

Map parameters: Longitude 42° 24' 21" N
Latitude 70° 32' 00" W
Vertical exaggeration 4x
This map is not intended for navigational purposes.

SUN ILLUMINATED TOPOGRAPHY

Both the median cell value within a specified neighborhood of cells and median to the corresponding cell location on the output grid. Square focal median filters vary in size from 3 x 3 cells, 11 x 11, 21 x 21, to 21 x 21 cells were tried and the last was selected as the best solution. The filtered grid was converted to contours with the 'lattice contour' routine. Finally, the resulting contours were edited manually with 'trimedit' to remove small artifacts that were not covered by the focal median filter in several very smooth areas of the sea bed.

SEABED FEATURES

Numerous previous surveys and investigations in selected areas of the disposal sites region have focused on seabed features, sediment chemistry, biological assemblages, and disposed materials. Many of the studies were conducted or contracted by the U.S. Army Corps of Engineers (New England Division, Waltham, MA) and the Environmental Protection Agency (Region 1, Boston, MA) who jointly administer the present MDSB and have reports of these activities. The purpose of this discussion is to describe the character of the sea floor in the disposal sites region as revealed by the new topographic and sidescan sonar backscatter (reflected) data and in the video and still photographic observations acquired by the cooperative USGS-NOAA mapping program in 1995.

Setting. The maps presented here depict the northwestern part of Stellwagen Bank and the northwest edge of Stellwagen Basin. The area mapped measures 3.7 x 3.8 nmi (11.4 nmi) and includes former and present disposal sites. The part of the Gulf of Maine was surveyed by the USGS in 1965 and 1966. The area was re-surveyed in 1995. The data base is updated by NOAA approximately every six years. The data base is updated by NOAA approximately every six years. The data base is updated by NOAA approximately every six years. The data base is updated by NOAA approximately every six years.

Topographic contours. Contours of processed bathymetric data was accomplished with the data acquisition and processing software (Environments Systems Research Institute, version 7.03). Processed data was formatted using the Arc/Info point generator routine into a point file containing 102,125 records consisting of latitude, longitude, and version 7.03 data in a geographic projection. The point file was transferred to a 1000 x 1000 grid with a cell size of 100 x 100 meters at 70° 34' 43" W, latitude of true scale at 42° 24' 21" N, a false easting of 4000 m, and a false northing of 0 m. The site description file was used to create a grid from the point file to assign depth values to individual grid cells. The cell size of the output grid was chosen carefully to minimize both data loss and a hanging artifact that occurs when point spacing is rectangular instead of square. A point spacing of rectangular form, it was necessary to utilize an output cell dimension that was larger than the square spacing. A final cell size of 5 m was chosen. Topographic contours at 5-meter intervals were generated using the 'vector contour' routine which converts a grid to a vector of contour of equal depth values. At this stage, the resulting contour lines contained artifacts in the form of high-frequency oscillations that were apparent only in areas of very smooth sea floor.

Backscatter images. The first of a large low-magnification 12° 25' N, 70° 35' W) located where the 'A' buoy marked a disposal point from 1975 to 1985 to the NW and later in the MDSB. This mound extends a few meters above the surrounding sea bed and is situated on the north side of a shallow depression. A total of 11 mounds were seen but none of them have been visually observed or identified. The largest is approximately 70 m in length (42° 26.27' N, 70° 36.36' W). In addition to the mounds, 20 undulating objects are mapped that do not have identifiable shapes but, in part, could be small mounds. In the backscatter images, a large circular object is present (42° 23.02' N, 70° 36.00' W) that has an inner 'ring' approximately 70 m wide and an overall diameter of approximately 100 m but little topographic expression. It is unclear whether this large object is the remains of the drydock caisson noted near this location on NOS Chart 13287 (NOAA, 1984).

