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PRELIMINARY REPORT ON THE GEOLOGY ALONG THE ATLANTIC CONTINENTAL MARGIN OF THE NORTHEASTERN UNITED STATES

BY

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1. Preliminary report on the geology along the Atlantic continental margin of the northeastern United States, by J. P. Minard, W. J. Perry, E. G. A. Weed, E. C. Rhodehamel, E. I. Robbins, and R. B. Mixon. 34 p., including 7 text figures.

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Contents

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171

Illustrations

Preliminary report on the geology along the Atlantic Continental Margin of the northeastern United States

By J.P. Minard, W.J. Perry, E.G.A. Weed, E.C. Rhodehamel, E.I. Robbins and R.B. Mixon

Abstract

The U.S. Geological Survey is conducting a geological and geophysical study of the northeastern United States Outer Continental Shelf and the adjacent slope from Georges Bank to Cape Hatteras. The study also includes the adjacent Coastal Plain because it is a more accessible extension of the shelf. The total study area is about 324,000 sq km, of which the shelf and slope constitute about 181,000 sq km and the Coastal Plain constitutes 143,000 sq km. The shelf width ranges from about 30 km at Cape Hatteras to about 195 km off Raritan Bay and on Georges Bank. Analyses of bottom samples make it possible to construct a preliminary geologic map of the shelf and slope to a water depth of 2,000 m. The oldest beds cropping out in the submarine canyons and on the slope are of early Late Cretaceous age. Beds of Early Cretaceous and Jurassic age are present in deep wells onshore and probably are present beneath the shelf in the area of this study.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171

Such beds are reported beneath the Scotian Shelf to the northeast where they include limestone, salt, and anhydrite. Preliminary conclusions suggest a considerably thicker Mesozoic sedimentary sequence than has been previously described. The region is large; the sedimentary wedge is thick; structures seem favorable, and the hydrocarbon potential may be considerable.

Introduction

The general geology of the sediments along the continental margin of the northeastern United States is discussed with particular emphasis on the Coastal Plain, Continental Shelf, and Slope from Cape Hatteras, North Carolina, to Georges Bank, off Massachusetts (fig. 1).

The region covers about 324,000 sq km, of which the Coastal Plain constitutes about 143,000 sq km and the submerged part forms the remaining 181,000 sq km. The shelf is more than 970 km long and ranges in width from 30 km at Cape Hatteras to nearly 195 km off Raritan Bay, New Jersey.

Although the main emphasis of this report is on the submerged part, discussion of the emerged part is important because it is more accessible and better known and therefore serves as a reliable framework for studying the offshore geology.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

Figure 1.--Index map of the northeastern United States Atlantic continental margin showing onshore drill-hole locations.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
887-100

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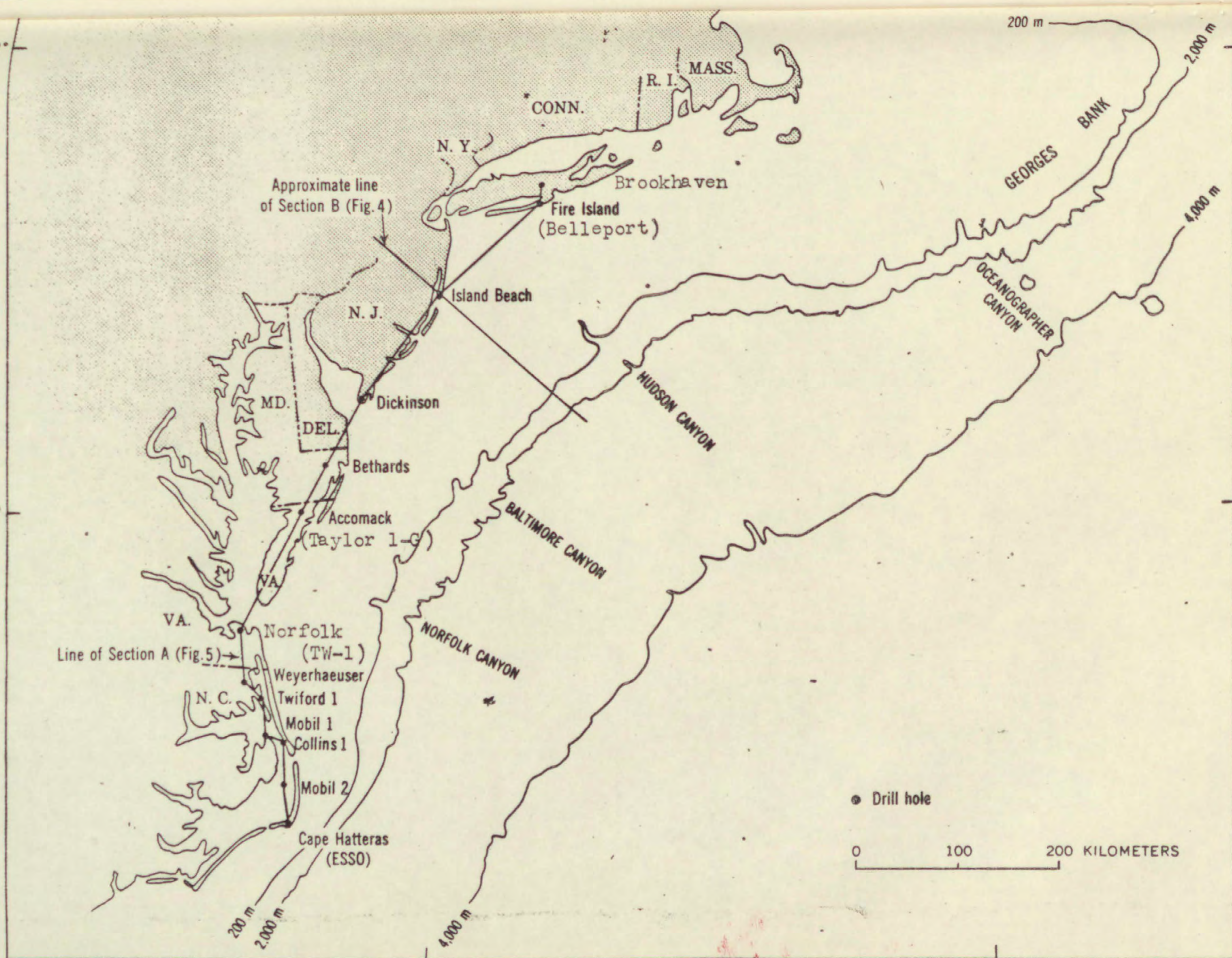
42°
38°
200 m
2,000 m
4,000 m
MASS.
R. I.
CONN.
N. Y.
GEORGES BANK
Brookhaven
Approximate line of Section B (Fig. 4)
Fire Island
(Belleport)
Island Beach
OCEANOGRAPHER CANYON
N. J.
HUDSON CANYON
MD.
Dickinson
DEL.
Bethards
Accomack
(Taylor 1-G)
BALTIMORE CANYON
VA.
VA.
Norfolk
(TW-1)
NORFOLK CANYON
Line of Section A (Fig. 5)
Weyerhaeuser
N. C.
Twiford 1
Mobil 1
Collins 1
Mobil 2
Drill hole
Cape Hatteras
(ESSO)
0
100
200 KILOMETERS
200 m
2,000 m
4,000 m

