

United States Department of the Interior
Geological Survey

X-ray mineralogy of cores from the North Atlantic
and Mid-Atlantic Slope and Rise

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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During August-September 1979 and September-October 1980, aboard the R/V ENDEAVOR cruises 042 and 056, the U.S. Geological Survey collected 135 cores from the U.S. North Atlantic and Mid-Atlantic Continental Slope and Rise (Fig. 1). The cores were used to determine the sedimentological, geotechnical, and geochemical properties of selected bottom features. These data were then used in environmental and geohazard analyses of the Georges Bank and Baltimore Canyon Outer Continental Shelf lease sale areas. Thirty of the 135 cores were analyzed by X-ray diffraction to determine their mineralogy and the results are reported herein (Tables 1 and 2). The cores analyzed for mineralogy were selected on the basis of their length, location, lithology, and to provide data necessary to the determination of the above properties.

The piston cores were collected with an Alpine Geophysical corer fitted with a 1364-kg core head and as much as 12.19 m of steel barrels per core. Plastic liners having internal diameters of 89-mm were used with these barrels. A few gravity cores (1.5-m length; 114-mm internal diameter) were also taken to sample undisturbed surficial sediment.

Northstar 6000, which utilized an updated (1979) card, and Micrologic Loran C units were used for navigation. Core sites were selected and target feature morphology was confirmed by seismic profile data obtained on-site by a tuned (3.5-kHz) transducer.

The cores were split, described, and sampled on board the R/V ENDEAVOR, and the samples were refrigerated at 4°C. In the laboratory, a split from each sample was mounted and X-rayed as a randomly oriented powder. The randomly oriented mounts were X-rayed between the angles of 2° and 70° two-theta, on a Philips X-ray diffractometer fitted with a curved crystal monochromator. This study used CuK α radiation, a scanning rate of 2°/minute, and a chart scale of 1000 counts per second full scale.

The clay fraction from each sample was separated by centrifuge and mounted as an oriented aggregate on a silver filter. Each oriented clay sample was subjected to four treatments to determine which clay minerals were present: air drying, glycolation with ethylene glycol, heating to 400°C, and heating to 550°C. After each treatment, the samples were X-rayed between the angles of 2° and 40° two theta.

The data from the randomly oriented and oriented aggregate mounts were combined and semiquantitative estimates of the minerals present (Tables 3, 4, 5, and 6) were made by comparing the sample diffraction peak intensities with the intensities recorded from a collection of standards. Relative percentages of the clay minerals were estimated by a method described by Biscaye (1965). These semiquantitative estimates are generally considered to be accurate to within 10 percent of their actual values; however, the smaller values may vary considerably more than this.

A split was taken from each sample and mounted in Caedex (N=1.56) as a smear slide. These slides were used to check the semiquantitative diffraction techniques, to detect amorphous minerals or those present in trace amounts, and to examine the biological debris.

Values reported as T for any given mineral in Tables 3, 4, 5, and 6 indicate that a trace amount of that mineral was detected. A blank indicates that the mineral was not detected. Values generated by X-ray diffraction are in relative percentages of the crystalline material.

