

# MICA data from USCGC Healy cruise HLY1202 from the Arctic, North of Alaska in 2012 (OA - Canada Basin project)

**Website:** <https://www.bco-dmo.org/dataset/528022>

**Version:** 09 September 2014

**Version Date:** 2014-09-09

## Project

» [Ocean Acidification in the Canada Basin: Roles of Sea Ice](#) (OA - Canada Basin)

## Program

» [Science, Engineering and Education for Sustainability NSF-Wide Investment \(SEES\): Ocean Acidification \(formerly CRI-OA\)](#) (SEES-OA)

Contributors	Affiliation	Role
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## Dataset Description

USGS Arctic Ocean Carbon Cruise 2012: MICA Data

MICA data from the HLY 1202 cruise

[Multiparameter Inorganic Carbon Analyzer \(MICA\)](#)

For additional information see:

[HLY1202 Cruise Report, Appendix E](#)

[U.S. Geological Survey Data Series 862 - Methods](#)

## Methods & Sampling

Underway Continuous Measurements

Approximately 1,800 continuous measurements of pH, TCO<sub>2</sub>, salinity, and temperature were collected from August 31, 2012, to September 2, 2012, using a flow-through Multiparameter Inorganic Carbon Analyzer (MICA) and Sea-Bird SBE49 CTD attached to the flow-through system of the USCGC Healy. The intake of the shipboard flow-through system was located approximately 8 meters (m) below the sea surface on the port side of the vessel. Water entered the sampling baffles at depth, was pumped to an ice chest for separation of

ice, and was then pumped to a multi-port sampling manifold located in the ship's laboratory. Filtered seawater then flowed through a custom made PVC de-bubbler containing a Sea-Bird SBE49, and was pumped peristaltically into the intake port of the MICA. Measurements were taken and logged approximately every 2 min except during a MICA flushing cycle which occurred for approximately 10 min each hour (h). The MICA was calibrated using Certified Reference Material from Professor Andrew Dickson of the University of California at San Diego. Precision and accuracy for each channel was 0.002 for pH and 2 micromoles per kilogram ( $\mu\text{mol/kg}$ ) for  $\text{TCO}_2$ .

For additional information see:

[HLY1202 Cruise Report, Appendix E](#)  
[U.S. Geological Survey Data Series 862 - Methods](#)

## Data Processing Description

### Underway Continuous Measurements

Approximately 1,800 continuous measurements of pH,  $\text{TCO}_2$ , salinity, and temperature were collected from August 31, 2012, to September 2, 2012, using a flow-through Multiparameter Inorganic Carbon Analyzer (MICA) and Sea-Bird SBE49 CTD attached to the flow-through system of the USCGC Healy. The intake of the shipboard flow-through system was located approximately 8 meters (m) below the sea surface on the port side of the vessel. Water entered the sampling baffles at depth, was pumped to an ice chest for separation of ice, and was then pumped to a multi-port sampling manifold located in the ship's laboratory. Filtered seawater then flowed through a custom made PVC de-bubbler containing a Sea-Bird SBE49, and was pumped peristaltically into the intake port of the MICA. Measurements were taken and logged approximately every 2 min except during a MICA flushing cycle which occurred for approximately 10 min each hour (h). The MICA was calibrated using Certified Reference Material from Professor Andrew Dickson of the University of California at San Diego. Precision and accuracy for each channel was 0.002 for pH and 2 micromoles per kilogram ( $\mu\text{mol/kg}$ ) for  $\text{TCO}_2$ .

The QA/QC process looked for internal consistencies in the data by comparing the values to known ranges for Arctic seawater. Additionally, the light intensity of acid and base spectrophotometric wavelengths were analyzed and points that did not meet minimum threshold values were discarded.

