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Assessing homogeneity of rare earth elements and Hf-isotope ratios in IAG U-Th-Pb geochronology reference zircons Rak-17 and Kara-18

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The International Association of Geoanalysts (IAG) recently completed a G-Chron proficiency testing scheme for the Permian Rak-17 zircon from Norway and late Archaean Kara-18 zircon from Western Australia. The intended use of both zircons is as a reference material for SIMS and LA-ICP-MS U-Th-Pb geochronology. We investigated the homogeneity of rare earth elements (REE), as well as $^{176}Hf/^{177}Hf$ in the zircons to assess their value as reference materials for REE and Hf-isotope analysis. REE were measured on 20-micron spots using a Nu AttoM SC-ICP-MS coupled to an ESI 193nm ArF excimer laser ablation system with NIST 612 glass as the external calibration standard. Hf-isotopes were measured on 40-micron spots using a Nu Plasma2 MC-ICP-MS and the same laser system.

Nine individual zircon grains from Kara-18 and nine zircon grain fragments from Rak-17 were analyzed for REE concentrations. For both Kara-18 and Rak-17, variability (%2RSD) of the mean of each REE for all analyses (n=110) is greater than the variability of the mean of the REE measured within grains. This suggests REE variability is greater between grains than within them. Individual Rak-17 grain fragments with uniform CL response have less than 20% (2s) variability for each REE. Rak-17 grain fragments with heterogeneous CL response displayed greater REE variability. A total of 51 Lu-Hf analyses were made on Rak-17 zircon with a 2SD of the mean of 35 ppm. Analyses made on CL dark Rak-17 zircon displayed greater variability (51 ppm, 2SD; n = 13) than CL grey regions (22 ppm, 2SD; n = 21) and CL bright regions (28 ppm, 2SD, n = 17). A total of 49 Lu-Hf analyses were made on Kara-18 zircon. The variability of the mean is 56 ppm (2SD). CL dark regions of Kara-18 zircons display slightly greater variability (73 ppm, 2SD, n= 18) than CL grey domains (38 ppm, 2SD, n = 22) or CL bright domains (33 ppm, 2SD, n = 9). Both Kara-18 and Rak-17 are homogeneous for Hf isotopes at the scale of sampling and show promise as secondary reference materials for in-situ Hf isotopic analysis.