

Dissolved oxygen from sediment cores collected on the R/V Nathaniel B. Palmer cruise NBP1601 to the West Antarctic continental shelf in January of 2016

Website: <https://www.bco-dmo.org/dataset/813140>

Data Type: Cruise Results

Version: 1

Version Date: 2020-06-08

Project

» [Organic Carbon Oxidation and Iron Remobilization by West Antarctic Shelf Sediments](#) (Antarctic Shelf Sediments)

Contributors	Affiliation	Role
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Abstract

Dissolved oxygen from sediment cores collected on the R/V Nathaniel B. Palmer cruise NBP1601 to the West Antarctic continental shelf in January of 2016.

Table of Contents

- [Coverage](#)
 - [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
 - [Data Files](#)
 - [Supplemental Files](#)
 - [Related Publications](#)
 - [Parameters](#)
 - [Instruments](#)
 - [Deployments](#)
 - [Project Information](#)
 - [Funding](#)
-

Coverage

Spatial Extent: N:-64.1583 E:-62.7317 S:-67.2417 W:-71.2217

Temporal Extent: 2016-01-15 - 2016-01-29

Dataset Description

Dissolved oxygen from sediment cores collected on the R/V Nathaniel B. Palmer cruise NBP1601 to the West Antarctic continental shelf in January of 2016.

Methods & Sampling

Sediment and pore water collection:

Short sediment cores were collected using a Bowers & Connelly megacorer, a multiple coring device that can collect ~20-40 cm long sediment cores with undisturbed sediment surfaces. Megacorer cores were either sectioned for solid phase analysis, profiled with polarographic microelectrodes to determine dissolved O₂

concentrations, or sectioned in a cold van under N2 for pore water sample extraction.

Dissolved oxygen analyses:

This was carried out by microprofiling sediment cores in a cold room using voltametric gold-amalgam (Au/Hg) microelectrodes, as described in detail elsewhere (Brendel and Luther, 1995; Luther et al., 1998; Luther et al., 2008). An Analytical Instrument Systems model DLK-100 voltammetric analyzer was used for all measurements, with profiling carried out using an AIS computer-controlled automated micromanipulator. Oxygen was determined by linear-sweep voltammetry (voltage range: -0.1 to -1.8 V, scan rate: 200 mV/s), and quantified based on the peak height at roughly -0.3 V. Electrodes were calibrated using a two-point calibration curve with O2 saturated bottom water and the electrode response in the deeper O2-free zone of the sediments (Cai and Sayles, 1996). Five scans were carried out at each depth, with the last three scans typically averaged for concentration determinations.

Data Processing Description

BCO-DMO Data Manager Processing Notes:

- * Data from file "O2 data.txt" imported into the BCO-DMO data system.
- * added a conventional header with dataset name, PI name, version date
- * modified parameter names to conform with BCO-DMO naming conventions (spaces, +, and - changed to underscores).
- * blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
- * Joined with supplemental station information file to add lat and lon into the dataset.
- * Added column for ISO_DateTime_UTC in 8601 format from fields in local time UTC-3.

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

Data Files

File
o2.csv (Comma Separated Values (.csv), 107.98 KB) MD5:da7041a1309163b2523a1f0f82d8b626
Primary data file for dataset ID 813140

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

Supplemental Files

File

NBP 1601 Station Information

filename: stations.csv

(Comma Separated Values (.csv), 1.63 KB)
MD5:2d8b6e6a1341ed3f9d2e6e61d7368c6c

Station locations and sampling information on cruise NBP 1601 (R/V Nathaniel B. Palmer, January 2016).

