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41. RELATIVE ABUNDANCES AND RANGES OF SELECT DIATOMS AND SILICOFLAGELLATES FROM SITES 699 AND 704, SUBANTARCTIC SOUTH ATLANTIC[1]

Paul F. Ciesielski[2]

ABSTRACT

The stratigraphic ranges and relative abundances of selected diatoms and silicoflagellates are presented from three Neogene sedimentary sequences from the subantarctic South Atlantic. These data were compiled from Hole 699A in the southwest South Atlantic and Holes 704A and 704B in the southeast South Atlantic. Thirty-five samples were examined from a 67.5-m section of Hole 699A, which is mostly late Miocene or younger in age. A total of 225 samples was examined from the upper 569.1-m lower Miocene to Quaternary section in Holes 704A and 704B. Although the partial census of the Site 704 sequences is only preliminary, it reveals that the Neogene is remarkably complete and serves as a reference for further detailed examination of an important biostratigraphic-magnetostratigraphic reference section for the Neogene record of the Southern Ocean.

INTRODUCTION

Leg 114 of the Ocean Drilling Program (ODP) drilled several sites in the subantarctic South Atlantic which contain well-preserved Neogene diatoms and silicoflagellates. This data report presents the ranges and relative abundances of selected species of diatoms and silicoflagellates from Hole 699A on the lower northeastern slope of the Northeast Georgia Rise (51°32.537′S, 30°40.619′W; 3705 m water depth) and Holes 704A and 704B on the Meteor Rise (46°52.76′S, 7°25.25′E; 2543 m water depth) (Fig. 1).

Of the two studied sites, sediments recovered from Site 704 represent the most complete biosiliceous section of the Neogene yet recovered from the Southern Ocean. Detectable hiatuses are only present in the middle Miocene, an interval recovered elsewhere at other Southern Ocean sites. Of particular importance is the presence of a thick lower Miocene section (~80 m), the first complete and expanded section (~200 m) of the upper Miocene, and a 187-m section of the upper Pliocene to Quaternary. Many of the studies presented in this volume complement the future use of this site as an important reference section for high-latitude micropaleontology of the Neogene, including detailed benthic, planktonic, and whole-fraction analyses of oxygen and carbon isotopes of the upper Miocene–Quaternary (Hodell and Ciesielski; Müller et al.; Mead et al.), a record of ice-rafted detritus (Allen and Warnke), carbonate and biogenic opal variability (Froelich et al.), and more. The presence of carbonate and biogenic silica throughout the Neogene of Holes 704A and 704B offers an opportunity to cross-calibrate siliceous and calcareous microfossil stratigraphy and correlate with the paleomagnetic record presented by Hailwood and Clement (this volume) and the stable isotopic stratigraphy defined by those previously mentioned.

The Neogene record of Hole 699A is less complete than that found at Site 704. The ranges and abundances are recorded herein for the upper Miocene–Quaternary. Significant reworking of siliceous microfossils in the sediments of Hole 699A complicates the stratigraphy of this section and may reduce the potential use of it for calibration of species ranges to the paleomagnetic record as defined by Hailwood and Clement (this volume).

It is the author's experience that the initial and last occurrences of species ranges are difficult to accurately define in Southern Ocean sediments because the abundances commonly do not exceed the background level of reworking. In addition, apparent biogeographic variations in their ranges (e.g., Fenner, this volume) complicate their regional applicability. For this reason, various ongoing investigations of recently recovered ODP sequences from the Southern Ocean are concentrating on quantitative studies of species abundances to offer more reliable stratigraphic boundaries based upon major abundance changes within or at the extremes of species ranges. This data report is an attempt to document the relative abundances and ranges of a number of taxa throughout most of the Neogene. This record now serves as a guide for ongoing (P. F. Ciesielski and A. Vrba, unpubl. data) and future quantitative studies of diatom and silicoflagellate occurrences. Some of the results of these quantitative studies are presented in Fenner (this volume). At this time few changes are offered to the Southern Ocean diatom zonation of Weaver and Gombos (1981), Gombos and Ciesielski (1983), and (Ciesielski, 1983), although a much higher resolution stratigraphy calibrated to the magnetostratigraphy and partially based on quantitative studies could be presented at this time. This approach is taken to allow further detailed studies by this and other authors to be completed so as to produce a more permanent stratigraphic zonation. The only change to the existing zonation as employed here is that the lowermost Miocene portion of the *Rocella gelida* Zone of Gombos and Ciesielski (1983) is replaced by the *Rossiella symmetrica* Zone, which extends from the last abundant appearance of *R. gelida* to the last consistent *R. symmetrica* as defined by quantitative studies by P. F. Ciesielski and A. Vrba (unpubl. data). Occurrences for these datums at the Leg 114 sites were documented by P. F. Ciesielski (unpubl. data).

PREPARATION OF SAMPLES AND METHODS OF STUDY

All samples used in this study were collected by the author during Leg 114. All samples were processed for shorebased investigations using the following technique: raw samples were placed in 200-mL beakers and heated with diluted

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[2] Department of Geology, University of Florida, Gainesville, FL 32611.

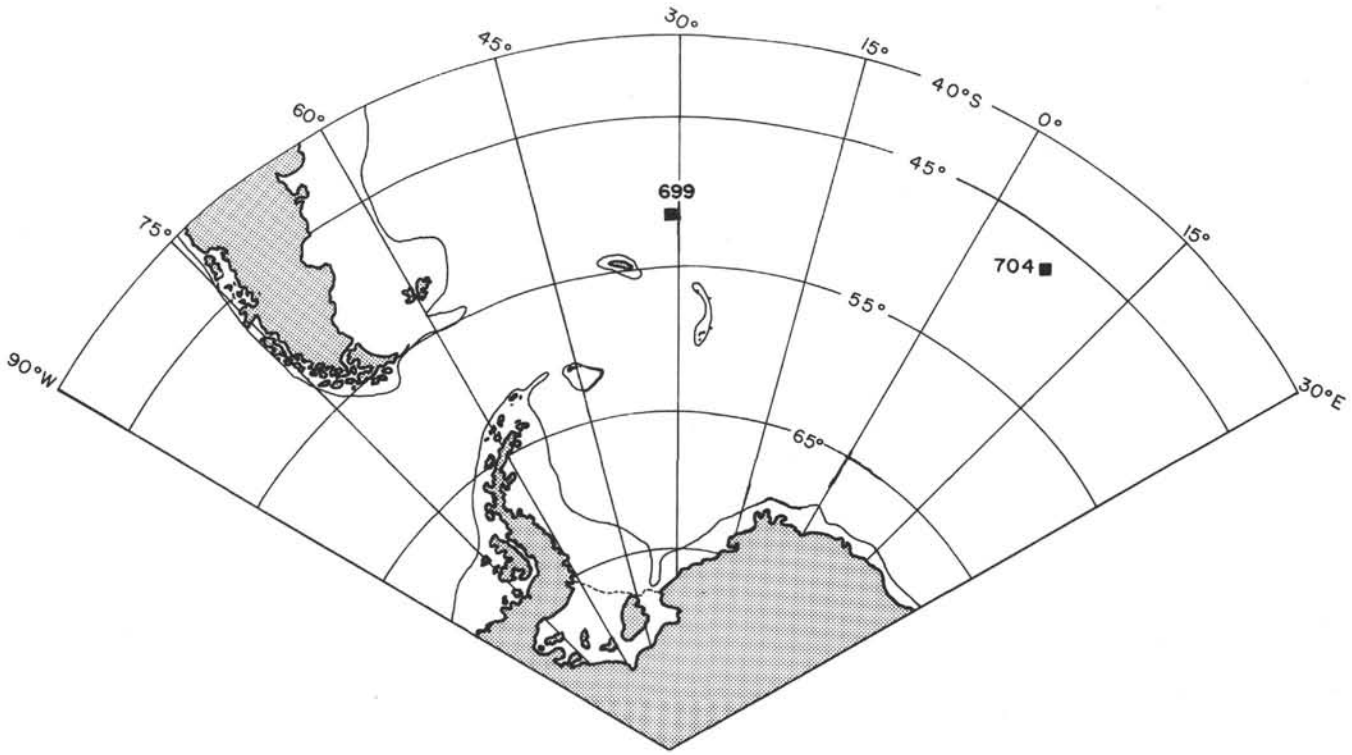

Figure 1. Map of the southern South Atlantic showing the location of Sites 699 and 704.

hydrogen peroxide to disassociate the sediment and remove organic carbon. Hydrochloric acid was then added to dissolve any carbonate present in the samples. The undissolved residues were diluted with distilled water, centrifuged, and decanted to remove the acid. This procedure was repeated three times. Next, the samples were washed with sodium pyrophosphate, centrifuged, and decanted to remove a significant proportion of the clay present in the samples. This step was repeated until the sediment suspension obtained a neutral pH. Processed residues were diluted with distilled water and stored in 50-mL bottles.

Strewn slides of all samples were prepared by shaking bottles containing the sediment and water until all sediment was in suspension, and a small amount of the suspension was pipetted from the middle of the bottle. A few drops of the pipetted solution were placed on a glass slide and dispersed uniformly. After the slides dried, cover slips were mounted using Hyrax (n.d. = 1.71) as the mounting medium.

Relative abundances of selected diatom and silicoflagellate species were determined from Holes 699A (Core 114-699A-1H through Section 114-699A-8H-2), 704A (entire hole), and 704B (Samples 114-704B-24X-1, 80–82 cm, through 114-704B-62X-2, 40–42 cm). Relative abundances were recorded as follows:

dominant = more than one specimen/field of view;
abundant = an average of one specimen/field of view;
common = one specimen/five fields of view;
frequent = one specimen/10 fields of view;
sparse = one specimen/20 fields of view;
rare = several specimens/slide;
very rare = only one observed specimen.

A "?" designates questionably present specimens, represented by fragments difficult to identify or poorly preserved. Specimens that are interpreted as reworked or displaced are indicated by a lowercase letter in the tables.

RESULTS

The stratigraphic ranges and relative abundances of selected diatoms and silicoflagellates are given in Table 1 (Hole 699A) and Tables 3 and 4 (Holes 704A and 704B). Accompanying each table is a species locator index citing the column number of alphabetically listed species. Silicoflagellate taxa are indicated by "(S)" after the species name. Paleomagnetic boundaries and chron/subchron identifications for Holes 704A and 704B (Hailwood and Clement, this volume; P. F. Ciesielski, unpubl. data) are presented in Table 2. Similar information was identified for Hole 699A (P. F. Ciesielski, unpubl. data).

References relating to the taxonomy of the cited taxa are not provided in this data report; however, they are readily available in widely accessible literature. Taxa endemic to the Southern Ocean are referenced and/or described and figured by the following: Schrader (1976), Fenner et al. (1976), Gombos (1977), Weaver and Gombos (1981), Gombos and Ciesielski (1983), Ciesielski (1983, 1985), and Fenner (this volume). Additional references to Southern Ocean diatom taxa and more cosmopolitan species are given in Barron (1981, 1983, 1985a) and Barron and Bauldauf (1986). The reader is referred to several other references for the few silicoflagellate taxa listed herein (Busen and Wise, 1977; Shaw and Ciesielski, 1983; Ciesielski et al., 1989; Ciesielski, this volume).

All siliceous and calcareous microfossil datums and paleomagnetic boundaries from Holes 699A, 704A, and 704B were tabulated in a biostratigraphic-magnetostratigraphic synthesis of ODP Leg 114 (P. F. Ciesielski, unpubl. data), which also figures the occurrence of all microfossil zonal schemes in relation to the paleomagnetic record. It is important to note that the data presented here do not represent all the compiled data regarding diatom and silicoflagellate ranges in the discussed holes. Fenner (this volume) presents quantitative data

of selected species ranges from the upper Pliocene–Quaternary of these holes and P. F. Ciesielski and A. Vrba (unpubl. data) have examined quantitative fluctuations of species from the upper Oligocene–lowermost Miocene section of Hole 699A and other taxa from the lower to lower upper Pliocene of Hole 704A. These results (P. F. Ciesielski, unpubl. data) have been combined to cite the depths, ages, and bracketing samples of Neogene silicoflagellate and diatom datums, in this volume.

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Table 1. Range chart of relative abundances of selected diatoms and silicoflagellates from Hole 699A in order of their highest appearances.

