Data report: diatoms from Sites U1334 and U1338, Expedition 320/321[1]

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Chapter contents

Abstract

The total number of diatoms, radiolarians, and silicoflagellates were recorded from the Eocene–Oligocene sequence of Integrated Ocean Drilling Program Site U1334, Expedition 320, and the Neogene–recent sequence of Site U1338, Expedition 321, in order to document the variability in overall abundance through these sequences.

Introduction

During Integrated Ocean Drilling Program (IODP) Expeditions 320 and 321, a series of sites associated with the paleoequator was cored in order to reconstruct Eocene to Holocene paleoceanographic conditions. Two sites of particular interest to this study are Sites U1334 (7°59.998′N, 131°58.408′W; 4799 m water depth) and U1338 (2°30.469′N, 117°58.178′W; 4200 m water depth). Sediments from Site U1334 represent the Eocene–Oligocene transition and provide insight into the response of the equatorial Pacific region associated with the greenhouse–icehouse transition. Sediments from Site U1338 represent early–middle Miocene to recent paleoceanographic conditions in the equatorial Pacific region, in particular the significant increase in sedimentation during the early middle Miocene.

Diatoms were examined from both sites, the Eocene–Oligocene sequence of Site U1334 and the Neogene–recent sequence of Site U1338. The purpose of the study was to document the overall variability in total diatom, silicoflagellate, and radiolarian abundance, as well as the variation in diatom species throughout the examined intervals. The emphasis of this study concerns variations in the diatom flora.

Methods and materials

A total of 279 samples were examined from Holes U1334A–U1334C, and 418 samples were examined from Holes U1338A–U1338C. The meter subbottom depth scale references are based upon the original shipboard splice (see the **"Expedition 320/321 summary"** chapter [Pälike et al., 2010]). **Wilkens et al.** (2013) and **Westerhold et al.** (2012) subsequently revised the original shipboard splice.

[1]Baldauf, J.G., 2013. Data report: diatoms from Sites U1334 and U1338, Expedition 320/321. *In* Pälike, H., Lyle, M., Nishi, H., Raffi, I., Gamage, K., Klaus, A., and the Expedition 320/321 Scientists, *Proc. IODP,* 320/321: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.proc.320321.215.2013
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Samples from Site U1334 were processed for semiqualitative analysis with strewn slides prepared following the methods of Baldauf (1984). The total number of diatoms, radiolarians, and silicoflagellates from typically the first 50 fields of view was tabulated. The relative percentage of diatom fragments was also estimated (<25%, 25%–50%, 50%–75%, or >75%) for each sample. Preservation (poor, moderate, or good) was defined based on the condition of the valve, breakage, and degree of silicification. For example,

Poor = contains typically fragments, partial dissolution may be observed, and finely silicified forms typically are not observed.

Moderate = significant fragmentation and finer silicified forms are present. Dissolution, if present, is much reduced when compared to the poorly preserved assemblages.

Good = minimal fragmentation with a balance of finely and coarsely silicified assemblages typical for the late Eocene–early Oligocene.

Samples from Site U1338 were processed for qualitative analysis using a modified method described by Scherer (1994). The primary adjustment to Scherer's method was to process typically 0.1 g of sediment and neutralize the residue in the same vial. Once the residue was neutral, the entire vial content was decanted into a settling chamber. This eliminated the potential loss of residue. Typically, the total number of diatoms, radiolarians, and silicoflagellates was tabulated for the first 100 fields of view or the first 300 diatoms encountered. In the case where a significant number of diatoms was present, the total number of diatoms, radiolarians, and silicoflagellates was tabulated for 50 fields of view or the first 600 diatoms encountered. The total numbers of diatom valves per gram sediment, as well as radiolarian and silicoflagellate skeletons per gram sediment, was calculated following the procedures of Scherer (1994).

All samples (from both sites) were examined at 500× using a Zeiss Axio ImagerA2. Species identifications were completed at 1250×. The counting techniques of Gersonde and Schrader (1978) were utilized for all samples. The total number of diatoms was not tabulated for the few samples where diatoms were rare or absent.

