

US EPA ARCHIVE DOCUMENT

CATALOG DOCUMENTATION  
EMAP-ESTUARIES PROGRAM LEVEL DATABASE  
1990 VIRGINIAN PROVINCE  
SEDIMENT GRAIN COMPOSITION DATA

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1. DATA SET IDENTIFICATION

1.1 Title of Catalog document

EMAP-Estuaries Program Level Database  
1990 Virginian Province  
Sediment Grain Composition Data by Station

1.2 Authors of the Catalog entry

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1.3 Catalog revision date

25 March 1996

1.4 Data set name

SEDGRAIN

## 1.5 Task Group

Estuaries

## 1.6 Data set identification code

00014

## 1.7 Version

001

## 1.8 Requested Acknowledgment

These data were produced as part of the U.S. EPA's Environmental Monitoring and Assessment Program (EMAP). If you plan to publish these data in any way, EPA requires a standard statement for work it has supported:

"Although the data described in this article has been funded wholly or in part by the U. S. Environmental Protection Agency through its EMAP-Estuaries Program, it has not been subjected to Agency review, and therefore does not necessarily reflect the views of the Agency and no official endorsement should be inferred."

## 2. INVESTIGATOR INFORMATION

### 2.1 Principal Investigator

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### 2.2 Investigation Participant-Sample Collection

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### 2.3 Principal Investigator-Sample Processing

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## 3. DATA SET ABSTRACT

### 3.1 Abstract of the Data Set

The Sediment Grain Size data set presents the results of grain composition analyses. These analyses were conducted on a surface sediment sample collected at a station in a Province.

Sediment grain size analyses were conducted on a sample extracted from a sediment homogenate. The sample was derived from sediment which was scraped from the top 2 cm of several grabs and homogenized. The homogenate was divided into samples for sediment chemistry analysis, a sediment toxicity test and full sediment grain size analysis. The grain size analyses included measurements of sand, silt, clay, per cent sand, per cent silt/clay, quartile this, quartile deviation and skewness.

### 3.2 Keywords for the Data Set

Grain analyses, silt/clay, grain size, sand, silt, clay, per cent sand, per cent silt/clay, quartile this, quartile deviation and skewness

## 4. OBJECTIVES AND INTRODUCTION

### 4.1 Program Objective

The Environmental Monitoring and Assessment Program (EMAP) was designed to periodically estimate the status and trends of the Nation's ecological resources on a regional basis. EMAP provides a strategy to identify and bound the extent, magnitude and location of environmental degradation and improvement on a regional scale based on station sites randomly located in estuaries. Only BASE Sampling Sites were included in this data set.

### 4.2 Data Set Objective

The objective of the sediment grain data set is to characterize the grain size distribution of sediment collected from estuaries in the Virginian Province. These samples represent only the top two cm of sediment, i.e., the recently deposited sediment analyzed for chemical contaminants and toxicity.

### 4.3 Background Discussion

The concentration of contaminants in sediments is dependent upon interactions between natural (e.g., physical sediment characteristics) and anthropogenic factors (e.g., type and volume of contaminant loadings). Sediment composition determinations were made to supplement contaminant analyses.

### 4.4 Summary of Data Set Parameters

Grain composition parameters were measured from a surface sediment homogenate collected at a station.

## 5.0 DATA ACQUISITION AND PROCESSING METHODS

### 5.1 Data Acquisition

#### 5.1.1 Sampling Objective

Collect sediment samples suitable for the analysis of sediment constituents. One (1) sediment sample was expected to be collected at each station.

#### 5.1.2 Sample Collection Methods Summary

The grab sampler was lowered through the water column. The grab penetrated the sediment by gravity releasing a trigger which kept the jaws of the grab open. When the grab was pulled from the sediment using the winch, the jaws closed, encapsulating the sediment sample.

Large, non-living surface items in the grab such as rocks or pieces of wood were removed from the sediment. The top two centimeters of the sediment were removed using a spoon (all items were washed with Alconox

and rinsed with ambient seawater before use). The sediment was placed in a pan or pot and placed in a cooler on ice for refrigerated storage. The procedure was repeated with each sediment grab collected until at least 3,000 cc of sediment had been collected. The sediment composite was then homogenized by stirring with a Teflon paddle for 10 minutes. A Whirl-Pak was filled with approximately 100 cc of sediment homogenate and the sample was stored on ice.

