INTRODUCTION

The Petite-Vallée map represents one of two shaded-relief maps of the Honguedo Strait area within the Gulf of St.Lawrence. Multibeam bathymetry covers an area between the Gaspe Peninsula and Anticosti Island in water depths ranging from 6m to 407m. In addition, approximately 130km of high-resolution seismic reflection data as well as sample data (4 camera transects; 5 grab van veen samples and 4 gravity cores) were collected for scientific interpretation during GSC cruise 2007-048 (Bolduc, 2008).
The Petite-Vallée map displays artificially illuminated seafloor topography that provides a basis for describing the regional geomorphology of the Honguedo Strait.

MULTIBEAM DATA COLLECTION AND DISPLAY

The maps are the product of several surveys conducted between 1999 and 2009 that used multibeam bathymetry to map the seafloor. Multibeam bathymetry data were collected by the Canadian Hydrographic Service (in collaboration with the Geological Survey of Canada) using the Canadian Coast Guard Ship *Frederick G. Creed* . Multibeam bathymetry systems onboard the *Creed* consisted of a Kongsberg EM-1000 (before 2005) and a Kongsberg EM-1002 (since 2005). The EM-1000 system operates with 60 beams at a beam width of 2.5° along and across track, over an arc with a maximal angle of 150°. The EM-1000 system was replaced by the EM-1002 system which operates with 111 beams, at a beam width of 2° along and across track, over an arc with a maximal angle of 120°. Most of data were collected using the EM-1002 system (Bolduc et al., 2008; Bolduc et al., 2009; Brake et al., 2010).The minimal overlap between survey lines was 10 % for the entire studied area.
Ship speed during data acquisition was approximately 12 knots. The positioning was based on the Coast Guard DGPS network. Sound velocity profiles of the water column were collected daily or more frequently if necessary by a moving vessel profiler. Corrections for sound velocity were applied to the data in real time to ensure accurate water-depth calculations.
Despite corrections, artifacts related to data collection and processing exist in the areas where survey lines overlap and at the boundary between surveys. As a result, survey track lines are clearly identified within most of the mapped area.
Topographic contours generated from the multibeam bathymetry data are shown in white at a depth interval of 20m. Bathymetric contours outside the survey (shown in blue) are from the Canadian Hydrographic Service maps.
Multibeam bathymetry data are gridded at 20m horizontal resolution and are artificially shaded to enhance bathymetric features. The shaded relief image was created by vertically exaggerating the topography 10 times and applying an artificial light source located at an azimuth of 315° and an angle of 30° above the horizontal.

REGIONAL GEOMORPHOLOGY

Honguedo Strait is an elongate body of water that separates the Gaspe Peninsula and Anticosti Island. Honguedo Strait stretches more than 200km and is approximately 70km wide at its narrowest point. The waters of Honguedo Strait mark the transition zone between the Lower St. Lawrence River Estuary and the northern Gulf of St. Lawrence. The Laurentian Channel, a long continuous trough that runs from the Atlantic continental shelf to where it ends abruptly at the mouth of the Saguenay River in the St. Lawrence River Estuary brings deep oceanic water through Honguedo Strait and into the estuary.
The water masses of western Gulf of St. Lawrence exhibit clear variations of salinity, temperature and depth. The surface water layer (0-30m) exhibits a wide range of temperatures from 2 to 15°C and has 26-31‰ salinity, while the intermediate layer (30-225m) is characterized by temperatures ranging from 2 to 5°C and salinity between 31-34‰. The bottom mixed water layer (225-300m) has a temperature of approximately 4.5°C and salinity between 34-35‰ (Saucier et al., 2003). Within Honguedo Strait the water masses are regulated by the Gaspé Current and the Anticosti cyclonic gyre that control the exchange of water at all depths (Smith et al., 2006). Outboard of the Forillon Peninsula are the deeper waters of the Laurentian Channel strongly influenced by inflow through Cabot Strait (Smith et al., 2006).
From a geologic point of view, Anticosti Island and much of the Honguedo Strait belong to the St. Lawrence platform, which corresponds to the Paleozoic authochtonous sedimentary cover of the eastern North American craton. On Anticosti Island, the sedimentary succession consists of Lower Ordovician to Lower Silurian rocks that dip approximately 3° toward the south. The monoclinical succession has been penetrated by 19 exploratory wells which intersect up to 3.69km of Paleozoic strata. Near the coastline of Honguedo Strait, the Gaspe Peninsula is composed of rocks belonging to the Humber zone, the frontal lithotectonic zone of the Appalachian orogen which includes Lower Paleozoic slope and rise deposits. The Humber zone is unconformably overlain by or in fault contact with Middle Paleozoic rocks of the Gaspé belt that form the bedrock in the Gaspé area.
Quaternary sediments form the seafloor and shallow subsurface of the Honguedo Strait (Josenhans et al., 1990; Rodrigues et al., 1993). The Quaternary succession is variable in thickness and ranges from less than 25m near the coastal areas of Gaspé Peninsula and Anticosti Island to 125m in the deepwater outboard of Forillon Peninsula (Syvitski and Praeg, 1989). Josenhans et al., (1990) recognized 5 seismic units based on their acoustic properties. Carbon-14 (or 14C) geochronology of core samples from units 2-5 constrain the age of the oldest sediment sampled to 14040 +/-240BP. The base of the succession was not reached by drilling and its age remains hypothetical (Rodrigues et al., 1993). Quaternary sediments consist of postglacial basinal ponded muds and ice contact sediment/till units with minor iceberg turbate, glaciomarine sediments and reworked sands/gravels (Josenhans et al., 1993; Josenhans 2007). Recent sedimentation rates range from 0.237cm yr⁻¹ to 0.042cm yr⁻¹ in the western and eastern parts of the study area respectively (Smith and Schafer 1999).

