U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

The texture of surficial sediments in southeastern Long Island Sound off Roanoke Point, New York

by

Poppe, L.J.[1], Taylor, B.B.[1], Blackwood, Dann[1], Lewis, R.S.[2], and DiGiacomo-Cohen, M.L.[2]

Open-File Report 97-529

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards (or with the North American Stratigraphic Code). Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

[1] Coastal and Marine Geology Program, USGS, Quissett Laboratories, Woods Hole, MA 02543

[2] Long Island Sound Resource Center, Connecticut Geological and Natural Survey, Avery Point Groton, CT 06340

ABSTRACT

Grain-size analyses were performed on 50 surficial sediment samples from off Roanoke Point in southeastern Long Island Sound. The relative grain-size frequency distributions and related statistics are reported herein. Descriptions of the benthic character from video tapes and still camera photographs of the bottom at these stations are also presented.

Sediments eroded from the bluffs along the north shore of Long Island have formed a series of shore-connected, cape-associated arcuate shoals, such as the shoal off Roanoke Point and a somewhat similar, but smaller, feature off Jacobs Point, New York. Five distinct sedimentary environments have been identified and these include: a shoal crest facies of clean, medium sand; a shoal edge or front facies; a basal apron facies composed predominantly of shell debris; a muddy basin floor facies; and a sandier basin floor facies that shows evidence of reworking by strong tidal currents.

INTRODUCTION

The purpose of this study was: 1) to measure the grain size distributions of the surficial sediment samples from southeastern Long Island Sound off Roanoke Point, New York, 2) to calculate statistical descriptions that adequately characterize these samples, and 3) to describe the sedimentary environments based on the textural parameters and photographic interpretation. These grain-size data will eventually be used to help describe the sedimentary processes active in this portion of eastern Long Island Sound, and to evaluate near-shore sand and gravel resources. Other potential uses for these textural data include benthic biologic studies that evaluate faunal distributions and relate them to habitats, and geochemical studies involving the transport and deposition of pollutants.

STUDY AREA

Long Island Sound is about 182 km long by a maximum of 32 km wide. It is bordered on the north by the rocky shoreline of Connecticut, on the west by the urbanized New York metropolitan area, on the east by Block Island Sound, and on the south by the eroding sandy bluffs of Long Island, New York. The study area (Figs. 1, 2), which covers approximately 34 km^2, lies just off Roanoke Point, New York in southeastern Long Island Sound.

The bedrock beneath Long Island Sound dips southward and is composed of gneissic and schistose metamorphic rocks of pre-Silurian age similar to the bedrock of adjacent Connecticut (Grim and others, 1970). Coastal-plain sediments of Cretaceous age overlie the bedrock across most of the southern portion of the Sound and form a southward and eastward thickening cuesta beneath Long Island (Lewis and Needell, 1987; Fuller, 1914). Wells drilled on Long Island have encountered a coastal-plain section composed of white micaceous sands and blue, white and red clays of the Raritan

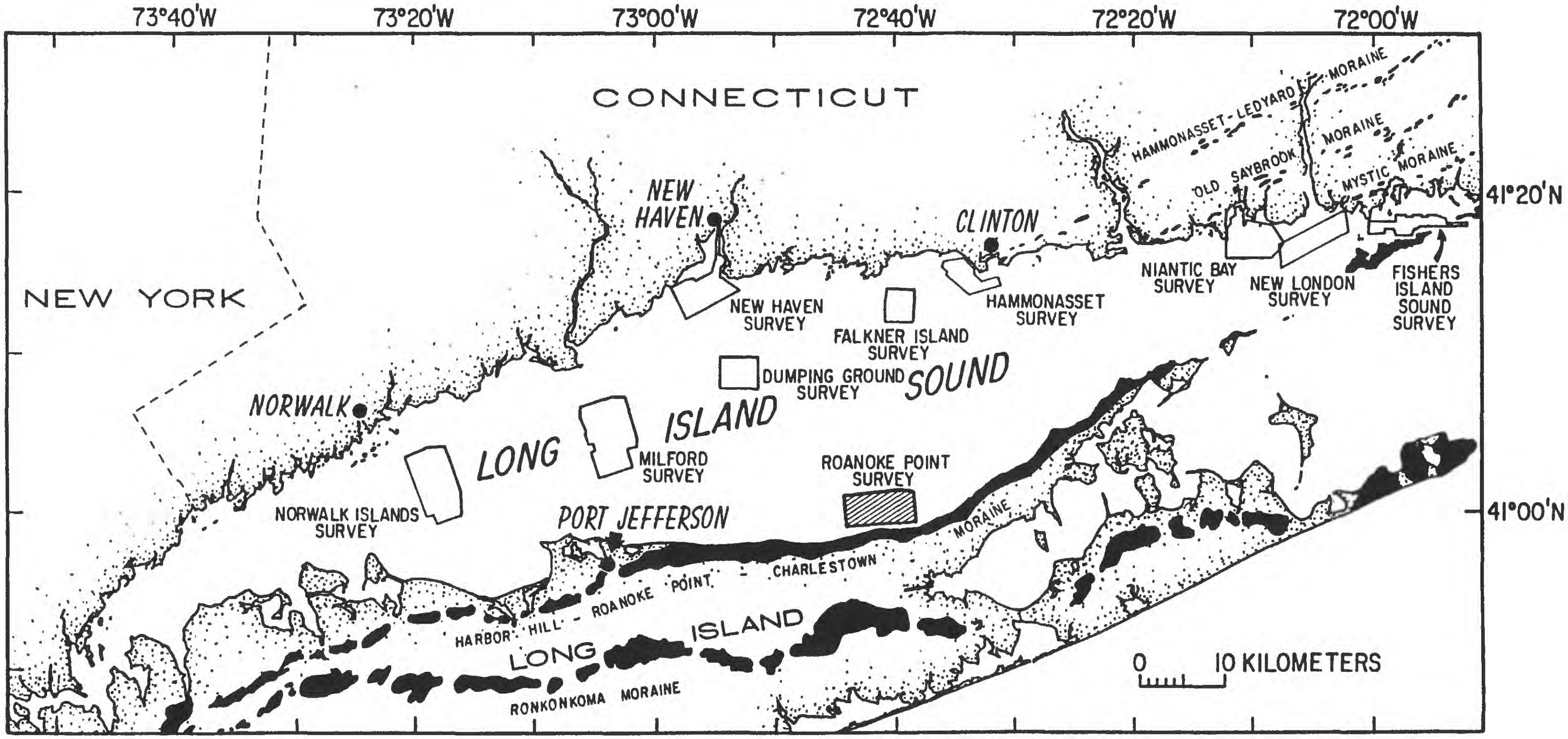

Figure 1. Index map showing the location of the Roanoke Point study area (solid polygon). Map also shows the locations of other sidescan sonar and sampling surveys (open polygons) being completed as part of this series (Poppe and others, 1992; Poppe and others, 1994; Moffett and others, 1994; Twichell and others, 1995; Poppe and others, 1995a; Poppe and others, 1995b; Poppe and others 1996a; Poppe and others 1996b; Poppe and others, 1996c; Twichell and others, 1997; Poppe and others, 1996d; Poppe and others, 1997).

Formation and the coarser, yellow and darker gravels, sands, and clays of the overlying Magothy Formation (Fuller, 1914).

The coastal-plain strata are unconformably overlain by at least two tills, one of early Wisconsinan-Illinoian age and one of late Wisconsinan age (Lewis and Needell, 1987; Needell and others, 1987; Stone and others, 1992). The older till is patchy, compact, eroded, and oxidized to a yellowish brown, and includes the Manhasset Formation, Jameco Gravel and Mannetto Gravel of Long Island (Schafer and Hartshorn, 1965) and the till exposed on Falkner Island (Gordon, 1980).