Southern Ocean diatom zone (Weaver and Gombos, 1981; Ciesielski, 1983)	Core, section, interval (cm)	1 *Charcotia actinochilus*	2 *Eucampia antarctica*	3 *Hemidiscus karstenii*	4 *Nitzschia kerguelensis*	5 Preservation	6 *Thalassiosira lentiginosa*	7 *Thalassiothrix longissima*	8 *Nitzschia angulata*	9 *Thalassiosira kolbei*	10 *Actinocyclus ingens*	11 *Thalassiosira elliptipora*	12 *Stephanopyxis turris*	13 *Thalassiosira vulnifica* + *T.* cf. *vulnifica*	14 *Rouxia* spp.	15 *Coscinodiscus marginatus*	16 *Nitzschia weaveri*	17 *Simonsenella barboi*	18 *Thalassionema nitzschioides*	19 *Denticulopsis dimorpha*	20 *Denticulopsis hustedtii*	21 *Thalassiosira insigna*	22 *Denticulopsis lauta*	23 *Nitzschia reinholdii*	24 *Thalassionema nitzschioides* var. *parva*	25 *Thalassiosira torokina*	26 *Hemidiscus cuneiformis*	27 *Rhizosolenia styliformis*	28 *Pyxilla* fragments	29 *Thalassiosira lentiginosa* var. *ovalis*	30 *Nitzschia interfrigidaria*	31 *Coscinodiscus endoi*	32 *Nitzschia praeinterfrigidaria*	33 *Nitzschia marina*
Thalassiosira lentiginosa	1H-1, 40–42	S	A	D	D	E	A	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-2, 140–142	F	C	R	D	G	A	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-3, 140–142	C	D	.	D	M	C	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-4, 140–142	F	C	.	D	G	A	C	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-5, 140–142	S	C	S	D	G	C	C	.	Ⓧ	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-6, 140–142	S	A	.	D	G	C	C	S	.	S	S	Ⓧ	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	2H-1, 110–112	.	F	R	C	P	F	S	.	.	F	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thalassiosira elliptipora/ Actinocyclus ingens	2H-2, 110–112	R	C	.	A	G	C	C	R	.	C	C	.	C	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	2H-3, 110–112	.	F	.	F	G	S	C	F	Ⓧ	C	F	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	2H-4, 110–112	.	F	.	F	G	F	C	C	.	C	F	.	.	S	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	3H-1, 67–70	.	F	.	F	G	F	C	C	Ⓧ	C	F	.	.	S	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
S. barboi/N. kerguelensis	3H-2, 67–69	.	S	X	S	F	S	F	F	.	C	S	.	X	.	S	Ⓧ	X	F	.	.	.	.	.	.	.	.	.	.	.	.	.
T. kolbei/S. barboi Zone through *T. insigna* Zone undifferentiated	3H-3, 60–62	.	F	.	S	M	F	F	F	S	C	S	R	S	.	S	.	S	R	Ⓧ	.	.	.	.	.	.	.	.	.	.	.	.
	3H-4, 108–110	.	F	.	S	M	F	F	C	F	C	S	.	R	.	S	.	S	F	Ⓧ	Ⓡ	.	S	.	.	.	.	.	.	.	.	.
	4H-1, 124–126	.	C	.	F	M	S	F	C	S	S	R	.	C	F	.	Ⓧ	.	S	Ⓧ	Ⓡ	S	Ⓧ	R	R	Ⓧ	.	.	.	.	.	.
	4H-2, 37–39	.	F	.	.	M	R	F	C	F	S	.	.	C	F	F	.	.	S	Ⓧ	Ⓧ	S	.	R	R	.	S	F	.	.	.	.
Nitzschia weaveri	4H-3, 38–40	.	S	.	.	F	F	S	S	R	.	.	X	F	.	S	X	.	F	.	Ⓧ	S	.	R	R	.	R	S	.	.	.	.
	4H-4, 38–40	.	S	X	.	F	S	S	F	S	.	S	F	S	S	S	C	.	F	Ⓧ	Ⓧ	C	.	.	.	.	.	.	Ⓧ	.	.	.
N. interfrigidaria/T. insigna	4H-5, 37–39	.	F	.	R	M	S	C	F	S	S	S	C	S	C	S	C	.	C	.	Ⓡ	C	Ⓧ	F	.	Ⓧ	S	S	.	X	C	.
	5H-2, 41–43	.	C	.	.	M	S	C	C	S	S	S	C	S	C	R	F	.	S	.	Ⓡ	F	.	.	.	Ⓧ	.	.	.	R	C	.	.
N. interfrigidaria and *N. praeinterfrigidaria* Zones	5H-3, 41–43	.	S	R	.	M	F	C	C	X	R	S	C	.	A	R	R	X	R	.	Ⓧ	X	.	.	.	.	.	.	.	.	A	R	S	.
	5H-4, 41–43	.	F	S	.	M	F	F	A	.	S	.	C	.	A	S	.	.	C	.	.	.	.	S	R	.	R	R	.	.	C	F	F	S
Nitzschia angulata	5H-5, 41–43	.	S	.	.	M	R	A	A	R	.	.	A	.	A	S	.	X	D	.	Ⓡ	.	.	S	.	.	.	S	.	.	.	F	F	X
Nitzschia reinholdii	6H-1, 40–42	.	S	.	.	G	.	F	.	R	.	.	C	.	F	S	.	.	D	Ⓧ	Ⓧ	.	.	F	.	Ⓢ	.	S	.	.	.	S	S	S
	6H-2, 40–42	.	F	R	.	M	.	C	.	.	F	.	C	.	F	S	Ⓢ	F	A	Ⓧ	S	R	.	C	.	.	.	S	Ⓧ	.	.	R	R
	6H-3, 40–42	.	S	.	.	M	.	F	Ⓢ	R	F	R	C	.	F	F	.	S	A	Ⓧ	F	S	.	F	.	X	.	S	.	.	Ⓧ	S	F
	6H-4, 40–42	.	C	R	.	M	R	F	.	.	S	.	C	.	C	F	.	S	A	.	S	R	.	S	.	X	.	.	.	.	.	.	S
	6H-5, 40–42	.	F	.	.	M	.	C	.	.	.	.	C	.	C	F	.	R	C	.	F	.	.	F	F	R	.	.	.	.	.	.	.
Denticulopsis hustedtii	6H-6, 41–43	.	F	R	.	M	.	F	.	.	F	.	C	.	C	F	.	F	C	Ⓧ	S	X	.	F	F	S	.	S	.	.	.	.	.
	7H-1, 39–43	.	S	.	.	M	R	F	Ⓐ	.	S	R	C	.	C	F	.	S	F	.	R	R	.	.	R	R	.	.	.	.	Ⓢ	S	Ⓢ	X
	7H-2, 44–47	.	R	R	Ⓡ	M	.	C	Ⓧ	.	S	.	.	.	F	F	.	S	R	.	C	S	.	.	R	X	S	C	Ⓧ	.	.	.	.	.
	7H-4, 42–46	.	R	R	.	M	.	F	.	.	C	.	.	.	F	C	.	S	F	.	C	S	.	S	R	S	F	C	.	.	.	.	.	.
	7H-5, 42–46	.	S	S	.	M	.	C	.	.	F	.	.	.	C	F	.	S	F	Ⓧ	C	F	Ⓡ	X	S	F	.	F	.	.	.	.	.	.
D. hustedtii–D. lauta	8H-1, 40–42	.	R	.	.	M	.	F	.	.	C	.	.	.	.	C	.	F	R	C	D	S	F	.	.	.	.	C	Ⓧ	.	.	F	.	.
Nitzschia denticuloides	8H-2, 40–42	.	.	.	.	M	.	C	.	.	F	.	S	.	C	F	.	.	S	.	A	.	R	.	S	.	.	.	Ⓡ	.	.	.	.	.

Table 1 (continued).

Southern Ocean diatom zone (Weaver and Gombos, 1981; Ciesielski, 1983)	Core, section, interval (cm)		34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
Thalassiosira lentiginosa	1H-1, 40–42		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-2, 140–142		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-3, 140–142		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-4, 140–142		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-5, 140–142		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	1H-6, 140–142		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thalassiosira elliptipora/ Actinocyclus ingens	2H-1, 110–112		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	2H-2, 110–112		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	2H-3, 110–112		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	2H-4, 110–112		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	3H-1, 67–70		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
S. barboi/N. kerguelensis	3H-2, 67–69		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
T. kolbei/S. barboi Zone through *T. insigna* Zone undifferentiated	3H-3, 60–62		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	3H-4, 108–110		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	4H-1, 124–126		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	4H-2, 37–39		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nitzschia weaveri	4H-3, 38–40		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	4H-4, 38–40		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
N. interfrigidaria/T. insigna	4H-5, 37–39		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	5H-2, 41–43		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
N. interfrigidaria and *N. praeinterfrigidaria* Zones	5H-3, 41–43		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	5H-4, 41–43		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nitzschia angulata	5H-5, 41–43		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nitzschia reinholdii	6H-1, 40–42		⊗	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	6H-2, 40–42		.	R	.	S	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	6H-3, 40–42		.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	6H-4, 40–42		X	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	6H-5, 40–42		.	R	.	.	.	.	.	R	⊗	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	6H-6, 41–43		.	.	.	S	R	.	.	X	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Denticulopsis hustedtii	7H-1, 39–43		.	.	.	R	R	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	7H-2, 44–47		.	.	.	R	R	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	7H-4, 42–46		.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	7H-5, 42–46		.	.	.	.	.	.	.	.	X	.	S	R	.	.	.	.	.	.	.	.	.	.	.	.	.
	8H-1, 40–42		R	.	.	.	R	.	.	.	X	.	X	.	C	R	R	.	.	.	.	.	.	.	.	.	.
D. hustedtii–D. lauta	8H-2, 40–42		.	.	.	.	X	.	.	.	.	.	.	.	S	.	.	⊗	⊗	R	⊗	⊗	⊗	C	S	R	S	⊗	⊛

Species location index

Index number is the column in which species appears.

Index number	Species
10	*Actinocyclus ingens*
40	*Bachmannocena circulus* (S)
34	*Bachmannocena diodon* (S)
1	*Charcotia actinochilus*
47	*Corbisema archangelskiana* (S)
31	*Coscinodiscus endoi*
9	*Thalassiosira kolbei*
15	*Coscinodiscus marginatus*
48	*Coscinodiscus rhombicus*
49	*Craspedodiscus coscinodiscus*
44	*Denticulopsis copulae*
19	*Denticulopsis dimorpha*
20	*Denticulopsis hustedtii*
22	*Denticulopsis lauta*
35	*Dictyocha pygmaea* (S)
37	*Dictyocha* spp. (S)
38	*Distephanus crux* (S)
36	*Distephanus pseudofibula* (S)
41	*Distephanus quinquangellus*
2	*Eucampia antarctica*
26	*Hemidiscus cuneiformis*
3	*Hemidiscus karstenii*
39	*Hemidiscus karstenii* forma 1 (Ciesielski, 1983)
50	*Lisitzinia ornata*
43	*Lithodesmium* sp.
51	*Naviculopsis biapiculata* (S)
52	*Naviculopsis ponticula spinosa* (S)
45	*Neobrunia mirabilis*
8	*Nitzschia angulata*
53	*Nitzschia denticuloides*
54	*Nitzschia efferans*
30	*Nitzschia interfrigidaria*
4	*Nitzschia kerguelensis*
33	*Nitzschia marina*
32	*Nitzschia praeinterfrigidaria*
55	*Nitzschia pusilla*
23	*Nitzschia reinholdii*
56	*Nitzschia* sp. 19 (Schrader, 1976)
16	*Nitzschia weaveri*
5	Preservation
28	*Pyxilla* fragments
27	*Rhizosolenia styliformis*
57	*Rocella gelida*
58	*Rocella vigilans* (large)
14	*Rouxia* spp.
17	*Simonsenella barboi*
46	*Simonsenella praebarboi*
12	*Stephanopyxis turris*
18	*Thalassionema nitzschioides*
24	*Thalassionema nitzschioides* var. *parva*
11	*Thalassiosira elliptipora*
21	*Thalassiosira insigna*
6	*Thalassiosira lentiginosa*
29	*Thalassiosira lentiginosa* var. *ovalis*
25	*Thalassiosira torokina*
13	*Thalassiosira vulnifica* + *T.* cf. *vulnifica*
7	*Thalassiothrix longissima*
42	*Thalassiothrix miocenica*

Note: X = very rare; R = rare; S = sparse; F = frequent; C = common; A = abundant; D = dominant; P = poor; F = fair; M = moderate; G = good; E = excellent; ? = questionably present; . = not present.

Table 2. Paleomagnetic datums in Holes 704A and 704B as defined by Hailwood and Clement (this volume).

Paleomagnetic datum	Age (Ma)	Bracketing samples	Depth range (mbsf)	Mean position (mbsf)
Brunhes/Matuyama boundary	0.73	704B-4H-6, 6 cm / 5H-1, 57 cm	33.26–35.77	34.51
Top Jaramillo Subchron	0.91	704B-5H-2, 132 cm / 5H-3, 61 cm	38.02–38.81	38.41
Base Jaramillo Subchron	0.98	704B-5H-6, 100 cm / 5H-7, 16 cm	43.70–44.85	44.27
Top Olduvai Subchron	1.66	704A-10H-4, 100 cm / 10H-5, 31 cm	88.69–89.50	89.09
Matuyama/Gauss boundary	2.47	704A-18X-6, 145 cm / 19X-1, 5 cm	168.15–168.75	168.75
Top Kaena Subchron	2.92	704A-19X-5, 126 cm / 19X-6, 5 cm	176.95–176.25	176.10
Base Kaena Subchron	2.99	704A-19X-7, 5 cm / 19X-7, 15 cm	177.75–177.85	177.80
Top Mammoth Subchron	3.08	704A-20X-1, 85 cm / 20X-1, 95 cm	179.05–179.15	179.10
Base Mammoth Subchron	3.18	704A-20X-3, 15 cm / 20X-3, 45 cm	181.35–181.65	181.50
Gauss/Gilbert boundary	3.40	704A-20X-6, 85 cm / 20X-6, 104 cm	186.55–186.75	186.65
Top Cochiti Subchron	3.88	704A-22X-1, 115 cm / 22X-2, 5 cm	198.35–198.75	198.55
Base Cochiti Subchron	3.97	704A-22X-4, 15 cm / 22X-4, 35 cm	201.85–202.05	201.95
Top Nunivak Subchron	4.10	704A-22X-5, 95 cm / 22X-5, 104 cm	204.15–204.24	204.20
Base Nunivak Subchron	4.24	704A-23X-3, 55 cm / 23X-3, 75 cm	210.25–210.45	210.35
Top Sidufjall Subchron	4.40	704A-23X-4, 75 cm / 23X-4, 85 cm	211.95–212.05	212.00
Base Sidufjall Subchron	4.47	704A-23X-5, 45 cm / 23X-5, 65 cm	213.15–213.35	213.25
Top Thvera Subchron	4.57	704A-23X-6, 10 cm / 24X-1, 33 cm	214.29–216.52	215.40
Base Thvera Subchron	4.77	704A-24X-3, 15 cm / 24X-3, 35 cm	219.35–219.55	219.45
Gilbert/C3AN boundary	5.35	704B-25X-1, 135 cm / 25X-2, 28 cm	224.55–224.97	224.76
C3AN.33	5.53	704B-25X-6, 25 cm / 25X-6, 45 cm	230.95–231.15	231.05
C3AN.61	5.68	704B-26X-1, 104 cm / 26X-1, 125 cm	233.74–233.95	233.85
C3AN/C3AR boundary	5.89	704B-26X-5, 45 cm / 27X-2, 41 cm	239.14–244.10	241.62
C3AR.59	6.37	704B-27X-6, 135 cm / 27X-7, 12 cm	251.05–251.45	251.25
C3AR.75	6.50	704B-28X-4, 45 cm / 28X-4, 65 cm	256.65–256.85	256.75
C3AR/C4N boundary	6.70	704B-28X-6, 25 cm / 28X-6, 35 cm	259.45–259.55	259.50
C4N.1	6.78	704B-29X-2, 115 cm / 29X-3, 56 cm	263.84–264.75	264.29
C4N.2	6.85	704B-29X-3, 115 cm / 29X-4, 56 cm	265.34–266.25	265.79
C4N.8	7.28	704B-29X-4, 115 cm / 29X-5, 56 cm	266.84–267.75	267.29
C4N.9	7.35	704B-29X-7, 31 cm / 30X-1, 45 cm	270.50–271.15	270.82
C4N/C4R boundary	7.41	704B-30X-4, 55 cm / 30X-4, 75 cm	275.75–275.95	275.85
C4R/C4AN boundary	7.90	704B-32X-1, 35 cm / 32X-1, 39 cm	290.05–290.08	290.06
C4AN.52	8.21	704B-35X-1, 25 cm / 35X-1, 45 cm	318.45–318.65	318.55
C4AN.85	8.41	704B-35X-4, 125 cm / 35X-5, 5 cm	323.95–324.25	324.10
C4AN/C4AR boundary	8.50	704B-35X-6, 115 cm / 35X-6, 145 cm	326.85–327.15	327.05
C4AR.50	8.71	704B-37X-1, 61 cm / 37X-2, 61 cm	337.80–339.30	338.55
C5N/C5R boundary	10.42	704B-44X-2, 54 cm / 45X-1, 36 cm	405.73–413.55	409.64
[a]Base C5R (truncated by hiatus)	<11.55	704B-46X-5, 80 cm / 46X-4, 82 cm	429.50–428.02	428.76
	Hiatus	704B-6X-5, 80 cm / 46X-4, 82 cm	429.50–428.02	428.76
[a]Top C5ACR (truncated by hiatus)	14.08	704B-46X-5, 80 cm / 46X-4, 82 cm	429.50–428.02	428.76
C5ACR/C5ADN boundary	14.20	704B-46X-5, 95 cm / 46X-5, 85 cm	429.65–429.55	429.60
C5ADN/C5ADR boundary	14.66	704B-47X-3, 45 cm / 47X-3, 55 cm	435.65–435.75	435.70
C5ADR/C5BN boundary	14.87	704B-47X-3, 135 cm / 47X-4, 5 cm	436.55–436.75	436.65
C5BN.2	14.96	704B-47X-4, 65 cm / 47X-4, 75 cm	437.35–437.45	437.40
C5BN.6	15.13	704B-47X-5, 115 cm / 47X-6, 40 cm	439.35–440.09	439.72
C5BN/C5BR boundary	15.27	704B-48X-1, 56 cm / 48X-2, 56 cm	442.25–443.75	443.00
[a]Base C5BR (truncated by hiatus)	<16.22	704B-49X-1, 75 cm / 49X-1, 115 cm	451.95–452.35	452.15
	Hiatus	704B-9X-1, 75 cm / 49X-1, 115 cm	451.95–452.35	452.15
[a]Top C5CN.8 (truncated by hiatus)	>16.80	704B-49X-1, 75 cm / 49X-1, 115 cm	451.95–452.35	452.15
C5CN/C5CR boundary	16.98	704B-49X-2, 55 cm / 49X-2, 125 cm	453.25–453.95	453.60
C5CR/C5DN boundary	17.57	704B-53X-3, 145 cm / 54X-2, 15 cm	486.15–492.85	489.50
C5DN/C5DR boundary	17.90	704B-54X-5, 95 cm / 54X-5, 104 cm	498.15–498.25	498.20
C5EN/C5ER boundary	19.09	704B-56X-2, 65 cm / 56X-2, 115 cm	512.34–512.84	512.59
C5ER/C6N boundary	19.35	704B-56X-3, 65 cm / 56X-3, 85 cm	513.84–514.04	513.94
C6N/C6R boundary	20.45	704B-58X-5, 55 cm / 58X-5, 65 cm	535.74–535.84	535.79
C6R/C6AN boundary	20.88	704B-58X-6, 85 cm / 59X-1, 35 cm	537.54–539.04	538.29
C6AAN/C6AAR boundary	22.35	704B-61X-1, 125 cm / 61X-1, 135 cm	558.94–559.04	558.99
C6BN/C6BR boundary	22.97	704B-62X-3, 35 cm / 62X-3, 55 cm	570.54–570.74	570.64

[a] Paleomagnetic chron not completely represented because of the hiatus that has removed an undetermined portion of it.

