

# Wintertime nitrate delta 15N and delta 18O from the surface (underway) from R/V S. A. Agulhas II cruise VOY03 in the Southern Ocean south of Africa in 2012 (Diatom-bound\_N\_Isotopes project)

**Website:** <https://www.bco-dmo.org/dataset/557900>

**Version:** 07 May 2015

**Version Date:** 2015-05-07

## Project

» [High-resolution, Assemblage-specific Records of Diatom-bound N Isotopes from the Indian Sector of the Antarctic Ocean](#) (Diatom-bound\_N\_Isotopes)

Contributors	Affiliation	Role
<a href="#">Sigman, Daniel M.</a>	Princeton University	Principal Investigator
<a href="#">Smart, Sandi M.</a>	Stellenbosch University	Contact
<a href="#">Rauch, Shannon</a>	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

## Table of Contents

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

## Dataset Description

Wintertime nitrate delta 15N and delta 18O from the Southern Ocean south of Africa from the surface (underway) taken on the July 2012 R/V *S.A. Agulhas II* VOY03 expedition.

Note: In addition to the awards identified below, the dataset was also supported by funding from the South African National Research Foundation (NRF), Applied Centre for Climate and Earth Systems Science (ACCESS), University of Cape Town (UCT), and the Grand Challenges Program of Princeton University.

## Methods & Sampling

Samples were collected aboard the R/V *S.A. Agulhas II* and analyzed in the Sigman lab at Princeton University using the "denitrifier method" to convert sample nitrate to N<sub>2</sub>O gas. The isotopic composition of N<sub>2</sub>O was measured by GC-IRMS using a Thermo MAT 253 mass spectrometer with a purpose-built on-line N<sub>2</sub>O extraction and purification system. For the nitrate+nitrite data, the pooled sample standard deviation is 0.05‰ for delta 15N (n = 3-7) and 0.17‰ for delta 18O (n = 3-5). For the 'nitrate-only' data, the pooled sample standard deviation is 0.05‰ for delta 15N (n = 3-7) and 0.13‰ for delta 18O (n = 3-7). See methods section of Smart et al. (2015) for details of sample collection, isotope analysis and data quality.

## Related Publications:

Smart, S.M., S.E. Fawcett, S.J. Thomalla, M.A. Weigand, C.J.C. Reason, and D.M. Sigman. 2015. Isotopic evidence for nitrification in the Antarctic winter mixed layer, *Global Biogeochem. Cycles*, 29, doi:

## Data Processing Description

Individual sample analyses were referenced against automated injections of N<sub>2</sub>O from a gas cylinder; however, the N<sub>2</sub>O cylinder is not used as the absolute reference. Rather, each sample run included replicates of two international reference materials, IAEA-N3 and USGS-34 that were used to calibrate isotope ratios to that of N<sub>2</sub> in air (for delta 15N) and VSMOW (for delta 18O). An in-house N<sub>2</sub>O standard was also run with each batch of samples to monitor mass spectrometry. See methods section of Smart et al. (2015) for a description of the procedures followed.

BCO-DMO Processing Notes:

- Modified parameter names to conform with BCO-DMO naming conventions.
- Replaced blanks (missing data) with 'nd', meaning 'no data'.

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

## Data Files

File
<b>underway.csv</b> (Comma Separated Values (.csv), 5.23 KB) MD5:6eff6137e81657639aa1172fcd7bfbb Primary data file for dataset ID 557900

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

## Parameters

Parameter	Description	Units
sample	Sample ID number.	dimensionless
date	Month, day, and year of sampling (GMT).	mm/dd/yy
month	2-digit month of year.	mm (01 to 12)
day	2-digit day of month.	dd (01 to 31)
year	4-digit year.	YYYY
time	Time (GMT), in hours, minutes, and decimal minutes, of sampling.	HHMM.mm
lat	Latitude in decimal degrees North. (Negative values = South).	decimal degrees

lon	Longitude in decimal degrees East.	decimal degrees
depth	Sample depth.	meters
NO3_NO2_mean	Mean nitrate (NO3) plus nitrite (NO2) concentration of a sample in micromolar units.	micromolar (uM)
NO3_NO2_stdev	Standard deviation of the nitrate (NO3) plus nitrite (NO2) concentration of a sample in micromolar units.	micromolar (uM)
d15N_NO3_NO2_mean	delta 15N of NO3+NO2. d15N (‰ vs. AIR) is the nitrogen isotopic composition of a sample expressed in delta notation (in units of per mil) relative to atmospheric N2, where $\delta 15N = \{ [ (15N/14N)_{sample} / (15N/14N)_{atmN2} ] - 1 \} \times 1000$ .	per mil
d15N_NO3_NO2_stdev	Standard deviation of d15N_NO3_NO2_mean.	per mil
d18Ocorr_NO3_NO2_mean	delta 18O of NO3+NO2. d18O (‰ vs. VSMOW) is the oxygen isotopic composition of a sample expressed in delta notation (in units of per mil) relative to Vienna Standard Mean Ocean Water (VSMOW), where $\delta 18O = \{ [ (18O/16O)_{sample} / (18O/16O)_{VSMOW} ] - 1 \} \times 1000$ .	per mil
d18O_NO3_NO2_stdev	Standard deviation of d18O_NO3_NO2_mean.	per mil
NO3_mean	Mean nitrate (NO3) concentration of a sample in micromolar units, measured after nitrite (NO2) had been removed (using the protocol of Granger and Sigman (2009)).	micromolar (uM)
NO3_stdev	Standard deviation of the nitrate (NO3) concentration of a sample in micromolar units, measured after nitrite (NO2) had been removed (using the protocol of Granger and Sigman (2009)).	micromolar (uM)
d15N_NO3_mean	delta 15N of NO3. d15N (‰ vs. AIR) is the nitrogen isotopic composition of a sample expressed in delta notation (in units of per mil) relative to atmospheric N2, where $\delta 15N = \{ [ (15N/14N)_{sample} / (15N/14N)_{atmN2} ] - 1 \} \times 1000$ .	per mil
d15N_NO3_stdev	Standard deviation of d15N_NO3_mean.	per mil