The late Wisconsinan age Laurentide Ice Sheet reached southern Long Island where its terminal position is marked by the Ronkonkoma Moraine (Fuller, 1914). The northward retreat of this ice sheet about 17,000 years ago produced the Harbor Hill Moraine across northern Long Island (Sirkin, 1967; Schafer and Hartshorn, 1965) and a succession of minor recessional moraines in Connecticut including the the Hammonasset-Ledyard, Old Saybrook, and Mystic Moraines (Flint and Gebert, 1976; Goldsmith, 1982; Poppe and others, 1997). Deltaic and varved lake deposits of glacial Lake Connecticut variously overlie the glacial drift in the Long Island Sound basin (Lewis and Stone, 1991; Stone and others, 1992). A marine mud facies, which occurs in quiet-water areas throughout the western and central parts of the Long Island Sound basin, overlies these earlier deposits and records deposition during the postglacial Holocene eustatic rise of sea level.

The northern shoreline of Long Island east of Port Jefferson is classified as a Glacial Deposition Coast because it coincides with the eroded and partially submerged portions of the Harbor Hill Moraine (Shepard, 1963). This section of the shoreline is characterized by gently curved beaches separated by headlands that project slightly into the Sound. These headlands, such as Herod, Roanoke, and Rocky Points, have higher bluffs (up to 40 m) and more layers of erosion-resistant clay and boulders (glacial eratics) than the sand and gravel of the adjacent bluffs (U.S. Army Corps Engineers, 1969; U.S. Army Corps Engineers, 1975; Koppleman and others, 1976).

The high bluffs on Long Island's north shore are steep, only partly covered by vegetation, and fronted by narrow beaches. The beaches near Roanoke Point average less than 12 m wide (Davies and others, 1973). Both the beaches and bluffs are eroding rapidly. For example, data from the vicinity of Roanoke Point show an average annual shoreline retreat of 0.82 m/year (Davies and others, 1973).

Precipitation, ground-water discharge, ice thaw, mass wasting (slumps and slides), wind-driven waves associated with storms, and sea-level rise play an important role in bluff erosion and the evolution of the northeastern coast of Long Island (Davies and others, 1973). As the bluffs recede, the eroded sediments accumulate in talus deposits on the narrow beaches. Wave attack during storms removes the talus and occasionally directly cuts the bluffs. Boulders and coarse gravel remain in lag deposits; the finer-grained sediments are winnowed away. The mean high water line migrates landward as the beach deposits are removed and the cycle of bluff and beach erosion continues.

Normal circulation in the Sound and prevailing westerly winds combine to set up a strong wave-driven longshore littoral drift (Davies and others, 1973). This eastward littoral transport direction is evidenced by beach accretion on the west or upstream side of jetties, groins, and other obstructions and erosion on the sediment-starved east or downstream side, such as occurs near Friars Head (Omholt, 1974; Fig. 2).

The sediments are transported easterly along the coast to headlands where the sands accumulate in a series of shore-connected, cape-associated arcuate shoals (Duane and others, 1972), such as the shoals present off Roanoke and Jacobs Points, and where the silts and clays are moved further offshore to lower-energy environments. In addition to acting as sediment sinks in the longshore regime, the shoals also serve to shield the headlands from wave action (Swift and others, 1972). Inasmuch as the onshore transport of offshore sediments from the deeper, lower energy benthic environments of the Sound is minimal (U.S. Army Corps Engineers, 1969; Davies and others, 1973), bluff erosion and the longshore regime are the only significant sources of sediment to these shoals.

Strong storm-generated waves and tidal currents continue to extensively erode and rework both the glacial and post-glacial deposits and to influence the sedimentary processes and surficial sediment distributions in and around Long Island Sound. The irregular bottom topography and extensive lag deposits of the eastern Sound reflect this scour, transport, and reworking of the sediments (Lewis and Needell, 1987; Needell and others, 1987; Lewis and Stone, 1991).

METHODS

Surficial sediment samples and bottom photographs were attempted at 50 locations during March, 1997 aboard the State of Connecticut Department of Environmental Protection vessel the RV JOHN DEMPSEY using a Van Veen grab sampler (Figs. 1 and 2). This grab sampler was equipped with Osprey video and still camera systems; the video system was attached to an 8 mm video cassette recorder. These photographic systems were used to appraise intra-station bottom variability and to observe boulder fields where sediment samples could not be collected (Appendix A). The 0-2 cm interval in the surficial sediments was subsampled from the grab sampler; these samples were frozen and stored for later analysis. Navigation was performed using a differential Global Satellite Positioning system.

A total of 50 sediment samples were collected for grain size analysis. The samples were thawed and visually inspected in the laboratory. If the sample contained gravel, the entire sample was analyzed. If the sample was composed of only sand, silt, and clay, an approximately 50 gram, representative split was analyzed. The

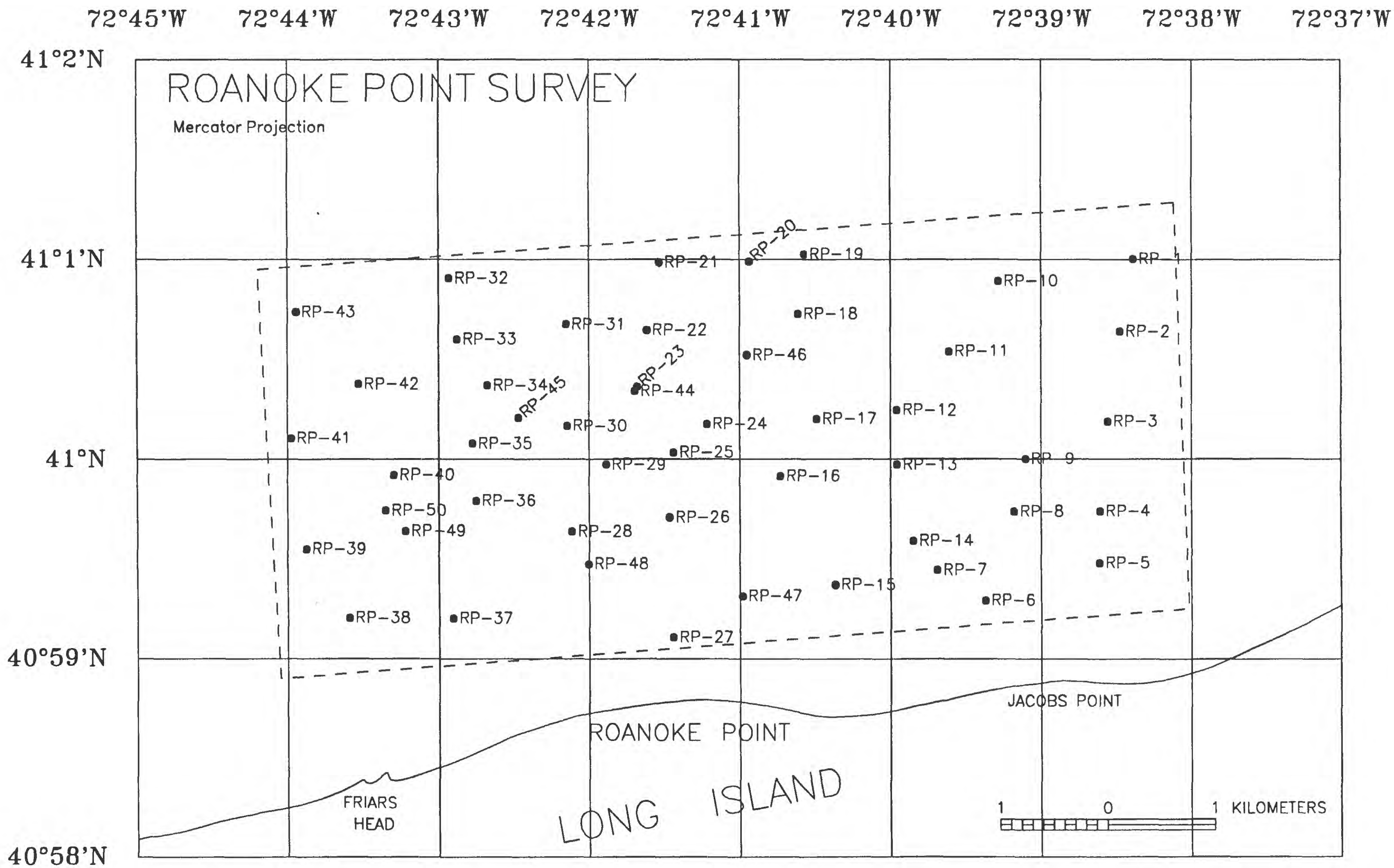

Figure 2. Map of the Roanoke Point study area in eastern Long Island Sound showing the sampling and bottom photography station locations.

