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Determination of n(13C)/n(12C) isotope ratios by MC-ICPMS and IRMS for providing improved R(13C/12C) value of the zero-point of the VPDB isotope delta scale

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Carbon isotope ratios are typically expressed as isotope delta values $d(^{13}C/^{12}C)$, often shortened to $d^{13}C$. These are isotope ratios expressed relative to an international measurement standard, which for more than 30 years has been the virtual carbonate Vienna Peedee Belemnite (VPDB). While carbon isotope delta values relative to VPDB can be obtained with very small uncertainties, maintenance of the VPDB scale itself is challenging as it is based upon artefacts with exactly assigned isotope delta values. Linking the VPDB isotope delta scale to the SI would alleviate some of the issues inherent to artefact-based scales and aid long-term comparability of measurement results. Such a link is provided by determination of absolute isotope ratios, i.e., $R(^{13}C/^{12}C)$.

New and improved methods for SI-traceable measurements of $R(^{13}C/^{12}C)$ by both gas source isotope ratio mass spectrometry (IRMS) and multicollector inductively coupled plasma mass spectrometry (MC-ICPMS) have been developed at LGC. These methods are based on the calibration approach using synthetic isotopologue mixtures. The developed methodology has been successfully applied to producing glycine reference materials, ERM-AE672a and LGC171-KT, with certified SI-traceable $n(^{13}C)/n(^{12}C)$ isotope amount ratios under ISO 17025 and 17034 accreditations together with indicative $d(^{13}C/^{12}C)_{VPDB}$ values traceable to VPDB.

These new reference materials realise an absolute isotope ratio for VPDB itself $R(^{13}C/^{12}C)_{VPDB}$ through regression of the $n(^{13}C)/n(^{12}C)$ against $d(^{13}C/^{12}C)_{VPDB}$ values. Examining all published values for $R(^{13}C/^{12}C)_{VPDB}$, including our most recent results, allows a better estimation of this quantity than has previously been achievable and points the way towards linking the VPDB isotope delta scale more firmly to the SI.