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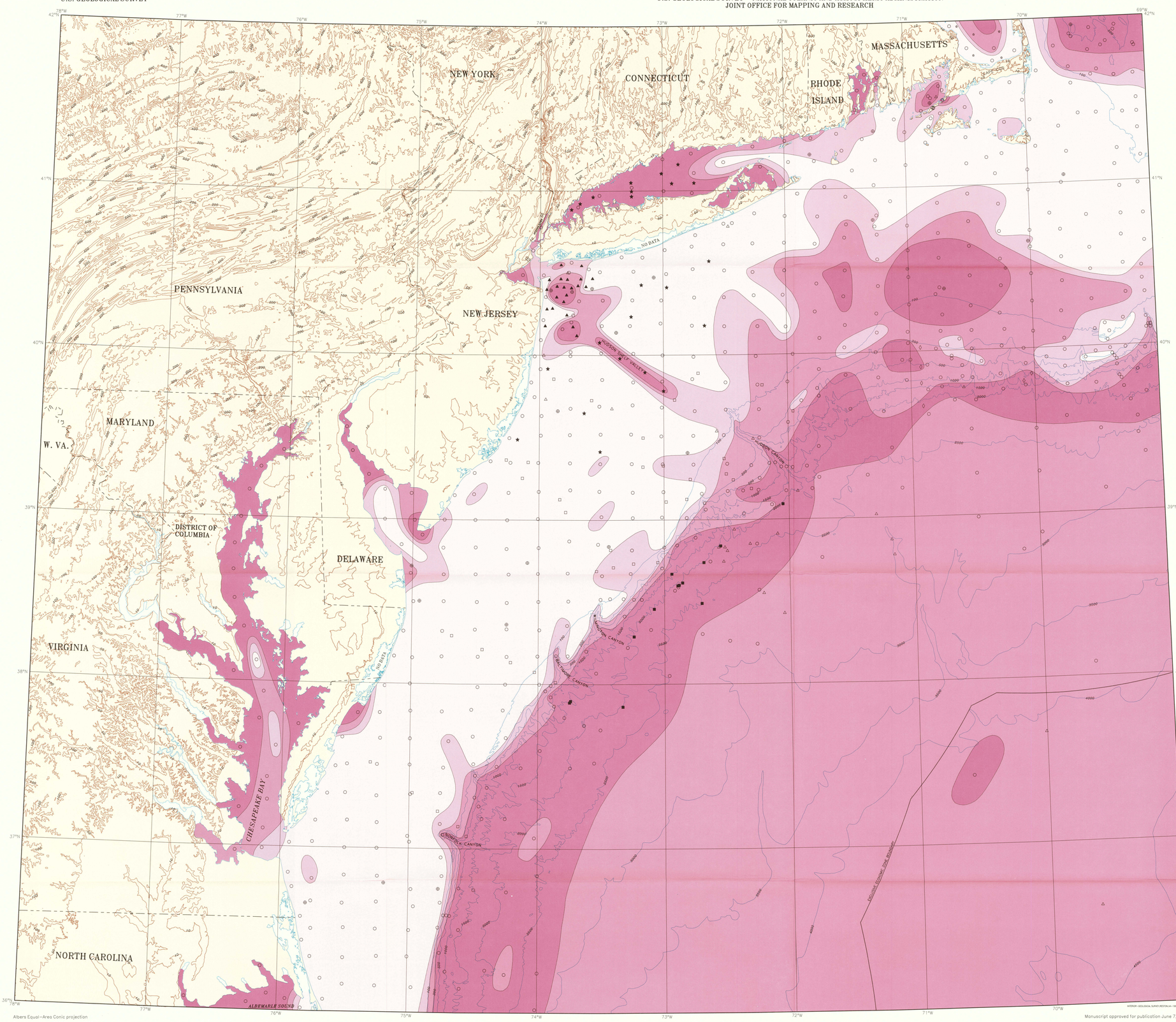
MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1987–B



Albers Equal–Area Conic projection
Standard parallels 29°30'N and 45°30'N

Bathymetry compiled from hydrographic surveys of variable quality. This information is not intended for navigational purposes

SCALE 1:1 000 000

25 0 25 50 75 100 NAUTICAL MILES
25 0 25 50 75 100 125 150 175 200 KILOMETERS
25 0 25 50 75 100 STATUTE MILES

TOPOGRAPHIC CONTOUR INTERVAL 200 METERS
WITH SUPPLEMENTARY CONTOURS AT 10, 50, and 100 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
BATHYMETRIC CONTOUR INTERVAL 500 METERS TO MAXIMUM DEPTH
WITH SUPPLEMENTARY CONTOURS AT 100 AND 200 METERS
DATUM: MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE

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MAP SHOWING WEIGHT PERCENT OF THE TOTAL ORGANIC CARBON IN THE SURFICIAL SEDIMENTS OF THE MID–ATLANTIC CONTINENTAL MARGIN, CAPE COD TO ALBEMARLE SOUND

