155	942	A	40,18	41,8	4	4A	Foraminifer-nannofossil-bearing clay and foraminifer-nannofossil-rich clay. Carbonate content ranges from 8.7% (upper part of Subunit IVA) to 15% (lower part of Subunit IVA).	Late Pleistocene	95	0,102	0,106
155	942	B	40,18	41,8	4	4A	Foraminifer-nannofossil-bearing clay and foraminifer-nannofossil-rich clay. Carbonate content ranges from 8.7% (upper part of Subunit IVA) to 15% (lower part of Subunit IVA).	Late Pleistocene	95	0,102	0,106
155	942	C	40,18	41,8	4	4A	Foraminifer-nannofossil-bearing clay and foraminifer-nannofossil-rich clay. Carbonate content ranges from 8.7% (upper part of Subunit IVA) to 15% (lower part of Subunit IVA).	Late Pleistocene	95	0,102	0,106
155	942	A	41,8	65,2	4	4B	Silty clay which alternates with beds of laminae of very fine sand and coarse silt. Carbonate content: 0.8%-2.0%	Late Pleistocene	95	0,106	0,126
155	942	B	41,8	65,2	4	4B	Silty clay which alternates with beds of laminae of very fine sand and coarse silt. Carbonate content: 0.8%-2.0%	Late Pleistocene	95	0,106	0,126
155	942	C	41,8	65,2	4	4B	Silty clay which alternates with beds of laminae of very fine sand and coarse silt. Carbonate content: 0.8%-2.0%	Late Pleistocene	95	0,106	0,126
155	942	A	65,2	66,07	5		Foraminifer-nannofossil clay and foraminifer-nannofossil-rich clay	Late Pleistocene	95	0,126	0,128
155	942	B	65,2	66,07	5		Foraminifer-nannofossil clay and foraminifer-nannofossil-rich clay	Late Pleistocene	95	0,126	0,128
155	942	C	65,2	66,07	5		Foraminifer-nannofossil clay and foraminifer-nannofossil-rich clay	Late Pleistocene	95	0,126	0,128
155	942	A	66,07	171,28	6		Color-banded and laminated silty clay with silt laminae and a few thin silt beds.	Middle Pleistocene	95	0,128	0,150

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	942	B	66,07	171,28	6	Color-banded and laminated silty clay with silt laminae and a few thin silt beds.	Middle Pleistocene	95	0,128	0,150	
155	942	C	66,07	171,28	6	Color-banded and laminated silty clay with silt laminae and a few thin silt beds.	Middle Pleistocene	95	0,128	0,150	
155	944	A	0	0,54	1	Moderately burrowed foraminifer-nannofossil clay, and three diagenetic horizons, and a semi-indurated iron-rich crust.	Holocene	87	0,000	0,001	
155	944	B	0	0,35	1	Moderately burrowed foraminifer-nannofossil clay, and three diagenetic horizons, and a semi-indurated iron-rich crust.	Holocene	87	0,000	0,000	
155	944	D	0	0,35	1	Moderately burrowed foraminifer-nannofossil clay, and three diagenetic horizons, and a semi-indurated iron-rich crust.	Holocene	87	0,000	0,000	
155	944	A	0,54	15,38	2 2A	Clay that grades to silty clay at approximately 1.50 mbsf.	Late Pleistocene	87	0,001	0,013	
155	944	B	0,54	15,38	2 2A	Clay that grades to silty clay at approximately 1.50 mbsf.	Late Pleistocene	87	0,001	0,013	
155	944	C	0,54	15,38	2 2A	Clay that grades to silty clay at approximately 1.50 mbsf.	Late Pleistocene	87	0,001	0,013	
155	944	D	0,54	15,38	2 2A	Clay that grades to silty clay at approximately 1.50 mbsf.	Late Pleistocene	87	0,001	0,013	
155	944	A	15,38	37,42	2 2B	Silt clay with silt laminae.	Late Pleistocene	87	0,013	0,014	
155	944	B	15,38	37,42	2 2B	Silt clay with silt laminae.	Late Pleistocene	87	0,013	0,014	
155	944	C	15,38	37,42	2 2B	Silt clay with silt laminae.	Late Pleistocene	87	0,013	0,014	
155	944	D	15,38	37,42	2 2B	Silt clay with silt laminae.	Late Pleistocene	87	0,013	0,014	
155	944	A	34,72	182	2 2C	Silty clay with silt laminae and thin beds of silt, very fine, fine, and medium sand.	Late Pleistocene	87	0,014	0,023	
155	944	B	34,72	182	2 2C	Silty clay with silt laminae and thin beds of silt, very fine, fine, and medium sand.	Late Pleistocene	87	0,014	0,023	
155	944	C	34,72	182	2 2C	Silty clay with silt laminae and thin beds of silt, very fine, fine, and medium sand.	Late Pleistocene	87	0,014	0,023	
155	944	D	34,72	182	2 2C	Silty clay with silt laminae and thin beds of silt, very fine, fine, and medium sand.	Late Pleistocene	87	0,014	0,023	
155	944	A	182	191,6	2 2D	Silty clay with thin beds and laminae of silt.	Late Pleistocene	87	0,023	0,025	
155	944	B	182	191,6	2 2D	Silty clay with thin beds and laminae of silt.	Late Pleistocene	87	0,023	0,025	
155	944	C	182	191,6	2 2D	Silty clay with thin beds and laminae of silt.	Late Pleistocene	87	0,023	0,025	
155	944	D	182	191,6	2 2D	Silty clay with thin beds and laminae of silt.	Late Pleistocene	87	0,023	0,025	
155	944	A	191,6	268,7	3	Clay and silty clay.	Late Pleistocene	87	0,025	0,041	
155	944	A	268,7	293,07	4 4A	Silty clay with black color banding and moderate bioturbation.	Middle Pleistocene	87	0,041	0,046	
155	944	A	293,07	355,4	4 4B	Silty clay with numerous silt laminae and beds of silt and sand.	Middle Pleistocene	87	0,046	0,074	
155	944	A	355,4	357,53	5	Silty clay and calcareous clay. Carbonate content: 4.5%	Middle Pleistocene	87	0,074	0,077	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
155	944	A	357,53	384,2	6	Silty clay with approximately 20 laminae and thin beds of silt per meter.	Middle Pleistocene	87	0,077	0,115	
