Chapter 11

Qualitative Planktonic Foraminiferal Biostratigraphy of Core MD02-2570, of Late Quaternary age, from the Northern Gulf of Mexico

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Abstract

Preliminary age models were developed for the RV *Marion Dufresne* Calipso piston core, MD02-2570, based on datum levels defined from the regional biostratigraphic zonation of planktonic foraminifers. Two datum levels were recognized, the base of the Z Zone, which is ~9.8 thousand years (ka) in the Gulf of Mexico, and the top of the Y2 Subzone, which is ~14 ka. The sedimentation rate in the Z Zone was 26 centimeters per thousand years (cm/k.y.), a rate somewhat slower than that found in other ponded basins in the northern Gulf of Mexico but faster than rates on the open slope and abyssal plain. In contrast, the rate of the Y1 Subzone was >200 cm/k.y., exceeding rates in local ponded basins. The fast rate may be related to "overbank" deposition from the Mississippi Canyon during deglaciation and possibly during slumping that formed the canyon.

Introduction

A 28-meter (m)-long Calipso core, MD02-2570, was recovered at Station 18 in the northern Gulf of Mexico during the research vessel (RV) *Marion Dufresne* cruise, International Marine Past Global Changes Study (IMAGES) VIII in 2002. IMAGES is a program of Paleoceanography of the Atlantic and Geochemistry (PAGES). The core site lies in a minibasin on the west flank of the Mississippi Canyon at 28° 4.26' N, 89° 41.39' W, in 631 m of water. The site is adjacent to a field of mud volcanoes associated with methane gas emissions (Carol Lutken, oral. commun., Center for Marine Resources and Environmental Technology, Mississippi Mineral Resources Institute, University of Mississippi, 2003).

Sediments in core MD02-2570 were divided into two units: (1) a bioturbated, silty clay with biogenic sand from the top to 3.8 meters below the sea floor (mbsf), and (2) a laminated silty clay below. The laminations of the second unit typically have sharp contacts with some cross beds and cut-and-fill structures. The second unit also contains several stringers and laminae of well-sorted silt, minor amounts (<2 percent by weight) of mineral sand from 9 to 18 mbsf, and an interval of particularly clay-rich sediment from 18 to 21 mbsf. The entire core is affected by gas expansion expressed in a continuum from reduced wet bulk density and small molds of apparent gas bubbles to large gaps that occur below 4 mbsf.

Methods

Thirty large samples of ~40 cubic centimeters (cm^3) were taken at 1-m intervals and prepared for microscopic examination of the sand-size fraction. Samples were dried in a forced-air oven at 40 °C, weighed, and soaked in a 1-percent (by weight) solution of Calgon® for no more than 3 hours in order to disaggregate the clay-rich sediment. The dispersed sediment was poured into a 9-inch sieve with 63-micrometer (µm) openings and rinsed with tap water until all of the silt and clay was removed. The sand-size residue was dried, weighed to determine the weight percent of sand, and vialed for microscopic examination.

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Dry sand samples were sieved in a 3-inch sieve with 150-µm openings, and the sands were examined under a dissecting microscope at magnifications up to 63X. The qualitative abundance of planktonic foraminifers relative to other constituents of the sand-size fraction, preservation state, and relative frequency of species of planktonic foraminifers was tabulated. Other constituents of the sand fraction were identified to general type and ranked by abundance.

The biostratigraphy of Ericson and Wollin (1968) was applied, as modified for use in the Gulf of Mexico by Kennett and Huddlestun (1972) and Kennett and others (1985). Ages of biostratigraphic horizons are from Flower and Kennett (1990) and Poore and others (2003).

Results

Dry bulk sediment samples range in weight from ~20 grams (g) at the top of the section to 60 to 120 g below 4 mbsf (fig. 1; table 1). The large samples contain an average of ~1-percent sand-size material by weight after sieving to remove silt and clay (fig. 2; table 1). Relatively coarse samples with more than 0.5-percent sand are limited to three intervals: above 4 mbsf, between 7 and 18 mbsf, and at 21 mbsf. The coarsest two samples at 3.04 and 9.00 mbsf have anomalously heavy sand-size fractions of 11 and 4 percent, respectively. These values are more than one standard deviation heavier than the mean weight percent of all samples.

