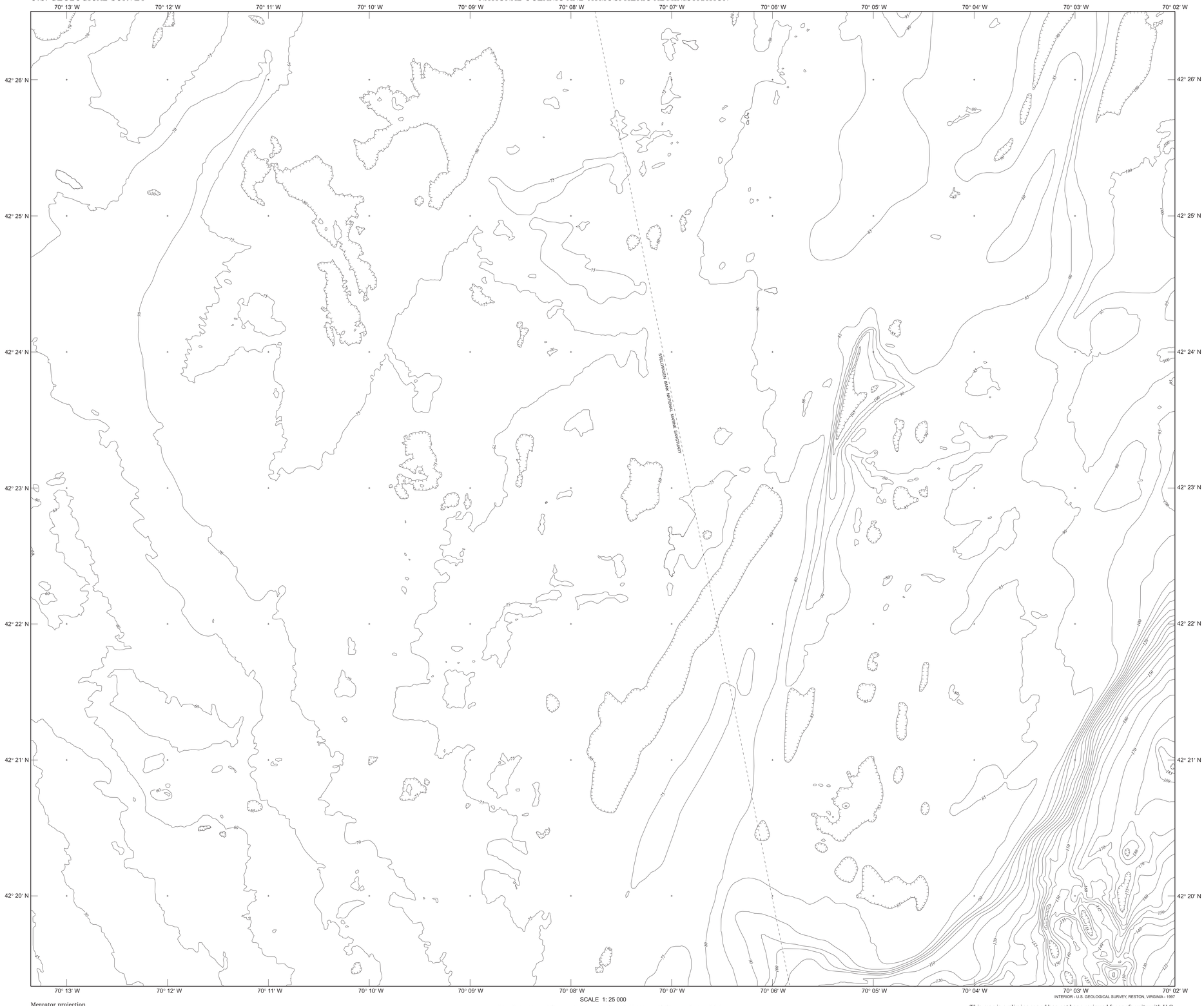
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

OPEN-FILE REPORT 97-682



SCALE 1: 25 000

ONE CENTIMETER ON THE MAP REPRESENTS 250 METERS ON THE SEA FLOOR

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 5 METERS

DATUM MEAN LOWER LOW WATER

INTERIOR - U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA - 1997

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.

