

# Michelle Muth

University of Washington  
Department of Earth and Space Sciences  
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## PROFESSIONAL APPOINTMENTS

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2023- present      *Assistant Professor*, University of Washington

2021- 2023      *Peter Buck Postdoctoral Fellow*, Smithsonian National Museum of Natural History

2016- 2021      *Graduate Researcher*, University of Oregon

2020      *GRIP Fellow*, Smithsonian National Museum of Natural History

2019      *Lead Instructor*, Sternberg Museum of Natural History Science

2015- 2016      *Geoscientist*, AECOM Philadelphia Area Remediation Services Group

2013- 2015      *Undergraduate Researcher*, Rice University Experimental Petrology Group

2013      *NSF-REU Intern*, University of Minnesota Institute for Rock Magnetism

## EDUCATION

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2021      *Ph.D. Earth Science*, University of Oregon, Eugene, OR  
Research advisor: Paul Wallace  
Dissertation: Sulfur Cycling in the Southern Cascade Arc: Implications for the Sulfur Content, Metal Content, and Oxidation State of Arc Magmas

2015      *B.S. Earth Science*, Rice University, Houston, TX  
Research advisor: Rajdeep Dasgupta  
Distinction in Research and Creative Work  
Thesis: The effect of variable Na/K on CO<sub>2</sub> solubility in slab-derived rhyolitic melts

## PUBLICATIONS

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In Press      Lanzirrotti, A., **Muth, M.**, Head, Elisabet., Newville, M., McCanta, M., Wallace, P.J., Zajacz, Z. The Role of Dissolved Sulfide in Controlling Copper Speciation in Basaltic Melts. *Geochimica et Cosmochimica Acta*.

- 2024 Hudak, M.R., Barry, P.H., Bekaert, D.V., Turner, S.J., Broadley, M.W., Walowski, K., Tyne, R.L., Li, K., Nielsen, S.G., Curtice, J.M., Kurz, M.D., Cahoon, E., Wallace, P., **Muth, M.**, Shaw, A.M. Deep Nitrogen Fluxes and Sources Constrained by Arc Lava Phenocrysts. *Geophysical Research Letters* 51.
- 2023 **Muth, M.J.**, Cottrell, E. No detectable redox exchange between sulfur and iron during rapid cooling of basalts. *Earth and Planetary Science Letters*. 616, 118210.
- 2022 **Muth, M.J.**, Wallace, P.J. Sulfur recycling in subduction zones and the oxygen fugacity of mafic arc magmas. *Earth and Planetary Science Letters*. 599, 117836.
- 2021 Lerner, A.H., **Muth, M.J.**, Wallace, P.J., Lanzirotti, A., Newville, M., Gaetani, G. A., Chowdhury, P., Dasgupta, R. Improving the reliability of Fe- and S-XANES measurements in silicate glasses: correcting beam damage and identifying Fe-oxide nanolites in hydrous and anhydrous melt inclusions. *Chemical Geology*, 586, 120610.
- 2021 **Muth, M.J.**, Wallace, P. J. Slab-derived sulfate generates oxidized basaltic magmas in the southern Cascade arc (California, USA). *Geology*, 49, 1177-1181.
- 2021 Rose-Koga, E.F., Bouvier, A.-S., Gaetani, G.A., Wallace, P.J., Allison, C.M., Andrys, J.A., Angeles de la Torre, C.A., Barth, A., Bodnar, R.J., Bracco Gartner, A.J.J., Butters, D., Castillejo, A., Chilson-Parks, B., Choudhary, B.R., Cluzel, N., Cole, M., Cottrell, E., Daly, A., Danyushevsky, L.V., DeVitre, C.L., Drignon, M.J., France, L., Gaborieau, M., Garcia, M.O., Gatti, E., Genske, F.S., Hartley, M.E., Hughes, E.C., Iveson, A.A., Johnson, E.R., Jones, M., Kagoshima, T., Katzir, Y., Kawaguchi, M., Kawamoto, T., Kelley, K.A., Koornneef, J.M., Kurz, M.D., Laubier, M., Layne, G.D., Lerner, A., Lin, K.-Y., Liu, P.-P., Lorenzo-Merino, A., Luciani, N., Magalhães, N., Marschall, H.R., Michael, P.J., Monteleone, B.D., Moore, L.R., Moussallam, Y., **Muth, M.**, Myers, M.L., Narváez, D.F., Navon, O., Newcombe, M.E., Nichols, A.R.L., Nielsen, R.L., Pamukcu, A., Plank, T., Rasmussen, D.J., Roberge, J., Schiavi, F., Schwartz D., Shimizu, K., Shimizu, K., Shimizu, N., Thomas, J.B., Thompson, G.T., Tucker, J.M., Ustunisik, G., Waelkens, C., Zhang, Y., Zhou, T. Silicate melt inclusions in the new millennium: A review of recommended practices for preparation, analysis, and data presentation. *Chemical Geology*, 570, 120145.
- 2020 **Muth, M.**, Duncan M.S., Dasgupta, R. The Effect of Variable Na/K on CO<sub>2</sub> Solubility in Slab-Derived Rhyolitic Melts. *Carbon in Earth's Interior AGU Monograph*, 195-208.
- 2014 Frahm, E., Feinberg, J. M., Schmidt-Magee, B.A., Wilkinson, K., Gasparyan, B., Yeritsyan, B., Karapetian, S., Meliksetian, K., **Muth, M.**, and Adler D.S. Sourcing geochemically identical obsidian: multiscalar magnetic variations

