



World Atlas of late Quaternary Foraminiferal Oxygen and Carbon Isotope Ratios

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World Atlas of late Quaternary Foraminiferal Oxygen and Carbon Isotope Ratios

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Abstract. We present a global atlas of downcore foraminiferal oxygen and carbon isotope ratios available at <https://doi.org/10.1594/PANGAEA.936747> (Mulitza et al., 2021a). The database contains 2106 published and previously unpublished stable isotope downcore records with 361 949 stable isotope values of various planktic and benthic species of Foraminifera from 1265 sediment cores. Age constraints are provided by 6153 uncalibrated radiocarbon ages from 598 (47 %) of the cores. Each stable isotope and radiocarbon series is provided in a separate netCDF file containing fundamental metadata as attributes. The data set can be managed and explored with the free software tool PaleoDataView. The atlas will provide important data for paleoceanographic analyses and compilations, site surveys, or for teaching marine stratigraphy. The database can be updated with new records as they are generated, providing a live ongoing resource into the future.

1 Introduction

Stable oxygen and carbon isotope ratios measured on foraminiferal shells are often regarded as the foundation of Marine Geology and Paleoceanography. The importance of these proxies stems from their broad applicability in time and space, their established and efficient analytical methods and their great value for stratigraphy and paleoceanographic reconstructions (see review by Pearson, 2012). Since the pioneering work of (Urey, 1947), millions of foraminiferal isotope measurements have been performed representing time slices from the Middle Jurassic (e.g., Vetoshkina et al., 2014) into the Anthropocene (e.g., McGregor et al., 2007). Foraminiferal isotopes have substantially contributed to the reconstruction and understanding of the global climate evolution since the Early Cretaceous (Cramer et al., 2009) including the validation of the orbital theory of the ice ages (Hays et al., 1976), reconstructions of ice volume (Shackleton and Opdyke, 1973; Waelbroeck et al., 2002) and water mass structure, ocean circulation, and carbon cycling (Curry et al., 1988; Duplessy et al., 1988; Boyle and Keigwin, 1987).

Despite their importance for the understanding of the Earth system, foraminiferal isotope data have not been systematically catalogued globally or stored in a database in a consistent and standardized format. Foraminiferal isotope data are usually available in arbitrary data formats and scattered across different data repositories, which hinders an automated analysis. Harmonized data collections have the advantage that (i) information about data coverage can be immediately accessed and visualized, for example in the planning phase of research projects, (ii) data can be quickly compared for verification/quality control or to separate local signals from global signals, and (iii) that customized software can be used to visualize and analyze the data.

Here we present the first global atlas of foraminiferal stable isotope data (with uncalibrated radiocarbon ages where available). The data are stored in netCDF format (Rew and Davis, 1990) and can be directly analyzed and visualized with the free software tool PaleoDataView (PDV, Langner and Mulitza, 2019). In PDV, age information for a specific sediment core is linked to any downcore proxy series imported for that core within the same collection. This strategy ensures the long-term maintainability and consistency of the age models across different proxy records (e.g., stable isotope records of different species) in the same collection. The netCDF format also allows the data to be analyzed using programming languages such as MATLAB, R, Fortran, C++ and Python.

2 Data sources and harmonization

The database is provided as a collection of 2106 netCDF files with $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ data of species-specific foraminiferal

carbonate and 598 netCDF files with raw radiocarbon ages (see references in Table A1). A detailed description of the attributes and variables in the netCDF files is provided in Sects. S1 and S2 in the Supplement. About 79 % of the files containing stable isotope records were derived from data downloaded either from PANGAEA (<http://www.pangaea.de>, last access: 19 May 2022) or NOAA's National Centers for Environmental Information (NCEI, <http://www.ncdc.noaa.gov>, last access: 19 May 2022). The remaining 21 % of the stable isotope files are based on data obtained directly from a stable isotope laboratory by one of the co-authors (8 %) or have been digitized from tables provided in papers, or paper supplements (6 %), or through personal communication (7 %). Radiocarbon data are not as frequently archived in public databases as stable isotope data. Only 62 % of the files containing radiocarbon data were obtained from NOAA or PANGAEA, whereas data in 32 % of the files were copied from tables in papers or paper supplements; 5 % of the files are based on data directly obtained from laboratories, while only 1 % were obtained through personal communication. The data set also includes 105 previously unpublished species-specific stable isotope downcore records including both $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ values and 45 species-specific isotope downcore records for which either $\delta^{13}\text{C}$ or $\delta^{18}\text{O}$ was previously unpublished (Sect. S3 in the Supplement). A table containing all data sources is available from Zenodo (<https://doi.org/10.5281/zenodo.6337519>, Mulitza et al., 2021b).

To generate the netCDF files, metadata, isotope data, and radiocarbon ages (if available) were first assembled in species- and site-specific Excel files in the format required by PDV. The species names were preserved as used in the original publication. If more than one stable isotope record of the same species was available for the same core, we added a suffix (e.g., size class or version) to the species name. The Excel files were then edited for units (mainly conversion from “cm” to “m” and years to kiloyears) and metadata were added. Unavailable data fields were filled with “NaN”. Finally, the Excel files were converted to netCDF files using the PDV import tool. Stable isotope data and radiocarbon data were saved in separate files to allow the radiocarbon file to link to several proxy records from the same core via the core label. After import, the data were inspected and quality controlled in PDV. Every row of the downcore data fields is associated with a “use flag” indicating whether the values should be included in an analysis (use flag = 1) or not (use flag = 0). This flag can be used to exclude outliers (e.g., due to turbidites) or radiocarbon reversals in a later analysis of the data while maintaining the original data in the file. Isotope values without replicates were imported with a use flag set to “1”. For replicate stable isotope measurements the use flags were set to “0” and an average of the replicates (use flag = 1) was added to the series with a comment “Mean of

multiple measurements” in the same row. Raw radiocarbon ages were generally imported with a use flag set to “0” since the data are uncalibrated. Most of the data are archived with original downcore depth of the samples. If a composite depth scale was used (e.g., for International Ocean Discovery Program (IODP) and its predecessors Deep Sea Drilling Program (DSDP) and Ocean Drilling Program (ODP) cores), a comment was added and care was taken that available radiocarbon dates were imported on the same depth scale. The data are stored as raw data, with all documented corrections removed from the data. This includes a previously subtracted reservoir age and corrections applied to the stable isotope values (e.g., to account for species offsets). Variables to store downcore radiocarbon reservoir and stable isotope corrections that may be applied to the data at a later stage are already included in the netCDF files. These variables have been imported with default values of 0.4 ka (± 0.1) for all radiocarbon reservoir ages and a stable isotope correction of “0” for all oxygen and carbon isotope ratios. Both reservoir ages and stable isotope corrections can be edited within PDV.

3 Data distribution

3.1 Spatial and vertical coverage

Stable isotope records are available from all major ocean basins (Fig. 1) but tend to cluster along continental margins, where higher sedimentation rates, and thus higher temporal resolutions, can be found compared to mid-ocean ridges or deep abyssal basins. About 65 % of the downcore records are from coring locations within 400 km of the coastline (Fig. 2). The deepest record in the atlas is from 5105 m water depth (EN066-29PG, eastern tropical Atlantic (Curry and Lohmann, 1983), the shallowest record from 50 m water depth (GeoB9503-5, Senegal mud belt, Mulitza, unpublished). However, the availability of records decreases in waters shallower than about 400 m (Fig. 3), where more dynamic sedimentation regimes exist, and below 3800 m due to carbonate dissolution which often prevents the production of reliable, continuous foraminiferal stable isotope records.

Records are available in all oceanic 5° latitude bands with the highest number in tropical latitudes and decreasing numbers towards high latitudes (Fig. 3). This pattern is likely the result of the year-round accessibility of low latitudes compared to high latitudes where, due to sea ice cover or harsh weather conditions in the cold season, expeditions are often constrained to the warm season. The largest fraction (~ 47 %) of the stable isotope records was measured on material from the Atlantic, whereas about 9 % are from the Southern Ocean (Fig. 4). However, with 21 cores per million square kilometers, the Mediterranean has the highest density of cores followed by the Arctic Ocean (7.8 cores (million km^{-2})) and the Atlantic (7.5 cores (million km^{-2})). The Pacific and Indian oceans are currently only covered by 2 and 2.1 cores (million km^{-2}), re-

spectively, which is likely a result of relatively low accumulation rates and poor carbonate preservation over large areas. In addition, the retrieval of sediment cores in the remote and deep central areas requires more ship time compared to the Atlantic and Mediterranean Sea.

3.2 Species distribution

The majority (61 %) of all stable isotope values available in this compilation were measured on planktic Foraminifera (see individual percentages for carbon and oxygen isotopes in Fig. 5). Among the planktic species, *Globigerinoides ruber* (37 %) and *Neogloboquadrina pachyderma* (28 %) are the most commonly used species, followed by *Globigerina bulloides* (17 %) and *Trilobatus sacculifer* (6 %). These species have a relatively broad geographical coverage and are considered as mixed-layer species in their respective environment (Schiebel and Hemleben, 2017). Isotope measurements on other planktic species (summarized under “other planktics”) constitute about 12 % of all values in the atlas (Fig. 5); 75 % of the included planktic oxygen isotope values and 88 % of the included benthic oxygen isotope values are reported together with the corresponding carbon isotope value. Most of the benthic isotope values (70 %) were obtained from species of the genus *Cibicides/Cibicidoides*. Isotope values from the in-faunal genus *Uvigerina* constitute about 18 % of all benthic isotope values in the atlas. The grouping of the original species names into species/genus names used in Figs. 5 and 6 is provided in Sect. S4 in the Supplement.

3.3 Species-specific and latitudinal distribution of oxygen and carbon isotope values

In the current version, the atlas contains a total of 201 593 $\delta^{18}\text{O}$ values. The lowest $\delta^{18}\text{O}$ value (-7.51 ‰) is observed in the species *G. ruber* white (Fig. 6) from the Gulf of Mexico core LOUIS1924 under the influence of Mississippi freshwater discharge (Aharon, 2003). The highest planktic $\delta^{18}\text{O}$ value (6.31 ‰) can be observed in the tropical species *G. ruber* from core M31_2-78_PC6 (Red Sea, Geiselschardt and Hemleben, 1998a). With latitude, planktic $\delta^{18}\text{O}$ values follow the typical bell-shaped pattern as expected from a dominant influence of sea surface temperature (Fig. 7). Benthic $\delta^{18}\text{O}$ values range from -2.85 ‰ from *Cibicides corbulentus* in core OC205-2-108GGC from the western tropical North Atlantic (Slowey and Curry, 1995) to 5.9 ‰ from *Uvigerina bifurcata* from South Atlantic site JR244-GC528 (Roberts et al., 2016). Vertically, the $\delta^{18}\text{O}$ of benthic foraminiferal species increases with water depth over the upper 800 m as expected from decreasing temperatures within the main thermocline (Fig. 8). Planktic $\delta^{18}\text{O}$ values do not show clear visual trends with water depth (not shown). Planktic and benthic $\delta^{18}\text{O}$ values converge towards polar regions as expected

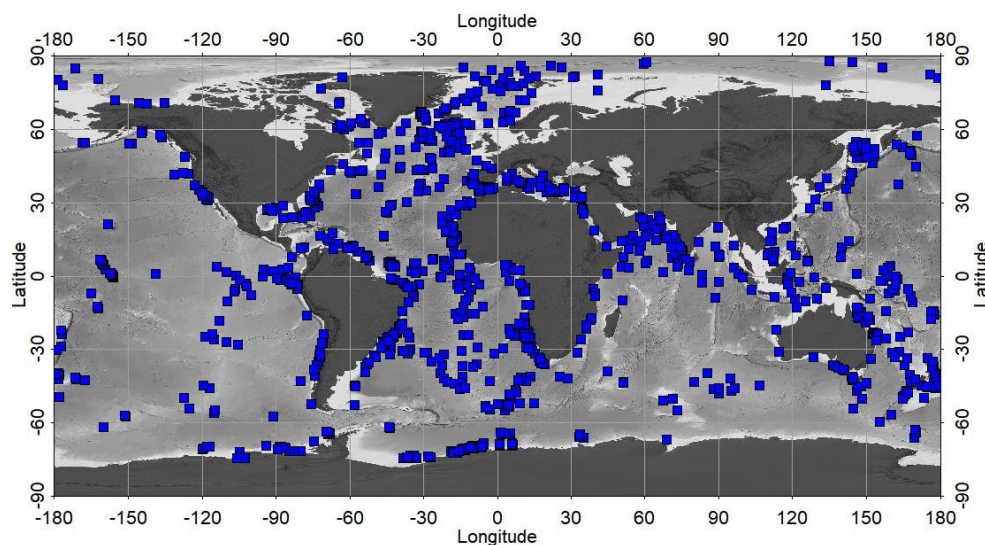


Figure 1. Spatial distribution of stable isotope records available in this atlas. The map has been generated with PaleoDataView (Langner and Mulitza, 2019).

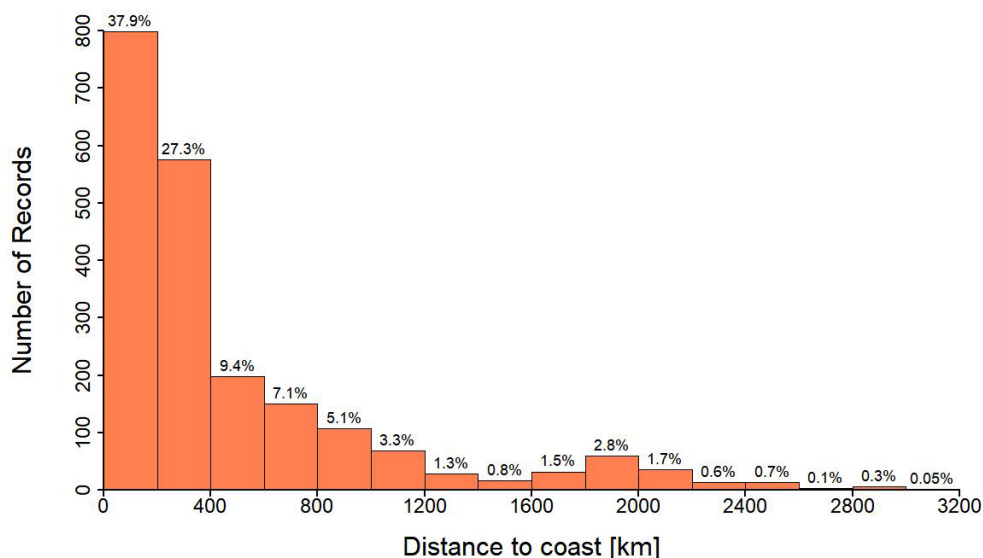


Figure 2. Number of isotope records available in this atlas versus distance to the coastline in 200 km bins. The global coastline was created with the free vector and raster map data from <http://www.naturalearthdata.com> (last access: 19 May 2022).

from the decreasing temperature stratification with increasing latitude (Fig. 7).

