Microfossils from Chesapeake Bay Sediments: Illustrations and Species Database

by

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Introduction

This report presents scanning electron microscope (SEM) photomicrographs of 64 species and genera of benthic foraminifers, diatoms, dinoflagellate cysts, ostracodes and pollen that represent the most common microfossil species preserved in sediments from Chesapeake Bay. In addition to SEM photomicrographs, this report also presents quantitative abundance data documenting the stratigraphic distribution of most microfossil species in 25 sediment cores in five appendices, one for each major group of microfossils.

This study is part of an interdisciplinary research project designed to investigate the environmental trends and functioning of the bay ecosystem over interannual through millennial time scales through paleoecological studies of radiometrically dated sediment cores. The primary goal is to use ecologically sensitive species to understand temporal and spatial variability in salinity, sediment accumulation rates and budgets, dissolved oxygen, temperature, and faunal and floral trends in Chesapeake Bay and its major tributaries (Cronin *et al*. in press). These species' census data together with the SEM photographs form the taxonomic basis for studies on Chesapeake Bay ecosystem history (Cronin *et al*. submitted; Karlsen *et al*. submitted).

Chesapeake Bay is 320 km long, ~20-40 km wide, covers an area of 6,500 km^2, and drains 166,000 km^2 of watershed mainly in Maryland, Virginia, Pennsylvania, the District of Columbia and New York (Figure 1). As the nation's largest and most productive estuary, Chesapeake Bay faces complex environmental issues related to eutrophication and anoxia, turbidity and sedimentation, toxic dinoflagellates, and sea level rise, coastal erosion and submergence. For example, Chesapeake Bay experiences large seasonal and interannual variability in salinity, temperature, and dissolved oxygen (DO) that are strongly influenced by precipitation and river discharge from the watershed. Nutrient concentrations in its tributaries and ecological (microbial degradation) and physical processes (such as wind advection) in the estuary are also important factors in determining seasonal and interannual variability in oxygen depletion. Many questions regarding the causes of environmental changes in the bay, particularly the contributions of anthropogenic factors like pollution, and climatological factors like precipitation and stream runoff can be answered through the reconstruction of paleoecological trends using microfossils.

To successfully apply microfossils to the reconstruction of Chesapeake Bay environments, however, one needs firm taxonomic and ecological foundations for the key species preserved in sediments. The literature on the major benthic and phytoplankton microfossil groups in east coast estuaries is sparse and widely scattered. Moreover, although there is a large amount of information on living macrobenthos, zooplankton and phytoplankton in Chesapeake Bay, there is relatively little published information available on the micropaleontology of Chesapeake Bay sediments. Among the exceptions, are studies of benthic foraminifers by Ellison and Nichols (1976), plant macrophytes by Davis (1985) and Brush and Davis (1984), and diatoms by Cooper and Brush (1991, 1993) and Cooper (1995), and ostracodes by Cronin (1979). This study attempts to assemble into a single report SEM illustrations and updated taxonomic identifications of the most important species of foraminifera, diatoms, dinoflagellate cysts, and ostracodes used in our paleoecological studies of the bay. It also provides SEM photographs of the major pollen types that have been transported into the bay from vegetation living in the surrounding watershed. Pollen in Chesapeake sediments is extremely useful in determining land-use changes and their impacts on the bay (e.g., Brush and DeFries, 1981; DeFries, 1986).

This study focused on microfossils from sediment cores taken in the middle regions of Chesapeake Bay (mostly mesohaline and lower polyhaline salinity regimes) and its major tributaries (Patuxent, Potomac, Choptank Rivers) (Figure 1). It is limited to microfossils preserved in sediments deposited during the late Holocene, the period covering the past 2000 years. Therefore, species characteristic of the lower bay (upper polyhaline and euhaline) and upper bay (oligohaline) regions and species that may have inhabited the bay during the early and middle Holocene (10,000 to 2,000 years ago) are not included. Table

1 gives location information on the sediment cores for which microfossil data are presented below.

