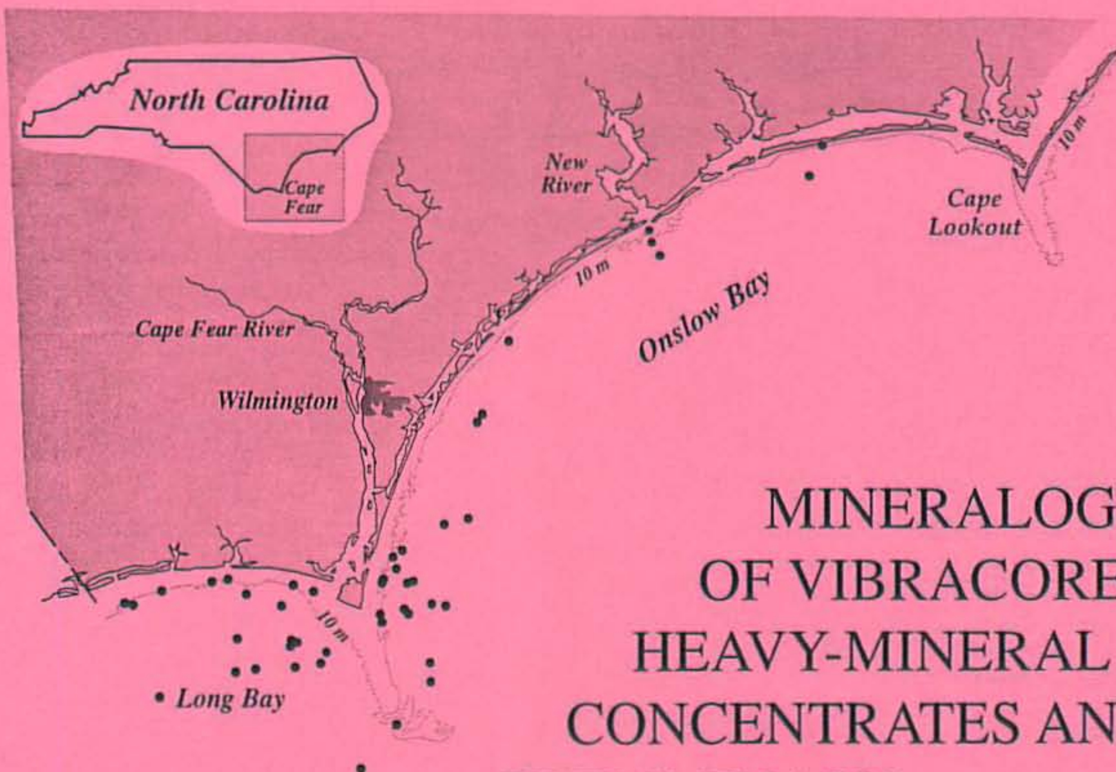

MINERALOGY OF VIBRACORE HEAVY-MINERAL CONCENTRATES AND PRELIMINARY STRATIGRAPHIC FRAMEWORK OF THE SOUTHERN INNER CONTINENTAL SHELF OF NORTH CAROLINA

NORTH CAROLINA GEOLOGICAL SURVEY

OPEN-FILE REPORT 94-2

Mineralogy of Vibracore Heavy-Mineral Concentrates and Preliminary Stratigraphic Framework of the Southern Inner Continental Shelf of North Carolina

by

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North Carolina Geological Survey
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HEALTH AND NATURAL RESOURCES
JOHNATHAN B. HOWES, SECRETARY

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Mineralogy of Vibracore Heavy-Mineral Concentrates and Preliminary Stratigraphic Framework of the Southern Inner Continental Shelf of North Carolina

by

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ABSTRACT

Heavy-mineral (specific gravity (sp gr) > 2.96) and textural data for 113 samples from 47 vibracores obtained from the southern inner Continental Shelf of North Carolina are presented. A preliminary lithostratigraphic framework for the project area is also presented. Subsamples from heavy-mineral concentrates from the vibracores were examined. Average total heavy-mineral (THM) content, expressed as a weight percentage of the bulk sample, is 0.51 percent in a range of <0.01 percent to 3.25 percent with a standard deviation of 0.50 percent. Average economic heavy mineral (EHM) content of the heavy-mineral concentrates is 45.78 weight percent in a range of 4.61 percent to 68.87 weight percent. Ilmenite is the most abundant heavy mineral, averaging 26.60 weight percent of the heavy-mineral concentrates.

Mean grain-size for the clastic samples is 2.88 phi (Ø), in a range of 0.85Ø to 4.44Ø with a standard deviation of 1.0Ø. Lithostratigraphic and limited biostratigraphic analyses reveal that Oligocene age sands in the project area contain the highest percentage of heavy minerals. These sands average 0.86 weight percent THM. Grain-size analyses of all clastic samples indicates that medium-grained to very fine grained quartz sands (1.9Ø to 3.5Ø) have weight percent THM values greater than or equal 1.0. These values are considered too low to warrant economic exploitation. Additional, more detailed analyses to determine the distribution of heavy minerals within stratigraphic units, however, may be of interest to other investigations.

INTRODUCTION

This paper presents a listing of heavy-mineral (specific gravity (sp gr) > 2.96) and textural data from a reconnaissance study of 47 vibracores from the southern inner Continental Shelf of North Carolina. A preliminary lithostratigraphic framework for the project area is also presented. Most of the vibracores were obtained from the Cape Fear cuspate foreland area (Figures 1, 2, and 3). This work is part of a multi-year project aimed at developing the stratigraphic framework and assessing the potential for heavy-mineral resources along the southern inner Continental Shelf of North Carolina. This is the fourth interim report generated from this project.

The first report (Hoffman and others, 1991) included the basic geology and heavy-mineral content of 19 vibracores. Mineralogical data from these 19 vibracores were summarized in Nickerson and others (1993) and are not repeated in this report. The second report (Nickerson and others, 1993) provided a summary of sample processing procedures and a tabulation of heavy-mineral data for 193 samples from 67 vibracores. The third report (Snyder and others, 1994) presented a working model of the stratigraphic framework for the inner shelf area from Mason Inlet to New Inlet, based on shallow, high-resolution seismic data.

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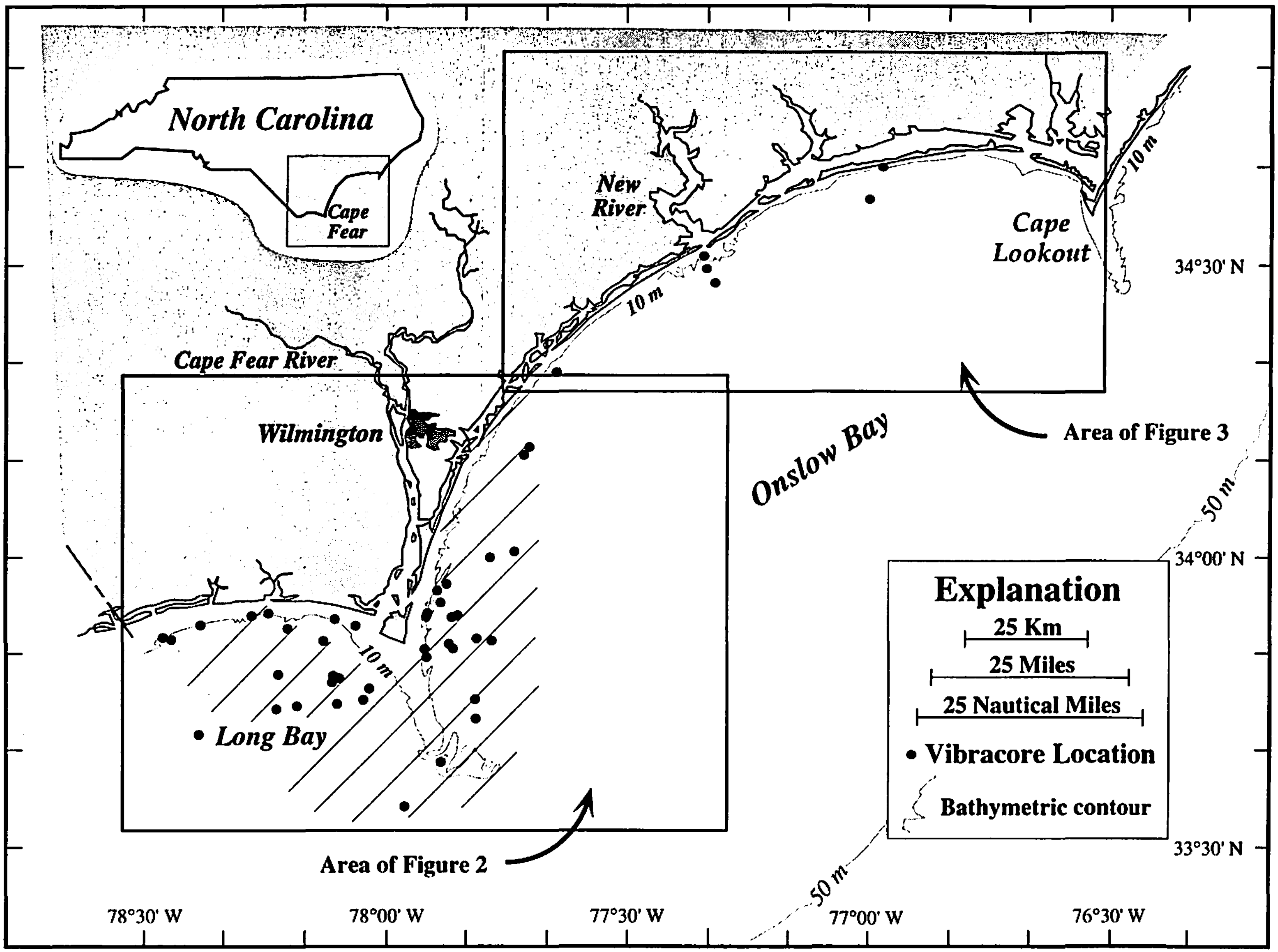

Figure 1. Cape Fear cuspate foreland project area (▨), and its relationship to the North Carolina Continental Shelf embayments of Onslow Bay and Long Bay.

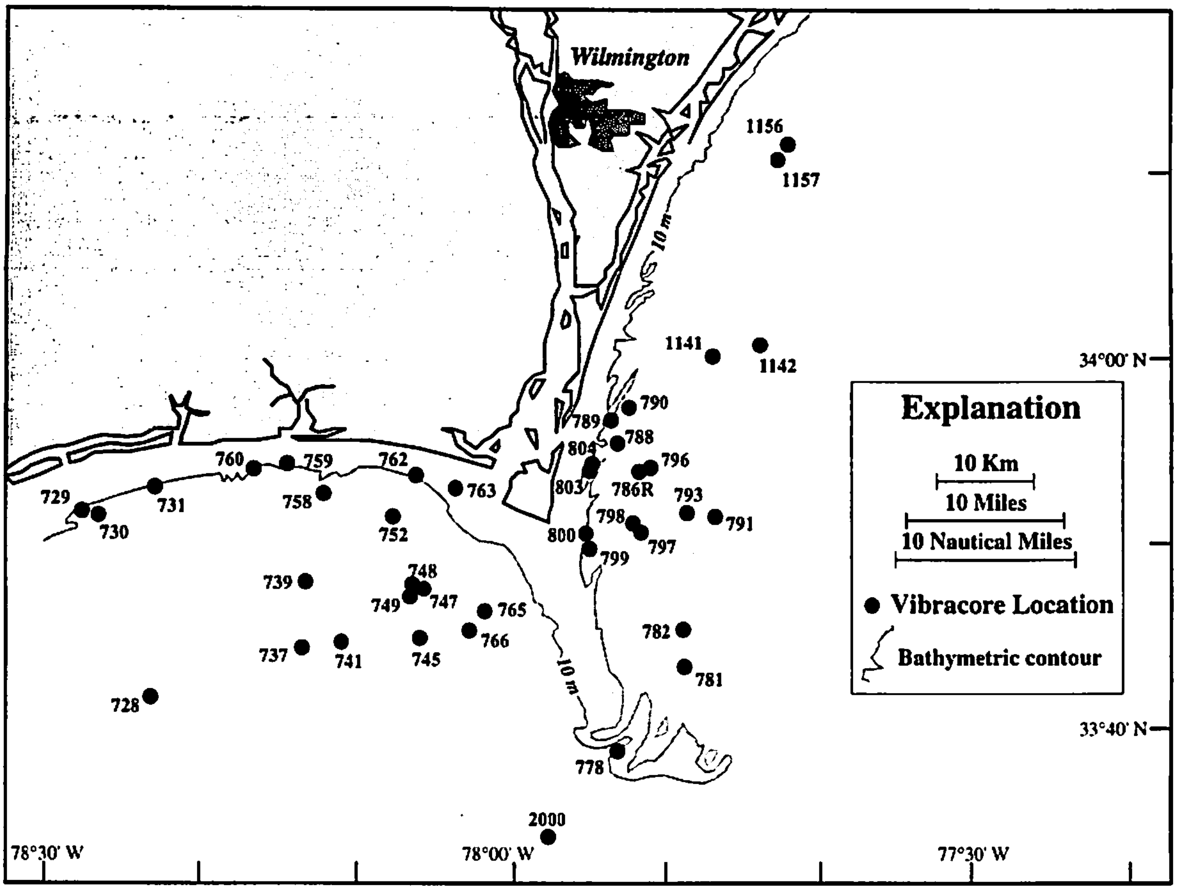

Figure 2. Location and USGS number for vibracores examined in this study in the Cape Fear cuspate foreland area, southern Onslow Bay and northeastern Long Bay

