

***In situ* Rb-Sr dating using collision cell MC-ICP-MS**

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A characteristic and complicating feature in the isotopic analysis of beta decay systems, which are used for radiometric dating, such as ⁸⁷Rb-⁸⁷Sr, is the inevitable isobaric overlap of the parent and daughter nuclides. This makes the *in situ* measurements of minerals with high Rb/Sr extremely difficult. 'Proteus', a one-of-a-kind tribrid MC-ICPMS (multicollector inductively-coupled plasma mass spectrometer) now provides an elegant solution to this important analytical barrier. We use, in combination, the two features which make Proteus unique among MC-ICPMS; a collision cell to chemically resolve interferences through ion-gas reactions, and a preceding quadrupole mass filter to limit the mass range of ions that are transmitted onward into the collision cell, which is especially important for *in situ* analysis.

A variety of reaction gases such as N₂O, SF₆ and CH₃F, can be used within a collision cell to allow the effective 'chemical resolution' of ⁸⁷Sr from ⁸⁷Rb during analysis. They are chosen for their reactivity with Sr⁺ to form molecular ions and, crucially, display little or no reactivity with Rb⁺ [1]. Some of these reaction gases have been successfully implemented using single-collector ICP-QQQ-MS (inductively coupled plasma – triple quadrupole mass spectrometer) for the dating of micas [2]. Proteus now permits high precision *in situ* ⁸⁷Sr/⁸⁶Sr analysis of less Rb-rich mineral phases.

Here we present the first application of laser ablation Rb-Sr dating using Proteus yielding an age and initial ⁸⁷Sr/⁸⁶Sr for the Dartmoor Granite. The age and initial ⁸⁷Sr/⁸⁶Sr measured using Proteus agree with previously conducted TIMS Rb-Sr analysis of the same intrusion [3]. The Rb-Sr isochron was produced using analyses of only plagioclase and alkali feldspar. Using this example, we demonstrate the advantages of Proteus over single-collector ICP-QQQ-MS. The enhanced sensitivity relative to ICP-QQQ-MS and the simultaneous collection of all Sr isotopes using multiple faraday cups allows Proteus to achieve superior precision for radiogenic Sr isotope ratios. Notably, this enables dating using the common major mineral, potassium feldspar, which has Rb/Sr too low for typical ICP-QQQ-MS approaches.

[1] Cheng *et al.* (2008) *Analytica chimica acta*, 627 148-153

[2] Hogmalm *et al.* (2017) *J. Anal. At. Spectrom.*, 32, 305-313.

[3] Darbyshire & Shepherd (1985) *Journal of the Geological Society*, 142, 1159-1177