HEAVY-MINERAL DATA FOR SELECTED VIBRACORES FROM THE SOUTHERN INNER CONTINENTAL SHELF OF NORTH CAROLINA

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NORTH CAROLINA GEOLOGICAL SURVEY

OPEN-FILE REPORT 93-37

DIVISION OF LAND RESOURCES

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DIVISION OF LAND RESOURCES

Charles H. Gardner, State Geologist

1993

State of North Carolina

James B. Hunt, Jr., Governor

Department of Environment, Health and Natural Resources
Jonathan B. Howes, Secretary

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ABSTRACT

This paper provides a listing of mineralogical data related to 193 samples from 67 vibracores from the southern inner Continental Shelf of North Carolina. A description of vibracore processing for heavy-mineral (sp gr > 2.96) content is also presented. The average total heavy-mineral (THM) content, expressed as a weight percentage of the bulk sample, is 0.56, with a range of <0.01 percent to 3.69 percent, and a standard deviation of 0.48. Economic heavy minerals (EHM) comprise an average of 44.4 weight percent of the heavy-mineral concentrates, in a range of 0.3 to 68.1, with a standard deviation of 13.2. Ilmenite is the most abundant mineral of the concentrates, and averages 26.07 weight percent. The potential for heavy-mineral resources in this area appears to be poor, and more work is needed to determine if there are selected geographic locations or stratigraphic units which may have favorable concentrations of heavy minerals.

INTRODUCTION

This paper provides a tabulation of heavy-mineral (sp gr > 2.96) data from 67 vibracores obtained from the North Carolina inner Continental Shelf, primarily from the Cape Fear cuspate foreland area (Figures 1, 2, and 3), and a description of vibracore processing. This work is part of a multi-year project, designed to develop a stratigraphic framework and to assess the potential for heavy-mineral resources along the southern portion of North Carolina's inner Continental Shelf. This interim report is the third report generated out of this project and focuses on textural data, general lithologic information, and mineralogy of heavy-mineral concentrates from 193 samples representing the 67 vibracores. Basic statistical information is included for certain aspects of the data set. The first report dealt with the geology and mineral resources from 19 vibracores (Hoffman and others, 1991). High-resolution, shallow seismic data formed the basis for the second report, which presented a working model of the stratigraphic framework for the inner shelf area from Mason Inlet to New Inlet, North Carolina (Snyder and others, in press).

The vibracores used in the present study were drilled by the U. S. Army Corps of Engineers Coastal Engineering Research Center (CERC) in 1971 and 1972 along the southern North Carolina inner Continental Shelf (Figures 1, 2, and 3). This drilling effort was part of a CERC reconnaissance study designed to locate and inventory suitable sand resources and to accumulate geologic data along the Atlantic Continental Shelf and 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, and 1979). The first report dealt exclusively with sand nourishment resources from this area and identified several borrow areas of acceptable-grade quartz sand, which Meisburger defined in his report as medium-grained to coarse-grained quartz sand ranging from 0.25 mm to 1.0 mm (2.00 phi to 0.0 phi) in diameter. The follow-up report synthesized the data to formulate a reconnaissance stratigraphic framework. This second report presented lithologic, textural, and limited biostratigraphic data for the North Carolina ICONS study area. Meisburger (1979) correlated cores chiefly on the basis of his lithologic data, with limited biostratigraphic work supporting his framework.

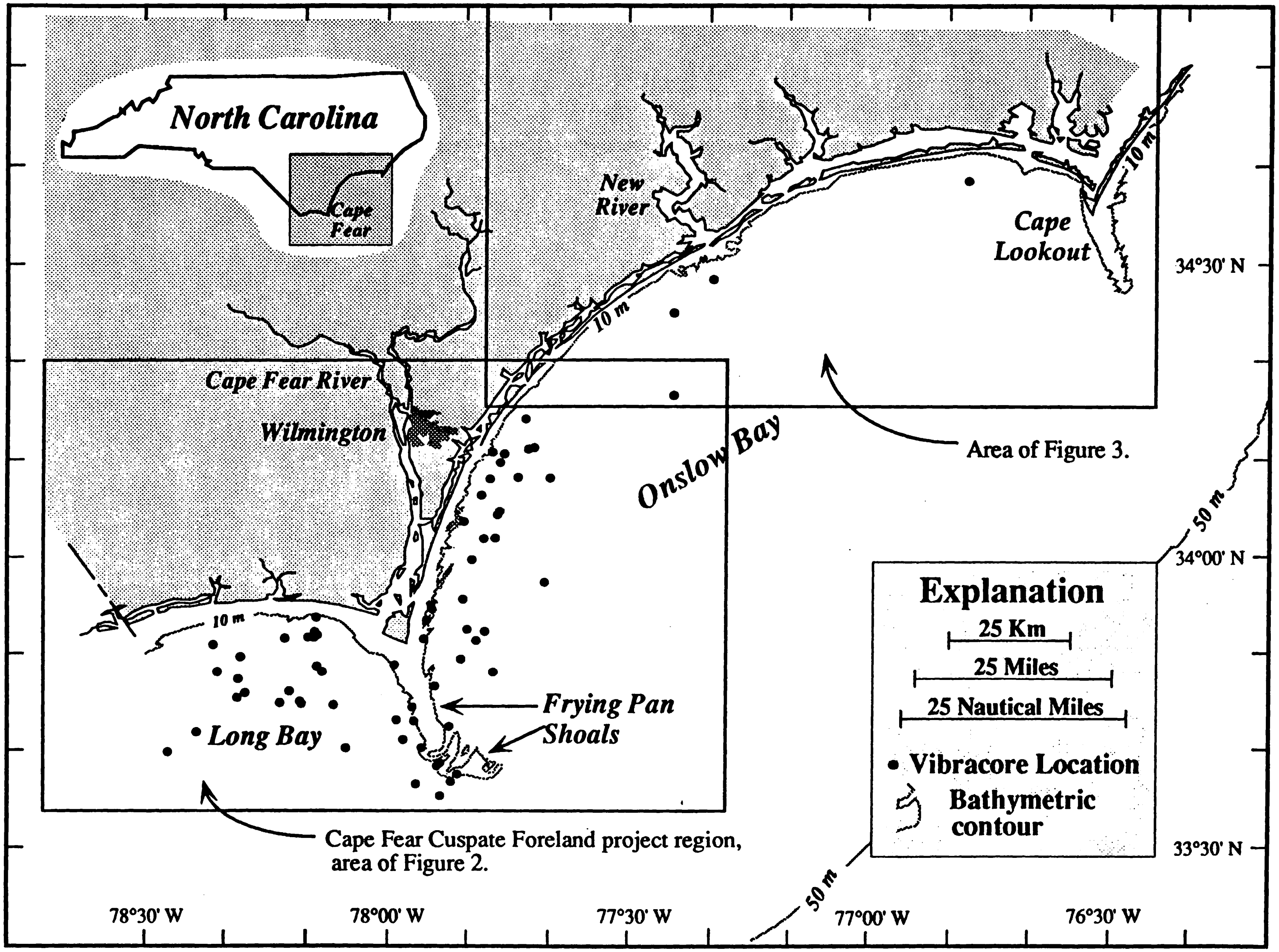


Figure 1. Location map of study area, showing the distribution of vibracores within the Cape Fear Cuspate Foreland (Figure 2) and northern Onslow Bay (Figure 3).

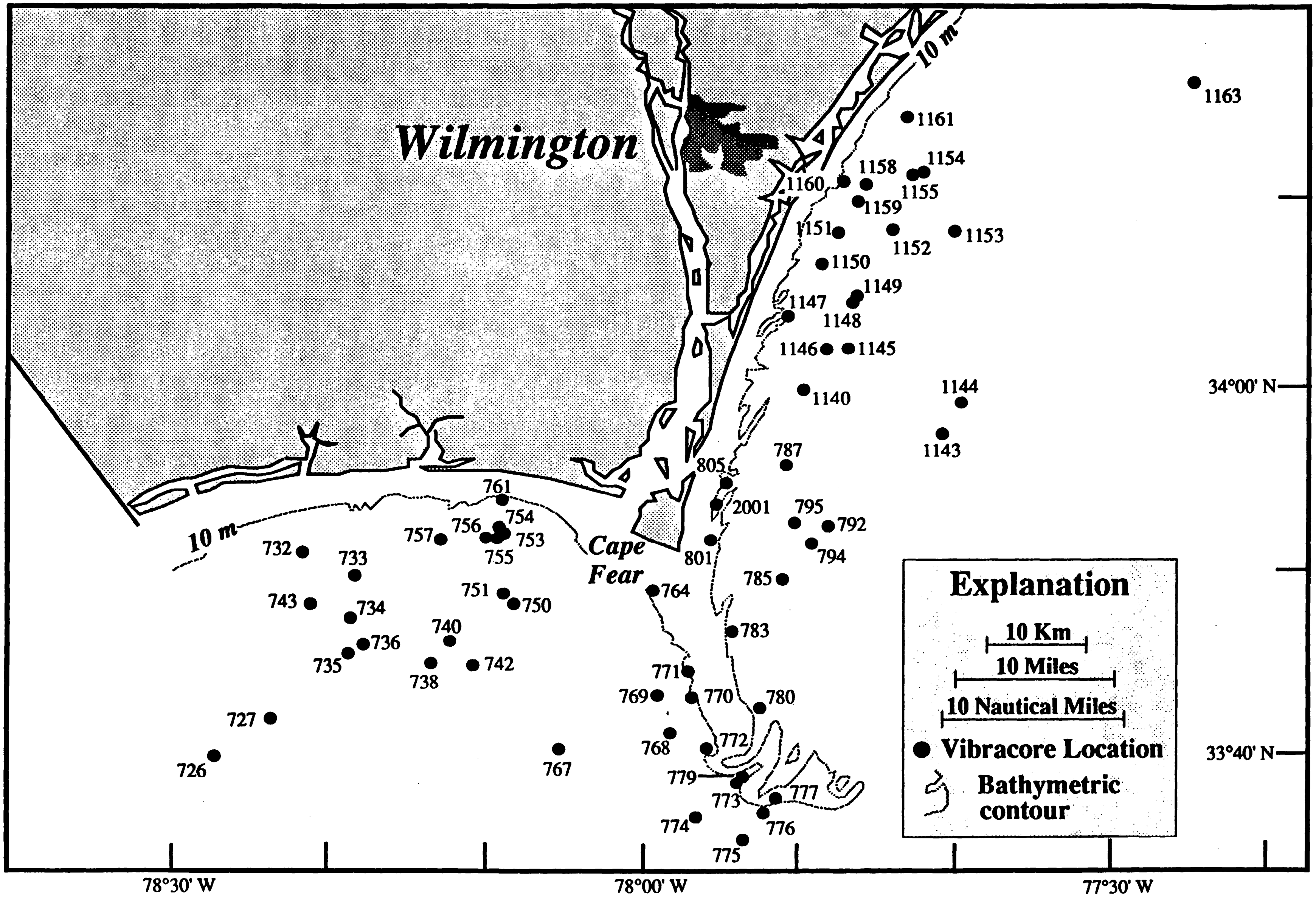


Figure 2. Map of southwestern portion of study area showing location and USGS number for vibracores used in this study.

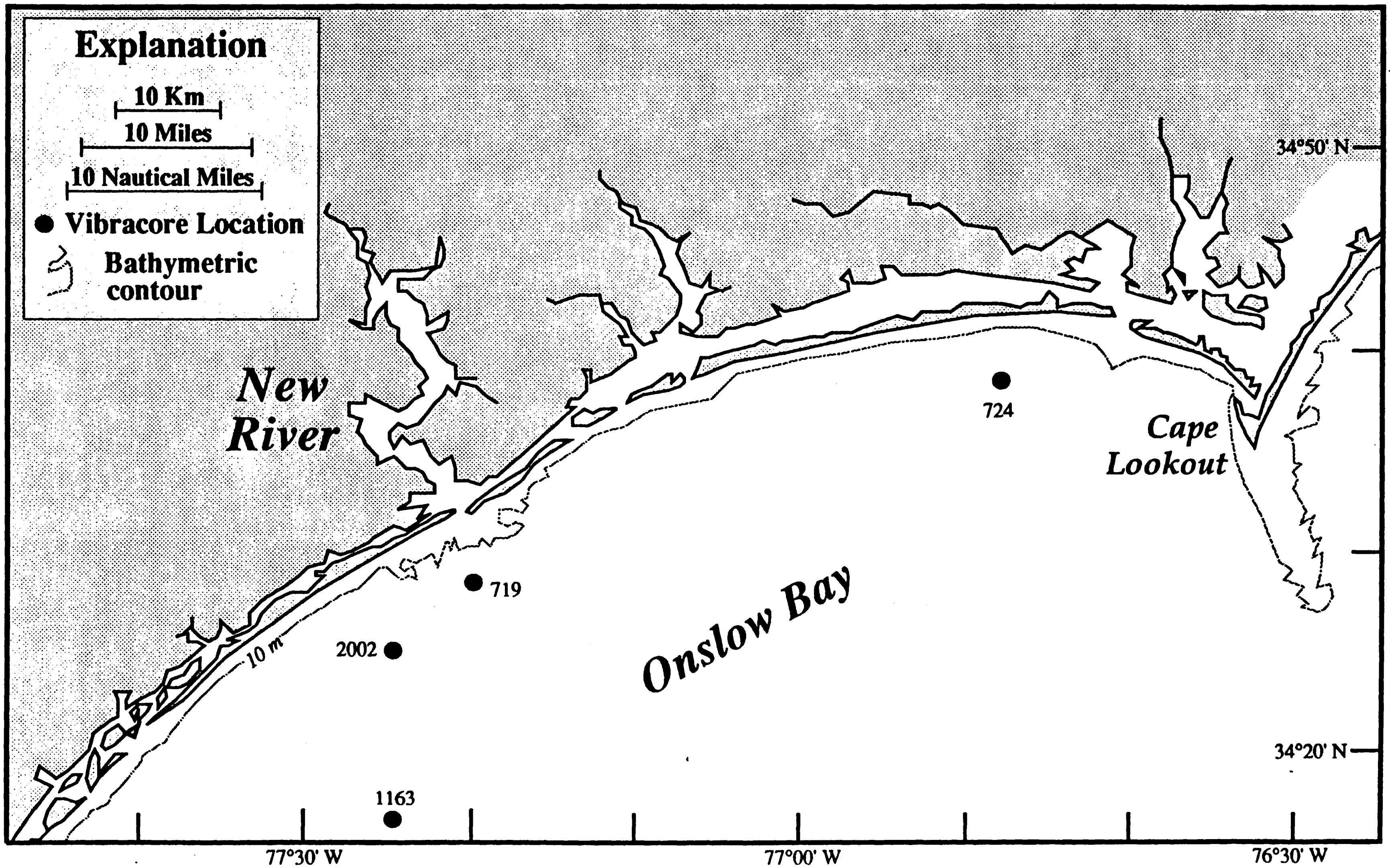


Figure 3. Map showing location and USGS number for vibracores in the northeastern portion of the study area, northern Onslow Bay.

Larry Zarra (unpublished data, 1991) provided more detailed foraminiferal work on 19 vibracores that were opened as a part of Hoffman and others' (1991) study and refined Meisburger's age determinations, primarily in the Pliocene to Holocene deposits. Both of these workers' results are listed in Appendix B.

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 here, 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 the 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) which revealed 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 attributed these grains to garnet, staurolite, and epidote, respectively, based upon previous mineralogical studies of the surficial shelf sediments in the area (Moore and Gorsline, 1963; Pilkey, 1963; Gorsline, 1963).

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

Weight percent heavy-mineral data were listed for 19 of the 67 vibracores of this report in Hoffman and others (1991). They presented stratigraphic information based upon lithologic and biostratigraphic data obtained from the vibracores.

LABORATORY PROCEDURES

Procedures used in vibracore processing are closely aligned with those outlined by Grosz, Berquist, and Fischler (1990). Vibracores of the present study were captured in clear polyvinyl-chloride (PVC) core tubes. They ranged in length from 0.6 meters to 6.1 meters, and were 4 inches in diameter (Figure 4). A static blade cutter was used to open the vibracores longitudinally; this device dictated the 1.6- meter maximum workable length for all vibracores (Figures 4 and 5). Vibracores with lengths greater than 1.6 m were cross-cut in such a fashion so as to limit the amount of PVC contamination. The samples were labeled with their USGS code, followed by ".1", to indicate the uppermost section of the core, and successive numbers were assigned to each interval with increasing depth. Appendix A contains basic data related to the vibracores. Because most of the vibracore material would ultimately be processed for heavy-mineral content, thereby generating a considerable sample volume, approximate sample length limits of two meters (maximum) and one meter (minimum) were established. Sample intervals generally coincided with lithologic intervals. Where 2 lithologies had to be combined in a given sample interval, the "short lithologic description" field in Appendix B includes both lithologies.

Subsampling followed the channel method, as described by Folk (1974), and was done to provide enough material (about one kilogram) for textural and component analyses as well as to obtain an archive sample. Next, the vibracores were photographed (30 cm interval per frame on color print film) with a 35mm tripod-mounted camera (Figure 6), videotaped, and described. After this, the vibracore samples were transferred into 20 liter buckets, and bulk weights were obtained. Tap water was added to the buckets to help disaggregate

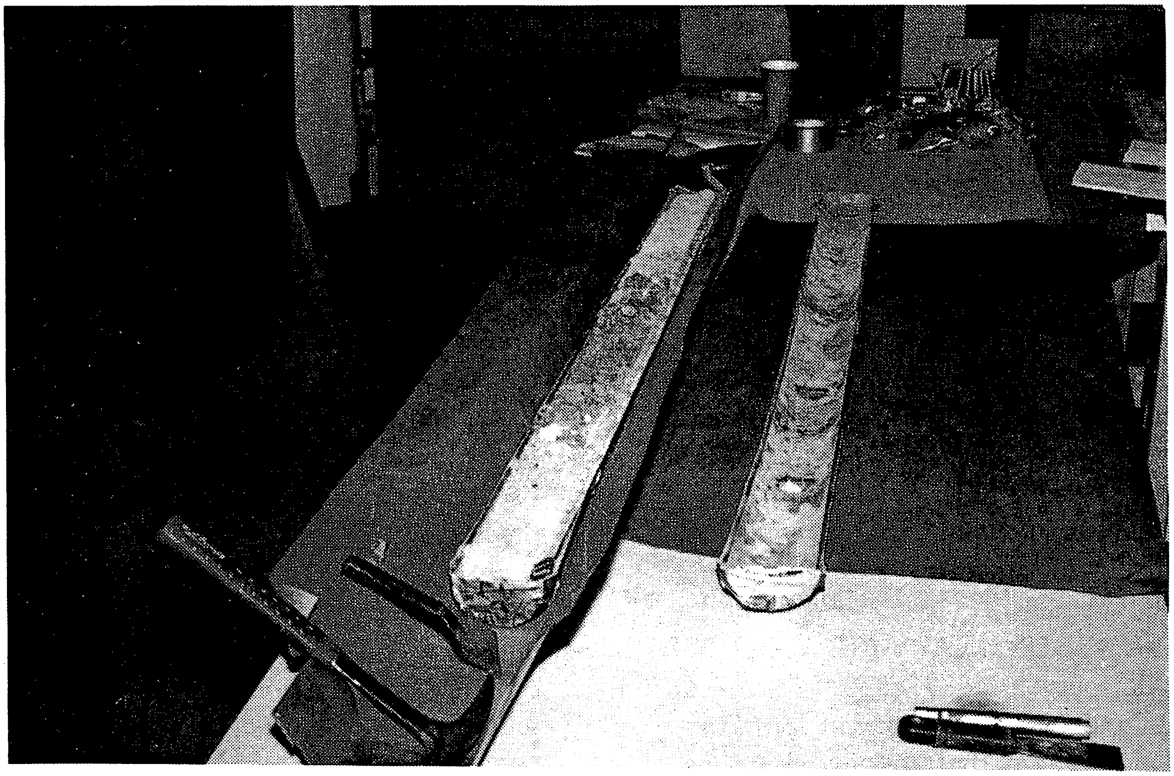


Figure 4. Photograph of vibracore sampling area showing a vibracore used in the study.