157	950	A	0	305,6	1	Thick clayey nannofossil mixed sediment and nannofossil clay turbidites, interbedded with pelagic nannofossil oozes, mixed sediments and clays. Below 150 mbsf the pelagic interbeds are all clays.	Pleistocene-middle Miocene (0-13.6 Ma)	93	0,0	13,5	
157	950	A	305,6	333	2	Massive calcarenite consisting of coarse shallow-water carbonate clasts with shallow water benthic foraminifers.	Middle Miocene (approximately 13.6-15 Ma)	93	13,5	15,4	
157	950	A	333	370	3	Red pelagic clays with interbeds of clayey nannofossil mixed sediment and zeolitized volcanic ash bands.	Middle Miocene-middle Eocene (15-47 Ma).	93	15,4	50,9	
157	950	A	370	381	4	Two depositional units of volcanoclastic siltstone and sandstone separated by clay.	Middle Eocene-early Eocene	93	50,9	61,5	
157	951	A	0	123	1 1a	Interbedded clayey nannofossil mixed sediment with interbeds of nannofossil ooze, mixed sediment, and clay. Calcium carbonate content: 40%-60%	Pleistocene-late Pliocene	92	0,0	3,7	
157	951	A	123	256	1 1b	Interbedded clay with nannofossils, thin interbeds of nannofossil ooze. Carbonate content: 10%-40%	Late Pliocene-Middle Miocene	92	3,7	8,1	
157	951	B	256	353,2	1 1b	Interbedded clay with nannofossils, thin interbeds of nannofossil ooze. Carbonate content: 10%-40%	Late Pliocene-Middle Miocene	92	7,6	12,6	
157	952	A	0	100	1 1a	Interbedded clayey nannofossil, mixed sediments with interbeds of nannofossil ooze, mixed sediment and clay. Carbonate content: 40%-60%	Pleistocene-late Pliocene	99	0,0	2,7	
157	952	A	100	380	1 1b	Interbedded clay nannofossils and clay with siliceous microfossils. Carbonate content: 10%-30%	Late Pliocene-probable middle Miocene	99	2,7	12,0	
157	952	A	380	405,5	1 1b1	Clay rip-up clasts supported in a matrix of poorly sorted sand, silt, and clay.	Middle Miocene	99	12,0	12,8	
157	952	A	405,5	425	1 1b	Interbedded clay nannofossils and clay with siliceous microfossils. Carbonate content: 10%-30%	Middle Miocene	99	12,8	13,3	
157	953	A	0	197	1	Nannofossil ooze, graded nannofossil clay-silt, foraminifer sands, lithic crystal sands and silts, volcanic ash	Holocene-late Pliocene	169	0,0	3,1	
157	953	C	197	264	2	Nannofossil ooze, graded nannofossil clay-silt, lithic crystal sandstones, and lapillistones	Late Pliocene	169	3,1	4,2	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
157	953	C	264	398	3	Nannofossil chalk, nannofossil mixed sedimentary rock, debris flows and slumped sediment sequences, graded nannofossil clay-siltstones, foraminifer sandstone, and lithic crystal sandstones and siltstones.	Early Pliocene-late Miocene	169	4,2	8,1	
157	953	C	398	504	4	4a	Nannofossil mixed sedimentary rock, nannofossil chalk, debris flows and slumped sediment sequences, graded nannofossil clay-siltstones, foraminifer sandstones, and lithic crystal sandstones and siltstones.	late Miocene-middle Miocene	169	8,1	10,1
157	953	C	504	754	4	4b	Nannofossil mixed sedimentary rock, lithic crystal sands and silts, lapillistones, nannofossil chalk, debris flows and slumped sediment sequences, graded nannofossil clay-siltstones.	late Miocene-middle Miocene	169	10,1	13,2
157	953	C	754	850	4	4c	Nannofossil mixed sedimentary rock, crystal vitric sands and silts, lapillistones, debris flows and slumped sediment sequences, graded nannofossil clay-siltstones.	Middle Miocene	169	13,2	14,1
157	953	C	850	889	5		Nannofossil mixed sedimentary rock, crystal vitric sands and silts.	Middle Miocene	169	14,1	14,6
157	953	C	889	969	6		Vesicular hyaloclastite lapillistone and sandstones interbedded with lithic crystal sandstone and minor nannofossil mixed sedimentary rock.	Middle Miocene	169	14,6	15,7
157	953	C	969	1158,7	7		Vesicular hyaloclastite tuff, lapillistones, and breccia.	Late-early Miocene	169	15,7	17,4
157	954	A	0	80	1		Nannofossil ooze, graded clayey nannofossil mixed sediments, bioclastic sands, crystal lithic sands and silts, lapillistones, volcanic ash and minor slumped sediments.	Holocene-late Pliocene	167	0,0	1,1
157	954	B	80	177	1		Nannofossil ooze, graded clayey nannofossil mixed sediments, bioclastic sands, crystal lithic sands and silts, lapillistones, volcanic ash and minor slumped sediments.	Holocene-late Pliocene	167	1,1	3,5
157	954	B	177	179	2		Lapillistones	Late Pliocene	167	3,5	3,5
157	954	B	179	408	3		Nannofossil chalk, graded clayey nannofossil mixed sedimentary rocks, crystal lithic sandstones, and thick slumped sediment sequences.	Early Pliocene-late Miocene	167	3,5	10,4
157	954	B	408	446	4		Massive basaltic breccia with hyaloclastites	Middle Miocene (14 Ma)	167	10,4	11,5
157	955	A	0	175	1	1a	Clayey nannofossil mixed sediment and ooze with foraminifers; abundant thick slumped sequences and matrix supported bioclastic debris of shallow water fauna.	Pleistocene-late Pliocene	172	0,0	3,4

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
157	955	A	175	207	1	1b	Clayey nannofossil mixed sediment and ooze with foraminifers; minor bioclastic material but an increase in clayey quartz sand and silt interbeds.	Late Pliocene-early Pliocene	172	3,4	4,0
