ACCESSION NUMBER 8600070

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DATA DOCUMENTATION FORM

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F144

NOAA FORM 24-13
(4-77)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEANOGRAPHIC DATA CENTER
RECORDS SECTION
WASHINGTON, DC 20235

FORM APPROVED
O.M.B. No. 41-R2651
EXPIRES 1–81

(While you are not required to use this form, it is the most desirable mechanism for providing the required ancillary information enabling the NODC and users to obtain the greatest benefit from your data.)

This form should accompany all data submissions to NODC. Section A, Originator Identification, must be completed when the data are submitted. It is highly desirable for NODC to also receive the remaining pertinent information at that time. This may be most easily accomplished by attaching reports, publications, or manuscripts which are readily available describing data collection, analysis, and format specifics. Readable, handwritten submissions are acceptable in all cases. All data shipments should be sent to the above address.

A. ORIGINATOR IDENTIFICATION

THIS SECTION MUST BE COMPLETED BY DONOR FOR ALL DATA TRANSMITTALS

1. NAME AND ADDRESS OF INSTITUTION, LABORATORY, OR ACTIVITY WITH WHICH SUBMITTED DATA ARE ASSOCIATED

U.S. Dept. of Interior
Geological Survey
Atlantic & Gulf Coast Branch
Woods Hole, MA

2. EXPEDITION, PROJECT, OR PROGRAM DURING WHICH DATA WERE COLLECTED

OCS/ Georges Bank Monitoring Program

3. CRUISE NUMBER(S) USED BY ORIGINATOR TO IDENTIFY DATA IN THIS SHIPMENT

M01 - M12, OC122, OC130, OC140 and G83-9

4. PLATFORM NAME(S)

See Attached List

5. PLATFORM TYPE(S) *(E.G., SHIP, BUOY, ETC.)*

Ships &Moored Sediment Traps

6. PLATFORM AND OPERATOR NATIONALITY(IES)

PLATFORM	OPERATOR
see	attached

7. DATES

FROM: MO/DAY/YR	TO: MO/DAY/YR
list	

8. ARE DATA PROPRIETARY?

[X] NO [ ] YES

IF YES, WHEN CAN THEY BE RELEASED FOR GENERAL USE? YEAR ____ MONTH ____

9. ARE DATA DECLARED NATIONAL PROGRAM (DNP)? (I.E., SHOULD THEY BE INCLUDED IN WORLD DATA CENTERS HOLDINGS FOR INTERNATIONAL EXCHANGE?)

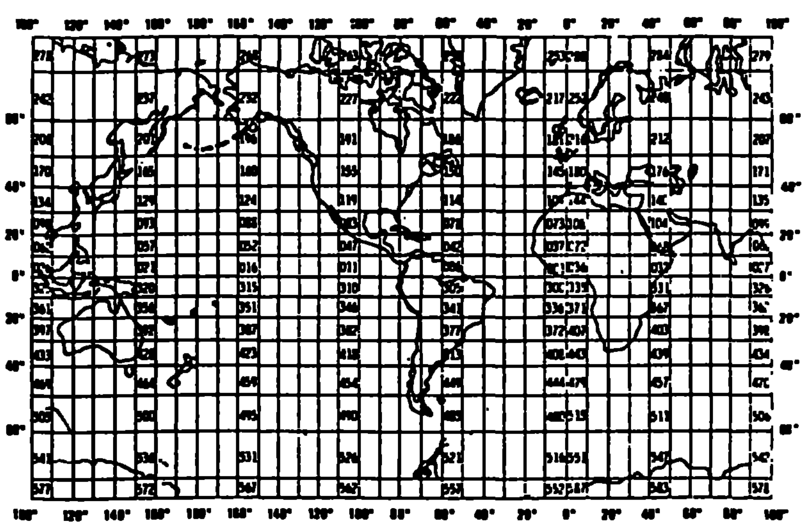
[X] NO [ ] YES [ ] PART *(SPECIFY BELOW)*

10. PERSON TO WHOM INQUIRIES CONCERNING DATA SHOULD BE ADDRESSED WITH TELEPHONE NUMBER *(AND ADDRESS IF OTHER THAN IN ITEM-1)*

Dr. Mike Bothner
Phone 617 548 8700

11. PLEASE DARKEN ALL MARSDEN SQUARES IN WHICH ANY DATA CONTAINED IN YOUR SUBMISSION WERE COLLECTED.

GENERAL AREA



B. SCIENTIFIC CONTENT

NAME OF DATA FIELD	REPORTING UNITS OR CODE	METHODS OF OBSERVATION AND INSTRUMENTS USED (SPECIFY TYPE AND MODEL)	ANALYTICAL METHODS (INCLUDING MODIFICATIONS) AND LABORATORY PROCEDURES	DATA PROCESSING TECHNIQUES WITH FILTERING AND AVERAGING
Aluminum Barium Cadmium Chromium Copper Iron Lead Manganese Mercury Nickel Vanadium Zinc Chloride Organic carbon	percent ppm ppm ppm ppm percent ppm ppm ppm ppm ppm ppm percent percent	Chemical analysis of grab, core, and sediment trap samples	See attached description extracted from Bothner, M. H., et al., 1985, The Georges Bank Monitoring Program: Analysis of Trace Metals in Bottom Sediments during the Third Year of Monitoring: Final Report submitted to Minerals Management Service under Interagency Agreement 14-12-0001-30153 Data generated in years 1 and 2 of this program are presented in Final Reports for each year by Bothner, et al., 1982, 1983 under Interagency Agreements AA851-IA2-18, 14-12-0001-30025.	

C. DATA FORMAT

COMPLETE THIS SECTION FOR PUNCHED CARDS OR TAPE, MAGNETIC TAPE, OR DISC SUBMISSIONS.

1. LIST RECORD TYPES CONTAINED IN THE TRANSMITTAL OF YOUR FILE
   GIVE METHOD OF IDENTIFYING EACH RECORD TYPE

This data set consists of only one record type. Sampling identification and analysis is recorded to this one record.

Files 1,2,&3 are identical in format except file 3 is missing the last field and is 158 bytes in length instead of 165 bytes

2. GIVE BRIEF DESCRIPTION OF FILE ORGANIZATION

This data set has been arranged into three separate files.

file #1 is a file of miscellaneous samples that cannot be logically grouped
file #2 is a file of standard analysis
file #3 is a file of fine fraction analysis

All files have been sorted into cruise/sediment trap/core order

3. ATTRIBUTES AS EXPRESSED IN ☐ PL-1 ☐ ALGOL ☐ COBOL XX FORTRAN ☐ ______ LANGUAGE

4. RESPONSIBLE COMPUTER SPECIALIST:
   NAME AND PHONE NUMBER ______
   ADDRESS ______

COMPLETE THIS SECTION IF DATA ARE ON MAGNETIC TAPE

5. RECORDING MODE: ☐ BCD ☐ BINARY XX ASCII ☐ EBCDIC ☐ ______

6. NUMBER OF TRACKS (CHANNELS): ☐ SEVEN XX NINE ☐ ______

7. PARITY: XX ODD ☐ EVEN

8. DENSITY: ☐ 200 BPI XX 1600 BPI ☐ 556 BPI ☐ 800 BPI ☐ ______

9. LENGTH OF INTER-RECORD GAP (IF KNOWN): ☐ 3/4 INCH ☐ ______

10. END OF FILE MARK: ☐ OCTAL 17 ☐ ______

11. PASTE-ON-PAPER LABEL DESCRIPTION *(INCLUDE ORIGINATOR NAME AND SOME LAY SPECIFICATIONS OF DATA TYPE, VOLUME NUMBER)*

U.S. Geological Survey Trace Metal Concentrations in Sediments - Georges Bank Monitoring Program

12. PHYSICAL BLOCK LENGTH IN BYTES

unblocked

13. LENGTH OF BYTES IN BITS

RECORD FORMAT DESCRIPTION

RECORD NAME ______

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN ___ (e.g. bits, bytes)	16. LENGTH NUMBER	16. LENGTH UNITS	17. ATTRIBUTES	18. USE AND MEANING
Blank	1	1			
field sample #	2	14		A14	Consists of cruise, sample, replicate identification
station #	16	4		A4	
laboratory #	20	8		A8	
year	28	4		I4	
month	32	2		I2	
day	34	2		I2	
latitude	36	9		F9.6	Reported in degrees to 5 places always north latitude
longitude	45	10		F10.6	Reported in degrees to 5 places minus indicates west longitude
top depth	55	2		I2	Upper depth of sediment analyzed reported in centimeters
bottom depth	57	2		I2	Lower depth of sediment analyzed reported in centimeters
water depth	59	5		F5.0	Reported in meters
gear code	64	7		A7	CODES = 0.10vv=.1 m sq. van veen grab HDC =hydraulically damped gravity corer ST =sediment trap BC =box corer
aluminum	71	6		F5.2,A1	%
barium	77	9		F8.0,A1	ppm
cadmium	86	8		F7.3,A1	ppm
chromium	94	7		F6.1,A1	ppm
copper	101	7		F6.1,A1	ppm
iron	108	6		F5.2,A1	%
mercury	114	6		F5.2,A1	ppm
manganese	120	7		F6.0,A1	ppm
nickel	127	7		F6.1,A1	ppm
lead	134	7		F6.1,A1	ppm
vanadium	141	7		F6.1,A1	ppm
zinc	148	7		F6.1,A1	ppm
chloride	155	6		F5.1,A1	%
organic carbon	161	5		F5.2	%

Note: Trace metal values flagged with an "L" represent values that are below the detection levels of the analytical technique used.

TRACE-METAL ANALYSIS PROCEDURES

The analyses of trace metals in marine sediments were carried out by the U.S. Geological Survey Branch of Analytical Laboratories, Reston, Va. Concentrations of the following elements were determined: aluminum (Al), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), vanadium (V), and zinc (Zn). Analyses were carried out by the U.S. Geological Survey Branch of Analytical Laboratories, Reston, Va. The various procedures employed in each of the analyses are detailed below and summarized in table 1.

Preparation of stock solution A

Exactly 0.5 g of ground bulk sediment or 0.2 g of the fine fraction was added to a covered teflon beaker and digested overnight with 5 mL of $HClO_4$, 5 mL of HNO_3, and 13 mL of HF at approximately 140°C. The covers were removed and the temperature was increased to between 180° and 190°C, first producing fumes of $HClO_4$ and then evaporating the solution to dryness. The residue was dissolved and diluted to exactly 25 mL with 8 N HCl. This solution is referred to as stock solution A.

Two blanks containing all reagents were analyzed along with samples. All reagents were analyzed for contaminants prior to use, as is always necessary. The Canadian reference sediment standard MESS-1 was analyzed in each set of samples. A series of solutions was prepared that approximated the concentration levels expected in the samples; this series was used as the standard in calibrating the inductively coupled plasma (ICP) spectrometer and atomic absorption (AA) spectrophotometer.

Table 1. Summary of analytical conditions

Element	Instrument	Instrument conditions	Extraction procedure	Procedure determination limit in sample, µg/g	Average blanks, as measured in µg/g in solution
Al	ICP (argon)	308.2 nm FP (Forward power)=1.1 kw Fixed cross flow nebulizer Spectral band width 0.036 nm Observation height 16 mm.	None	50	0.02
Ba	ICP (argon)	455.4 nm FP=1.1 kw Fixed cross flow nebulizer Spectral band width 0.036 nm Observation height 16 mm.	None	20	.01
Cd	Graphite furnace AA.	110°C dry temperature 250°C char temperature 2100°C atom temperature Regular graphite tube Interrupt gas flow W.l.=228.8 nm Slit=0.7 nm.	Butyl acetate and DDTC.	0.02	.0002
Cr	Graphite furnace AA.	110°C dry temperature 900°C char temperature 2700°C atom temperature Regular graphite tube Normal gas flow (low) W.l.=357.9 nm Slit=0.7 nm.	None	2	.003
Cu	Graphite furnace AA.	110°C dry temperature 850°C char temperature 2700°C atom temperature Regular graphite tube Interrupt gas flow W.l.=324.7 nm Slit=0.7 nm.	Butyl acetate and DDTC.	1	.005
Fe	ICP (argon)	259.9 nm FP=1.1 kw Fixed cross flow nebulizer Spectral band width 0.036 nm Observation height 16 mm.	None	50	.02

Table 1. Summary of analytical conditions - (continued)

Element	Instrument	Instrument conditions	Extraction procedure	Procedure determination limit in sample, µg/g	Average blanks, as measured in µg/g in solution
Hg	Induction furnace AA.	Wavelength=254 nm Cold vapor AA.	None	0.005	0.005
Mn	ICP (argon)	257.6 nm FP=1.1 kw Fixed cross flow nebulizer Spectral band width 0.036 nm Observation height 16 nm.	Butyl acetate (removal of iron).	10	.006
Ni	Graphite furnace AA.	110°C dry temperature 900°C char temperature 2700°C atom temperature Pyrolytic tube Normal gas flow (low) W.l.=232.0 nm Slit=0.2 nm.	None	2	.02
Pb	Graphite furnace AA.	110°C dry temperature 500°C char temperature 2700°C atom temperature Regular graphite tube Interrupt gas flow W.l.=283.3 Slit=0.7 nm.	Butyl acetate and DDTC.	1	.02
V	Graphite furnace AA.	110°C dry temperature 1000°C char temperature 2800°C atom temperature Pyrolytic curtin tube Normal gas flow (high) W.l.=318.4 nm Slit=0.7 nm.	None	3	.002
Zn	Flame AA.	Oxidizing; air-acetylene flame W.l.=213.9 Slit=0.7 nm.	Butyl acetate	1	.01

Preparation of stock solution B

Stock solution B was made by adding 10 mL of butyl acetate (distilled to remove impurities such as copper) to 15 mL of stock solution A in a 60-mL separatory funnel. This solution was vigorously agitated by an automatic shaker for six minutes to extract iron. The layers were separated, and the extraction step was repeated with an additional 10 mL of butyl acetate. The aqueous layer was evaporated to dryness at 150°C in a 50-mL beaker. The residue was dissolved and diluted to 25 mL with 1 N HCl.

Barium

The measurements for Ba were made by ICP spectrometry with 2 mL of stock solution A diluted to 4 mL with distilled H_2O.

Aluminum, iron, chromium, nickel, and vanadium

Concentrations of Al and Fe were determined by ICP spectrometry by using 1 mL of stock solution A diluted to 10 mL with H_2O. The measurements for Cr, Ni, and V were made by injecting 20 µL of diluted (1:10) stock solution A into a graphite-furnace AA spectrophotometer.

Lead, copper, and cadmium

Fifteen mL of 0.5-percent (weight: volume) diethyldithiocarbamic acid diethylammonium salt (DDTC) in chloroform were added to 10 mL of solution B in a 60-mL separatory funnel and mixed for 10 minutes by an automatic shaker. The chloroform layer was drained into a 30-mL beaker and the aqueous layer washed with 10 mL of chloroform. The second chloroform layer was combined with the first, and the total volume of chloroform was evaporated to dryness at 90°C. The organic matter was destroyed by adding 0.1 mL of concentrated HNO_3 and was evaporated to dryness. This residue then was dissolved in 2 mL of warm 1 N HCl. The beaker was rinsed four times with 2 mL portions of distilled H_2O, and the solution was transferred to a small polyethylene container. The measurements for Pb, Cu, and Cd were made by injecting 20 µL of the final solution into a graphite-furnace AA spectrophotometer.

Manganese and zinc

The measurements for Mn were made by ICP spectrometry with a solution made by diluting 2 mL of stock solution B to 4 mL with H_2O. Zinc was measured by flame AA directly from stock solution B.

Mercury

Mercury concentration was determined on a separate portion of the sample. Two hundred milligrams of sediment (100 mg if sample concentrations were expected to be >50 ppb) were decomposed in a 1-oz teflon screw-top vial with 2 mL of concentrated HNO_3 (J. T. Baker Chemical Co.) and 2 mL of $HClO_4$ (G. Frederick Smith Chemical Co. (GFS) double distilled from Vycor, a pure silica glass). The mixture was heated in a capped vial until the solution reached 200°C. The solution was then heated with the cap off for about 45 minutes, after which the samples were removed from the heat source. Immediately, 1 mL of concentrated HNO_3 was added; the vial was filled with H_2O and capped tightly until used. The sample solution then was added to a flask containing 125 mL of H_2O and 4 mL of 10-percent (weight:volume) $SnCl_2$ in 20-percent HCl. Nitrogen was passed through the solution to remove elemental Hg, which was collected on gold foil located in the center of the coils of an induction furnace. Activation of the furnace released the Hg, which was measured by a cold-vapor AA technique. Blanks, standard rocks, and internal sediment standards were analyzed for each set of samples. A series of solutions was prepared that had the same Hg- concentration range expected in the samples.

The concentrations of Hg in bottom sediments determined during the first year of the monitoring program were typically less than the detection limit of

0.01 ppm. During the second and third year of monitoring, we tested new procedures designed to lower the detection limit.

The contribution of Hg from various brands of nitric acid was determined. Baker "analyzed reagent grade" contained <0.5 parts per billion (ppb) Hg, the lowest concentration of the acids tested. Baker "ultrex" contained 2 ppb Hg, and Mallinckrodt nitric acid contained 1.3 ppb Hg. During the checks of $HClO_4$, we found that some bottles of GFS double distilled $HClO_4$ contained 5 ppb Hg. We ultimately selected GFS double distilled from Vycor which was found to contain <0.5 ppb Hg. The Hg concentration of each new bottle of acid and of every other reagent was determined before the reagent was used for analysis. The Hg contribution from the combined reagents was reduced to 0.5 ng±0.1 ng.

