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High precision Pu isotope ratios using MC-ICPMS equipped with collision-cell technology to suppress U isobaric interferences

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The measurement of Pu isotope ratios is of prime interest in both the environmental and nuclear research fields. First, new chronometric tracers need to be developed in order to understand and quantify the mechanisms and time-scales controlling the landscape evolution since it gives informations on climatic variations. Additionally, the analysis of Pu isotopes after irradiation of 235U is required in the transmutation field in order to determine basic neutronic data such as cross sections and reaction rates.

High precision isotope ratios measurements are usually performed with sector field mass spectrometers, either by Thermal Ionization Mass Spectrometry (TIMS) or by Multiple Collection Inductively Coupled Plasma Mass Spectrometry (MC-ICP-MS). One of the major drawbacks in analysing Pu isotopes is the occurrence of U isobaric interferences: 238U-238Pu and 238UH+-239Pu. Here we propose to suppress these interferences by adding reactive gases in the collision-reaction cell of the MC-ICP-MS (Isoprobe, GV Instruments, Manchester, UK). The difference of reactivity for U and Pu towards these gases allows the measurement of Pu isotopes with precision and accuracy similar to those obtained after a previous chemical separation of Pu from U using anion-exchange resin.

This study thus confirms that collision-reaction cells are powerful tools to perform isotopic measurements of soils, river sediments or irradiated materials without former systematic chemical separations as U interferences are completely removed in situ.

References

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