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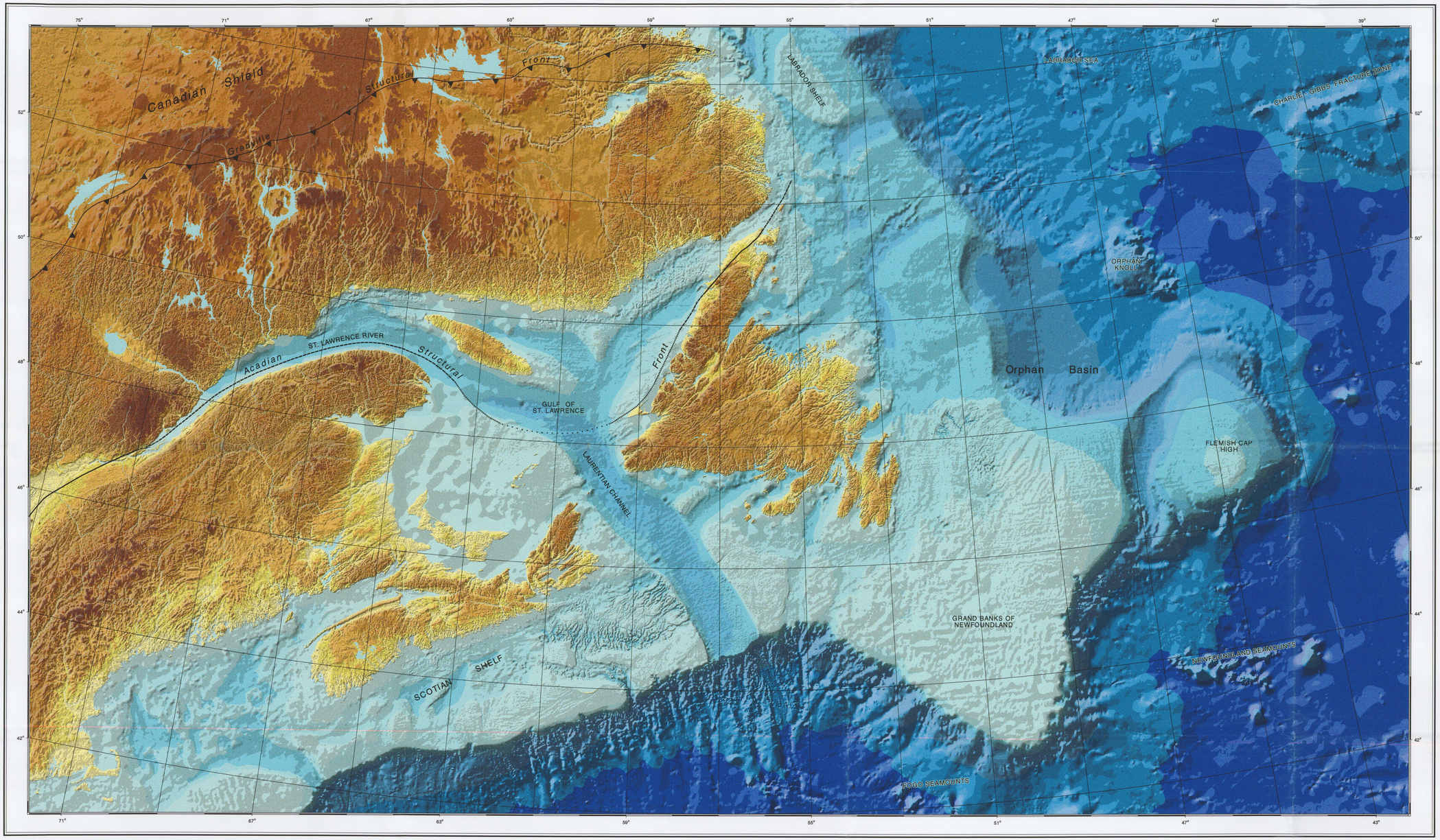
GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

Memorial University of Newfoundland



MORPHOLOGY

Two primary physiographic units comprise the landmass of eastern Canada and adjacent oceanic regions. Occupying the northwest corner of the map and consisting of older, crystalline rocks, the Precambrian Shield is divided by the Grenville Structural Front into the James and Laurentian Regions. Occupying the remainder of the map and consisting of younger, mostly stratified rocks, the Borderlands contain the St. Lawrence Lowlands Region in the northern Gulf of St. Lawrence, the Appalachian Region south of the Acadian Structural Front, and the Atlantic Continental Shelf seaward of the Nova Scotia and Newfoundland coasts.

One of the most striking aspects of the map is the portrayal of regional seafloor morphology in the Gulf of St. Lawrence and on the continental margins off Nova Scotia and Newfoundland. The dominant feature in the Gulf of St. Lawrence is the ancient river bed that appears as a prolongation of the present-day channel of the St. Lawrence River. Enlarged by glacial erosion, the river bed is joined by major tributaries to become the Laurentian Channel, and extends to the edge of the continental shelf. It serves as a conduit for erosional products from the North American heartland into the Atlantic Ocean, where they are deposited at the base of the continental slope.

