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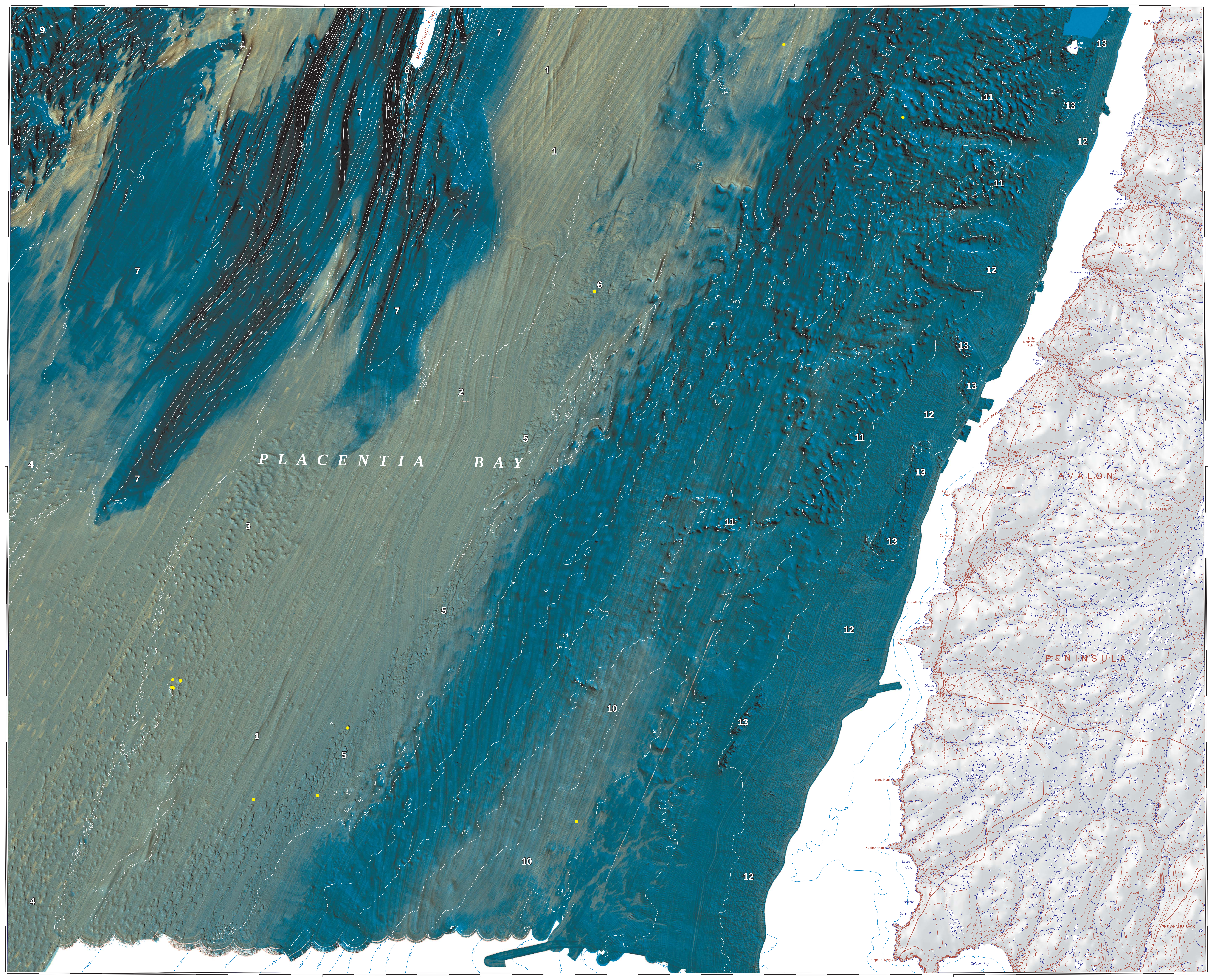

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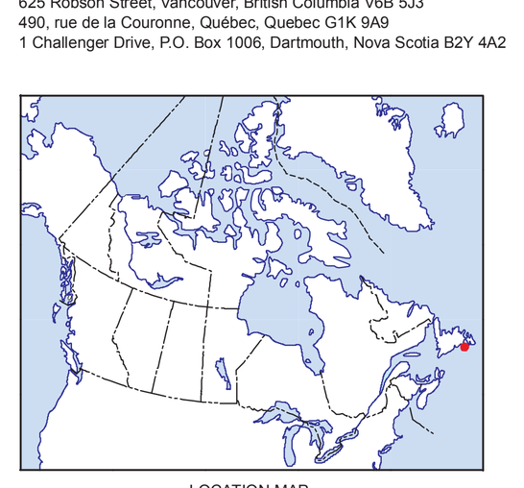


LOCATION MAP

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, 1981, 1983, 1986, and 1995

