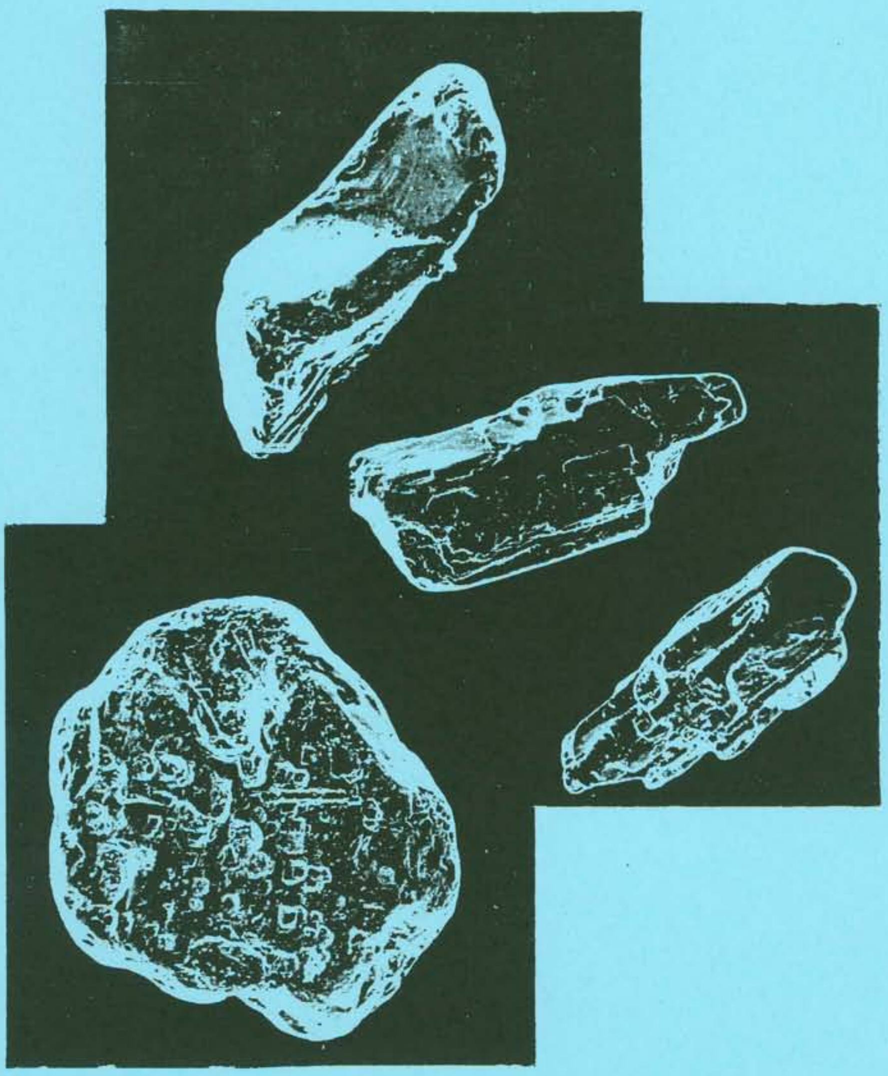
New Jersey Geological Survey
Open-File Report OFR 91-3

Preliminary Textural and Mineralogical Analyses of Vibracore Samples Collected Between Absecon and Barnegat Inlets, New Jersey



N.J. Department of Environmental Protection - Division of Science and Research

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Cover illustration: Scanning electron photomicrographs of three heavy-mineral phases from sediments collected on the Atlantic Continental Shelf offshore of New Jersey. Clockwise from the top, they are ilmenite (magnification = 120x), amphibole (magnification = 50x) and garnet (magnification = 90x). Photomicrographs taken by Frederick L. Muller on the ETEC scanning electron microscope, Ceramics Department, College of Engineering, Rutgers University.

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Preliminary Textural and Mineralogic Analyses of Vibracore Samples Collected Between Absecon and Barnegat Inlets, New Jersey

by

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Preliminary Textural and Mineralogic Analyses of Vibracore Samples Collected Between Absecon and Barnegat Inlets, New Jersey

ABSTRACT

Textural and mineralogical analyses of 119 samples from 65 vibracores were made in order to assess the sand, gravel and heavy-mineral resource potential of the Inner Continental Shelf offshore from Absecon Inlet to Barnegat Inlet, New Jersey. These data may help delineate areas where more thorough investigation is warranted.

The average heavy-mineral content of the vibracore samples is 1.9 weight percent, with a standard deviation of 2.1. The average heavy-mineral content recovered by the techniques of this analysis is 1.2 weight percent, with a standard deviation of 1.1.

The economically important heavy minerals, here defined as ilmenite (including altered ilmenite) + rutile + zircon + monazite + aluminosilicates (sillimanite, kyanite, andalusite), comprise on average 1.0 weight percent of the bulk sample with a standard deviation of 0.96. Thirteen samples from eight sites have concentrations of economically important heavy minerals exceeding 2 percent.

INTRODUCTION

A study by the New Jersey Geological Survey disclosed a significant economic heavy minerals province in the Coastal Plain of New Jersey (Markewicz and others, 1958). Exploration by industry subsequently proved two deposits to be economic and both were mined between 1960 and 1981. The occurrence of heavy minerals onshore suggests that similar deposits also may occur offshore if equivalent coastal plain strata extend seaward.

This report presents the results of textural and mineralogical analyses of vibracore samples made to assess the sand, gravel and heavy-mineral-resource potential of part of the Inner Continental Shelf in water depths of as much as 27 meters [1 meter (m) = 39.37 inches], extending as far as 22 kilometers [1 kilometer (km) = 0.622 mile] offshore of southern New Jersey (fig.1).

Grain-size distribution, mineralogy and heavy-mineral concentrations were determined for 119 samples taken from 65 vibracores collected by the U.S. Army Corps of Engineers.

The purpose of sampling by the Army Corps was to locate sand and gravel deposits on the Inner Atlantic Continental Shelf as possible sources of fill material for beach reclamation (Meisburger and Williams, 1982; Grosz, 1987). Sample locations are clustered in nearshore areas on and near shoals where seismic data had indicated sufficient thicknesses of sediments to suggest potential borrow sites. Heavy-mineral resource assessment was not an objective of the Corps' sampling. A total of about 200 vibracores was collected by the Corps offshore of New Jersey from Barnegat to Avalon. The 65 cores analyzed in this study were collected from Absecon Inlet to Barnegat Inlet (fig. 1). Although the geographic extent of the core sampling is limited, the data from this reconnaissance study, including information on texture and composition, may help delineate areas where more thorough investigation is warranted.

In contrast to data given by Grosz and others (1989a) on the mineralogy and texture of surficial sediments collected using a grab sampler, the vibracore samples provide information on the shallow subsurface to a depth of approximately six meters. It is thus possible to analyze for changes in heavy-mineral grade and composition with depth by use of vibracore samples.

LABORATORY PROCEDURES

The samples were analyzed according to the method of Grosz and others (1990). The 65 vibracores were split lengthwise, described, photographed, sampled for archival material and for peat and shell material where present (for age dating). Vibracores were divided into 119 samples. Divisions were at conspicuous changes in sediment type or at intervals no greater than 239 centimeters [1 centimeter (cm) = 0.39 inch] where sediment appeared to be uniform throughout the length of the core. The lengths of individual samples averaged 117 cm and ranged from 20 to 239 cm (table 1). These samples were then split into subsamples for repository storage and component analysis. The gravel fraction [>2.00 mm, (1mm = 0.039 inch)] was removed by wet sieving through a 10-mesh U.S. standard stainless steel sieve and weighed.

For each sample, a heavy-mineral concentrate was separated from the <2-mm-size fraction by use of a three-turn spiral concentrator. These concentrates were further refined using tetrabromoethane (specific gravity of 2.96). A 75-percent volume split of the heavy-liquid sink fraction was retained for mineralogic analyses. The balance was archived. An aliquot [averaging 317 grams, 1 gram (g) = 0.035 ounces] of homogenized sediment was grab-sampled from the material rejected by the spiral