The data set contains 160 356 $\delta^{13}\text{C}$ values. Planktic Foraminifera from tropical latitudes show the highest $\delta^{13}\text{C}$ values (Fig. 7) of up to 3.53‰ in shells of the species *G. ruber* from the Red Sea core M31_2-78_PC6 (Geiselhart and Hemleben, 1998a). Planktic $\delta^{13}\text{C}$ values get as low as -17.7 ‰ on *N. pachyderma* sinistral (Fig. 6) in core LV28-4-4 from the Sea of Okhotsk (Kaiser, 2001), which might be related to a potential contribution from authigenic carbonate minerals that form with the anaerobic oxidation of methane

(Cook et al., 2011). Benthic foraminiferal $\delta^{13}\text{C}$ gets as low as -7.99 ‰ in *Elphidium batialis* from western North Pacific core KT90-9_21 (Oba and Murayama, 2004) and as high as 3.36‰ in the aragonitic shells of *Hoeglundina elegans* from western North Atlantic core OC205-2-149JPC (Slowey and Curry, 1995). Benthic species of the genus *Cibicides/Cibicides* show a clear trend toward decreasing $\delta^{13}\text{C}$ values in the deep ocean (Fig. 8), as expected from the global distribution of $\delta^{13}\text{C}$ in dissolved ΣCO_2 (Kroopnick, 1985).

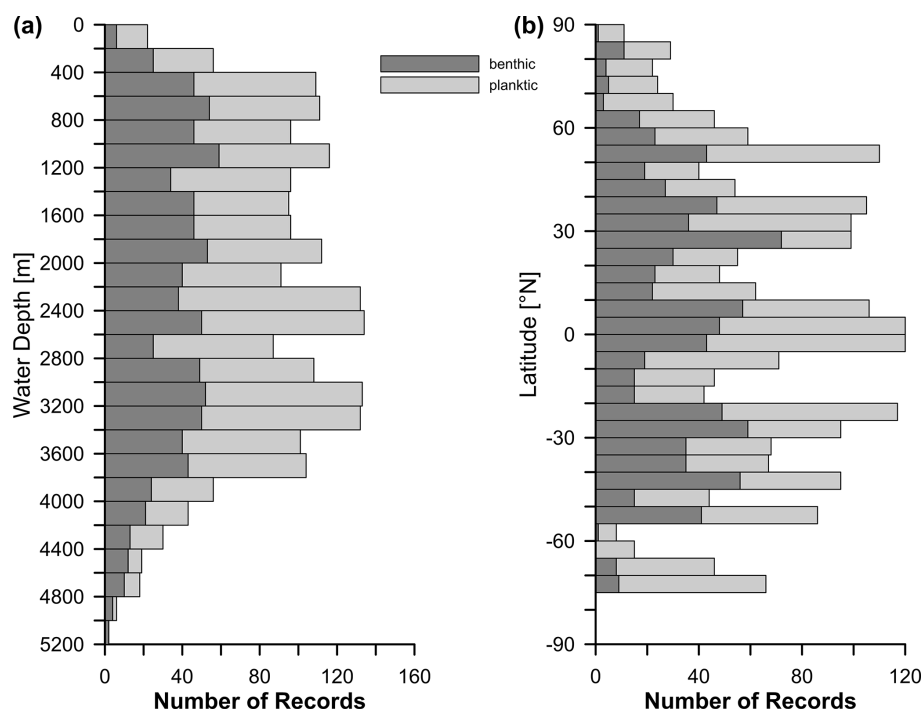


Figure 3. Distribution of stable isotope records with water depth in 200 m bins (a) and with latitude in 5° bins (b).

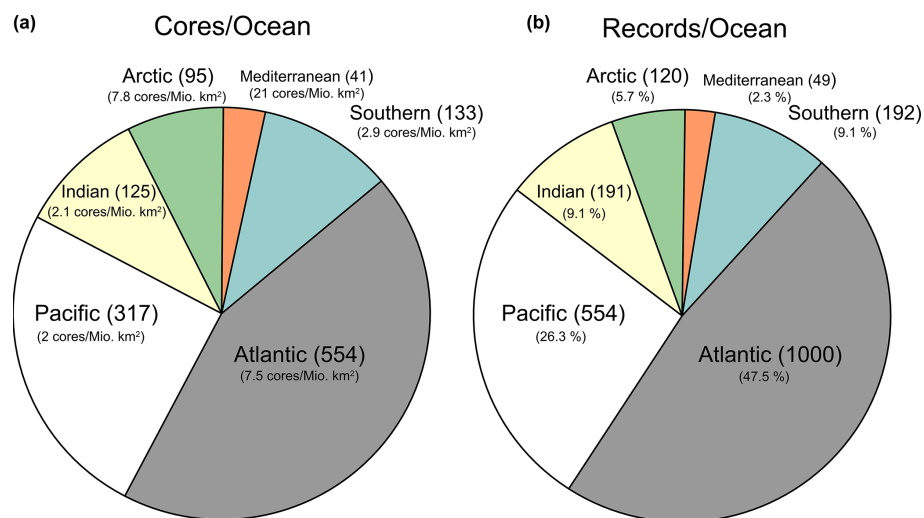


Figure 4. Number of cores (a) and records (b) for major ocean basins. A record is a downcore series of paired oxygen and carbon isotope measurements on a foraminiferal species or species group stored in a single netCDF file. Several records can exist for a single core. The counts include records/cores for which either $\delta^{18}\text{O}$ or $\delta^{13}\text{C}$ is missing. Numbers in small font below ocean basin name indicate density of cores in cores/10⁶ km² (a) and percentage from the total number of records in the atlas (b) in each basin. Ocean basins follow the definitions in the World Ocean Atlas 2001 (Stephens et al., 2002). Pacific includes the Sea of Japan and the Indian Ocean includes the Bay of Bengal and the Red Sea.

3.4 Distribution of radiocarbon ages

The data set contains 6153 individual radiocarbon ages with a maximum age of about 56 ka. About 47 % of the cores are associated with at least one radiocarbon date. Most of the radiocarbon-dated cores are from the Atlantic (44 %) fol-

lowed by the Pacific (28 %) and the Arctic Ocean (12 %) (Fig. 9). The temporal distribution of the radiocarbon ages (Fig. 10) shows that the last deglaciation has been preferentially dated, which is likely a consequence of the scientific attention focused on this time period and the limited stratigraphic extent of many coring techniques. The fraction of re-

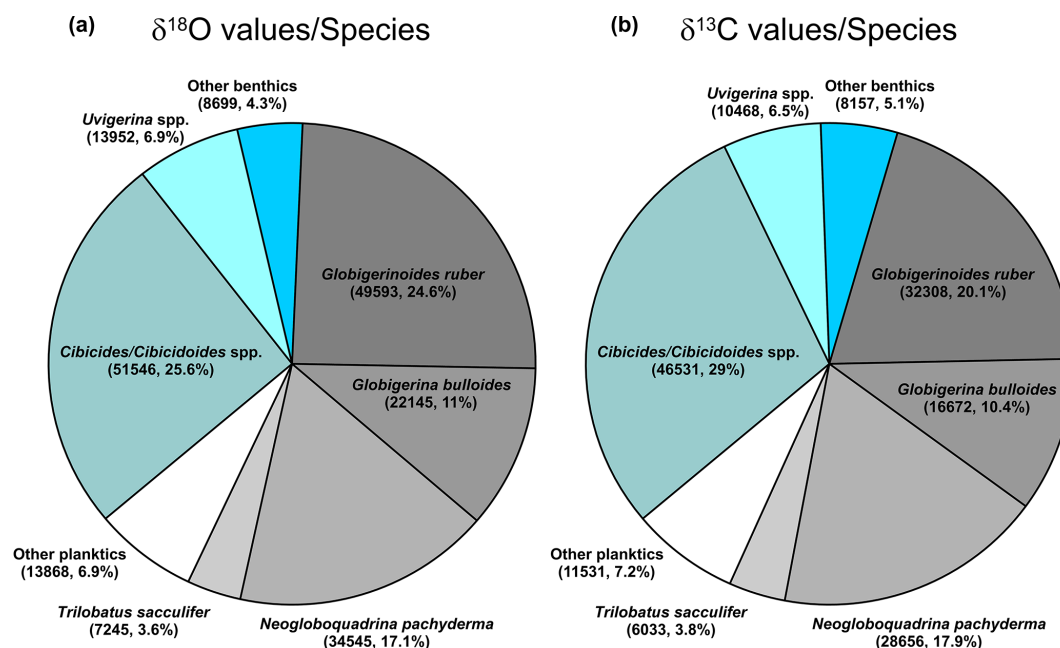


Figure 5. Fraction of oxygen (a) and carbon (b) isotope values measured on benthic (blue) and planktic (grey) species/species groups. Numbers below the species/genus names indicate absolute number of values and percentage from the total number of $\delta^{18}\text{O}$ (a) or $\delta^{13}\text{C}$ (b) values in the atlas. See Sect. S4 in the Supplement for the categorization of the individual species names from the original publications.

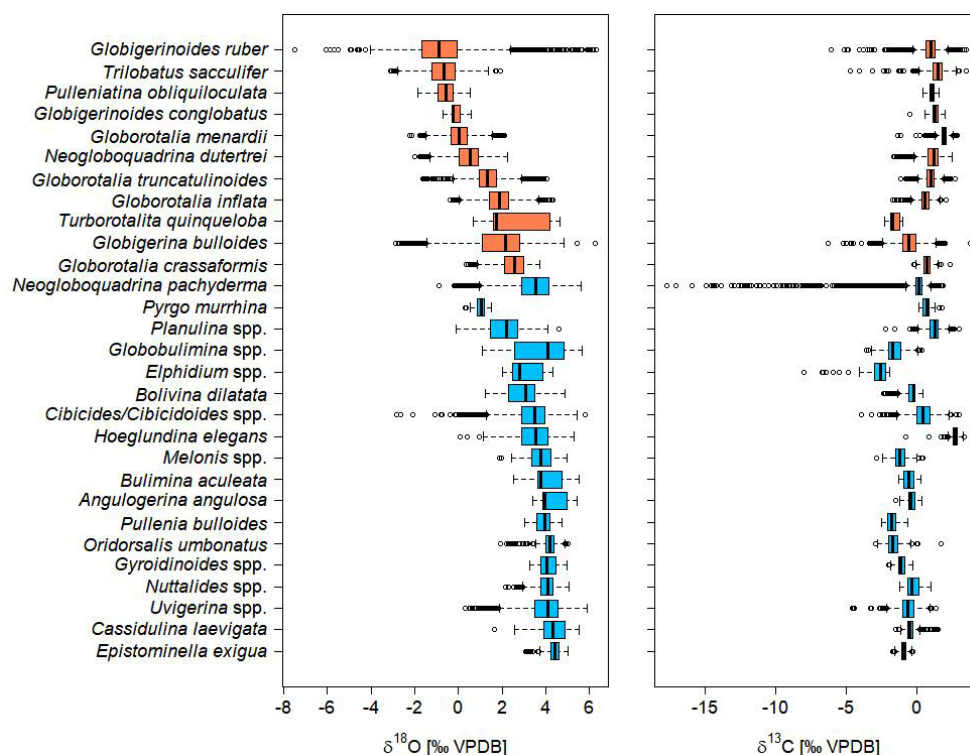


Figure 6. Box-and-whisker plot of oxygen (left) and carbon (right) stable isotope values of planktic (orange) and benthic (blue) Foraminifera at the species or genus level. The vertical line shows the median, left and right margins of the box indicate the 25th and 75th percentiles. The whiskers (the horizontal dashed lines) indicate the maximum/minimum values, or in case of outliers (open circles), highest/lowest data point that is less than 1.5 times above/below the interquartile range. The plot has been created with R's boxplot() function (R Core Team, 2017).

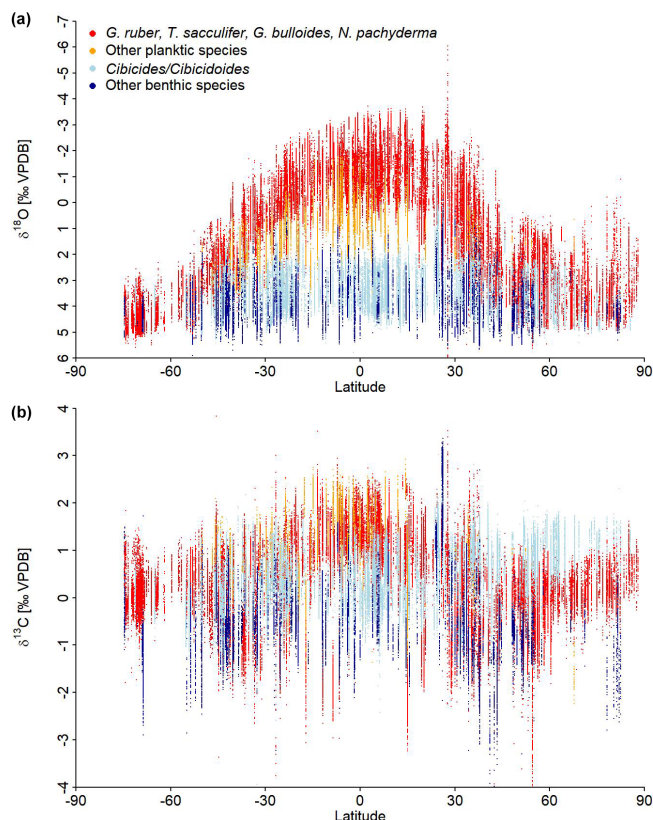


Figure 7. Distribution of $\delta^{18}\text{O}$ values (a) and $\delta^{13}\text{C}$ values (b) with latitude. Red/orange: planktic Foraminifera, blue: benthic Foraminifera. Extreme values outside the axis ranges are not shown.

