Tang, M., et al., 2020, Reconstructing crustal thickness evolution from europium anomalies in detrital zircons: Geology, v. 49, https://doi.org/10.1130/G47745.1

SUPPLEMENTAL MATERIAL

Analytical method

Zircon U-Pb isotopes and trace elements were measured simultaneously by LA-ICP-MS at the Institute of Geology and Geophysics, Chinese Academy of Sciences. The LA-ICP-MS consists of a COMPex Pro 193 nm excimer laser ablation system produced by Coherent and an Agilent Q-ICP-MS 7500. High purity He was used as a carrier gas to transport the aerosol from the sample cell to the ICP. The laser was operated with a fluence of 2-3 J/cm^2 and a repetition rate of 10 Hz. A laser spot size of 32 µm was used for all analyses. Each individual analysis consists of 10 s background acquisition and 50 s data acquisition. The isotopes were measured include ^{29}Si, ^{31}P, ^{43}Ca, ^{45}Sc, ^{49}Ti, ^{89}Y, ^{91}Zr, ^{93}Nb, ^{139}La, ^{140}Ce, ^{141}Pr, ^{146}Nd, ^{147}Sm, ^{153}Eu, ^{157}Gd, ^{159}Tb, ^{163}Dy, ^{165}Ho, ^{166}Er, ^{169}Tm, ^{173}Yb, ^{175}Lu, ^{177}Hf, ^{181}Ta, ^{204}Pb, ^{206}Pb, ^{207}Pb, ^{208}Pb, ^{232}Th and ^{238}U. The instruments were tuned to maintain a ThO/Th of < 0.2% before analyses.

For U-Pb dating, zircon GJ was used as the calibration standard, zircon 91500 and zircon SA01 were used as secondary standards to monitor instrument performance. SA01 is a reference zircon introduced by Huang et al. (2019), and has been demonstrated to have homogenous ^{206}Pb/^{238}U ages (535.08 ± 0.32 Ma, 2 SD, CA-ID-TIMS method; 536.4 ± 8.8 Ma, 2 SD, SIMS; 536 ± 11 Ma, 2 SD, LA-ICP-MS). 91500 is a widely used international reference zircon with a ^{206}Pb/^{238}U age of 1062.4 ± 0.8 Ma (2 SD, Wiedenbeck et al., 1995). Data reduction was performed by GLITTER. Our repeated measurements of the two reference zircons over the four-day session yielded mean ^{206}Pb/^{238}U ages of 534 ± 26 Ma (2 SD) and 1066 ± 47 Ma (2 SD) for SA01 and 91500, respectively.

For trace elements, NIST 610 was used as the calibration standard, and Si (15.32 wt.% in zircon) was used as the internal standard for isotope ratio-concentration conversion. Our repeated measurements of SA01 in four days yielded an average Eu/Eu* of 1.12 ± 0.06 (2 SD). This is consistent with the values reported by Huang et al. (2019). Reference zircon 91500 has extremely low MREE concentrations and its Eu is often below our detection limit (~0.2 ppm, mean background + 3 SD). Reference zircon results are provided in supplementary spreadsheet.

We measured a total of 1,639 detrital zircon grains extracted from four rivers in the Gangdese. We removed the analyses with La > 1 ppm (potentially affected by inclusions) or Th/U < 0.1 (potentially altered by metamorphic processes) or Sm-Eu-Gd below detection limits. These screening treatments downsized the dataset to n = 1,477 which we used to calculate crustal thickness.

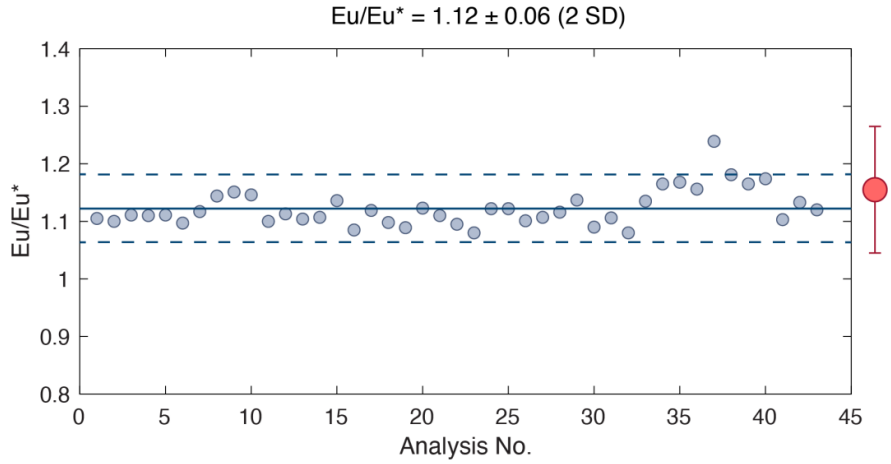

Fig. S1. Repeated measurements of Eu/Eu* in reference zircon SA01 over our four-day analytical session. The red dot with error bars on the right shows the average Eu/Eu* and uncertainties (2 SD) reported by Huang et al. (2019).

