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3. Data Report: Decimeter-Scale Sedimentologic and Ichnologic Observations on a ~520-m-Thick Pleistocene Sequence, Site 1073 (Leg 174A), New Jersey Continental Slope[1]

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INTRODUCTION

When examined in their sedimentologic and stratigraphic context, ichnofabrics and component ichnofossils can help decipher paleoceanography and sea-level histories from marine deposits (Savrda, 1995). Previous studies have demonstrated the utility of ichnology in interpreting decimeter-scale bedding rhythms in Cretaceous and Tertiary chalk-marl sequences that record paleoceanographic responses to Milankovitch-scale climate forcing (e.g., Savrda and Bottjer, 1994; Erba and Premoli-Silva, 1994; Savrda, 1998; Savrda and Locklair, 1998) and in recognizing climate dynamics in Neogene and Quaternary siliceous sediments of the Pacific rim (Baumgartner et al., 1989; Anderson et al., 1990; Ozalas et al., 1994; Behl and Kennett, 1996). In the context of sequence stratigraphy and sea-level studies, ichnofabrics have assisted in the recognition of key stratal surfaces (i.e., sequence boundaries and transgressive surfaces) (Savrda, 1991, 1995; Pemberton et al., 1992a; MacEachern et al., 1992; Taylor and Gawthorpe, 1993) and hold great promise in the delineation of smaller scale stratal packages (i.e., parasequences) and their bounding surfaces (Frey and Howard, 1990; Pemberton et al., 1992b; Krawinkel and Seyfried, 1996), particularly for marine sequences within which bioturbation has destroyed or masked

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physical sedimentologic evidence (Taylor and Gawthorpe, 1993; Ghibaudo et al., 1996).

Thus far, applications of ichnology in paleoceanographic investigations have been restricted to slowly deposited, predominantly biogenic sediments and/or strata deposited in oxygen-deficient, tectonically active basins. Moreover, ichnologic applications in sequence stratigraphic studies largely have been restricted to strata deposited in relatively shallow-water shelf or foreland basin settings. The limits of previous studies provided impetus for detailed postcruise examination of Quaternary deposits recovered at Ocean Drilling Program (ODP) Site 1073 on the New Jersey margin. These deposits provide the opportunity to assess the sedimentary and ichnofabric record of glacio-eustatic cycles in a passive continental slope setting characterized by relatively rapid accumulation of siliciclastic sediments in an area not far removed from the Laurentide ice margin.

The primary purpose of this data report is to present basic sedimentologic and ichnologic observations made at the decimeter scale throughout the Quaternary sequence from Site 1073. Data analysis and interpretation in the context of climate and sea-level histories, as inferred from oxygen isotopic, palynologic, and seismic studies, are ongoing and will be presented in subsequent papers prepared for open literature (e.g., Savrda et al., in press).

SITE 1073

ODP Leg 174A is part of the New Jersey Mid-Atlantic Sea-Level Transect (MAT) initiative, an ongoing effort to assess the effects of glacio-eustatic sea-level changes on a passive, siliciclastic-dominated continental margin (Austin, Christie-Blick, Malone, et al., 1998). The primary goal of the leg was to characterize and date Oligocene–Holocene ("Icehouse") stratigraphic packages and boundaries beneath the continental shelf, complementing results from drilling on the slope and rise during Leg 150 (Miller and Mountain, 1994) and at onshore New Jersey coastal plain sites during Legs 150X and 174AX (Miller et al., 1994; Miller, Sugarman, Browning, et al., 1998).

Site 1073 is located at a water depth of 639 m on the Hudson apron, which lies on the upper continental slope. In the context of the broader MAT mission, Site 1073 was chosen to (1) recover "Icehouse" sediments that could provide age and deep-water facies control for stratigraphic surfaces that at shelf sites are crucial for deciphering glacio-eustatic histories and (2) develop sequence stratigraphic interpretations for slope settings where sedimentary and paleoceanographic responses to sea-level dynamics may differ from those on the shelf.

A single hole (Hole 1073A) was drilled to a depth of 663.6 meters below seafloor (mbsf). Coring was rapid and recovery was excellent (99.9%), providing a virtually continuous and thick (519.8 m) Quaternary record dominated by clays, silty clays, sandy muds, and muddy sands and a thinner (~144 m) condensed package of variably glauconitic and diatomaceous clay, silty clay, nannofossil clay, and chalk of late Eocene through Pliocene age (519.8–663.6 mbsf).

