



# Environmental Seabed Conditions of the Lunenburg Marine Park

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Figure 1. Study area bathymetry, Lunenburg Bay to Cross Island



Figure 2. HMCS Saguenay during sinking

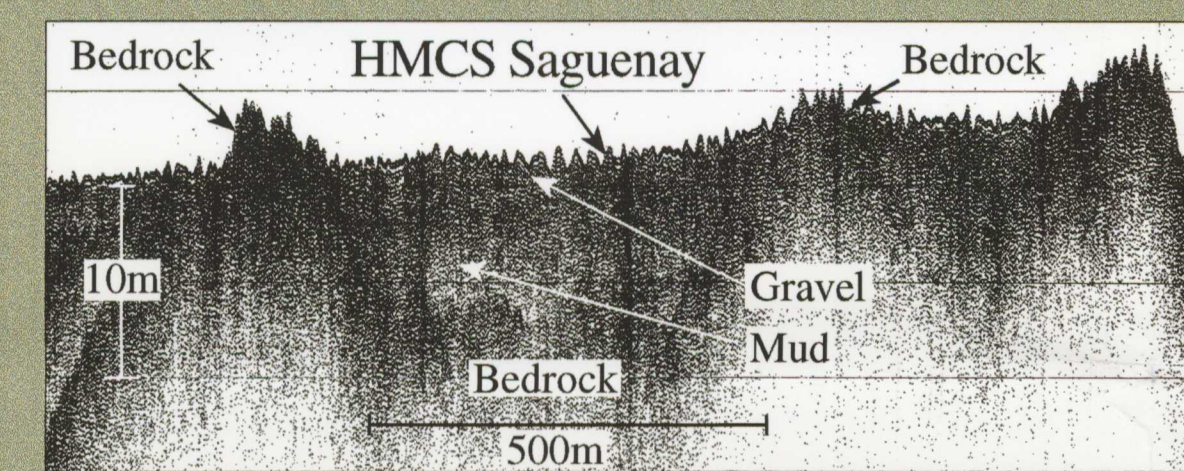


Figure 3. Seismic reflection profile

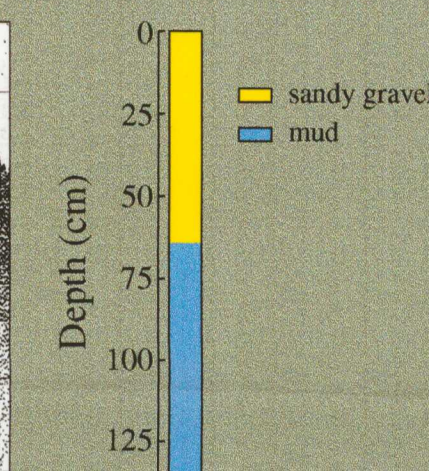


Figure 4. Sediment core

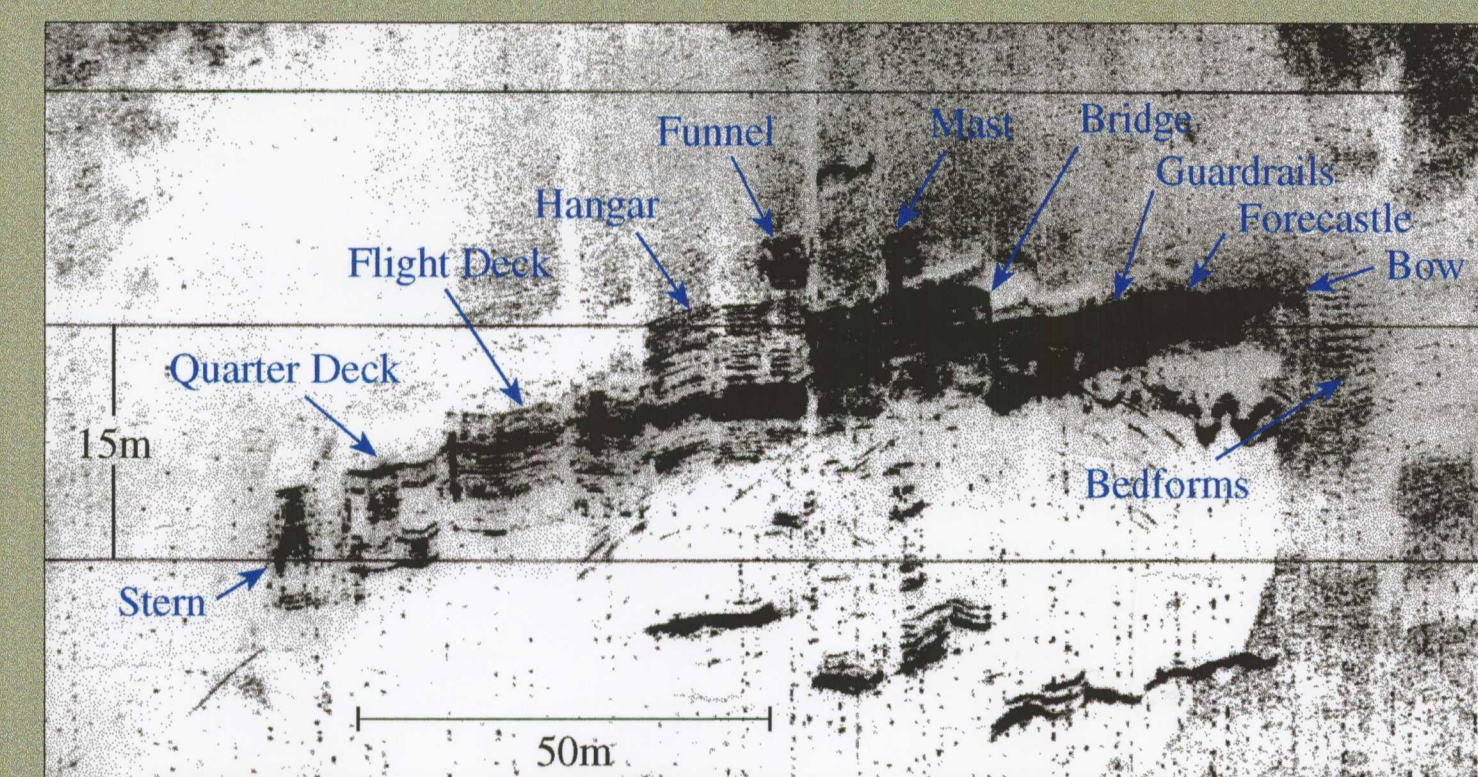


Figure 6. Sidescan sonar image of shipwreck

HMCS Saguenay is a decommissioned ISL class destroyer, DDH 206, (Helicopter Carrying Destroyer), which was sunk under controlled conditions, June 25, 1994, to establish a marine park in outer Lunenburg Bay (Figure 1 and 2).

The South Shore Marine Park Society, a non profit community group, was the proponent responsible for establishment of the park. It is operated by Lunenburg Marine Park Inc. as a tourism destination for scuba divers. Several community related concerns were raised during the initial planning stages. The park operation was not to conflict with the lobster fishery. As a result it was decided that the park would only be open during the lobster off-season, which runs from the beginning of June to the end of November. Concerns were also raised regarding how the shipwreck would affect sediment dynamics and would the ship continue to sink into the seafloor.

The purpose of this study, undertaken by the GSC (Atlantic), was to evaluate seabed and shallow subsurface conditions surrounding the shipwreck. A sidescan sonar mosaic (Figure 5) was completed using a Klein 595 dual frequency (100 and 500 kHz) sidescan sonar system with a line spacing of approximately 30 metres. High resolution seismic reflection data were collected concurrently using a Seistec, surface towed, line-in-cone array system. These data were recorded on DAT tape and the sidescan data were subsequently converted to digital files using the GSC (Atlantic)-developed, processing system (AGC DIG). The digital sidescan files were processed to remove geometric distortions and merged with the navigation. These files were then integrated into a raster based GIS system to produce a digital sidescan mosaic of the seafloor in the vicinity of the shipwreck. To build this mosaic, only the high frequency (500 kHz) data collected at a range of 60 metres were used. Some of the finer details of the Saguenay can be seen in the high resolution sidescan sonar image (Figure 6).