Results

Table T1 records the total number of radiolarians, silicoflagellates (total and total *Naviculopsis*), and diatoms observed from Site U1334 samples representing the Eocene–Oligocene transition. Fragmentation, preservation, and the diatom/radiolarian ratio are also included for each sample, as is the percentage of diatom specimens observed for a given species, variety, or group. Note that the shaded samples reflect samples where <5 specimens, or no diatoms, were observed in 100 fields of view. See also **"Supplementary material."**

Table T2 records the total number of radiolarians, silicoflagellates, and diatoms observed from Site U1338 samples representing the early middle Miocene to recent. The number of radiolarian and silicoflagellate skeletons, as well as the number of diatom valves per gram sediment, are also recorded for each sample (see Fig. F1). The specific number of diatom specimens observed for a given species, variety, or group is also recorded. Note that the shaded samples reflect samples where diatoms are sparse, so counts were not completed for such samples. See also DIATOMS in 215 in **"Supplementary material."**

Table T3 provides the sample depth (average core depth below seafloor [CSF] and composite core depth below seafloor [CCSF]) for Neogene diatom datums identified from Site U1338.

Table T4 provides the taxonomic list used in this report.

Acknowledgments

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Figure F1. Number of radiolarian and silicoflagellate skeletons and number of diatom valves per gram sediment.

