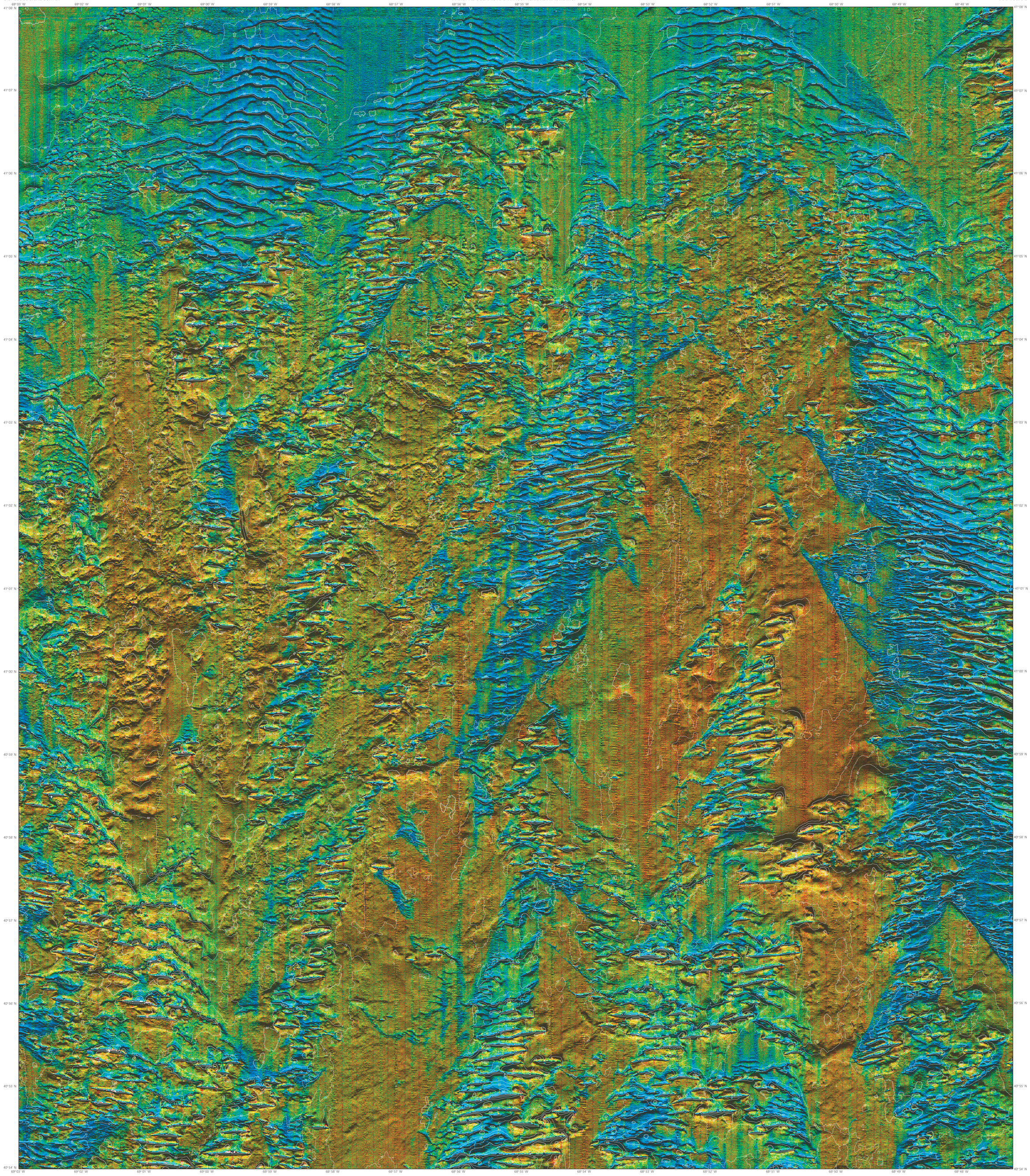
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

GEOLOGIC INVESTIGATIONS SERIES
MAP I-2698-E




Mercator projection

Geodetic Reference System 1980; North American Datum 1983
Longitude of central meridian 68 55' W.; latitude of true scale 40 50' N.
False easting 0 m; false northing 0 m

This map is not intended for navigational purposes.




[Interpretation of seabed type applies best in areas of low topographic relief.]




## DISCUSSION

### Introduction

The Georges Bank Mapping Project is a cooperative effort of the U.S. Geological Survey and the National Oceanic and Atmospheric Administration (NOAA), with support from the University of New Brunswick and the Canadian Hydrographic Service. This map shows sea floor imagery of Quadrangles 1 and 2 in the Great South Channel region (see location map) collected during a multibeam echo sounder survey that was conducted in November 1998. Backscatter intensity (or reflectivity) of the seabed is combined here with sun-illuminated sea floor topographic imagery (shaded relief) at a scale of 1:25,000. For maps showing only sea floor topography or sun-illuminated sea floor topographic imagery, and for a description of survey and image processing methods, see the companion maps by Valentine and others on this CD-ROM. Unnatural-looking stripes and patterns oriented parallel or perpendicular to survey tracklines (which run north-south) are artifacts of data collection. Topographic lows are identified by hachured contours (hachures face deeper water). Blank areas (gray on image) represent places where no data exists.

