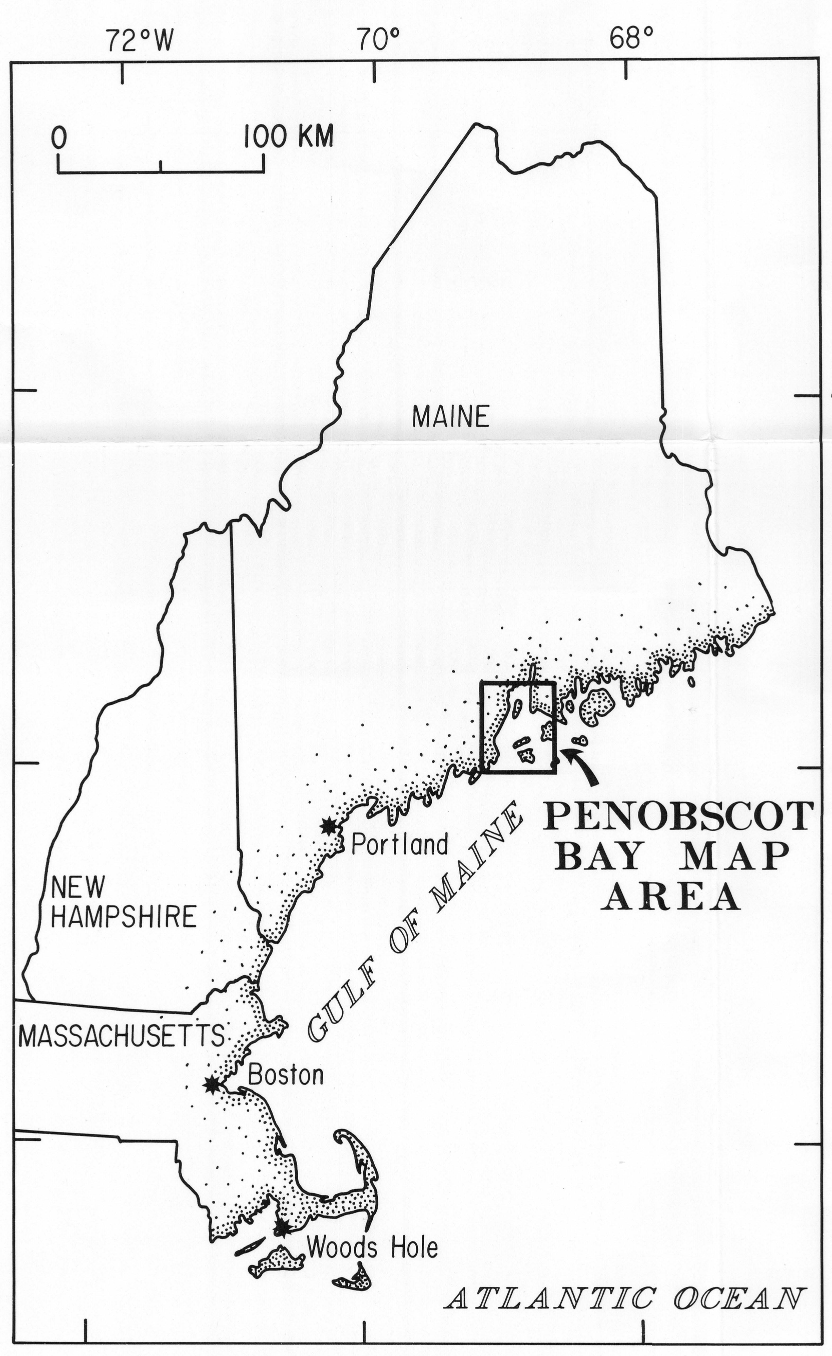

FIGURE 1.—INDEX MAP

INTRODUCTION

This report presents results of a high-resolution seismic-reflection survey conducted by the U.S. Geological Survey to determine the subbottom characteristics of Penobscot Bay, Maine. Penobscot Bay is one of the major embayments along the U.S. Atlantic coast (fig. 1), extending more than 50 km from the Gulf of Maine to the mouth of the Penobscot River. The bay constitutes an area of about 1,100 km^2 and is divided into three main passages by numerous islands.