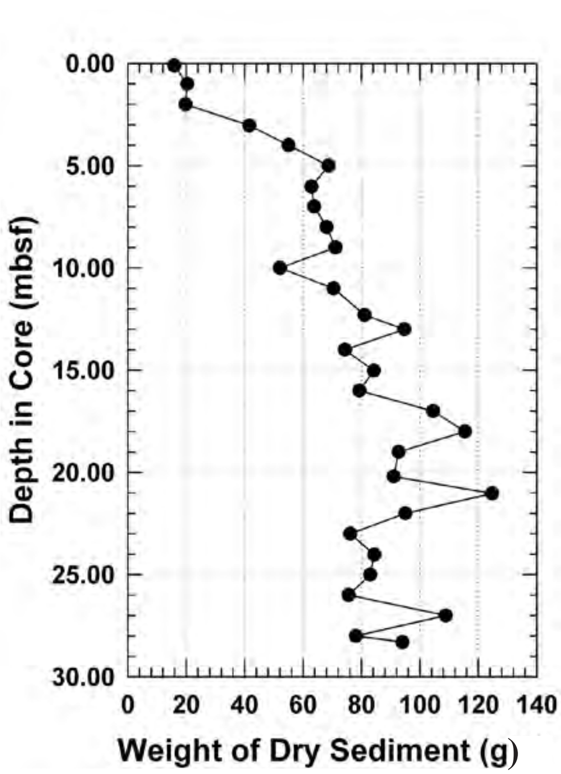

Figure 1. Weight of total dry bulk sediment in samples from core MD02-2570.

Table 1. Sample depths, dry sediment weight (grams, g), sand content (g), and sand content as weight percent for core MD02-2570.

[mbsf, meters below sea floor; g, grams; %, percent]

Depth (mbsf)	Dry bulk sediment weight (g)	Sand (g)	Sand (%)
0.10	15.888	0.400	2.5
1.00	20.355	0.226	1.1
2.00	19.736	0.141	0.7
3.04	41.600	4.725	11.4
4.00	55.030	0.228	0.4
5.00	68.719	0.052	0.1
6.03	62.892	0.036	0.1
7.00	63.779	0.123	0.2
8.00	68.047	0.389	0.6
9.00	71.111	3.121	4.4
10.00	52.070	1.108	2.1
11.00	70.445	0.382	0.5
12.31	81.064	1.676	2.1
13.00	94.653	0.144	0.2
14.00	74.339	1.458	2.0
15.03	84.215	0.807	1.0
16.00	79.254	1.392	1.8
17.00	104.513	1.004	1.0
18.00	115.362	0.136	0.1
19.00	92.679	0.023	0.0
20.20	91.057	0.381	0.4
21.03	124.678	1.035	0.8
22.00	95.010	0.031	0.0
23.00	76.166	0.127	0.2
24.03	84.377	0.053	0.1
25.00	83.019	0.067	0.1
26.00	75.576	0.156	0.2
27.00	108.830	0.060	0.1
28.00	78.109	0.029	0.0
28.30	93.997	0.013	0.0
		Average	1.1
		StDev	2.2

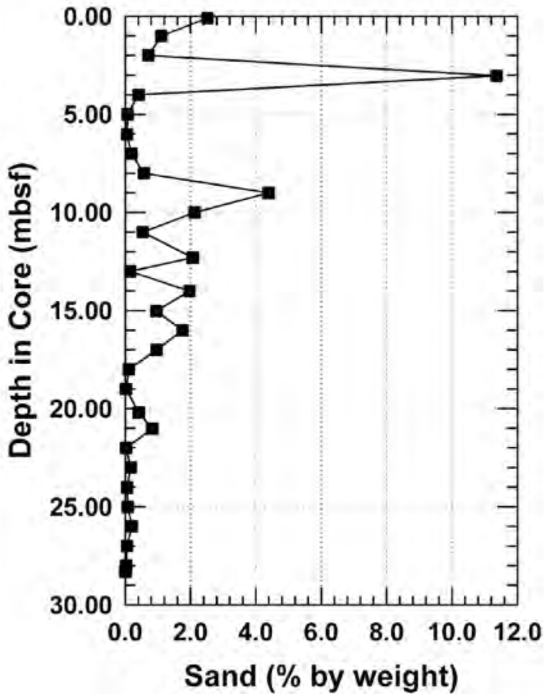

Figure 2. Sand content measured as weight percent in samples from core MD02-2570.

Microscopic assessment of the >150-µm fraction (table 2) shows that planktonic foraminifers dominate samples from the top of the core to <3 mbsf, framboidal pyrite or benthic foraminifers dominate from <3 to <9 mbsf, and mineral grains dominate from <9 to <18 mbsf. Below 17 to 18 mbsf, the cored section contains various amounts of siderite (?), unidentified organic disks, and foraminifers. Trace amounts of ostracodes and radiolarians occur sporadically throughout the core. The unusually heavy sand sample at 3.04 mbsf contains carbonate nodules, and the sample at 9.00 mbsf contains several large pieces of framboidal pyrite.