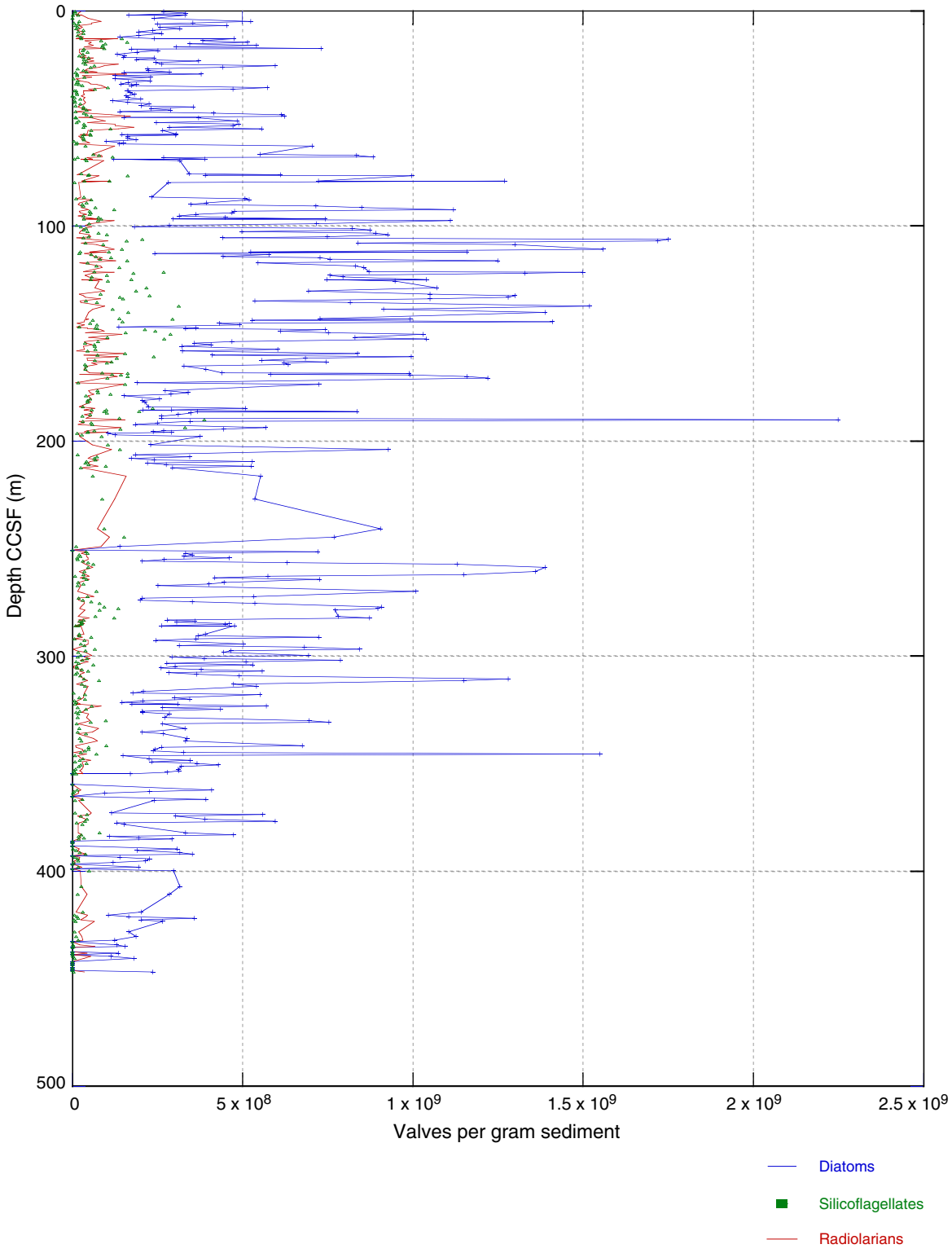

Table T1. Total number of radiolarians, silicoflagellates, and diatoms observed from Site U1334 representing the Eocene–Oligocene transition. This table is available in an **oversized format.**

Table T2. Total number of radiolarians, silicoflagellates, and diatoms observed from Site U1338 representing the early middle Miocene to recent. This table is available in an **oversized format.**

Table T3. Total number of radiolarians, silicoflagellates, and diatoms, Site U1338.