in the Gutansar volcanic complex and implications for Palaeolithic research in Armenia, *Journal of Archaeological Science*, 47, 164-178.

## GRANTS AND FELLOWSHIPS

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Pending	Collaborative Research: Co-evolution of volatiles and ore-forming metals in the volcanic trans-crustal system, <i>NSF Petrology and Geochemistry (Lead PI M. Muth, UW; Co-PI S. Ding, University of Florida)</i>
2024	Electron Microprobe Facility at the University of Washington, <i>Murdock Foundation. Amount: \$1,309,000 (Lead PI C. Condit, UW; Co-PI M. Muth, UW)</i>
2024	Tracking the fate of copper in Earth's deep crust, <i>UW Research Royalty Faculty Fund. Amount: \$37,573 (Lead PI M. Muth, UW)</i>
2024	User Beamtime Award, <i>National Synchrotron Light source II, Brookhaven NY</i>
2021	User Beamtime Award, <i>Argonne National Laboratory</i>
2020	Graduate Research Intern Program Award, <i>National Science Foundation</i>
2019	User Beamtime Award, <i>Argonne National Laboratory</i>
2018	Graduate Research Fellowship, <i>National Science Foundation</i>
2016	First Year Graduate Student Fellowship, <i>University of Oregon</i>

## HONORS

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2021	Research Recognition Award, <i>University of Oregon</i>
2021	Smith Scholarship, <i>University of Oregon</i>
2019	Warren DuPre Smith Research Award, <i>University of Oregon</i>
2018	Geology Emeritus Research Award, <i>University of Oregon</i>
2015	Torkild Rieber Award in Earth Science, <i>Rice University</i>
2013	Eugen Merten Memorial Prize in Geology and Geophysics, <i>Rice University</i>
2013	Chevron Earth Science Minority Scholarship, <i>Rice University</i>

## INVITED PRESENTATIONS

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2024	SZ4D Workshop on Mantle Magma Supply and Imaging Magmatic Systems; Cascades24 Workshop; Stanford University
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- 2023 CIDER Volatile Source to Surface Workshop; University of California Berkeley
- 2022 SZ4D Community Meeting; University of Wisconsin; Johns Hopkins University; GeoPrisms Volatiles Source to Surface Workshop; USGS Volcano Science Center
- 2021 University of Pittsburgh
- 2020 Carnegie Science Earth and Planets Laboratory; Smithsonian National Museum of Natural History, Dept. of Mineral Sciences; International Volcanology Seminar (*Collaborative Virtual Seminar Series*)

#### CONFERENCE PRESENTATIONS

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- 2024 **Muth, M.**, Cottrell, E. Lessons from Basalts, Experiments, and Models on the Behavior of Sulfur in Arc Magmas. *AGU 2024 Fall Meeting, Washington, D.C., 9-13 December. (invited).*
- 2023 **Muth, M.J.**, Cottrell, E. No detectable redox exchange between sulfur and iron during cooling of basalts. *Goldschmidt 2023 Conference, Lyon, France, 9-4 July.*
- 2023 Hudak, M.R., Barry, P.H., Bekaert, D.V., Turner, S.J., Walowski, K., Nielsen, S.G., Curtice, J., Tyne, R.L., Cahoon, E., Wallace, P., **Muth, M.J.** Olivine and pyroxene-hosted fluid inclusions record high arc nitrogen fluxes and multiple slab sources. *Goldschmidt 2023 Conference, Lyon, France, 9-4 July.*
- 2022 **Muth, M.J.**, Wallace, P., The effect of slab-derived sulfate on the sulfur content and oxygen fugacity of basaltic magmas in the southern Cascade arc. *Goldschmidt 2023 Conference, Lyon, France, 9-4 July. Goldschmidt 2022 Conference, Honolulu, HI, 10-15 July. (invited).*
- 2021 Lerner, A.H., Wallace, P.J., Gaetani, G.A., Kelly, P.J., **Muth, M.**, Lanzirrotti, A., Newville, M., Lee, R.L., Redox conditions of magmas from the 2018 eruption of Kīlauea, Hawai'i: combined Fe- and S-XANES measurements of glasses and the importance of redox re-equilibration in olivine-hosted melt inclusions. *AGU 2021 Fall Meeting, New Orleans, LA, 13-17 December.*
- 2021 **Muth, M.**, Wallace, P.J. The Influence of Slab-Derived Sulfur on the Metal Contents of Arc Magmas in the Southern Cascades. *AGU 2021 Fall Meeting, New Orleans, LA, 13-17 December.*
- 2020 **Muth, M.**, Wallace, P.J. Insights into global sulfur cycling from the melt

