Trace Element and Isotopic Composition of GJ Red Zircon Standard by Laser Ablation

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U-Pb zircon dating by laser ablation requires a reliable matrix-matched external standard to correct for instrumental isotopic fractionation. The most commonly used reference material, the 91500 zircon from Ontario, is almost exhausted, and GEMOC has searched for a suitable alternative zircon standard for U-Pb dating.

G & J Gem Merchants (Sydney) donated a parcel of large zircon fragments (~1cm across), believed to be from E. African pegmatites. These range in colour from red to pinkish-red, yellowish-green and brown. Assessment of homogeneity by cathodoluminescence (CL), BSE imaging and EMP and LA-ICP-MS major and trace-element analysis found no zoning or trace element variations within individual crystals. We also have found no variation in U-Pb age or Lu-Hf isotopic composition between differently-coloured populations of the GJ zircon. However, different colour groups show slightly different trace element composition. The red variety is used as a standard for U-Pb dating because it has a useful U content (230±13 ppm) and higher Th content (18±3ppm) than other GJ populations; the Th content allows more precise measurement of $^{208}Pb/^{232}Th$, which is used for the common-Pb correction [1].

Detailed analyses of trace-element composition, U-Pb age and Hf-isotopic composition were performed on 4 different large red GJ crystals. The average of 40 analyses is 11 ± 1ppm Lu and Yb= 61 ± 5 ppm; 20 EMP analyses of HfO2 = 0.79 ± 0.03 wt.%. 46 LA-ICPMS analyses yield an average $^{206}Pb/^{238}U$ age = 610±1.7 Ma (2s), within error of the TIMS value (608.5±0.4 Ma [2]). The mean ages of different grains are identical within 1s. Hf-isotope analysis by LAM-Multi-Collector ICPMS yields $^{176}Hf/^{177}Hf$ = 0.282015±19 (2s, n=25).

The GJ-red zircon is chemically and isotopically homogeneous, and thus is a suitable standard for in-situ trace element and isotopic analysis by laser ablation ICPMS. Material is available for distribution.

References

[1] Andersen,T (2002). Chemical Geology **192**, 59-79.

[2] Jackson,S.E., Pearson, N.J., Griffin,W.L., Belousova, E.A (2004). Chemical Geology **211**, 47-69.