#### 5.1.3 Sampling Start Date

19 July 1990

#### 5.1.4 Sampling End Date

30 September 1990

#### 5.1.5 Platform

Sampling was conducted from 8 m (24 ft), twin-engine Chesapeake style work boats.

#### 5.1.6 Sampling Equipment

A 1/25 m<sup>2</sup>, stainless steel (coated with Kynar), Young-modified Van Veen Grab sampler was used to collect sediments. This grab sampled an area of 440 cm<sup>2</sup> and a maximum depth of penetration in the sediment of 10 cm.

#### 5.1.7 Manufacturer of Instrument

Young's Welding, Sandwich, MA

#### 5.1.8 Key Variables

NA

#### 5.1.9 Collection Method Calibration

The sampling gear does not require any calibration. It required inspection for deformities incurred due to mishandling or impact on rocky substrates.

#### 5.1.10 Collection Quality Control

A successful grab had relatively level, intact sediment over the entire area of the grab and a sediment depth of 5 centimeters minimum. Unacceptable grabs included those: containing no sediments, which were partially filled or had shelly substrates or grossly slumped surfaces. Grabs completely filled to the top, where the sediment was in direct contact with the hinged top, were also unacceptable.

Field technicians were trained to follow Standard Operating Procedures to insure the collection of representative, uncontaminated and high quality samples. Examples of QA/QC measures taken in the field to avoid or reduce contamination and insure the collection of representative samples include the following: use of Teflon implements for mixing and transferring sediments, thorough cleaning and rinsing of the grab sampler and implements between samples, use of pre-cleaned sample containers for sediment storage, assuring that engines were off when

the sample was exposed to air and immediate storage of samples on ice following collection.

The chance of sampling the exact same location twice was minimized. After three (3) grabs were taken, the boat was moved five (5) meters downstream by letting out the appropriate length of anchor line.

#### 5.1.11 Sample Collection Method Reference

Strobel, C.J. 1990. Environmental Monitoring and Assessment Program-Near Coastal Component: 1990 Demonstration Project Field Operations Manual. U.S. EPA, Office of Research and Development, NHEERL-AED, Narragansett, RI. October 1990.

### 5.2 Data Processing and Sample Processing

#### 5.2.1 Sample Processing Objective

Process uncontaminated sediment samples to characterize the grain composition of the sediment chemistry samples.

#### 5.2.2 Sample Processing Methods Summary

Silt-clay and sand content in sediment samples was determined slightly differently depending on whether the sample being processed contained >25% fine particles.

SANDY SEDIMENTS (anticipated sand content of approximately 25% or more by weight)

The sediment was homogenized and about 125 g wet weight was removed and placed in a beaker. One mL of sodium hexametaphosphate (6.2 g/L) and 80-90 mL of distilled water were added to the sample and stirred on a magnetic stirrer for 15-20 minutes. The suspension was then sieved through a 63  $\mu$ m sieve.

The <63  $\mu$ m portion of the sample was transferred to a 1 L graduated cylinder and brought up to the next 50 mL mark with distilled water; the volume was recorded. The cylinder was shaken to create an even suspension, then two 20 mL sub-samples were removed (the suspension was shaken between sub-samples) and placed in separate tared evaporating dishes. These sub-samples were dried at 60 degrees Centigrade and weighed.

The >63  $\mu$ m portion of the sample was placed in a tared evaporating dish, dried at 60 degrees Centigrade, and weighed. Sufficient 5% HCl was then added to the dried >63  $\mu$ m portion of the sample to dissolve carbonates. After 1-4 hours, the sample was rinsed into a 63  $\mu$ m sieve using distilled water. The rinsed sample was transferred to the original tared evaporating dish, dried at 60 degrees C, and re-weighed to estimate the carbonate-free dry weight. The dried sample was then transferred into the top of a stack of clean stainless-steel sieves composed of: 500, 354, 250, 177, and 63  $\mu$ m sieves with a closed pan on the bottom. The sample was shaken through the sieves on a Ro-tap for 15 minutes. The sieved fractions were weighed as follows: a beaker was tared to zero; the 500  $\mu$ m fraction was added and weighed; the 354  $\mu$ m fraction was added and the total was weighed; the 250  $\mu$ m fraction was added and the total weighed; etc.