Figure 1

Acknowledgements

John C. Hathaway, John Schlee, John C. Behrendt, U.S. Geological Survey, and Charles D. Hollister, Woods Hole Oceanographic Institution, generously furnished unpublished data. Robert R. Jordan, State Geologist of Delaware and James L. Calver, State Geologist of Virginia, furnished valuable deep well logs, samples, and pollen slides. Leslie A. Sirkin of Adelphi University and James A. Doyle of Michigan State University made many palynological identifications. N.L. McIver and R.K. McCormack of Shell Oil furnished valuable well data from the Scotian Shelf. Edward McFarlan, Jr., Raymond Woods, and R.E. Johnson of Humble (Exxon) Research furnished core samples from the slope along most of the study area. Ruth Todd, Richard Scott, and Gene Doher of the U.S. Geological Survey made foraminiferal and palynological identifications on many slope samples. J.P. Owens, U.S. Geological Survey, offered valuable suggestions and advice during manuscript preparation. Personnel from the U.S. Geological Survey offices in New Jersey, Maryland, and Virginia supplied deep-well data.

Previous investigations

Much has been written, during the past 220 years, about the geology of the Coastal Plain but little had been written about the shelf and slope until about 40 years ago. Some of the earlier workers during the 1930's - Bassler, Cohee, Cushman, Ewing, Miller, Shepard, Stephenson, Stetson, Trefethan, Veatch, Wigglesworth, Woodsworth, and Woollard - were true pioneers in the study of the continental margin. As they continued their geological, geophysical, and paleontological work during the succeeding decades, they were joined by many others, especially personnel at the Lamont-Doherty Geological Observatory and Woods Hole Oceanographic Institution. Recent widespread interest in sea-floor spreading and plate tectonics, in relation to continent and ocean basin evolution, has further accelerated studies of the continental margin.

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867-100

Geophysics played a major role in the early study of the continental margin, as it does now. Drake and others (1959) set the stage for much subsequent structural interpretation. Geological studies, however, have literally only scratched the surface. Dredge and piston-core samples, penetrating only a few feet, represent the major retrieval from most of the shelf and much of the slope (Hathaway, 1971). Valuable additional data were obtained by a consortium of petroleum companies during a drilling program on the slope in 1967. Holes were drilled to as deep as 305 m in water depths ranging from 300 to 1,500 m (Minard and Rhodehamel were observers aboard the Caldrill during the drilling of several of the holes). Other samples were collected, using manned submersibles, from outcrops in water depths of as much as 1,820 m. Nevertheless, sample coverage is extremely sparse.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

Present investigation

The U.S. Geological Survey is studying the resources potential (especially petroleum) of the northeastern United States Outer Continental Shelf from Cape Hatteras to Georges Bank. For this study we depend heavily on published data, both on the shelf and the adjacent Coastal Plain. Besides older reports by authors already mentioned, several recent publications have been of particular help; these include Emery and Uchupi (1972), Kraft and others (1971), Garrison (1970), Gibson (1970), and Gibson and others (1968). Samples and logs from deep wells near the edge of the Coastal Plain supplied valuable data used to project the stratigraphy into the shelf, and to correlate seismic reflection and refraction horizons. Core and grab samples from the slope are particularly valuable to this study.

From these data we have constructed a geologic map of the Continental Shelf, Slope and Coastal Plain (fig. 2), and tentatively have interpreted some of the probable structures in this region.

Figure 2.--Geologic map showing distribution of Mesozoic and Tertiary strata along the continental margin of the northeastern United States (from Weed and others, in press).