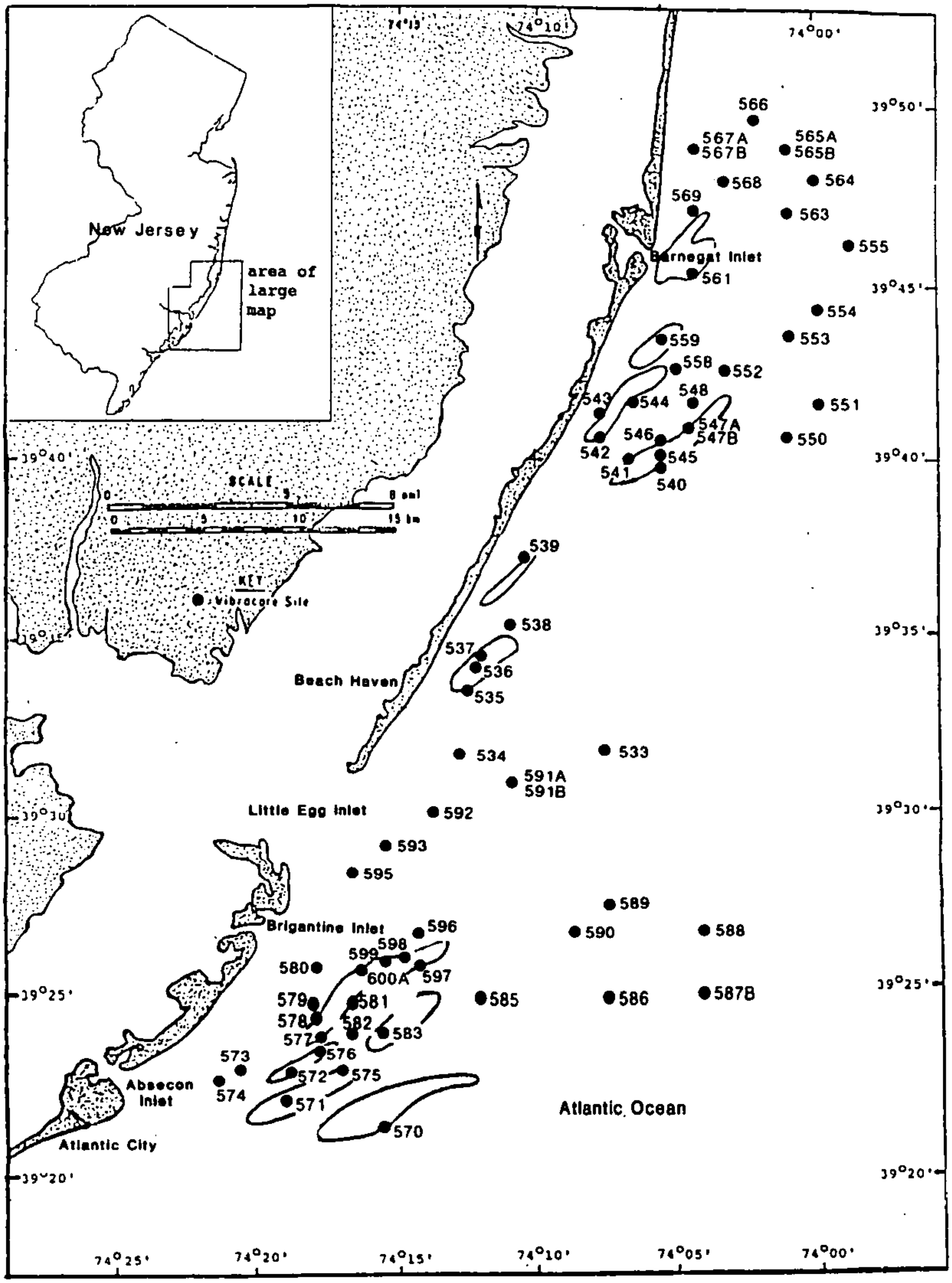

Figure 1. Map of the shelf area between Absecon andBarnegat Inlets showing shoals (elongate pods indicated in solid line offshore of the barrier islands) in which the vibracores were collected. The numbers correspond to the sample numbers in table 1. Inset shows location of study area in southern New Jersey (modified from Meisberger and Williams, 1982).

concentrator (spiral gangue) and processed in heavy liquids in the same manner as the spiral concentrates. The heavy fraction from this step was then analyzed to produce an estimate of the percentage of each heavy-mineral phase not recovered by the spiral concentrator.

To aid the mineralogic analyses, the samples were separated into six magnetic fractions by use of a Frantz magnetic barrier laboratory separator. The ferromagnetic constituents, primarily magnetite, ilmenite and pyroboles (undifferentiated pyroxenes and amphiboles), were collected in the first magnetic fraction. The remainder was processed at increasing magnetic field strengths with current settings ranging from 0.20 to 1.80 amperes (A) in order to segregate species of similar magnetic susceptibility.

The second fraction (magnetic at 0.20A) is dominated by three phases: ilmenite, garnet and pyroboles. The third fraction (magnetic at 0.40A) typically contains the largest volume of heavy minerals and has the most diverse grouping of heavy minerals. These include ilmenite, garnet, pyroboles, tourmaline, epidote and leucoxene (a phase of altered ilmenite). The fourth fraction (magnetic at 0.60A) is dominated by pyroboles, tourmaline, leucoxene, staurolite, and contains less ilmenite than the second and third fractions. The fifth fraction (magnetic at 1.80A) is dominated by leucoxene and the aluminosilicates (primarily sillimanite, kyanite and andalusite). The sixth fraction is the residuum, that is, phases not susceptible at 1.80A. The dominant mineral constituents in this fraction are the aluminosilicates, leucoxene, zircon and rutile.

Each subfraction was weighed and studied independently with petrographic and binocular microscopes. Comparison charts (Terry and Chillingar, 1955) and point counting were utilized to estimate mineral abundances in each magnetic fraction. The identification of zircon and monazite was aided by the use of long- and short-wave ultraviolet illumination. Data for individual mineral phases in each magnetic subfraction were summed and calculated as weight percentages of the total heavy-mineral fraction. Densities were not compensated for by this method. The data are given in table 1.

RESULTS AND DISCUSSION

GRAVEL

Preliminary data on the gravel content are given in table 1. Three values are provided:

weight percent >2 mm	(total gravel)
weight percent >6.4 mm	(coarse gravel)
weight percent >2 mm and <6.4 mm	(fine gravel)

The gravel fraction of these samples consists largely of shell material and quartz grains. A more detailed mineralogical analysis of the gravel fraction of the vibracores will be presented in a future report.

HEAVY MINERALS

Data are reported in two forms for each mineral (table 1). RHM (the weight percentage of recovered heavy minerals) was calculated following procedures in Grosz and others (1990) on the basis of the spiral concentrate/heavy liquid process only. THM (the total heavy minerals weight percentage) was calculated from data on the materials rejected by the spiral concentrator (spiral gangue) and from the heavy minerals recovered by the spiral/heavy-liquid method (RHM).

For the economically important heavy minerals (EHM: the sum of ilmenite + leucoxene + rutile + zircon + monazite + aluminosilicates), the THM value averages within 6 percent of the RHM value, indicating that the recovery methods were effective. A comparison of THM and RHM values for the individual phases is shown in figure 2. Figure 2a shows these values with all the TiO_2 phases grouped together; figure 2b shows values for ilmenite, leucoxene and rutile.

In table 1, note that the weight percents of the individual phases are for the RHM and THM concentrates as labeled and *not* a weight percent of the bulk.

Although quartz is not a heavy mineral, it is included in the data because of quartz contamination of the heavy-mineral concentrate in five samples.

Statistical measurements for heavy mineral concentrations are (as weight percent of the bulk):

	Average	Standard deviation	Median	Range
THM	1.9	2.1	1.3	0.3 - 13.49
RHM	1.2	1.1	0.9	0.03 - 8.16
EHM	1.0	0.96	0.7	0.1 - 6.44

ECONOMIC HEAVY MINERALS

Concentrations of economically important heavy minerals average 1.0 weight percent. Thirteen samples from eight sites have concentrations of economically important minerals exceeding 2 percent by weight. Individual economic heavy minerals as percentages of THM are:

	Average	Standard deviation	Median	Range
Ilmenite	32.9	11.1	33.2	0.7 - 59.6
Leucoxene	8.0	5.4	6.9	ND* - 34.7
Zircon	3.5	2.2	3.2	0.1 - 10.6
Rutile	0.2	0.2	0.1	ND* - 0.9
Monazite	0.8	0.7	0.7	ND* - 4.4
Aluminosilicates	8.3	5.4	6.8	1.4 - 26.8

**ND indicates not detected or <0.1 weight percent*

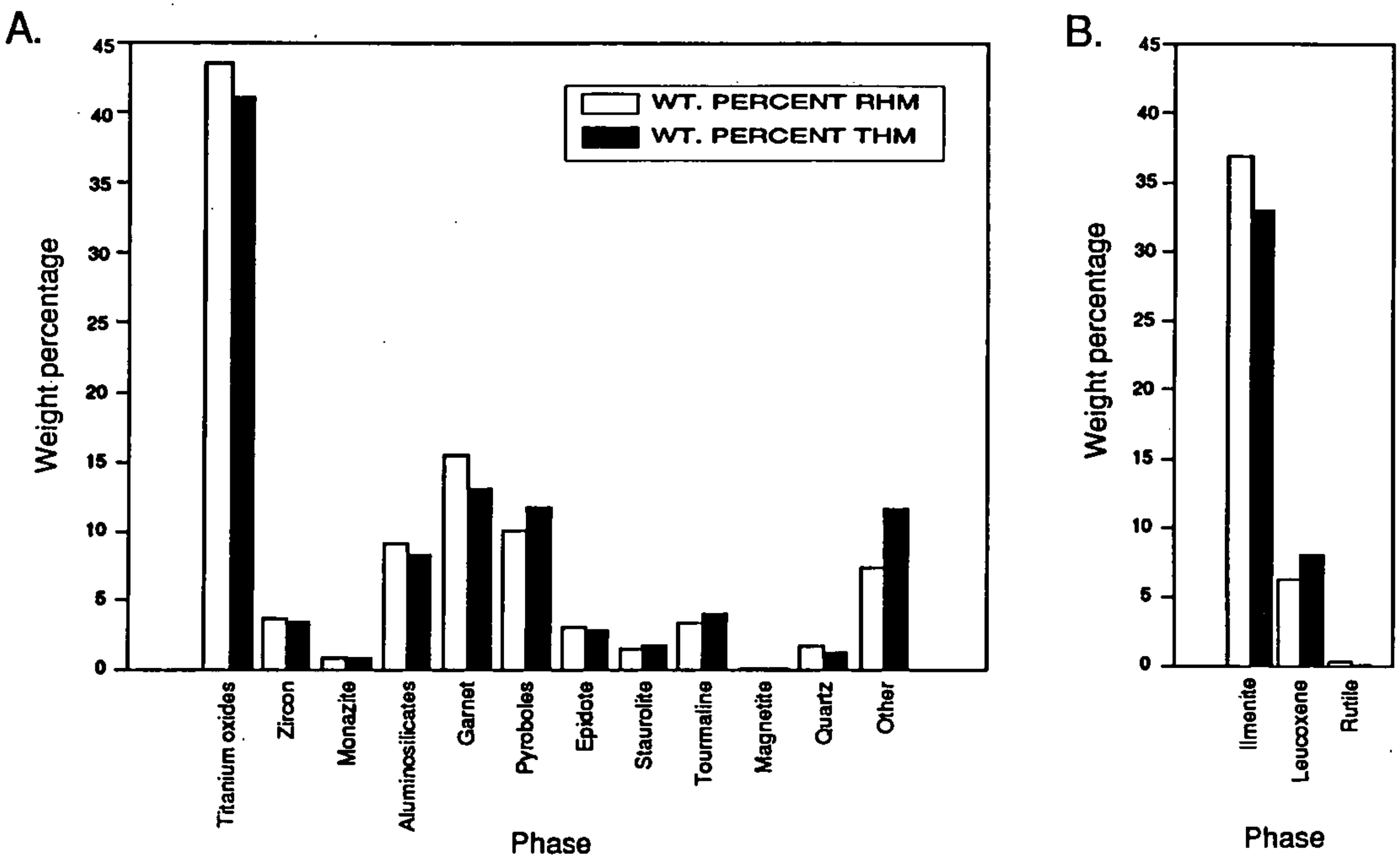

Figure 2. A. Histogram showing weight percentages of phases in the THM and RHM heavy-mineral suites; ilmenite, leucoxene, and rutile grouped as titanium oxides. B. Weight percentages of the individual titanium oxide phases (ilmenite, leucoxene and rutile) in the THM and RHM heavy-mineral suites.