We tried to lower the detection limit by increasing the sample size. Subsamples weighing 1 g were analyzed with various combinations of nitric and perchloric acids. The results were not encouraging because digestion was incomplete using small acid volumes or because blanks were too high when large acid volumes were used. The high sediment concentration in suspension during the gas-stripping procedure may have adsorbed some of the Hg, accounting for the lower concentration measured for large samples.

Another method of increasing sample size involved successive plating of Hg vapor from three 200-mg aliquots onto the gold foil of the induction furnace. This technique yielded poor reproducibility among replicates and decreased the number of samples that could be analyzed in a day by a factor of ~3.

The selection of reagents having the lower Hg concentration, addition of a digital readout voltmeter, and optimization of the optical system in the cold-vapor AA detection system (manufactured by Laboratory Data Control, Inc.) reduced the detection limit of our procedure from 0.01 ppm to 0.005 ppm.

Table 2. - Analysis of sediment standard and replicate sediment samples

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
MESS-1	5.40	270	0.41	50	23	2.9	480	36	32	80	160
	5.20	270	.44	52	23	2.9	460	36	31	72	170
	5.20	270	.44	52	23	2.9	460	34	30	79	170
	5.40	260	.45	54	23	2.9	470	36	30	72	180
	5.50	260	.45	52	23	2.9	470	36	30	79	170
	5.30	270	.44	50	24	2.9	470	36	31	76	170
	5.50	260	.45	52	24	2.9	450	37	37	74	190
	5.40	260	.49	48	25	2.9	510	35	38	70	160
	5.60	270	.39	48	25	2.9	490	37	34	78	170
	5.50	270	.53	52	29	3.0	470	35	37	82	170
	5.50	270	.47	51	26	2.9	500	30	32	70	160
	5.70	280	.46	50	28	3.0	480	37	36	78	160
$\bar{x}$	5.43	267	.46	51	24.8	2.92	476	35.4	33.3	75.5	170
σ	.15	7	.03	1.8	2.1	.04	18	2.0	3.2	4.1	8.9
CV(%)[1]	2.9	2	7.6	3.6	8.4	1.4	4	5.7	9.6	5.4	5.3
Best value[2]	5.8	270	.59	71	25	3.0	513	30	34	72	191
σ	.2		.1	11	4	.2	25	3	6	5	17

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
MAG	7.40	430	.14	88	27	4.6	710	64	22	110	140
	7.60	440	.15	93	28	4.6	720	64	22	110	140
	7.60	430	.13	92	30	4.6	700	60	21	120	140
	7.40	430	.15	90	27	4.6	720	64	21	110	140
	7.50	440	.13	90	27	4.6	700	64	21	120	140
$\bar{x}$	7.50	434	.14	90.6	27.8	4.6	710	63.2	21.4	114	140
σ	.1	6	.01	2.0	1.3	0	10	1.8	.5	5.5	0
CV(%)[1]	1.3	1	7.1	2.2	4.7	0	1	2.8	2.6	4.8	0
Best value	[3]8.9	[3]490	[3].15	[3]100	[3]33	[3]4.9	[3]710	[3]53.8	[3]26	[3]142	[3]148

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
B-12	3.10	260	0.067	39	6.3	1.6	290	12	15	40	43
	3.20	260	.071	37	6.3	1.6	290	10	16	40	40
	3.10	250	.080	39	6.8	1.6	290	13	18	40	40
	3.20	260	.075	39	6.8	1.6	300	10	17	40	40
	2.80	260	.083	37	6.3	1.6	290	10	16	34	40
$\bar{x}$	3.08	258	.080	38.2	6.5	1.6	292	11	16.4	38.8	40.6
σ	.16	5	.006	1.1	.3	0	5	1.4	1.1	2.7	1.3
CV(%)[1]	5.3	2	8.1	2.9	4.2	0	2	12.9	7.0	6.9	3.3

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M10-05-02-82	.12	26	<.02	5.0	<.1	.30	240	<2	3.6	7.5	4.2
	.12	26	<.02	6.0	<.1	.30	240	<2	3.3	6.5	4.2
	.12	25	<.02	6.0	<.1	.30	240	<2	3.6	6.5	4.2
	.12	24	<.02	5.0	<.1	.30	240	<2	3.3	7.5	4.2
	.12	23	<.02	5.0	<.1	.30	240	<2	3.3	7.5	4.2
$\bar{x}$	.12	25	<.02	5.4	<.1	.30	240	<2	3.4	7.1	4.2
σ	0	1	0	.6	0	0	0	0	.2	.6	0
CV(%)1	0	5	0	10.1	0	0	0	0	4.8	7.7	0

[1]Coefficient of variation.
[2]Values reported by the Marine Analytical Chemistry Standards Program, National Research Council, Canada.
[3]Value judged to be most appropriate based on multiple analyses conducted at USGS Analytical Labs, Reston, VA.

Table 2. - Analysis of sediment standard and replicate sediment samples—Continued

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M10-13AB1	4.50	280	.058	63	11	2.5	300	32	27	84	58
	4.70	290	.056	65	11	2.5	310	33	27	82	58
	4.60	280	.058	60	11	2.5	310	33	26	84	58
	4.70	280	.054	66	11	2.5	300	33	27	86	58
	4.50	290	.054	64	12	2.5	300	33	26	86	58
$\bar{x}$	4.6	284	.060	63.6	11.2	2.5	304	32.8	26.6	84.4	58
σ	.1	6	.002	2.3	.4	0	6	.4	.5	1.7	0
CV(%)[1]	2.2	2	3.3	3.6	4.0	0	2	1.4	2.1	2.0	0

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M10-13AB1x	5.20	290	0.055	61	12	2.6	310	30	26	78	65
	4.90	290	.050	59	12	2.6	300	29	26	84	66
	4.90	280	.038	60	12	2.6	310	29	27	81	66
	5.00	280	.038	61	12	2.6	310	29	27	81	65
	5.20	280	.046	61	12	2.7	310	29	27	78	65
$\bar{x}$	5.04	284	.050	60.4	12	2.62	308	29.2	26.6	80.4	65.4
σ	.15	6	.007	.9	0	.04	5	.4	.5	2.5	.5
CV(%)[1]	3.0	2	14.9	1.5	0	1.7	2	1.5	2.1	3.1	.8

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M11-5-16B1	.28	43	<.02	3.5	<1	.29	150	<2	3.6	4.0	3.7
	.28	42	<.02	3.5	<1	.29	150	<2	3.7	4.0	3.7
	.28	42	<.02	3.5	<1	.29	150	<2	4.0	4.0	3.7
	.28	42	<.02	3.5	<1	.29	150	<2	3.7	4.0	3.7
	.28	42	<.02	3.5	<1	.29	150	<2	3.7	4.0	3.3
$\bar{x}$	.28	42.2	<.02	3.5	<1	.29	150	<2	3.74	4.0	3.62
σ	0	.5	0	0	0	0	0	0	.15	0	.18
CV(%)[1]	0	1.1	0	0	0	0	0	0	4.1	0	4.9

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M11-16B1	.32	130	<.02	<2	<1	.18	110	<2	4.4	<2	5.0
	.32	130	<.02	<2	<1	.18	100	<2	4.4	<2	4.6
	.33	130	<.02	<2	<1	.18	110	<2	4.4	<2	4.6
	.33	130	<.02	<2	<1	.17	100	<2	4.4	<2	4.6
	.32	130	<.02	<2	<1	.17	100	<2	4.4	<2	4.6
$\bar{x}$	.32	130	<.02	<2	<1	.176	104	<2	4.4	<2	4.68
σ	.01	0	0	0	0	.005	6	0	0	0	.18
CV(%)[1]	1.7	0	0	0	0	3.1	5	0	0	0	3.8

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M11-16B1x	2.30	2600	0.13	29	20	1.7	740	27	39	49	80
	2.30	2600	.10	31	21	1.7	740	28	42	49	80
	2.40	2700	.12	29	20	1.7	750	28	43	49	81
	2.30	2600	.11	28	19	1.7	740	27	41	49	80
	2.30	2600	.12	32	21	1.7	740	27	41	49	80
$\bar{x}$	2.32	2620	.12	29.8	20.2	1.7	742	27.4	41.2	49	80.2
σ	.04	45	.01	1.6	.8	0	5	.6	1.5	0	.5
CV(%)[1]	1.9	2	9.5	5.5	4.1	0	6	2.0	3.6	0	.6

[1]Coefficient of variation.

Table 2. - Analysis of sediment standard and replicate sediment samples–Continued

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M12-19HX-2-4	3.90	230	.13	69	14	2.6	450	32	27	100	66
	3.90	230	.12	72	15	2.6	460	31	27	110	66
	3.90	230	.12	71	15	2.6	460	31	27	110	68
	3.90	230	.12	74	14	2.6	450	31	25	100	68
	3.90	230	.13	69	14	2.6	450	32	27	110	66
$\bar{x}$————	3.90	230	.124	71	14.4	2.6	454	31.4	26.6	106	66.8
σ————	0	0	.005	2.12	.5	0	6	.6	.9	5	1.1
CV(%)[1]———	0	0	4.4	3.0	3.8	0	1	1.7	3.4	2	1.6

Sample standard	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
OC140-39X8-10	4.00	200	.13	72	19	2.8	380	37	25	130	76
	3.90	200	.13	75	19	2.9	390	36	26	130	76
	3.80	200	.14	75	18	2.9	380	38	25	120	80
	3.80	200	.14	73	19	2.9	370	38	27	130	78
	3.80	200	.15	75	19	2.8	370	36	28	120	75
$\bar{x}$————	3.86	200	.138	74	18.8	2.86	378	37	26.2	126	77
σ————	8.9	0	.008	1.4	.5	5.5	8	1	1.3	5.5	2
CV(%)[1]	2.3	0	6.1	1.9	2.4	1.9	2	2.7	5.0	4.3	2.6

[1]Coefficient of variation.

Analytical precision was determined by periodically analyzing replicate aliquots taken from a single sample. Coefficients of variation shown in table 2 indicate that the standard deviation is typically less than 10 percent of the mean value, except for concentrations at or near the detection limit of the method.

To maintain our internal quality control and to provide typical sample material for interlaboratory comparisons, four sediment standards representing different textural types were prepared from large samples of Georges Bank sediment. The levels of trace metals are being established by several analytical methods. Splits of these materials are available to those interested in cross-calibration studies.

A. ← SHIP/CRUISE/DATES

USGS CR. #	SHIP NAME	DATES
M01	R/V EASTWARD	JUL 9-23 1981
M02	R/V OCEANUS	NOV 9-21 1981
M03	R/V ENDEAVOR	FEB 10-27 1982
M04	R/V CAPE HENLOPEN	MAY 10-12 1982
M05	R/V OCEANUS	JULY 21-28 1982
M06	R/V OCEANUS	NOV. 19-28 1982
M07	R/V ~~OCEANUS~~ ENDEAVOR	FEB. 5-11 1983
M08	R/V GYRE	MAY 13-21, 1983
M09	R/V GYRE	JUL 13-15, 1983
M10	R/V OCEANUS	NOV 11-13, 1983
M11	R/V OCEANUS	FEB 1-7, 1984
M12	R/V GYRE	JUN 1-10, 1984

USGS CR # ON CORE SAMPLES

OC122	R/V OCEANUS	CR-122	7-15 JUL 1982
OC130	R/V OCEANUS	CR-130	9-16 NOV. 1982
OC140	R/V OCEANUS	CR-140	17-24 OCT. 1983
83G-9	R/V GYRE	CR-83G-9	JUL. 1983

USGS CR # ON SEDIMENT TRAPS

	DATE DEPLOYED	DATE RECOVERED
ST ØØ1	79-12-15	80-05-25
ST 1Ø3	80-11-28	81-04-22
ST 222	81-04-29	81-09-26
ST 3Ø1	81-09-27	82-01-28
ST 4Ø3	82-01-31	82-07-07
ST 424	82-02-01	82-06-11
ST 426	82-02-01	82-06-11
ST 501	82-07-10	82-11-11
ST 502	82-07-10	82-11-11
ST 505	82-07-10	82-11-11
ST 506	82-07-10	82-11-11
ST 508	82-07-10	82-11-11
ST 510	82-07-10	82-11-11
ST 513	82-07-11	82-11-11
ST 515	82-07-11	82-11-11 ~~82-0~~
ST 536	82-07-08	82-11-11
ST 537	82-07-08	82-11-11

Department of Interior to File Type 144 Specifications

The input data consists of several files, in two similar formats. One file consists of a 158 character record, the other type a 165 character record. Both files are the same thru byte 154. Each file will require text records specific to that file to be generated at run time, based on input from the Department of interior. Thus text information for these, and future files, are to be included at the cruise level, and read-in as data cards.

Output record types will consist of type A, C, ~~D~~, E, F, and T with the latter appearing both at the cruise level and the station level. Portions of the input data will be written in fixed locations of the text records to allow for possible future selection of this information.

All data values will be converted to parts per million. Appendix 1 will be used to generate the appropriate output codes. Specific instructions for the various input fields to be converted to the proper output locations are explained hereafter. There will be two read statements required to differentiate between two input files. Both files contain the same twelve parameters in the same format, parameter thirteen is different, and fourteen exists for one file. The fourteen parameter file is described and the thirteenth parameter should be read via a switch setting.

Input (DOI) Bytes	Output (FT144) Bytes
	Record Type A*
	1-3, Code = 144
	4-9, File I.D., four number field with TT in bytes 4 and 5. This number should be read in at run time vial the first data card (bytes 1-4), and incremented by one whenever cruise changes.
	10, Record Type=A
30-35, Date of Observation	33-38, Start survey date YYMMDD (written in J format). End survey date will be added during processing, in bytes 39-44. The first station of each cruise for start, last station for end date.
	45-59, Investigator, Code = Michael Bottner
	60-74, Agency, Code = Interior Dept.
	Record Type T
	1-9, as above
	10, Code = T, These text records created only when record type A is generated.
Data Cards (following File I.D. data card) with any information desired by originator. Each card has text only in bytes 23-77.	23-77, Text as included on data cards. The field numbers (bytes 23-48 in station text records) are explained herein.

*This record type created whenever input bytes 1-4 changes.

Input (DOI) Bytes

Output (FT144) Bytes

Record Type T (con't)

"The first few characters to the left of the dash represent the originator's cruise number. The station number appears between the first dash until the first alpha character(s). Regional stations sometimes have 'site-specific locations' that are indicated by something other than zero following the second dash. A single alpha at the end of the station field identifies one of three replicates taken at each station for trace metal analysis. The notation "BL' indicates a blended composite sample made up of equal weights from each of the three replicates. Field numbers ending with 'X' indicate that analyses were performed on the fraction of sediment finer than 62 um.

78-80, Sequence number, starts with 001 and incremented by one.

Record Type C

1-9, as above

10, Code = C

11-14, NODC Station number, start with 0001 and increment by one for each record read in, when cruise changes, restart with one.

Input (DOI) Bytes	Output (FT144) Bytes
36-44, Latitude in F9.6 format, positive (understood) equals north hemisphere. There in no Southern hemisphere capability with this structure.	16-22, Transfer values to left of decimal as is. Values to right of decimal can be converted to minutes and seconds in two steps. To obtain minutes multiply value by 60 and divide result by 10^6. The integer portion is the minutes and the remainder is to be used for calculation of seconds, which proceeds exactly as above. The seconds result should be rounded.

Input (DOI) Bytes	Output (FT144) Bytes
	Record Type C (con't)
45-54, Longitude, F10.6 format, with hemisphere equal west when negative and east when positive. '–' W '+' E	23-30, Transfer and convert data in the same manner as above. Latitude and Longitude fields must be present, or input station is to be rejected.
30,35, Year, month, day	31,36, Transfer and incorporate zeroes if month and day fields contain a preceeding blank. These fields must be present or station is rejected.
	78-80, Sequence numbers, start at fifty for each new station (type C) record. This should allow sufficient number of text records describing the cruise.
	Record Type T
	1-9, as above
	10, Code = T, These text records generated to report the originator's cruise, station and lab number as they appear on the input data.
2-27, Originator's Identification	23-48, Transfer as is to fixed portion of text record.
	49-77, "See explanation in text records at cruise level."
	78-80, Sequence number, start at 051 and increment by one as necessary, for each additional text record.
	Record Type D
	1-14, as above, byte 10 = E
59-63, Water Depth in Format F5.1	16-19, Round to whole meters
	78-80, Sequence number, increment previous number by one.

Input (DOI) Bytes	Output (F144) Bytes
	Record Type E
	1-14, as above, byte 10=E
	23, Code = S
55-56, Upper Sample depth, in integer format, in cms.	28-29, Prefix zero if byte 55 is blank and 56 non-blank.
57-58, Lower sample depth, in integer format in cms.	34-35, as above
	39, Code = 4
64-70, Gear Code, alpha-numeric field	42-43, Compare bytes for VV, HDC or ST and convert to 06, 07 or 99 respectively. Ignore any other entries.
	78-80, Sequence number, increment previous number by one.
	Record Type F
	1-14, as above, byte 10=F
Floating point concentrations of fourteen parameters. The format and byte locations for these are	23-31, 40-48, 57-65, nine character parameter code (see app. 1), up to 3 parameter codes per type 'F' record.

