Nitrate (d15N and d18O) and nitrite (d15N) isotopic data, and corresponding hydrographic data from R/V Knorr cruise KN182-09 in the Peruvian Oxygen Deficient Zone in 2005 (N2O Cycling project)

Website: https://www.bco-dmo.org/dataset/3958
Data Type: Cruise Results
Version: 1
Version Date: 2013-06-05

Project
» Biogeochemistry of nitrous oxide cycling in the eastern tropical South Pacific (N2O Cycling)

Contributors	Affiliation	Role
Casciotti, Karen L.	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Nitrate (d15N and d18O) and nitrite (d15N) isotopic data, and corresponding hydrographic data from R/V Knorr cruise KN182-09 in the Peruvian Oxygen Deficient Zone in 2005.

Table of Contents

Coverage

Spatial Extent: **N**:-11 **E**:-75.07 **S**:-17.67 **W**:-79.3
Temporal Extent: 2005-10-18 - 2005-11-10

Dataset Description

Nitrogen and oxygen isotopic data from a 2005 cruise on R/V Knorr (KN182-09) in the Peruvian Oxygen Deficient Zone.

Methods & Sampling

Sampling and Analytical Methodology:
Samples were collected from Niskin bottles, syringe filtered through 0.2 um pore-size capsule filters and frozen immediately in 60 mL HDPE bottles. Samples were stored frozen until analysis. Nitrate and nitrite concentrations were measured on separate aliquots by auto analyzer at the WHOI nutrient facility.

Samples were initially analyzed for nitrate + nitrite d15N and d18O using the denitrifier method (Sigman et al., 2001; Casciotti et al., 2002), then nitrite d15N and d18O were subtracted out according to Casciotti and McIlvin (2007). Later, the samples were reanalyzed for nitrate d15N and d18O using the denitrifier method after

treatment with sulfamic acid using the method of Granger and Sigman (2009). These latter analyses, which we believe to be more accurate and precise, are reported here. Samples were analyzed in duplicate and are reported as the mean and standard deviation of replicate measurements. Typical precision for these analyses is 0.2-0.3 for d15N and 0.3-0.5 for d18O.

Samples were analyzed for nitrite d15N and d18O using the azide method (McIlvin and Altabet, 2005). Nitrite d18O data are not reported because it was determined that samples may have undergone O atom equilibration with water during storage (Casciotti et al., 2007). Typical precision for these analyses is 0.3-0.5 for d15N and 0.3-0.5 for d18O.

All isotopic measurements were conducted on a Thermo Finnigan Delta PLUS XP isotope ratio mass spectrometer.

Data Processing Description

Data Processing:
Nitrate d15N and d18O analyses were calibrated against aliquots of the nitrate isotope standards USGS32, USGS34, and USGS35 (Bohlke et al., 2003) prepared and analyzed in parallel with each batch of samples, according to McIlvin and Casciotti (2011).

Nitrite d15N analyses were calibrated against aliquots of the nitrite isotope standards RSIL-N23, RSIL-N7373, and RSIL-N10219 (Casciotti et al., 2007) prepared and analyzed in parallel with each batch of samples.

BCO-DMO Processing Notes: modified original parameter names to conform with BCO-DMO naming conventions; replaced blank/missing values with 'nd' to indicate "no data".

[table of contents | back to top]

Data Files

File	
N_and_O_isotopes.csv	(Comma Separated Values (.csv), 41.72 KB) MD5:7bd8d516271f7049dab2fcd141acc97c
Primary data file for dataset ID 3958	