The bay and surrounding coastal area have had a complex history of glaciation and sea-level change since late Wisconsinan time. The last ice sheet advanced across the area about 20,000 years ago, eroding the bedrock surface, removing most older sediments, and isostatically depressing the crust (Schafer and Hartshorn, 1965; Stuiver and Borns, 1975; Thompson, 1979). Deglaciation followed between about 12,700-13,500 years ago and was accompanied by a marine transgression (because of crustal depression), with ice and sea in contact (Stuiver and Borns, 1975; Thompson, 1979, 1982; Smith, 1982). Isostatic recovery of the crust then caused the coast to emerge during the immediate postglacial period, and emergence was completed by about 11,500 years ago (Stuiver and Borns, 1975; Thompson, 1979, 1982; Thompson and Smith, 1983). Finally, resubmergence of the Maine coast has accompanied the Holocene rise of sea level that began about 9,000 to 11,000 years ago (Bloom, 1963; Kaye and Barghoorn, 1964; Schnitker, 1974; Oldale and others, 1983).

In the maps presented here, we illustrate and briefly describe the sea-floor topography, bedrock morphology, and variable sediment thickness within Penobscot Bay that were either produced or modified during the period of geologic change since late Wisconsinan time.

ACKNOWLEDGMENT

We thank A. D. Colburn, Jr. of the Woods Hole Oceanographic Institution and skipper of the RV *Asterias* for his help in conducting the field work.

FIELD WORK

Numerous subbottom profiles were collected along 376 km of trackline within the study area during June 11-17, 1983; three were selected for interpretation in this report (figs. 2 and 3). The data were obtained by using a Uniboom[1] seismic system (800- to 1,500-Hz band pass; quarter-second sweep rate) that had a resolution of about 1 to 2 m. The locations and spacings of the cruise tracks were based on the bathymetry (fig. 2) and were designed to cover the entire bay. Navigational control for all tracklines was provided by loran-C and was supplemented by radar and visual fixes. The ship's speed during the survey typically was 7 km/h.