157	955	A	207	273	2		Clayey nannofossil mixed sediment with foraminifers.	Early Pliocene-late Miocene	172	4,0	6,1
157	955	A	273	374	3		Nannofossil clay; minor clayey quartz sand and silt interbeds at the base, pyrite nodules.	Late Miocene	172	6,1	9,7
157	955	A	374	513	4	4a	From clay with nannofossils to clayey nannofossil mixed sediment; minor sand interbeds with quartz, lithic, foraminifers, and crystals; zeolitized tuffs	Late-middle Miocene	172	9,7	12,7
157	955	A	513	567	4	4b	Clayey nannofossil mixed sedimentary rock, and nannofossil claystone; vitric-lithic-crystal tuffs	Middle Miocene	172	12,7	14,0
157	955	A	567	595	5		Clayey nannofossil mixed sedimentary rock with thin interbeds of silts and foraminifer-feldspar-quartz sands.	Middle Miocene	172	14,0	14,7
157	956	A	0	37,5	1	1a	Clayey nannofossil mixed sediment and ooze, bioclastic sand	Pleistocene	172	0,0	1,3
157	956	A	37,5	76,5	1	1b	Clayey nannofossil mixed sediment, pumice lapilli, vitric ash, crystal-lithic sand	Pleistocene-late Pliocene	172	1,3	2,3
157	956	A	76,5	158	1	1c	Clayey nannofossil mixed sediment, quartz sand, quartz silt, slumped sediment.	Late Pliocene	172	2,3	3,3
157	956	B	158,1	196,9	2		Basaltic lapillistone and sand, clayey nannofossil mixed sediment.	Late Pliocene-early Pliocene	172	3,3	4,0
157	956	B	196,9	367,5	3		Clayey nannofossil mixed sediment at base, clayey nannofossil ooze toward top; thick sequence of slumed sediment.	Early Pliocene-late Miocene	172	4,0	7,6
157	956	B	367,5	517,5	4	4a	Clayey nannofossil mixed sedimentary rock, lithic crystal sandstone, lithic vitric tuff, basaltic breccia	Late-middle Miocene	172	7,6	13,7
157	956	B	522,6	564,1	4	4b	Clayey nannofossil mixed sedimentary rock, crystal lithic sandstone, crystal vitric tuff, basaltic lapillistone	Middle Miocene	172	13,8	14,0
157	956	B	564,1	704	5		Hyaloclastite tuffs and breccias with minor clayey nannofossil mixed sedimentary	Middle Miocene	172	14,0	14,9
162	983	A	0	120	1	1A	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, variable color.	Pleistocene	25	0,0	1,0
162	983	B	0	120	1	1A	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, variable color.	Pleistocene	25	0,0	1,0

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
162	983	C	0	120	1	1A	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, variable color.	Pleistocene	25	0,0	1,0
162	983	A	120	180	1	1B	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment, nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, invariant color.	Pleistocene	25	1,0	1,4
162	983	B	120	180	1	1B	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment, nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, invariant color.	Pleistocene	25	1,0	1,4
162	983	C	120	180	1	1B	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment, nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, invariant color.	Pleistocene	25	1,0	1,4
162	983	A	180	260,2	1	1C	Clay, silty clay, clayey silt/cyclic lithologic changes, terrigenous components dominant, invariant color.	Pleistocene-late Pliocene	25	1,4	1,8
162	983	B	180	260,2	1	1C	Clay, silty clay, clayey silt/cyclic lithologic changes, terrigenous components dominant, invariant color.	Pleistocene-late Pliocene	25	1,4	1,8
162	983	C	180	260,2	1	1C	Clay, silty clay, clayey silt/cyclic lithologic changes, terrigenous components dominant, invariant color.	Pleistocene-late Pliocene	25	1,4	1,8
162	984	A	0	120	1	1A	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, variable color, abundant ash layers, dropstones.	Pleistocene	15	0,0	0,9
162	984	B	120	165	1	1B	Clay, silty clay, clayey silt, clayey nannofossil mixed sediment, nannofossil ooze, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components often nearly equal, invariant color, less common ash layers, dropstones.	Pleistocene	15	0,9	1,3
162	984	C	165	279	1	1C	Clay, silty clay, clayey silt/cyclic lithologic changes, terrigenous components dominant, invariant color, rare ash layers, one dropstone.	Pleistocene-late Pliocene	15	1,3	2,2
162	984	D	279	504	1	1D	Clay, silty clay, nannofossil clay/cyclic lithologic changes, terrigenous and biogenic components sometimes nearly equal, invariant color, rare ash layers, no dropstones, indurated sediment, high-amplitude low-frequency magnetic susceptibility signal.	Late Pliocene	15	2,2	2,9

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
164	995	A	0	0,2	1	1A	Bioturbated foraminifer-bearing nannofossil silty clay.	Holocene-late Pleistocene	177	0,00	0,03
164	995	A	0,2	13,4	1	1B	Alternating beds of bioturbated foraminifer-bearing nannofossil-rich clay, nannofossil-rich clay, and nannofossil clay.	Holocene-late Pleistocene	177	0,03	0,52
164	995	A	13,4	48,25	2	2A	Interbedded bioturbated nannofossil-rich clay.	Late Pleistocene- late Pliocene	177	0,52	1,11
164	995	A	48,25	131,9	2	2B	Interbeds of diatom-rich nannofossil-rich clay and nannofossil-rich clay, and nannofossil-bearing clay.	Late Pleistocene- late Pliocene	177	1,11	2,17
