

Workshop Report for the Pre-AGU Mini-Workshop: Research Prioritization in the Alaska-Aleutian Arc

Sunday, December 14, 1-5 PM Local Time

Tulane River and Coastal Center | 1370 Port of New Orleans Pl, New Orleans, LA 70130

Organizers

Madison Myers (Montana State University), Nick Barber (Washington and Lee University), Susanne Straub (Lamont Doherty Earth Observatory of the Columbia Climate School), Margarete Jadamec (University at Buffalo), Xiaotao Yang (Purdue University), Behnaz Hosseini (Montana State University), Mattia Pistone (University of Georgia)

Introduction

A half-day workshop took place from 1-5 PM CST on Sunday, December 14, 2025, preceding the 2025 American Geophysical Union (AGU) Fall Meeting in New Orleans, LA. The workshop followed an earlier National Science Foundation (NSF)-funded workshop focused on research prioritization in the Alaska-Aleutian arc, hosted at the University of Alaska Anchorage from May 28-30, 2025. The goal of the May workshop was to foster and initiate interdisciplinary research on the Aleutian-Alaska arc that has many active and potentially active volcanoes that threaten major Alaskan cities and aviation flightpaths (e.g., recently restless Mount Spurr and Mount Edgecumbe). While there are ongoing large-scale research efforts (PREEVENTS, AVERT, CONVERSE, SZ4D), the frequency of volcanic activity and the comprehensive data collected and archived by the Alaska Volcano Observatory (AVO) make the Alaska-Aleutian arc an ideal location to study active volcanic processes and improve predictions of volcanic geohazards in the United States. Through decades of individual studies and monitoring by AVO and scientists, there are many datasets (i.e., geologic samples, geodetic measurements, seismic recordings) available and accessible, which enable immediate opportunities and build a rich foundation for researchers to advance scientific understanding, hazard models, and geologic resources of the Aleutian-Alaska volcanic arc.

While the May 2025 workshop results in brainstorming high-priority research questions, the half-day follow-up workshop in December 2025 at AGU served two principal purposes:

- (i) To continue the collaborations thus far fueled by grass-roots efforts, review progress, reconnect over the first tangible results, and keep the momentum going to build collaborative interdisciplinary fundable projects that maximize the use of available resources.
- (ii) To provide a forum to invite and engage any interested scientists from diverse research backgrounds, career stages, and the international community who were not able to attend the May workshop and who want to become involved in Alaska-Aleutian arc science.

Pre-AGU Workshop

A total of 55 scientists registered for the half-day workshop at AGU 2025, which included seven early-career scientists (< 10 years from highest terminal degree) and 14 postdoctoral researchers and graduate students. Most registrants were able to attend in person, even if some were delayed by bad weather. Roughly 25 registrants became involved in the Alaska-Aleutian arc workshop for the first time.

The workshop began with a comprehensive overview of the May 2025 Alaska-Aleutian arc workshop, including updates from four working groups (see Agenda below), which resulted in three presentations at AGU Fall Meeting 2025 (Hosseini et al., 2025; Moss et al., 2025; Pistone et al., 2025):

Hosseini, B., Ding, S., Johnson, E.R., Wieser, P.E., Patounakis, K., Lerner, A.H., Kelly, P.J., Loewen, M.W., Larsen, J.F., Hudak, M.R., Myers, M.L., Hervig, R.L., Graham, N.A., Huggins, E.G., Cannatelli, C. (2025). A Community Approach to Rapidly Characterize Melt Inclusion Compositions from the June 1992 Explosive Eruption of Mount Spurr, Alaska. AGU Fall Meeting, New Orleans, LA.

Moss, M., Myers, M., Mark, F.M., Yang, X., Cheng, Y., Grapenthin, R., Lizik, Y.L., Portner, D.E., Lee, W.J.D., Wu, S.M., Larsen, J.F., Coombs, M.L., Freymueller, J.T., Abers, G.A. (2025). Petrologic and Geophysical Synthesis of the Magmatic System at Akutan Volcano. AGU Fall Meeting, New Orleans, LA.

Pistone, M., Barber, N., Straub, S., Hammerstrom, A., Jadamec, M., Graham, N., Van Horn, B., Williams-Mieding, B., Kragh, N., Kennedy, S., Oxborn, S., Grant, E. (2025). The Aleutian-Alaskan System: Revisiting the Correlations between Magma Geochemistry and Tectonic Parameters along the Northern Arc of the Ring of Fire. AGU Fall Meeting, New Orleans, LA.