Al-71-75, F5.2
Ba-77-85, F9.0
Cd-86-92, F7.3
Cr-94-99, F6.1
Cu-101-106, F6.1
Fe-108-112, F5.2
Mg-114-118, F5.2
Mn-120-126, F7.0
Ni-127-132, F6.1
Pb-134-139, F6.1
V- 141-146, F6.1
Zn-148-153, F6.1
Cl-155-159, F5.1
(Cl-155-158,F4.1) oe 13 parameter file
OC-161-165,F5.2

Input (DOI) Bytes	Output (FT144) Bytes
	Record Type F (con't)
	32, 49, 66, measurement code = B
76, 93, 100, 107, 113, 119, 133, 140, 147, 154, 160, one character (L) trace field for preceding parameter.	33, 50, 67, Trace field, code = L (L) if L exists on input with associated parameter.
	34-37, 51-54, 68-71, Transfer up to four significant (left-most non-blank*, non-zero) numbers. Values should be read with floating point "F" notation using the input decimal for definition of the value. The output, of course will not have decimal point.
Floating point inputs in ppm except Al and Fe which are given in parts per hundred.	38-39, 55-56, 72-73, Sign and exponent. Since all concentrations are written as an integer value the input location of the decimal point determines the sign and exponent on output. If input is to thousandths, hundredths, tenths or whole number (as defined on previous page definition of concentrations), the sign, and exponent will be -3, -2, -1, +0 respectively. If the four significant digits are not adjacent to decimal point the sign and exponent will increase by one for each power of ten that is implied.
	For the two concentrations given on the input in parts per hundred a +4 should be added to the computed value to determine the resulting value.
	78-80, Sequence number, increment each output record by one.

*If input data contains only zeroes, it should be treated as blanks and ignored.

Appendix 1

Parameter	Code
Aluminum (Al)	S7429905
Barium (Ba)	S7440393
Cadmium (Cd)	S7440439
Chromium (Cr)	S7440473
Copper (Cu)	S7440508
Iron (Fe)	S7439896
Mercury (Mg)	S7439976
Manganese (Mn)	S7439965
Nickel (Ni)	S7440020
Lead (Pb)	S7439921
Vanadium (V)	S7440622
Zinc (Zn)	S7440666
Chlorine (Cl)	S7782505
Organic Carbon (OC)	T7440440

U.S. DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

THE GEORGES BANK MONITORING PROGRAM: ANALYSIS OF TRACE METALS IN BOTTOM SEDIMENTS DURING THE SECOND YEAR OF MONITORING

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The analysis of trace-metal data discussed in this report identifies the general trends that exist both in time and space since exploratory drilling of any kind began on Georges Bank. The data have been entered into a computer data base for retrieval and also have been listed on magnetic tape. Navigation data for each sample analyzed for chemistry are compiled in appendix tables 1A and 1B.

FIELD SAMPLING AND SAMPLE PREPARATION

Special steps were taken to minimize contamination of sediment samples at sea. The samples for chemical analyses were collected with a 0.1-m^2 stainless steel Van Veen grab sampler with teflon coating on all surfaces in contact with sediment. A polyethylene-coated cable was used to lower the grab to the sea floor. Upon recovery of a sample, the overlying water was siphoned off with a glass tube and the upper 2 cm of material were: (1) collected with a noncontaminating utensil; (2) placed in an acid-washed polyethylene container; and (3) frozen until analyzed. Because individual grab samples were subsampled for both trace-metal and hydrocarbon analyses, the grab sampler was rinsed with distilled methanol and hexane before each use.

Sediment cores were collected on other USGS cruises in the study area with a hydraulically damped gravity corer similar to the one described by Pamatmat (1971). This apparatus has a slow rate of penetration controlled by a water-filled piston and collects cores as long as 70 cm (in mud) with minimal disturbance of the sediment. Cores containing the undisturbed water-sediment interface were collected in thin-walled fiberglass core barrels and were frozen after collection. The samples were later extruded, thawed, and cut into 1-cm sections for analysis.

The depth distribution of metals was also determined on samples removed in 2-cm depth intervals from grab samples.

In the laboratory, the samples were thawed, homogenized, and subsampled under a particle-free hood. Aliquots from individual grabs and sample blends, made up of equal weights from the individual grabs, were separated for chemical and textural analyses. Samples for chemical analyses were dried to a constant weight at 70°C in an oven with teflon-coated surfaces and a filtered nitrogen atmosphere. Dried samples were ground in an agate grinder after shell or sediment particles larger than 2 mm were removed. Drill cuttings, identified by their angular edges and unusual color, were not removed. These samples are referred to as bulk sediments (undifferentiated with respect to size) throughout this report.

To maximize the analytical resolution in identifying drilling mud components, sand and coarser material were removed from selected samples. Distilled water was used to wash the silts and clays through a nylon sieve with 60-μm openings. The resultant slurry was dried in a teflon-coated oven, then ground and analyzed by the same methods used for bulk sediments. Corrections were made for the weight of salt contributed by the interstitial water.

The field numbers (for example, M06-13-00-G and M07-05-28-BL) that identify samples in each data table have the following code. The first three characters indicate the cruise number; M06 stands for monitoring cruise 6. The station number appears after the first dash. In the examples given, 13-00 is a station in the regional sample array; station 05-28 is one of the site-specific stations around regional station 5 (see fig. 1B). A single alpha character at the end of the field number identifies one of three replicates taken at each station for trace-metal analysis. Alternatively, the notation

BL at the end indicates a blended composite sample made up of equal weights from each of the three replicates. Field numbers ending in X indicate that analyses were performed on the fraction of sediment finer than 60 µm.

GRAIN-SIZE ANALYSIS TECHNIQUES

Textural analyses were performed on wet sediments to avoid the formation of clay aggregates. Homogenized samples were wet sieved using a dispersant (5 percent Calgon) through a 63-µm sieve to remove silt and clay. The coarse fraction (containing shells if present) was dried, weighed, and then sieved through a 2-mm screen to remove the gravel, which was not further sized. The sand fraction was analyzed with a Rapid Sediment Analyser (Schlee, 1966). A gravimetric determination of the silts and clays was made by filtering. The size distribution of the silts and clays was determined with a Coulter Counter. Statistical parameters (mean, median, standard deviation, etc.) were determined by the method of moments (Krumbein and Pettijohn, 1938). All textural data are expressed in phi (ϕ) units which are defined as $-\log_2 D$ where D is the grain diameter in mm.

Samples obtained from sediment cores and sediment traps were not analyzed using the rapid sediment analyses because of insufficient sample size. These samples were passed through a sequence of sieves. The percentage of the major textural classes was determined gravimetrically. Textural classes finer than 63µm were detemined with a Coulter Counter.

TRACE-METAL ANALYSIS PROCEDURES

The analyses of trace metals in marine sediments were carried out by the U.S. Geological Survey Branch of Analytical Laboratories, Reston, Va. Concentrations of the following elements were determined: aluminum (Al), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), vanadium (V), and zinc (Zn). The various procedures employed in each of the analyses are detailed below and summarized in table 1.

Preparation of stock solution A

Approximately 0.5 g of ground bulk sediment or 0.2 g of the fine fraction was added to a covered teflon beaker and digested overnight with 5 ml of $HClO_4$, 5 ml of HNO_3, and 15 ml of HF at approximately 140°C. The covers were removed, and the temperature was increased to between 180° and 190°C, first producing fumes of $HClO_4$ and then evaporating the solution to dryness. The residue was dissolved and diluted to exactly 25 ml with 8 N HCl. This solution is referred to as stock solution A.

Two blanks containing all reagents were analyzed along with samples. All reagents were analyzed for contaminants prior to use, as is always necessary. The Canadian reference sediment standard MESS-1 was analyzed in each set of samples. A series of solutions was prepared that approximated the concentration levels expected in the samples and was used as the standard in calibrating the inductively coupled plasma (ICP) spectrometer and atomic absorption (AA) spectrophotometer.

Preparation of stock solution B

Stock solution B was made by adding 10 ml of butyl acetate (distilled to remove impurities such as copper) to 15 ml of stock solution A in a 60-ml separatory funnel. This solution was vigorously agitated by an automatic shaker for 6 minutes to extract iron. The layers were separated, and the extraction step was repeated with an additional 10 ml of butyl acetate. The aqueous layer was evaporated to dryness at 150°C in a 50-ml beaker. The residue was dissolved and diluted to 25 ml with 1 N HCl.

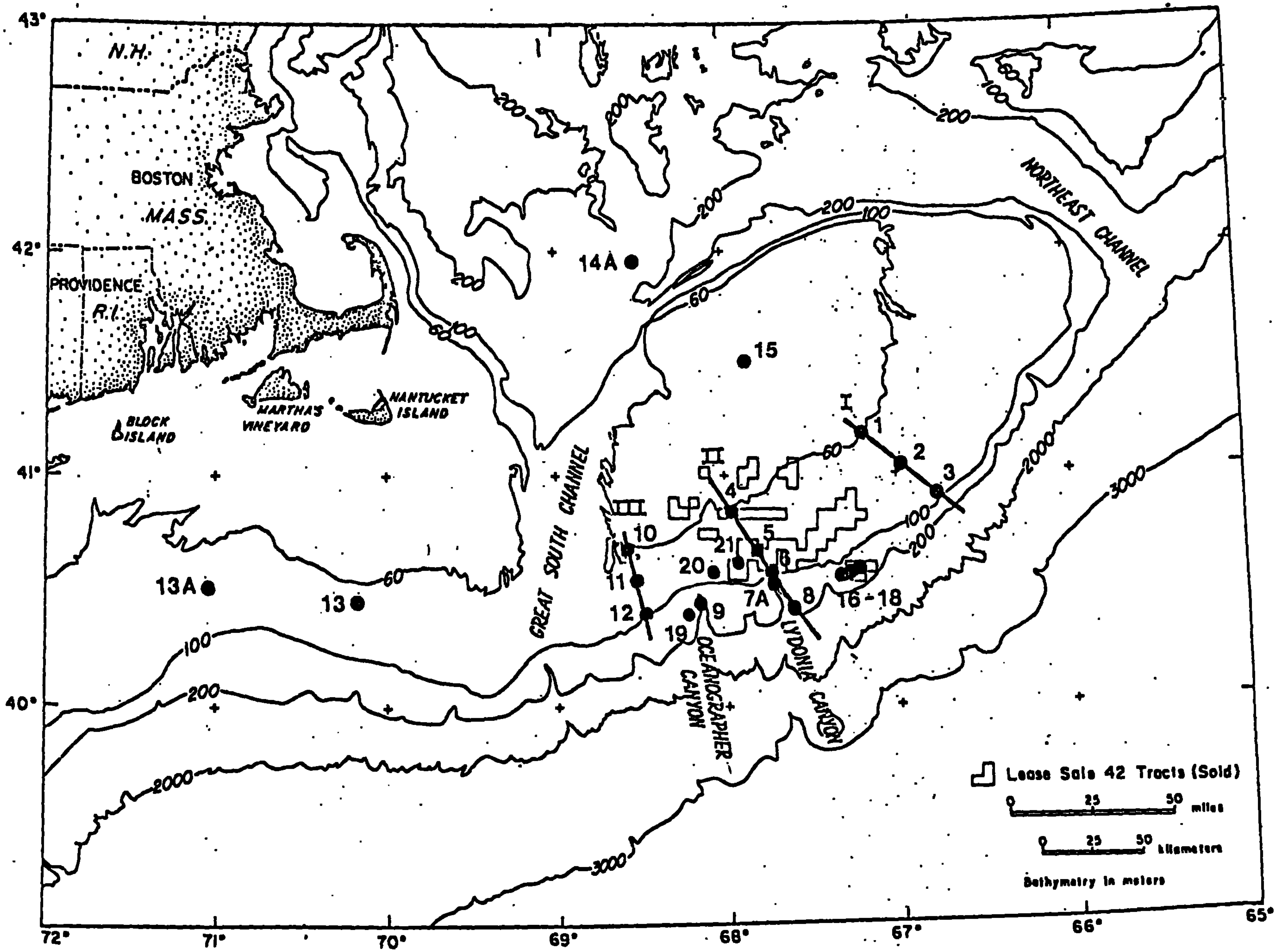


FIGURE 1A. Regional array of sampling stations. Site-specific array in block 312 is centered at station 5.

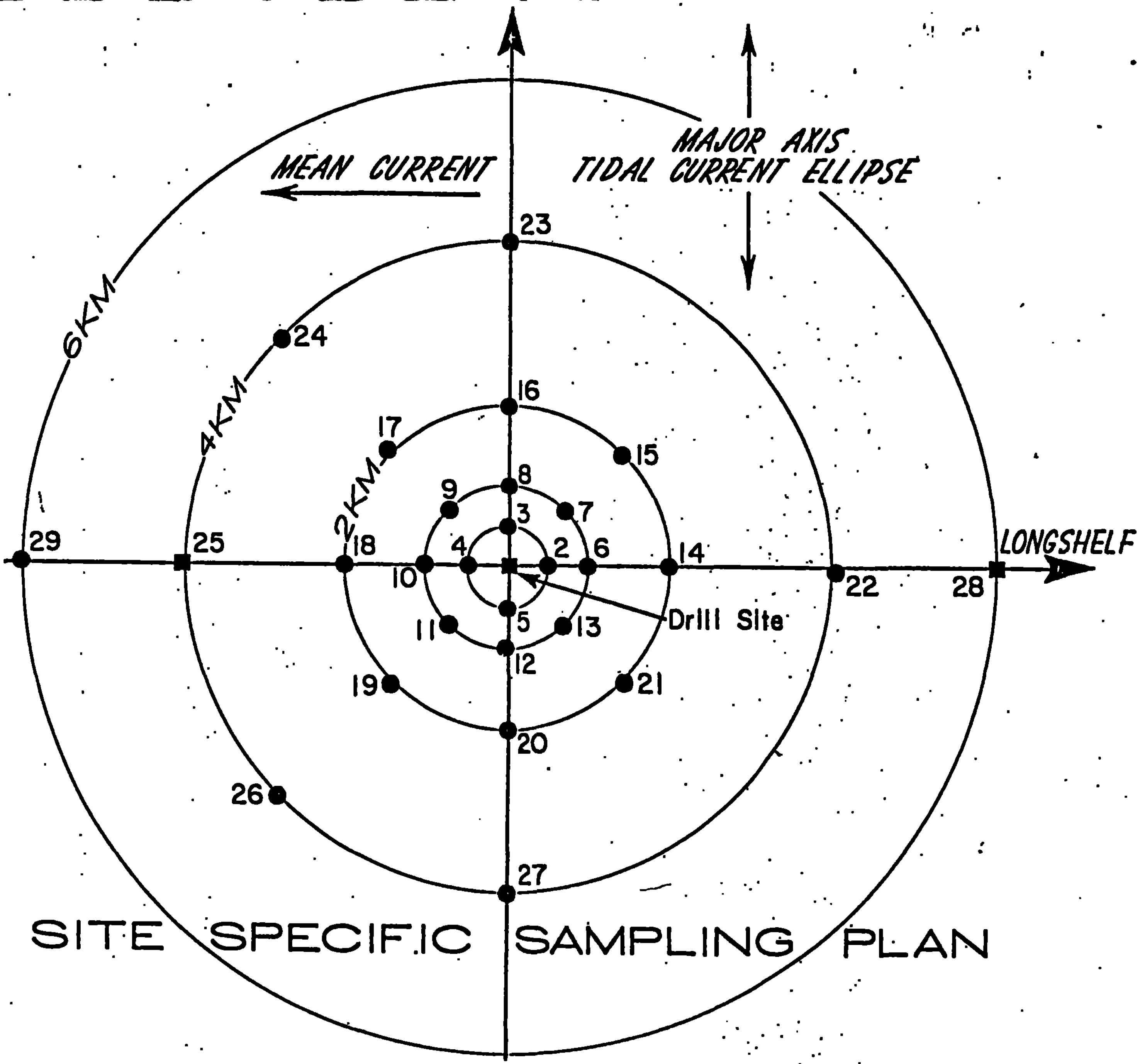


FIGURE 1B. Site-specific sampling array around regional station 5 (block 312). Stations 5-7, 5-13, 5-15, 5-17, 5-19, 5-21, 5-23, 5-24, 5-26, and 5-27 are secondary stations (of lower priority) and have not been analyzed routinely.

