GSA Mineralogy, Geochemistry, Petrology, and Volcanology (MGPV) Division Annual Report 2022

1 September 2022

[0] Requested Actions and/or Recommendations for GSA Council approval/ratification; or just required notifications

1. Approval of Dr. Katharine Venable Cashman, University of Bristol, UK, as the MGPV Distinguished Career Awardee for 2023. This is MGPV's primary or named award. Details in Item 22-1 below.
2. Dr. Carolina Munoz-Saez, Nevada Bureau of Mines and Geology, Mackay School of Earth Sciences and Engineering, University of Nevada, Reno, NV, USA, is the MGPV Early Geologic Career Awardee for 2023. This is MGPV's non-named Division Award. Details in Item 22-2 below.

[1] Division Mission:

- to provide a mechanism whereby Geological Society of America members whose common interests are mineralogy, geochemistry, petrology, and volcanology can organize to partner with adhering Associated Societies with the same interests;
- to act as an organized group within the framework of the Geological Society of America to better promote awareness, teaching, study, and research of these and relevant areas;
- to stimulate and facilitate within the framework of the Geological Society of America the presentation and discussion of problems, ideas, knowledge, and results of work and research in these areas;
- to cooperate with other Divisions and Sections of the Geological Society of America and with other Associated Societies and scientific organizations in fostering, aiding, furthering, and promoting these areas;
- to advise and assist the officers, council, and committees of the Geological Society of America in matters pertaining to the relevant areas.

[2] Officers: elected officers (between the 2021 and 2022 GSA Annual Meetings):

Past Chair: Rosemary C. Capo, University of Pittsburgh
Chair: Dennis L. Newell, Utah State University
1st Vice-Chair: Amanda B. Clarke, Arizona State University
2nd Vice-Chair: Alan Whittington, University of Texas-San Antonio
Secretary-Treasurer: J. Alexander Speer, Mineralogical Society of America

[3] Management Board (between the 2021 and 2022 GSA Annual Meetings):

Management Board: comprises the elected officers, representatives from the Adhering Societies, and the student representatives:

Past Chair: Rosemary C. Capo, University of Pittsburgh

Chair: Dennis L. Newell, Utah State University
1st Vice-Chair: Amanda B. Clarke, Arizona State University
2nd Vice-Chair: Alan Whittington, University of Texas-San Antonio
Secretary-Treasurer: J. Alexander Speer, Mineralogical Society of America
Geochemical Society (Frank C. Ramos, New Mexico State University)
Mineralogical Association of Canada (David A. Fowle, University of Kansas)
Clay Minerals Society (Warren D. Huff, University of Cincinnati)
Mineralogical Society of America (Ann Benbow)
Mineralogical Society of the United Kingdom and Ireland (Kevin Murphy)
GSA student representative: Lindsey Hernandez, The Ohio State University
GSA student representative: Chioma J. Onwumelu, University of North Dakota

[4] Committees:

(a) MGPV Distinguished Geologic Career Award (2023 award)

Amanda Clarke, 2022 Chair, Arizona State University
Dawnika Blatter (2022-2024), US Geological Survey,
Andrew Calvert (2020-2022), US Geological Survey, Menlo Park
Cailey Condit (2021-2023), University of Washington
Gregory Drummond (2021-2023), University of Arkansas
Peter LaFemina (2022-2024), Pennsylvania State University
Mary Leech (2020-2022), San Francisco State University

(b) MGPV Early Career Award (2023 award)

Alan Whittington, 2022 Chair, University of Texas-San Antonio
Tracy K. P. Gregg (2020-2022), University at Buffalo
Dina Lopez (2020-2022), Ohio University
David Peate (2020-2022), University of Iowa
Mary Reid (2020-2022), Northern Arizona University
Karen Bemis (2021-2023), Rutgers State University
Loyc Vanderkluysen (2021-2023), Drexel University

(c) Nomination for Officers

Rosemary Capo (2022), (Committee Chair, 2021 past MGPV chair)
Amanda B. Clarke (2022), Arizona State University
Alan Whittington (2022), University of Texas-San Antonio
J. Alexander Speer (2022), Mineralogical Society of America

(d) Student Research Grants (for 2022)

Past Chair: Rosemary C. Capo, University of Pittsburgh
Chair: Dennis L. Newell, Utah State University
1st Vice-Chair: Amanda B. Clarke, Arizona State University
2nd Vice-Chair: Alan Whittington, University of Texas-San Antonio

(e) Travel Grants (for 2022)

Chair: J. Alexander Speer (2022), Mineralogical Society of America
Alan Whittington, University of Texas-San Antonio
Elisabeth Widom, Miami University (of Ohio)

Kevin Murphy, Mineralogical Society of the United Kingdom and Ireland

[5] JTPC Representatives (for the 2022 meeting)**:**

Amanda B. Clarke, Arizona State University
Alan Whittington, University of Texas-San Antonio
J. Alexander Speer, Mineralogical Society of America

[6] Council Liaison:

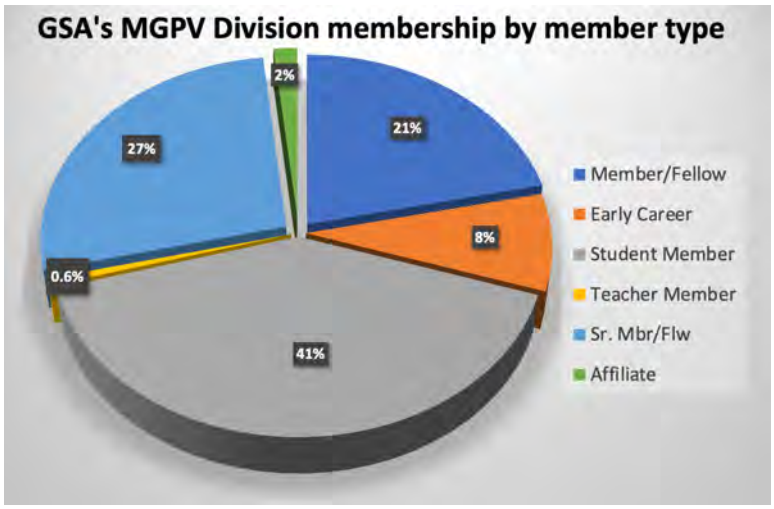
Carmala Garzione, University of Rochester

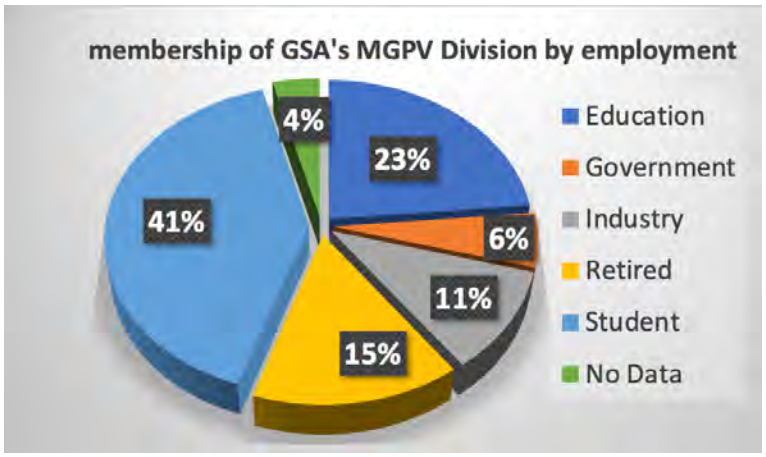
[7] Membership Information:

547 2009 Division affiliates as of 31 December 2009
972 2010 Division affiliates as of 30 December 2010
1,437 2011 Division affiliates as of 30 December 2011
1,434 2012 Division affiliates as of 30 December 2012
1,385 2013 Division affiliates as of 30 December 2013
2,261 2014 Division affiliates as of 30 December 2014
2,249 2015 Division affiliates as of 30 December 2015
2,238 2016 Division affiliates as of 30 December 2016
1,976 2017 Division affiliates as of 30 December 2017
2,035 2018 Division affiliates as of 30 December 2018
1,849 2019 Division affiliates as of 31 December 2019
1,796 2020 Division affiliates as of 31 December 2020
1,716 2021 Division affiliates as of 31 August 2021
1,712 2022 Division affiliates as of 31 August 2022

In 2014, GSA instituted a policy wherein students can join their first Division at no cost. This new policy dramatically increased MGPV membership, increasing student membership from about 30% to 60%. But another result is a loss of income. After 2014, the ups and downs in MGPV membership numbers more or less track the changes in total GSA membership numbers.

GSA provided a variety of MGPV member demographics. As of the beginning of June, 92.5% of MGPV members reside in North America. As can be seen in the accompanying pie diagrams, there is much more diversity in member types and employment. 28% of MGPV member have been GSA member for 3 years or less, but for any subsequent time-period the membership numbers are relatively even at 9-12%. Most MGPV members belong to the Cordilleran Section. There is a wide range of MGPV members' professional interests.





