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GSC Open File 3930

Habitat Mapping on Browns Bank, Scotian Shelf

B.J. Todd, V.E. Kostylev, G.B.J. Fader, R.C. Courtney, and R.A. Pickrill

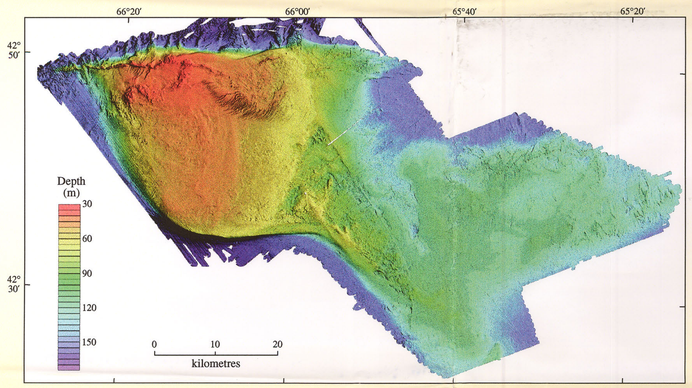
Geological Survey of Canada (Atlantic), P.O. Box 1006, Dartmouth, Nova Scotia, Canada B2Y 4A2

INTRODUCTION

An exciting new application for multibeam bathymetric surveying is sea floor habitat mapping, in which a geological interpretation of bottom sediments is integrated with biological and oceanographic information. The present area of interest, Browns Bank on the southwestern Scotian Shelf (3), is extensively fished for sea scallops (4) and ground fish. The purpose of this cooperative work between the Geological Survey of Canada (Atlantic), the Canadian Hydrographic Service and the Department of Fisheries and Oceans is to produce sea floor maps of Browns Bank for fisheries habitat management, the commercial fishery, navigation charting, and geological assessment.

1

Multibeam Bathymetry

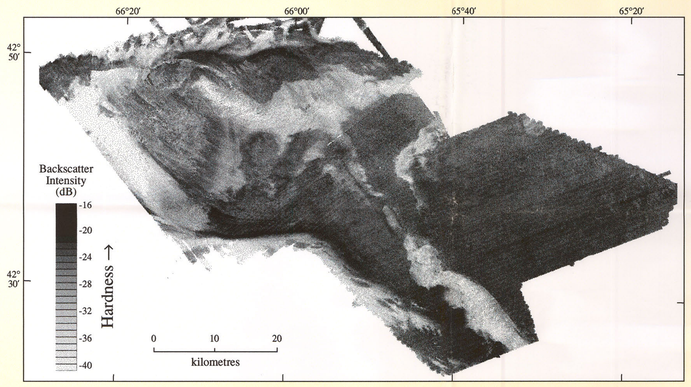


BATHYMETRY AND CURRENTS

The multibeam bathymetric image of Browns Bank shown at left (1) is the product of a sixty-day survey using a Simrad EM 1000 system. Depth is colour-coded with reds and oranges corresponding to shallow water and greens and blues indicating deeper water (see colour bar). The bank trends northwest-southeast and is about 100 km long and 40 km wide. Water depths are shallowest in the northwest, reaching a minimum of 33 m. The bank is bounded to the north by rough, outcropping bedrock on the sea floor with depths reaching greater than 100 m. The southwestern edge of Browns Bank drops abruptly into Northeast Channel with depths greater than 200 m. This channel is a major morphological feature on the Scotian Shelf, separating Browns Bank from Georges Bank, and forming the principal hydrodynamic connection between continental slope water and the Gulf of Maine. Ocean circulation over the top of the bank is in the form of a clockwise gyre. Along the northern edge of the bank, circulation is from west to east. Along the south edge of Browns Bank, adjacent to Northeast Channel, currents are strongly aligned from southeast to northwest.

2

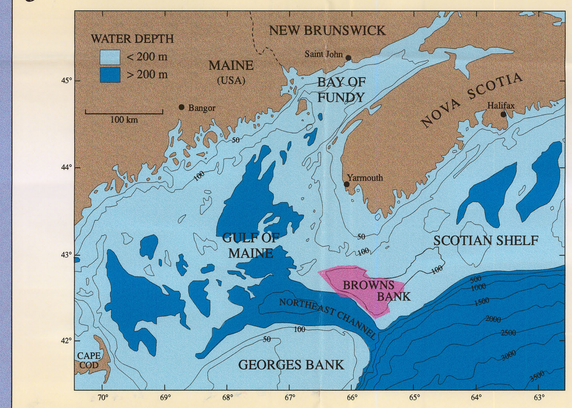
Acoustic Backscatter Intensity



ACOUSTIC BACKSCATTER INTENSITY

Acoustic backscatter intensity, recorded in conjunction with bathymetry during multibeam surveys, is a useful signal for differentiating sea floor materials and for understanding aspects of geological features not apparent in the bathymetric image. On the western part of the map to the left (2), high backscatter values (dark tones) are juxtaposed with low backscatter values (light tones), clearly demonstrating the effects of clockwise, high-velocity water flow on the distribution of sea floor materials. Because backscatter is a function of a suite of physical parameters, the backscatter image is interpreted in conjunction with other geophysical data and geological samples of sea floor materials. On Browns Bank, backscatter values were found to be typically -15 to -30 decibels (dark tones) for gravel and -30 to -40 decibels (light tones) for fine- grained sand. On the image, broad areas of light-toned sand are clearly visible in contrast to the dark-toned areas of gravel. The resulting patterns illustrate the complexity of sediment distribution on the bank.