Format of the Microfossil Database

This report presents information on Chesapeake Bay microfossils in five sections -- one each for benthic foraminifers, diatoms, dinoflagellates, ostracodes and pollen. Each section contains the following. First, a short summary is given on the biology and ecology of the group and its occurrence in Chesapeake Bay sediments. These sections are meant to provide introductory background material and important references to the primary literature on the group's taxonomy and ecology for those readers wishing more information. A table lists the species for each group in each section.

Second, SEM plates and plate captions illustrate the most common species using specimens taken from the sediment cores listed in Table 1. This section is not intended to be a formal taxonomic treatment of a group. Rather it is intended to illustrate important species using the most up-to-date generic and specific nomenclature. In the case of many species, these are the first published scanning electron photomicrographs of the species from Chesapeake Bay.

Third, at the end of each section, there is an appendix giving the abundance of each species in sediment core samples. For some cores only one or two groups were analyzed depending on preservation and time constraints. In these appendices, species and genera are given in the columns and samples are ordered stratigraphically in the rows. Because radiometric dating for many sediment cores is still in progress, chronostratigraphic information is not given. For the dinoflagellate cysts, there is also a data file in the appendix giving species' distributions in 48 surface sediment samples from Chesapeake Bay, in addition to species' occurrences in two long sediment cores.

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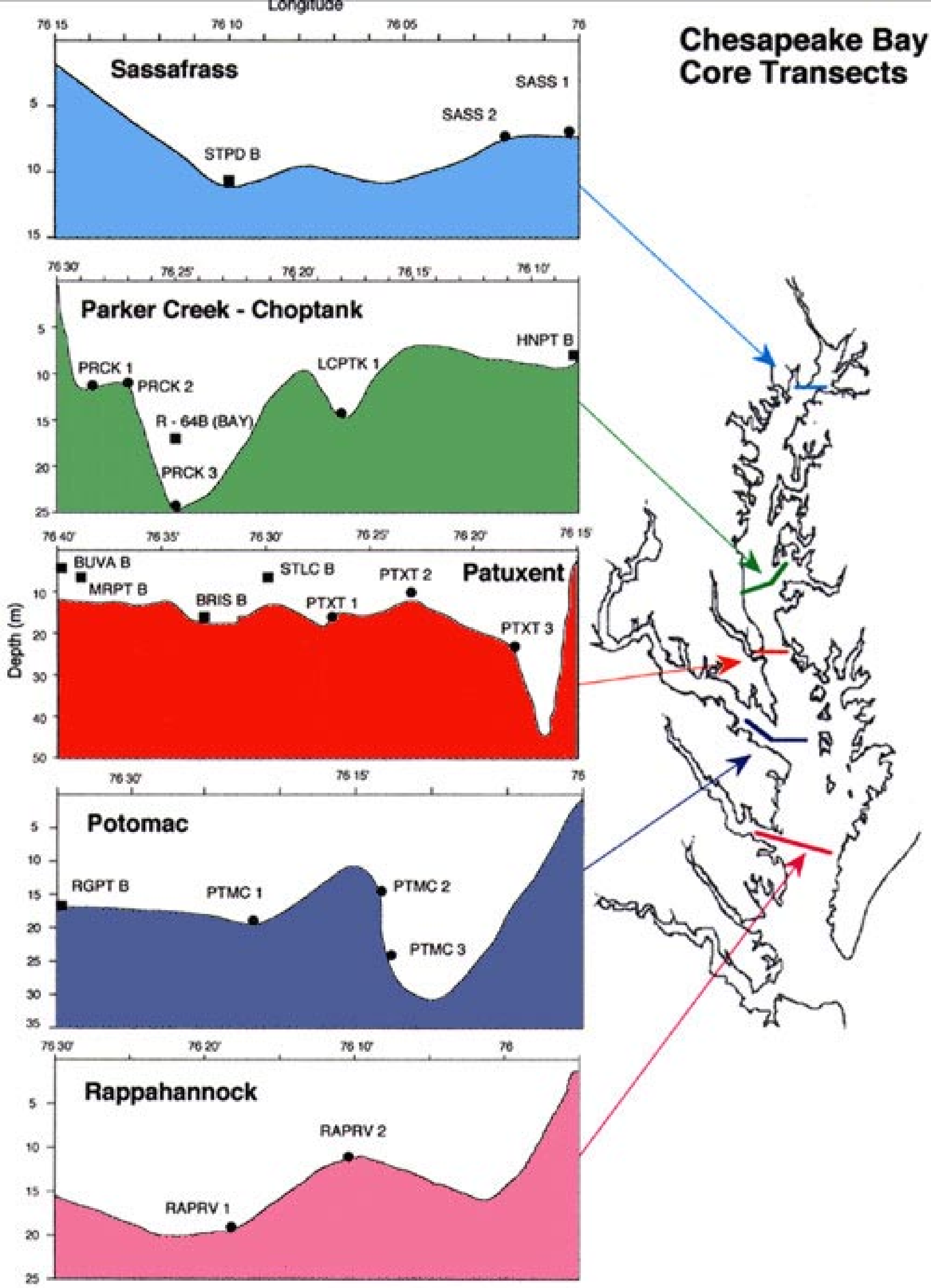
Figure 1. Map showing core locations on main transects in Chesapeake Bay and its tributaries. See Table 1 for details.