Section **	Total
CORD	631
NC	260
NE	339
RM	392
SC	169
SE	240
None	111
Total	2142

Professional Interest *	Total
Archaeological Geology	32
Biogeosciences	23
Climatology/Meteorology	13
Economic Geology	244
Energy Geology	53
Engineering Geology	35
Environmental Science	104
Geography	3
Geoinformatics	18
Geology and Health	20
Geophysics/Tectonophysics	45
Geoscience Education	118
Geothermal	32
History/Philosophy of Geology	18
Hydrogeology/Hydrology	54
Karst	8
Limnogeology	6
Marine and Coastal Geosciences	36
Mineral/Geochem/Petrology/Volcanology	1348
Other	25
Paleo Sciences	35
Planetary/Space Science	141
Policy/Regulatory	4
Quaternary Geology/Geomorphology	36
Seismology	2
Soil Science	5
Stratigraphy/Sedimentology	56
Structural Geology/Tectonics	286
Total	2800

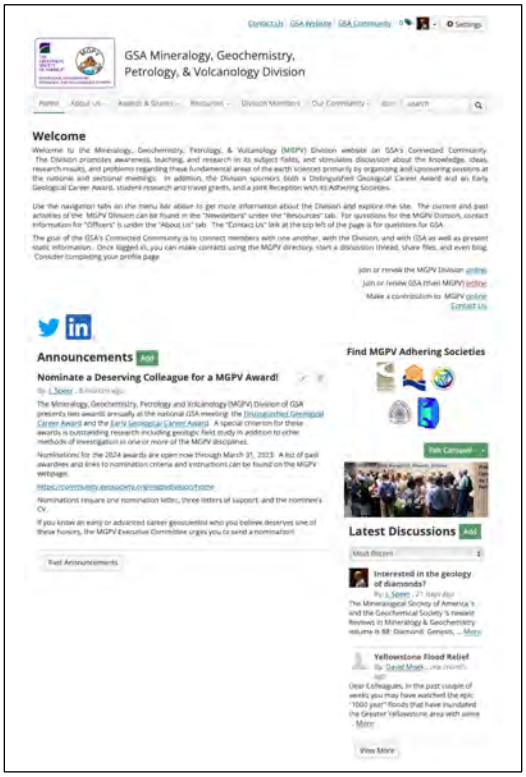
Newsletter of the GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division

Message from the Chair

[8] Newsletter and Publications:

Newsletters, at least one a year, are posted on MGPV's Connected Community website and a message is sent to all MGPV members when they are posted.

More time -sensitive announcements are made by bulk email or a "Latest Discussions" posting.



GSA Mineralogy, Geochemistry, Petrology, & Volcanology Division

Welcome

Announcements

Nominate a Deserving Colleague for a MGPV Award!

Find MGPV Adhering Societies

Latest Discussions

[9] Website & social media:

MGPV's Connected Community website - is updated as needed by the MGPV Secretary-Treasurer.

https://twitter.com/GSA_MGPV
https://www.linkedin.com/company/gsa-mgpv-division/

[10] Fundraising and Awareness: Each year the Division contacts the research grant fund donors, thanks them, and gives the links to that year's Lipman, Carmichael, Hollister, and MGPV student research grant awardess' write-ups written by the awardees themselves.

> The Lincoln S. and Sarah W. Hollister Graduate Student Research Awards Fund is new for 2022. The purpose of the Fund is to support research grants to graduate students working on field-based theses and dissertations that use the tools of metamorphic petrology for understanding the formation of continental crust. Tools include, but are not limited to, phase equilibria based on data obtained with the electron microprobe or SEM/EDS, radiometric analysis, ductile deformation including data from EBSD, fluid inclusions, trace element analysis, and crustal seismology. As relevant, the awards will seek to enhance the recipient's ability to reach remote regions and to conduct research in the safest manner possible.

[11] Financial Summary 2021-2022 (GSA's and the Division's fiscal year to July 1 through June 30)

As of 06/30/2022, MGPV had a (unrestricted) cash balance of $26,316.69.

Income

Dues income was $7,128.13. This is slightly less than the previous 12-month periods for dues of $7,129.16 (2020-2021), $7,336.30 (2019-20), $7,626.86 (2018-2019), $7,556.65 (2017-2018), and $7,437.98 (2016-2017).

The Division received $16,000 in transfers from the James B. Thompson, Jr. Fund of the GSA Foundation to support student research grants, student travel grants, and the awards and travel expenses for the 2022 Distinguished Geological Career and Early Career Awardees. In addition, for the student research grants the Lipman Research Fund provided $57,500, the Hollister Graduate Student Research Awards Fund

provided $7,500, the Ian S.E. Carmichael Research Award provided $1,430, and the GSA Foundation provided $1,070 to make up the short fall in the Carmichael Research Award.

Expenses

Division expenses during this period were $327.00 for AV services, meeting, postage, shipping, and freight. $7,000.00 was dispersed from the Thompson Fund for the DGCA and EGCA awards, and student and awardee travel support. $72,500 was dispersed for student research grants from the Lipman, Hollister, Carmichael, and Thompson Funds. There were no reception expenses for neither the GSA 2021 Connects nor upcoming GSA 2022 Connects meetings. This is a savings of about $5,000 (this is 1/3 of the total remaining cost after ticket sales with that balance due shared among MGPV, GS, and MSA).

Liabilities

With GSA 2020 Connects being online, travel and award plaque expenses were accrued the 2020 awardees (Cathy J. Busby travel and Sebastien Biass) and will be spent for their attendance at GSA 2022 in Denver, Colorado, USA.

[12] Awards:

MGPV Distinguished Geologic Career Awardee

- 2021: Michael Brown, University of Maryland, MD, USA
- 2022: Jane Selverstone, University of New Mexico, Albuquerque, NM, USA

MGPV Early Career Awardee

- 2201: Xiao-Ming Liu, University of North Carolina, Chapel Hill NC, USA
- 2022: Hannah R. Dietterich, US Geological Survey Alaska Volcano Observatory, Anchorage, AK, USA

[13] Grants:

Twenty-nine student research grants, totaling US$72,500, were awarded from 101 proposals submitted.

2022 MGPV Division Student Research Grant awardees are:

- **Megan Kalina**, The University of Texas Permian Basin, Odessa, TX, for her project *Evaluation of Cementing Phases in the Cherry Canyon Formation of the Delaware Mountain Group, Ford Geraldine Field, Texas*
- **Luiza Maria Pierangeli**, Central Michigan University, Mount Pleasant, MI, for their project *Can we use portable-XRF soil geochemical analysis for lithium exploration? Building a machine-learning predictive algorithm*

2022 Lipman Research Fund Student Research Grant awardees are:

- **Lindsey Abdale**, The University of British Columbia, Vancouver, BC Canada, for her project *Short-wave infrared spectroscopy of REE-bearing minerals from the Mount Grace extrusive carbonatite, southeastern British Columbia (Canada)*
- **Brooke Benz**, University of Missouri, Kansas City, Kansas City, MO, for her project *Magma Storage Conditions at Askja Volcano, Iceland*
- **Mariana Berger**, The Ohio State University, Hilliard, OH, for her project: Understanding the dominate processes influencing the calcium isotopic signature in cold seep barites from the Gulf of Mexico
- **Sarah Brooker**, University of Texas at Austin, Austin, TX, for her project: Stable Isotope Composition as a Tracer of Ancient Subduction

- **César Bucheli Olaya**, Missouri State University, Springfield, MO, for his project *Understanding the interaction between magmatic processes, volatile budgets, and eruptive style in Central Andean volcanoes: constrains to the plumbing systems of Lascar and Uturuncu*
- **Weiming Ding**, University of Minnesota, Twin Cities, Minneapolis, MN, for his project: A systematic investigation of stable cerium (Ce) isotope systematics and its potential application to reconstruction of paleoenvironmental conditions
- **Joy Foluso**, University of California, Davis, Davis, CA, for her project: The Investigation of the Concentration and Isotopic ratios of CO_2 in fluids as a Proxy for Mantle Processes in Rifting
- **Elmer Gonzalez**, University of Puerto Rico Mayaguez, Cabo Rojo, PR, for his project: Identifying Ore Deposits in Puerto Rico by using Geochemistry of Surface Waters
- **Alexander Holmwood**, University of Nevada, Reno, Reno, NV, for his project *Temporal evolution of the Majuba Hill Cu-(Sn) deposit, Pershing County, Nevada*
- **Jessica Johnson**, University of New Mexico, Albuquerque, NM, for her project *Understanding Fluid-Rock Interactions in Skarn Development via Skarn Garnets in New Mexico and New York*
- **Tess Johnson**, East Carolina University, Vass, NC, for her project *Constraints on subvolcanic magma plumbing system evolution from Crystal Size Distribution analysis of igneous groundmass*
- **Nathaniel Lenhard**, Missouri State University, Springfield, MO, for his project *Geochemical Comparison of the Chasca Orkho Series and Magmatic Inclusions at Volcán Ollagüe, Central Volcanic Zone, Northern Chile*
- **Charles Lewis**, Oregon State University, Corvallis, OR, for his project *The Chaxas Volcanic Center: Revealing Protracted Magmatic Lifecycles in High-Flux Arc Settings*
- **Mary Macquistan**, University of British Columbia, Vancouver, BC, Canada, for her project *The origin of exotic barium silicate minerals in the Cordillera: Characterization and comparison of the Gun occurrence (Yukon Territory) and localities in California*
- **Emily McQuarrie**, Western Washington University, Bellingham, WA, for her project *Using marine sediments off Grays Harbor to reconstruct deglaciation of the Puget Lobe of the Cordilleran Ice Sheet*
- **Cissy Ming**, Virginia Polytechnic Institute and State University, Blacksburg, VA, for her project *A tale of two reservoirs: Geochemical drivers impacting effectiveness of hypolimnetic oxygenation for manganese treatment*
- **Venkata Sailaja Pappala**, North Carolina State University, Raleigh, NC, for her project *Experimental determination of controls on lithium isotopic fractionation during water-vermiculite interactions in low temperature settings: Implication for continental silicate weathering*
- **Jason Parsons**, State University of New York at Buffalo, Buffalo, NY, for his project *The first complete rheological map of basalt at emplacement conditions*
- **Mollie Pope**, University of Wyoming, Laramie, WY, for her project *Apatite as an indicator of water contents in magmatic source regions*
- **Nanci Reyes Guzman**, Miami University, Oxford, OH, for her project *Initiation of the 2021 La Palma eruption: constraining the eruption trigger and timing by U-series disequilibria and olivine diffusion profiling*
- **Carli Schmidt**, Northern Illinois University, Genoa, IL, for her project *An experimental investigation of gold incorporation into bornite, intermediate solid solution (ISS), and pyrrhotite: Implications for constraining gold distribution in porphyry ore deposits*
- **Ashley Thrower**, Louisiana State University, Baton Rouge, LA, for her project *A new method for determining temperatures in geothermal systems: Application of intersector chemical zoning of tourmaline*
- **Simin Zhao**, Georgia Institute of Technology, Atlanta, GA, for her project *Effects of mineral substrates on authigenic clay precipitation in reverse weathering process*

