

## **Supplementary materials**

**Supplemental Table S1.** Minor and trace element ( $\mu\text{g/g}$ ) mass fractions of the GJ-1, Qinghu, and Tanz zircon RMs determined using LA-ICP-MS.

**Supplemental Table S2.** Element compositions of the GJ-1 zircon RM determined using different method.

**Supplemental Table S3.** Variation of detection limits (ppm,  $3\sigma$ ) for Yb, Al, Th, and Ti under different analytical conditions.

**Supplemental Table S4.** Major, minor and trace element results (wt.%) in GJ-1, Qinghu, and Tanz zircon RMs analyzed using EPMA.

**Supplemental Table S5.** Major, minor and trace element data of the zircon in CE-6 anorthosite determined using EPMA.

**Supplemental Fig.S1.** Compositional variation plots for key trace elements in GJ-1, Qinghu, and Tanz zircon RMs analyzed using LA-ICP-MS.