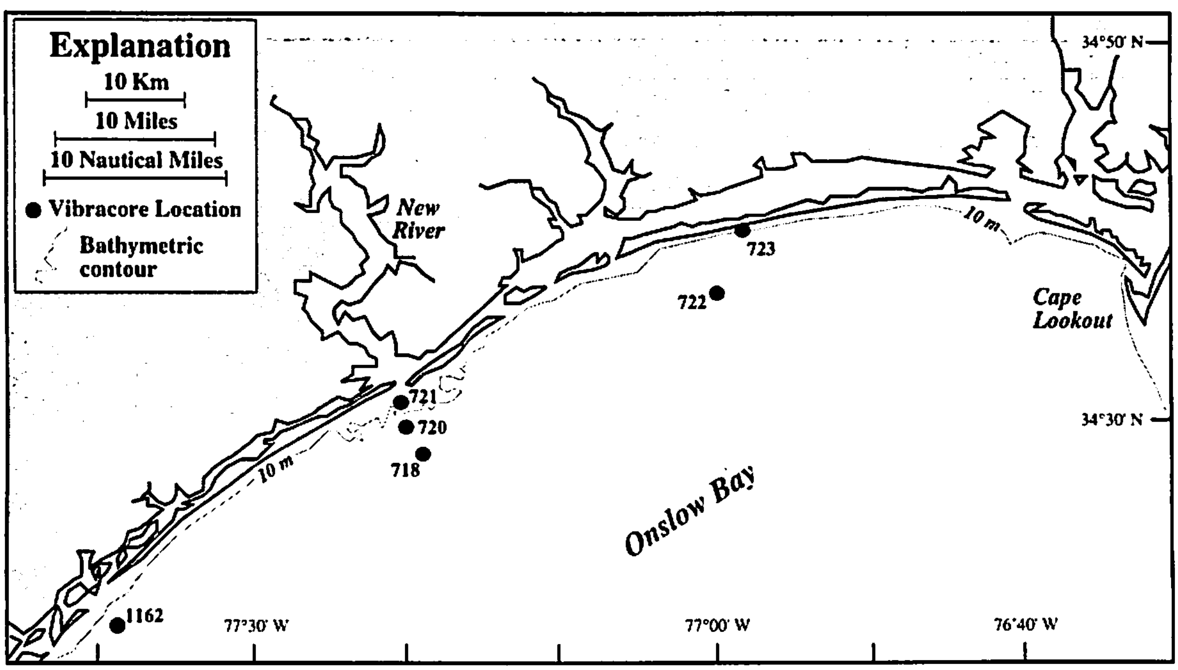

Figure 3. Location and USGS number for vibracores examined in this study in the northeastern portion of the sudy area, northern Onslow Bay.

(CERC) of the U. S. Army Corps of Engineers collected the vibracores in 1971 and 1972 as a part of a CERC reconnaissance study designed to locate and inventory suitable sand resources and to acquire geologic data along the Atlantic Continental Shelf. This program was known as the Inner Continental Shelf Sediment and Structure program (ICONS).

The North Carolina portion of the ICONS study resulted in two companion reports (Meisburger, 1977; 1979). The first report dealt exclusively with sand nourishment resources from this area; the second report presented lithologic, textural, and limited biostratigraphic data for the North Carolina ICONS study area. Meisburger (1979) correlated cores using lithologic data supported by limited biostratigraphic data.

The U.S. Geological Survey (USGS) inventoried and renumbered the ICONS vibracores after obtaining custody of them. The USGS numbering scheme for the vibracores is used herein; however, the CERC vibracore codes are also provided for cross-reference purposes. An "R" designation following the core number indicates a replicate vibracore.

PREVIOUS HEAVY-MINERAL WORK

Meisburger (1979) reported small quantities of colored, translucent mineral grains in these cores, and noted that their occurrence was mostly restricted to the "surficial and near-surface deposits." He performed heavy-liquid separation of a "few selected samples" in bromoform (sp gr = 2.87) and determined that most of these colored translucent mineral grains were heavier than quartz. He also noted that most of these minerals were pink to red, pale-yellow, or pale yellowish-green, and identified these grains as garnet, staurolite, and epidote, respectively, based upon previous mineralogical studies of the surficial shelf sediments in the area (Pilkey, 1963; Moore and Gorsline, 1963; Gorsline, 1963).

Eighty-seven ocean floor grab-samples from the North Carolina Continental Shelf were analyzed for mineralogy and texture (Grosz and others, 1990). Of the 87 samples, 54 were from the area referred to in that report as "south of Hatteras" which partially coincides with the current study area. These samples averaged 1.04 weight percent heavy minerals in a range of 0.04 to 3.27 weight percent with a standard deviation of 0.71.

Textural and mineralogical analyses for193 samples from 67 of the 114 ICONS vibracores were reported by Nickerson and others (1993). These samples averaged 0.56 weight percent total heavy minerals (THM) in a range of <0.01 to 3.69 weight percent with a standard deviation of 0.48.

The economic heavy minerals (EHM) ilmenite, leucoxene, rutile, zircon, monazite, and the aluminosilicates (undifferentiated kyanite, sillimanite, and andalusite) comprised an average of 44.4 weight percent of the heavy-mineral concentrates in a range of 0.27 to 68.1 weight percent. Ilmenite was found to be the most abundant EHM in the concentrates with an average weight percent of 26.07. The remaining EHM suite, on average, contained 5.75 weight percent rutile, 5.73 weight percent zircon, 4.45 weight percent leucoxene, 3.54 weight percent aluminosilicates, and 0.36 weight percent monazite.

Mean grain size for the clastic samples was determined to be 2.74Ø. Grain size analyses indicated that sediments with THM content greater than or equal to 1.0 weight percent had mean grain sizes that fell between the 2.0Ø and 4.0Ø size classes (fine- to very fine grained sand).

LABORATORY PROCEDURES

Heavy-Mineral Separation and Concentration

The procedures used in processing the vibracores are outlined in Nickerson and others (1993). Vibracores were opened, photographed, described, subsampled, and processed for heavy-mineral content. Channel subsamples (about one kilogram) were taken to provide material for textural and compositional analyses, and to produce an archive sample. The remainder of the core was consumed in the processing for heavy-minerals.

Preconcentration of the heavy minerals was performed with a 3-turn spiral device where water and centrifugal force act as separation agents. This separation produced two subsamples: a spiral concentrate and a spiral reject. Heavy-liquid separation of the spiral concentrate through Acetylene Tetrabromide (*Tetrabromoethane*, sp gr = 2.96) produced the final heavy-mineral concentrates referred to as SHTBS (Spiral Heavy Tetrabromoethane Sinks). A subsample of the spiral rejects material was also processed through Acetylene Tetrabromide to estimate the amount of heavy minerals "lost" in the spiraling operation. The spiral reject heavy-liquid concentrate is referred to as SLTBS (Spiral Light Tetrabromoethane Sink).

The amount of recovered heavy minerals (RHM) in the bulk sample was calculated by dividing the SHTBS weight by the bulk sample weight. The heavy mineral content of the spiral rejects (as estimated from a subsample) added to the RHM amount provides the THM value on a bulk sample basis.

The heavy-mineral concentrates were weighed, labeled, and fractionated using two electromagnetic devices; a Frantz Isodynamic Magnetic Separator and a Frantz Magnetic Barrier Laboratory Separator. The latter instrument can be set to operate a different amperages (A) to isolate mineral species of given magnetic susceptabilities. This separation facilitates the identification and quantification of the minerals present in the heavy-mineral fractions and reduces the number of mineral species in a given magnetic fraction. In most samples, 6 magnetic fractions (ferromagnetic; 0.2 A; 0.4 A; 0.6 A; 1.8 A and >1.8 A) were generated for each heavy-mineral concentrate; smaller heavy-mineral concentrates (<10 g) were split at 0.5 A. On average, the dominant mineral phases in the separations were as follows:

Separation	Minerals
Ferromagnetics	ilmenite, iron oxides, and trace amounts of epidote, aluminosilicates, zircon (with inclusions) and pyroboles (undifferentiated amphiboles and pyroxenes)
0.2 A fraction	ilmenite and garnet
0.4 A fraction	ilmenite, epidote, staurolite, and pyroboles
0.6 A fraction	epidote, tourmaline, sulfides (mainly framboidal pyrite/ marcasite), and staurolite
1.8 A fraction	leucoxene, sulfides, rutile, aluminosilicates, and tourmaline
>1.8 A fraction	zircon, quartz (present as a contaminant), rutile, aluminosilicates, and phosphate

Processing for Textural Data

Standard sieve analysis techniques were used to obtain grain-size data for all clastic samples. Mean grain size and standard deviation were calculated using the method of moments described by Folk (1974). A portion of the channel subsample was used for sieve analysis. Splits of this subsample were weighed and wet-sieved to remove material finer than 4Ø (0.044 mm–silt and clay fractions) and material coarser than -1.0Ø (2.0 mm– gravel fraction). The remaining sand-sized material was sieved, weighed, and archived. Calculations of mean grain size incorporated the finer than 4Ø weight fraction. Because the gravel fraction contained mostly shell material and no mineral grains, its weight was ignored in the calculations.

A representative split of the channel subsample was used to determine carbonate content by acid digestion. This work was performed by the North Carolina State University Minerals Research Laboratory in Asheville, North Carolina. Data for weight percent carbonate and mean grain size are listed in Appendix C.

Mineralogy

All samples were examined under a binocular microscope with reflected- and transmitted-light capability. Mineral identification was accomplished by observing the shape, color, and optical properties of the mineral grains. Short-wave (254 nm) and long-wave (365 nm) ultraviolet illumination aided in the identification of monazite and zircon, respectively. A petrographic microscope was used to confirm mineral identities. Sixteen mineral species consistently categorized are listed in Appendix D. Visual estimation of the relative mineral abundances in each magnetic fraction was accomplished by comparing binocular volumetric estimates to area percentage diagrams of Terry and Chilingar (1955).

A thin layer of mineral grains (ideally one-grain thick) was viewed through the microscope in order to allow for mineral identification and optimal correlation with the area percentage diagrams. Summing mineral species estimates across all magnetic fractions for a given sample determined the final heavy-mineral composition for that sample (Appendix D). Weight percent heavy minerals was calculated by multiplying the volumetric estimate for a given mineral species by the weight of that magnetic fraction, and dividing this product by the bulk sample weight.

Detailed statistical analysis of the heavy-mineral concentrates is an ongoing thesis project at North Carolina State University by Wenfeng Li and is planned to be presented in a future, comprehensive project report.

STRATIGRAPHY

A preliminary stratigraphic framework (Figure 4) was established for this data set on the basis of: 1) lithologic descriptions and photographs of the vibracores; 2) foraminiferal biostratigraphic analysis performed on 19 project cores by Larry Zarra, former geologist with the North Carolina Geological Survey (NCGS), as summarized in Hoffman and others (1991)—Zarra's micropaleontology notes remain on file at the NCGS and this work is cited extensively below as "Zarra (unpublished data);" 3) limited molluscan biostratigraphic analysis provided by L. W. Ward, Virginia Museum of Natural History; 4) additional biostratigraphic work performed by Mary Watson under this current study; and 5) seismic sequence analysis of a portion of the study area as reported in Snyder and others (1994).