2022 Ian S.E. Carmichael Fund Student Research Grant awardee is:

- **Ami Ward**, University of North Carolina, Chapel Hill, NC, for her project: *Investigating Post-Magmatic Alteration of Plutons through in situ B Isotope Analysis of the Late Cretaceous Tuolumne Intrusive Suite, CA*.

2022 Lincoln S. and Sarah W. Hollister Graduate Student Research Grant awardees are:

- **Juan Felipe Bustos Moreno**, Lehigh University, Bethlehem, PA, for his project: *Carbon mobility in subduction zone metamorphism: Evidence from HP/UHP Meta-Ophiolitic Breccias in the Western Alps*
- **Peter Lindquist**, University of Washington, Seattle, WA, for his project: *Tracking the history of metamorphic dehydration in the Catalina Schist*
- **Julisan Street**, University of Michigan, Ann Arbor, MI, for her project: *High-Temperature Granulite Metamorphism in Southwestern USA*

The MGPV student awardees are normally recognized at the Joint MGPV-MSA-GS Reception. The Lipman and Carmichael awardees are normally presented at the Penrose Circle Dinner and Student Awards Ceremony, hosted by the GSA Foundation. All student awardees will be acknowledged during the MGPV Division Awards session.

2021 Travel Grant awardees:

Ten student travel grants, totaling US$5,000, were awarded from 56 proposals submitted. These were only decided on after submission of the 2021 MGPV Division Annual report

- **Francisco Apen**, University of California-Santa Barbara *Apatites For Destruction: New Reference Apatites For U-Pb Petrochronology And Sm-Nd And Sr Isotope Geochemistry*
- **Umme Fatema**, Bowling Green State University, *The Role of Dissolved Organic Matter on Phosphorous Sorption onto Iron-enhanced Activated Alumina Media Using In-Field and Flow-through Column experiments*
- **Lisa Hlinka**, City University of New York, *Constraining Timescales Of Magmatic Processes In The Columbia River Flood Basalt Province*
- **Chioma Onwumelu**, University of North Dakota (UND)-Grand Forks, *Compensation Effect In Source Rock Kinetics: Influence Of Bitumen Formation*
- **Tiera Naber**, University of British Columbia *New Constraints On The Age, Geochemistry, And Environmental Impact Of High Arctic Large Igneous Province Magmatism: Tracing The Extension Of The Alpha Ridge Onto Ellesmere Island, Canada*
- **Ibrahim Ajibola Oladeni**, Georgia State University, *Rare-Earth Element Occurrence in Heavy Mineral Sand in SouthEast Georgia*
- **Elyssa Rivera**, Auburn University, *Building A Framework For Interpreting The Mo Isotopic Composition Of Ore*
- **Lorenzo Tavazzani,** Southern Methodist University, *Modeling Zircon Growth During Open-System Crystallization*
- **Audrey White**, University of Puget Sound, *Geochemistry and Petrology Of Eocene To Miocene Rocks In A Rear-Arc Setting, Central Cascades, Washington*
- **Yezi Yang**, Virginia Tech, *First report of the Archaeocyathid Extinction and the Redlichiid-Olenellid Extinction Carbon isotope Excursions (AECE and ROECE) in eastern Laurentia: Implications for perturbations in the late early Cambrian carbon cycle*

** Honorable mention should be made of **Sarah Lamm**, Kansas State University. She was among the finalist, but as she received a travel grant from another Division, the award could be given to another.

2022 Travel Grant awardees:

- 2022 awardees will not be known until after submission of this annual report.

[14] Associated Societies and Partnerships:

- The Clay Minerals Society
- The Geochemical Society
- The Mineralogical Association of Canada
- The Mineralogical Society of America
- The Mineralogical Society of the United Kingdom and Ireland

[15] 2022 GSA Annual Meeting Activities:

67 half-day Topical Sessions (co-)endorsed by MGPV Division and its Adhering Societies

(21 of which are poster sessions)

- T013. The Legacy of Kenneth L. Pierce: Interdisciplinary Studies along the Track of the Yellowstone Hotspot and Beyond I.
- T013. The Legacy of Kenneth L. Pierce: Interdisciplinary Studies along the Track of the Yellowstone Hotspot and Beyond II.
- T013. The Legacy of Kenneth L. Pierce: Interdisciplinary Studies along the Track of the Yellowstone Hotspot and Beyond (Posters).
- T015. Toward Unravelling the Dolomite Problem: New Approaches and Novel Perspectives.

- T018. Recent Advances in Soil and Paleosol Science.
- T018. Recent Advances in Soil and Paleosol Science (Posters).
- T029. Structural Analysis of Polyphase Deformation from Orogen to Thin Section I: A Special Session in Honor of Sharon Mosher.
- T029. Structural Analysis of Polyphase Deformation from Orogen to Thin Section II: A Special Session in Honor of Sharon Mosher.
- T029. Structural Analysis of Polyphase Deformation from Orogen to Thin Section (Posters): A Special Session in Honor of Sharon Mosher.
- T032. Cenozoic Tectonism, Magmatism, Sedimentation, and Landscape Evolution in the Intermountain West.
- T032. Cenozoic Tectonism, Magmatism, Sedimentation, and Landscape Evolution in the Intermountain West (Posters).
- T035. Evaluation of Proterozoic Tectonic Styles in North America and Their Influence on Phanerozoic Structures and Mineralization.
- T035. Evaluation of Proterozoic Tectonic Styles in North America and Their Influence on Phanerozoic Structures and Mineralization (Posters).
- T038. Late Paleozoic to Cenozoic of Mexico and Beyond: Stratigraphy, Magmatism, Geochronology, Tectonics and Paleomagnetism: A Tribute to Roberto Stanley Molina-Garza.
- T039. New Insights into the Evolution and Geodynamics of Metamorphic Core Complexes in North America and Around the World.
- T039. New Insights into the Evolution and Geodynamics of Metamorphic Core Complexes in North America and Around the World (Posters).
- T040. The Thermal Structure of Subduction Zones: Constraints, Evolution, and Consequences.
- T044. Critical Minerals and Framework Geology: The USGS Earth Mapping Resources Initiative (Earth MRI) and Related Activities I.
- T044. Critical Minerals and Framework Geology: The USGS Earth Mapping Resources Initiative (Earth MRI) and Related Activities II.
- T044. Critical Minerals and Framework Geology: The USGS Earth Mapping Resources Initiative (Earth MRI) and Related Activities (Posters).
- T051. Assessing Critical Mineral and Rare Earth Element Potential from Unconventional Resources in the United States.
- T052. Convergent Margin Magmatism and Ore Deposits to Honor the Range of Contributions by John H. Dilles.
- T054. Metal Recovery and Remediation at Hard Rock Legacy Mine Sites.
- T055. Metals in Hydrothermal Systems: From Source to Sink.
- T059. A Bird’s Eye View: Remote Sensing Applications for Geohazards.
- T059. A Bird’s Eye View: Remote Sensing Applications for Geohazards (Posters).
- T063. Reassessing Natural Hazard Risk in a Changing World (Posters).
- T068. Sigma Gamma Epsilon Student Research Exhibition (Posters).
- T074. Geoarchaeology at the Micro-Scale: New Applications of Microanalytical Techniques I.
- T074. Geoarchaeology at the Micro-Scale: New Applications of Microanalytical Techniques II.
- T075. Advances in Non-Traditional Stable Isotope Measurements and Utility as Proxies in Modern and Paleo-Settings.
- T077. Characteristics, Reactivity, and the Role of Natural Organic Matter (NOM) in Mobilizing Trace Elements of Health Concern in the Environment.
- T077. Characteristics, Reactivity, and the Role of Natural Organic Matter (NOM) in Mobilizing Trace Elements of Health Concern in the Environment (Posters).
- T079. GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division Awards Session.
- T081. Radiogenic Isotopes as Tracers of Geologic Processes: Dates, Rates, and Proxies I.
- T081. Radiogenic Isotopes as Tracers of Geologic Processes: Dates, Rates, and Proxies II.
- T081. Radiogenic Isotopes as Tracers of Geologic Processes: Dates, Rates, and Proxies (Posters).
- T082. The Geology and Environmental Impacts of Lithium Resources in North America and other Globally Significant Deposits I.
- T082. The Geology and Environmental Impacts of Lithium Resources in North America and other Globally Significant Deposits II.
- T082. The Geology and Environmental Impacts of Lithium Resources in North America and other Globally Significant Deposits (Posters).
- T084. Using Iron Oxides for Quantitative Reconstruction of Thermal Histories, Paleoenvironments, Hydrothermal Alteration, Planetary Evolution, and Fault Zone Processes.
- T085. Lava Flows and Their Hazards: A Session Inspired by Hannah Dietterich's Early Career Award from the Mineralogy, Geochemistry, Petrology, and Volcanology Division.
- T085. Lava Flows and Their Hazards: A Session Inspired by Hannah Dietterich's Early Career Award from the Mineralogy, Geochemistry, Petrology, and Volcanology Division (Posters).