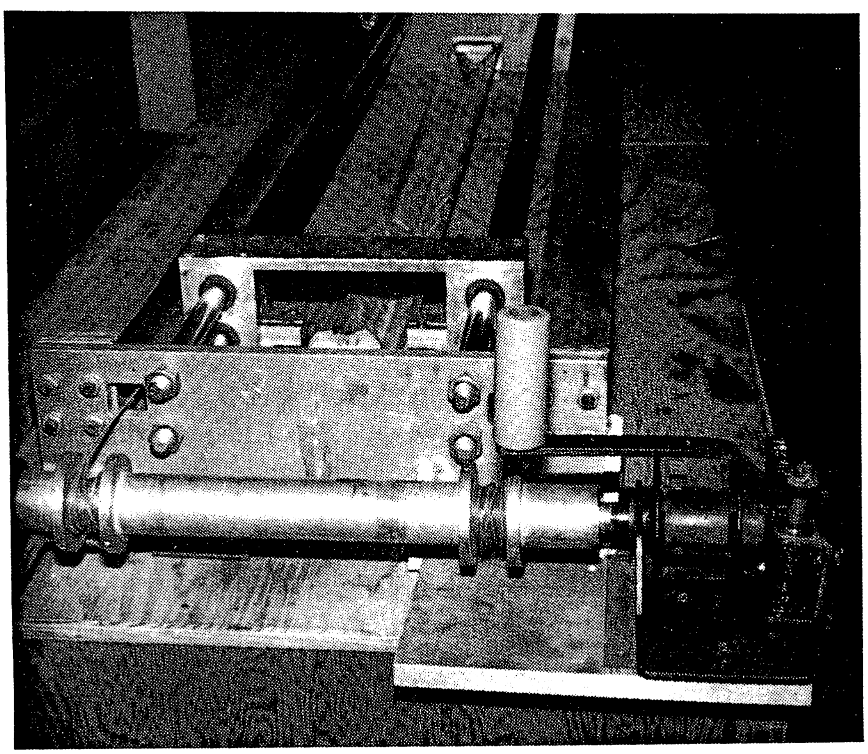
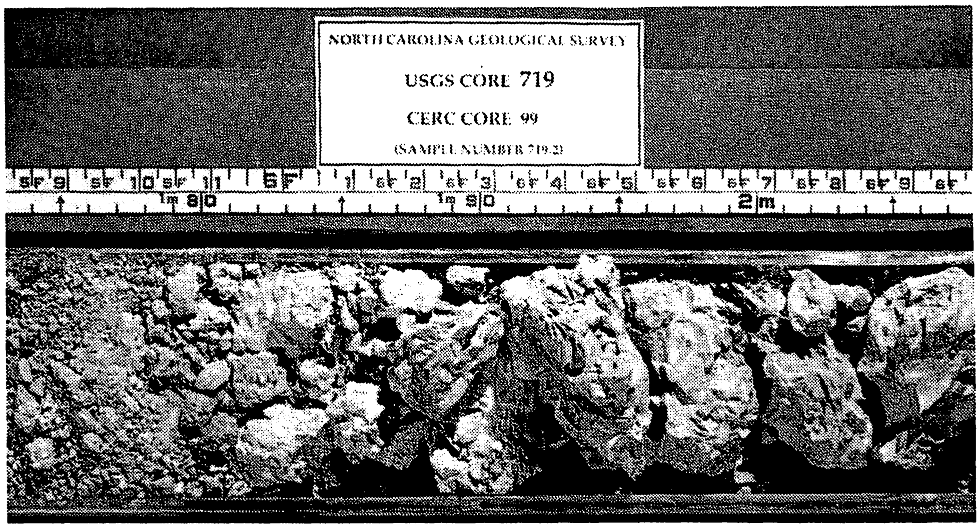
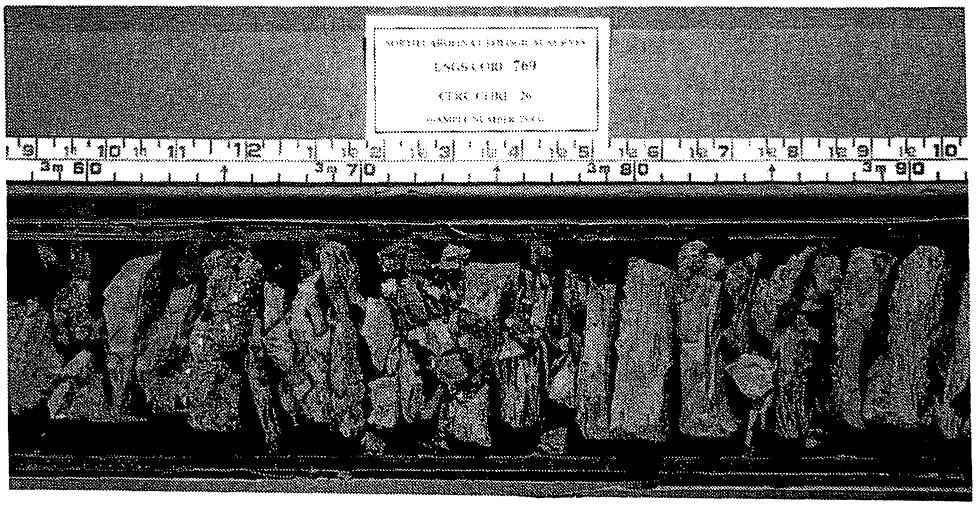


Figure 5. Photograph of static-blade cutter used to open the vibracores.

(A)



(B)



(C)

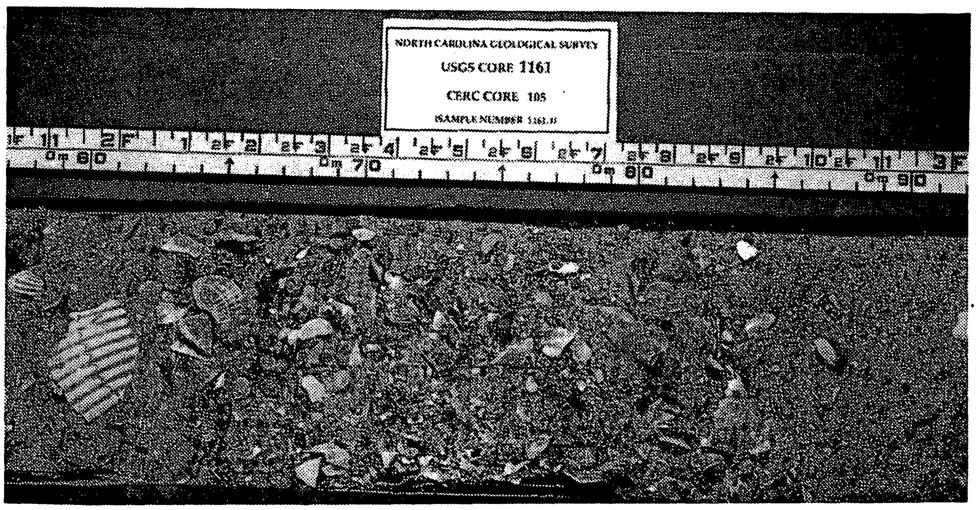


Figure 6. Photographs of typical vibracore lithologies encountered. (A) Sample 719.2, 175-205 cm, biosparite; (B) Sample 769.3, 360-390 cm, silty clay; (C) Sample 1161.1, 60-90 cm, clean, fine-grained, shelly quartz sand.

the sediment. The gravel-size and coarser material (coarser than 2.0 mm, 10 mesh, or -1.0 phi) from each sample was screened out to determine the gravel component of the samples. This was also done to quantify this component of the sediment and to remove material which would interfere with further sample processing. This material was labeled, weighed, described and archived.

SPIRAL CONCENTRATION

Preconcentration of the heavy-mineral fraction was the next step. This was accomplished by passing the remaining washed and screened material (finer than 2.0 mm, or -1.0 phi) through a spiral apparatus (Figure 7). By design, this spiral apparatus mixes water with the sample at a constant rate and thereby produces a slurry of water and mineral grains. The denser mineral grains pass along the inside of this three-turn spiral by centrifugal force while relatively lighter material passes along the outer portions of the spiral surface. Normally, when the slurry had reached the second turn of the spiral, an obvious separation of the sediment grains was achieved; an inner dark band (referred to as "spiral concentrate") of sediment consisting predominantly of heavy-mineral grains, and an outer lighter band (the "spiral rejects" sample) which mainly consisted of shell material and lighter-weight mineral grains (quartz and feldspar). A splitter device, located at the base of the spiral, ultimately separated these bands of sediment. This device served to channel sediment grains passing down the spiral into two separate collection chutes.

In an effort to increase the efficiency of the spiraling operation, a relatively large "cut" of the spiral concentrate was achieved on an initial sediment pass through the spiral; a second pass of the spiral concentrate sample through the spiral, with a relatively smaller cut, produced the final spiral concentrate sample (about 300 g dry weight). Because of the large volume of spiral reject material (several kilograms dry weight), this split was homogenized and an aliquot of about 300 g was taken. Both the spiral concentrate sample and the spiral rejects aliquot were processed through heavy liquid.

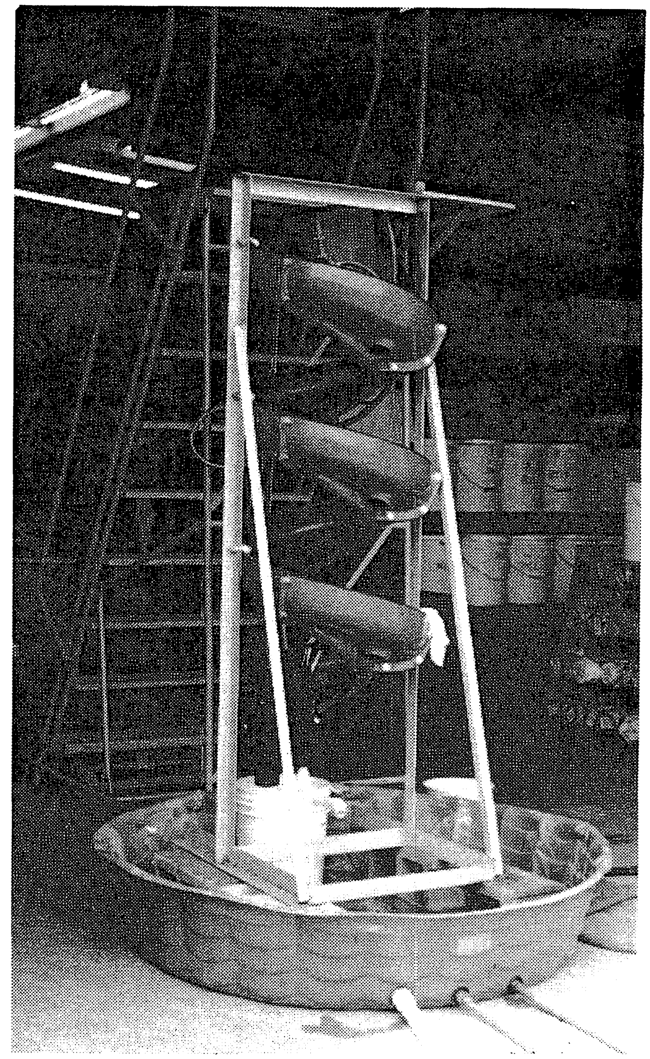


Figure 7. Photograph of three-turn spiral apparatus used to preconcentrate heavy-minerals.

HEAVY-LIQUID SEPARATION

The spiral concentrate sample was saved in its entirety for heavy-liquid separation through Acetylene Tetrabromide (sp gr = 2.96). The dry weight (g) of minerals settling through the heavy liquid column, called SHTBS, provided a determination of weight percent recovered heavy minerals (RHM) in the bulk sample. The aliquot from the spiral rejects was also processed through heavy liquid. The amount of heavy minerals obtained from this subsample was weighed and labeled SLTBS. The total amount of heavy minerals present in the entire spiral rejects sample was extrapolated from the aliquot result.

Summing the SHTBS sample and the calculated heavy-mineral amount in the spiral rejects provided a total weight (g) of heavy minerals in the bulk sample. This total weight of heavy minerals divided by the bulk sample weight provides an approximation of the total heavy-mineral content (THM) for the entire bulk sample (Appendix A).

Ideally, a low heavy-mineral content in the spiral rejects is desired. This would indicate an efficient spiraling operation in that most of the heavy minerals would be captured in the spiral concentrate sample. Generally, spiral efficiency was best for coarser samples and worst for finer-grained samples.

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, as reported by Folk (1974). A portion of the channel sample was used for sieve analysis. Subsamples were weighed and then wet-sieved to remove material finer than 0.044 mm (silt and clay) and material coarser than 2.0 mm (gravel). The remaining sand-sized material was sieved, weighed, and archived. For calculation purposes, the minus 0.044 mm weight was factored back in to obtain truer grain size data; because the plus 2.0 mm fraction contained mostly shell material and no mineral grains, its weight was ignored in the calculations.

Grain-size data on the 19 vibracores reported in Hoffman and others (1991) were derived differently. Subsamples from the spiral reject material were used to obtain grain-size information. These data were generated by the North Carolina State University Minerals Research Laboratory (MRL) in Asheville, North Carolina. The main difference in the MRL data is that some silt and clay material was lost because of elutriation during the spiraling process. This prevented factoring the silt and clay weights for the calculation process. Because the silt and clay weights were typically small, the difference between the two methods was judged to be insignificant for the purposes of this study.

A representative split of the channel sample was used to determine carbonate content by acid digestion. Samples with high carbonate content typically have low THM values (Figure 8). Data for weight percent carbonate and mean grain size are listed in Appendix C.

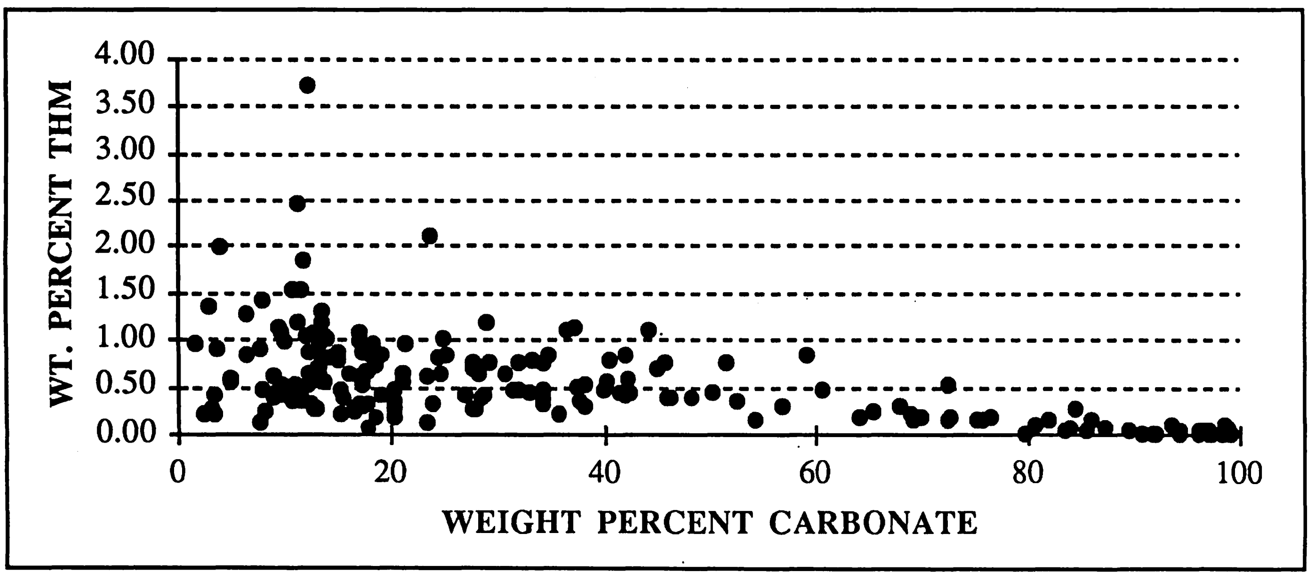


Figure 8. Plot of vibracore THM content versus weight percent carbonate.

MAGNETIC SEPARATION

After the RHM amount was calculated, a 75 percent/25 percent volumetric sample split of the RHM fraction was performed using a cone splitter. The 75 percent portion was retained for optical mineralogy, while the 25 percent portion was split to obtain 2 approximately equal 12.5 percent portions which were reserved for future analytical work and for archival purposes.

Two electromagnetic devices were used to separate minerals in the optical mineralogy fraction based upon their magnetic susceptibilities (Figure 9). Amperage settings for the separations were predetermined (Grosz, Berquist, and Fischler, 1990) to facilitate the identification and semi-quantification of the minerals present in the heavy-mineral fractions and to reduce the number of mineral species in a given magnetic fraction.

The first device used, a Frantz Isodynamic Magnetic Separator (FIMS) was used for an initial (ferromagnetic) separation at 0.5 amperes (A). This separation capitalized on a combination of gravity and magnetic attraction to isolate the most magnetic minerals within a sample. This was accomplished by slowly introducing a steady stream of the entire optical mineralogy fraction for a given sample into an approximately vertical 1-inch diameter glass tube, which was attached to the poles of the magnet (Figure 9). Using this equipment, the most magnetic minerals (ferromagnetics) are attracted by the magnetic field and are suspended within the glass tube. Less-magnetic material falls through the tube into a holding vessel, and is held for further processing. The ferromagnetic fraction is recovered by placing a clean vessel under the glass tube, and then powering down the magnet — allowing the ferromagnetic material to fall. This material was weighed and labeled.

The remaining material, from the holding vessel, was processed on a Frantz Magnetic Barrier Laboratory Separator (MBLS). This separator allows material to slowly pass through a magnetic-field along an inclined course. This course is normally inclined 25 to 30 degrees away from the

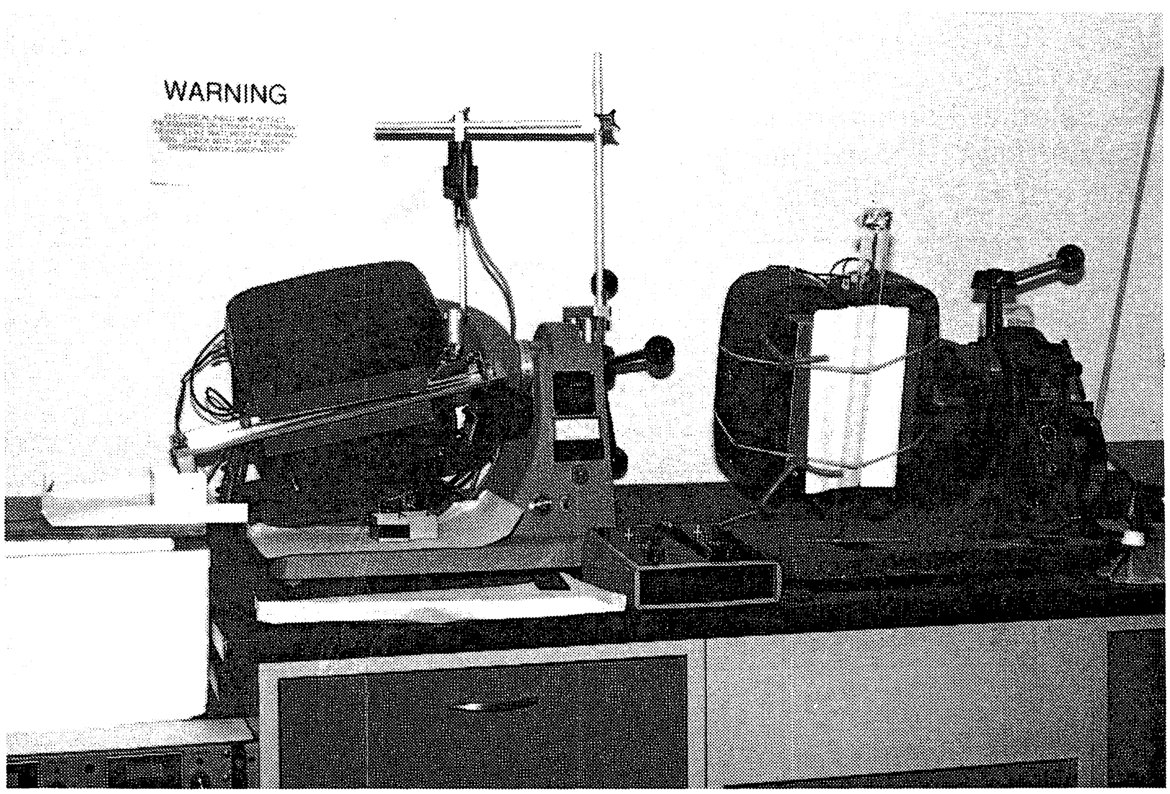


Figure 9. Photograph of electromagnets used in separating minerals: Frantz Magnetic Barrier Laboratory Separator (MBLS) shown on the left, and Frantz Isodynamic Separator (FIMS) is on the right.

magnet, toward the observer, and approximately 10 to 15 degrees laterally, toward collection vessels (Figure 9). With each pass through this separator, two samples are obtained — a magnetic one and a less-magnetic one. Material attracted by the magnetic field traverses close to the magnet poles, and is channeled into a collection vessel. Relatively non-magnetic material falls away from the magnet and is channeled into a different collection vessel. It is common for some grains to become directly attached to the magnet. These grains are captured when the magnet is powered down and are included in the magnetic fraction for that sample run.

Four passes at successively increasing amperage levels if 0.2A, 0.4A, 0.6A, and 1.8A (each using the less magnetic fraction from the previous step) produce the remaining magnetic fractions. This process produces sample splits in a declining order of magnetic susceptibility. The final step yields 2 fractions, a magnetic one and a non-magnetic one. In all, 6 magnetic fractions were generated for each sample having an RHM weight of 10 g or greater; RHM samples under 10 g were separated only once on the MBLS at 0.5 A.

On average, the dominant mineral phases in the separations were as follow: the ferromagnetics included ilmenite, iron oxides, and trace amounts of epidote, staurolite (with inclusions), zircon (with inclusions), and pyroboles; ilmenite and garnet were in the 0.2 A fraction; ilmenite, staurolite, garnet, pyroboles (undifferentiated pyroxenes and amphiboles) and epidote were in the 0.4 A fraction; epidote, tourmaline, staurolite, and leucoxene (altered ilmenite) were in the 0.6 A fraction; leucoxene, aluminosilicates (undifferentiated kyanite, andalusite, and sillimanite), epidote and phosphate were in the 1.8 A fraction; and zircon, aluminosilicates, and phosphate made up the non-magnetic fraction at 1.8 A.