MUD SEDIMENTS (anticipated sand content of less than approximately 25%)

The sediment was homogenized and about 75 g wet weight was removed and placed in a beaker. To dissolve organics, 6% H<sub>2</sub>O<sub>2</sub> was added to the sediment and allowed to stand (overnight for the first dose, then for several hours each successive dose) in one or more stages until no further reaction occurred. The treated sample was filtered through Whatman #50 filter paper. The mud was then gently scraped and rinsed from the filter and placed in a beaker. Ten mL of sodium hexametaphosphate was added to the sample and stirred on a magnetic stirrer for 10-20 minutes. The suspension was then sieved through a 63  $\mu$ m sieve. The >63  $\mu$ m portion of the sample was placed in a tared evaporating dish, dried at 60 degrees Centigrade, and weighed. If shell was present, 5% HCl was added to the sample and allowed to stand until the reaction stopped. The sample was then rinsed with distilled water, dried, and reweighed to determine carbonate content.

The <63  $\mu$ m portion of the sample was transferred to a graduated cylinder and allowed to stand overnight to come to room temperature. If the sample completely settled after a couple of hours, organics were still present in the sediment and was re-treated with H<sub>2</sub>O<sub>2</sub>. The sample was brought up to 1000 mL with distilled water. The sample was shaken to create an even suspension and 20 mL sub-samples withdrawn at depths and times listed in a table from Plumb (1981). The pipetted sample fractions were transferred to separate tared evaporating dishes, dried at 60 degrees Centigrade, and weighed. Each sample corresponds to a given size fraction as described in the Laboratory Manual.

#### TOTAL ORGANIC CARBON

The concentration of total organic carbon in each sediment sample was determined by ultraviolet light-promoted persulfate oxidation.

#### 5.2.3 Sampling Processing Method Calibration

NA

#### 5.2.4 Sampling Processing Quality Control

Quality control of sediment grain size analyses is accomplished by strict adherence to protocol and documentation of quality control checks.

Several procedures are critical to the collection of high quality particle size data. Most important to the dry sieve analysis is that the screens are clean before conducting the analysis, and that all of the sample is retrieved from them. To clean a screen, it should be inverted and tapped on a table, while making sure that the rim hits the table evenly. Further cleaning of brass screens may be performed by gentle scrubbing with a stiff bristle nylon brush. Stainless steel screens may be cleaned with a nylon or brass brush.

The most critical aspect of the pipet analysis is knowledge of the temperature of the silt-clay suspension. An increase of only 1 C will increase the settling velocity of a particle 50  $\mu$ m in diameter by 2.3 percent. It is generally recommended that the pipet analysis be conducted at a constant temperature of 20 C. However, Plumb (1981) provides a table to correct for settling velocities at other temperatures; this table is included in the EMAP-E Laboratory Methods

Manual (U.S. EPA, 1995). Thorough mixing of the silt-clay suspension at the beginning of the analysis is also critical. A perforated, plexiglass disc plunger is very effective for this purpose. If the mass of sediment used for pipet analysis exceeds 25 g, a subsample should be taken as described by Plumb (1981). Silt-clay samples in excess of 25 g may give erroneous results because of electrostatic interactions between the particles. Silt-clay samples less than 5 g yield a large experimental error in weighing relative to the total sample weight.

The analytical balance, drying oven, sieve shaker, and temperature bath used in the analysis should be calibrated at least monthly.

#### 5.2.5 Sample Processing Method Reference

U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses. U.S. Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/620/R-95/008.

#### 5.2.6 Sample Processing Method Deviations

None

### 6. DATA ANALYSIS AND MANIPULATIONS

#### 6.1 Name of New or Modified Values

% SILTCLAY	SICL_PC
% SAND	SAND_PC
% SILT	SILT_PC
% CLAY	CLAY_PC
25th percentile phi	Q1_PHI
75th percentile phi	Q3_PHI
Quartile Deviation	QUARDVTN
Skewness	SKEWNESS
50th percentile phi	MED_DIAM

#### 6.2 Data Manipulation Description

The data manipulations calculated the percentages of grain composition, based on the <63 um and the >63 um fraction weights. Quartile phi measurements were also estimated.