A total of 28 species of planktonic foraminifers were identified in the core (table 2). The tropical to subtropical foraminifer, *Globigerinoides ruber*, both the pink and the white form, which are likely different species (Darling and others, 1997), is the most abundant plexus, composing about half of the specimens. Two end-member foraminiferal assemblages occur in the core: (1) a tropical assemblage with abundant warm-water forms, such as *Globorotalia cultrata, Globorotalia tumida*, other members of the "*menardii*" plexus (Ericson and Wollin, 1968), and *Pulleniatina obliquiloculata;* and (2) a cool subtropical assemblage with reduced numbers of warm-water species and greater numbers of cool-tolerant species, such as *Globorotalia inflata, Globigerina falconensis,* and *Globigerina bulloides*. The tropical assemblage with the "*menardii*" plexus occurs in samples from the top of the core to <3 mbsf. The cool subtropical assemblage occurs in samples below 11 mbsf. An intermediate assemblage with neither the *"menardii"* plexus nor *Globorotalia inflata* bridges the interval between <3 and <12 mbsf.

A single planktonic foraminifer of late Paleocene to middle Eocene age, *Pseudohastigerina wilcoxensis*, was found mixed into the sand fraction at 11 mbsf. However, no fossils of Pliocene or Miocene age were observed (Kohl and Roberts, 1994). Reworking of material of pre-Quaternary age, presumably from the adjacent mud volcanoes, does not significantly affect the planktonic foraminifers in the >150-µm fraction (Kohl and Roberts, 1994; 1995) of this core.

Table 2. Biostratigraphy of core MD02-2570.

Tabulated are the sample depths; mbsf, meters below sea floor; assigned biostratigraphic zone; quality of planktonic foraminifer preservation; overall abundance of planktonic foraminifers relative to other constituents in the sand-size fraction; qualitative frequency of planktonic foraminifer species of Quaternary age (a=abundant, c=common, f=frequent, r=rare, vr=very rare); and listing of common constituents of the >150-micrometer (µm) fraction ranked in order of abundance.

Depth (mbsf)	Zone	Preservation	Abundance	*Beella digitata*	*Globigerina bulloides*	*Globigerina calida*	*Globigerina falconensis*	*Globigerina rubescens*	*Globigerinella aequilateralis*	*Globigerinita glutinata*	*Globigerinoides conglobatus*	*Globigerinoides quadrilobatus*	*Globigerinoides ruber (white)*	*Globigerinoides ruber (pink)*	*Globigerinoides tenellus*	*Globorotalia crassaformis*	*Globorotalia cultrata*	*Globorotalia hirsuta*	*Globorotalia inflata*	*Globorotalia scitula*	*Globorotalia truncatulinoides (right)*	*Globorotalia truncatulinoides (left)*	*Globorotalia tumida*	*Globorotalia ungulata*	*Hastigerina pelagica*	*Neogloboquadrina dutertrei*	*Neogloboquadrina pachyderma (right)*	*Neogloboquadrina pachyderma (left)*	*Orbulina universa*	*Pulleniatina obliquiloculata*	*Sphaeroidinella dehiscens*	Constituents of the >150-µm sand fraction
0.10	Z1	good	abundant			vr					r	f	c	r			c				f		f			f			r	r		Mostly planktonic foraminifers, rare benthics, a few pieces of iron oxide.
1.00	Z1 or Z2	good	abundant			vr				r		f	f	r			r				f		r			f			r	f	vr	Mostly planktonic foraminifers, few benthics, pyritized tubes, urchin spines.
2.00	Z2	mod	abundant			vr	r			r		f	r	r		f			r?		r		r			f			f	r		Mostly planktonic foraminifers, benthics, trace of pyrite in tests .
3.04	Y1	poor	common				r		r			f	f	vr		f					r				vr	r	r		f	vr		Mostly carbonate nodules, planktonic foraminifers, benthics, ostracodes, pyrite, plant fibers.
4.00	Y1	mod	rare			vr				vr		r	r	r												r						Mostly pyrite with benthic foraminifers, planktonics.
5.00	Y1	mod	rare		vr	vr				vr			r	r	vr						r					r						Mostly pyrite with planktonic foraminifers, benthics.
6.03	Y1	mod	few		vr	vr			r	vr		r	r	r	vr	r					r	vr				r	r		vr	vr		Mostly benthic foraminifers, planktonics, pyrite, radiolarians.
7.00	Y1	mod	rare		vr	vr	vr			vr			r	r			l									r			r			Mostly pyrite, benthic foraminifers, planktonics.
8.00	Y1	mod	rare		vr				r	vr		vr	r	r		r					vr	r				r			r			Mostly pyrite (slightly crystalline), benthic foraminifers, planktonics, quartz grains, ostracodes.
9.00	Y1	mod	rare		r	r	r	r		r			r	r		c				vr						r			r			Mostly mineral grains, benthic foraminifers, planktonics, ostracodes, >1-millimeter chunks of pyrite.
10.00	Y1	mod	common		r	r	r		r	r	vr	r	c	f		f				vr						r			r			Mostly mineral grains, benthic foraminifers, planktonics, trace of pyrite.