Chesapeake Bay
Core Transects
Longitude
Depth (m)
Sassafrass
SASS 1
SASS 2
STPD B
Parker Creek - Choptank
HNPT B
PRCK 1
PRCK 2
LCPTK 1
R - 64B (BAY)
PRCK 3
Patuxent
BUVA B
MRPT B
STLC B
PTXT 2
BRIS B
PTXT 1
PTXT 3
Potomac
RGPT B
PTMC 1
PTMC 2
PTMC 3
Rappahannock
RAPRV 2
RAPRV 1

Chesapeake Ecosystem Project Core Summary

Table 1

Transect	Site	Core	type	Water Depth (m)	Latitude	Longitude	Core Leng
Potomac	Potomac-1	PTMC 1-P-2	Piston	19	38°01.839'N	76°22.677'W	375 cm
	Potomac-1	PTMC 1-B-2	Box	19	38°01.839'N	76°22.677'W	20 cm
	Potomac-1	PTMC 1-G	Gravity	19	38°01.839'N	76°22.677'W	122cm
	Potomac-2	PTMC 2-P-2	Piston	13.2	37°58.400'N	76°13.733'W	354 cm
	Potomac-2	PTMC 2-B-2	Box	12	37°58.400'N	76°13.733'W	20 cm
	Potomac-3	PTMC 3-P-2	Piston	23.1	38 01.6118'N	76 13.1938'W	450 cm
	Potomac-3	PTMC 3-B-2	Box	22	38 01.6118'N	76 13.1938'W	20 cm
	Potomac-3	PTMC 3-G	Gravity	20	38°01.668'N	76°13.212'W	117cm
	Potomac-3	PTMC 3-G-2	Gravity	24.1	38 01.6118'N	76 13.1938'W	~100 cm
	Ragged Point	RGPT	Box	16.5	38°09.86' N	76°35.52' N	24 cm
Patuxent	Patuxent-1	PTXT 1-P-3	Piston	16.5	38°18.583'N	76°27.203'W	199 cm
	Patuxent-1	PTXT 1-B-3	Box	15	38°18.583'N	76°27.203'W	20 cm
	Patuxent-1	PTXT 1-G	Gravity	16.3	38°18.581'N	76°27.199'W	92cm
	Patuxent-2	PTXT 2-P-3	Piston	11.5	38°19.584'N	76°23.548'W	417 cm
	Patuxent-2	PTXT 2-B-3	Box	10	38°19.584'N	76°23.548'W	20 cm
	Patuxent-2	PTXT 2-G-2	Gravity	11.5	38°19.586'N	76°23.546'W	112cm
	Patuxent-2	PTXT 2-G-3	Gravity	11.5	38 19.588'N	76 23.540'W	100cm
	Patuxent-2	PTXT 2-G-4	Gravity	11.5	38 19.588'N	76 23.540'W	110cm
	Patuxent-3	PTXT 3-P-2	Piston	22.5	38°20.0007'N	76°18.5801'W	432 cm
	Patuxent-3	PTXT 3-B-2	Box	21	38°20.0007'N	76°18.5801'W	20 cm
	Patuxent-3	PTXT 3-G	Gravity	22.5	38°20.0007'N	76°18.5801'W	101cm
	Buena Vista	BUVA	Box	5	38°31.12' N	76°39.82' W	25 cm
	Marsh Point	MRPT	Box	7	38°26.81' N	76°39.13' W	25 cm
	Broomes Island	BRIS	Box	15	38°23.64' N	76°33.17' W	19 cm
	St. Leonard Creek	STLC	Box	6	38°22.88' N	76°30.06' W	21.5 cm