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
887-100

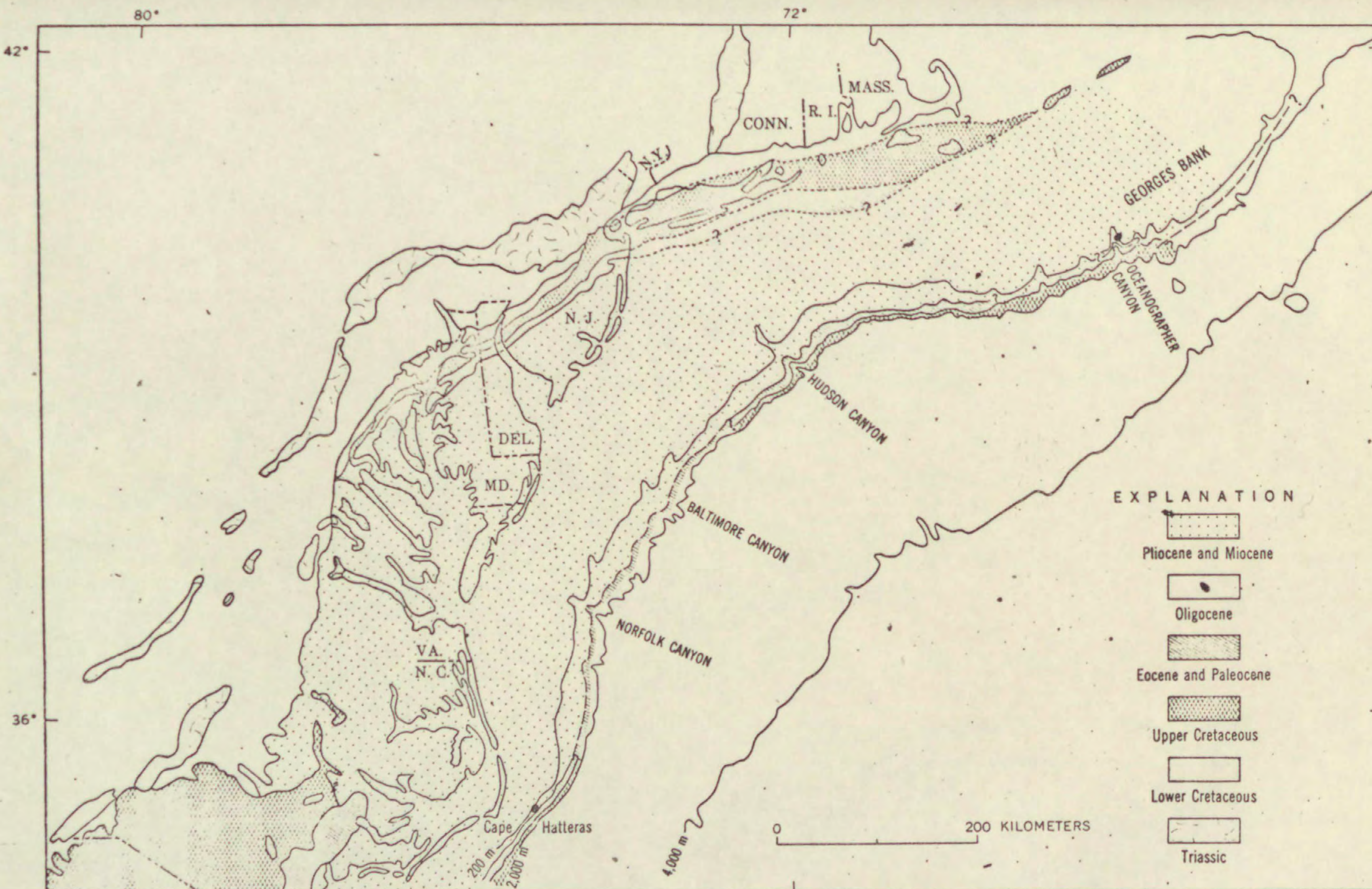
80°
72°
42°
36°
CONN.
R. I.
MASS.
N.Y.
GEORGES BANK
N. J.
OCEANOGRAPHER CANYON
HUDSON CANYON
DEL.
MD.
BALTIMORE CANYON
NORFOLK CANYON
VA.
N. C.
Cape Hatteras
200 m
2,000 m
4,000 m
0
200 KILOMETERS
EXPLANATION
Pliocene and Miocene
Oligocene
Eocene and Paleocene
Upper Cretaceous
Lower Cretaceous
Triassic

Figure 2.

Geologic setting

The Coastal Plain and Continental Shelf from Georges Bank to Cape Hatteras is a seaward-thickening wedge of sediments which are largely unconsolidated in the Coastal Plain and also in at least the inner shelf area. In outcrop on the Coastal Plain, these sediments range in age from late Early Cretaceous, Aptian (Doyle, 1969; Wolfe and Pakiser, 1971), to Holocene. The beds of Early Cretaceous age are of continental origin, whereas most younger beds, except some of Pleistocene and Holocene age, are of marine, estuarine, or beach-complex origin.

The cumulative thickness of this wedge of sediments near the inner edge of the outcrop in New Jersey is about 325 m (Owens and Sohl, 1969, p. 237). The sediments thicken to nearly 1,200 m southward along the New Jersey coast at Island Beach (Gill and others, 1963, table 4) and about 1,830 m at Cape May (Maher, 1971 table 1). In Maryland, the sediments are about 2,200 m thick near the coast (Maher, 1971, table 1). At Cape Hatteras, North Carolina, they are nearly 3,050 m thick (Maher, 1971, table 1).

The Coastal Plain sediments in the region lie with marked unconformity on metamorphosed Precambrian (?) and Paleozoic rocks and on chiefly unmetamorphosed Triassic rocks (Owens and Sohl, 1969, p. 235-237, fig. 1). The pre-Triassic rocks are largely gneisses, schists, quartzites, slates, and phyllites. The surface of the basement beneath the Coastal Plain deposits is irregular as a result of both basement warping and, to a lesser degree, post-Paleozoic erosion. The warping is reflected in the series of embayments and highs in the region (fig. 3). The influence of these structures in largely controlling the sediment dispersal pattern and thickness is discussed subsequently. A major depositional basin, the Baltimore Canyon trough, lies under the Outer Continental Shelf in the present seaward part of the Salisbury embayment. The long axis of the trough is parallel to the trend of the coastline, shelf edge, and the strike of the Coastal Plain stratigraphic units (Kraft and others, 1971, figs. 5, 7, 8). As proposed by Moore and Curray (1963, p. 2051) and later discussed in more detail by Garrison (1970, p. 122), upbuilding of the Continental Shelf occurred mostly during transgression of the sea and outbuilding on the slope occurred mostly during regression of the sea.

