

Meridional 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.

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 Service. The multibeam echo sounder survey was conducted on four research cruises between 1998 and 2001. This map shows one of a series of 18 quadrangles (see location map) in which sea floor depth information is depicted in sun-illuminated (or shaded) relief view at a scale of 1:25,000. The bathymetry is derived from the multibeam data. The shaded relief view uses a sun elevation angle of 45 degrees above the horizon from an azimuth of 330 degrees and a vertical exaggeration of four times. In effect, topographic relief is enlarged four times. The map is oriented with the top pointing toward the west-northwest, so that shadows are cast on the southern flanks of seabed features. Some features in the images are artifacts of data collection. They are especially noticeable when the bathymetry is viewed in shaded relief. The bathymetry shows a variety of scale-looking features and patterns that are oriented parallel or perpendicular to survey tracks. For a depiction of the topographic contours alone, and for an explanation of the bathymetry, see the discussion by Valentine and others (1997). Topographic contour maps of all 18 quadrangles in the map series are available on the Internet in ESRI shapefile format. Arc expert and Arc info formats are also available. The bathymetry and topographic contours are also available in the map series as a single file. Blank areas in the map are where no data are available.

Regional seabed features

The major topographic features depicted in the map series were formed by glacial processes. In broad terms, these features are interpreted here to represent a geological history that describes several stages. The earliest stage involved the sea floor across the region being scoured and scoured by the large blocks of ice, the ridges, and the valleys. Many other features observed here represent the latter stages of deglaciation. They are the features that are present when much of the area was covered by standing ice, and when at some time the ice was melting and ice falls were active in and near areas of high topographic relief. The sea invaded the region formerly occupied by ice, and sea floor features were partly eroded and some new sedimentary deposits were formed. Today, the sea floor is modified mainly by

strong southward-flowing bottom currents caused by storm winds from the northeast. These currents erode sediments from the shallow banks and transport them into deeper water, where they become coarser, as sand and mud are removed and gravel remains, and the western peaks of the banks, as well as adjacent banks, are built up by deposits of mud and sand.

Quadrangle 18 features

The sea floor in Quadrangle 18 is located regionally at approximately 6 m in water depth in the southwest to 155 m in the northeast. Within this regional setting, the seabed is topographically variable and includes valleys, basins, and hills; one prominent hill reaches a water depth of less than 10 m. The seabed in the southern and northern parts of the quadrangle is relatively flat, with numerous small hills and basins that probably reflect the movement of a regional ice sheet. This is similar to the bottom type observed in the adjacent Quadrangle 15 to the south (Valentine and others, 2001a). The seabed in the central part of the quadrangle is 10 to 15 m of relief. They are covered with gravel including patches of boulders and cobblestones that is partly covered with a thin veneer of sand. Between the hills, the seabed is relatively flat, with numerous small hills and basins. The seabed is composed of elongate, shallow, east- and southeast-trending basins in the central and eastern parts of the quadrangle, east of 70°09' W. These basins deepen from west to east, and the deepest point is at 17 m. The seabed is relatively flat in the northwest and north-central parts of the quadrangle, where deeper than 120 to 125 m, is too deep to have been marked by the grounded icebergs. The seabed grooves have a dominant northeast-trending orientation. They become

less distinct toward the northwest and southwest corners of the quadrangle. A large, conical hill is located along the northeast corner of the quadrangle (42°45.5' N and 70°10.5' W) on its southeastern bank. This is an outcrop of resistant bedrock whose shape has been modified by the scouring of glacial ice. The ice apparently moved from west to east, removing material from the eastern (or leeward) side of the hill and forming eastward-trending grooves and ridges (1 to 2.5 km long) in the bedrock. The bedrock is covered with a thin veneer of coarse-sandy and gravelly sediments. A similar, but smaller, bedrock hill is located approximately 3.25 km to the east-northeast of the large hill (42°45.9' N, 70°10.8' W). It reaches a water depth of 15 m and is located on its southeastern bank (42°45.9' N, 70°10.8' W) on its southern bank. Both features are similar in character to two small hills on Jeffreys Ledge in the adjacent Quadrangle 17 to the west (Valentine and others, 2001b). North and northeast of the large hill, a shallow basin flooded with sand is bounded on the east and northeast by numerous patches of cobbles and boulders that are covered with a thin veneer of sand.

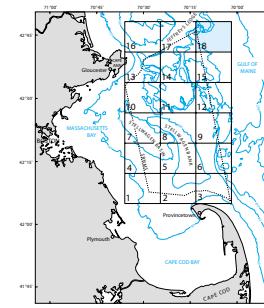
REFERENCES CITED

Valentine, P.C., Unger, T.S., Baker, J.L., and Roovorth, E.T., 1997, Sea floor topography of Quadrangle 18 in the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Open-File Report 97-731, scale 1:25,000, 18 p., 1 CD-ROM.

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Valentine, P.C., Baker, J.L., and Unger, T.S., 2001a, Sun-illuminated sea floor topography of Quadrangle 15 in the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I-2715, scale 1:25,000.

—2001b, Sun-illuminated sea floor topography of Quadrangle 17 in the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts: U.S. Geological Survey Geologic Investigations Series Map I-2717, scale 1:25,000.



Location map outlining the 18 quadrangles in the series. Quadrangle 18 is shown in blue. Boundary of Stellwagen Bank National Marine Sanctuary (NMFS) indicated by dashed line. Bathymetric contours in meters.

SUN-ILLUMINATED SEA FLOOR TOPOGRAPHY OF QUADRANGLE 18 IN THE STELLWAGEN BANK NATIONAL MARINE SANCTUARY OFF BOSTON, MASSACHUSETTS

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