### Sea floor character

The Great South Channel separates the western part of Georges Bank from Nantucket Shoals and is a major conduit for the exchange of water between the Gulf of Maine to the north and the Atlantic Ocean to the south. Water depths range mostly between 65 and 80 m in the region. A minimum depth of 45 m occurs in the east-central part of the mapped area, and a maximum depth of 100 m occurs in the northwest corner. The channel region is characterized by strong tidal and storm currents that flow dominantly north and south.

Major topographic features of the seabed were formed by glacial and postglacial processes. Ice containing rock debris moved from north to south, sculpting the region into a broad shallow depression and depositing sediment to form the irregular depressions and low gravelly mounds and ridges that are visible in parts of the mapped area. Many other smaller glacial features probably have been eroded by waves and currents at work since the time when the region, formerly exposed by lowered sea level or occupied by ice, was invaded by the sea. The low, irregular and somewhat lumpy fabric formed by the glacial deposits is obscured in places by drifting sand and by the linear, sharp fabric formed by modern sand features. Today, sand transported by the strong north-south-flowing tidal and storm currents has formed large, east-west-trending dunes. These bedforms (ranging between 5 and 20 m in height) contrast strongly with, and partly mask, the subdued topography of the older glacial features.

Backscatter intensity is a measure of the hardness and roughness of the sea floor as determined by the strength of the sound waves reflected from the seabed during the survey (see backscatter intensity scale bar). In the image shown here, backscatter intensity is represented by a suite of eight colors ranging from blue, which represents low intensity (soft bottom), to red, which represents high intensity (hard bottom). The backscatter intensity data are draped over a shaded relief image created by vertically exaggerating the topography four times and then artificially illuminating the relief by a light source positioned 45 degrees above the horizon from an azimuth of 0 degrees. The resulting image displays light and dark tones within each color band that are determined by a feature's position with respect to the light source. For example, north-facing slopes, receiving strong illumination, show as light tones within a color band, whereas south-facing slopes, being in shadow, show as dark tones within a color band. An interpretation of backscatter intensity based on sediment sampling and video imagery of the sea floor in the mapped area suggests that high backscatter values (6-7-8, yellow-orange-red) represent gravel and sandy gravel. Moderate backscatter values (3-4-5, green-yellow) represent sand and burrowed sand, and low backscatter values (1-2, blue) denote clean, fine- to coarse-grained sand. Some areas display relatively uniform levels of backscatter intensity, implying homogeneity of bottom sediment. However, in other places the backscatter intensity and bottom types are highly variable. For example, prominent east-west-trending sand dunes are separated by troughs where gravel seabed commonly is exposed. This is shown clearly by the backscatter intensity level, which ranges from 1 to 2 (blue) on individual sand dunes and from 5 to 8 (green-yellow-orange-red) on the sand, sandy gravel, and gravel between these features.

### DESCRIPTION OF SEDIMENTARY ENVIRONMENT UNITS



**Gravel and coarse sandy gravel**
Hard bottom with high backscatter intensity.
Seabed surface is smooth (upper image) to hummocky (lower image). Cobbles and boulders are present, but are most common in hummocky areas.

Bottom sediment types:
*Coarse sandy gravel*—Mixed sand and gravel, with gravel predominant (both images).
*Gravel pavement*—Pebble gravel with some sand visible between pebbles; also, pebble gravel partly covered by a thin veneer of rippled sand (both images).



**Gravel, sand and gravel, and sand**
Hard to soft bottom with high to low backscatter intensity.
Seabed surface is highly variable, ranging from gravel pavement to rippled sand and large sand dunes. Sand dunes vary in shape from round-crested with gentle slopes (upper image) to sharp-crested with steep slopes (lower image).

Bottom sediment types:
*Medium to coarse sand*—Clean sand forming sand dunes and containing no silt or clay (blue areas on both images).
*Gravelly sand and sandy gravel*—Mixed gravel and mobile sand. Located in areas adjacent to sand dunes and in troughs between dunes (upper image).
*Gravel pavement*—Pebble gravel partly covered by a thin veneer of rippled sand. Located in areas adjacent to sand dunes and in troughs between dunes (lower image).



**Sand**
Moderately hard bottom with moderate backscatter intensity.
Seabed surface is relatively smooth.

Bottom sediment types:
*Fine to medium sand*—Small and large burrows; no ripples (upper image).
*Coarse sand*—No burrows; few ripples (lower image).



**Sand**
Soft bottom with low backscatter intensity.
Seabed surface is sand dunes ranging in height from several meters up to 10–15 m. Dunes have rippled surfaces and are oriented east-west, normal to the major north and south directions of tidal and storm current flow.

Bottom sediment types:
*Sand*—Clean sand containing no silt or clay; sand is predominantly coarse-grained at shallow depths (45–55 m; upper image).
*Sand*—Clean sand containing no silt or clay; sand is fine-grained in deep parts of the map area (90–95 m; lower image).

# BACKSCATTER INTENSITY AND SUN-ILLUMINATED SEA FLOOR TOPOGRAPHY OF QUADRANGLES 1 AND 2

By

Page C. Valentine, Tammie J. Middleton, and Sarah J. Fuller

## Map E of

## Maps Showing Sea Floor Topography, Sun-Illuminated Sea Floor Topography, and Backscatter Intensity of Quadrangles 1 and 2 in the Great South Channel Region, Western Georges Bank

Page C. Valentine, editor

2002




Location map outlining the two quadrangles in this series. Closed Area I and Nantucket Lightship Closed Area were established in December 1994 by the New England Fishery Management Council. Bathymetric contours are in meters.



CD-ROM of I-2698 is for sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225; telephone: 1-888-ASK-USGS

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