

# Results from experiment examining $^{15}\text{N}$ -labeled contaminants in commercial $^{15}\text{N}_2$ gas: Particulate Nitrogen - The delta $^{15}\text{N}$ of *Dunaliella tertiolecta* organic matter after growth in media equilibrated with $^{15}\text{N}_2$ gas

Website: <https://www.bco-dmo.org/dataset/547774>

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## Project

» [The Ocean Nitrogen Imbalance Paradox: Environmental Controls on the Denitrification Isotope Effect](#) ( $^{15}\text{N}_2$  Contamination)

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## Dataset Description

The delta  $^{15}\text{N}$  of *Dunaliella tertiolecta* organic matter after growth in media equilibrated with  $^{15}\text{N}_2$  gas.

Refer to the following publication for more information:

Dabundo, R., Lehmann, M.F., Treibergs, L., Tobias, C.R., Altabet, M.A., Moisander, P.H., and Granger, J. 2014. The Contamination of Commercial  $^{15}\text{N}_2$  Gas Stocks with  $^{15}\text{N}$ -Labeled Nitrate and Ammonium and Consequences for Nitrogen Fixation Measurements. PLoS ONE, 9(10): e110335.

doi:[10.1371/journal.pone.0110335](https://doi.org/10.1371/journal.pone.0110335)

See related datasets:

[delta  \$^{15}\text{N}\$   \$\text{NO}\_3\$](#)

[delta  \$^{15}\text{N}\$   \$\text{NH}\_4\$](#)

[direct  \$\text{N}\_2\text{O}\$](#)

[\$\text{N}\_2\$](#)

## Methods & Sampling

Data was acquired from an isotope ratio mass spectrometer using Isodat 3.0 software.

### Particulate Nitrogen calculations:

The equation describing the linear regression of the standards' observed delta  $^{15}\text{N}$  PN and Assigned delta  $^{15}\text{N}$  (obs = x and assigned = y) was used to calculate delta  $^{15}\text{N}$  PN (y) of the samples from the uncorrected delta  $^{15}\text{N}$  (x).

**Refer to the following publication for more information:**

Dabundo, R., Lehmann, M.F., Treibergs, L., Tobias, C.R., Altabet, M.A., Moisander, P.H., and Granger, J. 2014. The Contamination of Commercial  $^{15}\text{N}_2$  Gas Stocks with  $^{15}\text{N}$ -Labeled Nitrate and Ammonium and Consequences for Nitrogen Fixation Measurements. PLoS ONE, 9(10): e110335. doi:[10.1371/journal.pone.0110335](https://doi.org/10.1371/journal.pone.0110335)

### Summary of methods from Dabundo et al. 2014:

#### Reagents:

Four lecture bottles of 98+ at%  $^{15}\text{N}$ -labeled  $\text{N}_2$  gas were purchased from Sigma-Aldrich, three from lot # SZ1670V, and one from lot # MBBB0968V. Two 1L lecture bottles of 98+ at%  $^{15}\text{N}_2$  were purchased from Cambridge Isotopes from lot #'s I1-11785A and I-16727. One 1L lecture bottle of 98+ at%  $^{15}\text{N}_2$  was purchased from Campro Scientific from lot # EB1169V. Ammonium and nitrate solutions were prepared with salts or with solutions obtained from different distributors: sodium nitrate ( $\text{NaNO}_3$ ), potassium nitrate ( $\text{KNO}_3$ ), and ammonium chloride ( $\text{NH}_4\text{Cl}$ ) from Fisher Scientific; analytical-grade potassium nitrate from Fluka Analytical and a gravimetric solution of ammonium chloride from SPEX CertiPrep.

#### *Dunaliella tertiolecta* cultures:

The marine green alga *Dunaliella tertiolecta* was cultured in growth media equilibrated with  $^{15}\text{N}_2$  gas in order to ascertain the susceptibility of  $^{15}\text{N}$ -labeled gas contaminants to assimilation by non- $\text{N}_2$ -fixing organisms. Culture medium was prepared from filtered Long Island Sound sea water supplemented with 50  $\mu\text{mol/L}$   $\text{NaNO}_3$ , 36.3  $\mu\text{mol/L}$   $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$ , and 107  $\mu\text{mol/L}$   $\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$ , as well as f/2 trace metals and f/2 vitamins, added from filter sterilized stock solutions. Medium (200 mL) was dispensed in 250 mL stoppered glass bottles. Experimental treatment bottles were equilibrated overnight with 0.2 mL  $^{15}\text{N}_2$  gas from either a Cambridge Isotopes or Sigma-Aldrich lecture bottle. Following inoculation, cultures were left loosely capped and placed on a windowsill with exposure to natural light. Nitrate concentrations were monitored daily. Upon the complete depletion of nitrate, 8 days after inoculation, the cultures were harvested on pre-combusted GF/F filters. Filters were dried at 60 degrees C for 18 hours pending N isotopic analysis of the particulate nitrogen.

