

# International expedition investigates climate change, alternative fuels in Arctic

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NRL's Marine Biogeochemistry section organized and led an international research expedition aboard the USCG Polar Sea in the Beaufort Sea during September 15-26, 2009. Credit: U.S. Coast Guard

Scientists from the Marine Biogeochemistry and Geology and Geophysics sections of the Naval Research Laboratory (NRL) organized and led a team of university and government scientists on an Arctic expedition to initiate methane hydrate exploration in the Beaufort Sea and determine the spatial variation of sediment contribution to Arctic climate change.

Utilizing the U.S. Coast Guard Cutter Polar Sea as a research platform, three cross-shelf transects were surveyed and sampled off Alaska's North Slope at Hammerhead, Thetis Island and Halkett representing three regions of the Alaskan shelf. The expedition integrated expertise in

coastal geophysics, [sediment geochemistry](#), dissolved and free [methane](#) fluxes through the water column and into the atmosphere, sediment and water column microbiology and biogeochemistry and detailed characterization of the sub-seafloor geology.

"The objective of the sampling is to help determine variations in the shallow sediment and water column methane sources, methane cycling and the subsequent flux to the atmosphere," said Richard Coffin, chief scientist, NRL Chemistry Division.

The content, location and distribution of methane in hydrate is variable and controlled by geothermal gradients and biological and thermal methane production. Large deposits of methane hydrates, frozen mixtures of hydrocarbon gas (mostly methane) and water, occur over large areas of the ocean floor. International research has begun with a primary goal of obtaining the methane in these hydrates as an energy source.

During the 12-day expedition, Methane In The [Arctic](#) Shelf and Slope (MITAS-1), the crew conducted 34 conductivity-temperature-depth (CTD) water column casts using a rosette of Niskin bottles and collected sediment samples from 14 piston cores, three vibrocores and 20 multicores. Regions selected for this study were based on the review of Minerals Management Service and U.S. Geologic Survey (USGS) seismic data with specific sample locations decided onboard through review of the 3.5 Kilohertz (kHz) sub-bottom profiler data.

The MITAS-1 crew focused on six primary goals to include:

- Acquire and integrate seismic, acoustic, temperature, geochemical, and lithostratigraphic data for evaluation of deep sediment hydrate distributions.

- Estimate spatial variation and controls on the vertical methane flux as it relates to variations in lithostratigraphy, geologic structures, water column temperatures, heat flow, seismic and acoustic profiles, and water depth.
- Develop and calibrate models to evaluate sediment hydrate loading, hydrate destabilization through warming, and the fate of methane after destabilization.
- Determine and model the transport of methane from the sediment through the water column into the atmosphere.
- Study the control of total methane emissions by microbial methane consumption in the sediment and in the water column.
- Study the contribution of methane to the benthic and pelagic carbon cycling.

The expedition was supported by NRL, Office of Naval Research (ONR), Department of Energy (DoE), Royal Netherlands Institute for Sea Research (NIOZ), French Research Institute for Exploitation of the Sea (IFREMER) and the German Leibniz Institute of Marine Sciences (IFM-Geomar). Future expeditions will also include scientists from Scotland's Herriot-Watt University, Norway's University of Bergen and GNS Science of New Zealand.

"Our project is intended to initiate a long-term collaboration in future expeditions in the Beaufort Sea and other regions of the Arctic Ocean," said Coffin.



Having the potential to provide a clean and abundant fuel alternative, deposits of methane hydrates -- frozen mixtures of hydrocarbon gas (mostly methane) and water -- occur over large areas of the ocean floor. Credit: US Geological Society

Source: Naval Research Laboratory ([news](#) : [web](#))

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