Table 4A. - Chemical analyses of sediment-trap samples collected before drilling began (Bothner and others, 1982)

	Al (ppm)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Hg (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
Mean	3.04	225	0.26	71	19	0.044	1.94	466	39	36	82	132
St.dev.	.79	66	.28	15	10	.009	.40	130	15	10	28	124
No. of analyses	13	13	2	13	13	13	10	13	13	12	13	13

Table 4B. - Chemical analyses of sediment-trap samples collected after drilling began

Field no.	Lab no.	Al (ppm)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Hg (ppm)	Fe (%)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
Lydonia Canyon: drilling in progress													
ST222-0-15[1]	W-221248	3.91	304.2	0.08	52.1	10.9	0.05	2.50	348	31.5	32.6	66.3	65.2
ST301-0-4	W-221249	3.78	266.5	.05	47.7	17.8	.04	2.33	444	27.8	33.3	53.3	64.4
ST403-0-20	W-221285	3.20	260.0	.09	40.0	14.0	.03	1.90	240	18.0	26.0	44.0	46.0
ST536-0-2	W-221271	3.54	274.2	.16	45.7	16.0	.03	2.06	366	17.1	28.6	41.1	62.8
1 km west of rig: drilling in progress													
ST424-0-4	W-221251	2.73	1783.6	.39	40.4	11.7	.04	2.14	345	14.3	34.5	42.8	89.2
ST424-4-7	W-221252	2.52	1889.1	.38	37.8	8.9	.03	2.14	290	12.6	30.2	45.3	74.3
ST424-7-10	W-221253	2.98	1152.9	.45	40.9	9.4	.04	2.36	310	16.1	27.3	54.5	62.0
ST424-10-15	W-221254	3.11	771.8	.18	40.3	11.1	.03	2.30	357	12.7	30.0	55.3	57.6
ST424-15-17	W-221255	3.34	1224.5	.17	44.5	13.6	.03	2.60	445	18.6	39.6	59.4	73.0
ST424-17-20.5	W-221256	3.40	551.7	.22	51.7	16.4	.03	2.70	481	17.6	64.6	69.3	89.2
6 km east of rig: drilling in progress													
ST426-0-4	W-221257	2.24	407.0	.51	27.5	10.2	.02	1.73	275	11.2	25.4	34.6	76.3
ST426-6-8	W-221258	3.09	482.4	.35	44.5	11.1	.04	2.47	346	13.6	30.9	56.9	56.9
ST426-12.5-15	W-221259	3.07	378.1	.45	40.2	11.8	.03	2.48	449	15.4	36.6	59.1	100.4
Rig site: post drilling													
ST501C-W[2]	W-221260	2.96	1023.5	1.08	24.2	24.2	.04	2.10	253	5.4	18.3	5.4	121.2
ST502-0-4	W-221261	3.24	802.7	.30	44.0	23.3	.05	2.46	867	24.6	46.6	62.1	79.0
ST502-4-8	W-221262	3.48	721.7	.55	43.8	20.6	.10	2.58	760	23.2	46.4	61.9	86.3
ST502-8-12	W-221263	3.42	756.7	.41	43.9	19.5	.07	2.56	622	22.0	43.9	61.0	74.5
ST502-12-14	W-221264	3.18	1070.5	.42	40.0	14.1	.04	2.35	459	15.3	31.8	56.5	69.4
ST505C-W	W-221265	3.49	1070.9	.14	49.8	18.7	.03	2.61	237	27.4	43.6	71.0	72.2
1 km west of rig: post drilling													
ST506C-W	W-221266	2.30	767.4	.73	26.9	13.6	.03	1.71	230	3.8	30.7	11.5	211.0
ST508C-W	W-221267	3.47	1165.3	.21	48.3	19.8	.04	2.60	198	24.8	44.6	64.5	74.4
ST510C-W	W-221268	1.98	626.0	.03	26.1	10.4	.02	1.46	250	10.4	26.1	23.0	55.3
6 km east of rig: post drilling													
ST513C-W	W-221269	3.28	625.8	.14	43.2	12.4	.04	2.38	328	11.2	37.2	41.7	76.0
ST515C-W	W-221270	3.28	610.6	.11	45.2	15.8	.03	2.37	226	21.5	33.9	66.7	79.2

[1]Depth interval (cm) in sediment-trap sample.
[2]W = whole sediment trap homogenized before analysis.

Table 5. - Chemical analysis of core samples and grab samples subsectioned in sequential depth intervals. Depth interval, in cm, is given at end of field number

Field no.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
Station 5-1													
OC122-64-01	W-220589	0.24	180.0	<0.02	5.3	<1.0	0.39	—	340	<2.0	5.3	11.0	6.6
OC122-64-02	W-220590	.22	43.0	.03	4.5	<1.0	.37	—	240	<2.0	4.5	9.5	4.4
OC122-64-03	W-220591	.21	32.0	<.02	4.8	<1.0	.37	—	200	<2.0	4.5	10.0	4.4
OC122-64-04	W-220592	.23	37.0	<.02	5.0	<1.0	.38	—	200	<2.0	4.2	11.0	4.4
OC122-64-05	W-220593	.26	36.0	<.02	5.3	<1.0	.47	—	420	<2.0	5.0	14.0	5.8
OC122-64-06	W-220594	.29	57.0	<.02	5.5	<1.0	.54	—	790	<2.0	5.9	17.0	6.6
OC122-64-10	W-220595	.19	22.0	.03	5.5	<1.0	.49	—	200	<2.0	4.3	15.0	4.4
OC122-64-20	W-220596	.22	41.0	<.02	4.5	<1.0	.62	—	400	<2.0	3.4	19.0	4.4
Station 5-1 fine fraction													
OC122-64X0-1	W-222018	3.34	7030.5	.51	59.6	17.9	2.62	.06	2026	32.2	51.2	71.5	143.0
OC122-64X1-2	W-222019	3.92	3528.8	.20	65.3	28.8	3.27	.06	1830	32.7	35.3	70.6	95.4
OC122-64X2-3	W-222020	4.15	1070.9	.19	62.9	24.1	3.48	.07	1606	34.8	34.8	75.0	81.7
OC122-64X3-4	W-222021	3.95	844.2	.18	59.9	24.5	3.27	.04	2315	40.8	44.9	83.1	83.1
OC122-64X4-5	W-222022	4.26	727.1	.21	60.2	23.8	3.51	.05	3134	50.1	60.2	86.5	116.6
OC122-64X9-10	W-222023	3.13	434.5	.17	36.5	29.5	3.65	.09	7646	64.3	73.0	93.8	93.8
Station 5-4													
OC122-62-01	W-220573	.31	70.0	<.02	7.0	<1.0	.40	—	200	<2.0	4.8	9.5	5.8
OC122-62-02	W-220574	.24	47.0	<.02	6.0	<1.0	.35	—	180	<2.0	4.5	9.5	4.4
OC122-62-03	W-220575	.22	42.0	.07	6.5	<1.0	.35	—	140	<2.0	4.0	10.0	5.0
OC122-62-04	W-220576	.22	38.0	.05	6.0	1.9	.41	—	260	<2.0	4.8	13.0	4.4
OC122-62-05	W-220577	.21	30.0	.32	5.5	<1.0	.35	—	150	<2.0	3.3	9.5	5.0
OC122-62-06	W-220578	.21	31.0	<.02	6.0	<1.0	.37	—	190	<2.0	3.8	10.0	5.8
OC122-62-10	W-220579	.25	31.0	<.02	7.0	<1.0	.40	—	130	<2.0	4.8	10.0	5.0
OC122-62-15	W-220580	.20	25.0	.07	6.5	<1.0	.40	—	120	<2.0	5.5	9.5	4.4
Station 5-10													
OC122-63-01	W-220581	.35	55.0	.03	7.3	<1.0	.43	—	280	<2.0	6.5	12.0	6.6
OC122-63-02	W-220582	.25	39.0	<.02	7.0	<1.0	.39	—	290	<2.0	5.3	11.0	4.4
OC122-63-03	W-220583	.24	35.0	<.02	7.0	<1.0	.43	—	280	<2.0	5.5	13.0	4.4
OC122-63-04	W-220584	.22	31.0	<.02	8.0	<1.0	.40	—	210	<2.0	5.1	13.0	4.4
OC122-63-05	W-220585	.23	32.0	<.02	7.3	<1.0	.38	—	180	<2.0	5.3	12.0	4.4
OC122-63-06	W-220586	.24	30.0	<.02	7.8	<1.0	.40	—	160	<2.0	5.9	12.0	5.0
OC122-63-10	W-220587	.25	31.0	<.02	7.5	<1.0	.42	—	56	<2.0	4.6	13.0	5.0
OC122-63-14	W-220588	.26	32.0	<.02	7.5	<1.0	.40	—	46	<2.0	2.9	11.0	5.0
Station 5-18													
OC122-37-01	W-220565	.30	53.0	<.02	2.3	<1.0	.16	—	120	<2.0	3.1	<2.0	6.6
OC122-37-02	W-220566	.31	54.0	<.02	2.3	<1.0	.16	—	80	<2.0	3.4	<2.0	5.8
OC122-37-03	W-220567	.30	61.0	.05	2.3	<1.0	.16	—	53	<2.0	3.3	<2.0	5.8
OC122-37-04	W-220568	.31	59.0	.08	2.8	<1.0	.16	—	30	<2.0	3.3	<2.0	6.6
OC122-37-05	W-220569	.32	40.0	<.02	3.0	<1.0	.16	—	33	<2.0	3.0	<2.0	<2.0
OC122-37-06	W-220570	.33	37.0	.17	2.5	<1.0	.17	—	33	<2.0	3.1	<2.0	4.4
OC122-37-10	W-220571	.44	40.0	.05	7.0	<1.0	.27	—	132	<2.0	3.5	2.5	6.6
OC122-37-22	W-220572	.32	38.0	.03	2.5	<1.0	.12	—	47	<2.0	1.8	<2.0	4.4

Table 5. - Chemical analysis of core samples and grab samples subsectioned in sequential depth intervals. Depth interval, in cm, is given at end of field number - (continued)

Field no.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
Station 16													
OC122-36-B-01	W-220557	0.38	210.0	<0.02	3.3	1.7	0.23	—	150	<2.0	5.5	2.5	12.0
OC122-36-B-02	W-220558	.29	110.0	.03	<2.0	<1.0	.14	—	75	<2.0	4.2	<2.0	4.4
OC122-36-B-03	W-220559	.27	59.0	.05	<2.0	<1.0	.13	—	16	<2.0	3.4	<2.0	4.4
OC122-36-B-04	W-220560	.27	33.0	<.02	<2.0	<1.0	.11	—	<10	<2.0	3.1	<2.0	3.7
OC122-36-B-05	W-220561	.27	36.0	.03	<2.0	<1.0	.12	—	21	<2.0	3.5	<2.0	4.4
OC122-36-B-06	W-220562	.27	31.0	.04	<2.0	<1.0	.12	—	26	<2.0	3.0	<2.0	3.7
OC122-36-B-10	W-220563	.34	36.0	<.02	3.3	<1.0	.20	—	130	<2.0	2.7	<2.0	5.8
OC122-36-B-22	W-220564	.32	29.0	.05	<2.0	<1.0	.13	—	24	<2.0	2.1	<2.0	4.4
Near station 7A													
OC130-2X0-2	W-222029	4.32	251.9	.19	67.2	22.8	2.40	.06	312	42.0	43.2	92.3	73.2
OC130-2X2-4	W-222030	4.66	251.9	.23	73.0	26.4	2.52	.07	327	44.1	36.5	95.7	76.8
OC130-2X4-6	W-222031	4.76	237.9	.31	72.5	27.2	2.38	.05	317	45.3	45.3	98.6	78.2
OC130-2X6-10	W-222032	5.05	234.8	.27	79.8	28.2	2.58	.07	305	50.5	48.1	108.	83.3
OC130-2X10-13	W-222033	4.69	218.1	.20	68.7	27.3	2.51	.04	316	46.9	38.2	103.	79.6
6 km north of station 5-1													
OC130-3AX2-10	W-222034	3.34	414.1	.21	52.6	22.3	3.19	.19	3663	38.2	51.0	92.4	79.6
OC130-3A2-10	W-222024	.26	94.7	.04	14.1	1.3	.29	.01	141	<2.0	3.8	7.0	4.2
OC130-3BLX0-2	W-222037	2.80	381.7	.24	40.7	20.4	2.52	.10	2799	35.6	6.9	63.6	71.3
OC130-3BX2-10	W-222035	2.21	294.5	.29	34.4	20.4	2.18	.11	3191	29.5	44.2	61.4	66.3
OC130-3B2-10	W-222025	.22	66.5	<.02	3.5	1.2	.24	.01	99	<2.0	3.3	5.0	4.2
OC130-3CX2-10	W-222036	2.86	450.2	.39	43.0	24.6	3.07	.15	6548	53.2	26.6	98.2	85.9
OC130-3C2-10	W-222026	.24	54.3	<.02	<2.0	1.2	.29	.01	191	<2.0	4.0	7.5	4.2
6 km south of station 5-1													
OC130-4A2-10	W-222027	.81	130.7	<.02	12.1	2.1	.53	.01	96	<2.0	7.2	12.1	10.1
OC130-4AX2-10	W-222038	4.29	650.4	.29	65.0	27.3	3.25	.12	442	42.9	82.0	117.	91.1
OC130-4B2-10	W-222028	.62	89.5	<.02	11.1	1.6	.42	.01	78	<2.0	8.1	10.1	7.5
OC130-4BLX0-2	W-222040	3.91	916.9	.19	55.3	24.3	2.97	.07	405	35.1	33.7	97.1	75.5
OC130-4BX2-10	W-222039	4.25	595.3	.33	62.4	28.3	3.26	.16	397	38.3	83.6	112.	89.3
45 km southwest of station 5-1													
M09-19-00-GX0	W-222041	4.95	288.8	.10	79.8	22.0	3.16	.07	509	35.8	28.9	99.0	77.0
M09-19-00-GX2	W-222042	5.02	244.6	.16	82.0	23.2	3.06	.07	391	39.1	44.0	103.	80.7
M09-19-00-GX4	W-222043	4.96	230.9	.20	73.9	25.4	3.00	.06	369	38.1	50.8	106.	84.3
M09-19-00-GX6	W-222044	5.04	234.3	.21	76.1	26.9	3.16	.06	363	38.7	38.7	117.	91.4
M09-19-00-GX8	W-222045	5.03	233.8	.20	80.7	25.7	3.16	.07	397	42.1	36.2	101.	87.7
45 km southwest of station 5-1													
M09-19-00-HX0	W-222046	4.54	274.7	.12	75.2	21.5	2.87	.07	454	33.4	39.4	96.7	72.8
M09-19-00-HX2	W-222047	4.72	236.0	.16	70.8	24.7	2.92	.06	416	37.1	30.3	106.	79.8
M09-19-00-HX4	W-222048	4.84	230.4	.25	70.3	25.3	3.00	.06	415	36.9	33.4	103.	80.6
M09-19-00-HX6	W-222049	4.75	220.2	.31	77.7	24.3	3.13	.05	440	38.3	44.0	109.	81.1

Table 5. - Chemical analysis of core samples and grab samples subsectioned in sequential depth intervals. Depth interval, in cm, is given at end of field number - (continued)

Field no.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
20 km southwest of station 5-1													
M09-20-00-IX0	W-222050	3.72	402.3	0.22	59.6	19.4	2.83	0.07	477	32.8	65.6	89.4	74.5
M09-20-00-IX2	W-222051	4.06	420.0	.23	65.0	23.0	2.98	.07	379	29.8	44.7	107.	82.7
M09-20-00-IX4	W-222052	4.23	372.0	.28	66.7	25.7	3.08	.06	346	34.6	53.9	114.	89.8
M09-20-00-IX6	W-222053	4.38	339.3	.20	63.6	25.4	3.11	.08	353	39.6	35.3	110.	86.2
10 km southwest of station 5-1													
M09-21-00-IX0	W-222054	4.03	552.8	.19	61.3	26.9	2.99	.09	433	32.9	34.4	108.	79.2
M09-21-00-IX2	W-222055	4.27	373.9	.23	62.8	28.0	3.07	.07	320	40.1	60.1	111.	86.8
M09-21-00-IX4	W-222056	3.99	384.7	.19	59.8	25.6	2.99	.07	313	41.3	52.7	107.	78.4
M09-21-00-IX6	W-222057	4.44	287.5	.22	65.3	26.1	3.14	.07	288	40.5	56.2	106.	85.0

Appendix table 4A. - Chemical analyses of station blends and individual samples. (Values accurate to two significant figures)