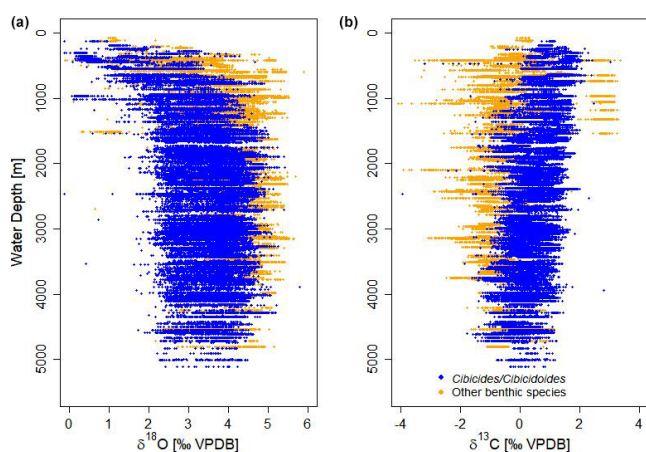


Figure 8. Distribution of benthic oxygen ($\delta^{18}\text{O}$, a) and carbon ($\delta^{13}\text{C}$, b) isotope values with water depth. Extreme values outside the axis ranges are not shown. Blue: *Cibicides/Cibicidoides*, orange: other benthic species.

versals is higher for the deglacial and glacial periods, where the higher sampling density increases the likelihood of reversals.

4 Possible applications

4.1 Marine geology and paleoceanography

Foraminiferal oxygen isotope ratios provide one of the most reliable tools for stratigraphy in marine sediments, particularly for time periods older than the range of the radiocarbon method, or if radiocarbon is not available or associated with large uncertainties due to unknown reservoir ages. Usually, oxygen-isotope stratigraphy is applied by using global (Imbrie et al., 1984; Prell et al., 1986; Lisiecki and Raymo, 2005) or basin-wide (Lisiecki and Stern, 2016) isotope reference curves. The collection presented here may provide the opportunity to find and align new records with the closest published isotope record measured on the same species, taking events into account that may only occur locally. Through its value for stratigraphy, our collection may also provide a foundation for the global mapping of seafloor sedimentation rates. The spatial quantitative mapping of sedimentation rates will allow the development of sediment budgets for the seafloor, including carbon burial.

Oxygen and carbon isotope ratios of Foraminifera are of great value for paleoclimatology by providing information on the history of seawater temperature and isotopic composition as well as circulation, productivity, and carbon sequestration. This isotope atlas will allow for new global compilations to be undertaken to understand these processes at a global scale. Although distorted by habitat effects and vital effects, there is hope that some of these effects can be represented and quantified in foraminiferal ecosystem/calci-fication models (e.g., Wolf-Gladrow et al., 1999; Schmidt and Mulitza, 2002; Fraile et al., 2008). Since the number of climate models containing the cycling of oxygen and carbon isotopes is constantly growing (Marchal and Curry, 2008; Kurahashi-Nakamura et al., 2017; Tierney et al., 2020; Muglia et al., 2018; Völpel et al., 2017), foraminiferal isotopes may provide the opportunity to validate climate model experiments directly. Given this prospect and the spatial coverage, foraminiferal isotope data should be rescued, assembled, and organized to secure the information for future applications as we continue to improve our understanding of the ecological and geochemical processes that determine isotope ratios in foraminiferal shells. Depending on the scientific problem, paleoceanographic compilations usually have specific criteria (e.g., temporal resolution or the availability of radiocarbon ages) for the selection of the records to be included (e.g., Jonkers et al., 2020). An atlas product that includes the majority of the available records enables quick selection of suitable data without an extensive literature review.

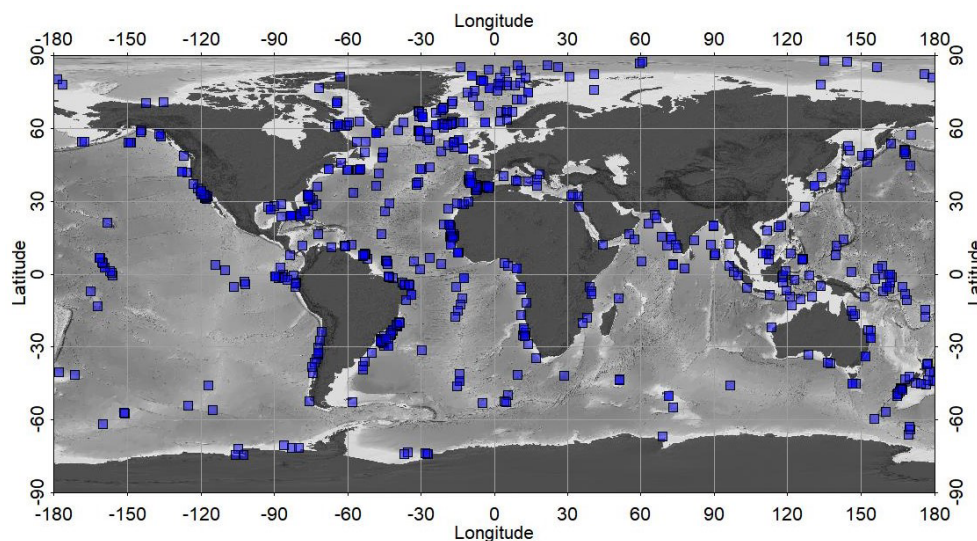


Figure 9. Spatial distribution of stable isotope records with at least one radiocarbon age. The map has been generated with PaleoDataView (Langner and Mulitza, 2019).

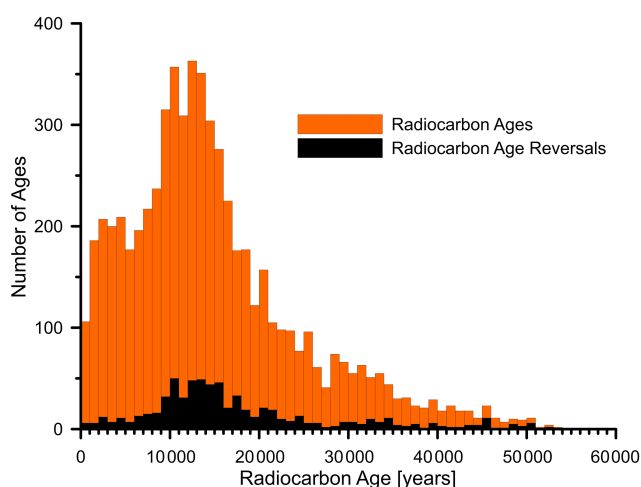


Figure 10. Distribution of radiocarbon ages in 1 kyr bins. Fraction of age reversals in black. Three negative radiocarbon ages are not included.

4.2 Expedition planning

The planning of marine coring campaigns requires prior knowledge of existing cores. Existing core locations are often resampled to get new sediment material or to extend the stratigraphic coverage with alternative coring gear that can penetrate deeper into the sediment. For example, many IODP and ODP cores are drilled at sites where short cores were previously retrieved. The knowledge of existing core locations and their stratigraphy allows identification of sampling gaps. Many aspects of marine expeditions are unpredictable, and schedules and coring plans regularly have to be adapted, often on a daily basis. The atlas we are presenting here provides

fast access to stratigraphic data and may aid the identification of suitable alternative coring locations on ocean expeditions. Both the freely available PDV software and the atlas do not require web access and are therefore suitable to be used with a standard laptop computer.

4.3 Education

Foraminiferal oxygen isotope ratios are still the most valuable stratigraphic tool in marine sediments. The atlas covers various sedimentation regimes and therefore provides numerous examples of how factors like local hydrography, species, or sedimentation rates influence the patterns of downcore isotope ratios. It therefore may be used as a resource to train students in regional isotope stratigraphy for studies in paleoceanography, paleoclimate, and marine geology. Lecturers may employ the atlas together with PaleoDataView or with custom software to show examples on how isotope stages may be identified in different geological settings and on how isotope differences between species may be explained by hydrography and foraminiferal ecology. Students may also actively explore the patterns of isotope stratigraphies from different parts of the global seafloor to actively learn how global factors such as ice volume and local factors such as sea surface temperature (SST) and freshwater input influence stable isotope records.

5 Data availability

All data included in the World Atlas of late Quaternary Foraminiferal Oxygen and Carbon Isotope Ratios can be downloaded at <https://doi.org/10.1594/PANGAEA.936747> (Mulitza et al., 2021a). For use with the soft-

ware PaleoDataView, the unzipped root directory (“WA_Foraminiferal_Isotopes_2022”) of the collection with all its content can be copied into the “Documents/PaleoDataView/” folder (Windows) or the /PaleoDataView/ folder under “Applications” (macOS). Select the root directory “WA_Foraminiferal_Isotopes_2022” under “Data → Change Collection → Change Working Directory” to explore the data. For use with custom software, netCDF files containing stable isotopes data are stored under “WA_Foraminiferal_Isotopes_2022\Foraminiferal_Isotopes\Data\” and the radiocarbon data under “WA_Foraminiferal_Isotopes_2022\Age\”. Information on the installation of PaleoDataView is available from Langner and Mulitza (2019).

6 Future: building a dynamic world atlas of marine sediments

The amount of proxy data from marine sediments is growing fast, and the demand of data sets that can constrain past states of the Earth system is increasing. The complexity of the data makes it challenging to maintain and reduce the data sets into spatially and chronologically coherent and meaningful data sets. We propose to initiate an atlas series that provides raw data in a consistent data format as a first step from data archived in public databases (as published) towards more sophisticated data products describing past states of the ocean and the seafloor (Fig. 11). Eventually, these harmonized data sets can form a continuously growing and sustainable public “database layer” where proxy-specific raw data can be queried and directly loaded into software that provides the tools to generate homogenized data products that can reach out into other disciplines, i.e., climate modeling. We present a simple file-based data collection where each file contains only one proxy record rather than all available data of the core. Paleoclimatic data are often analyzed and assembled in proxy-specific collections, because proxy-specific transfer functions have to be applied in order to quantify environmental variables. Furthermore, comparisons of records from different sites are preferably done on the same proxy type to ensure comparability. A single file per proxy facilitates the composition of proxy-specific collections, avoiding the additional costs (i.e., in terms of data management and disk space) of other downcore parameters in the same file. This modularity also allows individual scientists to separate their unpublished/unvalidated data from published/validated data that are ready to be included into a proxy collection. On the other hand, it is desirable to consistently apply the same stratigraphy to all proxies from a single core. PDV will automatically apply a single age model to all proxy records with the same core label. This requires that the depth scales and the core label of the different proxies are identical, when the data are imported.

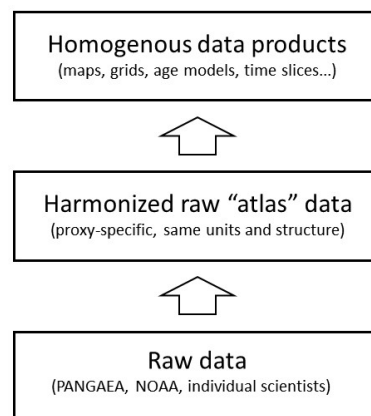


Figure 11. Potential workflow to form sustainable data products from raw databases.

Stable isotopes and radiocarbon ages usually provide the stratigraphic basis for further investigations. When collections of other proxies are added to PDV, these collections can rely on the stratigraphic data provided here and any changes in the stratigraphy will be applied to all proxy data in the collection. The efficient visualization of the data in PDV allows the identification of erroneous data and helps to improve the atlas product over time. The Excel export and import functions of PDV also ensure access to the data for individuals without strong programming skills.

As new foraminiferal isotope measurements become frequently available, we plan to update the atlas in reasonable intervals. Also, more historical isotope data may become available and need to be rescued (i.e., Borreggine et al., 2017). We hope this atlas will be a useful resource for the paleoceanography and marine geology community and will continue to grow through the contribution of new data sets as they are developed. Please contact the first author if you are interested in contributing to future updates of the atlas.

Appendix A

Table A1. References for the included stable isotope and radiocarbon data.

Core/site	References
12PC51	Sikes and Keigwin (1994)
3MO67	Znaidi-Rivault (2006a)
64PE-174P13	Scussolini and Peeters (2013)
75KS23	Znaidi-Rivault (2006b)
75KS5	Znaidi-Rivault (2006c)
75KS50	Znaidi-Rivault (2006d)
75KS76	Znaidi-Rivault (2006e)
75KS79	Znaidi-Rivault (2006f)
A179-15	Mix et al. (1986); CLIMAP Project Members (2004a)
A7	Sun et al. (2005)
AA_GC5	Rathburn et al. (1997)
AAS9_21	Govil and Naidu (2010)
AHF-11343	Mortyn et al. (1996)
AHF-16830	Mortyn et al. (1996)
AHF-16832	Mortyn et al. (1996)
AHF-28181	Mortyn et al. (1996)
AII-125JPC-76	Friddell (2003)
AI160-13APC	Curry and Lohmann (1982)
ALB226	Sarnthein et al. (1994)
AMK4-316GC	Barash et al. (2002); Spielhagen et al. (1999)
AOS94_B16	Poore et al. (1999)
AOS94_B17	Poore et al. (1999)
AOS94_B19	Poore et al. (1999)
AOS94_B8	Poore et al. (1999)
ASV13_1200	Duplessy et al. (2005)
AT_II-107_22	Keigwin and Boyle (1989)
BA84-02PC	Kallel et al. (1997)
BA84-08GC	Kallel et al. (1997)
BC42-11	Showers and Margolis (1985)
BC43-15	Showers and Margolis (1985)
BC44-12	Showers and Margolis (1985)
BC5-5	Showers and Margolis (1985)
BC79-8	Showers and Margolis (1985)
BCCF10-01	Dias et al. (2018)
BCCF10-01	Venancio et al. (2016)
BCCF10-04	Venancio et al. (2016)
BCCF10-09	Dias et al. (2018)
BCCF10-15	Dias et al. (2018)
BOFS14K	Bertram et al. (1995); Lowry and Machin (2016)
BOFS17K	Shimmield (2004a)
BOFS26_6K	Beveridge et al. (1995)
BOFS28_3K	Beveridge et al. (1995)
BOFS29_1K	Beveridge et al. (1995)
BOFS30_3K	Beveridge et al. (1995)
BOFS31_1K	Beveridge et al. (1995)
BOFS5K	Shimmield (2004b); Manighetti et al. (1995)
BS79-33	Cacho et al. (2001); Sbaffi et al. (2001)
BS88-6-10B	Horwege and Spielhagen, unpublished
BS88-6-12	Horwege and Spielhagen, unpublished
BS88-6-13	Horwege and Spielhagen, unpublished
BS88-6-14	Horwege and Spielhagen, unpublished
BS88-6-16	Horwege and Spielhagen, unpublished
BS88-6-17B	Horwege and Spielhagen, unpublished
BS88-6-18	Horwege and Spielhagen, unpublished
BS88-6-21	Horwege and Spielhagen, unpublished
BS88-6-23	Horwege and Spielhagen, unpublished
BS88-6-3	Horwege and Spielhagen, unpublished
BS88-6-4	Horwege and Spielhagen, unpublished
BS88-6-6	Horwege and Spielhagen, unpublished
BS88-6-7	Horwege and Spielhagen, unpublished
BS88-6-8	Horwege and Spielhagen, unpublished
BS-A	Ferreira et al. (2014)
BS-C	Costa et al. (2018)
BS-D	Ferreira et al. (2014)
BT4	Curry et al. (1988)

Table A1. Continued.

