**U-Th-Pb isotopes**

Each LA-SF ICP-MS analysis consisted of approximately 15 s background acquisition followed by 30 s data acquisition, using a laser spot-size of 25 and 35 µm, respectively. A common-Pb correction based on the interference- and background-corrected 204Pb signal and a model Pb composition 1 was carried out if necessary. The necessity of the correction is judged on whether the corrected 207Pb/206Pb lies outside of the internal errors of the measured ratios. Discordant analyses were generally interpreted with care. Raw data were corrected for background signal, common Pb, laser induced elemental fractionation, instrumental mass discrimination, and time-dependant elemental fractionation of Pb/Th and Pb/U using an Excel® spreadsheet program developed by Axel Gerdes (Institute of Geosciences, Johann Wolfgang Goethe-University Frankfurt, Frankfurt am Main, Germany). Reported uncertainties were propagated by quadratic addition of the external reproducibility obtained from the standard zircon GJ-1 (~0.6% and 0.5-1% for the 207Pb/206Pb and 206Pb/238U, respectively) 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) and frequency and relative probability plots using AgeDisplay 2. The 207Pb/206Pb age was taken for interpretation for all zircons >1.0 Ga, and the 206Pb/238U ages for younger grains. For further details on analytical protocol and data processing see 3. Th/U ratios are obtained from the LA-ICP-MS measurements of investigated zircon grains. U and Pb content and Th/U ratio were calculated relative to the GJ-1 zircon standard and are accurate to approximately 10%. Analytical results of U-Th-Pb isotopes and calculated U-Pb ages are given in Supplementary file 4. SEM and Cathodoluminescence images (CL) were performed with an EVO 50 scanning electron microscope (Zeiss) at Senckenberg Naturhistorische Sammlungen Dresden.

**References**

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