

Meridian 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.

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 vessels during the summers of 1998 and 1999. This map, Quadrangle 18, displays 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 bathymetric contours are based on the multibeam survey data and uses a sun elevation angle of 45 degrees above the horizon from an azimuth of 350 degrees and a vertical exaggeration of four times. In effect, topographic relief is enhanced by a factor of four. The bathymetric contours are based on the sea floor north of 42°41' N., 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 looking at the bathymetric contours, which are oriented perpendicular to survey tracks. For a depiction of the topographic contours alone, and for an explanation of the symbols used in this map, see the legend in the location map provided by Valentine and others (1999). Topographic contour maps of all 18 quadrangles in the map series are available as CD ROMs, EPS, PS, Arc export, and PDF file formats (Valentine and others, 1999). CD ROM areas are numbered 1 through 18.

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 geologic history that developed in several stages. Ice continental shelves, which are the region's caliper, sea floor, and bathymetric features to form the large basins, basins, 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 sea level low enough to allow the sea to inundate the land. When the ice falls were active in and near areas of high topographic relief, the sea invaded the region formerly occupied by ice, and seabed features were scoured 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 the deeper basins. Within this regional setting, the sea floor topography shows 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 bathymetric contours are based on the multibeam survey data and uses a sun elevation angle of 45 degrees above the horizon from an azimuth of 350 degrees and a vertical exaggeration of four times. In effect, topographic relief is enhanced by a factor of four. The bathymetric contours are based on the sea floor north of 42°41' N., 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 looking at the bathymetric contours, which are oriented perpendicular to survey tracks. For a depiction of the topographic contours alone, and for an explanation of the symbols used in this map, see the legend in the location map provided by Valentine and others (1999). Topographic contour maps of all 18 quadrangles in the map series are available as CD ROMs, EPS, PS, Arc export, and PDF file formats (Valentine and others, 1999). CD ROM areas are numbered 1 through 18.

Quadrangle 18 features

The sea floor in Quadrangle 18 is topographically variable, up to 85 m in water depth in the southwest to 150 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 35 m. The seabed in the southern portion of the quadrangle is characterized by numerous small, shallow, irregular 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 northeast is characterized by hills up to 10 m of relief. They are covered with gravel (including patches of boulders and cobble) that is partly covered with a thin veneer of sand. Between the hills, the seabed is characterized by numerous small, shallow, irregular hills and basins.

A series of elongate, shallow, east and southeast-trending basins is present in the central and eastern parts of the quadrangle, east of 70°09' W. These basins deepen from west to east, and the deepest basin is 75 m in depth. The seabed slopes down 10 m below the surrounding seafloor. The basin floors are relatively smooth and are covered with fine-grained sand and mud; the percentage of mud increases from west to east and near the deepest point.

The most striking topographic features in Quadrangle 18 are the many long, narrow grooves that dominate all but the northeastern part of the area. They typically are 10 to 100 m wide and 10 to 100 m deep, and up to 10 m in relief. The processes are inferred to be made by the lateral movement of ice that scoured the seabed by grounding here during the late stages of the last glaciation. The grooves are observed at 145 m in depth in the western corner of the quadrangle and they disappear at 75 m in depth in the western corner of the northwest portion of the quadrangle. The floors of numerous basins, where deeper than 120 to 125 m, are as deep as they are broad by the grounding of the icebergs. The scabbling grooves have a dominant northeast-southwest orientation. They become

less distinct toward the northwest and southwest corners of the quadrangle. A large, conical hill is located along the western margin of the quadrangle (42°45.5' N.) and has a height of 15 to 17 m above the sea floor. The hill is a large, irregular mass of 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 left side) of the hill and forming eastward-trending grooves and ridges (1 to 2.5 km long) to the east of the hill. The seabed to the east of the hill is covered with fine-grained 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°10.85' W.). It reaches a height of 12 m above the sea floor and has a diameter of 125 to 128 m on its southern flank. 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 seafloor basin flooded with sand is bounded on the east and north by a series of small, irregular ridges of cobbles and boulders that is partly covered with a thin veneer of sand.

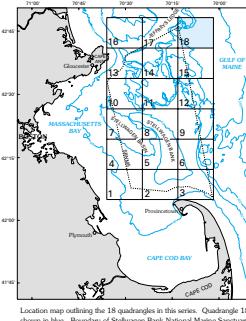
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SUN-ILLUMINATED SEA FLOOR TOPOGRAPHY OF QUADRANGLE 18 IN THE STELLWAGEN BANK NATIONAL MARINE SANCTUARY OFF BOSTON, MASSACHUSETTS

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