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AVO geologists M. Loewen and M. Coombs discuss geological processes and features associated with Mount Spurr, URL: https://avo.alaska.edu/image/view/197135

Raw Data Files provide elevation data, field observations, or analytical data. They are reviewed for clarity and consistency but do not undergo technical peer review.

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Whole-rock major- and trace-element compositions of samples from Mount Spurr volcano, Alaska

Michelle L. Coombs[1], Andrew T. Calvert[2], Kristi L. Wallace[1], Thomas W. Sisson[2], and James W. Vallance[3]

INTRODUCTION

This report presents major- and trace-element whole-rock compositions for 226 volcanic rock samples from Mount Spurr volcano. Alaska Volcano Observatory (AVO) staff and collaborators collected the samples between 2001 and 2012. Spurr is an active volcano on the west side of Cook Inlet, about 125 km west of Anchorage in south-central Alaska. Its eruptions produce ashfall that disrupts air travel and blankets communities and infrastructure across the region. These samples help reconstruct the volcano's eruptive history, which is essential for understanding its hazard impacts. The Peter Hooper GeoAnalytical Laboratory at Washington State University (WSU) in Pullman, Washington, analyzed all samples using X-ray fluorescence (XRF) and solution inductively coupled plasma–mass spectrometry (ICP–MS).

These data and accompanying report are released as a Raw Data File, and all publication components are available from the DGGS website at https://doi.org/10.14509/32171. Additionally, all analyses and metadata are archived in the Alaska Volcano Observatory geochemical database (Cameron and others, 2019, https://avo.alaska.edu/explore/geochem/). Other whole-rock data for samples from Mount Spurr are available in Nye and others (1995), Nye and others (2018), Washington and others (2025), and the AVO geochemical database. Most physical samples whose compositions are included in this report are archived at the Geologic Materials Center in Anchorage, Alaska, https://dggs.alaska.gov/gmc.

DATA PRODUCTS

- Methods report
- Analytical lab data and accompanying data dictionary

METHODS

Field data collection

Samples were collected during helicopter-supported fieldwork over several field seasons from 2001 to 2012 (fig. 1). Coordinates were determined using handheld GPS units and recorded in field notebooks. Latitude and longitude are referenced to the North American Datum of 1983 (NAD83). Station names (StationID) identify sample locations and areas of general observation. Sample names (SampleID) correspond to specific samples, and sample records include sample descriptions. Sample_type and Sample_type_two come from a list of preset terms, which

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geologists selected soon after fieldwork. During laboratory processing and analysis, laboratory identification numbers (Alaska_Tephra_Number) were assigned to a subset of samples, mainly tephras.

For lavas, geologists prioritized flow interiors to avoid weathered rinds and obtain crystalline material for argon geochronology. Pumice and scoria samples were collected from prominent tephra-fall deposits with coarse clasts, typically 0.5 cm or larger. Pyroclasts were collected from proximal pyroclastic-flow deposits.

