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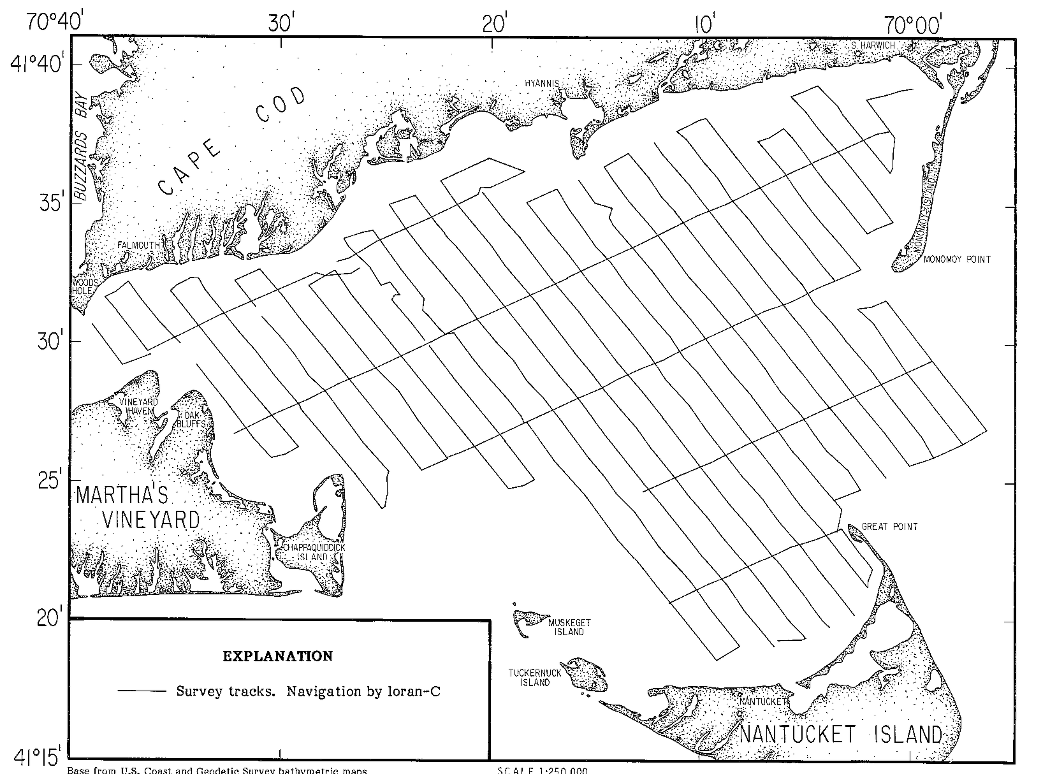

Base from U.S. Coast and Geodetic Survey bathymetric maps C. & G.S. 0808N-51, Block Island and Rhode Island Sounds, 1967; and C. & G.S. 0708N-51, Nantucket Sound and approaches, 1967. Transverse Mercator projection

FIGURE 1.—LOCATION OF TRACKLINES FOR HIGH-RESOLUTION SUBBOTTOM PROFILES

INTRODUCTION

This report presents results of marine geologic studies conducted by the U.S. Geological Survey (USGS) during the summers of 1976 and 1977 in Nantucket Sound, located off the southeastern coast of Massachusetts between Cape Cod and the islands of Martha's Vineyard and Nantucket. The study was made in cooperation with the Massachusetts Department of Public Works and the New England Division of the U.S. Army Corps of Engineers. It covered an area of the U.S. Atlantic Inner Continental Shelf between lat. 41°15' and 41°40' N. and between long. 69°55' and 70°40' W. (index map).

Major objectives included assessment of sand and gravel resources, evaluation of the environmental impact of offshore mining of these resources and of offshore disposal of solid waste and dredge spoil material, identification and mapping of the offshore geology, and determination of the geologic history of this part of the inner shelf. A total of 803 kilometers (km) of closely spaced high-resolution seismic-reflection profiles (fig. 1) and 20 cores totaling 120 meters (m) of recovered sediment were collected during the investigation.

This report is companion to geologic maps published for Cape Cod Bay (Oldale and O'Hara, 1975), Buzzards Bay (Robb and Oldale, 1977), and eastern Rhode Island Sound and Vineyard Sound, Mass. (O'Hara and Oldale, 1980).

METHODS

The subbottom seismic-reflection data (tracklines shown in figure 1) were obtained with a surface-towed EG&G Unit Pulse Boomer[1] having an energy output of 300 joules nominal at frequencies ranging from 400 Hertz (Hz) to 8 kiloHertz (kHz). Reflected acoustic energy was detected by a 4.6-m, eight-element hydrophone array, amplified, actively filtered (400- to 4000-Hz bandpass), and graphically displayed on an EPC[1] dry-paper recorder. The electromechanical transducer was triggered every 0.5 seconds (s) and the sweep rate of the recorder was 0.25 s. Profiler resolution was generally 1 to 1.5 m.

Cores were obtained with a vibrating coring device designed to provide 9-centimeter (cm)-diameter core samples up to 9.2 m long in water depths of 11 to 70 m. Core site selections were based on the nature and subbottom altitude of the acoustic units as defined by the seismic-reflection profiles.

Navigational control for all cruises was provided by loran-C (positional accuracy within 0.2 km), supplemented by radar and visual fixes. Positional information was logged at 15-minute intervals and at major course changes during the geophysical surveys. Ship speed over the bottom averaged 9 km/hour during the seismic-reflection surveys. Core sites were occupied within 0.03 km of their selected locations from the seismic data.

[1]Use of trade names is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

ACKNOWLEDGMENTS

The authors are indebted to the staffs of the Woods Hole Oceanographic Institution (WHOI) and the Marine Science Consortium for their cooperation in the use of their research vessels. We thank the Department of Public Works of the Commonwealth of Massachusetts and the New England Division of the Army Corps of Engineers for partial funding in support of this study. We are indebted to Capt. A. Colburn of the RV *Asterias* and Capt. G. Van Tassel and crew of the RV *Annandale* for their assistance during the research cruises. Special thanks are extended to M. Rubin and E. Spiker of the USGS for providing radiocarbon dates (^{14}C) and to T. Ager of the USGS for making palynological age determinations. We appreciate the cooperation and assistance of J. Katsolis for his field supervision of the vibracoring phase of the study. W. Ferrebee, J. McLane, P. Forrestel, R. Commeau, R. Sylwester, E. Winget, K. Parolski, D. Eskenasy, L. Dekay, J. Aaron, J. Eusden, and A. Whitney of the USGS, and G. Clayton of Massachusetts Coastal Zone Management, were particularly generous with their time and assistance on various cruises, in the laboratory, and in data reduction and preparation of the maps. For his suggestions and helpful discussions during the preparation of this report, we express our gratitude to G. Chase of the Army Corps of Engineers. We especially thank J. Zwinakis, P. Warwick, and P. Forrestel for drafting the illustrations, and S.W. Needell and Peter Popenoe for their thorough reviews of the manuscript.

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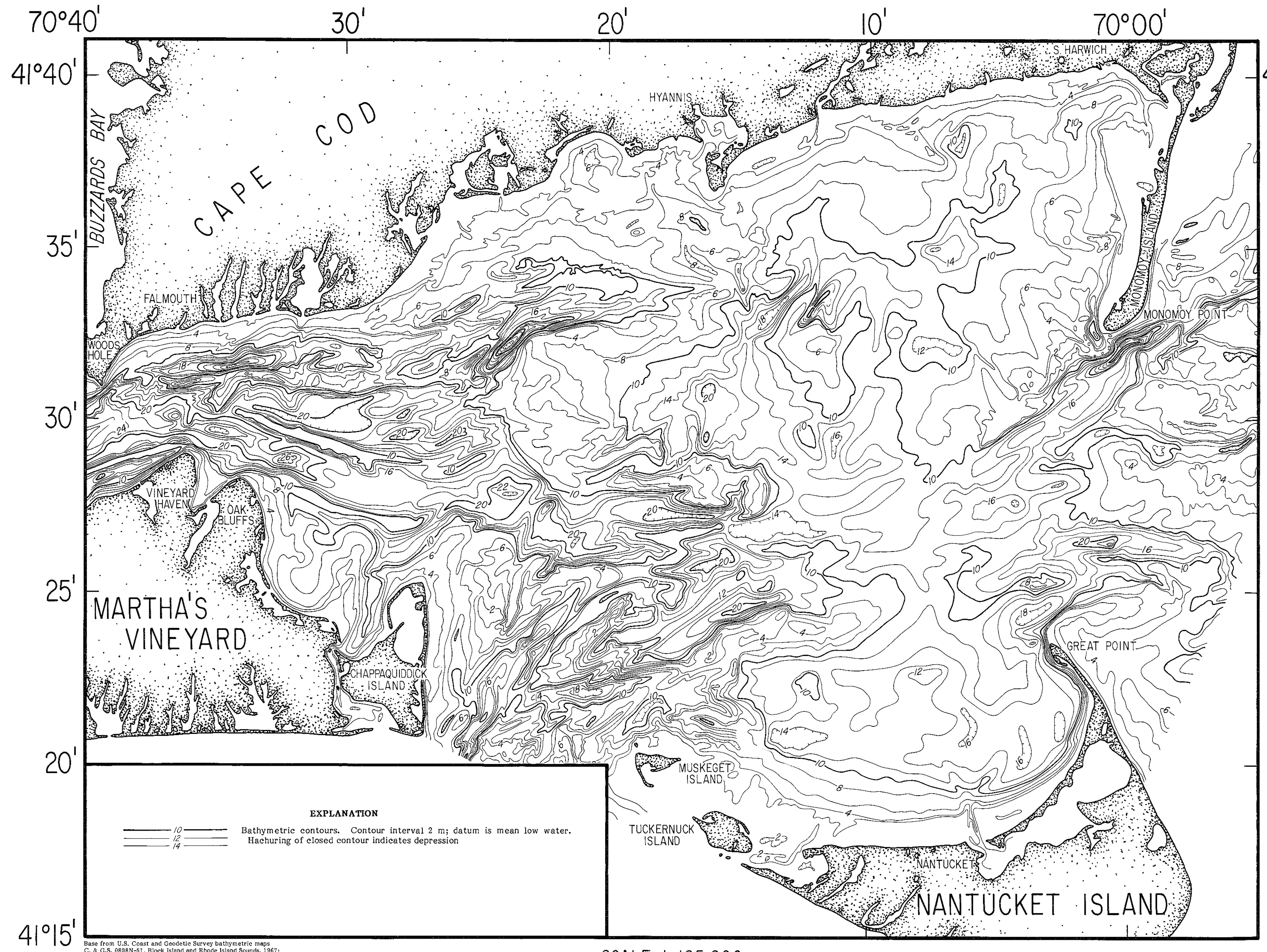