- T086. The Virtue of Fieldwork in Volcanology, Sedimentology, Structural Geology, and Tectonics I: A Session to Honor Cathy Busby, MGPV Distinguished Geological Career Award Recipient of 2020.
- T086. The Virtue of Fieldwork in Volcanology, Sedimentology, Structural Geology, and Tectonics II: A Session to Honor Cathy Busby, MGPV Distinguished Geological Career Award Recipient of 2020.
- T086. The Virtue of Fieldwork in Volcanology, Sedimentology, Structural Geology, and Tectonics: A Session to Honor Cathy Busby, MGPV Distinguished Geological Career Award Recipient of 2020 (Posters)
- T087. Source to Surface Magma Thermodynamics and Transport: Interdisciplinary Approaches to Documenting the How, Where, and When of Magma Generation and Evolution during Ascent, Storage, and Eruption I.
- T087. Source to Surface Magma Thermodynamics and Transport: Interdisciplinary Approaches to Documenting the How, Where, and When of Magma Generation and Evolution during Ascent, Storage, and Eruption II.
- T087. Source to Surface Magma Thermodynamics and Transport: Interdisciplinary Approaches to Documenting the How, Where, and When of Magma Generation and Evolution during Ascent, Storage, and Eruption (Posters).
- T088. Charting Soils at the Atomic Scale I: A Tribute to the Careers of David L. Bish and Jeffrey E. Post.
- T088. Charting Soils at the Atomic Scale II: A Tribute to the Careers of David L. Bish and Jeffrey E. Post.
- T088. Charting Soils at the Atomic Scale: A Tribute to the Careers of David L. Bish and Jeffrey E. Post (Posters).
- T089. Early Career Investigators in Mineralogy and Crystallography.
- T089. Early Career Investigators in Mineralogy and Crystallography (Posters).
- T090. Gemological Research in the Twenty-First Century—Gem Minerals and Localities.
- T090. Gemological Research in the Twenty-First Century—Gem Minerals and Localities (Posters).
- T095. Impact Cratering in Space and Time.
- T099. The Interplay of Volcanism, Tectonism, and Impacts across the Solar System.
- T102. Comings and Goings of Proterozoic Global Glaciations (Posters).
- T103. Cushman Foundation Symposium: Latest Advances on Foraminiferal Research: From Paleo-Sea-Level Reconstructions and Paleoecological Interpretations to Applications to Environmental Science. A Tribute to the Extraordinary Lives of John Haynes, John Murray, and David Scott.
- T106. Insights from Microfossils and Their Modern Analogs: From Traditional and Emerging Approaches to Critical Re-Evaluations.
- T108. Oceans and Climates through Earth History: From Proxy Reconstructions to Model Assessments (Posters).
- T129. Arsenic, Fluoride, and Other Geogenic Contaminants in Groundwater Systems: Advances in Data Science for Monitoring Long-Term Risks and Mitigation.
- T136. Uranium Fate and Transport in the Environment.
- T141. Karst Processes and Speleology (Posters).
- T143. New Frontiers in Cave and Karst Research: In Honor of the International Year of Caves and Karst.
- T177. Mineralogy, Petrology, and Geochemistry: New Approaches to Harnessing the Multidimensionality of Complex Systems.
- T177. Mineralogy, Petrology, and Geochemistry: New Approaches to Harnessing the Multidimensionality of Complex Systems (Posters).

Short Courses/Field Trips (co-)endorsed by MGPV Division and its Adhering Societies

- 402. The Warren Hamilton Field Trip: PC2 = PreCambrian Colorado: The Role of the Mesoproterozoic Picuris Orogeny in Colorado. Fri.–Sat., 7–8 Oct.
- 404. A Bike Tour: Geology, Geochronology, and Geochemistry of the Table Mountain Shoshonite, Golden, Colorado. Sat., 8 Oct.
- 502. Climate Adaptation Planning for Emergency Management. Tue., 27 Sept., 10 a.m.–2 p.m.; Wed., 28 Sept., 10 a.m.–2 p.m.
- 508. Multiphysics Modeling for the Geosciences. Fri., 7 Oct., 8 a.m.–5 p.m.
- 514. Improve Your Computational Petrology Skills: Designing and Executing a Computational Petrology Research Project and an Introduction to the Magma Chamber Simulator. Fri., 7 Oct., 1 p.m.–5 p.m.; Sat., 8 Oct., 8 a.m.–5 p.m.
- 527. Volcanic Crisis Awareness. Sat., 8 Oct., 8 a.m.–5 p.m.
- 531. Using the StraboSpot and StraboMicro Data Systems for Geology. Sat., 8 Oct., 8 a.m.–5 p.m.

Reception

There was no reception in 2021, and there will not be one in 2022.

Lectures or Special Events

- In 2021: GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division Awards Session, Monday, October 11, 2021; 8:00 AM - 12:00 PM

    - Introductory Remarks
    - 2021 EGCA Intro and Citation
    - MGPV Early Geologic Career Award Lecture: *Are Lithium Isotopes Good Tracers Of Continental Weathering?* Liu, Xiao-Ming, of North Carolina At Chapel Hill, Chapel Hill, NC
    - 2021 DGCA Intro and Citation
    - MGPV Distinguished Geologic Career Award Lecture: *Secular Change In Metamorphism And Metamorphic Cooling Rates Track The Evolving Plate Tectonic Regime On Earth*, Michael Brown, University of Maryland, College Park, Md 20742

- For 2022: GSA Mineralogy, Geochemistry, Petrology, and Volcanology Division Awards Session, Tuesday, October 11, 2022; 8:00 AM - 12:00 PM

    - Introductory Remarks
    - 2022 EGCA Intro and Citation
    - MGPV Early Geologic Career Award Lecture: *New Insights into Lava Flow Dynamics And Hazards From The 2018 Eruption of Kīlauea, Hawai'i.* H. Dietterich, M. R. Patrick, B. B. Carr, E. Gallant, D. Hyman, A. K. Diefenbach, K. Cashman, And G. Grant
    - 2022 DGCA Intro and Citation
    - MGPV Distinguished Geologic Career Award Lecture: *A Retrospective View of the P-T Path Revolution in Metamorphic Petrology*. J. Selverstone
    - 2020 DGCA Intro and Citation
    - MGPV Distinguished Geologic Career Award Lecture: *Importance Of Extensional Arcs in the Geologic Record.* C. Busby

[16] GSA Section Activities:

endorsed sessions

- MGPV agreed to sponsor sessions at the 2022 Cordilleran/Rocky Mountain Joint Section, Joint North-Central & Southeastern Section, Northeastern Section, and South-Central Section Meetings.

exhibit area

- MGPV exhibited at both the 2022 Joint Section North-Central & Southeastern Section (Cincinnati, OH) and the 2022 Northeastern Section (Lancaster, PA) meetings with the Mineralogical Society of America.

- MGPV will exhibit at 2022 GSA Connects in a joint booth with MSA.

[17] Activities with Other GSA Divisions:

- none beyond joint sponsorships of the sessions listed above.

[18] Business Meeting Summary:

MGPV operational meetings will be virtual via Zoom, and will NOT require registering for GSA Connects 2022 to attend:

- Management Board Meeting: 26 September 2022, 3-4 pm (EST)
- Annual Business Meeting: 3 October 2022, 2-4 pm (EST)

Details will be sent to MGPV members closer to the date..

[19] Other Meetings: none

[20] In-coming Officers and Board Members (between the 2022 and 2023 GSA Annual Meetings):

Past Chair: Dennis Newell, Utah State University
Chair: Dennis Amanda Clarke, Arizona State University
1st Vice-Chair: Alan Whittington, University of Texas-San Antonio
2nd Vice-Chair: Elisabeth Widom, Miami University (of Ohio)
Secretary-Treasurer: J. Alexander Speer, Mineralogical Society of America
Geochemical Society (Frank C. Ramos, New Mexico State University)
Mineralogical Association of Canada (David A. Fowle, University of Kansas)
Clay Minerals Society (Katerina Dontsova, University of Arizona)
Mineralogical Society of America (Ann Benbow)
Mineralogical Society of United Kingdom and Ireland (Kevin Murphy)
GSA student representative: Lindsey Hernandez, The Ohio State University
GSA student representative: Chioma J. Onwumelu, University of North Dakota

[21] Emerging Needs & Future Activities:

The Division's goals for the upcoming year are:

1. retaining current members and increasing membership
2. encouraging session proposals for the GSA 2023 Annual meeting
3. selection of the 2023 MGPV Distinguished Geologic Career and Early Career Awardees
4. selection of MGPV Division, Lipman, Carmichael, and Hollister Student Research Awardees
5. encouraging MGPV technical sessions at Sectional Meetings

[22] Requested Actions and/or Recommendations for GSA Council approval/ratification
(Changes/additions in Bylaws, Awards, Travel Grants, etc. for GSA Council final approval):

1. Approval of Dr. Katharine Venable Cashman, University of Bristol, as the MGPV Distinguished Geological Career Awardee for 2023. The MGPV Distinguished Geological Career Award Committee Report and Dr. Cashman 's nomination package is **Appendix A**.