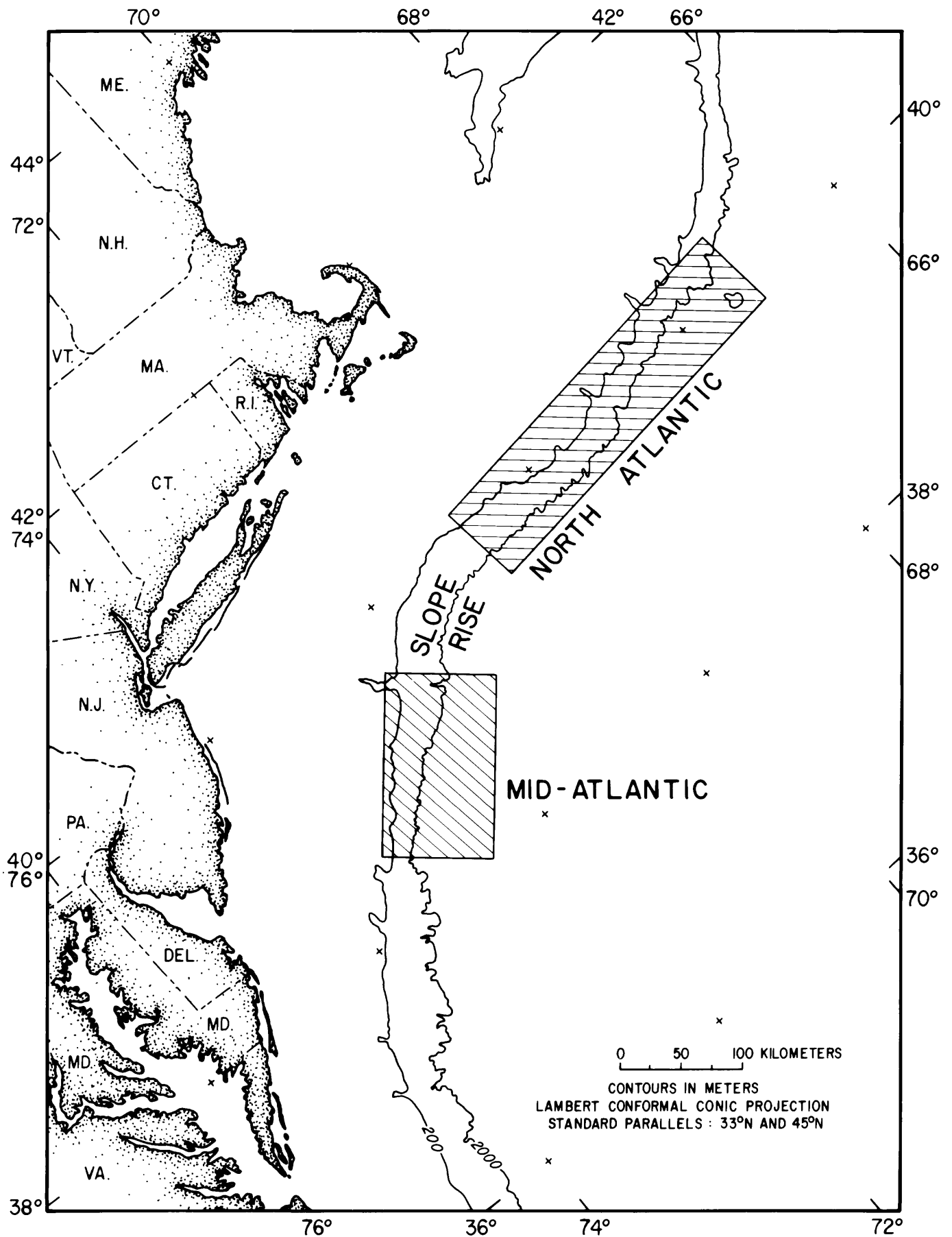


Figure 1.--Location map. Ruled sections show areas of the United States from which cores were collected.

SITE NO.	CORE TYPE	AREA	LATITUDE N.	LONGITUDE W.	WATER DEPTH (M)	CORE RECOVERED (M)	DATE

PC01	P	N	39 54.12'	70 27.52'	697	5.20	8/29/79
PC02	P	N	39 56.47'	70 23.40'	534	3.13	8/29/79
PC08	P	M	39 07.21'	72 24.82'	1,180	5.88	9/02/79
PC13	P	M	39 03.22'	72 40.83'	556	5.32	9/04/79
PC39	P	M	38 57.94'	72 49.40'	246	5.72	9/13/79
PC40	P	M	38 50.26'	72 47.53'	1,113	7.08	9/14/79
PC41	P	M	38 50.93'	72 48.08'	1,123	4.54	9/14/79
PC43	P	M	38 51.37'	72 52.18'	622	9.42	9/14/79
PC44	P	M	38 48.11'	72 55.42'	575	4.50	9/15/79
PC45	P	M	38 49.52'	72 54.03'	688	6.97	9/16/79
PC50	P	M	38 53.25'	72 46.07'	1,105	CC	9/17/79
PC53	P	M	38 52.32'	72 46.00'	1,035	10.06	9/17/79
PC54	P	M	38 54.13'	72 40.75'	1,145	8.54	9/17/79

Table 1. Sample site information for the R/V ENDEAVOR 042 cores which have been analyzed for mineralogy. CORE TYPE: P= piston core, G= gravity core. AREA: N= North Atlantic, M= Mid-Atlantic.