Table 2. Biostratigraphy of core MD02-2570. — Continued

Tabulated are the sample depths; mbsf, meters below sea floor; assigned biostratigraphic zone; quality of planktonic foraminifer preservation; overall abundance of planktonic foraminifers relative to other constituents in the sand-size fraction; qualitative frequency of planktonic foraminifer species of Quaternary age (a=abundant, c=common, f=frequent, r=rare, vr=very rare); and listing of common constituents of the >150-micrometer (µm) fraction ranked in order of abundance.

Depth (mbsf)	Zone	Preservation	Abundance	*Beella digitata*	*Globigerina bulloides*	*Globigerina calida*	*Globigerina falconensis*	*Globigerina rubescens*	*Globigerinella aequilateralis*	*Globigerinita glutinata*	*Globigerinoides conglobatus*	*Globigerinoides quadrilobatus*	*Globigerinoides ruber (white)*	*Globigerinoides ruber (pink)*	*Globigerinoides tenellus*	*Globorotalia crassaformis*	*Globorotalia cultrata*	*Globorotalia hirsuta*	*Globorotalia inflata*	*Globorotalia scitula*	*Globorotalia truncatulinoides (right)*	*Globorotalia truncatulinoides (left)*	*Globorotalia tumida*	*Globorotalia ungulata*	*Hastigerina pelagica*	*Neogloboquadrina dutertrei*	*Neogloboquadrina pachyderma (right)*	*Neogloboquadrina pachyderma (left)*	*Orbulina universa*	*Pulleniatina obliquiloculata*	*Sphaeroidinella dehiscens*	Constituents of the >150-µm sand fraction
11.00	Y1	good	very rare		vr	vr	vr		vr	vr		vr	vr	vr	vr		l									vr	vr		vr			Mostly mineral grains, benthic foraminifers, planktonics, ostracodes, trace of pyrite.
12.30	Y2	mod	common		r	f	r	vr		r		r	c	f		c			vr							vr	r		r			Mostly mineral grains, benthic foraminifers, planktonics, trace of pyrite.
13.00	Y	good	rare	vr	r			vr	vr			r	c	c	r	r		r	vr		r						vr					Mostly mineral grains, benthic foraminifers, planktonics, ostracodes, trace of pyrite.
14.00	Y	good	rare		r	r			r	r		r	c	c		r			c	r	r						r		r			Mostly mineral grains, benthic foraminifers, planktonics, ostracodes, trace of pyrite.
15.03	Y	good	common		r	r	r						c	c		f			r		r					r			r			Mostly mineral grains, benthic foraminifers, planktonics, pyrite, ostracodes.
16.00	Y	good	common			r	r		r	r	vr		c	c		f			r		r								r			Mostly mineral grains, benthic foraminifers, planktonics, pyrite, ostracodes.
17.00	Y	good	common		r				r	r		r	c			f			r	vr	r	r		vr		r			r			Mostly mineral grains, with equal amounts of benthic foraminifers, planktonics, and pyrite; ostracodes.
18.00	Y	good	common		r				r	r			c	c		r			r		r	r				r	r		r			Mostly siderite(?), organic discs?, with equal amounts of benthic foraminifers and planktonics; mineral grains, ostracodes.
19.00	Y	good	rare			r	r		r	r		vr	c	c	r	r					r					r			r			Mostly organic discs, planktonic foraminifers, benthics, siderite(?), ostracodes, mineral grains.

Table 2. Biostratigraphy of core MD02-2570. — Continued

Tabulated are the sample depths; mbsf, meters below sea floor; assigned biostratigraphic zone; quality of planktonic foraminifer preservation; overall abundance of planktonic foraminifers relative to other constituents in the sand-size fraction; qualitative frequency of planktonic foraminifer species of Quaternary age (a=abundant, c=common, f=frequent, r=rare, vr=very rare); and listing of common constituents of the >150-micrometer (µm) fraction ranked in order of abundance.