sample to be analyzed was placed in preweighed 100 ml beaker, weighed, and dried in a convection oven set at 75 °C. When dried, the samples were placed in a desiccator to cool and then weighed. The decrease in weight due to water loss was used to correct for salt; salinity was assumed to be 25 °/oo. The weight of the sample and beaker less the weight of the beaker and the salt correction gave the sample weight.

The samples were disaggregated and then wet sieved through a 4ϕ (number 230, 62 μm) sieve using distilled water to separate the coarse- and fine-fractions. The fine fraction was sealed in a Mason jar and reserved for analysis by Coulter Counter (Shideler, 1976). The coarse fraction was washed in tap water and reintroduced into the preweighed beaker. The coarse fraction was dried in the convection oven at 75 °C and weighed. The weight of the coarse (greater than 62 μm) fraction is equal to the weight sand plus gravel. The weight fines (silt and clay) can also be calculated by subtracting the coarse weight from the sample weight. The coarse fraction was dry sieved through a -1ϕ (number 10, 2.0 mm) sieve to separate the sand and gravel. The size distribution within the gravel fraction was determined by sieving. Because biogenic carbonates commonly form in situ, they may not be representative of the depositional environment from a textural standpoint. Therefore, bivalve shells and other biogenic debris greater than 0ϕ (2.0 mm) were manually removed from the samples and the weights corrected to mitigate this source of error.

If the sand fraction contained more than 16 grams of material (enough to run the analysis twice), a rapid sediment analyzer (Schlee, 1966) was used to determine the sand distribution. If less than 16 grams of sand were available, the sand fraction was dry sieved using a Ro-Tap shaker.

The fine fraction was analyzed by Coulter Counter. To minimize biologic or chemical changes, storage in the Mason jars prior to analysis never exceeded two days. The gravel, sand, and fine fraction data were processed by computer to generate the distributions, statistics, and data base (Poppe and others, 1985). One limitation of using a Coulter Counter to perform fine fraction analyses is that it has only the ability to "see" those particles for which it has been calibrated. Calibration for this study allowed us to determine the distribution down to 0.7 μm or about two-thirds of the 11ϕ fraction. Because clay particles finer than this diameter and all of the colloidal fraction were not determined, a slight decrease in the 11ϕ (and finer) fraction is present in the size distributions (Appendix B).

RESULTS AND COMMENTS

Sample locations, water depths, and brief comments on the bottom photography are presented in Appendix A. Sample locations with low numerical designations (e.g. RP-1) tend to be located in the eastern portion of the study area; sample locations with higher numerical designations (e.g. RP-42) tend to be located in the western portions of the study area (Fig. 2). The relative frequency distributions of the grain-size analyses are presented in Appendix B and the related statistics and verbal equivalents are presented in Appendix C. Size classifications are based on the method proposed by Wentworth (1929); the statistics were calculated using the method of moments (Folk, 1974). The verbal equivalents were calculated using the inclusive graphics statistical method (Folk, 1974) and are based on the nomenclature proposed by Shepard (1954).

On the basis of lithology, texture, bottom photography, and faunal assemblages, five major sedimentary environments were identified within the study area. Probably because of the constant mixing and reworking, contacts between these environments are gradational and changes in lithology are seldom abrupt.

The first facies is located on the crest of the Roanoke Point and Jacobs Point shoals in water depths of less than 10 m and is characterized by clean, medium-grained, moderately to moderately well sorted, siliciclastic sand (e.g. RP-5, RP-27, RP-28). This sand, which has means between 1 and 2ϕ and unimodal distributions, is typically finely skewed to nearly symmetrical and generally contains little or no gravel and less than 1 percent fines (silt plus clay). The shoal crest is subjected to the highest energy levels relative to the other depositional environments because of its relief above the wave base and the surrounding basin floor of the Sound. Current ripples are ubiquitously present and reflect the constant reworking by tidal and storm currents. Shells and shell debris and, occasionally, fine-grained organics are concentrated in the ripple troughs. Scattered worm tubes and clam burrows (?) were observed in the bottom video.

Facies 2, which occurs in water depths of between 10 and 22 m and represents the transition from shallow to deeper water depositional conditions, is a shoal edge or front environment. Average slopes across this facies exceed 9° off the northern tip of the shoal. Sediments in this facies are typically composed of medium to fine grained, poorly to very poorly sorted sand (e.g. RP-17, RP-44, RP-49). Sediments coarsen westward and become more finely skewed and platykurtic eastward. Worm tubes and hermit crabs are more common in this environment than in the shoal crest facies. Shells and shell debris, which commonly fill the troughs of current ripples and armor the bottom, and were observed in the bottom video cascading downslope.

Facies 3 forms a basal apron around the shoal front. Inorganic sediments in this environment are poorly sorted, very fine grained silty sand and sand-silt-clay, which are strongly finely skewed and platykurtic (e.g. RP-23, RP-31). Biogenic debris, including clam (quahog and razor), welk, and snail shells and shell hash, comprise most of the bulk sediment, producing a clast-supported fabric. Rock crabs are common.

Facies 4, which occurs to the northwest and in a narrow band extending to the northeast of the Roanoke Point shoal, represents the basin floor environment in this portion of Long Island Sound. The sediments in facies 4 are generally very poorly sorted, bi-modal, nearly symmetrical to coarsely skewed, and mesokurtic to very platykurtic clayey silt (e.g. RP-9, RP-33, RP-41).

The basin floor facies is characterized by extensive bioturbation and a lower energy depositional environment that is below the wave base of the Sound. Evidence for transport is limited to faint current ripples, shallow scour features around shells, and a variegated appearance due to current-swept organics. Worm and amphipod tubes and shrimp and clam burrows are abundant in the heavily bioturbated bottom; spider crabs are common. Perhaps because of its less prominent shoreward location away from the strong tidal currents or because of its leeward location in the longshore transport regime behind Roanoke Point, but the shoal front and base facies off Jacobs Point are less well developed or absent, and the basin floor environment occurs closer to shore and at shallower depths.

Facies 5 is limited to the area just west of the shoal (e.g. RP-34, RP-40, RP-50) and to northeastern corner of the study area (e.g. RP-1, RP-2, RP-10) where stronger tidally-dominated currents alter the basin floor depositional environment. The sediments that characterize facies 5 are very poorly sorted sand and bimodal silty sand and sand-silt-clay. Current ripples are always more conspicuous here than in areas dominated by facies 4 and anemones are common component of the faunal assemblage in the northeastern part of the study area.

