

Meridional projection
Geodetic datum system 1983 North American Datum 1983
Longitude of central meridian 70°19' W; (latitude of true scale 41°37' N;
False easting 0 m; False northing 5 m)

This map is not intended for navigational purposes.

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, National Marine Fisheries Service, University of New Hampshire, and the Canadian Hydrographic Service. The multi-beam echo sounder survey was conducted on four cruises over a two-year period from the fall of 1994 to the fall of 1996. This map shows one of a series of 18 quadrangles (see location map) in which sea floor topographic contour maps of the Stellwagen Bank area are shown at a scale of 1:25,000, with topographic contours overprinted in blue. The image shown here uses a sun elevation angle of 45 degrees above the horizon from an azimuth of 330 degrees, and a sun azimuth of 10 degrees. In effect, the horizon is elongated by having the sun illuminate the sea floor from a position 10 degrees west of north, so that shadows are cast on the southern flanks of seabed features. Some features are elongated in this perspective view, and some appear as small islands where the seabed is smooth, and they include small highs and lows and unusual-looking features and patterns that are oriented parallel or perpendicular to survey tracks. The map is a perspective view of the bathymetry and topography, not a map by Valentine and others (1997). Topographic contour maps of all 18 quadrangles in the map series are available on a CD-ROM and in PDF, Arc/INFO, and PGM file formats (download and select "17.mpr" from the list when in data extract).

Regional seabed features

The major topographic features in the map series were formed by glacial processes. In broad terms, these features are interpreted here to represent a geologic history that developed in several stages. Ice containing rock debris moved across the region, creating in surface and subsurface areas, ridges, basins, and ridges, and valleys. Many other features observed here represent the latter stages of deglaciation. They are the result of processes at work when much of the area was covered by ice, and when the ice was melting. The ice sheets, and the lakes and ice falls were active and in near areas of high topographic relief. The sea invaded the region formerly occupied by ice, and seabed features were partly eroded and some were partially deposited. In some areas, the sea floor topography is relatively complex. Strong southwest-flowing bottom currents driven by storm winds from the northeast. These currents erode sediments from the seabed and transport them into the basins. With time, the banks affected by these currents become coarser.

as sand and mud are removed and gravel remains; and the western flanks of the banks as well as adjacent banks, are built up by deposits of mud and sand.

Quadrangle 17 features

This quadrangle is bisected by a broad, northeast-trending bank, Jeffreys Ledge, that lies at a water depth of 35 to 65 m. The bank's surface is covered with gravel and includes many boulder piles. The boulders are oriented roughly parallel to the bank, parallel to the trend of the bank, are located mainly along the western side of the bank. They resemble and moraines deposited of rock debris piled up at the forward edge of a glacier. The eastern side of the bank is relatively smooth, and the bank, resemble eskers (sand and gravel deposited by running water in channels within stationary glacial ice). The bank's western margin is a well-defined scarp (25 to 35 m of elevation) that trends roughly east-northeast. In effect, the margin of the bank is eroded by having the sun illuminate the sea floor from a position 10 degrees west of north, so that shadows are cast on the southern flanks of seabed features. Some features are elongated in this perspective view, and some appear as small islands where the seabed is smooth, and they include small highs and lows and unusual-looking features and patterns that are oriented parallel or perpendicular to survey tracks. The map is a perspective view of the bathymetry and topography, not a map by Valentine and others (1997). Topographic contour maps of all 18 quadrangles in the map series are available on a CD-ROM and in PDF, Arc/INFO, and PGM file formats (download and select "17.mpr" from the list when in data extract).

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bank's northwestern margin is an apron of coarse sand (at depths of 6 to 75 m) that was transported from Jeffreys Ledge. The bank surface exhibits low, rounded hills and small, shallow basins. The hills are covered with gravel, including boulder piles. The gravel and boulders are piled up in the shallow basins. The hills are in the ridges; the sand also predominates in the shallow basins. Somewhat deeper basins and valleys on the southwestern margin of this bank are covered with muddy sand. Much of the sand is derived from the adjacent Jeffreys Ledge, which is about 50 m deep and typically is 50 to 100 m wide and less than 5 m deep. They are interpreted to be marks made by the jagged bottoms of boats that grazed the seabed by grounding here during the last glacial period. The Jeffreys Ledge deep basin is more pronounced than similar features that occur in Quadrangles 15 and 16 (Valentine and others, 2001a,b), possibly because they may have been partly filled by sand transported from Jeffreys Ledge. The Jeffreys Ledge deep basin is bounded by two deep basins that are bounded on their western sides by Jeffreys Ledge deep eastward and are flooded by muddy sand. The southern basin ranges in depth from 70 to 140 m, and the northern basin ranges from 70 to 100 m. The Jeffreys Ledge, narrow, low ridges that parallel topography extend along the western margins of both basins (42°42.5' N., 70°20.5' W. and 42°46.8' N., 70°15.3' W.). These ridges are interpreted to be lateral moraines (deposits of rock debris piled up at the edge of moving ice) now covered with sand transported from the bank.

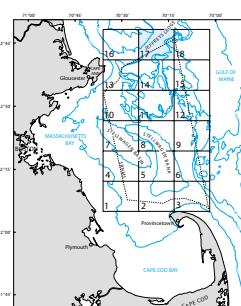
REFERENCES CITED

Valentine, P.C., Baker, J.L., Unger, T.S., and Rutherford, E.T., 1997, Sea floor topographic map and bathymetry of Quadrangle 17 in the Stellwagen Bank National Marine Sanctuary, off Boston, Massachusetts, U.S. Geological Survey Open-File Report 97-730, scale 1:25,000.

Valentine, P.C., Baker, J.L., Unger, T.S., and Polloni, C., 1998, Sea floor topographic map and perspective-view imagery of Quadrangles 1-18, Stellwagen Bank National Marine Sanctuary, off Boston, Massachusetts, U.S. Geological Survey Open-File Report 98-138, scale 1:25,000.

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.

Valentine, P.C., Baker, J.L., and Unger, T.S., 2001b, Sun-illuminated sea floor topography of Quadrangle 16 in the Stellwagen Bank National Marine Sanctuary off Boston, Massachusetts, U.S. Geological Survey Geologic Investigations Series Map I-2716, scale 1:25,000.



Location map outlining the 18 quadrangles in this series. Quadrangle 17 is shown in blue. Boundary of Stellwagen Bank National Marine Sanctuary (SBNNWS) indicated by dashed line. Bathymetry contours in meters.

SUN-ILLUMINATED SEA FLOOR TOPOGRAPHY OF QUADRANGLE 17 IN THE STELLWAGEN BANK NATIONAL MARINE SANCTUARY OFF BOSTON, MASSACHUSETTS

By

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

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