SITE NO.	CORE TYPE	AREA	LATITUDE N.	LONGITUDE W.	WATER DEPTH (M)	CORE RECOVERED (M)	DATE

056-5	P	N	40 10.47'	67 19.34'	2,190	7.92	9/29/80
056-7	P	N	40 10.08'	67 18.57'	2,235	3.90	9/28/80
056-9	P	N	40 04.39'	68 32.50'	800	4.29	9/30/80
056-11	P	N	39 44.35'	68 56.26'	2,225	7.57	9/30/80
056-13	P	M	38 58.32'	72 45.98'	710	2.77	10/03/80
056-14	P	M	38 58.39'	72 44.34'	685	6.03	10/04/80
056-15	P	M	38 57.35'	72 43.71'	950	6.30	10/04/80
056-16	P	M	38 56.95'	72 42.61'	1,045	6.06	10/04/80
056-17	P	M	38 56.43'	72 43.15'	1,195	2.72	10/04/80
056-18	P	M	38 51.35'	72 39.54'	1,600	5.84	10/05/80
056-19	P	M	38 52.09'	72 38.45'	1,475	7.25	10/05/80
056-20	P	M	38 52.49'	72 37.90'	1,500	5.62	10/05/80
056-21	P	M	38 52.76'	72 37.49	1,665	1.55	10/05/80
056-22	G	M	38 49.50'	72 35.78'	2,010	0.20	10/06/80
056-23	P	M	38 37.41'	72 21.53'	2,688	CC	10/07/80
056-24	P	M	38 28.99'	72 19.16'	2,815	2.19	10/08/80
056-25	P	M	38 35.41'	72 26.04'	2,655	2.19	10/08/80

Table 2. Sample site information for the R/V ENDEAVOR 056 cores which have been analyzed for mineralogy. CORE TYPE: P= piston core, G= gravity core. AREA: N= North Atlantic, M= Mid-Atlantic.

CORE	SEC	DS	C-S	SMC	CHL	I-S	VER	I/M	KAO	GLA	QTZ	FLD	CAL	D/A	PYR	SID	HEM	AMP	HAL	DC	APA
PC-1	1	64	T	2	15	3	T	30	7	T	29	12	T		T	T			T		
PC-2	2	59	T	1	14	2		29	5	2	26	19	T		T	T			T		
PC-2	2	97	T	2	14	3		29	6	2	26	16	T			T			T		
PC-2	3	209		3	12	1		32	7	1	27	14	T			T		1	T		T
PC-8	1	31	T	2	12	3		32	4	T	24	12	9	1	T				T		
PC-8	2	151	T	2	15	2		33	5	T	22	16	2		T	T		1	T		
PC-8	2	176	T	2	13	2		35	4	T	21	14	3	3	1	T		1	T		
PC-8	2	236		3	14	2		37	7	T	21	12	1		T	T		1	T		T
PC-8	3	360			11	T		39	4	T	26	15	1	1	T	T		T	T		
PC-8	3	411	2		12	2		36	3	T	17	11	12	4	T	T		1	T		
PC-8	4	511		2	12	2		32	11	T	23	15	1		T	T		T	T		
PC-8	4	546	T	T	8	2		20	2	5	23	9	28	T	1				T		T
PC-13	1	6	T	T	5	T		16	1	T	43	15	13	3				T	T		
PC-13	1	61	T	1	10	3		34	4	T	25	12	3	4	T			2	T		
PC-13	2	161		1	11	2		33	2	T	20	17	3	8	1				T		
PC-13	3	262	T	1	14	1		37	5	T	24	14	2	T	T	T		T	T		T
PC-13	3	362		2	17	3		34	6	T	23	12	T	2		T		T	T		
PC-13	4	459	T	3	12	2		38	6	T	21	15	T	T	T				T		
PC-39	4	564		T	8	T		16	T	T	55	14	1	3	3			1	T		
PC-40	1	64	1	2	16	3		32	4	T	16	10	10	4	T	T		T	T		
PC-40	2	124	T	1	13	3		31	3	T	21	19	3	2	T	T		1	T		T
PC-40	2	224		1	13	2		34	3	T	22	18	1	4	T	T			T		
PC-40	3	381	T	2	12	2		30	3	2	25	16	3	3	T			T	T		T
PC-40	4	472		1	8	1		19	1	5	40	18	2	3	T	T		1	T		
PC-40	5	577	T	1	14	3		36	3	2	19	10	3	8	T	T		T	T		

Table 3. Samples from R/V ENDEAVOR cruise 042. Estimated mineral modes from X-ray powder diffraction and smear slide observation in relative percent. CORE: core identification number; SEC: section; DS: depth of sample in core; C-S: mixed layer chlorite-smectite; SMC: smectites; CHL: chlorite; I-S: mixed layer illite-smectite; VER: vermiculite; I/M: illite/mica; KAO: kaolinite; GLA: glauconite; QTZ: quartz; FLD: feldspar; CAL: calcite; D/A: dolomite/ankerite; PYR: pyrite; SID: siderite; HEM: hematite; AMP: amphiboles; HAL: halite; DC: disordered cristobalite; APA: apatite.

