Accurate measurement of $^{236}U/^{238}U$ isotope ratio in 10^{-8} range in Soil using TIMS

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Precise measurement of uranium isotope ratios with sufficient accuracy is a challenge to resolve the range of natural variation in a representative set of samples. Variations in the isotope ratios $^{234}U/^{238}U$, $^{235}U/^{238}U$ and $^{236}U/^{238}U$ in natural uranium samples (e.g., uranium ores), are known to exist due to various physical, chemical, mass fractionation, redox transitions, radioactive decay, radioactive disequilibrium, alpha-recoil, and neutron capture.

Uranium was chemically separated from selected Fukushima soil samples with known ^{137}Cs concentration by a two-column separation procedure using UTEVA resin. U isotope ratios were measured using a thermal ionization mass spectrometer (TIMS). The abundance of minor isotopes within the same sample may be so small as to require measurement by specialized detector such as Daly photomultiplier. The TIMS (Phoenix, IsotopX, UK) used has nine Faraday cups collectors and a Daly ion-counting system detector and WARP (wide aperture retardation potential) filter. Abundance sensitivity of ^{237}U using NBS 030a was 5.86 ppb with WARP filter. The limit of detection for $^{236}U/^{238}U$ measurements using Daly ion counting system with WARP is about 10^{-9} order. This was evaluated using a certified natural uranium reference material from University of Vienna in house standard ($^{236}U/^{238}U$ = $1.01x10^{-8}$). This method represents a significant advance for uranium isotopic composition in analysis of environmental samples. Results will be discussed in detail during presentation.