Stoichiometric ilmenite, found mainly in the first two magnetic fractions, averaged 18.7 weight percent of the total heavy minerals (THM), with a standard deviation of 6.8. Altered ilmenite (excluding leucoxene, which was analyzed separately from other altered ilmenite in this study), found mainly in the third, fourth, fifth and sixth magnetic fractions, averaged 14.2 weight percent of the THM, with a standard deviation of 8.9.

Variability in the amount of heavy minerals per sample is high among the vibracores, as it was among the grab samples (Grosz and others, 1989a). Initial review of variability of heavy mineral content with depth (in the upper, middle and lower sections of the cores) shows as much as a 4-fold difference in EHM amounts with depth. However, there is not a clear trend of increase or decrease of heavy-mineral content with depth.

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Table 1. Textural and mineralogical data for 119 vibracore samples.

Sample number[1]	CERC number[2]	Longitude W	Latitude N	Water depth (m)[3]	Interval sampled: Top[4]	Interval sampled: Bottom[4]	Core length[5] (cm)	Bulk weight (g)	Gravel content (weight percent of bulk): >2.00 mm	>6.4 mm	>2.00, <6.4 mm	Total heavy-mineral content (weight percent of bulk): RHM[6]	THM[6]	EHM	Ilmenite RHM	Ilmenite THM	Leucoxene RHM	Leucoxene THM	Zircon RHM	Zircon THM	Rutile RHM	Rutile THM
															Phase (weight percent of RHM or THM concentrate as indicated)							
533.1	89	-74.12230	39.52649	18	0	145	145	9552	2.8	0.8	2.0	0.28	0.88	0.32	29.9	30.0	3.2	4.5	2.6	0.7	0.3	0.1
533.2		-74.12230	39.52649		145	310	165	11588	4.0	0.0[7]	4.0	0.08	0.39	0.15	27.9	29.6	2.6	4.5	1.4	0.3	0.2	0.0
534.1	67	-74.20850	39.52701	16	0	152	152	10099	0.6	0.0	0.6	0.42	0.97	0.28	21.4	12.2	4.6	3.6	3.1	1.1	0.3	0.1
534.2		-74.20850	39.52701		152	305	152	10386	0.5	0.0	0.5	0.37	0.58	0.26	34.4	28.1	7.7	4.3	2.2	1.3	1.0	0.5
535.1	77	-74.20850	39.55538	13	0	157	157	11172	3.0	1.4	1.6	0.58	0.81	0.45	40.2	33.2	6.2	4.8	3.6	4.1	0.1	0.1
535.2		-74.20850	39.55538		157	312	155	9708	3.0	1.0	1.9	0.32	0.38	0.21	38.7	36.1	6.3	5.5	2.3	2.8	0.1	0.1
536.0	76	-74.20070	39.56706	10	0	208	208	14259	2.5	0.9	1.6	0.72	0.99	0.57	38.2	31.5	5.6	6.1	3.4	2.6	0.3	0.2
537.1	44	-74.19860	39.57095	11	0	213	213	16352	2.7	1.3	1.4	1.14	1.34	0.80	36.6	33.5	5.6	5.1	3.1	2.9	0.2	0.2
537.2		-74.19860	39.57095		213	328	114	7660	0.4	0.1	0.3	0.42	1.00	0.39	11.5	20.3	1.9	0.7	1.4	0.5	0.0	0.0
538.1	45	-74.17950	39.58579		0	152	152	11642	15.0	1.8	13.2	0.90	1.28	0.78	47.6	39.4	5.3	10.6	4.4	5.4	1.1	0.7
538.2		-74.17950	39.58579		152	264	112	8589	4.4	0.1	4.3	0.54	0.68	0.42	35.4	35.3	15.1	15.1	2.1	1.6	1.2	0.9
539.1	75	-74.17290	39.61545	11	0	163	163	10979	0.8	0.4	0.4	1.24	3.94	2.47	19.9	34.8	1.0	11.4	4.2	1.1	0.5	0.1
539.2		-74.17290	39.61545		165	290	127	8218	0.2	0.0	0.2	0.25	2.41	0.68	9.1	0.7	0.1	0.0	1.9	0.2	0.1	0.0
540.0	51	-74.09150	39.66585	19	0	99	99	5260	9.8	1.2	8.7	0.51	0.61	0.32	32.8	31.2	6.2	5.7	3.1	2.5	1.0	0.8
541.0	50	-74.11130	39.67044	16	0	91	91	5994	9.6	1.8	7.8	0.10	0.40	0.18	35.6	31.3	2.9	2.2	3.0	3.0	0.7	0.2
542.1	39	-74.12930	39.67991	8	0	152	152	9343	1.3	0.2	1.0	2.53	3.21	1.92	42.6	38.0	4.7	3.4	3.2	3.2	0.8	0.6
542.2		-74.12930	39.67991		152	358	206	14291	1.3	0.5	0.7	1.96	4.44	2.16	25.4	22.0	3.1	4.3	5.5	2.1	0.8	0.3
543.1	40	-74.12970	39.69013	9	0	99	99	6436	0.6	0.4	0.3	1.34	2.48	1.20	27.2	21.2	3.3	2.1	1.9	0.9	0.3	0.1
543.2		-74.12970	39.69013		99	297	198	13563	0.2	0.1	0.2	0.17	0.63	0.10	21.7	10.2	2.8	0.6	1.5	0.3	1.0	0.2
544.1	41	-74.11030	39.69488	12	0	137	137	7495	0.7	0.3	0.4	0.21	0.55	0.27	44.6	35.3	6.7	6.9	3.6	1.3	0.5	0.2
544.2		-74.11030	39.69488		137	292	155	8998	4.7	1.3	3.5	0.04	0.53	0.13	25.8	15.6	3.7	4.9	2.6	0.2	0.2	0.0
545.0	52	-74.09280	39.67260	12	0	69	69	5567	10.2	1.1	9.0	0.64	0.70	0.42	44.4	42.4	6.6	6.9	3.0	3.4	0.4	0.3
546.1	53	-74.09220	39.67821	17	0	64	64	4258	17.4	6.1	11.2	0.20	1.17	0.48	44.8	28.0	2.6	4.6	4.7	3.3	0.5	0.1
546.2		-74.09220	39.67821		64	239	175	11444	32.6	7.1	25.5	0.41	0.60	0.31	34.9	33.0	5.9	9.5	2.7	2.5	0.5	0.3
547A	64A	-74.07280	39.67966	13	0	38	38	3228	4.0	0.8	3.2	0.64	0.73	0.39	36.6	35.5	6.4	7.0	4.3	4.4	0.6	0.5
547B	64B	-74.07280	39.67966		0	127	127	9313	3.6	1.0	2.6	0.94	1.11	0.68	48.2	43.6	4.4	5.5	3.8	4.6	0.1	0.1
548.1	55	-74.07350	39.69476	18	0	66	66	4088	2.4	0.9	1.5	0.68	0.79	0.49	38.6	37.1	9.9	12.5	3.0	2.8	0.2	0.2
548.2		-74.07350	39.69476		66	157	91	4323	3.2	1.0	2.3	0.26	0.66	0.20	31.1	20.3	5.6	5.2	2.2	0.7	0.2	0.1
548.3		-74.07350	39.69476		157	249	91	6629	36.0	22.5	13.5	0.44	0.53	0.29	36.6	33.0	5.3	5.7	3.9	3.7	0.2	0.1
550.1	65	-74.01680	39.67984	21	0	155	155	11327	6.3	2.4	3.9	0.63	0.80	0.44	44.2	39.2	3.7	4.1	2.0	1.5	0.0	0.0
550.2		-74.01680	39.67984		155	203	48	3110	8.6	4.5	4.1	3.73	4.24	1.52	26.8	25.7	0.5	0.4	0.9	0.8	0.2	0.2
551.1	26	-73.99770	39.69466	22	0	130	130	11566	39.4	22.6	16.9	0.87	1.19	0.70	39.6	40.2	3.5	8.9	1.8	1.9	0.2	0.2
551.2		-73.99770	39.69466		130	287	157	9122	0.2	0.1	0.2	0.11	0.77	0.25	23.3	20.4	14.0	6.1	1.1	1.9	0.2	0.0
552.1	57	-74.05470	39.70957	16	0	69	69	4598	5.9	1.8	4.2	0.99	1.08	0.72	51.1	51.0	6.2	6.5	4.8	4.8	0.1	0.1
552.2		-74.05470	39.70957		69	206	137	9678	0.8	0.1	0.6	1.47	1.68	1.14	42.5	39.7	8.2	7.4	4.1	3.6	0.2	0.1
553.0	37	-74.01660	39.72383	17	0	168	168	11373	14.9	7.6	7.3	0.29	0.50	0.28	38.1	31.5	7.3	13.8	3.0	2.5	0.1	0.1
554.1	27	-73.99820	39.73747	20	0	53	53	4529	50.5	35.8	14.7	0.54	0.61	0.37	43.2	42.0	5.5	9.2	5.0	4.3	0.2	0.2
554.2		-73.99820	39.73747		53	132	79	5844	1.9	0.4	1.5	1.14	1.35	0.82	42.3	39.9	8.0	11.3	1.4	1.3	0.1	0.1
555.1	28	-73.97690	39.76707	21	0	69	69	5205	38.1	20.3	17.8	0.83	0.98	0.67	35.0	36.0	6.5	11.0	2.7	2.4	0.0	0.0
555.2		-73.97690	39.76707		69	163	94	6233	0.4	0.2	0.3	1.96	3.39	2.14	32.4	21.4	9.0	24.2	5.6	2.8	0.4	0.2
558.0	54	-74.09180	39.70941	12	0	71	71	5171	2.9	1.1	1.7	0.87	0.99	0.66	41.5	40.5	13.4	13.6	5.8	5.7	0.4	0.3
559.1	32	-74.09100	39.72364	10	0	122	122	6152	5.0	1.2	3.8	0.52	0.55	0.37	43.6	42.4	9.2	9.3	5.5	5.5	0.2	0.1
559.2		-74.09100	39.72364		122	229	107	6194	0.9	0.2	0.7	2.35	2.73	1.66	40.1	34.8	6.9	7.5	4.5	4.1	0.2	0.2
561.1	24	-74.07420	39.75295	11	0	152	152	11400	2.3	0.7	1.7	0.98	1.39	0.96	43.5	42.2	7.9	12.2	2.6	3.5	0.3	0.2
561.2		-74.07420	39.75295		152	254	102	7210	1.2	0.3	0.9	1.63	2.07	1.39	41.8	37.4	10.6	8.6	4.0	4.3	0.3	0.2

