Analytical methodology for U-Pb geochronology

Geochronological data reported in this data release publication were generated using a variety of ID-TIMS and LA-ICP-MS analytical methods in two different laboratories. All mineral separations were done using conventional crushing, grinding, wet shaking table, heavy liquids and magnetic methods, followed by hand selection of grains for analysis using a binocular microscope. Most analyses were done on multi-grain fractions of zircon, which had had the outer portions of the grains removed by strong air abrasion (Krogh, 1982) to minimize the effects of post-crystallization Pb-loss. Zircons recovered from many of the samples contained visible inherited cores. Such grains were not selected for analysis in most cases, although for a few samples, clear, zoned, euhedral tips of igneous zircon were physically broken from grains with visible cores and were then air abraded prior to analysis.

The zircon samples were run with zircon reference materials. The reference materials were analyzed until fractionation was stable and the variance in the measured 206Pb/238U and 207Pb/206Pb ratios was at or near 1 percent. Reference materials were subsequently analyzed together with unknowns to monitor fractionation throughout the analytical session.

All U-Pb zircon and titanite analyses in this report that were done prior to 1992 were carried out at the Geochronological Laboratory at the Geological Survey of Canada (GSC) in Ottawa, Canada, using conventional isotope dilution–thermal ionization mass spectrometry ID-TIMS methods as described by Parrish et al. (1987) and Parrish and others (1992) for zircon and titanite analyses, respectively. Isotopic analyses were done on a Finnigan-MAT 261 variable multi-collector mass spectrometer. Most U-Pb zircon analyses done after 1992 were carried out at the Pacific Centre for Isotopic and Geochemical Research (PCIGR) at the University of British Columbia (UBC) in Vancouver, Canada. Analyses were by conventional ID-TIMS methods employing a VG 54R single collector mass spectrometer equipped with a Daly multiplier, and methods as described by Mortensen and others (1995, 2008). Instrumental mass fractionation factors for ID-TIMS analyses at the GSC and UBC were determined by replicate analyses of NBS U and Pb standards and the isotopic compositions recommended by Thirlwall (2000). Pb isotopic analyses were corrected for initial common Pb compositions based on the model of Stacey and Kramers (1975). Errors associated with calculated ages were determined using the numerical error propagation method of Roddick (1987) and are given at the 2σ level (95% confidence interval). All regressions of discordant U-Pb analyses were done using the methods recommended by Ludwig (2000).

Two U-Pb zircon samples were dated at UBC using laser-ablation-inductively-coupledmass spectrometry (LA-ICP-MS) employing methods as described by Tafti and others (2009). These analyses were done using a New Wave 213nm Nd-YAG laser coupled to a Thermo Finnigan Element2 high resolution ICP-MS.

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