Table 3. Range chart of relative abundances of selected diatoms and silicoflagellates from Hole 704A in order of their highest appearances.

Southern Ocean diatom zone (Weaver and Gombos, 1981 emended by Ciesielski, 1983)	Core, section, interval (cm)	1 *Actinocyclus ingens*	2 *Eucampia antarctica*	3 *Hemidiscus karstenii*	4 *Nitzschia kerguelensis*	5 Preservation	6 *Thalassiosira lentiginosa*	7 *Thalassiothrix longissima*	8 *Dictyocha* spp. (S)	9 *Hemidiscus cuneiformis*	10 *Thalassiosira lentiginosa* var. *ovalis*	11 *Rhizosolenia hebetata* forma *hiemalis*	12 *Rouxia* spp.	13 *Thalassionema nitzschioides*	14 *Thalassiosira oestrupii*	15 *Thalassiosira elliptipora*	16 *Rhizosolenia hebetata* forma *semispina*	17 *Nitzschia angulata*	18 *Charcotia actinochilus*	19 *Ethmodiscus* fragments	20 *Thalassiosira nativa*	21 *Thalassiosira kolbei*	22 *Coscinodiscus marginatus*	23 *Thalassiosira vulnifica*	24 *Thalassiosira insigna*	25 *Nitzschia interfrigidaria*	26 *Nitzschia weaveri*	27 *Simonsenella barboi*	28 *Rocella gelida*	29 *Rhizosolenia styliformis*	30 *Thalassiosira elliptipora* (very elongate aerolae)	31 *Denticulopsis dimorpha*	32 *Nitzschia fossilis*	33 *Thalassiosira convexa* var. *aspinosa*
	1H-2, 78–80	Ⓕ	C	C	D	M	C	F	.		.																								
	1H-3, 78–80	Ⓢ	S	F	D	M	C	S	S	S	S																								
	1H-5, 78–80	.	F	C	C	F	C	S	S																										
Thalassiosira lentiginosa	2H-1, 40–42	Ⓕ	S	C	C	F	F	S	R	.	R	S	R	F	S	.																		
	2H-2, 130–134	Ⓡ	C	.	D	G	A	S	.	.	S	.	C	.	.	Ⓥ	.																		
	2H-3, 130–134	.	S	.	D	M	F	S	.	.	.	.	F	.	.	.																		
	2H-4, 130–134	.	C	.	D	M	A	R	.	.	S	.	.	.	.	Ⓥ	S																		
	2H-5, 130–134	.	F	.	D	M	F	S	.	.	.	.	.	.	.	.	.	S	.	F	.														
	2H-7, 40–42	A	A	.	D	M	A	S	V	.	S	S	.	.	.	.	S	.	.	.															
	3H-1, 80–84	A	C	.	A	M	A	A	.	.	.	.	.	.	.	S	.	S	.	R	F														
	3H-2, 80–84	C	.	.	A	M	C	D	.	.	.	.	.	.	.	S	.	S	.	R	S														
	3H-3, 26–30	C	.	.	C	M	S	A	.	.	.	.	.	.	R	S	.	S	.	R	.														
	3H-4, 26–30	A	.	.	A	M	C	D	.	.	R	.	.	.	R	S	F	.	.	R	.														
	3H-5, 26–30	C	.	.	A	G	C	D	.	.	R	.	.	.	.	F	.	.	.	.	.														
	3H-6, 26–30	A	S	.	C	M	F	C	.	.	R	.	.	.	S	.	S	S	.	S	S	Ⓕ	Ⓕ	Ⓡ	Ⓕ	Ⓡ	Ⓕ	Ⓒ	Ⓧ	.					
	[a]4H-1, 120–122	D	F	.	C	M	A	C	.	.	.	S	.	.	.	.	R	.	.	.	.														
	[a]4H-2, 120–122	D	V	.	A	G	C	S	F	.	V	.	.	.	S	.	.	S	.	R	R										R	.	.	.	.
	[a]4H-3, 120–122	C	S	.	A	M	C	D	.	.	.	.	.	.	F	R	.	.	.	R	.										S	.	.	.	.
	[a]4H-4, 120–122	C	F	.	C	M	C	C	.	.	R	R	.	.	S	V	.	F	.	R	.	Ⓕ	Ⓕ	.	Ⓡ	.	.	Ⓒ	.	R	S	Ⓥ	S	R
	[a]4H-5, 120–122	C	C	.	D	M	A	C	.	.	.	.	.	.	.	.	.	.	.	C	R	.	Ⓥ	.	Ⓥ	.	.	Ⓢ	.	.	.	.	.	.
	5H-1, 50–52	C	.	.	A	M	C	C	.	.	.	R	V	.	R	F	.	.	.	R	.										R	.	.	R
	5H-2, 50–52	C	R	.	D	M	C	A	.	.	.	.	.	.	.	F	.	.	.	S	S										S	.	.	.	
	5H-3, 50–52	C	R	.	A	M	C	A	.	.	.	.	.	.	.	F	.	.	.	R	.										C	.	.	.	
	5H-4, 50–52	C	.	.	D	M	C	D	.	.	.	.	.	.	.	F	.	S	.	R	.										C	.	.	.	
	5H-5, 80–82	C	R	.	D	F	A	A	.	.	.	.	.	.	R	C	.	.	.	S	.										F	.	.	.	
	6H-1, 84–86	C	.	.	C	M	F	D	.	.	.	R	.	.	R	F	.	.	.	S	.										.	R	.	.	.
	6H-2, 84–86	F	.	.	A	M	F	D	.	.	.	.	.	.	.	F	.	.	.	S	.										.	R	.	.	R
	6H-3, 84–86	A	.	.	C	M	C	C	.	.	.	S	.	.	.	C	.	S	.	R	.										S	.	.	.	
	6H-4, 84–86	C	R	.	C	M	C	C	.	.	.	R	.	.	S	F	.	F	.	R	.										S	.	.	.	
	6H-5, 84–86	A	R	.	C	.	C	C	R	.	.	.	.	.	.	S	.	.	.	.	.										S	.	.	.	R
	6H-6, 84–86	A	.	.	A	M	F	D	.	.	.	R	.	.	.	R	R	.	.	S	.										V	.	.	.	
	7H-1, 59–61	D	S	.	A	G	C	F	.	.	S	R	.	.	.	F	.	.	.	S	.										.	.	.	.	
Thalassiosira elliptipora/ Actinocyclus ingens	7H-2, 59–61	D	S	.	A	M	C	C	.	.	.	S	.	.	.	.	.	F	.	.	.										.	.	.	.	
	7H-3, 59–61	D	.	.	A	M	C	C	C	.	.	.	.	.	.	R	.	F	.	.	.										.	.	.	.	
	7H-4, 59–61	D	.	.	C	M	C	A	C	.	.	.	.	.	S	.	.	F	.	F	.										.	.	.	.	
	7H-5, 59–61	A	.	.	C	G	C	C	C	.	R	.	.	.	R	.	.	S	.	S	R										.	.	.	.	
	7H-6, 59–61	D	S	.	C	M	C	C	S	.	.	.	.	.	.	S	.	C	.	S	.										.	.	.	.	
	8H-1, 80–82	A	.	.	A	F	F	D	.	.	.	R	.	.	.	S	.	.	.	S	R										.	.	.	.	
	8H-2, 80–82	D	R	.	C	M	F	F	R	.	.	.	.	.	.	.	.	S	.	S	R										.	.	.	.	
	8H-3, 80–82	C	.	.	C	G	C	F	.	.	.	.	.	.	.	.	.	F	.	.	.										.	.	.	.	
	8H-4, 80–82	D	R	.	A	G	.	C	.	.	F	.	.	.	F	.	.	S	.	S	S										.	.	.	.	
	8H-5, 80–82	D	R	.	C	M	F	C	.	.	.	.	.	.	.	.	.	F	.	S	R	.	S	.	.	.	.	Ⓢ	Ⓧ	S	.	.	.	.	
	8H-6, 80–82	D	.	.	A	F	C	A	.	.	S	.	.	.	S	.	.	F	.	S	S	.	S	.	.	.	.	.	.	.	.	.	.	.	
	9H-1, 80–82	A	.	.	D	M	C	A	.	.	F	.	.	.	F	.	.	F	.	S	.	.	S	.	.	.	.	.	.	.	.	.	.	.	
	9H-2, 80–82	D	.	.	A	M	A	C	.	.	.	.	.	.	C	.	.	C	.	.	F	.	S	.	.	.	.	.	.	S	.	.	.	.	
	9H-3, 80–82	A	.	.	D	M	C	C	.	.	S	.	.	.	C	.	.	F	.	S	S	.	C	.	.	.	.	.	.	F	.	.	.	.	
	9H-4, 80–82	C	.	.	A	M	C	C	.	.	R	.	.	.	F	.	.	F	.	R	S	.	S	.	.	.	.	.	.	R	.	.	.	.	
	9H-5, 80–82	A	V	.	C	M	A	C	.	.	R	R	.	.	F	.	.	A	.	F	S	.	F	.	.	.	.	.	.	R	.	.	.	.	
	9H-6, 80–82	C	.	.	C	M	C	C	.	.	F	.	.	.	C	.	.	C	.	F	.	.	F	.	.	.	.	.	.	.	.	.	.	.	
	10H-1, 79–81	D	.	.	C	M	C	S	.	.	F	S	.	F	S	.	.	C	.	S	S	.	S	.	.	.	.	.	.	R	.	.	.	.	
	10H-2, 79–81	C	.	.	C	F	C	D	.	.	.	.	.	C	C	.	.	C	.	S	C	.	S	.	.	.	.	.	.	.	.	.	.	.	
	10H-3, 79–81	A	.	.	C	M	C	D	.	.	S	R	.	C	R	.	.	C	.	S	S	.	S	.	.	.	.	.	.	.	.	.	.	.	
	10H-4, 79–81	A	.	.	C	M	F	C	.	.	S	R	.	A	S	.	.	S	.	R	S	.	S	.	.	.	.	.	.	.	.	.	.	.	
	10H-5, 79–81	C	.	.	C	M	C	A	.	.	R	.	.	C	R	.	.	D	.	R	.	.	S	.	.	.	.	.	.	.	.	.	.	.	
	10H-6, 79–81	A	.	.	D	M	C	C	.	.	F	.	.	C	.	.	.	C	.	F	.	.	S	.	.	.	.	.	.	V	.	.	.	.	
	11H-1, 80–82	C	.	C	C	M	C	A	.	F	F	R	.	C	S	.	.	C	.	R	R	.	R	.	.	.	.	.	.	C	.	.	.	.	
	11H-2, 80–82	A	.	S	C	M	F	C	.	.	R	.	.	A	R	.	.	F	.	R	R	.	S	.	.	.	.	.	.	.	.	.	.	.	
	11H-3, 80–82	A	.	R	C	M	S	C	.	.	R	R	.	D	R	.	.	F	.	R	.	.	S	.	.	.	.	.	.	R	.	.	.	.	
	11H-4, 80–82	A			C	G	C	A	.	.	.	.	.	C	R	.	.	D	.	S	S	.	.	.	.	.	.	C	.	.	.	.	.	.	
S. barboi/N. kerguelensis	11H-5, 80–82	D	.	.	C	G	F	C	.	.	R	.	.	C	F	.	.	A	.	R	F	.	R	.	.	.	.	C	.	S	.	.	.	.	
	11H-6, 80–82	A	.	.	F	M	C	C	.	.	.	.	.	C	C	.	.	C	.	R	S	S	C	.	.	.	.	A	.	.	.	.	.	R	

Table 3 (continued).

