Copies of this map may be obtained from the Geological Survey of Canada: 615 Booth Street, Ottawa, Ontario K1A 0E9 625 Robson Street, Vancouver, British Columbia V6B 5J3 490, rue de la Couronne, Québec, Quebec G1K 9A9 1 Challenger Drive, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2



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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, 1995, 2004–2006

Multibeam bathymetric 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 2145A SHADED SEAFLOOR RELIEF PLACENTIA BAY EAST OFFSHORE NEWFOUNDLAND AND LABRADOR

Scale 1:50 000/Échelle 1/50 000

kilometres 1 0 1 2 3 4 kilomètres

Universal Transverse Mercator Projection
North American Datum 1983

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Scale 1:50 000/Échelle 1/50 000

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

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This map is not to be used for navigational purposes

Cette carte ne doit pas être utilisée aux fins de navigation

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

Depth in metres below mean sea level

Magnetic declination 2009, 19°56'W, decreasing 12.1' annually

Elevations in feet above mean sea level

#### DESCRIPTIVE NOTES

INTRODUCTION

Placentia Bay is a major embayment on the south coast of the island of Newfoundland. This map sheet is one of five maps of the Placentia Bay area (see also Potter and Shaw, 2009a, b, c, d); this sheet depicts the bathymetry of the east-central part of the bay, adjacent to Avalon Peninsula. The bathymetry of this region is complex. In the north, the bay divides into three channels, separated by Merasheen Island and Long Island. In the northwest, the glacially overdeepened Western Channel is up to 420 m deep, whereas in the east, Eastern Channel is 300 m deep in places. Central Channel, in contrast, is quite shallow. Included in this map sheet is a group of embayments on the east coast, namely Long Harbour, Ship Harbour, Placentia Sound, Argentia Harbour, and Placentia Road. These bays host a series of human settlements and a range of industrial activities. The earliest multibeam sonar surveys were conducted in 1995, in association with the closure of the US Naval Air Facility Argentia. Extensive geophysical and sampling surveys in the Argentia region were conducted in 1989 (Shaw et al., 1990).

### MULTIBEAM BATHYMETRIC DATA COLLECTION

Data were collected using Canadian Coast Guard vessels. The first survey was in 1995, when CCGS Federick G. Creed was used to survey a swath of seafloor from Argentia to a deepwater dump site at the south end of Western Channel (in connection with the closure of the US Naval Air Facility Argentia). At this time Argentia Harbour was surveyed by the Department of Public Works using a boom-mounted sweep system; however, these data, which did not include backscatter, were superseded by data collected by multibeam sonar surveys. Most data were collected from 2004 to 2006, by joint Geological Survey of Canada (GSC)—Canadian Hydrographic Service (CHS) surveys.

The Frederick G. Creed is a SWATH (Small Waterplane Area Twin Hull) vessel that was initially equipped with a Kongsberg-Simrad EM1000 multibeam sonar system, with the transducer mounted in the starboard pontoon. In 2005 this vessel was re-equipped with a Kongsberg-Simrad EM1002 system. The CCGS Matthew was equipped with a Kongsberg-Simrad EM1002 multibeam sonar system during the 2004 surveys. The hydrographic launch Plover deployed a hull-mounted Kongsberg-Simrad EM3002 multibeam sonar system. A Differential Global Positioning System was used for navigation, providing positional accuracy of about 3 m. Survey speeds averaged 10 knots. Data were adjusted for tidal

positional accuracy of about 3 m. Survey speeds averaged 10 knots. Data were adjusted for tidal variations using output from a tide gauge installed at Argentia. Data were cleaned and gridded in 5 m (horizontal) bins using the CARIS Hydrographic Information Processing System, exported and subsequently imported into GRASS, a GIS developed by the U.S. Army Corps of Engineers.

SURVEY	REMARKS
1995	Survey by the CCGS Frederick G. Creed between Argentia and Western Channel using a Kongsberg-Simrad EM1000 system.
2004	Survey by the CCGS <i>Matthew</i> in Eastern Channel and east of Merasheen Bank, GSC cruise 2004-008 using a Kongsberg-Simrad EM1002 system.
2004	Survey by the hydrographic launch <i>Plover</i> of Long Harbour, Ship Harbour, and Argentia Harbour, part of GSC cruise 2004-008 using a Kongsberg-Simrad EM3002 system.
2004	Survey by the CCGS Federick G. Creed in the approaches to Long Harbour, and off the Avalon Peninsula using a Kongsberg-Simrad EM1000 system.
2005	Survey by the CCGS <i>Matthew</i> immediately east of Merasheen Bank using a Kongsberg-Simrad EM710 system.
2005	Surveys by the hydrographic launch <i>Plover</i> of areas including Placentia Roausing a Kongsberg-Simrad EM3002 system.
2005	Survey by the CCGS Federick G. Creed of small areas to the south and west of White Sail Bank and south of Red Island using a Kongsberg-Simrad EM1002 system.
2006	Survey by the hydrographic launch <i>Plover</i> of an area close to the coast of the Avalon Peninsula, GSC cruise 2006-015 using a Kongsberg-Simrad EM3002

# Table 1. Remarks on surveys carried out in the study area. DATA DISPLAY

Artificial sun illumination from 045° azimuth and 45° inclination was applied in the GRASS GIS. Vertical exaggeration is x10. A colour palette was applied to the bathymetric data; warm colours (e.g. reds) represent shallow water and cool colours (e.g. blues) represent deep water. Bathymetric divisions between colours were assigned such that equal areas are covered by each colour in the palette. Bathymetric contours in blue were generated from gridded data obtained from the Canadian Hydrographic Service collected prior to the multibeam surveys in this study.