#### Particulate nitrogen isotope ratio analyses:

The  $\delta^{15}\text{N}$  of particulate nitrogen (PN) was analyzed using a Costech Instruments elemental combustion system (model 4010) coupled to a Thermo Scientific Delta V Advantage IRMS. Analyses were standardized using L-glutamic acid reference materials, USGS-40, and USGS-41.

## Data Processing Description

Samples with the same ID are replicated measurements.

#### BCO-DMO Edits:

- Modified parameter names to conform with BCO-DMO naming conventions;
- Denoted 'Control' and 'Standard' in the lot\_number column;
- Replaced spaces with underscores.
- Replaced blanks (missing values) with 'nd' to indicate 'no data'.

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## Data Files

File
<b>particulate_N.csv</b> (Comma Separated Values (.csv), 2.14 KB) MD5:430ecbf043312153d0c242ca3f76d535
Primary data file for dataset ID 547774

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## Parameters

Parameter	Description	Units
lecture_bottle	Identifier of the lecture bottle of 15N-labeled N2 gas.	dimensionless
lot_number	Lot number of the 15N-labeled N2 gas; or 'Control' or 'Standard' for controls and standards respectively.	dimensionless
solution	Solution volume.	milliliters (mL)
headspace	Headspace volume.	milliliters (mL)
N2_injection	Quantity of 15N-labeled N2 gas supplemented in the headspace.	milliliters (mL)
sample_ID	Sample identification number.	dimensionless
initial_NO3	Initial concentration of nitrate (NO3).	micromolar (uM)
final_NO3	Final concentration of nitrate (NO3).	micromolar (uM)
uncorr_d15N	Uncorrected delta 15N.	per mille (‰)
d15N_PN	delta 15N of particulate Nitrogen (PN).	per mille (‰)
assigned_d15N	Assigned delta 15N.	per mille (‰)

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## Instruments

<b>Dataset-specific Instrument Name</b>	Costech Instruments 4010
<b>Generic Instrument Name</b>	CHN Elemental Analyzer
<b>Dataset-specific Description</b>	The delta 15N of particulate nitrogen (PN) was analyzed using a Costech Instruments elemental combustion system (model 4010) coupled to a Thermo Scientific Delta V Advantage IRMS.
<b>Generic Instrument Description</b>	A CHN Elemental Analyzer is used for the determination of carbon, hydrogen, and nitrogen content in organic and other types of materials, including solids, liquids, volatile, and viscous samples.

<b>Dataset-specific Instrument Name</b>	Thermo Scientific Delta V Advantage IRMS
<b>Generic Instrument Name</b>	Isotope-ratio Mass Spectrometer
<b>Dataset-specific Description</b>	The delta 15N of particulate nitrogen (PN) was analyzed using a Costech Instruments elemental combustion system (model 4010) coupled to a Thermo Scientific Delta V Advantage IRMS.
<b>Generic Instrument Description</b>	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).

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## Project Information

### The Ocean Nitrogen Imbalance Paradox: Environmental Controls on the Denitrification Isotope Effect ( $^{15}\text{N}_2$ Contamination)

*Description from NSF award abstract:*

This study will test the sensitivity of the amplitude of the denitrification isotope effect to culture conditions pertinent to the ocean environment. The isotope effect amplitude will be explored with respect to electron donor, trace oxygenation, and temperature, in both batch and continuous culture experiments of denitrifiers. The proposed work will also involve measurements of the enzymatic isotope effect of the respiratory nitrate reductase of denitrifiers, measurements of its enzymatic activity among cultures, and examination of cellular nitrate transport kinetics of denitrifying strains. The experiments are designed to reveal the physiological basis of the modulation of the isotope effect amplitude, which will further resolve this manifestation in the environment.

In regards to the broader significance and importance of this study, these new experimental data will provide a basis for integration of nitrogen isotope dynamics in ocean models to test how key environmental parameters can affect the global ocean distribution of nitrogen isotopes.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1233897</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1130495</a>
Swiss National Science Foundation (SNSF)	<a href="#">R Equip 121258</a>

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