Comma delimited file with column names: St_ID,Mo,Da,Yr,Time,Lat,Lon,Activity,ISO_DateTime_UTC

Parameter information:

St_ID,Station identifier,unitless

Mo,"Month (local time, Punta Arenas, UTC-3)",unitless

Da,"Day (local time, Punta Arenas, UTC-3)",unitless

Yr,"Year in format yyyy (local time, Punta Arenas, UTC-3)",unitless

Time,"Time in format HH:MM (local time, Punta Arenas, UTC-3)",unitless

Lat,Station latitude,decimal degrees

Lon,Station longitude,decimal degrees

Activity,"C = CTD cast; M = Mega-core collected; K = Kasten core collected",unitless

ISO_DateTime_UTC,Station date and time (UTC) in ISO 8601 format yyyy-mm-ddTHH:MMZ,unitless

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

Related Publications

Brendel, P. J., & Luther, G. W. I. (1995). Development of a Gold Amalgam Voltammetric Microelectrode for the Determination of Dissolved Fe, Mn, O₂, and S(-II) in Porewaters of Marine and Freshwater Sediments. *Environmental Science & Technology*, 29(3), 751–761. doi:[10.1021/es00003a024](https://doi.org/10.1021/es00003a024)

Methods

Cai, W.-J., & Sayles, F. L. (1996). Oxygen penetration depths and fluxes in marine sediments. *Marine Chemistry*, 52(2), 123–131. doi:10.1016/0304-4203(95)00081-x [https://doi.org/10.1016/0304-4203\(95\)00081-X](https://doi.org/10.1016/0304-4203(95)00081-X)

Methods

Luther, G. W., Brendel, P. J., Lewis, B. L., Sundby, B., Lefrançois, L., Silverberg, N., & Nuzzio, D. B. (1998). Simultaneous measurement of O₂, Mn, Fe, I⁻, and S(-II) in marine pore waters with a solid-state voltammetric microelectrode. *Limnology and Oceanography*, 43(2), 325–333. doi:[10.4319/lo.1998.43.2.0325](https://doi.org/10.4319/lo.1998.43.2.0325)

Methods

Luther, G. W., Glazer, B. T., Ma, S., Trouwborst, R. E., Moore, T. S., Metzger, E., ... Brendel, P. J. (2008). Use of voltammetric solid-state (micro)electrodes for studying biogeochemical processes: Laboratory measurements to real time measurements with an in situ electrochemical analyzer (ISEA). *Marine Chemistry*, 108(3-4), 221–235. doi:[10.1016/j.marchem.2007.03.002](https://doi.org/10.1016/j.marchem.2007.03.002)

Methods

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

Parameters

Parameter	Description	Units
St_ID	station ID number	unitless
Core	core ID number	unitless
Profile	profile number (a = first profile of a core; b = second profile of the same core)	unitless
Sample_Comment	Sample comment. "BW CTD" = dissolved oxygen measurements made with the CTD sensor ~5-10 meters off the seafloor	unitless
Depth	depth into the core relative to the sediment-water interface(0 = sediment surface; negative value are in the water overlying the core.	centimeters (cm)
O2	dissolved oxygen (bd = below analytical detection limit)	micromolar (uM)
Month	month (core collected). Local time (Punta Arenas, UTC-3).	unitless
Day_Coll	day (core collected). Local time (Punta Arenas, UTC-3).	unitless
Year	year (core collected) in format yyyy. Local time (Punta Arenas, UTC-3).	unitless
T_Coll	time core collected in format HH:MM:SS	unitless
Day_Prfl	day (profiling). Local time (Punta Arenas, UTC-3).	unitless
T_Prfl	time start of profiling in format HH:MM:SS. Local time (Punta Arenas, UTC-3).	unitless
Lat	station latitude, south is negative	decimal degrees
Lon	station longitude, west is negative	decimal degrees
ISO_DateTime_UTC_Prof	timestamp (UTC) at the start of profiling in ISO 8601 format yyyy-mm-ddTHH:MMZ	unitless
ISO_DateTime_UTC_Coll	timestamp (UTC) when the time core was collected in ISO 8601 format yyyy-mm-ddTHH:MMZ	unitless

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

Instruments

Dataset-specific Instrument Name	Bowers & Connelly megacorer
Generic Instrument Name	Multi Corer
Dataset-specific Description	Short sediment cores were collected using a Bowers & Connelly megacorer, a multiple coring device that can collect ~20-40 cm long sediment cores with undisturbed sediment surfaces.
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in <i>Oceanologica Acta</i> , 7, pp. 399-408.