Diatoms	Hole, core, section, interval (cm)		Average depth (CSF [m])		Depth (CCSF-A [m])	
	Top	Bottom	Top	Bottom	Top	Bottom
	320/321-	320/321-				
T *Fragilariopsis reinholdii*	U1338A-2H-3, 45	U1338A-2H-3, 120	6.155	6.905	6.893	7.57
T *Fragilariopsis fossilis*	U1338A-2H-5, 120	U1338A-2H-6, 45	9.905	10.655	10.28	10.598
T *Rhizosolenia matuyamai*	U1338B-2H-3, 120	U1338B-2H-4, 45	11.805	12.555	11.825	12.502
B *Rhizosolenia matuyamai*	U1338B-2H-4, 45	U1338B-2H-4, 120	12.555	13.305	12.502	13.18
T *Rhizosolenia praebergonii* var. *robusta*	U1338B-3H-2, 120	U1338B-3H-3, 45	19.805	20.555	19.756	20.434
B *Fragilariopsis doliolus*	U1338B-3H-5, 120	U1338B-3H-6, 45	24.305	25.055	23.821	24.499
T *Thalassiosira convexa var. convexa*	U1338A-4H-4, 45	U1338A-4H-4, 120	26.655	27.405	27.344	28.022
T *Nitzschia jouseae*	U1338A-5H-1, 45	U1338A-5H-1, 120	31.655	32.405	33.74	34.417
B *Rhizosolenia praebergonii var. robusta*	U1338A-5H-4, 120	U1338A-5H-5, 45	36.905	37.655	38.482	39.16
T *Actinocyclus ellipticus* f. *lanceolata*	U1338B-5H-5, 45	U1338B-5H-5, 120	42.555	43.305	42.322	42.999
B *Thalassiosira convexa* var. *convexa*	U1338B-6H-2, 45	U1338B-6H-2, 120	47.555	48.305	47.606	48.284
B *Asteromphalus elegans*	U1338A-7H-2, 45	U1338A-7H-2, 120	52.155	52.905	52.719	53.397
T *Fragilariopsis cylindrica*	U1338A-7H-3, 120	U1338A-7H-4, 45	54.405	55.155	54.752	55.429
B *Nitzschia jouseae*	U1338B-8H-6, 45	U1338A-9H-1, 120	72.555	73.045	71.481	72.13
B *Shionodiscus oestrupii*	U1338B-10H-4, 45	U1338B-10H-5, 45	88.555	90.055	88.121	89.476
T *Thalassiosira miocenica*	U1338B-10H-5, 45	U1338A-11H-1, 45	90.055	88.655	89.476	90.05
T *Asterolampra acutiloba*	U1338B-11H-3, 45	U1338B-11H-3, 120	96.555	97.305	96.134	96.811
T *Fragilariopsis miocenica*	U1338A-12H-3, 45	U1338A-12H-3, 120	101.055	101.905	102.529	103.207
T *Nitzschia miocenica* var. *elongata*	U1338B-12H-2, 45	U1338B-12H-2, 120	104.555	105.305	104.426	105.104
T *Thalassiosira praeconvexa*	U1338B-12H-6, 45	U1338A-13H-1, 120	110.555	108.305	109.846	110.32
T *Rossiella praepaleacea*	U1338C-14H-3, 122	U1338C-14H-4, 47	122.025	122.775	121.725	122.403
B *Thalassiosira miocenica*	U1338B-14H-2, 120	U1338B-14H-3, 120	124.305	125.805	124.074	125.429
B *Thalassiosira convexa*	U1338B-14H-2, 120	U1338B-14H-3, 120	124.305	125.805	124.074	125.429
B *Thalassiosira praeconvexa*	U1338A-15H-3, 45	U1338A-15H-3, 120	129.655	130.405	130.688	131.346
T *Nitzschia porteri*	U1338B-16H-5, 120	U1338B-16H-6, 45	147.805	148.555	148.04	148.717
B *Fragilariopsis miocenica*	U1338A-16H-6, 45	U1338A-17H-2, 45	148.555	147.155	148.717	149.26
T *Rossiella paleacea*	U1338A-17H-3, 45	U1338A-17H-4, 45	148.655	150.155	150.614	151.969
T *Thalassiosira burckliana*	U1338A-18H-3, 45	U1338A-18H-3, 120	158.155	158.905	160.28	160.958
T *Azpeitia nodulifera* var. *cyclopa*	U1338A-18H-6, 45	U1338B-18H-5, 45	162.655	166.055	164.345	165.899
B *Fragilariopsis reinholdii*	U1338B-19H-2, 120	U1338B-19H-3, 45	166.905	167.655	169.015	169.693
T *Actinocyclus ellipticus* var. *javanica*	U1338B-18H-5, 45	U1338B-18H-5, 120	166.055	166.805	165.899	166.576
B *Alveus marinus*	U1338B-19H-2, 120	U1338B-19H-3, 45	166.905	167.555	169.015	169.693
T *Thalassiosira yabei*	U1338B-18H-5, 45	U1338B-18H-5, 120	166.055	166.805	165.899	166.578
B *Fragilariopsis cylindrica*	U1338A-19H-5, 45	U1338A-19H-5, 120	170.655	171.405	172.403	173.08
B *Azpeitia nodulifera* var. *cyclopa*	U1338A-19H-6, 45	U1338B-19H-5, 45	172.155	175.555	173.758	175.977
T *Thalassiosira yabei* var. *elliptica*	U1338B-19H-5, 120	U1338B-19H-5, 45	176.305	177.055	175.655	176.332
T *Thalassiosira temperei* var. *delicata*	U1338A-20H-2, 120	U1338A-20H-3, 45	176.305	177.155	178.13	178.808
B *Fragilariopsis fossilis*	U1338A-20H-3, 45	U1338A-20-H5, 120	177.155	180.905	178.808	182
B *Thalassiosira yabei* var. *elliptica*	U1338A-20H-2, 120	U1338A-20H-3, 45	176.405	177.155	178.13	178.808
B *Thalassiosira burckliana*	U1338A-20H-3, 45	U1338A-20H-5, 120	177.155	180.905	178.808	182
T *Actinocyclus moronensis*	U1338B-22H-6, 70	U1338A-24H-2, 108	205.855	214.385	191.919	211.69
T *Denticulopsis simonsenii*	U1338A-21H-2, 45	U1338A-21H-1, 120	185.155	185.905	187.218	187.89
T *Cavitatus jouseana*	U1338B-25H-5, 45	U1338A-26H-2, 45	232.555	232.655	233.659	
T *Craspedodiscus coscinodiscus*	U1338C-28H-1, 122	U1338C-28H-2, 47	248.025	248.775	248.266	248.943
T *Coscinodiscus gigas* var. *diorama*	U1338C-28H-1, 122	U1338C-28H-2, 47	248.025	248.775	248.266	248.943
T *Actinocyclus ellipticus* var. *spiralis*	U1338C-28H-6, 47	U1338C-28H-6, 122	254.775	255.525	254.363	255.041
B *Hemidiscus cuneiformis*	U1338B-28H-1, 120	U1338B-28H-4, 45	258.305	262.055	258.311	261.698
T *Actinocyclus ingens*	U1338C-28H-7, 47	U1338C-29H-1, 47	256.275	256.775	255.718	256.17
T *Crucidenticula nicobarica*	U1338B-33H-5, 120	U1338B-33H-6, 45	299.605	300.355	298.103	298.78
T *Annellus californicus*	U1338B-32H-7, 45	U1338C-33H-1, 47	292.155	292.875	291.03	291.156
B *Coscinodiscus gigas* var. *diorama*	U1338B-34H-4, 45	U1338C-35H-1, 47	306.875	307.375	305.601	306.64
T *Araniscus lewisianus*	U1338B-34H-1, 45	U1338B-34H-2, 45	302.355	303.865	301.518	302.882
T *Thalassiosira tappanae*	U1338B-35H-3, 120	U1338B-35H-4, 45	315.605	316.355	314.706	315.384
B *Azpeitia nodulifera*	U1338C-36H-4, 47	U1338B-36H-1, 120	321.355	321.375	320.54	320.81
B *Denticulopsis simonsenii*	U1338C-38H-4, 122	U1338C-38H-5, 47	341.125	341.875	340.298	340.976
T *Cestodiscus peplum*	U1338C-38H-2, 122	U1338C-38H-3, 47	338.125	338.875	337.588	338.266
B *Actinocyclus ellipticus* var. *spiralis*	U1338C-38H-3, 47	U1338C-38H-4, 47	338.875	340.375	338.266	339.621
B *Thalassiosira tappanae*	U1338C-39H-1, 122	U1338C-39H-2, 45	346.125	346.875	341.897	346.361
T *Coscinodiscus blysmos*	U1338C-38H-5, 122	U1338C-39H-1, 122	342.625	346.125	341.897	346.361
B *Actinocyclus ingens*	U1338C-40H-7, 47	U1338C-42H-4, 120	368.475	369.605	360.298	361.292
B *Crucidenticula kanayae*	U1338C-44H-1, 45	U1338C-44H-2, 120	387.855	390.115	371.057	388.907
T *Cestodiscus peplum*	U1338C-44H-5, 120	U1338C-45H-1, 120	394.675	398.105	393.026	395.894

