Supplement of Biogeosciences, 15, 3873–3882, 2018
https://doi.org/10.5194/bg-15-3873-2018-supplement

Biogeosciences
Open Access

Supplement of

Estimation of isotope variation of N_2O during denitrification by *Pseudomonas aureofaciens* and *Pseudomonas chlororaphis*: implications for N_2O source apportionment

Joshua A. Haslun et al.

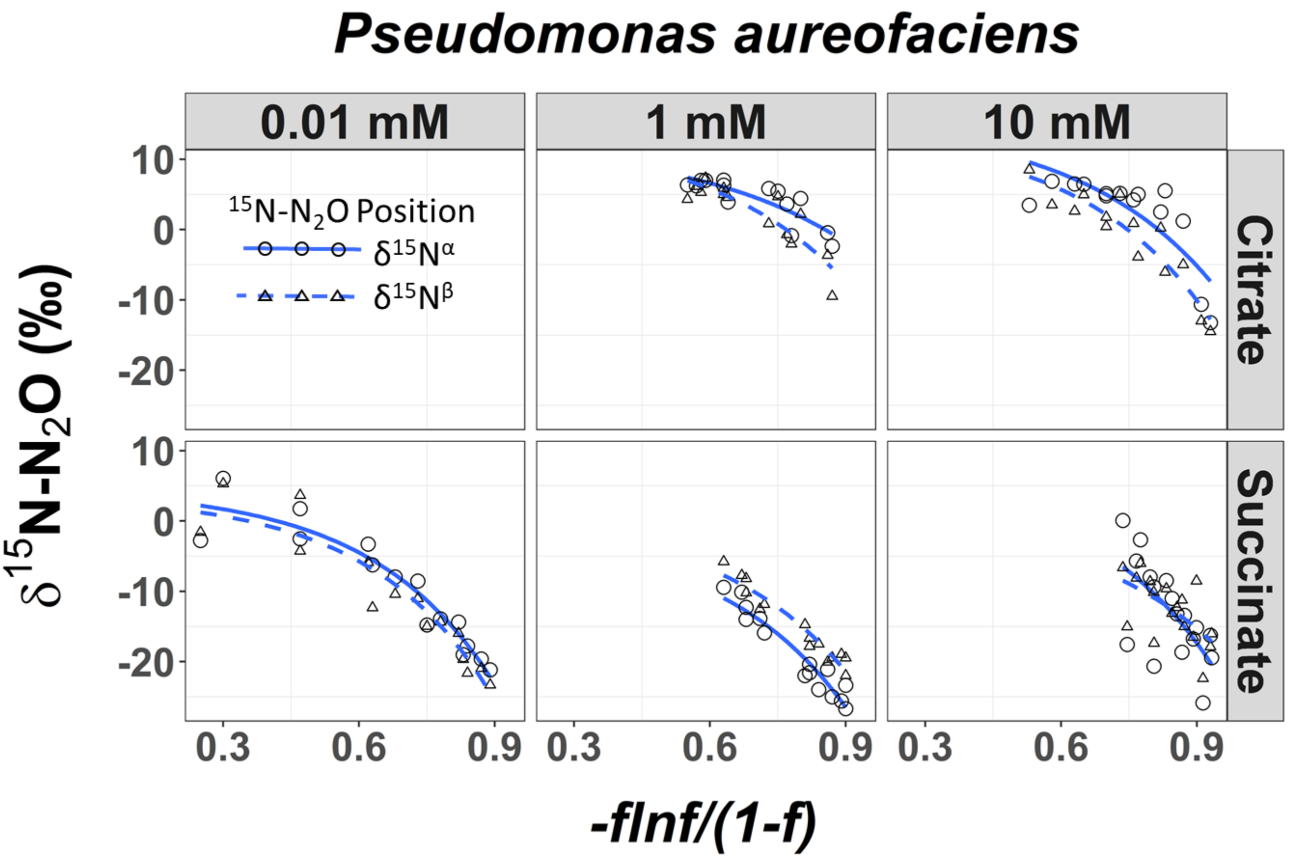
Correspondence to: Peggy H. Ostrom (ostrom@msu.edu)

Supplementary Table S1: Non-linear exponential models estimating the change in $\delta^{15}N$ isotope values following reduction of NO_3^- to N_2O by two species of denitrifying bacteria across an extent of the reaction. The coefficients of each equation were determined from non-linear regression of $\delta^{15}N$-N_2O on [-flnf/(1-f)]. The derivatives were used to determine η across the observed extent of the reaction.

