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B. Jacobsen, L. Borg, R. Williams, G. Brennecka,
I. Hutcheon

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ISOTOPIC COMPOSITIONS OF URANIUM REFERENCE MATERIALS

Benjamin Jacobsen, Lars Borg, Ross Williams, Gregory Brennecka, Ian Hutcheon

Uranium isotopic compositions of a variety of U standard materials were measured at Lawrence Livermore National Laboratory and are reported here. Both thermal ionization mass spectrometry (TIMS) and multi-collector inductively couple plasma mass spectrometry (MC-ICPMS) were used to determine ratios of the naturally occurring isotopes of U. Establishing an internally coherent set of isotopic values for a range of U standards is essential for inter-laboratory comparison of small differences in $^{238}\text{U}/^{235}\text{U}$, as well as the minor isotopes of U. Differences of $\sim 1.3\%$ are now being observed in $^{238}\text{U}/^{235}\text{U}$ in natural samples, and may play an important role in understanding U geochemistry where tracing the origin of U is aided by U isotopic compositions. The $^{238}\text{U}/^{235}\text{U}$ ratios were measured with a TRITON TIMS using a mixed ^{233}U - ^{236}U isotopic tracer to correct for instrument fractionation. This tracer was extremely pure and resulted in only very minor corrections on the measured $^{238}\text{U}/^{235}\text{U}$ ratios of ~ 0.03 . The values obtained for $^{238}\text{U}/^{235}\text{U}$ are: IRMM184 = 137.698 ± 0.020 (n=15), SRM950a = 137.870 ± 0.018 (n=8), and CRM112a = 137.866 ± 0.030 (n=16). Uncertainties represent 2 s.d. of the population. Our measured value for IRMM184 is in near-perfect agreement with the certified value of 137.697 ± 0.042 . However, the U isotopic compositions of SRM950a and CRM112a are not certified. Minor isotopes of U were determined with a Nu Plasma HR MC-ICPMS and mass bias was corrected by sample/standard bracketing to IRMM184, using its certified $^{238}\text{U}/^{235}\text{U}$ ratio. Thus, the isotopic compositions determined using both instruments are compatible. The values obtained for $^{234}\text{U}/^{235}\text{U}$ are: SRM950a = $(7.437 \pm 0.043) \times 10^{-3}$ (n=18), and CRM112a = $(7.281 \pm 0.050) \times 10^{-3}$ (n=16), both of which are in good agreement with published values. The value for $^{236}\text{U}/^{235}\text{U}$ in SRM950a was determined to be $(8.48 \pm 2.63) \times 10^{-6}$, whereas ^{236}U was not detected in CRM112a. We are currently obtaining the U isotopic composition of CRM129a. Preliminary results suggest that the $^{238}\text{U}/^{235}\text{U}$ ratio is within error, but slightly lower than the certified value of 137.71.

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