Stratigraphic identifications, queried or questioned where more data and analysis are needed, are compiled in Appendix E. Note that this table includes samples for which mineralogical and textural data have been given in earlier project reports (Hoffman and others, 1991; Nickerson and others, 1993). Those reports did not reflect the stratigraphic analysis done under this phase of the study.

Additional biostratigraphic work as well as more complete integration of the litho- and biostratigraphy with seismic sequence analysis of the region is anticipated in the next phase of this study. This effort will refine the working framework described below and stratigraphic

Quaternary	Recent	Qh_1
	Holocene	
	Pleistocene	PP_1 PP_2
Tertiary	Pliocene	
	Miocene	Pungo River Fm.
	Oligocene	River Bend Fm. Oligocene sand
	Eocene	Castle Hayne Fm.
	Paleocene	Beaufort Fm.
Late Cretaceous		Peedee Fm.

Figure 4. Preliminary stratigraphic framework for ICONS vibracore data set.

assignments given to the project samples in Appendix E.

The oldest unit encountered, the Peedee Formation of Late Cretaceous age, crops out in northwestern and north-central Long Bay (cores 732, 730, and 758). This unit is characteristically a muddy, fine- to medium-grained quartz sand with trace amounts of glauconite and phosphate. Zarra (unpublished data) assigned samples from this unit to the *Gansserina gansseri* planktic Zone, which is Maastrichtian (Upper Cretaceous). This unit has been traced through the subbottom via seismic records into southern Onslow Bay as seismic sequence K_{pd} of Snyder and others (1994).

The Paleocene Beaufort Formation occurs in cores 727, 736, 743, and 751. The unit consists of muddy, fine- to medium-grained glauconitic quartz sand with locally occurring turritelid-mold biosparrudite (core 751). Hoffman and others (1991) did not report any Paleocene section in the cores examined for that study. This unit is identified on the basis of: 1) lithologies that correlate with Paleocene age sediments reported by Harris (oral communication) from vibracores in Long Bay; 2) the presence of *Flabellum*, a coral commonly recognized as a Paleocene indicator, in sample 727.2; 3) similar lithologies described from onshore boreholes by Zarra (1991); and 4) stratigraphic identifications made by Meisburger (1979) on some of these same cores. Paleocene strata have been reported to crop out in Long Bay by Meisburger (1979).

The middle Eocene Castle Hayne Formation crops out in northern Long Bay (cores 752, and 755) and consists of a sandy bryozoan biomicrudite to a biosparrudite. Zarra (unpublished data) identified two diagnostic Castle Hayne foraminifera in core 755, *Eponides carolinensis* and *Siphonina danvillensis*, and core 767 contained the middle Eocene megafossil *Pecten membranosus*. Snyder and others (1994) showed that the Castle Hayne Formation, in southern Onslow Bay, is thin, discontinuous, and occupies channels cut into the underlying Peedee strata.

Oligocene age deposits are represented by the molluscan-mold biosparrudite of the River Bend Formation, and an unnamed fine- to very fine-grained, well-sorted, dolomitic, muddy quartz sand unit. The River Bend Formation crops out in the New River Inlet area in cores 718, 719, and farther south in core 2002. The unnamed sand unit is widespread in southwestern Onslow Bay and crops out in cores 1159, 1145, 1146, and 797. Hoffman and others (1991) reported that the unnamed Oligocene sand unit is biostratigraphically equivalent to the River Bend Formation.

Core 724 penetrated Miocene Pungo River Formation. The lithology consists of medium-grained, poorly sorted, slightly shelly phosphatic sand. Zarra (unpublished data) noted the presence of a middle to upper Miocene benthic index species, *Virgulinella miocenica*, and stated that the age could be in the range of planktic Zone N9 to N11.

Several large valley-fill lithosomes delineated by seismic data in southern and south-central Onslow Bay (PP_{vf} unit of Snyder and others, 1994) have been confirmed through vibracore data to be composed of biomicrudite, biomicrite, and biosparrudite. These deposits, informally called PP_1 in this study, commonly contain pieces of bryozoans, barnacle plates, abraded fragments of molluscan shells, and a mixture of Pliocene and Pleistocene micro and macrofaunas (cores 805, 792, 2001R in Hoffman and others, 1991; cores 788, 789, 795, 803, 804 in this study). The PP_1 unit occupies 4 northwest-southeast-trending paleovalleys greater than 3 kilometers wide and cut more than 15 meters deep into the Oligocene section (Snyder and others, 1994).

Muddy shelly sands and silty clays of Pliocene, Pleistocene, or mixed Plio/Pleistocene age have been identified here as the PP_2 unit. Within this range of lithologies, the unit exhibits a high degree of variability throughout the study area. Thirtytwo cores have outcropping PP_2 strata (Appendix E). Zarra (unpublished data) recognized *Globigerina woodi* and *Globigerina eamesi*, both of which became extinct in the Pliocene, in core 783. Other PP_2 samples carry a clearly Pleistocene fauna (for example, *Carolinapecten eboreus* in sample 781.2 or *Chama gardneri* in sample 745.1). Core 799 contained both Pliocene and Pleistocene faunas (*Mulinia congesta* and *Mulinia lateralis*).

The PP_2 unit is considered to be approximately correlative with two lithosomes identified from shallow, high-resolution seismic data by Snyder and others (1994): the lower shoreface, a seaward extension of the modern shoreface, and paleofluvial channel fill deposits which consist of distinct channel-fill deposits that can be traced locally onto the shelf (Snyder and others, 1994).

Loose, slightly shelly, medium- to coarse-grained quartz sands present at the sediment-water interface along the inner shelf are interpreted to represent the youngest unit in the area. It is preliminarily assigned a Holocene age, and labeled "Qh_1." Shells with original pigment remaining are characteristic of this unit. This unit likely represents the two shoal lithosomes (linear shoreface-attached shoals and inner shelf sand shoals) of Snyder and others (1994) and is most prevalent in the Frying Pan Shoals area.

RESULTS

Data are tabulated in Appendices A, B, C, D, and E. Average THM content of the vibracores, expressed as a weight percentage of the bulk sample, is 0.51 in a range of <0.01 weight percent (sample 793.2) to 3.25 weight percent (sample 1162.2) with a standard deviation of 0.50 weight percent. Average EHM of the heavy-mineral concentrates is 45.78 weight percent. Ilmenite is the most abundant mineral of the EHM suite, constituting an average of 26.60 weight percent of the heavy-mineral concentrates.

The remainder of the average EHM content contains 8.77 weight percent zircon with 4.47 weight percent rutile, 4.27 weight percent aluminosilicates, 3.04 weight percent leucoxene, and 0.19 weight percent monazite. Other minerals having lesser economic significance include staurolite, tourmaline, and garnet with average weight percentages of 11.31, 4.48, and 3.42, respectively.

Mean grain size for the clastic samples was determined to be 2.88Ø (0.130 mm - fine-grained sand) with a range of 0.80Ø (0.55 mm) to 4.44Ø (0.045 mm) and a standard deviation of 1.0Ø (0.5 mm). Grain size analysis indicates that sediments with weight percent THM greater than or equal to 1.0 have mean grain sizes that fall between 1.9Ø (0.26 mm) and 3.6Ø (0.08 mm) and are classified as medium- to very fine grained sand (Figure 5). Preliminary stratigraphic unit assignments indicate that the Oligocene sand unit has the greatest potential for heavy-mineral resources with an average weight percent THM of 0.86 (Figure 6).

The average zircon-tourmaline-rutile (ZTR) index (Hubert, 1962) for the quartz sands is 33, in a range of 17 to 68. The values obtained are highly variable and no obvious trend was identified. These results are listed in Appendix C.

CONCLUSIONS

1) Heavy-mineral resource potential along the southern inner Continental Shelf of North Carolina appears to be poor based upon the examination of this data set. The average THM content for 113 samples from 47 vibracores is 0.51 weight percent and is well below the 4 percent threshold generally considered to be of interest for economic resource potential (Garnar, 1978).

2) Average EHM of the heavy-mineral concentrates is 45.8 weight percent, with a range of 4.6 to 68.8 weight percent, and a standard deviation of 13.8. Ilmenite is the most common heavy mineral, constituting 26.6 weight percent of the heavy-mineral concentrates.

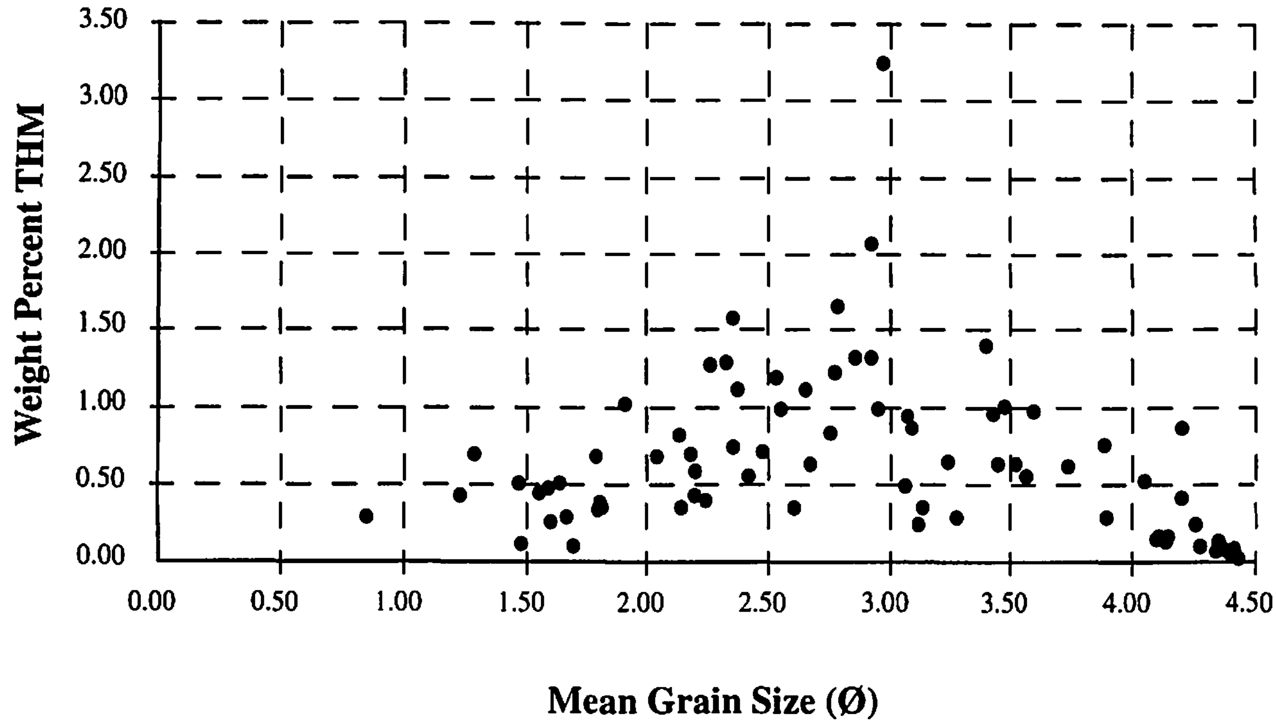

Figure 5. THM content versus mean grain size (Ø).