2. Dr. Carolina Munoz-Saez, Nevada Bureau of Mines and Geology, Mackay School of Earth Sciences and Engineering, University of Nevada, Reno, is the MGPV Early Geologic Career Awardee for 2023. This is MGPV's Non-named Division. The MGPV Distinguished Geological Career Award Committee Report and Dr Munoz-Saez's nomination package is **Appendix B**.

Annual Report Submitted By: J. Alex Speer, MGPV Secretary-Treasurer
Reporting Period: 1 September 2021 - 31 August 2022
Date Report Submitted: 31 August 2022

ASU SCHOOL OF EARTH & SPACE EXPLORATION
ARIZONA STATE UNIVERSITY
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To: MGPV Management Committee
From: Amanda B. Clarke, Chair MGPV DGCA Award Committee
Date: July 29, 2022
RE: Selection of 2023 MGPV Distinguished Geologic Career Award

There were nine complete nomination packages submitted or updated for the **2023 MGPV DGCA:**

Calvin Barnes - Texas Tech University
Marion Eugene (Pat) Bickford - Syracuse University
Katharine Venable Cashman - University of Bristol
Ian W.D. Dalziel – University of Texas Institute for Geophysics
John Hook Dilles – Oregon State University
Anita Lizzie Grunder – Oregon State University
Bruce F. Houghton – University of Hawai'I at Manoa
J. Michael Rhodes – University of Massachusetts
Michael L. Williams – University of Massachusetts

The Distinguished Geologic Career Award Committee members for the 2023 award were:

Amanda Clarke, chair (amanda.clarke@asu.edu), Arizona State University
Dawnika Blatter, US Geological Survey, CalVO
Andrew Calvert, US Geological Survey, Menlo Park, CalVO
Cailey Condit, University of Washington
Gregory Drummond, University of Arkansas
Peter LaFemina, Pennsylvania State University
Mary Leech, San Francisco State University

Compelling reasons were submitted by nominators and supporting letter-writers that each of the nominees is worthy of consideration for the MGPV Distinguished Geologic Career Award.

An initial discussion and ranking stage was conducted to identify the top-tier candidates, who were Cashman, Dilles, Grunder, Houghton, and Rhodes. After a brief discussion of these top nominees, we decided to proceed with a Borda Count ranking. One committee member was unreachable for the later stages of the vote, therefore the final decision was based on the ranking of six committee members.

The Borda Count results were as follows:

Cashman: 33 total; 5 of 6 top votes
Grunder: 22 total; 1 or 6 top votes
Houghton: 18 total; no top votes
Dilles: 17 total; no top votes
Rhodes: 15 total; no top votes

Professor Katharine Cashman was the clear top choice of the committee.

Committee comments regarding Professor Cashman's contributions are summarized here.

Cashman is a creative field-based scientist who has greatly advanced petrology and volcanology using innovative approaches to interrogate magmatic processes from the deep crust to the surface, and even the atmosphere. She uses field observations, textures, chemistry and physics to explain complicated phenomena and publishes readable products with compelling illustrations. She is an outstanding mentor with highly productive current

and former students and diverse colleagues worldwide. Her letters come from distinguished, diverse backgrounds and argue persuasively.

Professor Cashman is one of the best volcanologists around. She uses a wide range of techniques to understand magmatic systems in a wholistic way, in the subsurface as well as observable volcanic phenomena. Professor Cashman is more deserving than anyone in the field.

Additional information about the nominee:

Professor Katharine Venable Cashman, NAS, FRS
University of Bristol / University of Oregon
Email: cashman@oregon.edu
https://royalsociety.org/people/katharine-cashman-12849/?commitee=/about-us/committees/library-committee-69/
http://www.nasonline.org/member-directory/members/20038880.html

Key quotes from the nominating letters include the following:

"Kathy Cashman is a remarkable scientist. Her strengths are many, but she is an outstanding candidate for this award based on her attention to fundamental observations and field context, her incorporation of multiple disciplinary approaches, and her mentorship and collaborations with scientists with diverse backgrounds. Key to her success is her imaginative approach to all of her studies, devising novel solutions to old problems and helping us to understand more about magma storage, ascent, eruption, dispersal and landscape change in between. I cannot recommend her highly enough for this award." **Nominator Heather Wright USGS, Cascades Volcano Observatory, hwright@usgs.gov**

"In sum, there is probably no individual anywhere that is more deserving of the MGVP DGCA award than Dr. Kathy Cashman. She is probably the most creative and productive scientist in the field in a generation, and she is universally well-liked and respected. She performs extraordinarily high levels of service to the scientific and university communities. Most importantly from my perspective, she is probably the best graduate advisor I have ever known, thus she will continue to influence the fields of volcanology and petrology for decades after her retirement." **Dennis J. Geist Program Director, U.S. National Science Foundation Emeritus Professor, University of Idaho**

"Kathy studies volcanic systems from the magma reservoir to the Earth's surface using the combined tools of field observations and measurements, sample analysis for chemical and physical characteristics, laboratory experiments and theoretical models. The most distinctive aspect of her work is her use of quantitative analysis of all constituent phases of volcanic samples (glass, crystals and vesicles) to quantify the kinetics of phase transformations and relate these to temporal changes in the physical properties of volcanic materials. Her work has had major pioneering impacts in the fields of igneous petrology, physical volcanology, and magmatic processes, and has stimulated new areas of research in experimental petrology and volcano studies."

"Kathy Cashman's main contributions are in volcanology and igneous petrology. Her science is based primarily on observations, but she has deep understanding of the physical and chemical processes that govern volcanic and igneous processes. She has been particularly innovative in interpretation of structures and microscopic textures of volcanic rocks to make inferences about physical processes and conditions during volcanic eruptions. This work is characteristically novel and ground-breaking. Her research is based on meticulous attention to detail and thoroughness in her field and microscopic observations, combined with a flair for intuitive and original thinking. Indeed observations in the field scale down the microscope is where almost all her science is motivated.." **Professor Sir Stephen Sparks FRS CBE, University of Bristol**

Checklist for
GSA MGPV Division
Distinguished Geologic Career Award

****

Nominee:

Katharine Venable Cashman
School of Earth Sciences
University of Bristol
Bristol, BS8 1RJ
United Kingdom

Phone : (44) 117 3315131
Email: glkvc@bristol.ac.uk

****

Nominations will be from the Division membership at large, and should consist of:

A 1-2 page letter (with name and address of nominator) summarizing the Nominee's most important accomplishments in geologic approaches to mineralogy, geochemistry, petrology, and/or volcanology. Special attention should be paid to describing how the Nominee's published work demonstrates field-based multidisciplinary geologic accomplishments of a ground-breaking nature.

[x] Nominator: Heather Wright, Cascades Volcano Observatory, USGS

****

[x] Curriculum Vita of the nominee.

****

Three letters of support. These letters of support can be either from members or non-members of GSA or the MGPV Division.

[x] Co-Sponsor 1: Dennis J. Geist, U.S. National Science Foundation
[x] Co-Sponsor 2: Rebecca Lange, University of Michigan
[x] Co-Sponsor 3: Stephen Sparks, University of Bristol

United States Department of the Interior
US Geological Survey
1300 SE Cardinal Court, Building 10
Vancouver, WA 98683

Dear MGPV award committee,

I am writing to nominate **Dr. Katharine V. Cashman** for the MGPV Distinguished Geological Career Award of the Geological Society of America. Over her accomplished career, Dr. Cashman has made numerous notable advances in the fields of petrology and volcanology, using innovative, multidisciplinary approaches to tackle a wide variety of geologic problems. Importantly, all of her investigations are founded upon primary field observations and fundamental field research. Kathy's research has spanned an extraordinary variety of volcano types, tectonic settings and locations (see map below). Her work extends from the storage and ascent of magmas to the dispersal of volcanic ash in the atmosphere and the architecture of crustal magmatic systems. Her field observations, mapping, and stratigraphic and temporal sampling of volcanic products underpin her scientific method. These field results form the basis for subsequent investigations that range from petrologic analyses of volcanic products to quantification of macro- and microtextures of rocks to analog and high-temperature experimentation. She has incorporated concepts and theory from the fields of material science, fluid dynamics, atmospheric science, materials science, hydrology, and geomorphology to bring interdisciplinary expertise to solve petrologic and volcanic problems. Furthermore, she has highlighted the incredible value of traditional Indigenous knowledge and oral traditions for unravelling eruption histories, reinforcing hazard communication, and strengthening community resilience. As a mentor, she has passed on her passion and expertise for multidisciplinary research to over 50 graduate students at University of Oregon and University of Bristol, many of whom have gone on to successful careers in volcanology, academia and beyond. All together, these qualities make her an exemplary candidate for this award.