In shipboard descriptions (Shipboard Scientific Party, 1998), the Quaternary sequence addressed herein is placed into a single lithostratigraphic unit (Unit I) and divided into five subunits (Subunits IA–IE). The base of the unit is marked by a major discontinuity; subunit boundaries are delineated based on seemingly less prominent discontinuities and vertical changes in lithofacies associations. Current biostratigraphic data indicate that the unit-bounding discontinuity includes the lowermost Pleistocene. Calcareous nannofossils and dinocysts suggest that the sedimentary record for 0.9–1.7 Ma is either missing altogether or highly condensed within the basal few meters of the unit. ^{14}C analysis of a sample from near the top of the hole (0.4 mbsf) yielded an age of 14,800 ± 55 yr (C. McHugh, pers. comm., 1999), indicating that Holocene sediments at the site are absent or very thin. Additional hiatuses are likely associated with subunit bounding and other less prominent discontinuities.

METHODS

During the cruise, cores from Site 1073 were split, described, and sampled following standard ODP shipboard procedures. Shipboard section-by-section descriptions and core photographs are presented elsewhere (Shipboard Scientific Party, 1998). However, several factors necessitated that cores be revisited and described in greater detail at the ODP core repository at Lamont Doherty Earth Observatory: (1) core recovery at Site 1073 was rapid, precluding in-depth core examination; (2) potential inconsistencies in core description between shifts could introduce false observational signals; and, most importantly, (3) ichnofabric studies generally require observations at scales intermediate between 1.5-m-long core sections and the 20-cm^3 maximum shipboard sample size.

At the ODP core repository, archive halves of cores were carefully recleaned using glass slides and/or a thin metal spatula. To the maximum extent possible, sedimentologic and ichnologic observations were made for each 10-cm interval of core. Sedimentologic observations included general lithology based on sediment texture, presence and type of primary stratification and related physical sedimentary structures, and presence of macroscopic detrital (e.g., lithoclasts and shell or plant debris) and diagenetic (e.g., Fe-sulfide nodules and glauconite) components. Ichnologic observations focused on the degree of biogenic disruption of the primary sedimentary fabric and the type and abundance of particular biogenic structures, including diffuse burrow mottles and more discrete burrow forms. Data are reported in Table T1. Additional information on methods and observational strategies are provided in the description of this table below.

T1. Sedimentologic and ichnologic observations, Hole 1073A, p. 9.

TABLE DESCRIPTION

Table T1 consists of 24 columns (A–X) and 5077 rows. Columns A–C provide stratigraphic context for the observations, columns D–M contain sedimentologic information, and columns N–X provide ichnologic data.

Stratigraphic Framework

Columns A–C provide information on sample position. Column A designates the core number (Cores 174A-1073A-1H to 57X) followed by information on core length and percent recovery. Column B designates the core section (1–8 or core catcher [CC]). Column C designates the intervals from which data were derived from each section. These are generally successive 10-cm intervals measured from core section tops. However, in some cases, they deviate from 10-cm increments owing to gaps in core associated with gas voids and/or shipboard sampling intervals. These gaps are designated as “gas vd.” and “sample” in column D, respectively, in lieu of lithologic data.

Sedimentology

Columns D–M record sedimentologic attributes including general sediment type, physical sedimentary structures, and detrital and diagenetic components. Column D (lithology) indicates general texture or sediment type as determined by hand lens examination and “teeth” tests for grittiness. Intervals were designated 1–7, corresponding to clay, silty clay, silty clay to mud, mud, sandy mud, muddy sand, and sand, respectively. For intervals characterized by textures deemed to be on the borderline between these textural categories (e.g., clay vs. silty clay), intermediate values (e.g., 1.5) are assigned. Where intervals contain a contact between two texturally distinct units, a slash is employed. For example, if a 10-cm interval contains a contact between a sandy mud and a subjacent silty clay, lithology is designated as 5/2. The same slash approach is used for intervals containing thin (centimeter scale) layers of varying texture. For example, in the case of interlayered clays or silty clays and thin graded event layers of muddy fine sand or silt (column F; see below), texture is designated as 1/6 or 2/6. Little attempt was made to differentiate between silt and fine sand in individual thin event layers; typically an arbitrary value of 6 is employed to designate these relatively coarse components.