Figure 3.--Diagrammatic representation of the major tectonic features of the basement beneath the northeastern United States Atlantic Coastal Plain (modified from Owens and others, 1968, fig. 2).

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

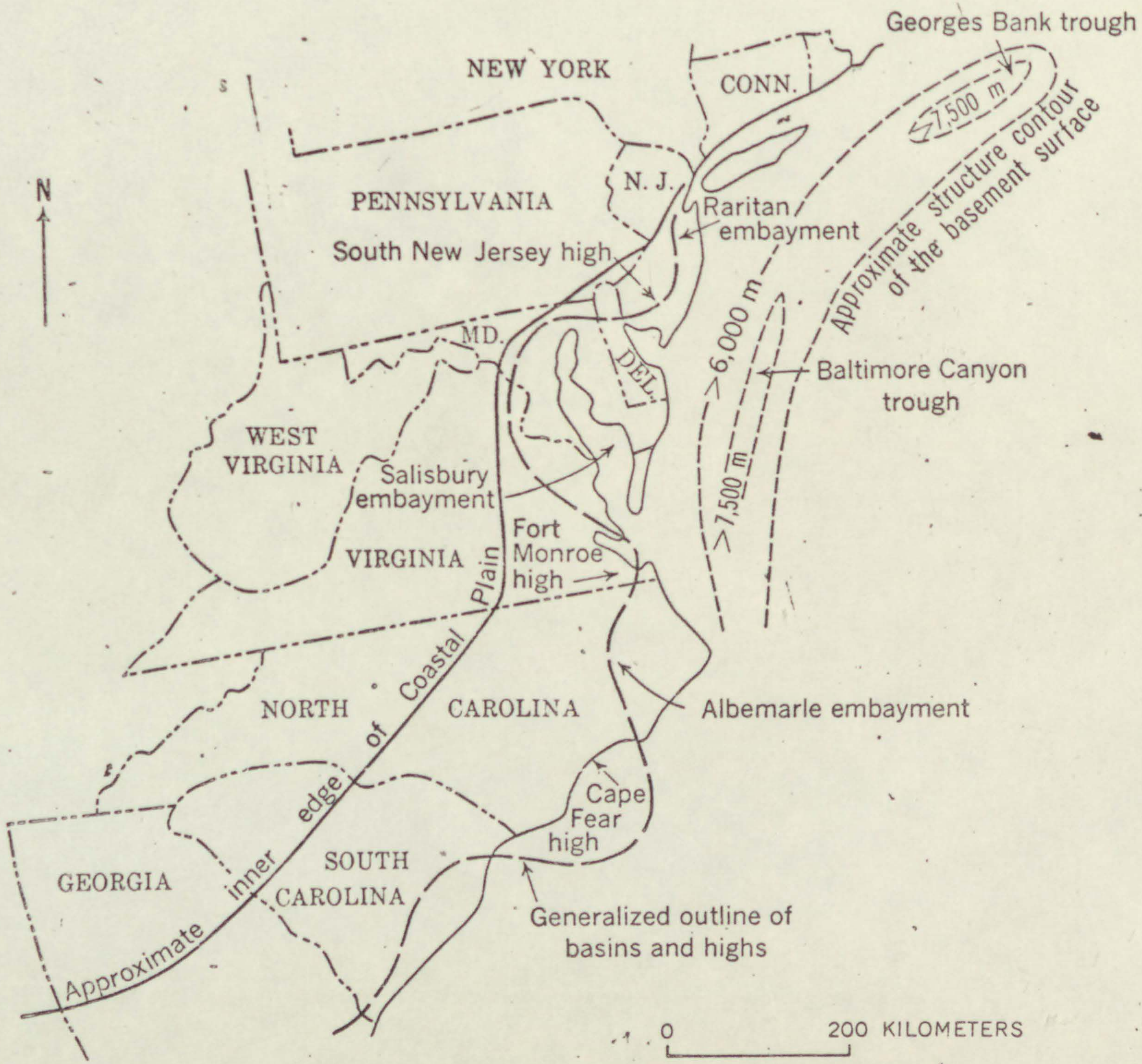
Georges Bank trough
NEW YORK
CONN.
N. J.
PENNSYLVANIA
N
Raritan embayment
South New Jersey high
>7,500 m
Approximate structure contour of the basement surface
>6,000 m
MD.
DEL.
Baltimore Canyon trough
>7,500 m
WEST VIRGINIA
Salisbury embayment
Fort Monroe high
VIRGINIA
Approximate inner edge of Coastal Plain
NORTH
CAROLINA
Albemarle embayment
Cape Fear high
SOUTH CAROLINA
GEORGIA
Generalized outline of basins and highs
0
200 KILOMETERS

Figure 3.

Garrison (1970) shows five prominent acoustical reflecting horizons south of New England and off Long Island, an area encompassing part of the Raritan embayment. These horizons are identified as: (1) crystalline basement; (2) Upper Cretaceous-Tertiary boundary; (3) Paleocene-Eocene boundary; (4) middle Tertiary event; and (5) Pleistocene erosional unconformity. He postulates two major Cenozoic regressions (p. 122-123). The first, during Oligocene time, was characterized by the growth of deltas which rapidly built the shelf outwards. An increase in the rate of subsidence accompanied this outgrowth which extended the shelf at least one hundred kilometers seaward (Garrison, 1970, p. 117-118). The second regression, during Pleistocene glaciation, resulted in deposition of some material at the edge of the shelf, but most was carried into the ocean basin.

Based on our studies of outcrops in the emerged Coastal Plain, a somewhat different correlation of Garrison's acoustical reflecting horizons with stratigraphic units is possible. The correlations used here to extrapolate the seaward thickening of sediments are: (1) top of cyrstalline basement; (2) base of Campanian (upper Upper Cretaceous); (3) base of middle Miocene; (4) base of middle Pliocene (?); and (5) Pleistocene erosional unconformity.