164	995	A	131,9	704,6	3		Homogenous diatom- and nannofossil-bearing clay and claystone, and diatom-bearing nannofossil-rich clay and claystone.	Late Pliocene-late Miocene	177	2,17	6,13
164	997	A	0	0,19	1	1A	Bioturbated foraminifer-bearing nannofossil-rich clay.	Holocene-late Pleistocene	177	0,00	0,02
164	997	A	0,19	6,2	1	1B	Foraminifer-bearing nannofossil-rich clay comprises 45- to 60-cm-thick beds, intense bioturbation common, and with interbedded foraminifer-bearing nannofossil-rich clay and nannofossil-rich clay.	Holocene-late Pleistocene	177	0,02	0,31
164	997	A	6,2	107,83	2		Intensely burrowd nannofossil-rich clay with varying amounts (<10%) of foraminifers, interbedded with bioturbated nannofossil-rich clay and nannofossil-bearing clay, and diatoms appear in the top of Unit II.	Late Pleistocene- late Pliocene	177	0,31	2,41
164	997	A	107,83	434,3	3		Homogeneous diatom-bearing nannofossil-bearing clay and clayston, and nannofossil-bearing diatom-rich clay and claystone.	Late Pliocene-late Miocene	177	2,41	5,04
164	997	B	318,5	750	3		Homogeneous diatom-bearing nannofossil-bearing clay and clayston, and nannofossil-bearing diatom-rich clay and claystone.	Late Pliocene-late Miocene	177	3,68	6,42
172	1057	A	0	79,9	1		Nannofossil clay or clay with nannofossil beds alternating with thinner nannofossil-dominated beds.	Holocene-middle Pleistocene	178	0,0	0,8
172	1057	B	0	79,67	1		Nannofossil clay or clay with nannofossil beds alternating with thinner nannofossil-dominated beds.	Holocene-middle Pleistocene	178	0,0	0,8
172	1057	C	0	74,25	1		Nannofossil clay or clay with nannofossil beds alternating with thinner nannofossil-dominated beds.	Holocene-middle Pleistocene	178	0,0	0,7
172	1057	A	79,9	89,43	2	2A	Nannofossil clay and clay with nannofossils.	Early Pleistocene	178	0,8	0,9
172	1057	B	79,67	89,98	2	2A	Nannofossil clay and clay with nannofossils.	Early Pleistocene	178	0,8	0,9
172	1057	A	89,43	131,8	2	2B	Clay, nannofossil clay, clay with silt and nannofossils, and more rarely, nannofossil clay mixed sediment.	Early Pleistocene	178	0,9	1,2

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
172	1057	B	89,98	137,31	2	2B	Clay, nannofossil clay, clay with silt and nannofossils, and more rarely, nannofossil clay mixed sediment.	Early Pleistocene	178	0,9	1,2
172	1058	A	0	106,6	1		Oxidized sediments, clay, nannofossil ooze, nannofossil clay with pyrite nodules, clay with silt and nannofossils.	Holocene-middle Pleistocene	176	0,0	0,9
172	1058	B	0	112,15	1		Oxidized sediments, clay, nannofossil ooze, nannofossil clay with pyrite nodules, clay with silt and nannofossils.	Holocene-middle Pleistocene	176	0,0	1,0
172	1058	C	0	102,83	1		Oxidized sediments, clay, nannofossil ooze, nannofossil clay with pyrite nodules, clay with silt and nannofossils.	Holocene-middle Pleistocene	176	0,0	0,9
172	1058	A	106,6	152,81	2		Clay with silt, with minor amounts of clay with silt and nannofossils.	Middle-early Pleistocene	176	0,9	1,4
172	1058	B	112,15	158,22	2		Clay with silt, with minor amounts of clay with silt and nannofossils.	Middle-early Pleistocene	176	1,0	1,4
172	1058	C	102,83	164,59	2		Clay with silt, with minor amounts of clay with silt and nannofossils.	Middle-early Pleistocene	176	0,9	1,5
172	1059	A	0	98,8	1		Nannofossil clay, nannofossil clay and nannofossil ooze, and clay with nannofossils and silt, and clay with silt.	Holocene-middle Pleistocene	176	0,0	0,5
172	1059	B	0	92,2	1		Nannofossil clay, nannofossil clay and nannofossil ooze, and clay with nannofossils and silt, and clay with silt.	Holocene-middle Pleistocene	176	0,0	0,5
172	1059	C	0	95	1		Nannofossil clay, nannofossil clay and nannofossil ooze, and clay with nannofossils and silt, and clay with silt.	Holocene-middle Pleistocene	176	0,0	0,5
172	1060	A	0	170,1	1		Nannofossil ooze, clayey nannofossil ooze, nannofossil clay mixed sediment, nannofossil clay, nannofossil clay with silt, clay with nannofossils and silt, clay with silt, clay with nannofossils, and clay with silt and nannofossils.	Holocene-middle Pleistocene	169	0,0	0,9
172	1060	B	0	129,9	1		Nannofossil ooze, clayey nannofossil ooze, nannofossil clay mixed sediment, nannofossil clay, nannofossil clay with silt, clay with nannofossils and silt, clay with silt, clay with nannofossils, and clay with silt and nannofossils.	Holocene-middle Pleistocene	169	0,0	0,6
172	1060	C	0	126,5	1		Nannofossil ooze, clayey nannofossil ooze, nannofossil clay mixed sediment, nannofossil clay, nannofossil clay with silt, clay with nannofossils and silt, clay with silt, clay with nannofossils, and clay with silt and nannofossils.	Holocene-middle Pleistocene	169	0,0	0,6
172	1061	A	11	164,55	1		Alternating beds of bioturbated and carbonate-rich (nannofossil ooze, nannofossil clay, clay with nannofossils) and more weakly bioturbated, carbonate poor sediments (clay with silt and nannofossils, clay with biosilica, clay with silt, clay).	Holocene-middle Pleistocene	163	0,05	0,87