Table 1

Chesapeake Ecosystem Project Core Summary

Transect	Site	Core	type	Water Depth (m)	Latitude	Longitude	Core Lengt
Parker Creek	Parker Creek-1	PRCK 1-G	Gravity	10.7	38° 32.8657'N	76° 28.7112'W	122cm
	Parker Creek-2	PRCK 2-G	Gravity	11.4	38° 33.1552	76° 27.6069	122 cm
	Parker Creek-3	PRCK 3-G	Gravity	24.3	38° 32.6359'N	76° 25.6199'W	132 cm
	Parker Creek-1	PRCK 1-P-2	Piston	10.7	38 32.519'N	76 29.427'W	315 cm
	Parker Creek-2	PRCK 2-P-1	Piston	11.4	38 33.93'N	76 27.344'W	426
	Parker Creek-2	PRCK 2-P-2	Piston	11.4	38 33.93'N	76 27.344'W	?
	Parker Creek-3	PRCK 3-P-2	Piston	24.3	38° 32.6349N	76 25.689'W	452cm
	Parker Creek-3	PRCK 3-B-2	Box	23	38° 32.6349N	76 25.689'W	20 cm
	Little Choptank-1	LCPTK 1-P-1	Piston	13.9	38° 31.4916'N	76° 18.1990'W	455 cm
	Little Choptank-1	LCPTK 1-B-1	Box	13.5	38° 31.4916'N	76° 18.1990'W	20 cm
	Little Choptank-1	LCPTK 1-G	Gravity	13.9	38° 31.4916'N	76° 18.1990'W	122cm
	Horn Point	HNPT	Box	8	38°37.18'	76°08.09'	22 cm
Susquehanna	Sassafras-1	SASS 1-P	Piston	?	39 22.7583'N	76 00.0000'W	407 cm
	Sassafras-1	SASS1-G	Gravity	?	39 22.7583'N	76 00.0000'W	100 cm
	Sassafras-2	SASS 2-P	Piston	?	39 25.2493'N	76 02.2528'W	383 cm
	Sassafras-2	SASS 2-G	Gravity	?	39 25.2493'N	76 02.2528'W	100 cm
	Still Pond	STPD	Box	10.5	39°20.809'	76°10.724'	24 cm
Rappahannock	Rappahannock-1	RAPRV 1-P-2	Piston	19.7	37 35'53.30"	76 18'27.65"	232 cm
	Rappahannock-2	RAPRV 2-G	Gravity	~19	37 32.47'N	76 10'21.9"W	~100 cm
	Rappahannock-2	RAPRV 2-P-2	Piston	11.5	37 32.47'N	76 10'21.9"W	405
Mainstem	R-64	R-64	Box	16.5	38°33.59'	76°25.63'	17 cm
	Point No Point	PNPT	Box	14	38°07.99'	76°15.13'	22 cm

lithologic logs and X-radiographs are found in Kerhin et al. 1998