This Reference Material (RM) defines the Vienna Peedee Belemnite (VPDB) scale for isotope-number ratios of carbon (C). It also defines the VPDB scale for isotope-number ratios of oxygen (O) in carbonates. The equivalent name for this RM, as used by the International Atomic Energy Agency (IAEA) and the U.S. Geological Survey (USGS), is NBS19 and is listed in column 1 of Table 1. This material was also formerly called TS Limestone. A unit of RM 8544 consists of one bottle containing approximately 0.4 g of carbonate.

Table 1. Reference Values for the Relative C and O Isotope-number Ratios

<table>
<thead>
<tr>
<th>Name</th>
<th>$10^3 \delta^{13}C_{\text{VPDB}}$</th>
<th>$10^3 \delta^{18}O_{\text{VPDB}}$</th>
<th>$10^3 \delta^{18}O_{\text{VSMOW}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBS19</td>
<td>+1.95 exact</td>
<td>-2.2 exact</td>
<td>+28.65</td>
</tr>
</tbody>
</table>

(a) The $\delta^{13}C_{\text{VPDB}}$ and $\delta^{18}O_{\text{VPDB}}$ values are exact values that form the basis for the VPDB scales for C and O and were set at an international consultants' meeting at the IAEA in 1984 [1].

(b) This value is calculated from data in [2] using the relationship between VPDB and VSMOW on page 36 in [3].

Reference Difference in Isotope-Number Ratio Values: The differences in measured isotope-number ratios of stable carbon isotopes [$N^{13}(13C)/N^{12}(12C)$] are reported as $\delta^{13}C$ values, where:

$$\delta^{13}C = \frac{[N_{\text{sample}}^{13}(13C)/N_{\text{sample}}^{12}(12C)] - [N_{\text{VPDB}}^{13}(13C)/N_{\text{VPDB}}^{12}(12C)]}{[N_{\text{VPDB}}^{13}(13C)/N_{\text{VPDB}}^{12}(12C)]}$$

VPDB refers to the Vienna PDB scale, which is determined by assigning a $\delta^{13}C$ value of +1.95 ‰ to this RM [1,4].

The differences in measured isotope-number ratios of stable oxygen isotopes [$N^{18}(18O)/N^{16}(16O)$] in carbonates are reported as:

$$\delta^{18}O_{\text{VPDB}}$ values, where $\delta^{18}O = \frac{[N_{\text{sample}}^{18}(18O)/N_{\text{sample}}^{16}(16O)] - [N_{\text{VPDB}}^{18}(18O)/N_{\text{VPDB}}^{16}(16O)]}{[N_{\text{VPDB}}^{18}(18O)/N_{\text{VPDB}}^{16}(16O)]}$$

VPDB refers to the Vienna PDB scale, which is determined by assigning a $\delta^{18}O$ value of –2.2 ‰ to this RM [1,4].

Expiration of Value Assignment: RM 8544 is valid, within the measurement uncertainty specified, until 31 December 2020, provided the RM is handled and stored in accordance with instructions given in this Report of Investigation (see “Instructions for Handling, Storage, and Use”). The reference values are nullified if the RM is damaged, contaminated, or otherwise modified.

Maintenance of RM Certification: NIST will monitor this RM over the period of its validity. If substantive technical changes occur that affect the value assignment before the expiration of this report, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

The technical aspects involved in the issuance of this RM were coordinated through the NIST Analytical Chemistry Division by R.D. Vocke, Jr.

Support aspects involved in the issuance of this RM were coordinated through the NIST Measurement Services Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Robert L. Watters, Jr., Chief
Measurement Services Division
INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

Distribution: The distribution of RM 8544 (NBS19) is limited to one unit per three-year period of time.

Storage and Stability: RM 8544 is stable at normal room temperatures. To minimize the potential for oxygen isotope exchange between carbonate and atmospheric water, this RM can be stored in a desiccator.

REFERENCES


Report Revision History: 12 January 2012 (Editorial changes); 18 March 2011 (This revision reflects an extension of expiration date with editorial changes); 01 November 2007 (Update of expiration date and editorial changes); 22 June 1992 (Original certificate date).

Users of this RM should ensure that the Report of Investigation in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/srm.