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
172	1061	B	0	9,82	1	Alternating beds of bioturbated and carbonate-rich (nannofossil ooze, nannofossil clay, clay with nannofossils) and more weakly bioturbated, carbonate poor sediments (clay with silt and nannofossils, clay with biosilica, clay with silt, clay).	Holocene-middle Pleistocene	163	0,00	0,05	
172	1061	C	0	158,31	1	Alternating beds of bioturbated and carbonate-rich (nannofossil ooze, nannofossil clay, clay with nannofossils) and more weakly bioturbated, carbonate poor sediments (clay with silt and nannofossils, clay with biosilica, clay with silt, clay).	Holocene-middle Pleistocene	163	0,00	0,83	
172	1061	D	0	163,26	1	Alternating beds of bioturbated and carbonate-rich (nannofossil ooze, nannofossil clay, clay with nannofossils) and more weakly bioturbated, carbonate poor sediments (clay with silt and nannofossils, clay with biosilica, clay with silt, clay).	Holocene-middle Pleistocene	163	0,00	0,86	
172	1061	E	0	19,53	1	Alternating beds of bioturbated and carbonate-rich (nannofossil ooze, nannofossil clay, clay with nannofossils) and more weakly bioturbated, carbonate poor sediments (clay with silt and nannofossils, clay with biosilica, clay with silt, clay).	Holocene-middle Pleistocene	163	0,00	0,09	
172	1061	A	164,55	258,03	2	Clay, nannofossil, and silt mixed sediments.	Early Pleistocene	163	0,87	1,53	
172	1061	C	158,31	167	2	Clay, nannofossil, and silt mixed sediments.	Early Pleistocene	163	0,83	0,88	
172	1061	D	163,26	183,41	2	Clay, nannofossil, and silt mixed sediments.	Early Pleistocene	163	0,86	1,00	
172	1061	A	258,03	357,5	3	Nannofossil clay, clay with nannofossils, clay with silt, and clay.	Early Pleistocene	163	1,53	3,39	
172	1062	A	0	75,8	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,67	
172	1062	B	0	77	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,68	
172	1062	C	0	78,8	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,70	
172	1062	D	0	78,5	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,70	
172	1062	E	0	63,8	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,69	
172	1062	F	0	60,6	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,48	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
172	1062	G	0	9,3	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,07	
172	1062	H	0	63,5	1	Interbedded clay and nannofossil-clay mixed sediment with gradual transitions from carbonate end-member to clay end member sediments.	Holocene-middle Pleistocene	166	0,00	0,51	
172	1062	A	75,8	164	2	Interbedded clay, clay with silt, nannofossil clay, nannofossil-clay mixed sediment, clayey nannofossil ooze, and layers of well-sorted and occasionally normally graded foraminiferal or carbonate silt.	Middle Pleistocene-late Pliocene	166	0,67	2,60	
172	1062	B	77	167	2	Interbedded clay, clay with silt, nannofossil clay, nannofossil-clay mixed sediment, clayey nannofossil ooze, and layers of well-sorted and occasionally normally graded foraminiferal or carbonate silt.	Middle Pleistocene-late Pliocene	166	0,68	2,65	
172	1062	C	78,8	132,9	2	Interbedded clay, clay with silt, nannofossil clay, nannofossil-clay mixed sediment, clayey nannofossil ooze, and layers of well-sorted and occasionally normally graded foraminiferal or carbonate silt.	Middle Pleistocene-late Pliocene	166	0,70	1,64	
172	1062	D	78,5	81,8	2	Interbedded clay, clay with silt, nannofossil clay, nannofossil-clay mixed sediment, clayey nannofossil ooze, and layers of well-sorted and occasionally normally graded foraminiferal or carbonate silt.	Middle Pleistocene-late Pliocene	166	0,70	0,74	
172	1062	E	63,8	139,5	2	Interbedded clay, clay with silt, nannofossil clay, nannofossil-clay mixed sediment, clayey nannofossil ooze, and layers of well-sorted and occasionally normally graded foraminiferal or carbonate silt.	Middle Pleistocene-late Pliocene	166	0,69	2,66	
172	1062	F	60,6	83,1	2	Interbedded clay, clay with silt, nannofossil clay, nannofossil-clay mixed sediment, clayey nannofossil ooze, and layers of well-sorted and occasionally normally graded foraminiferal or carbonate silt.	Middle Pleistocene-late Pliocene	166	0,48	0,76	
172	1062	A	165	180,7	3	Clay with nannofossils, which is interbedded with clay, clay with silt, and nannofossil clay.	Middle-early Pliocene	166	2,62	2,83	
172	1062	B	167	239	3	Clay with nannofossils, which is interbedded with clay, clay with silt, and nannofossil clay.	Middle-early Pliocene	166	2,65	4,27	
172	1062	E	139,5	208,8	3	Clay with nannofossils, which is interbedded with clay, clay with silt, and nannofossil clay.	Middle-early Pliocene	166	2,66	3,35	
172	1063	A	0	170,8	1 1A	Clay with varying portions of silt and carbonate- and siliceous-bearing nannofossils.	Holocene-early Pleistocene	103	0,0	1,0	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
172	1063	B	0	169,9	1	1A	Clay with varying portions of silt and carbonate- and siliceous-bearing nannofossils.	Holocene-early Pleistocene	103	0,0	1,0