For additional information see:

[HLY1202 Cruise Report, Appendix E](#)  
[U.S. Geological Survey Data Series 862 - Methods](#)

### BCO-DMO Processing Notes

- Generated from original file: "HLY1202\_MICA.csv" contributed by Lisa Robbins
- Parameter names edited to conform to BCO-DMO naming convention found at [Choosing Parameter Name](#)
- Single Date/Time field split into separate Date and Time fields
- Date reformatted from MM/DD/YYYY to YYYYMMDD
- Time reformatted from HH:MM to HHMM
- Duplicate Date/Time column deleted

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## Data Files

File
<b>MICA.csv</b> (Comma Separated Values (.csv), 113.86 KB) MD5:87e47a306e576cda15888bb4cf34f727
Primary data file for dataset ID 528022

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## Parameters

Parameter	Description	Units
Date	Date in Coordinated Universal Time (UTC); NIST	YYYYMMDD
Time	Time in Coordinated Universal Time (UTC); NIST	HHMM
Latitude	Latitude (South is negative); WGS 84	decimal degrees
Longitude	Longitude (West is negative); WGS 84	decimal degrees
TSG_Salinity	Salt content in Practical Salinity Units measured using the USCGC Healy's SBE45 instrument.	PSU
SST	Seawater Surface Temperature degrees Celsius measured using the USCGC Healy's SBE3 remote temperature probe. This value is the sea surface temperature	Degs Celsius
CT	Total amount of inorganic carbon present in seawater in micromoles per kilogram	micromole/kilogram
pH	pH at 25C (Total scale)	total scale

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## Instruments

<b>Dataset-specific Instrument Name</b>	MICA
<b>Generic Instrument Name</b>	Multi-parameter Inorganic Carbon Analyzer
<b>Dataset-specific Description</b>	Approximately 1,800 continuous measurements of pH, TCO <sub>2</sub> , salinity, and temperature were collected from August 31, 2012, to September 2, 2012, using a flow-through Multiparameter Inorganic Carbon Analyzer (MICA) and Sea-Bird SBE49 CTD attached to the flow-through system of the USCGC Healy
<b>Generic Instrument Description</b>	The Multi-parameter Inorganic Carbon Analyzer (MICA) developed in the USF/College of Marine Science is an autonomous multi-parameter flow-through CO <sub>2</sub> system capable of simultaneously measuring pH, carbon dioxide fugacity (fCO <sub>2</sub> ), atmospheric carbon dioxide partial pressure (pCO <sub>2</sub> ), and the total dissolved inorganic carbon (DIC) of natural water. Multiparameter Inorganic Carbon Analyzer (MICA)

<b>Dataset-specific Instrument Name</b>	pump-ship intake
<b>Generic Instrument Name</b>	Pump - Surface Underway Ship Intake
<b>Dataset-specific Description</b>	Approximately 1,800 continuous measurements of pH, TCO <sub>2</sub> , salinity, and temperature were collected from August 31, 2012, to September 2, 2012, using a flow-through Multiparameter Inorganic Carbon Analyzer (MICA) and Sea-Bird SBE49 CTD attached to the flow-through system of the USCGC Healy
<b>Generic Instrument Description</b>	The 'Pump-underway ship intake' system indicates that samples are from the ship's clean water intake pump. This is essentially a surface water sample from a source of uncontaminated near-surface (commonly 3 to 7 m) seawater that can be pumped continuously to shipboard laboratories on research vessels. There is typically a temperature sensor near the intake (known as the hull temperature) to provide measurements that are as close as possible to the ambient water temperature. The flow from the supply is typically directed through continuously logged sensors such as a thermosalinograph and a fluorometer. Water samples are often collected from the underway supply that may also be referred to as the non-toxic supply. Ideally the data contributor has specified the depth in the ship's hull at which the pump is mounted.

