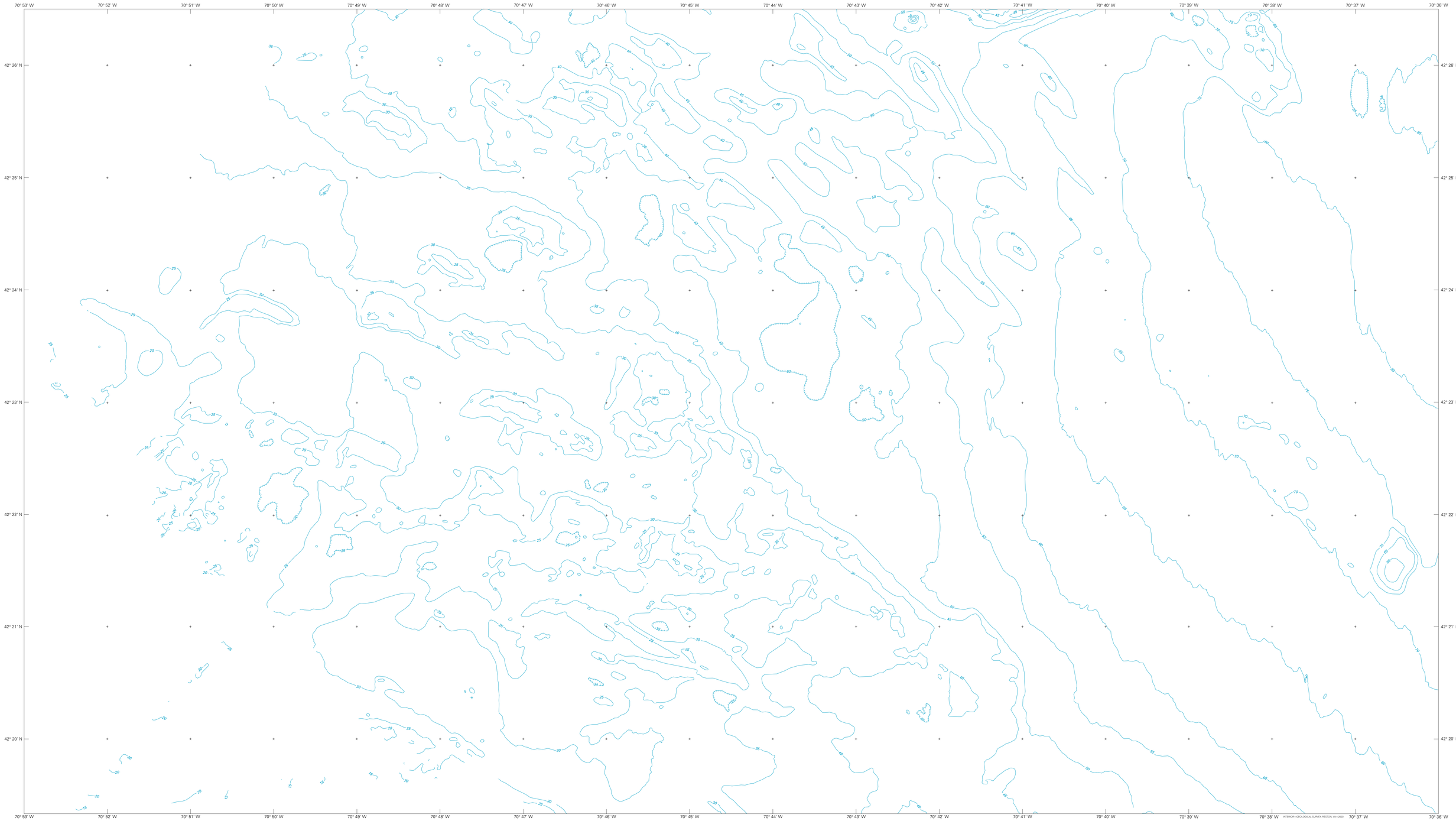
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

GEOLOGIC INVESTIGATIONS SERIES
MAP I–2732–A



INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—2003

Mercator projection

Geodetic Reference System 1980; North American Datum 1983
Longitude of central meridian 70°19' W.; latitude of true scale 41°39' N.
False easting 0 m; false northing 0 m

This map is not intended for navigational purposes.