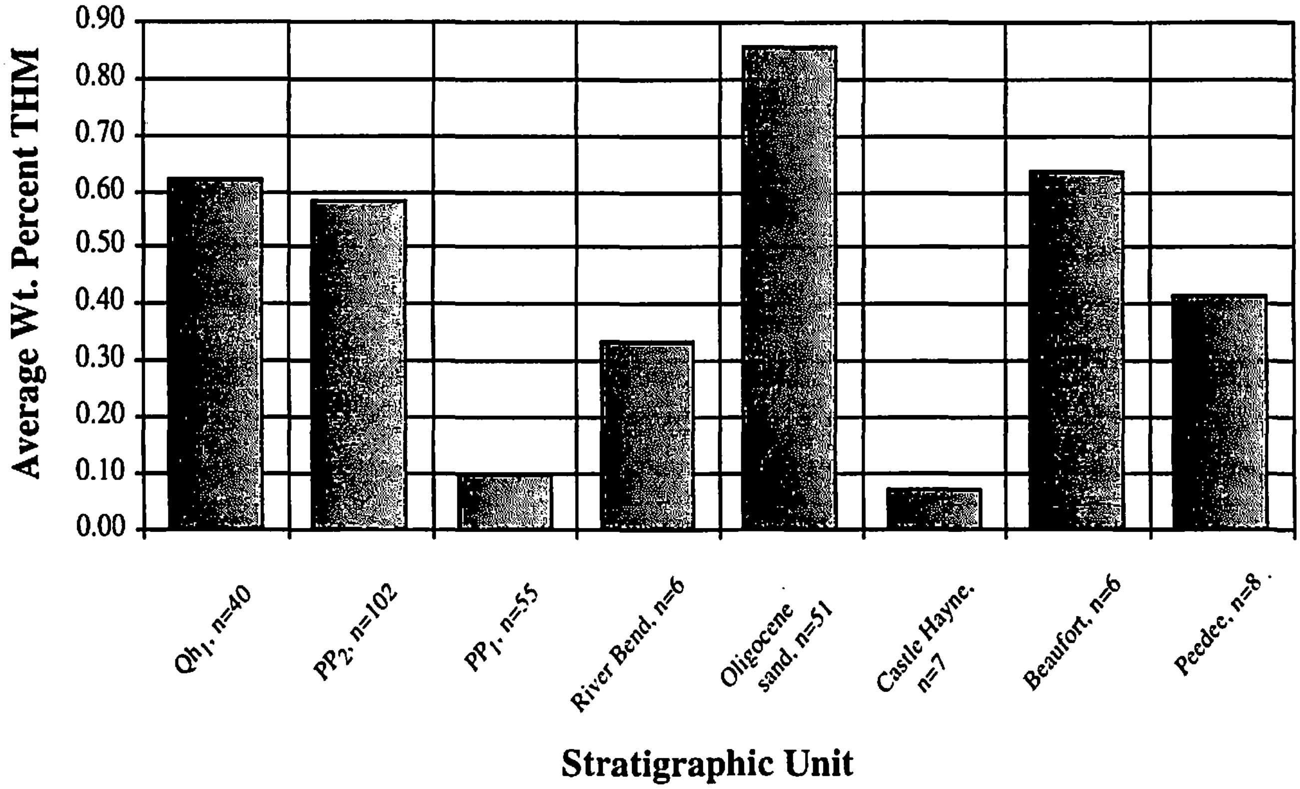

Figure 6. Average weight percent total heavy minerals (THM) for stratigraphic units identified in the Cape Fear cuspate foreland region.

3) Data derived from the initial 67 vibracores (Nickerson and others, 1993) are similar to concentrations derived from the 47 vibracores in the present study.

4) Preliminary stratigraphic unit assignments reveal that Oligocene sands in the project area, on average, contain 0.86 weight percent THM. This value is more than any other stratigraphic unit in the project area.

ACKNOWLEDGMENTS

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Andrew Grosz (USGS) provided the vibracores used in this study to the North Carolina Geological Survey and much of the equipment used in the sample processing. His guidance on various aspects of the study is gratefully acknowledged. Phillip Orozco assisted in sample processing courtesy of a grant supplied by the E. I. DuPont De Nemours and Company.

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APPENDIX A

Table showing sample number, CERC code, sample length (in meters), water depth of vibracores (in meters), bulk sample weight (in grams), weight percent of the gravel fraction of the bulk sample (+10 mesh–2 mm), and weight percent total heavy minerals (THM). Sample numbers are derived from the USGS core number and a decimal extension (.1, .2, etc.) to indicate a core segment that has been isolated as a sample interval. The .1 sample is the uppermost sample interval of a core, .2 is the next sample down, and so on. Samples are typically .5 to 2 m in length.

Appendix A

Sample Number	CERC Number	Sample Length (m)	Water Depth (m)	Bulk Weight (g)	Wt. % +10 mesh	Wt. % THM
718.1	98	0.77	13	5,612	52.4	0.22
720.3	100	1.54	11	15,365	43.7	0.50
720.4		1.58		15,419	1.7	1.16
721.1	101	1.24	9	7,029	1.5	0.86
721.2		1.78		14,508	0.1	0.54
722.1	97	0.77	16	4,614	16.9	1.28
722.2		1.21		4,905	1.2	0.07
722.3		1.96		14,311	15.1	1.11
723.1	96	0.89	14	4,683	28.7	0.49
723.2		1.45		8,401	36.8	0.06
728.1	8	1.82	19	7,692	0.5	0.28
728.2		1.50		5,859	0.1	0.01
728.3		1.56		6,170	0.2	0.05
729.1	22	0.93	10	5,916	18.0	0.67
729.2		0.72		5,740	3.0	0.95
730.1	23	1.01	11	7,402	31.2	0.27
731.1	41	1.81	9	11,280	16.9	0.82
731.2		1.43		12,730	25.3	0.22
737.1	28	1.52	18	10,451	3.3	0.99
737.2		1.39		6,521	0.3	0.14
737.3		1.69		7,720	0.2	0.22
737.4		1.48		6,271	0.1	0.09
739.1	27	2.28	16	16,039	6.0	0.69
739.2		1.88		8,614	0.7	0.09
739.3		1.25		4,967	1.5	0.06
741.1	11	1.56	17	8,992	4.0	0.33
741.2		1.55		12,335	54.9	0.06
741.3		1.53		11,655	45.5	0.07
741.4		1.34		9,313	40.2	0.06
745.1	44	1.37	16	9,804	3.5	1.31
745.2		1.48		6,482	0.1	0.12
745.3		1.50		6,191	0.1	0.04
745.4		1.54		8,081	0.1	0.50
747.1	2	0.62	14	2,820	30.2	0.28

Sample Number	CERC Number	Sample Length (m)	Water Depth (m)	Bulk Weight (g)	Wt. % +10 mesh	Wt. % THM
748.1	4	1.18	16	9,171	22.5	0.31
748.2		1.30		8,558	56.2	0.18
749.1	3	0.74	16	6,102	35.1	0.25
752.1	18	1.59	13	7,072	36.6	0.18
758.1	33	0.87	12	6,037	49.1	0.61
759.1	39	1.59	6	12,318	2.0	0.98
759.2		1.65		12,359	4.2	1.26
760.1	40	1.17	7	13,674	7.0	1.02
760.2		1.47		12,787	15.9	0.37
762.1	37	0.73	10	3,527	19.6	0.48
763.1	36	1.89	8	14,063	6.0	0.73
763.2		2.39		16,536	15.1	0.32
763.3		1.45		9,325	2.7	0.64
765.1	34	1.60	15	7,836	2.9	0.63
765.2		1.30		11,265	3.5	0.46
766.1	35	1.09	15	7,093	1.9	1.11
766.2		1.15		7,292	8.4	0.82
778.1	61	2.25	12	19,015	0.4	0.34
781.1	66	1.32	15	8,565	41.7	0.41
781.2		1.05		6,127	28.5	0.27
782.1	67	0.82	15	5,706	52.5	0.21
786.1	75	1.09	13	6,811	33.5	0.69
786.2		0.84		5,702	53.5	0.15
786R.1	75	0.71	13	4,477	52.0	0.14
786R.2		2.33		15,745	0.9	0.12
788.2	74	1.52	11	8,099	57.9	0.05
788.3		1.51		7,406	37.8	0.07
789.1	69	1.10	11	8,333	19.3	0.24
789.2		1.54		13,777	53.7	0.08

Appendix A

Sample Number	CERC Number	Sample Length (m)	Water Depth (m)	Bulk Weight (g)	Wt. % +10 mesh	Wt. % THM
790.1	60	1.09	15	7,759	3.0	0.57
790.2		1.53		12,847	0.8	0.97
790.3		1.35		11,768	0.1	0.74
790.4		1.34		11,853	0.1	0.51
791.1	113	1.44	16	16,495	15.1	0.24
791.2		1.40		16,644	25.5	0.07
791.3		1.51		18,307	21.3	0.04
791.4		1.50		14,176	39.3	0.08
793.1	76	1.01	18	5,493	44.0	0.05
793.2		1.02		6,218	40.1	0.01
793.3		1.49		9,157	48.1	0.01
793.4		1.59		10,103	46.4	0.02
796.1	78	1.92	14	12,901	30.1	0.50
796.2		1.06		7,742	0.3	0.15
796.3		1.40		10,675	0.1	0.41
797.1	48	1.62	13	12,703	1.3	0.62
797.2		1.54		13,185	0.2	0.62
797.3		1.50		12,663	0.2	0.55
797.4		1.51		12,405	0.1	0.61
798.1	49	1.66	15	12,776	10.4	1.40
799.1	50	1.01	11	6,994	5.0	0.50
799.2		2.11		12,017	4.0	0.38
799.3		2.31		18,940	15.7	1.57
799.4		0.74		4,936	10.1	0.32
800.1	51	2.10	11	14,341	22.7	0.66
800.2		1.81		9,162	2.0	0.15
800.3		1.09		5,381	0.7	0.07
800.4		1.14		8,790	21.4	0.34

Sample Number	CERC Number	Sample Length (m)	Water Depth (m)	Bulk Weight (g)	Wt. % +10 mesh	Wt. % THM
803.1	72	1.03	12	5,452	60.8	0.14
803.2		0.99		5,196	69.5	0.05
803.3		1.16		4,323	19.7	0.22
803.4		1.23		7,477	64.9	0.07
804.1	71	2.11	13	17,844	39.7	0.16
1141.2	108	1.86	15	15,410	4.8	0.48
1141.3		1.71		13,541	4.2	0.85
1142.1	109	0.30	16	824	1.9	0.34
1156.1	88	1.50	27	9,261	4.1	0.96
1156.2		1.57		8,714	1.2	1.00
1156.3		2.18		14,295	2.2	1.32
1156.4		0.90		5,597	0.2	0.93
1157.1	89	1.15	17	9,001	12.1	0.43
1157.2		1.90		14,596	0.2	1.18
1157.3		1.55		11,965	0.1	1.65
1157.4		1.37		8,218	0.3	2.06
1162.1	104	1.20	13	8,709	8.9	1.22
1162.2		1.23		9,161	0.4	3.25
2000.1	64	1.20	19	8,752	1.8	0.11
2000.2		1.61		13,832	1.7	0.08
2000.3		0.76		5,658	3.6	0.41
2000.4		0.90		6,534	2.5	0.69
Count (n):					113	113
Average:					17.0	0.51
Maximum:					69.5	3.25
Minimum:					0.1	<0.01
Stan. Dev.					19.6	0.50

APPENDIX B

Table showing sample number, a short lithologic description, and total heavy mineral content (THM) for samples in the study.