T = top, B = bottom.

Table T4. Taxonomic list for Sites U1134 and U1338. (Continued on next page.)

Taxonomic list
Actinocyclus divisus (Grunow) Hustedt
Actinocyclus ellipticus Grunow in van Heurck
Actinocyclus ellipticus var. *javanica* Reinhold
Actinocyclus ellipticus f. *lanceolata* Kolbe
Actinocyclus ellipticus var. *spiralis* Barron
Actinocyclus ingens Rattray
Actinocyclus moronensis Deby
Actinocyclus octonarius Ehrenberg
Actinoptychus senarius (Ehrenberg) Ehrenberg
Actinoptychus vulgaris Schumann
Alveus marinus (Grunow) Kaczmarska and Fryxell
Annellus californicus Tèmpere
*Araniscus lewisianus (*Greville) Komura
Asterolampra auctiloba Forti
*Asterolampra marylandica (*Ehrenberg) Leuduger-Fortmorel
Asterolampra vulgaris Greville
Asteromphalus arachne (Brébisson) Ralfs
Asteromphalus elegans Greville
Azpeitia africana (Janisch ex Schmidt) Fryxell and Watkins
Azpeitia bukryi (Barron) Barron
Azpeitia neocrenulata (VanLandingham) Fryxell and Watkins
Azpeitia nodulifera (Schmidt) Fryxell and Sims
Azpeitia nodulifera f. *cyclopa* (Jousé) Sims
Azpeitia oligocenica (Jousé) Sims
Azpeitia praenodulifera (Barron) Sims and Fryxell
Azpeitia salisburyana (Lohman) Sims
Azpeitia tabularis (Grunow) Fryxell and Sims
*Azpeitia tuberculata (*Greville) Sims
Azpeitia vetustissima (Pantocsek) Sims
Bogorovia veniamini Jousé ex Yanagisawa
Cavitatus jouseanus (Sheshukova-Poretzkaya) Williams
Cavitatus miocenicus (Schrader) Akiba and Yanagisawa
Cestodiscus convexus Castracane
*Cestodiscus demergitus (*Fenner) Fenner and Mikkelsen
Cestodiscus kulgeri Lohman
Cestodiscus peplum Brun
Cestodiscus pulchellus Greville
Cestodiscus pulchellus var. *maculata* Kolbe
Cestodiscus robustus Jousé
Cestodiscus reticulatus Fenner
Cestodiscus trochus Castracane
Coscinodiscus blysmos Barron
Coscinodiscus excavatus Greville ex Ralfs in Pritchard
Coscinodiscus gigas var. *diorama* (Schmidt) Grunow
Coscinodiscus lewisianus var. *robustus* Barron
Coscinodiscus lewisianus var. *similis* Rattray
Coscinodiscus loeblichii Barron
Coscinodiscus marginatus Ehrenberg
Coscinodiscus oculus-iridus Ehrenberg
Coscinodiscus radiatus Ehrenberg
Cosinodiscus temperi var. *delicata* Barron
Craspedodiscus barronii Bukry
*Craspedodiscus coscinodiscus (*Ehrenberg) Ehrenberg
Crucidenticula kanayae Akiba and Yanagisawa
*Crucidenticula nicobarica (*Grunow*)* Akiba and Yanagisawa
Crucidenticula punctata (Schrader) Akiba and Yanagisawa
Denticulopsis simonsenii (Simonsen & Kanaya) Simonsen