Sample number	Phase (continued from facing page, weight percent of RHM or THM concentrate as indicated)																					
	Monazite		Aluminosilicates[8]		Garnet		Pyroboles[9]		Epidote		Staurolite		Tourmaline		Magnetite		Quartz		Other[10]		EHM	
	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM
533.1	0.0	0.0	6.1	1.6	27.6	22.0	14.9	18.7	3.7	1.0	1.9	0.5	0.2	0.1	0.1	0.0	1.0	0.3	8.4	20.7	42.2	36.9
533.2	0.2	1.7	9.0	1.7	18.2	19.7	21.6	28.4	6.2	3.6	4.0	2.4	1.8	0.3	0.0	0.0	0.0	0.0	6.8	7.8	41.3	37.8
534.1	0.0	0.6	22.9	11.4	11.0	16.8	13.9	14.6	4.9	3.0	0.3	1.4	0.2	0.1	0.1	0.1	6.2	2.2	11.1	32.9	52.4	29.0
534.2	0.1	0.0	11.6	10.9	13.5	10.2	8.2	11.2	5.8	3.6	1.5	2.2	3.7	2.1	0.0	0.0	0.0	0.0	10.4	25.4	56.9	45.2
535.1	0.0	0.0	10.5	13.8	14.6	13.0	6.9	9.7	6.9	5.5	2.2	2.5	2.5	2.4	0.0	0.0	0.0	5.2	6.1	5.7	60.7	55.9
535.2	0.0	0.0	9.8	11.7	19.5	16.6	11.1	12.8	5.0	4.5	2.3	2.4	0.7	1.5	0.0	0.0	0.0	1.9	4.2	4.2	57.1	56.2
536.0	0.2	0.5	11.1	17.3	14.1	10.8	8.0	15.3	5.8	5.6	5.4	3.6	2.0	2.0	0.0	0.0	0.0	0.0	5.9	4.6	58.8	58.2
537.1	0.8	0.7	12.8	17.0	14.4	12.3	11.8	12.4	5.5	5.2	3.0	3.0	4.0	3.6	0.0	0.0	0.0	1.9	2.2	2.3	59.1	59.3
537.2	0.1	0.7	19.6	16.6	5.0	8.2	14.2	21.2	2.7	2.2	0.5	2.8	0.1	0.0	0.0	0.0	23.5	8.2	19.5[11]	18.5	34.5	38.7
538.1	0.0	0.0	5.8	5.2	8.9	9.3	10.6	10.4	1.6	2.5	4.8	7.4	5.9	4.1	0.0	0.0	1.4	0.9	2.6	4.2	64.3	61.3
538.2	0.0	0.0	9.0	9.3	15.6	14.1	9.3	12.2	4.9	4.7	1.7	1.8	4.2	3.9	0.0	0.0	0.0	0.0	1.3	1.2	62.9	62.1
539.1	1.2	1.8	23.6	13.5	10.3	6.4	21.3	9.2	4.2	5.5	0.5	2.3	1.0	1.7	0.0	0.0	0.0	3.7	12.5	8.4	50.4	62.7
539.2	1.0	1.9	30.0	25.4	4.4	0.3	21.8	20.1	3.7	4.9	0.5	0.0	2.6	0.2	0.0	0.0	6.2	6.9	18.6[12]	39.3	42.2	28.2
540.0	1.3	1.0	13.1	11.5	13.7	12.2	15.0	19.0	5.2	5.0	0.9	2.1	0.8	0.9	0.0	0.0	1.0	1.8	5.9	6.3	57.4	52.8
541.0	0.7	0.9	10.6	7.8	19.1	23.6	14.4	17.1	1.5	7.2	1.1	0.2	1.7	0.4	0.0	0.0	0.3	0.1	8.7	5.9	53.4	45.4
542.1	2.0	2.0	12.0	12.8	16.5	13.2	8.2	15.2	4.8	5.1	0.3	1.5	1.9	1.7	0.0	0.0	0.0	0.0	3.2	3.4	65.2	59.9
542.2	1.1	0.4	18.4	19.4	11.7	7.5	18.2	25.6	2.6	1.6	1.1	2.3	0.9	0.3	0.0	0.0	2.6	7.2	8.5	6.9	54.4	48.5
543.1	1.2	1.1	14.7	22.8	11.6	6.5	23.8	29.7	4.5	3.7	0.5	1.3	1.1	0.5	0.0	0.0	1.6	0.7	8.4	9.3	48.6	48.3
543.2	0.6	0.1	11.4	4.0	6.4	2.2	24.3	5.3	2.0	0.4	0.5	0.1	3.2	0.7	0.0	0.0	0.7	0.2	23.9[13]	75.7	38.9	15.5
544.1	0.8	0.3	5.9	6.0	15.2	15.1	6.9	4.4	3.8	1.4	0.8	4.1	5.6	3.9	0.0	0.0	1.1	0.4	4.5	20.8	62.1	49.9
544.2	0.1	0.0	9.1	3.4	10.4	7.2	26.6	1.5	1.9	0.1	0.8	0.0	1.7	2.9	0.0	0.0	0.0	0.0	17.1[14]	64.1	41.5	24.1
545.0	1.1	1.1	6.4	6.5	19.9	18.9	9.3	8.7	4.2	4.3	0.8	1.3	1.9	2.7	0.0	0.0	0.8	1.0	1.3	2.4	61.7	60.6
546.1	0.0	0.0	7.8	5.4	16.9	11.4	9.1	5.6	1.2	7.8	1.4	4.4	0.2	1.7	0.0	0.0	0.0	0.0	8.9	27.6	60.4	41.4
546.2	0.6	0.3	6.4	6.6	17.8	14.7	21.2	16.8	2.1	5.6	1.5	2.9	1.5	2.9	0.0	0.0	0.4	0.3	4.4	4.6	51.0	52.2
547A	0.7	0.6	5.2	5.5	22.1	22.1	11.6	10.6	2.5	2.7	1.5	2.4	2.2	2.6	0.0	0.0	1.2	1.0	5.2	5.2	53.8	53.5
547B	0.7	0.7	7.4	7.0	17.5	18.0	4.3	4.4	3.2	3.8	2.2	3.3	4.1	4.3	0.0	0.0	0.4	1.3	3.6	3.3	64.7	61.6
548.1	1.3	1.1	8.0	8.3	15.2	13.8	8.0	7.4	4.7	5.4	1.3	1.4	2.7	2.4	0.0	0.0	0.0	0.0	7.1	7.4	61.0	62.0
548.2	0.7	0.2	7.5	4.5	11.8	8.6	21.5	9.0	3.8	4.8	2.2	2.1	3.3	1.1	0.0	0.0	0.2	0.0	9.9	43.6	47.4	30.9
548.3	0.7	0.6	9.2	11.6	16.3	13.8	13.5	13.8	2.0	3.3	5.0	5.2	3.4	3.8	0.0	0.0	0.8	0.6	3.1	4.8	55.9	54.7
550.1	0.8	0.8	6.9	9.0	17.4	14.7	13.0	16.1	1.7	3.8	1.5	1.1	4.3	4.5	0.0	0.0	0.0	0.0	4.5	5.2	57.6	54.6
550.2	0.5	0.6	7.2	8.1	22.2	20.0	26.0	27.3	3.1	3.0	3.2	3.3	2.7	3.4	0.0	0.0	1.2	1.0	5.5	6.2	36.1	35.8
551.1	1.2	0.8	9.3	7.2	23.3	22.2	9.6	8.1	2.2	1.5	1.1	0.7	4.3	5.2	0.0	0.0	0.0	0.0	3.5	3.0	55.9	59.2
551.2	0.6	1.8	11.2	2.3	16.1	19.5	6.1	1.6	1.2	1.9	0.6	0.1	4.3	6.7	0.1	0.0	1.5	0.2	19.7[15]	37.5	50.4	32.6
552.1	0.8	0.7	3.8	4.3	19.2	18.5	3.6	3.4	2.1	2.0	2.4	2.2	3.4	4.0	0.0	0.0	0.0	0.1	2.5	2.4	66.8	67.5
552.2	1.1	0.9	11.5	16.1	12.9	11.0	8.0	7.5	1.8	1.8	2.9	2.6	5.8	5.7	0.0	0.0	0.0	0.5	0.8	2.9	67.7	67.9
553.0	0.8	0.3	9.6	7.2	14.8	12.3	12.3	8.6	1.3	0.6	1.4	1.2	4.9	5.0	0.0	0.0	0.3	0.7	6.4	16.4	58.7	55.3
554.1	1.4	1.2	3.3	3.6	28.3	25.5	3.6	3.5	1.8	1.8	1.0	0.9	2.7	3.8	0.1	0.1	0.0	0.0	3.8	4.0	58.7	60.4
554.2	1.5	1.2	7.9	7.3	13.2	11.6	5.2	8.1	2.1	1.9	1.0	0.8	13.3	11.7	0.0	0.0	0.0	0.0	4.0	4.8	61.1	61.1
555.1	0.8	0.6	22.1	18.4	20.9	18.8	3.3	2.9	1.1	1.3	0.7	0.7	2.2	3.1	0.0	0.0	0.0	0.0	4.8	4.8	67.0	68.3
555.2	0.2	0.1	21.7	14.5	14.6	7.9	2.5	11.1	0.5	0.2	0.8	0.9	2.6	3.8	0.0	0.0	0.0	0.0	9.7	12.8	69.2	63.2
556.0	1.4	1.4	4.9	5.2	14.3	13.7	3.6	4.1	1.6	1.8	3.7	3.3	6.4	6.9	0.0	0.0	0.0	0.0	3.0	3.4	67.4	66.7
559.1	0.8	0.8	7.1	7.6	17.8	17.1	2.6	2.7	2.5	2.4	2.7	2.8	5.3	6.1	0.0	0.0	0.0	0.0	2.6	2.9	66.4	65.9
559.2	0.9	0.6	13.1	13.4	9.6	8.4	11.7	18.4	2.0	2.0	2.2	2.0	5.2	4.3	0.0	0.0	0.0	0.0	3.6	4.2	65.7	60.7
561.1	1.1	1.0	12.7	9.9	11.3	9.0	6.2	7.7	1.1	1.4	2.7	2.8	6.5	7.7	0.0	0.0	0.0	0.7	2.2	1.4	68.0	69.1
561.2	0.7	0.6	7.3	15.8	10.9	9.4	7.0	6.5	2.4	2.0	1.7	1.3	10.7	10.5	0.0	0.0	0.0	0.0	2.6	3.2	64.7	67.1