Interested parties can obtain copies of the grain-size analysis data, the associated statistics, and an explanation of the variable headings in ASCII format and on 3.5" diskettes for this and other bottom sampling and photographic studies completed as part of this series (Poppe and others, 1992; Poppe and others, 1995b; Poppe and others, 1996a, Poppe and others, 1996b) at the offices of the Coastal and Marine Geology Program of the U.S. Geological Survey in Woods Hole, Massachusetts or at the Long Island Sound Resource Center at Avery Point, Groton, Connecticut. Videotapes showing the bottom character of the station locations can be viewed at the offices of the U.S. Geological Survey in Woods Hole, Massachusetts.

ACKNOWLEDGMENTS

Collection and analysis of the samples was funded through a State of Connecticut/U.S. Geological Survey cooperative. We thank J. Commeau and R. Rendigs for reviewing this report, and Pete Simpson, Miles Peterle, Dave Simpson, and Mark Alexander (Connecticut Department of Environmental Protection) who provided support onshore and aboard the RV JOHN DEMPSEY.

REFERENCES

Duane, D.B., Field, M.E., Meisburger, E.P., Swift, D.P., and Williams, S.J., 1972, Linear shoals on the Atlantic inner continental shelf, Florida to Long Island: In D.P. Swift, D.B. Duane, and O.H. Pilkey (Eds.), Shelf Sediment Transport - Process and Pattern, Dowden, Hutchinson, and Ross, Stroudsburg, PA, Chapter 22, p. 447-498.

Davies, D.S., Axelrod, E.W., and O'Conner, J.S., 1973, Erosion of the north shore of Long Island: Marine Sciences Research Center, State University of New York Technical Report 18, 101 p.

Flint, R.F., and Gebert, J.A., 1976, Latest Laurentide ice sheet - new evidence from southern New England: Geological Society of America Bulletin, v. 87, p. 182-188.

Folk, R.L., 1974, The petrology of sedimentary rocks: Hemphill Publishing Co., Austin, 182 p.

Fuller, M.L., 1914, The geology of Long Island, New York: U.S. Geological Survey Professional Paper 82, 231 p.

Goldsmith, Richard, 1982, Recessional moraines and ice retreat in southeastern Connecticut: In G.J. Larson and B.D. Stone (editors), Late Wisconsinan Glaciation of New England, Kendall/Hunt Publishing, Dubuque, p. 61-76.

Gordon, R.B., 1980, The sedimentary system of Long Island Sound: Advances in Geophysics, v. 22, p. 1-36.

Grim, M.S., Drake, C.L., and Heirtzler, J.R., 1970, Subbottom study of Long Island Sound: Geological Society America Bulletin, v. 81, p. 649-666.

Koppleman, L.E., Weyl, P.K., Gross, M.G., and Davies, D.S., 1976, The Urban Sea: Long Island Sound: Praeger Special Studies - Design /Environmental Planning series, Praeger, New York, 223 p.

Lewis, R.S., and Needell, S.W., 1987, Maps showing the stratigraphic framework and quaternary geologic history of eastern Long Island Sound: U.S. Geological Survey Miscellaneous Field Studies Map MF-1939-A, 7 p., 3 sheets.

Lewis, R.S., and Stone, J.R., 1991, Late Quaternary stratigraphy and depositional history of the Long Island Sound basin: Connecticut and New York: Journal Coastal Research, Special Issue 11, p. 1-23.

Moffett, A.M., Poppe, L.J., and Lewis, R.S., 1994, Trace metal concentrations in sediments from eastern Long Island Sound: U.S. geological Survey Open-File Report 94-620, 17 p.

Needell, S.W., Lewis, R.S., and Colman, S.M., 1987, Maps showing the Quaternary geology of east-central Long Island Sound: U.S. Geological Survey Miscellaneous Field Studies Map MF-1939-B, 3 sheets.

Omholt, Thore, 1974, Effects of small groins on shoreline changes on the north shore of Suffolk County, New York: New York Ocean Sciences Laboratory technical Report No. 0028, 44 p.

Poppe, L.J., Eliason, A.H., and Fredericks, J.J., 1985, APSAS - An automated particle size analysis system: U.S. Geological Survey Circular 963, 77 p.

Poppe, L.J., Lewis, R.S., and Moffett, A.M., 1992, The texture of surficial sediments in northeastern Long Island Sound: U.S. Geological Survey Open-File Report 92-550, 13 p.

Poppe, L.J., Lewis, R.S., Quarrier, Sidney, Zajac, Roman, and Moffett, A.M., 1994, Map showing the distribution of surficial sediments in Fishers Island sound, New York, Connecticut, and Rhode Island: U.S. Geological Survey Miscellaneous Investigations Series Map I-2456, 1 sheet.

Poppe, L.J., Twichell, D.C., Lewis, R.S., and Zajac, R.N., 1995a, Sidescan sonar image and acoustic interpretation of the Long Island Sound seafloor off Hammonasset Beach State Park, Connecticut: Geological Society America, Abstracts with Programs, v. 27, p. 74-75.

Poppe, L.J., Harmon, A.E., Taylor, B.B., Blackwood, Dann, and Lewis, R.S., 1995b, The texture of surficial sediments in north-central Long Island Sound off Hammonasset Beach State Park, Connecticut: U.S. Geological Survey Open-File Report 95-556, 15 p.

Poppe. L.J., Taylor, B.B., Harmon, A.E., Zajac, R.N., Lewis, R.S., Blackwood, Dann, DiGiacamo-Cohen, M.L., 1996a, The texture of surficial sediments in western Long Island Sound off the Norwalk Islands, Connecticut: U.S. Geological Survey Open-File Report 96-08, 19 p.

Poppe, L.J., Taylor, B.B., Zajac, R.N., Lewis, R.S., Blackwood, Dann, DiGiacomo-Cohen, M.L., 1996b, The texture of surficial sediments in central Long Island Sound off Milford, Connecticut: U.S. Geological Survey 96-14, 20 p.

Poppe, L.J., Denny, J.F., Parolski, K.F., Lewis, R.S., and DiGiacomo-Cohen, M.L., 1996c, Sidescan sonar imagery of the Long Island Sound sea floor in Niantic Bay, Connecticut: EOS, v. 77, p. 146.

Poppe, L.J., Taylor, B.B., Blackwood, Dann, Lewis, R.S., and DiGiacomo-Cohen, M.L., 1996d, The texture of surficial sediments in eastern Long Island Sound near Niantic Bay: U.S. Geological Survey Open-File Report 96-271, 16 p.

Poppe, L.J., Lewis, R.S., Zajac, R.N., Twichell, D.C., Schmuck, E.A., Parolski, K.F., and DiGiacomo-Cohen, M.L., 1997, Sidescan sonar image, surficial geologic interpretation, and bathymetry of the Long Island Sound sea floor off Hammonasset Beach State Park, Connecticut: U.S. Geological Survey Geologic Investigations Map MF-2588, 2 sheets.

Schafer, J.P., and Hartshorn, J.H., 1965, The Quaternary of New England, In: Wright, H.E., and Frey, D.G., (eds.), The Quaternary of the United States: Princeton, N.J., Princeton University Press, p. 113-127.

Schlee, J., 1966, A modified Woods Hole rapid sediment analyzer: Journal Sedimentary Petrology, v. 30, p. 403-413.

Shepard, F.P., 1954, Nomenclature based on sand-silt-clay ratios: Journal Sedimentary Petrology, v. 24, p. 151-158.

Shepard, F.P., 1963, Submarine Geology: Harper and Rowe Publishers, New York, 557 p.

Shideler, G.L., 1976, A comparison of electronic particle counting and pipet techniques in routine mud analysis: Journal of Sedimentary Petrology, v. 42, p. 122-134.