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FIGURE 2.—SEA-FLOOR TOPOGRAPHY

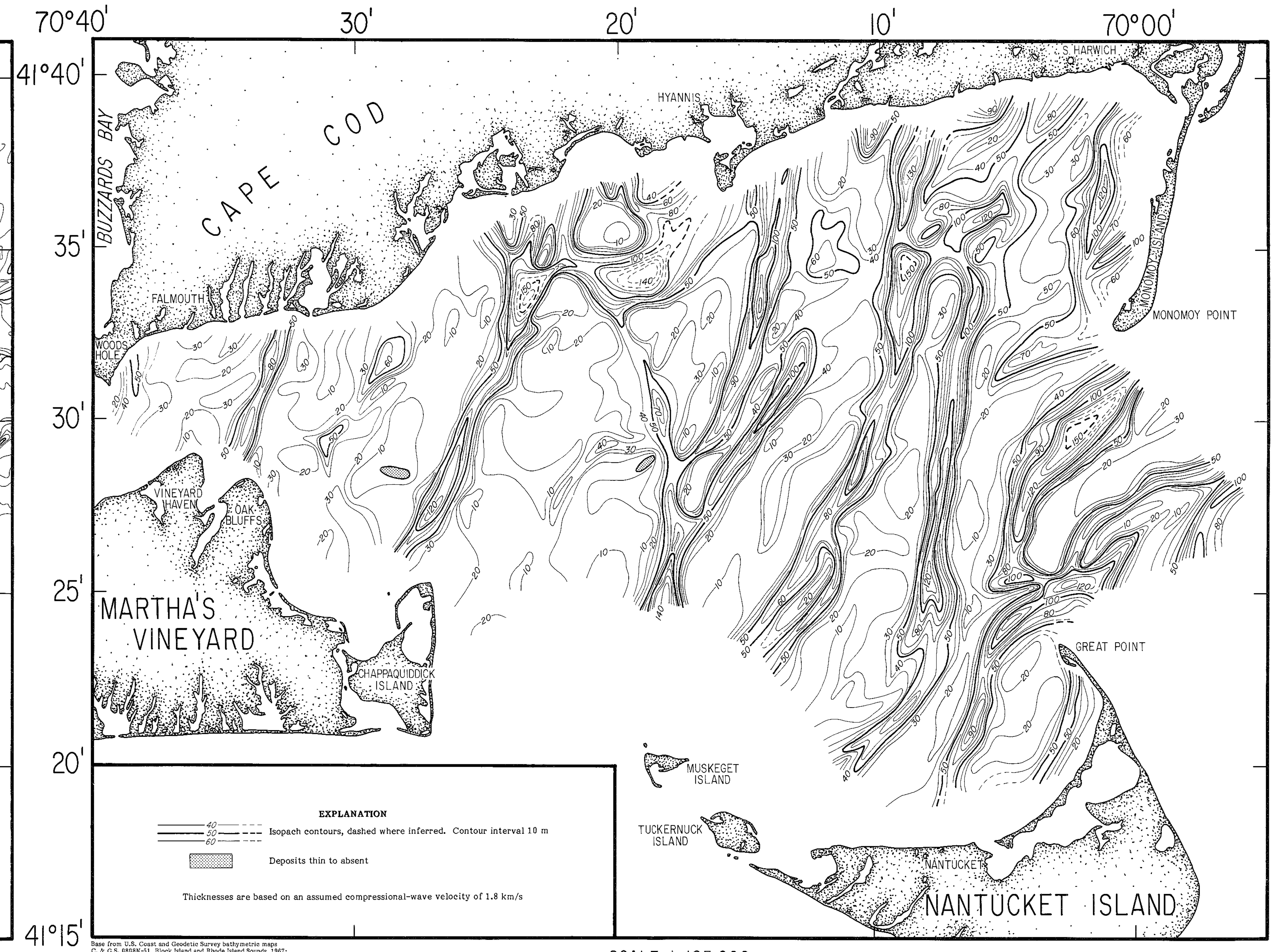

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FIGURE 5.—THICKNESS OF GLACIAL DRIFT DEPOSITS

DISCUSSION OF MAP UNIT

This map shows the distribution and thickness of the acoustic unit (fig. 15, unit Qd in profiles A-H) thought to represent glacial drift deposited mostly by the Cape Cod Bay ice lobe during its final retreat northward from southeastern Massachusetts. In the western and eastern parts of Nantucket Sound, the acoustic unit (Qd) may also include glacial sediments derived from the Buzzards Bay ice lobe and the South Channel ice lobe, respectively.

The drift, ubiquitous in the study area, is inferred to be mostly of late Wisconsinan (Woodfordian) age and to correlate with the moraines, proglacial outwash, and lake sediments found elsewhere in southern New England and on Block Island and Long Island (Schafer, 1961; Schafer and Hartshorn, 1965; Oldale, 1982). However, drift of pre-late Wisconsinan age similar to that thought to exist on Martha's Vineyard (Kaye, 1964a,b) and on Nantucket Island (Oldale and Eskenasy, 1983) may occur locally.

In the seismic-reflection profiles, the drift is generally well stratified; it is characterized by flat-lying to gently dipping internal reflectors (thought to represent outwash and ice-contact stratified drift) and by acoustically well layered sequences consisting of numerous closely spaced reflectors (thought to represent glaciolacustrine deposits). In other areas, the drift is characterized by highly irregular, discontinuous internal reflectors, numerous parabolic echoes, and, in some places, imbricate reflectors, all of which may represent layers of till or imbrication of older strata by overriding ice. Locally, the drift is acoustically massive, indicating little or no internal structure.

In Nantucket Sound, the drift unconformably overlies coastal plain and continental shelf sedimentary rocks of mostly Late Cretaceous age and, to a lesser extent, of Tertiary and perhaps early Pleistocene age. However, in the north-central part of the sound, the drift may directly overlie bedrock of pre-Mesozoic age, notably in the deeper parts of the valleys where erosion may have cut through the coastal plain rocks (fig. 4; fig. 15, profile B). The drift is thickest, locally up to 160 m, where it fills valleys deeply cut into the coastal plain formations; it is thinnest, generally less than 30 m, where it caps the preglacial topographic highs or broad flat-topped interfluves on the surface of the coastal plain deposits.

The glacial drift is capped by a major unconformity (fig. 15, reflector fu_1 in profiles B-E and H) inferred to have been fluvially cut in post-late glacial time during the lowstand of sea level, and, locally, by a planar marine unconformity (fig. 15, reflector mu in profiles A-C, E, and F) inferred to have been cut during subsequent sea-level rise. The drift is overlain locally by fluvial, freshwater lake(?), estuarine, and marine deposits (fig. 15, units Qfe and Qb in profiles A-F and H; and fig. 10, map unit Qm) of Holocene age. In Nantucket Sound, the drift crops out on the sea floor in many places (figs. 7 and 10), generally in association with the bathymetric lows (fig. 2). These lows or swales occur between the shoals and sand ridges, and are thought to be areas highly scoured by marine currents, causing and (or) maintaining exposure of the glacial drift on the seabed in these areas.

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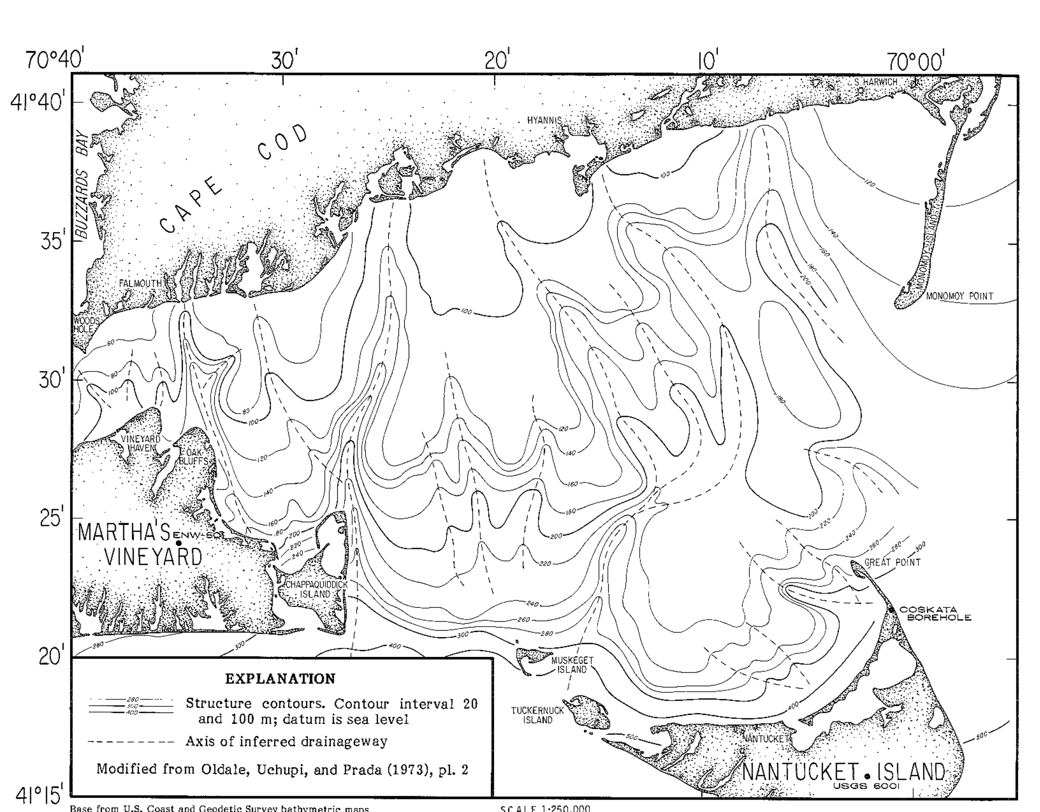

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FIGURE 3.—DEPTH TO BASEMENT (PRE-CRETACEOUS) ROCKS

COASTAL PLAIN DEPOSITS

Beneath Nantucket Sound, the deepest nearly-continuous and most prominent seismic reflector observed is believed to be underlain by rocks of Late Cretaceous age, and, to a lesser extent, by rocks of Tertiary to early Pleistocene age (fig. 15, unit Ku in profiles A-H), all of which unconformably overlie bedrock. Acoustic penetration was insufficient to map the bedrock (basement) surface (fig. 3), which is composed of crystalline rocks and consolidated sedimentary rocks of Mesozoic age or older (Oldale and others, 1973). The coastal plain deposits, which represent the submerged parts of the Atlantic Coastal Plain, are inferred to be mostly Upper Cretaceous strata and to consist predominantly of unconsolidated to semiconsolidated sand and silty clay containing some gravel. They are similar to sediments recovered in boreholes drilled on Martha's Vineyard (Hall and others, 1980) and Nantucket Island (Folger and others, 1978). The deposits are part of a seaward-thickening wedge of coastal plain and continental shelf sediments that are truncated on their landward side by an eastward trending erosional escarpment that faces north and roughly parallels the adjacent coastline. This escarpment, which defines the northernmost limit of the coastal-plain deposits beneath the inner shelf off southern New England, has been shown to extend from western Long Island Sound to eastern Georges Bank (Weed and others, 1974). However, results of this study indicate that within Nantucket Sound the deposits occur much farther north and are much more extensively eroded than is shown by Oldale and others (1973). The data suggest that these rocks may extend locally beneath inner Cape Cod, although they have not been recognized in the many boreholes (Maevsky and Drake, 1963) that have been drilled there. The seismic-profiling data show that most onshore wells on inner Cape Cod were too shallow (less than 30 m below sea level) to penetrate coastal plain strata, and that the few deeper borings (Koteff and Cotton, 1962; Oldale, 1976) were situated over preglacial valleys or between erosional remnants, or were well north of the escarpment (O'Hara, 1981a).