Table T4 (continued).

Taxonomic list
Distephanosira architecturalis (Brun) Gleser
Fragilariopsis cylindrica (Burckle) Censarek and Gersonde
Fragilariopsis doliolus (Wallich) Medlin and Sims
Fragilariopsis fossilis (Frengeulli) Medlin et Sims
Fragilariopsis maleinterpretaria (Schrader) Censarek & Gersonde
Fragilariopsis miocenica (Burckle) Censarek and Gersonde
*Fragilariopsis reinholdii (*Kanaya ex Barron and Baldauf) Zielinski and Gersonde
Hemiaulus polycystinorum (Ehrenberg) Grunow
Hemidiscus cuneiformis Wallich
Hyalopoda spiralis (Hajós) Kozyrenko et Jackovschikova
Medaria splendida Sheshukova-Poretzkaya
Nitzschia jouseae Burckle
Nitzschia miocenica var. *elongata* Burckle
Nitzschia porteri Frenguelli
Nitzschia praereinholdii Schrader
Paralia sulcata (Ehrenberg) Cleve
Proboscia barboi (Brun) Jordan and Priddle
Pseudorocella barbadensis Deflandre
Pyxidicula grunowii Grove and Sturt
Pyxidicula turris (Greville et Arnott) Strelnikova and Nikolajev
Raphidodiscus marylandicus Christian
Rhizosolenia matuyamai Burckle, Hammond and Seyb
Rhizosolenia praebergonii var. *robusta* Burckle and Trainer
Rhizosolenia styliformis Brightwell
Rossiella paleacea (Grunow) Desikachary and Maheshwari
Rossiella paleacea var. *elongata* (Barron) Desikachary
Rossiella praepaleacea (Schrader) Gersonde et Schrader
Skeletonemopsis barbadensis (Greville) Sims
Shionodiscus oestrupii (Ostenfeld) Alverson, Kang and Theriot
Thalassionema nitzschioides (Grunow) Mereschkowsky
Thalassionema nitzschioides var. *parva* Heiden and Kolbe
Thalassiosira burckliana Schrader
Thalassiosira convexa var. *aspinosa* Schrader
Thalassiosira convexa var. *convexa* Mukhina
Thalassiosira eccentrica (Ehrenberg) Cleve emended Fryxell and Hasle
Thalassiosira elliptica (Barron) Tanimura
Thalassiosira fraga Schrader
Thalassiosira leptopus (Grunow) Hasle and Fryxell
Thalassiosira miocenica Schrader
Thalassiosira nativa Sheshukova-Poretzkaya
Thalassiosira praeconvexa Burckle
Thalassiosira praeyabei (Schrader) Akiba and Yanagisawa
Thalassiosira symbolophora Schrader
Thalassiosira tappanae Barron
Thalassiosira temperi var. *delicata* Barron
Thalassiosira yabei (Kanaya) Akiba and Yanagisawa
Thalassiothrix longissima Cleve and Grunow
*Thalassiothrix robusta (*Schrader) Akiba
Triceratium barbadense Greville
Triceratium cinnamomeum Greville
Triceratium condecorum Ehrenberg