



National Institute of Standards & Technology

Report of Investigation

Reference Materials 8538–8542

- 8538: NBS30 (biotite)
- 8539: NBS22 (oil)
- 8540: PEF1 (polyethylene foil)
- 8541: USGS24 (graphite)
- 8542: Sucrose ANU (sucrose)

These Reference Materials (RMs) are intended to provide samples of known isotopic composition with D/H, $^{13}\text{C}/^{12}\text{C}$ and $^{18}\text{O}/^{16}\text{O}$ isotope ratios stated in parts per thousand difference (‰) from the Vienna Standard Mean Ocean Water [VSMOW (RM 8535)] or Vienna Pee Dee belemnite (VPDB, [1,2]) isotope-ratio standards. These RMs are not certified, but their use allows comparability of stable hydrogen, carbon, and oxygen isotope-ratio data obtained by investigators in different laboratories. RM 8538 (NBS30) is intended for stable hydrogen and oxygen isotope-ratio calibration of silicates and is issued in units of 2 g. Hydrogen isotope ratios should be determined on the water fraction (3.5%). RM 8539 (NBS22), RM 8540 (PEF1), and RM 8542 (Sucrose ANU) are intended for stable hydrogen and carbon isotope-ratio calibration of organic materials and are issued in units of 1 mL, a few mg, and 1 g, respectively. RM 8541 (USGS24) is intended for stable carbon isotope-ratio analysis and is issued in units of 0.8 g.

These RMs are distributed on behalf of the International Atomic Energy Agency (IAEA), Vienna, Austria.

The overall coordination of preparation for NIST distribution was carried out by T. B. Coplen, U.S. Geological Survey and R. D. Vocke, Jr., NIST Inorganic Analytical Research Division.

The supporting aspects concerning the distribution by NIST of these RMs were coordinated through the Standard Reference Materials Program by J. S. Kane.

Material Preparation

NBS30 was prepared by I. Friedman, J.R. O'Neil, and G. Cebula of the U.S. Geological Survey from a sample of Lakeview tonalite (Southern California batholith) provided by L. Silver, California Institute of Technology, Pasadena. RM 8539 (NBS22) was prepared by S. Silverman, Chevron Oil Company, La Habra, California. RM 8540 (PEF1) was prepared by H. Gerstenberger and M. Herrmann, Zentralinstitut für Isotopen-und Strahlenforschung, Leipzig, Germany [2]. RM 8541 (USGS24) was prepared by T.B. Coplen, U.S. Geological Survey from Baker® technical grade graphite (96%, <44 μm). Prior to splitting with a sample splitter, six spatially separated ~1-mg samples were analyzed to ensure isotopic homogeneity of the material. Peak-to-peak variation was 0.11‰. RM 8542 (Sucrose ANU) was supplied to the IAEA by H. Polach, Australian National University, Canberra, and was originally intended to replace NBS oxalic acid used for ^{14}C standardization [1].

Gaithersburg, MD 20899
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William P. Reed, Chief
Standard Reference Materials Program

(over)

Storage

It is recommended that these RMs be stored in the containers in which they are supplied to the user.

NOTE: Because very limited quantities of these materials exist, distribution is limited to one unit of each per three-year period of time. Users are strongly advised to prepare their own internal standards for daily use and calibrate those standards against these RMs.

Isotope Abundances

The hydrogen isotopic abundance of these RMs relative to VSMOW (RM 8535) is [1]:

RM	$\delta D_{VSMOW}, \text{‰}$
RM 8538 (NBS30)	-66.7 ± 0.3
RM 8539 (NBS22)	-118.5 ± 2.8
RM 8540 (PEF1)	-100.3 ± 2.0

The carbon isotopic composition of these RMs relative to VPDB using a $\delta^{13}C_{VPDB}$ value of +1.95 ‰ for RM 8544 (NBS19) is [1]:

RM	$\delta^{13}C_{VPDB}, \text{‰}$
RM 8539 (NBS22)	-29.73 ± 0.09 [1]
RM 8540 (PEF1)	-31.77 ± 0.08 [1]
RM 8541 (USGS24)	-15.9 ± 0.25 [5]
RM 8542 (Sucrose ANU)	-10.47 ± 0.13 [1]

The oxygen isotopic composition of NBS30 is:

RM	$\delta^{18}O_{VSMOW}, \text{‰}$
RM 8538 (NBS30)	-5.10 ± 0.02 [4] -5.24 ± 0.24 [1]

REFERENCES

1. Hut, G., Consultants' group meeting on stable isotope reference samples for geochemical and hydrological investigations, Report to the Director General, International Atomic Energy Agency, April 1987.
2. Coplen, T.B., Normalization of oxygen and hydrogen data, Chemical Geology (Isotope Geoscience Section), vol. 72, 293-297 (1988).
3. Gerstenberger, H., and Herrmann, M., Report on the intercomparison for the isotope standards Limestone KH2 and Polyethylene Foil PEF 1, ZFI-Mitteilungen, vol. 66, 67-83 (1983).
4. Coplen, T.B., Kendall, C., and Hopple, J., Comparison of stable isotope reference samples, Nature, vol. 302, 236-238 (1983).
5. Coplen, T.B., unpublished data.