This was followed by 18 lightning talks which were 2-slide, 2-minute presentations contributed by the workshop participants to foster discussion and brainstorming. All participants were invited to present on their research relevant to the Aleutian-Alaska arc, regardless of whether in the volcanic arc or not. The lightning talks included a presentation of the Alaska-Aleutian arc open datasets and sample resources available to researchers.

An online Poll Everywhere was then used to identify the research priorities of the participants. The participants split into four breakout groups for discussion. The workshop concluded with a presentation of the breakout group results and a plenary discussion.

Workshop Agenda

1:00 PM	Arrival and Welcome Coffee
1:30-1:45 PM	Introduction by Conveners - 2025 May Workshop Overview & Mini-Workshop Objectives (M. Myers & B. Hosseini)
1:45-2:30 PM	Working Group Updates

	1. Structure of Magma Plumbing Systems (M. Moss & X. Yang)
	2. Origins of Along-Arc Magma Diversity (N. Barber)
	3. Diversity of Seismic Sources in Volcanic Systems (H. Mark)
	4. Linking Melt Inclusion and Gas Datasets (B. Hosseini)
2:30-3:00 PM	18 Lightning Talks (Opportunity for the workshop participants to share their science)
3:00-3:15 PM	Coffee Break
3:15-4:30 PM	Breakout Groups (BG) (Discuss open science questions, current work & progress, and next steps)
	BG 1: Magma Ascent, Melt Inclusions, and Plumbing Systems
	BG 2: Along-Arc Magma Diversity
	BG 3: Integrating Geophysical & Petrological Data
	BG 4: The Next Big Experiment
4:30-4:50 PM	Plenary: Breakout Group Summaries
4:50-5:00 PM	Plenary: Next Steps and Future Directions
5:00 PM	Meeting Adjourned. (Participants invited to join the SZ4D Mixer event taking place in the same building, starting at 6 PM)

Lightning Talks

A. Whittington	Three-Phase Lava Rheology Measurements Reveal the Importance of Bubbles in Facilitating Fast Flow Emplacement
S. Straub	Primary arc melts tracked by magmatic olivines
H. Janiszewski	Data-Driven Investigation of Magmatic Systems in the Alaska-Aleutian Arc via Teleseismic Receiver Functions

A. Kolezar	Magma Geochemistry and Eruption Intensity at Augustine Volcano, Alaska
Y-L. Lizik	Imaging the Magma Plumbing System Beneath Okmok Volcano
V. Schulte-Pelkum	Imaging volcanic systems with receiver functions and anisotropy
A. Ghandi	Receiver Function Imaging of Alaskan-Aleutian Arc Volcanoes
D. Roman	Seismic Signatures and Patterns of Gas Pistoning During the Ongoing (2024-) Kilauea Eruption
T. Plank	Mush..... or No Mush? Crystal Ages in Arc Magmas
K. Bemis	Arc scale distributions of small and large volcanoes: implications for magma supply
D. Lee	Steady vs Sudden: Okmok 2008
J. Freymueller	Constraining Megathrust Earthquake Slip by Jointly Inverting for Slip and its Subsequent Afterslip
M. Pistone	The Alaska-Aleutian Arc: Revisiting the bulk rock geochemistry database to identify “gaps”
M. Pistone	Initiating the Drilling and Research In Volcanic Environments (DRIVE) in the US: Steering towards new scientific discoveries and exploration of geothermal energy
M. Myers	Geologic Database of Information on Volcanoes in Alaska: GeoDIVA
N. Barber	Making arc magma compositional data more accessible: the ArcMetals Database
M. Jadamec	Geophysical Monograph 290: Tectonics and Seismic Structure of Alaska and Northwestern Canada: EarthScope and Beyond
N. Gies	Modeling the Global Deep Water Cycle

Poll Everywhere Results

Three questions were posed online via Poll Everywhere and results were displayed on-screen to all participants.