Field No.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M01-05-07-BL	W-219687	0.23	29	<0.02	3.5	<1.0	0.33	—	190	<2.0	5.5	7.0	5.4
M01-05-13-BL	W-219688	.27	41	<.02	5.5	<1.0	.34	—	280	<2.0	6.0	11.0	4.2
M01-05-15-BL	W-219689	.22	28	<.02	2.3	<1.0	.22	—	140	<2.0	4.2	6.0	4.2
M01-05-17-BL	W-219690	.31	35	<.02	8.5	<1.0	.46	—	230	<2.0	8.3	13.0	7.1
M01-05-19-BL	W-219691	.24	35	<.02	7.5	<1.0	.39	—	210	<2.0	7.3	12.0	4.6
M01-05-21-BL	W-219692	.20	26	<.02	3.5	<1.0	.27	—	220	<2.0	4.2	7.0	4.2
M01-05-23-BL	W-219693	.25	35	<.02	3.5	<1.0	.28	—	180	<2.0	5.5	7.0	4.2
M01-05-24-BL	W-219694	.32	45	<.02	6.0	<1.0	.32	—	110	<2.0	6.0	6.0	10.0
M01-05-26-BL	W-219695	.32	40	<.02	7.5	<1.0	.41	—	270	<2.0	8.5	9.2	7.1
M01-05-27-BL	W-219696	.21	33	.04	5.5	<1.0	.35	—	240	<2.0	6.0	12.0	4.2
M05-01-00-BL	W-219026	.79	130	<.02	5.5	1.8	.38	—	70	3.5	2.1	9.0	7.5
M05-02-00-BL	W-219030	.26	38	<.02	2.5	1.2	.10	—	81	<2.0	1.2	6.5	4.6
M05-02-00-G	W-219027	.30	43	<.02	2.2	<1.0	.13	—	100	5.5	2.1	7.5	5.0
M05-02-00-H	W-219028	.26	38	<.02	1.9	<1.0	.11	—	100	<2.0	1.9	7.5	4.6
M05-02-00-I	W-219029	.25	37	<.02	2.3	1.1	.08	—	46	<2.0	<1.0	6.5	5.4
M05-03-00-BL	W-219031	.65	84	<.02	7.0	1.7	.35	—	140	2.4	7.7	14.0	10.0
M05-04-00-BL	W-219035	1.10	190	.17	13.0	1.7	.54	—	110	3.6	5.0	18.0	10.0
M05-04-00-G	W-219032	1.10	180	.14	15.0	1.5	.59	—	140	3.4	4.8	21.0	12.0
M05-04-00-H	W-219033	1.00	190	.15	11.0	1.9	.49	—	70	3.1	4.6	14.0	10.0
M05-04-00-I	W-219034	.96	180	.15	11.0	1.4	.51	—	99	3.3	5.4	21.0	10.0
M05-05-01-BL	W-218995	.27	120	<.02	7.0	<1.0	.43	—	320	2.7	2.7	13.0	4.7
M05-05-01-G	W-218992	.27	120	<.02	7.0	<1.0	.43	—	260	2.6	2.9	14.0	5.3
M05-05-01-H	W-218993	.24	75	<.02	6.0	1.1	.46	—	270	2.1	3.3	13.0	4.2
M05-05-01-I	W-218994	.30	200	<.02	6.0	1.1	.41	—	380	3.0	2.1	14.0	5.2
M05-05-02-BL	W-218996	.25	120	.04	6.0	<1.0	.44	—	390	3.4	4.7	14.0	4.9
M05-05-03-BL	W-218997	.24	73	.03	5.0	<1.0	.35	—	200	<2.0	2.5	12.0	3.7
M05-05-04-BL	W-218998	.24	72	.04	6.0	<1.0	.40	—	250	2.4	2.5	14.0	4.9
M05-05-05-BL	W-218999	.23	61	.03	6.0	<1.0	.37	—	240	2.4	2.1	13.0	4.9
M05-05-06-BL	W-219000	.24	55	.03	5.5	<1.0	.40	—	280	2.8	2.9	13.0	3.7
M05-05-07-BL	W-219001	.23	66	.04	6.0	<1.0	.38	—	210	2.2	3.5	13.0	3.9
M05-05-08-BL	W-219002	.26	84	<.02	6.0	<1.0	.37	—	220	<2.0	2.9	12.0	4.4
M05-05-09-BL	W-219003	.29	74	.05	6.0	<1.0	.42	—	250	3.1	4.2	13.0	5.6
M05-05-10-BL	W-219004	.25	52	.08	7.0	<1.0	.41	—	240	<2.0	5.0	16.0	6.3
M05-05-11-BL	W-219005	.23	47	.06	6.5	<1.0	.39	—	230	2.2	3.7	14.0	4.2
M05-05-12-BL	W-219006	.31	89	.08	6.5	<1.0	.39	—	270	2.5	3.6	15.0	5.2
M05-05-13-BL	W-219007	.26	70	.05	5.0	<1.0	.31	—	310	3.4	4.2	11.0	3.7
M05-05-14-BL	W-219008	.21	45	.09	6.0	<1.0	.41	—	390	4.0	3.5	15.0	4.7
M05-05-15-BL	W-219009	.25	46	.06	5.8	<1.0	.30	—	190	2.1	2.9	8.0	4.2
M05-05-16-BL	W-219010	.30	65	<.02	6.0	<1.0	.36	—	190	<2.0	4.2	13.0	5.3
M05-05-17-BL	W-219011	.29	58	<.02	6.5	<1.0	.47	—	290	2.6	2.3	20.0	5.2
M05-05-18-BL	W-219012	.27	58	<.02	9.0	1.3	.46	—	240	<2.0	4.2	16.0	4.9
M05-05-19-BL	W-219013	.27	57	.10	8.0	<1.0	.47	—	260	2.7	5.3	20.0	6.8
M05-05-20-BL	W-219014	.19	39	.04	5.5	<1.0	.37	—	220	<2.0	2.9	16.0	3.9
M05-05-21-BL	W-219015	.22	47	<.02	5.0	<1.0	.33	—	300	2.8	1.5	15.0	4.4
M05-05-22-BL	W-219016	.21	37	<.02	3.0	<1.0	.36	—	270	2.9	3.1	14.0	3.7
M05-05-23-BL	W-219017	.27	49	<.02	5.0	<1.0	.35	—	210	<2.0	1.7	13.0	4.9
M05-05-24-BL	W-219018	.36	70	<.02	5.5	<1.0	.34	—	95	<2.0	2.9	12.0	6.8
M05-05-25-BL	W-219019	.30	56	.10	8.0	1.1	.43	—	200	<2.0	4.7	16.0	5.2
M05-05-26-BL	W-219020	.29	50	.06	8.0	1.1	.44	—	220	<2.0	2.5	14.0	5.3
M05-05-27-BL	W-219021	.22	46	.09	6.0	<1.0	.34	—	180	2.1	1.7	14.0	3.2
M05-05-28-BL	W-219022	.26	38	.10	3.0	<1.0	.28	—	200	<2.0	<1.0	10.0	3.7
M05-05-29-BL	W-219023	.95	140	.07	14.0	1.6	.84	—	170	3.9	1.1	25.0	12.0
M05-06-00-BL	W-219036	.88	140	.14	12.0	2.7	.49	—	120	4.3	5.2	20.0	12.0
M05-07A00-BL	W-219037	2.70	260	.09	34.0	7.6	1.50	—	200	13.0	12.0	47.0	30.0
M05-08-00-BL	W-219038	.47	49	<.02	9.3	<1.0	.62	—	110	3.1	3.1	15.0	11.0
M05-09-00-BL	W-219039	.94	110	.07	16.0	2.6	.63	—	190	4.4	8.3	20.0	14.0
M05-10-00-BL	W-219040	1.00	100	.12	15.0	1.7	.64	—	360	3.1	5.4	24.0	13.0
M05-11-00-BL	W-219041	1.20	230	.10	19.0	2.4	.85	—	120	4.0	6.2	36.0	15.0

Appendix table 4A. - Chemical analyses of station blends and individual samples - (continued)
(Values are accurate to two significant figures)

Field No.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M05-12-00-BL	W-219042	0.72	66	0.10	11.0	2.1	0.67	—	140	4.2	8.3	17.0	14.0
M05-13A00-BL	W-219047	5.10	290	.17	55.0	12.0	2.60	—	280	31.0	19.0	89.0	59.0
M05-13-00-BL	W-219043	3.60	260	.15	42.0	7.3	1.80	—	260	19.0	13.0	61.0	40.0
M05-13A00-G	W-219044	4.70	280	.13	65.0	11.0	2.50	—	260	30.0	17.0	84.0	58.0
M05-13A00-H	W-219045	4.40	270	.17	55.0	11.0	2.40	—	260	30.0	15.0	87.0	56.0
M05-13A00-I	W-219046	5.10	290	.15	55.0	12.0	2.60	—	280	31.0	18.0	89.0	60.0
M05-14A00-BL	W-219048	5.20	310	.09	70.0	18.0	2.90	—	370	39.0	17.0	98.0	71.0
M05-15-00-BL	W-219049	.78	88	.09	7.8	1.3	.40	—	160	2.5	4.2	14.0	6.2
M05-16-00-BL	W-219888	.30	110	<.02	4.5	1.4	.18	—	120	<2.0	4.6	3.9	6.6
M05-16-00-G	W-219885	.36	120	<.02	4.5	1.3	.20	—	77	<2.0	6.2	5.0	8.3
M05-16-00-H	W-219886	.30	150	<.02	4.0	<1.0	.15	—	100	<2.0	5.8	3.7	6.2
M05-16-00-I	W-219887	.30	140	<.02	5.5	<1.0	.19	—	180	<2.0	4.6	4.3	6.2
M05-17-00-BL	W-219054	.29	27	<.02	9.5	<1.0	.17	—	130	<2.0	3.3	6.0	5.4
M05-18-00-BL	W-219055	.34	54	.03	12.0	<1.0	.19	—	93	<2.0	2.9	5.5	7.0
M06-01-00-BL	W-219653	.79	120	<.02	5.0	1.7	.41	—	93	<2.0	5.3	7.0	7.8
M06-02-00-BL	W-219654	.25	35	<.02	<2.0	1.2	.11	—	60	<2.0	3.4	3.5	4.8
M06-02-00-G	W-219655	.27	39	<.02	<2.0	<1.0	.11	—	54	<2.0	2.7	3.5	3.6
M06-02-00-H	W-219656	.29	39	<.02	<2.0	1.2	.17	—	110	<2.0	3.2	4.5	5.4
M06-02-00-I	W-219657	.23	34	<.02	<2.0	1.5	.09	—	51	<2.0	2.7	3.5	3.9
M06-03-00-BL	W-219658	.73	92	<.02	12.0	1.9	.39	—	170	<2.0	12.0	12.0	9.9
M06-04-00-BL	W-219659	1.20	190	.05	9.0	2.2	.54	—	100	<2.0	6.6	15.0	9.6
M06-04-00-G	W-219660	1.20	190	.05	9.0	1.9	.56	—	100	<2.0	9.4	15.0	11.0
M06-04-00-H	W-219661	1.20	190	<.02	14.0	1.9	.64	—	140	<2.0	9.7	17.0	13.0
M06-04-00-I	W-219662	1.20	190	.08	9.0	2.9	.54	—	94	<2.0	6.2	15.0	11.0
M06-05-01-BL	W-219697	.29	85	<.02	6.3	<1.0	.41	—	260	<2.0	7.4	10.0	6.8
M06-05-01-G	W-219698	.25	57	<.02	5.0	<1.0	.35	—	260	<2.0	7.6	9.7	4.6
M06-05-01-H	W-219699	.22	50	<.02	6.5	<1.0	.44	—	210	<2.0	6.6	13.0	6.2
M06-05-01-I	W-219700	.36	81	<.02	6.8	<1.0	.49	—	260	<2.0	8.0	12.0	16.0
M06-05-02-BL	W-219701	.29	59	<.02	5.5	<1.0	.52	—	430	<2.0	7.3	13.0	6.6
M06-05-03-BL	W-219702	.31	65	.03	7.5	<1.0	.43	—	260	<2.0	7.3	9.2	7.1
M06-05-04-BL	W-219703	.21	35	<.02	5.0	<1.0	.39	—	220	<2.0	5.7	9.7	4.6
M06-05-05-BL	W-219704	.23	44	.04	7.0	<1.0	.40	—	250	<2.0	7.3	9.7	5.4
M06-05-06-BL	W-219705	.21	35	<.02	4.0	<1.0	.41	—	280	<2.0	5.3	11.0	4.6
M06-05-08-BL	W-219706	.30	67	.05	4.8	<1.0	.38	—	210	<2.0	6.6	11.0	5.4
M06-05-09-BL	W-219707	.32	63	.05	7.8	<1.0	.48	—	250	<2.0	10.0	12.0	7.1
M06-05-10-BL	W-219708	.27	45	<.02	6.0	<1.0	.41	—	260	<2.0	8.5	9.2	4.6
M06-05-11-BL	W-219709	.26	42	.05	7.0	<1.0	.42	—	220	<2.0	7.1	9.2	5.4
M06-05-12-BL	W-219710	.23	41	<.02	7.0	<1.0	.36	—	170	<2.0	5.3	9.7	4.2
M06-05-14-BL	W-219711	.22	38	<.02	3.5	<1.0	.43	—	560	<2.0	8.0	12.0	4.6
M06-05-16-BL	W-219712	.32	44	.05	7.0	<1.0	.36	—	170	<2.0	6.1	9.7	5.8
M06-05-18-BL	W-219713	.31	47	.05	8.5	<1.0	.47	—	240	<2.0	7.3	14.0	5.8
M06-05-20-BL	W-219714	.23	38	<.02	5.5	<1.0	.32	—	220	<2.0	4.3	9.2	4.2
M06-05-22-BL	W-219715	.23	34	.04	3.5	<1.0	.39	—	270	<2.0	5.3	12.0	4.2
M06-05-25-BL	W-219716	.34	56	<.02	7.5	<1.0	.42	—	220	<2.0	8.3	12.0	5.8
M06-05-28-BL	W-219717	.25	33	<.02	4.5	<1.0	.31	—	250	<2.0	4.3	8.8	4.6
M06-05-29-BL	W-219718	.92	130	<.02	14.0	<1.0	.78	—	150	<2.0	15.0	22.0	7.1
M06-06-00-BL	W-219663	.93	150	<.02	14.0	3.6	.50	—	140	<2.0	9.4	17.0	12.0
M06-07A00-BL	W-219664	2.60	270	.07	35.0	6.8	1.30	—	210	12.0	16.0	45.0	30.0
M06-08-00-BL	W-219665	.50	54	<.02	10.0	4.6	.64	—	110	<2.0	5.4	13.0	11.0
M06-09-00-BL	W-219666	1.10	120	<.02	24.0	3.2	.67	—	200	<2.0	8.8	19.0	18.0
M06-10-00-BL	W-219667	1.10	120	<.02	6.5	2.2	.38	—	160	<2.0	7.7	12.0	7.5
M06-11-00-BL	W-219668	1.40	230	.04	17.0	3.6	.83	—	140	<2.0	12.0	24.0	14.0
M06-12-00-BL	W-219669	.61	70	<.02	12.0	2.9	.69	—	150	<2.0	11.0	15.0	13.0
M06-13-00-BL	W-219670	.83	270	.09	39.0	7.5	1.40	—	260	8.3	29.0	55.0	38.0
M06-13A00-BL	W-219671	1.80	290	.10	54.0	12.0	2.10	—	280	27.0	37.0	82.0	59.0
M06-13A00-G	W-219672	4.70	280	.12	56.0	12.0	2.40	—	270	26.0	36.0	80.0	58.0
M06-13A00-H	W-219673	4.60	290	.09	54.0	12.0	2.40	—	270	21.0	35.0	84.0	57.0

Appendix table 4A. – Chemical analyses of station blends and individual samples – (continued).