Sirkin, L., 1967, Late-Pleistocene pollen stratigraphy of western Long Island and eastern Staten Island, New York: In E.J. Cushing and H.E. Wright (Eds.) Quaternary Paleoecology, Yale University Press, New Haven, 425 p.

Stone, J.R., Schafer, J.P., London, E.H., and Thompson, W.B., 1992, Surficial materials map of Connecticut: U.S. Geological Survey Surficial Materials Map, scale 1:125,000, 2 sheets.

Swift, D.P., Kofoel, J.W., Saulsbury, F.P., and Sears, Phillip, 1972, Holocene evolution of the shelf surface, central and southern shelf of North America: In D.J.P. Swift, D.B. Duane, and O.H. Pilkey (Eds.), Shelf Sediment Transport - Process and Pattern, Dowden, Hutchinson, and Ross, Stroudsburg, PA, Chapter 23, p. 499-574.

Twichell, D.C., Poppe, L.J., Zajac, Roman, and Lewis, R.S., 1995, Sidescan sonar survey of the Long Island Sound seafloor off Milford, Connecticut: Geological Society America Abstracts with Programs, v. 27, p. 88.

Twichell, D.C., Zajac, Roman, Poppe, L.J., Lewis, R.S., Cross, VeeAnn, and Nichols, David, 1997, Sidescan sonar image, surficial geological interpretation, and bathymetry of Long Island Sound off Norwalk, Connecticut: U.S. Geological Survey Geologic Investigations Map, 2 sheets.

U.S. Army Corps Engineers, 1969, North shore of Long Island, Suffolk County, New York, beach erosion control and interim hurricane study: New York District, New York, 271 p.

U.S. Army Corps of Engineers, 1975, Erosion and sedimentation: Planning Report of the New England River Basins Commission, Long Island Sound Regional Study, 64 p.

Wentworth, C.K., 1929, Method of computing mechanical composition of sediments: Geological Society of America Bulletin, v. 40, p. 771-790.

APPENDIX A

This table contains a list of the sample numbers, navigation (latitudes and longitudes) in degrees decimal minutes, water depths in meters, and comments on the bottom character. Stations are presented in chronological order.

SAMPLE	LATITUDE	LONGITUDE	DEPTH (M)	COMMENTS
RP-1	41d01.0030'	-72d38.3858'	18.8	RIPPLED, SCATTERED SHELLS AND DEBRIS, ANEMONES, WORM TUBES, BURROWS
RP-2	41d00.6401'	-72d38.4723'	18.5	FAINTLY RIPPLED, SCATTERED SHELLS AND DEBRIS, ANEMONES, WORM TUBES
RP-3	41d00.1874'	-72d38.5525'	20.9	BIOTURBATED, WORM TUBES, BURROWS, CRAB TRACKS
RP-4	40d59.7360'	-72d38.6056'	8.0	RIPPLED, SCATTERED QUAHOG SHELLS AND DEBRIS, BARNACLES ON SHELLS, ABUNDANT FINE GRAINED SEDIMENT (ORGANICS?) IN RIPPLE TROUGHS
RP-5	40d59.4776'	-72d38.6072'	7.6	RIPPLED, SCATTERED SHELLS, WORM TUBES, HERMIT CRABS, STARFISH, HYDROZOANS
RP-6	40d59.2914'	-72d39.3705'	5.2	RIPPLED, TRACE OF SHELL DEBRIS
RP-7	40d59.4457'	-72d39.6900'	10.4	RIPPLED, ABUNDANT FINE-GRAINED SEDIMENT (ORGANICS?) IN RIPPLE TROUGHS, HERMIT CRABS, BURROWS, WORM TUBES, HYDROZOANS
RP-8	40d59.7354'	-72d39.1784'	10.1	RIPPLED, SPONGES ON QUAHOG SHELLS, HERMIT CRABS,
RP-9	41d00.0010'	-72d39.1050'	19.2	NO VIDEO, SOME AMPHIPOD AND WORM TUBES
RP-10	41d00.8927'	-72d39.2832'	21.0	FAINTLY RIPPLED, BIOTURBATED, TRACE OF SHELL DEBRIS, ANEMONES, WORM TUBES, BURROWS, TRACKS
RP-11	41d00.5423'	-72d39.6099'	22.0	FAINTLY RIPPLED, BIOTURBATED, TRACE OF SHELL DEBRIS, ANEMONES, WORM TUBES, BURROWS, SPIDER CRABS
RP-12	41d00.2451'	-72d39.9562'	21.0	FAINTLY RIPPLED, BIOTURBATED, TRACE OF SHELL DEBRIS, ANEMONES, WORM TUBES, BURROWS, VARIGATED BOTTOM DUE TO CURRENT SWEPT ORGANIC DEBRIS (PLANKTON?)
RP-13	40d59.9717'	-72d39.9556'	14.8	RIPPLED, BIOTURBATED, TRACE OF SHELL DEBRIS, WORM TUBES, ROCK, SPIDER, AND HERMIT CRABS, TRACKS
RP-14	40d59.5898'	-72d39.8486'	11.4	RIPPLED, ABUNDANT FINE SEDIMENT (ORGANICS?) IN RIPPLE TROUGHS, TRACE OF SHELL DEBRIS, WORM TUBES, BURROWS
RP-15	40d59.3691'	-72d40.3653'	8.7	RIPPLED, ABUNDANT FINE SEDIMENT (ORGANICS?) IN RIPPLE TROUGHS, SCATTERED RAZOR AND QUAHOG SHELLS AND DEBRIS, WORM TUBES, BURROWS, HERMIT CRABS
RP-16	40d59.9134'	-72d40.7315'	8.2	RIPPLED, SHELL DEBRIS IN TROUGHS, BURROWS, NONDESCRIPT SEAWEED
RP-17	41d00.2015'	-72d40.4872'	15.0	FAINTLY RIPPLED, BIOTURBATED, TRACE OF RAZOR CLAM DEBRIS, WORM TUBES, BURROWS, ROCK CRABS, SNAILS
RP-18	41d00.7271'	-72d40.6118'	26.9	BIOTURBATED, HEAVILY BURROWED, SCATTERED SHELL DEBRIS, VARIGATED BOTTOM DUE TO CURRENT-SWEPT ORGANICS
RP-19	41d01.0252'	-72d40.5716'	25.4	BIOTURBATED, FAINT RIPPLES AND CURRENT SHADOWS AROUND LARGER GRAINS, TRACE OF SHELL DEBRIS, WORM TUBES, BURROWS
RP-20	41d00.9901'	-72d40.9358'	27.1	BIOTURBATED, FAINT RIPPLES AND CURRENT SHADOWS AROUND LARGER GRAINS, SOME SHELL DEBRIS, BURROWS

