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Data Article

Zircon U-Pb geochronology and trace element dataset from the Southern Rocky Mountain Volcanic Field, Colorado, USA

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A B S T R A C T

This contribution provides *in-situ* LA-ICP-MS U-Pb ages and trace element determinations of zircons from dacitic to rhyolitic lavas, ignimbrites and intrusions in the Southern Rocky Mountain Volcanic Field (SRMVF) in Colorado, USA. The data record a period of intense magmatic activity in the Oligocene-early Miocene (~37–22 Ma) which gave rise to some of the largest explosive ignimbrites in the geological record (e.g. the Fish Canyon Tuff). Age data are drift corrected, but not corrected for radiation dosage or Th disequilibrium, in order to allow users to apply their own algorithms. Xenocrysts (much older crystals up to 2 Ga from the Proterozoic basement) are included in this record.

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Specifications Table

Subject	Earth Sciences
Specific subject area	Geochronology of magmatic events
Type of data	Tables
How data were acquired	Laser ablation inductively-coupled-plasma mass spectrometry (LA-ICP-MS) with a Thermo Element XR sector field ICP-MS and ASI Resolution S155 laser ablation system. Drift-corrected in Iolite v2.5 software, with exported U-Pb ages and ratios, not Th-corrected, not alpha-dose corrected
Data format	Analyzed Filtered
Description of data collection	Laser: 193 nm wavelength; ~2–3 J cm^{-2} fluence; 4–5 Hz repetition rate; 20–30 µm spot size; 30–40 s ablation time ICP-MS: ~1 l/min Ar + 0.7 l/min He flow (from ablation cell); ~10–20 ms integration time per mass; 250 ms per cycle (for U-Pb only) or 400 ms per cycle (U-Pb and trace element combined); see Table 2; Zircons older than 50 Ma are considered xenocrystic and reported separately
Data source location	Institution: Institute for Geochemistry and Petrology; ETH Zürich City: Zürich, Switzerland Samples coordinates: SW Colorado, USA (specific coordinates in Table 1)
Data accessibility	Repository name: Mendeley Data Data identification number: 10.17632/jrsrfks568.1 Direct URL to data: https://data.mendeley.com/public-files/datasets/jrsrfks568/files/edb7f05a-2b3c-4111-b951-04fb8550e392/file_downloaded

Value of the Data

- The Southern Rocky Mountain Volcanic Field (SRMVF) zircon data provide age constraints on volcanic units from Colorado, which detail the evolution of the volcanic field in the Oligocene-Miocene.
- Many of these zircons have trace element determinations that make it possible to track time vs compositional evolution of magma bodies.
- A compilation of xenocrystic zircons from within these Tertiary zircon suites provides constraints on the source of crustal assimilation.

1. Data Description

This article provides zircon U-Pb age and trace element data from the Southern Rocky Mountain Volcanic Field [1], including over 6,500 individual zircon analyzes (>4,400 with trace element data) spread across 31 analytical sessions and 3 years. This includes data from 10 caldera cycles as well as several lavas indirectly related to them and a batholith, namely: the Lake City Caldera (4 units, 5 samples, n = 325); Creede Caldera (3 units, 3 samples, n = 391); San Luis Caldera Complex (9, 16, n = 1952); South River Caldera (1, 1, n = 4); Bachelor Caldera (3, 3, n = 544); Silverton Caldera (1, 1, n = 84); La Garita Caldera (1, 1, n = 541); concealed source of Masonic Park Tuff (1, 1, n = 129); Bonanza Caldera (4, 4, n = 943); Mount Princeton Batholith (5, 13, n = 702); Mount Aetna (4, 8, n = 256) and the Conejos lavas (4, 4, n = 206).

The following data is available in this submission, arranged in order of workflow:

Table 1: Sample names, coordinates, and compilation of SRMVF zircon U-Pb data (Table S1), with summary statistics reported after grouping by session date and ID (n = 132)

Table 2: Analytical conditions (LA-ICP-MS)

Supplementary Table S1: All SRMVF zircon U-Pb data (n = 6,513), including reference materials from these sessions (n = 2,694), and including xenocrysts and xenocrystic cores (defined as having an age older than the volcanic field, i.e., > 50 Ma). Data are not corrected for Th disequilibrium or for alpha dose. See Table 1 for sample descriptions.