Column E (stratification) indicates the presence or absence of preserved bedding or internal stratification. Certain recurring millimeter- to centimeter-scale types of stratification are identified in columns F–H. These include thin (typically 0.5–2.0 cm), graded micaceous silt to fine muddy sand event beds (column F [graded]), fine millimeter-scale laminae in clays and silty clays (column G [lamination]), and slump structures (column H [convolution]) manifested as convoluted and/or microfaulted intervals that typically include deformed graded event layers or laminae.

Columns I–K indicate the presence of detrital components clearly visible on prepared core surfaces. Column I (shells) indicates the presence of macroscopic whole shells or shell fragments occurring either in isolation or in aggregates. No attempt was made to identify this fossil material; however, most appear to be molluscan (bivalve or gastropod). Column J (organics) indicates the presence of isolated clasts of plant macrodetritus, including apparently charcoalized wood fragments. Column K (pebbles) indicates the presence of large lithoclasts (clastic granules or pebbles), some of which likely represent glacial dropstones.

Column L (pyrite) indicates the presence of obvious millimeter- to centimeter-scale Fe-sulfide nodules (or their oxidized byproducts). Column M (glauconite) denotes sand-sized glauconite, which is virtually absent except within the lower 3 m of the Quaternary section.

Ichnology

On the whole, ichnologic observations were confounded by generally poor visibility and preservation of ichnofabrics. Depending on position in the core, observational difficulties were, to varying extents, dictated by (1) presumed original high fluidity of some substrates (e.g., clays and silty clays), which may have precluded the formation of distinct biogenic structures; (2) extreme textural and compositional homogeneity through large portions of the core, which limited contrast between biogenic structures and ambient sediments; (3) low degree of sediment induration, which led to fabric smearing, even on carefully prepared core surfaces; and/or (4) core disturbance such as biscuiting (a problem most prevalent in Cores 174A-1073A-32X through 36X), which disrupted the vertical continuity of core faces. These problems necessitated the "sequential" observational approach manifested in columns N–X.

Column N lists general ichnofabric indices (ii) that reflect the degree of biogenic disruption of the primary fabric. Using the schemes of Droser and Bottjer (1991), numerical indices range from 1, which reflects no apparent fabric disruption, to 5, which denotes complete bioturbation. However, a value of zero was assigned for most intervals characterized by slump features because it was often unclear if physical structures therein (e.g., laminae) were primary or artifacts of mass movement. Observational scale was a persistent problem in intervals characterized by numerous thin graded event beds. For these intervals, ichnofabric indices generally reflect the degree to which boundaries between event beds and host clay or silty clay layers were disrupted, even though the finer host sediments themselves may have been completely bioturbated.

Thoroughly bioturbated intervals (i.e., ii = 5) dominate the section and exhibit variable fabrics. Some are monochromatic and homogeneous; others are characterized by homogeneous background fabrics overprinted by diffuse burrow mottles (typically 2–6 mm in diameter), which may or may not be accentuated by dark amorphous? Fe-sulfide staining and/or more distinct burrow forms. Ichnofabrics of these intervals were further differentiated using a modified version of the "slash" method of Droser and Bottjer (1991), where the relative density of burrows and/or burrow mottles that overprint homogeneous background fabrics was visually estimated and numerically scored (column O [ii/]). Values range from zero (0), denoting truly homogeneous intervals with virtually no mottles or distinct burrows, through 5, reflecting progressively higher densities of mottles and/or distinct burrows.

Column P indicates the presence or absence of distinct burrows (i.e., those with clearly defined walls in contrast to diffuse burrow mottles), whether or not they are identifiable recurring forms. The distributions of various types of recurring, at least tentatively identified, biogenic structures are indicated in columns Q–X.

Column Q (SR) indicates isolated or clustered, horizontal to subvertical, narrow (2–7 mm), cylindrical burrows characterized by distinct thin (≤1 mm) clean silt and/or fine sand linings. These burrows, which preferentially occur in coarser intervals (i.e., muds, muddy sands, and sandy muds), are assigned to the ichnotaxon *Schaubcylindrichnus freyii* (Miller, 1995). Column R (SF) indicates the presence of narrow (2–4 mm), horizontal to subvertical burrows apparently filled with clean silt or fine sand that is texturally similar to the linings of *S. freyii*. These burrows may represent a different trace type altogether. However, based on their close distributional association and textural similarities with *S. freyii,* we suspect that many, if not all, of the "sand-filled" burrows are artifacts of smearing of narrower sand-lined tubes assignable to the same ichnotaxon.