<b>Dataset-specific Instrument Name</b>	SBE 45 MicroTSG
<b>Generic Instrument Name</b>	Sea-Bird SBE 45 MicroTSG Thermosalinograph
<b>Dataset-specific Description</b>	Salt content in Practical Salinity Units measured using the USCGC Healy's SBE45 instrument.
<b>Generic Instrument Description</b>	A small externally powered, high-accuracy instrument, designed for shipboard determination of sea surface (pumped-water) conductivity and temperature. It is constructed of plastic and titanium to ensure long life with minimum maintenance. It may optionally be interfaced to an external SBE 38 hull temperature sensor. Sea Bird SBE 45 MicroTSG (Thermosalinograph)

<b>Dataset-specific Instrument Name</b>	SBE-49
<b>Generic Instrument Name</b>	Sea-Bird SBE 49 FastCAT CTD Sensor
<b>Dataset-specific Description</b>	Approximately 1,800 continuous measurements of pH, TCO <sub>2</sub> , salinity, and temperature were collected from August 31, 2012, to September 2, 2012, using a flow-through Multiparameter Inorganic Carbon Analyzer (MICA) and Sea-Bird SBE49 CTD attached to the flow-through system of the USCGC Healy
<b>Generic Instrument Description</b>	The SBE 49 FastCAT is a CTD sensor for use in autonomous platforms. It contains a SBE 3P temperature sensor, a SBE 4C conductivity sensor and a strain-gauge pressure sensor as standard. It can operate in autonomous (16 Hz per sec) or polled mode (transmits each sample). The sensor is depth-rated to 350 m (plastic housing) or 7000 m (titanium housing). Accuracy: +/- 0.002 deg C (temperature), +/- 0.0003 S/m (conductivity), 0.1% of full scale range (pressure).

<b>Dataset-specific Instrument Name</b>	SBE-3 Temperature
<b>Generic Instrument Name</b>	Sea-Bird SBE-3 Temperature Sensor
<b>Dataset-specific Description</b>	Seawater Surface Temperature degrees Celsius measured using the USCGC Healy's SBE3 remote temperature probe. This value is the sea surface temperature
<b>Generic Instrument Description</b>	The SBE-3 is a slow response, frequency output temperature sensor manufactured by Sea-Bird Electronics, Inc. (Bellevue, Washington, USA). It has an initial accuracy of +/- 0.001 degrees Celsius with a stability of +/- 0.002 degrees Celsius per year and measures seawater temperature in the range of -5.0 to +35 degrees Celsius. more information from Sea-Bird Electronics

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## Deployments

### HLY1202

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/523780">https://www.bco-dmo.org/deployment/523780</a>
<b>Platform</b>	USCGC Healy
<b>Report</b>	<a href="http://dmoserv3.whoi.edu/data_docs/OA_Canada_Basin/HEALY1202_FINAL_CRUISE_REPORT-3.pdf">http://dmoserv3.whoi.edu/data_docs/OA_Canada_Basin/HEALY1202_FINAL_CRUISE_REPORT-3.pdf</a>
<b>Start Date</b>	2012-08-26
<b>End Date</b>	2012-09-24
<b>Description</b>	Original cruise data are available from the NSF R2R data catalog USCGC Healy Science-Technical Support Summary From August 25 to September 27, 2012, the United States Coast Guard Cutter (USCGC) Healy was part of an Extended Continental Shelf Project to determine the limits of the extended continental shelf in the Arctic. On a non-interference basis, a USGS ocean acidification team participated on the cruise to collect baseline water data in the Arctic. The collection of data extended from coastal waters near Barrow, Alaska, to 83°2'N., -175°36'W., and southward back to coastal waters near Barrow and on to Dutch Harbor, Alaska. As a consequence, a number of hypotheses were tested and questions asked associated with ocean acidification, including: - What is the saturation state for different parts of the basin? - What factors drive the saturation state in the different parts of the basin? - How does saturation state compare to other regions? - How do the carbon fluxes compare in the different parts of the basin? - What is the buffering capacity of the water (Revelle factor)? - What kind of variability does carbon demonstrate in the Arctic (near shore versus offshore and diurnal)? During the cruise, underway continuous and discrete water samples were collected, and discrete water samples were collected at stations to document the carbonate chemistry of the Arctic waters and quantify the saturation state of seawater with respect to calcium carbonate. These data are critical for providing baseline information in areas where no data have existed prior and will also be used to test existing models and predict future trends.