#### 6.3 Data Manipulation Examples

##### 6.3.1 SILTCLAY

a. Silt-clay weight = (gross wt. - tare wt.) \*  
(total volume in cylinder)/(sample volume from cylinder)

b. The percent silt-clay calculation is as follows:

% silt-clay =  
silt-clay wt/(sand wt + silt-clay wt) \* 100



6.3.2 SAND

Sand weight =gross wt.(sample+pan) - tare wt.(pan)

% sand =  
sand wt/(sand wt + silt-clay wt) \* 100

Percent  
frequency = (corrected fraction/total of all corrected fractions)\*100

6.3.3 Quartile phis

Median diameter was read from cumulative % curve

25 percentile (Q1f) and 75 percentile (Q3f) were read from cumulative % curve

Quartile deviation = (Q3f + Q1f) / 2

Skewness = ((Q1f + Q3f) / 2) - Mdf

7. DATA DESCRIPTION

7.1 Description of Parameters

#	Parameter SAS Name	Data Type	Len	Format	Parameter Label
1	STA_NAME	Char	8	8.	The Station Identifier
2	VST_DATE	Num	8	YYMMDD6.	The Date the Sample was Collected
3	SAND_PC	Num	8	5.1	Sand (%) in Sample
4	SICL_PC	Num	8	5.1	Silt/Clay (%) in Sample
5	SICL_PC	Num	8	5.1	Silt/Clay (%) in Sample
6	CLAY_PC	Num	8	5.1	Clay (%) in Sample
7	Q1_PHI	Num	8	5.1	25 % Quartile Diameter (Phi)
8	Q3_PHI	Num	8	5.1	75 % Quartile Diameter (Phi)
9	QUARDVTN	Num	8	5.1	Phi Quartile Deviation (Folk 1974)
10	SKEWNESS	Num	8	5.1	Phi Quartile Skewness (Folk 1974)
11	MED_DIAM	Num	8	5.1	50 % Quartile Diameter (Phi)

7.1.6 precision to which values are reported

Values are reported to one decimal point.

7.1.7 Minimum Value in Data Set

SAND_PC	0.2
SILT_PC	5.4
SICL_PC	0.1
CLAY_PC	4.5
Q1_PHI	0.2
Q3_PHI	1.6
QUARDVTN	0.1
SKEWNESS	1.1
MED_DIAM	0.5

7.1.8 Maximum Value in Data Set

SAND_PC	99.9
SILT_PC	77.2
SICL_PC	99.8
CLAY_PC	75.4
Q1_PHI	8.0
Q3_PHI	9.6
QUARDVTN	3.2
SKEWNESS	1.1
MED_DIAM	9.2

7.2 Data Record Example

7.2.1 Column Names for Example Records

STA_NAME	VST_DATE	SAND_PC	SILT_PC	SICL_PC	CLAY_PC	Q1_PHI	Q3_PHI
QUARDVTN	SKEWNESS	MED_DIAM					

7.2.2 Example Data Records

OBS	STA_NAME	VST_DATE	SAND_PC	SILT_PC	SICL_PC	CLAY_PC	Q1_PHI	Q3_PHI
1	VA90-021	900913	8.3	47.2	91.7	44.5	5.5	9.3
2	VA90-022	900914	3.9	58.7	96.1	37.5	5.3	9.2
3	VA90-023	900819	15.3	72.1	84.7	12.6	4.3	5.8
4	VA90-024	900913	45.7	25.7	54.3	28.6	3.0	8.5
5	VA90-025	900923	12.9	41.0	87.1	46.1	5.3	9.3