Depth (mbsf)	Zone	Preservation	Abundance	*Beella digitata*	*Globigerina bulloides*	*Globigerina calida*	*Globigerina falconensis*	*Globigerina rubescens*	*Globigerinella aequilateralis*	*Globigerinita glutinata*	*Globigerinoides conglobatus*	*Globigerinoides quadrilobatus*	*Globigerinoides ruber (white)*	*Globigerinoides ruber (pink)*	*Globigerinoides tenellus*	*Globorotalia crassaformis*	*Globorotalia cultrata*	*Globorotalia hirsuta*	*Globorotalia inflata*	*Globorotalia scitula*	*Globorotalia truncatulinoides (right)*	*Globorotalia truncatulinoides (left)*	*Globorotalia tumida*	*Globorotalia ungulata*	*Hastigerina pelagica*	*Neogloboquadrina dutertrei*	*Neogloboquadrina pachyderma (right)*	*Neogloboquadrina pachyderma (left)*	*Orbulina universa*	*Pulleniatina obliquiloculata*	*Sphaeroidinella dehiscens*	Constituents of the >150-µm sand fraction
20.00	Y	mod	rare	vr			r		r	r		r	c	c	r	r		vr	r		r					r	r		r			Mostly siderite(?), organic discs, planktonic foraminifers, benthics, mineral grains.
21.03	Y	mod	very rare				r					r	r	r															r			Mostly siderite(?) and mica; rare organic discs, benthic foraminifers, very rare planktonics.
22.00	Y	mod	rare			r	r		r	r			r						r							r	r		r			Mostly organic discs, benthic foraminifers, planktonics, mineral grains.
23.00	Y	good	common		r	r	r		r	r		r	c	c		r				r	vr	r				r	r		r			Mostly organic discs, benthic foraminifers, planktonics, mineral grains.
24.00	Y	good	very rare					vr	vr				vr	vr	vr																	Mostly siderite(?), with rare benthic foraminifers, planktonics, organic discs.
25.00	Y	good	very rare			vr			vr	vr			vr	vr		vr						vr				vr	vr		vr			Mostly siderite(?), with organic discs, rare benthic foraminifers, planktonics.
26.00	Y	mod	common			r	r		r		vr	r	c	c	r	r			r		r	r				r			r			Equal parts organic discs, planktonic foraminfiers, benthics; rare siderite(?).
27.00	Y	mod	rare			r	r		r	r		r	c	c	r	r			r		r	vr				r	r		r			Organic discs with benthic foraminifers and rare planktonic foraminifers.
28.00	Y	mod	rare			r	r	r	r	r			c		r	r			r		r	vr							r			Organic discs with benthic foraminifers and rare planktonic foraminifers.
28.30	Y	good	very rare	r	r				r				r	r	r	r					r						r	r	r			Organic discs with benthic foraminifers and very rare planktonic foraminifers.

Discussion

Zonation

The sequence of planktonic foraminiferal assemblages is consistent with the results of Kennett and others (1985), Flower and Kennett (1990), and Poore and others (2003) (fig. 3; table 2). The tropical assemblage at the top of the core correlates with the Z Zone of Ericson and Wollin (1968), which is equivalent to all but the bottom of the Holocene and Marine Isotope Stage (MIS) 1. This interval is tentatively subdivided into Subzones Z1 and Z2 of Kennett and Huddlestun (1972) with the boundary falling near 1 mbsf. Subzone Z2 is recognized based on the greater abundance of *Globorotalia crassaformis* and lesser abundance of *Globorotalia cultrata* compared to Subzone Z1, a pattern reaffirmed by the results of Poore and others (2003). However, Kennett and Huddlestun (1972) used census data, whereas this tentative assessment is based on qualitative frequency estimates. Although the core may contain sediment from Subzone Z1, it remains unresolved whether or not the core successfully sampled the topmost sediment of the subzone (for example, Dowsett and others, 2003).

The lower section of the core below 2 mbsf is assigned to the Y Zone of Ericson and Wollin (1968). This section can be further subdivided with confidence into Subzones Y1 and Y2 of Kennett and Huddlestun (1972), the boundary of which lies between 11.00 and 12.30 mbsf. Subzone Y1 is recognized based on the absence of both *Globorotalia cultrata* and *Globorotalia inflata*, whereas the top of Y2 is based on the occurrence of *Globorotalia inflata* without members of the *Gt. menardii* plexus. Subzone Y1 is equivalent to the Wisconsinan deglaciation in the upper part of MIS 2. The deglaciation is expressed in the Gulf of Mexico as a period of warming and rising sea level punctuated by events of low surface-water salinities, which caused excessively light values of oxygen-18 ($\delta^{18}O$). Subzone Y1A (Kennett and others, 1985; Flower and Kennett, 1990), which is equivalent to the Younger Dryas cooling, was not

