**Supplementary data, paragraphs 3.1 and 3.2.**

**3.1 Sample preparation**

After crushing up to 1 kg of the fresh sample in a jaw crusher, material was sieved for the fraction from 36 to 400 µm. Heavy mineral separation was achieved from this fraction using LST (lithium heteropolytungstate in water) prior to magnetic separation in the Frantz isomagnetic separator. Final selection of zircon grains for U-Pb dating was carried out by hand-picking under a binocular microscope (ZEISS Stemi 2000-C). If possible, at least 150 zircon grains of each sample were randomly picked in order to get a representative selection of the overall zircon populations (Fedo et al., 2003; Link et al., 2009). After selection, zircon grains of all sizes and colours, the morphologic types according to Pupin (1980), length and width, roundness and surface structure according to Gärtner et al. (2013) were determined with a scanning electron microscope (SEM). These characteristics of morphology are thought to supplement the isotopic data and may help to improve the precision of provenance studies. After this, zircon grains were mounted in resin blocks and polished to half their thickness in order to expose their internal structure. Cathodoluminescence (CL)-imaging was performed using a SEM coupled to a HONOLD CL-detector operating with a spot size of 550 nm at 20 kV.

**3.2 U-Th-Pb age determination via LA-ICP-MS**

Zircon areas showing monophase growth patterns were preferentially selected for isotope analyses in order to avoid mixed U-Pb ages resulting from different late- to post-magmatic or metamorphic influences. Measurements for U, Th and Pb were executed in 2014 at the GeoPlasma Lab, Senckenberg Naturhistorische Sammlungen Dresden using LA-ICP-MS (Laser Ablation with Inductively Coupled Plasma Mass Spectrometry) techniques. A Thermo-Scientific Element 2 XR instrument coupled to a New Wave UP-193 Excimer Laser System was utilised. For ablation, the mounts were put into a teardrop-shaped, low volume laser cell, produced by Ben Jähne (Dresden), which enables sequential sampling of heterogeneous grains (e.g. growth zones) during time-resolved data acquisition. Single measurement of one spot contained approximately 15 s background acquisition followed by 30 s data acquisition. Depending on grain structure and size, spot sizes ranged between 25 and 35 µm. More detailed specifications on the instruments settings are available in supplementary table S1. Correction of common-Pb, based on the interference- and background-corrected 204Pb signal and a model Pb composition (Stacey and Kramers, 1975), was carried out if necessary. Judgement of necessity for correction depended on whether the corrected 207Pb/206Pb lay outside the internal errors of the measured ratios. Interpretation with respect to the obtained ages was done for all grains within a range of 90–110% of concordance (e.g. Meinhold et al., 2011). Discordant analyses were generally interpreted with caution, even if they define a discordia. Finally, raw data were corrected for background signal, common-Pb, laser induced elemental fractionation, instrumental mass discrimination, depth- and time-dependant elemental fractionation of Pb/Th and Pb/U by use of an in-house Excel® spreadsheet program developed by Axel Gerdes (Institute of Geosciences, Johann Wolfgang Goethe-University Frankfurt [JWG], Frankfurt/Main, Germany). Measurement of Th-U ratios was carried out parallel to U-Th-Pb determination with the same combination of instruments. Reported uncertainties were propagated by quadratic addition of the external reproducibility obtained from standard zircon GJ-1 (~0.6% and 0.5–1.0% for the 207Pb/206Pb and 206Pb/238U, respectively, first described by Jackson et al., 2004) during individual analytical sessions and the within-run precision of each analysis. Concordia diagrams (2σ error ellipses) and concordia ages (95% confidence level) were produced using Isoplot/Ex 2.49 (Ludwig, 2001). Frequency and relative probability plots were generated via AgeDisplay (Sircombe, 2004). For zircon grains older than 1 Ga, 207Pb/206Pb ages were taken for interpretation, the 206Pb/238U ages for younger grains. For further details on analytical protocol and data processing see Gerdes and Zeh (2006).

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