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## Project Information

### Ocean Acidification in the Canada Basin: Roles of Sea Ice (OA - Canada Basin)

**Website:** <http://coastal.er.usgs.gov/ocean-acidification/polar.html>

**Coverage:** Beaufort Sea, Canada Basin

*Extracted from the NSF award abstract:*

The proposed research aims to identify mechanisms of ocean acidification and carbonate undersaturation in the Canada Basin of the Arctic Ocean. The investigators will use a 3-year dataset to address the role of two specific mechanisms involving sea-ice processes: (1) surface water freshening and undersaturation resulting from recent enhanced melting of multi-year sea-ice, and (2) surface water undersaturation resulting from a "carbon-pumping" mechanism driven by brine rejection and carbonate mineral precipitation during increasingly cyclical seasonal sea ice growth and decay. The proposed work would expand understanding of the inorganic carbon cycle, air-sea CO<sub>2</sub> exchange rates and acidification in the Arctic Ocean. Understanding baselines and how they are changing is important for setting realistic parameters for process studies on the effects of ocean acidification on flora and fauna.

Models project the Arctic Ocean will become undersaturated with respect to carbonate minerals in the next decade. Recent field results indicate parts may already be undersaturated in late summer months when ice melt is at its greatest extent. However, few comprehensive datasets of carbonate system parameters in the Arctic Ocean exist. Researchers from the U.S. Geological Survey (USGS) and University of South Florida (USF) collected high-resolution measurements of pCO<sub>2</sub>, pH, total dissolved inorganic carbon (DIC), total alkalinity (TA), and carbonate (CO<sub>3</sub>-2) from the Canada Basin that fill critical information gaps concerning Arctic carbon variability. A Multiparameter Inorganic Carbon Analyzer (MICA) was used to collect approximately 1,800 measurements of pH and DIC along an 11,965-km trackline in August and September 2012. In addition, over 500 discrete surface water samples were taken. These data are being used to characterize and model regional pCO<sub>2</sub>, pH, and carbonate mineral saturation state. A high-resolution, three-dimensional map of these results will be presented.

Data collected on the August 2012 Arctic Cruise will be used to create regional maps of seawater carbonate parameters, including pCO<sub>2</sub> flux/change maps, and derivative maps on saturation state. Maps depicting pCO<sub>2</sub> and carbonate saturation states over large latitudinal and nearshore to offshore gradients are needed for the Arctic, where significant decline of carbonate ecosystems, habitats, and calcifying organisms are predicted over the next decade. The data will allow the USGS to map variations in ocean chemistry along designated tracks and will be used in models to predict future Arctic Ocean saturation states.

*Note: Jonathan Wynn is a former Principal Investigator for this project*

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## **Program Information**

**Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)**

**Website:** [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503477](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477)

**Coverage:** global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF ([https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=504707](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707)).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

**Solicitations issued under this program:**

[NSF 10-530](#), FY 2010-FY2011

[NSF 12-500](#), FY 2012

[NSF 12-600](#), FY 2013

[NSF 13-586](#), FY 2014

NSF 13-586 was the final solicitation that will be released for this program.

**PI Meetings:**

[1st U.S. Ocean Acidification PI Meeting](#)(March 22-24, 2011, Woods Hole, MA)

[2nd U.S. Ocean Acidification PI Meeting](#)(Sept. 18-20, 2013, Washington, DC)

3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA - Tentative)

**NSF media releases for the Ocean Acidification Program:**

[Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification](#)

[Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?](#)

[Discovery nsf.gov - National Science Foundation \(NSF\) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation \(NSF\)](#)

[Press Release 12-179 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation \(NSF\)](#)

[Press Release 13-102 World Oceans Month Brings Mixed News for Oysters](#)

[Press Release 13-108 nsf.gov - National Science Foundation \(NSF\) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation \(NSF\)](#)

[Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants](#)

[Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation \(NSF\)](#)

[Press Release 14-010 nsf.gov - National Science Foundation \(NSF\) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation \(NSF\)](#)

[Press Release 14-116 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: NSF awards \\$11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation \(NSF\)](#)

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**Funding**

Funding Source	Award
<a href="#">NSF Arctic Sciences (NSF ARC)</a>	<a href="#">PLR-1220032</a>

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