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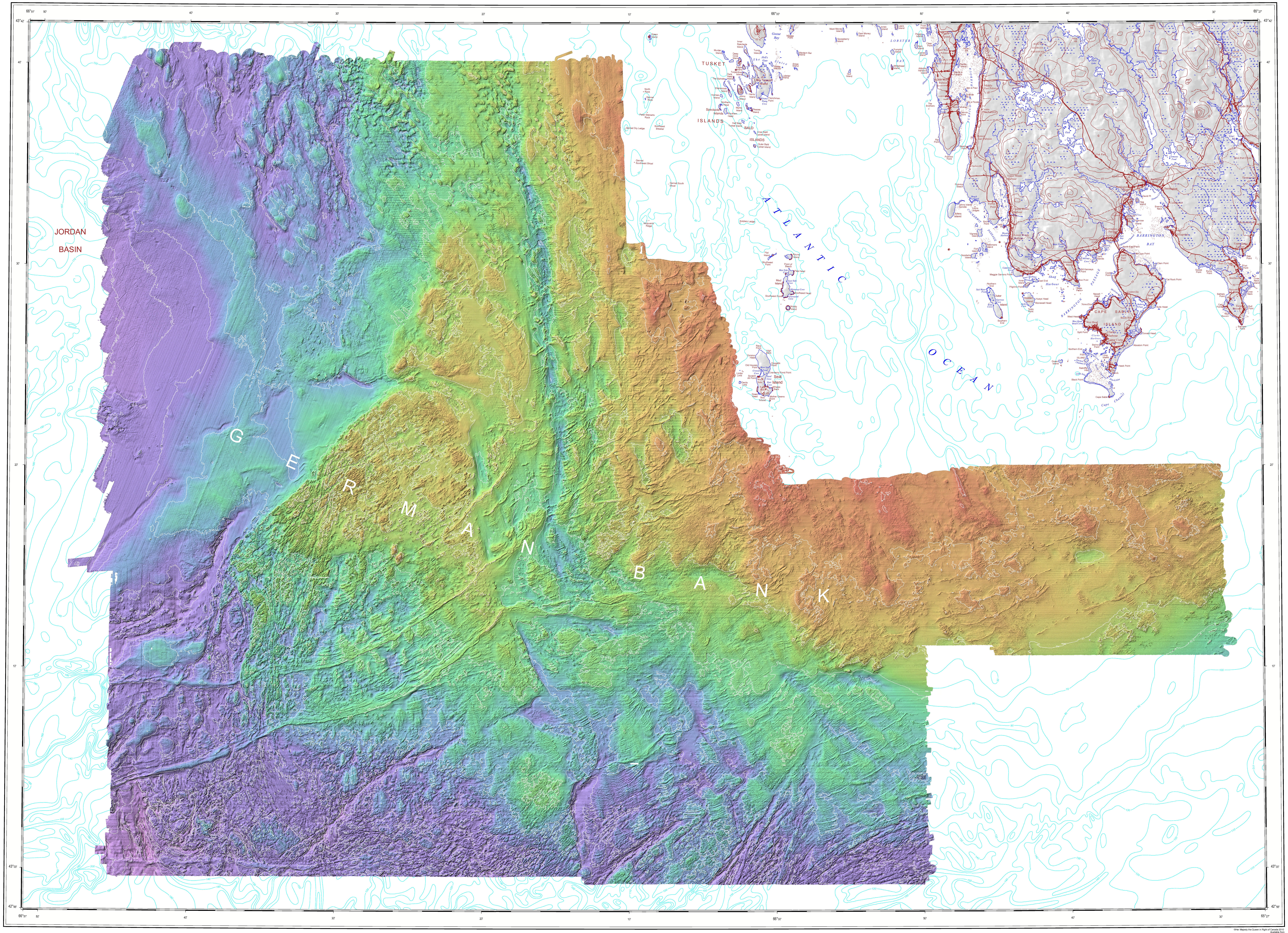
GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA



DESCRIPTIVE NOTES

INTRODUCTION

This map is part of a three-map series of German Bank, located on the Scotian Shelf off southern Nova Scotia. This map is the product of a number of surveys (1997–2003) that used a multibeam sonar system to map 5321 km^2 of the seafloor. Other surveys collected geological data for scientific interpretation. This map sheet shows the seafloor topography of German Bank in shaded-relief view and seafloor depth (coded by colour) at a scale of 1:100 000. Topographic contours generated from the multibeam data are shown (in white) on the colour-coded multibeam topography at a depth interval of 20 m. Bathymetric contours (in blue) outside the multibeam survey area, presented at a depth interval of 10 m, are from the Natural Resource Map series (Canadian Hydrographic Service, 1967, 1971a, 1971b, 1972). Sheet 2 shows coloured backscatter strength in shaded-relief view. Sheet 3 shows seafloor topography in shaded-relief view with colour-coded surficial geological units.

MULTIBEAM BATHYMETRY DATA COLLECTION

Multibeam bathymetric data were collected by the Canadian Hydrographic Service using the Canadian Coast Guard Ship *Frederick G. Creed*, a SWATH (small waterplane area twin hull) vessel. The ship was equipped with a Simrad Subsea EM1000 multibeam bathymetric survey system (95 kHz) with the transducer mounted in the starboard pontoon. This system produces 60 beams arrayed over an arc of 150° and operates by ensonifying a narrow strip of seafloor across track and detecting the seafloor echo. The width of seafloor imaged on each survey line was five to six times the water depth. Line spacing was about three to four times water depth to provide ensonification overlap between adjacent lines. The Differential Global Positioning System was used for navigation, providing positional accuracy of ±3 m. Survey speeds averaged 14 knots, resulting in an average data collection rate of about 5.0 km^2/h in water depths of 35–70 m. The sound velocity in the ocean was measured during multibeam data collection and used to correct variations of the speed of sound in water and the effect of sonar beam refraction. During the survey, water-depth values were inspected and erroneous values were removed. The data were adjusted for tidal variation using tidal predictions from the Canadian Hydrographic Service.