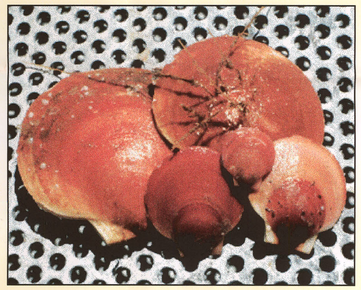
3



SURFICIAL SEDIMENTS AND BEDFORMS

The Browns Bank surficial sediment map at right (5) is based on interpretation of both the bathymetric and backscatter maps, as well as 850 km of high-resolution geophysical profiles (seismic reflection and sidescan sonar) and sea floor sediment samples collected over the bank. The bank is generally covered by gravel lag of the Sable Island Sand and Gravel Formation. This formation was generated during Holocene time by reworking during sea level transgression (about 10 000 years ago) of Pleistocene deposits of glacial till (Scotian Shelf Drift) and Emerald Silt (about 20 000 years old). In spite of the marine transgression, prominent Pleistocene-age moraines are evident, indicating former locations of the North American ice sheets. Modern sand deposits, varying in thickness from centimetres to tens of metres, are present in an array of bedforms. A thick sand sheet dominates the western edge of Browns Bank adjacent to Northeast Channel. A large sand wave field occupies the north-central area of the bank. Individual barchan dunes in the north and west are associated with linear obstacle marks (zones of non-deposition) in the down-current direction. The sand deposits generally overlie the regional gravel lag and migrate in response to ocean and storm-generated currents.

4



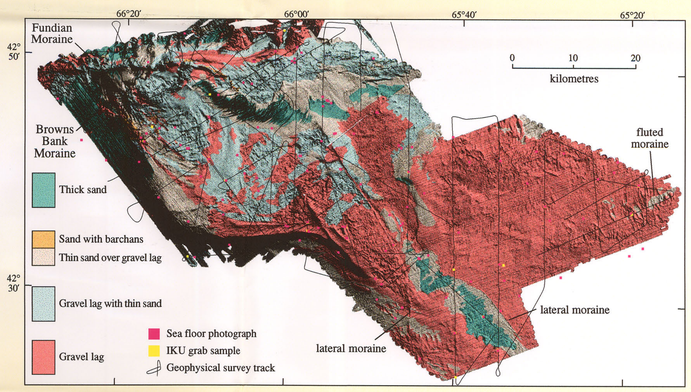
Sea scallops (*Placopecten magellanicus*)

0 5cm

Photograph courtesy of Ginette Robert, Fisheries and Oceans Canada.

5

Geological Interpretation

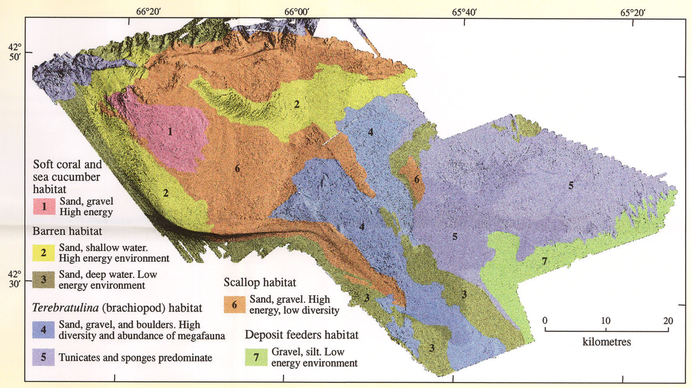


BENTHIC HABITATS

Multibeam bathymetric data and geophysical profiles were consulted to select locations for 26 sea floor photographic sites. These sites were augmented by photographs from an additional 90 stations collected on Browns Bank by Fisheries and Oceans Canada in 1984 and 1985. Based on this suite of photographs, benthic fauna was identified to the lowest taxonomic level. Species composition and frequencies of occurrence were estimated for each station. Statistical analysis indicated strong correlations between species composition, sediment type, and water depth. Six major habitat types were distinguished, based in part on the geological interpretation of the multibeam bathymetric image. The map of Browns Bank habitats shown on the right (6) is a conceptual model summarising the present understanding of bank ecology, and represents a first attempt at integration of geological, biological and dynamic conditions over a broad, offshore region.

6

Benthic Habitats



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