Volcanoes studied by Professor Cashman

Kathy's imaginative and multidisciplinary approach is evidenced as much in her early work as her recent studies. Her doctoral degree in the late 1980s applied crystal size distribution (CSD) methods borrowed from material science to igneous and metamorphic rocks. Seminal papers co-authored with Marsh and Ferry have been cited over 500 and 250 times, respectively [CV publications 6, 5]. This work demonstrated the potential of rock textures for unlocking key processes in their formation, such as growth and nucleation rate, that could in turn be linked to parameters such as magma ascent rate or cooling time. The application of CSDs in the volcanological community has continued to flourish since Kathy's pioneering work, and constitutes a significant advance in the quantitative interpretation of rock textures. Her recent review paper [197] brings this work full circle, showing us the advances and pitfalls in CSD analyses of volcanic rocks over the past 40 years, and challenging us to better understand discrepancies between crystal textures in nature and those created in experiments.

United States Department of the Interior
US Geological Survey
1300 SE Cardinal Court, Building 10
Vancouver, WA 98683

Kathy's examination of volcanic textures and their field context has led to far greater discoveries than those that CSDs alone can provide. For example, her study of glass and microlite crystals in dacite ash erupted in March and April 1980 at Mount St. Helens revealed that magma had successfully made its way to the surface *prior* to the climactic eruption of May 18, contrary to the interpretation made during the eruptive crisis [59]. This recognition changed interpretation of ash sequences around the world, providing a tool to fingerprint juvenile material, and initiating her continuing advancement of petrologic monitoring of volcanic eruptions. Kathy's subsequent work with Blundy on eruptive products from Mount St. Helens focused on the role that degassing plays on nucleation and growth of crystals. The recognition that a significant fraction of the *total* crystal load at Mount St. Helens (*i.e.* phenocrysts *and* microlites) is the result of decompression [42] is key to understanding what drives eruptions. By a logical extension of Tuttle and Bowen's classic experimental work on granites, Kathy was able to show that most silicic magmas continue to crystallise to very low pressures, as evidenced by the very high silica content of their matrix glasses [42]. She and her students have since applied this understanding to volcanic systems around the world, including studies of pyroclasts and lava domes at Merapi, Indonesia; Pinatubo, Philippines; Guagua Pichincha, Ecuador; Paricutin, Mexico; Fuego, Guatemala; at cinder cones and maars in the western US, and multiple others.

Kathy's interest in active volcanic systems extends to basaltic lava flows and consequential hazards. She has used field observations and direct sampling of lava flows in Hawai‘i to characterize surface flow textures and underlying crystal and bubble textures. This work has allowed her to infer spatiotemporal variations in temperature, crystallization, vesiculation, and resultant viscosity in a flow. Kathy championed the idea that apparent viscosity and shearing control the transition from pāhoehoe to ‘a‘ā surface textures and transport pathways from lava tubes to open channels ([36]; over 250 citations). Kathy's work also provided important field constraints on the kinetics of vesiculation in basalt; a process that is challenging to capture in a laboratory setting. Her contributions on lava flow dynamics include analog laboratory studies that have tested field hypotheses and derived scaling relationships of fundamental controls on lava flow behavior [e.g., 46, 51]. Her excellent grasp of the value of primary field observations is reflected in a paper she co-authored with Mangan reviewing a century of study of lava flows in Hawai‘i [134]. Her work on basaltic systems extends to lava flow mapping as well; she has applied lidar to help map flow fields in Oregon [117, 161], and has explored the implications of lava flow entry into active river systems in Iceland [196]. Together, these studies helped advance our understanding of the controls on lava flow emplacement and hazards generated from lava flows during eruptions.

Vesicles are another textural characteristic of volcanic rocks to which Kathy has applied her acumen for recognizing patterns and nuances. Her pioneering work on the rheology of bubble-bearing magmas [30] and the non-equilibrium nature of degassing [29] have played a key role in developing our understanding of conduit processes. Her work with Klug [20] on the formation of permeable networks through connected bubbles in magma has been cited over 350 times and has advanced our understanding of gas loss prior to and during volcanic eruptions. Her work with Rust [58] and subsequent studies of the evolution of pore networks in magma explored the existence of percolation thresholds and the role that degassing plays on eruption dynamics. Kathy demonstrated correlations between vesicle textures and eruptive styles that were key to understanding effusive-explosive transitions at basaltic volcanoes. A broader examination of crystal and bubble textures in tandem has shown the control of decompression rate on eruption style across a wide range of magma compositions, as reviewed in her 2018 paper with Cassidy [173].

Kathy's work on vesiculation and permeable gas migration also led to greater understanding of the controls on magma fragmentation, with important consequences for tephra transport in the

atmosphere and underwater. Her work with Rust [113] demonstrated the link between bubble size distributions on primary fragmentation and differences between silicic vs. mafic systems. Completed together with her students, subsequent extensions of this work focused on the ways that interaction with external water affects particle morphology, with particular focus on Icelandic eruptive products. She has also worked on bubble textures in submarine eruptions, where early work with Fiske [10] documented formation of pumice in an underwater environment in Japan, and led to further studies of eruption dynamics and tephra dispersal from submarine eruptions more broadly. Her work on dispersal of airborne ash has incorporated information from stratigraphic logs, from lake cores (including presence of cryptotephra), and from historical accounts and has highlighted the role of particle shape on transport, even at the smallest sizes.

Kathy has also focused on broader implications of rheological changes imposed by interactions between crystals and bubbles in volcanic systems. Kathy drew upon fault mechanics literature to better understand the rheology of highly crystalline 2004–2008 lava domes at Mount St. Helens that were bounded by concentrated shear zones [124]. She has worked with several students to study the interactions between crystals and bubbles in analog and high temperature experiments [e.g., 109, 163].

Furthermore, her work with Giordano [139], Sparks and Blundy [167], and Edmonds [182] among others has focused on the ways that petrology can be combined with information from seismology, geodesy, and numerical modeling to reveal the vertically extensive architecture of magma storage in the crust and to challenge the paradigm of long-lived large reservoirs. Her work supports a model of isolated melt lenses and distributed melt along grain boundaries in crystal mush, rather than as large magma chambers. Her recognition of the prevalence of transcrustal magmatic systems reflects her ability to extend outwards from the micro to the macro and is a hallmark of her method.

Kathy Cashman is a remarkable scientist. Her strengths are many, but she is an outstanding candidate for this award based on her attention to fundamental observations and field context, her incorporation of multiple disciplinary approaches, and her mentorship and collaborations with scientists with diverse backgrounds. Key to her success is her imaginative approach to all of her studies, devising novel solutions to old problems and helping us to understand more about magma storage, ascent, eruption, dispersal and landscape change in between. I cannot recommend her highly enough for this award.

Please expect letters of support from Steve Sparks, Rebecca Lange, and Dennis Geist. To my knowledge the person I am nominating has not breached GSA's Code of Ethics & Professional Conduct nor is this person under investigation for any action that would be a breach of GSA's Code of Ethics & Professional Conduct.

Heather Wright
USGS, 1300 SE Cardinal Court, Vancouver WA 98683
hwright@usgs.gov

Division of Earth Sciences
National Science Foundation
2415 Eisenhower Boulevard
Alexandria, Virginia 22314

Dr. Dennis Geist
March 27, 2021

To the MGVP Award Committee:

Kathy Cashman is a giant of modern volcanology and igneous petrology and clearly deserving of the MGVP Distinguished Geological Career Award by the Geological Society of America. My view is as an observer of her career: we have been friends and colleagues and shared ideas on volcanoes and magmatic processes since the 1980s, but we have never worked together.

Dr. Cashman's scholarly output is nothing short of overwhelming, and she has been a leader in a number of subdisciplines related to volcanology and petrology. I would say that she can be credited with pioneering several fields, including the application of quantitative textural analysis (crystal-size distributions), lava flow morphology and emplacement, vesicle formation and textures, and crystal-textural control on rheology (and multi-phase rheology in general). Any one of these topics would be the work of a lifetime by a typically productive academic. Although she has worked all over the world, it is impressive that she tackles some of the most iconic volcanoes anywhere, especially Mt. St. Helens, Pinatubo, Kilauea, Mazama, and Mauna Loa. Again, work on any one of these systems would be the life's work of most of us. It is a pretty simple math problem that given this diversity of topics and study sites, she is roughly ten-times more creative and productive than the typically creative and productive competition. At a career stage when most of us are pulling over to the right to let others pass, she takes on entirely new disciplines, including volcano seismology and the cultural impacts of volcanoes. Then to top it off, she writes a paper that sets a new paradigm for the plutonic structure of magmatic systems; I have seen the summary schematic from the new *Science* paper in almost every public presentation and paper on magmatic systems over the past 5 years, literally more than a hundred times. This paper is without question the most impactful piece of work in petrology in the past decade. It may eventually be the most important paper of the first half of the 21st century.

Because the other nominators will likely focus on Dr. Cashman's scholarly efforts and huge service to the community, I want to focus on what might be her most important legacy: the students she has mentored. For most in academia, advising graduate students who go on to great things is probably the most important way that one can influence the science. Good examples come from the 1970s, when the former students of Jim Hays and Ian Carmichael became a who's who list of modern petrology (in fact, Dr Cashman is the academic granddaughter of Carmichael). In my view, Kathy Cashman is by far the most important graduate advisor in a generation: institutions all over the world are populated by petrologists and volcanologists who have worked with her during graduate school.