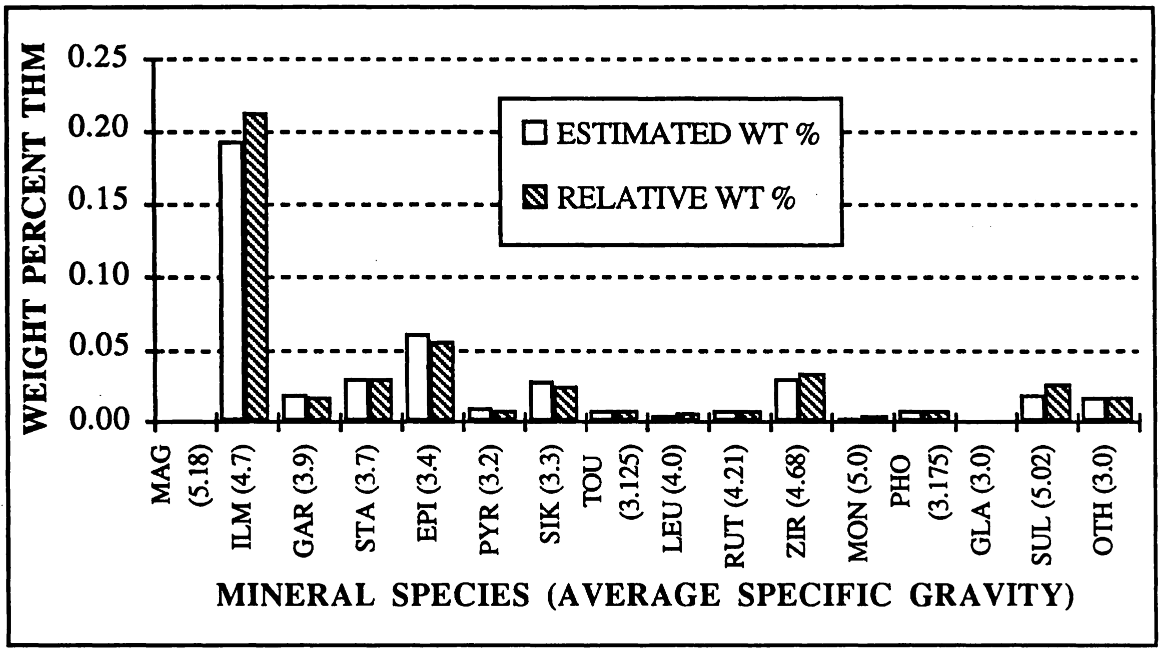
MINERALOGY

All magnetic fractions were examined under a binocular microscope with both reflected-light and transmitted-light capability. Mineral identification was performed by observing the shape, color, and optical properties of the mineral grains. Short-wave and long-wave ultraviolet illumination aided in the identification of monazite and zircon, respectively. A petrographic microscope was used to confirm mineral identities. Sixteen mineral species were consistently categorized and these are listed in Appendices D, and E. Visual estimation of the relative mineral abundances in each magnetic fraction was accomplished by comparing binocular volumetric estimates to area percentage diagrams (Terry and Chilingar, 1955). A one-grain-thick layer was attempted in each magnetic fraction in order to allow for mineral identification, and optimal correlation with the area percentage charts.

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. This is not a true weight percent but is reported this way to be consistent with other Atlantic continental shelf workers (Grosz, Berquist, and Fischler, 1990). To arrive at a *relative* weight percent, the difference in densities of the individual minerals would need to be compensated for. The difference between the mineral percentages reported here and computed *relative* weight percentages is insignificant for the purposes of this reconnaissance study. To illustrate this point, relative weight percentages were calculated for the heavy minerals on representative samples 724.1 and 733.1 and the results are graphically depicted in Figures 10A and 10B.

Because it is not feasible to determine absolute specific gravities for each mineral grain, and the specific gravity of a given mineral will vary depending upon such factors as solid solution substitution, and the presence of inclusions, average specific gravities (*Klein and Hurlbut, 1977, p. 570-583) were used for these examples and are listed in Figure 10. Summing mineral species estimates across all magnetic fractions for a given sample determined the final heavy-mineral composition for that sample (Appendix D).

(A)



(B)

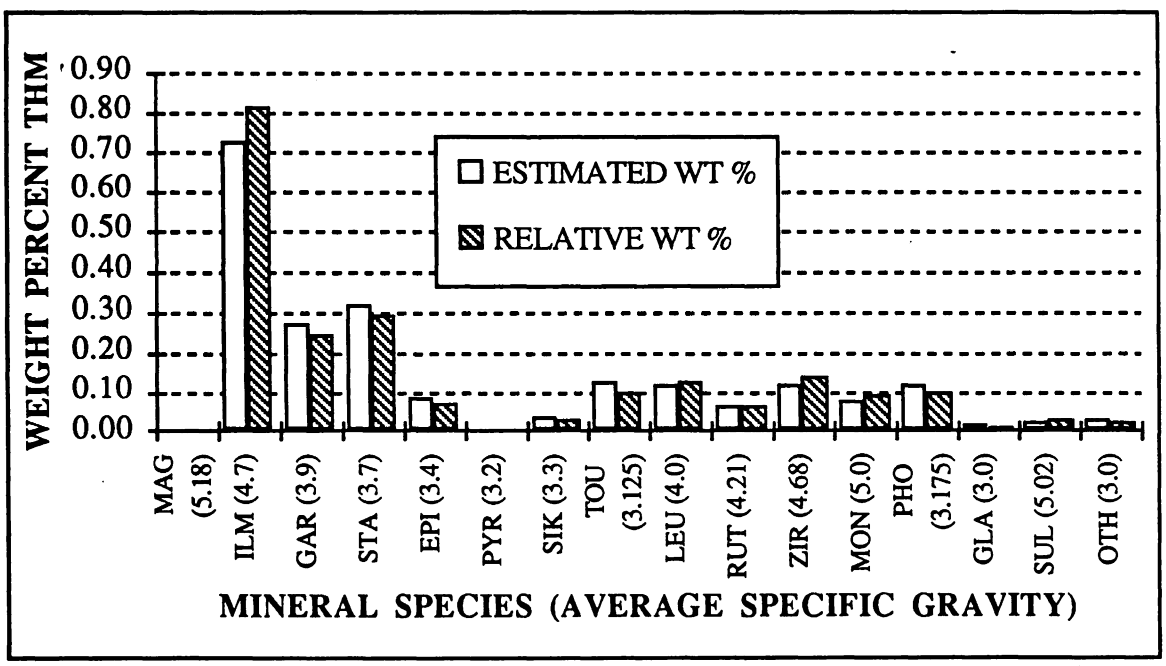


Figure 10. Charts showing the comparison between estimated weight percent heavy-minerals and calculated relative weight percent heavy-minerals; (A) Sample 724.1, THM=0.44; (B) Sample 733.1, THM=2.11. See Appendix D explanation for key to mineral abbreviations.

RESULTS

Data requiring calculations were entered into a computer spreadsheet, and the results are listed in Appendices A, C, D, and E. The average THM content is 0.56 weight percent, with a standard deviation of 0.48. The maximum and minimum values are 3.69 (sample 1159.1) and <0.01 (sample 792.2) percent, respectively. These data show that the heavy-mineral content of the sediments is variable, and that certain areas and or stratigraphic units may have greater potential than others. The economic heavy minerals (EHM) include ilmenite, leucoxene, zircon, rutile, monazite, and the aluminosilicates. The EHM of the heavy-mineral concentrates averaged 44.35 weight percent of the heavy-mineral fraction in a range of 0.27 to 68.1.

Ilmenite is by far the most abundant mineral of the EHM, and comprises an average of 26.07 weight percent of the heavy-mineral concentrates. The remainder of the average EHM content contains rutile with 5.75 percent, zircon at 5.73 percent, leucoxene with 4.45 percent, aluminosilicates at 3.54 percent and monazite with 0.36 percent. These values are similar to average EHM values reported for other Atlantic Continental Shelf (ACS) data sets (Uptegrove and others, 1991; Berquist and others, 1991; Grosz, Nocita, and others, 1989). Other minerals which have lesser economic significance include staurolite, tourmaline, and garnet with average weight percentages of 11.56, 6.29, and 3.61 respectively.

The samples were grouped according to lithology for a comparison with THM content. The muddy/silty sands have an average weight percent heavy-mineral content of 0.74 (Figure 11) followed closely by the clean sands with an average heavy-mineral content of 0.68 weight percent. Mean grain size for the sands and clays was determined to be 2.74 phi (0.150 mm - fine-grained sand), with a range of 0.80 phi (0.57 mm) to 4.47 phi (0.045 mm) and a standard deviation of 0.72 phi (0.6 mm). Grain size analyses indicate that sediments with heavy-mineral content greater than or equal to 1 percent have mean grain sizes that fall between the 2.0 phi (0.25 mm) and 4.0 phi (0.0625 mm) size classes (Figure 12), which are classified as fine-to very-fine sand, respectively. This trend of increasing THM content with decreasing grain size is also present in other ACS data sets (Berquist and others, 1991; Grosz, Nocita, and others, 1989).

The average zircon-tourmaline-rutile (ZTR) index (Hubert, 1962) for the quartz sands was determined to be 30, with a range of 9 to 68. Generally, samples with increasing depth have

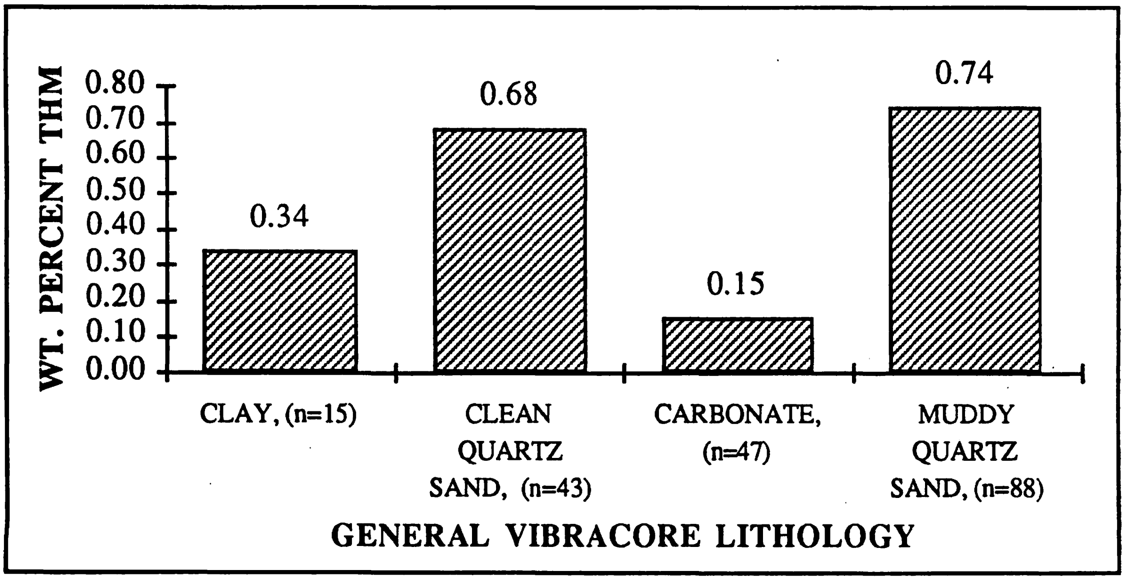


Figure 11. Histogram showing average THM content by general sediment type.

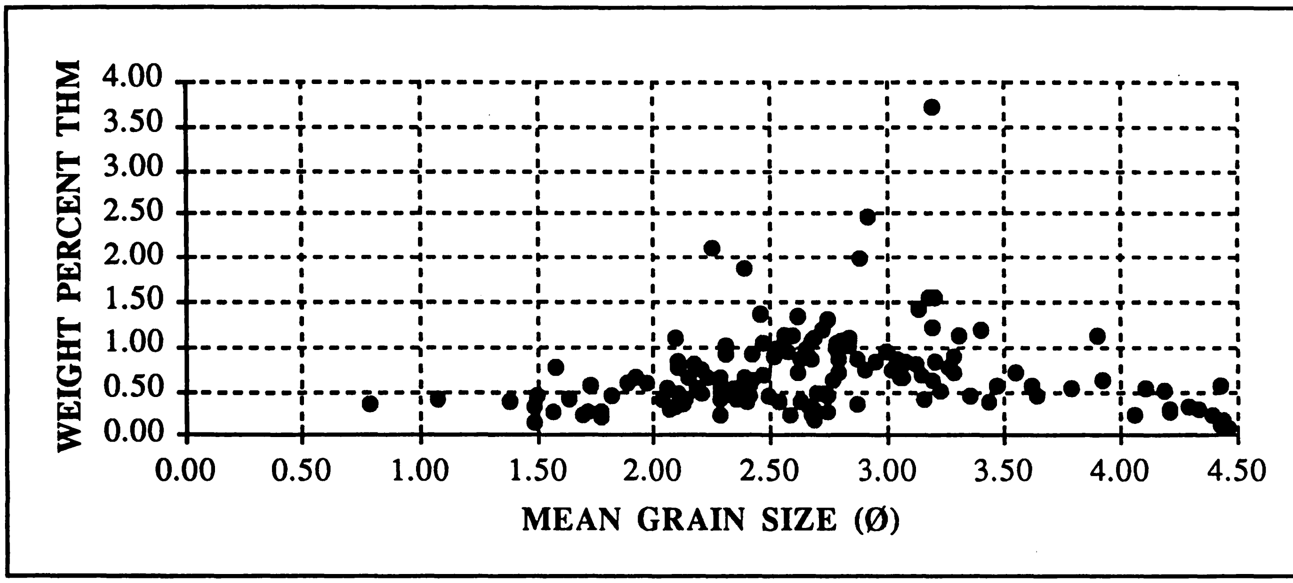


Figure 12. Plot of the THM content versus mean grain size (phi).

higher ZTR values (Appendix C) which correlate with relatively more mature sediments.

CONCLUSIONS

Heavy-mineral resource potential along the southern inner Continental Shelf of North Carolina based on this limited sampling, appears to be poor. The average THM content for 193 samples from 67 vibracores is 0.56 weight percent and is well below the 4 percent threshold generally considered to be of interest for economic resource potential (Garnar, 1978).

Average EHM of the heavy-mineral concentrates is 44.4 weight percent, with a range of 0.3 to 68.1 weight percent, and a standard deviation of 13.2. Ilmenite is the most common heavy mineral, averaging 26.07 weight percent of the heavy-mineral concentrates. Grain size data indicates that fine-grained sands have the greatest potential for heavy-mineral content.

Further work is needed to outline the relationship between the stratigraphic framework and the distribution of heavy minerals along the southern inner Continental Shelf of North Carolina. Although the average THM content is not very promising, there may be selected geographic sites or stratigraphic units that have more favorable concentrations of heavy minerals.

ACKNOWLEDGMENTS

This project was supported in part by the U. S. Department of Interior, Minerals Management Service (MMS) through a cooperative agreement with the Continental Margins Committee of the Association of American State Geologists (AASG). This subagreement is administered and coordinated for MMS by the University of Texas at Austin-Bureau of Economic Geology and includes the North Carolina Department of Environment, Health and Natural Resources as a subagreement recipient. The MMS-AASG cooperative agreement covering work reported herein is number 14-35-0001-30534; the subagreement number is 30534-NC. Andrew Grosz (USGS) provided the vibracores used in this study to the North Carolina Geological Survey (NCGS), sample processing equipment, and helpful guidance on various aspects of the study. Richard Dentzman of the NCGS provided considerable project support. Charles Brockman, Phillip Orozco, and Terri McManus assisted in sample processing courtesy of grants supplied by the North Carolina Department of Administration, E.I. Du Pont De Nemours and Company, and the North Carolina Department of Environment, Health and Natural Resources, respectively. Constructive

reviews by Charles Hoffman and Andrew Grosz improved this manuscript.

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APPENDIX A

Table showing sample number, CERC code, sample length (in cm), water depth of vibracores (in feet), bulk sample weight (in g), weight percent of the bulk sample greater than 10 mesh (2 mm) (gravel), and weight percent total heavy minerals (THM).

Appendix A

Sample Number	CERC Number	Sample Length (cm)	Water Depth (ft)	Bulk Weight (g)	WT % +10 mesh	WT % THM
719.1	99	150	41	11,960	17.3	0.74
719.2		149		10,732	70.8	0.18
724.1	95	206	51	4,422	30.5	0.44
724.2		177		2,596	3.9	0.64
724.3		157		2,155	0.8	1.00
726.1	6	205	57	8,746	0.6	0.48
726R.1	6	146	57	6,080	2.5	0.07
726R.2		134		4,853	3.3	0.12
726R.3		158		6,035	9.3	0.17
726R.4		141		6,744	9.6	0.69
727.1	7	167	60	6,650	0.5	0.18
727.2		169		12,450	43.8	0.02
727.3		120		8,950	0.7	0.52
727.4		149		11,850	0.0	0.23
732.1	42	154	40	4,025	48.0	0.23
732.2		154		2,871	5.8	0.21
732.3		126		1,982	17.3	0.16
733.1	16	170	47	18,336	8.0	2.11
734.1	30	115	51	7,108	4.1	1.84
734.2		117		8,952	23.8	0.84
735.1	9	173	54	11,250	4.8	0.86
735.2		179		6,250	0.4	0.55
735.3		103		7,650	11.8	0.70
736.1	14	148	53	11,550	9.4	0.95
736.2		138		11,950	2.7	0.98
738.1	29	220	58	3,933	15.3	0.58
738.2		105		2,309	2.5	0.67
738.3		156		3,099	0.0	0.83
738.4		130		2,523	0.0	0.62
740.1	13	141	53	3,007	3.7	0.87
740.2	13	183	53	3,140	62.9	0.03
740.3		202		5,049	58.7	0.02
742.1	12	150	53	17,037	8.6	0.46
742.2		251		20,757	0.7	0.85
742.3		151		11,501	0.5	0.72
743.1	15	78	45	4,250	8.2	0.69
743.2		76		6,850	36.8	0.30
750.1	5	220	51	17,050	3.8	0.55
751.1	10	134	52	10,250	13.7	0.74
751.2		244		17,150	7.0	1.10

Sample Number	CERC Number	Sample Length (cm)	Water Depth (ft)	Bulk Weight (g)	WT % +10 mesh	WT % THM
753.1	31	64	43	4,475	28.8	0.28
754.1	32	210	45	15,950	13.8	0.42
754R.1	32	127	45	3,150	0.7	1.98
754R.2		126		7,350	0.3	0.90
754R.3		104		8,350	0.2	1.35
754R.4		86		4,750	0.1	0.94
755.1	19	176	46	4,634	0.4	0.09
755.2		185		3,821	43.7	0.05
756.1	17	177	N/A	12,857	38.1	0.10
756.2		146	N/A	13,402	42.0	0.07
757.1	20	140	40	6,901	21.6	0.39
761.1	38	146	38	9,950	18.7	0.43
761.2		153		11,450	16.6	0.26
764.1	45	218	32	6,112	1.3	0.82
764.2		140		12,579	4.8	0.54
764.3		147		5,817	0.6	0.22
767.1	21	201	58	17,541	0.7	1.03
767.2		126		6,762	1.8	0.54
767.3	21	92	58	6,185	46.9	0.02
768.1	25	152	48	12,199	1.0	0.97
768.2		156		11,702	2.0	1.17
768.3		155		6,955	13.2	0.30
768.4		147		4,510	16.3	0.23
769.1	26	160	41	11,750	0.8	1.31
769.2		125		8,950	5.9	0.39
769.3		169		7,450	0.9	0.32
769.4		145		4,250	0.6	0.26
770.1	24	149	31	9,817	0.6	0.20
770.2		151		11,313	1.8	0.13
770.3		111		9,131	4.1	0.35
771.1	46	140	32	2,553	0.5	1.28
771.2		161		3,490	0.2	0.47
771.3		152		3,157	0.7	0.65
771.4		170		3,798	3.1	0.37
772.1	47	109	47	7,783	0.5	1.06
772.2		133		9,710	1.5	1.12
772.3		187		16,690	2.6	1.08
772.4		108		9,910	1.1	0.58
773.1	63	222	41	3,477	0.5	0.44
773.2		99		1,297	5.3	0.35
773.3		123		2,165	1.2	1.09

