

## **Towards achieving more precise in-situ Sr isotope measurements for apatite: a battle with interferences**

HEEJIN JEON<sup>1\*</sup>, MARTIN J. WHITEHOUSE<sup>1</sup>, ALEXANDER A. NEMCHIN<sup>2</sup>

<sup>1</sup>Swedish Museum of Natural History, Stockholm, Sweden  
(\* heejin.jeon@nrm.se)

<sup>2</sup>Department of Applied Geology, Curtin University, Perth, WA, Australia

The strontium isotope ratio ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) is a powerful tool to study crustal evolution. Apatite provides an unrivalled opportunity to determine the Sr isotopic composition of the crust at the time it formed, as it contains enough Sr to be measured but typically no Rb. Thus, apatite grains from Archean rocks and inclusions in ancient zircon are a prime target to understand the Sr isotope evolution of the early Earth. It is, however, technically challenging to measure Sr isotopes in apatite with good accuracy and precision by SIMS.

A well-known problem of in situ Sr analysis of apatite is the existence of  $\text{Ca}_2^+$  interferences on  $\text{Sr}^+$  species ( $^{86}\text{Sr}$ ,  $^{87}\text{Sr}$ ,  $^{88}\text{Sr}$ ), which requiring exceedingly-high mass resolution ( $\Delta m/m \sim \text{ca. } 18,000$ ) to separate. One solution has been to measure the combined signals of Sr isotopes and  $\text{Ca}_2$  at an intermediate mass resolution ( $\sim 5000$ ) and then subtract the  $\text{Ca}_2$  contributions based on a separately measured  $\text{Ca}_2$  signal (i.e.,  $^{40}\text{Ca } ^{42}\text{Ca}$ ; [1]), which is nominally a a clean peak. However, the low mass resolution method has several problems, particularly in low-Sr apatite: 1) It is critical to achieve a very good peak shape and centre the mass peaks precisely to be sure of getting completely combined signals of  $\text{Sr}^+$  and  $\text{Ca}_2^+$  whilst still resolving the  $^{40}\text{Ca } ^{31}\text{P } ^{16}\text{O}^+$  peak. 2)  $^{40}\text{Ca } ^{42}\text{Ca}$  signal is not a single, pure Ca dimer peak, but includes some minor interferences; thus the  $\text{Ca}_2$  correction cannot be perfect. 3) Rb correction cannot be made due to some trace elements (higher abundance than Rb) forming molecules, which interfere on  $^{85}\text{Rb}$ . 4) Some interferences are impossible to resolve from Sr isotopes even with a higher mass resolution. Those trace elements forming critical interferences for Sr isotope analysis can exist abundantly in apatite, possibly at more than the Sr concentration and/or have higher sensitivity by SIMS. Knowing these limitation, we present here the method developed and results obtained using a CAMECA IMS-1280 instrument.

[1] A. Lepland & M. J. Whitehouse (2011). *Int J Earth Sci* 100, 1-22.