

Radiocarbon data from R/V Blue Heron cruise BH10-14 on Lake Superior in August 2010 (Lake Superior Radiocarbon project)

Website: <https://www.bco-dmo.org/dataset/3920>

Data Type: Cruise Results

Version: 1

Version Date: 2013-07-19

Project

» [How important is quote old unquote Carbon in Lake Superior. A Radiocarbon Investigation](#) (Lake Superior Radiocarbon)

Contributors	Affiliation	Role
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Abstract

Radiocarbon data from R/V Blue Heron cruise BH10-14 on Lake Superior in August 2010.

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Coverage

Spatial Extent: N:48.027 E:-86.63017 S:46.836 W:-92.0054

Temporal Extent: 2010-08-25 - 2010-09-01

Dataset Description

DIC, DOC, POC, Zoopl Carbon concentration & isotopic data.
For POC and zooplankton C/N ratios also included.

Related files and references:

Sampling procedures, instrumentation, discussion of blanks, etc, included in Zigah, P.K., E.C. Minor, J.P. Werne, and S. L. McCallister, 2011. Radiocarbon and stable carbon isotopic insights into provenance and cycling of carbon in Lake Superior. *Limnology and Oceanography* 56(3), 867-886.

Methods & Sampling

Because the samples are initially processed on deck and radiocarbon is being measured, the engines of the R/V Blue Heron are shut down during this time allowing the vessel to drift (engines not going and thus less possibility for contamination from the stack), until the processing of the samples has been completed.

Related files and references:

Sampling procedures, instrumentation, discussion of blanks, etc, included in Zigah, P.K., E.C. Minor, J.P. Werne, and S. L. McCallister, 2011. Radiocarbon and stable carbon isotopic insights into provenance and cycling of carbon in Lake Superior. *Limnology and Oceanography* 56(3), 867-886.

Isotopic data were processed as described in Radiocarbon Data & Calculations:

<http://www.whoi.edu/nosams/page.do?pid=40146>

Concentration data for DOC and DIC are from a Shimadzu TOC-Vcsh Analyzer.

For DIC, the analyzer was calibrated using primary standard grade sodium carbonate and ACS reagent grade sodium bicarbonate. The inorganic carbon in the sample was volatilized with 25% H₃PO₄ (by weight) in a CO₂-free closed reaction vessel, and the CO₂ evolved was measured by a non-dispersive infrared (NDIR) gas detector.

For DOC, the samples were acidified to pH 2 with ACS reagent grade HCl at the time of sampling. The TOC analyzer was run in NPOC mode and calibrated with potassium hydrogen phthalate (KHP). Deep seawater from Florida Strait at 700 m (Batch-8 2008) reference waters obtained from the DOC Consensus Reference Program (Hansell laboratory, University of Miami, USA) and additional KHP standards were interspersed and analyzed along with the samples to assess instrumental performance.

Our mean DOC value of the external reference sample was $43.9 \pm 3.9 \mu\text{M}$ ($n = 5$), and agrees with the consensus value of 41-43 μM . For each sample and standard, three injections were performed. If the standard deviation was not $\leq 2.5\%$, two more injections were performed and the closest three of the five injections were averaged to yield sample concentration.

Particulate organic samples (on GF/F filters) were fumigated with HCl, dried, then loaded into tin capsules and analyzed for particulate organic carbon (POC) and particulate organic nitrogen (PON) concentrations using a Costech ECS 4010 elemental analyzer (EA) coupled to Finnigan Delta Plus XP isotope ratio mass spectrometer (IRMS). The EA was calibrated with acetanilide (Costech Analytical Technologies Inc., Valencia, CA, USA) and caffeine (SigmaUltra; Wheaton Science Products, NJ, USA) reference standard materials; C and N were quantified using the IRMS. Typical instrumental precisions for POC and PON measurements were respectively, 0.2% and 0.4% of the measured concentrations.

Data Processing Description

BCO-DMO Processing Notes

Generated from original .xls file "Collated_2010_radiocarbon.xls" contributed by Elizabeth Minor

BCO-DMO Edits

- Column inserted with cruise_id
- Station Id generated from "Submitter Identification"
- Lat/Lon values input from CTD Station Locations
- Amity Creek Station Location from Google Earth
- Date Recorded converted to YYYYMMDD
- "nd" (no data) value inserted in blank cells
- Commas in various fields converted to semicolons
- "<" symbol changed to "lt"
- Parameter names modified to conform to BCO-DMO convention
- Misc leading and trailing spaces and tabs in various fields removed
- Blank lines removed - Misc data checks performed 19July2013, srg

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Data Files

File**August2010_Radiocarbon.csv**(Comma Separated Values (.csv), 6.93 KB)

