

Sea Floor Image Maps Showing Topography, Sun-Illuminated Topography, Backscatter Intensity, Ruggedness, Slope, and the Distribution of Boulder Ridges and Bedrock Outcrops in the Stellwagen Bank National Marine Sanctuary Region off Boston, Massachusetts

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MAP B.—SUN-ILLUMINATED SEA FLOOR TOPOGRAPHY IN THE STELLWAGEN BANK NATIONAL MARINE SANCTUARY REGION

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DISCUSSION

Introduction

Sea floor mapping in the Stellwagen Bank National Marine Sanctuary (NMS) is a cooperative effort of the U.S. Geological Survey (USGS) and the National Oceanic and Atmospheric Administration, with technical support from the University of New Brunswick and the Canadian Hydrographic Service. The maps generated from this undertaking are based on a 1994–96 survey that used a multibeam echo sounder to map 1,100 square nautical miles of the sea floor (fig. 1). The technology and methods of image acquisition and topographic contouring that were used are described in publication 4 in the References section. USGS Scientific Investigations Maps (SIM) 2840–A to –F constitute a six-map (twelve-sheet) series in digital (DVD-ROM) format. The first three maps, SIM 2840–A, –B, and –C, were previously published on paper as USGS Geologic Investigations Series Maps I–2676–A, –B, and –C (publications 43–45 in the References). Preliminary versions of those three maps also had been released earlier on a CD-ROM as USGS Open-File Report 00–410 (publication 42).

The map area shown here is a composite of 18 individual quadrangle maps (fig. 1). Two map series of the 18 quadrangles have been published at a scale of 1:25,000 and show sea floor topography (publications 4–22) and sun-illuminated sea floor topography (fig. 2; see publications 23–41). Selected sea floor maps, photographs, CD-ROMs, fact sheets, posters, and geographic names related to research conducted in the Stellwagen Bank NMS region are available online at USGS Web site <http://woodshole.er.usgs.gov/project-pages/stellwagen/index.html>. See the References section for a complete numbered list of publications.

On the maps presented in this series, the locations of the corners of the 18 quadrangles are shown for reference as ticks labeled outside the map edges, and (on maps C and E) as large crossticks within the map area. Maps A, B, D, and F show the boundaries of the individual quadrangles. On the maps that show sun-illuminated sea floor topography, blank spaces represent areas of no data.

Sun-illuminated sea floor topography

This map shows contoured and sun-illuminated topography of the sea floor and the boundaries of the 18 individual quadrangles that constitute the map region. The topography shown in the multibeam sonar image is vertically exaggerated four times and artificially illuminated by a light source positioned 45 degrees above the horizon from an azimuth of 350 degrees. Unnatural-looking stripes and patterns oriented parallel or perpendicular to survey tracklines are artifacts of data collection. The topographic contour interval is 5 m. Contours are shown in blue except for topographic lows, which are shown in brown. In depressions outlined by several concentric contours, only the deepest contour is colored brown. The great topographic detail of the seabed revealed by this survey warranted the naming here of many geographic features; some features were named in consultation with local fishermen. The U.S. Board on Geographic Names has approved the names shown on the maps. Background information supporting the feature names is available online; see publication 48 in the References.

Glacial processes formed the major topographic features depicted here. Glacial ice containing rock debris moved across the region, sculpting its surface and depositing sediment to form the large basins, banks, ridges, and valleys. Smaller scale features were formed during latter stages of deglaciation when much of the area was covered by stationary rotting ice, and when small valley glaciers and icefalls were active in and near areas of high relief. The sea invaded the region formerly occupied by ice, seabed features were partly eroded, and some new sedimentary deposits were formed. Today, the sea floor is modified intermittently when strong southwestward-flowing bottom currents, caused by storm winds and waves from the northeast, erode sediments from the shallow banks. With time, the surficial sediments on these banks coarsen, as sand and mud are removed and gravel remains. The western flanks of the banks are built up by deposits of the displaced sand and mud.

Maps of the 18 individual quadrangles (scale 1:25,000) contain detailed discussions of the sea floor geomorphology; see publications 23–41 in the References.

REFERENCES

USGS publications can also be purchased from USGS Information Services, Box 25286, Denver Federal Center, Denver, CO 80225-0046; telephone (303) 202-4200 or 1-888-ASK-USGS

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Stellwagen Bank National Marine Sanctuary—Sun-Illuminated Sea Floor Topographic Imagery

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Terrain Ruggedness Index (TRI)

