CHESAPEAKE BAY
EARTH SCIENCE ATLAS NO. 2

MAP 2-3

WATER CONTENT

BY

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EXPLANATION

Introduction

In the characterization of the surficial sediments of the Chesapeake Bay bottom, the sedimentary environment is defined as consisting of the particulate matter (inorganic and organic) plus water. This assumes that the surficial sediments are 100% saturated with free water, water that is not bound in the internal structure of the clay minerals. The content of water (in percent) in the sediments is calculated as:

$$\text{Water Content \%} = \frac{\text{weight of water (grams)}}{\text{wet weight of sample (grams)}} \times 100$$

The weight of the water is determined as the difference between the wet weight and dry weight of the sample after drying at 65°C. In engineering studies, water content is expressed as a percentage of the dry weight of the sample instead of the wet weight as reported here.

Water content is closely related to various physical and geotechnical properties of the sediment. Numerous investigations have shown that water content is directly proportional to porosity and organic carbon and inversely proportional to unit weight and grain size (Harrison et al., 1964; Keller, 1974). Water content also provides a first approximation of the cohesiveness and erodability of sediments, and insight into the compaction history of the finer-grained muds (SILTY CLAY, CLAYEY SILTS and CLAYS). Current velocity studies have shown that within a given sediment type the higher the water content the lower the current velocity needed to erode and transport the sediment.

Distribution

Water content, as determined from the analysis of 576 samples, is strongly related to grain size (Table 1). Generally, SAND averages 21%, SILT, 61%, and CLAY, 67%, indicating that grain size is inversely correlated with water content. Within a given size class, the range of water content varies. In the SAND categories (including SILTY SAND and CLAYEY SAND), the variation in water content is related to the various admixtures of finer or coarser grained particles within the sediment type. In the SILTY CLAY category, the wide range in water content (24.67-78.48%) appears to be related to another geologic process, compaction. As finer-grained sediments are buried they undergo compaction and pore water is expelled. The actual decrease in water content with depth of burial depends not only on the grain size of the sediment but also on the overburden pressures and the length of burial time. The lower water contents observed in the SILTY CLAY (25%) may indicate sediments that have undergone burial. These sediments may represent pre-Holocene material, possibly of the Pleistocene Kent Island or Talbot Formation.

The distribution of water content in the bottom sediments conforms to the Bay geometry and correlates with the distribution of sediment types. Finer grained sediments (SILTY CLAY and CLAYEY SILT) with high water content (over 60%) are generally located in the main channel areas. Proceeding towards the shoreline, water content decreases to 20% or less for the SAND of the nearshore areas.

Table 1. Percent water measured in the different sediment size classifications.

TYPE	RANGE (%) H_2O	MEAN (%) H_2O	NUMBER
SAND	11.02-46.36	24.55	185
SILTY SAND	20.66-48.79	33.35	6
CLAYEY SAND	29.00-67.47	45.17	18
(SANDS)	(11.02-67.47)	(26.54)	(208)
SILT	-	-	-
SANDY SILT	34.70	34.70	1
CLAYEY SILT	54.00-72.00	63.05	61
(SILTS)	(34.70-72.00)	(62.59)	(62)
CLAY	68.20-73.53	70.09	3
SANDY CLAY	56.79-62.48	59.63	2
SILTY CLAY	24.67-78.48	67.33	264
(CLAYS)	(24.67-78.48)	(67.31)	(269)
SAND/SILT/CLAY	19.20-71.51	56.76	37

References

Harrison, W., M. Lynch, and A. Altschaefel, 1964, Sediments of Lower Chesapeake Bay, with emphasis on mass properties: Jour. of Sed. Petrology, vol. 34, p. 727-755.

Keller, G., 1974, Marine geotechnical properties: Interrelationships and relationships to depth of burial: in Inderbitzen, A.L., ed., Deep Sea Sediments, Physical and Mechanical Properties: New York, Plenum Press, p. 77-100.

LEGEND

CONTOUR INTERVAL 15% WET WEIGHT

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