Appendix B

Sample Number	Lithologic Description	Wt % THM
718.1	phosphatic, sandy, moldic biomicrudite	0.22
720.3	sandy, moldic, biomicrite / calcareous, fine-grained quartz sand	0.50
720.4	calcareous, fine-grained quartz sand	1.16
721.1	very fine grained quartz sand/ muddy quartz sand/ silty, laminated mudstone	0.86
721.2	silty mudstone / fine-grained quartz sand	0.54
722.1	shelly, loose, fine- to medium-grained quartz sand	1.28
722.2	silty, sandy clay	0.07
722.3	muddy, shelly, medium- to fine-grained quartz sand / phosphatic, sandy, dolomite cobble	1.11
723.1	muddy, shelly, medium-grained quartz sand / shell beds / flat, oblong pebbles at base	0.49
723.2	sandy, bryozoan biomicrudite, scattered pebbles	0.06
728.1	muddy, medium- to fine-grained quartz sand / silty clay	0.28
728.2	silty clay	0.01
728.3	silty clay	0.05
729.1	shelly, muddy, medium- to fine-grained quartz sand	0.67
729.2	silty organic-rich clay	0.95
730.1	muddy, coarse- to fine-grained quartz sand / glauconitic, phosphatic, silty mudstone	0.27
731.1	slightly shelly, muddy medium- to fine-grained quartz sand / sandy clay	0.82
731.2	glauconitic, phosphatic, very fine grained, sandy, dolomitic clay	0.22
737.1	shelly, muddy, fine-grained quartz sand	0.99
737.2	muddy, fine-grained quartz sand, scattered shells	0.14
737.3	silty laminated mudstone/ lenses of sand, silty partings,	0.22
737.4	silty laminated mudstone/ lenses of sand, silty partings,	0.09
739.1	coarse-grained quartz sand / muddy, fine-grained quartz sand / silty mudstone	0.69
739.2	silty mudstone	0.09
739.3	silty mudstone	0.06
741.1	muddy, slightly shelly, fine-grained quartz sand	0.33
741.2	sandy bryozoan biomicrudite	0.06
741.3	sandy bryozoan biomicrudite	0.07
741.4	sandy bryozoan biomicrudite	0.06
745.1	muddy fine-grained sand	1.31
745.2	silty laminated clay	0.12
745.3	silty laminated clay	0.04
745.4	silty laminated clay /fine-grained muddy sand	0.50
747.1	sandy shell hash	0.28
748.1	sandy biomicrudite	0.31
748.2	sandy biomicrudite	0.18
749.1	sandy biomicrite	0.25
752.1	bryozoan biomicrudite	0.18
758.1	muddy, slightly shelly, medium- to granular-sized quartz sand, fines downward	0.61
759.1	slightly muddy, shelly medium- to fine-grained quartz sand	0.98
759.2	shelly, muddy coarse to fine-grained quartz sand / organic-rich clay	1.26
760.1	shelly, coarse- to fine-grained quartz sand	1.02
760.2	shelly, coarse- to fine-grained quartz sand	0.37
762.1	shelly, sandy clay/ shelly, muddy coarse-grained quartz sand	0.48
763.1	shelly, muddy coarse-grained sand / sandy clay	0.73
763.2	shelly, muddy, coarse- to medium-grained quartz sand / sandy clay	0.32

Appendix B

Sample Number	Lithologic Description	Wt % THM
763.3	interbedded shelly, muddy, medium- to fine-grained quartz sand & organic rich clay	0.64
765.1	silty, muddy, fine-grained quartz sand/ shells/ wood fragments	0.63
765.2	coarse-medium, clean quartz sand	0.46
766.1	muddy, fine-grained quartz sand	1.11
766.2	muddy, fine-grained quartz sand / calcareous muddy quartz sand	0.82
778.1	medium- to coarse-grained, slightly shelly clean quartz sand	0.34
781.1	muddy, shelly, coarse- to medium-grained quartz sand with abraded (rounded) shell fragments	0.41
781.2	muddy,shelly, fine- to coarse-grained quartz sand	0.27
782.1	shelly quartz sand / phosphatic, sandy, moldic biomicrudite	0.21
786.1	pebbly, shelly, medium-grained quartz sand	0.69
786.2	sandy, bryozoan biomicrudite	0.15
786R.1	moldic biomicruditewith common mollusc steinkerns	0.14
786R.2	glauconitic, phosphatic, silty, dolomitic quartz sand	0.12
788.2	biomicrudite	0.05
788.3	biomicrudite	0.07
789.1	sandy biomicrudite	0.24
789.2	sandy bryozoan biomicrudite	0.08
790.1	medium-grained quartz sand / phosphatic, dolomitic quartz sand	0.57
790.2	glauconitic, phosphatic, fine-grained, dolomitic quartz sand	0.97
790.3	phosphatic, muddy, fine-grained, dolomitic quartz sand	0.74
790.4	glauconitic, phosphatic, fine-grained, dolomitic quartz sand	0.51
791.1	shelly coarse sand / muddy medium-grained quartz sand/ sandy biomicrudite	0.24
791.2	sandy biomicrudite	0.07
791.3	sandy biomicrudite	0.04
791.4	sandy biomicrudite	0.08
793.1	bryozoan biomicrudite	0.05
793.2	bryozoan biomicrudite	0.01
793.3	bryozoan biomicrudite	0.01
793.4	bryozoan biomicrudite	0.02
796.1	shelly fine-grained quartz sand / shelly, muddy coarse- to medium-grained quartz sand / silty, sandy clay	0.50
796.2	dolomitic, muddy, silty, fine-grained quartz sand	0.15
796.3	dolomitic, muddy, silty, fine-grained quartz sand	0.41
797.1	muddy, dolomitic, fine-grained quartz sand, phosphate, glauconite	0.62
797.2	muddy, dolomitic, fine-grained quartz sand, phosphate, glauconite	0.62
797.3	muddy, dolomitic, fine-grained quartz sand, phosphate, glauconite	0.55
797.4	muddy, dolomitic, fine-grained quartz sand, phosphate, glauconite	0.61
798.1	thin shell lag with coarse- to fine -grained quartz sand / muddy, dolomitic fine-grained quartz sand	1.40
799.1	slightly shelly, coarse- to fine-grained quartz sand with scattered pebbles	0.50
799.2	interbedded slightly shelly, muddy quartz sand and organic-rich clay and muddy fine-grained quartz sand	0.38
799.3	muddy, very shelly, fine-grained quartz sand / muddy, shelly quartz sands	1.57
799.4	phosphatic, muddy, dolomitic sands	0.32
800.1	Silty clay / muddy, shelly quartz sand	0.66
800.2	slightly shelly, silty, clay w/ lenses of shelly, medium- to coarse-grained quartz sand	0.15
800.3	slightly shelly, silty, clay w/ lenses of shelly, medium-to coarse-grained quartz sand	0.07
800.4	muddy, shelly quartz sand/ muddy, dolomitic quartz sand	0.34

Appendix B

Sample Number	Lithologic Description	Wt % THM
803.1	thin coarse, shelly quartz sand / bryozoan biomicrudite	0.14
803.2	bryozoan biomicrudite	0.05
803.3	bryozoan biomicrudite	0.22
803.4	bryozoan biomicrudite	0.07
804.1	bryozoan biomicrudite	0.16
1141.2	phosphatic, glauconitic, dolomitic muddy quartz sand, rounded, and well-sorted	0.48
1141.3	phosphatic, glauconitic, dolomitic muddy quartz sand, rounded, and well-sorted	0.85
1142.1	slightly shelly, muddy, medium-to coarse-grained quartz sand	0.34
1156.1	shelly, muddy fine-grained quartz sand / laminated silty clay	0.96
1156.2	shelly, muddy fine-grained quartz sand / laminated silty clay	1.00
1156.3	shelly, muddy fine-grained quartz sand, laminated silty clay / shelly, med-fine grained quartz sand	1.32
1156.4	glauconitic, very fine grained quartz sand	0.93
1157.1	muddy, shelly, coarse- to medium-grained quartz sand	0.43
1157.2	slightly muddy, fine-grained quartz sand, glauconite	1.18
1157.3	slightly muddy, fine-grained quartz sand, glauconite	1.65
1157.4	slightly muddy, fine-grained quartz sand, glauconite	2.06
1162.1	shelly, muddy, medium-grained quartz sand	1.22
1162.2	muddy fine-grained quartz sand	3.25
2000.1	shelly, coarse-grained quartz sand	0.11
2000.2	shelly fine-grained quartz sand	0.08
2000.3	shelly fine-grained quartz sand	0.41
2000.4	shelly fine-grained quartz sand	0.69

APPENDIX C

Sample number, THM in weight percent, zircon-tourmaline-rutile index (ZTR) for the quartz sand samples, mean grain size (in phi units) for all clastic samples, and weight percent carbonate. ZTR index is a measure of the samples maturity; ZTR= (Zircon+Tourmaline+Rutile in weight percent)/(sum of the transparent minerals in weight percent).

APPENDIX C

Sample Number	Wt % THM	ZTR Index	Mean Grain Size (Ø)	$CaCO_3$ Wt%
718.1	0.22	—	—	58.9
720.3	0.50	—	—	48.5
720.4	1.16	38	—	14.3
721.1	0.86	—	4.20	15.0
721.2	0.54	32	2.43	6.7
722.1	1.28	28	2.33	30.3
722.2	0.07	—	4.37	18.0
722.3	1.11	38	2.38	20.4
723.1	0.49	20	—	67.9
723.2	0.06	—	—	93.5
728.1	0.28	—	3.90	14.6
728.2	0.01	—	4.44	19.7
728.3	0.05	—	4.39	17.0
729.1	0.67	39	1.79	25.3
729.2	0.95	—	3.60	58.3
730.1	0.27	—	3.28	54.4
731.1	0.82	18	2.76	44.6
731.2	0.22	—	3.12	71.7
737.1	0.99	24	2.96	20.9
737.2	0.14	24	4.10	13.7
737.3	0.22	—	4.26	17.9
737.4	0.09	—	4.35	18.5
739.1	0.69	40	2.18	20.1
739.2	0.09	—	4.28	19.9
739.3	0.06	—	4.34	26.7
741.1	0.33	41	2.61	18.1
741.2	0.06	—	—	93.8
741.3	0.07	—	—	90.6
741.4	0.06	—	—	89.5
745.1	1.31	35	2.86	14.2
745.2	0.12	—	4.35	24.2
745.3	0.04	—	4.40	26.9
745.4	0.50	—	4.06	15.7
747.1	0.28	—	0.85	76.4
748.1	0.31	—	—	58.7
748.2	0.18	—	—	70.6

Sample Number	Wt % THM	ZTR Index	Mean Grain Size (Ø)	$CaCO_3$ Wt%
749.1	0.25	—	—	60.1
752.1	0.18	—	—	83.5
758.1	0.61	—	—	51.5
759.1	0.98	18	2.56	18.2
759.2	1.26	29	2.27	21.9
760.1	1.02	25	1.91	27.1
760.2	0.37	18	1.81	26.4
762.1	0.48	47	1.62	50.3
763.1	0.73	17	2.36	17.5
763.2	0.32	34	1.80	38.1
763.3	0.64	25	3.24	20.3
765.1	0.63	42	2.68	14.8
765.2	0.46	42	1.60	4.6
766.1	1.11	26	2.66	16.3
766.2	0.82	26	2.14	20.3
778.1	0.34	27	2.15	9.9
781.1	0.41	24	1.23	52.6
781.2	0.27	35	1.67	55.2
782.1	0.21	—	—	61.3
786.1	0.69	39	1.29	47.8
786.2	0.15	—	—	94.0
786R.1	0.14	—	—	86.7
786R.2	0.12	47	4.14	25.3
788.2	0.05	—	—	95.7
788.3	0.07	—	—	93.8
789.1	0.24	—	—	56.8
789.2	0.08	—	—	95.9
790.1	0.57	25	2.20	34.1
790.2	0.97	50	3.60	53.8
790.3	0.74	41	3.89	50.5
790.4	0.51	36	4.05	51.7
791.1	0.24	29	1.61	56.8
791.2	0.07	—	—	84.3

APPENDIX C

Sample Number	Wt % THM	ZTR Index	Mean Grain Size (Ø)	$CaCO_3$ Wt%
791.3	0.04	—	—	94.0
791.4	0.08	—	—	94.7
793.1	0.05	—	—	99.6
793.2	0.01	—	—	99.5
793.3	0.01	—	—	99.6
793.4	0.02	—	—	99.3
796.1	0.50	43	1.48	45.9
796.2	0.15	68	4.11	20.9
796.3	0.41	57	4.20	18.1
797.1	0.62	48	3.45	38.0
797.2	0.62	34	3.52	38.2
797.3	0.55	50	3.57	33.2
797.4	0.61	52	3.74	27.6
798.1	1.40	48	3.40	24.5
799.1	0.50	30	1.64	8.1
799.2	0.38	25	2.25	25.2
799.3	1.57	39	2.36	45.3
799.4	0.32	22	—	57.0
800.1	0.66	31	2.04	42.0
800.2	0.15	—	4.15	20.7
800.3	0.07	—	4.42	21.8
800.4	0.34	40	3.14	37.8
803.1	0.14	—	—	77.9
803.2	0.05	—	—	93.9
803.3	0.22	—	—	68.5
803.4	0.07	—	—	82.5

Sample Number	Wt % THM	ZTR Index	Mean Grain Size (Ø)	$CaCO_3$ Wt%
804.1	0.16	—	—	87.1
1141.2	0.48	32	3.07	41.8
1141.3	0.85	34	3.10	41.8
1142.1	0.34	27	1.82	46.3
1156.1	0.96	—	3.43	26.6
1156.2	1.00	—	3.48	20.7
1156.3	1.32	34	2.93	19.7
1156.4	0.93	21	3.08	5.5
1157.1	0.43	26	1.56	14.6
1157.2	1.18	17	2.54	5.9
1157.3	1.65	23	2.79	4.4
1157.4	2.06	20	2.93	6.3
1162.1	1.22	36	2.78	16.6
1162.2	3.25	41	2.97	9.2
2000.1	0.11	34	1.49	5.9
2000.2	0.08	40	1.70	13.0
2000.3	0.41	39	2.20	23.5
2000.4	0.69	38	2.48	19.7
Count (n):	113	63	80	113
Average:	0.51	34	2.91	42.4
Maximum:	3.25	68	4.44	99.6
Minimum:	<0.01	17	0.85	4.4
Stan. Dev:	0.50	11	0.98	29.2

APPENDIX D

Table showing sample number, THM in weight percent, weight percent EHM of the heavy-mineral concentrates, and weight percentages for the sixteen minerals categorized in this study. The mineral abundances are expressed as weight percentages of the heavy-mineral concentrates. "ND" means not detected, or concentrations below visually quantifiable limits (< 1%); trace amounts of minerals, which were visually quantifiable, are reported as <0.01 weight percent. Mineral species abbreviations are: MAG=magnetite, ILM=ilmenite, GAR=garnet, STA=staurolite, EPI=epidote, PYR=pyroboles (undifferentiated pyroxenes and amphiboles), SIK=aluminosilicates (undifferentiated kyanite, sillimanite and andalusite), TOU=tourmaline, LEU=leucoxene (altered ilmenite), RUT=rutile, ZIR=zircon, MON=monazite, PHO=phosphate, GLA=glauconite, SUL=sulfides (framboidal pyrite/marcasite), CAR=carbonate material (generally sulfide-filled foraminiferal tests), and OTH=unidentified mineral grains.