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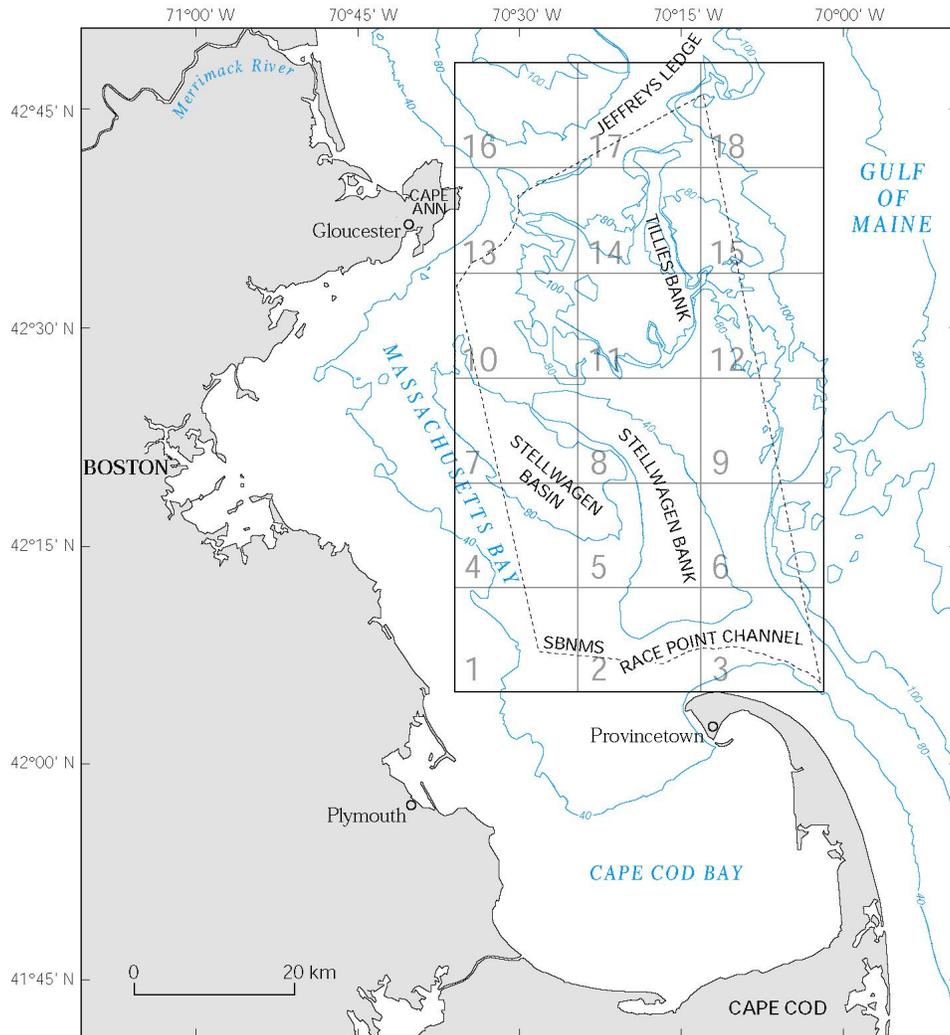


Figure 1. Regional setting of the map area (outlined in black). Publications specific to the entire map area or to individual quadrangles 1–18 (outlined in gray) are listed in the References section. Stellwagen Bank National Marine Sanctuary (SBNMS) boundary is shown as a dashed line. Bathymetric contours are labeled in meters.

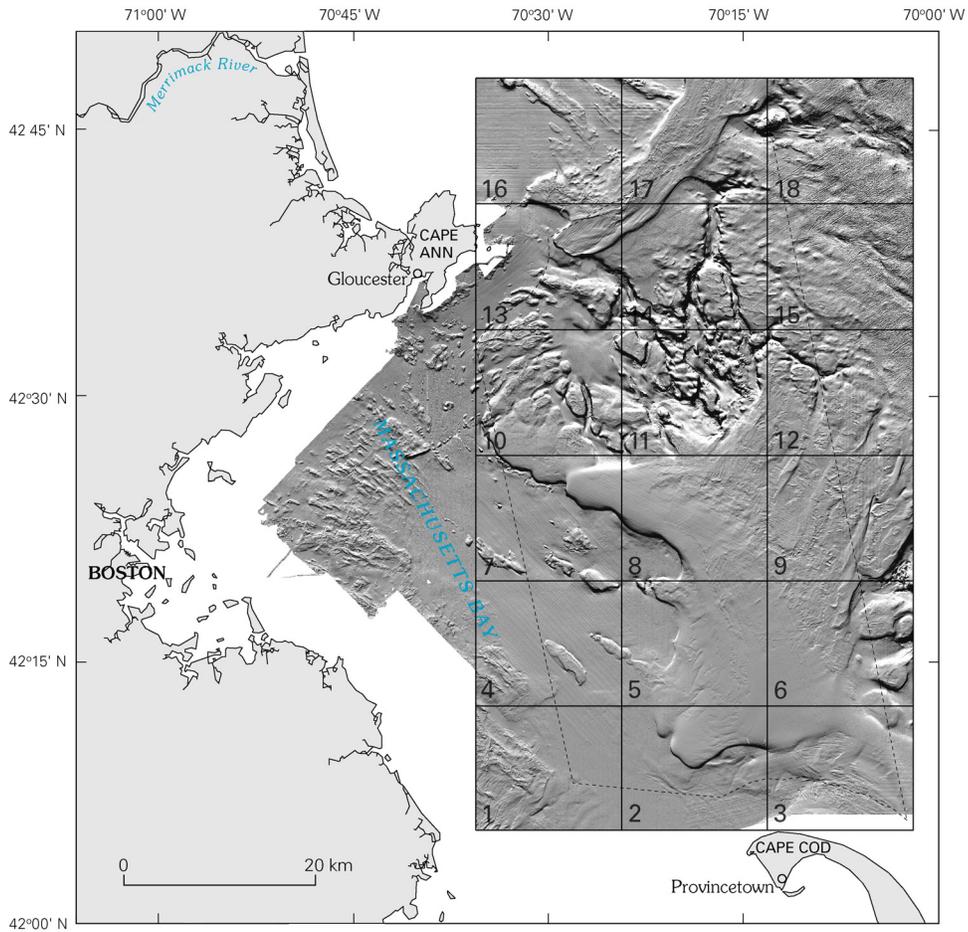


Figure 2. Sun-illuminated sea floor topographic imagery of the Stellwagen Bank National Marine Sanctuary and Massachusetts Bay region, and the 18 quadrangles of the map area. Dashed line is the sanctuary boundary.