Nitrogen Fixation in the Eastern Tropical South Pacific

Datasets:

- 15N₂ incubation-based N₂ fixation rates in the Eastern Tropical South Pacific
- Nitrate plus nitrite concentration and d15N in the Eastern Tropical South Pacific
- Sediment trap PN mass flux and isotopic composition in the Eastern Tropical South Pacific

Dataset: nitrate plus nitrite

Projects:

[Expression of Microbial Nitrification in the Stable Isotopic Systematics of Oceanic Nitrite and Nitrate](#) (Microbial Nitrification)

[Documenting N₂ fixation in N deficient waters of the Eastern Tropical South Pacific](#) (N₂ fixation ETSP)

Lead Principal Investigator:

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Principal Investigator:

[Dr William M. Berelson](#) (University of Southern California, USC-WIES)

[Dr Karen L. Casciotti](#) (Woods Hole Oceanographic Institution, WHOI)

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[Dr Angela Knapp](#) (Florida State University, FSU - Oce)

Validated: No

Data version: 2015-04-09

Version Date: 04/09/2015

Current State: Restricted

[Description](#)

Brief Description: Nitrate + nitrite concentration and d15N from the Eastern Tropical South Pacific, 2010-2011

These data are restricted until manuscript is accepted for publication. Please contact PI for further information.

[Acquisition Description](#)

Water column sample collection: Samples were collected on the R/V Atlantis in January through February 2010, and the R/V Melville in March through April 2011 on a zonal transect along 20° S between 80° W and 100° W, with exact station locations and sample depths, nutrient concentrations and isotopic compositions reported below. Water column samples were collected by Niskin bottles deployed on a rosette equipped with conductivity-temperature-depth (CTD) sensors. All samples were collected into acid-washed, sample-rinsed HDPE bottles, and samples from the upper 400 m passed a 0.2 µm filter before collection. All samples were stored at -20° C until analysis on land.

Nitrate plus nitrite (NO₃-+NO₂-) concentration: The concentration of NO₃-+NO₂- ([NO₃-+NO₂-]) was determined using chemiluminescent analysis (in a configuration with a detection limit of 0.05 µM, + 0.1 µM 1 S.D.).

Reference: Braman, R. S. & Hendrix, S. A. Nanogram Nitrite and Nitrate Determination in Environmental and Biological-Materials by Vanadium(III) Reduction with Chemi-Luminescence Detection. Analytical Chemistry 61, 2715-2718 (1989).

NO3+NO2 d15N: The d15N of NO3+NO2 was determined using the denitrified method on samples with >0.3 µM NO3+NO2 with a standard deviation <0.2 per mil.

References:

Sigman, D. M. et al. A bacterial method for the nitrogen isotopic analysis of nitrate in seawater and freshwater. Analytical Chemistry 73, 4145-4153 (2001).

Casciotti, K. L., Sigman, D. M., Hastings, M. G., Bohlke, J. K. & Hilkert, A. Measurement of the oxygen isotopic composition of nitrate in seawater and freshwater using the denitrifier method. Analytical Chemistry 74, 4905-4912 (2002).

McIlvin, M. R. & Casciotti, K. L. Technical Updates to the Bacterial Method for Nitrate Isotopic Analyses. Analytical Chemistry 83, 1850-1856 (2011).

[Processing Description](#)

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- added cruise id column
- replaced blank cells with nd

[Funding Sources](#)

Funding Source Award Number

[NSF Ocean Sciences](#) [OCE-0850801](#)

[NSF Ocean Sciences](#) [OCE-0961098](#)

[NSF Ocean Sciences](#) [OCE-0850905](#)

[Deployments](#)

Deployment	Synonyms	Start Date	Platform	Investigator	
AT15-61	• ETSP2010	29 Jan 2010	R/V Atlantis	Dr Douglas Capone (Chief Scientist) Dr William M. Berelson (Co-Chief Scientist)	data info
MV1104	• ETSP2011	23 Mar 2011	R/V Melville	Dr William M. Berelson (Chief Scientist) Dr Angela Knapp (Co-Chief Scientist)	data info

[Instruments](#)

[CTD profiler](#)

Short Name: CTD

[Community Standard Description](#)

Generic Description

The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This instrument designation is used when specific make and model are not known.