Summary statistics for the data set are given at the end of the table. "COUNT" in summary statistics refers to number of samples used in calculations.

Appendix D

Sample Number	Wt% THM	Wt% EHM	MAG Wt%	ILM Wt%	GAR Wt%	STA Wt%	EPI Wt%	PYR Wt%	SIK Wt%	TOU Wt%	LEU Wt%	RUT Wt%	ZIR Wt%	MON Wt%	PHO Wt%	GLA Wt%	SUL Wt%	CAR Wt%	OTH Wt%
718.1	0.22	52.7	ND	35.05	6.00	16.82	16.38	ND	3.74	2.72	3.01	1.03	9.91	ND	4.08	ND	ND	ND	1.27
720.3	0.50	47.2	ND	29.69	3.45	21.84	9.77	ND	3.31	11.61	3.45	5.65	5.13	ND	2.53	ND	ND	3.37	0.20
720.4	1.16	50.2	ND	29.09	6.04	19.94	7.07	ND	1.38	7.88	6.95	5.71	7.11	ND	3.47	ND	ND	ND	5.37
721.1	0.86	52.5	ND	31.64	8.45	14.20	8.39	ND	4.88	5.28	3.51	4.30	8.13	ND	4.11	ND	ND	ND	7.10
721.2	0.54	40.5	ND	22.53	1.11	14.78	8.11	5.20	5.43	6.45	2.67	5.75	4.16	ND	2.42	ND	ND	ND	21.39
722.1	1.28	52.0	ND	36.13	4.34	12.28	12.64	5.32	3.88	6.75	4.13	2.63	5.21	ND	3.51	ND	ND	ND	3.17
722.2	0.07	63.8	ND	42.03	2.38	15.86	7.93	5.55	3.66	2.38	4.69	3.11	10.35	ND	1.04	ND	ND	ND	1.04
722.3	1.11	59.2	ND	41.88	2.90	10.00	7.79	1.57	2.81	4.01	2.90	3.12	8.50	ND	5.31	ND	3.99	ND	5.23
723.1	0.49	60.4	ND	45.84	4.37	7.95	13.93	5.37	3.06	1.06	3.71	2.04	5.78	ND	3.34	ND	0.09	1.55	1.91
723.2	0.06	33.1	ND	15.90	2.65	5.12	3.71	0.53	3.29	0.47	2.35	6.29	5.23	ND	3.29	ND	45.41	5.76	ND
728.1	0.28	47.2	ND	28.74	4.15	1.52	24.00	15.47	4.39	3.98	4.81	2.89	6.42	ND	0.58	ND	1.26	ND	1.80
728.2	0.01	24.0	ND	ND	ND	3.00	5.00	30.00	7.00	ND	7.00	5.00	5.00	ND	ND	ND	35.00	ND	3
728.3	0.05	37.8	ND	15.82	1.58	3.95	27.68	18.98	8.14	2.37	1.46	3.14	9.28	ND	ND	ND	3.42	ND	4.18
729.1	0.67	38.8	ND	20.78	6.54	6.64	9.94	13.56	5.21	17.13	3.29	2.49	7.00	ND	0.59	ND	3.17	ND	3.67
729.2	0.95	68.9	ND	48.21	1.98	13.21	ND	ND	2.36	0.66	1.32	3.40	13.58	ND	8.49	ND	3.40	ND	3.40
730.1	0.27	49.5	ND	34.14	2.73	13.01	19.99	3.22	5.84	1.62	2.58	1.42	5.58	ND	3.21	ND	6.68	ND	ND
731.1	0.82	37.7	<0.01	19.00	5.10	11.07	17.47	18.97	6.85	5.65	4.60	2.04	5.18	ND	3.05	ND	0.06	ND	0.96
731.2	0.22	47.8	ND	28.49	2.08	13.90	6.95	4.86	4.58	6.95	8.05	3.61	3.05	ND	9.15	0.69	7.63	ND	ND
737.1	0.99	44.2	ND	30.04	1.69	5.08	32.90	1.49	1.16	1.29	1.04	2.52	9.39	ND	0.18	ND	<0.01	ND	13.21
737.2	0.14	34.2	ND	11.45	ND	1.53	24.08	27.48	6.18	4.05	2.24	3.47	10.89	ND	ND	ND	ND	ND	8.63
737.3	0.22	33.8	ND	16.24	0.81	0.81	34.61	20.30	3.50	1.62	2.56	3.75	7.71	ND	ND	ND	ND	ND	8.07
737.4	0.09	32.8	1.58	15.77	ND	2.21	27.62	24.71	7.00	1.85	1.06	3.69	5.29	ND	ND	ND	ND	ND	9.23
739.1	0.69	47.6	<0.01	24.52	4.39	15.07	9.74	1.92	3.72	8.26	4.66	6.48	8.26	ND	6.52	ND	5.63	ND	0.82
739.2	0.09	40.2	ND	14.59	0.73	10.94	14.59	2.19	6.14	7.29	5.00	7.71	6.77	ND	1.35	ND	18.65	ND	4.06
739.3	0.06	20.0	ND	ND	3.00	10.00	10.00	3.00	5.00	5.00	5.00	7.00	3.00	ND	2.00	ND	37.00	ND	10.00
741.1	0.33	61.3	ND	36.00	1.56	6.86	13.10	3.37	5.61	5.83	3.97	5.17	10.52	ND	2.86	ND	ND	ND	5.16
741.2	0.06	45.8	ND	19.25	2.14	17.82	3.56	ND	4.30	1.43	2.87	2.72	16.66	ND	6.44	ND	22.82	ND	ND
741.3	0.07	39.9	ND	21.44	2.14	28.59	3.57	ND	3.57	7.15	2.71	5.00	7.13	ND	9.28	0.71	7.99	ND	0.71
741.3	0.07	39.9	ND	21.44	2.14	28.59	3.57	ND	3.57	7.15	2.71	5.00	7.13	ND	9.28	0.71	7.99	ND	0.71
741.4	0.06	44.6	ND	24.43	3.70	25.91	3.70	ND	7.41	7.66	3.52	4.04	5.19	ND	3.90	ND	9.23	ND	1.30
745.1	1.31	56.2	ND	33.86	3.24	4.38	17.48	9.53	3.83	7.30	5.36	5.35	7.86	ND	1.02	ND	ND	ND	0.81
745.2	0.12	42.7	ND	19.36	2.32	3.87	26.34	19.36	4.51	3.87	5.64	4.58	8.57	ND	ND	ND	0.45	ND	1.13
745.3	0.04	44.2	ND	23.53	ND	5.49	19.61	15.69	2.16	ND	4.31	5.59	8.63	ND	ND	ND	15.00	ND	ND
745.4	0.50	55.2	ND	16.01	1.71	ND	20.19	20.12	22.84	1.44	6.02	3.42	6.93	ND	ND	ND	ND	ND	1.33
747.1	0.28	62.2	ND	36.89	4.97	10.64	2.13	ND	2.91	2.13	1.45	2.03	18.88	ND	5.00	ND	0.87	ND	12.09
748.1	0.31	55.7	ND	35.81	2.59	15.69	4.43	ND	3.65	4.78	2.13	3.24	10.91	ND	14.43	ND	1.76	ND	0.57

Appendix D

Sample Number	Wt% THM	Wt% EHM	MAG Wt%	ILM Wt%	GAR Wt%	STA Wt%	EPI Wt%	PYR Wt%	SIK Wt%	TOU Wt%	LEU Wt%	RUT Wt%	ZIR Wt%	MON Wt%	PHO Wt%	GLA Wt%	SUL Wt%	CAR Wt%	OTH Wt%
748.2	0.18	51.1	ND	29.90	0.65	19.50	5.25	ND	5.90	4.55	3.05	3.50	8.75	ND	12.80	ND	4.40	ND	1.75
749.1	0.25	51.3	1.29	35.55	1.29	16.51	6.46	ND	5.31	2.29	1.00	4.18	5.31	ND	13.09	ND	1.06	5.95	0.71
752.1	0.18	34.0	ND	16.01	5.60	24.02	2.40	ND	1.99	4.00	1.00	2.99	11.96	ND	1.99	ND	24.02	ND	4.00
758.1	0.61	23.1	ND	14.82	1.65	10.80	11.30	0.47	3.31	5.21	0.86	1.02	3.15	ND	4.99	ND	40.59	ND	1.83
759.1	0.98	38.7	ND	18.88	1.61	10.37	21.81	20.91	7.72	4.23	2.50	3.72	5.89	ND	2.17	ND	ND	ND	0.21
759.2	1.26	51.1	ND	34.12	5.59	17.26	15.01	3.46	2.34	5.61	2.53	2.86	9.24	ND	0.42	ND	ND	ND	1.57
760.1	1.02	47.9	<0.01	28.55	2.13	10.30	28.48	6.86	1.88	1.73	3.02	3.17	11.33	ND	0.29	ND	ND	ND	2.27
760.2	0.37	44.9	ND	31.57	1.51	13.79	25.31	6.87	2.49	1.38	1.43	2.76	6.69	ND	0.12	ND	0.02	ND	6.06
762.1	0.48	67.5	ND	44.25	2.25	15.00	5.25	1.50	1.75	4.50	2.75	3.75	15.00	ND	2.75	ND	ND	ND	1.25
763.1	0.73	45.0	<0.01	27.14	3.25	14.79	29.08	3.82	5.99	2.43	2.90	2.28	6.67	ND	0.35	ND	ND	ND	1.30
763.2	0.32	48.2	ND	27.83	5.31	18.82	16.97	ND	2.61	7.28	2.26	4.03	11.49	ND	0.02	ND	1.86	0.02	1.50
763.3	0.64	46.7	ND	30.80	2.70	6.37	19.77	9.27	3.92	5.28	3.47	3.61	4.90	ND	0.58	ND	4.80	0.19	4.34
765.1	0.63	50.7	ND	23.09	0.87	13.33	17.55	2.00	5.68	11.34	5.26	8.19	8.48	ND	0.57	ND	ND	ND	3.66
765.2	0.46	56.8	ND	27.51	2.57	17.86	6.13	4.39	5.88	10.57	6.89	5.75	10.78	ND	ND	ND	0.23	ND	1.42
766.1	1.11	49.7	ND	28.27	1.13	4.39	31.78	3.12	3.52	2.09	4.35	3.97	9.64	ND	0.53	ND	ND	ND	7.21
766.2	0.82	49.5	ND	32.67	1.69	6.48	28.99	1.34	1.82	2.94	3.45	3.84	7.75	ND	0.07	ND	ND	0.64	8.32
778.1	0.34	48.1	<0.01	27.60	4.48	17.38	18.56	0.07	4.95	4.38	2.93	6.78	5.88	ND	0.69	ND	ND	0.68	5.63
781.1	0.41	36.9	ND	20.22	14.85	22.72	14.87	0.75	3.04	6.43	2.53	3.20	7.91	ND	2.07	ND	ND	ND	1.41
781.2	0.27	50.4	ND	27.51	3.52	16.64	17.92	ND	4.20	7.12	3.27	3.69	11.77	ND	0.55	ND	2.84	ND	0.98
782.1	0.21	52.5	ND	25.45	28.27	3.53	3.53	ND	4.17	7.07	ND	5.86	17.01	ND	2.17	ND	ND	ND	2.93
786.1	0.69	51.8	ND	30.20	9.83	14.40	8.70	1.71	1.34	4.59	2.22	3.70	14.39	ND	0.95	ND	6.95	ND	1.01
786.2	0.15	7.0	ND	2.00	2.00	3.00	2.00	1.00	2.00	ND	ND	2.00	1.00	ND	2.00	ND	83.00	ND	ND
786R.1	0.14	34.2	ND	18.05	3.01	12.03	5.01	ND	ND	5.00	ND	4.59	11.56	ND	3.80	1.20	35.76	ND	ND
786R.2	0.12	40.8	<0.01	19.56	2.67	3.96	1.59	ND	8.25	1.43	ND	7.98	5.05	ND	5.83	0.05	41.73	ND	1.90
788.2	0.05	4.6	ND	ND	1.08	8.08	2.00	ND	0.92	ND	ND	1.38	2.31	ND	3.92	ND	80.31	ND	ND
788.3	0.07	12.2	ND	5.51	1.65	5.51	5.20	1.10	1.35	7.00	ND	3.15	2.25	ND	6.15	ND	61.15	ND	ND
789.1	0.24	58.2	ND	31.00	5.47	13.96	9.40	2.77	4.66	6.11	2.29	6.57	13.70	ND	2.74	ND	1.24	ND	0.11
789.2	0.08	49.1	ND	22.71	4.42	12.61	6.31	1.26	1.85	4.42	1.11	4.95	18.46	ND	1.37	ND	20.54	ND	ND
790.1	0.57	42.2	ND	20.66	4.80	19.05	19.38	ND	5.96	4.00	3.13	3.63	8.80	ND	4.64	ND	1.25	ND	4.70
790.2	0.97	46.5	ND	18.51	0.52	10.85	0.60	<0.01	8.57	2.16	1.31	3.50	14.66	ND	6.87	ND	24.53	1.16	6.77
790.3	0.74	68.6	ND	33.23	2.22	7.86	0.31	ND	16.32	1.93	2.71	5.02	11.31	ND	3.86	0.15	10.64	1.53	2.91
790.4	0.51	62.0	ND	27.91	1.35	11.51	ND	ND	15.97	0.86	2.59	4.34	11.24	ND	5.06	0.49	11.30	1.37	6.03
791.1	0.24	43.9	ND	24.52	3.09	20.46	20.68	ND	2.66	4.40	1.99	4.28	10.44	ND	3.81	ND	ND	ND	3.67
791.2	0.07	40.2	ND	27.64	1.49	4.49	26.65	ND	2.52	0.25	0.51	3.51	6.07	ND	7.59	ND	11.96	6.55	0.76
791.3	0.04	26.4	ND	6.56	0.44	2.75	8.74	ND	2.13	1.31	0.56	5.87	11.26	ND	8.44	ND	29.18	21.63	1.13