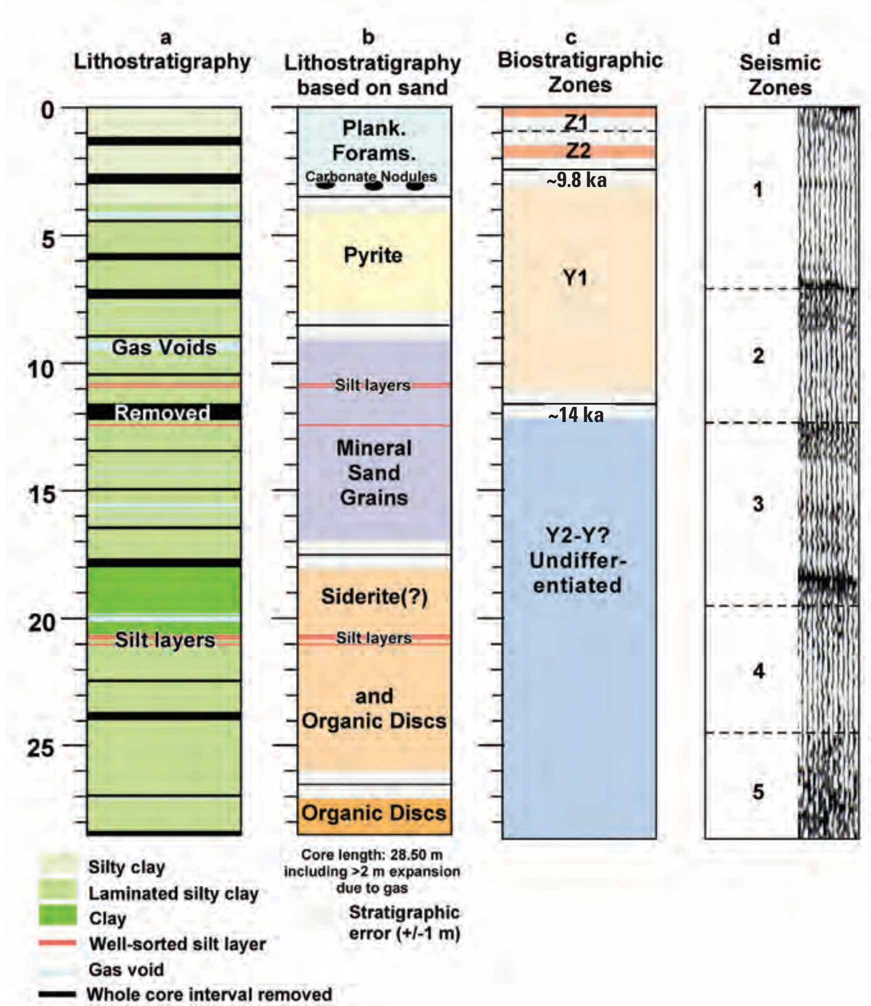

Figure 3. (a) Lithology of core MD02-2570. The core was described onboard the RV *Marion Dufresne* by cruise scientists. (b) Microscopic assessment of the >150-micrometer-size class shows that planktonic foraminifers dominate samples from the top of the core to ~3 meters below sea floor (mbsf), framboidal pyrite or benthic foraminifers dominate from ~3 to 9 mbsf, and mineral grains dominate from ~9 to 18 mbsf. Below 17 to 18 mbsf, the section contains various amounts of siderite (?), spore-like organic disks, and foraminifers. Trace amounts of ostracodes and radiolarians occur sporadically throughout the core. Carbonate nodules were observed at 3 mbsf. Several of these sand-size constituents are authigenic byproducts of anoxic bacterial respiration and methanogenesis. (c) The core is divided into four biostratigraphic zones based on qualitative assessment of assemblages of planktonic foraminifers (Kennett and others, 1985; Flower and Kennett, 1990). Zones include the Z1 and Z2 Subzones, which span most of the Holocene from 0–9.8 ka, Subzone Y1, which covers most of the glacial termination from 9.8–14 ka, and an as yet undifferentiated Y Zone. Extrapolation of the sedimentation rate in Zone Y1 (220 centimeters per thousand years (cm/k.y.)) suggests that the base of the core is no younger than ~22 ka. (d) The biostratigraphy of core MD02-2570 can be loosely correlated to the seismic stratigraphy of Lutken and others (2003). The core penetrated apparently to the top of Seismic Unit 5; however, there is uncertainty in correlation for several reasons, including gas expansion in the core.

recognized, perhaps because the sampling interval is too coarse (the 1-m sample interval corresponds to a period of ~500 years on average in Subzone Y1).

The Y Zone below the Y1–Y2 boundary cannot be further subdivided based on qualitative estimates of species frequencies; however, the age of the bottom can be constrained. Two volcanic ashes occur in the northeastern Gulf of Mexico in the Y Zone: (1) a distinctive ash layer within Subzone Y8 and (2) a dispersed ash in Y6 (Kennett and Huddlestun, 1972; Ledbetter, 1986). No volcanic ash was reported in the core description, so the base of the core may lie above Y6 and below the top of Y2. The base of the core, without question, lies above the top of the X Zone, which is near the MIS 5.1–MIS 5.2 boundary, which is ~86 ka (Williams, 1984; Martinson and others, 1987).

