High precision uranium-thorium geochronology on the Nu Plasma II-ES

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U-Th dating has been broadly used to offer precise and accurate dating of Earth surface processes and climate changes of the last 600,000 years. Since its invention in the 1990s, the Multicollector-Inductively Coupled Plasma Mass Spectrometry (MC-ICPMS) technique has opened up new horizons for U-Th geochronology with its higher ionization efficiency of Th and U atoms, pushing measurement precision to ε-unit level.

In this study we evaluate the capability of the Nu Plasma II MC-ICPMS equipped with an Enhanced Sensitivity (ES) interface for high precision U-Th isotope measurements. The typical ion transmission of U and Th was 1.2 – 1.5% on the instrument. For the preliminary experiments, samples ranging in age from <100 a to ~400 ka were analysed in static mode with ^{234}U measured on a full size discrete dynode ion counting multiplier, and other U isotopes on Faraday cups. For Th analyses, ^{229}Th was measured on a Faraday cup with a 10^{12} ohm resistor, ^{230}Th on an ion counter and ^{232}Th on a 10^{11} ohm resistor. Using the 10^{12} ohm resistor to measure small ^{229}Th beams had the potential of substantially reducing the ^{229}Th spike usage and corrections for ^{230}Th in the spike while maintaining the advantages of static analysis. U and Th isotope standards were used to monitor ion counter gain drifts, which limit precision in ^{230}Th/^{229}Th and ^{234}U/^{238}U ratios to 1-2 per mil using this method. In order to improve measurement precision for ages >300 ka, samples of high concentrations were analysed in static mode involving all Faraday cups. A combination of 10^{10} ohm (^{238}U) and 10^{11} ohm resistors were used for U isotopes, and a combination of 10^{12} ohm (^{230}Th) and 10^{11} ohm resistors were used for Th isotopes. Additional experiments are in progress to further demonstrate the capability of the Nu Plasma II-ES for high precision U-Th isotope measurements.