- inclusion record. *AGU 2020 Fall Meeting, Virtual, 1-17 December. (invited).*
- 2020 **Muth, M.**, Wallace, P.J. The influence of slab-derived sulfur on the sulfur content and oxidation state of arc magmas in the Southern Cascades. *AGU 2020 Fall Meeting, Virtual, 1-17 December.*
- 2020 Lerner, A., **Muth, M.**, Wallace, P.J., Lanzirotti A., Newville, M., Gaetani, G., Chowdhury, P., Dasgupta, R. Correcting Fe- and S-XANES Beam Damage and Recognizing Rapid Redox Equilibration of Olivine-Hosted Melt Inclusions. *Goldschmidt Conference, Virtual, 21-26 June.*
- 2020 **Muth, M.**, Wallace, P.J. Tracking Slab-Derived Sulfur and its Effect on Magma Oxidation State in the Southern Cascades. *Goldschmidt Conference, Virtual, 21-26 June.*
- 2019 **Muth, M.**, Wallace, P.J., Gaetani, G.A. Drawing connections between slab-derived sulfur, mantle melting, and arc magma oxidation state: A case study in the southern Cascades. *AGU 2019 Fall Meeting, San Francisco, CA, 9-13 December.*
- 2019 **Muth, M.**, Wallace, P.J. How does slab-derived sulfur affect magma redox in the southern Cascades? Insights from the melt inclusion record. *GSA Cordilleran Section-115th Annual Meeting, Portland, OR, 15-17 May.*
- 2018 **Muth, M.**, Wallace, P.J. Insights into Arc Magma Volatile Cycling and Oxidation State from Global Sulfur Trends. *AGU 2018 Fall Meeting, Washington, DC, 10-14 December.*
- 2017 **Muth, M.**, Wallace, P.J., Walowski, K.J. The Role of Hydrous Slab Melts in the Sulfur Content, Metal Content, and Oxidation State of Primitive Arc Magmas in the Southern Cascades. *AGU 2017 Fall Meeting, New Orleans, LA, 11-15 December.*
- 2017 Harvey, K.M., Perry-Houts J., Domino J., **Muth M.**, Carruthers S., Kotowski A.J., DeGrandpre K., Faul, U., Kent, A.J., Abers, G.A., Krawczynski, M. The ins and outs of mélange diapirs: a multidisciplinary approach to formation, ascent, and observation. *AGU 2017 Fall Meeting, New Orleans, LA, 11-15 December.*
- 2014 **Muth, M.**, Duncan, M. S., Dasgupta, R. Effect of variable Na/K ratio on CO<sub>2</sub> solubility in slab-derived rhyolitic melts- An experimental study. *AGU 2014 Fall Meeting, San Francisco, CA, 15-19 December.*

## FIELD EXPERIENCE

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- 2024 *Indian Heaven Volcanic Area, WA*  
Field sampling of tephra and hyaloclastite deposits at targeted mafic cents.

- 2019 *Lassen Volcanic Area, CA*  
Field sampling of tephra deposits with high school students during a two-week volcanology field course.
- 2018 *Trinity Ophiolite, CA*  
Field trip with the University of Delaware Mantle Processes group for 3 days in the Trinity Ophiolite.
- 2018 *Santorini, Greece*  
Field trip focusing on the volcanic deposits on the island of Santorini and deformation structures associated with the neotectonics of the surrounding region.
- 2017 *Lassen Volcanic Area, CA*  
Sample collection of tephra deposits at selected cinder cones, targeting deposits likely to contain rapidly quenched primitive melt inclusions.
- 2017 *Long Valley Caldera, CA*  
Sample collection of inter-layered ignimbrite and fall deposits.