d18O_NO3_mean	delta 18O of NO3. d18O (‰ vs. VSMOW) is the oxygen isotopic composition of a sample expressed in delta notation (in units of per mil) relative to Vienna Standard Mean Ocean Water (VSMOW), where $\delta 18O = \left[ \left( \frac{18O}{16O} \right)_{\text{sample}} / \left( \frac{18O}{16O} \right)_{\text{VSMOW}} - 1 \right] \times 1000$ .	per mil
d18O_NO3_stdev	Standard deviation of d18O_NO3_mean.	per mil
ISO_DateTime.UTC	Date and time (UTC) formatted to ISO 8601 standard, where T indicates the start of the time string and Z indicates UTC.	YYYY-mm-ddTHH:MM:SS.xZ

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

## Instruments

<b>Dataset-specific Instrument Name</b>	Sea-Bird conductivity-temperature-depth (CTD)
<b>Generic Instrument Name</b>	CTD Sea-Bird
<b>Dataset-specific Description</b>	The major circumpolar fronts were identified from surface and subsurface (200m) temperature and salinity properties using data obtained from a Sea-Bird conductivity-temperature-depth (CTD) sensor mounted on the Niskin bottle rosette, as well as from 28 underway-CTD and 88 expendable bathythermograph deployments.
<b>Generic Instrument Description</b>	A Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics. This instrument designation is used when specific make and model are not known or when a more specific term is not available in the BCO-DMO vocabulary. Refer to the dataset-specific metadata for more information about the specific CTD used. More information from: <a href="http://www.seabird.com/">http://www.seabird.com/</a>

<b>Dataset-specific Instrument Name</b>	Sea-Bird SBE 43
<b>Generic Instrument Name</b>	Sea-Bird SBE 43 Dissolved Oxygen Sensor
<b>Dataset-specific Description</b>	Dissolved oxygen profiles (obtained for every CTD cast from a mounted Sea-Bird SBE 43 sensor) were used together with potential density, salinity, and nitrate profiles to identify key water masses.
<b>Generic Instrument Description</b>	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

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

## Deployments

VOY03

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/557788">https://www.bco-dmo.org/deployment/557788</a>
<b>Platform</b>	R/V S.A. Agulhas II
<b>Start Date</b>	2012-07-10
<b>End Date</b>	2012-08-06
<b>Description</b>	R/V S.A. Agulhas II, VOY03 (July 2012): The winter "shake-down" cruise, part of the GoodHope monitoring programme. Transect extends from the subtropics (offshore of Cape Town, South Africa; 33.9°S, 18.4°E) to just beyond the winter sea-ice edge (encountered at 56.7°S, 0.0°E), covering a 0-2000 m depth range.

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

---

## Project Information

### High-resolution, Assemblage-specific Records of Diatom-bound N Isotopes from the Indian Sector of the Antarctic Ocean (Diatom-bound\_N\_Isotopes)

**Coverage:** Kerguelen Plateau

*Description from NSF award abstract:*

The high concentration of the major nutrients nitrate and phosphate is a fundamental characteristic of the Antarctic Zone in the Southern Ocean and is central to its role in global ocean fertility and the global carbon cycle. The isotopic composition of diatom-bound organic nitrogen is one of the best hopes for reconstructing the nutrient status of polar surface waters over glacial cycles, which in turn may hold the explanation for the decline in atmospheric carbon dioxide during ice ages. The PIs propose to generate detailed diatom-bound nitrogen isotope ( $\delta^{15}\text{N}_{\text{db}}$ ) records from high sedimentation rate cores from the Kerguelen Plateau. Because the cores were collected at relatively shallow seafloor depths, they have adequate planktonic and benthic foraminifera to develop accurate age models. The resulting data could be compared with climate records from Antarctic ice cores and other archives to investigate climate-related changes, including the major steps into and out of ice ages and the millennial-scale events that occur during ice ages and at their ends. The records generated in this project will provide a critical test of hypotheses for the cause of lower ice age  $\text{CO}_2$ .

This study will contribute to the goal of understanding ice ages and past  $\text{CO}_2$  changes, which both have broad implications for future climate. Undergraduates will undertake summer internships, with the possibility of extending their work into junior year projects and senior theses. In addition, the PI will lead modules for two Princeton programs for middle school teachers and will host a teacher for a six-week summer research project.

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

---

## Funding

<b>Funding Source</b>	<b>Award</b>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1136345</a>
<a href="#">NSF Division of Polar Programs (NSF PLR)</a>	<a href="#">PLR-1401489</a>
<a href="#">NSF Division of Polar Programs (NSF PLR)</a>	<a href="#">PLR-0612198</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1060947</a>
European Commission Seventh Framework Programme (FP7-ENV-2010)	<a href="#">FP7 265294</a>

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