**Section S1. Analytical methods**

Except for samples UD14 and UD17, the U–Pb dating of zircons was conducted using a Photon Machines Analyte Excite 193 nm excimer laser system equipped with a two-volume HelEx ablation cell, coupled to an Agilent 7900 quadrupole ICP-MS instrument at the CGS. Samples were ablated in a helium atmosphere (0.8 L/min) at a pulse repetition rate of 5 Hz, using a spot size of 25 μm and a laser fluence of 7.59 J/cm². Each measurement comprised 20 seconds of blank acquisition followed by 40 seconds of ablation. Signal collection was performed for masses 202Hg, 204Pb, 206Pb, 207Pb, 208Pb, 232Th, and 238U using a secondary electron multiplier (SEM) detector, with one data point per mass peak and dwell times of 10, 10, 15, 30, 20, 10, and 15 ms respectively, resulting in a total sweep time of 0.134 seconds. Data reduction in Iolite followed the method of Paton et al. (2010), involving subtraction of an ‘on-peak’ gas blank and correction for laser-induced elemental fractionation (LIEF) by comparison with the behavior of the 91500 reference zircon (Wiedenbeck et al., 1995). This correction was validated by analyses of zircon standards GJ-1 (~609 Ma; Jackson et al., 2004) and Plešovice (~337 Ma; Sláma et al., 2008). U–Pb isotopic data were acquired across multiple non-consecutive analytical sessions; full reporting of standards data for each session is provided in Section S2.

Samples UD14 and UD17 were measured using a Nu AttoM high resolution ICP-MS coupled to a 193 nm ArF excimer laser (Resonetics RESOlution M-50 LR) at the University of Bergen, Norway. The laser was fired at 5 Hz and energy of 80 mJ with 19 micron spot size. The measurement of blank (15 s) was followed by collection of U Th and Pb signals from the ablated zircon for another 30 seconds. The data were acquired in time resolved – peak jumping – pulse counting mode with 1 point measured per peak for masses 204Pb + Hg, 206Pb, 207Pb, 208Pb, 232Th, 235U, and 238U. Due to a non-linear transition between the counting and attenuated (= analog) acquisition modes of the ICP instrument, the raw data were pre-processed using a purpose-made Excel macro. As a result, the intensities of 238U are left unchanged if measured in a counting mode and recalculated from 235U intensities if the 238U was acquired in an attenuated mode. Data reduction was carried out off-line using the Iolite data reduction package version 3.0 with VizualAge utility (Petrus and Kamber, 2012). Full details of the data reduction methodology can be found in Paton et al. (2010). The data reduction included 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 but the low concentrations of common Pb were controlled by observing 206Pb/204Pb ratio during measurements. Residual elemental fractionation and instrumental mass bias were corrected by normalization to the natural zircon reference material GJ-1 (Jackson et al., 2004). Zircon reference materials Plešovice (Sláma et al., 2008) and 91500 (Wiedenbeck et al., 1995) were periodically analysed during the measurement for quality control.

Hf isotopic data were acquired from selected samples representing different stratigraphic levels. Hf analysis targeted zircon domains that yielded concordant U-Pb ages and could accommodate a larger laser spot size of 40–45 μm. The Hf data were obtained in two consecutive analytical sessions following the procedure described by Soejono et al. (2022). Hf isotopes were analyzed using the same Photon Machines Analyte Excite 193 nm excimer laser system with a two-volume HelEx ablation cell, connected to a Thermo-Finnigan Neptune MC ICP-MS equipped with eight movable Faraday collectors (L4, L3, L2, L1, H1, H2, H3, H4) and one fixed center collector (C). Measurements were conducted in static multi-collection, low mass resolution mode. Samples were ablated in a helium atmosphere (0.8 L/min) with a laser energy of 9.42 J/cm², beam diameter of 40 μm, and repetition rate of 10 Hz. Each measurement included 20 seconds of blank acquisition followed by 40 seconds of ablation.

The Faraday cup configuration allowed simultaneous detection of all Hf isotopes as well as potential isobaric interferences: L4 – 171Yb, L3 – 173Yb, L2 – 175Lu, L1 –176Hf, C – 177Hf, H1 – 178Hf, H2 – 179Hf, and H3 – 180Hf. Data were corrected for gas blanks and isobaric interferences of Yb and Lu on 176Hf by monitoring interference-free isotopes 171Yb, 173Yb, and 175Lu. The 176Yb and 176Lu contributions were calculated using isotopic abundances from Chu et al. (2002). Mass bias for Yb was corrected using a 173Yb/171Yb normalization factor of 1.132685 (Chu et al., 2002). Instrumental mass bias for Hf was corrected based on measured 179Hf and 177Hf intensities and the natural ratio (179Hf/177Hf = 0.7325) using the exponential law (Chu et al., 2002). Data quality was monitored by periodic analyses of natural zircon reference samples 91500 (Wiedenbeck et al., 1995), GJ-1 (Jackson et al., 2004), and Plešovice (Sláma et al., 2008b). Multiple laser ablation MC ICP-MS analyses of these standards yielded 176Hf/177Hf ratios of 0.282231 ± 0.000043 (2σ), 0.281931 ± 0.000037 (2σ), and 0.282409 ± 0.000023 (2σ), respectively. Complete reference data are provided in the Section S2.

The values used for Hf isotopic calculations were as follows: chondritic uniform reservoir (CHUR), with 176Lu/177Hf = 0.0332 and 176Hf/177Hf = 0.282772 (Blichert-Toft and Albarede, 1997); depleted mantle (DM), with 176Lu/177Hf = 0.0384 and 176Hf/177Hf = 0.28325 (Chauvel and Blichert-Toft, 2001); and a 176Lu decay constant of 1.8648 × 10-11 (Scherer et al., 2001).

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