## TEACHING EXPERIENCE

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- 2023-present *Courses taught at University of Washington*  
ESS 212: Earth Materials and Plate Tectonics. ESS 462: Volcanic Processes.
- 2019 *Lead Instructor, Fort Hays State University Museum of Natural History*  
Designed the curriculum for a newly introduced two-week field volcanology course for high school based in the Pacific Northwest. Lead instructor for the field course, assisted by an undergraduate student TA.
- 2017-2018 *Teaching Assistant, University of Oregon*  
GEOL 202: Earth Surface and Environment  
GEOL 331: Mineralogy

## STUDENT MENTORING

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- 2023-present PhD Advisor: Luan Heywood
- 2023- present PhD Advisor: Xinkai He
- 2023- present PhD Committee Member: Peter Lindquist, Winnie Fan, Nicole Aikin

## RESEARCH TECHNIQUES

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Raman Spectroscopy  
Fourier Transform Infrared Spectroscopy (FTIR)

Electron Microprobe (EPMA)  
X-Ray Absorption Near Edge Structure (XANES)  
Laser Ablation ICP-MS  
Secondary Ion Mass Spectrometry (SIMS)  
End-loaded Piston Cylinder Apparatus  
MATLAB, Python  
Melt inclusion preparation and analysis

## PROFESSIONAL ACTIVITIES

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| 2024 | Cascades24: An examination of magmatism from the perspective of the Cascades Arc system<br><i>Bend, OR</i>   |
| 2024 | SZ4D Workshop on Mantle Magma Supply and Imaging Magmatic Systems<br><i>Lamont, NY</i>   |
| 2023 | CIDER Volatile Source to Surface Workshop<br><i>Berkely, CA</i>  |
| 2022 | SZ4D Community Workshop<br><i>Houston, TX</i>  |
| 2022 | GeoPrisms Volatiles Source to Surface Workshop<br><i>Bozeman, MT</i>   |
| 2019 | GeoPrisms Synthesis and Integration Theoretical and Experimental Institute<br><i>San Antonio, TX</i>   |
| 2018 | Thermodynamic modeling with alphaMELTS and other MELTS software Workshop<br><i>Caltech, CA</i>   |
| 2018 | Annual Workshop in Secondary Ion Mass Spectrometry<br><i>University of Arizona, AZ</i>   |
| 2018 | Mineral-Hosted Melt Inclusions Workshop<br><i>Woods Hole Oceanographic Institution, MA</i>   |
| 2017 | CIDER (Cooperative Institute for Dynamic Earth Research)<br><i>University of California Berkeley, CA</i><br>Participated in collaborative research effort: "The ins and outs of mélange diapirs: a multidisciplinary approach to formation, ascent, and observation".<br>Presented results at 2017 AGU Fall meeting. |

## OUTREACH ACTIVITIES

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- 2022 *Newsletter Feature, Smithsonian National Museum of Natural History*  
Wrote a description of mantle xenolith research for the volunteer newsletter for the museum's Hall of Geology, Gems, and Minerals.
- 2020 *"Expert Is In", Smithsonian National Museum of Natural History*  
Led a 2-hour interactive public discussion on museum floor around the theme "The Many Faces of Sulfur".
- 2016-2019 *"Mad Duck" Science Outreach Program, University of Oregon*  
Organized and lead several 4-hour long science outreach modules for local middle school students through NSF-funded 'Mad Duck' program. Facilitated module design collaborations between Mad Duck and other graduate student organizations. Module design for Oregon paleontology is still in use.

## PROFESSIONAL SERVICE

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- 2022-present *Eos Science Advisor, Volcanology Petrology Geochemistry*
- 2022 *Session Convener, AGU Fall Meeting*  
"Volatile Cycling in Subduction Zones: A Holistic Approach from Slab to Surface"
- 2022 *Member, Unlearning Racism in Geoscience (URGE) pod*  
*Smithsonian National Museum of Natural History*
- 2020 *Session Convener, AGU Fall Meeting*  
"Constraining Petrological and Geochemical Variations in Magmas to Capture the Evolution of Volcanoes over Space and Time"
- 2019 *Session Convener, Cordilleran Section GSA Annual Meeting*  
"Crystal Windows into Igneous Processes"
- 2017-2021 *Board Member, CMiS (Community for Minorities in STEM)*  
*University of Oregon*  
UO CMiS is a graduate student organization dedicated to helping minority graduate students in STEM succeed through professional workshops, social and networking events, and community building activities. Elected Social and Outreach Chair 2017-2018, Seminar Chair 2018-2019 and Vice President 2019-2021.
- 2018-2021 *Organizing Team, IgDEAS (Inclusivity and Gender Diversity in Earth and Atmospheric Science)*  
*University of Oregon*



The mission of IgDEAS is to provide geoscience-specific professional and social support to women and non-binary researchers and students at the University of Oregon. Co-founded in 2018.

Volunteer Reviewer for manuscript contributions to *Geology*, *Nature Communications*, *Nature Geoscience*, *American Mineralogist*, *Journal of Petrology*, *Earth and Planetary Science Letters*, *Geochimica et Cosmochimica Acta*, *Volcanica*, *Chemical Geology*