Appendix A

Sample Number	CERC Number	Sample Length (cm)	Water Depth (ft)	Bulk Weight (g)	WT % +10 mesh	WT % THM
774.1	55	260	63	11,244	20.4	0.53
774.2		224		12,935	1.1	0.28
774.3		93		6,256	40.4	0.14
775.1	56	111	75	6,550	2.1	0.67
775.2		179		9,050	0.3	0.40
775.3		144		9,750	6.3	0.46
776.1	57	218	58	12,650	0.5	1.02
776.2		130		6,350	12.8	0.21
776.3		176		8,050	8.2	0.42
777.1	58	153	36	2,712	0.8	0.41
777.2		155		2,829	1.9	0.53
777.3		133		1,445	0.8	0.42
777.4		128		2,096	1.0	0.36
779.1	62	109	23	1,549	1.0	0.38
779.2		112		1,943	1.3	0.31
779.3		142		2,292	0.6	0.26
780.1	65	112	44	4,990	1.0	0.84
780.2		256		12,165	0.2	0.27
780.3		232		16,526	15.8	0.44
783.1	53	162	37	3,181	5.5	0.62
783.2		156		2,447	3.4	0.65
783.3		144		2,010	6.4	0.77
783.4		152		2,863	23.6	0.34
785.1	54	91	48	6,108	7.8	0.41
785.2		207		15,353	15.3	0.48
785.3		125		8,626	54.9	0.19
785.4		122		8,331	55.8	0.16
787.1	59	159	51	10,232	24.3	0.46
787.2		152		12,758	3.2	1.10
787.3		159		13,708	3.2	0.76
787.4		145		11,130	0.5	0.36
792.1	77	149	57	3,573	3.6	0.04
792.2		100		1,763	18.0	<0.01
792.3		145		2,936	64.9	0.01
792.4		136		2,730	9.2	0.03
794.1	68	197	56	18,550	2.5	0.29
794.2		246		22,150	2.5	0.38
794.3		150		11,450	1.2	0.20
795.1	112	203	50	9,895	69.2	0.02
795.2		136		10,494	59.2	0.01
795.3		124		8,971	61.1	0.01
801.3	52	152	29	9,450	2.1	0.54
801.4		149		11,250	8.9	1.05
805.1	70	131	43	1,949	38.6	0.05
805.2		130		2,216	5.1	0.01
805.3		163		3,095	52.5	0.02
805.4		135		2,479	88.0	0.01
1140.1	79	190	44	4,135	1.3	0.65
1140.2		122		2,361	9.1	0.44
1140.3		148		2,570	10.2	0.54
1143.2	111	76	62	6,237	48.9	0.52
1144.1	110	107	60	8,858	28.0	0.14
1144.2		97		8,525	13.0	0.17
1145.1	107	149	51	11,150	1.0	0.63
1145.2		156		12,150	0.0	1.19
1146.1	80	151	59	2,600	3.3	0.74
1146.2		148		2,554	5.1	0.50
1146.3		163		3,322	0.6	0.77
1146.4		152		4,065	0.0	0.81
1147.1	81	133	40	8,850	14.9	0.76
1147.2		172		14,850	5.0	0.26
1147R.1	81	144	40	10,950	9.8	0.47
1147R.2		150		10,750	14.9	0.78
1148.1	93	138	45	10,660	2.7	0.65
1148.2		160		11,330	4.9	0.61
1149.1	92	104	44	856	6.5	0.32
1149.2		162		3,827	8.4	0.29
1149.3		153		3,514	0.2	0.32
1149.4		156		3,803	0.0	0.26
1150.1	82	96	51	6,350	6.8	0.80
1150.2	82	151	51	9,350	7.1	0.19
1150.3		117		6,950	2.8	0.14
1150.4		102		6,050	13.5	0.16
1151.1	83	160	51	8,750	35.6	0.05
1151.2		161		9,350	24.0	0.05
1151.3		150		10,450	30.6	0.10
1151.4		142		9,250	19.1	0.07
1152.1	91	216	56	13,950	1.0	0.70
1152.2		138		8,250	2.4	1.18
1152.3		153		8,350	0.6	0.61
1153.1	90	90	60	7,331	13.2	0.33
1153.2		166		14,240	4.4	1.08
1153.3		85		15,297	0.6	0.94
1153.4		161		11,283	0.4	0.83

Appendix A

Sample Number	CERC Number	Sample Length (cm)	Water Depth (ft)	Bulk Weight (g)	WT % +10 mesh	WT % THM
1154.1	106	127	46	2,346	2.5	0.38
1154.2		140		2,738	5.5	0.43
1154.3		185		1,447	4.1	2.45
1154.4		156		2,662	0.1	1.40
1155.1	87	107	60	7,650	19.5	0.40
1155.2		207		14,950	8.1	0.51
1158.1	85	160	50	11,250	38.7	0.14
1158.2		153		10,950	45.8	0.08
1158.3		89		6,750	19.9	0.17
1159.1	84	151	55	1,363	0.3	3.69
1159.2		159		3,218	0.0	1.52
1159.3		152		3,203	0.2	1.52
1159.4		93		2,065	0.1	0.87
1160.1	86	169	37	10,450	11.1	0.85
1160.2		176		12,350	18.2	0.84

Sample Number	CERC Number	Sample Length (cm)	Water Depth (ft)	Bulk Weight (g)	WT % +10 mesh	WT % THM
1161.1	105	87	45	7,150	23.9	0.65
1161.2		234		20,050	12.3	0.74
1161.3		194		15,650	11.9	0.53
1163.3	103	144	63	10,834	1.2	0.90
1163.4		143		12,890	2.8	0.96
2001R.1	73	203	40	1,586	33.9	1.12
2001R.2		149		3,001	58.4	0.02
2001R.3		145		2,695	63.7	0.03
2001R.4		93		1,759	83.7	0.01
2002.1	102	152	42	3,063	26.3	0.38
2002.2		155		3,010	13.4	0.41
2002.3		152		3,377	36.2	0.39
2002.4		146		3,956	26.0	0.47
AVERAGE VALUE:					**13.6**	**0.56**
MAXIMUM VALUE:					**88.0**	**3.69**
MINIMUM VALUE:					**0.0**	**<0.01**
STANDARD DEVIATION:					**18.7**	**0.48**

APPENDIX B

Table showing sample number, reported sediment ages from Meisburger (1979) and Zarra (unpublished data, 1991), and a short lithologic description for samples in the study.

Appendix B

Sample Number	Age (Meisburger)	Age (Zarra)	Short Lithologic Description
719.1	Oligocene	not examined	biomicrudite
719.2	Oligocene	not examined	biosparite
724.1	Miocene	Pliocene	muddy, sandy, shell hash
724.2	Miocene	Miocene (Pungo River Fm.)	muddy, slightly shelly, poorly sorted, medium-grained phosphatic quartz sand
724.3	Miocene	Miocene (Pungo River Fm.)	muddy, slightly shelly, poorly sorted, medium-grained phosphatic quartz sand
726.1	Paleocene	not examined	silty, fine-grained, slightly shelly clay
726R.1	Paleocene	not examined	clay, with sulfer staining
726R.2	Paleocene	not examined	clay, with sulfer staining
726R.3	Paleocene	not examined	clay, with sulfer staining
726R.4	Paleocene	not examined	silty clay, slightly shelly
727.1	Paleocene	not examined	clay with very fine grained quartz sand partings
727.2	Paleocene	not examined	bryozoan biosparrudite
727.3	Paleocene	not examined	muddy, very fine grained, well-sorted, quartz sand
727.4	Paleocene	not examined	muddy, very fine grained, well-sorted, quartz sand
732.1	Cretaceous	Cretaceous (Peedee Fm.)	muddy, poorly sorted, medium quartz sand with shelly and partially indurated zones
732.2	Cretaceous	Crctaceous (Peedee Fm.)	muddy, moderately sorted, medium quartz sand
732.3	Cretaceous	Cretaceous (Peedee Fm.)	muddy, moderately sorted, fine quartz sand
733.1	Cretaceous	not examined	muddy, moderately well sorted, fine to-coarse-grained, shelly, quartz sand
734.1	Paleocene	not examined	muddy, fine-grained, shelly, moderately sorted, quartz sand
734.2	Paleocene	not examined	muddy, fine-grained, very shelly quartz sand / dense clayey silt
735.1	Holocene & Pleistocene	not examined	clean, well-sorted, fine-grained quartz sand, muddy at base
735.2	Holocene & Pleistocene	not examined	clay with very fine grained quartz sand partings
735.3	Paleocene	not examined	muddy, very fine grained quartz sand, glauconitic, calcareous
736.1	Holocene & Pleistocene	not examined	shelly, muddy, fine-grained, well-sorted, quartz sand
736.2	Paleocene	not examined	shelly, muddy, fine-grained, well sorted, quartz sand
738.1	Holocene & Pleistocene	Plio-Pleistocene	shelly, muddy, medium quartz sand
738.2	Holocene & Pleistocene	Plio-Pleistocene	slightly shelly, silty, fine quartz sand
738.3	Holocene & Pleistocene	Plio-Pleistocene	silty fine quartz sand
738.4	Holocene & Pleistocene	Plio-Pleistocene	silty fine quartz sand
740.1	Holocene & Pleistocene	Pliocene	muddy, moderately well sorted, shelly, medium quartz sand
740.2	Holocene & Pleistocene	Pliocene	biomicrudite
740.3	Holocene & Pleistocene	Pliocene	biomicrudite
742.1	Paleocene	not examined	muddy, fine-grained, shelly, moderately well sorted, quartz sand
742.2	Paleocene	not examined	shelly, fine to granular quartz sand /very fine grained, muddy, slightly shelly calcareous quartz sand

Appendix B

Sample Number	Age (Meisburger)	Age (Zarra)	Short Lithologic Description
742.3	Paleocene	not examined	muddy, very fine grained, slightly shelly, well-sorted, calcareous quartz sand
743.1	Holocene & Pleistocene	not examined	shelly, muddy, fine to medium quartz sand
743.2	Holocene & Pleistocene	not examined	sandy biosparrudite
750.1	Holocene & Pleistocene	not examined	shelly, muddy, fine-to medium-grained, moderately well sorted, quartz sand
751.1	Holocene & Pleistocene	not examined	slightly muddy, fin-to coarse-grained, shelly quartz sand with carbonate stringers
751.2	Paleocene	not examined	muddy, well-sorted, fine-to medium-grained quartz sand / basal 30 cm is molluscan-mold biosparrudite
753.1	Eocene	not examined	slightly muddy, medium-to coarse-grained, shelly quartz sand / biomicrite
754.1	Paleocene	not examined	muddy, shelly, fine-grained quartz sand / basal 20 cm is a moldic biosparrudite
754R.1	Paleocene	not examined	clean, fine-grained, slightly shelly, well-sorted, quartz sand
754R.2	Paleocene	not examined	slightly muddy, fine-grained, slightly shelly, well-sorted, quartz sand
754R.3	Paleocene	not examined	muddy, fine-grained, slightly shelly, well-sorted, quartz sand
754R.4	Paleocene	not examined	slightly muddy, fine-grained, slightly shelly, well-sorted, quartz sand
755.1	Eocene	M. Eocene (Castle Hayne Fm.)	bryozoan biomicrudite
755.2	Eocene	M. Eocene (Castle Hayne Fm.)	bryozoan biomicrudite
756.1	Holocene & Pleistocene	not examined	biomicrite
756.2	Holocene & Pleistocene	not examined	biomicrite
757.1	Holocene & Pleistocene	not examined	sandy shell hash
761.1	Holocene & Pleistocene	not examined	muddy, fine-to coarse-grained, moderately well sorted, quartz sand
761.2	Paleocene	not examined	muddy, shelly, fine-to coarse-grained quartz sand
764.1	Holocene & Pleistocene	not examined	muddy, fine to very fine grained, moderately well sorted, quartz sand
764.2	Holocene & Pleistocene	not examined	muddy, medium-to coarse-grained, shelly, quartz sand
764.3	Holocene & Pleistocene	not examined	slightly shelly, slightly muddy, moderately sorted, medium-to coarse-grained, loose quartz sand
767.1	Eocene	not examined	muddy, fine-to medium-grained, slightly shelly, quartz sand
767.2	Eocene	not examined	shelly, slightly muddy, medium-to coarse-grained, quartz sand
767.3	Eocene	not examined	biosparrudite
768.1	Holocene & Pleistocene	not examined	slightly muddy, fine-grained, shelly, quartz sand
768.2	Holocene & Pleistocene	not examined	slightly muddy, fine-grained, shelly, quartz sand
768.3	Holocene & Pleistocene	not examined	silty clay
768.4	Holocene & Pleistocene	not examined	silty clay, shelly at base
769.1	Holocene & Pleistocene	not examined	muddy, slightly shelly, fine-to medium-grained, moderately well sorted quartz sand
769.2	Holocene & Pleistocene	not examined	muddy, slightly shelly, fine-to medium-grained, moderately well sorted quartz sand
769.3	Holocene & Pleistocene	not examined	silty clay
769.4	Holocene & Pleistocene	not examined	silty clay

Appendix B

Sample Number	Age (Meisburger)	Age (Zarra)	Short Lithologic Description
770.1	Holocene & Pleistocene	not examined	slightly shelly, medium-grained, very well sorted, loose, quartz sand
770.2	Holocene & Pleistocene	not examined	slightly shelly, medium-grained, well-sorted, loose, quartz sand
770.3	Holocene & Pleistocene	not examined	slightly shelly, medium-grained, well-sorted, loose, quartz sand
771.1	Holocene & Pleistocene	Plio-Pleistocene	slightly shelly, loose, well-sorted, fine quartz sand
771.2	Holocene & Pleistocene	Plio-Pleistocene	slightly shelly, loose, well-sorted, fine quartz sand
771.3	Holocene & Pleistocene	Plio-Pleistocene	slightly shelly, loose, well-sorted, fine to medium quartz sand with clay lenses
771.4	Holocene & Pleistocene	Plio-Pleistocene	slightly shelly, loose, well-sorted, medium quartz sand with clay lenses
772.1	Holocene & Pleistocene	not examined	slightly shelly, fine-to medium-grained, well-sorted, slightly muddy, quartz sand
772.2	Holocene & Pleistocene	not examined	slightly shelly, fine-to medium-grained, well-sorted, slightly muddy, quartz sand
772.3	Holocene & Pleistocene	not examined	slightly shelly, fine-to medium-grained, well-sorted, slightly muddy, quartz sand
772.4	Holocene & Pleistocene	not examined	slightly shelly, medium-to coarse-grained, quartz sand; slightly muddy towards base
773.1	Holocene & Pleistocene	Pliocene	slightly shelly, loose, well-sorted, fine quartz sand
773.2	Holocene & Pleistocene	Pliocene	shelly, well-sorted, loose, medium quartz sand; 4-cm-thick clay lens at 248-252 cm
773.3	Holocene & Pleistocene	Pliocene	muddy, slightly shelly, moderately well sorted, fine quartz sand
774.1	Plio-Pleistocene	not examined	muddy, fine-grained, shelly quartz sand / silty clay
774.2	Plio-Pleistocene	not examined	muddy, medium-to coarse-grained, shelly quartz sand
774.3	Plio-Pleistocene	not examined	sparse biomicrite
775.1	Holocene & Pleistocene	not examined	shelly, loose, medium-to coarse-grained, well-sorted, quartz sand
775.2	Holocene & Pleistocene	not examined	silty clay with peat
775.3	Holocene & Pleistocene	not examined	muddy, shelly, fine-to coarse-grained quartz sand with scattered biomicrite cobbles
776.1	Holocene & Pleistocene	not examined	well-sorted, very-fine to fine-grained quartz sand, muddy in lower part
776.2	Holocene & Pleistocene	not examined	shelly, fine-to coarse-grained, loose, moderately well sorted, quartz sand; very shelly at base
776.3	Holocene & Pleistocene	not examined	muddy, shelly, fine-grained quartz sand
777.1	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium quartz sand
777.2	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium quartz sand
777.3	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium quartz sand
777.4	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium quartz sand
779.1	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium to coarse quartz sand
779.2	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium to coarse quartz sand
779.3	Holocene & Pleistocene	Holo/Pleistocene	shelly, loose, well-sorted, medium to coarse quartz sand
780.1	Holocene & Pleistocene	not examined	slightly muddy, fine-grained, well-sorted, shelly, quartz sand
780.2	Holocene & Pleistocene	not examined	silty clay, slightly shelly
780.3	Holocene & Pleistocene	not examined	muddy, fine-to medium-grained, shelly, quartz sand

Appendix B

Sample Number	Age (Meisburger)	Age (Zarra)	Short Lithologic Description
783.1	Holocene & Pleistocene	Pliocene	slightly shelly, muddy, pebbly, poorly sorted fine quartz sand
783.2	Holocene & Pleistocene	Pliocene	slightly shelly, muddy, pebbly, poorly sorted fine quartz sand
783.3	Holocene & Pleistocene	Pliocene	muddy, shelly, poorly sorted, fine to medium quartz sand; thin interbeds of clay and coarse quartz sand
783.4	Holocene & Pleistocene	Pliocene	muddy, sandy, poorly sorted shell hash
785.1	Plio-Pleistocene	not examined	slightly muddy, medium to granular, poorly sorted, shelly, quartz sand; pebble lag at base
785.2	Plio-Pleistocene	not examined	silty, shelly, clay
785.3	Plio-Pleistocene	not examined	biomicirte
785.4	Plio-Pleistocene	not examined	biomicirte
787.1	Oligocene	not examined	muddy, fine-to coarse-grained, shelly sand / fossiliferous micrite
787.2	Oligocene	not examined	muddy, well-sorted, fine-grained, calcareous sand
787.3	Oligocene	not examined	muddy, well-sorted, fine-grained, calcareous sand
787.4	Oligocene	not examined	muddy, well-sorted, fine-grained, calcareous sand
792.1	Plio-Pleistocene	Plio-Pleistocene	biosparrudite
792.2	Plio-Pleistocene	Plio-Pleistocene	biosparrudite
792.3	Plio-Pleistocene	Plio-Pleistocene	biosparrudite
792.4	Plio-Pleistocene	Plio-Pleistocene	biosparrudite
794.1	Plio-Pleistocene	not examined	sandy micrite
794.2	Oligocene	not examined	sandy calcarenite
794.3	Oligocene	not examined	sandy calcarenite
795.1	Plio-Pleistocene	not examined	biomicrudite
795.2	Plio-Pleistocene	not examined	biomicrudite
795.3	Plio-Pleistocene	not examined	biomicrudite
801.3	Holocene & Pleistocene	not examined	muddy, fine-to coarse-grained, slightly shelly, quartz sand
801.4	Holocene & Pleistocene	not examined	muddy, fine-grained, moderately well sorted, shelly quartz sand
805.1	Plio-Pleistocene	Plio-Pleistocene	biomicrudite
805.2	Plio-Pleistocene	Plio-Pleistocene	biomicrudite
805.3	Plio-Pleistocene	Plio-Pleistocene	biomicrudite
805.4	Plio-Pleistocene	Plio-Pleistocene	biomicrudite
1140.1	Oligocene	Pliocene	shelly, loose, well-sorted, fine to medium quartz sand
1140.2	Oligocene	Oligocene	well sorted, carbonate-cemented, very-fine to fine quartz sand
1140.3	Oligocene	Oligocene	well sorted, carbonate-cemented, very-fine to fine quartz sand
1143.2	Plio-Pleistocene	not examined	biomicrite

Appendix B

Sample Number	Age (Meisburger)	Age (Zarra)	Short Lithologic Description
1144.1	Plio-Pleistocene	not examined	calcarenite
1144.2	Plio-Pleistocene	not examined	sandy calcarenite
1145.1	Oligocene	not examined	muddy, shelly, fine-to medium-grained, well-sorted, quartz sand
1145.2	Oligocene	not examined	muddy, fine-to medium-grained quartz sand
1146.1	Oligocene	Oligocene	silty, shelly, well-sorted, fine to medium quartz sand
1146.2	Oligocene	Oligocene	silty, shelly, well-sorted, fine to medium quartz sand
1146.3	Oligocene	Oligocene	silty, shelly, well-sorted, fine to medium quartz sand
1146.4	Oligocene	Oligocene	silty, shelly, well-sorted, fine quartz sand
1147.1	Oligocene	not examined	muddy, fine-to coarse-grained, shelly sand
1147.2	Oligocene	not examined	clean, fine-to coarse-grained quartz sand
1147R.1	Oligocene	not examined	slightly muddy, coarse-grained, poorly sorted, shelly quartz sand; dense calc. siltstone stringers
1147R.2	Oligocene	not examined	slightly muddy, coarse-grained, shelly quartz sand; dense calcareous silstone stringers
1148.1	Oligocene	not examined	shelly, fine-to medium-grained, moderately well sorted, slightly muddy, loose quartz sand
1148.2	Oligocene	not examined	muddy, fine to very fine grained, shelly quartz sand
1149.1	Oligocene	Pleistocene	shelly, loose, moderately well-sorted, medium to coarse quartz sand
1149.2	Oligocene	Oligocene	shelly, silty, well-sorted, medium quartz sand with carbonate cement
1149.3	Oligocene	Oligocene	shelly, silty, well-sorted, medium quartz sand with carbonate cement
1149.4	Oligocene	Oligocene	shelly, silty, well-sorted medium quartz sand with carbonate cement
1150.1	Holocene & Pleistocene	not examined	muddy, shelly, fine-to coarse-grained, moderately well sorted, quartz sand
1150.2	Holocene & Pleistocene	not examined	bryozoan biomicrudite
1150.3	Holocene & Pleistocene	not examined	bryozoan biomicrudite
1150.4	Holocene & Pleistocene	not examined	bryozoan biomicrudite
1151.1	Plio-Pleistocene	not examined	sparse biomicrite
1151.2	Plio-Pleistocene	not examined	sparse biomicrite
1151.3	Plio-Pleistocene	not examined	biomicrite
1151.4	Plio-Pleistocene	not examined	biomicrite
1152.1	Holocene & Pleistocene	not examined	muddy, shelly, fine-grained, well-sorted, quartz sand
1152.2	Holocene & Pleistocene	not examined	muddy, slightly shelly, fine-grained, well-sorted, quartz sand
1152.3	Holocene & Pleistocene	not examined	very fine grained, sandy clay
1153.1	Oligocene	not examined	shelly, medium to very coarse grained, poorly sorted, loose, quartz sand
1153.2	Oligocene	not examined	muddy, fine-to medium-grained, well-sorted, slightly shelly, quartz sand
1153.3	Oligocene	not examined	muddy, fine to very fine grained, well-sorted, calcareous quartz sand
1153.4	Oligocene	not examined	muddy, fine to very fine grained, well-sorted, calcareous quartz sand

