Supporting Information for

**The detrital zircon record of Phanerozoic magmatism in the southern central Andes**

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**Additional Supporting Information (Files uploaded separately)**

Captions for Datasets S1 to S8

**Introduction**

Supporting information provided here include detailed metadata for zircon U-Pb and Lu-Hf analyses.

Text S1

**Analytical Metadata**

Zircon (U-Pb) Geochronometry

Laboratory name: UTChron, The University of Texas at Austin

Sample type/mineral: Detrital zircons

Sample preparation: Conventional mineral separation, 1” pour mount

**Laser ablation system**

Make, Model & type: Photon Machines Analyte G2

Ablation cell & volume: HelEx cell, dual volume

Laser wavelength (nm): 193 nm

Pulse width (ns): <4 ns

Fluence (J.cm-2): ~1.24 J/cm-2

Repetition rate (Hz): 10 Hz

Ablation duration (secs): ~30 secs

Ablation pit depth / ablation rate: ~15-17 μm pit depth

Spot diameter (μm) nominal/actual: 30 μm

Sampling mode: Static spot ablation

Carrier gas: 100% He in the cell

**ICP-MS Instrument**

Make, Model & type: ThermoFischer, Element 2, HR-ICP-MS

Sample introduction: Ablation aerosol

RF power (W): 1100-1250 W

Make-up gas: flow Argon controlled by MFC set at 1/02 LPM

Detection system: second electron multiplier (SEM)

Masses measured: 202, 204, 206, 207, 208, 232, 235, 238

**Data Processing**

Gas blank: 25 second on-peak zero subtracted

Calibration strategy: GJ1 as primary standard; Plesovice and Pak-1 secondary standard

Reference Material info: GJ1 (600.4 ± 0.1 Ma; Jackson et al., 2004), Plesovice (PL-1; 337.2 ± 0.4 Ma; Sláma et al., 2008) and Pak-1 (43.03 Ma; in house standard)

Data processing package used /

Correction for LIEF: Iolite (Paton et al., 2011) and VizsualAge data reduction scheme (Petrus and Kamber, 2012)

Mass discrimination: 207Pb/206Pb and 206Pb/238U normalised to reference material

Common-Pb correction, composition

and uncertainty: No common Pb correction was applied

Uncertainty level & propagation: Uncertainties of isotope ratios and ages are reported in DR Table 5 at 1-sigma.

Age uncertainties are reported with only internal (measurement)

uncertainties and also with internal and external (systematic) uncertainties

combined by quadratic addition.

Zircon (Lu-Hf) Geochemistry

Laboratory name: Department of Earth Sciences, University of Hong Kong

Sample type/mineral: Detrital zircons

Sample preparation: Conventional mineral separation, 1” pour mount

**Laser ablation system**

Make, Model & type: Resonetics LLC, RESOlution M-50, ArF excimer laser

Ablation cell & volume: HelEx cell, dual volume

Laser wavelength (nm): 193 nm

Pulse width (ns): ~20 ns

Fluence (J.cm-2): ~5 J/cm-2

Repetition rate (Hz): 6 Hz

Ablation duration (secs): ~45 secs

Ablation pit depth / ablation rate: ~20-40 μm pit depth

Spot diameter (μm) nominal/actual: 55 μm

Sampling mode: Static spot ablation

Carrier gas: 500 ml/min; He + 2 ml/min N‑, Ar make-up gas

**ICP-MS Instrument**

Make, Model & type: Nu Instruments, Nu Plasma HR, MC-ICP-MS

Sample introduction: Ablation aerosol

RF power (W): 1300 W

Make-up gas: 400 ml/min Ar

Detection system: mixed Faraday-multiple ion counting array

Masses measured: 172–179, 204, 206, 207, 238

**Data Processing**

Gas blank: 20 second on-peak zero subtracted

Calibration strategy: GJ-1 used as primary standard; and 91500 secondary standards

Reference Material info: 176Hf/177Hf value of 0.282015 ±19 (Elhlou et al., 2006) and 0.282307 (Wu et al., 2006)

Data processing package used /

Correction for LIEF: ICPMSDataCal (Liu et al., 2010)

Mass discrimination: 207Pb/206Pb and 206Pb/238U normalized to reference material

Uncertainty level & propagation: Ages are quoted at 2 sigma absolute, propagation is by quadratic addition. Reproducibility and age uncertainty of reference material are propagated.

**Table S2 Pleistocene-Holocene Andean Volcanos and Slab Geometry**

 Pleistocene to Holocene Andean volcano identification and location (lat, long) metadata with derived data from the Nazca slab (depth, thickness, strike, dip) from Slab 2.0 model (Hayes et al., 2018). Data was collected using ArcGis Desktop.

**Table S3 Pleistocene-Holocene Volcanic Arc Width and Melt Depth Calculations**

Pleistocene-Holocene Andean arc width and melting depth calculations across latitudinal segments. Segments are defined in Figure 3.

**Table S4 Bedrock Geochronology and Location Compilation**

Compilation of Phanerozoic bedrock geochronology between -33-28°S from Pilger, 2018.

**Table S5 MZ-CZ slab angel calculations**

Mesozoic-Cenozoic arc width, restored arc width, slab angle, averaged zircon Hf, and averaged zircon Th/U values for 2Myr intervals.

**Table S6 Detrital Zircon U-Pb Data**

New detrital zircon U-Pb ages for sandstone samples VILE 10 and VILE11 (Figure 5A and 5B).

**Table S7 Detrital Zircon Hf Data**

New detrital zircon Lu-Hf analysis (Figure 5C)

**Table S8 Detrital Zircon U-Th-Pb Compilation**

Compiled published detrital zircon U-Pb ages and Th/U ratios (Figure 6A and 6B)

**Table S9 Zircon Hf Compilation**

Compiled published detrital zircon and in-situ zircon Lu-Hf analysis (Figure 6C)