Deposits in the sea bed. Two kinds of depressions in the sea bed are recognized. Three shallow (0.5 m) subcircular depressions (50-100 m in diameter) with a raised rim are visible in both the topographic and backscatter images. They resemble large anchor scars in some respects, and 2 of the 3 are located on the mound of disposed material that was deposited from 1975 to 1985. However, they differ from the anchor scars described previously by their large size and their reflectivity. A second kind of depression has a strong topographic expression, but has no raised rim and is not visible in backscatter images. Fourteen shallow (1.2 m), irregularly shaped depressions range from 25 to 70 m in their longest dimension. Sixteen of the 14 depressions are clustered in an area of the basin where from 1983 to 1975 the U.S. Coast Guard maintained a buoy marking a disposal point (42° 24.21' N, 70° 35.00' W) for a variety of materials, apparently including munitions. Three 11 depressions are within 100 m of this disposal point, and it is conceivable they were formed by neglecting munitions on the sea bed. This explanation is conjecture, but it might explain the presence of shallow, sharply defined depressions in a uniformly smooth sea bed, whose formation is not related in an obvious way to disposal of other materials or to natural processes.

SEAFLOOR INTERPRETIVE MAP

EXPLANATION OF MAP SYMBOLS

SEAFLOOR INTERPRETIVE MAP

Massachusetts Bay Disposal Site (MDSB) - Cont'd at 42° 25.1' N, 70° 35.0' W

Probable anchor vessel - Linear shape, topographic relief; most display sidescan sonar backscatter

Unidentified object - Topographic relief; some display sidescan sonar backscatter and may be sunken vessels

Shallow depression with rim - Crater shape, sidescan sonar backscatter

Shallow depression - No rim visible, no sidescan sonar backscatter

Video drift station - Symbol marks end of drift where sediment sample taken

Video drift station - Symbol marks end of drift; no sediment sample taken

Unidentified circular object - Of probable man-made origin

Booy anchor scar - On mound of disposed material where tail-scan buoy marks present disposal point in Massachusetts Bay Disposal Site

Linear deposits (lines) and point deposits (circles) of disposed material on mud sea bed - Longer dimension of circle deposits indicated as follows: small circles, less than 50 m; medium circles, 50 to less than 100 m; large circles, 100 m and greater

Mound of disposed material (dot pattern) - Northern mound last disposal point in use from 1975 to 1985; southern mound in at disposal point approximately 42° 25.1' N, 70° 34.45' W in use since 1985 to present MDSB

Scattered rock debris (dot pattern) on natural gravelly sand sea bed - Strong sidescan sonar backscatter (dotted images) shown as dashed lines

Piles of rock debris (dot pattern) on gravelly sand sea bed - Rock piles display strong sidescan sonar backscatter and topographic relief (images shown as heavy lines)

Deposits of rock debris (dot pattern) on mud sea bed - Strong sidescan sonar backscatter but no topographic relief (dotted images) shown as light lines. Adjacent areas of weaker backscatter (dot pattern) may represent scattered rocks and/or mud sea bed disturbed during deposition of rock debris

Deposits of rock debris (dot pattern) on bank slope - Strong sidescan sonar backscatter but no topographic relief (dotted images) shown as light lines. Adjacent areas of weaker backscatter observed