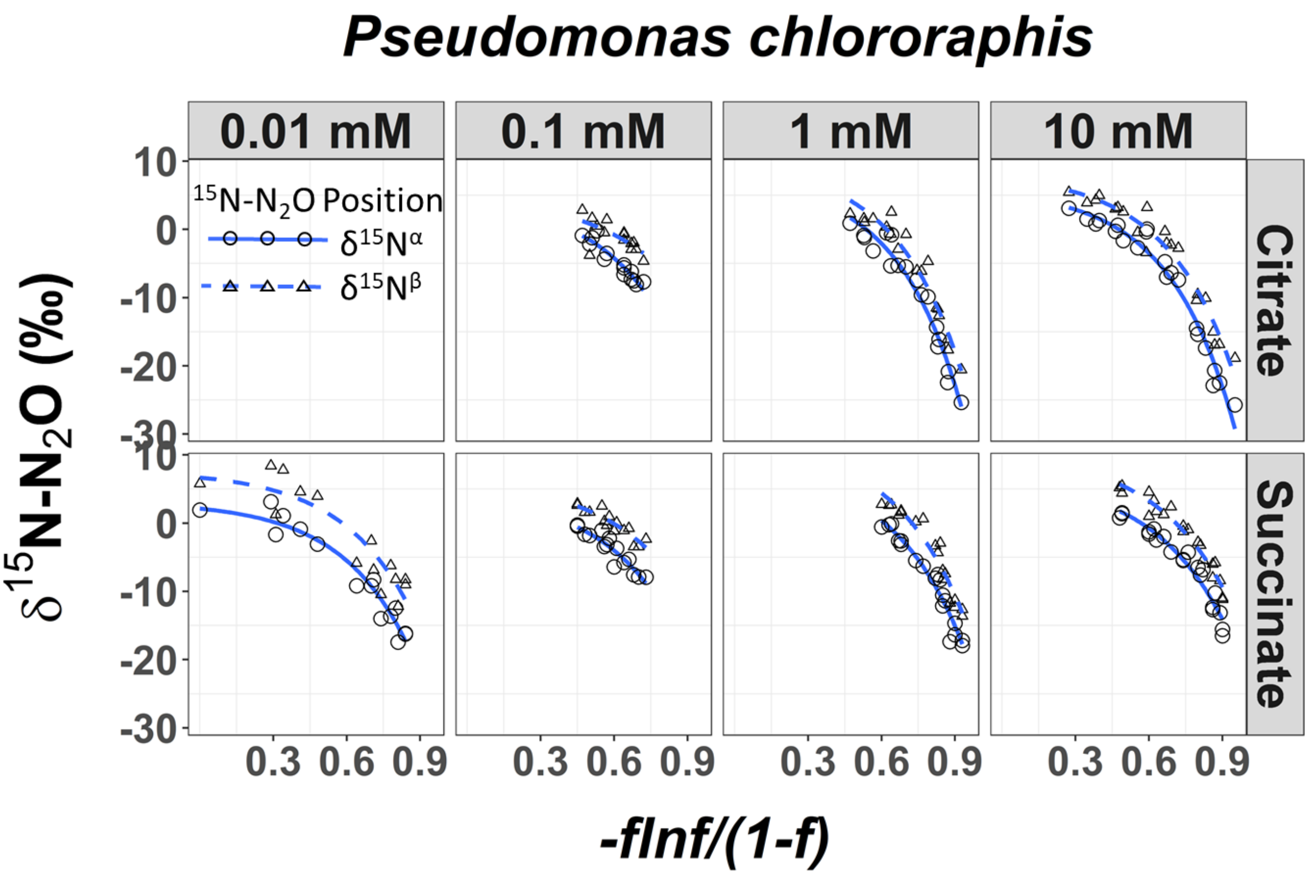
Species	Carbon Source	Concentration	Non-Linear Model	Derivative of Non-Linear Model
Pseudomonas aureofaciens	Citrate	1	$\delta^{15}N = 12.986 - e^{3.187\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.187e^{3.187\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{15}N = 14.821 - e^{3.455\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.455e^{3.455\left[\frac{-f\ln f}{(1-f)}\right]}$
	Succinate	0.01	$\delta^{15}N = 4.257 - e^{3.726\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.726e^{3.726\left[\frac{-f\ln f}{(1-f)}\right]}$
		1	$\delta^{15}N = -0.097 - e^{3.524\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.524e^{3.524\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{15}N = 4.481 - e^{3.378\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.378e^{3.378\left[\frac{-f\ln f}{(1-f)}\right]}$
Pseudomonas chlororaphis	Citrate	0.1	$\delta^{15}N = 4.997 - e^{3.356\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.356e^{3.356\left[\frac{-f\ln f}{(1-f)}\right]}$
		1	$\delta^{15}N = 8.852 - e^{3.752\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.752e^{3.752\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{15}N = 7.188 - e^{3.664\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.664e^{3.664\left[\frac{-f\ln f}{(1-f)}\right]}$
	Succinate	0.01	$\delta^{15}N = 5.411 - e^{3.548\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.548e^{3.548\left[\frac{-f\ln f}{(1-f)}\right]}$
		0.1	$\delta^{15}N = 5.516 - e^{3.370\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.370e^{3.370\left[\frac{-f\ln f}{(1-f)}\right]}$
		1	$\delta^{15}N = 10.582 - e^{3.504\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.504e^{3.504\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{15}N = 8.746 - e^{3.356\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.356e^{3.356\left[\frac{-f\ln f}{(1-f)}\right]}$