A simple straight-line projection of the Coastal Plain-basement contact (dotted line, fig. 4) indicates a thick sequence of sediments may be present near the edge of the shelf, something on the order of 3,050 m off New Jersey. This approximates Drake and others (1959, fig. 29) seismically determined thickness. Recent interpretations of seismic data have shown, however, that the thickness of the sediment beneath the deepest trough (Baltimore Canyon trough) is considerably greater than that proposed by Drake and others. For example, unpublished data from a refraction survey conducted by University of Wisconsin personnel off the Virginia coast in 1965 (Lawrence, written commun., 1973) at locations between Cape Hatteras and the deepest part of the trough indicate an acoustic interface, interpreted as basement, at a depth of about 9,000 m. Revised basin thicknesses are shown by dashed lines on figure 4.

The inferred thick wedge of sediments under the shelf is compatible with Dietz's (1963, p. 315-318) comparison of the continental terrace of the eastern United States to a monoclinal wedge of prograded deposits in which depression of the ocean floor downwarped the adjacent continental margin. In retrospect, the fact that the Baltimore Canyon trough off Delaware Bay is the site of the thickest sedimentary section known in the northeastern Atlantic Continental Shelf (Kraft and others, 1971), may have been predictable from studies of the geology of the embayments along the emerged Coastal Plain.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511

Figure 4.--Diagrammatic cross section B of the continental margin units in and adjacent to New Jersey; line of section shown on figure 1.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

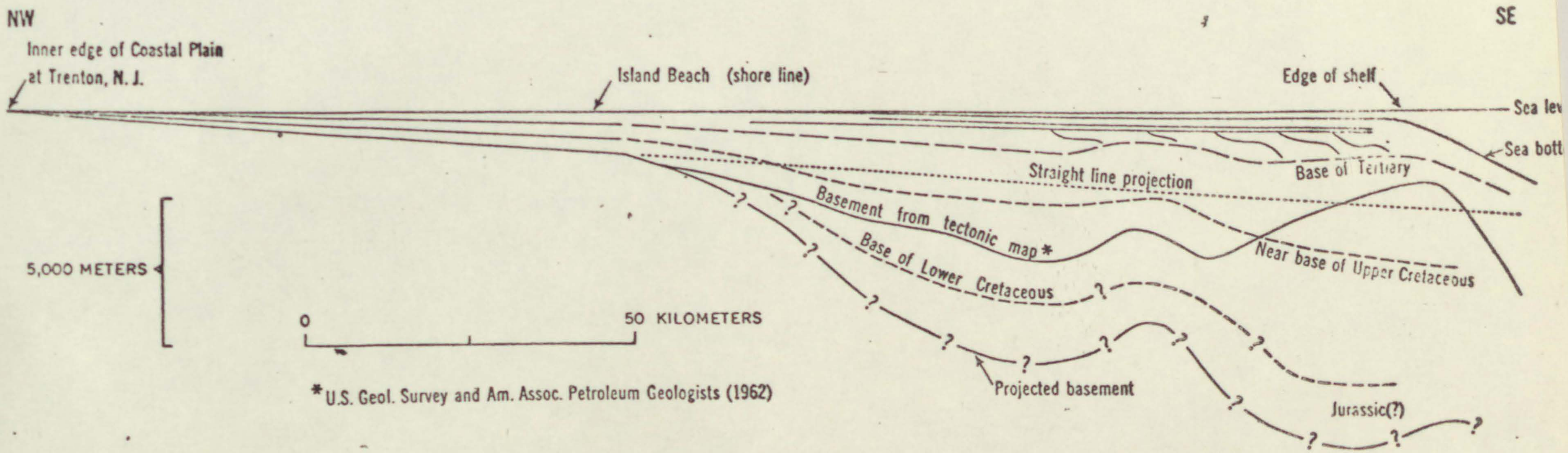
NW
SE
Inner edge of Coastal Plain
at Trenton, N. J.
Island Beach (shore line)
Edge of shelf
Sea lev
Sea bott
Base of Tertiary
Straight line projection
Basement from tectonic map*
Base of Lower Cretaceous
Near base of Upper Cretaceous
5,000 METERS
0
50 KILOMETERS
Projected basement
Jurassic(?)
*U.S. Geol. Survey and Am. Assoc. Petroleum Geologists (1962)

Figure 4.

Thickness and character of Coastal Plain sediments

There is a growing awareness of the importance of coastal deltaic deposits in the stratigraphic framework of the Cretaceous and Tertiary of the northern Coastal Plain (for example, Owens and others, 1968, Owens and Sohl, 1969). A realization of the continuity of these deltaic deposits with unknown stratigraphic units in the Outer Continental Shelf has led Kraft and others (1971) to derive preliminary paleoenvironmental interpretations (stratigraphic models) of the Tertiary and Cretaceous deposits of the continental shelf.

The thickest wedge of coastal-plain deltaic sediments occurs in the Cretaceous of the Salisbury embayment, one of the largest embayments in the region (fig. 3,5, and Kraft and others, 1971, fig. 8). This accumulation of Early and and early Late Cretaceous deltaic sediments, termed the Potomac Group, extends through coastal Virginia, Maryland, most of Delaware, and portions of New Jersey. In outcrop and under the emerged Coastal Plain these sediments are chiefly gravels, sands, silts, and clays which were deposited by a large river system(s) in a deltaic environment. These sediments are overlapped unconformably by a thinner sequence of chiefly marine sediments that total several hundred meters in thickness where exposed in the inner Coastal Plain. These younger sediments range in age from Late Cretaceous through Miocene (and possibly into Pliocene) and are themselves unconformably overlain by Pleistocene and Holocene nonmarine clastics.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511

Figure 5.--Cross section A, near and along the coast from Cape Hatteras, N.C., to ~~the south shore of~~ Long Island, N.Y.; line of section shown on figure 1.