Core/site	References
CEUTA10PC08	Ausín et al. (2015a)
CF10-01B	Lessa et al. (2016); de Oliveira Lessa et al. (2014)
CF10-09A	Lessa et al. (2016)
CH0182-36	Slowey and Curry (1987)
CH22KW31	Pastouret et al. (1978)
CH69-K09	Labeyrie et al. (1999)
CH71-07	Sarnthein et al. (1994)
CH72-02	Curry et al. (1988)
CH73-139C	Duplessy (1982); Labeyrie and Duplessy (1985); Bard et al. (1987)
CH74-227	Labeyrie (1996)
CH75-03	Curry et al. (1988)
CH75-04	Curry et al. (1988)
CH84-27	Labeyrie (1996)
CHAT_16k	Yu et al. (2007)
CHAT_1K	Weaver et al. (1998); McCave et al. (2008)
CHAT10K	McCave et al. (2008); Maxson et al. (2019)
CHAT3K	McCave et al. (2008)
CHN115-70PC	Curry and Lohmann (1982)
CHN115-88PC	Curry and Lohmann (1982)
CHN115-89PC	Curry and Lohmann (1982)
CHN115-90PC	Curry and Lohmann (1982)
CHN115-91PC	Curry and Lohmann (1982)
CHN115-92PC	Curry and Lohmann (1982)
CHN82-20	Keigwin and Lehman (1994)
CHN82-24	Curry et al. (1988)
CMU-14	Toledo et al. (2007)
CS70-5	Znaidi-Rivault (2006g)
CS72-37	Kallel et al. (1997)
D11957P	Lebreiro et al. (1997)
DSDP590	Nelson et al. (1994, 1993)
DSDP591	Nelson et al. (1994, 1993)
DSDP592	Nelson et al. (1994, 1993)
DSDP593	Elmore et al. (2015c)
DSDP594	Nelson et al. (1986)
E11-2	Mashiotta et al. (1999); Zheng et al. (2002)
E27-23	Ferry et al. (2015); Anderson et al. (2009)
E45-29	Howard and Prell (1992)
E49-17	Howard and Prell (1992)
E49-18	Howard and Prell (1992)
E49-21	Howard and Prell (1992)
E49-23	Howard and Prell (1992)
ELT25.011-CP	Waddell et al. (2009)
ELT48.022-PC	Rickaby and Elderfield (1999)
EN066-10PG	Curry and Lohmann (1983)
EN066-16PG	Curry and Lohmann (1983)
EN066-21PG	Curry and Lohmann (1983)
EN066-26PG	Curry and Lohmann (1983)
EN066-29PG	Curry and Lohmann (1983)
EN066-32PG	Curry and Lohmann (1983)
EN066-36PG	Curry and Lohmann (1983)
EN066-38PG	Curry and Lohmann (1983)
EN066-44PG	Curry and Lohmann (1983)
EN32-PC6	Flower et al. (2004)
EN540-GGC-2	Keigwin, unpublished
ENAM9321	Rasmussen et al. (1996)
ERDC-093P	Shackleton et al. (1992)
ERDC-124P	Wu et al. (1990)
ESP-08	Toledo et al. (2007)
EW0408-26JC	Praetorius and Mix (2014); Praetorius et al. (2015, 2016)
EW0408-26TC	Praetorius et al. (2015, 2016)
EW0408-66JC	Praetorius and Mix (2014); Praetorius et al. (2016)
EW0408-85JC	Praetorius et al. (2015); Davies-Walczak et al. (2014)
EW0408-87JC	Praetorius et al. (2015); Davies-Walczak et al. (2014)
EW9209-1JPC	Curry et al. (1999)
EW9209-2JPC	Curry et al. (1999)
EW9209-3JPC	Curry et al. (1999)
EW9302-24GGC	Oppo et al. (2015)
EW9302-25GGC	Oppo et al. (2015)
EW9302-26GGC	Oppo et al. (2015)

Table A1. Continued.

Core/site	References
EW9504-02	Stott et al. (2000)
EW9504-03	Stott et al. (2000)
EW9504-04	Stott et al. (2000)
EW9504-05	Stott et al. (2000)
EW9504-08	Stott et al. (2000)
EW9504-09	Stott et al. (2000)
F2-92-P3	van Geen et al. (1996); Zheng et al. (2000)
F8-90-G21	van Geen et al. (1996)
Fan_17	Parker et al. (2016)
FFC15	Keigwin and Lehman (2015)
FR01_97-09	Bostock et al. (2009)
FR01_97-10	Bostock et al. (2009); Bostock et al. (2004)
FR01_97-11	Bostock et al. (2009)
FR01_97-12	Bostock et al. (2004)
FR01_97-13	Bostock et al. (2009)
FR01_97-14	Bostock et al. (2009)
FR1_94-GC3	de Deckker et al. (2019)
FR4-92-PC16	Dunbar et al. (2000)
FR4-92-PC36	Dunbar et al. (2000)
FR4-92-PC42	Dunbar et al. (2000)
FR4-92-PC6	Dunbar et al. (2000)
FR5-90-PC27a	Bostock et al. (2006)
GC34	Moy et al. (2006)
GeoB10038-4	Mohtadi et al. (2010a, b); Mohtadi, unpublished
GeoB10053-7	Mohtadi et al. (2011); Mohtadi, unpublished
GeoB10069-3	Gibbons et al. (2014); Mohtadi, unpublished
GeoB1007-4	Mulitza and Rühlemann (2000); Mulitza, unpublished
GeoB1008-3	Schneider (1991); Govin, unpublished
GeoB1016-3	Schneider et al. (1995); Govin, unpublished
GeoB1023-5	Schneider et al. (1995); Kim and Schneider (2003)
GeoB1028-5	Wefer et al. (1996); Bickert and Mackensen (2004)
GeoB1031-4	Wefer et al. (1996); Bickert and Mackensen (2004)
GeoB1032-2	Bickert and Mackensen (2004)
GeoB1032-3	Wefer et al. (1996); Bickert and Mackensen (2004)
GeoB1034-1	Bickert and Mackensen (2004)
GeoB1034-3	Bickert and Mackensen (2004)
GeoB1035-3	Bickert and Mackensen (2004)
GeoB1035-4	Bickert and Mackensen (2004)
GeoB1041-1	Bickert and Mackensen (2004)
GeoB1041-3	Wolff (1998); Bickert and Mackensen (2004)
GeoB1101-4	Bickert and Mackensen (2004)
GeoB1101-5	Bickert and Mackensen (2004)
GeoB1105-3	Kemle-von Mücke (1994); Bickert and Mackensen (2004)
GeoB1105-4	Meinecke (1992); Kemle-von Mücke (1994); Bickert and Mackensen (2004)
GeoB1112-3	Bickert and Mackensen (2004)
GeoB1112-4	Kemle-von Mücke (1994); Bickert and Mackensen (2004)
GeoB1113-4	Sarnthein et al. (1994)
GeoB1113-7	Sarnthein et al. (1994)
GeoB1115-3	Bickert and Mackensen (2004)
GeoB1115-4	Bickert and Mackensen (2004)
GeoB1117-2	Bickert and Mackensen (2004)
GeoB1117-3	Bickert and Mackensen (2004)
GeoB1118-2	Bickert and Mackensen (2004)
GeoB1118-3	Bickert and Mackensen (2004)
GeoB1211-1	Bickert and Mackensen (2004)
GeoB1211-3	Bickert and Mackensen (2004)
GeoB1214-1	Bickert and Mackensen (2004)
GeoB1214-2	Bickert and Mackensen (2004)
GeoB1220-1	Wefer et al. (1996); Bickert and Mackensen (2004)
GeoB12605-3	Kuhnert et al. (2014); Kuhnert, unpublished
GeoB12615-4	Romahn et al. (2014)
GeoB12624-1	Liu et al. (2016); Bouimetarhan et al. (2015)
GeoB1306-1	Bickert and Mackensen (2004)
GeoB1306-2	Bickert and Mackensen (2004)
GeoB1309-2	Hale and Pflaumann (1999a)
GeoB1312-2	Hale and Pflaumann (1999a); Bickert and Mackensen (2004)
GeoB13601-4	Just et al. (2012)
GeoB13731-1	Fink et al. (2013); Wang et al. (2019)
GeoB13801-2	Bender et al. (2013)

Table A1. Continued.

Core/site	References
GeoB13825-2	Bickert, unpublished
GeoB13862-1	Voigt et al. (2015)
GeoB1408-3	Dürkoop et al. (1997a); Mulitza (2009a)
GeoB1413-4	Wefer et al. (1996)
GeoB1417-1	Meinecke (1992); Bickert and Mackensen (2004)
GeoB1419-2	Bickert and Mackensen (2004)
GeoB15005-1	Martínez-Méndez et al. (2013)
GeoB1501-4	Dürkoop et al. (1997b); Bickert and Mackensen (2004)
GeoB1503-1	Dürkoop et al. (1997c); Bickert and Mackensen (2004); Mulitza, unpublished
GeoB1505-2	Bickert and Mackensen (2004)
GeoB1506-2	Wolff (1998)
GeoB1508-4	Dürkoop et al. (1997d); Bickert and Mackensen (2004)
GeoB1515-1	Rühlemann et al. (1996); Vidal et al. (1999)
GeoB1520-1	Bickert and Mackensen (2004)
GeoB1520-2	Bickert and Mackensen (2004)
GeoB1523-1	Mulitza (1994); Bickert and Mackensen (2004); Mulitza (2009b)
GeoB1523-1	Rühlemann et al. (2001)
GeoB1523-2	Bickert and Mackensen (2004)
GeoB16202-2	Freymüller (2013); Vahlenkamp (2013); Huppertz (2014); Mulitza et al. (2017); Voigt et al. (2017); Venancio et al. (2018); Mulitza, unpublished; Mulitza and Mackensen, unpublished
GeoB16206-1	Zhang et al. (2015); Voigt et al. (2017)
GeoB16224-1	Krummrei (2015); Zhang et al. (2015); Voigt et al. (2017); Crivellari et al. (2018); Mulitza, unpublished
GeoB16320-2	Matos et al. (2017)
GeoB1701-4	Dürkoop et al. (1997e); Mulitza, unpublished
GeoB1704-4	Mollenhauer (2002); Mollenhauer, unpublished
GeoB1706-2	Little et al. (1997)
GeoB1710-2	Bickert and Mackensen (2004)
GeoB1710-3	Schmiedl and Mackensen (1997)
GeoB1711-4	Bickert and Mackensen (2004); Vidal et al. (1999); Little et al. (1997); Balmer et al. (2016)
GeoB1711-5	Bickert and Mackensen (2004)
GeoB1712-4	Mollenhauer, unpublished
GeoB1720-2	Dickson et al. (2009)
GeoB1721-4	Bickert and Mackensen (2004)
GeoB1721-7	Bickert and Mackensen (2004)
GeoB1722-1	Bickert and Mackensen (2004)
GeoB1722-3	Bickert and Mackensen (2004)
GeoB1903-3	Dürkoop et al. (1997f); Bickert and Mackensen (2004); Niebler and Mulitza (2009)
GeoB1905-3	Bickert and Mackensen (2004)
GeoB2004-2	Bickert and Mackensen (2004); Mulitza (2009c)
GeoB2016-1	Niebler (2004g); Bickert and Mackensen (2004)
GeoB2019-1	Bickert and Mackensen (2004); Niebler (2004h); Mulitza, unpublished
GeoB2021-5	Niebler (2004i); Mulitza, unpublished
GeoB2104-3	Steinborn (2003); Hickey (2010); Mulitza, unpublished
GeoB2105-1	Steinborn (2003)
GeoB2106-3	Steinborn (2003)
GeoB2107-3	Dürkoop (1998); Portilho-Ramos et al. (2018); Heil (2006); Rühlemann, unpublished
GeoB2109-1	Hale and Pflaumann (1999b); Dürkoop et al. (2004a); Mulitza (2009d); Huang (2013)
GeoB2110-4	Gingele et al. (1999)
GeoB2116-4	Niebler (2004j); Mulitza (2004)
GeoB2117-1	Dürkoop et al. (1997g)
GeoB2125-1	Dürkoop et al. (1997h)
GeoB2126-3	Govin, unpublished
GeoB2202-4	Dürkoop et al. (1997i)
GeoB2204-1	Dürkoop (1998); Bickert and Mackensen (2004); Mulitza, unpublished
GeoB2204-2	Dürkoop (1998); Bickert and Mackensen (2004); Mulitza, unpublished
GeoB2215-10	Wolff (1998); Bickert and Mackensen (2004)
GeoB2819-1	Dürkoop et al. (1997j); Hale and Pflaumann (1999a); Bickert and Mackensen (2004)
GeoB3004-1	Schmiedl and Mackensen (2006)
GeoB3005-1	Müller and Budziak (2004)
GeoB3104-1	Arz et al. (1998); Arz et al. (1999b)
GeoB3117-1	Arz et al. (1999a)
GeoB3129-1	Arz et al. (1999a)
GeoB3176-1	Arz et al. (1999a)
GeoB3202-1	Arz et al. (1999b); Behling et al. (2002)
GeoB3229-2	Arz et al. (1999b)
GeoB3302-1	Lamy (1998); Mohtadi et al. (2008)
GeoB3304-5	Bernhardt et al. (2016, 2015)
GeoB3313-1	Lamy et al. (2002)
GeoB3327-5	Ho et al. (2012)

Table A1. Continued.