Supplementary Table S2: Non-linear exponential models estimating the change in $\delta^{18}O$ isotope values following reduction of NO_3^- to N_2O by two species of denitrifying bacteria across an extent of the reaction. The coefficients of each equation were determined from non-linear regression of $\delta^{18}O$ on [-f lnf/(1-f)]. The derivatives were used to determine η across the observed extent of the reaction.

Species	Carbon Source	Concentration	Non-Linear Model	Derivative of Non-Linear Model
Pseudomonas aureofaciens	Citrate	1	$\delta^{18}O = 15.593 - e^{2.549\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -2.549e^{2.549\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{18}O = 13.606 - e^{2.260\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -2.260e^{2.260\left[\frac{-f\ln f}{(1-f)}\right]}$
	Succinate	0.01	$\delta^{18}O = 11.737 - e^{1.813\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -1.813e^{1.813\left[\frac{-f\ln f}{(1-f)}\right]}$
		1	$\delta^{18}O = 52.359 - e^{3.312\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.312e^{3.312\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{18}O = 50.978 - e^{3.079\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.079e^{3.079\left[\frac{-f\ln f}{(1-f)}\right]}$
Pseudomonas chlororaphis	Citrate	0.1	$\delta^{18}O = 70.519 - e^{2.675\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -2.675e^{2.675\left[\frac{-f\ln f}{(1-f)}\right]}$
		1	$\delta^{18}O = 75.956 - e^{3.433\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.433e^{3.433\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{18}O = 73.385 - e^{3.289\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.289e^{3.289\left[\frac{-f\ln f}{(1-f)}\right]}$
	Succinate	0.01	$\delta^{18}O = 66.495 - e^{3.014\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.014e^{3.014\left[\frac{-f\ln f}{(1-f)}\right]}$
		0.1	$\delta^{18}O = 69.863 - e^{2.974\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -2.974e^{2.974\left[\frac{-f\ln f}{(1-f)}\right]}$
		1	$\delta^{18}O = 78.748 - e^{3.343\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.343e^{3.343\left[\frac{-f\ln f}{(1-f)}\right]}$
		10	$\delta^{18}O = 76.600 - e^{3.127\left[\frac{-f\ln f}{(1-f)}\right]}$	$\eta = -3.127e^{3.127\left[\frac{-f\ln f}{(1-f)}\right]}$



Supplementary Figure S1: The $\delta^{15}N^{\alpha}$ (o) and $\delta^{15}N^{\beta}$ (Δ) isotope values of N_2O produced during the anaerobic reduction of NO_3^- by *Pseudomonas aureofaciens.* Similar trends can be observed by non-linear models fit to $\delta^{15}N^{\alpha}$ (solid line) and $\delta^{15}N^{\beta}$ (dashed line).



Supplementary Figure S2: The $\delta^{15}N^{\alpha}$ (o) and $\delta^{15}N^{\beta}$ (Δ) isotope values of N_2O produced during the anaerobic reduction of NO_3^- by *Pseudomonas chlororaphis.* Similar trends can be observed by non-linear models fit to $\delta^{15}N^{\alpha}$ (solid line) and $\delta^{15}N^{\beta}$ (dashed line).