PI supplied instrument name: CTD

Dataset-specific description

Parameters

<u>Supplied Name</u>	<u>Supplied description</u>	<u>Supplied Units</u>	<u>Standard Name</u>
<u>date</u>	sample collection date (local)	yyyy-mm-dd	date_local
<u>station</u>	station	unitless	sta
<u>lat</u>	latitude; north is positive	decimal degrees	lat
<u>lon</u>	longitude; east is positive	decimal degrees	lon
<u>depth</u>	sample depth	meters	depth
<u>sigma_theta</u>	seawater density	unitless	sigma_theta
<u>NO3_NO2</u>	nitrate + nitrite concentration	micro mols N per liter	NO3_NO2
<u>NO3_NO2_sd</u>	nitrate + nitrite concentration standard deviation	micro mols N per liter	std_dev
<u>del15N_NO3NO2</u>	delta 15N of nitrate + nitrite, reported in units of permil vs. atmospheric N2	per mil versus air	del15N_NO3NO2
<u>del15N_NO3NO2_sd</u>	delta 15N of nitrate + nitrite; 1 standard deviation, reported in units of permil vs. atmospheric N2	per mil versus air	std_dev

Dataset: nitrogen fixation rates

Project:

[Documenting N₂ fixation in N deficient waters of the Eastern Tropical South Pacific](#) (N₂ fixation ETSP)

Lead Principal Investigator:

[Dr Douglas Capone](#) (University of Southern California, USC-WIES)

Principal Investigator:

[Dr William M. Berelson](#) (University of Southern California, USC-WIES)

[Dr Dennis Hansell](#) (University of Miami Rosenstiel School of Marine and Atmospheric Science, UM-RSMAS)

Co-Principal Investigator:

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Contact:

[Dr Angela Knapp](#) (Florida State University, FSU - Oce)

Validated: No

Data version: 2015-04-09

Version Date: 04/09/2015

Current State: Restricted

[Description](#)

Brief Description: 15N₂-based N₂ fixation rates from the Eastern Tropical South Pacific, 2010-2011

These data are restricted until manuscript is accepted for publication. Please contact PI for further information.

[Acquisition Description](#)

Water column sample collection: Samples were collected on the R/V Atlantis in January through February 2010, and the R/V Melville in March through April 2011 on a zonal transect along 20° S between 80° W and 100° W, with exact station locations and sample depths, nutrient concentrations and isotopic compositions reported below. Water column samples were collected by Niskin bottles deployed on a rosette equipped with conductivity-temperature-depth (CTD) sensors. All samples were collected into acid-washed, sample-rinsed HDPE bottles, and samples from the upper 400 m passed a 0.2 µm filter before collection. All samples were stored at -20° C until analysis on land.

15N₂ fixation rate measurements: Short-term N₂ fixation rate measurements incubated with 15N₂ gas from Sigma Aldrich (lot #s SZ1670V and MBBB0968V) were carried out in acid-washed, sample-rinsed light transparent 4 L polycarbonate bottles amended with 1.5 mL of 99% 15N₂ and 1.5 mL of 0.5M NaH₁₃CO₃. Incubations were performed under simulated in situ conditions of temperature and light and run for staggered periods (e.g. 0, 12, 24 and 48 hrs). Incubations were terminated by filtration of the 4 L sample onto a precombusted 25 mm Whatman GF/F, which was then analyzed by mass spectrometry at the University of Southern California for d15N and d13C. During ESTP 1, periodic time zero incubations were measured, with samples filtered within 5 to 10 minutes of injection of 15N₂. Zero time enrichments were typically near natural abundance levels with the greatest observed enrichment in 8 experiments at 23‰, essentially at natural abundance level for our tracer experiments. We assumed natural abundance (0.3663 atom %) for calculations. Limits of detection are about 10-14 µg for N and 6-10 µg for C. Reproducibility as the standard deviation for isotopic analysis is about ±0.3‰ for d15N and ±0.2‰ for d13C, and about ±0.1-0.2 µg for mass determinations.