DISCUSSION

BRIEF HISTORY OF THE DISPOSAL SITE REGION

Since at least the 1940's, a region in the northern part of Stellwagen Basin has been used as a repository for dredged material, rock debris, sunken vessels, munitions, construction debris, and industrial and low-level radioactive waste. Hazardous materials have not been disposed there in recent years. The disposal region lies 17 nautical miles from east of entrance to Boston Harbor and is adjacent to the western boundary of the Stellwagen Bank National Marine Sanctuary (NMS) established in 1992 (see location map). Disposal has occurred in several areas of the region (U.S. Environmental Protection Agency and U.S. Army Corps of Engineers, 1989; U.S. Environmental Protection Agency, 1992; U.S. Congress, 1980a,b). In the 1960's-1975 period, the U.S. Coast Guard maintained a disposal point marked by the 'A' buoy (42° 25.1' N, 70° 35.0' W) in the northern part of the region above here that was known as the Industrial Waste Site (IWS). In 1975, the 'A' buoy was moved 1.1 km to the south (42° 25.1' N, 70° 35.0' W) to mark the center of a disposal site also known as the Industrial Waste Site. Two years later, in 1977, this second IWS was replaced by a new disposal site designated the dredged material (DM) site. The MDSB was established in 1985 (see location map) and is located south of the DM site. In 1995 the MDSB was replaced by the present site for dredged material known as the Massachusetts Bay Disposal Site (MDSB; center at 42° 25.1' N, 70° 34.9' W). It is located south of the MDSB. The MDSB was established so that the disposal site would be outside the western boundary of the newly designated Stellwagen Bank NMS. The MDSB and the sanctuary boundary are shown on the accompanying seabed topographic and backscatter images and on the interpretive map.

The history of disposal since 1975 is complicated by the fact that a disposal 'raft' (a circular area 2 km in diameter) has been established at 3 locations while a disposal 'point' (marked by a buoy) has been established at 2 locations. In addition, the disposal point (marked by a buoy) located at the center of the disposal site since 1977, all three disposal sites established since 1975 (second IWS, MDSB, MDSB) are identical in size and overlap each other to some extent, as shown on NOS Chart 13287 (National Oceanic and Atmospheric Administration, 1984). From 1975 to 1985, the 'A' buoy (42° 25.1' N, 70° 35.0' W) marked the disposal point in both the second IWS and the MDSB. From 1985 to the present, the 'DM' buoy (42° 25.1' N, 70° 34.45' W) has been used for disposal of dredged material in both the MDSB and the MDSB. Most disposal since 1985 has occurred at buoyed points in water depths of 85 to 90 meters in Stellwagen Basin. However, from June, 1982 to October, 1983 disposal of fresh blasted rock debris (from an excavation in Boston Harbor) was permitted in the MDSB at an unbuoyed point (42° 26.27' N, 70° 34.0' W) on the edge of Stellwagen Bank at 50 m water depth.

METHODS

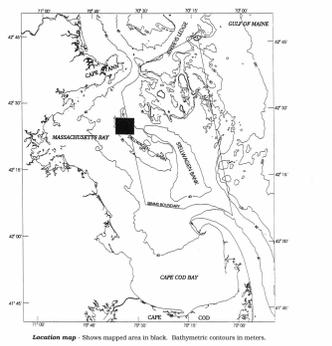
Survey vessel. Multibeam echo sounder data was collected aboard the Canadian Hydrographic Survey vessel, Frederick G. Crowl, an aluminum SWATH (Small Waterplane Area Twin Hull) ship that surveys at speeds up to 16 knots. The sounder system, in cooperation with the National Oceanic and Atmospheric Administration (NOAA), was used to map the seafloor in the disposal sites in the order of 100 m of water depth at 10-hour runs from 2 to 6 per second to create a composite seabed backscatter (reflected) image across the entire strip of sounder sea floor. Soundings were recorded at depth but were from 2 to 6 per second to create a composite seabed backscatter (reflected) image across the entire strip of sounder sea floor. Soundings were recorded at depth but were from 2 to 6 per second to create a composite seabed backscatter (reflected) image across the entire strip of sounder sea floor. Soundings were recorded at depth but were from 2 to 6 per second to create a composite seabed backscatter (reflected) image across the entire strip of sounder sea floor.

MAPS SHOWING TOPOGRAPHY, BACKSCATTER, AND INTERPRETATION OF SEAFLOOR FEATURES IN THE MASSACHUSETTS BAY DISPOSAL SITE REGION OFF BOSTON, MASSACHUSETTS

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Location map - Shows mapped area in black. Bathymetric contours in meters.