Online Supplementary material A1

Analytical methods

U–Pb zircon dating

Zircon from the heavy liquid separates was hand-picked under a binocular microscope, mounted in epoxy resin and polished to about half-thickness. Prior to U–Pb analysis the prepared zircon mounts were imaged with cathodoluminescence (CL) on a scanning electron microscope at the Institute of Petrology and Structural Geology, Charles University in Prague. A Thermo Scientific Element 2 sector field ICP-MS coupled to a 193 nm ArF excimer laser (Teledyne Cetac Analyte Excite laser) at the Institute of Geology of the Czech Academy of Sciences, Prague, Czech Republic, was used to measure the Pb/U and Pb isotopic ratios in zircon grains. The laser was fired at a repetition rate of 5 Hz and fluence of 4 J/cm^2 with 25 micron spot size. He carrier gas was flushed through the two-volume ablation cell at a flow rate of 0.9 l/min and mixed with 0.68 l/min Ar and 0.005 l/min N_2 prior to introduction into the ICP. The in-house glass signal homogenizer (design of Tunheng & Hirata 2004) was used for mixing all the gases and aerosol resulting in a smooth, spike-free signal. The signal was tuned for maximum sensitivity of Pb and U, Th/U ratio close to unity and low oxide level, commonly below 0.2 %. Typical acquisitions consisted of 15 second measurement of blank followed by measurements of U Th and Pb signals from the ablated zircon for another 35 seconds. The total of 420 mass scans data were acquired in the time resolved – peak jumping – pulse counting/analogue mode with 1 point measured per peak for masses ^{204}Pb + Hg, ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{232}Th, ^{235}U, and ^{238}U. Due to a non-linear transition between the counting and analogue acquisition modes of the ICP instrument, the raw data were pre-processed using a purpose-made Excel macro. As a result, the intensities of ^{238}U were left unchanged if measured in a counting mode and recalculated from ^{235}U intensities if the ^{238}U was acquired in analogue mode. Data reduction was then carried out off-line using the Iolite data reduction

package version 3.4 with VizualAge utility (Petrus & Kamber 2012). Full details of the data reduction methodology can be found in Paton *et al*. (2010). The data reduction included the correction for gas blank, laser-induced elemental fractionation of Pb and U and instrument mass bias. For the data presented here, blank intensities and instrumental bias were interpolated using an automatic spline function while down-hole inter-element fractionation was corrected using an exponential function. No common Pb correction was applied to the data due to the high Hg contamination of the commercially available He carrier gas, which precludes accurate correction of the interfering ^{204}Hg on the very small signal of ^{204}Pb (common lead). Residual elemental fractionation and instrumental mass bias were corrected by normalization of internal natural zircon reference material Plešovice (Sláma *et al.* 2008). Zircon reference materials GJ-1 (Jackson *et al.* 2004) and 91500 (Wiedenbeck *et al.* 1995) were periodically analysed during the measurement for quality control. The values obtained from analyses performed over 4 different analytical sessions (slightly discordant GJ-1 with mean Concordia ages between 603 ± 5 Ma to 606 ± 6 Ma (2σ); near-concordant 91500 with mean Concordia ages between 1060 ± 7 and 1072 ± 9 Ma (2σ)) correspond perfectly and are less than 1 % accurate within the published reference values (GJ-1: ^{207}Pb/^{206}Pb age of 608.53 ± 0.4 Ma, (Jackson *et al.* 2004); 91500: ^{207}Pb/^{206}Pb age of 1065.4 ± 0.3 Ma, (Wiedenbeck *et al.* 1995). The CL images of representative zircons from the dated samples are shown in Fig. 3. The zircon U–Pb ages are presented as a concordia diagrams generated with the ISOPLOT program v. 3.70 (Ludwig 2008), and histograms with kernel density estimate (Andersen *et al.* 2017). Only analyses less than 10 % discordant were taken into account. For the data interpretation, the ^{207}Pb/^{206}Pb age was taken for zircons older than 1 Ga, while the ^{206}Pb/^{238}U age was used for zircons younger than 1 Ga. A summary of the isotope ratio measurements and dating results are presented in the supplementary material A2. Age errors are quoted at 2 sigma confidence levels.

Whole-rock geochemistry

Major and trace elements were determined in the AcmeLabs Vancouver (now Bureau Veritas Minerals) by ICP-OES/MS. The dissolution of the samples for the ICP-ES/MS studies was by $LiBO_2/Li_2B_4O_7$ fusion (rare earth and refractory elements).

Data management, recalculation, plotting and statistical evaluation of the whole-rock geochemical and isotopic data were facilitated by *GCDkit* (Janoušek *et al.* 2006). In this work, the mg number (mg#) is defined as molar $100 \times MgO / (FeOt + MgO)$ and the A/CNK index (Shand 1943) as molar $Al_2O_3 / (CaO + Na_2O + K_2O)$. For description of chondrite-normalized REE patterns serves the Eu/Eu* ratio, reflecting the magnitude of the Eu anomaly ($\frac{Eu}{Eu*} = Eu_N / \sqrt{Sm_N Gd_N}$), where *N* refers to concentrations normalized to chondritic abundances (Boynton 1984).

Sr–Nd isotopic composition

For the isotopic study, samples were decomposed using hot HF–HNO_3 mixture. The dry residuum was further treated by few drops of $HClO_4$ and dissolved in 6M HCl. Pure Sr and Nd fractions were isolated from bulk matrix by the ion-exchange chromatography techniques using AG 50W-X8 (BioRad), TRU-spec, Ln-spec and Sr resins (TrisKem Intl.) by methods adapted from Pin *et al.* (1994) and Pin & Zalduegui (1997). Isotopic analyses were performed on a Triton Plus thermal ionization mass spectrometer housed at the Czech Geological Survey. Neodymium was analysed in Re double filament assembly and strontium in single Ta assembly, both in static mode. The $^{143}Nd/^{144}Nd$ mass bias was corrected to $^{146}Nd/^{144}Nd = 0.7219$ (Wasserburg *et al.* 1981), and the $^{87}Sr/^{86}Sr$ ratios assuming $^{86}Sr/^{88}Sr = 0.1194$. External reproducibility was estimated from repeat analyses of the NBS 987 ($^{87}Sr/^{86}Sr = 0.710253 \pm 18$ (2σ), n = 58) and JNdi-1 ($^{143}Nd/^{144}Nd = 0.512099 \pm 10$ (2σ, n = 33)) isotopic standards. The JG-1a reference material (Geological Survey of Japan) yields values $^{87}Sr/^{86}Sr = 0.711050 \pm 9$ (2SM)

and $^{143}Nd/^{144}Nd = 0.512365 \pm 6$ (2SM), which are in good agreement with published values (Yamamoto et al. 2013). The Rb, Sr, Sm and Nd concentrations were obtained by ICP-MS in Acme Labs, Canada (see above).

The decay constants applied to age-correct the isotopic ratios are from Villa *et al.* (2015 – Sr) and Lugmair & Marti (1978 – Nd). The ε^{i}_{Nd} values and single-stage CHUR Nd model ages were obtained using Bulk Earth parameters of Jacobsen & Wasserburg (1980), the two-stage Depleted Mantle Nd model ages ($T^{DM}_{Nd\ .2stg}$) were calculated after Liew & Hofmann (1988).

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