Appendix B

Sample Number	Age (Meisburger)	Age (Zarra)	Short Lithologic Description
1154.1	Oligocene	Pliocene	shelly, loose, well-sorted, fine quartz sand
1154.2	Oligocene	Pliocene	shelly, pebbly, muddy, poorly sorted, fine to medium quartz sand
1154.3	Oligocene	Oligocene	shelly, muddy, poorly sorted, fine to medium quartz sand
1154.4	Oligocene	Oligocene	shelly, muddy, poorly sorted, fine to medium quartz sand
1155.1	Holocene & Pleistocene	not examined	muddy, shelly, fine to pebbly, poorly sorted, quartz sand
1155.2	Holocene & Pleistocene	not examined	muddy, shelly, fine to pebbly, poorly sorted, quartz sand / calcareous siltstone stringers
1158.1	Plio-Pleistocene	not examined	fossiliferous micrite
1158.2	Plio-Pleistocene	not examined	fossiliferous micrite / bryozoan biomicrudite
1158.3	Oligocene	not examined	bryozoan biomicrudite / muddy,very fine grained, well-sorted, quartz sand
1159.1	Oligocene	Oligocene	slightly shelly, silty, well-sorted, fine quartz sand
1159.2	Oligocene	Oligocene	slightly shelly, silty, well-sorted, fine quartz sand
1159.3	Oligocene	Oligocene	slightly shelly, silty, well-sorted, fine quartz sand
1159.4	Oligocene	Oligocene	slightly shelly, silty, well-sorted, fine quartz sand
1160.1	Holocene & Pleistocene	not examined	muddy, fine-grained, moderately well sorted, shelly, quartz sand
1160.2	Plio-Pleistocene	not examined	biomicrudite / muddy, very fine grained, well-sorted, quartz sand
1161.1	Holocene & Pleistocene	not examined	clean, fine-grained, well-sorted, quartz sand
1161.2	Holocene & Pleistocene	not examined	muddy, fine-grained, shelly, moderately well sorted, quartz sand
1161.3	Holocene & Pleistocene	not examined	muddy, fine-grained, moderately well sorted, shelly, quartz sand
1163.3	Oligocene	not examined	slightly muddy, fine-grained, calcareous, quartz sand
1163.4	Oligocene	not examined	slightly muddy, fine-grained, calcareous, quartz sand
2001R.1	Plio-Pleistocene	Plio-Pleistocene	muddy, poorly sorted, shelly, fine to medium quartz sand; whole shells
2001R.2	Plio-Pleistocene	Plio-Pleistocene	biosparrudite
2001R.3	Plio-Pleistocene	Plio-Pleistocene	biosparrudite
2001R.4	Plio-Pleistocene	Plio-Pleistocene	biosparite
2002.1	Oligocene	Oligocene	sandy, molluscan-mold biosparrudite
2002.2	Oligocene	Oligocene	sandy, molluscan-mold biosparrudite
2002.3	Oligocene	Oligocene	sandy, molluscan-mold biosparrudite
2002.4	Oligocene	Oligocene	sandy, molluscan-mold biosparrudite

APPENDIX C

Table showing sample number, THM content, zircon-tourmaline-rutile index (ZTR) for the quartz sand samples, mean grain size (in phi units) for all clastic samples, and weight percent carbonate.

Appendix C

Sample Number	Wt % THM	ZTR Index	Mean Grain Size(Ø)	$CaCO_3$ Wt %
719.1	0.74	—	—	51.3
719.2	0.18	—	—	64.2
724.1	0.44	—	—	50.4
724.2	0.64	26	2.16	28.3
724.3	1.00	24	2.31	24.9
726.1	0.48	—	4.20	15.4
726R.1	0.07	—	4.47	18.0
726R.2	0.12	—	4.44	23.4
726R.3	0.17	—	—	20.4
726R.4	0.69	—	3.55	13.4
727.1	0.18	—	4.45	18.8
727.2	0.02	—	—	96.1
727.3	0.52	68	3.80	11.1
727.4	0.23	55	4.07	8.5
732.1	0.23	25	2.60	65.5
732.2	0.21	28	2.68	69.1
732.3	0.16	30	2.70	54.5
733.1	2.11	30	2.26	23.8
734.1	1.84	33	2.40	12.0
734.2	0.84	36	2.80	34.8
735.1	0.86	29	3.05	15.1
735.2	0.55	—	4.44	13.8
735.3	0.70	33	2.80	45.0
736.1	0.95	25	2.66	13.3
736.2	0.98	28	2.84	17.1
738.1	0.58	38	1.90	42.3
738.2	0.67	28	2.68	17.6
738.3	0.83	26	3.21	19.3
738.4	0.62	29	3.20	17.5
740.1	0.87	27	2.53	17.4
740.2	0.03	—	—	89.7
740.3	0.02	—	—	79.8
742.1	0.46	31	2.22	20.4
742.2	0.85	43	2.88	18.2
742.3	0.72	53	3.06	18.7
743.1	0.69	19	2.63	27.8
743.2	0.30	—	—	57.0
750.1	0.55	31	2.30	17.5
751.1	0.74	23	2.91	31.9
751.2	1.10	46	3.91	44.3
753.1	0.28	—	—	84.6
754.1	0.42	43	1.83	28.8
754R.1	1.98	10	2.89	4.0
754R.2	0.90	9	2.43	3.8
754R.3	1.35	12	2.47	3.1
754R.4	0.94	18	2.58	1.9
755.1	0.09	—	—	93.6
755.2	0.05	—	—	97.1
756.1	0.10	—	—	98.7
756.2	0.07	—	—	99.0
757.1	0.39	—	—	48.5
761.1	0.43	32	1.51	42.5
761.2	0.26	33	1.78	27.8
764.1	0.82	32	2.96	14.5
764.2	0.54	41	2.42	21.2
764.3	0.22	37	1.70	2.7
767.1	1.03	35	2.48	12.1
767.2	0.54	34	1.74	5.0
767.3	0.02	—	—	98.4
768.1	0.97	27	2.79	10.2
768.2	1.17	31	2.73	11.4
768.3	0.30	—	4.34	17.5
768.4	0.23	—	4.40	16.7
769.1	1.31	21	2.63	13.7
769.2	0.39	18	2.29	28.6
769.3	0.32	—	4.30	17.1
769.4	0.26	—	4.22	13.1
770.1	0.20	36	1.78	3.7
770.2	0.13	35	1.49	7.9
770.3	0.35	29	2.13	10.9
771.1	1.28	25	2.76	6.5
771.2	0.47	32	2.73	8.1
771.3	0.65	36	1.93	13.3
771.4	0.37	30	2.41	11.2
772.1	1.06	19	2.81	12.9
772.2	1.12	34	2.60	9.7
772.3	1.08	31	2.84	9.9
772.4	0.58	28	1.97	5.0
773.1	0.44	37	2.75	11.7
773.2	0.35	26	2.88	20.4
773.3	1.09	28	2.36	13.3
774.1	0.53	21	4.11	12.4
774.2	0.28	35	2.08	20.4
774.3	0.14	—	—	86.2
775.1	0.67	37	2.48	17.9
775.2	0.40	—	3.17	3.7
775.3	0.46	41	2.11	40.2
776.1	1.02	32	2.79	14.1
776.2	0.21	43	2.29	15.4
776.3	0.42	28	3.65	19.3
777.1	0.41	30	2.15	9.1
777.2	0.53	29	2.19	9.9
777.3	0.42	23	2.36	11.0
777.4	0.36	22	2.55	11.7
779.1	0.38	45	1.39	15.6
779.2	0.31	37	1.49	17.9
779.3	0.26	29	1.72	13.0
780.1	0.84	29	2.64	6.6
780.2	0.27	—	4.22	16.6
780.3	0.44	35	2.42	33.0
783.1	0.62	20	2.43	9.1
783.2	0.65	25	3.06	21.3
783.3	0.77	27	2.12	15.2
783.4	0.34	—	—	52.7
785.1	0.41	34	1.64	9.9
785.2	0.48	—	2.40	34.2
785.3	0.19	—	—	72.7
785.4	0.16	—	—	69.2

— indicates data not determined

Appendix C

Sample Number	Wt % THM	ZTR Index	Mean Grain Size(Ø)	$CaCO_3$ Wt %
787.1	0.46	30	2.30	60.6
787.2	1.10	40	3.31	36.5
787.3	0.76	32	3.27	45.8
787.4	0.36	22	3.44	37.8
792.1	0.04	—	—	94.5
792.2	<0.01	—	—	97.5
792.3	0.01	—	—	97.3
792.4	0.03	—	—	96.9
794.1	0.29	—	—	68.0
794.2	0.38	—	—	34.4
794.3	0.20	—	—	35.7
795.1	0.02	—	—	99.3
795.2	0.01	—	—	99.3
795.3	0.01	—	—	99.3
801.3	0.54	27	3.48	13.6
801.4	1.05	34	2.69	13.8
805.1	0.05	—	—	94.4
805.2	0.01	—	—	92.2
805.3	0.02	—	—	92.0
805.4	0.01	—	—	94.5
1140.1	0.65	29	2.40	12.5
1140.2	0.44	31	3.37	41.6
1140.3	0.54	31	3.62	40.4
1143.2	0.52	—	—	72.5
1144.1	0.14	—	—	75.4
1144.2	0.17	—	—	69.4
1145.1	0.63	34	3.07	24.8
1145.2	1.19	28	3.20	29.0
1146.1	0.74	29	3.03	34.4
1146.2	0.50	26	3.24	37.5
1146.3	0.77	29	3.13	40.6
1146.4	0.81	27	3.09	24.6
1147.1	0.76	42	2.11	27.4
1147.2	0.26	36	1.57	3.4
1147R.1	0.47	30	2.71	31.5
1147R.2	0.78	27	2.18	33.3
1148.1	0.65	16	2.24	16.2
1148.2	0.61	25	2.78	23.5
1149.1	0.32	40	2.10	24.0
1149.2	0.29	30	2.70	38.3
1149.3	0.32	31	2.67	34.3
1149.4	0.26	30	2.76	28.1
1150.1	0.80	48	2.11	13.6

Sample Number	Wt % THM	ZTR Index	Mean Grain Size(Ø)	$CaCO_3$ Wt %
1150.2	0.19	—	—	76.5
1150.3	0.14	—	—	75.7
1150.4	0.16	—	—	72.6
1151.1	0.05	—	—	85.5
1151.2	0.05	—	—	83.7
1151.3	0.10	—	—	80.8
1151.4	0.07	—	—	87.3
1152.1	0.70	37	3.29	13.1
1152.2	1.18	35	3.41	13.6
1152.3	0.61	—	3.93	17.2
1153.1	0.33	43	0.80	12.6
1153.2	1.08	30	2.70	17.2
1153.3	0.94	26	3.01	21.4
1153.4	0.83	23	3.21	25.2
1154.1	0.38	28	2.64	9.1
1154.2	0.43	25	2.50	9.4
1154.3	2.45	22	2.93	11.5
1154.4	1.40	19	3.14	8.2
1155.1	0.40	29	2.04	42.0
1155.2	0.51	20	2.35	38.2
1158.1	0.14	—	—	82.0
1158.2	0.08	—	—	84.2
1158.3	0.17	—	—	70.1
1159.1	3.69	18	3.20	12.4
1159.2	1.52	12	3.18	11.7
1159.3	1.52	26	3.21	10.9
1159.4	0.87	24	3.29	12.3
1160.1	0.85	32	2.69	42.0
1160.2	0.84	—	—	59.2
1161.1	0.65	38	2.30	30.8
1161.2	0.74	31	2.21	29.2
1161.3	0.53	31	2.07	17.5
1163.3	0.90	17	2.28	7.8
1163.4	0.96	27	2.38	18.5
2001R.1	1.12	28	2.57	37.2
2001R.2	0.02	—	—	97.4
2001R.3	0.03	—	—	96.3
2001R.4	0.01	—	—	91.0
2002.1	0.38	—	—	46.0
2002.2	0.41	—	—	26.9
2002.3	0.39	—	—	46.4
2002.4	0.47	—	—	31.9
AVERAGE:	**0.56**	**30**	**2.74**	**36.2**
MAXIMUM:	**3.69**	**68**	**4.47**	**99.3**
MINIMUM:	**<0.01**	**9**	**0.80**	**1.9**
STAN. DEV.:	**0.48**	**9**	**0.72**	**29.8**

— indicates data not determined

APPENDIX D

Table showing sample number, THM content, 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; trace amounts of minerals 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%
719.1	0.74	40.0	0.10	21.02	3.51	18.41	23.40	0.20	2.16	6.86	1.50	5.61	9.76	ND	3.71	ND	0.89	1.75	1.40
719.2	0.18	48.5	0.70	32.49	3.63	9.32	21.41	0.20	0.86	5.11	2.28	5.07	7.82	ND	7.23	ND	3.30	0.77	0.62
724.1	0.44	60.1	0.10	43.79	4.33	6.65	13.70	2.05	6.28	1.77	1.15	1.71	6.56	0.61	1.89	ND	4.20	1.61	3.70
724.2	0.64	63.9	<0.01	46.97	5.29	17.38	3.59	0.37	5.83	3.57	3.51	2.63	4.92	0.80	4.63	0.80	0.38	0.80	0.69
724.3	1.00	59.9	<0.01	39.10	4.08	10.92	15.49	2.14	5.52	1.88	5.25	2.07	7.85	0.80	5.19	ND	ND	ND	0.42
726.1	0.48	25.9	0.10	12.51	0.35	2.68	32.20	34.54	3.53	2.79	2.68	3.62	3.55	ND	0.50	ND	ND	ND	1.49
726R.1	0.70	20.0	ND	ND	ND	ND	47.08	25.36	4.88	1.00	5.80	5.32	3.20	0.84	ND	ND	ND	ND	6.52
726R.2	0.12	19.2	ND	ND	ND	ND	40.44	32.33	7.22	2.62	3.77	4.34	3.84	ND	ND	ND	ND	ND	5.45
726R.3	0.17	20.7	ND	ND	ND	0.84	35.90	33.47	7.45	4.18	3.31	5.82	4.08	ND	ND	ND	ND	ND	4.96
726R.4	0.69	41.2	0.42	30.43	5.41	10.95	20.07	3.82	3.10	9.03	2.70	2.29	2.71	ND	4.14	0.50	1.90	0.16	2.82
727.1	0.18	43.9	5.03	9.97	9.94	9.94	19.92	3.01	2.98	6.96	1.03	24.97	5.00	ND	ND	ND	ND	ND	1.27
727.2	0.20	31.0	3.10	15.08	1.99	0.99	0.11	0.99	1.01	5.00	ND	9.94	4.97	ND	ND	ND	31.82	19.89	5.10
727.3	0.52	12.2	0.56	5.14	2.92	1.94	2.50	0.28	1.94	15.14	ND	5.14	ND	ND	ND	ND	63.19	ND	1.25
727.4	0.23	36.4	0.17	14.64	6.31	3.56	8.09	1.97	0.66	5.83	1.34	3.36	16.41	ND	4.05	ND	29.54	ND	4.07
732.1	0.23	62.2	ND	36.72	4.48	12.39	9.03	2.09	6.12	0.78	8.68	3.06	7.39	0.26	3.06	1.39	2.43	ND	2.13
732.2	0.21	68.1	0.10	46.68	2.19	13.44	4.54	ND	5.79	3.20	8.79	1.71	5.12	ND	5.53	ND	ND	ND	3.00
732.3	0.16	51.9	ND	28.44	4.98	17.77	2.13	ND	8.67	10.66	7.60	1.45	5.78	ND	7.23	2.13	0.87	ND	2.29
733.1	2.11	50.3	0.20	34.20	12.73	15.08	4.04	ND	1.89	5.72	5.67	5.17	3.35	ND	8.90	0.70	1.13	ND	1.40
734.1	1.84	49.7	0.10	32.48	2.02	9.83	22.48	3.32	2.95	10.53	4.62	5.88	3.74	ND	1.57	ND	ND	ND	0.56
734.2	0.84	56.7	0.20	36.56	1.73	9.15	15.24	2.28	1.40	3.23	4.89	6.68	7.21	ND	3.69	ND	6.99	ND	0.91
735.1	0.86	39.6	0.30	25.18	0.69	5.46	32.27	7.45	3.29	11.50	2.15	6.70	2.29	ND	1.81	ND	0.11	ND	1.07
735.2	0.55	31.9	0.25	0.15	1.04	2.97	29.90	20.00	2.01	9.95	9.90	14.90	4.95	ND	1.98	ND	0.99	0.99	0.20
735.3	0.70	21.1	0.27	7.78	5.02	5.33	7.78	ND	2.82	0.60	0.87	4.33	5.28	ND	17.66	10.97	29.68	ND	1.61
736.1	0.95	35.3	0.60	19.04	2.12	4.70	27.75	19.16	1.52	7.16	3.38	6.10	5.31	ND	2.47	ND	0.80	ND	1.15
736.2	0.98	47.4	0.30	36.84	1.22	10.26	7.92	ND	2.90	2.64	1.40	3.93	2.30	ND	9.10	2.60	15.81	ND	3.06
738.1	0.58	59.1	ND	34.59	3.16	11.09	12.92	3.64	2.29	4.68	5.95	5.91	9.90	0.46	2.42	ND	0.80	ND	2.19
738.2	0.67	57.7	ND	37.70	4.06	8.62	17.16	ND	6.24	5.22	4.83	4.67	4.09	0.19	4.19	ND	2.10	ND	0.93
738.3	0.83	51.2	ND	32.85	5.04	5.52	15.83	5.75	6.65	7.34	5.43	3.36	2.93	ND	7.81	ND	0.52	ND	0.98
738.4	0.62	58.8	ND	39.48	2.79	8.43	13.98	1.98	6.63	3.19	2.33	2.43	7.92	ND	7.00	ND	0.60	ND	3.24
740.1	0.87	55.1	ND	35.89	1.63	12.55	21.48	1.91	1.95	3.19	5.93	2.35	9.00	ND	1.52	ND	0.46	ND	2.14
740.2	0.30	62.9	ND	28.22	3.71	11.14	7.43	ND	16.80	2.23	6.29	0.77	10.30	0.51	4.23	ND	8.12	ND	0.26
740.3	0.20	21.0	ND	14.27	1.65	11.43	1.65	ND	3.16	3.00	1.35	2.25	ND	ND	5.90	ND	29.02	22.22	4.10
742.1	0.46	45.3	<0.01	28.48	1.34	9.15	27.12	3.09	1.91	10.29	5.62	5.26	4.03	ND	1.16	ND	ND	ND	2.57
742.2	0.85	59.4	0.20	40.68	2.49	11.31	10.25	ND	2.37	6.21	2.78	9.77	3.83	ND	5.08	ND	3.03	ND	2.18
742.3	0.72	64.7	0.30	42.39	1.74	8.26	9.49	0.54	1.24	6.30	2.92	7.89	10.22	ND	5.63	0.30	0.70	ND	2.62
743.1	0.69	34.1	0.60	19.99	3.11	9.41	13.93	28.91	2.28	6.91	5.12	1.15	5.55	ND	2.93	ND	0.50	ND	0.61
743.2	0.30	40.2	0.17	15.29	9.95	4.97	14.92	9.94	1.99	4.98	0.99	19.89	1.99	ND	9.94	ND	4.97	ND	ND
750.1	0.55	53.5	0.70	31.10	2.14	14.89	19.63	3.08	1.01	3.68	6.55	6.01	8.82	ND	2.28	ND	ND	ND	0.73
751.1	0.74	48.8	0.70	31.88	2.47	5.28	19.32	14.51	1.55	2.58	4.84	4.85	5.73	ND	1.59	ND	2.77	ND	2.58
751.2	1.10	51.6	0.28	35.33	3.18	6.63	9.30	2.07	1.98	9.91	4.75	5.73	3.78	ND	2.58	ND	10.70	ND	3.78
753.1	0.28	28.8	0.49	18.83	1.23	10.41	12.02	2.45	3.31	11.75	2.04	2.24	2.35	ND	0.97	ND	22.04	7.64	2.21