By
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1990

DESCRIPTION OF MAP UNITS

Weight percent of total organic carbon in surficial sediments

- < 0.20
- 0.20–0.39
- 0.40–0.80
- > 0.80

EXPLANATION OF MAP SYMBOLS

The following references supplied raw data and control points and are listed in order of sample abundance. Each reference is preceded by a map symbol corresponding to the associated sample localities. The number given in parentheses after each reference is the number of sample localities plotted from that study

- ○ Hathaway, J.C., 1971, Data file––continental margin program, Atlantic Coast of the United States: Woods Hole Oceanographic Institution Reference No. 71–15, 496 p. (582)
- □ Bothner, M.H., 1977, Trace metals in surface sediments of the Middle Atlantic Continental Shelf, in Folger, D.W., ed., Middle Atlantic Outer Continental Shelf environmental studies: Final Report to the U.S. Bureau of Land Management by the U.S. Geological Survey: Virginia Institute of Marine Science contract no. 08550–CT5–42, v. 3, chapter 9, 18 p. (37)
- △ Rowe, G.T., and Clifford, C.H., 1978, Sediment data from short cores taken in the northwest Atlantic Ocean: Woods Hole Oceanographic Institution Technical Report 78–46, 56 p. (24)
- ★ Reid, R.N., 1982, Sediment granulometry, organic carbon and nitrogen, in Reid, R.N., O'Reilly, J.E., and Zdanowicz, V.S., eds., Contaminants in New York Bight and Long Island Sound sediments and demersal species, and contaminant effects on benthos, summer 1980: National Oceanic and Atmospheric Administration Technical Memorandum NMFS–F/NEC–16, 96 p. (23)
- ⊕ National Marine Fisheries Service, 1983, Annual NEMP report on the health of the northeast coastal waters of the United States, 1981: National Oceanic and Atmospheric Administration Technical Memorandum NMFS–F/NEC–20, 86 p. (23)
- ▲ National Marine Fisheries Service, 1981, Northeast monitoring program––annual NEMP report on the health of the northeast coastal waters of the United States, 1980: National Oceanic and Atmospheric Administration Technical Memorandum NMFS–F/NEC–10, 79 p. (22)
- ■ Maciolek, N., Grassle, J.F., Hecker, B., Boehm, P.D., Brown, B., Dade, B., Steinhauer, W.G., Baptiste, E., Ruff, R.E., and Petrecca, R., 1986, Study of biological processes on the U.S. Mid–Atlantic Slope and Rise: Final Report to the Department of the Interior, Minerals Management Service, MMS contract no. 14–12–0001–30064, 314 p. (13)
- ☆ Schlee, John, Folger, D.W., and O'Hara, C.J., 1973, Bottom sediments of the continental shelf off the northeastern United States––Cape Cod to Cape Ann, Massachusetts: U.S. Geological Survey Miscellaneous Investigations Series Map I–746. (5)
- ◊ Maciolek, N., Hecker, B., Butman, C.A., Grassle, J.F., Dade, W.B., Boehm, P.D., Steinhauer, W.G., Starczk, V., Baptiste, E., Ruff, R.E., and Brown, B., 1986, Study of biological processes on the U.S. North Atlantic Slope and Rise: Final Report to the Department of the Interior, Minerals Management Service, MMS 86–0022, 201 p. (6)
- ⊙ Bothner, M.H., Rendigs, R.R., Campbell, Esma, Doughten, M.W., Aruscavage, P.J., Dorrzapf, A.F., Johnson, R.G., Parmenter, C.M., Pickering, M.J., Brewster, D.C., and Brown, F.W., 1984, The Georges Bank monitoring program 1983; analysis of trace metals in bottom sediments: U.S. Geological Survey Circular 915, 36 p. (2)

INTRODUCTION

This map shows the distribution of total organic carbon in the surficial sediments of the Atlantic continental margin from southern New England to North Carolina. The map was produced as part of the U.S. Geological Survey's (USGS) Continental Margin Map (CONMAP) series. The weight–percent contours shown on this map were derived primarily from published reports that supplied the sample points (see explanation of map symbols for a list of the studies), and to a lesser extent from more general studies, which did not supply sample localities (Hulsemann, 1967; Emery and Uchupi, 1972; Lisitzin, 1972; and Premuzic and others, 1982). Studies of inshore areas, such as the Hudson River and Chesapeake Bay (Boon and MacIntyre, 1968; Byrne and others, 1982; DePalco, 1967; Folger, 1972; Panuzio, 1965; and Young, 1968) were examined to improve the detail of the maps in those areas. Blank parts of the map indicate areas where data were insufficient to infer carbon content. These areas are generally limited to the upper, more landward parts of the estuaries or embayments and to sounds landward of barrier islands. Any literature citations that are not in the references cited are listed in the explanation of map symbols.