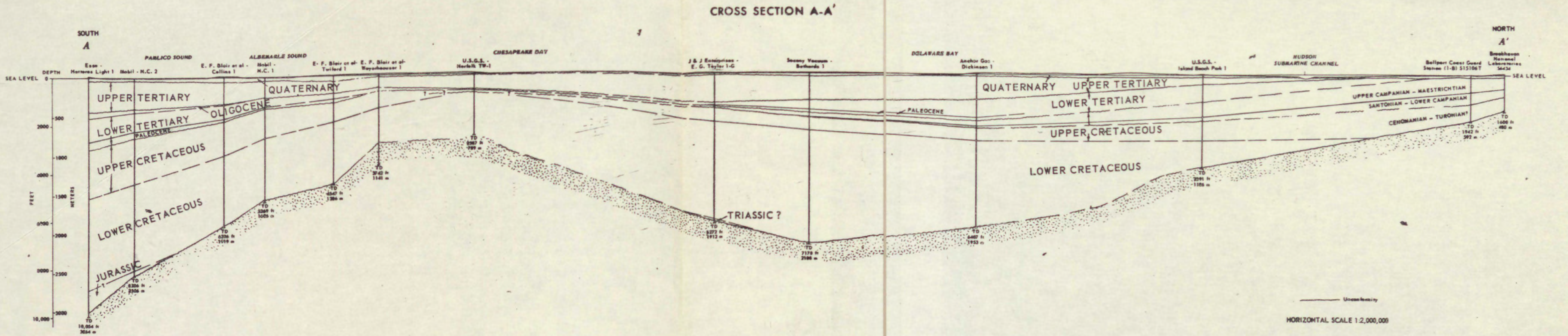
CROSS SECTION A-A'
SOUTH
A
NORTH
A'
PABLICO SOUND
ALBEMARLE SOUND
CHESAPEAKE BAY
DELAWARE BAY
HUDSON SUBMARINE CHANNEL
Esso - Hatteras Light 1
Mobil - N.C. 2
E. F. Blair et al - Collins 1
Mobil - N.C. 1
E. F. Blair et al - Twiford 1
E. F. Blair et al - Weyerhaeuser 1
U.S.G.S. - Norfolk TW-1
J & J Enterprises - E. G. Taylor 1-G
Socony Vacuum - Bethards 1
Anchor Gas - Dickinson 1
U.S.G.S. - Island Beach Park 1
Bellport Coast Guard Station (1-B) S15106T
Brookhaven National Laboratories S6434
SEA LEVEL
DEPTH
FEET
METERS
QUATERNARY
UPPER TERTIARY
OLIGOCENE
LOWER TERTIARY
PALEOCENE
UPPER CRETACEOUS
LOWER CRETACEOUS
JURASSIC
TRIASSIC ?
UPPER CAMPANIAN – MAESTRICHTIAN
SANTONIAN – LOWER CAMPANIAN
CENOMANIAN – TURONIAN?
Unconformity
HORIZONTAL SCALE 1:2,000,000

Figure 5

The deltaic sediments of the Potomac Group thickens eastward from about 460 m in outcrop to about 1,200 m in the Bethards well in eastern Maryland (fig. 5). Projection seaward to sample localities on the slope (see Weed and others, in press), suggests that under the outer part of the shelf these sediments may be as much as 4,000 to 5,000 m thick (fig. 4).

Another deltaic sequence lies to the north in the Raritan embayment and under Long Island. In outcrop and under the emerged Coastal Plain, the sediments in the Raritan embayment differ from those of the Salisbury embayment (fig. 3) in that they do not include the thick Lower Cretaceous section at the base, but do constitute a more complete Upper Cretaceous section. This Upper Cretaceous section is largely marine but also contains deltaic sediments in the Raritan and overlying Magothy formations. Under Long Island these Upper Cretaceous sediments are predominately nonmarine to marginal-marine sands. Near the inner edge of the emerged Coastal Plain in New Jersey the Upper Cretaceous sediments are about 300 m thick, and under the outer edge of the emerged plain at Island Beach, New Jersey, they are about 800 m thick (Gill and others, 1963, table 4). Under the outer shelf these sediments may be two or three times as thick as at Island Beach.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171

The Cretaceous deltaic sequences have components similar to the present Niger River delta of Africa described in detail by Allen (1964, 1965). The Potomac Group in the Salisbury embayment consists largely of continental deposits, including channel sands and gravels in addition to flood-plain and swamp deposits. In accordance with the results of palynological studies (Brenner, 1963, Doyle, 1969 and oral commun., Aug. 4, 1971, Wolfe and Pakiser, 1971), the deltaic sequence represented by this group has been subdivided into spore-pollen zones I, II and III, of respectively Aptian, Albian, and Albian to Cenomanian age.

Upper Cretaceous deltaic sediments in the Raritan embayment contain marine deposits such as tidal-flat and prodelta beds in addition to continental deposits. The balance of these sediments were deposited in such intermediate environments as beaches, barrier bars, spits, lagoons, and estuaries (Owens and others, 1968). Deltaic sedimentation appears to have continued in the Raritan embayment well into Late Cretaceous (Campanian) time.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511

The Salisbury and Raritan embayments are partly separated by the south New Jersey basement high in southeastern New Jersey. However, this basement high does not extend as far east as the present coastal margin, as shown by Brown and others (1972, pl. 5). At least locally, therefore, deltaic deposits of Late Cretaceous age overlap those of the Potomac Group. Although the Potomac Group sediments under the emerged plain are largely continental, the thick section under the shelf probably was partly or largely deposited in a marine environment.