Field No.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M06-13A00-I	W-219674	5.10	300	0.09	58.0	13.0	2.50	—	280	24.0	37.0	82.0	61.0
M06-14A00-BL	W-219675	5.20	310	.13	64.0	15.0	2.90	—	370	31.0	33.0	97.0	62.0
M06-15-00-BL	W-219676	.73	86	<.02	2.5	1.2	.34	—	170	<2.0	4.8	13.0	6.0
M06-16-00-BL	W-219677	.28	170	.03	4.0	<1.0	.17	—	100	<2.0	8.5	4.3	8.3
M06-16-00-G	W-219678	.30	230	<.02	4.5	<1.0	.17	—	98	<2.0	8.3	3.9	9.1
M06-16-00-H	W-219679	.34	170	<.02	4.5	<1.0	.18	—	100	<2.0	5.8	4.6	8.3
M06-16-00-I	W-219680	.27	150	<.02	4.0	<1.0	.14	—	110	<2.0	6.8	4.1	7.9
M06-17-00-BL	W-219681	.28	43	.04	3.0	<1.0	.14	—	76	<2.0	3.6	3.7	4.2
M06-18-00-BL	W-219682	.31	66	.03	4.0	<1.0	.17	—	72	<2.0	4.0	3.4	5.6
M06-18-00-G	W-219919	.28	54	<.02	8.8	<1.0	.47	—	320	<2.0	6.3	14.0	6.4
M06-18-00-H	W-219920	.29	42	<.02	9.7	<1.0	.44	—	180	<2.0	6.3	14.0	7.2
M06-18-00-I	W-219921	.28	48	<.02	8.5	<1.0	.44	—	240	<2.0	4.9	13.0	6.0
M07-01-00-BL	W-219854	.78	110	<.02	4.5	<1.0	.45	—	110	<2.0	5.0	10.0	6.6
M07-02-00-BL	W-219855	.24	28	.04	<2.0	<1.0	.10	—	69	<2.0	2.7	<2.0	2.1
M07-02-00-G	W-219856	.26	28	.05	<2.0	<1.0	.10	—	70	<2.0	2.7	<2.0	2.1
M07-02-00-H	W-219857	.24	28	.03	<2.0	<1.0	.09	—	67	<2.0	3.1	<2.0	2.1
M07-02-00-I	W-219858	.21	21	.04	<2.0	<1.0	.09	—	59	<2.0	2.7	<2.0	2.1
M07-03-00-BL	W-219859	.72	85	.04	<2.0	1.2	.37	—	180	<2.0	9.1	8.0	7.9
M07-05-01-BL	W-219914	.32	120	<.02	6.9	<1.0	.42	—	330	<2.0	5.9	14.0	7.2
M07-05-01-G	W-219915	.37	150	<.02	7.4	<1.0	.44	—	400	<2.0	4.9	14.0	9.2
M07-05-01-H	W-219916	.29	88	<.02	8.8	<1.0	.42	—	310	<2.0	5.2	13.0	6.4
M07-05-01-I	W-219917	.24	60	<.02	6.0	<1.0	.36	—	250	<2.0	21.0	10.0	5.6
M07-05-28-BL	W-219922	.18	22	<.02	4.1	<1.0	.21	—	110	<2.0	2.2	5.8	3.6
M07-05-28-G	W-219923	.17	22	<.02	6.9	<1.0	.19	—	88	<2.0	2.2	5.0	2.8
M07-05-28-H	W-219924	.19	23	<.02	4.6	<1.0	.24	—	160	<2.0	2.6	6.5	2.8
M07-05-28-I	W-219925	.21	25	<.02	4.6	<1.0	.22	—	84	<2.0	3.2	7.3	4.0
M07-06-00-BL	W-219860	.93	130	.03	16.0	1.2	.53	—	140	<2.0	9.6	21.0	11.0
M07-07A00-BL	W-219861	2.60	250	.07	34.0	5.3	1.40	—	190	13.0	17.0	51.0	29.0
M07-07A00-G	W-219862	2.60	250	.07	32.0	5.5	1.40	—	180	12.0	16.0	51.0	29.0
M07-07A00-H	W-219863	2.70	250	.07	34.0	5.9	1.40	—	190	14.0	22.0	53.0	31.0
M07-07A00-I	W-219864	2.60	250	.06	31.0	4.8	1.30	—	190	10.0	19.0	47.0	27.0
M07-08-00-BL	W-219865	.49	41	<.02	3.5	<1.0	.63	—	100	<2.0	5.0	8.0	10.0
M07-10-00-BL	W-219866	.95	85	<.02	<2.0	<1.0	.35	—	160	<2.0	4.3	8.0	7.5
M07-13-00-BL	W-219867	3.50	250	.04	30.0	5.9	1.70	—	260	11.0	20.0	59.0	40.0
M07-13-00-G	W-219868	3.40	250	<.02	29.0	5.0	1.60	—	250	11.0	22.0	58.0	35.0
M07-13-00-H	W-219869	3.30	250	.03	38.0	5.6	1.60	—	240	11.0	23.0	54.0	35.0
M07-13-00-I	W-219870	3.70	260	.03	32.0	9.1	1.80	—	260	12.0	26.0	69.0	40.0
M07-14A00-BL	W-219871	4.60	290	.08	52.0	15.0	2.70	—	370	28.0	27.0	120.	66.0
M07-14A00-G	W-219872	4.60	300	.08	54.0	16.0	2.80	—	400	29.0	26.0	120.	68.0
M07-14A00-H	W-219873	5.00	300	.05	52.0	15.0	2.70	—	350	31.0	18.0	120.	69.0
M07-14A00-I	W-219874	4.90	300	<.02	52.0	13.0	2.70	—	350	28.0	23.0	110.	68.0
M07-15-00-BL	W-219875	.76	77	<.02	<2.0	<1.0	.35	—	160	<2.0	3.7	8.0	5.8
M07-16-00-BL	W-219876	.27	62	<.02	<2.0	<1.0	.15	—	84	<2.0	2.8	<2.0	3.7
M07-16-00-G	W-219877	.26	100	<.02	<2.0	<1.0	.11	—	84	<2.0	3.0	<2.0	2.9
M07-16-00-H	W-219878	.26	44	<.02	<2.0	<1.0	.11	—	59	<2.0	2.5	<2.0	2.5
M07-16-00-I	W-219879	.31	130	<.02	<2.0	<1.0	.21	—	150	<2.0	3.5	<2.0	6.2
M07-17-00-G	W-219881	.25	19	<.02	<2.0	<1.0	.11	—	73	<2.0	1.8	<2.0	2.5
M07-17-00-H	W-219882	.32	27	<.02	<2.0	<1.0	.17	—	70	<2.0	4.3	<2.0	3.7
M07-17-00-I	W-219883	.28	22	<.02	<2.0	<1.0	.12	—	44	<2.0	3.0	<2.0	3.3
M07-18-00-BL	W-219918	.30	51	<.02	9.2	1.2	.48	—	270	<2.0	6.3	14.0	8.0
M08-01-00-BL	W-220597	.82	120	<.02	4.0	<1.0	.37	—	56	<2.0	4.3	3.0	5.4
M08-02-00-BL	W-220601	.25	29	<.02	<2.0	<1.0	.11	—	71	<2.0	2.7	<2.0	2.9
M08-02-00-G	W-220598	.30	35	<.02	<2.0	<1.0	.13	—	95	<2.0	2.7	<2.0	2.9
M08-02-00-H	W-220599	.25	27	<.02	<2.0	<1.0	.11	—	83	<2.0	2.0	<2.0	2.5
M08-02-00-I	W-220600	.23	24	<.02	<2.0	<1.0	.08	—	43	<2.0	2.3	<2.0	2.1
M08-03-00-BL	W-220602	.71	81	<.02	4.5	1.7	.38	—	170	<2.0	11.0	7.5	8.3
M08-04-00-BL	W-220606	1.20	160	<.02	14.0	<1.0	.59	—	140	<2.0	7.6	9.5	9.5

Appendix table 4B. – Chemical analyses of fine fraction (less than 60 µm) from station blends and individual samples.

[Values are accurate to two significant figures].

Field no.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
H01-05-01-BLX	W-220287	3.53	258.5	0.22	47.0	23.5	3.53	—	8461	49.4	108.	75.2	98.7
H01-05-07-BLX	W-220249	2.77	162.4	.04	45.5	21.8	2.77	—	5149	53.5	37.6	75.3	71.3
H01-05-13-BLX	W-220250	2.78	190.6	.28	42.8	16.5	3.43	—	10278	81.4	25.7	98.5	85.6
H01-05-15-BLX	W-220251	2.86	154.7	.05	26.2	18.3	2.62	—	4285	38.1	9.8	57.1	73.8
H01-05-17-BLX	W-220252	3.51	191.7	.26	52.7	17.6	3.19	—	3674	35.1	31.9	68.7	70.3
H01-05-19-BLX	W-220253	3.15	171.1	.06	47.2	18.9	3.34	—	5899	66.9	51.1	78.7	82.6
H01-05-21-BLX	W-220254	2.73	193.2	.32	25.0	19.8	2.96	—	8410	65.9	21.8	70.5	77.3
H01-05-23-BLX	W-220255	3.06	154.9	.48	36.3	18.7	2.87	—	3441	24.9	28.7	72.7	72.7
H01-05-24-BLX	W-220256	3.20	154.0	.06	61.0	25.3	2.91	—	2412	32.0	24.1	58.1	78.4
H01-05-26-BLX	W-220257	3.71	177.2	.05	48.3	17.7	3.22	—	3062	30.6	33.8	75.7	70.9
H01-05-27-BLX	W-220258	3.12	206.5	.34	33.6	28.8	3.36	—	8645	57.6	40.8	98.5	96.1
H01-05-29-BLX	W-220288	3.63	188.3	.04	55.1	13.5	3.23	—	740	28.2	29.6	60.5	74.0
H05-02-00-BLX	W-220842	1.72	102.4	.35	21.5	13.7	1.43	—	2236	24.2	21.5	56.6	53.9
H05-03-00-BLX	W-220843	3.65	189.6	.19	43.8	24.8	2.63	—	627	24.8	51.0	84.6	77.3
H05-05-01-BLX	W-220289	4.19	7258.4	.09	65.7	10.2	3.28	—	5106	38.3	58.4	69.3	102.1
H05-05-02-BLX	W-220290	3.41	6242.1	.09	53.6	15.3	3.09	—	4389	42.3	68.3	61.8	97.5
H05-05-03-BLX	W-220291	3.33	3129.6	.10	68.3	11.8	2.83	—	2497	30.0	31.6	63.3	73.2
H05-05-04-BLX	W-220292	3.24	2678.0	.08	121.1	10.6	2.90	—	3411	63.1	29.0	49.5	95.5
H05-05-05-BLX	W-220293	3.20	3495.8	.11	47.0	14.5	3.01	—	5262	30.1	39.5	52.6	120.3
H05-05-06-BLX	W-220294	3.42	2250.0	.11	57.6	19.8	2.88	—	2700	28.8	70.2	59.4	86.4
H05-05-07-BLX	W-220259	4.73	6652.5	.06	78.9	25.8	4.21	—	4470	34.2	42.1	105.	94.7
H05-05-08-BLX	W-220295	3.43	3368.4	.09	50.7	13.6	2.78	—	2453	29.4	27.8	47.4	78.5
H05-05-09-BLX	W-220296	3.33	1622.7	.10	53.0	14.3	3.05	—	2410	33.7	32.1	56.2	80.3
H05-05-10-BLX	W-220297	3.32	1935.9	.09	57.1	12.7	2.95	—	2947	27.6	27.6	53.4	84.7
H05-05-11-BLX	W-220298	3.28	1896.7	.09	52.9	17.5	2.74	—	2553	29.2	69.3	51.1	80.2
H05-05-12-BLX	W-220299	3.68	3057.6	.31	53.4	14.9	3.13	—	3315	33.2	38.7	55.3	88.4
H05-05-13-BLX	W-220260	4.65	4720.5	.66	259.3	26.9	4.65	—	9973	49.9	53.2	113.	126.3
H05-05-14-BLX	W-220300	3.25	1495.4	.08	49.6	12.8	2.91	—	3593	32.5	32.5	41.1	73.3
H05-05-15-BLX	W-220261	4.44	1792.5	.24	53.2	24.4	3.77	—	2662	28.8	28.8	88.7	95.4
H05-05-16-BLX	W-220301	3.39	1286.8	.14	53.1	10.5	2.95	—	2211	31.0	39.8	51.6	79.6
H05-05-17-BLX	W-220262	3.61	1640.0	.07	54.1	14.3	3.44	—	4756	29.5	41.0	91.8	82.0
H05-05-18-BLX	W-220302	3.29	1638.8	.08	50.2	10.0	2.95	—	2772	26.0	31.2	57.2	67.6
H05-05-19-BLX	W-220263	4.08	2446.4	.20	114.2	24.5	3.87	—	4893	34.7	59.1	91.7	104.0
H05-05-20-BLX	W-220303	3.78	1930.8	.15	47.2	12.0	3.30	—	5901	42.5	40.1	66.1	87.3
H05-05-21-BLX	W-220264	5.16	3153.2	.07	61.3	38.7	4.52	—	4841	42.0	48.4	83.9	113.0
H05-05-22-BLX	W-220304	3.18	956.1	.13	52.4	13.2	2.86	—	3335	33.4	54.0	52.4	88.9
H05-05-23-BLX	W-220265	3.88	1250.0	.23	54.7	26.5	3.53	—	3178	49.4	61.8	83.0	84.7
H05-05-24-BLX	W-220266	3.96	3170.9	.06	51.0	22.9	3.68	—	2033	12.5	34.0	73.6	87.8
H05-05-25-BLX	W-220305	3.44	1080.4	.55	79.9	17.2	3.13	—	3445	28.2	108.	65.8	87.7
H05-05-26-BLX	W-220267	4.20	1255.6	.16	54.2	28.0	3.85	—	5072	36.7	71.7	115.	101.4
H05-05-27-BLX	W-220268	4.51	3967.1	.08	60.5	32.9	4.16	—	6045	49.1	71.8	98.2	120.9
H05-05-28-BLX	W-220306	3.15	598.4	.10	48.8	13.4	2.68	—	2047	29.9	34.6	52.0	81.9
H05-05-29-BLX	W-220307	3.72	333.5	.12	64.1	10.6	3.34	—	449	26.9	28.2	80.8	88.5
H05-08-00-BLX	W-220844	3.55	262.5	.10	50.9	18.5	2.62	—	849	29.3	29.3	86.5	71.0
H05-09-00-BLX	W-220845	3.89	228.1	.11	67.1	14.8	2.82	—	590	24.2	18.8	96.6	64.4
H05-12-00-BLX	W-220846	4.44	255.6	.12	65.9	21.5	3.23	—	484	32.3	41.7	108.	80.7
H05-13-00-BLX	W-220847	5.40	308.4	.09	66.1	14.3	2.97	—	419	29.7	24.2	99.1	72.7
H05-13A00-BLX	W-220848	5.71	331.3	.03	64.0	11.4	2.97	—	388	26.3	21.7	93.7	68.5
H05-14A00-BLX	W-220849	5.78	342.3	.04	68.5	19.3	3.32	—	481	37.4	26.7	105.	81.3
H05-16-00-BLX	W-220850	3.90	8079.0	.14	55.3	29.3	2.76	—	1788	32.5	50.4	74.8	143.0
H05-16-00-GX	W-220269	4.05	5309.2	.13	51.4	21.8	2.49	—	825	26.5	46.7	59.2	186.8
H05-16-00-HX	W-220270	3.56	10951.	.24	47.5	29.7	2.38	—	1327	25.7	79.2	69.3	156.4
H05-16-00-IX	W-220271	3.73	7530.1	.34	45.0	23.3	2.48	—	2018	26.4	37.3	52.8	138.2

Appendix table 4B. - Chemical analyses of fine fraction (less than 60 µm) from station blends and individual samples - (continued)
[Values are accurate to two significant figures]

Field no.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M05-17-00-BLX	W-220851	3.16	632.6	0.15	38.0	31.6	2.32	—	1413	27.4	35.8	59.0	69.6
M05-17-00-GX	W-220272	3.36	746.7	.12	33.6	20.5	2.43	—	1456	24.3	24.3	44.8	78.4
M05-17-00-HX	W-220273	4.69	993.8	.28	44.2	33.1	3.04	—	1546	35.9	52.5	49.7	104.9
M05-17-00-IX	W-220274	2.45	515.5	.05	13.7	19.4	1.74	—	908	10.8	17.4	27.0	78.5
M05-18-00-BLX	W-220852	3.49	1719.6	.35	42.7	31.0	2.33	—	1241	29.1	40.7	67.9	87.2
M05-18-00-GX	W-220308	3.62	2100.4	.11	44.8	9.1	2.24	—	723	27.5	29.3	36.2	89.5
M05-18-00-HX	W-220309	3.15	2095.3	.04	38.9	8.9	2.23	—	1539	24.1	31.5	35.2	77.9
M05-18-00-IX	W-220310	2.71	1642.8	.75	41.7	9.6	1.79	—	563	22.9	15.6	15.6	68.8
M06-02-00-BLX	W-220853	2.13	119.7	<.07	23.3	28.6	1.63	—	1662	19.9	16.6	53.2	56.5
M06-03-00-BLX	W-220854	3.66	196.9	.21	43.6	26.7	2.67	—	647	33.8	43.6	78.8	74.6
M06-05-01-BLX	W-220894	3.89	3287.9	.25	60.3	21.4	3.11	—	2335	31.1	25.3	85.6	73.9
M06-05-02-BLX	W-220895	3.58	1512.5	.28	58.5	20.7	3.21	—	4715	43.4	35.8	113.	94.3
M06-05-04-BLX	W-220896	2.99	989.6	.41	48.3	20.7	2.53	—	3222	32.2	32.2	75.9	73.6
M06-05-06-BLX	W-220897	3.05	738.0	.28	50.9	20.6	2.80	—	4581	40.7	61.1	84.0	81.4
M06-05-10-BLX	W-220898	3.75	1154.4	.13	67.1	23.7	3.35	—	4539	45.4	49.3	118.	84.9
M06-05-14-BLX	W-220899	3.30	858.3	.19	52.8	22.0	3.30	—	8583	66.0	52.8	101.	83.6
M06-05-16-BLX	W-220900	3.49	888.1	.17	53.9	22.5	3.11	—	3108	31.7	73.0	88.8	79.3
M06-05-18-BLX	W-220901	4.40	898.6	.18	70.7	22.9	3.82	—	3441	53.5	51.6	126.	101.3
M06-05-20-BLX	W-220902	2.41	901.	.36	57.7	22.7	2.95	—	11200	68.5	82.9	101.	82.9
M06-05-22-BLX	W-220903	5.83	806.7	.09	85.2	40.3	5.38	—	7171	76.2	71.7	157.	138.9
M06-05-25-BLX	W-220904	2.77	836.7	.23	55.4	16.5	2.95	—	2252	34.6	46.8	100.	64.1
M06-05-28-BLX	W-220905	2.51	855.9	.05	38.8	17.3	2.51	—	4337	59.3	38.8	73.0	57.1
M06-05-29-BLX	W-220906	3.08	537.4	.06	64.4	21.0	3.22	—	280	32.2	36.4	102.	64.4
M06-08-00-BLX	W-220855	4.00	311.2	.13	54.8	22.2	2.96	—	874	34.1	38.5	77.1	75.6
M06-09-00-BLX	W-220856	4.69	312.6	.16	85.3	18.5	3.13	—	611	31.3	32.7	105.	79.6
M06-12-00-BLX	W-220857	4.45	287.2	.07	61.7	21.5	3.30	—	560	33.0	30.2	96.2	83.3
M06-13A00-BLX	W-220859	4.16	309.6	<.02	58.7	10.7	2.56	—	331	26.7	24.6	93.9	64.1
M06-13-00-BLX	W-220858	5.06	296.8	.04	66.0	14.3	2.86	—	429	25.3	29.7	103.	71.5
M06-14A00-BLX	W-220860	5.25	366.2	.03	76.9	18.3	3.30	—	513	39.1	30.5	110.	86.7
M06-16-00-BLX	W-220861	3.29	7343.5	.12	50.1	21.9	2.35	—	1722	36.0	48.5	67.3	144.1
M06-16-00-GX	W-220275	3.78	11636.	.04	49.8	24.0	2.75	—	1407	30.9	39.5	49.8	137.3
M06-16-00-HX	W-220276	3.99	6884.8	.29	43.5	19.9	2.54	—	1667	23.6	39.9	47.1	253.6
M06-16-00-IX	W-220277	3.06	10286.	.13	38.2	26.8	2.29	—	1682	24.9	30.6	40.2	147.2
M06-17-00-BLX	W-220862	3.39	716.6	.08	41.5	20.7	2.26	—	943	35.8	47.1	64.1	81.1
M06-17-00-GX	W-220278	3.79	658.2	.06	37.9	25.9	2.59	—	878	25.9	63.8	45.9	95.7
M06-17-00-HX	W-220279	3.51	613.8	.22	30.7	21.5	2.41	—	877	17.8	26.3	50.4	83.3
M06-17-00-IX	W-220280	3.78	432.0	.04	37.8	21.6	2.70	—	702	27.0	30.6	46.8	93.6
M06-18-00-BLX	W-220863	2.86	1622.1	.08	39.3	21.5	2.15	—	966	30.4	19.7	53.7	76.9
M06-18-00-GX	W-220311	3.13	1670.6	.09	42.4	8.1	2.03	—	903	35.0	27.6	35.0	84.7
M06-18-00-HX	W-220312	2.99	1685.0	.60	42.7	9.8	2.35	—	1152	23.5	23.5	38.4	70.4
M06-18-00-IX	W-220313	3.63	2540.7	.25	47.8	7.6	2.47	—	1287	34.6	33.0	36.3	85.8
M07-02-00-BLX	W-220864	1.32	255.0	<.06	15.0	9.9	1.08	—	2130	18.0	19.8	39.0	45.0
M07-03-00-BLX	W-220865	3.80	292.5	.12	49.7	26.3	2.92	—	1243	38.0	65.8	87.7	84.8
M07-05-01-BLX	W-220866	3.34	7884.7	.10	55.1	16.9	2.75	—	5112	37.4	31.5	78.7	78.7
M07-05-01-GX	W-220314	3.60	9333.1	.04	60.1	7.9	2.92	—	4977	30.9	29.2	51.5	82.4
M07-05-01-HX	W-220315	4.23	8307.5	.11	66.5	7.5	3.02	—	4436	38.3	28.2	56.5	84.7
M07-05-01-IX	W-220316	2.34	10429.	.11	30.7	7.5	2.26	—	7250	22.6	41.8	36.2	75.3
M07-05-18-BLX	W-220323	3.49	796.6	.28	48.1	14.8	2.99	—	3631	39.8	34.9	63.1	79.7
M07-05-18-GX	W-220317	3.65	1415.7	.04	51.4	21.6	2.99	—	3485	34.9	56.4	58.1	83.0
M07-05-18-HX	W-220318	3.56	778.1	.08	50.9	15.4	3.22	—	3221	40.7	35.6	69.5	91.5
M07-05-18-IX	W-220319	3.48	1324.7	.09	53.1	18.3	3.11	—	4025	38.4	45.7	73.2	87.8
M07-05-28-BLX	W-220324	2.17	212.0	<.09	<9.4	13.7	1.74	—	5653	32.5	10.8	<9.4	56.5
M07-05-28-GX	W-220320	1.16	164.0	<.07	<7.5	13.0	1.34	—	5591	37.3	8.6	<7.5	44.7