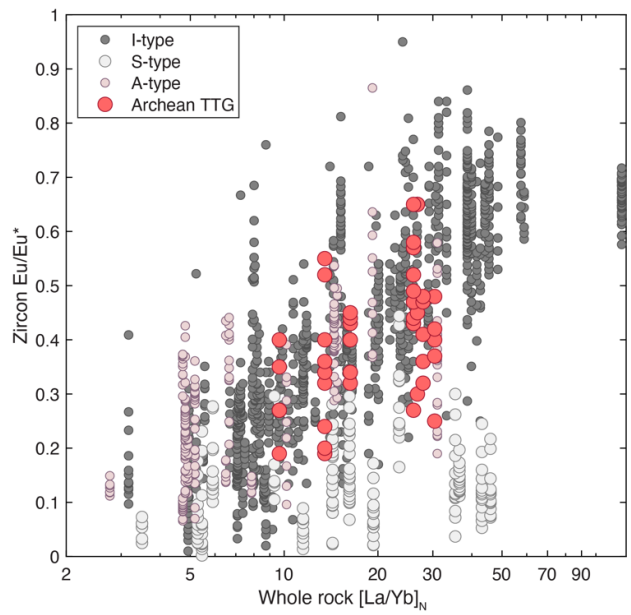

Fig. S2. Individual zircon Eu/Eu* vs. whole rock $[La/Yb]_N$ for various types of granitic samples.

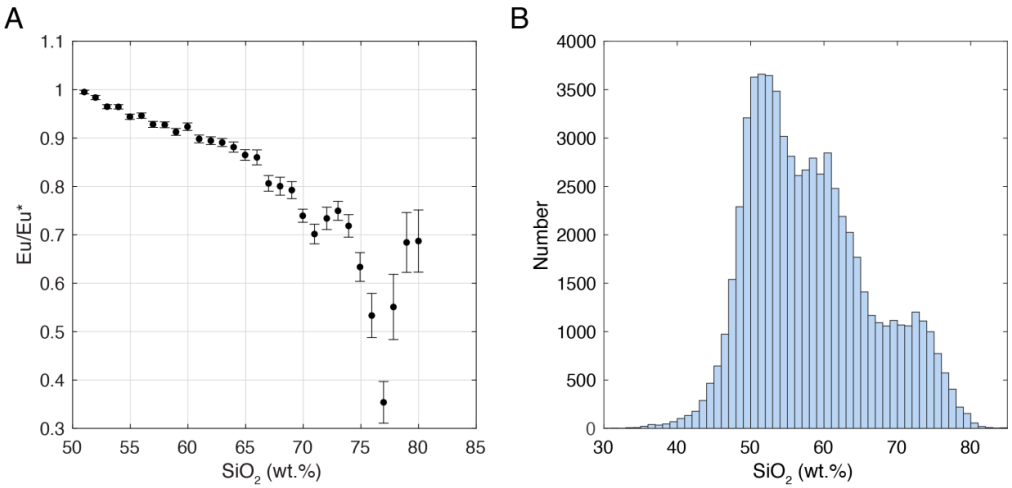

Fig. S3. Eu/Eu* vs. SiO_2 (A) and SiO_2 content distribution (B) in modern magmatic rocks. Data in A are presented as SiO_2 binned (bin size = 1 wt.%) averages and errors (2 se). Data from GeoRoc (http://georoc.mpch-mainz.gwdg.de/georoc/).

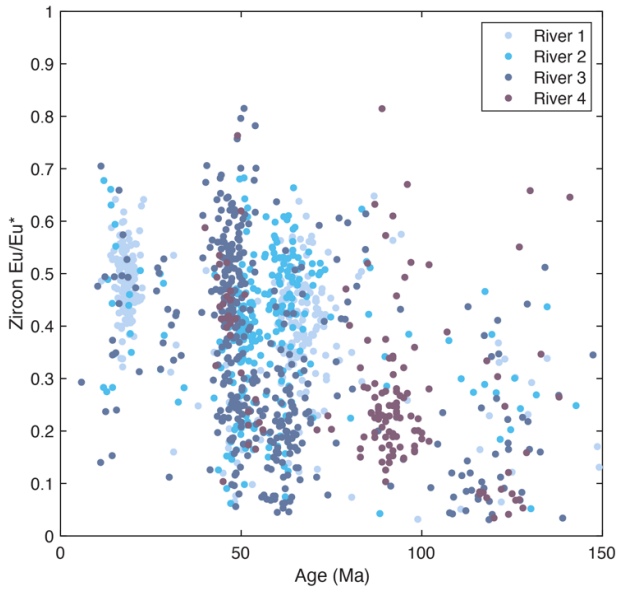

Fig. S4. Scatter plot of zircon Eu/Eu* vs. $^{206}Pb/^{238}U$ age for the detrital zircons extracted from the river sands in the Gangdese magmatic belt, southern Tibet.

