# Michelle Muth

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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<br>Research advisor: Paul Wallace<br>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<br>Research advisor: Rajdeep Dasgupta<br>Distinction in Research and Creative Work<br>Thesis: The effect of variable Na/K on $CO_2$ solubility in slab-derived rhyolitic melts |

## PUBLICATIONS

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|---|---|
| In Revision | Lanzirotti, 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 $CO_2$ 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, *NSF Petrology and Geochemistry (Lead PI M. Muth, UW; Co-PI S. Ding, University of Florida)* |
| 2024 | Electron Microprobe Facility at the University of Washington, *Murdock Foundation. Amount: $1,309,000 (Lead PI C. Condit, UW; Co-PI M. Muth, UW)* |
| 2024 | Tracking the fate of copper in Earth's deep crust, *UW Research Royalty Faculty Fund. Amount: $37,573 (Lead PI M. Muth, UW)* |
| 2024 | User Beamtime Award, *National Synchrotron Light source II, Brookhaven NY* |
| 2021 | User Beamtime Award*, Argonne National Laboratory* |
| 2020 | Graduate Research Intern Program Award, *National Science Foundation* |
| 2019 | User Beamtime Award, *Argonne National Laboratory* |
| 2018 | Graduate Research Fellowship, *National Science Foundation* |
| 2016 | First Year Graduate Student Fellowship, *University of Oregon* |

## HONORS

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

## 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.,** Lanzirotti, 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., Krawczynksi, 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 $CO_2$ solubility in slab-derived rhyolitic melts- An experimental study. *AGU 2014 Fall Meeting, San Francisco, CA, 15-19 December.*

## FIELD EXPERIENCE

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

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

## TEACHING EXPERIENCE

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| 2023-present | *Courses taught at University of Washington*<br>ESS 212: Earth Materials and Plate Tectonics. ESS 462: Volcanic Processes. |
| 2019 | *Lead Instructor, Fort Hays State University Museum of Natural History*<br>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*<br>GEOL 202: Earth Surface and Environment<br>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

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

## Outreach Activities

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| 2022 | *Newsletter Feature, Smithsonian National Museum of Natural History*<br>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*<br>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*<br>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*<br>"Volatile Cycling in Subduction Zones: A Holistic Approach from Slab to Surface" |
| 2022 | *Member, Unlearning Racism in Geoscience (URGE) pod*<br>*Smithsonian National Museum of Natural History* |
| 2020 | *Session Convener, AGU Fall Meeting*<br>"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*<br>"Crystal Windows into Igneous Processes" |
| 2017-2021 | *Board Member, CMiS (Community for Minorities in STEM)*<br>*University of Oregon*<br>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)*<br>*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*