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Upcoming food matrix stable isotope reference materials from the USGS: honeys, vegetable oils, flours, and collagens

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An international project developed, quality-tested, and measured isotope−delta values of 10 new food matrix reference materials (RMs) for hydrogen, carbon, nitrogen, oxygen, and sulfur stable isotope-ratio measurements to support food authenticity testing and food provenance verification. These new RMs will enable users to normalize measurements of samples to isotope−delta scales. The RMs span a range of δ^2H_{VSMOW} values from −207.4 to −43.3 mUr or ‰, for $\delta^{13}C_{VPDB}$ from −30.60 to −13.72 mUr, for $\delta^{15}N_{air}$ from +1.78 to +14.96 mUr, for $\delta^{18}O_{VSMOW}$ from +18.20 to +26.33 mUr, and for $\delta^{34}S_{VCDT}$ from −20.25 to +17.49 mUr. The RMs include (i) a pair of honeys from Canada and tropical Vietnam, (ii) flours from C3 (rice) and C4 (millet) plants, (iii) four vegetable oils from C3 (olive, peanut) and C4 (corn) plants, and (iv) collagen powders from marine fish and terrestrial mammal origins. After thorough homogenization of the bulk materials, multiple aliquots were sealed in glass under vacuum or noble gas to exclude oxygen and to potentially extend the shelf life to decades when stored at –18 °C in the dark. A total of six laboratories from five countries used various analytical approaches and instrumentation for two- or multiple-point isotopic normalization against international RMs. The use of reference waters and organic liquids in silver tubes allowed direct normalization of δ^2H values of organic materials against isotopic reference waters following the principle of identical treatment, minimizing interference from atmospheric moisture. An errors-in-variables regression model that included the uncertainty associated with the measured and assigned values of the RMs was applied centrally to normalize results and obtain consensus values and measurement uncertainties reported here for new RMs USGS82 to USGS91. Because of exchangeable hydrogen and H_2O in some RMs (especially in honeys, collagens, and flours), sample loading in contact with laboratory air and different types of pre-treatment can result in significant bulk δ^2H variance. Utilization of these new RMs should

foster mutual compatibility of δ^2H values if harmonized technical/analytical approaches are followed and documented in data reports.