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

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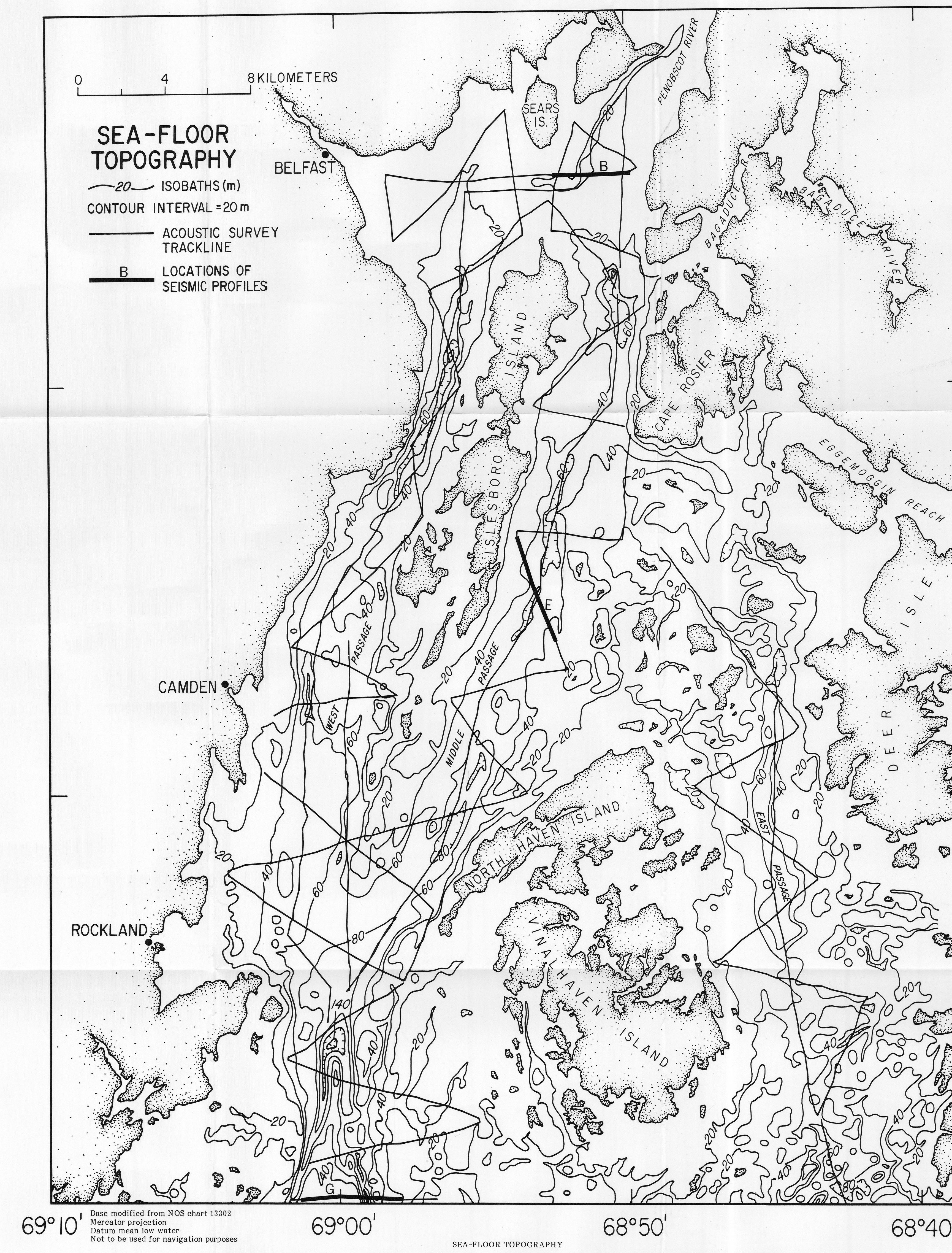

Base modified from NOS chart 13302
Mercator projection
Datum mean low water
Not to be used for navigation purposes

SEA-FLOOR TOPOGRAPHY

Depth contours (in meters) within the study area were drawn from soundings (in feet) presented on National Ocean Survey (1981) bathymetric chart 13302 for Penobscot Bay and approaches. Datum for the soundings is mean low water.

The topography of the bay floor is very irregular (fig. 2). Beneath the main passages, small knolls and ridges interrupt the bottom, and isolated depressions create reversals in the axial gradients. Water depth varies considerably over short distances and reaches a maximum of more than 150 m near the confluence of Middle and West Passages (fig. 2). An irregular bathymetric sill having water depths of less than 80 m is present at the bay entrance. The sea floor generally is smooth beneath the head of the bay.

The acoustic profiles reveal a strong correlation between the sea-floor topography and both the morphology of the bedrock surface and the distribution of sediments (Knebel and Scanlon, in press). These relationships enabled us to use the bathymetry as a basis for extrapolating between survey lines in mapping the depth to bedrock (fig. 4) and the sediment thickness (fig. 5).

FIGURE 2.—SEA-FLOOR TOPOGRAPHY AND LOCATIONS OF ACOUSTIC SURVEY TRACKLINES AND SELECTED SEISMIC PROFILES.

KEY TO ACOUSTIC UNITS AND EXPLANATION FOR SEISMIC PROFILES

Qh —Marine sediments
Qf —Fluvial deposits
Qp —Glaciomarine detritus
Qdu—Glacial drift
Pz —Bedrock

Horizontal scales are approximate.

Vertical scales are based on an assumed compressional-wave velocity of 1,500 m/s.

V.E. = Vertical exaggeration.

Profile location shown in figure 2.