METHODS

Procedures used to measure total organic–carbon content included both gasometric methods similar to the technique described by Kolpack and Bell (1968) and titrametric methods similar to the one described by Allison (1935). However, only analyses carried out on calcium carbonate–free sediment samples and expressed as percent dry weight of the sample were plotted on the map. Although most of the samples were collected using some type of grab sampler (Campbell, Van Veen, or Smith–McIntyre), a few of the samples were obtained by coring. When core samples were used or when changes in sediment type with depth were present in the grab sample, only the analyses from the uppermost interval were included. The data were contoured at the 0.20, 0.40, and 0.80 percent intervals of organic carbon.

Because some of the studies used different analytical techniques, there may be a systematic difference between data sets. For example, Hulsemann and Kadar, as tabulated by Hathaway (1971), used the hydrochloric acid leach method to dissolve calcium carbonate. This leaching method may have removed some of the organic carbon, resulting in values that are slightly low. The seasonal variation in the total organic–carbon content in the surficial sediments is another source of variability in the data because the sampling programs for the various source studies were conducted at different times during the year. Maciolek and others (1986) reported an average seasonal variation of ± 0.095 weight–percent total organic carbon in the sediments on the continental slope. Although most of the studies provided the results of replicate analyses made to determine the reproducibility of the sampling and analytical methods, a few studies did not supply this data.

ORGANIC–CARBON DISTRIBUTION

These data reflect the amount of natural organic matter in surficial sediments, which is derived principally from phytoplankton in the marine environment and to a lesser degree from continental sources. As noted by Hulsemann (1967), the total organic–carbon concentration varies inversely with grain size; it is highest in dark–gray, fine–grained sediment. The relationship between amount of organic carbon and sediment texture is dependent on the fine–grained nature of the organic carbon itself, the adsorption of organics onto the charged surfaces of clay minerals, and the grain surface area available for adsorption (Froelich and others, 1971).

On the map, highest values of organic carbon (greater than 0.80 percent) are seaward of the continental shelf edge where fine–grained sediment is present, and in one area on the shelf south of Cape Cod (the "Mud Patch") where fine–grained sediment winnowed from Georges Bank is actually accumulating (Bothner and others, 1981). Other areas of high concentration are located in sounds, bays, and inlets along or near the coast where fine–grained organic–rich sediment has been deposited either from the outfall of nearby urban centers or from debris in nearby marshlands. Certainly the anthropogenic effects of urban areas like New York City are evident in the high concentrations of organic material in sewage and dredge spoils in the Hudson Shelf Valley, southeast of the entrance to New York Harbor. High concentrations are also found associated with the heads of major submarine canyons (Hudson, Baltimore, Norfolk, and Wilmington) that indent the shelf edge. The canyons are likely traps for fine–grained sediment swept from the shelf and inshore areas.

The lowest concentrations of organic carbon (less than 0.20 percent) are associated with the sandy continental shelf and most of the coastline. The slow or negative modern sedimentation rate over much of the shelf (Knebel, 1981; Schlee, 1973) permits the removal of organics by bottom scavengers and the winnowing of fine–grained sediment and organic debris by storm– and tidally induced wave and current action (Gorsline, 1963).

Concentrations of organic carbon in the surficial sediments gradually decrease seaward across the continental rise. This decrease is caused by oxidation during transit to the deeper waters and by macro– and microbiologic reworking in the slowly accumulating pelagic sediments (Gorsline, 1963; Lisitzin, 1972).

ACKNOWLEDGMENTS

Digital data bases used to prepare this map were assembled, corrected, and verified by Edward Escowitz, Muriel Grim, and Christina Lief. Gerald Evenden developed the computer software system, MAPGEN, used to compose this map. Advice provided by Will Stettner regarding the cartographic design substantially improved the quality of this map.

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INDEX MAP

CONTINENTAL MARGIN MAPS

A part of the U.S. Geological Survey marine mapping program is the preparation of the Continental Margin Map (CONMAP) series at a scale of 1:1,000,000. These maps are organized in overlapping panels that provide complete coverage of the nation's Exclusive Economic Zone. This map of the area off the mid–Atlantic states is one of six providing coverage of the Atlantic and Gulf of Mexico continental margin.

The base information on this map (coastline, bathymetry, topography, and state boundaries) was extracted from the U.S. Geological Survey–National Oceanic and Atmospheric Administration (NOAA) Joint Office for Mapping and Research (JOMAR) digital data library. Topographic contours in the JOMAR library were generated by computer using a modified version of the 3 arc–second elevation data provided by the Defense Mapping Agency (DMA). Bathymetric contours were synthesized using depth data from various sources. Coastline data are a modified version of the NOAA digital coastline file. State boundaries are from the USGS National Atlas files.

For sale by U.S. Geological Survey, Map Distribution, Box 25286, Federal Center, Denver, CO 80225