172	1063	C	0	169,5	1	1A	Clay with varying portions of silt and carbonate- and siliceous-bearing nannofossils.	Holocene-early Pleistocene	103	0,0	1,0
172	1063	D	0	171,2	1	1A	Clay with varying portions of silt and carbonate- and siliceous-bearing nannofossils.	Holocene-early Pleistocene	103	0,0	1,0
172	1063	A	170,8	269,6	1	1B	Clay with variable proportions of silt and nannofossils. Occasionally nannofossil clay mixed sediment.	Early Pleistocene- latest Pliocene	103	1,0	1,8
172	1063	B	169,9	274,3	1	1B	Clay with variable proportions of silt and nannofossils. Occasionally nannofossil clay mixed sediment.	Early Pleistocene- latest Pliocene	103	1,0	1,9
172	1063	C	169,5	212,7	1	1B	Clay with variable proportions of silt and nannofossils. Occasionally nannofossil clay mixed sediment.	Early Pleistocene- latest Pliocene	103	1,0	1,3
172	1063	D	171,2	173	1	1B	Clay with variable proportions of silt and nannofossils. Occasionally nannofossil clay mixed sediment.	Early Pleistocene- latest Pliocene	103	1,0	1,0
172	1063	A	269,6	418,8	1	1C	Clay with silt, clay with nannofossils, nannofossil clay.	Latest Pliocene- middle Pliocene	103	1,8	3,5
172	1063	B	274,3	351,6	1	1C	Clay with silt, clay with nannofossils, nannofossil clay.	Latest Pliocene- middle Pliocene	103	1,9	2,6
177	1088	A	0	9	1		Nannofossil foraminifer ooze, subordinate, more foraminifer-rich sediment (up to 80% foraminifers) commonly incorporate ice-rafted debris, rare dropstones, and may also contain diatoms.	Pleistocene-middle Miocene	105	0,0	0,7
177	1088	B	0	129	1		Nannofossil foraminifer ooze, subordinate, more foraminifer-rich sediment (up to 80% foraminifers) commonly incorporate ice-rafted debris, rare dropstones, and may also contain diatoms.	Pleistocene-middle Miocene	105	0,0	9,8
177	1088	C	0	233,7	1		Nannofossil foraminifer ooze, subordinate, more foraminifer-rich sediment (up to 80% foraminifers) commonly incorporate ice-rafted debris, rare dropstones, and may also contain diatoms.	Pleistocene-middle Miocene	105	0,0	14,7
177	1089	A	0	216,3	1		Alternating beds of diatom- and mud-bearing nannofossil ooze and diatom mud.	Late Pliocene- Pleistocene	98	0,0	1,6
177	1089	B	0	264,9	1		Alternating beds of diatom- and mud-bearing nannofossil ooze and diatom mud.	Late Pliocene- Pleistocene	98	0,0	2,2
177	1089	C	0	194,4	1		Alternating beds of diatom- and mud-bearing nannofossil ooze and diatom mud.	Late Pliocene- Pleistocene	98	0,0	1,4
177	1089	D	0	118	1		Alternating beds of diatom- and mud-bearing nannofossil ooze and diatom mud.	Late Pliocene- Pleistocene	98	0,0	0,9

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
177	1091	A	0	310,9	1	Diatom ooze, nannofossil-, foraminifer-, and mud-bearing diatom ooze, and diatom nannofossil ooze.	Pleistocene-Pliocene	60	0,0	2,7	
177	1091	B	0	273,8	1	Diatom ooze, nannofossil-, foraminifer-, and mud-bearing diatom ooze, and diatom nannofossil ooze.	Pleistocene-Pliocene	60	0,0	1,9	
177	1091	D	0	203,1	1	Diatom ooze, nannofossil-, foraminifer-, and mud-bearing diatom ooze, and diatom nannofossil ooze.	Pleistocene-Pliocene	60	0,0	1,4	
177	1091	E	0	51,7	1	Diatom ooze, nannofossil-, foraminifer-, and mud-bearing diatom ooze, and diatom nannofossil ooze.	Pleistocene-Pliocene	60	0,0	0,4	
177	1092	A	0	45	1 1A	Alternations of foraminifer, nannofossil, and diatom ooze with various mixtures of all biogenic components plus admixtures of mud. Dropstones and IRD are scattered throughout.	Pleistocene-late Pliocene	90	0,0	2,2	
177	1092	B	0	50,1	1 1A	Alternations of foraminifer, nannofossil, and diatom ooze with various mixtures of all biogenic components plus admixtures of mud. Dropstones and IRD are scattered throughout.	Pleistocene-late Pliocene	90	0,0	2,6	
177	1092	C	0	42	1 1A	Alternations of foraminifer, nannofossil, and diatom ooze with various mixtures of all biogenic components plus admixtures of mud. Dropstones and IRD are scattered throughout.	Pleistocene-late Pliocene	90	0,0	2,0	
177	1092	D	36,4	51,1	1 1A	Alternations of foraminifer, nannofossil, and diatom ooze with various mixtures of all biogenic components plus admixtures of mud. Dropstones and IRD are scattered throughout.	Pleistocene-late Pliocene	90	1,5	2,7	
177	1092	A	46	188,5	1 1B	Nannofossil ooze with variable amounts of foraminifers and diatoms down to ~100 mbsf in Hole 1092A, minor component mud.	Late Pliocene-early Miocene	90	2,3	15,2	
177	1092	B	50,1	168,9	1 1B	Nannofossil ooze with variable amounts of foraminifers and diatoms down to ~100 mbsf in Hole 1092A, minor component mud.	Late Pliocene-middle Miocene	90	2,6	11,0	
177	1092	C	51,5	165,5	1 1B	Nannofossil ooze with variable amounts of foraminifers and diatoms down to ~100 mbsf in Hole 1092A, minor component mud.	Late Pliocene-middle Miocene	90	2,8	11,0	
177	1092	D	51,1	64,9	1 1B	Nannofossil ooze with variable amounts of foraminifers and diatoms down to ~100 mbsf in Hole 1092A, minor component mud.	Late Pliocene-Pliocene/Miocene	90	2,7	3,9	