Core/site	References
GeoB3359-3	Mohtadi et al. (2008)
GeoB3369-1	Bernhardt et al. (2016, 2015)
GeoB3375-1	Lamy et al. (1998, 2000)
GeoB3603-2	Bickert and Mackensen (2004)
GeoB3606-1	Romero et al. (2003)
GeoB3722-2	Mollenhauer (2002); Niebler et al. (2003); Mollenhauer, unpublished; Niebler, unpublished
GeoB3801-6	Bickert and Mackensen (2004); Mulitza (2009e)
GeoB3808-6	Hale and Pflaumann (1999c) Bickert and Mackensen (2004); Dürkoop et al. (2004b)
GeoB3813-3	Bickert and Mackensen (2004); Mulitza (2009f)
GeoB3914-2	Govin, unpublished
GeoB3935-2	Schlünz et al. (2000)
GeoB3938-1	Schlünz et al. (2000); Govin et al. (2014a)
GeoB4216-1	Freudenthal et al. (2002)
GeoB4223-2	Freudenthal et al. (2002); Henderiks et al. (2002)
GeoB4240-2	Freudenthal et al. (2002); Henderiks et al. (2002)
GeoB4241-11	Freudenthal (2000); Henderiks et al. (2002)
GeoB4403-2	Bickert and Mackensen (2004)
GeoB4411-2	Hörner (2012); Govin et al. (2014a)
GeoB4420-2	Mulitza, unpublished
GeoB4901-8	Adegbie (2001)
GeoB4905-4	Adegbie et al. (2003); Weldeab et al. (2005); Zimmermann (2013)
GeoB5115-2	Niebler (2004k); Bickert and Mackensen (2004)
GeoB5121-2	Niebler (2004l); Bickert and Mackensen (2004)
GeoB5844-2	Arz et al. (2003)
GeoB5901-2	Schirrmacher et al. (2020); Rühlemann, unpublished
GeoB6201-5	Portilho-Ramos et al. (2018)
GeoB6211-2	Steinborn (2003); Chiessi et al. (2008, 2009); Voigt et al. (2015); Chiessi, unpublished
GeoB6212-1	Chiessi and Mulitza, unpublished
GeoB6213-2	Mulitza and Chiessi, unpublished
GeoB6308-3	Voigt et al. (2015)
GeoB6340-2	Mulitza, unpublished
GeoB6403-3	Donner, unpublished
GeoB6405-6	Donner, unpublished
GeoB6408-4	Donner, unpublished
GeoB6412-2	Barbara Donner, unpublished
GeoB6421-2	Barbara Donner, unpublished
GeoB6425-2	Donner, unpublished
GeoB6518-1	Schefuss et al. (2005)
GeoB6719-1	Rüggeberg et al. (2005)
GeoB6910-2	Steinborn (2003)
GeoB6914-2	Steinborn (2003)
GeoB7010-2	Kuhr (2011); Govin et al. (2014b, a)
GeoB7112-5	Mohtadi and Hebbeln (2004); Mohtadi et al. (2004)
GeoB7165-1	Mohtadi et al. (2008)
GeoB7920-2	Tjallingii et al. (2008)
GeoB7926-2	Romero et al. (2008); Kim et al. (2012); McKay et al. (2014)
GeoB8453-1	Rathmann and Mulitza, unpublished
GeoB8507-3	Kohn et al. (2011)
GeoB9064-1	El Frihmat et al. (2015)
GeoB9069-1	El Frihmat et al. (2015)
GeoB9311-1	Dupont and Kuhlmann (2017)
GeoB9501-5	Mulitza et al. (2010); Kuhnert and Mulitza, unpublished data
GeoB9503-5	Mulitza, unpublished; Bouimetarhan et al. (2009)
GeoB9506-1	Mulitza, unpublished
GeoB9508-5	Mulitza et al. (2008); Johnstone, unpublished
GeoB9510-1	Völpe et al. (2019); Lynch-Stieglitz, unpublished
GeoB9512-5	Völpe et al. (2019); Lynch-Stieglitz, unpublished
GeoB9513-3	Völpe et al. (2019); Mulitza, unpublished
GeoB9516-5	Itambi et al. (2009); Mulitza, unpublished
GeoB9526-5	Zarriß, 2010; Zarriß and Mackensen (2010); Zarriß et al. (2011)
GeoB9528-3	Castañeda et al. (2009); Gemmeke (2010)
GeoB9532-2	Huang and Mulitza, unpublished
GeoB9533-2	Huang and Mulitza, unpublished
GeoB9534-5	Huang and Mulitza, unpublished
GeoB9535-4	Collins et al. (2011); Huang and Mulitza, unpublished
GeoB9624-1	Henrich et al. (2010); Bickert, unpublished
GEOFARKF13	Richter (1998)
GeoTu_SL110	Ehrmann et al. (2016)
GGC-49	Leech et al. (2013)

Table A1. Continued.

Core/site	References
GIK11944-1	Winn et al. (1991)
GIK11944-2	Zahn-Knoll (1986)
GIK12392-1	Zahn et al. (1986)
GIK13289-2	Sarnthein et al. (1994)
GIK13291-1	Hommers et al. (2019)
GIK13519-1	Sarnthein et al. (1984)
GIK15612-2	Sarnthein et al. (1994); Kiefer (1998)
GIK15637-1	Kiefer (1998); Sarnthein et al. (1994); Zahn-Knoll and Sarnthein (2003)
GIK15666-6	Weinelt and Sarnthein (2003a); Zahn et al. (1987)
GIK15669-1	Sarnthein et al. (1994); Zahn et al. (1987)
GIK15670-5	Weinelt and Sarnthein (2003b); Weinelt (1993); Zahn et al. (1987)
GIK16004-1	Sarnthein et al. (1994); Zahn et al. (1987)
GIK16160-3	Wang et al. (2013a, b)
GIK16396-1	Sarnthein et al. (1994)
GIK16459-1	Sarnthein (2004)
GIK16771-2	Sarnthein et al. (1994)
GIK16773-1	Sarnthein et al. (1994)
GIK16776-1	Hüls (1991)
GIK16856-2	Sarnthein et al. (1994); Schulz (1995)
GIK16867-2	Sarnthein (1997a)
GIK16867-3	Sarnthein (1997a)
GIK17045-2	Sarnthein et al. (1994)
GIK17045-3	Sarnthein et al. (1994)
GIK17048-3	Sarnthein (1997b)
GIK17048-4	Sarnthein (1997b)
GIK17049-6	Jung (1996)
GIK17050-1	Jung and Sarnthein (2003a)
GIK17051-3	Jung and Sarnthein (2003a, b)
GIK17054-1	Sarnthein et al. (1988)
GIK17055-1	Winn and Sarnthein (1991); Winn et al. (1991)
GIK17055-2	Winn and Sarnthein (1991); Winn et al. (1991)
GIK17286-1	Lauterbach et al. (2020)
GIK17304-1	Winn (2013e)
GIK17304-2	Winn (2013f)
GIK17747-1	Winn (2013g)
GIK17747-2	Winn (2013h)
GIK17748-2	Mohtadi and Hebbeln (2004); Mohtadi et al. (2008)
GIK17790-3	Winn (2013b)
GIK17795-2	Winn (2013c)
GIK17812-1	Winn (2013d)
GIK17940-2	Wang et al. (1999a, b)
GIK17954-2	Wang et al. (1999a)
GIK17961-2	Wang et al. (1999a)
GIK17964-2	Wang et al. (1999a)
GIK18471-1	Lo Giudice Cappelli et al. (2016)
GIK18517-2	Hendrizan et al. (2017b, a)
GIK18519-2	Schröder et al. (2018)
GIK18522-3	Schröder et al. (2018)
GIK18526-3	Schröder et al. (2018)
GIK18540-3	Schröder et al. (2018)
GIK23071-3	Voelker (1999)
GIK23074-1	Voelker (1999)
GIK23258-2	Weinelt (1993); Sarnthein et al. (2003)
GIK23258-3	Sarnthein et al. (2003)
GIK23259-2	Weinelt (1993)
GIK23323-1	Bauch et al. (2003)
GIK23415-9	Jung (1996)
GIK23416-4	Jung and Sarnthein (2003c)
GIK23417-1	Jung and Sarnthein (2003d)
GIK23419-8	Jung (1996)
GIK23519-4	Millo et al. (2006)
GIK23519-5	Millo et al. (2006)
GL-1090	Santos et al. (2017a, b, 2020)
GL-1248	Venancio et al. (2018)
GL-74	Portilho-Ramos et al. (2014)
GL-75	Portilho-Ramos et al. (2014)
GL-852	Toledo et al. (2016)
GL-854	Camillo et al. (2020); de Almeida et al. (2015)
GS07-150_11_1MC-C	Santos et al. (2013)

Table A1. Continued.

Core/site	References
GS07-150_17_2MC-A	Santos et al. (2013)
GS07-150_MC-B	Santos et al. (2014)
H214	Sikes et al. (2016); Samson et al. (2005)
HER_GC_T1	Ausín et al. (2015b)
HER-GC-ALB2	Català et al. (2019)
HLY02-02-51	Cook et al. (2011); Caissie et al. (2010)
HLY02-02-57	Cook et al. (2011)
HLY03-05GC	Jennings et al. (2011)
HLY1302-JPC-15	Keigwin et al. (2018)
HLY1302-JPC-2	Keigwin et al. (2018)
HLY1302-JPC-6	Keigwin et al. (2018)
HLY1302-JPC-9	Keigwin et al. (2018)
HM79-4_6	Karpuz and Jansen (1992)
HU2001043-008	Hoffman (2016)
HU2001043-008TWC	Hoffman (2016)
HU2006040-006	Hoffman (2016)
HU72-021-3	Keigwin and Jones (1995)
HU72-021-7	Keigwin and Jones (1995)
HU73-011-1	Keigwin and Jones (1995)
HU73-031-7	Keigwin and Jones (1995)
HU75-41	Labeyrie and Duplessy (1985)
HU75-42	Labeyrie and Duplessy (1985)
HU76-029-033	Hillaire-Marcel et al. (1989)
HU77-148	Andrews et al. (1991)
HU77-149	Andrews et al. (1991)
HU77-150	Andrews et al. (1991)
HU77-151	Andrews et al. (1991)
HU77-154	Andrews et al. (1991)
HU77-156	Andrews et al. (1991)
HU84-008	Andrews et al. (1991)
HU85-027-016P	Hillaire-Marcel et al. (1989)
HU85-027-016TWC	Hillaire-Marcel et al. (1989)
HU87-033-009	Andrews and Tedesco (1992)
HU-90-013-011BC	Hillaire-Marcel et al. (1994)
HU-90-013-013P	Hillaire-Marcel et al. (1994)
HU-90-013-017BC	Hillaire-Marcel et al. (1994)
HU-91-045-052P	Hillaire-Marcel, unpublished
HU91-045-094	Hillaire-Marcel et al. (1994)
HUD91_039-012P	Knudsen et al. (2008); Blake et al. (1996)
HYIV2015-B9	Li et al. (2018)
IN68-5	Jorissen et al. (1993)
INMD-097BX	Berger et al. (1985)
INMD-101BX	Berger et al. (1985)
INMD-104BX	Berger et al. (1985)
INMD-109BX	Berger et al. (1985)
INMD-110BX	Berger et al. (1985)
INMD-111BX	Berger et al. (1985)
INMD-113BX	Berger et al. (1985)
INMD-115BX	Berger et al. (1985); Berger and Vincent (1986)
IOW226660-5	Mollenhauer et al. (2003); Mollenhauer, unpublished
IOW226920-3	Mollenhauer et al. (2003); Mollenhauer, unpublished
J-11	Gorbarenko and Southon (2000)
JM11-FI-19PC	Hoff et al. (2016)
JM96-1225_1-GC	Hagen and Hald (2002)
JM96-1225_2-GC	Hagen and Hald (2002)
JR104-GC352	Hillenbrand et al. (2010)
JR104-GC357	Hillenbrand et al. (2010)
JR104-GC368	Hillenbrand et al. (2010)
JR104-GC370	Hillenbrand et al. (2010)
JR104-GC372	Hillenbrand et al. (2010)
JR179-TC493	Lu et al. (2016)
JR244-GC528	Roberts et al. (2016)
JR298-PC726	Channell et al. (2019)
JR298-PC728	Channell et al. (2019)
JR298-PC736	Channell et al. (2019)
KC82-21	Znaidi-Rivault (1982); Caralp (1988); Vergnaud-Grazzini and Pierre (1991)
KC82-26	Znaidi-Rivault (1982); Caralp (1988); Vergnaud-Grazzini and Pierre (1991)
KET82-21	Colin et al. (2021)
KF-12	Costa et al. (2016a)

Table A1. Continued.

Core/site	References
KF14	Leonhardt et al. (2015)
KF16	Repschläger et al. (2015)
KH94-3_LM-8	Oba and Murayama (2004)
KN07304-0003PG	Curry et al. (1988)
KN166-14-11JPC	Elmore et al. (2015a, b)
KN166-14-3GGC	Elmore et al. (2015b)
KN166-14-JPC-13	Hodell et al. (2010)
KNR110-43PC	Curry and Crowley (1987)
KNR110-50	Curry et al. (1988)
KNR110-55	Sarnthein et al. (1988)
KNR110-58	Curry et al. (1988)
KNR110-66	Curry et al. (1988)
KNR110-71	Curry et al. (1988)
KNR110-75	Curry et al. (1988)
KNR110-82	Curry et al. (1988)
KNR110-91	Curry et al. (1988)
KNR140-01JPC	Keigwin (2004)
KNR140-02JPC	Keigwin (2004)
KNR140-02PG	Keigwin (2004)
KNR140-12JPC	Keigwin (2004)
KNR140-21GGC	Keigwin (2004)
KNR140-22JPC	Keigwin (2004)
KNR140-22PG	Keigwin (2004)
KNR140-28GGC	Keigwin (2004)
KNR140-29GGC	Keigwin (2004)
KNR140-2JPC-37	Hagen and Keigwin (2002)
KNR140-30GGC	Keigwin (2004)
KNR140-31GGC	Keigwin (2004)
KNR140-39GGC	Keigwin (2004); Keigwin and Schlegel (2002)
KNR140-40GGC	Keigwin (2004)
KNR140-43GGC	Keigwin (2004)
KNR140-50GGC	Keigwin (2004)
KNR140-51GGC	Keigwin (2004); Carlson et al. (2008); Rasmussen and Thomsen (2012)
KNR140-56GGC	Keigwin (2004)
KNR140-63JPC	Keigwin (2004)
KNR140-64GGC	Keigwin (2004)
KNR140-66GGC	Keigwin (2004)
KNR140-67JPC	Keigwin (2004)
KNR159-5-120GGC	Hoffman and Lund (2012)
KNR159-5-125GGC	Lund et al. (2015); Hoffman and Lund (2012)
KNR159-5-14GGC	Lund et al. (2015)
KNR159-5-17JPC	Lund et al. (2015); Tessin and Lund (2013)
KNR159-5-20JPC	Lund et al. (2015)
KNR159-5-22GGC	Lund et al. (2015); Hoffman and Lund (2012)
KNR159-5-30GGC	Lund et al. (2015); Tessin and Lund (2013)
KNR159-5-33GGC	Lund et al. (2015); Tessin and Lund (2013)
KNR159-5-36GGC	Lund et al. (2015); Carlson et al. (2008); Sortor and Lund (2011); Came et al. (2003)
KNR159-5-42JPC	Lund et al. (2015); Hoffman and Lund (2012)
KNR159-5-54GGC	Hoffman and Lund (2012)
KNR159-5-63GGC	Lund et al. (2015)
KNR159-5-78GGC	Lund et al. (2015); Tessin and Lund (2013)
KNR159-5-90GGC	Lund et al. (2015)
KNR166-2-105JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-106JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-113JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-119JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-127JPC	Lynch-Stieglitz et al. (2011)
KNR166-2-132JPC	Lynch-Stieglitz et al. (2011)
KNR166-2-135JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-1GGC	Lynch-Stieglitz et al. (2009)
KNR166-2-26JPC	Schmidt and Lynch-Stieglitz (2011); Lynch-Stieglitz et al. (2011)
KNR166-2-29JPC	Lynch-Stieglitz et al. (2011)
KNR166-2-2JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-31JPC	Lynch-Stieglitz et al. (2011)
KNR166-2-48JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-51JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-59JPC	Lynch-Stieglitz et al. (2009)
KNR166-2-73GGC	Lynch-Stieglitz et al. (2011)
KNR166-2-8GGC	Lynch-Stieglitz et al. (2009)

Table A1. Continued.

