

CN Report

The Stable Isotope Core Laboratory has analyzed the following samples received for isotopic analysis. For questions please contact Benjamin Harlow and refer to the Our Lab ID numbers associated with your project. These isotopic results supersede any results that may have been submitted to you previously.

Method

Samples for carbon and nitrogen isotopic analysis are converted to N₂ and CO₂ with an elemental analyzer (ECS 4010, Costech Analytical, Valencia, CA); these two gases are separated with a 3m GC column and analyzed with a continuous flow isotope ratio mass spectrometer (Delta PlusXP, Thermofinnigan, Bremen) (Brenna et al., 1997; Qi et al., 2003). Isotopic reference materials are interspersed with samples for calibration. Contribution of ¹⁷O is corrected by the IRMS software using the Santrock correction (Santrock et al. 1985).

Reporting of Carbon Isotope Ratios

Carbon isotopic results were previously reported in per mill relative to VPDB (Vienna Pee Dee belemnite) by assigning a value of +1.95 per mill to NBS 19 CaCO₃ (Coplen 1994). Current NIST calibration of VPDB uses NBS 19 and L-SVEC as anchor points. The carbon isotopic compositions of internationally distributed isotopic reference materials, had they been analyzed in this laboratory with your samples, are (Coplen et al. 2006):

NBS 19	CaCO ₃	+1.95 (exactly)
NBS 18	CaCO ₃	-5.01
IAEA-CO-1	CaCO ₃	+2.49
L-SVEC	Li ₂ CO ₃	-46.6
RM 8542	Sucrose	-10.45
USGS24	graphite	-16.05
NBS 22	oil	-30.03
USGS40	glutamic acid	-26.39
USGS41	glutamic acid	+37.63
IAEA-CO-9	BaCO ₃	-47.32 (exactly)

The 2-sigma uncertainty of carbon isotopic results is 0.5 per mill unless otherwise indicated. This means that if the same sample were resubmitted for isotopic analysis, the newly measured value would lay within the uncertainty bounds 95 percent of the time.

Your samples were normalized using two of our internal running standards (see accompanying .xls file). Running standards were previously calibrated to NBS 19, RM 8542, and IAEA-CO-9 as defined above in our library. The precision (1 sigma) of standards used and associated normalization coefficients are provided in the accompanying .xls results file.

Reporting of Nitrogen Isotope Ratios

Nitrogen isotope ratios are reported in parts per thousand (per mill) relative to N₂ in air. The nitrogen isotopic compositions of nitrogen-bearing internationally distributed isotopic reference materials, had they been analyzed in this laboratory with your samples, are (Coplen et al. 2002):

N ₂ in air		0 (exactly)
IAEA-N-1	(NH ₄) ₂ SO ₄	+0.43
IAEA-N-2	(NH ₄) ₂ SO ₄	+20.39
IAEA-NO-3	KNO ₃	+4.70
USGS25	(NH ₄) ₂ SO ₄	-30.40
USGS26	(NH ₄) ₂ SO ₄	+53.50
USGS32	KNO ₃	+180 (exactly)
USGS34	KNO ₃	-1.8
USGS35	NaNO ₃	+2.7
USGS40	glutamic acid	-4.52
USGS41	glutamic acid	+47.57

The 2-sigma uncertainty of nitrogen isotopic results is 0.5 per mill, unless otherwise indicated.

Your samples were normalized using two or more of our internal running standards (see accompanying .xls file). Our running standards were calibrated to USGS 32, USGS 25, and USGS 26 as defined above. The precision (1 sigma) of standards used and associated normalization coefficients are provided in the accompanying .xls results file.

Quality Assurance

Instrument stability checks and necessary instrument calibrations are performed prior to all analyses. When possible, samples and reference material are prepared to yield signals of the same amplitude, to account for bias associated with amplitude. A linearity check prior to your analysis indicated ¹³C linearity of 0.045 per mil/V and ¹⁵N linearity of 0.04 per mil per volt. This is within the 0.06 per mil/V spec as defined by the IRMS manufacturer. In addition, blind reference material is analyzed with your samples as a check of the normalization. In this case an independent 2 replicates of protein standard **B-2155, (Elementar microanalysis)** were included in each sequence. The normalized values are provided in the accompanying .xls file.

Elemental Composition

Acetanilide was used in a multi point correction to estimate C% and N%.

References

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