The Tertiary section near the inner edge of the emerged Coastal Plain is only about 115 meters thick. At Island Beach, New Jersey the section is reported to be 315 m thick (Gill and others, 1963, table 4). Under the outer shelf the Tertiary section off New Jersey is about 1,070 m thick (Garrison, 1970); and deltaic sedimentation apparently continued into the Tertiary. The entire region north of Cape Fear, N.C., is a Late Cretaceous and Tertiary glauconite province, of which the Raritan embayment forms the center and area of greatest abundance of glauconite. This is in contrast with the region south of Cape Fear which is a carbonate province. Glauconite largely is in the marine beds overlying the Potomac Group and Raritan Formation sediments.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

Sediments in the emerged Coastal Plain of New Jersey and Delaware particularly reflect a widespread uniform and cyclic sedimentation pattern in which a deeper water glauconite sand represents the basal unit. This is succeeded upward by a nearer-shore, clayey and silty-to-fine-sandy unit, which is overlain by a near-shore or beach-complex medium-coarse sandy unit. This cycle is repeated as many as five times; some cycles are complete, whereas others are not because of partial removal during erosion intervals. The typical three-part cyclical unit was deposited during a transgressive-regressive pulse of the sea.

The Upper Cretaceous and lower Tertiary glauconite units constitute distinctive marker beds that are readily recognizable and persist for long distances with remarkable continuity of lithologies and thicknesses. Although glauconite units continue into the Salisbury embayment and farther south, they are not as numerous, thick, and well defined. This probably is chiefly because of the change from a definite open-shelf marine depositional environment to a nearer-shore depositional environment (Owens, and others, 1970, p. 17-18).

An interesting characteristic of the rocks in the study area is the almost complete lack of lithification of the sedimentary units underlying the Coastal Plain, even where the sediments are more than 2,000 m thick. On a worldwide basis, Cretaceous sedimentary rocks include lithified shales, sandstones, conglomerates, and limestones. Perhaps these rocks were once more deeply buried than were the rocks in the Coastal Plain of the northeastern United States. Because depth of burial is a factor in lithification, well lithified rocks are probably present in the sedimentary sequence beneath the shelf where the base of the Cretaceous or Jurassic (?) section may be buried at least as deep as 9,000 m (Lawrence, written communication, 1973). The deeply-buried Cretaceous and (or) Jurassic sedimentary rocks near Cape Hatteras, North Carolina include dense limestones (Maher, 1971, and unpublished data).

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

Inferred thickness and character of shelf sediments

As previously discussed, the total thickness of the sediment wedge under the shelf in the Baltimore Canyon trough probably exceeds 9,000 m. Emery and Uchupi (1972) suggest about 12,000 m of sediment near the trough axis. This is several thousand meters more than the anticipated thickness of the Lower and Upper Cretaceous and Tertiary sediments (fig.4) and indicates greater subsidence than previously thought. McIver (1972, p. 57-63) shows thick salt beds (up to 762 m) under the Scotian Shelf, overlain by other evaporites and limestones, shales, siltstones, and sandstones, all of Jurassic age. Rona (1970, p. 148), based on a geological comparison of the opposing continental margins of Cape Hatteras and Cap Blanc, Africa, concluded that rock salt of Jurassic age should lie seaward of Cape Hatteras. It is quite possible that the several thousand meters of section that appear to be present below the Lower Cretaceous section of the Baltimore Canyon trough are largely composed of a correlative Jurassic section. A thick Jurassic section probably is present beneath the Cretaceous under Georges Bank (Schultz and Grover, 1973).

Structure

The structure of the Coastal Plain sediments is largely controlled by the configuration of the basement surface. Major irregularities, such as structural embayments and highs, evolved from basement faulting and warping (figs. 3, 5). Local basement irregularities and erosional remnants in the Coastal Plain caused small deviations in the regional structure, resulting in shallow warping and small domal structures with closures of several tens of feet (Minard and Owens, 1966). Similar structures continue downdip seaward into the shelf. Farther seaward, however, the dip locally increases considerably (Maher, 1971; Kraft and others, 1971), such as in the vicinity of the Baltimore Canyon trough (figs. 3, 4) and on Georges Bank (figs. 3, 6).

The Baltimore Canyon trough appears to be a major synclinorium involving the crystalline basement (Kraft and others, 1971, fig. 7). The trough is bordered on the east by a basement (?) ridge (Drake and others, 1959; Mattick and others, 1973) whose axis is nearly beneath and parallel to the edge of the shelf. As mentioned above, the basement surface may lie as much as 12,000 m below sea level in the trough.

U. S. GOVERNMENT PRINTING OFFICE : 19

Figure 6.--Diagrammatic cross section through Georges Bank, based upon Emery and Uchupi (1972, fig. 133), Schultz and Grover (1973), and Mattick and others (1973).

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171

Georges Bank is a shallow platform off the Massachusetts coast, underlain by a deep sediment-filled trough (base of trough about -7,000 to - 8,000 m, Schultz and Grover, 1973). See figure 6. The linear axis of the trough trends northeast and the trough is shallow towards the northeast and plunges southwest (fig. 7).

Shultz and Grover (1973) suggest that the overall stratigraphy of the Georges Bank trough is similar to that of the western Scotian Shelf, but that probably the predominantly marine Lower Cretaceous and Jurassic units are thicker than those of the western Scotian Shelf. Based upon their discussion of the publically released geophysical data salt diapirs have not been detected, but deformation appears to be chiefly restricted to high-angle normal faulting involving the basement and the lower part of the sedimentary sequence. There appear to be sediments in the Georges Bank trough which may have been downfaulted into the basement, and later erosion proceeded until the upper surfaces were continuous with the surface of the surrounding basement rocks (Hathaway, unpublished data) (fig. 6).

The general structural pattern off Virginia and North Carolina appears to be fairly uniform seaward-dipping layers of sediments with only local and low-relief warping.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-10

Figure 7.--Possible buried structures under Georges Bank and Nantucket Shoals, extrapolated from Emery and Uchupi (1972), Schultz and Grover (1973), and Hathaway (unpublished data, 1973).

