

Palmer Station Sediment Trap

Website: <https://www.bco-dmo.org/dataset/881127>

Data Type: Cruise Results

Version: 1

Version Date: 2022-08-02

Project

» [Quantifying Processes Driving Interannual Variability in the Biological Carbon Pump in the Western Antarctic Peninsula](#) (WAP Carbon export)

Contributors	Affiliation	Role
Stukel, Michael	Florida State University (FSU - EOAS)	Principal Investigator
Newman, Sawyer	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Table of Contents

- [Dataset Description](#)
 - [Methods & Sampling](#)
- [Related Publications](#)
- [Parameters](#)
- [Instruments](#)
- [Project Information](#)
- [Funding](#)

Methods & Sampling

Data comes from VERTEX-style, bottom-tethered (moored) sediment trap deployments. Particle interceptor tubes were deployed on cross-pieces with 4 tubes attached at a depth of 50 m. Tubes were deployed with a dense formaldehyde brine created by adding NaCl and formaldehyde to filtered seawater. After recovery, overlying seawater was removed from each tube by gentle suction. Tubes were then gravity filtered through a 200-micron nitex mesh filter, and the 200-micron filters were carefully analyzed under a stereomicroscope and all metazoan zooplankton “swimmers” were removed from the sample. Filtrate and remaining material on the 200-micron filter were then each filtered through separate pre-combusted quartz (QMA) filter. Samples were then dried, mounted in RISO plachets and counted on a RISO low-level beta multi-counter. After subsequent background counts, samples were acidified to remove calcium carbonate and analyzed for carbon and nitrogen on an elemental analyzer.

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

Related Publications

Stukel, M. R., Asher, E., Couto, N., Schofield, O., Strebel, S., Tortell, P., & Ducklow, H. W. (2015). The imbalance of new and export production in the western Antarctic Peninsula, a potentially “leaky” ecosystem. *Global Biogeochemical Cycles*, 29(9), 1400–1420. Portico. <https://doi.org/10.1002/2015gb005211>

<https://doi.org/10.1002/2015GB005211>

Methods

Stukel, M. R., Schofield, O. M. E., & Ducklow, H. W. (2022). Seasonal variability in carbon:234thorium ratios of suspended and sinking particles in coastal Antarctic waters: Field data and modeling synthesis. *Deep Sea Research Part I: Oceanographic Research Papers*, 184, 103764. <https://doi.org/10.1016/j.dsr.2022.103764>

Methods

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

Parameters

Parameters for this dataset have not yet been identified

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

Instruments

Dataset-specific Instrument Name	Riso low-level GM beta multi-counter
Generic Instrument Name	GM multiscouter
Dataset-specific Description	Collected sediment trap samples were dried, mounted in RISO planchets and counted on a RISO low-level beta multi-counter.
Generic Instrument Description	A gas flow multiscouter (GM multiscouter) is used for counting low-level beta doses. GM multiscouters can be used for gas proportional counting of ^{32}Si to ^{32}P . For more information about GM multiscouter usage see Krause et. al. 2011.

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

Project Information

Quantifying Processes Driving Interannual Variability in the Biological Carbon Pump in the Western Antarctic Peninsula (WAP Carbon export)

Coverage: Western Antarctic Peninsula (Palmer LTER Study Region)

NSF abstract:

Algae in the surface ocean convert carbon dioxide into organic carbon through photosynthesis. The biological carbon pump transports this organic carbon from the atmosphere to the deep ocean where it can be stored for tens to hundreds of years. Annually, the amount transported is similar to that humans are currently emitting by burning fossil fuels. However, at present we cannot predict how this important process will change with a warming ocean. These investigators plan to develop a 15+ year time-series of vertical carbon transfer for the Western Antarctic Peninsula; a highly productive Antarctic ecosystem. This region is also rapid transition to warmer temperatures leading to reduced sea ice coverage. This work will help researchers better understand how the carbon cycle in the Western Antarctic Peninsula will respond to climate change. The researchers will develop the first large-scale time-series of carbon flux anywhere in the ocean. This research will also support the education and training of a graduate student and support the integration of concepts in Antarctic research into two undergraduate courses designed for non-science majors and advanced earth science students. The researchers will also develop educational modules for introducing elementary and middle-school age students to important concepts such as gross and net primary productivity, feedbacks in the marine and atmospheric systems, and the differences between correlation and causation. Results from this proposal will also be incorporated into a children's book, "Plankton do the Strangest Things", that is targeted at 5-7 year olds and is designed to introduce them to the incredible diversity and fascinating adaptations of microscopic marine organisms.

This research seeks to leverage 6 years (2015-2020) of ^{234}Th samples collected on Palmer LTER program, 5 years of prior measurements (2009-2010, 2012-2014), and upcoming cruises (2021-2023) to develop a time-series of summertime particle flux in the WAP that stretches for 15 years. The ^{238}U - ^{234}Th disequilibrium approach utilizes changes in the activity of the particle-active radio-isotope ^{234}Th relative to its parent nuclide ^{238}U to quantify the flux of sinking carbon out of the surface ocean (over a time-scale of ~one month). This

proposal will fund ^{234}Th analyses from nine years' worth of cruises (2015-2023) and extensive analyses designed to investigate the processes driving inter-annual variability in the BCP. These include: 1) physical modeling to quantify the importance of advection and diffusion in the ^{234}Th budget, 2) time-series analyses of particle flux, and 3) statistical modeling of the relationships between particle flux and multiple presumed drivers (biological, chemical, physical, and climate indices) measured by collaborators in the Palmer LTER program. This multi-faceted approach is critical for linking the measurements to models and for predicting responses to climate change. It will also test the hypothesis that export flux is decreasing in the northern WAP, increasing in the southern WAP, and increasing when integrated over the entire region as a result of earlier sea ice retreat and a larger ice-free zone. The project will also investigate relationships between carbon export and multiple potentially controlling factors including: primary productivity, algal biomass and taxonomic composition, biological oxygen saturation, zooplankton biomass and taxonomic composition, bacterial production, temperature, wintertime sea ice extent, date of sea ice retreat, and climate modes.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756610
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1951090
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1340886
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1440435

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