Core/site	References
KNR191-CDH19	Henry et al. (2016)
KNR195-5-CDH23	Kalansky et al. (2015)
KNR195-5-MC42C	Rustic et al. (2015)
KNR197-10-17GGC	Keigwin and Swift (2017)
KNR197-3-23GGC	Oppo et al. (2018)
KNR197-3-36GGC	Oppo et al. (2018)
KNR197-3-45GGC	Oppo et al. (2018)
KNR197-3-46CDH	Oppo et al. (2018)
KNR197-3-47CDH	Oppo et al. (2018)
KNR197-3-53GGC	Oppo et al. (2018)
KNR197-3-60GGC	Oppo et al. (2018)
KNR197-3-9GGC	Oppo et al. (2018).
KNR198-GGC-4	Keigwin, unpublished
KNR207-2_GGC3	Middleton et al. (2018)
KNR207-2_GGC6	Middleton et al. (2018)
KNR31-GPC5	Keigwin et al. (1991); Keigwin and Jones (1994, 1995)
KNR73_4PC	Keigwin and Lehman (2015)
KNR73_6PG	Keigwin and Lehman (2015)
KS82-30	Vergnaud-Grazzini and Pierre (1991); Caralp (1988)
KS82-31	Vergnaud-Grazzini and Pierre (1991); Caralp (2006a)
KS82-32	Thunell (2006a); Caralp (2006b)
KT90-9_21	Oba and Murayama (2004)
KT90-9_5	Oba and Murayama (2004)
LaPAS-KF02	Pivel et al. (2013)
LO09_21-2	Lackschewitz et al. (1998)
LO09_23-2	Lackschewitz et al. (1998)
LOUIS1610	Aharon (2003)
LOUIS1639	Aharon (2003)
LOUIS1640	Aharon (2003)
LOUIS1900	Aharon (2003)
LOUIS1924	Aharon (2003)
LOUIS1938	Aharon (2003)
LOUIS2023	Aharon (2003)
LV27-10-1	Kaiser (2001)
LV27-10-5	Kaiser (2001)
LV27-12-2	Kaiser (2001)
LV27-12-3	Kaiser (2001)
LV27-15-1	Kaiser (2001)
LV27-4-2	Kaiser (2001)
LV27-4-3	Kaiser (2001)
LV27-5-5	Kaiser (2001)
LV27-7-2	Kaiser (2001)
LV27-7-3	Kaiser (2001)
LV27-8-3	Kaiser (2001)
LV27-9-4	Kaiser (2001)
LV28-2-3	Kaiser (2001)
LV28-40-4	Kaiser (2001)
LV28-41-3	Kaiser (2001)
LV28-41-4	Kaiser (2001)
LV28-42-3	Kaiser (2001)
LV28-42-4	Kaiser (2001)
LV28-4-3	Kaiser (2001)
LV28-4-4	Kaiser (2001); Lembke-Jene et al. (2017)
LV28-44-2	Kaiser (2001)
LV28-44-3	Kaiser (2001)
M1_105KK	Sirocko (1989)
M1_114KK	Sirocko (1989)
M1_143KK	Sirocko (1989)
M1_162KK	Sirocko (1989)
M1_169SK	Sirocko (1989)
M1_181SK	Sirocko (1989)
M1_182SK	Sirocko (1989)
M1_223SK	Sirocko (1989)
M1_232SK	Sirocko (1989)
M125_469-3	Campos et al. (2020)
M125-34-2	Bahr et al. (2020)
M125-50-3	Campos et al. (2020)
M125-55-7	Hou et al. (2020)
M174_KI11	Rohling et al. (2008)

Table A1. Continued.

Core/site	References
M25_4-KL11	Allen et al. (1999); Emeis et al. (2000)
M31_2-78_PC6	Geiselsart and Hemleben (1998a)
M31_2-84_PC6	Geiselsart and Hemleben (1998b)
M31_3_KL35	Müller and Budziak (2004)
M31_3_SL3011-1	Ivanova et al. (2003)
M33_1_SL_EAST	Ivanova et al. (2003)
M35003-4	Hüls (2000); Rühlemann et al. (1999); Mulitza et al. (1999); Hüls and Zahn (2000); Vink et al. (2001); Mulitza and Rühlemann, unpublished
M35027-1	Stüber (1999)
M39008-3	Cacho et al. (2001); Löwemark et al. (2004)
M40_4_SL67	Weldeab et al. (2003)
M40_4_SL71	Weldeab et al. (2003)
M40_4_SL87	Weldeab et al. (2003)
M44_3_KL83	Weldeab et al. (2003)
M5_3a-420.2	Sirocko (1989)
M5_3a-422_2	Sirocko (1989)
M74_4_1096-1	Paul et al. (2012)
M74_4_1143-1	Betzler et al. (2013)
M77_2_052-2	Glock et al. (2018); Erdem et al. (2016)
M77_2_059-1	Nürnberg et al. (2015); Mollier-Vogel et al. (2013)
M78_1_235-1	Reißig et al. (2019); Hoffmann et al. (2014); Poggemann et al. (2018)
MC-29D	Keigwin et al. (2003)
MD00-2361	Stuut et al. (2019); Spooner et al. (2011)
MD01-2378	Holbourn et al. (2005); Dürkop et al. (2008)
MD01-2392	Li et al. (2010)
MD01-2416	Gebhardt et al. (2008); Sarnthein et al. (2015)
MD01-2421	Oba and Murayama (2004)
MD01-2446	Marino et al. (2014)
MD01-2461	Peck et al. (2008, 2007)
MD02-2488	Govin et al. (2009)
MD02-2489	Gebhardt et al. (2008)
MD02-2496	Taylor et al. (2014); Cosma et al. (2008)
MD02-2503	Hill et al. (2006); Grelaud et al. (2009); Sarnthein et al. (2015)
MD02-2550	Williams et al. (2010); LoDico et al. (2006)
MD02-2575	Ziegler et al. (2008); Nürnberg et al. (2008)
MD02-2588	Diz et al. (2007); Ziegler et al. (2008)
MD02-2594	Martínez-Méndez et al. (2010); Dyez et al. (2014)
MD03-2607	Lopes dos Santos et al. (2013)
MD03-2611G	Gingele et al. (2007); Moros et al. (2009); de Deckker et al. (2012)
MD03-2698	Lebreiro et al. (2009)
MD03-2699	Voelker et al. (2010); Rodrigues et al. (2010)
MD03-2707	Weldeab et al. (2016); Weldeab et al. (2007)
MD03-MUC3	Moros and de Deckker (2020)
MD05-2896	Wang et al. (2016); Huang and Tian (2012); Tian et al. (2010); Wan and Jian (2014)
MD05-2897	Wang et al. (2016); Huang and Tian (2012)
MD05-2901	Li et al. (2009)
MD05-2904	Ge et al. (2010); Huang et al. (2015); Wan and Jian (2014)
MD05-2925	Lo et al. (2017)
MD06-2986	Ronge et al. (2015)
MD06-2990	Ronge et al. (2015)
MD06-3018	Russon et al. (2009, 2011)
MD06-3067	Bolliet et al. (2011)
MD06-3075	Fraser et al. (2014)
MD07-3076	Vázquez Riveiros et al. (2010); Skinner et al. (2010); Waelbroeck et al. (2011); Gottschalk et al. (2015, 2016)
MD07-3128	Caniupán et al. (2011)
MD08-3180	Repschläger et al. (2015); Schwab et al. (2012)
MD09-3259	Govin, unpublished
MD10-3340	Dang et al. (2015)
MD13-3455G	Fentimen et al. (2020)
MD73-025	Duplessy (1982); Labeyrie and Duplessy (1985); Labracherie et al. (1989)
MD76-123	Sirocko (1989)
MD76-125	Curry et al. (1988); Sirocko (1989)
MD76-127	Sirocko (1989)
MD76-128	Sirocko (1989)
MD76-131	Duplessy (1982); Sarnthein et al. (1988); Singh et al. (2011)
MD76-132	Sirocko (1989)
MD76-135	Sarnthein et al. (1988)
MD76-135	Sirocko (1989)
MD77-191	Sirocko (1989)

Table A1. Continued.

Core/site	References
MD77-194	Sarnthein et al. (1988); Sirocko (1989)
MD77-200	Sarnthein et al. (1988)
MD77-202	Sarnthein et al. (1988); Sirocko (1989)
MD77-203	Sarnthein et al. (1988)
MD79-254	Curry et al. (1988)
MD79-257	Duplessy et al. (1991); Levi et al. (2007)
MD80-304	Labeyrie and Duplessy (1985)
MD81-BC15	Thunell (2006b)
MD81-LC03	Jenkins and Williams (2004)
MD81-LC07	Jenkins and Williams (2004)
MD84-527	Pichon et al. (1992); Labracherie et al. (1989)
MD84-551	Labracherie et al. (1989)
MD84-629	Znaidi-Rivault (2006h)
MD84-641	Fontugne and Calvert (1992); Melki et al. (2010)
MD88-769	Rosenthal et al. (1997)
MD88-770	Labeyrie et al. (1996)
MD88-784	Lynch-Stieglitz et al. (2016)
MD90-912	Colin et al. (2021)
MD90-963	Bassinot et al. (1994)
MD95-2002	Eynaud et al. (2012); Auffret et al. (2002); Zaragosi et al. (2006)
MD95-2011	Dreger (1999), Hevrey, unpublished
MD95-2012	Dreger (1999)
MD95-2037	Labeyrie et al. (2005); Gherardi et al. (2009)
MD95-2039	Schönfeld et al. (2003)
MD95-2040	Voelker and de Abreu (2011); de Abreu et al. (2003)
MD95-2042	Shackleton et al. (2000); Hoogakker et al. (2015); Shackleton et al. (2004); Bard et al. (2004c, b, a)
MD95-2043	Cacho et al. (2006)
MD96-2048	Caley et al. (2018)
MD96-2080	Rau et al. (2002)
MD96-2084	Rau (2003)
MD96-2085	Chen et al. (2002)
MD96-2098	Pichevin et al. (2005); Daniau et al. (2013)
MD97-2106	Moy et al. (2006)
MD97-2114	Cobianchi et al. (2012)
MD97-2121	Carter and Manighetti (2006)
MD97-2138	de Garidel-Thoron et al. (2007)
MD97-2142	Chen et al. (2003); Ren et al. (2017)
MD97-2151	Wei et al. (2006); Lee et al. (1999)
MD98-2170	Stott et al. (2007)
MD98-2176	Stott et al. (2007)
MD98-2181	Stott et al. (2007, 2002); Stott (2007); Khider et al. (2014)
MD99-2227	Evans et al. (2007)
MD99-2227P	Evans et al. (2007)
MD99-2236	Jennings et al. (2015)
MD99-2254	de Vernal and Hillaire-Marcel (2006)
MD99-2263	Andrews et al. (2009)
MD99-2339	Voelker et al. (2006)
MD99-2343	Frigola et al. (2008)
ME0005-24JC	Kienast et al. (2013, 2007); Kusch et al. (2010); Dubois et al. (2011)
ME0005A-43JC	Benway et al. (2006)
MG237	Giresse et al. (1982); Sarnthein et al. (1994)
ML1208-06BB	Lynch-Stieglitz et al. (2015)
ML1208-10GC	Lynch-Stieglitz et al. (2015)
ML1208-11GC	Lynch-Stieglitz et al. (2015)
ML1208-12GC	Lynch-Stieglitz et al. (2015)
ML1208-13BB	Monteagudo et al. (2021); Lynch-Stieglitz et al. (2015); Costa and McManus (2017)
ML1208-15GC	Lynch-Stieglitz et al. (2015)
ML1208-17PC	Lynch-Stieglitz et al. (2015)
ML1208-17TC	Lynch-Stieglitz et al. (2015)
ML1208-18GC	Lynch-Stieglitz et al. (2015); Monteagudo et al. (2021); Lynch-Stieglitz, unpublished
ML1208-19GC	Lynch-Stieglitz et al. (2015)
ML1208-20BB	Monteagudo et al. (2021); Lynch-Stieglitz et al. (2015); Costa and McManus (2017)
ML1208-27BB	Lynch-Stieglitz et al. (2015); Monteagudo et al. (2021); Lynch-Stieglitz, unpublished
ML1208-28BB	Lynch-Stieglitz et al. (2015); Costa et al. (2016b); Costa and McManus (2017); Monteagudo et al. (2021); Lynch-Stieglitz, unpublished
ML1208-30BB	Lynch-Stieglitz et al. (2015)
ML1208-31BB	Lynch-Stieglitz et al. (2015); Jacobel et al. (2016); Monteagudo et al. (2021); Lynch-Stieglitz, unpublished
ML1208-32BB	Monteagudo et al. (2021); Costa and McManus (2017)
ML1208-34BB	Lynch-Stieglitz et al. (2015)

Table A1. Continued.

