Fluid inclusion analysis by laser ablation ICPMS: How consistent are element ratios?

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Analysis of fluid inclusions is a commonly used technique to obtain insights into fluid evolution and ore forming processes. Laser ablation ICPMS offers the possibility to analyse individual inclusions for a wide range of elements and certain isotope ratios, with low detection limits. Quantification of inclusion composition is commonly performed by normalising measured element signals to those of Na or Cl, which are used as internal standards, with their concentrations determined via micro thermometry.

Using a Resonetics M-50 laser probe which allows for analysis of fluid inclusion at depths up to several hundred microns, we observed that values of some element signal ratios change between shallow inclusions and deep inclusions by up to a factor of 2.5. This limits the accuracy of inclusion analysis at larger depth from the sample surface. The Cl/Na and the Pb/Na ratios were found to be affected the most. Ablating a scapolite sample with homogeneous Na, Pb and Cl concentrations showed very similar behaviour. Such strong fractionation behaviour of chlorine has not been reported to date for LA-ICPMS analysis. This may account for some of the scatter observed when analysing a series of individual fluid inclusions, as inclusions are commonly located at a range of depth below the surface. Results from two different brine assemblages will be presented and discussed.

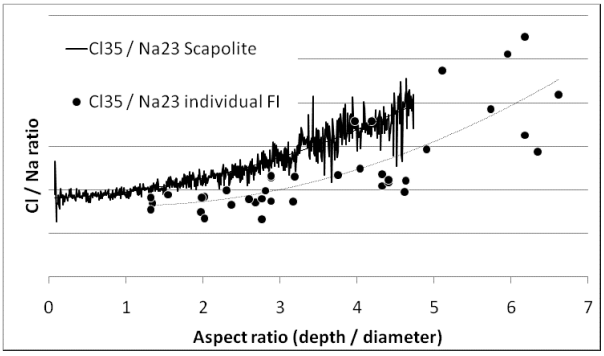

Figure 1: Aspect ratio dependent Cl/Na ratios for scapolite mineral and a fluid inclusion assemblage.

U-Pb SHRIMP and geochemical data of granitoids characterizing the evolution of shear zones in NE Brazil

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A large volume of granitic magmatism associated with large scale shear zone and metamorphism under high-T conditions, characterize the Brasiliano/Pan African Orogeny in the Borborema Province, NE Brazil. Granitoids from two plutons and later dykes intruded along a large dextral sense E-W trending Shear Zone show distinct crystallization ages and geochemical signature. The oldest studied granitoids (U-Pb SHRIMP age of 618 ± 5 Ma), Serra de Inácio Pereira Pluton (SIPP), show high Ba (4440 to 6654 ppm) and Sr (2358 to 2962 ppm) and medium to high Zr (321 a 378 ppm), low Y (19 a 25 ppm) and Nb (14.7 to 17.0 ppm) contents. Their REE patterns are characterized by small or no negative Eu anomalies (Eu/Eu*= 0.92 – 1.15) and $(Ce/Yb)_N$ ratios ranging from 28.34 to 40.09. In contrast, the granitoids showing crystallization age of 563 ± 4 Ma, the Serra do Marinho Pluton (SMP) have low Sr (238 to 272 ppm), and high Zr (755 to 846 ppm) contents. The contents of Y (40 to 75 ppm) and Nb (9.0 to 51.0 ppm) are higher and the Ba (1660 to 1680 ppm) contents lower compared to the values recorded in the SIPP granitoids. Their REE patterns are characterized by negative Eu anomalies (Eu/Eu*= 0.39 – 0.59) and $(Ce/Yb)_N$ ratios ranging from 6.62 to 20.25. Later dykes of subvolcanic granitoids have crystallization ages of 527 ± 6 Ma and A-type geochemical signature. The SIPP granitoids are coeval with the peak of regional metamorphism and originated by melting of a paleoproterozoic source. The SMP show geochemical signature of post-collisional A-type granites and the later dykes have signature of A-type post-orogenic extension-related granitoids coeval with the deposition of small sedimentary basin.