Figure 1. Cruise 2008-052 (CCGS Shamook), station 15, photograph 24, depth 83 m, at 47°10.307N, 54°58.13'W. This photograph was taken in an area of rugged bedrock topography. An attempt to collect a grab sample in this vicinity (station 17) returned only a trace of silt. The photograph shows a 'hard' bottom comprised of large sub-angular gravel clasts with patches of *Lithothamnion* sp. A large anemone and several smaller ones are attached, indicating clast immobility. The interstices appear to contain shelly gravelly sand. Photograph by A. Robertson, 26 October 2008, 2009-394

Figure 2. Cruise 2008-052 (CCGS Shamook), station 28, photograph 31, depth 85 m, at 47°10.21'N, 55°05.12'W. This photograph was taken in Mortier Bay, at the north end of the narrow entrance channel. The rugged topography and high backscatter is indicative of either a ridge of glacial sediment, or perhaps (less likely) bedrock. Like the previous photograph (Fig. 1) outside the bay (Fig. 1) the authors observed tightly packed large gravel clasts, also with attached anemones. Other life forms include brittlestars and starfish; however, this relatively sheltered site also shows a veneer of silt on the clasts as well as an absence of *Lithothamnion* sp. Photograph by A. Robertson, 27 October 2008, 2009-395

Figure 3. Cruise 2008-052 (CCGS Shamook), station 21, photograph 24, depth 121 m, at 47°10.727N, 55°05.82'W. This photograph was taken inside Mortier Bay, in an area of smooth seafloor and low backscatter. It illustrates the fine-grained silty mud that accumulates in the harbours around Placentia Bay. The seafloor displays microrelief possibly due to animal burrows, and animal tracks are common. The only creatures visible in the murky water are small shrimp. Photograph by A. Robertson, 27 October 2008, 2009-396

DESCRIPTIVE NOTES

INTRODUCTION

Multibeam systems record mean energy and time series of amplitudes returned in each beam. This mean energy is commonly called the backscatter amplitude. It is tempting to use this as a direct proxy for surficial sediment type, but consideration of the physics of the problem presents a more convoluted picture (Courtney and Shaw, 2000), and there exists no direct relationship between backscatter amplitude and surficial sediment type; however, for angles of incidence greater than roughly 20° there is a general correspondence between backscatter amplitudes and surficial sediment roughness that can be used for cursory mapping and sediment identification. Coarse gravel and cobbles tend to be locally rough and return high-amplitude, wide-angle backscatter signals, whereas sand and fine-grained materials can be locally smooth with a much lower backscatter. This map sheet is one of five maps of the Placentia Bay area (see also Potter and Shaw, 2010a, b, c, d).

EXTRACTION, GRIDDING, AND LEVELLING OF BACKSCATTER

Backscatter was extracted using tools developed in-house at GSC Atlantic. Raw Kongsberg datagrams from the various sounder systems used in Placentia Bay were first converted to Generic Sensor Format (GSF; ftp://www.ngdc.noaa.gov/mgg/dimagsf/; accessed January 4, 2010), an open source standard file format for bathymetry. The backscatter extraction software reads in gsf files and creates raster files of backscatter amplitude corrected for beam dependence, thus reducing or eliminating the typical track-parallel corrugation in the backscatter signal.

Each contiguous survey block corresponding to a unique multibeam system and year was 'gridded' separately then later merged while applying a static shift in order to level the synthetic surface to a common datum. This was necessary because each survey block had a different backscatter intensity range. Some of the more recent multibeam systems displayed anomalously high backscatter ranges (e.g. -35 dB to +5 dB) so the merged data sets were levelled to the older EM1000 surveys that were reporting more sensible ranges of -50 dB to -10 dB. The amount of shift to apply to each survey block was determined by analysis of backscatter values in areas of overlap between surveys of differing ages and sounder systems. By generating histograms of the difference between values reported within each grid cell in the overlap, the backscatter grid for the entire Placentia Bay area was 'stitched together'.

DISTRIBUTION OF BACKSCATTER VALUES

Backscatter is depicted using a colour scale ranging from almost white (low backscatter) to indigo (high backscatter). The coloured backscatter is draped over a grey digital elevation model of the bathymetry. The distribution of backscatter values in the map area is strongly bimodal, with a primary peak at -38 dB (low backscatter) and secondary peak at -25 dB (high backscatter). Throughout Newfoundland coastal waters, areas of low backscatter (mud) generally occur in the deepest areas, and in depressions, whereas areas of high backscatter (gravel and sand) occur in shallow areas and near coasts. High backscatter predominates in this map area.