Lunenburg Bay is a relatively flat-bottomed embayment along the south shore of Nova Scotia (Figure 1). Bedrock, which is Halifax Formation slate and siltstone, outcrops frequently and is separated by infilled channels. The Saguenay was sunk over one of these channels (Figure 3). Piper et al. (1986) published on the stratigraphy of one of these channels. They noted that a core (#78-100), penetrated through approximately 65 cm of sandy gravel overlying mud with several sand lenses (Figure 4). The ship presently rests near a small patch of sand surrounded by gravelly sediments within a zone mapped as the gravelly facies of the Sable Island Sand and Gravel Formation (King, 1970 and Piper et al 1986). Its orientation, bow to stern, is roughly east to west (Figure 5). The water depth in the immediate vicinity of the wreck ranges from 17.7 metres, (a bedrock outcrop approximately 0.75 km to the east north east), to 25.6 metres. In general the seabed where the Saguenay lays is flat and averages 22 metres in water depth. The wreck presently has 35 feet (10.9 metres) of water above its shoalest point and lies partly on its side.

Figure Captions:

Figure 1. A section of Hydrographic chart 4384 with sidescan mosaic superimposed.

Figure 2. Photograph of Saguenay taken during the sinking process. Insert shows diver on location on the wreck. Photographs by John Webber (inset) and Sky-Shots, Chester, N.S. (Saguenay).

Figure 3. Seismic profile collected using an I.K.B., Seistec, line-in-cone array system over the area where the Saguenay presently rests. It shows a series of infilled channels, interpreted as gravel at the surface, overlying lacustrine muds. The bedrock is slate/siltstone of the Halifax Formation. The Saguenay rests over the middle channel shown in this profile. The maximum depth to bedrock in this channel is approximately 10 metres. The corrugations at the sea floor are due to swell.

Figure 4. Core log of core 78-100, collected in one of the channels in Lunenburg Bay. (Piper et al, 1986). The core penetrated approximately 65 cm of sandy gravel before bottoming out in mud. The mud has several, thin sand layers.

Figure 5. Sidescan sonar mosaic showing the environment of the seafloor where the Saguenay presently rests. The seafloor is generally covered with gravel of the Sable Island Sand and Gravel Formation (King, 1970). The ship rests with the bow facing east and the stern facing west in a small patch of sand interpreted to have resulted from sediment transport associated with the vessel on the seabed. There are no strong indicators of current-induced features, (ie. bedforms or erosional scour features). Bedrock crops out to the east and west of the Saguenay.

Figure 6. High resolution (500 kHz) sidescan sonogram of the Saguenay showing some of the finer details not easily visible on the mosaic. The white patch around the ship is sand. The bow of the ship is to the right side of the image; working left toward the stern of the vessel, the bridge structure is clearly visible as is the helicopter flight deck and the stern of the vessel. The wavy aspect of the image is due to the large swell at the sea surface produced by a series of offshore hurricanes which passed this section of Nova Scotia during the time of the survey. Small bedforms are visible to the right of the bow of the vessel. Their orientation suggests currents moving along a south-north axis. The detail of the image is fine enough to resolve the railing ropes on the deck of the bow of the vessel.

References:

King, L.H., 1970, Surficial geology of the Halifax-Sable Island map area: Canadian Hydrographic Service, Marine Sciences Paper 1,16p.

Piper, David, J.W., Mudie, P.J., Letson, J.R.J., Barnes, N.E., and Iulivucci, R.J., 1986, The marine geology of the inner Scotian Shelf off the South Shore, Nova Scotia: Geological Survey of Canada paper 85-19, 65p, 2 inserts.

Acknowledgments:

The author would like to acknowledge the efforts of W.A. Boyce, GSC(Atlantic), for electronic support, and Darrell Beaver GSC(Atlantic), for providing navigation. The success of the mission was made possible greatly from the efforts of Captain Pius Antle and crew of the C.S.S. Hart who traversed from Shelburne to Lunenburg during sloppy sea conditions to get to the survey site. The knowledge of the setting of HMCS Saguenay provided by Richard W. Welsford, Saguenay House was invaluable. Special thanks are reserved for Ken Hale, GSC(Atlantic)/Publications, for assistance in layout and design.