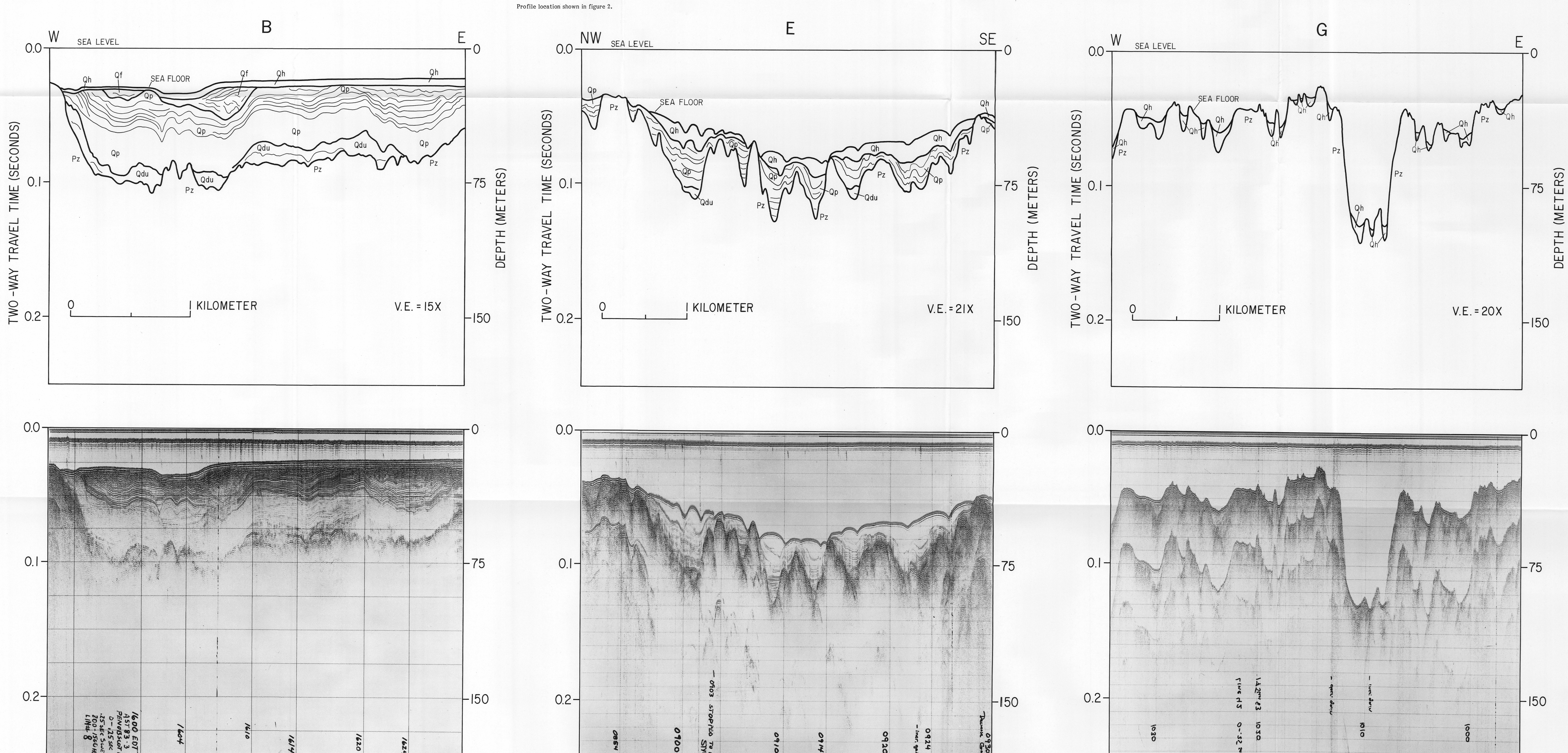

FIGURE 3.—SELECTED SEISMIC PROFILES AND INTERPRETIVE SECTIONS.

MAPS SHOWING SEA-FLOOR TOPOGRAPHY, DEPTH TO BEDROCK, AND SEDIMENT THICKNESS, PENOBSCOT BAY, MAINE

By
Harley J. Knebel and Kathryn M. Scanlon
1985

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