Appendix table 4C. - Chemical analyses of the following size fractions of bottom sediment: S0, undifferentiated; S1, >1,000 µm; S2, 1,000-5,000 µm; S3, 500-210 µm; S4, 210-105 µm; S5, 105-60 µm; S6, 60-30 µm; S7, 30-10 µm; S8, 10-1 µm; S9, <1 µm.

Field no.	Lab no.	Al (%)	Ba (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Hg (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	V (ppm)	Zn (ppm)
M04-02-00-S0	W-221282	.27	83	<0.02	<2.0	<1.0	0.11	0.01	110	<2.0	2.7	<2.0	5.0
M04-02-00-S1	W-219904	.32	51	<.02	3.3	<1.0	.27	—	300	4.9	4.0	10.0	4.6
M04-02-00-S2	W-219905	.16	32	<.02	<2.0	<1.0	.09	—	84	<2.0	1.9	3.1	2.1
M04-02-00-S3	W-219906	.25	51	<.02	10.0	<1.0	.07	—	26	<2.0	2.7	<2.0	<2.0
M04-02-00-S4	W-219907	1.20	150	.03	24.0	<1.0	1.90	—	1400	8.3	13.0	16.0	23.0
M04-02-00-S5	W-219908	2.00	260	.26	49.0	4.6	2.30	—	3900	32.0	11.0	59.0	51.0
M04-02-00-S6	W-219893	1.90	280	8.20	38.0	13.0	1.80	—	11000	78.0	28.0	51.0	98.0
M04-02-00-S7	W-219894	3.00	240	1.60	36.0	45.0	2.90	—	8400	110.0	75.0	85.0	150.0
M04-02-00-S8	W-219895	3.00	480	3.70	98.0	240.0	3.00	—	7500	320.0	110.	70.0	290.0
M04-02-00-S9	W-219896	.18	34	.19	3.3	<5.0	.16	—	290	9.4	3.1	7.5	17.0
M04-05-02-S0	W-221272	.24	87	<.02	3.0	<1.0	.38	.01	250	<2.0	5.5	6.0	6.6
M04-05-02-S1	W-221273	.19	74	<.02	<2.0	<1.0	.72	.01	310	<2.0	4.0	22.0	6.6
M04-05-02-S2	W-221274	.11	16	<.02	<2.0	<1.0	.35	.01	190	<2.0	4.0	5.0	4.6
M04-05-02-S3	W-221275	.23	43	<.02	<2.2	<1.0	.28	.01	180	<2.0	5.9	2.2	7.3
M04-05-02-S4	W-221276	1.30	279	<.02	24.0	1.7	1.10	.01	650	<2.0	14.0	30.0	20.0
M04-05-02-S5	W-221277	2.20	1060	.05	37.0	3.6	1.80	.01	1700	8.5	27.0	64.0	34.0
M04-05-02-S6	W-221278	3.30	12000	.29	55.0	20.0	3.20	.05	5000	34.0	66.0	100.	100.0
M04-05-02-S7	W-221279	3.70	4500	.40	58.0	28.0	3.40	.08	4700	46.0	99.0	110.	120.0
M04-05-02-S8	W-221280	3.60	3500	.46	69.0	130.0	3.40		4300	46.0	120.	28.0	320.0
M04-05-02-S9	W-221281	.63	359	.09	9.0	14.8	.54	.13	448	9.0	17.9	9.0	53.8
M04-16-00-S1	W-219897	.52	72	<.02	3.1	<1.0	.24	—	51	2.9	3.7	5.4	5.4
M04-16-00-S2	W-219898	.16	27	<.02	<2.0	<1.0	.06	—	<10	<2.0	2.0	<2.0	2.1
M04-16-00-S3	W-219899	.26	44	<.02	2.2	<1.0	.14	—	83	<2.0	2.7	2.9	4.2
M04-16-00-S4	W-219900	1.00	280	<.02	33.0	2.0	2.20	—	1500	9.3	23.0	22.0	32.0
M04-16-00-S5	W-219909	2.40	4150	.61	34.0	5.3	1.60	—	400	17.0	16.0	34.0	67.0
M04-16-00-S6	W-219910	3.40	3730	.84	43.0	22.0	2.50	—	900	27.0	64.0	51.0	120.0
M04-16-00-S7	W-219911	3.90	1900	2.90	57.0	50.0	3.00	—	1100	79.0	120.	49.0	250.0
M04-16-00-S8	W-219912	4.40	1200	2.60	62.0	56.0	3.40	—	1300	78.0	120.	63.0	260.0
M04-16-00-S9	W-219913	1.60	250	.29	25.0	11.0	1.30	—	500	27.0	20.0	34.0	80.0

ACCESSION NUMBER

DATA DOCUMENTATION FORM

NOAA FORM 24-13
(4-77)

85NODC062

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEANOGRAPHIC DATA CENTER
RECORDS SECTION
WASHINGTON, DC 20235

FORM APPROVED
O.M.B. No. 41-R2651
EXPIRES 1—81

(While you are not required to use this form, it is the most desirable mechanism for providing the required ancillary information enabling the NODC and users to obtain the greatest benefit from your data.)

This form should accompany all data submissions to NODC. Section A, Originator Identification, must be completed when the data are submitted. It is highly desirable for NODC to also receive the remaining pertinent information at that time. This may be most easily accomplished by attaching reports, publications, or manuscripts which are readily available describing data collection, analysis, and format specifics. Readable, handwritten submissions are acceptable in all cases. All data shipments should be sent to the above address.

A. ORIGINATOR IDENTIFICATION

THIS SECTION MUST BE COMPLETED BY DONOR FOR ALL DATA TRANSMITTALS

1. NAME AND ADDRESS OF INSTITUTION, LABORATORY, OR ACTIVITY WITH WHICH SUBMITTED DATA ARE ASSOCIATED

U.S. Dept. of Interior
Geological Survey
Atlantic & Gulf Coast Branch
Woods Hole, MA

2. EXPEDITION, PROJECT, OR PROGRAM DURING WHICH DATA WERE COLLECTED

OCS/ Georges Bank Monitoring Program

3. CRUISE NUMBER(S) USED BY ORIGINATOR TO IDENTIFY DATA IN THIS SHIPMENT

M01 - M12, OC122, OC130, OC140 and G83-9

4. PLATFORM NAME(S)

See Attached List

5. PLATFORM TYPE(S) *(E.G., SHIP, BUOY, ETC.)*

Ships &Moored Sediment Traps

6. PLATFORM AND OPERATOR NATIONALITY(IES)

PLATFORM | OPERATOR

see attached list

7. DATES

FROM: MO/DAY/YR TO: MO/DAY/YR

8. ARE DATA PROPRIETARY?

[X] NO [ ] YES

IF YES, WHEN CAN THEY BE RELEASED FOR GENERAL USE? YEAR ____ MONTH ____

9. ARE DATA DECLARED NATIONAL PROGRAM (DNP)?
(I.E., SHOULD THEY BE INCLUDED IN WORLD DATA CENTERS HOLDINGS FOR INTERNATIONAL EXCHANGE?)

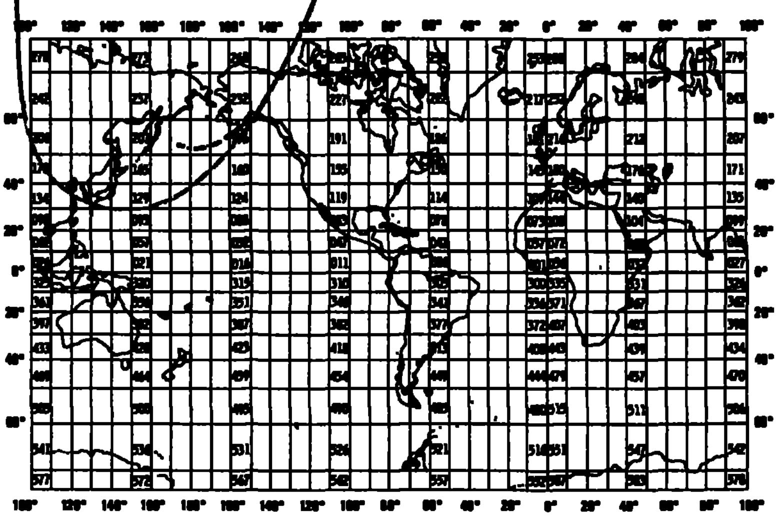
[X] NO [ ] YES [ ] PART *(SPECIFY BELOW)*

10. PERSON TO WHOM INQUIRIES CONCERNING DATA SHOULD BE ADDRESSED WITH TELEPHONE NUMBER *(AND ADDRESS IF OTHER THAN IN ITEM-1)*

Dr. Mike Bothner
Phone 617 548 8700

11. PLEASE DARKEN ALL MARSDEN SQUARES IN WHICH ANY DATA CONTAINED IN YOUR SUBMISSION WERE COLLECTED.

GENERAL AREA



NOAA FORM 24-13

B. SCIENTIFIC CONTENT

Include enough information concerning manner of observation, instrumentation, analysis, and data reduction routines to make them understandable to future users. Furnish the minimum documentation considered relevant to each data type. Documentation will be retained as a permanent part of the data and will be available to future users. Equivalent information already available may be substituted for this section of the form (i.e., publications, reports, and manuscripts describing observational and analytical methods). If you do not provide equivalent information by attachment, please complete the scientific content section in a manner similar to the one shown in the following example.

EXAMPLE (HYPOTHETICAL INFORMATION)

NAME OF DATA FIELD	REPORTING UNITS OR CODE	METHODS OF OBSERVATION AND INSTRUMENTS USED (SPECIFY TYPE AND MODEL)	ANALYTICAL METHODS (INCLUDING MODIFICATIONS) AND LABORATORY PROCEDURES	DATA PROCESSING TECHNIQUES WITH FILTERING AND AVERAGING
Salinity	‰	Nansen bottles	Inductive salinometer (Hytech model S510)	N/A (Not applicable)
		STD Bissett-Berman Model 9006	N/A	Values averaged over 5-meter intervals
Water color	Forel scale	Visual comparison with Forel bottles	N/A	N/A
Sediment size	ϕ units and percent by weight	Ewing corer	Standard sieves. Carbonate fraction removed by acid treatment	Same as "Sedimentary Rock Manual," Folk '65

(SPACE IS PROVIDED ON THE FOLLOWING TWO PAGES FOR THIS INFORMATION)

B. SCIENTIFIC CONTENT

NAME OF DATA FIELD	REPORTING UNITS OR CODE	METHODS OF OBSERVATION AND INSTRUMENTS USED (SPECIFY TYPE AND MODEL)	ANALYTICAL METHODS (INCLUDING MODIFICATIONS) AND LABORATORY PROCEDURES	DATA PROCESSING TECHNIQUES WITH FILTERING AND AVERAGING
ALUMINUM BARIUM CADMIUM CHROMIUM COPPER IRON LEAD MANGANESE MERCURY NICKEL VANADIUM ZINC CHLORIDE ORGANIC CARBON	PER CENT PPM PPM PPM PPM PER CENT PPM PPM PPM PPM PPM PPM PER CENT PER CENT	CHEMICAL ANALYSIS OF GRAB, CORE, AND SEDIMENT TRAP SAMPLES	SEE ATTACHED DESCRIPTION EXTRACTED FROM: BOTHNER, M.N., ET AL 1982, THE GEORGES BANK MONITORING PROGRAM: ANALYSIS OF TRACE METALS IN BOTTOM SEDIMENTS. U.S. GEOLOGICAL SURVEY, DEC. 28, 1982. FINAL REPORT SUBMITTED TO THE BUREAU OF LAND MANAGEMENT UNDER INTERAGENCY AGREEMENT AA851-IA2-18	

B. SCIENTIFIC CONTENT

NAME OF DATA FIELD	REPORTING UNITS OR CODE	METHODS OF OBSERVATION AND INSTRUMENTS USED (SPECIFY TYPE AND MODEL)	ANALYTICAL METHODS (INCLUDING MODIFICATIONS) AND LABORATORY PROCEDURES	DATA PROCESSING TECHNIQUES WITH FILTERING AND AVERAGING

C. DATA FORMAT

This information is requested only for data transmitted on punched cards or magnetic tape. Have one of your data processing specialists furnish answers either on the form or by attaching equivalent readily available documentation. Identify the nature and meaning of all entries and explain any codes used.

1. List the record types contained in your file transmittal (e.g., tape label record, master, detail, standard depth, etc.).

2. Describe briefly how your file is organized.

3-13. Self-explanatory.

14. Enter the field name as appropriate (e.g., header information, temperature, depth, salinity.

15. Enter starting position of the field.

16. Enter field length in number columns and unit of measurement (e.g., bit, byte, character, word) in unit column.

17. Enter attributes as expressed in the programming language specified in item 3 (e.g., "F 4.1," "BINARY FIXED (5.1)").

18. Describe field. If sort field, enter "SORT 1" for first, "SORT 2" for second, etc. If field is repeated, state number of times it is repeated.

C. DATA FORMAT

COMPLETE THIS SECTION FOR PUNCHED CARDS OR TAPE, MAGNETIC TAPE, OR DISC SUBMISSIONS.

1. LIST RECORD TYPES CONTAINED IN THE TRANSMITTAL OF YOUR FILE
   GIVE METHOD OF IDENTIFYING EACH RECORD TYPE

This data set consists of only one record type. Sampling identification and analysis is recorded to this one record.