Column S (CH) indicates rare occurrences of networks of apparently branched, small diameter (1–3 mm), cylindrical, mostly horizontal to subhorizontal unlined burrows that are assigned to the ichnogenus *Chondrites*. Column T (HE) refers to similar small (1–2 mm) horizontal, cylindrical burrows with no apparent branching. These structures are assigned to the ichnogenus *Helminthopsis,* although the lack of three-dimensional views makes this assignment tentative.

Column U (TA) indicates rare occurrences of larger (3–6 mm diameter), horizontal to subhorizontal, cylindrical unlined burrows with concentrically laminated (meniscate) fills. These burrows are most allied with the ichnogenus *Taenidium.*

Columns V and W indicate the presence of two varieties of larger diameter (1–3 cm), roughly cylindrical, variably oriented unlined burrows that apparently form branched networks. These varieties, both of which are assigned to the ichnogenus *Thalassinoides,* are distinguished on the basis of wall sharpness and textural contrast between burrow fills and ambient sediments. The first form (column V [THr]) is characterized by burrows fills that are comparable to that of host sediments (typically sandy mud and muddy sand) and, consequently, burrows walls are not as well defined. The second form (column W [THs]) is found in finer grained intervals (typically clay or silty clay) that lie with sharp contact beneath sandier intervals. Burrows generally have very sharp walls and are filled with coarser sediments derived from above, making them some of the most conspicuous structures in the Pleistocene sequence. The latter structures are diagnostic of firm substrates (firmgrounds), which often characterize marine disconformities (Savrda, 1995).

The last column (column X [OP]) indicates the presence of horizontal to subhorizontal cylindrical burrows with linings that vaguely express what appears to be a nodose (pellet-lined?) outer wall. These features, which are extremely rare (only found at the very base of the investigated interval in sands), are tentatively identified as *Ophiomorpha.* However, smearing or grain plucking during preparation of core surfaces precluded a definite diagnosis.

EPILOGUE

This report was prompted by the reality that the robust data set presented herein was not otherwise available to other members of the Leg 174A Scientific Party and could not be published in its entirety in open literature. This raw data is currently being synthesized and integrated with results of other sedimentologic, paleontologic, geochemical, and geophysical investigations by Leg 174A scientists. A paper that emphasizes sedimentologic and ichnologic responses to Pleistocene climate dynamics and the ichnofabric signature of sequence stratigraphic surfaces is forthcoming (Savrda et al., in press).

REFERENCES

Anderson, R.Y., Linsley, B.K., and Gardner, J.V., 1990. Expression of seasonal and ENSO forcing in climatic variability at lower than ENSO frequencies: evidence from Pleistocene marine varves off California. *Palaeogeogr., Palaeoclimatol., Palaeoecol.,* 78:287–300.

Austin, J.A., Jr., Christie-Blick, N., Malone, M.J., et al., 1998. *Proc. ODP, Init. Repts.,* 174A: College Station, TX (Ocean Drilling Program).

Baumgartner, T.R., Michaelsen, J., Thompson, L.G., Shen, G.T., Soutar, A., and Casey, R.E., 1989. The recording of interannual climatic change by high-resolution natural systems: tree-rings, coral bands, glacial ice layers, and marine varves. *In* Peterson, D.H. (Ed.), *Aspects of Climate Variability in the Pacific and the Western Americas.* U.S. Geol. Surv., Geophys. Monogr., 55:1–14.

Behl, R.J., and Kennett, J.P., 1996. Brief interstadial events in the Santa Barbara Basin, NE Pacific, during the last 60 kyr. *Nature,* 379:243–246.

Droser, M.L., and Bottjer, D.J., 1991. Trace fossils and ichnofabric in Leg 119 cores. *In* Barron, J., Larsen, B., et al., *Proc. ODP, Sci. Results,* 119: College Station, TX (Ocean Drilling Program), 635–641.

