**SUPPLEMENTARY DATA SD1**

**U-Pb ANALYTICAL METHODS**

**Zircon**

Samples were crushed by mechanical disaggregation, and heavy minerals separated using a Wilfley table followed by heavy liquid separation at the Geochronology facility, GSC, Ottawa. Zircon grains were sorted using a Frantz isodynamic separator to a non-magnetic fraction at 1.8 A and 10 degree side-slope. Zircons were cast in 2.5 cm diameter epoxy mounts (along with fragments of the GSC laboratory standard zircon; z6266, with 206Pb/238U age = 559 Ma (Stern and Amelin, 2003)). The mid-sections of the zircons were exposed using 9, 6, and 1 μm diamond compound, and the internal features of the zircons (such as zoning, structures, alteration, etc.) were characterized in back-scattered electron mode (BSE) utilizing a Zeiss Evo 50 scanning electron microscope. The count rates at eleven masses (YbO, Zr, HfO, 204Pb, background, 206Pb, 207Pb, 208Pb, 238U, 248ThO, 254UO) were sequentially measured with a single electron multiplier corrected for a deadtime of 20 ns. Analytical procedures are modified from those described by Stern (1997) with data processing using SQUID2 (version 2.22; Ludwig 2009). The 1σ external errors of 206Pb/238U ratios reported in the data table incorporate the error in calibrating the standard. Common Pb correction utilized the Pb composition of the surface blank (Stern 1997). Yb and Hf concentration data were calculated using sensitivity factors derived from standard 6222 with values of 229 and 8200 ppm respectively. A secondary internal reference zircon (1242) was analyzed to monitor accuracy of the measured 207Pb/206Pb ratios and correct for any instrumental mass bias. Thirty-one of thirty-tree analyses yield a weighted mean age of (2677.9 ± 2.3 Ma (MSWD = 1.7) within error of its measured TIMS age of 2679 Ma (unpublished U-Pb ID-TIMS data). No mass bias was applied to the data. Isoplot v. 3.00 (Ludwig 2003) was used to generate concordia plots and calculate regression ages and weighted means. The error ellipses on the concordia diagrams and the weighted mean errors are reported at 95% confidence intervals. Probability plots constructed using methods of Sircombe (2004).

**Monazite**

Monazite targets were identified in polished thin section using a scanning electron microscope in back scatter mode. Individual target areas were drilled out of the thin sections and mounted together with pre-polished plug of reference monazites (GSC# 8153; 3345; 2908 Stern in a standard 2.5 cm diameter epoxy mount. No additional polishing was done. The count rates at eleven masses (Y, Ce, HfO, 204Pb, background, 206Pb, 207Pb, 208Pb, 238U, 248ThO, 254UO) were sequentially measured with a single electron multiplier corrected for a deadtime of 20 ns. Energy filtering at the exit slit of the electrostatic analyzer was employed to minimize possible isobaric interference on 204Pb. Common Pb corrections are based on the measured 204Pb counts using the Stacey and Kramers (1975) model. An instrumental mass fractionation correction of 1.0037 ±
0.27% (95% confidence) was applied to 207Pb/206Pb ratios based on replicate analyses of the 3345 monazite relative to its ID-TIMS age 1821 Ma. The uncertainty in the IMF correction was added in quadrature to calculate uncertainties in the weighted mean ages reported in the text.

REFERENCES CITED

Figure DR1. Photomicrographs of representative detrital zircon grains.
| Spot name      | U (ppm) | Th (ppm) | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* | Pb* | err | % Pb* |
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This file consists of Backscatter electron images of thin sections and individual monazite grains analysed in the study. The location of individual monazite grains is indicated on the thin section image by number (e.g. F241). Note: not all monazite grains identified on the thin section were analysed. The individual analyses listed in Table 6 are identified by the file name in the lower right of the BSE images, which follows the convention: sample name – grain number. Grain number corresponds to those listed in Table 6.
HY79-S31a
Thin section scan in BSE
Areas cored out as indicated
HY-C433-1977
Thin section scan in BSE
Areas cored out as indicated
HY-C367-1977
Thin section scan in BSE
Areas cored out as indicated