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Supplemental Material

Text S1. Analytical Methods

Table S1. U–Pb LA–ICP–MS data for zircons from granulite and amphibolite.

Table S2. U–Pb LA–ICP–MS data for zircons from metapelite and metapsammite.

Table S3. Zircon trace-element compositions from granulite and amphibolite.

Table S4. Hf isotopic compositions for zircons from granulite and amphibolite.

SUPPLEMENTAL MATERIAL S1. ANALYTICAL METHODS

Whole-Rock Major and Trace-Elements

Whole-rock major and trace-element concentrations analyses were determined at the State Key Laboratory of Isotope Geochemistry (SKLaBIG), Guangzhou Institute of Geochemistry Chinese Academy of Sciences (GIG-CAS). Samples for whole-rock analyses were crushed and pulverized in an agate mill ~200 mesh grain size. Major element (wt%) analyses were determined on fused glass disks of ~50 mg rock-powder and ~4.0 g Li₂B₄O₇ flux using Rigaku ZSX100e X-ray fluorescence spectrometer. Loss on ignition (LOI) was determined by the weight difference after ignition at 950 °C. Analytical precision for most major elements is within 1%–5%. The detailed analytical procedures described by Li X.H. et al. (2002). Trace element analyses were performed using a Perkin-Elmer Sciex ELAN 6000 ICP-MS instrument. Sample powders (~50 mg) were digested with mixed HNO₃ and HF acid in steel-bomb coated Teflon beakers for 48h in order to ensure complete dissolution of refractory minerals. USGS rock standards G-2, W-2, MRG-1 and AGV-1 and Chinese national standards GSD-12, GSR-1, GSR-2 and GSR-3 were used to calibrate the trace element concentrations of the measured samples. Analytical precision was generally better than 5%.

The low chemical index of alteration (CIA) of metasediments has been calculated as follows: $CIA = Al_2O_3 / (Al_2O_3 + CaO + Na_2O + K_2O) \times 100$. The index of compositional variability (ICV) used to discuss maturity of metasediments has been calculated as follows: $ICV = (Fe_2O_3 + K_2O + Na_2O + CaO + MgO + TiO_2) / Al_2O_3$.

Sr–Nd Isotopic Analysis

Sr–Nd isotopic analyses were performed on a Micromass Isoprobe multi-collector mass spectrometer (MC-ICP-MS) at the SKLaBIG, GIG-CAS, using the analytical procedures described in Li X.H. et al. (2004). Cation columns were used for separation of REE and Sr. Nd fractions were further separated using HDEHP-coated Kef columns. Measured ⁸⁷Sr/⁸⁶Sr and

$^{143}\text{Nd}/^{144}\text{Nd}$ ratios were normalized to $^{86}\text{Sr}/^{88}\text{Sr} = 0.1194$ and $^{146}\text{Nd}/^{144}\text{Nd} = 0.7219$, respectively. Reported $^{87}\text{Sr}/^{86}\text{Sr}$ and $^{143}\text{Nd}/^{144}\text{Nd}$ ratios were adjusted to the NBS SRM 987 standard $^{87}\text{Sr}/^{86}\text{Sr} = 0.710256 \pm 22$ (2σ) and the Shin Etsu JNdi-1 standard $^{143}\text{Nd}/^{144}\text{Nd} = 0.512110 \pm 8$ (2σ).

Zircon U–Pb Dating

Zircons were separated using conventional heavy liquid and magnetic separation techniques before being handpicked under binocular microscope. Zircon grains were mounted in epoxy resin disk and polished at about half grain size prior to analysis. Cathodoluminescence (CL) images of zircon were obtained at the SKLaBIG, GIG-CAS using a JEOL JXA-8100 electron probe micro-analyzer fitted with a Mono CL3 CL System for high-resolution imaging and spectrometry.