In the seismic-reflection profiles, the surface of the deposits is seen as a distinct, well defined, smooth to slightly irregular acoustic reflector (fig. 15, reflector fu_2 in profiles A-H) that defines numerous deeply cut valleys (thalweg depths as much as 170 m below sea level) and adjacent broad, shallow (generally 30-40 m below sea level), relatively flat-topped interfluves that are oriented mostly north-south. Internal flat-lying to gently seaward-dipping reflectors are seen within the deposits, but they are mostly discontinuous and are truncated by the flanks of the valleys. Erosional outliers are present in the north-central part of Nantucket Sound (fig. 15, profile B).

All the major valleys are continuous across the sound and may be floored locally by bedrock in their northernmost parts. They are filled with glacial drift deposits (fig. 15, unit Qd in profiles A-H) of late Pleistocene age. Vibracore data (figs. 13 and 14, cores 4923, 4933, 4934, and 4935) suggest that the valley-fill deposits consist chiefly of silt and clay probably of glaciolacustrine origin. They, in turn, are blanketed by proglacial outwash sediments of mostly sand and gravel. The nearshore positions of the major valleys are found to correlate with large reentrants, bays, and estuaries along the adjacent coastlines, which suggests that the valleys may have influenced glacial deposition and drift morphology of the region (O'Hara, 1981b) during late Pleistocene time.

TERTIARY AND EARLY PLEISTOCENE(?) DRAINAGE

The structure-contour map (fig. 4) shows a surface inferred to represent a major unconformity (fig. 15, reflector fu_2 in all profiles) that was cut by streams during late Tertiary and early Pleistocene time. This period of extended subaerial erosion produced a lowland underlain on the north side by crystalline rocks and on the south side by coastal plain rocks. Drainage within the lowland is thought to have consisted of south-flowing streams on the bedrock surface and north-flowing streams on the north-facing escarpment (O'Hara and others, 1976; O'Hara and Oldale, 1980). Valleys defined by the unconformity within Nantucket Sound are believed to have been tributary to a drainage system that flowed east, breached the escarpment through a water gap, and drained south across the shelf. Great South Channel (a large bathymetric low separating Nantucket Island from Georges Bank), thought by Oldale and others (1973) to have drained the western Gulf of Maine during the late Tertiary, may have been the water gap. Subsequent glacial erosion in Nantucket Sound during the Pleistocene most likely widened and locally overdeepened some of the valleys, but otherwise little altered the preglacial morphology.

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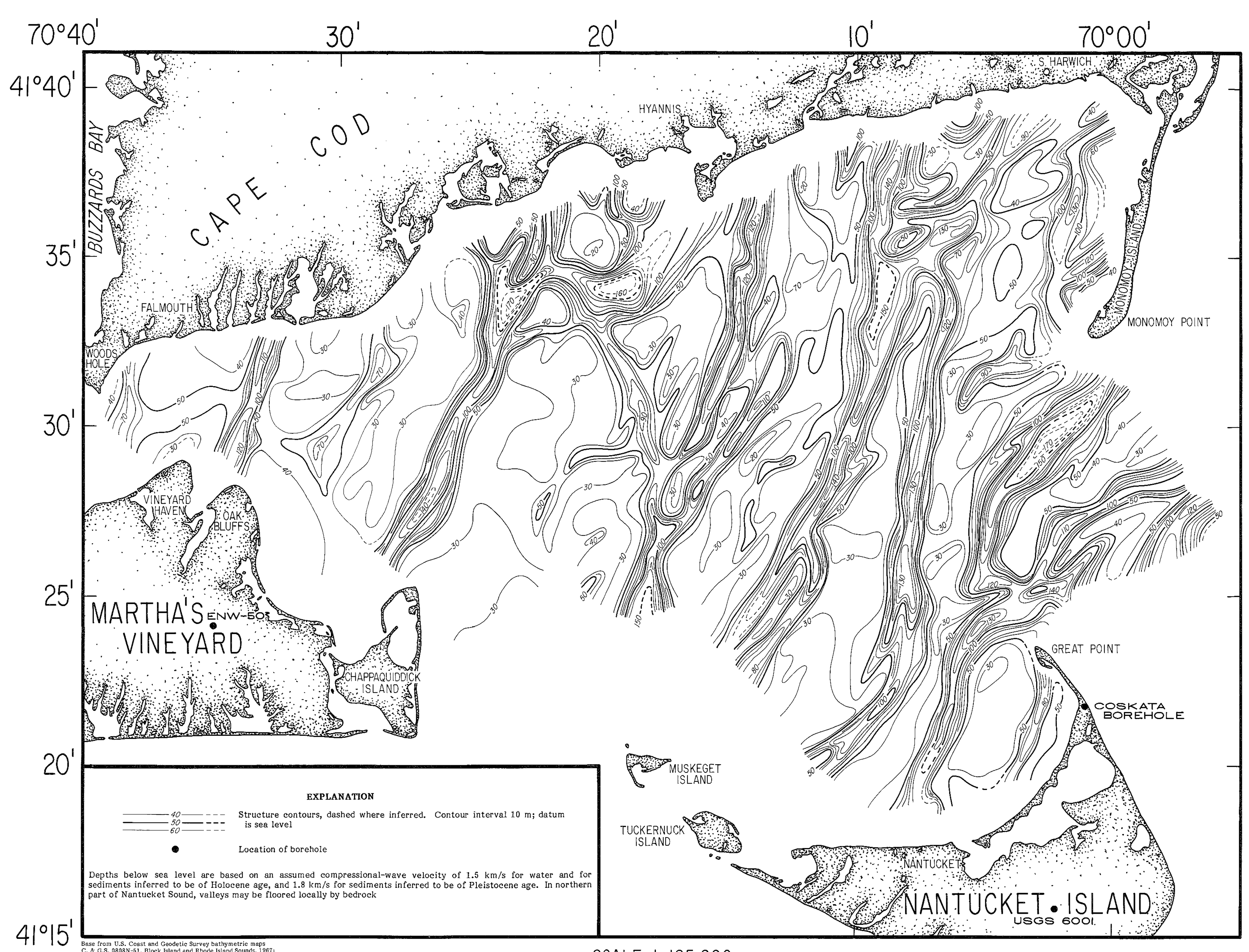

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FIGURE 4.—DEPTH TO SUBMERGED COASTAL PLAIN ROCKS

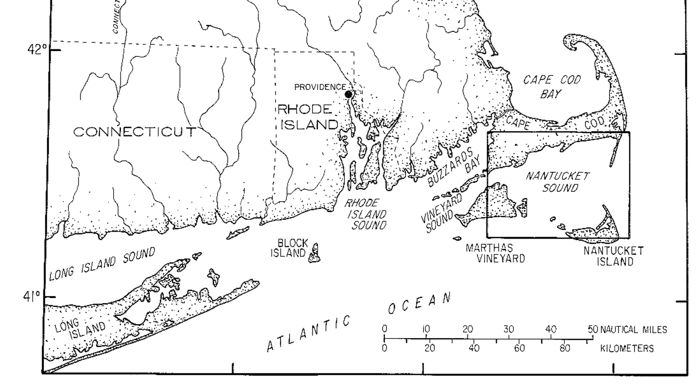
Units of Measurement

International System (SI or metric) units of measurement herein are used in preference to Customary (English) units. Some conversion factors are given below.

Multiply	By	To obtain
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
kilometers (km)	0.6214	miles (mi)
kilometers	0.540	nautical miles

TABLE OF CONTENTS FOR SHEETS 1-4

	Figure	Sheet
Introduction		1
Methods		1
Acknowledgments		1
Index map showing study area		1
Maps showing:		
Location of tracklines for high-resolution subbottom profiles	1	1
Sea-floor topography	2	1
Depth to basement (pre-Cretaceous) rocks	3	1
Depth to submerged coastal plain rocks	4	1
Thickness of glacial drift deposits	5	1
Structure of glacial drift surface	6	2
Thickness of postglacial (Holocene) deposits	7	2
Thickness of post-transgressive marine deposits	8	2
Sea-floor microtopography	9	2
Surficial geology	10	3
Interpretive geologic sections A-A' and B-B', from figure 10	11	3
Map showing potential geologic hazards	12	3
Map showing location of vibracoring sites	13	3
Lithologic and stratigraphic columns of vibracores, including table showing radiocarbon age determinations	14	3
Selected seismic profiles and interpretive sections, including locality map	15	4



