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 91,500 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 (~1 cm 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-ICPMS 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 ± 3 ppm) than other GJ populations; the Th content allows more precise measurement of $^{208}Pb/^{232}Th$, which is used for the common-Pb correction (Andersen, 2002).

Detailed analyses of trace-element composition, U–Pb age and Hf-isotopic composition were performed on four different large red GJ crystals. The average of 40 analyses is 11 ± 1 ppm Lu and $Yb = 61 \pm 5$ ppm; 20 EMP analyses of $HfO_2 = 0.79 \pm 0.03$ wt.%. forty-six LA-ICPMS analyses yield an average $^{206}Pb/^{238}U$ age $= 610 \pm 1.7$ Ma (2 s), within error of the TIMS value (608.5 ± 0.4 Ma (Jackson et al., 2004)). The mean ages of different grains are identical within 1 s. Hf-isotope analysis by LAM-Multi-Collector ICPMS yields $^{176}Hf/^{177}Hf = 0.282015 \pm 19$ (2 s, $n = 25$).

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

Andersen, T., 2002. *Chem. Geol.* **192**, 59–79.

Jackson, S.E., Pearson, N.J., Griffin, W.L., Belousova, E.A., 2004. *Chem. Geol.* **211**, 47–69.