The list is nothing short of awesome: Hammer at Hawaii, Soule at Woods Hole, and Roman at Carnegie are each a leader in the field; I can cite from memory their top publications.

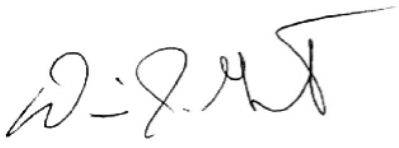
Internationally, there is Castro at Mainz and Rust at Bristol, who likewise are extraordinarily productive scholars and internationally renowned. Leaders in the volcanic hazards team at the USGS, the premier organization of its type in the world, are now largely former Cashman students: Wright, Johnson, Deligne, and Dietterich most notably. Any one of these would have been the best student I ever had (and they have been exceptional). And my list comprises just those with whom I am most familiar. This is just about half of her students, and only those from Oregon up until 2014!

In 2011, Dr. Cashman assumed an endowed chair at Bristol. I think I speak for the entire U.S. volcanology community that we were saddened to lose her, but that disappointment was clearly misguided, as she maximized the opportunities of that position, and her research and advising career actually accelerated. Since she assumed the Bristol position, she has been the principal advisor for eleven more Ph.D. students who are now leaders in academia, industry, and government positions in the U.K. and Europe. We are exceedingly fortunate in that Dr. Cashman has not reduced her visibility in the U.S. since moving, brought to light with her election to the U.S. National Academy of Sciences in 2016.

The impact Dr. Cashman has had on bringing female scientists into the field of volcanology is immeasureable. She rose through the academic and research ranks at a time when it was especially difficult for women, in a field that had been dominated (and almost exclusively comprised) by males. Of the 9 internationally known former students whom I know best (those cited above), 7 are women. This is not an aberation: by any measure, Dr. Cashman has been the most influential person in the world in terms of working to correct the shameful gender disparity in our field.

In sum, there is probably no individual anywhere that is more deserving of the MGVP award than Dr. Kathy Cashman. She is probably the most creative and productive scientist in the field in a generation, and she is universally well-liked and respected. She performs extraordinarily high levels of service to the scientific and university communities. Most importantly from my perspective, she is probably the best graduate advisor I have ever known, thus she will continue to influence the fields of volcanology and petrology for decades after her retirement.

Cordially,



Dennis J. Geist
Program Director, U.S. National Science Foundation
Emeritus Professor, University of Idaho

Earth and Environmental Sciences
UNIVERSITY OF MICHIGAN

Professor Rebecca Lange

Department of Earth and Environmental Sciences

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March 21, 2021

Nomination letter for Kathy Cashman: MGPV Distinguished Career Award

It is both a great pleasure and an honor to write this letter in support of Kathy Cashman's nomination for the MGPV Distinguished Geological Career Award of the Geological Society of America. I have closely followed Kathy's work for the past 30+ years and have benefitted from countless, wide-ranging scientific discussions with her. Although we have never directly collaborated, her insights and published papers into magmatic/volcanic systems have strongly influenced my research and teaching. The sheer breadth and depth of the scientific questions that she has pursued, and made substantial contributions to, are truly remarkable. I believe that Kathy has four key qualities that have been foundational to her impactful success as a scientist, collaborator, and mentor of students, to the benefit of all of us in the broad field of volcanology and petrology.

First, Kathy is insatiably curious about the world around her, and is a voracious reader not just of a broad scientific literature, but also of books and articles that range across the arts and social sciences as well. This has led her to engage in collaborations with artists and those interested in the impact of volcanism on human history (e.g., Cashman and Cronin, 2008; Cronin and Cashman, 2008; Cashman and Giordano, 2008; Hales and Cashman, 2008). Her research has taken her to nearly all parts of the world, and she actively solicits international collaborations with those who live and work in these regions (e.g., Kauahikaua et al., 1998, 2002, 2003; Gurioli et al., 2005; Pistolesi et al., 2011; 2013, to name a few).

Second, Kathy is a superb communicator, and brings a clarity to her writing that makes her papers on complex, multidisciplinary topics highly accessible to those who are not deeply immersed in the topic (i.e., students, collaborators in adjacent sub-fields, etc.). She often creates artistic illustrations (in both talks and publications) that capture the "big picture" while drawing attention to crucial details. She is increasingly sought after to write review papers (e.g., Cashman, 2020; Cashman and Rust, 2020, 2016; Cashman and Edmonds, 2019; Cashman et al., 2017; Sparks and Cashman, 2017; Cashman and Mangan, 2014; Cashman and Biggs, 2014; Cashman and Sparks, 2013; Cashman, 2004; etc.) and is superbly positioned to do so. Kathy's papers, in addition to pulling together widely diverse sources of information into a coherent overview, generally have two broad impacts on readers (speaking for myself): (1) they often clarify a long-standing puzzle or piece of muddled, collective thinking in the literature, and/or (2) they spark new questions, only triggered by reading her papers. Some recent papers that have done both for me include Cashman and Giordano (2014) and the idea that caldera-forming eruptions do not require the existence of a large magma chamber, but instead can form even when the erupted magma was widely dispersed in smaller, distributed melt bodies. This paper has strongly influenced my group in our on-going work on the high-SiO_2 rhyolites erupted before, during and after the Long Valley caldera formed in eastern California. Another recent favorite of mine (though not a review paper) is the Bennett et al. 2019 paper (Bennett is

student first-author) on the significance of plagioclase textures in mid-ocean ridge basalt. Figure 2 of that paper clearly explains the origin of so many textures that my students and I have seen, not only in natural samples but also in our experimental run products. It explains how re-crystallized patches of sodic plagioclase (with other portions that are more calcic) in a single crystal does not necessarily require magma mixing, but can also develop due to the kinetics, undercooling, and features inherent to the plagioclase binary loop. These insights are important for disciplined interpretations of natural samples, and thus shed a brighter light on processes that produce magma diversity and what drives/enables their eruption.

Third, she is highly collaborative and also fearless about asking questions she does not know the answer to. When she sees something that does not add up, she often asks penetrating, on-the mark, questions that are only obvious in hindsight. Usually, her first thought is that she must not understand something and subsequently digs into the literature to educate herself. More often than not, she discovers a "hole" in prior thinking, and either fills it with her (and her students') meticulous field/analytical observations (e.g., Krug and Cashman, 1996; Liu et al., 2017, 2018, among many others) and/or eagerly seeks out collaborations with those from different sub-fields and expertise (e.g., papers with Griffiths, Kerr, Soule, Manga, Blundy, etc.). It is telling that these collaborations often last for several years, if not decades. The simple reason is that working with Kathy is so rewarding for her collaborators, because she brings to the table novel and testable questions, high-quality data sets, and a willingness to do far more than her share of the work.

Fourth, Kathy is widely known for her enormous generosity of spirit. One of the ways it manifests itself is with how freely she shares her original, often novel, ideas with her colleagues, collaborators and especially her students. One reason why Kathy is so generous with her ideas is because she has so many of them. They are not a finite resource to be guarded, but rather a bountiful source to be shared!

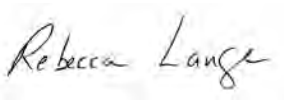
All of these attributes have led Kathy along a career path that is filled with substantive contributions that have re-directed whole lines of thinking among multiple sub-fields within the broad area of both volcanology and petrology. Indeed, her work has shown, more than just about anyone else's, how these two fields are inextricably linked. Examples include the role of degassing during ascent in driving not just growth of microlites, but also of *phenocrysts* (e.g., Cashman and Blundy, 2000; Blundy and Cashman, 2001). The Cashman and Blundy papers that emphasize the growth of phenocrysts during ascent have very strongly influenced my thinking and helped re-direct my own research questions. The interplay of degassing and crystal growth (as well as the role of "gas charging" and crystal resorption) cannot be separated, and increasingly the fields of volcanology and petrology are merging in the literature, as they always have for Kathy.

The four key characteristics outlined above also explain her success with graduate students, the sheer number of them is notable, as well as the diversity of their thesis topics, which again speaks to Kathy's remarkable scientific *breadth*. Kathy has always worked to enable

and encourage her students' own areas of interests, which may partly explain the breadth of thesis topics. Also important is the widespread success of her students in their post-graduate careers, with several of them well-known and accomplished in their own right. Again, her generosity of spirit, with her students' best interests as her main priority, would be instantly recognized by her wide circle of friends outside of academia.

In summary, Kathy Cashman is richly deserving of this recognition, and she is an inspiring choice for this award.

Yours sincerely,



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Committee for the MGPV Distinguished Geological Career Award (4th March 2021)

Dear Committee,

I am writing to nominate Professor Kathy Cashman for the MGPV Distinguished Geological Career Award. Kathy Cashman is one of the World's outstanding researchers in volcanology. Her career fits extraordinarily well into the scope of the Award given her work has involved major contributions to geochemistry, petrology and volcanology, is characterized by a multidisciplinary approach and involves field research at its core.

Kathy studies volcanic systems from the magma reservoir to the Earth's surface using the combined tools of field observations and measurements, sample analysis for chemical and physical characteristics, laboratory experiments and theoretical models. The most distinctive aspect of her work is her use of quantitative analysis of all constituent phases of volcanic samples (glass, crystals and vesicles) to quantify the kinetics of phase transformations and relate these to temporal changes in the physical properties of volcanic materials. Her work has had major pioneering impacts in the fields of igneous petrology, physical volcanology, and magmatic processes, and has stimulated new areas of research in experimental petrology and volcano studies.

