

Composition of dissolved organic matter in Arctic sea ice and the underlying water column

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What were the primary questions you were trying to address with this research? (Or, if more appropriate, was there a hypothesis or theory that you were trying to prove or disprove?)

The primary questions of this project were (1) What is the quantity and composition of dissolved organic matter in Arctic sea ice and the underlying water column? And (2) how is dissolved organic matter partitioned between sea ice and the underlying water column, and is there spatial variability in the partitioning of organic matter?

What have you discovered or learned that you didn't know before you started this work?

This project is the first molecular-level assessment of dissolved organic matter in Arctic sea ice. While data analysis has only just begun, I will be able to identify organic compounds characteristic of sea ice and use that information to define how organic matter is (or is not) transferred between sea ice and the water column.

What is the significance of your findings for others working in this field of inquiry and for the broader scientific community?

Changes in sea ice have already altered the Arctic carbon cycle. However, there is no baseline information on the composition of organic matter found within sea ice. This study is providing fundamental information on the organic compounds found in sea ice. These compounds may have different fates in the absence of sea ice, yet without prior knowledge about the organic compounds, we cannot determine their role in the future Arctic carbon cycle.

What is the significance of this research for society?

Organic matter is mostly ignored by society because you cannot see organic compounds and thus studying organic matter requires specialized instrumentation. Yet organic matter is the base of the food web and changes in organic compounds could have ramifications that reverberate throughout Arctic environments.

What were the most unusual or unexpected results and opportunities in this investigation?

Berths on Arctic icebreakers are difficult for researchers to obtain because of the limited number of ships working in the area. This funding enabled a researcher new to Arctic research to participate in an Arctic cruise, and to obtain and analyze samples collected during the cruise. The ongoing data analysis will be used as preliminary results in a proposal to be submitted to NSF in 2013.

What were the greatest challenges and difficulties?

The cruise was repeatedly delayed which has also delayed the processing of samples associated with this project. Furthermore, the cruise (originally intended for January-February) was shifted to earlier in winter because of a change in availability of US icebreakers. While we were still obtain to obtain sufficient ice and water samples, the sample processing is not yet complete for the project due to the delays.

When and where was this investigation conducted? (For instance, did you conduct new field research, or was this a new analysis of existing data?)

This research was conducted in the Bering, Chukchi, and Beaufort Seas during a November to December 2011 cruise.

What were the key tools or instruments you used to conduct this research?

The primary instrument used to analyze these samples was the 7-T ESI FT-ICR mass spectrometer located in the FT-MS facility at WHOI.

Is this research part of a larger project or program?

The cruise was an NSF-funded collaborative project lead by researchers at WHOI (Carin Ashjian), University of Rhode Island (Robert Campbell), and University of Alaska Fairbanks (Steven Okkonen).

What are your next steps?

The data analysis will be completed in the fall of 2012 and the results presented at the Alaska Marine Sciences Symposium in early 2013. A proposal for NSF is planned for 2013. In addition, the funding from OCCI has allowed Longnecker to establish new scientific collaborations with Arctic researchers that will be valuable in allowing Longnecker to continue research into organic matter in the Arctic.