SCALE 1:25 000
ONE CENTIMETER ON THE MAP REPRESENTS 250 METERS ON THE SEA FLOOR

1 .5 0 1 2 3 4 5 KILOMETERS

1 .5 0 1 2 NAUTICAL MILES

CONTOUR INTERVAL 5 METERS
DATUM MEAN LOWER LOW WATER

DISCUSSION

Introduction

This map shows sea floor depth as topographic contours at a scale of 1:25,000. It is based on multibeam echo-sounder data collected during four cruises conducted between the fall of 1994 and the fall of 1998. The map is part of a 3-quadrangle map series showing the area offshore of Boston, Mass., that is companion to the Stellwagen Bank National Marine Sanctuary map series (Valentine and others, 2001, 2003a–c; also see location map). Other maps of Quadrangle 2 depict shaded relief and topographic contours (Butman and others, 2003a), and backscatter intensity, shaded relief, and topographic contours (Butman and others, 2003b).

Survey methods

The multibeam echo-sounder surveys were conducted aboard the vessel *Frederick G. Creed*, a SWATH (Small Waterplane Area Twin Hull) ship that surveys at speeds up to 15 knots. A Simrad Subsea EM 1000 Multibeam Echo Sounder (95 kHz), mounted on the starboard pontoon of the *Creed*, was used to acquire these data. In water depths ranging between 5 and 200 m, the EM 1000 generates an aimed array of 60 beams, spaced at intervals of 2.5 degrees, that insonify a strip of sea floor measuring in width approximately 7.5 times the water depth. In this configuration, the horizontal spatial resolution of the data is approximately 10 percent of the water depth at 15 knots, and the vertical resolution is approximately 1 percent of the water depth. The ship's position was determined with an accuracy of 10 m or better using a differential geographic positioning system (GPS). Software developed by the Ocean Mapping Group, University of New Brunswick, was used to process and edit the bathymetric and navigation data. Tidal corrections using the National Oceanic and Atmospheric Administration tide gauge in Boston (located at 42°21.3' N., 71°03.1' W.) were made to reference the observed water depths to mean lower low water. This processing produced a grid of spatially referenced, tidally corrected bathymetric observations over the survey area.

Topographic contour mapping

Bathymetric data were contoured using ARC/INFO geographic information system software (Environmental Systems Research Institute, Inc., version 7.2.1). The processed data were formatted into a point file using the ARC/INFO "generate" routine. The point file was transformed to a Mercator projection having the longitude of the central meridian at 70°19' W. and the latitude of true scale at 41°39' N., to match the projection parameters of the Stellwagen Bank National Marine Sanctuary map series. The "pointgrid" routine was used to assign depth values to a grid having a cell size of 6 m. Smoothing of the data was accomplished using a 9-cell by 9-cell (54 m by 54 m) median filter with the "focalmedian" routine. Topographic contours at a 5-meter interval were generated from the grid using the "latticecontour" routine. Contour lines were edited to match at the quadrangle boundaries. Contours that could not be resolved at map scale and fragmented contours were removed; otherwise the contours are displayed here unedited. Topographic lows are identified by hachured contours (hachures face deeper water). Blank spaces in the western one-fifth of the quadrangle are areas of no data. The two narrow strips of data in the southwest corner of the quadrangle were collected along single ship transits to Boston Harbor. Sometimes small errors in depth at the outermost edge of the beam pattern, caused by refraction of survey beams in the water column, produced unrealistic waviness in contour lines that is especially evident in areas of flat sea floor. For example, see the area between 42°20' N., 70°36' W. and 42°22' N., 70°40' W. The map layout was created in ArcView 3.1 (Environmental Systems Research Institute, Inc.) and exported to Adobe Illustrator (Adobe Systems, Inc., version 7.0), where all map labels and text were added.