CORE	SEC	DS	C-S	SMC	CHL	I-S	VER	I/M	KAO	GLA	QTZ	FLD	CAL	D/A	PYR	SID	HEM	AMP	HAL	DC	APA
PC-41	1	31	1	3	12	3		28	3	1	21	11	14	2	T				T		T
PC-41	1	64		1	12	3		37	4	1	24	12	1	4	T	T			T		
PC-41	2	248	T	3	8	4		35	3	1	22	11	10	1	T	T		T			
PC-43	2	59	1	2	13	3		33	3		27	11	3	3	T				T		T
PC-43	4	412	1	1	13	2		38	3	T	21	14	2	3	T	T		T			
PC-43	5	562	T	T	14	1		38	3	T	21	13	3	4	T	T		T			T
PC-43	6	712	T	1	12	2		35	2	T	22	15	3	4	T	T		1			T
PC-43	7	862	1	T	12	T		32	2	T	24	18	3	5	T			1			
PC-44	1	2	T	1	8	1		19	3	T	32	18	14	2	T			T			
PC-44	1	61	T	T	10	2		36	5	T	20	18	2	3	T	T		1			T
PC-44	2	226	T	1	11	2		29	5	T	26	16	2	6	T	T		T			T
PC-44	3	371	T	T	9	3		33	4	T	28	17	2	3							
PC-45	1	11	T	T	6	1		21	3	T	29	16	17	3	T						
PC-45	2	201			11	3		32	3	T	26	13	3	7	T	T					T
PC-50	CC	4	T	2	13	2		35	6	T	21	12	2	3	T	T		2			
PC-50	CC	11	T		11	3		35	3	T	20	11	7	8	T	T		T			
PC-53	1	79	T		13	4		36	3	T	18	17	3	3	1			1			
PC-53	2	230	T	1	13	1		37	3	T	15	10	10	7	T		T				
PC-53	3	371	T	2	13	2		35	4	T	20	13	9	T	T						
PC-53	4	521	1	T	13	1		36	3	T	22	14	3	4	T			1			
PC-53	5	671	T	T	11	2		37	3	T	22	13	5	4	T	T		1			
PC-53	6	793	T	1	10	2		33	3	2	26	13	3	8	T	T		T			
PC-53	7	921	T	T	11	2		38	3	T	24	14	3	3	T						
PC-54	1	41		3	14	2		40	5		17	11	3	3	T			1			
PC-54	2	171		T	12	1		40	4		18	10	8	5				1			

Table 4. Samples from R/V ENDEAVOR cruise 042. Estimated mineral modes from X-ray powder diffraction and smear slide observation in relative percent. CORE: core identification number; SEC: section; DS: depth of sample in core; C-S: mixed layer chlorite-smectite; SMC: smectites; CHL: chlorite; I-S: mixed layer illite-smectite; VER: vermiculite; I/M: illite/mica; KAO: kaolinite; GLA: glauconite; QTZ: quartz; FLD: feldspar; CAL: calcite; D/A: dolomite/ankerite; PYR: pyrite; SID: siderite; HEM: hematite; AMP: amphiboles; HAL: halite; DC: disordered cristobalite; APA: apatite.