OBS	QUARDVTN	SKEWNESS	MED_DIAM
1	1.9	-0.2	7.6
2	1.9	0.1	7.1
3	0.8	0.0	5.1
4	2.8	1.1	4.7
5	2.0	-0.4	7.7

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude

-77 Degrees 17 Minutes 4.80 Decimal Seconds

8.2 Maximum Longitude

-70 Degrees 04 Minutes 18.60 Decimal Seconds

8.3 Minimum Latitude

36 Degrees 49 Minutes 54.60 Decimal Seconds

8.4 Maximum Latitude

41 Degrees 38 Minutes 33.00 Decimal Seconds

## 8.5 Name of area or region

Virginian Province

Stations were located in estuaries along the East Coast of the United States from Cape Cod, Massachusetts, to Cape Henry, Virginia, at the mouth of the Chesapeake Bay. The area includes the District of Columbia and the States of Virginia, Maryland, New Jersey, Delaware, Pennsylvania, New York, Connecticut, Rhode Island and Massachusetts.

## 9. QUALITY CONTROL/QUALITY ASSURANCE

### 9.1 Measurement Quality Objectives

The maximum allowable precision goal for sediment grain composition analysis was 10%. The completeness goal for these data was 90%.

### 9.2 Quality Assurance/Control Methods

#### 9.2.1 Sediment Composition Analyses

Quality control for the sediment analysis procedures was accomplished by reanalyzing samples that failed either a range check or recovery check. For the range check, any sample results that fell outside expected ranges were reanalyzed. For example, any percentage that totaled greater than 100% was reanalyzed. For the recovery check, if the total weight of the recovered sample was 10% (by weight) less or greater than the starting weight of the sample, the sample was reanalyzed.

Quality assessment included reanalysis of randomly selected archived samples in the following manner:

1. Approximately 10% of each batch completed by the same technician was reanalyzed.
2. A random selection of the samples was processed in the same manner as the original sample batch.
3. If the absolute difference between the original silt-clay percentage and the second silt-clay percentage was greater than 10% then a third analysis was completed by a different technician. In addition, all of the other samples in the same batch should have been re-analyzed, and the laboratory protocol and/or technician's practices should have been reviewed and corrected to bring the measurement error under control.
4. The values closest to the third value were entered into the data base.
5. If more than 10% of the data from a batch were found in error, the whole batch was reprocessed using the archived sediment. A third check of the reanalyzed samples was completed by a different technician to assure that the reanalyzed values were correct.
6. Reanalysis and QA checks were accomplished within 30 days of the date of the original sediment analysis.

The analytical balance (accurate to 0.1 mg) and drying oven used in the analysis should have been calibrated at least monthly.

### 9.2.2 Total Organic Carbon analyses

All QC results for the analysis of total organic carbon in the 1991 sediment samples fell within required control limits. The Certified Reference Material PACS-1 (issued by the National Research Council of Canada) was utilized as the Laboratory Control Material. The certified concentration of total carbon in this reference material is 3.69% (percent dry weight). The average percent recovery achieved by the laboratory for n = 11 batches of TOC samples (i.e., 11 separate analyses of CRM PACS-1) was 94.1%, with all values falling within the range 88% to 99%. Since the PACS-1 certified concentration includes both organic carbon and a very small fraction of inorganic carbon, the laboratory's percent recovery values for organic carbon are expected to be below 100%.

Based on the good overall percent recovery of organic carbon in the Certified Reference Material, the 1991 sediment TOC data were deemed acceptable for use without qualification.

### 9.3 Actual Measurement Quality

All "sediment grain size" and "benthic grain size" samples collected per station were analyzed for the determination of percent silt/clay. Approximately 10% of these analyses were performed in duplicate and the percent difference determined as per the EMAP-VP 1990 QA Project Plan. The maximum allowable percent difference for the predominant fraction (silt/clay or sand) is 10%. The mean difference for the samples analyzed was 2.78%, with none exceeding 10% so no remedial action or retesting was required.

## 10. DATA ACCESS

### 10.1 Data Access Procedures

Data can be downloaded from the WWW server.

### 10.2 Data Access Restrictions

### 10.3 Data Access Contact Persons

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### 10.4 Data Set Format

Data can be downloaded in several formats from the web application and web site.

## 10.5 Information Concerning Anonymous FTP

Not accessible

## 10.6 Information Concerning WWW

Data can be downloaded from the WWW server.

## 10.7 EMAP CD-ROM Containing the Data Set

Data not available on CD-ROM.

## 11. REFERENCES

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## 12. TABLE OF ACRONYMS

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