INDEX MAP SHOWING STUDY AREA

MAPS SHOWING GEOLOGY, SHALLOW STRUCTURE, AND BEDFORM MORPHOLOGY OF NANTUCKET SOUND, MASSACHUSETTS

By
Charles J. O'Hara and Robert N. Oldale
1987

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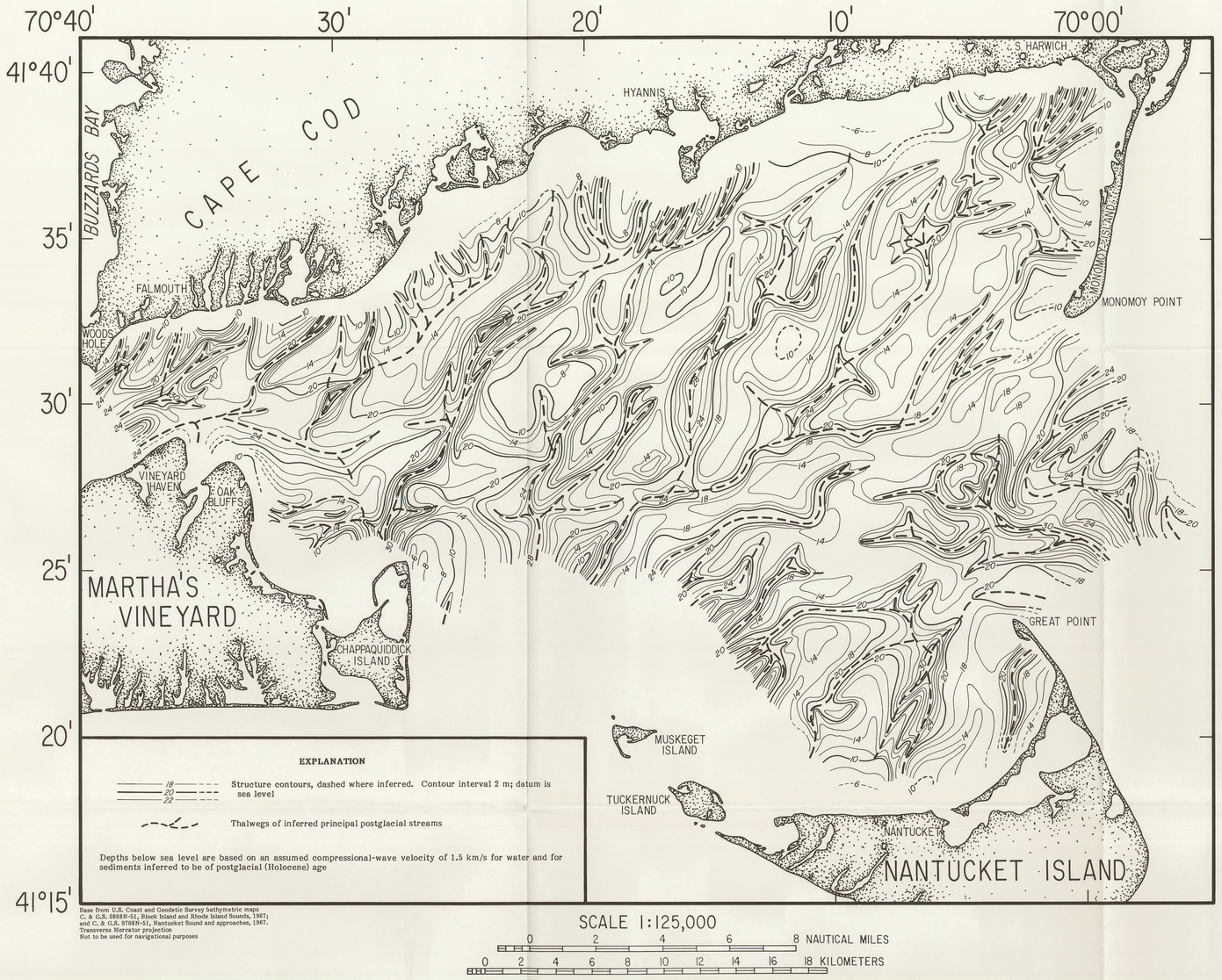

FIGURE 6.—STRUCTURE OF GLACIAL DRIFT SURFACE

◄ DISCUSSION

The structure contours are drawn on a surface underlain by upper Wisconsinan glacial deposits. The glacial drift surface is overlain in most places by freshwater, estuarine, and marine (mainly sand) deposits of Holocene age, but it does crop out on the sea floor (figs. 7 and 10) in many places in Nantucket Sound, notably in the northern and western parts.

POSTGLACIAL DRAINAGE

The mapped surface is inferred to represent a major unconformity (fig. 15, reflector fu_1 in profiles B-E and H) that was fluvially cut in post-late glacial time during a lowstand of sea level when this part of the inner shelf was subaerially exposed. The postglacial valleys cut into the glacial drift have local relief of up to 14 m and thalweg depths greater than 34 m below sea level. They form dendritic patterns indicating that drainage was mostly to the south and southwest. In the westernmost part of Nantucket Sound, the valleys appear to have been tributary to streams that drained Vineyard Sound and the southern part of eastern Rhode Island Sound (index map) to the west (O'Hara and Oldale, 1980). In the northern and central parts of Nantucket Sound, the valleys were tributary to a stream that drained south through the area now occupied by Muskeget Channel (figs. 8 and 2) located between Chappaquiddick Island off Martha's Vineyard, and Muskeget Island, just northwest of the island of Nantucket. In the eastern part of Nantucket Sound, north of Nantucket Island, drainage was to the north and east and the valleys were probably tributary to a major stream that drained south through the area now occupied by Great South Channel, east of Nantucket Island.

Vibracore data show that the valleys are filled with silt and clay of nonmarine and estuarine origin that were deposited as the sea transgressed and gradually submerged the pre-existing, fluvially modified, glacial drift surface. Radiocarbon dates on freshwater peats cored nearby in Buzzards Bay by Robb and Oldale (1977) suggest that postglacial marine submergence of this part of the Atlantic Inner Continental Shelf may not have been complete prior to 5,000 years before present.

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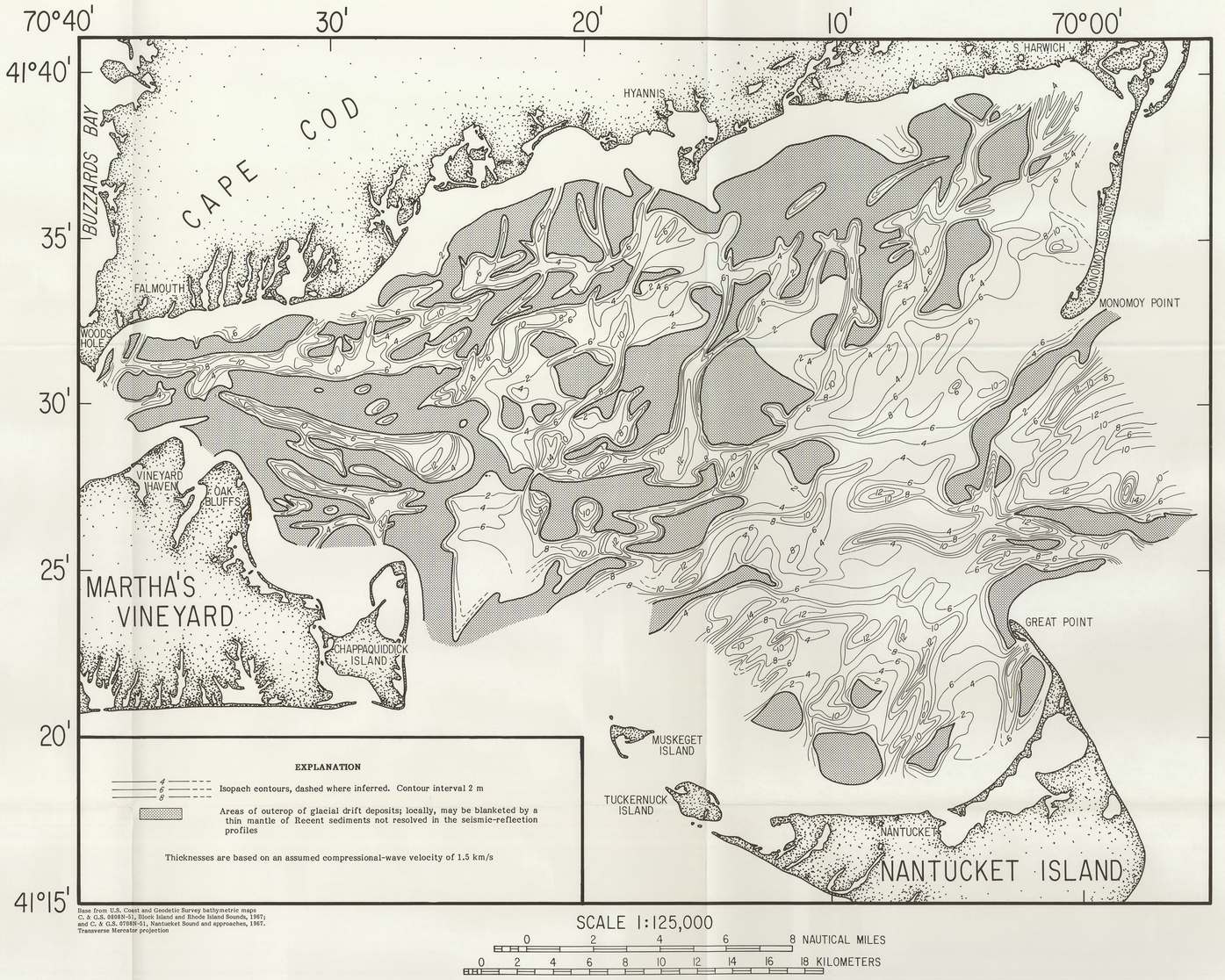

FIGURE 7.—THICKNESS OF POSTGLACIAL (HOLOCENE) DEPOSITS

DISCUSSION OF MAP UNIT ►

This map shows the distribution and combined thickness of acoustic units believed to represent subaerial and marine sediments of Holocene age (fig. 15, units Qfe and Qb in profiles A-F and H). The older sediments (Qfe) occur atop a postglacial fluvial unconformity (fig. 15, reflector fu_1 in profiles B-E and H), and consist of pre-transgressive fluvial sand and gravel and freshwater bog and lake(?) deposits, and transgressive estuarine and salt-marsh deposits. Post-transgressive marine deposits (Qb) are mostly sand and occur atop the transgressive marine unconformity (mu). The deposits of Holocene age are underlain by upper Wisconsinan drift (mostly outwash, and, locally, glaciolacustrine silt and clay). Deposits are thickest, in places as much as 20 m, where they bury postglacial channels cut into the glacial drift and where they occur as submerged bars, linear sand ridges, and tidal deltas. Deposits are thin to absent where they mantle glacial topographic highs.

Internal reflectors are mostly flat-lying to gently dipping, and locally are indicative of crossbedding. Steeply dipping reflectors, generally restricted to the offshore bars and sand ridges, suggest foreset bedding. In areas of deeper water, the deposits are seen to be acoustically well layered and to contain numerous closely spread internal reflectors. In some places (eastern part of Nantucket Sound) the unit is acoustically impenetrable. Vibracore samples (see figure 13 for localities) indicate that the surficial sediments in these areas consist of highly organic silt and clay saturated with gas that is probably of biogenic origin. Similar acoustically turbid sediments were found by O'Hara and Oldale (1980) to occur in Vineyard Sound and eastern Rhode Island Sound.