U–Pb dating of zircon was measured with an ELEMENT XR (Thermo Fisher Scientific) ICP-SF-MS coupled with a 193-nm (ArF) Resonetics RESOLUTION M-50 laser ablation system at the SKLaBIG, GIG-CAS. The detailed experiment procedure and data reduction strategy are described in Zhang L. et al. (2018). Laser condition was set as following: beam size, 33 μm ; repetition rate, 6Hz; energy density, ~ 4 J cm^{-2} . A smoothing device (The Squid, Laurin Technic) was used to smooth the sample signal. Each spot analysis consisted of 20 s gas blank collection with the laser off, and 30 s sample signal detection with the laser on. Signals of the following masses were detected: ^{202}Hg , $^{204}(\text{Hg}+\text{Pb})$, ^{206}Pb , ^{207}Pb , ^{208}Pb , ^{232}Th and ^{238}U . The oxide molecular yield, indicated by the $^{238}\text{U}^{16}\text{O}/^{238}\text{U}$ ratio, was less than 0.3%. Zircon Plešovice (Sláma et al., 2008) was selected as the calibration standard and every five sample analyses were followed with two analyses of Plešovice. Zircon 91500 (Wiedenbeck et al., 1995) was measured as unknown to evaluate the analytical precision and accuracy. 20 analyses of 91500 yield an average $^{206}\text{Pb}/^{238}\text{U}$ age of 1060.5 ± 10 Ma, agreeing well with the ID-TIMS value. Off-line inspection and integration of background and analysis signals as well as time-drift correction and quantitative calibration for trace element analyses and U–Pb dating were performed using the Glitter software version 4.0 of the Macquarie University.

Zircon U–Pb dating and zircon trace-elements of granulite and amphibolite was performed using LA-ICP-MS at Key Laboratory of Mineralogy and Metallogeny (KLaBMM) at the GIG-CAS using a Resonetic 193 nm ArF excimer laser, operated at a constant energy of 80 mJ, with a repetition rate of 8Hz and a spot size of 30 μm . Helium was used as a carrier gas to transport the ablated material from the standard laser-ablation cell and then mixed with Ar gas via a mixing chamber before entering into the ICP-MS torch. Each spot analysis consisted of ~ 30 s background acquisition and ~ 40 s of sample data acquisition. Zircon Plešovice and NIST SRM 610 were used as external standard for age calculations and concentrations calculations respectively. Each block of 8 sample analyses was bracketed by external standard analysis. Off-line inspection and integration of background and analysis signals as well as time-drift correction and quantitative calibration for trace element analyses and U–Pb dating were performed using ICPMSDataCal software (Liu Y.S. et al., 2008, 2010). The detailed analytical technique can be found in Li Q. et al. (2011).

Age calculations, concordia diagrams and weighted mean calculations were performed using Isoplot/Ex (Ludwig, 2003).

Zircon Hf isotopic composition

All zircon Hf isotope analyses in this study were performed on a Neptune Plus MC-ICP-MS (Thermo Scientific), coupled with a RESolution M-50 193 nm laser ablation system (Resonetics), which are hosted at the SKLaBIG, GIG-CAS. The detailed description of the two instruments can be found in Zhang L. et al. (2014). An X-skimmer cone in the interface was used to improve the instrumental sensitivity. All isotope signals are detected with Faraday cups under static mode. The laser parameters were set as follow: beam diameter, 45 μm ; repetition rate, 6 Hz; energy density, $\sim 4 \text{ J cm}^{-2}$. Helium was chosen as the carrier gas (800 $\text{ml} \cdot \text{min}^{-1}$). A “squid” smoothing device on the gas line to the ICP gives a smooth signal. Each analysis consisted of 400 cycles with an integration time of 0.131 s per cycle. The first 28 s was used to detect the gas blank with the laser beam off, followed by 30 s laser ablation for sample signals collection with laser beam on. During the measurement of this study, the gas blank of ^{180}Hf was less than 0.2 mv. ^{173}Yb and ^{175}Lu were used to correct the isobaric interference of ^{176}Yb and ^{176}Lu on ^{176}Hf . The natural ratio values of $^{176}\text{Yb}/^{173}\text{Yb}$ and $^{176}\text{Lu}/^{175}\text{Lu}$ used in the correction are 0.79381 (Segal et al., 2003) and 0.02656 (Wu et al., 2006). The mass bias factor of Yb is calculated from the measured $^{173}\text{Yb}/^{171}\text{Yb}$ and the natural ratio of 1.13268. The mass bias factor of Lu is assumed to be the same as that of Yb. The mass bias of $^{176}\text{Hf}/^{177}\text{Hf}$ was normalized to $^{179}\text{Hf}/^{177}\text{Hf} = 0.7325$ with an exponential law. The detailed data reduction procedure is reported in Zhang L. et al. (2015). 40 analyses of the Plešovice zircon during the course of this study yielded a weighted mean of $^{176}\text{Hf}/^{177}\text{Hf} = 0.282483 \pm 0.000035$ (2SD), which is consistent within errors with the reported value in Sláma et al. (2008).

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