Appendix D

Sample Number	Wt% THM	Wt% EHM	MAG Wt%	ILM Wt%	GAR Wt%	STA Wt%	EPI Wt%	PYR Wt%	SIK Wt%	TOU Wt%	LEU Wt%	RUT Wt%	ZIR Wt%	MON Wt%	PHO Wt%	GLA Wt%	SUL Wt%	CAR Wt%	OTH Wt%
791.4	0.08	12.5	ND	3.72	0.74	7.44	11.16	ND	0.77	2.74	ND	5.46	2.56	ND	6.41	ND	46.44	12.56	ND
793.1	0.05	67.3	ND	38.03	4.59	13.11	3.28	0.66	3.44	4.59	ND	5.17	20.66	ND	3.44	ND	ND	1.72	1.31
793.2	0.01	15.0	ND	5.00	2.00	7.00	ND	3.00	ND	ND	ND	5.00	5.00	ND	3.00	ND	70.00	ND	ND
793.3	0.01	8.6	ND	2.52	0.84	1.68	0.84	ND	1.32	ND	ND	0.79	3.97	ND	ND	ND	88.03	ND	ND
793.4	0.02	8.8	ND	2.98	0.60	1.39	0.40	ND	0.20	ND	ND	1.60	4.01	ND	2.80	ND	86.03	ND	ND
796.1	0.50	55.6	<0.01	30.69	7.68	12.10	11.48	0.06	4.13	8.09	2.22	7.55	11.02	ND	4.14	ND	0.84	ND	ND
796.2	0.15	66.0	ND	28.71	1.51	7.56	2.52	1.01	2.48	1.51	4.99	8.49	21.34	ND	9.93	ND	9.96	ND	ND
796.3	0.41	42.2	ND	19.76	4.03	9.85	ND	<0.01	2.82	2.62	ND	7.60	12.02	ND	12.20	1.80	19.90	ND	7.39
797.1	0.62	64.3	<0.01	39.71	1.60	9.98	0.53	ND	7.46	2.69	2.08	5.29	9.81	ND	6.29	ND	3.37	ND	11.20
797.2	0.62	64.5	<0.01	33.64	2.25	12.36	1.23	ND	14.40	1.08	1.91	4.23	10.31	ND	5.14	ND	0.83	ND	12.62
797.3	0.55	59.7	<0.01	37.38	2.87	10.92	1.82	ND	2.51	1.80	3.10	3.97	12.70	ND	5.38	ND	3.40	ND	14.16
797.4	0.61	53.9	ND	34.53	0.89	11.03	1.58	ND	1.31	1.19	3.12	4.34	10.61	ND	4.42	ND	0.36	ND	26.61
798.1	1.40	66.0	ND	36.82	2.72	11.12	0.88	ND	8.38	3.39	2.88	9.30	8.62	ND	9.31	ND	0.72	ND	5.86
799.1	0.50	50.5	ND	31.37	3.82	6.55	23.74	6.54	3.18	4.64	2.21	3.92	9.80	ND	0.62	ND	0.65	ND	2.95
799.2	0.38	48.2	<0.01	29.69	1.38	7.66	27.30	7.56	2.66	2.38	3.06	3.63	9.18	ND	0.35	ND	2.91	0.25	1.99
799.3	1.57	54.9	ND	33.72	1.39	7.60	19.72	3.06	2.27	4.75	2.18	4.49	12.20	ND	2.85	0.15	1.04	0.04	4.55
799.4	0.32	41.3	ND	26.89	4.95	13.54	17.08	ND	4.39	3.00	2.05	2.17	5.85	ND	7.31	ND	10.91	1.00	0.88
800.1	0.66	52.6	ND	34.95	7.19	12.83	14.04	1.46	3.86	5.65	1.53	6.41	5.90	ND	1.80	ND	0.93	ND	3.45
800.2	0.15	48.5	ND	27.20	3.89	7.77	15.54	2.33	8.34	13.22	1.11	3.34	8.47	ND	1.11	ND	6.55	ND	1.11
800.3	0.07	40.5	ND	25.30	2.53	5.90	5.90	2.53	2.35	4.22	0.78	3.13	8.93	ND	0.47	ND	37.95	ND	ND
800.4	0.34	46.6	ND	23.22	5.56	10.81	15.78	1.31	2.60	4.92	1.57	6.30	12.87	ND	5.13	ND	6.18	ND	3.73
803.1	0.14	50.2	ND	31.84	3.70	14.81	11.11	0.74	2.56	7.40	1.52	3.34	10.90	ND	1.30	ND	10.01	ND	0.78
803.2	0.05	14.0	ND	ND	1.00	10.00	ND	1.00	5.00	3.00	ND	7.00	2.00	ND	5.00	1.00	65.00	ND	ND
803.3	0.22	51.9	ND	26.70	4.92	14.05	12.03	1.41	3.49	10.00	2.97	6.57	12.19	ND	3.59	ND	2.08	ND	ND
803.4	0.07	48.4	ND	23.43	3.17	15.83	9.50	0.63	1.83	4.43	3.67	5.50	13.93	ND	4.47	ND	13.60	ND	ND
804.1	0.16	47.7	0.01	23.84	13.09	3.08	11.34	ND	2.00	11.66	1.24	4.48	16.17	ND	3.03	0.70	9.20	ND	0.15
1141.2	0.48	45.3	<0.01	23.27	4.29	19.70	13.20	ND	4.16	5.37	4.05	6.07	7.75	ND	7.75	ND	1.96	ND	2.41
1141.3	0.85	47.2	ND	27.52	5.08	15.41	14.98	0.62	2.78	4.89	1.57	7.46	7.86	ND	6.70	ND	ND	ND	5.13
1142.1	0.34	42.9	ND	22.73	7.10	17.10	20.66	0.71	4.32	5.00	2.87	3.61	9.40	ND	6.50	ND	ND	ND	ND
1156.1	0.96	52.4	ND	29.22	2.88	8.28	17.76	ND	2.50	1.80	2.24	5.77	12.64	ND	4.04	ND	2.27	0.09	10.51
1156.2	1.00	41.6	ND	28.01	3.04	10.05	20.36	0.74	1.21	0.77	1.00	2.78	8.59	ND	2.76	ND	1.62	0.01	19.07
1156.3	1.32	48.5	ND	31.44	1.73	12.12	19.26	0.01	1.32	3.84	1.78	4.77	9.24	ND	3.57	ND	1.91	ND	9.00
1156.4	0.93	37.3	ND	26.41	2.90	10.97	19.50	<0.01	0.31	0.63	2.00	2.44	6.13	ND	1.83	3.84	1.22	ND	21.81
1157.1	0.43	51.7	<0.01	33.03	1.26	10.71	16.20	ND	5.27	3.09	4.48	3.75	5.01	0.19	1.14	ND	11.25	ND	4.62
1157.2	1.18	44.5	<0.01	32.50	2.29	17.67	22.22	ND	1.99	1.26	2.51	2.80	4.68	ND	0.09	ND	ND	ND	12.00
1157.3	1.65	50.1	<0.01	34.72	3.09	15.78	20.14	ND	2.00	1.84	3.06	5.60	4.70	ND	0.05	ND	ND	ND	9.00

Appendix D

Sample Number	Wt% THM	Wt% EHM	MAG Wt%	ILM Wt%	GAR Wt%	STA Wt%	EPI Wt%	PYR Wt%	SIK Wt%	TOU Wt%	LEU Wt%	RUT Wt%	ZIR Wt%	MON Wt%	PHO Wt%	GLA Wt%	SUL Wt%	CAR Wt%	OTH Wt%
1157.4	2.06	47.9	ND	35.51	2.89	15.84	20.42	ND	1.29	1.23	2.35	3.14	5.60	ND	3.05	ND	0.45	ND	8.23
1162.1	1.22	54.4	ND	37.14	4.58	15.29	7.93	0.17	3.84	5.13	0.36	6.56	6.49	ND	7.45	ND	ND	ND	5.05
1162.2	3.25	37.4	ND	18.28	1.45	13.20	6.44	ND	2.02	0.78	2.02	7.05	8.07	ND	7.13	ND	1.83	ND	31.74
2000.1	0.11	51.3	ND	26.08	2.30	12.67	24.17	0.77	5.43	8.83	5.03	6.96	7.76	ND	ND	ND	ND	ND	ND
2000.2	0.08	61.1	ND	31.76	0.77	7.75	19.37	2.32	6.76	7.75	5.28	8.80	8.54	ND	0.45	ND	ND	ND	0.45
2000.3	0.41	59.8	ND	31.29	1.51	7.99	21.91	0.02	4.61	8.19	8.97	5.99	8.95	ND	0.47	ND	ND	ND	0.10
2000.4	0.69	63.4	<0.01	35.38	0.99	10.22	20.19	0.04	3.98	4.03	6.19	9.05	8.79	ND	ND	ND	ND	ND	1.15
Count (n):	113	113	19	109	109	112	108	71	111	106	100	113	113	1	101	11	78	20	91
Average:	0.51	45.78	0.15	26.60	3.42	11.31	13.34	5.48	4.27	4.48	3.04	4.47	8.77	0.19	3.83	0.98	16.00	3.30	5.13
Maximum:	3.25	68.87	1.58	48.21	28.27	28.59	34.61	30.00	22.84	17.13	8.97	9.30	21.34	0.19	14.43	3.84	88.03	21.63	31.74
Minimum:	<0.01	4.61	<0.01	2.00	0.44	0.81	0.31	<0.01	0.20	0.25	0.36	0.79	1.00	0.19	0.02	0.05	<0.01	0.01	0.10
Stan. Dev:	0.50	13.80	0.45	9.35	3.38	5.69	8.79	7.40	3.27	3.06	1.69	1.88	3.95	n/a	3.17	1.08	22.77	5.35	5.86

APPENDIX E

Table showing sample number, preliminary stratigraphic unit, and weight percent total heavy minerals (THM) for all CERC vibracore samples from the Cape Fear cuspate foreland project area. See text for descriptions of units and for key to abbreviations used.