SAMPLE	LATITUDE	LONGITUDE	DEPTH (M)	COMMENTS
RP-21	41d00.9844'	-72d41.5348'	30.7	BIOTURBATED, FAINT RIPPLES AND CURRENT SHADOWS AROUND LARGER GRAINS, SCATTERED SHELL DEBRIS, WORM TUBES, BURROWS
RP-22	41d00.6474'	-72d41.6150'	36.6	BIOTURBATED, FAINT RIPPLES, SCATTERED SHELL DEBRIS, WORM TUBES
RP-23	41d00.3631'	-72d41.6812'	25.0	BASE OF SLOPE OFF SHOAL, ABUNDANT CLAM, WELK, AND SNAIL SHELLS, ROCK CRABS
RP-24	41d00.1753'	-72d41.2173'	7.9	RIPPLED, FINE-GRAINED SEDIMENT IN TROUGHS, TRACE OF QUAHOG SHELL DEBRIS
RP-25	41d00.0338'	-72d41.4387'	7.6	RIPPLED, SOME QUAHOG SHELLS AND DEBRIS, BURROWS, SHELLS AND FINES IN TROUGHS
RP-26	40d59.7074'	-72d41.4658'	6.7	RIPPLED, SCATTERED SHELL DEBRIS IN TROUGHS
RP-27	40d59.1075'	-72d41.4407'	5.1	RIPPLED, SCATTERED QUAHOG SHELLS AND DEBRIS
RP-28	40d59.6364'	-72d42.1128'	6.8	RIPPLED, SCATTERED SHELL DEBRIS IN TROUGHS, BURROWS, HYDROZOANS ON SHELLS
RP-29	40d59.9721'	-72d41.8860'	8.2	RIPPLED, SCATTERED QUAHOG SHELL DEBRIS IN TROUGHS, SNAILS, HERMIT CRABS
RP-30	41d00.1653'	-72d42.1441'	6.3	RIPPLED, SCATTERED SHELL DEBRIS IN TROUGHS, HERMIT CRABS
RP-31	41d00.6758'	-72d42.1513'	35.9	BIOTURBATED, FAINT RIPPLES, VENEER OF SAND OVER MUD, BURROWS
RP-32	41d00.9064'	-72d42.9316'	34.7	BIOTURBATED, FAINT RIPPLES AND CURRENT SHADOWS, TRACE OF SHELL DEBRIS, WORM TUBES, BURROWS, VENEER OF ORGANICS
RP-33	41d00.6020'	-72d42.8770'	35.7	BIOTURBATED, SCATTERED NUCLEA SHELL DEBRIS, HYDROZOANS ON SHELLS, WORM TUBES, BURROWS, THIN VENEER OF ORGANICS
RP-34	41d00.3680'	-72d42.6762'	31.1	FAINTLY RIPPLED, TRACE OF SHELL DEBRIS, WORM TUBES
RP-35	41d00.0774'	-72d42.7762'	15.0	SHOAL EDGE SLOPE, RIPPLED, ABUNDANT QUAHOG SHELLS AND DEBRIS APPEAR TO ARMOR BOTTOM, HERMIT CRABS
RP-36	40d59.7899'	-72d42.7525'	6.1	RIPPLED, SCATTERED SHELL DEBRIS, STARFISH
RP-37	40d59.2011'	-72d42.9064'	5.4	RIPPLED, FINE-GRAINED ORGANICS AND SCATTERED SHELL DEBRIS IN TROUGHS
RP-38	40d59.2036'	-72d43.5898'	12.5	RIPPLED, SOME SHELL DEBRIS, HERMIT CRABS
RP-39	40d59.5476'	-72d43.8758'	22.7	BIOTURBATED, FAINTLY RIPPLED, SOME SHELL DEBRIS, WORM TUBES, BURROWS, TRACKS
RP-40	40d59.9208'	-72d43.2944'	25.1	BIOTURBATED, FAINT CURRENT FEATURES, WORM TUBES, BURROWS, SNAILS, SHELL DEBRIS
RP-41	41d00.1043'	-72d43.9760'	28.8	BIOTURBATED, FAINT RIPPLES AND CURRENT SHADOWS, TRACE SHELL DEBRIS, WORM TUBES, BURROWS
RP-42	41d00.3763'	-72d43.5276'	32.3	BIOTURBATED, FAINTLY RIPPLED, SCATTERED SHELLS AND DEBRIS, WORM TUBES, BURROWS
RP-43	41d00.7363'	-72d43.9435'	31.9	BIOTURBATED, WORM TUBES, VARIEGATED BOTTOM DUE TO CURRENT-SWEPT DARKER ORGANICS AND LIGHTER SEDIMENT
RP-44	41d00.3410'	-72d41.6976'	20.4	SHOAL EDGE, RIPPLED, ABUNDANT SHELL DEBRIS IN TROUGHS, HERMIT CRABS
RP-45	41d00.2060'	-72d42.4678'	18.5	SHOAL EDGE SLOPE, RIPPLED, TROUGHS MOSTLY FILLED WITH SHELLS AND DEBRIS
RP-46	41d00.5231'	-72d40.9504'	35.2	BIOTURBATED, THIN SAND LAYER SAND OVER MUD, WORM TUBES, BURROWS, VARIGATED BOTTOM DUE TO CURRENT SWEPT ORGANICS
RP-47	40d59.3130'	-72d40.9829'	8.1	RIPPLED, FINE-GRAINED SEDIMENT CONCENTRATED IN TROUGHS, SCATTERED SHELLS AND DEBRIS, HERMIT CRABS
RP-48	40d59.4732'	-72d42.0025'	6.8	RIPPLED, SCATTERED QUAHOG SHELLS AND DEBRIS IN TROUGHS
RP-49	40d59.6384'	-72d43.2190'	14.5	FAINTLY RIPPLED, SOME SHELL DEBRIS, ABUNDANT HERMIT CRABS
RP-50	40d59.7414'	-72d43.3483'	23.4	POOR VIDEO, BIOTURBATED, WORM TUBES, BURROWS

APPENDIX B

This table contains the relative grain-size frequency distributions by weight in whole phi units for each sample. The -5ϕ fraction contains all sediment coarser than 32 mm; the 11ϕ fraction contains sediment with diameters between .001 and .00072 mm.

	CLAY				SILT			SAND					GRAVEL				
SAMPLE NUMBER	11ϕ	10ϕ	9ϕ	8ϕ	7ϕ	6ϕ	5ϕ	4ϕ	3ϕ	2ϕ	1ϕ	0ϕ	-1ϕ	-2ϕ	-3ϕ	-4ϕ	-5ϕ
RP-1	3.50	4.98	6.40	6.42	6.77	5.30	6.64	48.41	11.58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP-2	8.45	8.85	11.33	12.14	12.93	10.48	10.36	24.24	1.22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP-3	5.85	13.05	17.59	20.08	17.92	4.99	5.66	13.64	0.88	0.14	0.12	0.09	0.0	0.0	0.0	0.0	0.0
RP-4	0.02	0.03	0.04	0.05	0.05	0.05	0.04	1.10	19.75	70.91	6.38	1.60	0.0	0.0	0.0	0.0	0.0
RP-5	0.03	0.05	0.06	0.07	0.07	0.08	0.06	1.29	8.86	44.71	43.82	0.90	0.0	0.0	0.0	0.0	0.0
RP-6	0.0	0.01	0.02	0.02	0.03	0.03	0.02	0.90	8.29	57.32	32.85	0.50	0.0	0.0	0.0	0.0	0.0
RP-7	0.09	0.19	0.20	0.20	0.20	0.20	0.17	24.29	60.33	13.63	0.49	0.0	0.0	0.0	0.0	0.0	0.0
RP-8	0.05	0.08	0.09	0.09	0.12	0.09	0.06	2.29	4.08	40.27	52.79	0.0	0.0	0.0	0.0	0.0	0.0
RP-9	4.36	11.07	14.67	16.20	16.92	14.35	6.21	12.88	2.77	0.29	0.23	0.04	0.0	0.0	0.0	0.0	0.0
RP-10	4.33	10.70	13.66	12.40	12.12	9.68	4.12	30.49	2.51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP-11	3.87	10.41	14.52	17.60	17.45	10.44	9.46	14.41	1.23	0.22	0.30	0.10	0.0	0.0	0.0	0.0	0.0
RP-12	5.46	9.90	12.50	12.93	12.24	6.78	9.24	28.41	2.29	0.0	0.25	0.0	0.0	0.0	0.0	0.0	0.0
RP-13	1.53	2.12	2.43	2.45	2.51	1.33	0.55	11.32	31.44	40.14	3.13	1.04	0.0	0.0	0.0	0.0	0.0
RP-14	0.22	0.47	0.52	0.48	0.45	0.42	0.19	20.13	63.89	12.35	0.0	0.88	0.0	0.0	0.0	0.0	0.0
RP-15	0.02	0.04	0.05	0.07	0.08	0.07	0.05	2.69	19.42	40.34	36.26	0.90	0.0	0.0	0.0	0.0	0.0
RP-16	0.03	0.06	0.07	0.08	0.09	0.10	0.09	1.49	38.50	49.74	9.75	0.0	0.0	0.0	0.0	0.0	0.0
RP-17	1.14	3.19	4.06	3.75	2.86	0.99	0.22	8.30	26.65	38.46	8.88	1.51	0.0	0.0	0.0	0.0	0.0
RP-18	6.30	15.05	18.47	18.48	12.05	6.37	5.61	16.43	0.73	0.17	0.19	0.15	0.0	0.0	0.0	0.0	0.0
RP-19	3.88	9.70	12.55	13.50	12.70	8.66	4.67	31.93	2.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP-20	4.14	11.62	15.32	16.11	16.17	8.97	3.54	22.72	0.70	0.70	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP-21	3.71	9.73	12.97	12.46	11.49	8.45	14.28	25.58	1.32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RP-22	2.42	6.59	9.01	10.35	10.03	6.01	5.92	13.17	6.31	14.46	14.66	1.09	0.0	0.0	0.0	0.0	0.0
RP-23	2.03	4.55	5.81	6.15	6.70	4.57	4.27	16.55	33.82	14.90	0.0	0.66	0.0	0.0	0.0	0.0	0.0
RP-24	0.02	0.04	0.05	0.05	0.06	0.07	0.09	0.10	12.92	42.81	40.14	2.66	0.99	0.0	0.0	0.0	0.0