Erba, E., and Premoli-Silva, I., 1994. Orbitally driven cycles in trace-fossil distribution from the Piobicco core (late Albian, central Italy). *In* De Boer, P.L., and Smith, D.G. (Eds.), *Orbital Forcing and Cyclic.* Spec. Publ. Int. Assoc. Sedimentol., 19:211–225.

Frey, R.W., and Howard, J.D., 1990. Trace fossils and depositional sequences in a clastic shelf setting, Upper Cretaceous of Utah. *J. Paleontol.,* 64:803–820.

Ghibaudo, G., Grandesso, P., Massari, F., and Uchman, A., 1996. Use of trace fossils in delineating sequence stratigraphic surfaces (Tertiary Venetian Basin, northeastern Italy). *Palaeogeogr., Palaeoclimatol., Palaeoecol.,* 120:261–279.

Krawinkel, H., and Seyfried, H., 1996. Sedimentologic, palaeoecologic, taphonomic and ichnologic criteria for high-resolution sequence analysis: a practical guide for the identification and interpretation of discontinuities in shelf deposits. *Palaeogeogr., Palaeoclimatol., Palaeoecol.,* 102:79–110.

MacEachern, J.A., Raychaudhuri, I., and Pemberton, S.G., 1992. Stratigraphic application of the *Glossifungites* ichnofacies: delineating discontinuities in the rock record. *In* Pemberton, S.G. (Ed.), *Applications of Ichnology to Petroleum Exploration.* Soc. Econ. Paleontol. Mineral., Core Workshop, 17:169–198.

Miller, K.G., et al., 1994. *Proc. ODP, Init. Repts.,* 150X: College Station, TX (Ocean Drilling Program).

Miller, K.G., and Mountain, G.S., 1994. Global sea-level change and the New Jersey margin. *In* Mountain, G.S., Miller, K.G., Blum, P., et al., *Proc. ODP, Init. Repts.,* 150: College Station, TX (Ocean Drilling Program), 11–20.

Miller, K.G., Sugarman, P.J., Browning, J.V., et al., 1998. *Proc. ODP, Init. Repts.,* 174AX: College Station, TX (Ocean Drilling Program).

Miller, W., III, 1995. *"Terebellina"* (=*Schaubcylindrichnus freyi* ichnosp. nov.) in Pleistocene outer-shelf mudrocks of northern California. *Ichnos,* 4:141–149.

Ozalas, K., Savrda, C.E., and Fullerton, R., 1994. Bioturbated oxygenation-event beds in siliceous facies: Monterey Formation (Miocene), California. *Palaeogeogr., Palaeoclimatol., Palaeoecol.,* 112:63–83.

Pemberton, S.G., McEachern, J.A., and Frey, R.W., 1992a. Trace fossil facies models: environmental and allostratigraphic significance. *In* Walker, R.G., and James, N.P. (Eds.), *Facies Models: Response to Sea Level Change.* Geol. Assoc. Canada, 42–72.

Pemberton, S.G., van Wagoner, J.C., and Wach, G.D., 1992b. Ichnofacies of a wave-dominated shoreline. *In* Pemberton, S.G. (Ed.), *Applications of Ichnology to Petroleum Exploration: A Core Workshop.* Soc. Econ. Paleontol. Mineral., Core Workshop, 17:339–382.

Savrda, C.E., 1991. Ichnology in sequence stratigraphic studies: An example from the lower Paleocene of Alabama. *Palaios,* 6:39–53.

———, 1995. Ichnologic applications in paleoceanographic, paleoclimatic, and sea-level studies. *Palaios,* 10:565–577.

———, 1998. Ichnology of the Bridge Creek Limestone Member: evidence for temporal and spatial variations in paleo-oxygenation in the Western Interior seaway. *In* Dean, W.E., and Arthur, M.A. (Eds.), *Stratigraphy and Paleoenvironments of the Western Interior Seaway, USA*. Soc. Econ. Paleontol. Mineral., Concepts Sedimentol. Paleontol., 6:127–136.

Savrda, C.E., and Bottjer, D.J., 1994. Ichnofossils and ichnofabrics in rhythmically bedded pelagic/hemipelagic carbonates: recognition and evaluation of benthic redox and scour cycles. *In* de Boer, P., and Smith, D.G. (Eds.), *Orbital Forcing and Cyclic Sequences*. Int. Assoc. Sedimentol., Spec. Publ., 19:195–210.