Age Models

Two datum levels that were clearly recognized from the biostratigraphy were combined with two inferred datum levels to develop age models of the core. The ages of the two well-controlled biostratigraphic levels are known from radiocarbon dating in the Gulf of Mexico. The base of the Z Zone is 9.8 ka, and the base of Y1 is 14 ka (Flower and Kennett, 1990; Poore and others, 2003). These ages are not calibrated to calendar years. The two inferred datum levels are the present-day and the top of Subzone Y6. The top of the core may or may not be present-day, but it is tentatively assumed to be 0 ka. The bottom of the core may be younger or older than Y6, the top of which is equivalent to the top of MIS 4 (Kennett and Huddlestun, 1972; Williams and Kohl, 1986). The top of MIS 4 is 59 ka based on astronomical tuning of the Spectral Analysis and Mapping Project (SPECMAP) composite oxygen isotope curve (Martinson and others, 1987).

Two age models were formulated to embrace the likely minimum and maximum ages of the base of the core (fig. 4). The tops of both models are the same and estimate sedimentation rates of 26 cm/k.y. in the Z Zone and 217 cm/k.y. in the deglacial Subzone Y1 interval. Below the deglacial Y1 Subzone, model 1 is based on the assumption that the age of the base of the core is 59 ka, equivalent to the top of the Y6 Subzone. Model 1 implies that the sedimentation rate of this interval is 37 cm/k.y., not much faster than the interglacial interval. In model 2, the sedimentation rate of the deglacial Y1 interval is extrapolated to the base of the core. The age of the base of the core in model 2 is ~22 ka. The two models indicate that the age of the base of core MD02-2570 is between 22 and 59 ka. The actual age of the base of the core cannot be younger than 14 ka nor older than 86 ka, the respective ages of the base of Subzone Y1 and the top of Zone X.

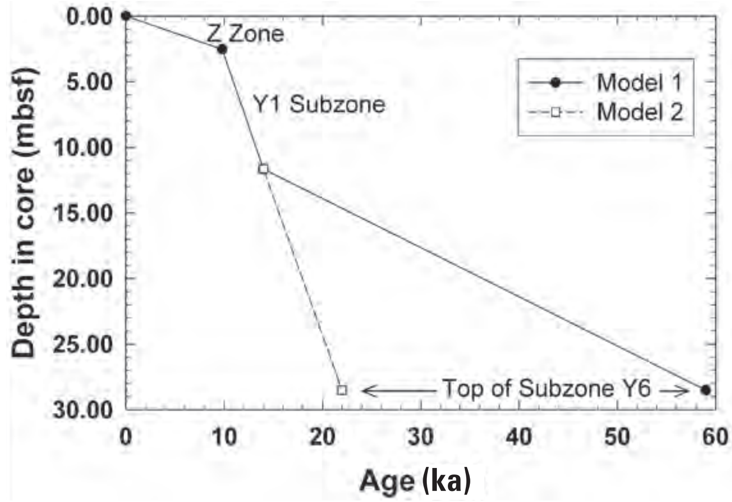

Figure 4. Age models 1 and 2 for core MD02-2570. Age model 1 is based on the assumption that the base of the core lies at the top of Subzone Y6, and age model 2 is based on the assumption that the rate of sedimentation in Subzone Y1 extends to the base of the core.

Comparisons to Other Sections From Gulf of Mexico Ponded Basins

Core MD02-2570 is comparable to other cores from two ponded basins in the northern Gulf of Mexico—the Pigmy and Orca Basins (fig. 5a, b). DSDP Site 618 in the Pigmy Basin recovered an orderly sequence to 74 mbsf, reaching the W Zone of Ericson and Wollin (1968; Kohl, 1986). The base of the Z Zone is 5 mbsf, and the base of the Y Zone is 147 mbsf, with the Y8 ash layer at 142 mbsf (85 Ka, Ledbetter, 1986; Williams and Kohl, 1986). Core EN32-PC6 in the south section of the Orca Basin recovered a continuous section to 11 mbsf, reaching the Y2 Subzone of Kennett and Huddlestun (1972). The base of the Z Zone lies at 4 mbsf, and the base of the Y1 Subzone lies at 6.4 mbsf. The age of the base of the core is ~29 ka based on extrapolation from radiocarbon ages in the section.

Sedimentation rates in the Z Zone are 26, 51, and 41 cm/k.y. at the MD02-2570 site, DSDP Site 618, and EN32-PC6, respectively. For comparison, the sedimentation rate in the Z Zone for several cores outside ponded basins in the northern Gulf of Mexico are <20 cm/k.y. (Poore and others, 2003).