SAMPLE NUMBER	CLAY 11ϕ	10ϕ	9ϕ	SILT 8ϕ	7ϕ	6ϕ	5ϕ	SAND 4ϕ	3ϕ	2ϕ	1ϕ	0ϕ	GRAVEL -1ϕ	-2ϕ	-3ϕ	-4ϕ	-5ϕ
RP-25	0.01	0.02	0.02	0.03	0.04	0.05	0.06	0.50	6.59	39.51	50.99	2.20	0.0	0.0	0.0	0.0	0.0
RP-26	0.03	0.06	0.08	0.10	0.12	0.16	0.17	1.39	6.16	36.24	54.61	0.89	0.0	0.0	0.0	0.0	0.0
RP-27	0.01	0.02	0.03	0.05	0.06	0.07	0.04	0.0	4.89	37.99	54.14	2.69	0.0	0.0	0.0	0.0	0.0
RP-28	0.02	0.03	0.04	0.06	0.06	0.07	0.06	0.0	13.45	56.10	27.80	2.29	0.0	0.0	0.0	0.0	0.0
RP-29	0.04	0.07	0.09	0.10	0.11	0.12	0.08	0.50	9.74	48.70	39.06	1.39	0.0	0.0	0.0	0.0	0.0
RP-30	0.01	0.02	0.03	0.04	0.05	0.06	0.06	0.0	12.17	52.26	35.30	0.0	0.0	0.0	0.0	0.0	0.0
RP-31	3.03	7.31	10.43	11.79	11.49	6.32	2.82	11.70	7.77	20.22	6.93	0.19	0.0	0.0	0.0	0.0	0.0
RP-32	4.39	11.38	15.95	17.91	18.92	17.30	7.09	5.85	0.48	0.28	0.29	0.15	0.0	0.0	0.0	0.0	0.0
RP-33	5.88	10.51	14.36	15.83	15.70	12.96	6.32	10.92	2.09	2.67	1.47	0.66	0.63	0.0	0.0	0.0	0.0
RP-34	0.50	1.51	2.67	3.41	3.85	3.27	1.98	9.28	22.61	39.83	9.44	1.66	0.0	0.0	0.0	0.0	0.0
RP-35	0.25	0.57	0.61	0.67	0.61	0.56	3.75	7.01	27.66	56.19	1.44	0.0	0.0	0.0	0.0	0.0	0.0
RP-36	0.01	0.02	0.03	0.04	0.04	0.04	0.07	0.07	4.49	53.86	40.10	1.30	0.0	0.0	0.0	0.0	0.0
RP-37	0.01	0.03	0.04	0.05	0.06	0.06	0.05	0.10	14.76	50.06	31.01	3.79	0.0	0.0	0.0	0.0	0.0
RP-38	0.18	0.43	0.51	0.54	0.54	0.51	0.33	15.71	19.78	23.27	36.84	1.36	0.0	0.0	0.0	0.0	0.0
RP-39	4.35	11.47	16.12	18.44	18.44	11.76	2.91	10.41	2.67	1.44	1.14	0.86	0.0	0.0	0.0	0.0	0.0
RP-40	1.05	2.64	3.51	3.53	3.34	2.45	2.26	16.57	18.20	40.62	5.85	0.0	0.0	0.0	0.0	0.0	0.0
RP-41	4.14	10.92	15.31	17.39	18.65	13.41	3.75	10.13	2.05	1.56	1.35	1.34	0.0	0.0	0.0	0.0	0.0
RP-42	2.98	7.19	10.17	11.76	13.29	12.08	7.09	13.40	8.86	11.91	1.28	0.0	0.0	0.0	0.0	0.0	0.0
RP-43	4.13	11.48	15.89	18.52	20.06	17.37	6.21	4.58	0.66	0.37	0.33	0.41	0.0	0.0	0.0	0.0	0.0
RP-44	0.11	0.25	0.30	0.29	0.28	0.32	0.40	1.47	26.67	49.91	17.65	2.35	0.0	0.0	0.0	0.0	0.0
RP-45	0.04	0.09	0.10	0.11	0.13	0.14	0.15	0.60	11.02	72.15	13.99	1.49	0.0	0.0	0.0	0.0	0.0
RP-46	2.27	6.18	8.89	10.70	10.74	5.27	6.21	19.00	5.42	16.96	7.26	1.09	0.0	0.0	0.0	0.0	0.0
RP-47	0.02	0.04	0.05	0.06	0.06	0.07	0.08	2.59	19.72	48.31	28.19	0.80	0.0	0.0	0.0	0.0	0.0
RP-48	0.01	0.02	0.03	0.05	0.05	0.06	0.05	0.50	4.49	73.70	19.65	1.50	0.0	0.0	0.0	0.0	0.0
RP-49	0.23	0.51	0.58	0.59	0.60	0.52	0.49	4.44	11.19	30.78	48.73	1.35	0.0	0.0	0.0	0.0	0.0
RP-50	1.96	5.13	6.87	7.04	7.16	6.50	2.44	30.76	19.31	9.31	2.83	0.69	0.0	0.0	0.0	0.0	0.0

APPENDIX C

This table contains the sample weight analyzed, percent gravel (>2.0 mm), percent sand (2.0 mm>x>0.062 mm), percent silt (0.063 mm>x>0.004 mm), percent clay (<0.004 mm), the verbal-equivalent sediment classification (Shepard, 1954), and the related method of moments statistics for each sample. Modes are given in the middle of whole phi intervals.