REFERENCE CITED

O'Hara, C.J., and Oldale, R.N., 1980, Maps showing geology and shallow structure of eastern Rhode Island Sound and Vineyard Sound, Massachusetts: U.S. Geological Survey Miscellaneous Field Studies Map 1186, 5 sheets, scale 1:125,000.

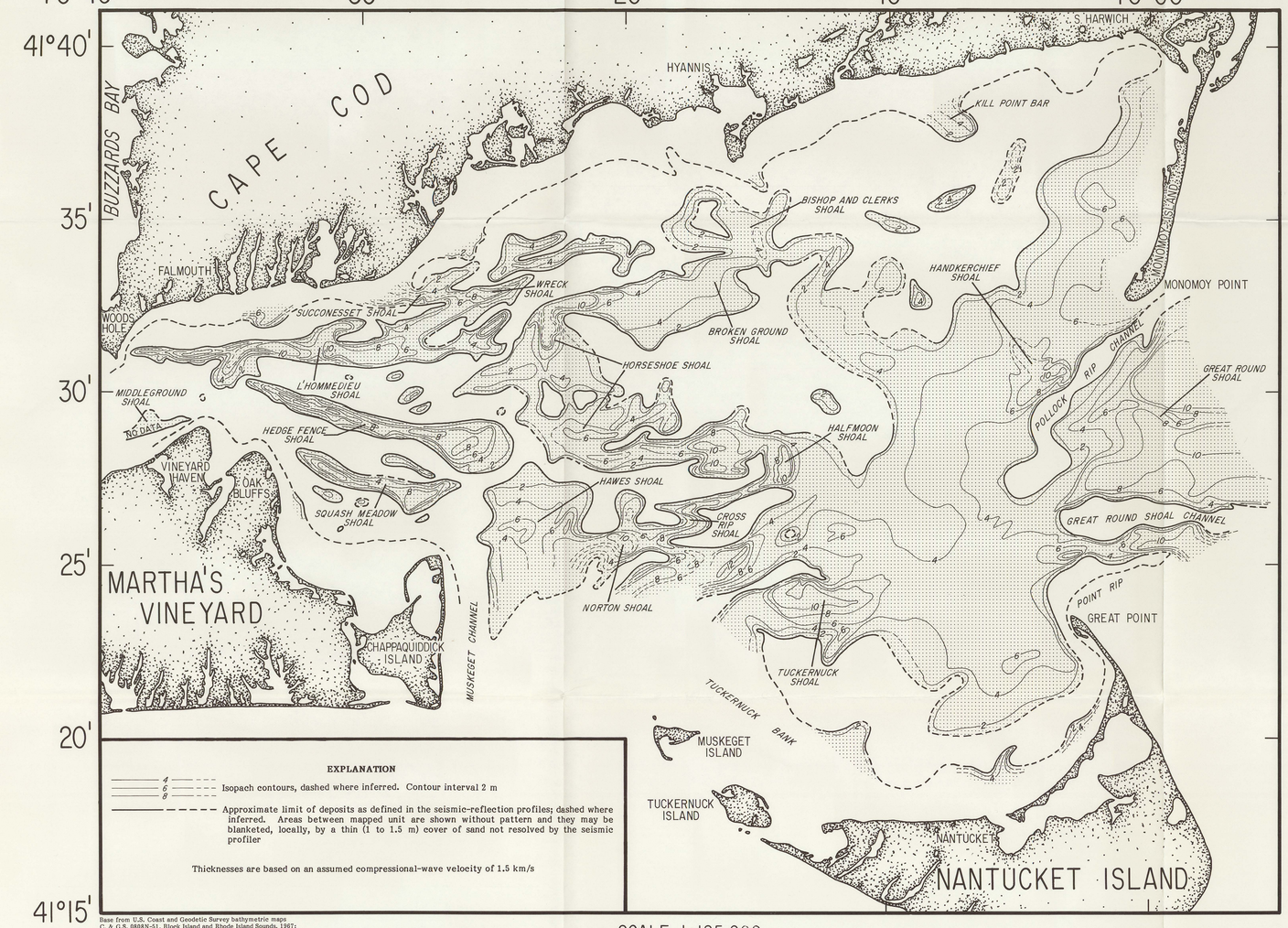

FIGURE 8.—THICKNESS OF POST-TRANSGRESSIVE MARINE DEPOSITS

◄ DISCUSSION ►

Figure 8 shows the distribution and thickness of the acoustic units thought to represent Holocene marine beach and bar deposits and quiet-water deposits laid down atop a planar marine unconformity (fig. 15, reflector mu in profiles A-C, E, and F) that was cut as the sea transgressed across the inner shelf, eroding estuarine and glacial deposits. The beach and bar deposits (fig. 10, unit Qb) are inferred to have been constructed during sea-level rise by wave action and by littoral and tidal currents that caused reworking of the inner-shelf sediments and redeposition upon the nearly flat-lying wave-cut surface. The deposits consist mostly of medium to very coarse sand containing abundant shell hash, and, locally, small lenses of gravel. However, core data (figs. 13 and 14, vibracores 4928 and 4929) indicate a facies change to finer grained sand, silt, and clay in the area north of Nantucket Harbor and west of Great Point (fig. 10, unit Qm). The sand and gravel are most likely derived from the adjacent glacial drift (upper Wisconsinan outwash). Finer grained material in the drift was probably winnowed by currents and transported into areas of quieter water within Nantucket Sound and (or) was flushed out of the sound into deeper water offshore.

Seismic-reflection profiles show that the shelly coarse sand deposits are responsible for the salient submarine topographic features that occur in Nantucket Sound and that represent very large-scale bed forms (fig. 2). Morphologically, these bed forms include linear sand ridges, broad shoals, tidal deltas, and submerged spits. The shelly coarse sand deposits blanket 60 percent of the sound and are thickest—in places, 13 m—where they occur as linear ridges (as much as 39 km long and 3 km wide) but generally, they are 4-6 m thick. Internal reflectors are mostly flat lying and continuous beneath broad flat-topped shoals and tidal deltas, and are steeply dipping beneath sand ridges. Dipping reflectors suggest local foreset bedding.

Figure 9 shows the distribution of sand waves and megaripples (heights to 9 m and wavelengths to 150 m) that locally superpose the larger bed forms. Although generally restricted to the flanks of the larger bedforms, they also occur within the swales or troughs between the shoals and ridges. The sand waves and megaripples are mostly well developed and are strongly asymmetric. This suggests that tidal-driven bottom currents are presently active in these areas and that bed-form construction, maintenance, and migration are dominated or controlled by the ebbing or flooding phase of each tidal cycle, probably during periods of peak flow. The largest sand-wave fields occur atop a submerged spit and ebb-tidal delta complex located between Great Point and Monomoy Point in eastern Nantucket Sound.

The beach and bar deposits (fig. 8) are underlain in most places by glacial drift of late Pleistocene age, and in some places by fluvial and estuarine sediments of Holocene age. These deposits are considered to be a potential source of sand and perhaps gravel for use as construction aggregate. Although the vibracore samples show a paucity of gravel within these deposits, a more detailed sampling program would determine if commercial quantities do exist. Significant concentrations of gravel are found to be generally restricted to underlying glacial-outwash sediments and postglacial fluvial deposits.