Files 1,2,&3 are identical in format except file 3 is missing the last field and is 158 bytes in length instead of 165 bytes

2. GIVE BRIEF DESCRIPTION OF FILE ORGANIZATION

This data set has been arranged into three separate files.

file #1 is a file of miscellaneous samples that cannot be logically grouped
file #2 is a file of standard analysis
file #3 is a file of fine fraction analysis

All files have been sorted into cruise/sediment trap/core order

3. ATTRIBUTES AS EXPRESSED IN ☐ PL-1 ☐ ALGOL ☐ COBOL ☒ (XX) FORTRAN ☐ ______ LANGUAGE

4. RESPONSIBLE COMPUTER SPECIALIST:
   NAME AND PHONE NUMBER ______
   ADDRESS ______

COMPLETE THIS SECTION IF DATA ARE ON MAGNETIC TAPE

5. RECORDING MODE: ☐ BCD ☐ BINARY ☒ (XX) ASCII ☐ EBCDIC ☐ ______

6. NUMBER OF TRACKS (CHANNELS): ☐ SEVEN ☒ (XX) NINE ☐ ______

7. PARITY: ☒ (XX) ODD ☐ EVEN

8. DENSITY: ☐ 200 BPI ☒ (XX) 1600 BPI ☐ 556 BPI ☐ 800 BPI ☐ ______

9. LENGTH OF INTER-RECORD GAP (IF KNOWN): ☐ 3/4 INCH ☐ ______

10. END OF FILE MARK: ☐ OCTAL 17 ☐ ______

11. PASTE-ON-PAPER LABEL DESCRIPTION *(INCLUDE ORIGINATOR NAME AND SOME LAY SPECIFICATIONS OF DATA TYPE, VOLUME NUMBER)*

U.S. Geological Survey Trace Metal Concentrations in Sediments - Georges Bank Monitoring Program

12. PHYSICAL BLOCK LENGTH IN BYTES

unblocked

13. LENGTH OF BYTES IN BITS

RECORD FORMAT DESCRIPTION

RECORD NAME ______

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN ____ (e.g., bits, bytes)	16. LENGTH NUMBER	16. LENGTH UNITS	17. ATTRIBUTES	18. USE AND MEANING
Blank	1	1			
field sample #	2	14		A14	consists ~~constist~~ of cruise, sample, replicate identification
station #	16	4		A4	
laboratory #	20	8		A8	
year	28	4		I4	
month	32	2		I2	
day	34	2		I2	
latitude	36	9		F9.6	reported in degrees to 5 places always north latitude
longitude	45	10		F10.6	reported in degrees to 5 places minus indicates west longitude
top depth	55	2		I2	upper depth of sediment analysed reported in centimeters
bottom depth	57	2		I2	lower depth of sediment analysed reported in centimeters
water depth	59	5		[redacted] I5	reported in meters
gear code	64	7		A7	CODES =
					0.10vv= .1meter sq. van veen grab
					HDC = hydraulically damped gravity corer
					ST = sediment trap
					BC = box corer
aluminum	71	6		f5.2,A1	%
barium	77	9		[redacted] F8.0,A1	ppm
cadmium	86	8		F7.3,A1	ppm
chromium	94	7		F6.1,A1	ppm
copper	101	7		F6.1,A1	ppm
iron	108	6		F5.2,A1	%
mercury	114	6		F5.2,A1	ppm
manganese	120	7		[redacted] F6.0,A1	ppm
nickel	127	7		F6.1,A1	ppm
lead	134	7		F6.1,A1	ppm
vanadium	141	7		F6.1,A1	ppm
zinc	148	7		F6.1,A1	ppm
chloride	155	6		F5.1,A1	%
organic carbon	161	5		F5.2	%

Note: Trace metal values flagged with an "L" represent values that are below the detection levels of the analytical technique used.

RECORD FORMAT DESCRIPTION

RECORD NAME ______________________________

14. FIELD NAME	15. POSITION FROM-1 MEASURED IN ______ (e.g., bits, bytes)	16. LENGTH		17. ATTRIBUTES	18. USE AND MEANING
		NUMBER	UNITS		

RECORD FORMAT DESCRIPTION

RECORD NAME ____________________

14. FIELD NAME	15. POSITION FROM - 1 MEASURED IN ______ (e.g., bits, bytes)	16. LENGTH		17. ATTRIBUTES	18. USE AND MEANING
		NUMBER	UNITS		

RECORD FORMAT DESCRIPTION

RECORD NAME ______________________

14. FIELD NAME	15. POSITION FROM - 1 MEASURED IN ______ (e.g., bits, bytes)	16. LENGTH NUMBER	16. LENGTH UNITS	17. ATTRIBUTES	18. USE AND MEANING
50					

NOAA FORM 24-13

D. INSTRUMENT CALIBRATION

This calibration information will be utilized by NOAA's National Oceanographic Instrumentation Center in their efforts to develop calibration standards for voluntary acceptance by the oceanographic community. Identify the instruments used by your organization to obtain the scientific content of the DDF (i.e., STD, temperature and pressure sensors, salinometers, oxygen meters, velocimeters, etc.) and furnish the calibration data requested by completing and/or checking ("✓") the appropriate spaces. Add the interval time (i.e., 3 months, 6 months, 9 months, etc.) if the fixed interval calibration cycle is checked.

INSTRUMENT TYPE (MFR., MODEL NO.)	DATE OF LAST CALIBRATION	INSTRUMENT WAS CALIBRATED BY		CHECK ONE: INSTRUMENT IS CALIBRATED					INSTRUMENT IS NOT CALIBRATED (✓)
		YOUR ORGANIZATION (✓)	OTHER ORGANIZATION (GIVE NAME)	AT FIXED INTERVALS (✓)	BEFORE OR AFTER USE (✓)	BEFORE AND AFTER USE (✓)	ONLY AFTER REPAIR (✓)	ONLY WHEN NEW (✓)	

TRACE-METAL ANALYSIS PROCEDURES

The analyses of trace metals in marine sediments were carried out by the U.S. Geological Survey Branch of Analytical Laboratories, Reston, VA. Concentrations of the following elements were determined: aluminum (Al), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), manganese (Mn), nickel (Ni), lead (Pb), vanadium (V), and zinc (Zn). The various procedures employed in each of the analyses are detailed below.

Preparation stock solution A

For most samples, 0.5 g of ground sediment was added to a covered teflon beaker and digested with 5 ml of $HClO_4$, 5 ml of HNO_3, and 20 ml of HF at approximately 140°C overnight. The covers were removed and the temperature increased to 180°-190°C, first producing fumes of $HClO_4$ and then evaporating the solution to dryness. The residue was dissolved and diluted to exactly 25 ml with 8N HCl. This solution is referred to as stock solution A.

Two blanks containing all reagents were analyzed along with samples. All reagents were analyzed for contaminants prior to use (always necessary). The Canadian reference sediment standard MESS-1 and the USGS sediment standard MAG-1 also were analyzed with each set of samples. A series of solutions was prepared that approximated the concentration levels expected in the samples and used as standards in calibrating the inductively coupled plasma (ICP) spectrometer and atomic absorption (AA) spectrophotometer. A summary of methods is presented in table 1.

Preparation of stock solution B

Stock solution B was made by adding 10 ml of butyl acetate (distilled to remove impurities such as copper) to 15 ml of stock solution A in a 60 ml separatory funnel. This solution was vigorously agitated for 6 minutes using an automatic shaker to extract iron. The layers were separated, and the extraction step was repeated with an additional 10 ml of butyl acetate. The aqueous layer was evaporated to dryness at 150°C in a 50-ml beaker. The residue was dissolved and diluted to 25 ml with 1N HCl.

Barium

The measurements for Ba were made by ICP spectrometry using 2 ml of stock solution A diluted to 4 ml with H_2O.

Aluminum, iron, chromium, nickel, and vanadium

Al and Fe were determined by ICP spectrometry using 1 ml stock solution A diluted to 10 ml with H_2O. The measurements for Cr, Ni, and V were made by injecting 20 μl of diluted (1/10) stock solution A into a graphite furnace AA.

Lead, copper, and cadmium

Fifteen ml of 0.5% (w/v) diethyldithiocarbamic acid diethylammonium salt (DDTC) in chloroform were added to 10 ml of solution B in a 60-ml separatory funnel and mixed for 10 minutes using an automatic shaker. The chloroform layer was drained into a 30-ml beaker, and the aqueous layer washed with 10 ml of chloroform. The second chloroform layer was combined with the first, and the total volume of chloroform was evaporated to dryness at 90°C. The organic matter was destroyed by adding 0.1 ml of concentrated HNO_3 and evaporated to dryness. This residue then was dissolved in 2 ml of warm 1N HCl. The beaker was rinsed four times with 2 ml portions of H_2O and transferred to a small polyethylene container. The measurements for Pb, Cu, and Cd were made by by injecting 20 ml of the final solution into a graphite furnace AA.

Manganese and zinc

The measurements for Mn were made by ICP spectrometry using a solution made by diluting 2 ml of stock solution B to 4 ml with H_2O. Zinc was measured by flame AA directly from stock solution B.

Mercury

Mercury was determined on a separate portion of the sample. Two hundred milligrams of sediment were decomposed in a 1-ounce teflon screw-top vial with 2 ml of concentrated HNO_3 and 2 ml of $HClO_4$. The mixture was heated in the uncapped vial at 200°C for one hour. Immediately, 1 ml of concentrated HNO_3 was added; the vial was filled with H_2O and capped tightly until used. The sample solution was then added to a flask containing 125 ml of H_2O and 4 ml of 10 percent (w/v) $SnCl_2$ in 20 percent HCl. Nitrogen was passed through the solution to remove elemental Hg which was collected on gold foil located in the center of the coils of an induction furnace. Activation of the furnace released the Hg which was measured by a cold vapor AA technique. Blanks, standard rocks, and internal sediment standards were analyzed with each set of samples. A series of solutions was prepared having the same mercury concentration range expected in the samples.

Organic carbon

Organic carbon was determined on samples collected during the first monitoring cruise. Analyses were carried out on a LECO carbon analyzer by combusting the ground sample that had been leached in 1N HCl to remove carbonate.

Additional methods

Results of barium and chromium analyses on selected Georges Bank samples were cross checked by an energy dispersive X-ray fluorescence technique. The determination of barium was made with a Kevex 0700 energy dispersive X-ray fluorescence spectrometer. Powdered samples of about 1 g were analyzed with a gadolinium secondary target for excitation of the K-alpha line. Resulting intensities were corrected for absorption effects by a ratio-to-target Compton Scatter peak. This ratio was then compared to a standard calibration curve in order to determine the concentration of Ba.

The chromium determination is very similar to Ba; however, an Fe-secondary target was used to maximize excitation efficiency. Absorption corrections were made in the same way, and the corrected intensity ratio was compared to the standard calibration curve to determine concentrations.

Selected samples were also analysed for Ba using a Na-metaborate fusion technique followed by direct current (DC) plasma emission spectrometry. Details of this method are reported by Bowker and Manheim (1982).

ANALYTICAL PRECISION AND ACCURACY

Analytical precision was determined by periodically analyzing five replicate aliquots taken from a single sample. Coefficients of variation shown in table 2 indicate that the standard deviation is typically less than 10 percent of the mean value except for concentrations at or near the detection limit of the method.

Accuracy was determined by analyzing rock standards MESS-1 and MAG-1. There is excellent agreement between our results and values established by other laboratories (table 3). There was also excellent agreement among aliquots of samples submitted as blind replicates (appendix table 4).

To maintain our internal quality control and to provide typical sample material for interlaboratory comparisons, four sediment standards representing different textural types were prepared from large samples of Georges Bank sediment. The levels of trace metals are being established by several analytical methods. Splits of these materials are available to those interested in cross-calibration studies.

Barium sulphate, $BaSO_4$, a major component in drilling mud, is well known for its resistance to decomposition by acid attack. To check the effectiveness of our dissolution prodecures, we spiked Georges Bank sediments with various amounts of standard drilling-mud solids. The drilling-mud standard was provided by the Environmental Protection Agency Environmental Research Laboratory, Gulf Breeze, Fla. Our results indicate that the standard HF, $HClO_4$, and HNO_3 digestion gives high precision and accuracy on all uncontaminated samples and on samples spiked with 0.1 percent drilling mud. In samples containing 1 percent and 10 percent drilling mud however, dissolution of Ba is only 85 percent and 50 percent, respectively. To circumvent this problem, we have analyzed all samples showing more than 1,000 ppm Ba by X-ray fluorescence, which does not require $BaSO_4$ dissolution, or by a fusion-digestion method which yields 100 percent of the Ba at 10 percent drilling-mud concentrations.

The agreement between the acid decomposition/ICP method for Ba and the fusion/DC plasma methods carried out in independent laboratories is excellent (fig. 2), and the linear correlation coefficient is 0.99. Other checks of Ba analyses comparing the acid decomposition technique with X-ray fluorescence yielded a correlation coefficient of 0.98. A comparison of Cr analyses using the graphite furnace atomic absorption method with X-ray fluorescence yielded a correlation coefficient of 0.95. All these correlation coefficients are significant at the 99.9 percent level of confidence.

We also have determined the precision of sediment textural data by analyzing a larger well-mixed sample repeatedly. The results (table 4) show excellent reproducibility for the weight-percent of modal size classes, mean and median ϕ sizes, and for sorting coefficient (σ). Coefficients of variation for these parameters are usually less than 10 percent.

NOAA FORM 24-5
(8-73)

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

TRANSMITTAL AND RECEIPT RECORD

(Please sign and return carbon copy acknowledging receipt)

TO: National Oceanographic Data Ctr. 3300 Whitehaven St., NW Washington, D.C. 20235	REFER TO ATTENTION Francis Mitchell

THE ITEM(S) LISTED BELOW WERE FORWARDED TO YOU BY

[XX] ORDINARY MAIL [ ] REGISTERED MAIL [ ] AIR MAIL [ ] CERTIFIED MAIL [ ] GOVERNMENT TRUCK [ ] BY HAND [ ] OTHER

The following trace metal data set is forwarded to NODC for processing:

The enclosed tape contains the results of three years of monitoring the trace metal concentrations in Georges Bank sediments. The sediment samples were generally collected on a quarterly basis for the period July 1981 - June 1984. The data have been grouped into three separate files: file # 1 is a miscellaneous file of sample types and analysis that cannot be logically grouped, file # 2 is standard or regular analysis, and file # 3 is fine fraction analysis.

These data were received from Dr. Mike Bothner, U.S. Geological Survey,

and are to be considered part of the OCS George Bank Monitoring Program.

a..One reel of magnetic tape
b..Data Documentation Form (with attachments)
c..Complete dump of entire tape (printer wraps at pos. 85)

85NODC062

cc: M. Bothner, USGS
T. Sullivan, MMS

RCVD MARCH 5, 85

FORWARDED BY (Signature)	TITLE	DATE FORWARDED
George Heimerdinger	NODC Liaison Officer	Feb. 27, 85
RECEIVED BY (Signature)	TITLE	DATE RECEIVED
F. Mitchell		3/5/85

NOAA FORM 24-5 (8-73)

Password:

accNo	fleA	refNo	proj	inst	ship	startDate	cruise	catId
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8600070	F144	TT4993	0091	31W4	317F	1980/11/29	ST103	159623
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8600070	F144	TT4995	0091	31W4	317F	1981/09/27	ST301	159625
8600070	F144	TT4996	0091	31W4	317F	1982/01/31	ST403	159626
8600070	F144	TT4997	0091	31W4	317F	1982/02/01	ST424	159627
8600070	F144	TT4998	0091	31W4	317F	1982/02/01	ST426	159628
8600070	F144	TT4999	0091	31W4	317F	1982/07/10	ST501	159629
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8600070	F144	TT5026	0091	31W4	31EZ	1982/11/19	M06	159643
8600070	F144	TT5027	0091	31W4	31EZ	1983/02/06	M07	159644
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8600070	F144	TT5031	0091	31W4	31EZ	1984/02/01	M11	159648
8600070	F144	TT5032	0091	31W4	31EZ	1984/06/03	M12	159649
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8600070	F144	TT5015	0091	31W4	32EV	1983/02/06	M07	159661
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8600070	F144	TT5010	0091	31W4	32OC	1981/11/10	M02	159656

(50 rows affected)

Password:

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8600070	F144	TT5030	31EZ	36	247	83/11/12	83/11/18
8600070	F144	TT5031	31EZ	37	256	84/02/01	84/02/06
8600070	F144	TT5032	31EZ	53	302	84/06/03	84/06/09
8600070	F144	TT5009	31EZ	69	522	81/07/10	81/07/18
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8600070	F144	TT5012	32CW	64	433	82/05/11	82/05/18
8600070	F144	TT5015	32EV	38	277	83/02/06	83/02/11
8600070	F144	TT5011	32EV	51	355	82/02/12	82/02/27
8600070	F144	TT5016	32GY	58	397	83/05/14	83/05/21
8600070	F144	TT5017	32GY	61	349	83/07/14	83/07/20
8600070	F144	TT5020	32GY	77	400	84/06/02	84/06/08
8600070	F144	TT4983	32GY	13	140	83/07/29	83/07/29
8600070	F144	TT4985	32GY	17	168	83/07/18	83/07/19
8600070	F144	TT4988	32GY	31	251	84/06/05	84/06/08
8600070	F144	TT5013	32OC	65	439	82/07/22	82/07/28
8600070	F144	TT5014	32OC	55	379	82/11/19	82/11/27
8600070	F144	TT5018	32OC	50	313	83/11/12	83/11/18
8600070	F144	TT5019	32OC	53	331	83/11/15	84/02/06
8600070	F144	TT4989	32OC	46	331	82/07/11	82/07/14
8600070	F144	TT4990	32OC	17	168	82/11/12	82/11/14
8600070	F144	TT4991	32OC	15	147	83/10/22	83/10/24
8600070	F144	TT4986	32OC	43	307	83/11/13	83/11/15
8600070	F144	TT4987	32OC	7	91	84/02/03	84/02/03
8600070	F144	TT5010	32OC	50	349	81/11/10	81/11/20

(50 rows affected)