Southern Ocean diatom zone (Weaver and Gombos, 1981 emended by Ciesielski, 1983)	Core, section, interval (cm)	1 *Actinocyclus ingens*	2 *Eucampia antarctica*	3 *Hemidiscus karstenii*	4 *Nitzschia kerguelensis*	5 Preservation	6 *Thalassiosira lentiginosa*	7 *Thalassiothrix longissima*	8 *Dictyocha* spp. (S)	9 *Hemidiscus cuneiformis*	10 *Thalassiosira lentiginosa* var. *ovalis*	11 *Rhizosolenia hebetata* forma *hiemalis*	12 *Rouxia spp.*	13 *Thalassionema nitzschioides*	14 *Thalassiosira oestrupii*	15 *Thalassiosira elliptipora*	16 *Rhizosolenia hebetata* forma *semispina*	17 *Nitzschia angulata*	18 *Charcotia actinochilus*	19 *Ethmodiscus* fragments	20 *Thalassiosira nativa*	21 *Thalassiosira kolbei*	22 *Coscinodiscus marginatus*	23 *Thalassiosira vulnifica*	24 *Thalassiosira insigna*	25 *Nitzschia interfrigidaria*	26 *Nitzschia weaveri*	27 *Simonsenella barboi*	28 *Rocella gelida*	29 *Rhizosolenia styliformis*	30 *Thalassiosira elliptipora* (very elongate aerolae)	31 *Denticulopsis dimorpha*	32 *Nitzschia fossilis*	33 *Thalassiosira convexa* var. *aspinosa*
	12H-1, 80–82	D	.	.	.	M	C	F	.	.	S	.	.	S	F	.	.	A	.	F	.	S	S	.	Ⓥ	.	.	C	.	.	.	.	.	.
	12H-2, 80–82	D	F	.	C	E	C	C	.	.	R	.	.	C	F	A	.	A	.	R	.	S	S	.	.	.	.	S	.	R	.	.	.	.
	12H-3, 80–82	A	.	.	C	M	C	C	.	.	.	S	.	C	S	.	.	A	.	F	.	S	.	.	.	.	.	D	.	.	.	.	.	.
	12H-4, 80–82	A	.	.	F	M	C	S	.	.	.	S	.	.	F	.	.	C	.	F	.	S	.	.	.	.	.	A	.	.	.	.	.	.
	12H-5, 80–82	C	.	.	C	M	F	C	.	.	.	.	.	.	C	.	.	A	.	R	F	C	.	.	.	.	.	D	.	.	.	.	.	.
	12H-6, 80–82	A	.	.	C	G	C	F	.	.	.	R	.	R	C	.	.	D	.	S	F	C	R	.	.	.	.	A	.	.	.	.	.	S
Thalassiosira kolbei/ Simonsenella barboi	13H-1, 80–82	A	.	.	F	M	C	F	.	.	.	R	.	A	.	.	.	A	.	S	.	R	R	.	.	.	.	R	.	R	.	.	.	.
	13H-2, 80–82	D	R	.	C	M	C	F	.	.	.	.	.	A	.	.	.	C	.	S	.	S	S	.	.	.	.	S	.	.	.	.	.	.
	13H-3, 80–82	C	R	.	F	M	C	F	.	.	R	.	.	C	F	.	.	D	.	S	S	S	R	.	.	.	.	D	.	.	.	.	.	.
	13H-4, 80–82	C	R	.	C	F	C	F	.	.	V	.	.	V	F	.	.	C	.	F	S	S	R	.	.	.	.	D	.	R	.	.	.	.
	13H-6, 80–82	C	.	.	C	M	F	F	.	.	R	.	.	.	C	.	.	C	.	F	S	C	.	.	.	.	.	D	.	.	.	.	.	.
	14H-1, 80–82	C	.	.	C	M	C	C	.	.	.	.	.	.	C	.	.	A	.	S	F	F	.	.	.	.	.	A	.	S	.	.	C	.
	14H-2, 80–82	C	.	.	F	F	F	C	.	.	R	R	.	.	C	.	.	C	.	S	S	F	F	.	.	.	.	D	.	C	.	.	C	.
	14H-3, 80–82	F	.	.	R	M	F	A	.	.	.	R	R	.	C	.	.	C	.	S	S	F	.	.	.	.	.	D	.	S	.	.	.	S
	14H-4, 80–82	S	.	.	S	F	F	C	.	.	.	.	.	S	A	.	.	A	.	R	S	V	R	V	V	.	.	C	.	R	.	.	C	.
	14H-5, 80–82	.	V	V	R	M	C	C	V	.	.	R	.	R	F	.	.	A	.	F	.	C	F	F	C	.	Ⓢ	C	.	.	.	.	.	F	R
	14H-6, 80–82	.	.	S	.	G	F	C	.	S	.	R	.	.	F	.	.	A	.	S	.	C	C	C	.	.	.	S	.	.	.	.	.	.	.
	15H-1, 80–82	R	R	.	C	M	C	A	.	.	.	S	.	.	F	.	.	D	.	S	S	C	F	C	.	.	.	V	.	.	.	.	.	S	R
	15H-2, 80–82	V	V	V	.	M	F	C	.	.	R	.	.	.	S	V	.	C	.	S	C	C	F	V	V	.	.	C	.	.	.	.	.	.	.
	15H-3, 80–82	V	.	V	.	M	C	C	.	.	R	R	.	.	C	.	.	D	.	F	.	C	F	S	.	.	.	R	.	.	.	.	.	.	R
	15H-4, 80–82	S	R	C	.	M	F	A	.	.	.	S	.	.	F	.	.	A	.	R	S	A	C	C	.	.	.	S	.	.	.	.	.	.	.
	15H-6, 80–82	.	.	R	S	F	R	A	.	.	.	R	.	.	S	.	.	A	.	R	.	C	C	R	.	.	.	.	.	.	.	.	.	.	.
Thalassiosira vulnifica	16H-2, 80–82	R	.	R	R	M	S	C	.	R	.	.	.	.	S	.	.	C	.	S	.	A	C	V	.	.	.	R	.	.	.	.	.	.	R
	16H-3, 80–82	.	F	.	.	M	F	F	.	R	.	C	F	F	V	.	R	C	.	R	.	S	C	C	R	.	.	S	.	F	.	.	R	.	.
	16H-4, 80–82	S	R	R	.	F	C	S	.	R	.	.	.	.	.	.	.	C	.	R	.	.	C	S	R	.	Ⓥ	.	.	F	.	.	.	.	.
	16H-6, 80–82	.	.	R	.	G	S	C	.	R	.	.	S	.	C	.	.	A	.	S	F	A	C	R	.	.	.	R	.	.	.	.	.	.	.
	17H-2, 80–82	.	.	R	.	F	F	C	.	V	R	.	.	.	.	.	.	F	.	S	R	F	C	C	R	.	.	.	.	.	.	.	.	.	.
	17H-4, 80–82	C	C	V	.	M	C	S	.	.	C	S	.	C	S	S	.	C	.	F	.	C	F	.	V	.	.	F	.	S	.	.	R	.	.
	17H-6, 80–82	F	R	.	.	F	C	R	.	R	S	.	.	.	.	.	.	F	.	R	.	.	C	F	.	.	.	.	.	R	.	.	.	.	.
	18H-2, 76–78	S	S	.	.	F	C	F	.	.	S	.	.	C	.	R	.	C	.	S	.	.	C	C	.	.	.	.	.	F	.	.	.	.	R
	18H-4, 76–78	.	.	.	.	M	C	C	.	.	.	S	.	.	R	.	.	A	.	S	.	C	F	R	.	.	.	C	.	.	.	.	.	.	.
	18H-5, 76–78	R	.	R	.	M	S	C	.	R	R	R	.	.	S	.	.	D	.	S	.	A	S	C	.	.	.	R	.	R	.	.	.	.	R
Thalassiosira insigna	18H-6, 76–78	.	R	R	.	M	C	C	.	S	R	R	.	F	S	.	.	A	.	S	.	S	C	C	S	Ⓢ	.	.	.	R	.	.	.	.	S
	19H-1, 60–62	.	.	.	.	M	R	C	.	.	.	.	.	.	F	.	.	D	.	F	.	A	.	R	D	.	Ⓡ	R	.	.	.	.	.	.	R
	19H-2, 60–62	F	.	R	.	M	F	C	.	S	.	.	.	.	S	.	.	C	.	F	.	F	R	R	D	.	D	R	.	.	.	.	S	.	.
Nitzschia weaveri and *Nitzschia interfrigidaria/Thalassiosira vulnifica* zonal equivalent	19H-3, 60–62	R	.	F	.	G	S	D	.	S	S	.	V	S	C	.	.	C	.	R	.	C	.	.	C	.	A	.	.	.	.	.	.	.
	19H-4, 60–62	F	V	F	.	M	F	C	.	F	S	R	.	F	.	.	.	F	.	F	.	S	S	V	C	.	A	.	.	.	.	.	.	.	.
	19H-5, 60–62	C	F	R	.	F	C	C	.	.	F	S	.	C	F	.	.	F	.	F	.	F	.	S	A	.	C	R	.	.	.	.	V	.	.
	19H-6, 60–62	C	R	S	.	M	F	C	.	R	R	.	.	.	.	.	.	R	.	S	.	F	S	V	C	.	A	V	.	.	.	.	R	.	.
	20H-1, 80–82	S	V	R	.	G	C	F	.	.	.	R	R	S	.	.	.	C	.	S	R	S	V	V	S	.	D	R	.	.	.	.	R	.	.
	20H-2, 80–82	.	.	S	.	G	F	C	.	V	.	.	S	C	F	.	.	F	.	S	.	C	R	.	S	C	A	R	.	V	.	.	R	.	.
Nitzschia interfrigidaria	20H-3, 80–82	.	.	.	.	M	C	C	.	.	R	.	R	.	.	.	.	C	.	S	.	R	R	.	S	F	C	R	.	R	.	.	R	.	.
	20H-4, 80–82	.	.	S	.	F	F	C	.	.	.	.	R	.	S	.	.	C	.	S	.	R	R	.	.	A	V	R	.	.	.	.	V	.	.
	20H-5, 80–82	.	.	F	.	M	F	C	.	.	.	.	R	.	S	.	.	F	.	F	.	S	.	.	.	D	.	.	.	.	.	.	V	.	.
	20H-6, 80–82	R	.	C	.	F	F	F	.	.	.	.	R	.	F	.	.	F	.	F	.	R	R	.	.	A	.	.	.	.	.	.	.	.	.
	21H-1, 80–82	F	.	C	.	M	F	C	.	F	.	.	S	.	S	.	.	F	.	S	.	.	F	.	R	A	.	S	.	S	.	.	V	.	.
	21H-2, 50–52	C	.	F	.	M	S	C	R	C	.	S	F	.	S	.	.	F	.	S	.	R	C	.	.	A	.	F	.	R	.	.	.	.	.
Nitzschia praeinterfrigidaria	21H-3, 80–82	S	.	F	.	F	S	C	.	F	.	R	.	.	.	.	.	F	.	S	.	.	F	.	.	C	.	C	.	.	.	.	R	.	.
	21H-4, 50–52	S	.	S	.	M	C	C	S	S	.	.	.	S	S	.	.	C	.	S	.	.	C	.	R	S	.	F	Ⓥ	R	.	Ⓡ	S	R	.
	22H-1, 81–83	F	.	S	.	M	S	C	V	S	.	R	C	R	S	.	.	R	.	F	.	.	C	.	V	R	.	C	.	S	.	.	S	.	.
	22H-2, 50–52	R	V	F	.	M	.	C	S	R	.	F	C	A	S	.	.	.	.	S	.	.	C	.	S	R	.	C	.	C	.	Ⓥ	F	.	.
	22H-3, 81–83	S	.	C	.	M	.	A	.	.	.	S	F	C	.	.	.	.	.	S	.	.	C	.	.	.	.	F	.	R	.	.	S	.	.
	22H-4, 139–141	F	.	.	.	M	V	C	S	R	.	F	F	C	.	.	.	.	.	F	.	.	C	.	R	V	.	C	.	S	.	Ⓥ	S	.	.
	22H-5, 81–83	C	.	C	.	M	.	C	.	R	.	S	F	C	S	.	.	R	.	S	.	.	F	.	.	.	.	C	.	S	.	.	R	.	.
Nitzschia angulata	23H-1, 80–82	S	.	.	.	F	F	C	S	R	.	R	S	F	.	.	.	R	.	S	.	.	S	.	.	.	.	S	Ⓡ	R	.	.	R	.	.
	23H-2, 80–82	R	.	S	.	F	.	C	S	R	.	F	S	C	S	.	.	.	.	S	.	.	F	.	R	.	.	C	Ⓥ	F	.	V	R	.	.
	23H-3, 80–82	R	.	.	.	M	R	C	S	.	.	S	.	S	S	.	.	V	.	S	R	.	C	.	.	.	.	F	.	F	.	.	R	.	.
Nitzschia reinholdii	23H-5, 80–82	R	.	R	.	G	.	A	C	.	.	.	C	C	F	.	.	.	.	F	.	.	S	.	.	.	.	C	Ⓥ	S	.	.	F	.	.

[a]Sample from Hole 704B.

Table 3 (continued).

	34 *Stephanopyxis turris*	35 *Thalassiosira* cf. *vulnifica*	36 *Rhizosolenia* sp. A	37 *Coscinodiscus lineatus*	38 *Asteromphalus parvulus*	39 *Denticulopsis hustedtii*	40 *Coscinodiscus tabularis*	41 *Nitzschia* cf. *interfrigidaria*	42 *Thalassiosira lineata*	43 *Thalassionema nitzschioides* var. *parva*	44 *Nitzschia reinholdii*	45 *Nitzschia marina*	46 *Thalassiosira convexa*	47 *Thalassiothrix miocenica*	48 *Actinocyclus divisus*	49 *Cosmiodiscus intersectus*	50 *Nitzschia clementia*	51 *Rouxia naviculoides*	52 *Thalassiosira* "praevulnifica"	53 *Actinocyclus ingens* (ovate form)	54 *Nitzschia praeinterfrigidaria*	55 *Actinocyclus ellipticus*	56 *Asteromphalus kennettii*	57 *Coscinodiscus endoi*	58 *Distephanus quinquangellus* (S)	59 *Nitzschia* aff. *praeinterfrigidaria*	60 *Asteromphalus hookeri*	61 *Distephanus pseudofibula* (S)	62 *Nitzschia cylindrica* (S)	63 *Nitzschia jouseae*	64 *Rouxia* sp. 1 (Ciesielski, 1983)	65 *Rouxia californica*	66 *Neobrunia mirabilis*	67 *Hemidiscus* triangulus	68 *Hemidiscus karstenii* forma 1 (Ciesielski, 1983)	69 *Chaetoceros* spines	70 *Bachmannocena borderlandensis* (S)	71 *Bachmannocena diodon* (S)
1H-2, 78–80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1H-3, 78–80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1H-5, 78–80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2H-1, 40–42	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2H-2, 130–134	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2H-3, 130–134	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2H-4, 130–134	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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5H-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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10H-6, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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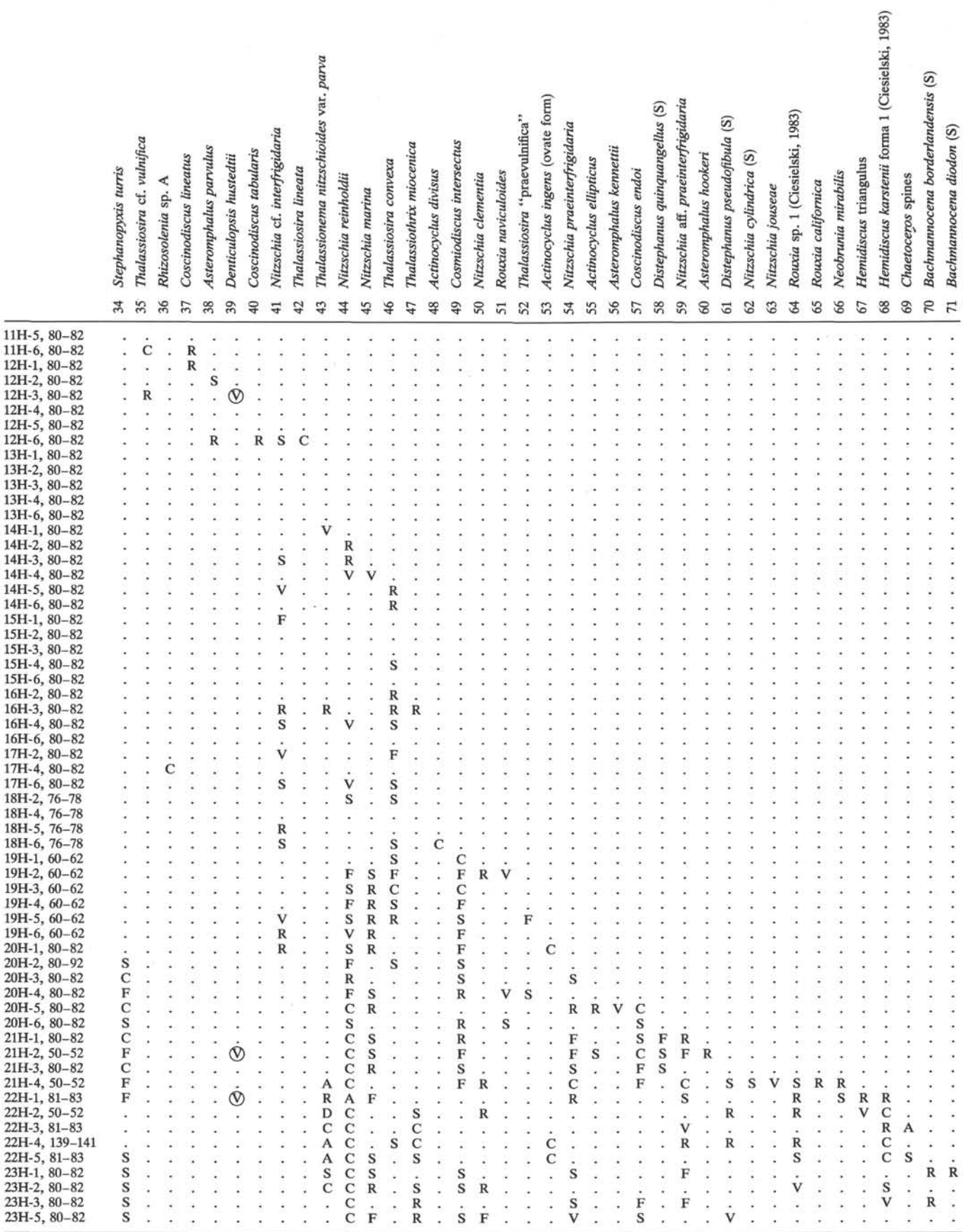
34 Stephanopyxis turris
35 Thalassiosira cf. vulnifica
36 Rhizosolenia sp. A
37 Coscinodiscus lineatus
38 Asteromphalus parvulus
39 Denticulopsis hustedtii
40 Coscinodiscus tabularis
41 Nitzschia cf. interfrigidaria
42 Thalassiosira lineata
43 Thalassionema nitzschioides var. parva
44 Nitzschia reinholdii
45 Nitzschia marina
46 Thalassiosira convexa
47 Thalassiothrix miocenica
48 Actinocyclus divisus
49 Cosmiodiscus intersectus
50 Nitzschia clementia
51 Rouxia naviculoides
52 Thalassiosira "praevulnifica"
53 Actinocyclus ingens (ovate form)
54 Nitzschia praeinterfrigidaria
55 Actinocyclus ellipticus
56 Asteromphalus kennettii
57 Coscinodiscus endoi
58 Distephanus quinquangellus (S)
59 Nitzschia aff. praeinterfrigidaria
60 Asteromphalus hookeri
61 Distephanus pseudofibula (S)
62 Nitzschia cylindrica (S)
63 Nitzschia jouseae
64 Rouxia sp. 1 (Ciesielski, 1983)
65 Rouxia californica
66 Neobrunia mirabilis
67 Hemidiscus triangulus
68 Hemidiscus karstenii forma 1 (Ciesielski, 1983)
69 Chaetoceros spines
70 Bachmannocena borderlandensis (S)
71 Bachmannocena diodon (S)
11H-5, 80–82
11H-6, 80–82
12H-1, 80–82
12H-2, 80–82
12H-3, 80–82
12H-4, 80–82
12H-5, 80–82
12H-6, 80–82
13H-1, 80–82
13H-2, 80–82
13H-3, 80–82
13H-4, 80–82
13H-6, 80–82
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15H-3, 80–82
15H-4, 80–82
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16H-2, 80–82
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19H-2, 60–62
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19H-4, 60–62
19H-5, 60–62
19H-6, 60–62
20H-1, 80–82
20H-2, 80–92
20H-3, 80–82
20H-4, 80–82
20H-5, 80–82
20H-6, 80–82
21H-1, 80–82
21H-2, 50–52
21H-3, 80–82
21H-4, 50–52
22H-1, 81–83
22H-2, 50–52
22H-3, 81–83
22H-4, 139–141
22H-5, 81–83
23H-1, 80–82
23H-2, 80–82
23H-3, 80–82
23H-5, 80–82

Species location index

Index number is the column in which species appears.