Table 1. Textural and mineralogical data for 119 vibracore samples (cont.).

Sample number[1]	CERC number[2]	Longitude	Latitude	Water depth (m)[3]	Interval sampled		Core length[5] (cm)	Bulk weight (g)	Gravel content (weight percent of bulk)			Total heavy-mineral content (weight percent of bulk)			Phase (weight percent of RHM or THM concentrate as indicated)							
		W	N		Top[4]	Bottom[4]			>2.00 mm	>6.4 mm	>2.00, <6.4 mm	RHM[6]	THM[6]	EHM	Ilmenite RHM	Ilmenite THM	Leucoxene RHM	Leucoxene THM	Zircon RHM	Zircon THM	Rutile RHM	Rutile THM
561.3		-74.07420	39.75295		254	361	107	7655	2.2	1.0	1.3	1.73	2.32	1.75	42.1	39.9	4.1	4.4	4.2	3.9	0.0	0.0
563.0	36	-74.01690	39.78171	18	0	20	20	1156	18.0	13.1	4.9	1.21	1.40	1.05	55.2	52.1	4.4	9.0	3.0	3.3	0.1	0.1
564.1	29	-73.99880	39.79636	20	0	64	64	4299	38.6	26.9	11.7	1.34	1.57	1.09	47.2	46.7	4.1	9.2	3.8	4.1	0.1	0.1
564.2		-73.99880	39.79636		64	130	66	6120	49.2	32.0	17.2	0.43	0.69	0.41	42.7	41.5	3.4	6.4	3.0	3.9	0.3	0.2
564.3		-73.99880	39.79636		130	221	91	6590	3.4	0.9	2.5	1.16	1.77	1.15	39.6	31.5	5.0	11.2	3.9	3.1	0.6	0.3
565A	34A	-74.01690	39.81056	18	0	53	53	3705	31.4	13.8	17.6	0.59	0.82	0.52	49.3	46.1	5.3	5.2	3.1	4.5	0.4	0.2
565B.1	34B	-74.01690	39.81056		0	102	102	5469	25.5	11.4	14.1	0.80	0.90	0.60	49.3	45.7	10.8	12.1	2.8	2.7	0.4	0.4
565B.2		-74.01690	39.81056		102	201	99	5154	2.0	0.4	1.6	0.76	0.86	0.62	47.9	45.2	10.5	12.7	2.6	2.3	0.3	0.3
566.1	30	-74.03650	39.82517	17	0	76	76	6503	43.1	18.2	25.0	0.43	0.75	0.52	20.9	27.4	7.4	16.1	6.6	5.8	0.0	0.0
566.2		-74.03650	39.82517		76	251	175	12276	47.5	18.8	28.7	0.17	0.35	0.28	65.0	32.3	12.4	34.7	9.2	9.7	0.4	0.2
567A.1		-74.07320	39.81066		0	28	28	2000	6.7	1.3	5.4	0.67	1.01	0.67	34.9	33.1	22.6	19.8	5.1	5.8	0.7	0.5
567A.2	33A	-74.07320	39.81066	16	28	122	94	7698	10.3	3.4	6.9	1.06	1.48	0.96	54.6	49.8	5.3	4.6	2.2	3.1	0.0	0.0
567B.1	33B	-74.07320	39.81066	16	0	163	163	11020	4.9	1.9	3.1	0.45	0.54	0.38	34.5	34.6	10.6	8.9	12.2	10.6	0.9	0.7
567B.2		-74.07320	39.81066		163	254	91	6111	7.6	3.1	4.5	1.02	1.30	0.88	45.9	45.6	5.5	6.8	3.5	2.8	0.9	0.6
568.2	35	-74.05450	39.79646	12	183	272	89	5968	0.3	0.0	0.2	1.10	1.62	1.25	48.8	35.9	14.9	24.5	6.4	4.0	1.3	0.8
568.3		-74.05450	39.79646		272	325	53	4174	35.5	20.3	15.2	0.63	0.93	0.77	57.5	59.6	8.4	7.1	9.3	9.6	0.7	0.4
569.1	25	-74.07320	39.78210	10	0	239	239	3378	3.0	1.6	1.4	0.41	0.56	0.43	52.9	55.9	10.6	10.4	4.7	5.4	0.3	0.2
569.2		-74.07320	39.78210		239	335	97	6001	0.1	0.0	0.1	0.05	0.87	0.39	24.1	17.3	5.2	19.3	3.3	4.9	0.3	0.0
570.0	86	-74.25830	39.35685	15	0	165	165	13163	14.2	1.7	12.4	0.93	1.77	1.18	44.1	41.9	4.7	15.7	4.8	6.0	0.1	0.1
571.0	81	-74.31260	39.36893	12	0	160	160	14942	1.8	0.5	1.2	0.73	1.12	0.70	40.0	44.2	4.2	8.7	3.6	4.2	0.0	0.0
572.1	82	-74.31230	39.38288	12	0	107	107	7571	1.8	0.4	1.3	3.58	5.41	2.83	36.2	31.7	5.6	7.4	6.7	4.8	0.2	0.1
572.2		-74.31230	39.38288		107	168	61	3743	1.1	0.3	0.8	2.99	5.32	2.75	34.1	27.0	10.5	15.3	4.3	3.6	0.5	0.3
573.0	78	-74.33950	39.38332	8	0	155	155	11078	0.8	0.3	0.5	3.83	11.47	6.01	31.8	23.3	4.8	15.8	6.9	5.5	0.4	0.1
574.1	79	-74.35040	39.37899	8	0	102	102	7480	2.2	1.0	1.3	8.16	13.49	6.44	28.2	19.8	6.8	15.2	5.5	5.3	0.5	0.2
574.2		-74.35040	39.37899		102	193	91	6823	0.3	0.1	0.2	2.32	9.35	3.40	21.5	20.3	6.0	9.2	4.1	3.2	0.3	0.1
575.1	83	-74.28250	39.38356	13	0	165	165	13291	2.2	0.9	1.3	1.19	1.51	0.90	41.4	40.5	6.3	10.0	3.3	3.3	0.0	0.0
575.2		-74.28250	39.38356		165	269	84	5834	4.1	1.6	2.5	1.85	3.01	1.18	29.5	25.2	4.4	5.6	3.1	2.6	0.3	0.2
576.0	68	-74.29490	39.38987	10	0	137	137	9549	1.4	0.4	0.9	1.69	2.53	1.57	39.8	45.9	5.6	7.4	3.6	3.0	0.1	0.1
577.1	69	-74.29490	39.39743	12	0	122	122	9339	1.4	0.3	1.0	1.55	1.80	0.91	30.2	30.2	7.7	10.7	3.2	3.0	0.1	0.1
577.2		-74.29490	39.39743		122	178	56	3934	1.3	0.2	1.1	3.65	4.53	2.14	27.3	26.7	6.3	8.4	4.1	4.3	0.1	0.1
578.1	70	-74.29520	39.40643	11	0	61	61	4376	3.6	1.7	1.9	1.41	1.55	0.98	36.4	37.9	8.9	10.1	5.0	5.0	0.7	0.6
578.2		-74.29520	39.40643		61	191	130	9793	0.6	0.1	0.4	1.72	2.26	1.05	37.6	32.7	3.9	4.8	2.8	2.9	0.1	0.1
579.0	71	-74.29660	39.41256	12	0	203	203	13865	0.6	0.2	0.4	3.15	4.85	2.06	31.1	24.4	3.7	6.3	4.2	3.3	0.2	0.1
580.1	49	-74.29530	39.42764	11	0	127	127	8994	1.1	0.3	0.8	1.15	1.39	0.92	33.6	34.1	5.2	9.6	10.3	9.1	0.3	0.3
580.2		-74.29530	39.42764		127	305	178	10910	0.1	0.0	0.1	1.99	5.66	2.56	33.8	27.6	6.0	5.3	2.3	2.1	0.6	0.2
581.1	46	-74.27640	39.41311	15	0	145	145	9589	1.4	0.4	1.1	1.55	2.01	1.14	45.1	36.5	6.7	10.5	3.2	2.8	0.1	0.1
581.2		-74.27640	39.41311		145	206	61	3472	6.3	3.0	3.2	1.95	3.45	1.98	39.7	42.4	6.7	3.8	2.6	6.3	0.2	0.1
582.1	84	-74.27590	39.39842	16	0	127	127	8392	1.4	0.7	0.7	2.71	4.41	2.07	32.0	24.3	1.9	2.4	1.9	1.0	0.0	0.0
582.2		-74.27590	39.39842		127	269	142	9524	7.1	2.3	4.7	1.83	2.23	1.37	43.7	45.1	5.4	6.4	2.9	3.3	0.1	0.1
583.0	85	-74.25800	39.39827	10	0	157	157	12112	3.2	1.1	2.1	1.41	1.98	1.33	52.9	51.9	2.6	2.4	4.9	4.9	0.0	0.0
585.1	48	-74.20110	39.41319	19	0	41	41	3256	6.1	0.4	5.6	0.56	0.68	0.44	48.2	48.6	6.4	5.5	1.9	1.9	0.1	0.0
585.2		-74.20110	39.41319		41	221	180	13357	3.2	1.5	1.7	0.61	0.96	0.59	52.1	42.5	5.3	4.3	1.9	1.5	0.0	0.0
585.3		-74.20110	39.41319		221	353	132	9400	1.5	0.8	0.7	0.49	0.96	0.59	47.1	31.7	6.8	5.8	1.9	0.8	0.1	0.0
586.1	92	-74.12640	39.41242	23	0	168	168	4645	0.2	0.0	0.2	0.03	0.25	0.13	18.3	49.0	0.0	0.0	0.5	0.1	0.0	0.0
586.2		-74.12640	39.41242		168	338	170	8913	1.8	0.1	1.7	0.31	0.83	0.32	28.6	22.7	2.0	1.3	1.8	1.2	0.1	0.0

