

Tropical Pacific nitrate N and O isotopes in the tropical Pacific from 2003-2007 (CAREER project, Diatom-bound_N_Isotopes project)

Website: <https://www.bco-dmo.org/dataset/615082>

Version: 19 January 2016

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Project

» [CAREER: Nitrate Isotopes and Biogeochemistry: A Plan for coupling](#) (CAREER)

» [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
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Dataset Description

Spatial distribution and temporal variation of nitrate nitrogen and oxygen isotopes in the upper equatorial Pacific Ocean

Nitrate N and O isotopes reveal nitrate utilization spatial and temporal variability

These data were collected on the R/V Ka'imimoana and R/V Ronald H. Brown (various cruises between 2003 and 2007)

Related files and references:

This dataset is discussed in Rafter, P.A., Sigman, D.M., 2016. Spatial distribution and temporal variation of nitrate nitrogen and oxygen isotopes in the upper equatorial Pacific Ocean. *Limnol. Oceanogr.* 61, 14-31. doi:10.1002/lno.10152

Methods & Sampling

Sampling and Analytical Methodology:

Nitrate isotope measurements were performed using the "Denitrifier" method (Sigman et al. 2001; Casciotti et al. 2002). Measurements are referenced to atmospheric N₂ or Vienna Standard Mean Ocean Water, respectively. The analytical precision was 0.2 per mil for nitrate N isotopes and 0.3 per mil for nitrate O isotopes based on a seawater-based, in-house standard included in every batch of analyses. Nitrite was removed from all samples using the protocol of Granger and Sigman (2009). Nitrate concentrations were measured by reduction to NO using a vanadium(III) reagent, followed by chemiluminescence measurement of NO (Braman and Hendrix 1989). Hydrographic data (salinity, temperature, and oxygen) for each cruise were acquired from NOAA's Pacific Marine Environmental Laboratory data portal (www.epic.noaa.gov). Acoustic Doppler Current Profiler (ADCP) measurements for the upper 200 m were available for most stations (with the

notable exception of the boreal spring 2005 cruise along 1108W) and are available through the University of Hawai'i (currents.soest.hawaii.edu).

Data Processing Description

Data Processing:

Data are averages of at least 2 measurements per sample.

BCO-DMO Processing Notes

- Generated from original file "prafter2015EqPacSurfNitrateData-LO.txt contributed by Patrick Rafter
- Individual Day, Month, Year columns combined into a single date column formatted as YYYYMMDD
- Parameter names edited to conform to BCO-DMO naming convention found at [Choosing Parameter Name](#)
- "no data" in original file replaced with "nd" (no data)
- Data updated with corrected lat/lon values 19Jan2016/srg

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Data Files

File
Surface_Nitrate.csv (Comma Separated Values (.csv), 38.99 KB) MD5:fa9b16ed899c2734e64f2c35c6ce8740
Primary data file for dataset ID 615082

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Parameters

Parameter	Description	Units
Sampling_Date	Sampling Date	YYYYMMDD
Latitude	Latitude	degrees
Longitude	Longitude	degrees
Depth	Depth	meters
nitrate	nitrate	umol*kg ⁻³
nitrate_d15N	nitrate d15N	per mil
nitrate_d18O	nitrate d18O	per mil
temperature	temperature	degrees celsius
salinity	salinity	PSU
potential_temperature	potential temperature	degrees celsius
potential_density	potential density	kg*m ⁻³
oxygen	oxygen	umol/kg
mixed_layer_depth	mixed layer depth	meters
zonal_velocity	zonal velocity	cm*s ⁻¹

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Deployments

RAFTER-TropicalPacific

Website	https://www.bco-dmo.org/deployment/632805
Platform	RAFTER Tropical Pacific Nitrate N and O Isotopes
Start Date	2003-10-10
End Date	2007-09-30

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Project Information

CAREER: Nitrate Isotopes and Biogeochemistry; A Plan for coupling (CAREER)

Coverage: Subantarctic waters, Antarctic Zone, and Ross Sea

Nitrate is a ubiquitous form of biologically available nitrogen in the environment. Based on previous method development in the principal investigator's laboratory, CAREER graduate students and undergraduates investigate the nitrogen (N) and oxygen (O) isotopes of nitrate as 'tracers' of the N cycle, focusing on the marine environment. Research centers on two projects: (1) lab culture, in vitro assay, and field incubation studies of the coupled N and O isotope dynamics of nitrate assimilation and denitrification, two of the critical reactions in the N cycle; and (2) incorporation of the N and O isotopes of nitrate into numerical models of ocean circulation and biogeochemistry. These projects, in the context of the oceanic data sets generated in the principal investigator's laboratory, allow for the quantification of biogeochemical processes the signals of which are otherwise complicated by their simultaneous occurrence and by ocean circulation.

Oceanic data used in this project includes Nitrogen and delta 15N of dissolved nitrate relative to atmospheric N₂ (dN15_NO3) collected during five cruises in the Southern Ocean -- in September, 1997, March, 1998, and August, 1998, February, 2001, and November 2006. During the last two cruises, samples of Oxygen isotopic composition (18O/16O) of nitrate (d180_NO3) were also collected.

Related files and references:

DiFiore, P. J., D. M. Sigman, T. W. Trull, M. J. Lourey, K. Karsh, G.Cane, and R. Ho (2006), Nitrogen isotope constraints on subantarctic biogeochemistry, *J. Geophys. Res.*, 111, C08016, doi:10.1029/2005JC003216.

DiFiore, P. J., D. M. Sigman, and R. B. Dunbar (2009), Upper ocean nitrogen fluxes in the Polar Antarctic Zone: Constraints from the nitrogen and oxygen isotopes of nitrate, *Geochem. Geophys. Geosyst.*, 10, Q11016, doi:10.1029/2009GC002468.

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 CO₂.

This study will contribute to the goal of understanding ice ages and past CO₂ 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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0447570
NSF Division of Ocean Sciences (NSF OCE)	OCE-1060947

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