Index number	Species
48	*Actinocyclus divisus*
55	*Actinocyclus ellipticus*
1	*Actinocyclus ingens*
53	*Actinocyclus ingens* (ovate form)
60	*Asteromphalus hookeri*
56	*Asteromphalus kennettii*
38	*Asteromphalus parvulus*
70	*Bachmannocena borderlandensis* (S)
71	*Bachmannocena diodon* (S)
69	*Chaetoceros* spines
18	*Charcotia actinochilus*
52	*Thalassiosira* "praevulnifica"
57	*Coscinodiscus endoi*
37	*Coscinodiscus lineatus*
22	*Coscinodiscus marginatus*
40	*Coscinodiscus tabularis*
49	*Cosmiodiscus intersectus*
31	*Denticulopsis dimorpha*
39	*Denticulopsis hustedtii*
8	*Dictyocha* spp. (S)
61	*Distephanus pseudofibula* (S)
58	*Distephanus quinquangellus* (S)
19	*Ethmodiscus* fragments
2	*Eucampia antarctica*
9	*Hemidiscus cuneiformis*
3	*Hemidiscus karstenii*
68	*Hemidiscus karstenii* forma 1 (Ciesielski, 1983)
67	*Hemidiscus triangulus*
66	*Neobrunia mirabilis*
59	*Nitzschia* aff. *praeinterfrigidaria*
17	*Nitzschia angulata*
41	*Nitzschia* cf. *interfrigidaria*
50	*Nitzschia clementia*
62	*Nitzschia cylindrica*
32	*Nitzschia fossilis*
25	*Nitzschia interfrigidaria*
63	*Nitzschia jouseae*
4	*Nitzschia kerguelensis*
45	*Nitzschia marina*
54	*Nitzschia praeinterfrigidaria*
44	*Nitzschia reinholdii*
26	*Nitzschia weaveri*
5	Preservation
11	*Rhizosolenia hebetata* forma *hiemalis*
16	*Rhizosolenia hebetata* forma *semispina*
36	*Rhizosolenia* sp. A
29	*Rhizosolenia styliformis*
28	*Rocella gelida*
65	*Rouxia californica*
51	*Rouxia naviculoides*
64	*Rouxia* sp. 1 (Ciesielski, 1983)
12	*Rouxia* spp.
27	*Simonsenella barboi*
34	*Stephanopyxis turris*
13	*Thalassionema nitzschioides*
43	*Thalassionema nitzschioides* var. *parva*
35	*Thalassiosira* cf. *vulnifica*
46	*Thalassiosira convexa*
33	*Thalassiosira convexa* var. *aspinosa*
15	*Thalassiosira elliptipora*
30	*Thalassiosira elliptipora* (very elongate aerolae)
24	*Thalassiosira insigna*
21	*Thalassiosira kolbei*
6	*Thalassiosira lentiginosa*
10	*Thalassiosira lentiginosa* var. *ovalis*
42	*Thalassiosira lineata*
20	*Thalassiosira nativa*
14	*Thalassiosira oestrupii*
23	*Thalassiosira vulnifica*
7	*Thalassiothrix longissima*
47	*Thalassiothrix miocenica*

Note: V = very rare; R = rare; S = sparse; F = frequent; C = common; A = abundant; D = dominant; P = poor; VP = very poor; P = poor; F = fair; M = moderate; G = good; E = excellent; ? = questionably present; . = not present.

Table 4. Range chart of relative abundances of selected diatoms and silicoflagellates from Hole 704B in order of their highest appearances.

Northeast Pacific diatom zone (see Barron, 1985b)	Southern Ocean diatom zone (Weaver and Gombos, 1981)	Core, section, interval (cm)	1 *Actinoptychus* spp.	2 *Asteromphalus kennettii*	3 *Bachmannocena borderlandensis* (S)	4 *Bachmannocena diodon* (S)	5 *Bachmannocena dumitricae* (S)	6 *Coscinodiscus marginatus*	7 *Denticulopsis hustedtii*	8 *Hemidiscus cuneiformis*	9 *Hemidiscus karstenii*	10 *Neobrunia mirabilis*	11 Preservation	12 *Simonsenella barboi*	13 *Rhizosolenia hebetata* f. *hiemalis*	14 *Rhizosolenia styliformis*	15 *Thalassionema nitzschioides*	16 *Thalassiothrix longissima*	17 *Thalassiothrix miocenica*	18 *D. lauta* and *D. hustedtii* (copulae)	19 *Denticulopsis lauta*	20 *Dictyocha* spp. (S)	21 *Thalassionema nitzschioides* var. *parva*	22 *Actinocyclus ingens*	23 *Thalassiosira insigna*	24 *Nitzschia reinholdii*	25 Other *Nitzschia* spp.	26 *Coscinodiscus endoi*	27 *Cosmiodiscus intersectus*	28 *Dictyocha pygmaea* (S)	29 *Nitzschia claviceps*	30 *Nitzschia clementia*	31 *Nitzschia fossilis*	32 *Nitzschia januaria*	33 *Nitzschia marina*
Thalassiosira oestrupii	*Denticulopsis hustedtii*	24X-1, 80–82	R	F	R	S	Ⓡ	C	F	C	A	R	M	R	C	R	S	C	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-2, 80–82	R	S	.	.	Ⓒ	A	C	R	R	R	F	R	F	R	R	F	R	R	Ⓧ	R	C	.	.	.	.	.	.	.	.	.	.	.
		24X-3, 80–82	R	F	.	R	Ⓢ	C	F	R	R	S	F	C	C	R	S	S	R	.	.	.	.	S	X	S	R	.	.	.	.	.	.	.
		24X-4, 80–82	.	.	.	.	.	R	.	.	C	.	G	A	S	R	A	A	R	.	.	R	.	S	R	C	A	R	F	S	S	R	R	C	C
		24X-5, 80–82	.	.	.	.	.	S	.	.	C	.	M	C	S	S	C	A	R	.	.	R	.	S	R	C	A	S	C	R	S	R	R	F	C
		24X-6, 80–82	.	.	.	.	.	F	.	R	F	R	M	C	R	S	S	C	F	.	.	S	R	C	X	C	C	.	.	.	.	S	R	S	S
		25X-1, 80–82	.	.	.	.	.	A	R	.	F	.	F	F	A	C	C	C	.	.	.	R	.	S	.	F	C	.	.	.	.	.	.	.	.
		25X-2, 80–82	.	.	.	.	.	A	R	R	S	.	M	C	F	S	D	C	R	.	.	S	D	S	.	C	C	.	.	.	.	R	S	C	F
		25X-3, 80–82	.	.	.	.	.	C	.	R	S	.	M	C	S	S	D	C	R	.	.	S	D	S	.	C	C	.	.	.	.	.	S	R	C
		25X-4, 80–82	.	.	.	.	.	C	R	S	C	.	M	S	C	S	D	A	.	.	.	R	C	S	.	C	C	R	.	X	.	.	.	R	F
		25X-5, 80–82	.	.	.	.	.	C	.	R	F	.	G	C	F	F	C	C	F	.	.	R	A	R	.	C	C	.	.	.	.	.	R	S	F
		25X-6, 80–82	.	.	.	.	Ⓧ	C	R	.	F	.	M	C	C	F	A	A	S	.	.	C	C	S	.	C	S	.	.	.	.	.	S	.	S
		26X-1, 80–82	.	.	.	.	.	C	R	F	S	.	G	F	S	F	D	A	R	.	.	R	D	S	.	C	S	.	.	.	.	.	S	S	S
		26X-2, 80–82	.	.	.	.	.	F	.	R	S	R	M	F	S	S	A	A	S	.	.	.	D	C	.	C	S	.	.	.	.	.	F	S	S
		26X-3, 80–82	.	.	.	.	.	C	R	S	C	.	M	S	F	S	C	C	S	.	.	.	C	C	.	C	F	.	.	.	.	.	S	.	S
		26X-4, 80–82	.	.	.	S	.	C	R	C	C	.	M	F	F	S	D	A	R	.	.	R	D	S	.	C	S	.	.	.	.	.	S	R	S
		27X-2, 110–112	.	.	.	.	Ⓡ	S	R	F	R	A	G	F	C	S	C	C	S	.	.	S	C	F	F	S	A	C	.	.	.	.	S	R	.
		27X-3, 20–22	.	.	.	.	.	S	.	A	R	C	G	R	C	F	.	S	S	.	.	R	.	R	.	R	F	F	.	.	.	.	S	R	.
		27X-3, 110–112	.	.	.	.	.	S	R	A	R	C	G	F	C	S	R	F	.	.	.	R	R	S	F	.	F	F	.	.	.	.	S	R	.
		27X-4, 110–112	.	R	.	R	Ⓡ	S	S	R	F	C	M	R	C	R	R	C	.	.	.	.	.	S	.	S	C	C	.	.	.	.	C	S	R
		27X-5, 20–22	.	.	.	S	.	S	R	R	C	A	M	R	C	F	F	S	.	.	.	F	S	S	S	R	F	F	.	.	.	.	F	S	.
		27X-5, 110–112	.	.	.	R	Ⓧ	C	R	S	C	A	M	S	F	S	R	C	S	.	.	R	R	S	C	S	C	C	.	.	.	.	F	R	.
		27X-6, 110–112	.	R	.	S	Ⓡ	C	R	S	F	C	M	S	C	C	S	C	.	.	.	.	S	F	C	R	S	C	.	.	.	.	S	R	.
		27X-7, 20–22	.	X	.	R	.	F	F	R	R	F	M	R	C	S	S	C	.	.	.	.	S	D	F	R	S	R	.	.	.	.	S	S	.
		28X-1, 79–81	.	X	.	S	.	C	C	.	.	S	F	R	C	S	.	F	.	S	.	.	.	C	.	R	R	R	.	.	.	.	R	S	.
		28X-2, 79–81	.	.	.	R	.	A	R	.	R	S	F	.	F	C	X	S	.	.	.	.	X	C	.	S	R	.	.	.	.	.	X	R	X
		28X-3, 79–81	.	.	.	.	.	R	R	.	S	.	F	R	F	.	.	S	.	.	.	.	.	C	S	S	R	.	.	.	.	.	X	.	.
Nitzschia reinholdii Zone and *Thalassiosira antiqua* Zone and *Denticulopsis hustedtii* Zone		28X-4, 79–81	F	R	.	.	C	.	R	F	F	.	F	R	A	R	R	S	S	R	.	.	X	R	R	X	R	.	.	.	.	.	.	.
	Denticulopsis hustedtii/ Denticulopsis lauta	28X-5, 79–81	.	X	.	.	.	S	C	S	S	R	F	R	C	R	F	C	A	S	S	.	R	S	.	.	R	.	.	.	.	R	.	.
		28X-6, 79–81	.	.	.	R	.	F	S	S	F	.	F	R	C	.	R	F	C	.	R	.	S	R	.	.	.	.	.	.	.	R	.	.
		29X-1, 80–82	.	X	.	.	.	R	X	.	.	R	P	.	F	X	F	S	S	.	.	.	S	S	S	S	R	R	.	.	.	.	R	R	R
		29X-2, 80–82	.	.	.	.	.	R	.	.	.	X	P	.	S	.	.	R	.	.	.	.	.	C	A	R	R	.	.	.	.	.	.	.	X
		29X-3, 80–82	S	R	.	R	S	S	S	F	C	R	F	R	C	.	S	S	S	.	.	.	S	S	.	R	F	.	.	.	.	S	S	.
		29X-4, 80–82	R	.	.	R	R	C	S	A	C	R	M	R	A	.	R	F	F	.	R	.	.	S	.	.	S	.	.	.	.	S	.	.
		29X-5, 80–82	.	S	.	.	R	C	S	C	S	.	P	R	C	.	S	S	.	S	R	.	S	S	.	.	.	.	.	.	.	.	.	.
		29X-6, 80–82	R	S	.	R	R	F	R	C	R	R	F	R	F	R	S	F	R	.	.	.	S	R	.	C	.	.	.	.	.	S	S	S
		30X-1, 80–82	.	.	.	R	.	C	.	.	.	C	M	R	C	C	.	F	.	.	.	.	.	C	.	C	F	.	.	.	.	.	.	.	.
		30X-2, 80–82	.	R	.	.	.	A	.	F	R	C	M	R	C	F	F	F	S	.	R	.	C	C	C	F	C	.	S	.	.	X	S	R
		30X-7, 80–82	.	.	.	F	.	S	C	C	S	.	M	.	C	.	S	C	C	.	F	.	R	S	.	.	.	.	.	.	.	.	.	.	.
		30X-8, 80–82	R	C	.	R	X	A	C	A	S	S	M	S	A	S	S	S	S	.	.	.	S	S	.	.	S	S	.	.	.	.	S	X	.
		31X-1, 80–82	S	F	.	.	.	C	F	F	S	S	F	S	C	R	S	F	R	.	R	.	F	R	.	.	X	.	.	.	.	.	.	X	.
		31X-2, 80–82	.	S	.	.	R	C	S	F	S	.	R	.	C	.	R	S	.	.	.	.	S	S	.	.	.	.	.	.	.	.	.	.	.
		31X-3, 80–82	S	X	.	.	R	F	C	S	S	.	P	.	C	.	X	S	R	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.
		31X-4, 80–82	S	S	.	R	.	X	C	S	S	.	P	R	S	.	.	S	R	.	.	.	.	R	.	.	.	X	.	.	.	.	.	.	.
		31X-5, 80–82	.	F	.	.	.	F	S	S	S	R	P	R	C	.	F	F	.	.	.	.	C	.	.	.	.	.	.	.	.	.	.	.	.
		31X-6, 80–82	S	F	.	R	.	C	F	C	C	S	M	S	C	.	R	C	R	.	.	.	C	R	.	.	S	.	.	.	S	.	R	.	.
		32X-1, 80–82	.	S	.	R	R	C	C	C	A	S	G	R	F	.	S	C	S	.	X	R	F	S	.	.	.	.	.	.	.	.	.	.	.
		32X-2, 80–82	.	.	.	.	R	C	R	S	C	R	G	C	C	.	C	C	S	.	.	.	S	S	X	C	C	.	S	.	S	C	S	C	S
		32X-3, 80–82	.	S	.	.	.	C	S	R	S	.	P	S	C	R	R	F	S	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.
		32X-4, 80–82	.	.	.	.	.	C	D	F	C	.	G	C	C	S	C	F	R	.	.	.	S	C	.	C	C	R	S	.	S	S	S	C	S
		32X-5, 80–82	F	C	.	.	.	A	C	S	R	R	F	R	C	.	S	F	R	.	.	R	A	.	.	.	X	.	.	.	.	.	.	.	.
		32X-6, 80–82	.	.	.	.	.	S	R	S	C	.	M	C	R	R	C	D	R	.	.	.	C	S	R	F	C	R	C	.	S	R	.	C	S
		33X-1, 80–82	R	R	.	.	.	C	S	.	.	.	P	S	C	R	.	C	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.
		33X-3, 80–82	.	S	.	.	X	C	R	R	C	.	F	.	C	.	.	C	.	.	.	.	C	R	.	.	.	.	.	.	.	.	.	.	.
		33X-5, 80–82	.	F	.	.	R	C	C	.	.	.	F	.	C	.	C	F	.	R	R	.	C	.	.	.	.	.	.	.	.	.	.	.	.
		34X-1, 80–82	.	F	.	.	S	C	C	R	S	R	F	R	F	.	S	F	A	F	R	.	F	.	.	.	.	.	.	.	.	.	.	.	.
		34X-3, 80–82	.	S	.	R	R	C	C	S	S	.	F	R	C	.	.	C	R	.	R	.	S	.	.	.	.	.	.	.	.	.	.	.	.
		34X-5, 80–82	.	R	.	R	.	C	F	C	C	S	F	R	C	.	S	C	F	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.
		35X-1, 80–82	S	F	.	.	R	C	F	S	.	S	F	R	C	R	F	C	.	.	R	.	C	.	.	.	.	.	.	.	.	.	.	.	.