Core/site	References
ML1208-35BB	Lynch-Stieglitz et al. (2015)
ML1208-36BB	Costa et al. (2016b); Costa and McManus (2017); Monteagudo et al. (2021); Lynch-Stieglitz, unpublished
ML1208-37BB	Lynch-Stieglitz et al. (2015); Jacobel et al. (2016); Monteagudo et al. (2021)
MR00-K03-PC-01	Harada et al. (2004)
MR00-K03-PC-04	Harada et al. (2004)
MS21PC	Hennekam et al. (2015)
MSM05_5_723-2	Werner et al. (2016)
MV0502-4JC	Waddell et al. (2009)
MW9109-15GGC	Patrick and Thunell (1997); Yu et al. (2010)
MW9109-36BC	Broecker et al. (2001); Lynch-Stieglitz, unpublished
MW9109-44GGC	Broecker et al. (2001); Lynch-Stieglitz, unpublished
MW9109-48GGC	Yu et al. (2010); Lynch-Stieglitz, unpublished
MW9109-51BC	Lynch-Stieglitz, unpublished
MW9109-55GGC	Fehrenbacher and Martin (2011); Lynch-Stieglitz, unpublished
NA87-22	Vidal et al. (1997); Waelbroeck et al. (2001, 2006)
NBP9802_3GC1	Chase et al. (2003)
NBP9802_4GC1	Chase et al. (2003)
NBP9802_5GC1	Chase et al. (2003)
NEAP-04K	Rickaby and Elderfield (2005); Hall et al. (2004)
OC205-103GGC	Curry et al. (1999)
OC205-2-100GGC	Slowey and Curry (1995); Came et al. (2008)
OC205-2-103GGC	Slowey and Curry (1995); Curry et al. (1999); Came et al. (2003)
OC205-2-106GGC	Slowey and Curry (1995)
OC205-2-108GGC	Slowey and Curry (1995)
OC205-2-117JPC	Slowey and Curry (1995)
OC205-2-149JPC	Slowey and Curry (1995)
OC205-2-33GGC	Slowey and Curry (1995)
OC205-2-7JPC	Slowey and Curry (1995)
OC205-2-97JPC	Slowey and Curry (1995)
OCE326-26GGC	Keigwin et al. (2005)
OCE326-MC25B	Keigwin et al. (2005)
OCE3326-14GGC	Keigwin et al. (2005)
OCE400-MC44	Keigwin et al. (2005)
OD-041-04	Nørgaard-Pedersen et al. (2003)
OD96_30_3_1	Nørgaard-Pedersen (2000a)
ODP1063	Channell et al. (2012)
ODP1078C	Rühlemann et al. (2004); Kim et al. (2003); Mulitza, unpublished
ODP1079	Lynch-Stieglitz et al. (2006)
ODP1084	Mollenhauer, unpublished
ODP1084B	Lynch-Stieglitz et al. (2006)
ODP1119	Carter et al. (2004)
ODP1120	Duncan et al. (2016)
ODP1123	Elderfield et al. (2012)
ODP1125	Peterson et al. (2020)
ODP1127	Andres (2002)
ODP1168	Nürnberg et al. (2004)
ODP1170	Nürnberg et al. (2004)
ODP1172A	Nürnberg et al. (2004); Nürnberg and Groeneveld (2006)
ODP658C	Knaack and Sarnthein (2005); Knaack (1997); deMenocal et al. (2000)
ODP769	Linsley (1996)
ODP817A	Haddad et al. (1993)
ODP818B	Haddad et al. (1993)
ODP819A	Alexander et al. (1993)
ODP820A	Peerdeman et al. (1993)
ODP980	Oppo et al. (2003)
ODP984	Praetorius et al. (2008)
OK92_2182	Kaiser (2001)
OK92_2185	Kaiser (2001)
Orgon4-KS8	Sirocko (1989); Sirocko et al. (2000)
P1-003MC	Sejrup et al. (2010)
P69	Weaver et al. (1998); Nelson et al. (2000)
P71	Duncan et al. (2016)
PAR87A-01	Zahn et al. (1991)
PAR87A-02	Zahn et al. (1991)
PAR87A-10	Zahn et al. (1991)
PASSAP_PS009PC	Hennekam et al. (2015)
PC17	Lee et al. (2001)
PC20	Lee et al. (2001)
PC75-1	Shao et al. (2019)

Table A1. Continued.

Core/site	References
PC75-2	Shao et al. (2019)
PC83-1	Shao et al. (2019)
PLDS-7G	Keigwin and Lehman (2015)
POS200_10_6-2	Abrantes et al. (2018, 2001, 1998); Baas et al. (1997); Mienert et al. (1998)
POS457-905-2	Mirzaloov et al. (2019)
POS457-909-2	Mirzaloov et al. (2019)
PS1006-1	Grobe and Mackensen (1992)
PS1021-1	Grobe (1986a)
PS1023-1	Grobe (1986b)
PS1224-1	Grobe (1986b)
PS1243-1	Bauch (2001)
PS1290-4	Hebbeln (1992); Elverhøi et al. (1995)
PS1294-4	Hebbeln (1992); Elverhøi et al. (1995)
PS1295-4	Jones and Keigwin (1988)
PS1308-3	Spielhagen, unpublished
PS1367-2	Grobe and Mackensen (1992)
PS1368-3	Grobe (1996a)
PS1369-2	Grobe (1996b)
PS1370-2	Grobe (1996c)
PS1375-3	Grobe (1996d)
PS1378-3	Grobe (1996e)
PS1379-3	Grobe (1996f)
PS1380-3	Grobe and Mackensen (1992)
PS1381-3	Grobe (1996g)
PS1385-3	Grobe and Mackensen (1992)
PS1387-3	Grobe (1996h)
PS1388-3	Mackensen et al. (1989)
PS1389-3	Grobe and Mackensen (1992)
PS1390-3	Grobe and Mackensen (1992)
PS1392-1	Grobe (1996i)
PS1394-4	Grobe and Mackensen (1992)
PS1420-1	Melles (1991)
PS1420-2	Melles (1991)
PS1431-1	Grobe and Mackensen (1992)
PS1436-1	Ott and Gersonde (1997a)
PS1451-1	Cordes and Fütterer (1997a)
PS1458-1	Winn (2014d)
PS1458-2	Winn (2014e)
PS1461-1	Grobe (1996j)
PS1467-1	Cordes and Fütterer (1997b)
PS1479-2	Grobe and Mackensen (1992)
PS1481-3	Grobe et al. (1990)
PS1494-2	Melles (1991)
PS1494-3	Melles (1991)
PS1498-1	Melles (1991)
PS1498-2	Melles (1991)
PS1506-1	Mackensen et al. (1994)
PS1519-12	Horwege and Spielhagen, unpublished
PS1524-1	Köhler (1991)
PS1527-10	Köhler (1991)
PS1535-5	Spielhagen et al. (2004); Nørgaard-Pedersen et al. (2003)
PS1535-8	Spielhagen et al. (2004); Nowaczyk et al. (2003)
PS1563-2	Grobe (2002a)
PS1564-2	Grobe (2002b)
PS1565-2	Hillenbrand (1995)
PS1576-2	Brehme (1992)
PS1577-1	Brehme (1992)
PS1588-1	Grobe (1996k)
PS1591-1	Grobe et al. (1990)
PS1599-3	Weber (1992); Weber et al. (1994)
PS1606-3	Melles (1991)
PS1607-1	Melles (1991)
PS1607-3	Melles (1991)
PS1609-3	Melles (1991)
PS1611-3	Melles (1991)
PS1612-1	Melles (1991)
PS1612-2	Melles (1991)
PS1613-2	Melles (1991)
PS1613-4	Melles (1991)

Table A1. Continued.

Core/site	References
PS1640-1	Grobe and Mackensen (1992)
PS1648-1	Grobe and Mackensen (1992)
PS1649-2	Ott and Gersonde (1997b)
PS1650-1	Ott and Gersonde (1997c)
PS1650-2	Ott and Gersonde (1997d)
PS1651-1	Ott and Gersonde (1997e)
PS1651-2	Ott and Gersonde (1997f)
PS1652-1	Ott and Gersonde (1997g)
PS1652-2	Ott and Gersonde (1997h)
PS1653-1	Ott and Gersonde (1997i)
PS1653-2	Ott and Gersonde (1997j)
PS1654-1	Ott and Gersonde (1997k)
PS1654-2	Ott and Gersonde (1997l); Bianchi and Gersonde (2004)
PS1704-4	Horwege and Spielhagen, unpublished
PS1706-1	Horwege and Spielhagen, unpublished
PS1707-1	Horwege and Spielhagen, unpublished
PS1708-1	Horwege and Spielhagen, unpublished
PS1730-2	Nam (1997); Stein et al. (1996)
PS1754-1	Niebler (1995)
PS1768-8	Mulitza et al. (1999); Gersonde et al. (2003)
PS1769-1	Niebler (1995)
PS1789-1	Weber (1992); Weber et al. (1994)
PS1790-1	Weber (1992); Weber et al. (1994)
PS1805-6	Grobe (1996l)
PS1811-8	Grobe (1996m)
PS1812-1	Grobe (1996n)
PS1812-6	Grobe (1996o)
PS1813-6	Grobe (1996p)
PS1816-1	Grobe (1996q)
PS1878-3	Nowaczyk et al. (2003); Telesiński et al. (2014a, b)
PS1894-7	Nørgaard-Pedersen et al. (2003); Telesiński et al. (2014a, b)
PS1906-1	Magnus (2000); Nørgaard-Pedersen et al. (2003)
PS1906-2	Nees (1993); Nørgaard-Pedersen et al. (2003)
PS1910-1	Telesiński et al. (2014a)
PS1920-1	Stein et al. (1996)
PS1927-2	Nam (1997); Stein et al. (1996)
PS1951-1	Stein et al. (1996)
PS2037-3	Bonn (1995)
PS2038-2	Bonn et al. (1998)
PS2039-1	Bonn (1995)
PS2040-2	Bonn (1995)
PS2045-3	Bonn (1995)
PS2046-1	Bonn (1995)
PS2047-3	Bonn (1995)
PS2049-4	Bonn (1995)
PS2050-1	Bonn (1995)
PS2055-2	Bonn (1995)
PS2056-1	Bonn (1995)
PS2076-3	Niebler (1995)
PS2082-1	Mackensen et al. (1994)
PS2085-2	Niebler (1995)
PS2102-2	Niebler (1995); Gersonde et al. (2003)
PS2121-4	Müller (1995)
PS2138-1	Knies and Stein (1998a); Knies et al. (1998); Wollenburg et al. (2001); Nowaczyk et al. (2003)
PS2166-2	Nørgaard-Pedersen et al. (1998)
PS2170-4	Stein et al. (1994)
PS2177-1	Nørgaard-Pedersen et al. (2003, 1998)
PS2185-3	Spielhagen et al. (2004); Nørgaard-Pedersen et al. (1998)
PS2195-4	Nørgaard-Pedersen et al. (1998)
PS2200-2	Nørgaard-Pedersen et al. (1998)
PS2206-4	Stein et al. (1994)
PS2208-1	Stein et al. (1994); Stein and Schneider (2003)
PS2212-3	Wollenburg et al. (2001)
PS2250-5	Niebler (1995)
PS2423-4	Notholt (1998)
PS2424-1	Notholt (1998)
PS2446-4	Knies and Stein (1998b); Stein and Fahl (2000)
PS2458-4	Spielhagen et al. (2005); Spielhagen, unpublished
PS2487-6	Flores et al. (1999)

Table A1. Continued.

Core/site	References
PS2495-3	Mackensen et al. (2001); Gersonde et al. (2003); Niebler (2004a, b, c)
PS2498-1	Mackensen et al. (2001); Gersonde et al. (2003); Niebler (2004d, e, f)
PS2499-5	Mackensen et al. (2001); Gersonde et al. (2003)
PS2539-2	Hillenbrand et al. (2003)
PS2540-1	Hillenbrand et al. (2003)
PS2541-2	Hillenbrand et al. (2003)
PS2543-3	Hillenbrand et al. (2003)
PS2547-2	Hillenbrand et al. (2003)
PS2547-3	Hillenbrand et al. (2003)
PS2548-2	Hillenbrand et al. (2003)
PS2550-2	Hillenbrand et al. (2003)
PS2551-1	Hillenbrand et al. (2002)
PS2556-1	Hillenbrand et al. (2003)
PS2556-2	Braun (1997)
PS2561-2	Krueger et al. (2008)
PS2644-2	Voelker (1999)
PS2644-5	Voelker (1999)
PS2646-5	Voelker (1999)
PS2647-2	Voelker (1999)
PS2709-1	Flores et al. (2000)
PS2819-2	Vernaleken (1999)
PS2820-1	Vernaleken (1999)
PS2837-5	Nørgaard-Pedersen et al. (2003)
PS2876-1	Nørgaard-Pedersen et al. (2003)
PS2876-2	Nørgaard-Pedersen et al. (2003)
PS2887-1	Nørgaard-Pedersen and Spielhagen (2000); Nørgaard-Pedersen et al. (2003)
PS2887-2	Nørgaard-Pedersen (2000b); Nørgaard-Pedersen et al. (2003)
PS51_038-3	Nørgaard-Pedersen (2006)
PS51_038-4	Spielhagen et al. (2004)
PS66_309-1	Winkelmann et al. (2008)
PS69_251-1	Hillenbrand et al. (2017); Smith et al. (2014)
PS69_912-3	Ronge (2019b, a)
PS69_912-4	Ronge (2019b, a)
PS72_396-3	Geibert et al. (2021)
PS75_056-1	Ullermann et al. (2016)
PS75_072-4	Benz et al. (2016); Tiedemann and Lembke-Jene, unpublished
PS75_073-2	Benz et al. (2016); Tiedemann and Lembke-Jene, unpublished
PS75_085-1	Benz et al. (2016); Tiedemann and Lembke-Jene, unpublished
PS75_160-1	Hillenbrand et al. (2017)
PS75_167-1	Hillenbrand et al. (2017)
PS75-059-2	Ullermann et al. (2016); Ronge et al. (2016)
Q208	Winn (2013a)
Q585	Weaver et al. (1998)
Q859	Winn and Fenner (2013a)
Q861	Winn and Fenner (2013b)
R657	Weaver et al. (1998)
RAMA44P	Keigwin (1987)
RAPiD-10-1P	Thornalley et al. (2011, 2010)
RAPiD-12-1K	Thornalley et al. (2010, 2009)
RAPiD-15-4P	Thornalley et al. (2010)
RAPiD-17-5P	Thornalley et al. (2010)
RC09-150	Bé and Duplessy (1976)
RC09-166	Tierney et al. (2017)
RC10-131	Anderson et al. (1989)
RC10-289	Matsumoto and Lynch-Stieglitz (2003)
RC11-120	Curry et al. (1988)
RC11-238	Koutavas and Lynch-Stieglitz (2003)
RC11-83	Charles et al. (1996); Charles and Fairbanks (1992); Piotrowski et al. (2004)
RC11-86	Shackleton (2003)
RC12-109	Anderson et al. (1989)
RC12-113	Anderson et al. (1989)
RC12-279	Lynch-Stieglitz et al. (2006)
RC12-294	CLIMAP Project Members (2003)
RC12-339	Naqvi et al. (1994)
RC12-344	Duplessy (1982); Naqvi et al. (1994); Rashid et al. (2007)
RC13-110	Lyle et al. (2002)
RC13-115	Lyle et al. (2002)
RC13-140	Koutavas and Lynch-Stieglitz (2003)
RC13-228	Curry et al. (1988)

Table A1. Continued.

