Precise and accurate strontium isotope determination of natural samples with the Nu Sapphire Collision Cell MC-ICP-MS

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Strontium (Sr) isotopes are widely studied in geochemistry and archaeology. Multi-collector ICP-MS (MC-ICP-MS) is commonly used for high precision Sr isotope measurements due to the high ionizaion efficiency and fast sample throughput afforded by the technique. Such analyses are not straightforward, however, as accuarcy can be affected by both Kr and Rb interference corrections and baseline scatter from the large $^{40}Ar^{40}Ar$ ion beam.

Here, the Nu Sapphire, a novel Collision Cell MC-ICP-MS instrument equipped with a dual-path design, which includes both a conventional MC-ICP-MS (high-energy) pathway and a collision-reaction cell (low-energy) pathway, is used for Sr isotope analysis. Following extraction of the ions from the plasma at 6 kV, they can be deflected off-axis and slowed to <20 eV to enter the RF multipole collision cell. Here, the ions mix with collision gases to remove interfering species and are then re-accelerated to 6 kV and focused back onto the high-energy ion path. Alternatively, the ions can by-pass the collision cell so that they are directed directly to the mass analyser, such that the instrument operates as a conventional MC-ICP-MS. Application of the collision-reaction cell will be beneficial for routine Sr isotope measurements, as the technology enables efficient removal of both the Kr and Rb interferences and the large $^{40}Ar^{40}Ar$ ion beam.

In this study, a range of relevant samples (silicate rocks and minerals, sediments and organic materials, including bones and teeth) will be analysed with the Sapphire operating in both low-energy and high-energy modes. For reference, a further sample aliquot will be analysed by TIMS at Imperial College London. As such, the analyses will verify in detail the capability of the Nu Sapphire Collision Cell MC-ICP-MS to provide accurate and precise Sr isotope data at high sample throughput for a wide range of relevant natural samples.