Note that this table includes samples for which mineralogical and textural data have been given in earlier project reports (Hoffman and others, 1991; Nickerson and others, 1993). Those reports did not reflect the stratigraphic work done under this phase of the study.

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Sample Number	Stratigraphic Unit	Wt % THM
718.1	River Bend	0.22
719.1	Oligocene sand	0.74
719.2	River Bend	0.18
720.3	Oligocene sand	0.50
720.4	Oligocene sand	1.16
721.1	PP_2	0.86
721.2	PP_2	0.54
722.1	Qh_1	1.28
722.2	PP_2	0.07
722.3	PP_2	1.11
723.1	PP_2	0.49
723.2	PP_1	0.06
724.1	PP_2	0.44
724.2	PP_2	0.64
724.3	Pungo River	1.00
726.1	Qh_1 and PP_2	0.48
726R.1	PP_2	0.07
726R.2	PP_2	0.12
726R.3	PP_2	0.17
726R.4	PP_2	0.69
727.1	PP_2	0.18
727.2	PP_1 and Paleocene?	0.02
727.3	Paleocene	0.52
727.4	Paleocene	0.23
728.1	PP_2	0.28
728.2	PP_2	0.01
728.3	PP_2	0.05
729.1	PP_2 and Peedee?	0.67
729.2	Peedee	0.95
730.1	Peedee	0.27
731.1	PP_2 and Peedee?	0.82
731.2	Peedee	0.22
732.1	Peedee	0.23
732.2	Peedee	0.21
732.3	Peedee	0.16
733.1	Qh_1 and PP_2 and Peedee	2.11
734.1	Qh_1 and PP_2	1.84
734.2	PP_2 and Paleocene?	0.84
735.1	PP_2	0.86
735.2	PP_2	0.55
735.3	Peedee	0.70
736.1	Qh_1 and Paleocene?	0.95
736.2	Paleocene	0.98
737.1	PP_2	0.99
737.2	PP_2	0.14
737.3	PP_2	0.22
737.4	PP_2	0.09
738.1	PP_2	0.58
738.2	PP_2	0.67
738.3	Oligocene sand	0.83
738.4	Oligocene sand	0.62
739.1	PP_2	0.69
739.2	PP_2	0.09
739.3	PP_2	0.06
740.1	PP_2	0.87
740.2	PP_1	0.03
740.3	PP_1	0.02
741.1	PP_2	0.33
741.2	Castle Hayne	0.06
741.3	Castle Hayne	0.07
741.4	Castle Hayne	0.06
742.1	PP_2	0.47
742.2	PP_2	0.86
742.3	Paleocene	0.73
743.1	Qh_1 and PP_2	0.69
743.2	Paleocene	0.30
745.1	PP_2	1.31
745.2	PP_2	0.12
745.3	PP_2	0.04
745.4	PP_2	0.50
747.1	Qh_1	0.28
748.1	??????	0.31
748.2	??????	0.18
749.1	??????	0.25
750.1	PP_2	0.55
751.1	PP_2	0.74
751.2	Paleocene	1.10
752.1	Castle Hayne	0.18
753.1	Qh_1 and PP_2 and PP_1	0.28
754.1	PP_2 and ?????	0.42
754R.1	Qh_1	1.98
754R.2	Qh_1	0.90
754R.3	Qh_1	1.35
754R.4	Qh_1	0.94
755.1	Castle Hayne	0.09
755.2	Castle Hayne	0.05
756.1	PP_1	0.10
756.2	PP_1	0.07
757.1	Qh_1	0.39
758.1	Peedee	0.61
759.1	Qh_1	0.98
759.2	PP_2	1.26
760.1	Qh_1	1.02
760.2	Qh_1	0.37
761.1	PP_2	0.43
761.2	PP_2 and ??	0.26
762.1	PP_2	0.48
763.1	PP_2	0.73
763.2	PP_2	0.32
763.3	PP_2	0.64
764.1	Qh_1	0.83
764.2	PP_2	0.55
764.3	PP_2	0.22
765.1	PP_2	0.63

APPENDIX E

Sample Number	Stratigraphic Unit	Wt % THM	Sample Number	Stratigraphic Unit	Wt % THM
765.2	PP_2	0.46	783.2	PP_2	0.65
766.1	PP_2	1.11	783.3	PP_2	0.77
766.2	PP_2	0.82	783.4	PP_2	0.34
767.1	Qh_1 and PP_2	1.03	785.1	Qh_1 and PP_2	0.41
767.2	PP_2	0.54	785.2	PP_2	0.48
767.3	Castle Hayne	0.02	785.3	PP_1	0.19
768.1	Qh_1	0.97	785.4	PP_1	0.16
768.2	Qh_1	1.18	786.1	PP_1	0.69
768.3	PP_2	0.30	786.2	PP_1	0.15
768.4	PP_2	0.23	786R.1	PP_1	0.14
769.1	PP_2	1.31	786R.2	Oligocene sand	0.12
769.2	PP_2	0.39	787.1	PP_2 and PP_1	0.46
769.3	PP_2	0.32	787.2	Oligocene sand	1.11
769.4	PP_2	0.26	787.3	Oligocene sand	0.76
770.1	Qh_1	0.20	787.4	Oligocene sand	0.36
770.2	Qh_1	0.13	788.2	PP_1	0.05
770.3	Qh_1	0.35	788.3	PP_1	0.07
771.1	PP_2	1.28	789.1	PP_1	0.24
771.2	PP_2	0.47	789.2	PP_1	0.08
771.3	PP_2	0.65	790.1	Qh_1 and Oligocene sand	0.57
771.4	PP_2	0.37	790.2	Oligocene sand	0.97
772.1	Qh_1	1.07	790.3	Oligocene sand	0.74
772.2	PP_2	1.14	790.4	Oligocene sand	0.51
772.3	PP_2	1.09	791.1	Qh_1 and PP_1	0.24
772.4	PP_2	0.58	791.2	PP_1	0.07
773.1	Qh_1	0.44	791.3	PP_1	0.04
773.2	Qh_1	0.35	791.4	PP_1	0.08
773.3	Qh_1	1.09	792.1	PP_1	0.04
774.1	PP_2	0.53	792.2	PP_1	<0.01
774.2	PP_2	0.28	792.3	PP_1	0.01
774.3	PP_1	0.14	792.4	PP_1	0.03
775.1	Qh_1	0.67	793.1	PP_1	0.05
775.2	PP_2	0.40	793.2	PP_1	0.01
775.3	PP_2	0.46	793.3	PP_1	0.01
776.1	Qh_1	1.02	793.4	PP_1	0.02
776.2	Qh_1	0.21	794.1	Oligocene sand	0.29
776.3	PP_2	0.42	794.2	Oligocene sand	0.38
777.1	Qh_1	0.41	794.3	Oligocene sand	0.02
777.2	Qh_1	0.53	795.1	PP_1	0.01
777.3	Qh_1	0.42	795.2	PP_1	0.01
777.4	Qh_1	0.36	795.3	PP_1	0.10
778.1	Qh_1	0.34	796.1	Qh_1 and PP_2	0.50
779.1	Qh_1	0.38	796.2	Oligocene sand	0.15
779.2	Qh_1	0.31	796.3	Oligocene sand	0.41
779.3	Qh_1	0.26	797.1	Oligocene sand	0.62
780.1	Qh_1 and PP_2	0.84	797.2	Oligocene sand	0.62
780.2	PP_2	0.27	797.3	Oligocene sand	0.55
780.3	PP_2	0.44	797.4	Oligocene sand	0.61
781.1	PP_2	0.41	798.1	Oligocene sand	1.40
781.2	PP_2	0.27	799.1	PP_2	0.50
782.1	PP_1	0.21	799.2	PP_2	0.38
783.1	PP_2	0.62	799.3	PP_2	1.57

APPENDIX E

Sample Number	Stratigraphic Unit	Wt % THM
799.4	Oligocene sand	0.32
800.1	PP_2	0.66
800.2	PP_2	0.15
800.3	PP_2	0.07
800.4	PP_2 and Oligocene sand	0.34
801.3	PP_2	0.54
801.4	PP_2	1.05
803.1	PP_1	0.14
803.2	PP_1	0.05
803.3	PP_1	0.22
803.4	PP_1	0.07
804.1	PP_1	0.16
805.1	PP_1	0.05
805.2	PP_1	0.01
805.3	PP_1	0.02
805.4	PP_1	0.01
1140.1	Qh_1	0.65
1140.2	Oligocene sand	0.44
1140.3	Oligocene sand	0.54
1141.2	Oligocene sand	0.48
1141.3	Oligocene sand	0.85
1142.1	PP_1	0.34
1143.2	PP_1	0.52
1144.1	PP_1	0.14
1144.2	PP_1	0.18
1145.1	Oligocene sand	0.63
1145.2	Oligocene sand	1.19
1146.1	Oligocene sand	0.74
1146.2	Oligocene sand	0.50
1146.3	Oligocene sand	0.77
1146.4	Oligocene sand	0.81
1147.1	PP_2	0.76
1147.2	PP_2	0.26
1147R.1	PP_2	0.47
1147R.2	PP_2	0.78
1148.1	Qh_1	0.65
1148.2	PP_2	0.62
1149.1	Qh_1	0.32
1149.2	Oligocene sand	0.29
1149.3	Oligocene sand	0.32
1149.4	Oligocene sand	0.26
1150.1	Qh_1 and PP_2	0.80
1150.2	PP_1	0.19
1150.3	PP_1	0.14
1150.4	PP_1	0.16
1151.1	PP_1	0.05
1151.2	PP_1	0.05
1151.3	PP_1	0.10
1151.4	PP_1	0.07
1152.1	PP_2	0.70
1152.2	PP_2	1.18
1152.3	PP_2	0.61

Sample Number	Stratigraphic Unit	Wt % THM
1153.1	Qh_1 and PP_2	0.33
1153.2	Oligocene sand	1.08
1153.3	Oligocene sand	0.95
1153.4	Oligocene sand	0.83
1154.1	Qh_1	0.38
1154.2	Qh_1 and Oligocene sand	0.43
1154.3	Oligocene sand	2.45
1154.4	Oligocene sand	1.40
1155.1	PP_2	0.40
1155.2	PP_2	0.51
1156.1	Qh_1 and PP_2	0.96
1156.2	PP_2	1.00
1156.3	PP_2	1.32
1156.4	Oligocene sand	0.93
1157.1	PP_2 and Oligocene sand	0.43
1157.2	Oligocene sand	1.18
1157.3	Oligocene sand	1.65
1157.4	Oligocene sand	2.06
1158.1	PP_1	0.14
1158.2	PP_1	0.08
1158.3	PP_1 and Oligocene sand	0.17
1159.1	Oligocene sand	3.69
1159.2	Oligocene sand	1.52
1159.3	Oligocene sand	1.52
1159.4	Oligocene sand	0.87
1160.1	PP_2	0.85
1160.2	PP_1 and Oligocene sand	0.84
1161.1	Qh_1	0.65
1161.2	PP_2	0.74
1161.3	PP_2	0.53
1162.1	PP_2	1.22
1162.2	PP_2	3.25
1163.3	Oligocene sand	0.91
1163.4	Oligocene sand	0.97
2000.1	Qh_1	0.11
2000.2	Qh_1	0.08
2000.3	Qh_1	0.41
2000.4	Qh_1	0.69
2001R.1	PP_2	1.12
2001R.2	PP_1	0.02
2001R.3	PP_1	0.03
2001R.4	PP_1	0.01
2002.1	River Bend	0.38
2002.2	River Bend	0.41
2002.3	River Bend	0.39
2002.4	River Bend	0.47

Count (n):	306
Average:	0.54
Maximum:	3.69
Minimum:	<0.01
Stan. Dev.:	0.49