SAMPLE NUMBER	WEIGHT (GRAMS)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT	PERCENT CLAY	SEDIMENT CLASS	MEDIAN (Φ)	MEAN (Φ)	STANDARD DEVIATION	SKEWNESS	KURTOSIS	MODE 1 (Φ)	MODE 2 (Φ)	MODE 3 (Φ)
RP-1	33.0608	0.00	59.99	25.14	14.88	SILTY SAND	3.79	4.88	2.27	0.55	-0.17	3.5	6.5	
RP-2	26.3320	0.00	25.46	45.91	28.63	SAND-SILT-CLAY	6.29	6.36	2.35	0.11	-1.24	3.5	6.5	
RP-3	23.6990	0.00	14.86	48.66	36.48	CLAYEY SILT	7.33	7.05	2.10	-0.23	-0.61	7.5	3.5	
RP-4	39.8710	0.00	99.73	0.19	0.09	SAND	1.59	1.64	0.60	1.23	32.52	1.5		
RP-5	42.1500	0.00	99.58	0.28	0.14	SAND	1.12	1.18	0.76	1.51	23.49	1.5		
RP-6	40.7878	0.00	99.86	0.11	0.03	SAND	1.29	1.27	0.61	0.80	13.36	1.5		
RP-7	38.2424	0.00	99.75	0.78	0.47	SAND	2.59	2.66	0.79	1.75	27.29	2.5		
RP-8	38.8084	0.00	99.42	0.36	0.22	SAND	0.95	1.09	0.79	2.15	33.34	0.5		
RP-9	23.4952	0.00	16.21	53.68	30.10	CLAYEY SILT	6.78	6.67	2.12	-0.11	-0.76	6.5	3.5	
RP-10	26.9164	0.00	32.99	38.32	28.69	SAND-SILT-CLAY	6.26	6.20	2.36	0.07	-1.38	3.5	8.5	
RP-11	24.5015	0.00	16.26	54.94	28.80	CLAYEY SILT	6.79	6.62	2.10	-0.10	-0.77	7.5	3.5	
RP-12	26.1799	0.00	30.94	41.20	27.86	SAND-SILT-CLAY	6.25	6.18	2.38	0.09	-1.30	3.5	7.5	
RP-13	36.9850	0.00	87.08	6.84	6.08	SAND	2.18	2.81	2.15	1.02	3.60	1.5		
RP-14	37.4311	0.00	97.25	1.55	1.20	SAND	2.58	2.69	1.04	1.80	21.58	2.5		
RP-15	42.5364	0.00	99.61	0.27	0.12	SAND	1.32	1.39	0.86	0.89	10.53	1.5		
RP-16	38.9215	0.00	99.49	0.36	0.15	SAND	1.81	1.83	0.71	1.19	22.54	1.5		
RP-17	36.5238	0.00	83.79	7.82	8.39	SAND	2.04	2.87	2.45	0.82	1.66	1.5		
RP-18	21.2304	0.00	17.67	42.51	39.82	CLAYEY SILT	7.45	7.03	2.23	-0.22	-0.83	7.5	3.5	
RP-19	26.8328	0.00	34.33	39.53	26.14	SAND-SILT-CLAY	6.18	6.10	2.33	0.09	-1.35	3.5	7.5	
RP-20	26.4562	0.00	24.12	44.79	31.09	SAND-SILT-CLAY	6.83	6.58	2.23	-0.08	-1.14	3.5	6.5	
RP-21	27.4362	0.00	26.90	46.69	26.42	SAND-SILT-CLAY	6.03	6.13	2.25	0.13	-1.30	3.5	8.5	
RP-22	29.2340	0.00	49.68	32.30	18.01	SILTY SAND	4.05	4.57	3.09	0.09	-1.29	0.5	3.5	7.5
RP-23	28.1502	0.00	65.92	21.69	12.39	SILTY SAND	3.04	4.12	2.54	0.48	-0.31	2.5	6.5	
RP-24	40.9223	0.99	98.63	0.27	0.10	SAND	1.14	1.17	0.81	0.73	13.77	1.5		
RP-25	41.7431	0.00	99.78	0.17	0.05	SAND	0.94	1.03	0.67	1.07	15.90	0.5		
RP-26	39.9690	0.00	98.28	0.55	0.16	SAND	0.90	1.06	0.79	1.87	26.77	0.5		
RP-27	41.0219	0.00	99.71	0.23	0.07	SAND	0.87	0.97	0.65	1.46	26.62	0.5		
RP-28	38.6875	0.00	99.65	0.26	0.09	SAND	1.35	1.33	0.71	0.95	19.58	1.5		

SAMPLE NUMBER	WEIGHT (GRAMS)	PERCENT GRAVEL	PERCENT SAND	PRECENT SILT	PRECENT CLAY	SEDIMENT CLASS	MEDIAN (ϕ)	MEAN (ϕ)	STANDARD DEVIATION	SKEWNESS	KURTOSIS	MODE 1 (ϕ)	MODE 2 (ϕ)	MODE 3 (ϕ)
RP-29	40.3589	0.00	99.38	0.42	0.20	SAND	1.20	1.18	0.79	1.71	28.57	1.5		
RP-30	40.3016	0.00	99.72	0.21	0.07	SAND	1.28	1.28	0.65	1.12	19.63	1.5		
RP-31	29.1734	0.00	46.81	32.42	20.77	SAND	5.06	4.95	3.05	0.05	-1.40	1.5	7.5	3.5
RP-32	21.8207	0.00	7.05	61.23	31.72	CLAYEY SILT	6.98	6.96	1.88	-0.14	-0.10	6.5		
RP-33	23.1153	0.63	17.81	50.81	30.75	CLAYEY SILT	6.78	6.51	2.48	-0.30	0.06	7.5	3.5	
RP-34	37.0186	0.00	82.82	12.51	4.68	SAND	1.98	2.72	2.18	0.80	1.89	1.5		
RP-35	37.7513	0.00	96.05	2.52	1.43	SAND	0.86	1.28	1.46	1.74	14.28	0.5		
RP-36	40.0966	0.00	99.74	0.20	0.06	SAND	1.16	1.13	0.59	1.29	29.77	1.5		
RP-37	40.1941	0.00	99.72	0.21	0.08	SAND	1.30	1.28	0.76	0.66	12.63	1.5		
RP-38	39.5951	0.00	96.96	1.91	1.13	SAND	1.51	1.79	1.48	1.00	6.82	0.5		
RP-39	21.8014	0.00	16.52	51.55	31.94	CLAYEY SILT	7.02	6.73	2.28	-0.35	0.20	6.5	3.5	
RP-40	35.7691	0.00	81.23	11.57	7.20	SAND	2.19	3.05	2.32	0.78	1.52	1.5		
RP-41	22.4316	0.00	16.43	53.19	30.38	CLAYEY SILT	6.88	6.63	2.32	-0.36	0.34	6.5	3.5	
RP-42	25.6604	0.00	35.46	44.22	20.33	SAND-SILT-CLAY	5.62	5.46	2.64	0.00	-1.11	3.5	6.5	1.5
RP-43	22.2485	0.00	6.35	62.14	31.50	CLAYEY SILT	7.00	6.98	1.88	-0.23	0.55	6.5		
RP-44	37.6484	0.00	98.05	1.29	0.65	SAND	1.60	1.68	1.07	1.54	19.25	1.5		
RP-45	36.9600	0.00	99.25	0.52	0.23	SAND	1.48	1.46	0.70	2.19	44.72	1.5		
RP-46	29.1543	0.00	49.73	32.92	17.34	SILTY SAND	4.04	4.74	2.91	0.10	-1.19	3.5	1.5	6.5
RP-47	40.0128	0.00	99.60	0.28	0.12	SAND	1.44	1.47	0.81	0.90	12.37	1.5		
RP-48	39.1927	0.00	99.73	0.21	0.06	SAND	1.39	1.34	0.54	1.44	44.30	1.5		
RP-49	39.8020	0.00	96.49	2.19	1.31	SAND	1.00	1.39	1.42	1.62	13.52	0.5		
RP-50	26.9441	0.00	62.91	23.14	13.96	SILTY SAND	3.58	4.45	2.56	0.35	-0.57	3.5	6.5	