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%
754.1	0.42	54.8	0.40	30.93	4.56	7.95	11.79	5.81	3.98	8.46	3.08	7.40	9.45	ND	0.43	0.52	3.01	0.20	2.57
754R.1	1.98	38.7	1.22	31.39	7.88	2.32	26.62	20.44	1.66	2.54	1.44	0.46	3.24	0.46	ND	ND	ND	ND	0.32
754R.2	0.90	44.5	0.85	35.38	6.77	2.26	21.73	20.73	3.16	2.63	2.38	0.75	2.37	0.50	ND	ND	0.20	ND	0.47
754R.3	1.35	55.9	0.60	44.93	6.43	1.07	16.35	17.94	2.34	1.47	4.06	1.41	3.18	ND	ND	ND	ND	ND	0.21
754R.4	0.94	58.5	3.25	44.98	3.76	1.78	14.32	15.93	2.86	2.12	4.36	3.28	2.96	0.50	ND	ND	ND	ND	0.35
755.1	0.90	60.5	ND	22.94	1.72	11.60	14.34	1.15	17.06	2.87	4.71	8.53	5.97	1.28	ND	ND	ND	5.12	2.72
755.2	0.50	63.2	ND	27.05	4.51	12.88	9.66	1.93	6.41	0.64	5.71	8.54	14.24	1.29	1.07	ND	1.07	0.71	4.29
756.1	0.10	50.7	ND	24.03	ND	2.28	36.61	2.28	2.39	2.43	5.48	15.00	3.58	0.24	1.48	ND	ND	0.72	3.48
756.2	0.70	0.4	0.13	0.36	ND	0.50	0.40	ND	ND	0.20	ND	ND	ND	ND	0.98	ND	68.64	29.73	0.50
757.1	0.39	48.8	0.10	28.98	2.83	20.48	11.04	0.72	2.40	14.28	4.53	6.96	5.89	ND	1.26	ND	ND	ND	0.61
761.1	0.43	55.5	0.30	31.84	6.45	12.27	18.10	2.45	4.26	3.29	2.41	10.22	6.73	ND	0.18	ND	1.04	0.10	0.73
761.2	0.26	47.4	0.10	22.42	4.29	11.94	20.28	5.63	4.16	6.76	5.22	10.61	5.00	ND	0.76	0.56	1.69	ND	0.64
764.1	0.82	45.6	0.10	28.70	1.56	6.15	26.83	5.76	1.04	9.52	6.26	4.65	4.98	ND	2.33	ND	ND	ND	2.21
764.2	0.54	49.9	<0.01	30.18	1.89	9.39	22.46	0.11	2.97	13.00	3.92	7.24	5.53	ND	0.31	ND	ND	ND	2.99
764.3	0.22	49.4	<0.01	22.64	3.79	13.46	17.48	3.36	2.83	11.65	11.46	7.50	4.84	0.16	ND	ND	ND	ND	0.83
767.1	1.03	49.9	0.10	25.84	0.73	7.04	22.96	6.85	4.40	11.47	8.56	7.59	3.49	ND	0.15	ND	ND	ND	0.90
767.2	0.54	53.7	<0.01	30.02	1.42	7.04	22.75	6.62	3.69	8.44	7.07	6.06	6.82	ND	ND	ND	ND	ND	0.40
767.3	0.20	43.2	ND	9.87	ND	9.87	14.87	3.29	3.42	9.87	3.42	18.29	8.21	ND	11.71	ND	5.13	1.71	0.34
768.1	0.97	49.0	0.90	29.53	2.67	7.26	23.24	8.91	2.26	6.72	7.49	4.65	5.04	ND	0.34	ND	ND	ND	1.79
768.2	1.17	47.3	0.10	27.31	1.58	6.99	26.54	5.97	1.37	7.09	6.55	5.55	6.47	ND	0.64	ND	ND	ND	3.94
768.3	0.30	59.1	0.20	30.28	2.02	6.68	25.24	2.85	2.41	3.60	10.45	6.43	9.49	0.50	ND	ND	ND	ND	0.46
768.4	0.23	54.4	0.90	27.97	1.90	9.17	21.93	1.86	3.82	7.23	7.77	6.05	8.80	0.40	ND	ND	0.50	ND	3.32
769.1	1.31	41.6	0.30	26.91	1.73	5.47	34.51	5.40	2.91	6.78	5.42	2.59	3.75	ND	3.22	ND	ND	ND	1.26
769.2	0.39	55.7	0.20	37.48	12.89	2.80	18.41	5.53	5.77	3.38	6.20	3.82	2.45	ND	0.34	ND	ND	ND	0.92
769.3	0.32	37.0	0.10	15.00	5.00	6.99	33.98	7.02	2.00	5.02	ND	19.98	0.10	ND	ND	ND	4.99	ND	ND
769.4	0.26	39.6	0.50	17.63	1.25	1.91	34.54	16.12	2.47	3.27	4.95	9.87	4.02	0.64	ND	ND	0.18	0.60	3.05
770.1	0.20	41.4	0.10	15.00	1.70	14.97	24.41	2.28	3.58	13.89	10.20	10.48	2.12	0.60	0.21	ND	ND	ND	1.08
770.2	0.13	46.4	<0.01	21.84	1.19	13.81	22.43	3.42	3.85	10.80	7.22	10.86	2.64	ND	0.64	ND	ND	ND	1.28
770.3	0.35	48.2	0.10	28.20	1.78	6.99	27.46	4.47	1.95	7.06	7.96	5.30	4.81	ND	2.35	ND	ND	ND	1.66
771.1	1.28	48.7	ND	31.79	2.70	11.01	14.21	11.37	3.03	5.39	5.12	3.01	5.71	ND	5.14	ND	ND	ND	1.52
771.2	0.47	55.5	ND	32.95	2.53	11.64	10.49	8.64	6.88	8.72	5.84	3.96	5.83	ND	1.45	ND	ND	ND	1.07
771.3	0.65	56.3	ND	32.55	2.57	11.05	8.89	5.81	6.18	7.85	5.97	3.55	8.01	ND	1.03	ND	ND	ND	6.55
771.4	0.37	58.0	0.10	34.47	4.08	11.47	16.21	1.92	4.96	3.72	4.91	4.16	8.92	0.61	1.14	ND	ND	ND	3.43
772.1	1.06	44.3	0.10	30.54	0.67	9.84	29.58	6.04	1.61	3.69	4.53	4.38	3.27	ND	3.30	ND	ND	ND	2.53
772.2	1.12	49.7	<0.01	31.43	0.80	9.22	21.01	5.80	2.44	9.53	5.52	5.35	5.00	ND	1.20	ND	ND	ND	2.70
772.3	1.08	51.3	0.10	33.65	1.05	5.91	20.58	8.60	2.19	6.29	4.05	6.71	4.64	0.30	0.62	ND	ND	ND	5.66
772.4	0.58	54.5	<0.01	35.92	2.36	9.07	26.11	0.64	1.99	4.74	5.58	5.26	5.65	0.90	0.31	ND	0.28	ND	2.01
773.1	0.44	54.0	ND	30.94	0.72	9.06	16.56	3.13	5.96	9.21	5.35	3.44	8.27	ND	3.06	ND	ND	ND	4.30
773.2	0.35	47.7	ND	25.90	2.58	8.92	23.50	5.90	6.50	7.84	6.49	4.25	4.52	ND	1.99	ND	ND	0.90	1.52
773.3	1.09	51.0	ND	26.65	2.21	13.34	11.95	8.44	8.57	7.22	6.10	3.65	6.00	ND	4.53	ND	ND	ND	1.34
774.1	0.53	40.8	0.10	21.30	1.07	7.28	32.41	11.41	3.62	4.93	4.98	6.61	3.74	0.56	0.30	ND	ND	ND	1.78

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%
774.2	0.28	39.5	<0.01	20.88	4.62	18.77	20.55	0.60	1.60	12.38	3.64	7.05	5.75	0.57	ND	ND	ND	ND	3.57
774.3	0.14	45.2	ND	16.86	2.02	13.49	15.00	3.37	1.63	7.07	4.88	13.37	8.46	ND	8.53	ND	1.00	3.65	0.65
775.1	0.67	58.8	0.20	37.68	1.63	9.97	16.42	2.43	3.66	7.85	5.08	6.93	5.46	ND	ND	ND	ND	ND	2.85
775.2	0.40	59.0	0.20	24.99	2.00	10.00	15.01	6.99	2.00	7.01	5.00	24.98	2.00	ND	ND	ND	ND	ND	ND
775.3	0.46	54.5	0.10	34.72	2.63	11.06	11.56	1.36	3.93	7.54	2.36	3.78	9.67	ND	0.78	ND	5.08	0.22	5.28
776.1	1.02	52.5	0.20	31.17	1.25	5.54	22.76	8.73	3.01	6.22	5.20	7.51	5.56	ND	0.77	ND	ND	ND	2.24
776.2	0.21	47.0	0.20	15.03	3.00	9.99	19.99	9.99	3.00	9.99	5.00	22.98	1.00	ND	ND	ND	ND	ND	0.10
776.3	0.42	48.5	0.30	27.64	1.91	7.83	23.08	10.65	3.57	6.12	5.27	7.27	4.73	ND	ND	ND	0.50	ND	1.83
777.1	0.41	43.8	ND	24.84	2.66	18.29	16.48	5.87	3.07	8.35	4.59	3.84	7.47	ND	2.20	ND	ND	ND	2.33
777.2	0.53	50.8	ND	30.92	3.59	14.61	20.90	0.27	3.31	7.22	5.23	3.43	7.28	0.65	2.40	ND	ND	ND	0.17
777.3	0.42	48.8	ND	25.78	2.41	16.54	16.62	5.01	7.73	6.38	7.49	2.79	5.01	ND	3.23	ND	ND	ND	1.01
777.4	0.36	60.9	ND	37.30	3.02	12.22	11.83	4.41	8.97	4.37	7.71	2.20	4.76	ND	2.06	ND	ND	ND	1.15
779.1	0.38	49.6	ND	24.07	6.61	19.28	7.15	1.71	1.86	9.33	3.42	5.36	14.93	ND	3.78	ND	ND	ND	2.50
779.2	0.31	58.7	ND	37.90	4.86	18.05	9.83	1.27	1.05	4.87	4.27	4.41	11.10	ND	1.85	ND	ND	ND	0.54
779.3	0.26	54.8	ND	32.36	5.33	17.49	10.81	2.53	7.58	7.69	4.83	3.14	6.91	ND	1.15	ND	ND	ND	0.19
780.1	0.84	43.1	<0.01	22.55	1.44	6.88	31.73	6.57	3.83	8.21	3.90	8.31	4.56	ND	1.19	ND	ND	ND	0.83
780.2	0.27	54.0	0.10	29.53	1.36	9.08	25.66	4.16	2.06	4.56	6.62	9.01	6.81	ND	0.85	ND	ND	ND	0.28
780.3	0.44	52.9	0.20	33.39	2.01	8.50	20.97	5.68	1.72	7.05	4.30	6.27	7.18	ND	1.06	<0.01	1.33	0.80	0.46
783.1	0.62	35.2	<0.01	13.84	5.28	6.56	26.80	14.32	6.23	4.49	4.54	2.48	8.13	ND	4.38	ND	1.85	ND	1.11
783.2	0.65	37.2	0.10	16.39	0.96	4.11	28.60	16.49	5.24	7.73	4.84	2.60	8.16	ND	1.30	ND	1.98	0.55	1.03
783.3	0.77	42.2	ND	21.59	5.94	10.33	20.92	7.16	4.30	6.88	4.37	3.66	7.71	0.52	2.95	ND	0.78	0.17	2.71
783.4	0.34	41.0	ND	20.12	5.43	10.21	16.40	12.12	4.59	3.64	6.74	3.17	6.42	ND	7.63	ND	1.72	0.47	1.33
785.1	0.41	45.0	<0.01	23.73	9.08	9.28	22.69	2.98	2.22	10.53	5.79	4.13	9.09	ND	ND	ND	0.46	ND	0.10
785.2	0.48	48.2	<0.01	33.76	2.92	9.67	21.28	4.84	0.81	8.05	2.68	4.79	6.16	ND	0.18	ND	0.72	1.02	3.11
785.3	0.19	32.0	<0.01	19.39	3.85	16.44	17.09	ND	1.74	8.68	1.78	2.82	6.27	ND	10.39	0.20	4.65	5.78	1.11
785.4	0.16	33.6	0.10	20.58	2.46	18.21	17.14	ND	1.71	6.74	2.62	3.51	5.21	ND	17.10	ND	1.06	3.29	0.38
787.1	0.46	32.3	0.10	18.55	11.53	15.07	16.20	1.76	1.72	9.29	1.51	1.75	8.79	ND	3.59	0.30	8.16	0.90	1.15
787.2	1.10	62.4	0.30	47.66	2.32	5.57	11.15	0.12	1.39	3.73	3.65	2.06	7.62	ND	3.43	ND	7.47	ND	3.80
787.3	0.76	51.5	<0.01	33.72	2.55	9.00	18.44	0.14	0.82	5.81	8.10	1.43	7.41	ND	3.31	ND	5.29	ND	3.96
787.4	0.36	29.4	0.10	15.28	5.10	18.99	29.12	0.46	1.09	7.68	5.74	1.84	5.49	ND	4.06	ND	3.49	ND	1.65
792.1	0.40	62.6	ND	30.39	2.76	13.82	3.87	ND	0.89	1.66	1.34	6.71	23.26	ND	6.13	ND	1.34	6.71	1.11
792.2	<0.01	18.0	ND	7.00	1.00	8.00	ND	ND	5.00	2.00	1.00	5.00	ND	ND	5.00	ND	50.00	10.00	6.00
792.3	0.10	17.0	ND	5.00	2.00	10.00	ND	ND	5.00	3.00	3.00	2.00	2.00	ND	3.00	ND	45.00	15.00	5.00
792.4	0.30	22.0	5.00	15.00	1.00	5.00	1.00	ND	5.00	ND	1.00	ND	1.00	ND	3.00	ND	20.00	28.00	15.00
794.1	0.29	49.1	0.10	28.68	5.18	16.37	14.05	0.80	3.20	3.24	4.38	6.80	6.04	ND	3.57	ND	2.19	1.16	5.06
794.2	0.38	29.4	0.40	13.46	4.36	14.40	21.87	0.14	1.94	10.29	3.90	4.49	5.59	ND	1.03	ND	13.26	0.52	4.72
794.3	0.20	42.9	0.37	13.15	4.96	19.88	0.18	ND	2.01	10.00	6.91	19.82	0.99	ND	9.88	ND	9.88	1.98	ND
795.1	0.20	7.2	ND	4.19	0.34	2.52	2.52	0.50	0.50	1.68	ND	2.52	ND	ND	2.17	0.17	73.41	9.50	ND
795.2	0.10	0.3	ND	ND	ND	ND	0.27	ND	ND	ND	ND	0.27	ND	ND	3.00	ND	69.65	25.35	1.46
795.3	0.10	3.3	ND	2.26	ND	0.15	0.30	ND	ND	ND	ND	1.06	ND	ND	ND	ND	48.96	41.98	5.28
801.3	0.54	40.0	0.20	21.96	3.53	8.17	22.43	11.09	2.38	6.37	4.31	4.94	6.45	ND	1.45	ND	3.15	0.41	3.35

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%
801.4	1.05	41.3	0.40	24.52	3.36	5.48	22.98	7.77	1.66	8.28	1.68	6.99	6.43	ND	3.50	ND	2.72	0.32	4.28
805.1	0.50	56.2	ND	30.91	5.03	17.97	5.03	7.19	7.03	3.59	2.81	5.62	9.84	ND	ND	ND	2.81	ND	2.16
805.2	0.10	52.0	ND	27.00	3.00	10.00	3.00	7.00	5.00	3.00	7.00	3.00	10.00	ND	7.00	ND	5.00	5.00	5.00
805.3	0.20	43.0	ND	24.13	3.26	9.78	3.26	3.26	8.48	4.57	1.74	1.74	6.96	ND	8.04	ND	15.00	8.04	1.74
805.4	0.10	28.0	ND	10.00	3.00	5.00	3.00	ND	ND	5.00	5.00	10.00	3.00	ND	5.00	ND	20.00	26.00	5.00
1140.1	0.65	41.6	ND	20.56	3.33	19.62	9.54	5.91	4.31	9.46	8.46	2.38	5.85	ND	6.66	ND	ND	ND	3.94
1140.2	0.44	52.3	ND	33.59	6.27	14.91	4.71	1.10	5.96	5.78	3.66	3.30	5.84	ND	13.27	ND	ND	ND	1.61
1140.3	0.54	60.5	ND	34.16	4.08	15.34	5.04	ND	11.66	5.24	4.20	3.93	6.56	ND	8.37	ND	ND	ND	1.40
1143.2	0.52	44.7	0.10	22.24	11.94	19.49	12.52	0.20	3.02	6.98	2.11	5.03	12.30	ND	3.76	ND	ND	ND	0.57
1144.1	0.14	32.2	0.10	19.86	3.42	19.03	22.86	ND	1.24	6.90	3.23	1.87	6.05	ND	5.86	ND	3.28	3.02	3.36
1144.2	0.17	26.6	0.30	18.84	3.12	18.10	23.81	0.10	0.96	6.39	0.96	1.49	4.40	ND	6.53	ND	7.34	3.91	4.14
1145.1	0.63	27.4	0.20	12.99	4.10	16.73	10.19	0.16	2.39	8.66	3.20	4.11	4.68	0.70	6.78	<0.01	20.11	ND	5.80
1145.2	1.19	42.5	0.20	25.91	4.63	21.23	12.43	<0.01	2.82	5.88	3.85	5.70	4.24	ND	6.80	0.20	1.05	ND	5.43
1146.1	0.74	54.3	ND	33.13	7.15	14.51	7.67	ND	6.27	4.77	5.23	3.02	6.70	ND	8.78	ND	ND	ND	2.78
1146.2	0.50	44.2	ND	24.99	5.40	16.30	11.50	ND	4.74	6.44	7.79	3.71	2.95	ND	13.10	0.70	ND	ND	3.01
1146.3	0.77	51.6	ND	30.86	7.05	16.90	8.71	ND	4.36	5.33	6.78	3.10	6.53	ND	9.99	0.25	ND	ND	0.14
1146.4	0.81	53.8	ND	37.78	6.48	14.24	9.68	0.20	3.90	5.38	4.75	2.74	4.68	ND	10.12	0.60	ND	ND	<0.01
1147.1	0.76	51.8	0.10	13.53	7.14	18.36	10.69	2.23	6.37	5.90	5.43	16.48	9.95	0.20	2.37	ND	ND	ND	1.53
1147.2	0.26	44.9	0.20	15.14	8.13	8.30	17.98	10.97	4.32	6.75	4.52	14.21	6.68	0.70	0.55	ND	0.21	ND	2.16
1147R.1	0.47	41.1	0.10	25.40	2.91	21.32	15.61	0.30	2.83	7.87	2.73	5.91	4.19	0.60	2.84	ND	4.93	0.33	3.02
1147R.2	0.78	43.1	0.10	28.54	5.33	20.60	15.15	0.10	3.93	7.19	1.29	5.08	4.21	0.10	4.62	ND	0.99	0.14	2.91
1148.1	0.65	49.4	0.10	36.60	1.85	12.64	24.59	0.64	2.87	2.88	4.45	2.13	3.38	0.10	7.86	ND	ND	ND	0.90
1148.2	0.61	41.7	<0.01	29.67	1.03	12.29	28.36	0.20	1.20	6.70	2.95	3.17	4.65	0.10	4.03	0.10	ND	2.33	3.57
1149.1	0.32	55.6	ND	39.23	4.00	16.01	11.99	ND	3.99	8.01	4.40	2.99	3.99	1.00	4.40	ND	ND	ND	ND
1149.2	0.29	49.5	ND	30.50	4.19	16.26	6.23	ND	7.60	7.83	4.64	1.75	5.02	ND	14.24	0.80	1.36	ND	0.29
1149.3	0.32	51.8	ND	33.92	2.81	10.79	5.89	ND	6.87	5.49	4.86	3.05	3.12	ND	20.33	0.30	2.46	ND	0.90
1149.4	0.26	44.4	ND	29.57	3.74	13.23	6.43	1.01	5.54	6.70	2.88	3.05	3.36	ND	23.99	0.48	ND	ND	<0.01
1150.1	0.80	60.3	0.40	33.84	5.78	5.16	11.50	2.60	3.48	10.72	7.53	9.10	6.34	ND	1.12	ND	ND	ND	2.80
1150.2	0.19	25.0	0.20	10.00	2.00	9.99	7.00	ND	3.00	9.99	1.00	9.99	1.00	ND	19.98	ND	9.99	15.99	0.40
1150.3	0.14	24.0	0.20	10.00	2.00	31.98	5.01	0.10	2.01	10.00	ND	9.99	2.00	ND	19.98	ND	5.00	2.00	0.10
1150.4	0.16	26.0	0.10	5.00	2.00	34.98	2.01	<0.01	3.00	10.01	1.00	14.99	2.00	ND	19.99	ND	5.00	ND	0.10
1151.1	0.50	26.7	0.19	9.87	1.97	9.87	14.81	0.99	0.99	2.96	0.99	9.87	4.94	ND	4.94	ND	26.66	9.87	1.08
1151.2	0.50	26.0	0.10	15.05	1.00	9.95	27.89	2.99	1.00	6.97	0.10	9.95	ND	ND	9.95	ND	10.10	4.99	0.70
1151.3	0.10	37.9	0.12	20.02	1.00	4.99	26.97	2.03	1.00	4.98	1.99	14.94	ND	ND	6.97	ND	9.96	5.00	0.20
1151.4	0.70	10.9	0.33	4.96	4.96	14.88	9.92	ND	ND	14.88	0.99	4.96	ND	ND	9.92	ND	28.76	4.96	0.50
1152.1	0.70	49.4	0.40	24.59	3.71	9.89	21.93	1.23	2.81	5.04	3.84	8.91	9.27	ND	1.36	ND	ND	<0.01	7.37
1152.2	1.18	51.1	0.30	30.44	3.77	6.53	22.38	2.28	2.36	4.80	2.71	7.07	8.50	ND	2.60	0.43	ND	ND	6.10
1152.3	0.61	49.3	0.20	29.84	3.52	5.09	25.58	1.73	2.21	5.34	3.84	7.33	6.09	ND	2.82	ND	ND	ND	6.58
1153.1	0.33	58.3	<0.01	36.90	3.78	15.40	11.90	0.20	1.02	7.07	3.39	5.32	11.70	ND	2.81	ND	ND	ND	0.69
1153.2	1.08	57.8	0.10	39.32	1.05	12.15	17.15	<0.01	2.77	3.73	5.59	4.61	5.53	ND	3.17	ND	1.89	ND	3.03
1153.3	0.94	58.6	0.10	43.92	0.22	9.12	19.46	<0.01	1.40	3.73	6.66	3.81	2.81	ND	5.15	ND	1.66	ND	2.07