CORE	SEC	DS	C-S	SMC	CHL	I-S	VER	I/M	KAO	GLA	QTZ	FLD	CAL	D/A	PYR	SID	HEM	AMP	HAL	DC	APA
5	1	26		1	11	2		25	2	1	24	11	20	T	T	T		T			
5	2	75		T	13	2		28	4	1	26	14	8	T		T	2		T		
5	2	140	T	1	13	3		32	3	1	26	16	3		T	T			T		
5	3	244		T	2	T		4	T	1	69	18	1	T	T	T		1	T		
5	4	400	T	2	15	2		32	3	1	29	13	1		T	T			T		
5	5	545	T	1	11	2	T	23	3	1	44	11	2	T	T	T			T		
5	6	705		1	13	7	T	28	2	1	31	12	4		T	T			T		
7	1	10			7	4	T	15	1	1	30	12	29						T		
7	1	50		1	11	5		23	1		33	14	9	T	T	T		T	T		
7	2	108	T		12	5		27	2	T	26	13	10	T	T	T	2	T	T		T
7	3	305	T	T	13	5		23	4	1	33	15	3		T	T		T	T		T
9	1	20	T	T	5	2		8	T	2	54	17	8	T	T	T			T		
9	1	35	T		6	3		14	T	1	44	15	10	3		T	1	T	T		
9	2	200	T	1	10	5		25	2	2	38	14	1		T			1	T		T
9	3	300		2	15	6		28	3	1	29	13	1		T	T			T		
11	1	20		1	8	5		20	2	1	16	9	36		T	T		T	T		
13	1	80		T	6	1		16	2	T	20	9	44	T	1				T		
14	1	50	T		9	2		37	3	T	25	13	6	4	T	T		T	T		
14	4	599		T	9	1		29	3	T	28	16	8	5	1	T		T	T		
15	2	35		T	11	1		29	3	T	23	13	18	1	T			T	T		
15	5	506		T	10	2		34	2	T	24	19	3	3	T	T		T	T		
16	1	31		T	10	2		26	2	T	24	10	22	2	T	T		T	T		
16	2	195	T	T	10	T	T	28	2	T	21	13	10	8	T	T			T		T
17	1	100		T	10	3		25	2	T	25	13	18	1	1	T		T	T		
18	1	21		T	8	3		26	3	T	21	10	27	T	T	T			T		

Table 5. Samples from R/V ENDEAVOR cruise 056. Estimated mineral modes from X-ray powder diffraction and smear slide observation in relative percent. CORE: core identification number; SEC: section; DS: depth of sample in core; C-S: mixed layer chlorite-smectite; SMC: smectites; CHL: chlorite; I-S: mixed layer illite-smectite; VER: vermiculite; I/M: illite/mica; KAO: kaolinite; GLA: glauconite; QTZ: quartz; FLD: feldspar; CAL: calcite; D/A: dolomite/ankerite; PYR: pyrite; SID: siderite; HEM: hematite; AMP: amphiboles; HAL: halite; DC: disordered cristobalite; APA: apatite.

CORE	SEC	DS	C-S	SMC	CHL	I-S	VER	I/M	KAO	GLA	QTZ	FLD	CAL	D/A	PYR	SID	HEM	AMP	HAL	DC	APA
18	4	561		T	14	3		36	5	T	23	15	2		T	T		T			
19	1	9	T	T	9	2		26	2	T	23	9	25	T	T	T		T			
19	4	558			8	2		20	2	T	44	15	3	3	T			T			
19	5	706	T	1	12	3		35	4	T	24	18	T	T	T	T		T			
20	1	15	T	T	9	2		26	3	T	17	9	31	T	T	T		T			
20	4	485		T	13	3		35	2	T	20	14	10	T	T			1			
21	1	101		30	2	1		4	2		2	T	58								
22	CC			43	T	T		5	3	T	1	T	46								
23	CC			25	T	T		4	T		T		56								10
24	CC		T	T	11	2	T	29	3	T	17	21	11	2	1			1			
25	2	34	T	2	9	3		18	2	T	17	9	38	T	T						
25	3	216			6	2		18	1	T	46	18	3	3	T	T		1			
28	CC																				

BLUE CRYSTALS WERE HAND PICKED FROM THIS SAMPLE AND X-RAYED. THEY WERE FOUND TO BE VIVIANITE.

Table 6. Samples from R/V ENDEAVOR cruise 056. Estimated mineral modes from X-ray powder diffraction and smear slide observation in relative percent. CORE: core identification number; SEC: section; DS: depth of sample in core; C-S: mixed layer chlorite-smectite; SMC: smectites; CHL: chlorite; I-S: mixed layer illite-smectite; VER: vermiculite; I/M: illite/mica; KAO: kaolinite; GLA: glauconite; QTZ: quartz; FLD: feldspar; CAL: calcite; D/A: dolomite/ankerite; PYR: pyrite; SID: siderite; HEM: hematite; AMP: amphiboles; HAL: halite; DC: disordered cristobalite; APA: apatite.

The cores, detailed core descriptions, X-ray diffraction patterns, and smear slides may be examined at the U.S. Geological Survey offices in Woods Hole, MA 02543.

References Cited

Biscaye, P.E., 1965, Mineralogy and sedimentation of recent deep-sea clay in the Atlantic Ocean and adjacent seas and oceans, Geological Society of America Bulletin, v. 76, no. 7, p. 803-832.