In general terms, the continental shelves off Nova Scotia and Newfoundland may be divided into three zones. Moving progressively offshore, these consist of eroded basement bedrock, deep marginal troughs, and flat banks that extend to the edge of the shelf where water depth increases abruptly. The continental shelf off Nova Scotia is characterized by complex erosional structures and isolated basins and banks. Southeast of Newfoundland, it consists primarily of the broad, featureless Grand Banks. Northeast of Newfoundland, it is deeper than elsewhere in the region, due to the subsidence of continental crust upon the onset of rifting and seafloor spreading. Semi-isolated features such as Flemish Cap and Orphan Knoll are continental fragments that broke free from the edge of the North American plate during early phases of seafloor spreading. Along the peripheries of the shelves are well-defined canyons that incise the continental slope and rise; these are remnants of ancient erosional processes that prevailed during episodes of reduced sea levels.

MAP CONSTRUCTION

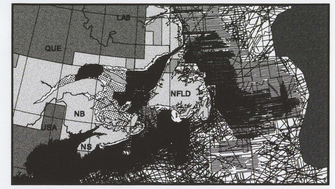
This map portrays the contents of a rectangular grid that defines bathymetry (depth of water) and topography (height of land) at regular horizontal intervals of 500 m.

Bathymetric observations were acquired with conventional single-beam echo sounders during numerous cruises beginning in the early 1960's (see Data Distribution diagram). The bulk of the observations were extracted from the digital archives of the Geological Survey of Canada and the Canadian Hydrographic Service in Dartmouth, NS. The remaining observations were obtained directly from their originators or through the intermediary services of the US National Geophysical Data Center in Boulder, CO (see Sources of Bathymetric Information). Individual data sets were reviewed for errors, revised as needed, and homogenized to facilitate merging. A uniform sound velocity of 1463 m/s was assumed, with no corrections applied for variations in sound velocity. A minimum curvature algorithm was used to convert the assembled observations into a grid of depth values at rectangular intervals of 1 km. In the easternmost section of the map area, the density of original observations was inadequate for the construction of a grid that portrayed the sea floor at a level of detail that matched other portions of the map. Accordingly, generalized bathymetric contour lines were extracted from the GEBCO Digital Atlas, and used to construct a grid segment for that region. The final bathymetric grid was re-sampled at 500 m for subsequent merging with the topographic grid.

Grids of topographic information at resolutions of 3 and 30 arc-seconds were obtained from Geomatics Canada, the US Geological Survey, and the US National Geophysical Data Center (see Data Distribution diagram). Derived in large part from contours portrayed on published topographic maps, these grids were reasonably free of errors and required few corrections; they were easily combined and re-sampled at 500 m intervals, using the same origin as the bathymetric grid.

Finally, the bathymetric and topographic grids were merged to produce a single grid that contained a relief value for every grid point in the map area. Interpolation was necessary to compute grid values in certain nearshore areas where bathymetry was sparse or nonexistent (see Data Distribution diagram). The merged grid was plotted with artificial illumination from the northwest to enhance surface texture.

DATA DISTRIBUTION



USGS 3 arcsec grid
Geomatics 3 arcsec grid
Geomatics 1:250000 contours
EROS 30 arcsec grid
GEBCO digital atlas
GSC (Atlantic) marine database

SOURCES OF BATHYMETRIC INFORMATION

Canadian Hydrographic Service; Dartmouth NS, Canada
GEBCO 97 Digital Atlas; BODC, Merseyside UK
Geological Survey of Canada; Dartmouth NS, Canada
IFREMER; Brest, France
Institute of Oceanographic Sciences; Southampton, UK
Lamont-Doherty Earth Observatory; Palisades NY, USA
Scripps Institution of Oceanography; La Jolla CA, USA
University of Rhode Island; Narragansett RI, USA
US Geological Survey; Woods Hole MA, USA
Woods Hole Oceanographic Institution; Woods Hole MA, USA

ACKNOWLEDGEMENTS

David Monahan and Keith White facilitated access to data holdings in CHS archives. Allen Stark and Kevin Desroches assembled and corrected the bathymetry observations. Andre Comeau assembled and merged the topographic data sources. Software for data processing and visualization was developed by Karl Usow working under the direction of Jacob Verhoef. David Vardy constructed the geographic overlay and the map surround. David Piper reviewed a draft version of the map and offered valuable suggestions for improvement.

ATLANTIC CANADA MAP SERIES
GEOPHYSICS, GEOLOGY AND PHYSIOGRAPHY

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DEDICATED TO OUR LATE COLLEAGUE AND FRIEND, ALLEN STARK

LOCATION MAP - LOCALISATION DE LA CARTE

MORPHOLOGY MAP
TOPOGRAPHY / BATHYMETRY
ATLANTIC REGION
CANADA

Scale 1:3 000 000 - Échelle 1:3 000 000

Kilometres 50 0 50 100 150 200 250 Kilomètres

Lambert Conformal Projection
Standard Parallels 43°N and 68°N CM=57°W

-4000 -2500 -1000 -400 -200 -100 0 50 100 200 400 600 800
metres

Copies of this map can be obtained from
the Geological Survey of Canada (Atlantic)
PO Box 1006, Dartmouth, Nova Scotia,
Canada, B2Y 4A2
email: agc@agc.bio.ns.ca
web: http://agcwww.bio.ns.ca

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