

O exchange with water during denitrification with the denitrifier method (Biological Nitrogen Isotope Fractionation project)

Website: <https://www.bco-dmo.org/dataset/865666>

Data Type: experimental

Version: 1

Version Date: 2021-12-01

Project

» [CAREER: The biological nitrogen isotope systematics of ammonium consumption and production](#)
(Biological Nitrogen Isotope Fractionation)

| Contributors | Affiliation | Role |
|---------------------------------|---|------------------------|
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Abstract

Effects of sample volume and salinity on O atom exchange with water during denitrification with the denitrifier method. The percentages of O atom exchange were derived from the regression slopes of $\delta^{18}\text{O}_{\text{N}_2\text{O}}$ vs. $\delta^{18}\text{O}_{\text{H}_2\text{O}}$.

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Coverage

Temporal Extent: 2020-06-16 - 2020-08-19

Acquisition Description

Sampling and analytical procedures:

Effects of sample volume and salinity on O atom exchange with water

Using the lab experiment data in the dataset “ ^{18}O -labeled water”, the percentage of O atom exchange with water during denitrification was derived from the regression slopes of $\delta^{18}\text{O}_{\text{N}_2\text{O}}$ vs. $\delta^{18}\text{O}_{\text{H}_2\text{O}}$.

Processing Description

Processing notes from researcher:

- Data were processed using Microsoft Excel

BCO-DMO processing notes

- Date formats were changed from mm/dd/yy to yyyy-mm-dd
- Spaces and units removed from column headers

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Related Datasets

IsDerivedFrom

Zhou, M., Granger, J., Chang, B. X. (2021) **Analyses of nitrate reference solutions in 18O-labeled water with the denitrifier method (Biological Nitrogen Isotope Fractionation project)**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-11-29 <http://lod.bco-dmo.org/id/dataset/865519> [[view at BCO-DMO](#)]

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Parameters

| Parameter | Description | Units |
|--------------------|---|------------------------|
| Strain | The denitrifying bacteria strains used in the laboratory experiment: P. aureofaciens | unitless |
| Date | Date of the experiments; yyyy-mm-dd | unitless |
| Trial | Trial name | unitless |
| Solution | Nitrate reference materials IAEA-NO3 and USGS-34 | unitless |
| Salinity_in_vial | Nitrate reference materials (IAEA-NO3 and USGS-34) were diluted with a mixture of DIW and nitrate-deplete surface Sargasso seawater to difference salinity | ppt |
| Concentration | Concentrations of nitrate reference solutions | $\mu\text{mol L}^{-1}$ |
| Sample_volume | Sample volume injected to aliquot 10 nmol of nitrate | mL |
| O_exchange_ratio_x | The fraction of O atoms in the N2O product originated from water, x, was estimated from the slope of the observed delta 18ON2O vs. the corresponding delta 18OH2O | % |
| stdev_of_x | Propagated standard deviation of x for each trial | unitless |

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Project Information

CAREER: The biological nitrogen isotope systematics of ammonium consumption and production (Biological Nitrogen Isotope Fractionation)

NSF Award Abstract:

The nitrogen (N) cycle in the marine environment is controlled by biological processes. Unfortunately, quantifying these processes and assessing their effect on the N cycle is difficult by direct measurements because of large spatial and temporal differences. Isotopic composition measurements of N provide a means to constrain these processes indirectly; however, there is still a great deal to be understood about isotope fractionation of recycled nitrogen through biological processes, which has made interpretation of novel nitrogen isotope data difficult. A researcher from the University of Connecticut plans to determine the influence of biological consumption and production on the isotope fractionation in ammonium. By helping to understand the processes surrounding fractionation of recycled ammonium at the organism level, this research will create a basis for which future researchers can better interpret isotope composition data to infer nitrogen cycle dynamics. A graduate student, a postdoctoral fellow, and two or more undergraduate students will be involved in the research. The researcher plans to integrate science with community-engaged learning by developing an undergraduate field and laboratory course that will require the students to present their research to stakeholders in the community. There will be a manual created for this course that will be disseminated in open-access forums for teachers hoping to develop similar courses.

Biological nitrogen isotope fractionation associated with nitrogen recycling remains poorly constrained despite the advent of a variety of new techniques to analyze nitrogen isotopes in recent years. The use of isotopic composition data can be incredibly useful to interpreting nitrogen cycle processes in the ocean that are difficult to measure directly, which makes it crucial to further understand the processes behind fractionation to catch up with the advancement of the datasets available to researchers. This research will characterize the isotope fractionation dynamics of ammonium during biological consumption and production. The researchers will investigate whether the characteristic low concentrations of ammonium in the surface ocean affect isotope fractionation when the ammonium is recycled and whether there is a trophic isotope effect associated with ammonium recycling by protozoan grazers. With this research, there will be a baseline from which researchers can interpret recycled nitrogen dynamics from ammonium isotope datasets. The methods of comparing nitrogen cycling studies will become significantly clearer with such a standard making interpretation uniform by removing significant uncertainties.

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Funding

| Funding Source | Award |
|--|-----------------------------|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1554474 |

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