MD5:095d4a667f17a13328ebf968a94f4d73

Primary data file for dataset ID 3920

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Parameter	Description	Units
cruise_id	Cruise Id	text
Receipt_Number	Receipt Number	dimensionless
Date_Reported	Date the samples were analyzed at NOSAMS in yyyyymmdd format.	unitless
station_id	Station Id	text
lat	Latitude (South is negative)	decimal degrees
lon	Longitude (West is negative)	decimal degrees
Submitter_Identification	Submitter Identification Comments from original sheet: Comment 1: HMW DOM are 1kDa material Comment 2: DOCW means	text
Type	Type	text
Process	Process type	text
Accession_Number	Accession Number	OS-xxxxx
F_Modern	fraction modern	Unitless
Fm_Error	the error in fraction modern (as determined by NOSAMS)	Unitless
Age	Age	Radiocarbon years
Age_Error	Age Error	Radiocarbon years
d13C	delta13C	per mille
d13C_Source	delta13C Source	text
D14C	DELTA14C	per mille
DIC_Conc	DIC Conc	mmol/kg
DOC_Conc	DOC Conc	um/kg

[\[table of contents \]](#) | [\[back to top \]](#)**Instruments**

Dataset-specific Instrument Name	CHN Elemental Analyzer
Generic Instrument Name	CHN Elemental Analyzer
Dataset-specific Description	Costech ECS 4010 elemental analyzer (EA) Finnigan Delta Plus XP isotope ratio mass spectrometer (IRMS) Particulate organic samples (on GF/F filters) were fumigated with HCl, dried, then loaded into tin capsules and analyzed for particulate organic carbon (POC) and particulate organic nitrogen (PON) concentrations using a Costech ECS 4010 elemental analyzer (EA) coupled to Finnigan Delta Plus XP isotope ratio mass spectrometer (IRMS). The EA was calibrated with acetanilide (Costech Analytical Technologies Inc., Valencia, CA, USA) and caffeine (SigmaUltra; Wheaton Science Products, NJ, USA) reference standard materials; C and N were quantified using the IRMS. Typical instrumental precisions for POC and PON measurements were respectively, 0.2% and 0.4% of the measured concentrations.
Generic Instrument Description	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

Dataset-specific Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Costech ECS 4010 elemental analyzer (EA) Finnigan Delta Plus XP isotope ratio mass spectrometer (IRMS) Particulate organic samples (on GF/F filters) were fumigated with HCl, dried, then loaded into tin capsules and analyzed for particulate organic carbon (POC) and particulate organic nitrogen (PON) concentrations using a Costech ECS 4010 elemental analyzer (EA) coupled to Finnigan Delta Plus XP isotope ratio mass spectrometer (IRMS). The EA was calibrated with acetanilide (Costech Analytical Technologies Inc., Valencia, CA, USA) and caffeine (SigmaUltra; Wheaton Science Products, NJ, USA) reference standard materials; C and N were quantified using the IRMS. Typical instrumental precisions for POC and PON measurements were respectively, 0.2% and 0.4% of the measured concentrations.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Shimadzu TOC-V Analyzer
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	Concentration data for DOC and DIC are from a Shimadzu TOC-Vcsh Analyzer.
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

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Deployments

BH10-14

Website	https://www.bco-dmo.org/deployment/59025
Platform	R/V Blue Heron
Start Date	2010-08-25
End Date	2010-09-01
Description	Original data are available from the NSF R2R data catalog

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Project Information

How important is quote old unquote Carbon in Lake Superior. A Radiocarbon Investigation (Lake Superior Radiocarbon)

Coverage: Lake Superior

Organic carbon present in aquatic ecosystems has the potential to either be sequestered by sedimentary organic matter or recycled and contributed to the atmosphere through microbial respiration. Ultimately, the fate of organic matter is dependant upon its source, as well as the physical transport mechanisms and biogeochemical transformations it is exposed to in the water column. Because these processes vary significantly within aquatic systems, such as the ocean, it is difficult to assess the biogeochemical importance of organic carbon; however, it is a problem of critical importance whose results could be utilized to resolve key issues in global biogeochemical carbon cycles and to determine the net heterotrophy of most aquatic environments.

Scientists from the University of Minnesota-Duluth and Virginia Commonwealth University would address this problem by studying organic carbon dynamics in Lake Superior because its biogeochemistry is similar to that of the world ocean. Using Lake Superior as a natural laboratory, the researchers plan to carry out radiocarbon measurements of particulate organic carbon (POC), dissolved organic carbon (DOC), dissolved inorganic carbon (DIC), and bacterially-respired CO₂, as well as obtain the chemical composition of DOC and POC during stratified and non-stratified periods. Results would be used to identify the sources of carbon in the lake and determined transformations of carbon between POC, DOC, DIC, and bacterially-respired CO₂.

Educational impacts include workshops and presentation for K-12 audiences as well as research and training opportunities for graduate and undergraduate students in Water Resources Science and Biochemistry classes.

[Cruise pictures and info \(for a general audience\)](#)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0825600

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