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%
1153.4	0.83	53.4	0.10	39.47	0.76	10.31	24.98	0.60	0.82	3.60	5.71	4.11	3.31	ND	3.03	ND	1.60	ND	1.69
1154.1	0.38	51.3	ND	33.60	2.46	14.59	19.05	1.57	3.24	7.51	6.12	3.68	4.68	ND	3.24	ND	ND	ND	0.26
1154.2	0.43	58.6	ND	37.13	3.58	6.68	18.16	4.95	5.66	3.95	6.49	3.47	5.90	ND	3.44	ND	0.37	ND	0.21
1154.3	2.45	45.1	ND	30.46	3.44	17.06	17.32	2.07	3.36	5.89	4.88	2.11	4.32	ND	6.85	ND	2.21	ND	0.30
1154.4	1.40	42.4	ND	27.91	2.87	13.89	21.56	4.97	4.08	4.62	4.10	2.81	3.49	ND	5.55	ND	3.95	ND	0.20
1155.1	0.40	51.9	0.10	32.01	6.72	11.26	13.25	2.96	5.90	6.17	3.91	6.77	3.32	ND	2.25	0.55	2.01	0.20	2.87
1155.2	0.51	54.0	0.10	41.14	8.04	17.08	9.46	ND	4.71	4.87	3.01	1.25	3.92	ND	3.30	ND	1.06	ND	2.14
1158.1	0.14	34.0	0.20	19.99	5.00	22.98	15.00	<0.01	1.00	9.99	1.00	9.99	2.00	ND	9.99	ND	1.00	2.00	0.40
1158.2	0.80	33.0	0.10	19.99	5.00	17.99	10.01	ND	1.00	10.01	ND	9.99	2.00	ND	9.99	ND	8.99	5.00	0.20
1158.3	0.17	18.1	0.70	2.06	2.99	4.98	3.06	0.10	1.02	5.07	0.50	9.95	4.98	ND	9.95	1.99	33.84	19.90	ND
1159.1	3.69	46.0	ND	31.79	5.00	15.80	19.91	1.99	3.08	4.25	5.35	2.18	3.59	ND	4.82	0.11	1.85	0.20	0.80
1159.2	1.52	52.9	ND	43.74	4.16	15.97	15.36	2.32	3.75	2.94	2.70	1.81	0.91	ND	3.22	ND	1.56	ND	1.55
1159.3	1.52	53.2	ND	43.64	4.16	13.38	16.03	ND	0.84	6.19	3.11	3.09	2.51	ND	5.83	ND	0.98	ND	0.25
1159.4	0.87	49.1	ND	33.51	0.40	13.74	22.24	2.06	2.49	5.95	6.27	3.28	3.59	ND	4.84	ND	1.39	ND	0.23
1160.1	0.85	51.1	0.20	28.21	3.99	15.28	17.08	2.69	3.66	5.15	4.18	5.71	9.30	ND	1.10	ND	ND	ND	3.64
1160.2	0.84	42.8	0.10	22.55	2.54	12.54	12.59	ND	2.93	5.20	2.80	5.62	8.85	ND	2.20	0.63	16.85	0.24	4.44
1161.1	0.65	37.5	0.20	17.18	3.54	19.11	15.89	0.71	4.56	14.21	3.40	3.69	8.72	ND	7.41	ND	ND	ND	1.56
1161.2	0.74	46.4	0.60	25.52	4.44	26.45	10.61	0.68	3.91	7.12	3.11	4.83	9.01	ND	2.03	ND	0.50	ND	2.18
1161.3	0.53	50.3	0.10	30.20	4.14	26.34	9.32	0.50	3.85	6.46	2.59	4.17	9.44	ND	1.29	ND	ND	ND	2.14
1163.3	0.90	41.1	<0.01	27.49	2.39	27.90	16.39	0.10	2.35	4.68	5.98	2.35	2.95	ND	6.05	ND	ND	ND	1.46
1163.4	0.96	39.3	0.20	25.06	2.64	23.75	16.15	0.30	0.63	7.67	5.01	3.70	4.90	ND	7.83	ND	ND	ND	2.61
2001R.1	1.12	36.3	ND	12.95	7.88	8.11	17.82	13.08	2.24	4.41	6.49	4.60	10.05	ND	5.31	ND	4.71	2.06	0.28
2001R.2	0.20	32.0	ND	7.00	3.00	7.00	10.00	3.00	5.00	3.00	7.00	10.00	3.00	ND	7.00	ND	25.00	10.00	ND
2001R.3	0.30	15.6	ND	5.68	4.14	17.22	3.97	2.84	2.16	5.68	1.30	4.32	2.16	ND	7.00	ND	22.16	19.11	2.27
2001R.4	0.10	17.0	ND	7.00	1.00	7.00	5.00	ND	ND	5.00	3.00	7.00	ND	ND	15.00	ND	15.00	28.00	7.00
2002.1	0.38	42.7	ND	30.54	4.97	20.99	12.74	ND	2.18	7.27	4.35	1.93	3.75	ND	10.88	ND	ND	ND	0.41
2002.2	0.41	47.2	ND	30.19	6.59	21.46	9.65	ND	2.44	6.37	7.26	2.44	4.91	ND	6.41	ND	2.28	ND	<0.01
2002.3	0.39	44.6	ND	27.10	7.32	17.28	14.72	ND	3.75	7.67	6.37	2.83	4.60	ND	6.40	ND	1.95	ND	0.10
2002.4	0.47	49.6	ND	32.81	5.12	17.27	14.67	ND	3.95	8.29	3.76	2.93	6.15	ND	4.98	ND	ND	ND	0.80
COUNT (n):	193	193	124	189	185	190	191	154	187	190	184	191	182	34	168	28	113	65	18
AVERAGE:	0.56	44.4	0.24	26.07	3.61	11.56	16.28	5.35	3.54	6.29	4.45	5.75	5.73	0.36	4.91	0.93	9.58	6.69	2.15
MAXIMUM:	3.69	68.1	5.03	47.66	12.89	34.98	47.08	34.54	17.06	15.14	11.46	24.98	23.26	1.29	23.99	10.97	73.41	41.98	15.00
MINIMUM:	<0.01	0.3	<0.01	0.15	0.22	0.50	0.40	0.10	0.50	0.20	0.10	0.27	0.10	0.10	0.50	0.10	0.20	0.10	0.10
STAN. DEV.:	0.48	13.2	0.8	10.4	2.4	6.0	8.8	6.7	2.4	3.0	2.2	4.4	3.0	0.4	4.5	2.2	15.6	9.4	2.0

APPENDIX E

Table showing sample number, weight percent EHM of the bulk sample, and weight percentages for the sixteen minerals categorized in this study. The mineral abundances are expressed as weight percentages of the bulk sample. "ND" means not detected; trace amounts of minerals 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 E

SAMPLE NUMBER	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%
719.1	0.30	<0.01	0.15	0.30	0.14	0.17	<0.01	0.20	0.50	0.10	0.40	0.70	ND	0.30	ND	0.10	0.10	0.10
719.2	0.90	<0.01	0.60	0.10	0.20	0.40	<0.01	<0.01	0.10	<0.01	0.10	0.10	ND	0.10	ND	0.10	<0.01	<0.01
724.1	0.27	<0.01	0.19	0.20	0.30	0.60	0.10	0.30	0.10	0.10	0.10	0.30	<0.01	0.10	ND	0.20	0.10	0.20
724.2	0.41	<0.01	0.30	0.30	0.11	0.20	<0.01	0.40	0.20	0.20	0.20	0.30	<0.01	0.30	<0.01	<0.01	<0.01	<0.01
724.3	0.60	<0.01	0.39	0.40	0.11	0.15	0.20	0.50	0.20	0.50	0.20	0.80	<0.01	0.50	ND	ND	ND	<0.01
726.1	0.12	<0.01	0.60	<0.01	0.10	0.15	0.17	0.20	0.10	0.10	0.20	0.20	ND	<0.01	ND	ND	ND	0.10
726R.1	0.10	ND	ND	ND	ND	0.30	0.20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	ND	ND	ND	<0.01
726R.2	0.20	ND	ND	ND	ND	0.50	0.40	0.10	<0.01	<0.01	0.10	<0.01	ND	ND	ND	ND	ND	0.10
726R.3	0.30	ND	ND	ND	<0.01	0.60	0.60	0.10	0.10	0.10	0.10	0.10	ND	ND	ND	ND	ND	0.10
726R.4	0.28	<0.01	0.21	0.40	0.80	0.14	0.30	0.20	0.60	0.20	0.20	0.20	ND	0.30	<0.01	0.10	<0.01	0.20
727.1	0.70	0.10	0.20	0.20	0.20	0.30	0.10	<0.01	0.10	<0.01	0.40	0.10	ND	ND	ND	ND	ND	<0.01
727.2	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	<0.01	ND	ND	ND	0.10	<0.01	<0.01
727.3	0.60	<0.01	0.30	0.20	0.10	0.10	<0.01	0.10	0.80	ND	0.30	ND	ND	ND	ND	0.33	ND	0.10
727.4	0.80	<0.01	0.30	0.10	0.10	0.20	<0.01	<0.01	0.10	<0.01	0.10	0.40	ND	0.10	ND	0.70	ND	0.10
732.1	0.14	ND	0.80	0.10	0.30	0.20	<0.01	0.10	<0.01	0.20	0.10	0.20	<0.01	0.10	<0.01	0.10	ND	<0.01
732.2	0.14	<0.01	0.10	<0.01	0.30	0.10	ND	0.10	0.10	0.20	<0.01	0.10	ND	0.10	ND	ND	ND	0.10
732.3	0.10	ND	0.50	0.10	0.30	<0.01	ND	0.30	0.20	0.10	<0.01	0.10	ND	0.10	<0.01	<0.01	ND	<0.01
733.1	1.06	<0.01	0.72	0.27	0.32	0.90	ND	0.40	0.12	0.12	0.11	0.70	ND	0.19	0.10	0.20	ND	0.30
734.1	0.92	<0.01	0.60	0.40	0.18	0.41	0.60	0.50	0.19	0.90	0.11	0.70	ND	0.30	ND	ND	ND	0.10
734.2	0.48	<0.01	0.31	0.10	0.80	0.13	0.20	0.10	0.30	0.40	0.60	0.60	ND	0.30	ND	0.60	ND	0.10
735.1	0.34	<0.01	0.21	0.10	0.50	0.28	0.60	0.30	0.10	0.20	0.60	0.20	ND	0.20	ND	<0.01	ND	0.10
735.2	0.17	<0.01	<0.01	0.10	0.20	0.16	0.11	0.10	0.50	0.50	0.80	0.30	ND	0.10	ND	0.10	0.10	<0.01
735.3	0.15	<0.01	0.50	0.40	0.40	0.50	ND	0.20	<0.01	0.10	0.30	0.40	ND	0.12	0.80	0.21	ND	0.10
736.1	0.34	<0.01	0.18	0.20	0.40	0.26	0.18	0.10	0.70	0.30	0.60	0.50	ND	0.20	ND	<0.01	ND	0.10
736.2	0.46	<0.01	0.36	0.10	0.10	0.80	ND	0.30	0.30	0.10	0.40	0.20	ND	0.90	0.30	0.15	ND	0.30
738.1	0.34	ND	0.20	0.20	0.60	0.70	0.20	0.10	0.30	0.30	0.30	0.60	<0.01	0.10	ND	<0.01	ND	0.10
738.2	0.38	ND	0.25	0.30	0.60	0.11	ND	0.40	0.30	0.30	0.30	0.30	<0.01	0.30	ND	0.10	ND	0.10
738.3	0.42	ND	0.27	0.40	0.50	0.13	0.50	0.50	0.60	0.40	0.30	0.20	ND	0.60	ND	<0.01	ND	0.10
738.4	0.36	ND	0.24	0.20	0.50	0.90	0.10	0.40	0.20	0.10	0.10	0.50	ND	0.40	ND	<0.01	ND	0.20
740.1	0.48	ND	0.31	0.10	0.11	0.19	0.20	0.20	0.30	0.50	0.20	0.80	ND	0.10	ND	<0.01	ND	0.20
740.2	0.20	ND	0.10	<0.01	<0.01	<0.01	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01
740.3	0.10	ND	<0.01	<0.01	<0.01	<0.01	ND	<0.01	<0.01	<0.01	<0.01	ND	ND	<0.01	ND	<0.01	<0.01	<0.01
742.1	0.21	<0.01	0.13	0.10	0.40	0.13	0.10	0.10	0.50	0.30	0.20	0.20	ND	0.10	ND	ND	ND	0.10
742.2	0.51	<0.01	0.35	0.20	0.10	0.90	ND	0.20	0.50	0.20	0.80	0.30	ND	0.40	ND	0.30	ND	0.20
742.3	0.46	<0.01	0.30	0.10	0.60	0.70	<0.01	0.10	0.50	0.20	0.60	0.70	ND	0.40	<0.01	0.10	ND	0.20
743.1	0.23	<0.01	0.14	0.20	0.60	0.10	0.20	0.20	0.50	0.40	0.10	0.40	ND	0.20	ND	<0.01	ND	<0.01
743.2	0.12	<0.01	0.50	0.30	0.10	0.40	0.30	0.10	0.10	<0.01	0.60	0.10	ND	0.30	ND	0.10	ND	ND
750.1	0.29	<0.01	0.17	0.10	0.80	0.11	0.20	0.10	0.20	0.40	0.30	0.50	ND	0.10	ND	ND	ND	<0.01
751.1	0.36	<0.01	0.23	0.20	0.40	0.14	0.11	0.10	0.20	0.40	0.40	0.40	ND	0.10	ND	0.20	ND	0.20
751.2	0.57	<0.01	0.39	0.30	0.70	0.10	0.20	0.20	0.11	0.50	0.60	0.40	ND	0.30	ND	0.12	ND	0.40

Appendix E

SAMPLE NUMBER	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%
753.1	0.80	<0.01	0.50	<0.01	0.30	0.30	0.10	0.10	0.30	0.10	0.10	0.10	ND	<0.01	ND	0.60	0.20	0.10
754.1	0.23	<0.01	0.13	0.20	0.30	0.50	0.20	0.20	0.40	0.10	0.30	0.40	ND	<0.01	<0.01	0.10	<0.01	0.10
754R.1	0.76	0.20	0.62	0.16	0.50	0.53	0.40	0.30	0.50	0.30	0.10	0.60	0.10	ND	ND	ND	ND	0.10
754R.2	0.40	0.10	0.32	0.60	0.20	0.20	0.19	0.30	0.20	0.20	0.10	0.20	<0.01	ND	ND	<0.01	ND	<0.01
754R.3	0.76	0.10	0.61	0.90	0.10	0.22	0.24	0.30	0.20	0.50	0.20	0.40	ND	ND	ND	ND	ND	<0.01
754R.4	0.55	0.30	0.42	0.40	0.20	0.13	0.15	0.30	0.20	0.40	0.30	0.30	<0.01	ND	ND	ND	ND	<0.01
755.1	0.40	ND	0.20	<0.01	0.10	0.10	<0.01	0.10	<0.01	<0.01	0.10	0.10	<0.01	ND	ND	ND	<0.01	<0.01
755.2	0.30	ND	0.10	<0.01	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.10	<0.01	<0.01	ND	<0.01	<0.01	<0.01
756.1	0.50	ND	0.20	ND	<0.01	0.40	<0.01	<0.01	<0.01	0.10	0.10	<0.01	<0.01	<0.01	ND	ND	<0.01	<0.01
756.2	<0.01	<0.01	<0.01	ND	<0.01	<0.01	ND	ND	<0.01	ND	ND	ND	ND	<0.01	ND	0.50	0.20	<0.01
757.1	0.19	<0.01	0.11	0.10	0.80	0.40	<0.01	0.10	0.60	0.20	0.30	0.20	ND	<0.01	ND	ND	ND	<0.01
761.1	0.24	<0.01	0.14	0.30	0.50	0.80	0.10	0.20	0.10	0.10	0.40	0.30	ND	<0.01	ND	<0.01	<0.01	<0.01
761.2	0.12	<0.01	0.60	0.10	0.30	0.50	0.10	0.10	0.20	0.10	0.30	0.10	ND	<0.01	<0.01	<0.01	ND	<0.01
764.1	0.38	<0.01	0.24	0.10	0.50	0.22	0.50	0.10	0.80	0.50	0.40	0.40	ND	0.20	ND	ND	ND	0.20
764.2	0.27	<0.01	0.16	0.10	0.50	0.12	<0.01	0.20	0.70	0.20	0.40	0.30	ND	<0.01	ND	ND	ND	0.20
764.3	0.11	<0.01	0.50	0.10	0.30	0.40	0.10	0.10	0.30	0.30	0.20	0.10	<0.01	ND	ND	ND	ND	<0.01
767.1	0.51	<0.01	0.27	0.10	0.70	0.24	0.70	0.50	0.12	0.90	0.80	0.40	ND	<0.01	ND	ND	ND	0.10
767.2	0.29	<0.01	0.16	0.10	0.40	0.12	0.40	0.20	0.50	0.40	0.30	0.40	ND	ND	ND	ND	ND	<0.01
767.3	0.10	ND	<0.01	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	<0.01	<0.01
768.1	0.47	<0.01	0.29	0.30	0.70	0.22	0.90	0.20	0.60	0.70	0.40	0.50	ND	<0.01	ND	ND	ND	0.20
768.2	0.55	<0.01	0.32	0.20	0.80	0.31	0.70	0.20	0.80	0.80	0.60	0.80	ND	0.10	ND	ND	ND	0.50
768.3	0.17	<0.01	0.90	0.10	0.20	0.70	0.10	0.10	0.10	0.30	0.20	0.30	<0.01	ND	ND	ND	ND	<0.01
768.4	0.13	<0.01	0.60	<0.01	0.20	0.50	<0.01	0.10	0.20	0.20	0.10	0.20	<0.01	ND	ND	<0.01	ND	0.10
769.1	0.54	<0.01	0.35	0.20	0.70	0.45	0.70	0.40	0.90	0.70	0.30	0.50	ND	0.40	ND	ND	ND	0.20
769.2	0.22	<0.01	0.14	0.50	0.10	0.70	0.20	0.20	0.10	0.20	0.10	0.10	ND	<0.01	ND	ND	ND	<0.01
769.3	0.12	<0.01	0.50	0.20	0.20	0.11	0.20	0.10	0.20	ND	0.60	<0.01	ND	ND	ND	0.20	ND	ND
769.4	0.10	<0.01	0.50	<0.01	<0.01	0.90	0.40	0.10	0.10	0.10	0.30	0.10	<0.01	ND	ND	<0.01	<0.01	0.10
770.1	0.80	<0.01	0.30	<0.01	0.30	0.50	<0.01	0.10	0.30	0.20	0.20	<0.01	<0.01	<0.01	ND	ND	ND	<0.01
770.2	0.60	<0.01	0.30	<0.01	0.20	0.30	<0.01	<0.01	0.10	0.10	0.10	<0.01	ND	<0.01	ND	ND	ND	<0.01
770.3	0.17	<0.01	0.10	0.10	0.20	0.10	0.20	0.10	0.20	0.30	0.20	0.20	ND	0.10	ND	ND	ND	0.10
771.1	0.62	ND	0.40	0.30	0.14	0.18	0.14	0.40	0.70	0.70	0.40	0.70	ND	0.70	ND	ND	ND	0.20
771.2	0.26	ND	0.15	0.10	0.50	0.50	0.40	0.30	0.40	0.30	0.20	0.30	ND	0.10	ND	ND	ND	<0.01
771.3	0.36	ND	0.21	0.20	0.70	0.60	0.40	0.40	0.50	0.40	0.20	0.50	ND	0.10	ND	ND	ND	0.40
771.4	0.21	<0.01	0.13	0.10	0.40	0.60	0.10	0.20	0.10	0.20	0.20	0.30	<0.01	<0.01	ND	ND	ND	0.10
772.1	0.47	<0.01	0.32	0.10	0.10	0.31	0.60	0.20	0.40	0.50	0.50	0.30	ND	0.40	ND	ND	ND	0.30
772.2	0.56	<0.01	0.35	0.10	0.10	0.24	0.70	0.30	0.11	0.60	0.60	0.60	ND	0.10	ND	ND	ND	0.30
772.3	0.56	<0.01	0.36	0.10	0.60	0.22	0.90	0.20	0.70	0.40	0.70	0.50	<0.01	0.10	ND	ND	ND	0.60
772.4	0.31	<0.01	0.21	0.10	0.50	0.15	<0.01	0.10	0.30	0.30	0.30	0.30	<0.01	<0.01	ND	<0.01	ND	0.10
773.1	0.24	ND	0.14	<0.01	0.40	0.70	0.10	0.30	0.40	0.20	0.20	0.40	ND	0.10	ND	ND	ND	0.20
773.2	0.16	ND	0.90	0.10	0.30	0.80	0.20	0.20	0.30	0.20	0.10	0.20	ND	0.10	ND	ND	<0.01	0.10
773.3	0.55	ND	0.29	0.20	0.14	0.13	0.90	0.90	0.80	0.70	0.40	0.60	ND	0.50	ND	ND	ND	0.10

