



Canada's Arctic Continental Shelf: Research Under Ocean and Ice

The continental shelf is an underwater extension of land that can stretch out to sea for many kilometres. Canadian scientists are studying the Canadian continental shelf in the Arctic as part of the Extended Continental Shelf (ECS) Program, a large research initiative set up to identify characteristics of the shelf under the Atlantic and Arctic Oceans. The scientific data collected by this study will be required for Canada's submission to the United Nations Commission on the Limits of the Continental Shelf (CLCS), the aim of which is to define the outer limits of the shelf where it extends beyond 200 nautical miles from coastal baselines.

In the Arctic, continental shelf research consists of on-ice and ship-borne surveys across an area extending approximately a thousand kilometres from east to west. The research will identify where Canada may exercise its existing sovereign rights over the natural resources of the seabed.

Canada and the four other Arctic coastal states, Denmark, Norway, Russia and the United States, are among approximately 60 states around the world involved in research to define their extended continental shelves.

Research Under Sea Ice

Data collection in remote Arctic locations means dealing with harsh conditions, including extreme cold, ice, fog and darkness. Research takes place from temporary ice camps in the eastern Arctic during a six-to-eight week period in the springtime (March/April); icebreakers are used for scientific surveying in the western Arctic Ocean during a similar time period in the fall (August/September).



Figure 1. Base Camp was set up in the Arctic during the spring of 2009 at Ward Hunt.

Photo: Janice Lang, PCSP/NRCan, CHS/DFO

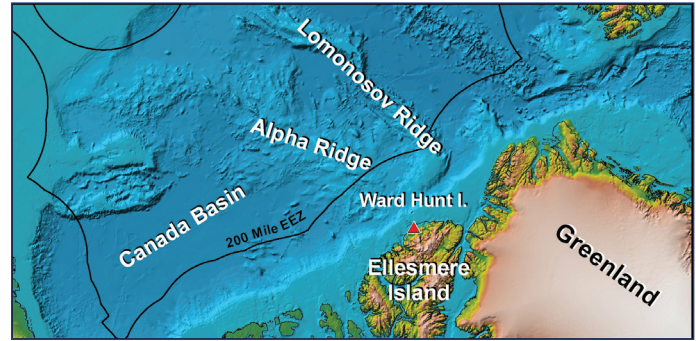


Diagram: Kevin DesRoches, GSC/NRCan

Figure 2. Canada's Arctic areas where continental shelf research surveys take place.

In the eastern Canadian Arctic, research is required to identify whether underwater mountain ridges are naturally linked extensions of Canada's continental shelf. This research is mainly done from ice camps and uses high-powered sound waves to penetrate deep beneath the seafloor, as well as bathymetric soundings to identify the shape of the underwater mountain ridges.

In the western Canadian Arctic, researchers conduct bathymetric surveys to identify underwater topography (the shape of the ocean floor or seabed) as well as seismic research to identify the thickness of the sedimentary layer. For the past four years, research surveys were conducted using Canada's largest ice breaker, the Canadian Coast Guard Ship (CCGS) *Louis S. St-Laurent*.

Partnering in Extreme Arctic Conditions

Canadian scientists have conducted research both independently and collaboratively in the Arctic under challenging conditions. For operational and scientific reasons, it is highly advantageous to work with other Arctic coastal states in the collection and interpretation of scientific data. To date, there has been extensive joint survey work, including five collaborative projects with Denmark, conducted in the eastern Arctic. These projects took place between 2006 and 2009 on the Lomonosov Ridge, north of Greenland and Ellesmere Island. In the spring of 2009, this research took place from the Ward Hunt Island ice camp.

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Joint surveys for data collection with the US were completed in the western Arctic in 2008 and 2009, using an icebreaker from each country (the CCGS *Louis S. St-Laurent* and the US Coast Guard Cutter *Healy*). Canadian, Danish and Russian scientists have also met several times to discuss issues of common interest, mostly relating to Arctic ridges.



Photo: Patrick Kelley (USCG)

Figure 3. The CCGS *Louis S. St-Laurent* (left) conducts seismic surveys following the USCGC *Healy* icebreaker.

Key Findings

1. To date, researchers have collected data across the Lomonosov and Alpha Ridges, two underwater mountain ranges in the eastern Arctic, and large amounts of seismic information in the western Arctic, within the Canada Basin. Initial results indicate that significant amounts of sediment occur in the basin.
2. The ECS Program is on track to complete the scientific data collection by 2011, followed by analysis and preparation for submission to the CLCS by 2013.
3. Successful international collaboration has allowed the program to take advantage of additional expertise resulting in extensive, high quality data for the program.

Preparing Canada's Submission

Foreign Affairs and International Trade Canada is the lead in the ECS program and has overall responsibility for Canada's submission to the CLCS. The scientific data collection and interpretation are the responsibility of Natural Resources Canada's Geological Survey of Canada and Fisheries and Oceans Canada's Canadian Hydrographic Service.

The ECS program is an example of how cooperation across disciplines, sectors and countries can advance scientific research. Assisting with the collection of scientific data are the Canadian Coast Guard, the Department of National Defence, collaborating scientists at Defence Research and Development Canada, the Canadian Ice Service and various international scientific networks. The program also includes collaboration with the United States, Denmark and Russia to share resources and scientific data.

Making a Difference

The next phase of the research will experiment with the use of new technology using specially designed autonomous underwater vehicles (unmanned, mini-submersibles) to collect bathymetry data under the ice, west of Ellesmere Island. This new method of data collection will be tried for the first time in harsh Arctic conditions.

All data collected from the various survey methods will form the basis for the submission to the United Nations CLCS, on track for 2013. By determining the limits of the continental shelf, the submission will secure international recognition of Canadian sovereign rights over resources on and under the continental shelf beyond 200 nautical miles from coastal baselines.



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