Table 4—Part A.

Northeast Pacific diatom zone (see Barron, 1985b)	Southern Ocean diatom zone (Weaver and Gombos, 1981)	Core, section, interval (cm)	1 *Actinoptychus* spp.	2 *Asteromphalus kennettii*	3 *Bachmannocena borderlandensis* (S)	4 *Bachmannocena diodon* (S)	5 *Bachmannocena dumitricae* (S)	6 *Coscinodiscus marginatus*	7 *Denticulopsis hustedtii*	8 *Hemidiscus cuneiformis*	9 *Hemidiscus karstenii*	10 *Neobrunia mirabilis*	11 Preservation	12 *Simonsenella barboi*	13 *Rhizosolenia hebetata* f. *hiemalis*	14 *Rhizosolenia styliformis*	15 *Thalassionema nitzschioides*	16 *Thalassiothrix longissima*	17 *Thalassiothrix miocenica*	18 *D. lauta* and *D. hustedtii* (copulae)	19 *Denticulopsis lauta*	20 *Dictyocha* spp. (S)	21 *Thalassionema nitzschioides* var. *parva*	22 *Actinocyclus ingens*	23 *Thalassiosira insigna*	24 *Nitzschia reinholdii*	25 Other *Nitzschia* spp.	26 *Coscinodiscus endoi*	27 *Cosmiodiscus intersectus*	28 *Dictyocha pygmaea* (S)	29 *Nitzschia claviceps*	30 *Nitzschia clementia*	31 *Nitzschia fossilis*	32 *Nitzschia januaria*	33 *Nitzschia marina*
	Denticulopsis hustedtii-Denticulopsis lauta subzone d	35X-3, 80–82	F	C	.	R	S	C	C	C	R	.	M	F	C	S	S	C	S	.	X	.	F	.			.					R		
		35X-5, 80–82	.	C	.	S	R	C	F	S	R	S	F	C	C	S	.	C	.	.	X	.	R	R	.	.	X	.	.						
		36X-1, 80–82	.	S	.	F	C	F	C	R	C	C	F	C	C	R	S	C	R	C	S	S	S	.	.	.	X	.							
		37X-1, 80–82	.	.	.	.	F	C	C	F	F	R	M	F	C	R	F	C	F	S	.	R	A	R	.	.	.	F							
		37X-3, 80–82	F	.	.	.	R	C	F	F	S	.	F	R	C	.	S	F	C	.	.	.	S	R				S							
		39X-2, 80–82	.	.	.	.	.	C	C	F	S	R	F	S	C	R	S	A	S	S	R	R	S	S	.	.	.	R							
		39X-5, 80–82	.	.	.	.	.	S	C	S	.	R	F	S	F	.	R	F	.	S	R	.	.	C	.	.	.	F							
		40X-2, 80–82	.	.	.	.	.	F	C	.	.	R	F	F	C	R	R	F	R	R	S	.	F	C	.	.	.	F							
		41X-2, 80–82	.	R	.	.	.	S	C	.	.	S	M	S	C	S	S	S	F	.	R	R	R	A	.	.	.	S							
		41X-5, 80–82	.	S	.	.	.	S	A	.	.	S	M	F	C	.	C	C	.	S	R	S	C	A	.	.	.	R							
		42X-2, 80–82	.	S	.	.	R	S	A	.	.	R	M	S	F	.	.	S	.	S	R	.	.	A	.	.	.	S							
		42X-6, 80–82	.	.	.	.	.	S	C	.	.	F	F	S	F	R	.	F	.	S	R	R	.	C	.	.	.	S							
		43X-3, 79–81	.	.	.	.	R	C	C	.	.	R	F	R	S	.	R	S	.	F	C	.	.	C	.	.	.	S							
		43X-5, 79–81	.	.	.	.	.	S	F	.	.	R	P	S	S	S	.	S	.	F	F	.	.	F	.	.	.	.							
		44X-1, 80–82	.	.	.	.	S	S	C	.	.	.	F	S	F	S	.	F	.	S	S	.	.	A	.	.	.	.							
		45X-2, 81–83	.	.	.	.	.	C	C	.	.	.	M	C	S	R	.	F	.	S	F	.	.	C	.	.	.	S							
		46X-2, 80–82	.	.	.	.	.	S	S	S	.	S	P	R	R	.	.	S	.	R	S	.	.	S	.	.	.	S							
		46X-3, 80–82	R	.	.	.	.	S	R	.	.	X	F	.	R	.	.	S	.	R	R	.	.	S	.	.	.	.					S		
		46X-4, 80–82	.	.	.	.	.	S	C	.	.	S	M	.	S	R	.	S	.	S	C	S	.	F	.	.	.	.					.		

Table 4—Part B.

	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66
	Nitzschia sp. 14 (Schrader, 1976)	*Rouxia californica*	*Rouxia naviculoides*	*Stephanopyxis turris*	*Thalassiosira hyalinopsis*	*Thalassiosira nativa*	*Thalassiosira oestrupii*	Other *Rouxia* spp.	*Actinocyclus ellipticus*	*Nitzschia sicula* var. *rostrata*	*Rouxia isopolica*	*Rouxia* sp. 1 (Ciesielski, 1983)	*Thalassiosira convexa* var. *aspinosa*	*Thalassiosira praeoestrupii*	*Actinocyclus cubitus*	*Actinocyclus ehrenbergii* var. *tenella*	*Denticulopsis dimorpha*	*Distephanus pseudofibula* (S)	*Eucampia antarctica*	*Hemidiscus karstenii* f. 1 (Ciesielski, 1983)	*Pyxilla* fragments	*Rocella gelida*	*Rouxia ciesielski*	*Hemidiscus triangulus*	*Nitzschia cylindrica*	*Lithodesmium* cf. *minusculum*	*Nitzschia heteropolica*	*Denticulopsis punctata* f. *hustedtii*	*Rocella vigilans* (large)	*Rocella gelida* var. *schraderi*	*Thalassiosira praeconvexa*	*Thalassiosira* cf. *multipora*	*Thalassiosira lentiginosa*
24X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24X-4, 80–82	C	F	R	R	R	C	C	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24X-5, 80–82	C	R	R	A	R	F	C	X	R	X	F	X	R	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24X-6, 80–82	R	R	R	R	R	.	R	X	R	X	R	.	.	R	C	C	Ⓧ	R	S	S	X	Ⓧ	S	.	.	.	.	.	.	.	.	.	.
25X-1, 80–82	.	.	.	.	.	A	R	.	F	.	F	F	A	C	C	C	.	.	.	R	.	S	.	F	C	.	.	.	.	.	.	.	.
25X-2, 80–82	.	.	.	.	.	A	R	R	S	.	M	C	F	S	D	C	R	.	.	S	D	S	.	C	C	.	.	.	.	R	S	C	F
25X-3, 80–82	S	S	X	.	.	.	.	X	.	.	.	.	.	.	X	S	.	.	R	R	.	.	.	.	R	.	.	.	.	.	.	.	.
25X-4, 80–82	X	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	S	X	R	C	.	Ⓧ	.	.	X	X	.	.	.	.	.	.	.
25X-5, 80–82	.	.	.	.	.	.	.	C	.	.	S	.	.	.	.	.	Ⓧ	R	.	R	.	.	C	.	.	.	X	.	.	.	.	.	.
25X-6, 80–82	X	.	F	.	.	.	.	.	.	X	.	.	S	.	.	.	Ⓡ	S	.	S	.	.	R	.	R	.	.	R	.	.	.	.	.
26X-1, 80–82	.	R	F	.	.	.	.	R	.	.	.	C	S	.	.	.	.	R	.	A	.	.	C	.	.	.	R	.	.	.	.	.	.
26X-2, 80–82	.	.	.	.	.	S	.	.	.	.	.	A	S	.	.	.	.	S	.	A	.	.	A	.	.	.	.	.	Ⓧ	.	.	.	.
26X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	S	R	.	.	.	Ⓡ	R	.	C	.	.	C	R	R	.	R	.	.	.	.	.	.
26X-4, 80–82	.	.	.	R	.	R	.	.	.	.	.	R	R	.	R	R	.	R	.	F	.	Ⓧ	R	.	R	.	.	.	Ⓧ	Ⓧ	R	.	.
27X-2, 110–112	.	S	R	.	.	R	.	.	S	X	.	.	.	.	.	X	Ⓧ	R	R	.	.	.	.	A	C	.	S	.	.	.	.	S	.
27X-3, 20–22	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	C	F	.	.	.	Ⓧ	.	.	S	.
27X-3, 110–112	.	R	.	.	.	.	.	R	R	.	.	.	.	.	.	.	Ⓧ	S	.	.	.	.	.	A	F	.	.	.	Ⓧ	.	.	.	Ⓧ
27X-4, 110–112	.	S	.	.	.	R	.	.	S	.	.	.	.	.	.	.	Ⓧ	.	R	C	.	.	.	C	C	R	R	.	.	.	.	S	.
27X-5, 20–22	.	S	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	S	.	C	.	.	.	S	C	.	.	.	.	.	.	S	.
27X-5, 110–112	.	R	.	R	.	.	.	.	.	.	.	.	.	.	.	.	Ⓧ	R	.	A	.	Ⓧ	.	C	C	.	.	.	.	.	.	.	.
27X-6, 110–112	.	R	.	R	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	Ⓧ	.	F	R	.	.	X	.	.	.	.	.
27X-7, 20–22	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	Ⓧ	.	.	.	.	.	.	.	.	.	.	.	.	Ⓧ	X	X	.
28X-1, 79–81	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓧ	X	X	.
28X-2, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	.
28X-3, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28X-4, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
28X-5, 79–81	.	.	.	R	.	.	.	.	R	.	.	.	.	.	.	.	Ⓡ	.	R	.	.	Ⓧ	.	.	.	.	.	.	.	.	.	.	.
28X-6, 79–81	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29X-1, 80–82	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	.
29X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.
29X-3, 80–82	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓡ	.	.	C	.	Ⓡ	.	.	X	.	.	R	.	.	.	.	.
29X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓡ	.	.	C	.	.	.	.	.	R	.	.	.	Ⓧ	.	.	.
29X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓡ	.	.	.	.	Ⓡ	.	.	.	.	.	.	.	Ⓧ	.	.	.
29X-6, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓡ	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30X-7, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓡ	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30X-8, 80–82	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓧ	.	.	.	.	Ⓡ	.	.	.	.	.	.	.	Ⓡ	.	.	.
31X-1, 80–82	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.
31X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31X-3, 80–82	.	.	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.
31X-4, 80–82	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.
31X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31X-6, 80–82	.	.	.	.	.	R	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	F	.	.	.	.	.
32X-2, 80–82	.	R	F	.	.	C	.	F	.	.	.	.	.	.	.	.	Ⓡ	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.
32X-3, 80–82	.	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Ⓧ	.	.	.
32X-4, 80–82	.	.	.	.	.	F	.	S	.	X	.	.	.	.	R	.	Ⓡ	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.
32X-5, 80–82	.	.	.	.	.	.	.	X	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32X-6, 80–82	.	.	.	R	.	S	.	X	.	.	.	R	.	.	.	.	.	.	.	.	.	.	R	R	.	.	.	.	.	.	.	.	.
33X-1, 80–82	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33X-5, 80–82	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 4—Part B.

	34 *Nitzschia* sp. 14 (Schrader, 1976)	35 *Rouxia californica*	36 *Rouxia naviculoides*	37 *Stephanopyxis turris*	38 *Thalassiosira hyalinopsis*	39 *Thalassiosira nativa*	40 *Thalassiosira oestrupii*	41 Other *Rouxia* spp.	42 *Actinocyclus ellipticus*	43 *Nitzschia sicula* var. *rostrata*	44 *Rouxia isopolica*	45 *Rouxia* sp. 1 (Ciesielski, 1983)	46 *Thalassiosira convexa* var. *aspinosa*	47 *Thalassiosira praeoestrupii*	48 *Actinocyclus cubitus*	49 *Actinocyclus ehrenbergii* var. *tenella*	50 *Denticulopsis dimorpha*	51 *Distephanus pseudofibula* (S)	52 *Eucampia antarctica*	53 *Hemidiscus karstenii* f. 1 (Ciesielski, 1983)	54 *Pyxilla* fragments	55 *Rocella gelida*	56 *Rouxia ciesielski*	57 *Hemidiscus triangulus*	58 *Nitzschia cylindrica*	59 *Lithodesmium* cf. *minusculum*	60 *Nitzschia heteropolica*	61 *Denticulopsis punctata* f. *hustedtii*	62 *Rocella vigilans* (large)	63 *Rocella gelida* var. *schraderi*	64 *Thalassiosira praeconvexa*	65 *Thalassiosira* cf. *multipora*	66 *Thalassiosira lentiginosa*
35X-3, 80–82	.	.	.	.	.	S	.	.	R	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
35X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
36X-1, 80–82	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
37X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.
37X-3, 80–82	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.
41X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
41X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42X-6, 80–82	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43X-3, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43X-5, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
45X-2, 81–83	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
46X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.
46X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	S	.	.	.	.	.	.	⊗	⊗	.	.	.
46X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	D	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.

Table 4—Part C.