177	1093	A	0	309,4	1 1A	Mud-bearing diatom ooze, foraminifer-bearing diatom ooze, diatom ooze, foraminifer diatom ooze. Carbonate concentration varies between 0 to 53 wt%.	Holocene-Pleistocene	43	0,0	1,2	
177	1093	B	0	221,8	1 1A	Mud-bearing diatom ooze, foraminifer-bearing diatom ooze, diatom ooze, foraminifer diatom ooze. Carbonate concentration varies between 0 to 53 wt%.	Holocene-Pleistocene	43	0,0	0,9	

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
177	1093	C	0	169,5	1	1A	Mud-bearing diatom ooze, foraminifer-bearing diatom ooze, diatom ooze, foraminifer diatom ooze. Carbonate concentration varies between 0 to 53 wt%.	Holocene-Pleistocene	43	0,0	0,7
177	1093	D	136	434,4	1	1A	Mud-bearing diatom ooze, foraminifer-bearing diatom ooze, diatom ooze, foraminifer diatom ooze. Carbonate concentration varies between 0 to 53 wt%.	Holocene-Pleistocene	43	0,5	1,7
177	1093	E	4	42,5	1	1A	Mud-bearing diatom ooze, foraminifer-bearing diatom ooze, diatom ooze, foraminifer diatom ooze. Carbonate concentration varies between 0 to 53 wt%.	Holocene-Pleistocene	43	0,0	0,2
177	1093	F	36,92	46,42	1	1A	Mud-bearing diatom ooze, foraminifer-bearing diatom ooze, diatom ooze, foraminifer diatom ooze. Carbonate concentration varies between 0 to 53 wt%.	Holocene-Pleistocene	43	0,2	0,2
177	1093	D	434,4	563,5	1	1B	Mud diatom ooze with highly variable carbonate concentrations between 0 and 60 wt%.	Late-latest early Pliocene	43	1,7	3,4
177	1093	D	578,5	597,7	2		Poor recovery below the Pliocene/Miocene hiatus (a time gap of ~3-4 myrs. Lithified remnants of laminated mudrocks and diatomites.	Late Miocene	43	3,7	4,0
177	1094	A	0	98	1	1A	Diatom ooze with significant amounts of mud and minor amounts of carbonate, nannofossils and foraminifers in thin, pink- or salmon-colored intervals.	Holocene-Pleistocene	20	0,0	0,7
177	1094	B	0	33,2	1	1A	Diatom ooze with significant amounts of mud and minor amounts of carbonate, nannofossils and foraminifers in thin, pink- or salmon-colored intervals.	Holocene-Pleistocene	20	0,0	0,2
177	1094	C	0	67,2	1	1A	Diatom ooze with significant amounts of mud and minor amounts of carbonate, nannofossils and foraminifers in thin, pink- or salmon-colored intervals.	Holocene-Pleistocene	20	0,0	0,5
177	1094	D	28,6	93,2	1	1A	Diatom ooze with significant amounts of mud and minor amounts of carbonate, nannofossils and foraminifers in thin, pink- or salmon-colored intervals.	Holocene-Pleistocene	20	0,2	0,7
177	1094	A	98	157,6	1	1B	Carbonate-bearing diatom ooze with higher abundances of nannofossils and foraminifers than in Subunit 1A.	Pleistocene	20	0,7	1,4
177	1094	D	93,2	171,1	1	1B	Carbonate-bearing diatom ooze with higher abundances of nannofossils and foraminifers than in Subunit 1A.	Pleistocene	20	0,7	1,6
208	1262	A	0	38,6	1		Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Pleistocene-Miocene	70	0,0	4,2
208	1262	B	0	43,9	1		Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Miocene	70	0,0	7,3

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
208	1262	A	38	57,7	2	2A	Clay, ash-bearing clay, and nannofossil clay	Miocene- Oligocene	70	4,0	18,9
208	1262	B	43,9	63,3	2	2A	Clay, ash-bearing clay, and nannofossil clay	Miocene- Oligocene	70	7,3	23,6
208	1262	A	57	66,8	2	2B	Nannofossil ooze, foraminifer-bearing nannofossil ooze, and clayey nannofossil ooze.	Oligocene	70	18,3	26,5
208	1262	B	63,3	72	2	2B	Nannofossil ooze, foraminifer-bearing nannofossil ooze, and clayey nannofossil ooze.	Oligocene	70	23,6	30,7
208	1262	A	66,5	74	2	2C	Clay, ash-bearing clay, and nannofossil clay	Late Eocene- middle Eocene	70	26,3	32,0
208	1262	B	72	82,6	2	2C	Clay, ash-bearing clay, and nannofossil clay	Late Eocene- middle Eocene	70	30,7	38,9
208	1262	A	76	144,6	3	3A	Nannofossil ooze	Middle Eocene- late Paleocene	70	32,9	55,3
208	1262	B	82,6	152,7	3	3A	Nannofossil ooze	Middle Eocene- late Paleocene	70	38,9	55,9
208	1262	C	90	152,1	3	3A	Nannofossil ooze	Middle Eocene- late Paleocene	70	49,4	55,8
208	1262	A	144,6	162	3	3B	Clayey nannofossil ooze	Late Paleocene- Maastrichtian	70	55,3	56,7
208	1262	B	152,9	209,7	3	3B	Clayey nannofossil ooze	Late Paleocene- Maastrichtian	70	55,9	63,7
208	1262	C	152,1	213	3	3B	Clayey nannofossil ooze	Late Paleocene- Maastrichtian	70	55,8	64,4
208	1263	A	0	87,3	1	1A	Foraminifer-bearing nannofossil ooze and nannofossil ooze	Pleistocene-late Eocene	86	0,0	33,1
208	1263	B	46	84,4	1	1A	Foraminifer-bearing nannofossil ooze and nannofossil ooze	Pleistocene-late Eocene	86	25,8	32,7
208	1263	A	87,3	271,6	1	1B	Nannofossil ooze, foraminifer-bearing nannofossil ooze, clay-bearing nannofossil ooze, and chalky nannofossil ooze	Late Eocene-early Eocene	86	33,1	52,2
208	1263	B	84,4	271,6	1	1B	Nannofossil ooze, foraminifer-bearing nannofossil ooze, clay-bearing nannofossil ooze, and chalky nannofossil ooze	Late Eocene-early Eocene	86	32,7	52,2
208	1263	C	90	272,6	1	1B	Nannofossil ooze, foraminifer-bearing nannofossil ooze, clay-bearing nannofossil ooze, and chalky nannofossil ooze	Late Eocene-early Eocene	86	33,4	52,3