Supplementary Table S2: Xenocrystic SRMVF zircon U-Pb data (n = 121).

2. Experimental Design, Materials and Methods

2.1. Sample Collection and Preparation

Samples were collected during multiple field campaigns in southwest Colorado, USA. Rock samples were crushed using a SELFRAG high voltage fragmentation device at ETH Zürich and zircons were separated using methylene iodide using standard protocols. A subset of zircons were pre-treated either by thermal annealing for 48 h at 850 °C, or by thermal annealing combined with chemical abrasion (CA) [2]. Zircons were mounted in epoxy and polished to a 1 µm finish using a combination of SiC grinding paper (p2500 grit) and diamond suspension (6, 3 and 1 µm, sequentially).

2.2. Reference Materials

GJ-1 (601.86 ± 0.37 Ma; [3,4]) was used as a calibration reference material (CRM). Validation reference materials (VRM's) include: AusZ7-1 (~38.9 Ma; [5]; AusZ7-5 (2.4082 Ma ± 0.0022; [6]; OD-3 (33.0 ± 0.1 Ma; [7]); Plešovice (337.15 Ma; [4,8]); Mud Tank (731.65 ± 0.49; [4,9]); Temora2 (416.78 ± 0.33 Ma; [10]) and 91500 (1063.51 ± 0.39 Ma; [4,11]).

2.3. LA-ICP-MS Instrumentation and data Reduction

Data were collected using an ASI Resolution 193 nm ArF laser and a Laurin Technic S155 constant geometry 2-volume ablation cell, connected to a Thermo Element XR sector field ICP-MS. Ablation was performed under a pure He atmosphere (0.7 l/min, downstream of a Hg trap), after which the ablated aerosol was mixed with Ar in the ablation funnel and homogenized in a signal smoothing device prior to ionization in the plasma. Typical background values for ^{202}Hg over the course of this study were ~1500 cps (95% CI = ~500–4300 cps), while ^{206}Pb backgrounds were typically 20 cps (95% CI = 5–80 cps). More analytical parameters, including spot size, laser fluence and repetition rate, can be found in Table 2.

Data were reduced using VizualAge (Petrus and Kamber 2012) on the Iolite platform (v2.5; Paton et al. (2011)). Hg, U, Th and Pb were measured for geochronology, and the data reduction scheme for U-Pb dating consists of: (1) baseline subtraction of raw counts on masses 202, 204, 206, 207, 208, 232, 235 and 238; (2) calculation of U/Pb ratios by the mean-of-ratios method; (3) downhole fractionation by cubic or exponential spline, as relevant [12]; (4) instrumental drift correction; and (5) normalization to the ID-TIMS U/Pb ratio of the chemically-abraded (CA) or non-abraded CRM (for CA and non-CA samples, respectively). Trace element data reduction was performed separately using the TraceElements.ipf routine in VizualAge, including slightly modified steps: (1) background subtraction; (2) calculation of trace element: Si ratios by a means-of-ratios method; (3) instrumental drift correction and normalization to NIST-612 synthetic glass using Si as an internal reference (15% Si in zircon by wt.). Signal segments that were identified to have inclusions (e.g. high La) or high discordance were avoided, while ensuring that the remaining signal was at least ~10 s long.

2.4. Data Handling

Preliminary data filtering was performed during data reduction (e.g., removal of fractionated early and late signal, removal of non-zircon analyzes, removal of failed data acquisitions), after which minimal data filtering was performed in order to allow data users to apply their own preferred methods. Old zircons (> 50 Ma, interpreted as xenocrystic) are included. Discordance filters are not applied, nor was a Th disequilibrium correction, alpha dose correction or outlier rejection algorithm. However, the necessary input parameters for each of these data processing steps are provided.

Ethics Statement

This study did not use human subjects or conduct animal experimentation.

Declaration of Competing Interest

The authors do not declare any competing interests.

Data Availability

SRMVF Zircon Geochronology and Geochemistryv2 (Original data) (Mendeley Data).

CRediT Author Statement

J.T. Sliwinski: Conceptualization, Methodology, Software, Writing – original draft; **M. Guillong:** Methodology; **P.W. Lipman:** Conceptualization, Investigation, Resources, Validation; **M.J. Zimmerer:** Investigation; **C. Deering:** Investigation; **O. Bachmann:** Supervision, Resources, Funding acquisition.

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