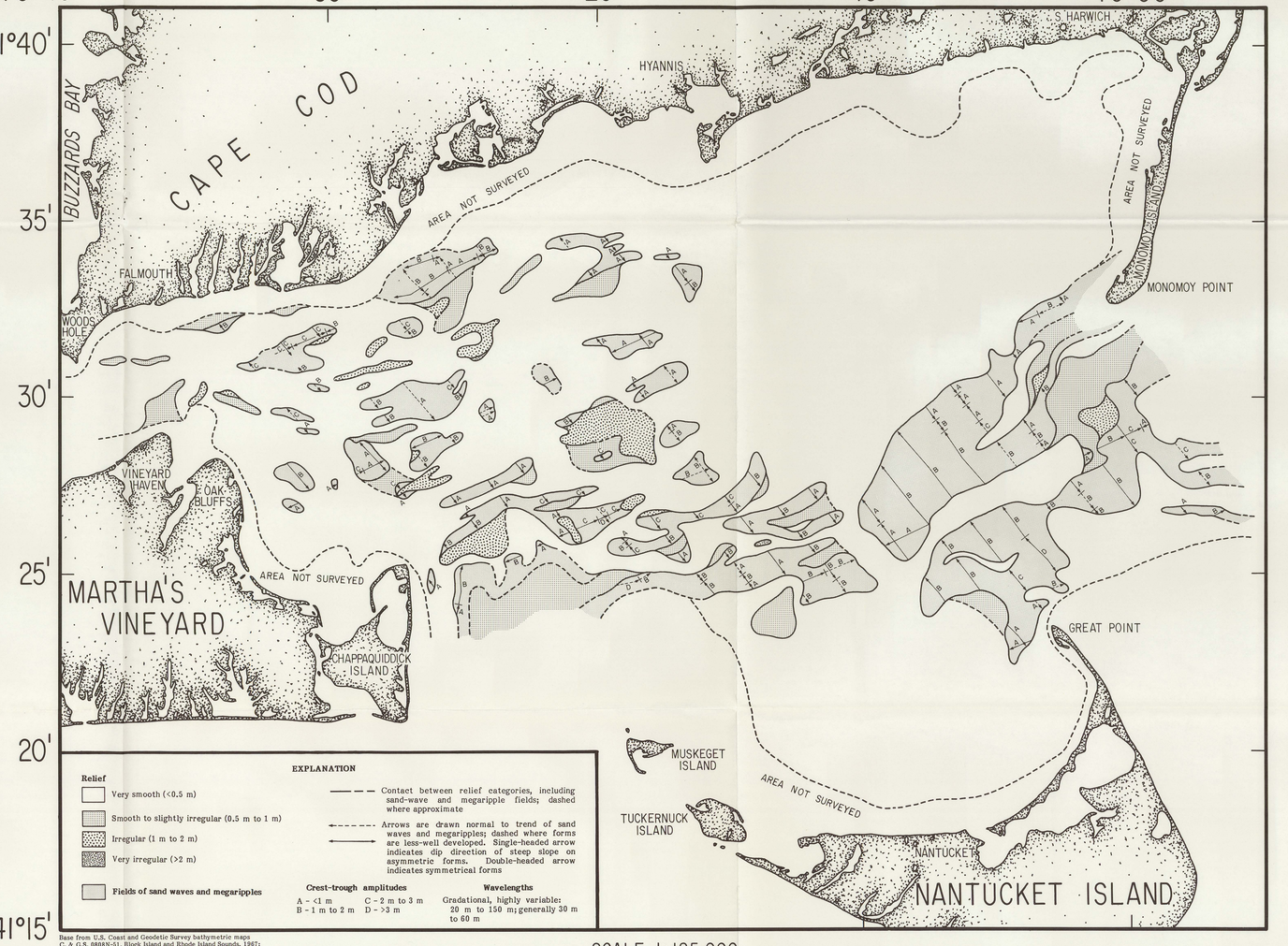

FIGURE 9.—SEA-FLOOR MICROTOPOGRAPHY

MAPS SHOWING GEOLOGY, SHALLOW STRUCTURE, AND BEDFORM MORPHOLOGY OF NANTUCKET SOUND, MASSACHUSETTS

By
Charles J. O'Hara and Robert N. Oldale

1987

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1987

PREPARED IN COOPERATION WITH
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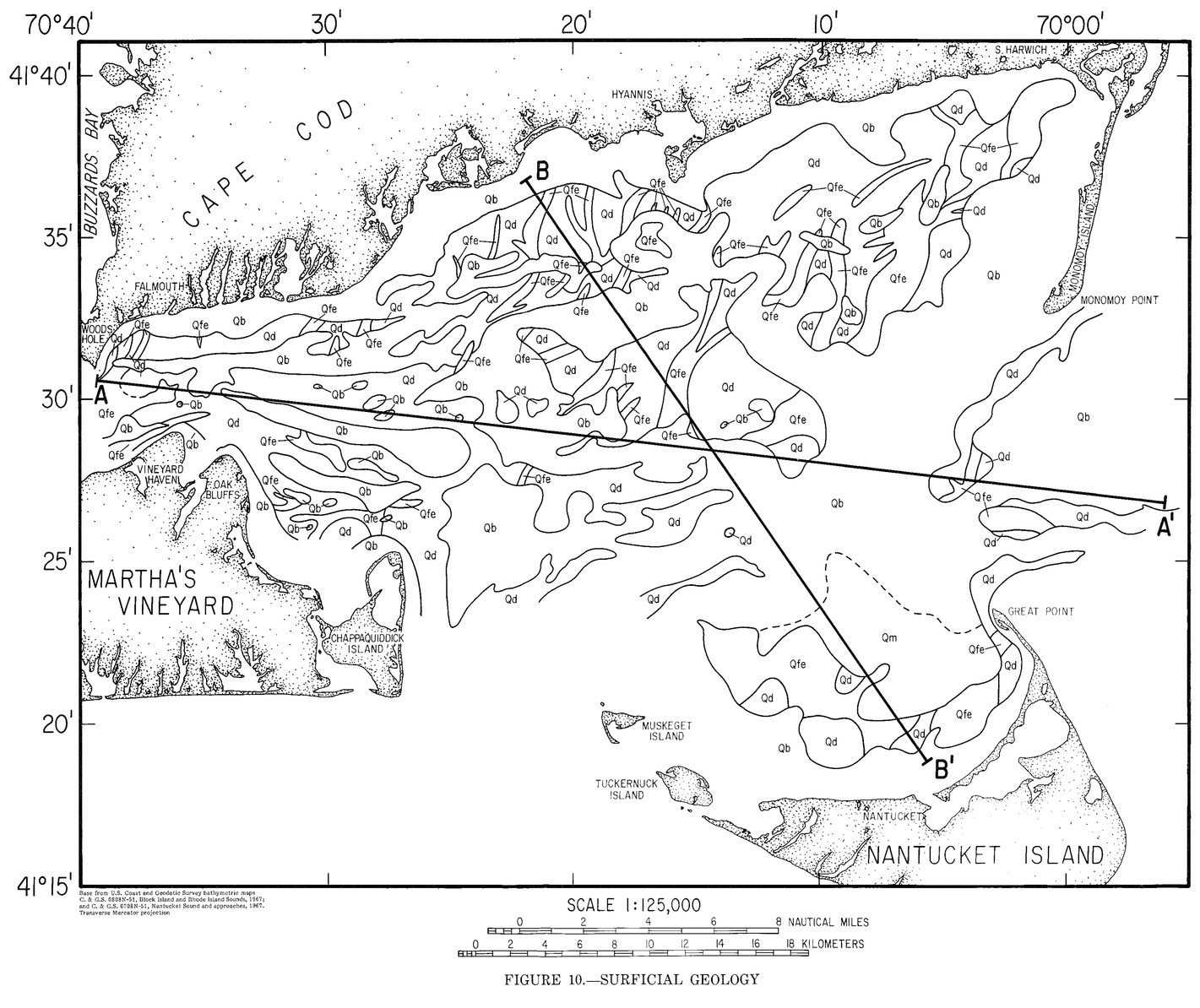
THE ARMY CORPS OF ENGINEERS, NEW ENGLAND DIVISION



Base from U.S. Coast and Geodetic Survey bathymetric maps C. & G.S. 68885-51, Block Island and Rhode Island Sounds, 1967; and C. & G.S. 67684-51, Nantucket Sound and approaches, 1967. Transverse Mercator projection

FIGURE 10.—SURFICIAL GEOLOGY

EXPLANATION FOR FIGURES 10 AND 11

Contact—On map is dashed where approximately located or where inferred; in cross sections is dashed where inferred

DESCRIPTION AND CORRELATION OF MAP UNITS FOR FIGURES 10 AND 11

NOTE: The distribution and lithology of the geologic map units are based in part on the acoustic nature of the seismic-reflection data, and in part on the vibracore data. Locally, the units mapped may be overlain by sediments too thin to be resolved by the seismic profiler.

Qm

QUIET-WATER MARINE DEPOSITS

Recent marine deposits consisting mostly of silt and clay with some shell and shell fragments, and, locally, lenses of fine to very fine sand. Unit is up to 6 m thick. Internal bedding mostly flat lying and continuous. Grades to coarser-grained marine beach and bar deposits. Deposits are thought to be largely locally derived by marine winnowing of adjacent glacial drift

Qb

MARINE BEACH AND BAR DEPOSITS

Recent marine deposits consisting of medium to very coarse sand and minor amounts of gravel. In the area north of Nantucket Harbor and west of Great Point, grades to finer-grained quiet-water deposits (unit Qm). Sand is mostly quartz with abundant shells and shell hash scattered throughout. Internal bedding is mostly flat lying and continuous, but in places is steeply dipping, suggesting foresets. Unit is locally up to 13 m thick. Fields of sand waves and megaripples are commonly found associated with these deposits, and therefore are believed to be presently active. Deposits are considered a potential minable source of relatively clean sand and possibly gravel. Sand and gravel are thought to be mostly derived from the adjacent glacial drift by marine reworking

MARINE UNCONFORMITY

Qfe

FLUVIAL AND ESTUARINE DEPOSITS

Recent fluvial sand and gravel and fine-grained estuarine mud. Sand and gravel are moderately to well sorted. Estuarine deposits are mostly silt and clay with abundant shells and shell fragments and occasional lenses of sand. In places, the unit contains remnant organic debris from freshwater bog, lake, and salt-marsh environments. Internal stratification is predominantly flat lying to crossbedded; some places may be foreset bedded. Unit generally is 4-6 m thick and locally up to 8 m thick. Top of unit is truncated by the marine planation surface formed during the last sea-level rise. Unit occurs within the shallow subsurface of the inner shelf and crops out on the sea floor in many places, notably the eastern part of Nantucket Sound. The fluvial deposits are considered to be a potential source of sand and gravel

POSTGLACIAL FLUVIAL UNCONFORMITY

Qd

GLACIAL DRIFT (UNDIFFERENTIATED)

Ice-contact stratified drift, outwash plain, and proglacial lake sediments deposited by glacial meltwater streams. Deposits are derived mostly from the Cape Cod Bay ice lobe and locally may include glacial drift derived from the Buzzards Bay ice lobe (westernmost part of Nantucket Sound) and South Channel ice lobe (easternmost part of sound). Unit is inferred to be mostly of late Wisconsinan age, but in places it may include pre-upper Wisconsinan drift. Deposits consist predominantly of moderately to well sorted outwash sand and gravel and glaciolacustrine silt and clay. Locally, unit is thought to include ice-contact fluvial and deltaic deposits and subglacial till. Outwash sand and gravel are largely flat lying, but probably are crossbedded locally. Glacial lake deposits are extensive and are well stratified, thin bedded to laminated. Unit thickness is highly variable, in places up to 160 m. The upper surface of the unit represents an unconformity formed fluvially during the lowstand of sea level, and a wave-cut unconformity formed during the subsequent marine transgression. Most of the gravel encountered in the vibracores is associated with the unit. Glacial lake sediments recovered in the cores were nonfossiliferous (Robert T. Cushman and Jack McLaren, USGS, oral commun., 1978)