Core/site	References
RC13-229	Oppo and Fairbanks (1987)
RC13-254	Charles et al. (1991)
RC13-259	Shemesh et al. (1995)
RC13-269	Shemesh et al. (1995)
RC14-31	Broecker et al. (2000)
RC14-33	Broecker et al. (2000)
RC15-93	Charles et al. (1991)
RC16-119	Oppo and Horowitz (2000)
RC16-59	Lynch-Stieglitz, unpublished
RC16-84	Oppo and Horowitz (2000)
RC16-86	Oppo and Horowitz (2000)
RC17-176	Leech et al. (2013)
RC17-69	CLIMAP Project Members (1981)
RC8-102	Koutavas and Lynch-Stieglitz (2003)
RC9-150	Wells et al. (1994)
RC9-203	Oppo and Fairbanks (1987)
RECORD23	Colin et al. (2021)
RNDB-11PC	Keigwin and Lehman (2015)
RNDB-13PC	Keigwin and Lehman (2015)
RR0503_125JPC	Schiraldi et al. (2014); Sikes et al. (2016)
RR0503_41JPC	Sikes et al. (2016)
RR0503-79JPC	Sikes et al. (2016)
RR0503_83JPC	Sikes et al. (2016)
RR0503_83TC	Sikes et al. (2016)
RR0503-87JPC	Sikes et al. (2016)
RR0503_87TC	Sikes et al. (2016)
RR0503-64JPC	Schiraldi et al. (2014); Sikes et al. (2016)
RR0503-79JPC	Schiraldi et al. (2014)
RR0503-87JPC	Schiraldi et al. (2014)
RS105_GC23	Troedson and Davies (2001)
RS105GC25	Troedson and Davies (2001); Bostock et al. (2006)
RS112GC10	Troedson and Davies (2001)
RS112GC9	Troedson and Davies (2001); Bostock et al. (2006)
RS147-GC07	Sikes et al. (2016, 2009)
RS67-GC13	Lynch-Stieglitz et al. (1994)
RS67-GC16	Lynch-Stieglitz et al. (1994)
RS67-GC27	Lynch-Stieglitz et al. (1994)
RS67-GC3	Lynch-Stieglitz et al. (1994)
RS67-GC52	Lynch-Stieglitz et al. (1994)
RS78-GC18	Lynch-Stieglitz et al. (1994)
S794	Weaver et al. (1998)
SAN-76	Toledo et al. (2007)
SAT-048A	Frezza et al. (2020)
SBB2012DB	Osborne et al. (2020)
SCS90-36	Huang et al. (1997)
SHAK06-5K	Ausín et al. (2019)
SK129-CR05	Guptha et al. (2005)
SK157-15	Raza et al. (2014)
SK157-16	Raza et al. (2014)
SK157-20	Naik and Naidu (2016)
SK157-GC04	Saraswat et al. (2005)
SK200-GC17	Naik et al. (2014)
SK218_1	Govil and Divakar Naidu (2011); Govil, Naidu, and Mulitza, unpublished
SK237-GC04	Saraswat et al. (2013)
SK237-GC09	Saraswat et al. (2019)
SL-1	Guptha et al. (2005)
SL-4	Guptha et al. (2005)
SN6	Tiwari et al. (2015)
SO12_98	Winn (2012)
SO126_39KL	Weldeab et al. (2019)
SO130_261KL	von Rad et al. (2003)
SO135_03GKG	Winn (2014a)
SO135_04SL	Winn (2014b)
SO135_05GKG	Winn (2014c)
SO135_21GKG	Winn (2014f)
SO135_40KL	Winn (2014f)
SO136_003GC	Ronge et al. (2015); Barrows et al. (2007)
SO136-111	Crosta et al. (2004); Sturm (2003)
SO161_5_50SL	Blumberg et al. (2008)

Table A1. Continued.

Core/site	References
SO164-03-4	Reiðig et al. (2019)
SO178-13-6	Max et al. (2014); Lembke-Jene et al. (2017)
SO189-119KL	Mohtadi et al. (2014); Mohtadi, unpublished
SO189-144KL	Mohtadi et al. (2014); Mohtadi, unpublished
SO189-39KL	Mohtadi et al. (2014); Mohtadi, unpublished
SO201-2-12KL	Riethdorf et al. (2013)
SO201-2-85	Riethdorf et al. (2013); Max et al. (2014)
SO202_1_27-6	Maier et al. (2015, 2018)
SO213_2_60-1	Molina-Kescher et al. (2016)
SO213_2_82-1	Ronge et al. (2015)
SO213_2_84-1	Ronge et al. (2015)
SO213-59-2	Tapia et al. (2015); Molina-Kescher et al. (2016); Nürnberg, unpublished
SO225-08-3	Raddatz et al. (2017); Nürnberg, unpublished
SO225-53-3	Raddatz et al. (2017); Nürnberg, unpublished
SO236_52-4	Bunzel et al. (2017)
SO26_127KA	Winn et al. (1991)
SO26_131KA	Winn et al. (1991)
SO26_141KA	Sarnthein and Winn (2013b)
SO26_189KA	Sarnthein and Winn (1991)
SO26_222KA	Sarnthein and Winn (2013a)
SO26_58KA	Winn et al. (1991)
SO26_90KA	Winn et al. (1991)
SO28-05KL	Sirocko (1989)
SO28-11KL	Sirocko (1989)
SO28-18KL	Sirocko (1989)
SO35_2_101KL	Winn et al. (1990)
SO35_2_102KL	Winn et al. (1990)
SO35_3_182KL	Winn et al. (1990)
SO35_3_211KL	Winn et al. (1990)
SO35_3_272KL	Winn (2013i)
SO36_2_17SL	Lynch-Stieglitz et al. (1994)
SO36-SL17	Lynch-Stieglitz et al. (1994)
SO36-SL7	Lynch-Stieglitz et al. (1994)
SO42-15KL	Sirocko (1989)
SO42-26KL	Sirocko (1989)
SO42-51KL	Sirocko (1989)
SO42-57KL	Sirocko (1989)
SO42-64KL	Sirocko (1989)
SO42-70KL	Sirocko (1989)
SO42-71KL	Sirocko (1989)
SO42-74KL	Sirocko et al. (2000)
SO42-82KL	Sirocko (1989)
SO42-87KL	Sirocko (1989)
SO75_3_26KL	Zahn et al. (1997)
SO82_2-2	Lackschewitz et al. (1998)
SO82_4-2	Lackschewitz et al. (1998); Moros et al. (1997)
SO82_5-2	Jung (1996); Lackschewitz et al. (1998); van Kreveland et al. (2000)
SO82_7-2	Lackschewitz et al. (1998)
SO90_137KA	von Rad et al. (1999)
SO93_1_22KL	Weber (1997)
Station-8s-MC	Harada et al. (2004)
Station-8s-PC	Harada et al. (2004)
SU81-07	Kallel et al. (1997)
SU81-18	Bard et al. (1987); Sarnthein et al. (1994); Duplessy (1996); Bard et al. (2000); Waelbroeck et al. (2001, 2019); Missiaen et al. (2019)
SU81-32	Sarnthein et al. (1994)
SU81-44	Sarnthein et al. (1994)
SU81-50	Sarnthein et al. (1994)
SU90-08	Missiaen et al. (2020); Grousset et al. (1993); Elliot et al. (1998)
SU90-09	Grousset et al. (2001)
SU90-11	Labeyrie et al. (1995)
SU90-24	Elliot et al. (2002)
SU90-I02	Schulz (1995)
SU90-I03	Schulz (1995)
SU90-I06	Schulz (1995)
SU90-I07	Schulz (1995)
SU90-I08	Schulz (1995)
SU92-21	Sarnthein et al. (1994)
T86-15P	Sarnthein et al. (1994)

Table A1. Continued.

Core/site	References
T86-15S	Sarnthein et al. (1994)
T87_2_20G	Thunell et al. (1977)
TAN0803-09	Maxson et al. (2019); Bostock et al. (2015)
TAN0803-27	Maxson et al. (2019)
TAN1106-11	Maxson et al. (2019)
TAN1106-15	Maxson et al. (2019)
TAN1106-28	Bostock et al. (2015)
TAN1106-34	Maxson et al. (2019); Bostock et al. (2015)
TAN1106-43	Maxson et al. (2019); Bostock et al. (2015)
TAN1106-7	Maxson et al. (2019)
TGS-931	Schröder et al. (2018)
TR163-19	Spero et al. (2003)
TR163-25T	Hoogakker et al. (2018)
TR163-31	Patrick and Thunell (1997); Curry et al. (1988)
TTN057-13-PC4	Kanfoush et al. (2002, 2000); Shemesh et al. (2002)
TTN057-6-PC4	Hodell et al. (2003)
TTR13-AT-455G	Seidenkrantz et al. (2021)
TTR13-AT-479G	Seidenkrantz et al. (2021)
U306	Winn (2016)
U938	Weaver et al. (1998)
Ulleung_C11	Kim et al. (2000)
Ulleung_C21	Kim et al. (2000)
UM94PC31	Corselli et al. (2002)
V10-49	Kallel et al. (1997)
V10-51	Kallel et al. (1997)
V12-70	Lynch-Stieglitz et al. (2006)
V16-51	Lynch-Stieglitz et al. (2006)
V17-178	Keigwin and Jones (1995)
V19-236	Lynch-Stieglitz et al. (2006)
V19-258	Lynch-Stieglitz et al. (2006)
V19-259	Lynch-Stieglitz et al. (2006)
V19-27	Koutavas and Lynch-Stieglitz (2003)
V19-28	Koutavas and Lynch-Stieglitz (2003)
V19-30	Curry et al. (1988)
V20-234	Lynch-Stieglitz, unpublished
V21-146	Hovan et al. (1991)
V21-29	Koutavas and Lynch-Stieglitz (2003)
V21-30	Koutavas and Lynch-Stieglitz (2003)
V21-40	Koutavas and Lynch-Stieglitz (2003)
V22-108	Charles et al. (1991)
V22-174	Shackleton (1977)
V22-196	Sarnthein et al. (1994)
V22-197	Curry et al. (1988)
V22-222	Mix et al. (1986)
V23-100	Sarnthein et al. (1994)
V23-81	Jansen and Veum (1990); Elliot et al. (1998)
V24-109	Shackleton et al. (1992)
V24-157	Anderson et al. (1989)
V24-161	Anderson et al. (1989)
V24-166	Anderson et al. (1989)
V24-170	Anderson et al. (1989)
V24-184	Anderson et al. (1989)
V24-253	Oppo and Horowitz (2000)
V25-21	Curry and Crowley (1987)
V25-59	Curry et al. (1988)
V26-175	Matsumoto and Lynch-Stieglitz (2003)
V26-176	Sarnthein et al. (1988); Matsumoto and Lynch-Stieglitz (2003); CLIMAP Project Members (2004b)
V26-177	Matsumoto and Lynch-Stieglitz (2003)
V27-180	Lynch-Stieglitz, unpublished
V28-122	Oppo and Fairbanks (1987); W. S. Broecker et al. (1988); W. Broecker et al. (1988); Schmidt et al. (2004)
V28-127	Oppo and Fairbanks (1990)
V28-14	Curry et al. (1988)
V28-304	Curry et al. (1988)
V28-73	Oppo and Lehman (1993)
V29-135	Sarnthein et al. (1994)
V29-140	Lynch-Stieglitz et al. (2006)
V29-193	Oppo and Lehman (1993)
V29-198	Oppo and Lehman (1993)
V29-202	Oppo and Lehman (1993)

Table A1. Continued.

Core/site	References
V29-204	Curry et al. (1999)
V29-9	Lynch-Stieglitz, unpublished
V30-40	Oppo and Fairbanks (1987)
V30-49	Curry et al. (1988)
V30-5	Matsumoto and Lynch-Stieglitz (2003)
V32-8	Mix et al. (1986)
V34-90	Gorbarenko et al. (2002)
V34-98	Gorbarenko et al. (2002)
V35-5	Oppo and Fairbanks (1987)
Vi-37GC	Keigwin (1998)
VM12-107	Schmidt et al. (2012)
VM18-222	Lynch-Stieglitz et al. (1994)
VM19-110	Leech et al. (2013)
VM24-110	Leech et al. (2013)
VM24-150	Leech et al. (2013)
VM28-213	Leech et al. (2013)
VM28-227	Leech et al. (2013)
VM28-229	Leech et al. (2013)
VM28-230	Leech et al. (2013)
VM28-233	Leech et al. (2013)
VM28-234	Leech et al. (2013)
VM28-235	Leech et al. (2013)
VM28-235TW	Leech et al. (2013)
VM28-236	Leech et al. (2013)
VM28-246	Leech et al. (2013)
VM34-2	Leech et al. (2013)
VNTR01_10PC	Keigwin and Lehman (2015)
W8402A-14	Jasper et al. (1994)
W8709A-1	Lyle et al. (1992)
W8709A-13	Lyle et al. (1992); Lund and Mix (1998)
W8709A-8	Lyle et al. (1992); Ortiz et al. (1997)
W8709A-8TC	Lyle et al. (1992); Ortiz et al. (1997)
WIND-28K	Kiefer et al. (2006); Johnstone et al. (2014)
Y71-06-12	Shackleton (1977)
Y71-09-101	Lyle et al. (2002)
Z2108	Nelson et al. (1994)
Z2112	Sikes et al. (2016)

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