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511171
867-100

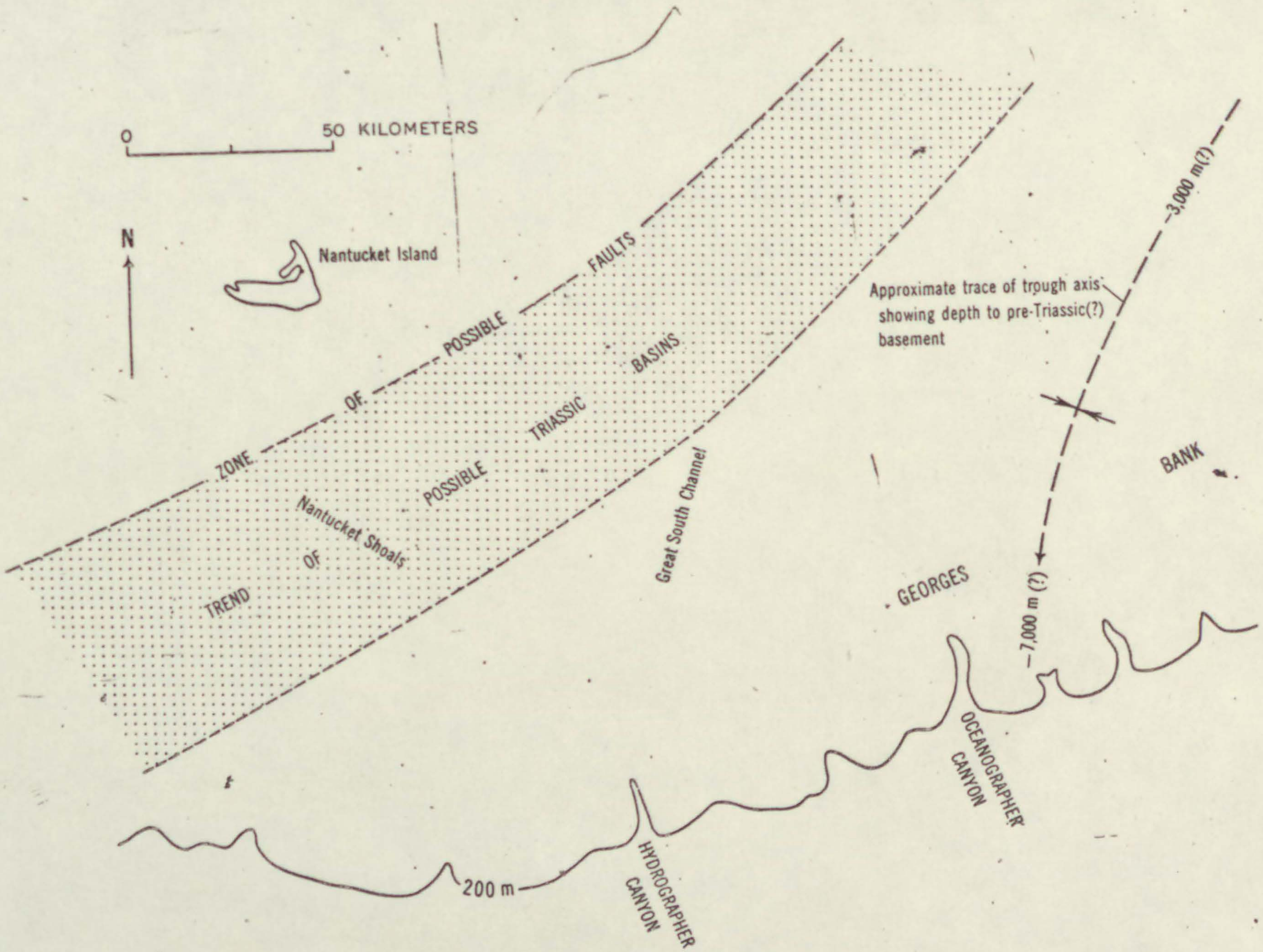
0
50 KILOMETERS
N
Nantucket Island
ZONE OF POSSIBLE FAULTS
TREND OF POSSIBLE TRIASSIC BASINS
Nantucket Shoals
Great South Channel
Approximate trace of trough axis showing depth to pre-Triassic(?) basement
-3,000 m(?)
-7,000 m (?)
GEORGES
BANK
OCEANOGRAPHER CANYON
HYDROGRAPHER CANYON
200 m

Figure 7.

Summary and conclusions

A much thicker sedimentary section exists under the Continental Shelf than has been reported previously, especially in the vicinity of the Baltimore Canyon trough and Georges Bank trough. The section may be as thick as 12,000 m, compared with 6,000 to 8,000 m as previously postulated.

Using new data available from the slope, in addition to published data on the Coastal Plain, shelf, and slope, it was possible to construct the map (fig. 2) showing geologic time units on the shelf and slope and their correlation with units on the Coastal Plain.

Petroleum potential. Based on these data, known structures, and probable source and reservoir rocks, a hydrocarbon potential of considerable value is indicated beneath the continental margin of the northeastern United States. Another favorable factor to petroleum exploration and development is the accessibility of much of the apparently promising area with water depths of 200 m or less.

U. S. GOVERNMENT PRINTING OFFICE : 1959 O - 511

The areas that appear most favorable, based on thickness of sediments and structural data, are the Baltimore Canyon and Georges Bank trough. The Baltimore Canyon trough area contains possibly 10,000 to 12,000 m of sedimentary rocks and apparently favorable structures. These structures include possible anticlinal fault traps. The Georges Bank trough contains possibly 7,000 to 8,000 m of sedimentary rocks and high angle normal faulting.

Not to be ruled out are the more difficult to locate stratigraphic traps; these may be important and more plentiful off Virginia and North Carolina where the major structure appears to be a seaward-dipping monocline.

A more definitive regional appraisal of the petroleum potential of the Atlantic Outer Continental Shelf off the northeastern United States will be established as exploration progresses, drill-hole data become available, and geologic structures are better understood through the efforts of further investigations.

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