MULTIBEAM BATHYMETRIC DATA DISPLAY

The multibeam bathymetric data are presented at 5 m/pixel horizontal resolution. The shaded-relief image was created by vertically exaggerating the topography 10 times and then artificially illuminating the relief by a virtual light source positioned 45° above the horizon at an azimuth of 315°. In the resulting image, topographic features are enhanced by strong illumination on the northwest-facing slopes and by shadows cast on the southeast-facing slopes. Small topographic features are accentuated that could not be effectively shown by contours at this scale. Superimposed on the shaded-relief image are colours assigned to water depth, ranging from red (shallow) to violet (deep). In order to apply the widest colour range to the most frequently occurring water depths, hypsometric analysis was used to calculate the cumulative frequency of water depth. The resulting colour ramp highlights subtle variations in water depth that would otherwise be obscured.

Some features in the multibeam data are artifacts of data collection and environmental conditions during the survey periods, particularly on survey tracks that are normal to the artificial illumination angle. The orientation of the survey track lines can, in some instances, be identified by faint parallel stripes in the image (for example near 43°31´N, 66°25´W). Because these artifacts are usually regular and geometric in appearance on the map, the human eye can disregard them and distinguish real topographic features.

GEOMORPHOLOGY

The Scotian Shelf is a formerly glaciated continental margin characterized by a topographically rugged inner shelf which is an offshore continuation of the prominent Maritime peneplain on the adjacent land area (King and MacLean, 1976). The geomorphology of German Bank is dominated by outcropping bedrock consisting of Cambro-Ordovician metasedimentary rocks (Meguma Group) intruded by Late-Devonian–Carboniferous granitoid plutons (Drapeau and King, 1972; Pe-Piper and Loncarevic, 1989; Pe-Piper and Jansa, 1999). Bedrock has been modified by glacial erosion and exhibits a rugged surface.

During the late Quaternary period glacial maximum at approximately 20 000 BP (20 ka), German Bank was below sea level and covered by a regional ice sheet that terminated to the south on the Scotian Slope (Schnitker et al., 2001; Hundert, 2003). The glacial maximum was followed by a multiphased retreat of the ice front and emergence of the bank. Ice-front retreat and glaciomarine deposition began as early as 18 ka with grounded ice absent from the Gulf of Maine by approximately 14 ka (King and Fader, 1986; Schnitker et al., 2001). German Bank exhibits geomorphological features formed during the Quaternary glaciation of the bank and during the subsequent sea level transgression as the ice sheet retreated; these features are discussed on the third sheet in this Open File.

ACKNOWLEDGMENTS

G. Costello of the Canadian Hydrographic Service (CHS) organized the multibeam bathymetric survey of German Bank and oversaw data processing. Canadian Hydrographic Service provided the data to the Geological Survey of Canada (GSC) for further processing and interpretation. The authors thank the master and crew of the CCGS *Frederick G. Creed* for their efforts at sea. R.A. Pickrill (GSC), G. Costello, and M. Lamplugh (CHS) supported the development of the German Bank maps. Geographical Information Systems and cartographic support was provided by S. Hayward, W.A. Rainey, S. Hynes, and P. O'Regan. V. Barrie, A. Bolduc, and R.A. Pickrill reviewed the map.

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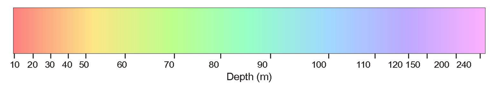

LOCATION MAP

Authors: B.J. Todd and P.C. Valentine

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

Geological compilation by B.J. Todd, Geological Survey of Canada and P.C. Valentine, U.S. Geological Survey.

Multibeam bathymetric data collected by Canadian Hydrographic Service, 1997, 1998, 2000, 2002, and 2003

Multibeam bathymetric data compiled by Canadian Hydrographic Service and Geological Survey of Canada, 1997, 1998, 2000, and 2002–2004

Digital cartography by P. O'Regan, Data Dissemination Division (DDD) and S. Hayward, GSC (Atlantic)

OPEN FILE 6124

SHADED SEAFLOOR RELIEF, BACKSCATTER STRENGTH, AND SURFICIAL GEOLOGY

GERMAN BANK

SCOTIAN SHELF
OFFSHORE NOVA SCOTIA

Scale 1:100 000/Échelle 1/100 000

kilometres 2 0 2 4 6 8 kilomètres

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

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

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

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

Mean magnetic declination 2010, 17°18'W, decreasing 6.0' annually. Readings vary from 16°59'W in the SW corner to 17°37'W in the NE corner of the map

Depth in metres below mean sea level

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Available from
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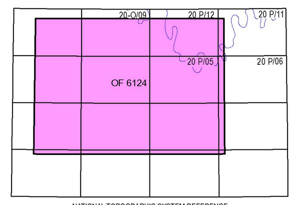

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE

OPEN FILE
DOSSIER PUBLIC
6124
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2010
SHEET 1 OF 3
FEUILLET 1 ET 3

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Les dossiers publics sont des produits qui n'ont pas été soumis au processus officiel de publication de la CGC.

Sheet 1 of 3, shaded seafloor relief

Recommended citation:
Todd, B.J. and Valentine, P.C., 2010. Shaded seafloor relief, backscatter strength, and surficial geology; German Bank, Scotian Shelf, offshore Nova Scotia; Geological Survey of Canada, Open File 6124, scale 1:100 000.

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