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The Zurich Sea Water (ZSW) intercomparison for ^{236}U and other actinides

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In 2011, during the Fenice11 expedition to the Tyrrhenian Sea, a total of about 350 L of sea water samples were collected and prepared as large volume intercomparison sample for $^{236}\text{U}/^{238}\text{U}$. In this contribution, the results of the intercomparison will be presented.

All samples were filtered through several 0.45 μm membrane filters and collected in a 400 L plastic tank. Afterwards, the pH value was adjusted to 3. After some months of equilibration time, the seawater was filled into 35 ten liter plastic cubitainers ready for shipment. One or two cubitainers were sent out to each participating lab. The labs were asked to apply their standard sample processing procedures, with the primary goal of returning information on the $^{236}\text{U}/^{238}\text{U}$ ratio. Additionally, an interest in ^{236}U -, ^{238}U -, and other actinide-concentrations of the sample was communicated.

The ZSW intercomparison sample was processed in six different chemistry labs and measured on six different mass spectrometers, five AMS systems and one MC-ICP-MS system. All labs returned information on the $^{236}\text{U}/^{238}\text{U}$ ratio of the intercomparison sample and most of them provided results on ^{236}U and ^{238}U concentrations. Additionally, some laboratories reported $^{233}\text{U}/^{238}\text{U}$ ratios and results on Pu-isotopes. Furthermore, indicative concentration values for Am-, and Np-isotopes were reported for the ZSW sample.

The analysis of the reported U-isotopic data shows that the scatter, indicated by the one sigma uncertainty for a single measurement, of the $^{236}\text{U}/^{238}\text{U}$ ratios and the $^{236,238}\text{U}$ -concentrations is 5% and 3%, respectively. A χ^2 -analysis shows that the external error (lab-scatter) is 1-2% and 3% for the $^{236,238}\text{U}$ -concentrations and the $^{236}\text{U}/^{238}\text{U}$ ratios, respectively.

The consensus value for the $^{236}\text{U}/^{238}\text{U}$ ratio and the $^{236,238}\text{U}$ -concentrations of the ZSW sample will be presented. Also, indicative values for Pu-isotopes will be presented but the number of contributing labs is too small for providing a consensus value. The fact that the ZSW sample has been characterized by many different (A)MS labs makes it a valuable internal standard for quality control not only for the analysis of anthropogenic U-isotopes in seawater.

Some of the ^{236}U -measurements were performed on the newly installed MILEA system at ETH Zurich. In addition to the above results, the MILEA setup for U-isotopes will be presented and discussed. The MILEA system provides an abundance sensitivity at the order of 10^{-13} in the mass range of the actinides and thus allows determining the $^{236}\text{U}/^{238}\text{U}$ ratio in samples containing U from both, anthropogenic and natural sources.

Student Submission

No

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