A NEW LABORATORY FOR LA-ICP-MS ANALYSIS OF FLUID INCLUSIONS: CALIBRATIONS USING SOLID, LIQUID AND FLUID INCLUSION

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We have established a Laser Ablation ICP-MS laboratory that is primarily dedicated to the analysis of fluid inclusions. The laser is a 193 nm ArF Lambda Physik Excimer laser, packaged as the Geolas Q plus system by Microlas. It is coupled to an Agilent 7500c ICP-MS, with a collision cell to reduce interferences on Ar masses. As a result, it is possible to analyse for Ca at m/z 40 and Fe at m/z 56, although there is loss of sensitivity for Cl as a result.

Ablation takes place in a He gas flow, and the ablated material is mixed with Ar make-up gas in a cyclone mixer before being introduced to the plasma. The design of the ablation cell and mixer have been optimised to give a smooth, stable signal during ablation of solids, and to broaden the peak arriving from a single laser pulse to about 1 second, permitting precise multi-element analysis.

Calibration has been carried out using a combination of standard silicate glasses (NIST 610, 612, 614, 616, and WRS 601), analysed with the sample stage slowly moving beneath the laser, and standard multi-element solutions in glass capillary tubes (labelled A, B, C). Capillaries are first breached with a 50 μm spot size, and then steadily ablated with a 25 □m spot. The signal obtained during progressive ablation for ca. 100 seconds is extremely stable, and at most masses the %RSD over 20s blocks is around 1-3%. Linear calibrations of element counts normalised to Na, across up to 4 orders of magnitude, have been obtained for a wide range of elements, including: B, Mg, K, Ca, Mn, Fe, Cu, Zn, Rb, Sr, Sn, Sb, Cs, Ba, La, and Pb. In most cases, solutions in capillary tubes plot on the same calibration as solid standards, within errors of a few percent, suggesting matrix-independent sensitivity.

We are now in the process of comparing analyses of synthetic fluid inclusions in quartz, containing the same solution B used in capillaries (c. 21% total salts), and a 5x dilution, B2. Figures 1 and 2 are calibration curves for K/Na and Mn/Na, respectively, including the results of the synthetic fluid inclusion analyses. The agreement is excellent in Figure 1, although the analyses of dilute fluid inclusions are less precise than the more concentrated ones. In detail, Mn is one of a number of divalent cations for which the synthetic inclusion analyses lie slightly below the calibration, and we are currently evaluating why this should be.