This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

SEA FLOOR TOPOGRAPHY OF QUADRANGLE 9 IN THE STELLWAGEN BANK NATIONAL MARINE SANCTUARY OFF BOSTON, MASSACHUSETTS

By

Page C. Valentine, Jessica L. Baker, Tanya S. Unger, and Edwin T. Roworth

U.S. Geological Survey, Woods Hole Field Center
Woods Hole, Massachusetts

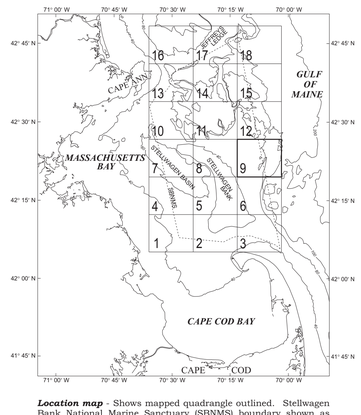
1997

DISCUSSION

Introduction - The Stellwagen Bank National Marine Sanctuary Mapping Project is a cooperative effort of the U.S. Geological Survey and the National Oceanic and Atmospheric Administration, with support from the University of New Brunswick and the Canadian Hydrographic Survey. The survey was conducted on four cruises over a two-year period from the fall of 1994 to the fall of 1996. The project is mapping an area of 1100 square nautical miles. This map shows one of a series of 18 quadrangles (see location map) in which sea floor topography is presented at a scale of 1:25,000.

Survey methods - The survey was conducted with a multibeam echo sounder aboard the Canadian Hydrographic Survey vessel *Frederick G. Creed*, a SWATH (Small Waterplane Area Twin Hull) ship that surveys at speeds up to 16 knots. During the survey, the ship's position was determined with an accuracy of 10 m or better using a geographic positioning system (GPS) receiver in conjunction with differential GPS corrections transmitted by U.S. Coast Guard radio beacons. The multibeam data were collected utilizing a Simrad Subsea EM 1000 Multibeam Echo Sounder (95 kHz) that is permanently installed in the hull of the *Creed*. In water depths between 5 and 200 m, the EM 1000 produces 60 aimed 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; horizontal spatial resolution is on the order of 10 percent of the water depth at 16 knots; and vertical resolution is approximately 1 percent or better. Software developed by the Ocean Mapping Group, University of New Brunswick, was used to process and edit the bathymetric and navigation data; and tidal corrections based on NOAA's Boston tide gauge were used to reference depth data to mean lower low water.

Topographic contour mapping - Bathymetric data were contoured with Arc/Info geographic information system software (Environmental Systems Research Institute, Inc., version 7.03). Processed data were formatted into a point file using the Arc/Info "point generate" routine. The point file was transformed to a Mercator projection with the longitude of the central meridian at 70° 19' W and the latitude of true scale at 41° 39' N. The "point grid" routine was used to create a grid from the point file and to assign depth values to individual grid cells. The cell size of the output grid was 13 m. Topographic contours at 5-meter intervals were generated using the "lattice contour" routine. Most of the contour lines are displayed here unedited. However, in areas of very smooth sea floor, some contours displayed distortions that are due to problems encountered during data acquisition at nadir (directly below the vessel's keel) and to refraction effects at the outermost edge of the beam pattern. These distortions were smoothed by using a user-defined low-frequency "focal median" filter routine on the grid created by "point grid." Square focal median filters varying in size from 5 x 5 to 21 x 21 cells were tried, and a 9 x 9 cell size was selected. The resulting contours were compared with features displayed in sun-illuminated seabed imagery of the same data and edited manually with "Arc/Edit" to remove small artifacts that remained after filtering. Each of the quadrangles was contoured independently, and contours that extend into adjacent quadrangles were edited manually to match at the boundary.



Location map - Shows mapped quadrangle outlined. Stellwagen Bank National Marine Sanctuary (SBNMS) boundary shown as dashed line. Bathymetric contours in meters.