

## Sr Isotope analysis of Apatite using the SHRIMP at IG-USP

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*In situ* Sr isotopic analysis of apatite mineral were analyzed by SHRIMP at Geoscience Institute - São Paulo University-Brazil to have an apatite substandard. For comparison, two crystals were analyzed: one of hydrothermal origin (AP-BR) and another from Belo Horizonte (AP-BH). Apatite AP-BR is blue-green and has a 3cm x 2cm tabular shape. AP-BH has a caramel color and is a hexagonal prism with size 2x3cm. Both samples are relatively homogeneous and have very few inclusions.

SHRIMP analytical conditions were: primary beam = 3nA, spot size = 30µm. A post-ESA slit was used to give resolution greater than 4500: this excludes double charge interferences from rare earth elements on Sr isotopes and also separates the isobaric complex  $^{40}\text{Ca}^{31}\text{P}^{16}\text{O}$  from  $^{87}\text{Sr}$ . Ca dimers, such as  $^{40}\text{Ca}^{44}\text{Ca}$  (m=84),  $^{42}\text{Ca}^{42}\text{Ca}$  (m=84),  $^{40}\text{Ca}^{46}\text{Ca}$  (m=86)  $^{42}\text{Ca}^{44}\text{Ca}$  (m=86), etc., were corrected by monitoring  $^{40}\text{Ca}^{40}\text{Ca}$  and  $^{40}\text{Ca}^{42}\text{Ca}$  and  $^{87}\text{Rb}$  interference on  $^{87}\text{Sr}$  was corrected by measuring  $^{85}\text{Rb}$ . Presence of  $^{40}\text{Ca}^{40}\text{Ca}$  and  $^{42}\text{Ca}^{40}\text{Ca}$  indicates that they will have Ca molecular interferences in the Sr and Rb isotopes.  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios were normalized to  $^{86}\text{Sr}/^{88}\text{Sr}=0.1194$ .

The mean  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio from 10 analyses of AP-BR was  $0.72824 \pm 0.00073$  (2s) and 8 analyses of AP-BH gave an average value of  $0.70926 \pm 0.00055$  (2s). These values are very close to those obtained by TIMS analysis using a TRITON at IG-USP, which gave  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios of  $0.728216 \pm 0.000016$  (2s) for AP-BR and  $0.709244 \pm 0.000007$  (2s) for AP-BH. The analytical errors of the SHRIMP results are higher than TIMS because measurements are made in peak jump mode as opposed to multi-collection. The Sr concentrations found for these apatites using the NIST610 standard were: AP-BR =  $474 \pm 24$  ppm and AP-BH =  $492 \pm 55$  ppm (2 sigma errors). Rb was detected but contents were practically negligible.

Highlights: The  $^{87}\text{Sr}/^{86}\text{Sr}$  of AP-BR is high (0.72824) with a Rb content less than 1ppm and uranium content around 10ppm yielding SHRIMP  $^{206}\text{Pb}/^{238}\text{U}$  age of ~1.0Ga and the analysed mineral is homogeneous throughout its entire area (10000x10000µm). For the AP-BH sample, the  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio (0.709244) is very close to sea water composition, also with very low Rb and U contents (<0.5ppm) and the  $^{206}\text{Pb}/^{238}\text{U}$  SHRIMP age is estimated around 0.5 Ga to 0.2 Ga. The homogeneity of both apatite crystals suggests that they could be used as a potential standards in the future. Interferences on Sr isotopes measurements in apatite are correctable with mass resolution (MR) around 4500 - 5000, but for silicate minerals need MR > 10.000. Si molecular combinations with other elements such as Fe can cause a lot of problems at Sr isotopes (for example,  $^{28}\text{Si}^{56}\text{Fe}= 84$ ,  $^{32}\text{Si}^{54}\text{Fe}= 86$ , etc).

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