INTERPRETATION OF BACKSCATTER

The interpretations of backscatter in this area are based on the following GSC marine seismic and sampling surveys: *Navicula* 89-026 (Shaw et al., 1990), *Matthew* 2005-051 (Shaw et al., 2006), and *Shamook* 2008-052 (J. Shaw, V. Kostylev, and A. Robertson, unpub. report, 2008).

Extensive areas of high backscatter (area 1) correspond with glacial ridges (drumlins) composed of till that were formed when glaciers flowed into Placentia Bay, from northwest to southeast. In places, narrow ridges (area 2) superimposed on the drumlins were formed during retreat of the ice. The limited number of bottom photographs and grab samples from these glaciated terrains reveal muddy bouldery gravel. It is possible that some of the glacial ridges have a drape of glaciomarine sediment a few metres thick, in which case the seafloor texture is a veneer of angular gravel. This is even more likely in areas where the ridges are buried by younger sediments (area 3). Areas of high backscatter (area 4) in the outer bay probably correspond with bedrock (area 4). The submerged platform (area 5) with high backscatter in Mortier Bay is a delta that formed during the early Holocene lowstand of relative sea-level (Shaw and Forbes, 1995), and has been subsequently submerged. The surface is muddy sandy gravel, with dredge-spoil deposits in places.

Low backscatter areas are mostly silty mud (area 6) that has accumulated in seafloor depressions. The mud is imprinted with sedimentary furrows in Paradise Sound (area 7), indicating relatively strong current activity. The mud has accumulated in Mortier Bay (area 8) where darker patches are indicative of dredge-spoil deposits (area 9).

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2010a: Backscatter strength and shaded seafloor relief, Placentia Bay east, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2153A, scale 1:50 000.

2010b: Backscatter strength and shaded seafloor relief, Placentia Bay north, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2151A, scale 1:50 000.

2010c: Backscatter strength and shaded seafloor relief, Placentia Bay southeast, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2155A, scale 1:50 000.

2010d: Backscatter strength and shaded seafloor relief, Placentia Bay southwest, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2154A, scale 1:50 000.

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SYMBOLS

Grab sample

Gravity core

Seafloor photograph

-60 Low | -50 | -40 | -30 | -20 | -10 | 0 High

Approximate backscatter strength (dB)

Copies of this map may be obtained from the Geological Survey of Canada
Pacific Division, 9860 West Saanich Rd.
605 Robson Street, Vancouver, British Columbia V6B 5J3
490, rue de la Couronne, Québec, Québec G1K 9A9
1 Challenger Drive, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2

LOCATION MAP

Authors: D.P. Potter and J. Shaw

This map was produced by Natural Resources Canada in co-operation with Fisheries and Oceans Canada

Multibeam bathymetric data collected by Canadian Hydrographic Service and Natural Resources Canada, 1997, 2005–2006

Multibeam backscatter data compiled by D.P. Potter, 2007 and 2008

Digital cartography by P.A. Melbourne, Data Dissemination Division (DDD)

Any revisions or additional geographic information known to the user would be welcomed by the Geological Survey of Canada

MAP 2152A

BACKSCATTER STRENGTH AND SHADED SEAFLOOR RELIEF

PLACENTIA BAY WEST

OFFSHORE NEWFOUNDLAND AND LABRADOR

Scale 1:50 000/Échelle 1/50 000

Universal Transverse Mercator Projection
North American Datum 1983
© Her Majesty the Queen in Right of Canada 2010
This map is not to be used for navigational purposes

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983
© Sa Majesté la Reine du chef du Canada 2010
Cette carte ne doit pas être utilisée aux fins de navigation

Digital base map (land areas) from data compiled by Geomatics Canada, modified by GSC (Atlantic)

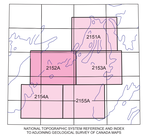
Digital bathymetric contours in metres supplied by Canadian Hydrographic Service and GSC (Atlantic)

Magnetic declination 2010, 19°46'W, decreasing 11.5' annually

Elevations in feet above mean sea level

Depth in metres below mean sea level

Published 2010



NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ADJOINING GEOLOGICAL SURVEY OF CANADA MAPS

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2010: Backscatter strength and shaded seafloor relief, Placentia Bay west, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2152A, scale 1:50 000.

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