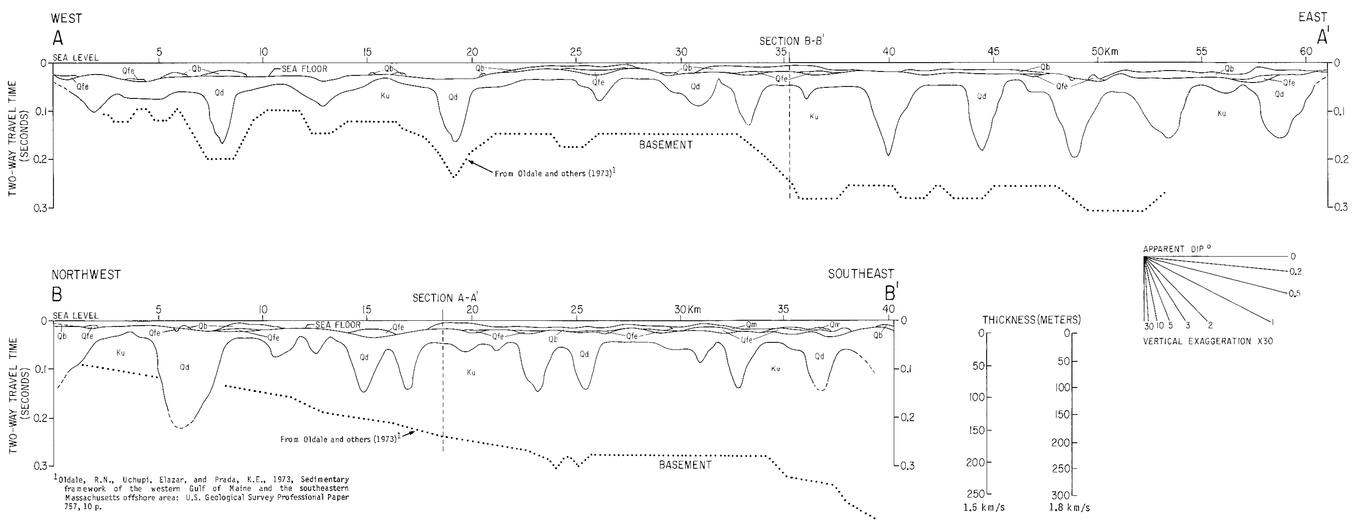
LATE TERTIARY-EARLY PLEISTOCENE FLUVIAL UNCONFORMITY

Ku

COASTAL PLAIN DEPOSITS

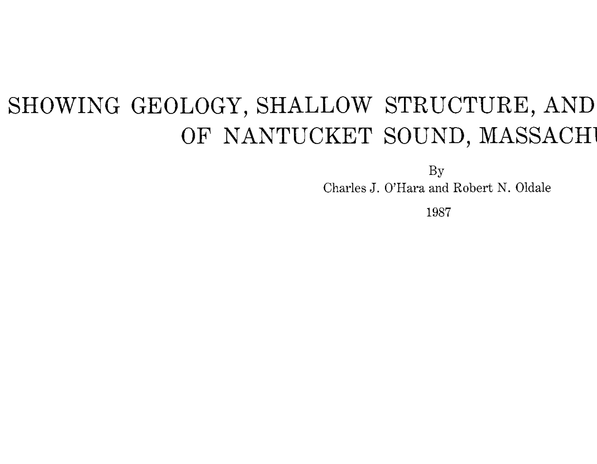
Coastal plain and continental shelf sedimentary rocks inferred to be mostly of Late Cretaceous age and to consist of unconsolidated to semiconsolidated sand, gravel, silt, and clay. Deposits occur beneath a deeply eroded escarpment and thicken seaward. Internal bedding is thought to be mostly continuous and flat lying to gently seaward dipping. Top of unit represents a major unconformity, having relief of 60 to 140 m, that is inferred to have formed during the late Tertiary or early Pleistocene. Locally, unit may include continental shelf strata of Tertiary and early Pleistocene age. Shown on cross sections only

Qm, Qb, Qfe, Qd	Holocene	QUATERNARY
Qd	Pleistocene (upper Wisconsinan)	
Ku	Upper Cretaceous (possibly including some Tertiary and pre-upper Wisconsinan deposits)	PRE-QUATERNARY



[1]Oldale, R.N., Uchupi, Elazar, and Prada, K.E., 1973, Sedimentary framework of the western Gulf of Maine and the southeastern Massachusetts offshore area: U.S. Geological Survey Professional Paper 757, 10 p.

FIGURE 11.—INTERPRETIVE GEOLOGIC SECTIONS A–A′ AND B–B′ FROM FIGURE 10



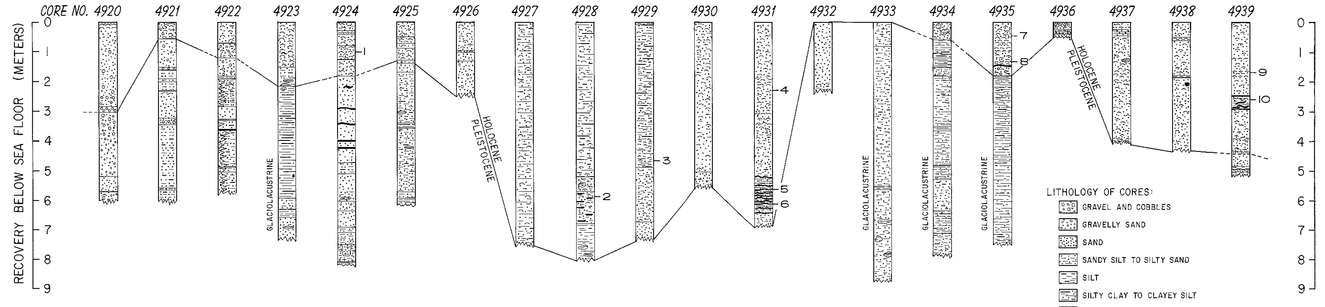
Base from U.S. Coast and Geodetic Survey bathymetric maps C. & G.S. 68885-51, Block Island and Rhode Island Sounds, 1967; and C. & G.S. 67684-51, Nantucket Sound and approaches, 1967. Transverse Mercator projection

FIGURE 13.—LOCATION OF VIBRACORING SITES

TABLE SHOWING RADIOCARBON AGE DETERMINATIONS

Sample number	Core number	Sample depth below sea level (meters)	Sample description	Laboratory number	Age[1] (years before present)
1	4924	14.0	Shells	W-4169	2,920±200
2	4928	20.5	Peat	W-4136	6,830±250
3	4929	16.7	Shells	W-4168	1,210±200
4	4931	17.5	Shells	W-4170	4,460±200
5	4931	20.8	Organic carbon	W-4145	5,810±200
6	4931	21.3	Organic carbon	W-4144	5,970±200
7	4935	21.7	Shells	W-4166	310±200
8	4935	22.7	Shells	W-4167	490±200
9	4939	15.4	Shells	W-4191	5,090±200
10	4939	16.4	Peat	W-4138	6,470±200

[1]Radiocarbon (^{14}C) dates were determined by the U.S. Geological Survey, Reston, Va., and are based on the Libby half-life of 5,570 years and referenced to the year A.D. 1950.



Lithologic descriptions are based on megascopic examination of split sections of cores. Sediments shown at the top of some of the cores may not be representative of the surficial bottom sediments that occur at the core sites because some material may have washed out during coring and retrieval.

Inferred ages are based on lithology, radiocarbon dates, megafossils, palynology, and stratigraphic position indicated by the seismic-reflection data. Numbers along side of columns indicate radiocarbon-dated-sample locality (see table).

FIGURE 14.—LITHOLOGIC AND STRATIGRAPHIC COLUMNS OF VIBRACORES, INCLUDING TABLE SHOWING RADIOCARBON AGE DETERMINATIONS

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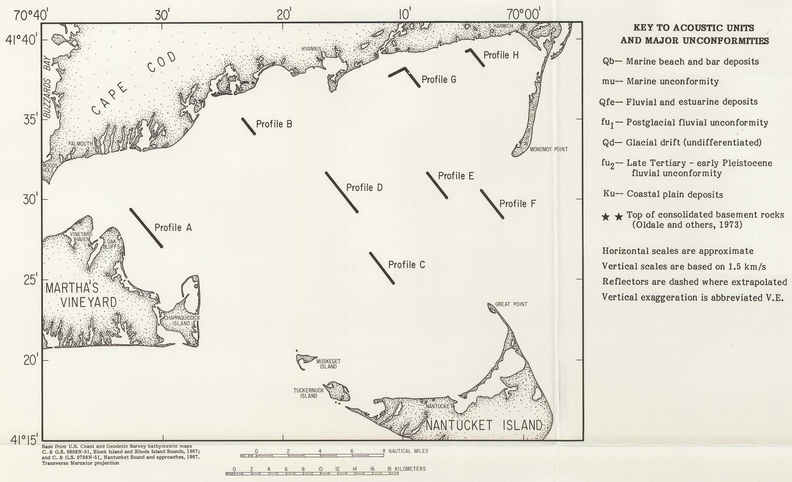


Base from U.S. Coast and Geodetic Survey bathymetric maps C. & G.S. 8888P-51, Block Island and Rhode Island Sounds, 1987; and C. & G.S. 8709N-51, Nantucket Sound and approaches, 1987. Transverse Mercator projection

KEY TO ACOUSTIC UNITS AND MAJOR UNCONFORMITIES

Qb— Marine beach and bar deposits

mu— Marine unconformity

Qfe— Fluvial and estuarine deposits

fu_1— Postglacial fluvial unconformity

Qd— Glacial drift (undifferentiated)

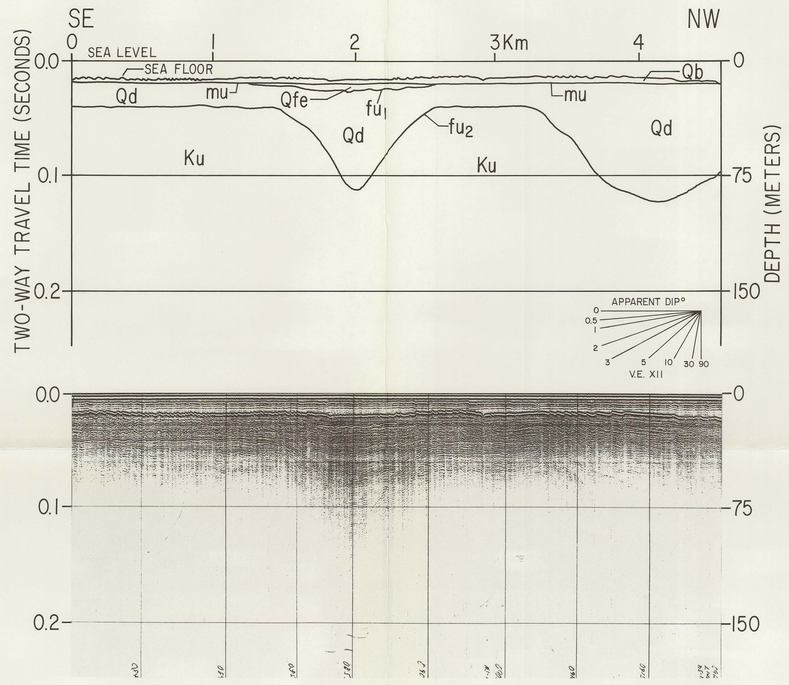
fu_2— Late Tertiary – early Pleistocene fluvial unconformity

Ku— Coastal plain deposits

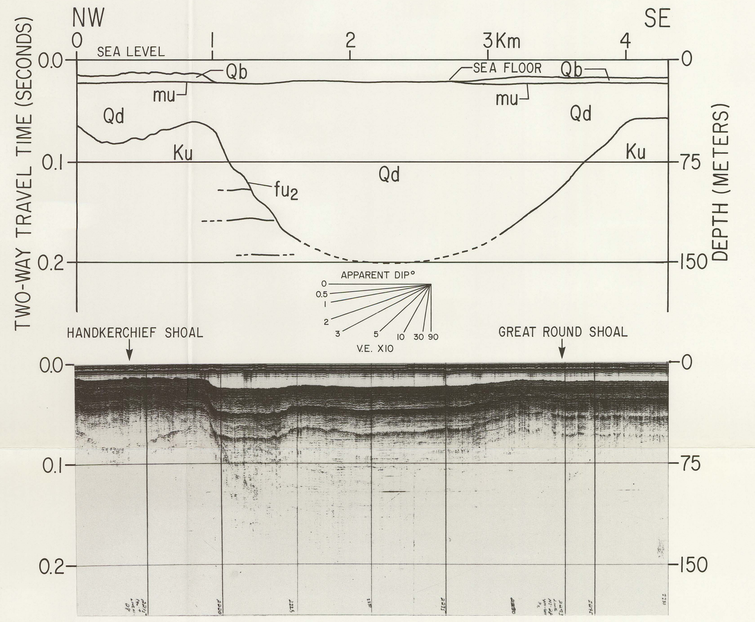
★★ Top of consolidated basement rocks (Oldale and others, 1973)

Horizontal scales are approximate
Vertical scales are based on 1.5 km/s
Reflectors are dashed where extrapolated
Vertical exaggeration is abbreviated V.E.