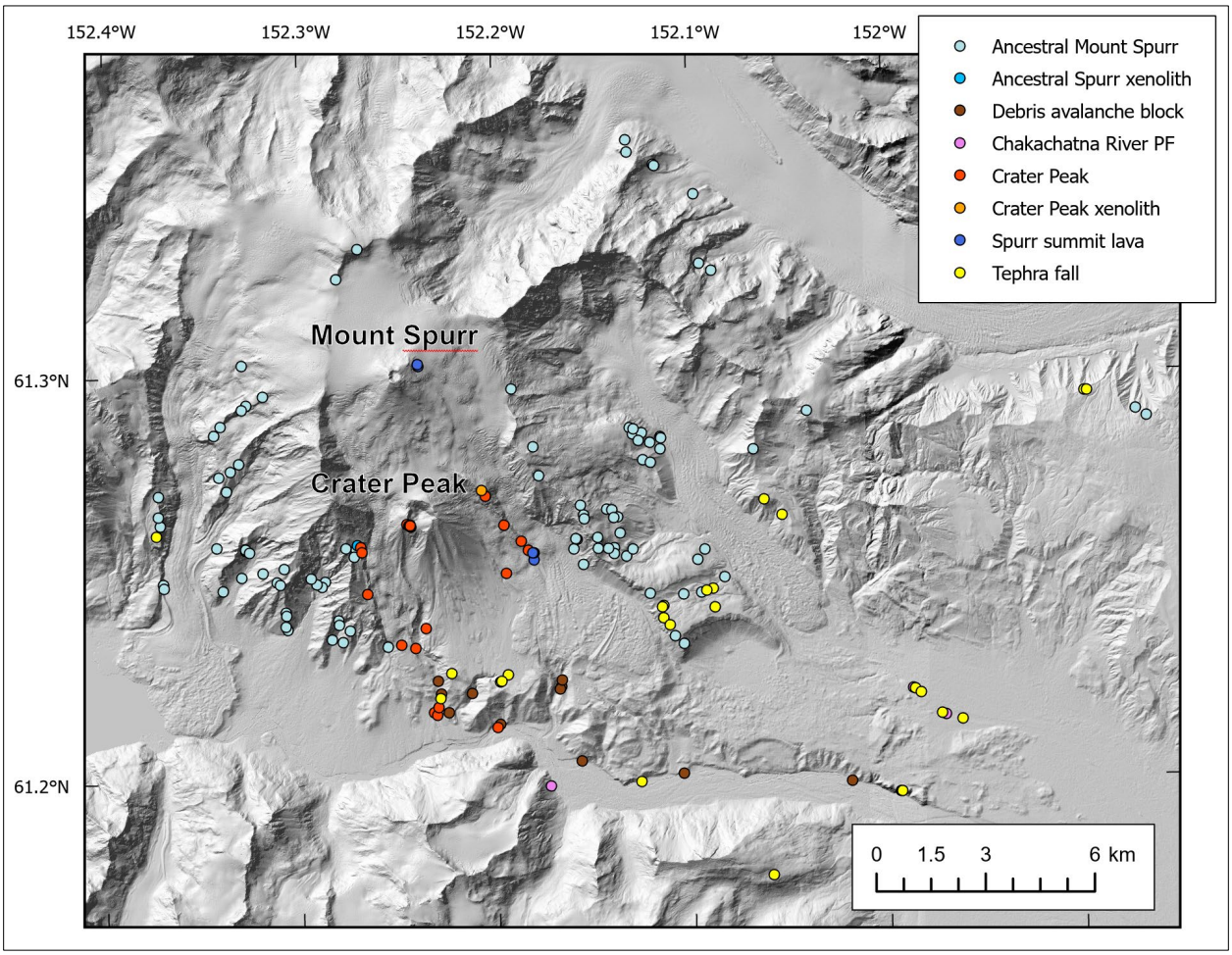

Figure 1. Location of samples with whole-rock compositions reported in this study at Mount Spurr volcano. Basemap is an IFSAR-derived hillshade. PF, pyroclastic-flow deposit.

Whole-rock analyses

We trimmed weathered edges from lavas and larger pyroclasts in the field. The trimmed samples were crushed to approximately 1-cm pieces, sonicated, and dried. For pumice and scoria, a single lapillus, or a small number of similar-appearing lapilli, was sampled from each fall unit, scrubbed and rinsed under tap water, sonicated in tap water until the water remained clear, and dried at 60 °C for 48 hours.

Samples were sent to WSU GeoAnalytical Laboratory for XRF and solution ICP-MS analysis. Procedures followed the methods of Johnson and others (1999) and the technical notes posted on the laboratory website (Washington State University, n.d.). Nye and others (2018) provide a detailed analysis and discussion of major- and trace-element uncertainty for samples submitted to this laboratory, demonstrating 2σ precision of less than 0.5 relative percent for major oxides (1.2 relative percent for total iron oxide, or FeOT) and 4 relative percent for most trace elements. Following Nye and others (2018), we reduced all ICP-MS data using the 2006 calibration to ensure internal dataset consistency.

GEOLOGIC UNIT ASSIGNMENTS

We assigned samples to generalized geologic units (Geologic_unit) in the data table based on field relationships and interpretations from previous studies. The next sections describe each unit, and figure 2 shows compositions of newly analyzed samples grouped by simplified geologic unit. Future publications will present additional interpretive work, petrography, radiometric dating results, and assignments to more specific geologic units and ages. Ages come from previous studies where available, and the units are generally listed from oldest to youngest.