Surveys by CCGS Matthew (Simrad EM710 system) and the launch Plover (Kongsberg-Simrad EM3002) of areas close to the Avalon Peninsula, and small areas elsewhere; Canadian Hydrographic Service personnel only.

MORPHOLOGY

This region is topographically complex, and shows evidence of strong bedrock structural control, together with the effects of glaciation and modern oceanographic processes. The seafloor in harbours has been considerably modified by human activities such as dredging, dumping, and anchor dragging. Soft, muddy seafloors occur in deep water as well as in coastal embayments such as Long Harbour and Ship Harbour. The intervening areas commonly comprise much harder substrates. For purposes of description the region is divided into several areas. Sites on the map labelled as A to T are referenced in

The deepest water in the region (about 420 m) is found on the floor of Western Channel, a glacially overdeepened trough. The floor of the channel is smooth due to a fill of postglacial mud overlying glaciomarine silt. Banks of postglacial mud can be seen at site A. De Geer moraines (site B) on the shallow shelf southwest of the channel record glacial retreat.

Central Channel
Central Channel is narrow and shallow in comparison with the channels to either side. At the southern end
of the channel, De Geer moraines (site C), formed by the northward retreat of glacier ice, are visable on
the seabed. Folded bedrock ridges occur on the shallow shelf immediately east of the entrance to the
channel (site D).

Eastern Channel
Eastern Channel is swept by currents, so that banks of mud (site E) occur on either flank of the channel
where as older sediments (glaciomarine mud) outcrop in the deepest areas. On the west side of the
channel, the glaciomarine sediments failed in places during the late-glacial period, leaving slump scars
(site F); the failed sediments accumulated in deep water (site G). In shallower water on the west side of
the channel, just above the slumps, the seafloor has been heavily impacted by icebergs, forming both pits
and furrows (site H). Evidence of strong flow of glacial ice toward the southwest takes the form of cragand-tail features (site J) and drumlins (site K).

Merasheen Bank (site L) consists of a series of shallow bedrock ridges that trend in a southwesterly direction; however, the bedrock is mantled by glaciomarine sediments, giving a smooth appearance, and is probably only exposed at the seabed in the shallowest areas.

The relatively smooth seabed of the south-central part of the bay is due to a cover of glaciomarine and postglacial mud overlying Carboniferous bedrock. In shallower areas, the complex topography at the seabed is due to the presence of glacial landforms, notably moraines parallel to the modern coast (site M).

The east coast In the shallowest water, close to the coast of the Avalon Peninsula, glacial sediments were eroded by wave action during the postglacial lowstand of relative sea level (Shaw and Forbes, 1995), forming a somewhat planar erosional platform (site N) that extends to depths of about 30 m, interrupted in a few places (site O) by north-trending bedrock ridges.

Embayments on the Avalon Peninsula

The relatively large embayments on the east coast have distinctive morphologies. In Placentia Road the smooth seafloor is due to the presence of a sandy shoreface wedge (site P) that connects with the gravel beach-ridge plain at Placentia. At the adjacent Placentia Gut (site Q), strong tidal flow has formed complex sandy bedforms at the seafloor, hard to see on the main map sheet, but clearly seen on the inset maps. Argentia Harbour, Placentia Sound, and Ship Harbour contain shallow platforms (e.g. site R; Fig. 1) that result from erosion of moraines (glacial ridges) during the postglacial sea-level lowstand (Shaw and Forbes, 1995). Between these shoals the bays are filled with soft, gas-charged postglacial mud. High-resolution surveys show that the seabed in the bays has been modified by human activities, resulting in dredged areas (e.g. site S; Fig. 2), and accumulations of dredge spoils and debris. Long Harbour contains varying thicknesses of soft postglacial mud. At the head of the harbour, a shallow platform (site T) is a submerged early Holocene delta (Shaw and Forbes, 1995).

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## REFERENCES

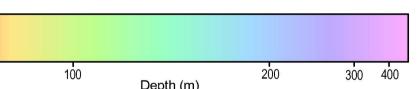
Potter, D.P. and Shaw, J.

2009a: Shaded seafloor relief, Placentia Bay north, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2143A, scale 1:50 000.

2009b: Shaded seafloor relief, Placentia Bay southeast, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2147A, scale 1:50 000.

Shaded seafloor relief, Placentia Bay southwest, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2146A, scale 1:50 000.
 Shaded seafloor relief, Placentia Bay west, offshore Newfoundland and Labrador; Geological Survey of Canada, Map 2144A, scale 1:50 000.
 Shaw, J. and Forbes, D.L.

The post-glacial relative sea-level lowstand in Newfoundland; Canadian Journal of Earth Sciences, v. 32, p. 1308–1330.
 Shaw, J., Johnston, L., and Wile, B.
 Cruise report 89026, Navicula operations in Placentia Bay, Newfoundland; Geological Survey of Canada, Open File 2029, 72 p.



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