Question 1: Of the four breakout working groups that presented today, which one are you most excited about? (Multiple Choice)

Answer: Origins of Along-Arc Magma Diversity (40%); Structure of Magma Plumbing Systems (25%); Diversity of Seismic Sources in Volcanic Systems (14%); Linking Melt Inclusion and Gas Datasets (18%); Other (4%)

Question 2: What Alaska-Aleutian research priority areas do you have interest in that may not be represented by our existing working groups? (Voted)

Answer: Ascent of magma on different timescales (13 votes); Joining forces: geophysics, geochemistry, geodynamics and more (12); Let's dream big: What is our next big experiment? (8); Failed eruptions: unrest that ends with no eruptive event (6); Public education & outreach (5); Eruptive behavior and geochemistry (5); Rapid response for the next eruption: more than geochemistry (4); Geophysical and petrologic integration (4); Breakout by volcano for interdisciplinary discussion (4); Scientific drilling (4); Submarine volcanism in Aleutians (3); Connecting tectonic variations with volcano spatial distribution (3); Far western Aleutian volcanism, and evolution into oblique movement (3); Mantle wedge seismicity (3); Physical and thermal properties (contributes to all focus areas) (2); Co-eruptive seismicity (2); How recycling modifies mantle and primary mantle melts (1); Community experiment: new data on a focus volcano (1).

Question 2: What ideas do you have for advancing research in Alaska-Aleutians given the current challenging (and uncertain) funding environment? (Open-ended)

Answer: Memecoins; 'Cascading hazards'; Geohazard potential; Group effort helps; Multidisciplinary study; Let hazards drive the science - expand to agencies beyond NSF; Fluid; Collaboration; Collaboration with geothermal exploration corporations; Advocate for funding as a group; Workshops focused on getting work done; Using existing data and sample; Geohazard; Resources; Correlate volcano science with critical minerals; AI; Build spatial database of volcano morphology; Cascading hazards modeling; New tools on existing data; New analyses on existing samples; Integration of existing datasets; Existing-samples; Open labs and resources; Industry; Geotourism; Join forces with scientists outside of the US; Leverage existing fiber networks; REUs; Cooperating with European communities and funding schemes; Shared list of available facilities with low cost usage; More undergraduate involvement

Topics Presented for Breakout Discussion

Four new breakout groups were formed:

Breakout Group 1: Magma Ascent, Melt Inclusions, and Plumbing Systems

Breakout Group 2: Along Arc Magma Diversity with Geophysics and Tectonics Group

Breakout Group 3 Integrating Geophysical & Petrological Data:

Breakout Group 4: The Next Big Experiment

Breakout Group 1: Magma ascent, melt inclusions and plumbing system

Participants: M. Sita, J. Larsen, J. Andrys, A. Koleszar, M. Hudak, D. Lee, A. Whittington, J. Freymueller

Summary: This group discussed how to link geodesy and petrology for addressing three key issues of eruption forecasts: degassing, timescales, and depth. Geodesy tracks surface deformation. Pulses of surface deformation are evident from the geodetic data of volcanic systems that may be rooted in mid to lower crustal levels, but it is unclear how these can be combined with petrologic information to better constrain the crustal depth of magma reservoirs, crustal magmatic volumes, and magma ascent rates. Petrologic data should be able to complement geodesy, but owing to ‘crustal overprinting’ (fractional crystallization, melt mixing, diffusive re-equilibration) en route to the surface, the information on the deeper crust is commonly lost. The group identified Aleutian-Alaska volcanoes, Okmok, Akutan, Westdahl, and Spurr as volcanoes with have a good geodetic time series since their previous eruptions, which may be relevant to petrologic changes of the systems and thus are potential targets for detailed comparison with petrologic data. The group agreed that expertise in magma chamber modeling is useful, and that phase equilibria may help with determining depth, but acknowledged that such an approach is complex and time-consuming, and even with machine learning techniques, the uncertainties may be large.