208	1263	A	271,6	340,1	1	1C	Nannofossil ooze, chalky nannofossil ooze	Early Eocene-late Paleocene	86	52,2	55,0
208	1263	B	271,1	337,1	1	1C	Nannofossil ooze, chalky nannofossil ooze	Early Eocene-late Paleocene	86	52,2	54,8

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
208	1263	C	272,6	289,1	1	1C	Nannofossil ooze, chalky nannofossil ooze	Early Eocene-late Paleocene	86	52,3	53,1
208	1263	D	272	286,6	1	1C	Nannofossil ooze, chalky nannofossil ooze	Early Eocene-late Paleocene	86	52,2	53,1
208	1264	A	0	23,5	1		Foraminifer-bearing nannofossil ooze, foraminifer nannofossil ooze, and nannofossil foraminifer ooze.	Pleistocene-early Pliocene	87	0,0	3,3
208	1264	B	0	26,6	1		Foraminifer-bearing nannofossil ooze, foraminifer nannofossil ooze, and nannofossil foraminifer ooze.	Pleistocene-early Pliocene	87	0,0	3,6
208	1264	C	0	3	1		Foraminifer-bearing nannofossil ooze, foraminifer nannofossil ooze, and nannofossil foraminifer ooze.	Pleistocene-early Pliocene	87	0,0	0,5
208	1264	A	23,5	100,4	2	2A	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Early Pliocene-late Miocene	87	3,3	7,2
208	1264	B	26,6	103,3	2	2A	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Early Pliocene-late Miocene	87	3,6	7,2
208	1264	A	100,4	280,9	2	2B	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Late Miocene-early Oligocene	87	7,2	26,4
208	1264	B	103,3	283,2	2	2B	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Late Miocene-early Oligocene	87	7,2	26,7
208	1265	A	0	48	1		Foraminifer-bearing nannofossil ooze and nannofossil ooze.	Pleistocene-late Miocene	86	0,0	10,6
208	1265	B	0	48,3	1		Foraminifer-bearing nannofossil ooze and nannofossil ooze.	Pleistocene-late Miocene	86	0,0	10,6
208	1265	A	48	169	2	2A	Nannofossil ooze and foraminifer-bearing nannofossil ooze	Late Miocene-late Eocene	86	10,6	30,6
208	1265	B	48,3	170,3	2	2A	Nannofossil ooze and foraminifer-bearing nannofossil ooze	Late Miocene-late Eocene	86	10,6	31,1
208	1265	A	169	218,2	2	2B	Nannofossil ooze and foraminifer-bearing nannofossil ooze	Late Eocene-early Eocene	86	30,6	40,5
208	1265	B	170,3	217,1	2	2B	Nannofossil ooze and foraminifer-bearing nannofossil ooze	Late Eocene-early Eocene	86	31,1	40,2
208	1265	C	185	204,3	2	2B	Nannofossil ooze and foraminifer-bearing nannofossil ooze	Late Eocene-early Eocene	86	32,0	37,3
208	1265	A	218,2	312,4	2	2C	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Early Eocene-late Paleocene	86	40,5	54,8
208	1265	B	217,1	251,9	2	2C	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Early Eocene-late Paleocene	86	40,2	51,9
208	1265	D	248	274,9	2	2C	Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Early Eocene-late Paleocene	86	51,5	53,2

Appendix 2: Sediment lithologies - Ocean Drilling Program (ODP)

Leg	Site	Hole	Depth (mbsf)		Lithologic Unit	Lithologic Subunit	Lithologic Description	Epoch/Stage	Numerical age (Ma)		
			Top	Base					Crust	Top	Base
208	1266	A	0	65,1	1		Foraminifer-bearing nannofossil ooze and nannofossil ooze.	Pleistocene- Miocene	84	0,0	5,2
208	1266	B	0	7,7	1		Foraminifer-bearing nannofossil ooze and nannofossil ooze.	Pleistocene- Miocene	84	0,0	0,7
208	1266	C	62	68,6	1		Foraminifer-bearing nannofossil ooze and nannofossil ooze.	Pleistocene- Miocene	84	5,1	5,3
208	1266	A	65,1	184,5	2		Clay-bearing nannofossil ooze and nannofossil ooze	Miocene through Oligocene	84	5,2	30,3
208	1266	C	71,5	188	2		Clay-bearing nannofossil ooze and nannofossil ooze	Miocene through Oligocene	84	5,3	30,8
208	1266	A	184,6	294,9	3		Clay-bearing nannofossil ooze, nannofossil ooze, and nannofossil chalk	Oligocene-late Paleocene	84	30,3	53,3
208	1266	B	220	318,9	3		Clay-bearing nannofossil ooze, nannofossil ooze, and nannofossil chalk	Oligocene-late Paleocene	84	34,6	55,9
208	1266	C	188	331,1	3		Clay-bearing nannofossil ooze, nannofossil ooze, and nannofossil chalk	Oligocene-late Paleocene	84	30,8	56,1
208	1267	A	0	93,4	1		Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Pleistocene- Miocene	70	0,0	5,6
208	1267	B	0	91,7	1		Nannofossil ooze and foraminifer-bearing nannofossil ooze.	Pleistocene- Miocene	70	0,0	5,5
208	1267	A	93,4	113,3	2 2A		Clay-bearing nannofossil ooze, nannofossil clay, and hematite-bearing clay.	Miocene- Oligocene	70	5,6	20,7
208	1267	B	91,7	112	2 2A		Clay-bearing nannofossil ooze, nannofossil clay, and hematite-bearing clay.	Miocene- Oligocene	70	5,5	18,5
208	1267	A	113,3	129,9	2 2B		Nannofossil ooze, foraminifer-bearing nannofossil ooze, and clayey nannofossil ooze.	Oligocene-late Eocene	70	20,7	31,6
208	1267	B	112	128,6	2 2B		Nannofossil ooze, foraminifer-bearing nannofossil ooze, and clayey nannofossil ooze.	Oligocene-late Eocene	70	18,5	31,4
208	1267	A	129,9	141,9	2 2C		Clayey nannofossil ooze, clay-bearing nannofossil ooze, ash-bearing nannofossil clay, and ash-bearing clay.	Late Eocene- middle Eocene	70	31,6	33,3
208	1267	B	128,6	142,4	2 2C		Clayey nannofossil ooze, clay-bearing nannofossil ooze, ash-bearing nannofossil clay, and ash-bearing clay.	Late Eocene- middle Eocene	70	31,4	33,4