Reference: Montoya, J. P., Voss, M., Kahler, P. & Capone, D. G. A simple, high-precision, high-sensitivity tracer assay for N-2 fixation. Applied and Environmental Microbiology 62, 986-993 (1996).

[Processing Description](#)

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- added cruise id column

Funding Sources

Funding Source Award Number

[NSF Ocean Sciences](#) [OCE-0850801](#)

[NSF Ocean Sciences](#) [OCE-0850905](#)

Deployments

Deployment	Synonyms	Start Date	Platform	Investigator	
AT15-61	<ul style="list-style-type: none"> ETSP2010 	29 Jan 2010	R/V Atlantis	Dr Douglas Capone (Chief Scientist) Dr William M. Berelson (Co-Chief Scientist)	data info
MV1104	<ul style="list-style-type: none"> ETSP2011 	23 Mar 2011	R/V Melville	Dr William M. Berelson (Chief Scientist) Dr Angela Knapp (Co-Chief Scientist)	data info

Instruments

CTD profiler

Short Name: CTD

[Community Standard Description](#)

Generic Description

The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This instrument designation is used when specific make and model are not known.

PI supplied instrument name: CTD

Dataset-specific description

Gas Chromatograph

Short Name: Gas Chromatograph

[Community Standard Description](#)

Generic Description

Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

PI supplied instrument name: Gas Chromatograph

Dataset-specific description

Parameters

<u>Supplied Name</u>	<u>Supplied description</u>	<u>Supplied Units</u>	<u>Standard Name</u>
date	sample collection date (local)	yyyy-mm-dd	date_local
station	station	unitless	sta
lat	latitude; north is positive	decimal degrees	lat
lon	longitude; east is positive	decimal degrees	lon
depth	sample depth	meters	depth
Nfix_umol_N_m2_d	24 hr 15N2 fixation rate	umol N m-2 d-1	N2_fix
Nfix_stddev	24 hr 15N2 fixation rate standard deviation	umol N m-2 d-1	std_dev

Dataset: sediment trap PN flux

Project:

[Documenting N₂ fixation in N deficient waters of the Eastern Tropical South Pacific](#) (N₂ fixation ETSP)

Lead Principal Investigator:

[Dr Douglas Capone](#) (University of Southern California, USC-WIES)

Principal Investigator:

[Dr William M. Berelson](#) (University of Southern California, USC-WIES)

[Dr Dennis Hansell](#) (University of Miami Rosenstiel School of Marine and Atmospheric Science, UM-RSMAS)

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[Dr Angela Knapp](#) (University of Miami Rosenstiel School of Marine and Atmospheric Science, UM-RSMAS)

Scientist:

[Dr Masha Prokopenko](#) (University of Southern California, USC-WIES)

Contact:

[Dr Angela Knapp](#) (Florida State University, FSU - Oce)

Validated: No

Data version: 2015-04-09

Version Date: 04/09/2015

Current State: Restricted

[Description](#)

Brief Description: PNsink mass flux and d15N from floating sediment trap deployments

These data are restricted until manuscript is accepted for publication. Please contact PI for further information.