Savrda, C.E., and Locklair, R.E., 1998. Ichnology of rhythmically bedded Demopolis Chalk (Upper Cretaceous, Alabama): implications for paleoenvironment, depositional cycle origins, and tracemaker behavior. *Palaios,* 13:423–438.

Savrda, C.E., Krawinkel, H., McCarthy, F.M.G., McHugh, C.M.G., Olson, H.C., and Mountain, G., in press. Ichnofabrics of a Pleistocene slope succession, New Jersey margin: relations to climate and sea-level dynamics. *Palaeogeogr., Palaeoclimatol., Palaeoecol.*

Shipboard Scientific Party, 1998. Site 1073. *In* Austin, J.A., Jr., Christie-Blick, N., Malone, M.J., et al., *Proc. ODP, Init. Repts.,* 174A: College Station, TX (Ocean Drilling Program), 153–191.

Taylor, A.M., and Gawthorpe, R.L., 1993. Application of sequence stratigraphy and trace fossil analysis to reservoir description: examples from the Jurassic of the North Sea. *In* Parker, J.R. (Ed.), *Petroleum Geology of Northwest Europe*. Proc. 4th Conf. Geol. Soc. London, 317–335.

Table T1. Sedimentologic and ichnologic observations made at the decimeter scale throughout the Quaternary interval (0-520 mbsf) of Hole 1073A, Leg 174A, New Jersey margin.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
Core/depth (mbsf)/ recovery	Section	Interval (cm)	Lithology	Stratification	Graded	Lamination	Convolution	Shells	Organics	Pebbles	Pyrite	Glauconite	ii	ii/	Burrow	SR	SF	CH	HE	TA	THr	THs	OP
174A-1073A-																							
1H	1	0-10	6										5	0									
0.0-6.6		10-20	5					X					5	0									
100.5%		20-30	5										5	0									
		30-40	4										5	0									
		40-50	4										5	0									
		50-60	2										5	0									
		60-70	2										5	0									
		70-80	2										5	0									
		80-90	2										5	0									
		90-100	2										5	0									
		100-110	2										5	0									
		110-120	2					X					5	0									
		120-130	2/6										5	0									
		130-140	2										5	0									
		140-150	sample																				
	2	0-10	2										5	1									
		10-20	2										5	0									
		20-30	2										5	0									
		30-40	2										5	0									
		40-50	2										5	1									
		50-60	2										5	1									
		60-70	2										5	1									
		70-80	2										5	1									
		80-90	2										5	1									
		90-100	2										5	0									
		100-110	2										5	0									
		110-120	2										5	1									
		120-130	2										5	0									
		130-140	2										5	1									
		140-150	2										5	1									
	3	0-10	2										5	0									
		10-20	2										5	0									
		20-30	2										5	0									
		30-40	2										5	1									
		40-50	2										5	1									
		50-60	2										5	5									
		60-70	2										5	0.5									
		70-80	2					X					5	1									
		80-90	2										5	1									
		90-100	2										5	2									
		100-110	2										5	2									
		110-120	2										5	1									
		120-130	2										5	0									
		130-140	2										5	1									
		140-150	sample																				
	4	0-10	2										5	1									
		10-20	2										5	2.5									
		20-30	2										5	2									
		30-40	2										5	1									
		40-50	2										5	1									
		50-60	2										5	1									
		60-70	2										5	2									
		70-80	2										5	3									

Notes: Sedimentology: 1 = clay, 2 = silty clay, 3 = silty clay-mud, 4 = mud, 5 = sandy mud, 6 = muddy sand, 7 = sand. Ichnofabric indices (ii) are given on a scale of 1 to 5; 1 = no apparent fabric disruption and 5 = complete bioturbation. 0 = unclear whether physical structures are a result of mass movement. ii/ is given on a scale of 0 to 5; 0 = no mottles or distinct burrows (completely homogeneous) and 5 = high density of mottles or distinct burrows. Biogenic structures: SR = *Schaubcylindrichnus freyii* (<1 mm), SF = sand-filled burrows associated with *S. freyii*, CH = *Chondrites,* HE = *Helminthopsis*(?), TA = *Taenidium,* THr = softground *Thalassinoides* with less well-defined burrow walls, THs = firmground *Thalassinoides* with sharp burrow walls, OP = *Ophiomorpha.* Only a portion of this table appears here. The complete table is available in **ASCII format.**