

46°N to 75°N (Quebec City to the Beaufort Sea):
2011 Ocean Mapping Group Operations in the Canadian Arctic, Part I

By Brad Eisan

At 5 PM, July 19, 2011 the CCGS Amundsen left her home port of Quebec City, embarking on a three and half month science expedition in the Canadian Arctic. Among the forty scientists onboard for the first six weeks of the expedition were two University of New Brunswick students belonging to the Ocean Mapping Group (OMG) of UNB's Geodesy and Geomatics Engineering Department. Travis Hamilton, a master's student studying under Dr. John Hughes Clarke and myself, Brad Eisan, a fourth year undergraduate student in the department. As the Amundsen headed east along the St. Lawrence, through the Strait of Belle Isle and veered north up the coast of Labrador, OMG's 24/7 mapping initiative was already well underway.

Using two acoustic echo sounders mounted on the hull of the Amundsen, Travis and I were able to continuously survey the ocean floor while the ship was in transit along its entire journey. Using a Kongsberg EM302 multibeam and Knudsen 320BR sub-bottom echo sounders, we were able to collect depth, backscatter and sub-bottom data, developing a better understanding of the sea bottom topography and geological structure. Working with the Canadian Coast Guard, the ship was continuously kept on a course that allowed us to collect new data, building on the coverage of existing transits since 2003.

In the early hours of July 22, off the coast of Labrador, NL, the Amundsen wearily approached the Petermann Ice Island, an enormous piece of glacial ice measured at over 10 km x 5 km. As the ice island drifted slowly southward, the Amundsen circumnavigated the ice while a team of on-ice scientists were deployed by helicopter to study it. This allowed us an opportunity to gather new mapping data in the area before heading north towards a dedicated mapping area in the North Labrador Sea.

By July 24, after being battered by 40 knot winds and a 4-5 meter swell for nearly two days, the Amundsen had made her way northeast to Saglek Bank, off the continental shelf of northern Labrador, an area of interest to the Geological Survey of Canada. In water depths of up to 2000 m, the Amundsen carried out several hours of mapping while transiting through the area, to help shed light on potential seabed geohazards in the area. Afterward, mapping continued as the Amundsen followed a course along the coast of Nunavut, toward the Northwest Passage.

After rendezvousing with a local fishing boat in Cumberland Sound, Baffin Island, the Amundsen spent the day classifying marine life in the area, before continuing north in the evening. In the interim, we prepared mapping equipment aboard the Amundsen's much smaller, deployable barge, used for mapping in shallow water or areas too hazardous for the Amundsen. The barge was a well suited platform for the rare opportunity to map the underside of an iceberg. In anticipation of this survey, the OMG had made modifications to their pole-mounted EM3002

multibeam echo sounder, changing its orientation to point towards the underside of an iceberg as opposed to directly at the sea floor.

On July 27, past the Arctic Circle at 66.5°N, long days gave way to a complete loss of darkness. The Amundsen's barge was deployed in a thick fog near Baffin Island to do the first trial run on mapping an iceberg, a few miles off the ship. Working with a team operating an autonomous underwater vehicle (AUV), a couple of hours were spent circling and mapping the iceberg with OMG's echo sounder and the AUV, testing equipment and preparing for a more substantial ice mapping project in the days to come.

Three days later, the Amundsen had entered the Northwest Passage and spent some time in Eclipse Sound near Bylot Island and Pond Inlet at the top of Baffin Island. As the weather cleared up, the scenery was incredible. Huge glaciers flowed in impossible natural patterns, meandering through the hilly northern terrain and meeting the water with powerful defiance. A large chunk of glacial ice was chosen in the early morning of July 30 as the target of more mapping efforts by the OMG. Working again with the AUV team, the barge was deployed and we spent several hours circling and mapping the iceberg and assisting with the deployment of the AUV. The ship's helicopter was also sent to place scientific equipment on the ice. Some excellent mapping data was collected that the OMG will use to develop three-dimensional models of the underside of the iceberg.

The following day, the Amundsen anchored near Pond Inlet and several VIPs boarded the ship for the transit through the northwest passage to Resolute on Cornwallis Island. Amongst those onboard were Canadian astronaut Julie Payette, ex-prime minister of France Michel Rocard, and Canadian jazz singer Emilie-Claire Barlow. It made for an enjoyable few days, full of things not typical of an Arctic expedition; great food choices and excellent live music. It was also a good chance to meet some very interesting people.

By August 2, the Amundsen had made her way into Wellington Channel to seek refuge from some windy weather in Lancaster Sound. This was a great opportunity to gather some new data in an area previously unmapped by the OMG. The storm passed by morning and the Amundsen moved on to Resolute where the VIPs disembarked. With mapping activities stopped while at anchor, some members of the science crew, including ourselves, caught a helicopter to spend the day in Resolute. Exhibits were set up at the airport to teach eager local children about the science being conducted in the Arctic. In addition, a presentation with traditional music and a meal of BBQ Muskox burgers was put on by members of the community of about 250.

After spending an extra day anchored off Resolute due to more bad weather, the Amundsen turned south into Peel Sound and headed toward Kugluktuk for a crew change. This mainland hamlet used to be known as Coppermine, being situated at the mouth of the river of the same name. Along the way, we collected new data in transit and in the sometimes shallow and narrow areas around Coronation Gulf. On August 10, by utilizing the barge and Amundsen

simultaneously for several hours, we were able to collect a corridor of new mapping data in Cambridge Bay.

In Kugluktuk on August 11, a resupply and a full crew change of Coast Guard and science personnel was carried out, while we remained on board for the next leg of the expedition. Under the guidance of a new captain and crew, the Amundsen headed north into the Beaufort Sea to conduct ice sampling of multiyear ice flows from 70-75°N latitude. We collected mapping data along the way and assisted with ice operations when the ship was moored to an ice flow. Drilling ice cores, conducting on-ice laser scanning, and monitoring for polar bears were daily tasks, combined with a continued effort to map when the Amundsen was not breaking ice.

After a busy two weeks of on-ice operations, by August 25, the Amundsen had made her way to Sachs Harbour on Banks Island to meet a charter flight headed to Yellowknife. After attempting a science personnel change in foggy weather, the flight was cancelled and we returned to the Amundsen to await a break in the fog. The weather defines life in the north, and the unpredictability of Arctic weather, paired with the tragic 737 crash in Resolute only days before, were enough to cancel the flight for the evening. The next day, the crew change went smoothly in better weather. Travis and I prepared to head south back to Fredericton and were met by Ian Church, James Muggah, Carlos Rubrio Marques and Rodrigo Carvalho who would continue mapping operations.

The Amundsen will continue work in the Beaufort Sea, heading back into the cooler temperatures, continuous ice breaking and 24-hour sunlight. Just six weeks earlier, the Amundsen had left 30° temperatures on calm seas from Quebec City. She will see her home port again on October 29, when this field season of Arctic mapping operations will conclude for the OMG.