ACKNOWLEDGMENTS

The multibeam echo-sounder surveys were conducted with support from the Canadian Hydrographic Service and the University of New Brunswick. For their skillful work at sea, we thank G. Costello, N. Doucet, J. Gagne, R. Sanfacon, and B. Tessier of the Canadian Hydrographic Service, E. Radford of the National Oceanic and Atmospheric Administration, and the officers and crew of the Canadian Hydrographic Service survey vessel *Frederick G. Creed*. We also thank J.H. Clark of the University of New Brunswick for his assistance in data acquisition, processing, and interpretation.

REFERENCES CITED

Butman, Bradford, Hayes, Laura, Danforth, W.W., and Valentine, P.C., 2003a, Shaded relief and sea floor topography of Quadrangle 2 in western Massachusetts Bay offshore of Boston, Massachusetts: U.S Geological Survey Geologic Investigations Series Map I–2732–B, scale 1:25,000.

——2003b, Backscatter intensity, shaded relief, and sea floor topography of Quadrangle 2 in western Massachusetts Bay offshore of Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I–2732–C, scale 1:25,000.

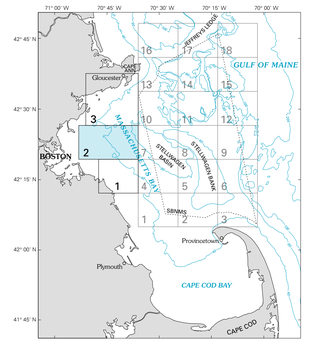
——2003c, Sea floor topography of Quadrangle 1 in western Massachusetts Bay offshore of Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I–2731–A, scale 1:25,000.

Valentine, P.C., Middleton, T.J., and Fuller, S.J., 2001, Maps showing sea floor topography, sun-illuminated sea floor topography, and backscatter intensity of the Stellwagen Bank National Marine Sanctuary region off Boston, Massachusetts: U.S. Geological Survey Open-File Report 00–410, 1 CD-ROM, scale 1:60,000.

Valentine, P.C., Baker, J.L., and Unger, T.S., 2003a, Sea floor topography of the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I–2676–A, scale 1:60,000.

Valentine, P.C., Unger, T.S., and Baker, J.L., 2003b, Sun-illuminated sea floor topography of the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I–2676–B, scale 1:60,000.

——2003c, Backscatter intensity and sun-illuminated sea floor topography of the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I–2676–C, scale 1:60,000.



Location map showing mapped Quadrangle 2 shaded in blue. The western Massachusetts Bay map series comprises quadrangles 1–3 (outlined in black); the maps for Quadrangle 2 include this map and Butman and others (2003a,b). Topography of Quadrangle 1 is shown at scale 1:25,000 in Butman and others (2003c). Quadrangles 1–18 (outlined in gray) compose the companion Stellwagen Bank National Marine Sanctuary (SBNMS) map series. The sea floor topography of the entire area of quadrangles 1–18 is shown at scale 1:60,000 in Valentine and others (2001, 2003a); it is also shown by quadrangle at scale 1:25,000 as follows (all are U.S. Geological Survey Open-File Reports (OFRs)): quadrangles 1 to 8, OFR 97–502 to –509; quadrangles 9 to 12, OFR 97–682 to –685; and quadrangles 13 to 18, OFR 97–726 to –731. The SBNMS boundary is shown as a dashed line. Selected bathymetric contours are labeled in meters.

SEA FLOOR TOPOGRAPHY OF QUADRANGLE 2 IN WESTERN MASSACHUSETTS BAY OFFSHORE OF BOSTON, MASSACHUSETTS

By

Bradford Butman, Laura Hayes, William W. Danforth, and Page C. Valentine

2003

Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225; telephone 1-888-ASK-USGS

For more information contact:
Bradford Butman, U.S. Geological Survey,
384 Woods Hole Road, Woods Hole, MA 02543

Printed on recycled paper

USGS
science for a changing world