Sample number	Monazite		Aluminosilicates[8]		Garnet		Pyroboles[9]		Epidote		Staurolite		Tourmaline		Magnetite		Quartz		Other[10]		EHM	
	Phase (continued from facing page, weight percent of RHM or THM concentrate as indicated)																					
	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM
561.3	0.4	0.6	37.5	26.8	3.4	3.0	2.0	7.6	0.4	0.6	0.5	0.3	3.0	5.2	0.0	0.0	0.0	0.3	2.3	7.5	88.3	75.5
563.0	0.5	0.4	11.7	10.3	7.0	6.7	9.8	8.3	1.0	1.0	0.4	0.5	3.4	4.4	0.0	0.0	0.0	0.2	3.5	3.7	74.9	75.2
564.1	0.7	0.6	9.5	8.4	26.6	22.6	1.7	2.0	0.9	0.7	0.7	0.6	3.9	4.2	0.0	0.0	0.0	0.0	0.7	1.0	65.4	69.0
564.2	0.6	0.4	9.5	6.6	30.6	30.4	2.2	2.5	1.9	1.1	0.2	0.5	3.7	4.3	0.0	0.0	0.0	0.9	1.9	1.5	59.6	58.9
564.3	0.0	0.0	21.4	18.7	4.0	3.6	13.1	13.9	0.7	0.4	1.4	0.8	4.3	5.4	0.0	0.0	0.0	0.0	6.1	11.0	70.4	64.9
565A	0.7	0.8	7.7	6.8	19.0	19.3	3.3	2.5	1.2	1.1	1.0	1.0	4.4	5.3	0.0	0.0	0.0	0.0	4.6	7.1	66.6	63.6
565B.1	0.7	0.6	6.3	5.6	22.4	19.8	0.3	0.4	0.8	0.7	0.9	0.7	1.3	1.9	0.0	0.0	0.0	0.0	4.1	9.3	70.2	67.1
565B.2	1.1	1.0	11.4	10.4	10.5	9.3	4.5	6.1	0.5	0.6	2.0	2.0	5.1	5.9	0.0	0.0	0.0	0.0	3.3	4.1	73.9	72.0
566.1	0.1	0.0	35.9	19.5	4.9	6.0	0.1	0.0	0.1	0.0	1.0	0.5	1.2	5.6	0.0	0.0	16.3	8.2	5.7	10.8	70.8	68.9
566.2	0.0	0.0	8.8	5.4	0.0	1.2	0.0	0.0	0.0	0.0	1.2	1.7	1.0	6.3	0.0	0.0	0.0	0.0	2.0	8.5	95.8	82.3
567A.1	0.0	0.4	7.1	7.0	14.3	12.7	5.0	5.0	0.9	0.9	4.3	5.3	2.2	2.9	0.0	0.0	0.0	1.9	2.8	4.7	70.4	66.6
567A.2	0.7	0.5	9.1	6.8	13.3	11.3	1.5	1.0	0.8	0.5	2.0	2.0	7.9	16.8	0.0	0.0	0.0	0.3	2.6	3.4	71.9	64.7
567B.1	1.2	0.9	10.7	13.8	9.4	8.9	4.3	3.4	1.9	1.4	2.1	2.1	6.4	7.2	0.0	0.0	0.0	0.2	5.9	7.2	70.0	69.6
567B.2	1.2	0.9	12.5	11.0	12.4	10.4	6.4	6.6	2.5	1.8	2.3	2.0	2.5	4.6	0.0	0.0	0.0	0.3	4.3	6.7	69.5	67.8
568.2	0.0	0.0	13.7	12.3	3.5	2.6	1.6	2.9	0.3	0.2	1.4	0.8	1.7	4.9	0.0	0.0	0.0	1.1	6.4	10.1	85.2	77.5
568.3	0.0	0.0	8.4	5.9	2.7	2.4	0.0	0.0	0.2	0.5	0.7	1.2	1.4	2.8	0.0	0.0	0.0	0.0	10.7	10.4	84.3	82.6
569.1	0.7	0.5	4.7	3.6	7.9	8.5	1.1	1.1	1.6	1.1	2.9	2.6	9.3	7.5	0.0	0.0	0.0	0.0	3.4	3.3	73.9	76.0
569.2	0.3	0.0	26.4	3.1	6.1	2.2	18.8	29.5	0.6	0.0	0.6	0.0	2.3	6.8	0.0	0.0	0.0	0.0	11.9	16.8	59.6	44.7
570.0	0.7	0.3	5.3	3.0	28.5	23.9	5.1	2.3	0.6	0.4	0.9	0.9	3.4	3.2	0.0	0.0	0.0	0.0	1.7	2.4	59.7	66.9
571.0	1.4	1.2	5.5	4.4	28.3	20.6	4.1	3.6	1.0	1.4	1.0	0.6	7.5	6.4	0.0	0.0	0.0	0.8	3.4	3.6	54.7	62.8
572.1	1.2	1.1	10.2	7.3	12.9	6.9	9.5	19.8	3.7	3.0	0.9	0.5	3.6	6.2	0.0	0.0	2.1	3.3	7.3	6.0	60.0	52.3
572.2	1.0	0.5	10.3	5.1	11.7	7.3	12.7	21.5	4.5	2.7	0.6	0.3	3.7	3.4	0.0	0.0	0.8	0.9	5.2	12.2	60.8	51.7
573.0	1.0	1.0	11.1	6.7	16.3	8.1	15.3	25.9	3.7	2.5	0.6	0.2	3.7	6.1	0.0	0.0	0.0	0.7	4.4	4.1	56.0	52.4
574.1	1.0	1.0	9.9	6.3	14.2	8.6	15.8	24.7	4.0	3.5	0.5	0.3	5.3	5.2	0.0	0.0	4.1	2.2	4.1	7.7	51.8	47.8
574.2	0.7	0.9	5.1	2.6	15.3	3.9	25.5	29.1	4.5	2.5	0.7	0.9	3.5	8.7	0.0	0.0	0.1	0.0	12.6	18.5	37.8	36.4
575.1	1.0	0.7	5.0	5.0	20.3	15.4	8.9	11.9	2.1	1.8	1.4	1.0	8.1	7.8	0.0	0.0	0.0	0.3	2.2	2.4	57.0	59.4
575.2	1.0	0.5	7.1	5.2	17.1	11.7	23.1	30.7	4.8	3.1	1.2	0.6	2.2	2.6	0.0	0.0	0.5	0.7	5.8	11.3	45.3	39.3
576.0	0.8	0.5	7.4	5.3	17.2	13.1	11.9	10.0	2.7	2.8	2.0	1.6	6.2	7.7	0.0	0.0	0.1	0.1	2.5	2.7	57.4	62.0
577.1	1.6	1.3	6.0	5.5	13.5	11.3	15.2	17.8	4.0	3.3	1.3	1.2	3.2	3.0	0.0	0.0	0.0	0.0	2.0	2.7	48.8	50.8
577.2	1.2	0.9	8.2	6.7	14.1	11.2	24.2	26.8	4.9	4.2	1.1	0.9	3.6	3.9	0.0	0.0	0.4	0.5	4.5	5.4	47.2	47.1
578.1	0.6	0.5	10.3	9.2	18.4	17.4	6.3	5.8	2.2	2.0	1.0	1.1	4.2	4.5	0.0	0.0	1.2	1.1	4.9	4.6	61.8	63.4
578.2	0.8	0.9	8.2	5.3	16.6	12.4	17.8	24.2	1.6	1.7	0.4	0.5	7.4	8.1	0.0	0.0	0.5	0.9	4.1	5.5	51.7	46.6
579.0	1.1	1.1	10.4	7.3	15.0	9.2	14.8	25.3	2.8	2.5	0.2	0.5	8.4	11.2	0.0	0.0	1.6	1.8	6.5	7.1	50.7	42.5
580.1	0.8	0.8	15.1	12.4	14.5	12.4	5.9	6.1	1.3	1.4	0.6	0.9	3.1	4.0	0.0	0.0	3.4	2.9	5.9	5.9	65.4	66.4
580.2	0.0	0.0	10.4	10.1	14.2	11.2	14.7	25.5	2.7	2.2	5.5	3.0	2.4	4.2	0.0	0.0	0.0	3.5	7.5	5.0	53.0	45.2
581.1	1.5	1.0	6.1	5.8	18.6	14.3	5.7	12.8	3.0	2.7	1.7	1.8	4.4	6.0	0.0	0.0	0.0	0.0	3.7	5.8	62.7	56.8
581.2	1.0	0.5	5.7	4.3	13.1	24.2	16.1	8.0	3.2	1.6	0.1	0.1	5.3	4.2	0.0	0.0	0.0	0.5	6.2	4.1	55.9	57.4
582.1	0.7	0.4	9.6	18.8	19.9	13.2	16.9	16.0	7.3	6.2	0.4	1.1	0.7	0.4	0.1	0.0	2.3	8.1	6.4	8.0	45.9	46.9
582.2	2.0	2.0	4.9	4.3	24.7	20.2	4.0	4.7	4.5	3.5	0.4	0.5	4.2	4.8	0.0	0.0	0.3	0.5	3.0	4.6	59.0	61.3
583.0	0.2	0.1	7.0	8.1	22.8	20.1	1.9	2.3	2.1	2.8	1.9	3.0	0.5	1.1	0.0	0.0	0.1	0.8	3.2	2.8	67.4	67.3
585.1	1.0	0.8	7.6	7.4	17.0	15.6	7.5	7.0	2.1	1.8	2.3	2.4	0.9	1.1	0.0	0.0	0.0	0.6	5.2	7.1	65.1	64.3
585.2	0.2	0.1	8.1	13.2	14.1	12.3	8.9	11.6	3.4	3.7	2.4	2.7	0.8	0.9	0.0	0.0	0.0	0.0	2.8	7.2	67.6	61.7
585.3	0.3	0.1	7.0	22.9	13.7	9.9	10.5	10.2	3.5	2.1	1.6	1.3	1.1	1.6	0.0	0.0	0.9	3.2	5.5	10.3	63.2	61.4
586.1	0.3	0.0	1.4	1.9	1.7	17.0	1.7	6.1	0.7	1.0	0.0	1.7	0.0	0.8	0.0	0.0	1.1	1.0	74.3[10]	21.4	20.4	51.0
586.2	0.5	0.2	8.5	13.0	17.2	19.1	26.7	25.5	6.1	4.0	0.8	0.9	0.3	0.8	0.0	0.0	0.0	0.0	7.4	11.3	41.5	38.4