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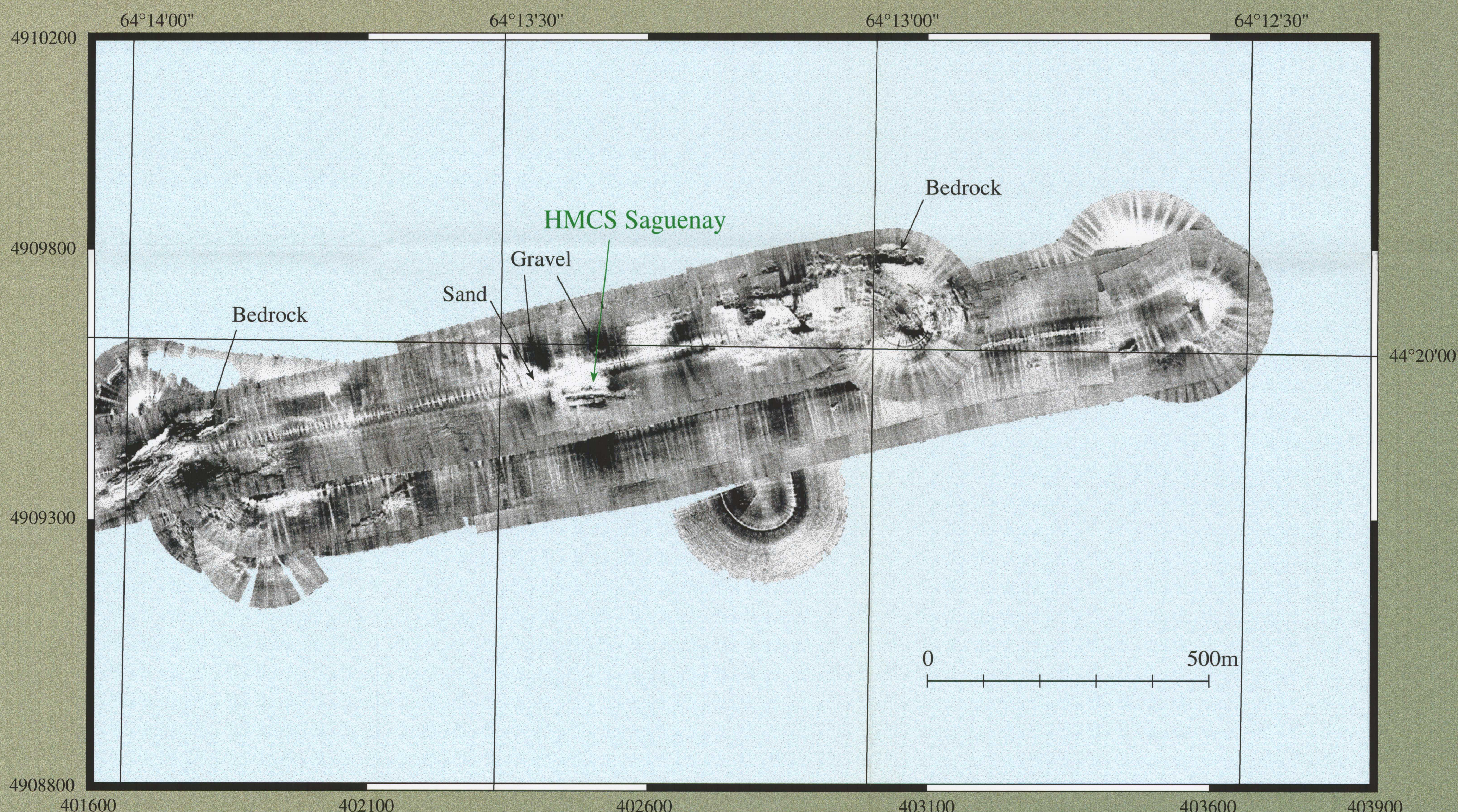


Figure 5. Sidescan sonar mosaic