Dataset-specific Instrument Name	Analytical Instrument Systems model DLK-100
Generic Instrument Name	Voltammetry Analyzers
Generic Instrument Description	Instruments that obtain information about an analyte by applying a potential and measuring the current produced in the analyte.

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

Deployments

NBP1601

Website	https://www.bco-dmo.org/deployment/813143
Platform	RVIB Nathaniel B. Palmer
Start Date	2016-01-08
End Date	2016-02-03

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

Project Information

Organic Carbon Oxidation and Iron Remobilization by West Antarctic Shelf Sediments (Antarctic Shelf Sediments)

Coverage: West Antarctic Continental Shelf

NSF Award Abstract:

General Statement:

The continental shelf region west of the Antarctic Peninsula has recently undergone dramatic changes and ecosystem shifts, and the community of organisms that live in, or feed off, the sea floor sediments is being impacted by species invasions from the north. Previous studies of these sediments indicate that this community may consume much more of the regional productivity than previously estimated, suggesting that sediments are a rich and important component of this ecosystem and one that may be ripe for dramatic change. Furthermore, under richer sediment conditions, iron is mobilized and released back to the water column. Since productivity in this ecosystem is thought to be limited by the availability of iron, increased rates of iron release from these sediments could stimulate productivity and promote greater overall ecosystem change. In this research, a variety of sites across the shelf region will be sampled to accurately evaluate the role of sediments in consuming ecosystem productivity and to estimate the current level of iron release from the sediments. This project will provide a baseline set of sediment results that will present a more complete picture of the west Antarctic shelf ecosystem, will allow for comparison with water column measurements and for evaluation of the fundamental workings of this important ecosystem. This is particularly important since high latitude systems may be vulnerable to the effects of climate fluctuations. Both graduate and undergraduate students will be trained. Presentations will be made at scientific meetings, at other universities, and at outreach events. A project web site will present key results to the public and explain how this new information improves understanding of Antarctic ecosystems.

Technical Description of Project:

In order to determine the role of sediments within the west Antarctic shelf ecosystem, this project will determine the rates of sediment organic matter oxidation at a variety of sites across the Palmer Long Term Ecosystem Research (LTER) study region. To estimate the rates of release of iron and manganese from the sediments, these same sites will be sampled for detailed vertical distributions of the concentrations of these metals both in the porewaters and in important mineral phases. Since sediment sampling will be done at LTER

sites, the sediment data can be correlated with the rich productivity data set from the LTER. In detail, the project: a) will determine the rates of oxygen consumption, organic carbon oxidation, nutrient release, and iron mobilization by shelf sediments west of the Antarctic Peninsula; b) will investigate the vertical distribution of diagenetic reactions within the sediments; and c) will assess the regional importance of these sediment rates. Sediment cores will be used to determine sediment-water fluxes of dissolved oxygen, total carbon dioxide, nutrients, and the vertical distributions of these dissolved compounds, as well as iron and manganese in the pore waters. Bulk sediment properties of porosity, organic carbon and nitrogen content, carbonate content, biogenic silica content, and multiple species of solid-phase iron, manganese, and sulfur species will also be determined. These measurements will allow determination of total organic carbon oxidation and denitrification rates, and the proportion of aerobic versus anaerobic respiration at each site. Sediment diagenetic modeling will link the processes of organic matter oxidation to metal mobilization. Pore water and solid phase iron and manganese distributions will be used to model iron diagenesis in these sediments and to estimate the iron flux from the sediments to the overlying waters. Finally, the overall regional average and distribution of the sediment processes will be compared with the distributions of seasonally averaged chlorophyll biomass and productivity.

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

Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1551195

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