Table 1. Textural and mineralogical data for 119 vibracore samples (cont.).

Sample number[1]	CERC number[2]	Longitude W	Latitude N	Water depth (m)[3]	Interval sampled: Top[4]	Interval sampled: Bottom[4]	Core length[5] (cm)	Bulk weight (g)	Gravel content (weight percent of bulk): >2.00 mm	Gravel content: >6.4 mm	Gravel content: >2.00, <6.4 mm	Total heavy-mineral content (weight percent of bulk): RHM[6]	Total heavy-mineral content: THM[8]	Total heavy-mineral content: EHM	Phase (weight percent of RHM or THM concentrate as indicated): Ilmenite RHM	Ilmenite THM	Leucoxene RHM	Leucoxene THM	Zircon RHM	Zircon THM	Rutile RHM	Rutile THM
587B.1	91B	-74.07050	39.41327	27	0	33	33	2404	4.7	1.1	3.6	0.96	1.24	0.51	29.0	25.2	3.1	3.6	1.3	1.2	0.2	0.1
587B.2		-74.07050	39.41327		33	86	53	3121	2.0	0.3	1.7	0.75	1.67	0.65	33.9	25.0	0.2	0.7	2.1	0.8	0.1	0.1
588.1	90	-74.07010	39.44231	24	0	157	157	11100	5.0	0.6	4.4	0.29	1.10	0.44	31.7	22.4	0.4	0.9	1.6	1.1	0.1	0.0
588.2		-74.07010	39.44231		157	272	114	7839	20.4	4.2	16.2	1.40	2.18	0.72	29.3	23.1	0.3	0.2	0.9	0.5	0.1	0.0
589.1	88	-74.12640	39.45499	19	0	84	84	5483	18.7	5.0	13.8	1.17	1.42	0.82	47.2	42.1	3.4	3.1	2.6	3.1	0.3	0.2
589.2		-74.12640	39.45499		84	231	147	10428	4.3	0.5	3.7	1.33	1.49	0.63	27.2	25.5	6.5	8.3	1.3	1.8	0.7	0.6
589.3		-74.12640	39.45499		231	353	122	8868	5.1	1.3	3.7	0.64	0.75	0.42	33.1	31.5	8.7	10.9	3.7	4.3	0.2	0.1
590.1	87	-74.14580	39.44295	19	0	109	109	8093	4.3	0.9	3.4	0.97	1.25	0.73	32.9	30.7	8.9	13.3	1.8	2.8	0.1	0.1
590.2		-74.14580	39.44295		109	221	112	7874	1.8	0.5	1.2	0.78	0.91	0.49	35.5	33.6	11.2	11.9	1.5	2.4	0.1	0.1
591A	66A	-74.18320	39.51467	19	0	173	173	10937	3.0	0.1	2.9	0.20	0.44	0.15	29.6	23.7	12.9	6.8	2.6	1.0	0.1	0.1
591B.1	66B	-74.18320	39.51467		0	112	112	8424	3.3	0.2	3.1	0.27	0.41	0.15	42.1	27.5	7.2	4.8	2.1	1.1	0.0	0.0
591B.2		-74.18320	39.51467		112	218	107	6944	4.4	1.3	3.2	0.29	0.39	0.24	36.1	37.3	14.8	14.8	2.6	2.7	0.0	0.0
592.1	62	-74.22950	39.50048	17	0	165	165	11211	1.2	0.1	1.1	0.07	0.51	0.21	41.9	17.7	17.2	15.2	3.1	4.8	0.2	0.0
592.2		-74.22950	39.50048		165	320	155	10620	10.5	6.6	4.0	0.79	1.12	0.53	31.0	25.1	11.7	14.7	6.0	4.9	0.0	0.0
593.1	60	-74.25610	39.48480	12	0	58	58	3386	5.9	4.5	1.4	3.12	5.32	1.71	25.3	17.9	3.4	5.1	2.9	4.9	0.0	0.0
593.2		-74.25610	39.48480		58	198	140	8992	0.5	0.1	0.5	0.89	1.54	0.67	41.8	23.6	3.8	6.9	4.3	7.1	0.2	0.1
593.3		-74.25610	39.48480		198	272	74	3264	0.2	0.0	0.2	0.61	2.32	0.74	19.0	12.0	8.2	13.5	4.7	3.4	0.5	0.1
595.1	61	-74.27620	39.47032	9	0	99	99	5056	0.7	0.3	0.4	1.56	3.71	1.04	21.0	10.6	3.7	4.5	4.9	6.3	0.4	0.1
595.2		-74.27620	39.47032		99	165	66	5207	0.3	0.1	0.3	2.62	5.87	1.59	23.1	14.9	3.0	7.4	5.3	2.0	0.3	0.1
595.3		-74.27620	39.47032		165	264	99	5782	0.2	0.0	0.2	4.94	6.76	1.79	22.4	15.8	1.3	1.9	5.0	3.7	0.2	0.1
596.1	58	-74.23840	39.44226	17	0	48	48	2964	1.2	0.3	0.9	1.53	1.68	1.07	47.2	46.4	7.9	7.8	4.0	3.9	0.2	0.2
596.2		-74.23840	39.44226		48	160	112	5444	1.8	0.3	1.5	0.52	0.97	0.42	38.1	23.2	8.4	4.1	7.4	8.8	0.5	0.2
596.3		-74.23840	39.44226		160	290	130	6853	0.3	0.0	0.3	0.09	0.52	0.16	21.1	7.9	8.5	5.6	3.5	4.7	0.0	0.0
597.1	47	-74.23910	39.42733	13	0	107	107	7235	3.7	0.8	3.0	1.08	1.86	1.30	47.7	50.3	8.9	9.4	5.1	7.5	0.2	0.1
597.2		-74.23910	39.42733		107	213	107	7714	3.7	0.9	2.8	1.66	1.90	1.12	45.8	42.8	5.5	5.8	4.6	4.7	0.2	0.2
598.1	73	-74.24510	39.42785	15	0	147	147	11088	4.7	1.2	3.5	1.62	2.26	1.37	42.9	44.3	4.0	6.1	5.7	5.5	0.0	0.0
598.2		-74.24510	39.42785		147	221	74	5277	1.5	0.6	0.9	3.83	4.53	2.45	37.4	34.1	7.9	8.3	4.1	5.2	0.1	0.1
599.0	72	-74.25790	39.42805	11	0	183	183	11888	1.1	0.3	0.8	0.94	1.58	1.06	45.2	45.1	7.6	6.3	3.4	8.9	0.1	0.1
600A	63A	-74.26930	39.42476	9	0	142	142	8667	0.7	0.2	0.5	1.14	1.36	0.84	44.5	42.6	4.1	5.4	4.6	5.7	0.4	0.4
							Minimum	1156	0.1	0.0	0.1	0.03	0.25	0.10	9.1	0.7	0.0	0.0	0.5	0.1	0.0	0.0
							Average	7848	7.3	3.1	4.2	1.18	1.94	0.98	36.9	32.9	6.3	8.0	3.7	3.5	0.3	0.2
							Maximum	16352	50.5	35.8	28.7	8.16	13.49	6.44	65.0	59.6	22.8	34.7	12.2	10.8	1.3	0.9
							Standard deviation	3236	11.6	6.6	5.7	1.15	2.08	0.96	9.9	11.1	3.7	5.4	1.9	2.2	0.3	0.2