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruise_id	Cruise identifier	text
station	Station identifier	integer
lat	Latitude. Positive values = North.	decimal degrees
lon	Longitude. Negative values = West.	decimal degrees
lon_360	Longitude east (0 to 360 degrees).	decimal degrees
press	Pressure	decibars
depth	Depth	meters
sal	Practical salinity.	PSU
temp	Temperature (Celsius)	degrees C
density_in_situ	In-situ density in kilograms per liter.	kg/L
O2	Oxygen in micromoles per kilogram.	umol/kg
AOU_umol_kg	Apparent oxygen utilization (AOU). Equal to O2saturation - O2measured; where O2 saturation was calculated according to Garcia and Gordon (1992).	umol/kg
AOU_umol_L	Apparent oxygen utilization (AOU). Equal to AOU_umol_kg x density_in_situ.	umol/L
NO3_preformed	Preformed NO3 in micromoles per liter.	umol/L
NO3_expected	Expected NO3 in micromoles per liter.	umol/L
DIN_deficit	DIN defecit = NO3_expected - NO3 - NO2	umol/L
NO3_deficit	NO3 defecit = NO3_expected - NO3	umol/L
PO4	PO4	umol/L
NO3	NO3-	umol/L
NO2	NO2-	umol/L
NO2_NO3	NO2- + NO3-	umol/L
d15N_NO3	delta15N-NO3 (permil vs. N2) = ((15N/14N NO3) / (15N/14N atmospheric N2) -1) *1000	permil
d15N_NO3_sd	Standard deviation of replicate d15N-NO3 measurements.	permil
d18O_NO3	delta18O-NO3 (permil vs. VSMOW) = ((18O/16O NO3) / (18O/16O VSMOW) -1) *1000	permil
d18O_NO3_sd	Standard deviation of replicate d18O-NO3 measurements.	permil
d15N_NO2	delta15N-NO2 (permil vs. N2) = ((15N/14N NO2) / (15N/14N atmospheric N2) -1) *1000	permil
d15N_NO2_sd	Standard deviation of replicate d15N-NO2 measurements.	permil
D15_18	D(15,18) = (d15N-NO3 - 5.5 permil) - (d18O-NO3 - 2.5 permil)	permil
D15_18_sd	Standard deviation of D(15,18) calculated from propagated error of replicate d15N-NO3 and d18O-NO3 measurements.	permil
Dd15N	Dd15N (permil) = d15N-NO3 minus d15N-NO2	permil
Dd15N_sd	Standard deviation of Dd15N calculated from propagated error of replicate d15N-NO3 and d15N-NO2 measurements.	permil
sigma_0	sigma theta density	kilograms per cubic meter (kg/m3)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	All isotopic measurements were conducted on a Thermo Finnigan Delta PLUS XP isotope ratio mass spectrometer.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Samples were collected from Niskin bottles.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Nutrient Autoanalyzer
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Nitrate and nitrite concentrations were measured on separate aliquots by auto analyzer at the WHOI nutrient facility.
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

[table of contents | back to top]

Deployments

KN182-09

Website	https://www.bco-dmo.org/deployment/59037
Platform	R/V Knorr
Start Date	2005-10-18
End Date	2005-11-10
Description	Cruise departed from Arica, Chile and ended at Manzanillo, Mexico. Most work occurred in the Peruvian Oxygen Deficient Zone. Funded by NSF award OCE-0327226, "Speciation of Bioactive Metals in Oxygen Minimum Zones". See more information on KN182-09 from Rolling Deck to Repository (R2R).

[table of contents | back to top]

Project Information

Biogeochemistry of nitrous oxide cycling in the eastern tropical South Pacific (N2O Cycling)

Coverage: Peruvian Oxygen Deficient Zone

The eastern tropical South Pacific (ETSP) is a hot spot for oceanic nitrogen cycling. This region of upwelling and high productivity fuels high rates of oxygen consumption below the mixed layer, nitrate regeneration from nitrification, and ultimately denitrification of nitrate to N2 gas. The climatically important trace gas nitrous oxide (N2O) also reaches extreme high concentrations in the oxycline and extreme low concentrations in the heart of the oxygen minimum zone (OMZ), indicating active cycling in this region. Despite many years of investigation, the mechanism of N2O production in this hot spot is ambiguous because of the potential overlap or coupling of nitrification and denitrification processes at low oxygen tensions.

The investigators employed novel stable isotopic techniques to identify processes involved with nitrous oxide production and consumption in the water column at multiple sites within the eastern tropical South Pacific. They also sought to map the natural distributions of nitrate, nitrite and nitrous oxide concentrations and isotopes at high spatial resolution in order to develop a dataset with which to constrain ocean models based on their rate measurements.

Incubation experiments were carried out at sea to quantify the rates of nitrification and N2O cycling in samples throughout the oxygen minimum zone. In addition, approximately 1000 samples were collected for nitrate and nitrite isotopic analysis and 500 samples for N2O isotopic analysis. The investigators worked closely with other researchers onboard to work towards developing the most coherent picture of nitrogen cycling in the eastern tropical Pacific to date.

[table of contents | back to top]

Funding

Funding Source	Award
WHOI Access to the Sea Fund (Access to the Sea)	27500006

[table of contents | back to top]