Sedimentation rates for the Y1 Subzone are 217, 89, and 57 cm/k.y. (fig. 5a) at the MD02-2570 site, DSDP Site 619, and EN32-PC6, respectively. The rate at the MD02-2570 site is substantially faster than those at the other locales and may be related to formation of the Mississippi Canyon by megaslumping event(s) culminating ~20 ka (Coleman and others, 1983). Alternatively, the sands may be overbank deposits derived from the already-formed Mississippi Canyon, which channelized debris from low-stand coastal deposits drowned by rising sea level.

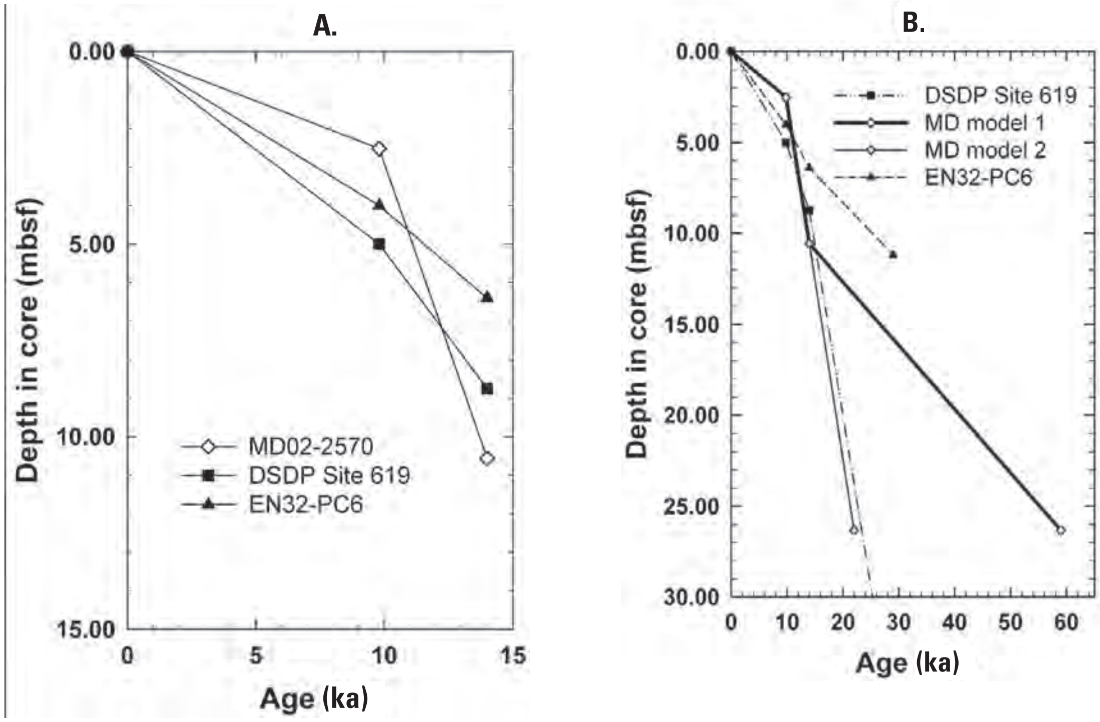

Figure 5. (A) Comparison of age model 1 for core MD02-2570 (diamond symbols) with two cores from other ponded basins in the northern Gulf of Mexico, DSDP Site 619 (squares) and piston core EN32-PC6 (triangles). (B) Comparison of age model 2 for core MD02-2570 (diamond symbols) with two cores from other ponded basins in the northern Gulf of Mexico, DSDP Site 619 (squares) and piston core EN32-PC6 (triangles).

Mean sedimentation rates in the lower Y Zone range between 205 and 32 cm/k.y. at DSDP Site 619 and EN32-PC6, respectively (fig. 5b). These rates bracket the rates of the MD02-2570 site for the two age models, which estimate rates of 37 and 217 cm/k.y. below the Y1 Subzone.

Conclusion

Core MD02-2570 of late Quaternary age contains sediments from the Z and upper Y Zones of Ericson and Wollin (1968). The sedimentary record spans the Wisconsinan deglaciation and the Holocene interglacial period with quite high average rates of sedimentation, 217 and 26 cm/k.y., respectively, although the continuity of the record cannot be reliably established based on these data. The fossils remain in excellent condition based on visual inspection; however, the presence of free gas, possibly gas hydrate, and abundant alteration products, such as carbonate nodules, pyrite, and siderite(?), raises some questions regarding the potential use of either carbon or oxygen isotopes in fossil tests for high-resolution biostratigraphy, geochronology, and paleoclimate analysis. The effects of possible density-current activity must be assessed below 3.8 mbsf prior to further faunal analysis. The cored section may contain the depositional signature associated with excavation of the Mississippi Canyon and(or) subsequent drowning of lowstand coastal deposits during the last Wisconsinan transgression of the sea.

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