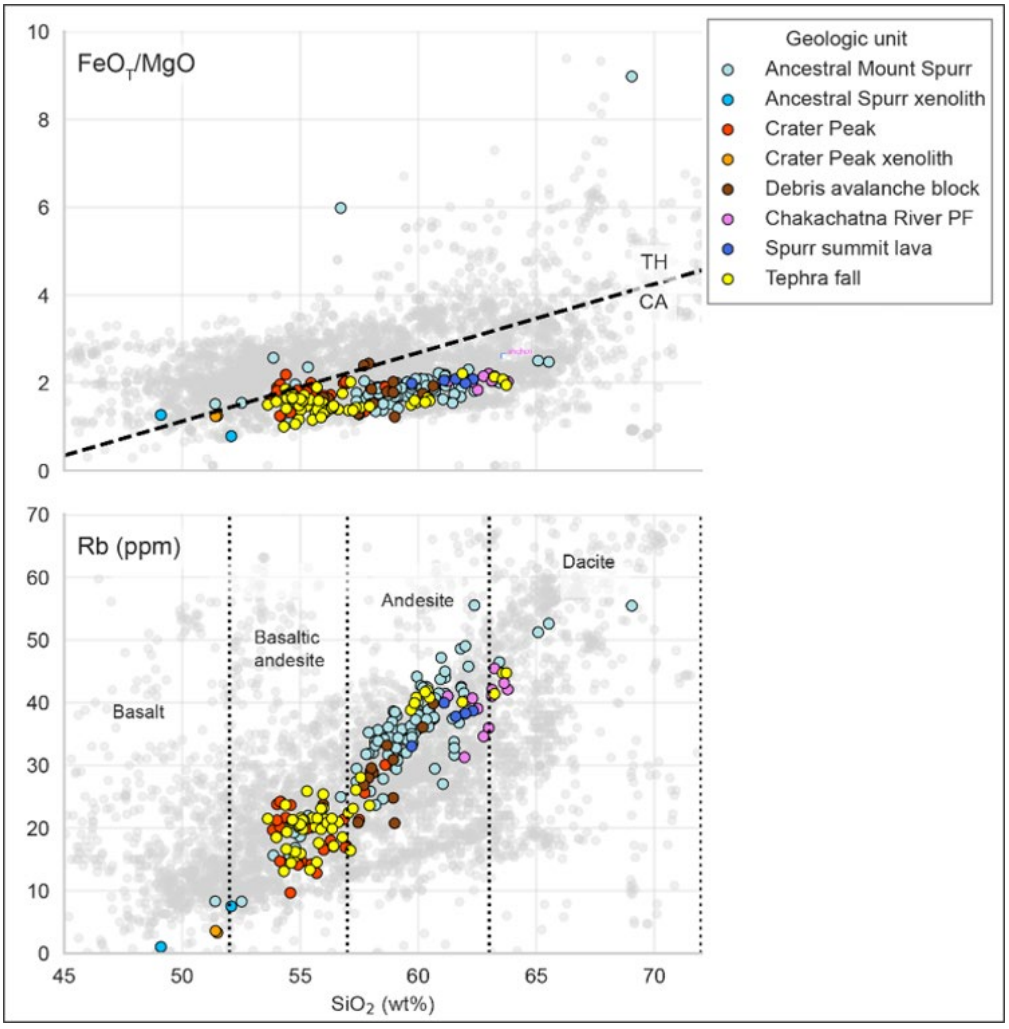

Figure 2. Summary of compositions of newly analyzed samples from Mount Spurr, symbolized by simplified geologic units as described in the text. Gray dots are other published analyses from the subaerial Aleutian-Alaskan arc (Cameron and others, 2019). Tholeiitic (TH)/calc-alkaline (CA) boundary from Miyashiro (1974). PF, pyroclastic-flow deposit.

Ancestral Mount Spurr lavas, pyroclastic-flow deposits, and xenoliths

Ancestral Mount Spurr is composed of lava flows and pyroclastic units that erupted during the Late Pleistocene (Nye and Turner, 1990). We report compositions for 106 lava samples and two granitoid xenoliths. We also report compositions of two clasts we collected from lahar deposits east of the volcano, which Herriott and others (2014) attribute to ancestral Mount Spurr. A few samples collected furthest from the volcano's summit have compositions that fall off main Spurr arrays and may instead be part of the Cretaceous basement (Intermediate and Felsic Volcanic Rocks, Kv; Wilson and others, 2012).

Debris avalanche deposit

A debris-avalanche deposit along the Chakachatna River that formed during a collapse of ancestral Mount Spurr (Riehle, 1985). The collapse event has not been directly dated but is thought to have occurred in the latest Pleistocene or early Holocene (Riehle, 1985; Nye and Turner, 1990). This report includes analyses of 14 lava clasts from the deposit.

Chakachatna River pyroclastic flow deposit

A partially welded ash-flow tuff deposit that overlies the debris-avalanche deposit described above (Nye and Turner, 1990; Riehle, 1985), and is exposed in three localities along the Chakachatna River. This report includes analyses of 13 pumice and scoria clasts from the deposit.

Spurr summit lavas

Lavas from the summit dome complex of Mount Spurr and from lava flows downslope of the dome complex, exposed on a rock cleaver in the middle of Kidazgeni Glacier. This report includes analyses of three samples collected from the summit dome complex in 2011, as well as samples from the downslope lava flows. The downslope flows underlie Crater Peak lavas and closely match the compositions of lavas collected at the summit, so we assigned them to the summit unit. Riehle (1985) interpreted the summit as active in the early to mid-Holocene.

Crater Peak lavas, pyroclastic-flow deposits, and xenoliths

Lavas, pyroclastic-flow deposits, and gabbroic xenoliths from Crater Peak, a satellite vent that grew in a breach formed by caldera collapse of ancestral Mount Spurr. Numerous explosive and effusive eruptions have built the cone, most recently in 1992. We assigned samples to Crater Peak because they were collected from the cone itself or from coarse-grained fragmental deposits downslope of the cone. This report includes analyses of 17 lavas, 9 clasts from pyroclastic-flow deposits (including some block-and-ash-flow deposits), and 2 fist-sized gabbroic xenoliths that appear to have erupted in 1992.

Holocene tephra samples

Coarse lapilli from tephra-fall deposits in the area around Mount Spurr, which record its explosive Holocene eruption history (Riehle, 1985; Wallace, 2003). The compositions of these lapilli overlap with those of both Spurr summit and Crater Peak lavas, and the tephras probably came from both source vents. This report includes analyses of lapilli from 56 tephra falls that were coarse enough for whole-rock analysis.

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