

DISCUSSION

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 bathymetry extends from the surface to 1,000 m depth and covers an area of 1,000 km². The bathymetry was collected during 11 research 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 depth is contoured at 10-m intervals. The bathymetry is shown in meters, ranging from 0 to 1,300 m, with topographic contours overlaid in grey. The image shown here uses a sun angle elevation of 45 degrees above the horizon from an azimuth of 330 degrees. The bathymetry is shaded to show the depth of the sea floor, with shadows enhanced 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 seafloor features. Some bathymetric features are labeled with their names. The bathymetry is shown as shaded relief, where the seabed is smooth, and include small highs and lows and unsnarled lighting features and patterns that are oriented parallel or perpendicular to survey lines. For a depiction of the bathymetry as it would appear in the absence of survey lines and processing methods, see the complete map and an explanation of survey lines and processing methods.

Quadrangle 7 feature

This quadrangle covers the northwestern end of Stellwagen Bank and the central part of Stellwagen Basin. The bank crest, in the northeastern part of the quadrangle,

is relatively flat in water depths of 30 to 35 m, where it is covered with sand and gravelly sand. A band of fine-grained sand caps the northern edge of the bank. The eastern part of the bank's northern flanks slopes steeply through water depths of 40 to 90 m to a broad terrace. The terrace is bounded on the east by a scarp leading into Quadrangle 10 to the north (Valentini and others, 2000a). The valley head is covered with sand, becoming finer grained with depth. The western part of the bank's northern flanks slopes more gradually through water depths of 40 to 90 m to a broad terrace that extends the bank northward. Sand transported from the northern bank of the flume covers the southeastern part of the terrace, where the surface is smooth except for shallow gullies on the eastern side. Both Stellwagen Bank and the northern bank of the flume have a base to their southern by a continuous northward trending escarpment that is 40 m high along the bank edge and is reduced to 25 m along the terrace edge. A band of irregular seabed at the base of the escarpment is covered with sand and gravel, with some scattered shallow depressions; it is interpreted as a glacial feature deposited by a flow that overflowed the terrace. Some of the roughness of this glacial feature is caused by a veneer of gravel deposited by a glaciogenic stream. The northern bank is covered with gravelly sand and gravel, which is shaped as a depression with gravel, including boulder piles and ridges, and it displays irregularly shaped depressions that possibly outline the

former locations of large masses of melting glacial ice. Steeply basin-parallel, the central, western, and southern parts of the quadrangle are underlain by glaciogenic sediments. The basin floor ranges in depth from 70 to 95 m, is covered by glacial and related sediments, and contains numerous areas of topographic highs and some small shallow depressions. The most prominent basin features are three large elongate banks that lie in the southern part of the quadrangle. They are part of a group of three elongate banks that have been grouped into the Stellwagen and 7 Islands groups (Hobart and others, 2009a, 2009b). These banks are aligned with the sharp west margin of Stellwagen Bank in Quadrangle 5. The three banks in Quadrangle 7 are 3.0 to 6.3 km in length, their tops in water depths of 20 to 30 m, and they are composed of sand, gravel, and sand and gravel, including boulder ridges, and a thin veneer of mud. The internal composition of the banks is unknown. They represent northeast-shape elongate banks and are on two different axes. They are the result of glacial processes that eroded unconsolidated, less-resistant sediment and rock during ice movement toward the southeast and that further modified the banks during melting of the ice. The surfaces and perimeters of the two westernmost banks are irregular, and the eastern bank is elongate and roughly parallel to the coast (see Quadrangle 4) and the similarly aligned spur in Quadrangle 5. This suggests that either the banks differ in composition or the younger banks are younger than the older spur. The elongate banks are the result of ice movement toward the southeast of bank formation followed by destructive erosion. A large, broad, hummocky mound is located north of the banks (42° 21' N, 70° 28' W). It is covered with sand and gravel, including boulder ridges, and is surrounded a central mound. Observations have shown that the mound is gravel, including boulders, that are frequently by groundwater. Some boulders are as large as 1 m in diameter and are surrounded by sand.

The depressions are interpreted to have been formed by the scouring action of glacial runoff that has exposed the gravel habitat and prevented its burial. Representative scour depressions are present in areas centered on 42° 21' 26.0" W and 70° 21' 31.0" N, 42° 21' 26.0" W and 70° 21' 31.0" N, and 42° 21' 26.0" W and 70° 21' 31.0" N.

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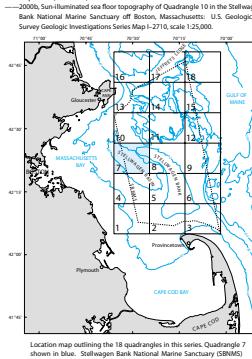
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Depressions are present in areas 20.1 to 20.5 mm.



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SUN-ILLUMINATED SEA FLOOR TOPOGRAPHY OF QUADRANGLE 7 IN THE STELLWAGEN BANK NATIONAL MARINE SANCTUARY OFF BOSTON, MASSACHUSETTS

By