[Acquisition Description](#)

Sinking particulate nitrogen (PNsink) mass and d15N analysis: Sinking particulate material was collected using surface-tethered floating particle-interceptor traps (PIT) equipped with 12 polycarbonate cylinders, deployed for up to 70 hours. Floating sediment traps were deployed at 200 m at Stations 3 and 5 on the 2010 cruise; for all other stations, traps were deployed at 100 m. Sediment trap samples were collected into a brine solution and then filtered and split into replicate samples. In most cases, two splits were collected from each sediment trap, one of which was acidified to remove inorganic carbon. In 2010 filtration removed the contribution of “swimmers” from sediment trap material. On the 2011 cruise, “swimmers” were identified by dissecting microscopy and hand-picked from sediment trap samples using sterilized micropipettors and forceps to remove their isotopic contribution to the sinking flux. Mass and isotopic fluxes were determined by dividing the mass of sinking particulate material captured in each trap by the trap surface area and by the duration (hrs) of trap deployment. Subsequently, the total mass flux was multiplied by the %N determined by combustion analysis of trap samples at the UC Davis Stable Isotope Facility to calculate PNsink mass fluxes; the d15N of trap samples was determined at the same time. The limit of detection for combustion analysis is 1.5 $\mu\text{mol N}$ and the precision of the d15N measurement is + 0.3‰. No systematic difference was observed in the d15N of acidified vs. non-acidified trap samples.

References:

Soutar, A., Kling, S. A., Crill, P. A. & Duffrin, E. MONITORING MARINE-ENVIRONMENT THROUGH SEDIMENTATION. Nature 266, 136-139, doi:10.1038/266136a0 (1977).

Knauer, G. A., Martin, J. H. & Bruland, K. W. Fluxes of particulate carbon, nitrogen, and phosphorus in the upper water column of the northeast Pacific. Deep-Sea Research 26, 97-108, doi:10.1016/0198-0149(79)90089-X (1979).

[Processing Description](#)

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- added cruise id column
- replaced blank cells with nd

[Funding Sources](#)

Funding Source Award Number

[NSF Ocean Sciences](#) [OCE-0850801](#)

[NSF Ocean Sciences](#) [OCE-0850905](#)

[Deployments](#)

Deployment	Synonyms	Start Date	Platform	Investigator	
AT15-61	• ETSP2010	29 Jan 2010	R/V Atlantis	Dr Douglas Capone (Chief Scientist) Dr William M. Berelson (Co-Chief Scientist)	data info
MV1104	• ETSP2011	23 Mar 2011	R/V Melville	Dr William M. Berelson (Chief Scientist) Dr Angela Knapp (Co-Chief Scientist)	data info

[Instruments](#)

[Microscope-Optical](#)

Short Name:

[Community Standard Description](#)

Generic Description

Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

PI supplied instrument name: dissecting microscope

Dataset-specific description

[Sediment Trap - Floating](#)

Short Name: Sed Trap - Float

[Community Standard Description](#)

Generic Description

Floating sediment traps are specially designed sampling devices deployed to float in the water column (as opposed to being secured to a mooring at a fixed depth) for periods of time to collect particles from the water column that are falling toward the sea floor. In general a sediment trap has a container at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. The 'Sediment Trap -Floating' designation is used for a floating type of sediment trap about which no other design details are known.

PI supplied instrument name: Sed Trap - Float

Dataset-specific description

[Parameters](#)

Supplied Name	Supplied description	Supplied Units	Standard Name
date	sample collection date (local)	yyyy-mm-dd	date_local
station	station	unitless	sta
lat	latitude; north is positive	decimal degrees	lat
lon	longitude; east is positive	decimal degrees	lon
depth	Depth trap was deployed	meters	depth
traps_per_depth	Number of traps deployed per depth (Total # sample splits)	unit	num_reps

<u>Supplied Name</u>	<u>Supplied description</u>	<u>Supplied Units</u>	<u>Standard Name</u>
duration	Length of trap deployment	hours	duration
PNsink_flux	Particulate Nitrogen sinking mass flux	milli mol N m ⁻² d ⁻¹	PNsink
PNsink_flux_sd	Particulate Nitrogen sinking mass flux; 1 standard deviation	milli mol N m ⁻² d ⁻¹	std_dev
del15N_PNsink	Particulate Nitrogen sinking flux d15N (per mil relative to N2 in air)	per mil	del15N_PNsink
del15N_PNsink_sd	Particulate Nitrogen sinking flux d15N (per mil relative to N2 in air); 1 standard deviation	per mil	std_dev