DESCRIPTIVE NOTE, PETITE-VALLÉE

This map covers an area north of the Gaspe Peninsula capturing the geometry of the south margin of Honguedo Strait between Rivière de la Grande-Vallée in the upstream area and the Forillon Peninsula downstream. The map does not image the bathymetry of the entire strait; therefore a comparison between the north and south margins is not possible. The surficial sediments of the strait consist of calcipelite, sandy pelite and gravelly pelitic sand (Loring and Nota 1973; Josenhans 2007). Conversely, Bolduc (2008) described three grab samples collected within Honguedo Strait during cruise 2007048 as cohesive grey clay.
Within Honguedo Strait, the seafloor of the Laurentian Channel exhibits a slope less than 1°. Two domains are noted along the south margin of the Laurentian Channel (Fig. 1). The first domain (D1) is located north of the Gaspe Peninsula, roughly parallel to the shoreline. D1 has an average slope of 3° and encompasses several ridges with steeper flanks (up to 7°) that extend from 12 to 17km along-strike. High-resolution seismic reflection data indicate that sedimentary cover is thin above these ridges. The second domain, D2, is located further seaward and trends parallel to D1. It is characterized by an average slope of about 1°. No evidence of paleo-failure was observed.
Three west-northwest trending lineaments corresponding to topographic depressions are located within the Laurentian Channel measuring 5 to 37 km in length. A seismic line across one of these features indicates that lineaments correspond to depressions in the underlying bedrock draped by Quaternary sediments.
In the northwestern area of the map in water depths of 315 to 370m, a composite positive bathymetric feature defines an arc-shaped lineament (Fig. 1). Based on high-resolution seismic profiles, this lineament is interpreted as the surficial expression of an erosion resistant unit involved in a broad open fold (Fig. 2).
Outboard of the Forillon Peninsula the continuation of the Devonian Upper Gaspé limestone is observed as a linear ridge (FR) with steep flanks (up to 6°) and extending as much as 10km from the shoreline. North of the Forillon Ridge (FR), on Banc Norwick, a smooth mounded deposit forms a positive bathymetric feature that rises up to 5m above the surrounding seafloor
Numerous iceberg scours 100s of meters in length, with an average width of 50m, and depth of 2 to 4m are located within the Laurentian Channel. Scour orientation is dominantly parallel to the present day channel axis. Locally, scours exhibit multiple cross-cutting relationships indicating that they belong to several generations. High-resolution seismic reflection data indicate that the present-day scour morphology is largely inherited as they are are partially infilled with sediments.
Pockmarks, corresponding to crater-like depressions on the seafloor are observed north of the fold hinge in the northwest corner of the map as well as along the base of the Laurentian Channel seaward of D2 and south of the west-northwest trending lineaments (Fig. 1). In general pockmarks have a scattered distribution with the exception of a few linear pockmark chains consisting of 3 to 5 pockmarks and few clusters of 2 or 3 features. In the St. Lawrence River Estuary, the presence of pockmarks is interpreted as related to the release of fluid from the subsurface (Pinet 2008). However, large diameter (>200m) pockmarks such as those described in the St Lawrence River Estuary are absent.

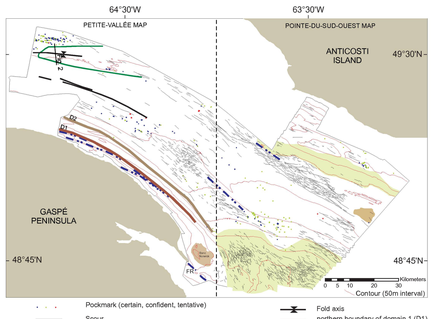

Figure 1: Thematic map of Honguedo Strait highlighting main geomorphologic features. D1=domain 1; D2=domain 2; FR=Forillon Ridge;

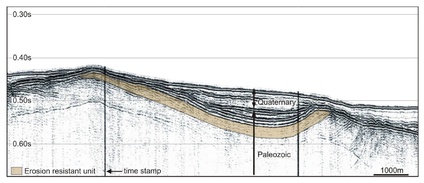

Figure 2: Seismic line providing a cross-section of the arc-shaped lineament observed in the northwest corner of the map.

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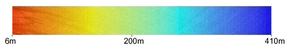

Bathymetric contours supplied by the Canadian Hydrographic Service. The presentation of non-standard contours is the result of a direct mathematical conversion from fathom contours to metres.

Topographic contours, Transportation route, and hydrographic data were downloaded from CanVec

ASTER GDEM downloaded from the Earth Remote Sensing Data Analysis Center

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SHADED SEAFLOOR RELIEF
PETITE-VALLÉE
HONGUEDO STRAIT

scale 1:100 000

0 2.5 5 10 15 20 Kilometres

Universal Transverse Mercator Projection
North American Datum 1983
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This map is not to be used for navigational purposes

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