Appendix E

SAMPLE NUMBER	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%
774.1	0.22	<0.01	0.11	0.10	0.40	0.17	0.60	0.20	0.30	0.30	0.40	0.20	<0.01	<0.01	ND	ND	ND	0.10
774.2	0.11	<0.01	0.60	0.10	0.50	0.60	<0.01	<0.01	0.30	0.10	0.20	0.20	<0.01	ND	ND	ND	ND	0.10
774.3	0.60	ND	0.20	<0.01	0.20	0.20	<0.01	<0.01	0.10	0.10	0.20	0.10	ND	0.10	ND	<0.01	<0.01	<0.01
775.1	0.39	<0.01	0.25	0.10	0.70	0.11	0.20	0.20	0.50	0.30	0.50	0.40	ND	ND	ND	ND	ND	0.20
775.2	0.24	<0.01	0.10	0.10	0.40	0.60	0.30	0.10	0.30	0.20	0.10	0.10	ND	ND	ND	ND	ND	ND
775.3	0.25	<0.01	0.16	0.10	0.50	0.50	0.10	0.20	0.30	0.10	0.20	0.40	ND	<0.01	ND	0.20	<0.01	0.20
776.1	0.53	<0.01	0.31	0.10	0.60	0.23	0.90	0.30	0.60	0.50	0.80	0.60	ND	0.10	ND	ND	ND	0.20
776.2	0.10	<0.01	0.30	0.10	0.20	0.40	0.20	<0.01	0.20	0.10	0.50	<0.01	ND	ND	ND	ND	ND	<0.01
776.3	0.20	<0.01	0.11	0.10	0.30	0.10	0.40	0.10	0.30	0.20	0.30	0.20	ND	ND	ND	<0.01	ND	0.10
777.1	0.18	ND	0.10	0.10	0.70	0.70	0.20	0.10	0.30	0.20	0.20	0.30	ND	0.10	ND	ND	ND	0.10
777.2	0.27	ND	0.16	0.20	0.80	0.11	<0.01	0.20	0.40	0.30	0.20	0.40	<0.01	0.10	ND	ND	ND	<0.01
777.3	0.20	ND	0.11	0.10	0.70	0.70	0.20	0.30	0.30	0.30	0.10	0.20	ND	0.10	ND	ND	ND	<0.01
777.4	0.22	ND	0.13	0.10	0.40	0.40	0.20	0.30	0.20	0.30	0.10	0.20	ND	0.10	ND	ND	ND	<0.01
779.1	0.19	ND	0.90	0.20	0.70	0.30	0.10	0.10	0.40	0.10	0.20	0.60	ND	0.10	ND	ND	ND	0.10
779.2	0.18	ND	0.12	0.20	0.60	0.30	<0.01	<0.01	0.20	0.10	0.10	0.30	ND	0.10	ND	ND	ND	<0.01
779.3	0.14	ND	0.80	0.10	0.50	0.30	0.10	0.20	0.20	0.10	0.10	0.20	ND	<0.01	ND	ND	ND	<0.01
780.1	0.36	<0.01	0.19	0.10	0.60	0.27	0.60	0.30	0.70	0.30	0.70	0.40	ND	0.10	ND	ND	ND	0.10
780.2	0.15	<0.01	0.80	<0.01	0.20	0.70	0.10	0.10	0.10	0.20	0.20	0.20	ND	<0.01	ND	ND	ND	<0.01
780.3	0.23	<0.01	0.15	0.10	0.40	0.90	0.20	0.10	0.30	0.20	0.30	0.30	ND	<0.01	<0.01	0.10	<0.01	<0.01
783.1	0.22	<0.01	0.90	0.30	0.40	0.17	0.90	0.40	0.30	0.30	0.20	0.50	ND	0.30	ND	0.10	ND	0.10
783.2	0.24	<0.01	0.11	0.10	0.30	0.19	0.11	0.30	0.50	0.30	0.20	0.50	ND	0.10	ND	0.10	<0.01	0.10
783.3	0.32	ND	0.17	0.50	0.80	0.16	0.60	0.30	0.50	0.30	0.30	0.60	<0.01	0.20	ND	0.10	<0.01	0.20
783.4	0.14	ND	0.70	0.20	0.30	0.60	0.40	0.20	0.10	0.20	0.10	0.20	ND	0.30	ND	0.10	<0.01	<0.01
785.1	0.18	<0.01	0.10	0.40	0.40	0.90	0.10	0.10	0.40	0.20	0.20	0.40	ND	ND	ND	<0.01	ND	<0.01
785.2	0.23	<0.01	0.16	0.10	0.50	0.10	0.20	<0.01	0.40	0.10	0.20	0.30	ND	<0.01	ND	<0.01	<0.01	0.10
785.3	0.60	<0.01	0.40	0.10	0.30	0.30	ND	<0.01	0.20	<0.01	0.10	0.10	ND	0.20	<0.01	0.10	0.10	<0.01
785.4	0.60	<0.01	0.30	<0.01	0.30	0.30	ND	<0.01	0.10	<0.01	0.10	0.10	ND	0.30	ND	<0.01	0.10	<0.01
787.1	0.15	<0.01	0.80	0.50	0.70	0.70	0.10	0.10	0.40	0.10	0.10	0.40	ND	0.20	<0.01	0.40	<0.01	0.10
787.2	0.69	<0.01	0.53	0.30	0.60	0.12	<0.01	0.20	0.40	0.40	0.20	0.80	ND	0.40	ND	0.80	ND	0.40
787.3	0.39	<0.01	0.26	0.20	0.70	0.14	<0.01	0.10	0.40	0.60	0.10	0.60	ND	0.30	ND	0.40	ND	0.30
787.4	0.11	<0.01	0.60	0.20	0.70	0.11	<0.01	<0.01	0.30	0.20	0.10	0.20	ND	0.10	ND	0.10	ND	0.10
792.1	0.30	ND	0.10	<0.01	0.10	<0.01	ND	<0.01	<0.01	<0.01	<0.01	0.10	ND	<0.01	ND	<0.01	<0.01	<0.01
792.2	<0.01	ND	<0.01	<0.01	<0.01	ND	ND	<0.01	<0.01	<0.01	<0.01	ND	ND	<0.01	ND	<0.01	<0.01	<0.01
792.3	<0.01	ND	<0.01	<0.01	<0.01	ND	ND	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	<0.01	<0.01
792.4	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	ND	<0.01	ND	<0.01	ND	0.10	0.10	<0.01
794.1	0.14	<0.01	0.80	0.10	0.50	0.40	<0.01	0.10	0.10	0.10	0.20	0.20	ND	0.10	ND	0.10	<0.01	0.10
794.2	0.11	<0.01	0.50	0.20	0.60	0.80	<0.01	0.10	0.40	0.10	0.20	0.20	ND	<0.01	ND	0.50	<0.01	0.20
794.3	0.90	<0.01	0.30	0.10	0.40	<0.01	ND	0.10	0.20	0.10	0.40	0.00	ND	0.20	ND	0.20	<0.01	ND
795.1	<0.01	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	ND	<0.01	<0.01	0.10	<0.01	ND
795.2	<0.01	ND	ND	ND	ND	<0.01	ND	ND	ND	ND	<0.01	ND	ND	<0.01	ND	0.10	<0.01	<0.01

Appendix E

SAMPLE NUMBER	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%
795.3	<0.01	ND	<0.01	ND	<0.01	<0.01	ND	ND	ND	ND	<0.01	ND	ND	ND	ND	0.10	0.10	<0.01
801.3	0.21	<0.01	0.12	0.20	0.40	0.12	0.60	0.10	0.30	0.20	0.30	0.30	ND	0.10	ND	0.20	<0.01	0.20
801.4	0.43	<0.01	0.26	0.40	0.60	0.24	0.80	0.20	0.90	0.20	0.70	0.70	ND	0.40	ND	0.30	<0.01	0.40
805.1	0.30	ND	0.20	<0.01	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.10	ND	ND	ND	<0.01	ND	<0.01
805.2	<0.01	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	<0.01	<0.01
805.3	0.10	ND	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	<0.01	<0.01
805.4	<0.01	ND	<0.01	<0.01	<0.01	<0.01	ND	ND	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	<0.01	<0.01
1140.1	0.27	ND	0.13	0.20	0.13	0.60	0.40	0.30	0.60	0.60	0.20	0.40	ND	0.40	ND	ND	ND	0.30
1140.2	0.23	ND	0.14	0.30	0.60	0.20	<0.01	0.30	0.20	0.20	0.10	0.30	ND	0.60	ND	ND	ND	0.10
1140.3	0.33	ND	0.18	0.20	0.80	0.30	ND	0.60	0.30	0.20	0.20	0.40	ND	0.50	ND	ND	ND	0.10
1143.2	0.23	<0.01	0.11	0.60	0.10	0.60	<0.01	0.20	0.40	0.10	0.30	0.60	ND	0.20	ND	ND	ND	<0.01
1144.1	0.40	<0.01	0.30	<0.01	0.30	0.30	ND	<0.01	0.10	<0.01	<0.01	0.10	ND	0.10	ND	<0.01	<0.01	<0.01
1144.2	0.50	<0.01	0.30	0.10	0.30	0.40	<0.01	<0.01	0.10	<0.01	<0.01	0.10	ND	0.10	ND	0.10	0.10	0.10
1145.1	0.17	<0.01	0.80	0.30	0.10	0.60	<0.01	0.10	0.50	0.20	0.30	0.30	<0.01	0.40	<0.01	0.12	ND	0.40
1145.2	0.50	<0.01	0.31	0.50	0.25	0.15	<0.01	0.30	0.70	0.50	0.70	0.50	ND	0.80	<0.01	0.10	ND	0.60
1146.1	0.40	ND	0.24	0.50	0.11	0.60	ND	0.50	0.40	0.40	0.20	0.50	ND	0.60	ND	ND	ND	0.20
1146.2	0.22	ND	0.12	0.30	0.80	0.60	ND	0.20	0.30	0.40	0.20	0.10	ND	0.60	<0.01	ND	ND	0.10
1146.3	0.40	ND	0.24	0.50	0.13	0.70	ND	0.30	0.40	0.50	0.20	0.50	ND	0.80	<0.01	ND	ND	<0.01
1146.4	0.44	ND	0.31	0.50	0.12	0.80	<0.01	0.30	0.40	0.40	0.20	0.40	ND	0.80	<0.01	ND	ND	<0.01
1147.1	0.39	<0.01	0.10	0.50	0.14	0.80	0.20	0.50	0.40	0.40	0.13	0.80	<0.01	0.20	ND	ND	ND	0.10
1147.2	0.12	<0.01	0.40	0.20	0.20	0.50	0.30	0.10	0.20	0.10	0.40	0.20	<0.01	<0.01	ND	<0.01	ND	0.10
1147R.1	0.19	<0.01	0.12	0.10	0.10	0.70	<0.01	0.10	0.40	0.10	0.30	0.20	<0.01	0.10	ND	0.20	<0.01	0.10
1147R.2	0.33	<0.01	0.22	0.40	0.16	0.12	<0.01	0.30	0.60	0.10	0.40	0.30	<0.01	0.40	ND	0.10	<0.01	0.20
1148.1	0.32	<0.01	0.24	0.10	0.80	0.16	<0.01	0.20	0.20	0.30	0.10	0.20	<0.01	0.50	ND	ND	ND	<0.01
1148.2	0.25	<0.01	0.18	0.10	0.70	0.17	<0.01	0.10	0.40	0.20	0.20	0.30	<0.01	0.20	<0.01	ND	0.10	0.20
1149.1	0.18	ND	0.12	0.10	0.50	0.40	ND	0.20	0.30	0.10	0.10	0.10	<0.01	0.10	ND	ND	ND	ND
1149.2	0.14	ND	0.90	0.10	0.50	0.20	ND	0.20	0.20	0.10	0.10	0.10	ND	0.40	<0.01	<0.01	ND	<0.01
1149.3	0.16	ND	0.11	0.10	0.30	0.20	ND	0.20	0.20	0.20	0.10	0.10	ND	0.60	<0.01	0.10	ND	<0.01
1149.4	0.12	ND	0.80	0.10	0.30	0.20	<0.01	0.10	0.20	0.10	0.10	0.10	ND	0.60	<0.01	ND	ND	<0.01
1150.1	0.48	<0.01	0.27	0.50	0.40	0.90	0.20	0.30	0.90	0.60	0.70	0.50	ND	0.10	ND	ND	ND	0.20
1150.2	0.40	<0.01	0.20	<0.01	0.20	0.10	ND	<0.01	0.20	<0.01	0.20	<0.01	ND	0.40	ND	0.20	0.30	<0.01
1150.3	0.40	<0.01	0.10	<0.01	0.50	0.10	<0.01	<0.01	0.10	ND	0.10	<0.01	ND	0.30	ND	0.10	<0.01	<0.01
1150.4	0.40	<0.01	0.10	<0.01	0.60	<0.01	<0.01	<0.01	0.20	<0.01	0.20	<0.01	ND	0.30	ND	0.10	ND	<0.01
1151.1	0.10	<0.01	<0.01	<0.01	<0.01	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	0.10	<0.01	<0.01
1151.2	0.10	<0.01	0.10	<0.01	0.10	0.10	<0.01	<0.01	<0.01	<0.01	0.10	ND	ND	0.10	ND	0.10	<0.01	<0.01
1151.3	0.40	<0.01	0.20	<0.01	<0.01	0.30	<0.01	<0.01	<0.01	<0.01	0.10	ND	ND	0.10	ND	0.10	<0.01	<0.01
1151.4	0.10	<0.01	<0.01	<0.01	0.10	0.10	ND	ND	0.10	<0.01	<0.01	ND	ND	0.10	ND	0.20	<0.01	<0.01
1152.1	0.34	<0.01	0.17	0.30	0.70	0.15	0.10	0.20	0.30	0.30	0.60	0.60	ND	0.10	ND	ND	<0.01	0.50
1152.2	0.60	<0.01	0.36	0.40	0.80	0.26	0.30	0.30	0.60	0.30	0.80	0.10	ND	0.30	0.10	ND	ND	0.70
1152.3	0.29	<0.01	0.18	0.20	0.30	0.15	0.10	0.10	0.30	0.20	0.40	0.40	ND	0.20	ND	ND	ND	0.40
1153.1	0.19	<0.01	0.12	0.10	0.50	0.40	<0.01	<0.01	0.20	0.10	0.20	0.40	ND	0.10	ND	ND	ND	<0.01

Appendix E

SAMPLE NUMBER	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%
1153.2	0.62	<0.01	0.42	0.10	0.13	0.18	<0.01	0.30	0.40	0.60	0.50	0.60	ND	0.30	ND	0.20	ND	0.30
1153.3	0.55	<0.01	0.41	<0.01	0.90	0.18	<0.01	0.10	0.40	0.60	0.40	0.30	ND	0.50	ND	0.20	ND	0.20
1153.4	0.44	<0.01	0.33	0.10	0.90	0.21	0.10	0.10	0.30	0.50	0.30	0.30	ND	0.30	ND	0.10	ND	0.10
1154.1	0.20	ND	0.13	0.10	0.60	0.70	0.10	0.10	0.30	0.20	0.10	0.20	ND	0.10	ND	ND	ND	<0.01
1154.2	0.25	ND	0.16	0.20	0.30	0.80	0.20	0.20	0.20	0.30	0.10	0.30	ND	0.10	ND	<0.01	ND	<0.01
1154.3	1.11	ND	0.75	0.80	0.42	0.43	0.50	0.80	0.14	0.12	0.50	0.11	ND	0.17	ND	0.50	ND	<0.01
1154.4	0.60	ND	0.39	0.40	0.20	0.30	0.70	0.60	0.60	0.60	0.40	0.50	ND	0.80	ND	0.60	ND	<0.01
1155.1	0.21	<0.01	0.13	0.30	0.40	0.50	0.10	0.20	0.20	0.20	0.30	0.10	ND	0.10	<0.01	0.10	<0.01	0.10
1155.2	0.27	<0.01	0.21	0.40	0.90	0.50	ND	0.20	0.20	0.20	0.10	0.20	ND	0.20	ND	0.10	ND	0.10
1158.1	0.50	<0.01	0.30	0.10	0.30	0.20	<0.01	<0.01	0.10	<0.01	0.10	<0.01	ND	0.10	ND	<0.01	<0.01	<0.01
1158.2	0.30	<0.01	0.20	<0.01	0.10	0.10	ND	<0.01	0.10	ND	0.10	<0.01	ND	0.10	ND	0.10	<0.01	<0.01
1158.3	0.30	<0.01	<0.01	0.10	0.10	0.10	<0.01	<0.01	0.10	<0.01	0.20	0.10	ND	0.20	<0.01	0.60	0.30	ND
1159.1	1.70	ND	1.17	0.18	0.58	0.74	0.70	0.11	0.16	0.20	0.80	0.13	ND	0.18	<0.01	0.70	0.10	<0.01
1159.2	0.80	ND	0.66	0.60	0.24	0.23	0.40	0.60	0.40	0.40	0.30	0.10	ND	0.50	ND	0.20	ND	0.20
1159.3	0.81	ND	0.66	0.60	0.20	0.24	ND	0.10	0.90	0.50	0.50	0.40	ND	0.90	ND	0.10	ND	<0.01
1159.4	0.43	ND	0.29	<0.01	0.12	0.19	0.20	0.20	0.50	0.50	0.30	0.30	ND	0.40	ND	0.10	ND	<0.01
1160.1	0.43	<0.01	0.24	0.30	0.13	0.14	0.20	0.30	0.40	0.40	0.50	0.80	ND	0.10	ND	ND	ND	0.30
1160.2	0.35	<0.01	0.19	0.20	0.10	0.10	ND	0.20	0.40	0.20	0.50	0.70	ND	0.20	0.10	0.14	<0.01	0.40
1161.1	0.24	<0.01	0.11	0.20	0.12	0.10	<0.01	0.30	0.90	0.20	0.20	0.60	ND	0.50	ND	ND	ND	0.10
1161.2	0.34	<0.01	0.19	0.30	0.19	0.80	0.10	0.30	0.50	0.20	0.40	0.70	ND	0.10	ND	<0.01	ND	0.20
1161.3	0.27	<0.01	0.16	0.20	0.14	0.50	<0.01	0.20	0.30	0.10	0.20	0.50	ND	0.10	ND	ND	ND	0.10
1163.3	0.37	<0.01	0.25	0.20	0.25	0.15	<0.01	0.20	0.40	0.50	0.20	0.30	ND	0.50	ND	ND	ND	0.10
1163.4	0.38	<0.01	0.24	0.30	0.23	0.15	<0.01	0.10	0.70	0.50	0.40	0.50	ND	0.70	ND	ND	ND	0.20
2001R.1	0.41	ND	0.14	0.90	0.90	0.20	0.15	0.20	0.50	0.70	0.50	0.11	ND	0.60	ND	0.50	0.20	<0.01
2001R.2	0.10	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	<0.01	<0.01	ND
2001R.3	<0.01	ND	<0.01	<0.01	0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	ND	0.10	0.10	<0.01
2001R.4	<0.01	ND	<0.01	<0.01	<0.01	<0.01	ND	ND	<0.01	<0.01	<0.01	ND	ND	<0.01	ND	<0.01	<0.01	<0.01
2002.1	0.16	ND	0.12	0.20	0.80	0.50	ND	0.10	0.30	0.20	0.10	0.10	ND	0.40	ND	ND	ND	<0.01
2002.2	0.19	ND	0.12	0.30	0.90	0.40	ND	0.10	0.30	0.30	0.10	0.20	ND	0.30	ND	0.10	ND	<0.01
2002.3	0.18	ND	0.11	0.30	0.70	0.60	ND	0.10	0.30	0.20	0.10	0.20	ND	0.30	ND	0.10	ND	<0.01
2002.4	0.23	ND	0.15	0.20	0.80	0.70	ND	0.20	0.40	0.20	0.10	0.30	ND	0.20	ND	ND	ND	<0.01
COUNT (n):	193	124	189	185	190	191	154	187	190	184	191	182	34	168	28	113	65	185
AVERAGE:	0.26	<0.01	0.17	0.20	0.60	0.10	0.30	0.20	0.30	0.30	0.30	0.30	<0.01	0.20	0.10	0.20	0.10	0.10
MAXIMUM:	1.70	0.30	1.17	0.27	0.58	0.74	0.40	0.11	0.19	0.20	0.13	0.13	0.10	0.19	0.80	0.33	0.30	0.70
MINIMUM:	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
STAN. DEV.:	0.24	<0.01	0.17	0.30	0.70	0.10	0.50	0.20	0.30	0.30	0.20	0.20	<0.01	0.30	0.10	0.40	0.10	0.10

The Geological Survey Section examines, surveys, and maps the geology, mineral resources, and topography of the state to encourage the wise conservation and use of these resources by industry, commerce, agriculture, and government agencies for the general welfare of the citizens of North Carolina.

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