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

Canada

MAP 2155A

BACKSCATTER STRENGTH AND SHADED SEAFLOOR RELIEF

PLACENTIA BAY SOUTHEAST

OFFSHORE NEWFOUNDLAND AND LABRADOR

Scale 1:50 000/Échelle 1/50 000

Universal Transverse Mercator Projection
North American Datum 1983

This map is not to be used for navigational purposes

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

Cette carte ne doit pas être utilisée aux fins de navigation

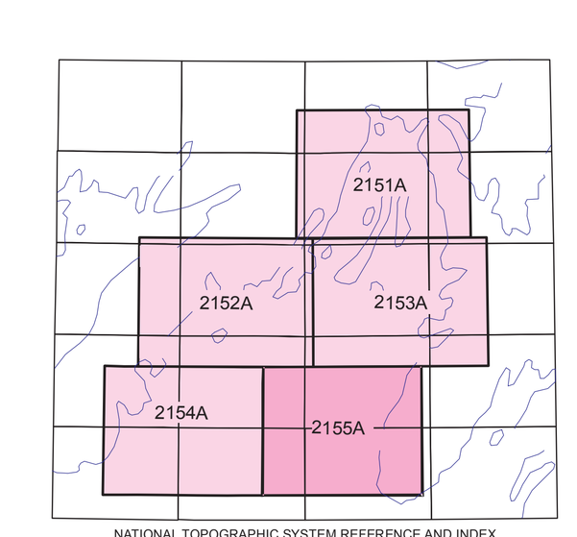
Digital base map (land area) from data compiled by Geomatics Canada, modified by GSC (Atlantic)

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

Magnetic declination 2010, 19°35'W, decreasing 11.4' annually

Elevations in feet above mean sea level

Depth in metres below mean sea level



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

Published 2010

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; http://www.saic.com/maritime/gsf/; 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. Initially, histograms were generated for each survey block to assess backscatter data 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 intensity predominates off the Avalon Peninsula and in the northwest, whereas low backscatter predominates in the zone of deepest water that extends from southwest to northeast.

INTERPRETATION OF BACKSCATTER

The interpretations of backscatter in this area are based on GSC marine seismic and sampling survey *Hudson* 2006-039 (Shaw et al., 2007). The large area of low backscatter corresponds with thick deposits of postglacial silty mud. In some areas (area 1) the mud is marked by sedimentary furrows that are indicative of current action at the seafloor. Care must be taken to distinguish between these and survey artifacts (area 2), the latter being distinguished by parallel ridges aligned along the tracks of the survey vessel. Extensive areas of the mud are marked by pockmarks, some of which are near circular (area 3), whereas others are elongated (area 4). In the 'megaflute zone' (Fader and Miller, 1986) the mud has been eroded to form elongate pits (area 5) with steep sidewalls up to 8 m high, whereas just north of the megaflute zone, erosion of the seafloor has resulted in a 'choppy' appearance (area 6).

In the northwest, currents have winnowed the glaciomarine sediments that are draped over a series of northeast-trending bedrock ridges, producing a seafloor with high backscatter (area 7), likely indicating the presence of muddy, sandy fine gravel. In the shallow water, where bedrock topography is more evident, the sediment veneer may coarsen into sandy gravel (area 8). In the extreme northwest, high backscatter (area 9) indicates the presence of muddy gravel overlying glacial ridges (i.e. drumlins).

High backscatter predominates at the seafloor east of the megaflute zone, except for a wide strip of low backscatter (area 10). A bottom sample from this zone (sample 045, cruise *Hudson* 2006-039, Shaw et al. (2007) from a depth of 88 m contained shelly coarse sand. This high backscatter is due to a strong current — perhaps a branch of the Labrador Current — that has winnowed fine sediment or precluded its deposition. Sediment texture coarsens eastward toward the shallow water. The irregular topography is due to the presence of several types of ridged landforms (area 11) that formed under glaciers. Close to the coast, however, the seafloor has low relief, indicative of a zone of reworking (area 12) by waves during the early Holocene lowstand of relative sea level in the region (Shaw and Forbes, 1995). This smooth seafloor is interrupted by bedrock ridges (area 13).

ACKNOWLEDGMENTS

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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 southwest, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2154A, scale 1:50 000.
2010d: 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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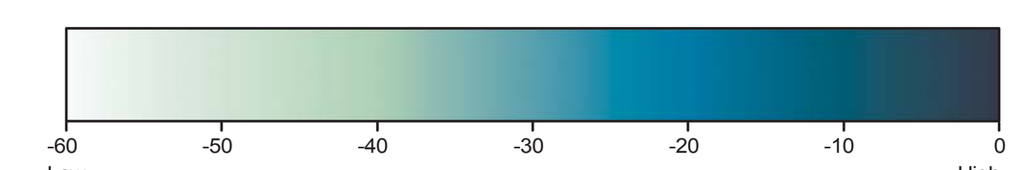
SYMBOLS

Grab sample .... (yellow dot)
Seafloor photograph .... (red triangle)



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