Northeast Pacific diatom zone (see Barron, 1985b)	Southern Ocean diatom zone (Weaver and Gombos, 1981)	Core, section, interval (cm)	67 *Denticulopsis* sp. copulae	68 *Hemiaulus polymorphus*	69 *Denticulopsis hustedtii* var. *ovata*	70 *Nitzschia porteri*	71 *Nitzschia praereinholdii*	72 *Lithodesmium cornigerum*	73 *Denticulopsis* sp.	74 *Denticulopsis punctata*	75 *Nitzschia maleinterpretaria*	76 *Thalassiosira plicata*	77 *Denticulopsis miocenica*	78 *Rossiella symmetrica*	79 *Denticulopsis hyalina*	80 *Simonsenella praebarboi*	81 *Nitzschia denticuloides*	82 *Hemiaulus polycistinorum*	83 *Nitzschia* cf. *denticuloides*	84 *Lisitzinia ornata*	85 *Naviculopsis biapiculata*
	Denticulopsis hustedtii	24X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		24X-6, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		25X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		25X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		25X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		25X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		25X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		25X-6, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		26X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		26X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		26X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		26X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-2,110–112	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-3, 20–22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-3,110–112	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-4,110–112	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-5, 20–22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-5,110–112	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-6,110–112	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		27X-7, 20–22	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		28X-1, 79–81	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		28X-2, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		28X-3, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		28X-4, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Nitzschia reinholdii Zone and *Thalassiosira antiqua* Zone and *Denticulopsis hustedtii* Zone		28X-5, 79–81	.	⊗	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		28X-6, 79–81	.	⊗	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Denticulopsis hustedtii/ *Denticulopsis lauta*	29X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		29X-2, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		29X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		29X-4, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		29X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		29X-6, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		30X-1, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		30X-2, 80–82	.	.	S	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		30X-7, 80–82	C	.	.	.	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.
		30X-8, 80–82	S	.	.	S	R	.	R	.	.	.	.	.	.	.	.	.	.	.	.
		31X-1, 80–82	S	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		31X-2, 80–82	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		31X-3, 80–82	S	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		31X-4, 80–82	A	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		31X-5, 80–82	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		31X-6, 80–82	C	.	.	.	R	.	F	X	.	.	.	.	.	.	.	.	.	.	.
		32X-1, 80–82	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		32X-3, 80–82	.	.	.	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		32X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		32X-4, 80–82	.	.	.	.	.	.	.	.	⊗	.	.	.	.	.	.	.	.	.	.
		32X-5, 80–82	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		32X-6, 80–82	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		33X-1, 80–82	C	.	.	.	.	.	F	X	.	.	.	.	.	.	.	.	.	.	.
		33X-3, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		33X-5, 80–82	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		34X-1, 80–82	S	.	.	.	.	.	R	.	.	R	.	.	.	.	.	.	.	.	.
		34X-3, 80–82	D	.	.	.	.	.	C	.	.	.	.	.	.	.	.	.	.	⊗	⊗
		34X-5, 80–82	F	.	.	.	.	.	S	.	.	.	.	.	.	.	.	.	.	.	.
		35X-1, 80–82	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 4—Part C.

Northeast Pacific diatom zone (see Barron, 1985b)	Southern Ocean diatom zone (Weaver and Gombos, 1981)	Core, section, interval (cm)	67 *Denticulopsis* sp. copulae	68 *Hemiaulus polymorphus*	69 *Denticulopsis hustedtii* var. *ovata*	70 *Nitzschia porteri*	71 *Nitzschia praereinholdii*	72 *Lithodesmium cornigerum*	73 *Denticulopsis* sp.	74 *Denticulopsis punctata*	75 *Nitzschia maleinterpretaria*	76 *Thalassiosira plicata*	77 *Denticulopsis miocenica*	78 *Rossiella symmetrica*	79 *Denticulopsis hyalina*	80 *Simonsenella praebarboi*	81 *Nitzschia denticuloides*	82 *Hemiaulus polycistinorum*	83 *Nitzschia* cf. *denticuloides*	84 *Lisitzinia ornata*	85 *Naviculopsis biapiculata*
	Denticulopsis hustedtii-Denticulopsis lauta subzone d	35X-3,80–82	R	.	R	.	F	.	S	.	.	.	R	.	.	.	.	.	.	.	.
		35X-5,80–82	.	.	.	.	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		36X-1,80–82	.	.	S	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.
		37X-1,80–82	.	.	R	.	.	.	.	.	.	.	C	.	.	.	.	.	.	.	.
		37X-3,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		39X-2,80–82	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.	.
		39X-5,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		40X-2,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		41X-2,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		41X-5,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		42X-2,80–82	.	.	.	.	.	.	.	.	.	.	.	⊗	.	.	.	.	.	.	.
		42X-6,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		43X-3,79–81	.	.	.	.	.	.	.	.	.	.	.	.	R	S	.	.	.	.	.
		43X-5,79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.
		44X-1,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	S	.	.	.	.	.
		45X-2,81–83	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		46X-2,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.
		46X-3,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	F	⊗	C	.	.
		46X-4,80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Species location index

Index number is the column in which species appears.

Index number	Species
48	*Actinocyclus cubitus*
49	*Actinocyclus ehrenbergii* var. *tenella*
42	*Actinocyclus ellipticus*
22	*Actinocyclus ingens*
1	*Actinoptychus* spp.
2	*Asteromphalus kennettii*
3	*Bachmannocena borderlandensis* (S)
4	*Bachmannocena diodon* (S)
5	*Bachmannocena dumitricae* (S)
26	*Coscinodiscus endoi*
6	*Coscinodiscus marginatus*
27	*Cosmiodiscus intersectus*
50	*Denticulopsis dimorpha*
7	*Denticulopsis hustedtii*
69	*Denticulopsis hustedtii* var. *ovata*
79	*Denticulopsis hyalina*
19	*Denticulopsis lauta*
18	*D. lauta* and *D. hustedtii* (copulae)
77	*Denticulopsis miocenica*
74	*Denticulopsis punctata*
61	*Denticulopsis punctata* f. *hustedtii*
73	*Denticulopsis* sp.
67	*Denticulopsis* sp. copulae
28	*Dictyocha pygmaea* (S)
20	*Dictyocha* spp. (S)
51	*Distephanus pseudofibula* (S)
52	*Eucampia antarctica*
82	*Hemiaulus polycistinorum*
68	*Hemiaulus polymorphus*
8	*Hemidiscus cuneiformis*
9	*Hemidiscus karstenii*
53	*Hemidiscus karstenii* f. 1 (Ciesielski, 1983)
57	*Hemidiscus triangulus*
84	*Lisitzinia ornata*
59	*Lithodesmium* cf. *minusculum*
72	*Lithodesmium cornigerum*
85	*Naviculopsis biapiculata*
10	*Neobrunia mirabilis*
83	*Nitzschia* cf. *denticuloides*
29	*Nitzschia claviceps*
30	*Nitzschia clementia*
58	*Nitzschia cylindrica*
81	*Nitzschia denticuloides*
31	*Nitzschia fossilis*
60	*Nitzschia heteropolica*
32	*Nitzschia januaria*
75	*Nitzschia maleinterpretaria*
33	*Nitzschia marina*
70	*Nitzschia porteri*
71	*Nitzschia praereinholdii*
24	*Nitzschia reinholdii*
43	*Nitzschia sicula* var. *rostrata*
34	*Nitzschia* sp. 14 (Schrader, 1976)
25	Other *Nitzschia* spp.
41	Other *Rouxia* spp.
11	Preservation
54	*Pyxilla* fragments
13	*Rhizosolenia hebetata* f. *hiemalis*
14	*Rhizosolenia styliformis*
55	*Rocella gelida*
63	*Rocella gelida* var. *schraderi*
62	*Rocella vigilans* (large)
78	*Rossiella symmetrica*
35	*Rouxia californica*
56	*Rouxia ciesielski*
44	*Rouxia isopolica*
36	*Rouxia naviculoides*
45	*Rouxia* sp. 1 (Ciesielski, 1983)
12	*Simonsenella barboi*
80	*Simonsenella praebarboi*
37	*Stephanopyxis turris*
15	*Thalassionema nitzschioides*
21	*Thalassionema nitzschioides* var. *parva*
65	*Thalassiosira* cf. *multipora*

Species location index

Index number is the column in which species appears.

Index number	Species
46	*Thalassiosira convexa* var. *aspinosa*
38	*Thalassiosira hyalinopsis*
23	*Thalassiosira insigna*
66	*Thalassiosira lentiginosa*
39	*Thalassiosira nativa*
40	*Thalassiosira oestrupii*
76	*Thalassiosira plicata*
64	*Thalassiosira praeconvexa*
47	*Thalassiosira praeoestrupii*
16	*Thalassiothrix longissima*
17	*Thalassiothrix miocenica*

Note: X = very rare; R = rare; S = sparse; F = frequent; C = common; A = abundant; D = dominant; P = poor; F = fair; M = moderate; G = good; E = excellent; ? = questionably present; . = not present.

Table 4—Part I.

Southern Ocean diatom zonation (Weaver and Gombos, 1981[a]; Ciesielski, herein[b])	North Pacific diatom zonation (see Barron, 1985b)		Equatorial Pacific diatom zonation (Barron, 1983)		Silicoflagellate zonation (Martini, 1971 and 1972[a]; Bukry, 1981[b]; Ciesielski in Shaw and Ciesielski, 1983[c])
see Table 4	see Table 4				
No zonal assignment	*Denticulopsis lauta* (NNPD4)	b	*Cestodiscus peplum*		*Corbisema triacantha*[a]
Coscinodiscus lewisiamus[a]		a			
Nitzschia maleinterpretaria[a]	*Thalassiora fraga* (NNPD2)		*Crucidenticula nicobarica*	*b*	
Coscinodiscus rhombicus[a,b]				*a*	
			Triceratium pileus zonal equivalent		*Naviculopsis ponticula*[b]
			Craspedodiscus elegans zonal equivalent		
Rossiella symmetrica[b]	No zonal assignment		No zonal assignment		No zonal assignment
					Naviculopsis biapiculata[c]

Table 4—Part E.

Core, section, interval (cm)	1 *Antinocyclus ingens*	2 *Actinocyclus ingens* var. *nodus*	3 *Cestodiscus peplum*	4 *Corbisema triacantha* (S)	5 *Coscinodiscus endoi*	6 *Coscinodiscus marginatus*
46X-5, 80–82	F	F	X	R	S	S
47X-2, 79–81	C	C	.	R	S	S
47X-5, 79–81	C	.	.	R	.	R
48X-1, 79–81	F	.	.	S	.	C
48X-3, 79–81	C	.	X	S	.	F
49X-1, 47–49	.	.	.	.	F	S
49X-4, 47–49	.	.	.	R	S	F
50X-1, 45–47	.	.	.	R	S	S
51X-1, 40–42	.	.	.	R	R	S
52X-1, 40–42	.	.	.	C	R	S
52X-4, 40–42	.	.	.	R	.	C
53X-1, 40–42	.	.	.	S	R	C
53X-3, 40–42	.	.	.	F	.	C
54X-2, 40–42	.	.	.	F	.	C
54X-5, 40–42	.	.	.	C	.	S
55X-1, 39–40	X	.	.	.	.	F
55X-4, 39–40	.	.	.	.	.	C
56X-1, 85–87	.	.	.	F	.	C
56X-3, 85–87	.	.	.	C	.	F
57X-2, 82–84	.	.	.	X	.	C
58X-2, 70–72	.	.	.	.	.	F
58X-5, 70–72	.	.	.	.	.	C
59X-2, 80–82	.	.	.	X	.	D
59X-4, 80–82	.	.	.	X	.	C
60X-2, 80–82	.	.	.	X	.	S
60X-5, 80–82	.	.	.	.	.	S
61X-2, 80–82	.	.	.	.	.	F
62X-2, 40–42	.	.	.	.	.	F

Table 4—Part E.

Core, section, interval (cm)	7 *D. lauta* and *D. hustedtii* copulae	8 *Denticulopsis hustedtii*	9 *Denticulopsis lauta*	10 *Dictyocha* spp. (S)	11 *Neobrunia mirabilis*	12 *Nitzschia maleinterpretaria*	13 Preservation	14 *Simonsenella barboi*	15 *Rhizosolenia hebetata* f. *hiemalis*	16 *Simonsenella praebarboi*	17 *Rhizosolenia styliformis*	18 *Thalassionema nitzschioides*	19 *Thalassionema nitzschioides* var. *parva*	20 *Thalassiothrix longissima*	21 *Actinoptychus* spp.	22 *Bachmannocena diodon* (S)	23 *Denticulopsis hyalina*	24 *Crucidenticula kanayae*	25 *Crucidenticula nicobarica*	26 *Denticulopsis punctata*	27 *Synedra jouseana* and *S. miocenica*	28 Blade diatom	29 *Coscinodiscus lewisianus*	30 *Denticulopsis maccollumii*	31 *Nitzschia grosspunctata*	32 Opaque diatoms	33 *Rocella gelida*
46X-5, 80–82	R	F	S	F	R	X	F	F	S	F	R	S	S	S	.	.	.	.	.	.	R	S	.	.	.	.	.
47X-2, 79–81	.	S	S	S	F	.	M	F	S	S	.	C	A	F	R	S	X	X	C	X	R	S	.	.	.	.	.
47X-5, 79–81	.	.	R	F	.	.	F	S	R	F	R	R	R	F	R	.	.	.	F	.	R	C	R	S	R	R	Ⓧ
48X-1, 79–81	.	.	S	R	.	.	M	C	F	S	S	S	S	C	F	.	.	.	S	.	R	C	R	S	X	S	.
48X-3, 79–81	.	X	R	S	.	R	M	.	.	F	.	F	S	S	S	.	.	.	S	.	S	F	S	C	R	.	.
49X-1, 47–49	.	.	.	.	.	.	P	F	S	R	.	R	R	R	R	.	.	.	.	.	F	S	R	F	R	.	Ⓧ
49X-4, 47–49	.	.	.	S	R	R	G	.	R	.	.	.	C	R	R	.	.	.	C	D	S	C	R	R	R	.	⊗
50X-1, 45–47	.	.	.	R	.	F	P	.	.	.	.	.	.	S	S	.	.	.	R	R	S	S	.	.	R	.	⊗
51X-1, 40–42	.	.	.	S	R	S	F	.	R	.	.	R	F	S	F	.	.	.	S	F	R	S	R	.	.	.	⊗
52X-1, 40–42	Ⓢ	.	.	C	R	R	F	.	.	.	.	S	C	F	.	.	.	.	R	C	S	S	X	.	.	.	Ⓡ
52X-4, 40–42	.	.	.	S	.	.	P	.	.	R	.	S	S	S	S	.	.	.	.	.	R	S	.	.	.	S	.
53X-1, 40–42	.	.	.	F	F	.	G	.	R	S	.	S	.	S	C	.	.	.	.	.	R	S	.	.	.	R	.
53X-3, 40–42	.	.	.	S	R	X	M	.	X	S	.	S	S	F	C	.	.	.	.	.	R	S	R	.	.	.	⊗
54X-2, 40–42	.	.	.	.	F	F	E	.	.	F	.	S	X	S	F	.	.	.	.	C	R	F	.	.	.	.	Ⓡ
54X-5, 40–42	.	.	.	.	.	R	M	.	.	F	.	.	.	S	.	.	.	.	.	.	S	S	.	.	.	.	.
55X-1, 39–40	.	.	.	.	.	.	P	.	.	R	.	.	.	.	.	.	.	.	.	.	F	S	.	.	.	S	.
55X-4, 39–40	.	.	.	.	.	.	F	.	X	R	.	S	F	R	R	.	.	.	.	.	C	R	.	.	.	R	R
56X-1, 85–87	.	.	.	.	.	R	G	R	X	F	.	.	.	S	.	.	.	.	.	.	A	C	.	.	.	S	R
56X-3, 85–87	.	.	.	R	.	.	F	S	R	S	.	S	.	R	.	.	.	.	.	.	C	S	.	.	.	R	.
57X-2, 82–84	.	.	.	.	.	.	M	.	.	R	.	.	.	R	R	.	.	.	.	.	C	S	.	.	.	C	F
58X-2, 70–72	.	.	.	.	.	.	M	R	R	X	.	R	X	R	.	.	.	.	.	.	C	S	.	.	.	.	R
58X-5, 70–72	.	.	.	.	.	.	M	.	.	.	.	F	S	F	R	.	.	.	.	.	C	S	.	.	.	.	S
59X-2, 80–82	.	.	.	.	.	.	M	.	R	R	.	S	.	F	R	.	.	.	.	.	C	C	.	.	.	.	X
59X-4, 80–82	.	.	.	.	.	.	M	.	.	S	.	R	S	R	.	.	.	.	.	.	C	S	.	.	.	.	S
60X-2, 80–82	.	.	.	.	.	.	G	.	R	S	.	S	R	.	R	.	.	.	.	.	C	S	.	.	.	.	C
60X-5, 80–82	.	.	.	.	.	.	F	.	R	.	.	X	S	.	F	.	.	.	.	.	C	R	.	.	.	.	F
61X-2, 80–82	.	.	.	.	.	.	F	.	.	R	.	F	R	S	.	.	.	.	.	.	C	F	.	.	.	.	R
62X-2, 40–42	.	.	.	.	.	.	P	.	.	S	.	F	.	.	.	.	.	.	.	.	S	R	.	.	.	S	S

Table 4—Part I.