Sample number	Phase (continued from facing page, weight percent of RHM or THM concentrate as indicated)																					
	Monazite		Aluminosilicates[8]		Garnet		Pyroboles[9]		Epidote		Staurolite		Tourmaline		Magnetite		Quartz		Other[10]		EHM	
	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM	RHM	THM
587B.1	0.3	0.2	8.4	10.3	18.2	17.3	24.8	23.4	4.9	4.9	1.8	1.8	1.0	1.6	0.1	0.0	0.0	0.0	7.0	10.1	42.3	40.7
587B.2	0.0	0.0	8.5	12.7	13.8	14.6	18.7	16.3	3.7	3.9	1.2	2.4	0.0	0.7	0.8	0.3	0.0	0.0	16.9[17]	22.7	44.9	39.2
588.1	0.1	0.0	5.8	15.5	21.0	20.2	21.3	24.2	4.0	3.2	1.3	1.1	0.2	0.0	0.0	0.0	0.0	0.0	12.8	11.3	39.7	39.9
588.2	1.1	0.6	3.6	8.5	34.3	30.3	16.8	20.3	2.6	4.1	2.8	2.5	0.2	0.1	0.1	0.0	0.0	0.0	8.0	9.7	35.2	33.0
589.1	0.6	0.4	6.9	8.8	17.1	17.8	9.1	10.5	2.7	3.2	1.5	1.6	0.1	0.3	0.0	0.0	0.0	0.0	8.5	8.8	60.9	57.8
589.2	1.9	2.3	2.9	3.5	26.8	24.1	3.7	4.6	6.0	5.8	2.9	2.5	9.4	9.5	0.0	0.0	0.0	0.0	10.6	11.4	40.5	42.1
589.3	5.0	4.4	3.3	4.6	19.8	16.9	4.6	5.6	3.6	4.1	3.9	3.5	8.3	8.0	0.0	0.0	0.0	0.2	5.9	5.7	53.9	55.9
590.1	3.0	3.0	7.9	8.4	20.6	16.4	9.2	9.4	4.5	4.4	0.7	0.5	1.8	2.1	0.0	0.0	0.0	0.5	8.6	8.4	54.6	58.2
590.2	1.5	2.2	3.2	3.5	19.6	17.0	5.3	6.1	9.9	8.7	0.6	0.7	1.5	3.0	0.0	0.0	0.0	0.0	10.1	10.8	53.0	53.7
591A	1.1	0.4	4.6	1.8	13.1	6.3	11.2	4.9	2.5	1.0	1.2	0.5	4.6	1.8	0.3	0.1	0.0	0.0	16.2[18]	51.7	51.0	33.8
591B.1	0.8	0.5	5.0	3.6	18.9	10.3	2.4	1.3	4.4	2.4	3.0	2.1	1.4	3.1	0.1	0.1	0.0	0.0	12.5	43.2	57.2	37.6
591B.2	1.4	1.3	5.9	5.0	18.8	13.8	5.3	5.2	3.0	2.7	1.7	2.7	1.9	1.3	0.0	0.0	0.0	0.0	8.4	13.1	60.8	61.2
592.1	0.7	1.0	3.5	2.1	14.7	4.2	4.2	18.4	2.8	2.1	0.5	2.7	0.6	2.8	0.4	0.0	0.1	0.0	10.1	28.9	66.7	40.9
592.2	1.3	0.8	1.4	1.6	15.5	10.5	1.1	0.7	1.6	1.4	1.4	0.9	1.5	1.7	0.0	0.0	19.8	13.2	7.7	24.3	51.4	47.2
593.1	1.5	1.7	2.2	2.6	16.4	12.8	8.3	16.4	8.9	6.0	0.4	0.2	5.0	5.0	0.1	0.0	9.3	7.2	14.4	20.1	35.3	32.2
593.2	2.6	1.8	5.1	4.1	9.4	5.8	5.4	17.6	4.3	3.2	1.4	1.7	8.3	6.6	0.0	0.0	4.0	2.5	9.4	19.1	57.8	43.5
593.3	1.0	0.2	1.6	2.7	5.4	2.0	8.4	25.2	3.1	0.7	1.5	1.1	0.4	1.7	0.0	0.0	34.6	9.2	11.7	28.3	34.9	31.9
595.1	1.3	2.4	2.0	4.0	10.6	6.9	19.4	32.8	8.5	4.9	0.9	1.0	4.1	2.1	0.1	0.0	7.3	2.5	15.9[19]	21.8	33.3	27.9
595.2	0.6	0.2	1.8	2.5	21.0	7.9	6.1	21.1	7.2	5.2	1.2	3.6	1.8	5.0	0.0	0.0	15.7	5.9	12.9	24.2	34.1	27.2
595.3	1.6	1.8	2.4	3.3	18.1	12.8	14.1	22.5	6.2	5.1	2.3	1.5	3.4	5.5	0.0	0.0	6.2	4.5	16.8[20]	21.4	33.0	26.4
596.1	3.4	3.2	2.2	2.3	14.1	13.3	2.5	3.4	5.5	5.3	1.7	1.7	4.0	4.3	0.0	0.0	0.9	0.8	6.4	7.6	64.9	63.5
596.2	1.4	1.2	7.3	6.1	11.6	8.2	7.5	16.8	5.0	4.0	1.8	0.8	0.9	4.1	0.0	0.0	4.6	2.2	7.2	20.3	61.1	43.6
596.3	0.8	1.0	4.2	10.6	7.9	2.3	19.0	28.0	4.8	2.5	1.9	0.4	4.7	2.5	0.0	0.0	9.6	1.8	14.0	32.8	38.1	29.8
597.1	1.5	1.2	1.9	1.4	15.1	12.6	1.4	0.7	2.6	3.3	1.9	2.4	7.7	6.4	0.0	0.0	0.5	0.8	5.6	3.8	65.2	70.0
597.2	3.3	2.7	2.6	3.0	19.6	17.2	2.0	3.3	2.0	2.2	2.1	2.6	4.5	7.0	0.0	0.0	0.5	0.6	7.3	8.1	62.0	59.1
598.1	0.9	1.3	3.9	3.6	20.9	16.1	3.0	3.0	3.1	2.7	3.6	3.1	3.6	4.7	0.0	0.0	0.1	1.1	8.3	8.6	57.4	60.7
598.2	1.8	1.6	4.7	4.8	21.5	18.3	6.4	11.0	1.4	1.5	0.8	0.9	6.0	5.8	0.0	0.0	1.2	1.0	6.7	7.5	56.0	54.1
599.0	1.6	0.8	6.5	5.8	18.1	14.3	5.4	5.2	1.2	1.6	1.1	1.5	6.0	6.5	0.0	0.0	0.6	0.3	3.1	3.5	64.4	67.0
600A	1.5	1.4	5.3	6.2	22.3	19.8	5.7	5.5	2.7	2.5	1.2	1.3	4.2	5.4	0.0	0.0	1.0	1.0	2.5	2.8	60.4	61.6
Minimum	0.0	0.0	1.4	1.4	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.0	20.4	15.5
Average	0.9	0.8	9.1	8.3	15.5	13.0	10.0	11.8	3.1	2.8	1.6	1.7	3.4	4.0	0.0	0.0	1.7	1.3	7.4	11.7	57.1	53.7
Maximum	5.0	4.4	37.5	26.8	34.3	30.4	26.7	32.8	9.9	8.7	5.5	7.4	13.3	16.8	0.8	0.3	34.6	13.2	74.3	75.7	95.8	82.6
Standard deviation	0.8	0.7	6.3	5.4	6.2	6.2	7.1	8.7	2.0	1.8	1.1	1.2	2.5	2.8	0.1	0.0	4.6	2.3	7.7	12.5	12.3	13.8

Notes

1. The sampling code is as follows: a suffix of .0 refers to the entire core (commonly less than 1.5 m), .1 refers to the top section (usually the upper 1.5 m), .2 refers to the middle (or bottom) section, .3 refers to the bottom section on longer cores. An "A" or "B" designates a first and second core, respectively, taken at the same location (Grosz and others 1989b).
2. This number was assigned to each vibracore by the U.S. Army Corps' Coastal Engineering Research Center (CERC) in Fort Belvoir, Va. (Meisburger and Williams, 1982).
3. Uncorrected.
4. Depth from the sediment/water surface to upper end (TOP) of the core section, and the depth from the sediment/water surface to the lower end (BOTTOM) of the core section. As many as three sections are taken from each vibracore. Thus, the BOTTOM depth of the first (.1) section is the TOP depth of the next lower (.2) section of the entire vibracore, etc.
5. Of the core section.
6. That is, specific gravity > 2.96. RHM, recovered heavy minerals; THM, total heavy minerals; EHM, economic heavy minerals.
7. 0.0 denotes none determined, or occurring in amounts less than 0.1 percent.
8. May include sillimanite, kyanite and andalusite.
9. Undifferentiated pyroxenes and amphiboles.
10. May include glauconite, polymineralic grains, limonite, sphene, clay balls, shell fragments, biotite, muscovite, chlorite, apatite, hematite, pyrite, sulfide-filled foraminiferal tests, gypsum, spinel, diopside, unidentified opaques and nonopaques.
11. Consists predominantly of clay balls, quartz, and polymineralic grains.
12. Consists predominantly of clay balls and limonite.
13. Consists predominantly of clay balls and clay coatings.
14. Consists predominantly of clay balls and unidentified opaques and nonopaques.
15. Consists predominantly of clay balls.
16. Consists predominantly of clay balls.
17. Consists predominantly of clay, and sulfide-filled foraminiferal tests.
18. Consists predominantly of clay balls, and unidentified opaques and nonopaques.

Preliminary Textural and Mineralogical Analyses of Vibracore Samples Collected between Absecon and Barnegat Inlets, New Jersey
(New Jersey Geological Survey Open-File Report OFR 91-3)