Breakout Group 2: Along Arc Magma Diversity

Participants: N. Barber, B. Jicha, M. Jadamec, M. Myers, S. Straub, M. Pistone, K. Bemis, K. Zylstra, N. Gies, E. Alzate

Summary: Over its length of 3000 km, the Aleutian-Alaska arc exhibits changes in the compositional diversity of its magmas, along with changes in thickness and composition of the crustal basement, convergence rate, distance to trench, and slab input and other subduction parameters. While previous studies demonstrated that relationships between some of these variables may exist, detailed relationships remain often unclear owing to a lack of a comprehensive, high-quality database of Aleutian-Alaska arc volcanic rocks. The recent compilation by Pistone et al. (2025, present at the AGU Fall Meeting) reveals major gaps in compositional data, and in particular radiogenic isotope data. With plans now underway to close these gaps by future studies (proposals are being prepared), the group discussed how the

compositional data could be combined with other data (hyperspectral data, high frequency earthquakes, long period volcanic-tectonic earthquakes, seismic structure and seismicity, plate motion, geochronology) to address the following integrative science questions: (i) Is diversity in magmas/volcanics more related to crustal, mantle, or slab diversity? (ii) How do we track magma fluxes and the release of deep volatiles, and determine their influence on magma diversity? (iii) How to contribute to geohazards assessment; (iv) How do the factors controlling magma diversity relate to the formation of porphyry-copper deposits? (v) Why do Aleutian-Alaska volcanoes differ so strongly from neighboring arcs (Kamchatka); (vi) How can these studies serve the American people?

Breakout Group 3: Integrating Geophysical & Petrological Data

Participants: Y-L. Lizik, Y. Cheng, M. Moss, S. McNutt, V. Schulte-Pelkum, A. Gandhi, Y. Kyoto, X. Yang

Summary: This group discussed geophysical and petrological methods in studying the structure and dynamics of magma plumbing systems, particularly along the Aleutian arc. Building on top of the keynote presentations and the lightning talks, this group focused mostly on how these two disciplinary methods could help each other. For eruption forecasting, an integrative framework for interdisciplinary studies of the crustal plumbing system is needed. Cross-validating by several methods is essential because each method has its drawbacks and limitations. In this context, linking petrologic, seismic, and geodetic data remains a major challenge. This group discussed the (i) pairing of seismicity with mineral barometry and diffusion chronometry (interdisciplinary intersection with temporal constraints), the (ii) pairing of geodetic modelling with radial/azimuthal anisotropy (interdisciplinary intersection with spatial orientations), and the combination of teleseismic and local seismicity (to create an improved event catalogue for imaging). Volcanoes of interest for future synthesis are Okmok and Akutan, where the existing 1D models can be expanded to 2D and 3D structures of the magmatic system, ideally including temporal constraints.

Breakout Group 4: Next Big Experiment - Islands of Four Mountains (IFM) to Seguam

Participants: H. Janiszewski, T. Plank, G. Abers, P. Izbekov, G. Pang, D. Roman, B. Hosseini, E. Brodsky, K. McKee

Summary: This group focused on the next big exciting community experiment. Discussion largely focused on furthering work in the Alaska-Aleutian arc segment between the Islands of Four Mountains (IFM) and Seguam. In this segment, the crustal basement is largely oceanic, the slab is shallow, and the islands are comparatively small, yet may house the largest caldera (IFM) of the arc. Currently, this region of the arc has a dearth of seismic deployments. The question is how to investigate this segment seismically by combining ocean bottom seismometers (OBS) and on-land broadband (BB) stations. Additionally, the group discussed the opportunity to leverage fiber optic cables (land and seafloor). The group also discussed the duration of a community experiment—should we deploy instrumentation in a particular area for a long time, or

do an intensive, short-duration experiment? Also, what would be the required instrumentation to achieve the desired resolution? Overall, the goal of this community experiment would be to map the entire structure from the mantle to the volcanic edifice in the IFM-Seguam segment of the arc.

Workshop Materials, Outcomes, and Future Directions

Before the half-day pre-AGU workshop, all materials from the May 2025 workshop were made publicly available via Linktree (<https://linktr.ee/alaskaaleutianarcscience>), including recorded science talks and a summary report from the May workshop. All half-day workshop materials, including the workshop report, are available on the same website as the Alaska-Aleutian Arc Research Prioritization Workshop (<https://www.sz4d.org/events/agu-mini-workshop-alaska-aleutian-arc>) (scroll to the lower half of the webpage).

Major Next Steps

Group leaders and participants continue to work within their respective working groups, conducting science and preparing research proposals. During the meeting, there were renewed calls to encourage everyone interested (not limited to workshop participants) to attend follow up Zoom/Teams meetings to continue pushing the science questions forward. Anticipated next steps include NSF grant submission, and some peer-reviewed paper submissions. Currently the results of this initiative are being shared at the AVO Annual Coordination Meeting.

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