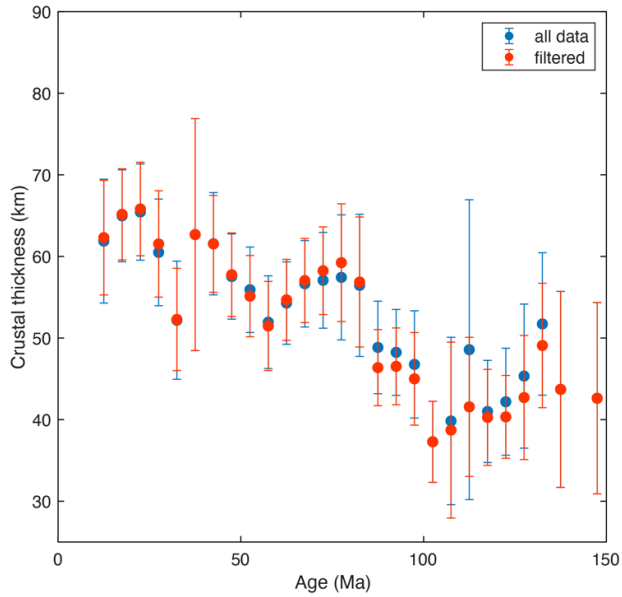

Fig. S5. The filtered trend shows the effect of removing 10% highest and 10% lowest Eu/Eu* analyses within each 5 Ma bin. Both "all data" and "filtered" trends have been screened by Th/U and La concentration.

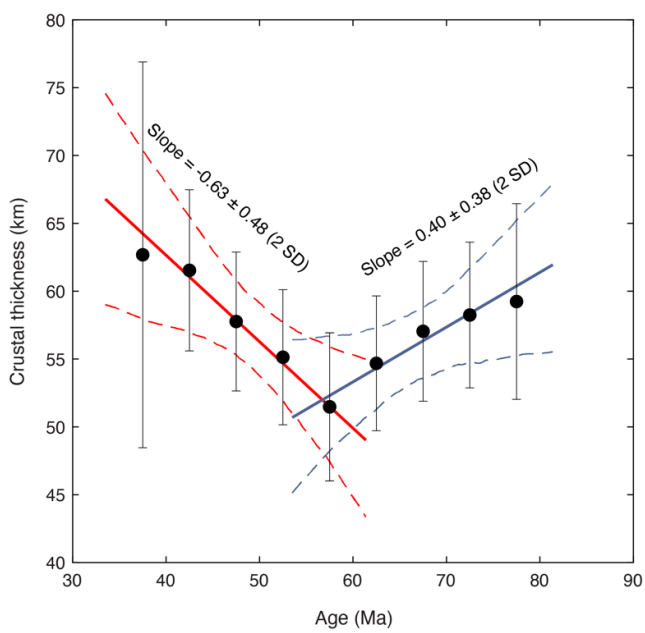

Fig. S6. Statistical tests of crustal thinning at 80-55 Ma and thickening trends at 55-35 Ma. The solid and dashed lines are mean and 2 SD boundaries, respectively.

Table S1. GPS coordinates of river sand collecting sites in southern Tibet

	Latitude	Longitude
River 1	29.841726	91.742029
River 2	29.365879	91.832431
River 3	29.442720	90.929076
River 4	29.195833	93.131944

References

Huang, C., Wang, H., Yang, J. H., Ramezani, J., Yang, C., Zhang, S. B., Yang, Y. H., Xia, X. P., Feng, L. J., and Lin, J., 2019, SA01–A Proposed Zircon Reference Material for Microbeam U-Pb Age and Hf-O Isotopic Determination: Geostandards and Geoanalytical Research.

Wiedenbeck, M., Alle, P., Corfu, F., Griffin, W., Meier, M., Oberli, F. v., Quadt, A. v., Roddick, J., and Spiegel, W., 1995, Three natural zircon standards for U-Th-Pb, Lu-Hf, trace element and REE analyses: Geostandards newsletter, v. 19, no. 1, p. 1-23.