Southern Ocean diatom zonation (Weaver and Gombos, 1981[a]; Ciesielski, herein[b])	North Pacific diatom zonation (see Barron, 1985b)		Equatorial Pacific diatom zonation (Barron, 1983)		Silicoflagellate zonation (Martini, 1971 and 1972[a]; Bukry, 1981[b]; Ciesielski in Shaw and Ciesielski, 1983[c])
see Table 4	see Table 4				
No zonal assignment	*Denticulopsis lauta* (NNPD4)	b	*Cestodiscus peplum*		*Corbisema triacantha*[a]
Coscinodiscus lewisiamus[a]		a			
Nitzschia maleinterpretaria[a]	*Thalassiora fraga* (NNPD2)		*Crucidenticula nicobarica*	*b*	
Coscinodiscus rhombicus[a,b]				*a*	
			Triceratium pileus zonal equivalent		*Naviculopsis ponticula*[b]
			Craspedodiscus elegans zonal equivalent		
Rossiella symmetrica[b]	No zonal assignment		No zonal assignment		No zonal assignment
					Naviculopsis biapiculata[c]

Table 4—Part F.

	34 *Thalassiosira bukryi*	35 *Lisitzinia ornata*	36 *Raphidodiscus marylandicus*	37 *Synedra jouseana* f. *linearis*	38 *Thalassiosira fraga*	39 *Hemiaulus* sp.	40 *Lithodesmium* sp. 2
46X-5, 80–82	.	.	.	.	.	.	.
47X-2, 79–81	.	.	.	.	.	.	.
47X-5, 79–81	.	.	.	.	.	.	.
48X-1, 79–81	.	.	.	.	.	.	.
48X-3, 79–81	Ⓡ	.	.	.	.	.	.
49X-1, 47–49	.	Ⓧ	S	Ⓡ	S	.	.
49X-4, 47–49	.	Ⓧ	C	.	R	F	X
50X-1, 45–47	.	Ⓧ	X	.	.	.	.
51X-1, 40–42	S	.	.	.	.	S	.
52X-1, 40–42	R	.	.	.	R	S	X
52X-4, 40–42	R	.	.	.	.	.	.
53X-1, 40–42	R	.	.	.	S	.	.
53X-3, 40–42	R	.	.	R	R	.	.
54X-2, 40–42	.	.	.	R	C	.	.
54X-5, 40–42	.	.	.	S	F	.	.
55X-1, 39–40	.	.	X	S	S	.	.
55X-4, 39–40	X	.	R	C	S	.	.
56X-1, 85–87	.	.	.	.	F	.	.
56X-3, 85–87	R	.	.	C	S	.	.
57X-2, 82–84	.	Ⓧ	.	F	S	.	.
58X-2, 70–72	X	.	.	S	.	.	.
58X-5, 70–72	.	Ⓧ	X	C	R	.	.
59X-2, 80–82	.	Ⓧ	.	S	.	.	.
59X-4, 80–82	.	.	.	C	.	.	.
60X-2, 80–82	.	Ⓧ	.	F	.	.	.
60X-5, 80–82	.	Ⓧ	.	F	.	.	.
61X-2, 80–82	.	.	X	S	.	.	.
62X-2, 40–42	.	.	.	R	.	.	.

Table 4—Part F.

	41 *Naviculopsis ponticula ponticula* (S)	42 *Pleurosigma planktonica*	43 *Azpeitia praenodulifer*	44 *Coscinodiscus rhombicus*	45 *Azpeitia salisburyanus*	46 *Rocella gelida* var. *schraderi*	47 *Denticulopsis punctata* v. *hustedtii*	48 *Rhizosolenia* cf. *oligocaenica*	49 *Asteromphalus oligocenicus*	50 *Asteromphalus inaegabilis*	51 *Bachmannocena apiculata apiculata* (S)	52 *Actinocyclus ellipticus*	53 *Coscinodiscus lewisianus* var. *robustus*	54 *Naviculopsis ponticula spinosa* (S)	55 *Nitzschia pusilla*	56 *Rocella vigilans* (large)	57 *Thalassiosira spinosa*	58 *Macrora stella*	59 *Thalassiosira primalabiata*	60 *Triceratium polymorphus*	61 *Triceratium pileus*	62 *Actinocyclus radionovae*	63 *Coscinodiscus lewisianus* var. *rhomboides*	64 *Thalassiosira spumellaroides*	65 *Pyxilla* fragments	66 *Rocella semigelida*
46X-5, 80–82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47X-2, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
47X-5, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48X-1, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48X-3, 79–81	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49X-1, 47–49	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
49X-4, 47–49	X	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
50X-1, 45–47	.	X	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
51X-1, 40–42	.	X	.	X	X	Ⓧ	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52X-1, 40–42	.	X	.	R	X	Ⓕ	Ⓕ	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52X-4, 40–42	.	.	.	.	.	.	.	.	R	R	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53X-1, 40–42	.	S	.	F	.	.	.	.	.	S	R	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.
53X-3, 40–42	.	R	.	X	.	Ⓧ	.	X	.	F	S	.	R	R	R	Ⓧ	X	.	.	.	.	.	.	.	.	.
54X-2, 40–42	R	S	.	F	.	Ⓧ	.	X	.	F	.	.	X	F	S	Ⓡ	X	R	R	Ⓧ	S	.	.	.	.	.
54X-5, 40–42	.	S	.	C	.	.	.	.	.	.	X	.	.	.	X	.	S	R	S	.	S	R	X	.	.	.
55X-1, 39–40	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.	.	.	.	.	X	.	.
55X-4, 39–40	.	X	.	S	X	.	.	X	R	.	.	.	.	.	X	.	R	.	.	.	.	.	R	X	Ⓧ	Ⓡ
56X-1, 85–87	.	F	F	F	.	.	.	.	.	.	.	.	.	R	S	.	S	R	R	.	X	.	S	R	.	.
56X-3, 85–87	R	.	R	R	.	.	.	R	.	.	.	.	.	R	.	X	.	.	.	.	.	.	.	S	.	.
57X-2, 82–84	.	R	R	R	.	F	.	.	X	.	X	.	.	.	X	F	.	.	.	R	.	X	.	.	Ⓧ	Ⓡ
58X-2, 70–72	.	.	S	S	.	R	.	.	.	.	R	.	.	.	.	R	S	.	.	.	.	.	S	.	.	.
58X-5, 70–72	.	X	X	.	.	X	.	.	R	.	.	.	.	.	.	X	.	.	X	.	.	.	.	.	.	.
59X-2, 80–82	.	X	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	F	.	.
59X-4, 80–82	.	.	.	R	.	S	.	X	.	.	.	.	.	.	.	S	.	.	.	.	.	.	.	F	.	S
60X-2, 80–82	.	X	.	S	.	F	.	.	.	.	.	.	.	.	.	C	.	.	F	.	.	.	X	S	.	S
60X-5, 80–82	.	.	.	S	.	F	.	X	.	.	.	.	.	.	.	F	.	.	.	.	.	R	.	.	Ⓡ	S
61X-2, 80–82	.	.	.	.	.	R	.	.	.	.	.	.	.	.	.	R	.	X	.	.	.	.	.	.	.	R
62X-2, 40–42	.	.	.	.	.	R	.	X	.	.	R	.	.	.	.	S	.	.	S	.	.	.	.	R	.	R

Table 4—Part I.

Southern Ocean diatom zonation (Weaver and Gombos, 1981[a]; Ciesielski, herein[b])	North Pacific diatom zonation (see Barron, 1985b)		Equatorial Pacific diatom zonation (Barron, 1983)		Silicoflagellate zonation (Martini, 1971 and 1972[a]; Bukry, 1981[b]; Ciesielski in Shaw and Ciesielski, 1983[c])
see Table 4	see Table 4				
No zonal assignment	*Denticulopsis lauta* (NNPD4)	b	*Cestodiscus peplum*		*Corbisema triacantha*[a]
Coscinodiscus lewisiamus[a]		a			
Nitzschia maleinterpretaria[a]	*Thalassiora fraga* (NNPD2)		*Crucidenticula nicobarica*	*b*	
Coscinodiscus rhombicus[a,b]				*a*	
			Triceratium pileus zonal equivalent		*Naviculopsis ponticula*[b]
			Craspedodiscus elegans zonal equivalent		
Rossiella symmetrica[b]	No zonal assignment		No zonal assignment		No zonal assignment
					Naviculopsis biapiculata[c]

Table 4—Part G.

	67 *Rossiella paleacea*	68 *Rossiella symmetrica*	69 *Stephanopyxis turris* group	70 *Hemiaulus polymorphus*	71 *Cestodiscus robustus*
46X-5, 80–82	.	.	.	.	.
47X-2, 79–81	.	.	.	.	.
47X-5, 79–81	.	.	.	.	.
48X-1, 79–81	.	.	.	.	.
48X-3, 79–81	.	.	.	.	.
49X-1, 47–49	.	.	.	.	.
49X-4, 47–49	.	.	.	.	.
50X-1, 45–47	.	.	.	.	.
51X-1, 40–42	.	.	.	.	.
52X-1, 40–42	.	.	.	.	.
52X-4, 40–42	.	.	.	.	.
53X-1, 40–42	.	.	.	.	.
53X-3, 40–42	.	.	.	.	.
54X-2, 40–42	.	.	.	.	.
54X-5, 40–42	.	.	.	.	.
55X-1, 39–40	.	.	.	.	.
55X-4, 39–40	X	.	.	.	.
56X-1, 85–87	.	X	R	.	.
56X-3, 85–87	.	.	R	⊗	.
57X-2, 82–84	.	S	X	.	X
58X-2, 70–72	.	S	X	.	X
58X-5, 70–72	.	R	X	.	.
59X-2, 80–82	.	S	R	.	.
59X-4, 80–82	.	R	.	⊗	.
60X-2, 80–82	.	C	R	⊗	R
60X-5, 80–82	.	R	R	⊗	R
61X-2, 80–82	.	.	F	.	.
62X-2, 40–42	X	C	R	.	.

Table 4—Part G.

	72 *Hemiaulus polycistinorum*	73 *Hemiaulus taurus*	74 *Naviculopsis biapiculata* (S)	75 *Rocella* sp.	76 *Triceratium groningensis*	77 *Asterolampra tela*	78 *Corbisema archangelskiana* (S)	79 *Paralia sulcata*	80 *Naviculopsis constricta* (S)
46X-5, 80–82	.	.	.	.	.	.	.	.	.
47X-2, 79–81	.	.	.	.	.	.	.	.	.
47X-5, 79–81	.	.	.	.	.	.	.	.	.
48X-1, 79–81	.	.	.	.	.	.	.	.	.
48X-3, 79–81	.	.	.	.	.	.	.	.	.
49X-1, 47–49	.	.	.	.	.	.	.	.	.
49X-4, 47–49	.	.	.	.	.	.	.	.	.
50X-1, 45–47	.	.	.	.	.	.	.	.	.
51X-1, 40–42	.	.	.	.	.	.	.	.	.
52X-1, 40–42	.	.	.	.	.	.	.	.	.
52X-4, 40–42	.	.	.	.	.	.	.	.	.
53X-1, 40–42	.	.	.	.	.	.	.	.	.
53X-3, 40–42	.	.	.	.	.	.	.	.	.
54X-2, 40–42	.	.	.	.	.	.	.	.	.
54X-5, 40–42	.	.	.	.	.	.	.	.	.
55X-1, 39–40	.	.	.	.	.	.	.	.	.
55X-4, 39–40	.	.	.	.	.	.	.	.	.
56X-1, 85–87	.	.	.	.	.	.	.	.	.
56X-3, 85–87	.	.	.	.	.	.	.	.	.
57X-2, 82–84	Ⓧ	Ⓧ	Ⓧ	X	Ⓧ	.	.	.	.
58X-2, 70–72	.	.	.	.	.	.	.	.	.
58X-5, 70–72	.	.	X	.	.	F	?	X	.
59X-2, 80–82	.	.	X	.	.	S	.	.	.
59X-4, 80–82	.	.	S	X	.	.	.	.	.
60X-2, 80–82	Ⓡ	Ⓡ	C	.	Ⓢ	.	Ⓧ	X	Ⓧ
60X-5, 80–82	.	.	C	.	.	X	Ⓧ	.	.
61X-2, 80–82	.	.	S	.	R	.	.	.	.
62X-2, 40–42	.	.	S	X	R	.	.	.	.

Species location index

Index number is the column in which species appears.

Index number	Species
52	*Actinocyclus ellipticus*
1	*Actinocyclus ingens*
2	*Actinocyclus ingens* var. *nodus*
62	*Actinocyclus radionovae*
21	*Actinoptychus* spp.
77	*Asterolampra tela*
50	*Asteromphalus inaegabilis*
49	*Asteromphalus oligocenicus*
43	*Azpeitia praenodulifer*
45	*Azpeitia salisburyanus*
51	*Bachmannocena apiculata apiculata* (S)
22	*Bachmannocena diodon* (S)
28	Blade diatom
3	*Cestodiscus peplum*
71	*Cestodiscus robustus*
78	*Corbisema archangelskiana* (S)
4	*Corbisema triacantha* (S)
5	*Coscinodiscus endoi*
29	*Coscinodiscus lewisianus*
63	*Coscinodiscus lewisianus* var. *rhomboides*
53	*Coscinodiscus lewisianus* var. *robustus*
6	*Coscinodiscus marginatus*
44	*Coscinodiscus rhombicus*
24	*Crucidenticula kanayae*
25	*Crucidenticula nicobarica*
8	*Denticulopsis hustedtii*
23	*Denticulopsis hyalina*
9	*Denticulopsis lauta*
7	*D. lauta* and *D. hustedtii* copulae
30	*Denticulopsis maccollumii*
26	*Denticulopsis punctata*
47	*Denticulopsis punctata* v. *hustedtii*
10	*Dictyocha* spp. (S)
72	*Hemiaulus polycistinorum*
70	*Hemiaulus polymorphus*
39	*Hemiaulus* sp.
73	*Hemiaulus taurus*
35	*Lisitzinia ornata*
40	*Lithodesmium* sp. 2
58	*Macrora stella*
74	*Naviculopsis biapiculata* (S)
80	*Naviculopsis constricta* (S)
41	*Naviculopsis ponticula ponticula* (S)
54	*Naviculopsis ponticula spinosa* (S)
11	*Neobrunia mirabilis*
31	*Nitzschia grossepunctata*
12	*Nitzschia maleinterpretaria*
55	*Nitzschia pusilla*
32	Opaque diatoms
79	*Paralia sulcata*
42	*Pleurosigma planktonica*
13	Preservation
65	*Pyxilla* fragments
36	*Raphidodiscus marylandicus*
15	*Rhizosolenia hebetata* f. *hiemalis*
48	*Rhizosolenia* cf. *oligocaenica*
17	*Rhizosolenia styliformis*
33	*Rocella gelida*
46	*Rocella gelida* var. *schraderi*
66	*Rocella semigelida*
75	*Rocella* sp.
56	*Rocella vigilans* (large)
67	*Rossiella paleacea*
68	*Rossiella symmetrica*
14	*Simonsenella barboi*
16	*Simonsenella praebarboi*
69	*Stephanopyxis turris* group
27	*Synedra jouseana* and *S. miocenica*
37	*Synedra jouseana* f. *linearis*
18	*Thalassionema nitzschioides*
19	*Thalassionema nitzschioides* var. *parva*
34	*Thalassiosira bukryi*
38	*Thalassiosira fraga*
59	*Thalassiosira primalabiata*

Species location index

Index number is the column in which species appears.

Index number	Species
57	*Thalassiosira spinosa*
64	*Thalassiosira spumellaroides*
20	*Thalassiothrix longissima*
76	*Triceratium groningensis*
61	*Triceratium pileus*
60	*Triceratium polymorphus*

Note: X = very rare; R = rare; S = sparse; F = frequent; C = common; A = abundant; D = dominant; P = poor; F = fair; M = moderate; G = good; E = excellent; ? = questionably present; . = not present.