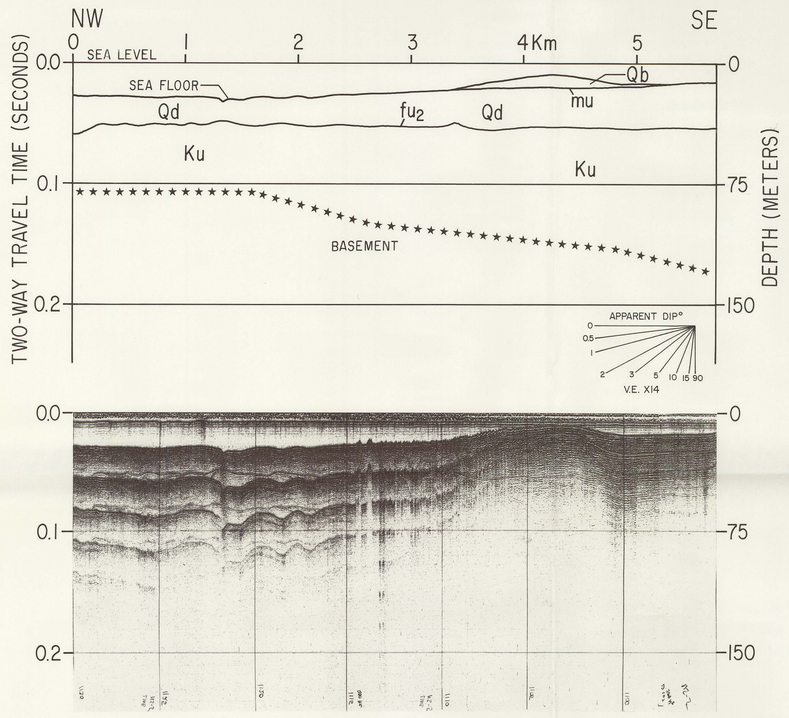
LOCALITIES OF SELECTED SEISMIC PROFILES



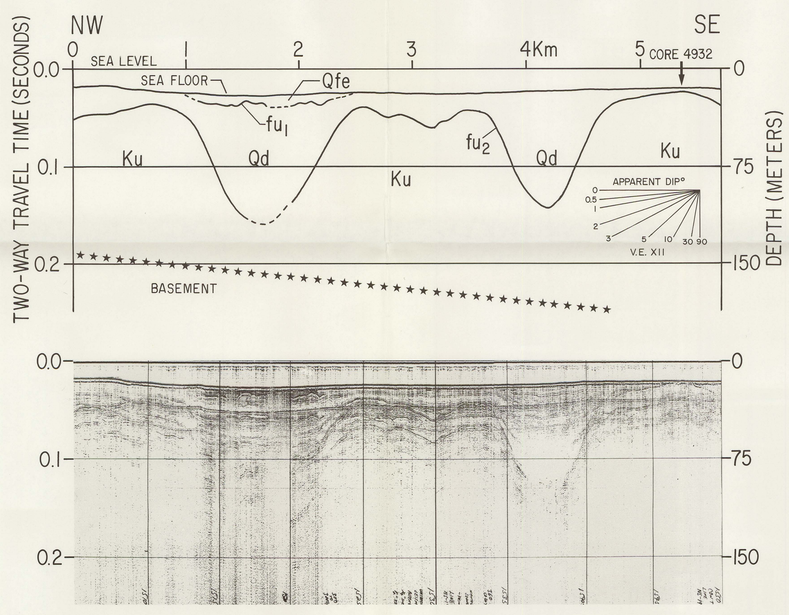
SEISMIC PROFILE C



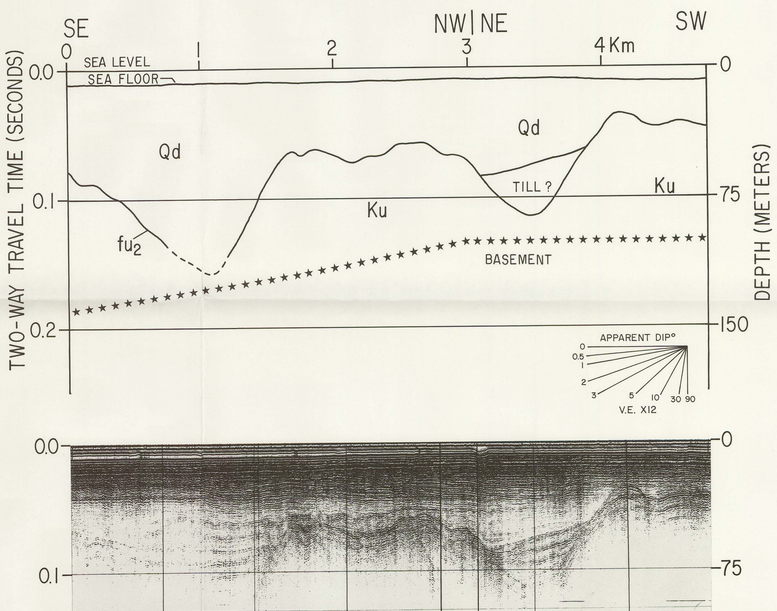
SEISMIC PROFILE F



SEISMIC PROFILE A



SEISMIC PROFILE D



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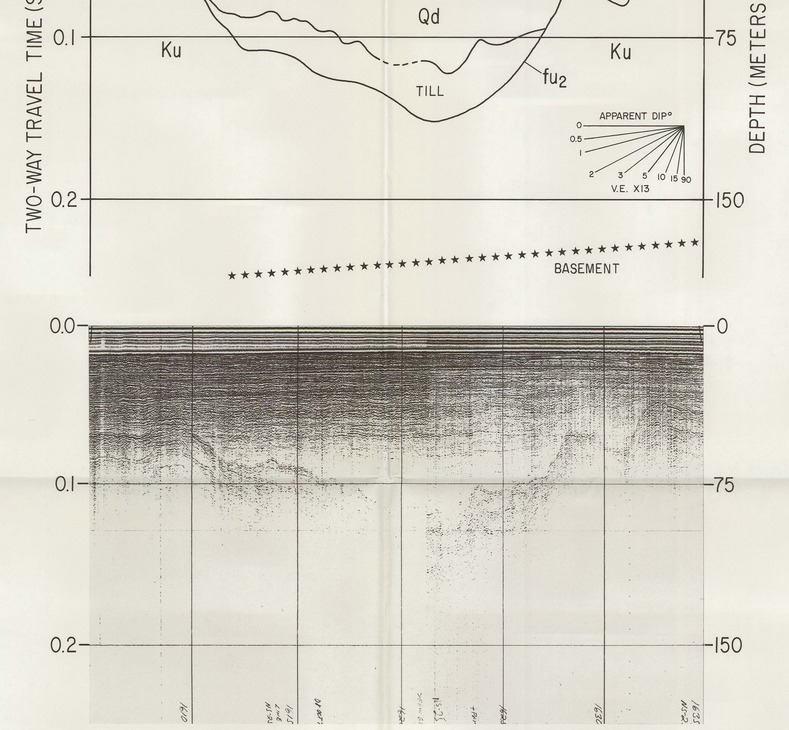
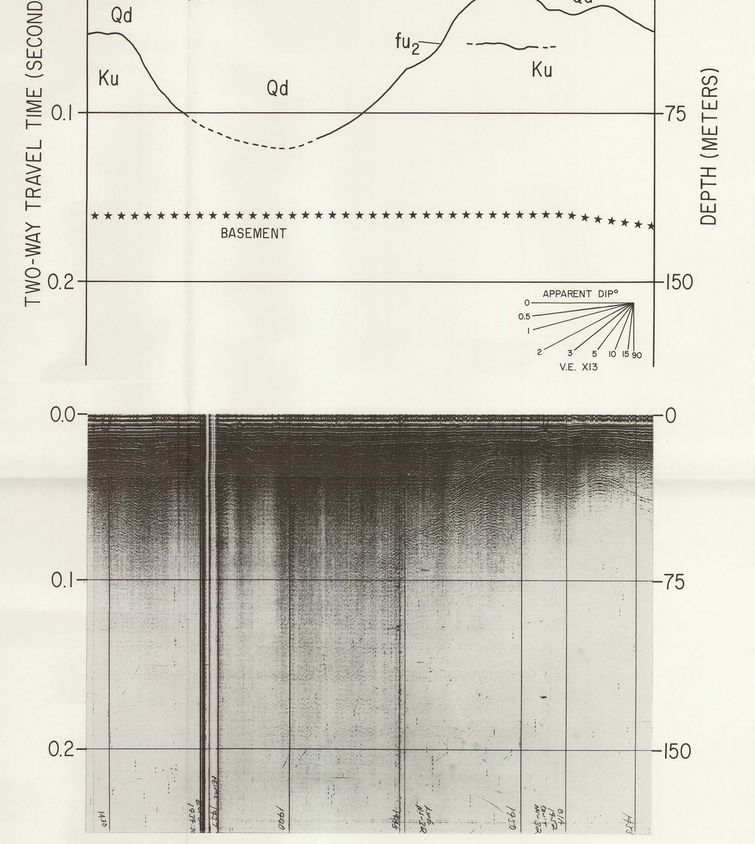


SEISMIC PROFILE E



SEISMIC PROFILE H

FIGURE 15.—SELECTED SEISMIC PROFILES AND INTERPRETIVE SECTIONS

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