She is one of the most innovative and respected geoscientists in the USA and this is demonstrated not only by a large number of highly cited publications but being winner of the Bowen Award of the American Geophysical Union (AGU) and being a past President of the Volcanology, Petrology and Geochemistry Section of AGU. Her recent elections as Fellow of the American Academy of Arts and Sciences, membership of the National Academy of Sciences and to Fellowship of the Royal Society of London indicates her high standing. With 200 publications and many with very high citations record her work is highly influential and important.

Kathy Cashman's main contributions are in volcanology and igneous petrology. Her science is based primarily on observations, but she has deep understanding of the physical and chemical processes that govern volcanic and igneous processes. She has been particularly innovative in interpretation of structures and microscopic textures of volcanic rocks to make inferences about physical processes and conditions during volcanic eruptions. This work characteristically novel and ground-breaking. Her research is based on meticulous attention to detail and thoroughness in her field and microscopic observations, combined with a flair for intuitive and original thinking. Indeed observations in the field ort down the microscope is where almost all her science is motivated.

She first made an impact as a result of her PhD thesis with Bruce Marsh at John Hopkins where she pioneered with Bruce understanding how to quantify crystal size distributions (CSDs) in igneous rocks and then providing interpretations in terms of the kinetics of crystallization rates and the dynamics of volcanic processes. The generation of CSD's has now become routine following their pioneering demonstration that the study of CSD's was a powerful approach. Following her PhD Cashman developed strategies for sampling volcanic material in real time, so that time scales could be

constrained independently, and nucleation and growth rates determined uniquely. These studies, by necessity, focused on quantification of very small crystals formerly relegated to the (largely ignored) category of “groundmass”, and required that she apply emerging techniques of digital image analysis to quantify groundmass textures from data collection using backscattered electron imaging techniques. Her 1992 paper on crystallization of Mount St Helens magma was a landmark contribution, showing in particular that much of the crystallization in magmas related to decompression and degassing rather than cooling as had been commonly invoked. She developed these understanding of crystallization ideas in several subsequent papers, including a highly cited paper (265) with Jon Blundy on ascent-driven crystallization of dacite during the 1980-1986 eruption of Mount St Helens in 2001, an important study of Mount Pinatubo products and demonstration that ascending and crystallizing magmas will heat up significantly due to latent heat effects. The central idea has proved to be a key to understand magma ascent and on controls of eruptions styles. Her insights have the way to understanding how crystallization in conduits controls episodicity of lava dome extrusions and pressurization in conduits.

The late 1980s she started to develop new strands of volcanology research. Especially notable was her collaboration with R.S. Fiske (Smithsonian Institution). At that time, most volcanologists believed that explosive volcanism (and related pumice and ash formation) could occur only on land or in very shallow water (≤ 10m). Cashman and Fiske’s work dramatically changed this perspective by identifying ways to recognize pumice deposits formed entirely under water, quantifying the effect of magmatic gas condensation and seawater ingestion on the density of submarine-generated pumice as it cools and demonstrating the role of density in controlling sedimentation from submarine eruption plumes. This work foreshadowed more recent discoveries of numerous calderas and active volcanic systems in the submarine environment.

Two related topics where Kathy has been a major leader in cutting edge research concern permeability development and fragmentation of magma during explosive eruptions. Her contributions have come both from research into the physics of magma fragmentation and in observational studies which have documented the size distributions of volcanic ash in eruptions. Whether magma erupted explosively or effuses quietly as lava depends on how permeability develops as gases exsolves from magma during flow up volcanic conduits. Her work with research students Klug and then Rust was pioneering in measuring the permeability in pumice and then highlighting the importance of development of interconnected porosity for fragmentation in explosive eruptions. A significant later contribution with Rust showed how the size distribution of bubbles in magma was the major control on the particle size distribution flowing fragmentation in explosive eruptions. Recent research with PhD student Emma Liu shows how the size distribution of bubbles controls fragmentation in phreatomagmatic explosive eruptions and indicates that water-magma interaction must be after primary fragmentation.

Investigations at Mount St Helens have provided a natural laboratory for her research in petrology. Collaborating closely with Jon Blundy she has made major strides in understanding the degassing history of the magmas extending from their origin at 35 km depth or within the shallow magmatic system and during flow up the conduit. They have been able to gain great insights through forensic analyses of zoning patterns in crystals, notably plagioclase, and in melt inclusions to track the changes in Mount St Helens magmas as they rise. These studies demonstrate complex histories in which melts and crystals are derived from a great range of depths in a transcrustal magma system. Degassing with mixing of crystals and melts from different depths have controlled much of what is observed, making the case for equilibrium conditions questionable.

A major strand of her recent research concerns questioning some of the central ideas concerning processes in magma systems and the role of shallow magma chambers. A provocative and highly

original 2014 paper with Guido Giordano proposes that the magmas in major caldera forming eruptions involved rapid amalgamation of many magma layers embedded on crystal mush. The work builds on her earlier research on Mount St Helens demonstrating multiple levels of magma storage. This has led to some new concepts on magmatic system structure and the idea of rapid destabilisation of magmatic systems consisting of numerous pockets and layers leading up to major caldera-forming explosive eruptions. She was lead author on a synoptic paper on transcrustal magmatic systems in Science in 2017 with Jon Blundy and I which is attracting very high citations (156).

A key characteristic of her research has been the quantification of the morphology and textures in basaltic lavas and volcanic ash, providing insights into emplacement, key eruptive processes and related hazards. Her work on the textures related progressive crystallization of basalt lavas as they are emplaced and on flood basalts in Columbia River are important contributions to understanding lava emplacement. This work includes advancing understanding of transitions between major types of lava (aa and pahohoe) and textural studies of silicic lavas and domes. She has collaborated with modelers and experimentalists to bring her field observations and textural studies to bear on understanding the controls of rheology and cooling on lava emplacement and morphology. There are many disruptive properties of volcanic ash, which affect for example human health, functioning of electrical equipment and agriculture. These hazards have motivated Kathy's research on volcanic ash. In the case of ash her work with PhD student Emma Liu has developed a much more robust methodology to characterize the shape of ash particles, enabling them to demonstrate the key role of bubbles in determining the shape properties of a wide variety of volcanic ash types. She has also begun to unravel some of the environmental effects of ash. A recent highlight with Emma Liu is the demonstration of the far-reaching effects of reworked ash in Iceland, demonstrating that several different sources contribute to "ash storms" and that models of ash dispersal do not capture the actual distributions of secondary ash well.

Kathy Cashman is an outstanding lecturer with an ability to engage many different kinds of audiences from specialist in her field of volcanology thorough to lectures for the public. Her talks are characterised by superb illustrations and the subject of volcanoes is very popular. She has broad interests in wider aspects of science and volcanology, which enable help to relate to ideas and connections well outside science. Her early work as communications and outreach officer during the 1980 Mount St Helens eruption likely was a pivotal experience that has shaped her strong interests in volcanic hazards and the effects of volcanoes on society. She has developed an increasing interest in working with historians in reconstructing past and identifying events. A major interest is in art related to volcanoes and she has collaborated with Emma Stibbon RA, one of the UK's finest landscape artists, in Iceland. They have held joint Exhibitions to integrate art and science at Eton College and at the Rochester Art Gallery These wider dimensions allow her to connect well with those outside science. Her career achievements make her as an exceptional person to receive the MGPV Distinguished Geological Career Award.

Yours sincerely,

Professor Sir Stephen Sparks FRS CBE

Arthur L. Day medalist

KATHARINE VENABLE CASHMAN

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PROFESSIONAL APPOINTMENTS

2014- AXA Endowed Chair of Volcanology, University of Bristol, UK
2011-2014 AXA Research Chair, University of Bristol, UK
2007-2010 Head, Department of Geological Sciences, University of Oregon, USA
1997-2014 Professor of Geological Sciences, University of Oregon, USA
1991-1997 Associate Professor of Geological Sciences, University of Oregon, USA
1986-1991 Assistant Professor of Geological Sciences, Princeton University, USA

EDUCATION

1982-1986 Ph.D. Geological Sciences, The Johns Hopkins University, USA
1977-1979 M.Sc. 1st class honors, Victoria University, New Zealand
1972-1976 B.A. Geology/Biology, cum Laude, Middlebury College, USA

HONORS AND AWARDS

2020 Murchison Medal, Geological Society of London
2016 Elected Member, National Academy of Science
2016 Elected Fellow of the Royal Society
2014 Elected Member, Academia Europaea
2013 Royal Society Wolfson Merit Award
2012 Elected Fellow, American Academy of Arts and Sciences
2009 Elected Fellow, American Geophysical Union (AGU)
2008 Honorary Doctor of Science, Middlebury College
2007 Philip H. Knight Distinguished Professor of Natural Sciences, University of Oregon
2007 APEX Awards Grand Award for Writing [awarded to an issue of the Phi Kappa Phi Forum to which KVC was a contributor]
2006 AGU Volcanology, Geochemistry, Petrology Division Bowen Award

DISTINGUISHED LECTURESHIPS

2020 John & Anne Phillips lecture, Yorkshire Philosophical Society
2019 Annual Address, Swedish Academy
2018 Inaugural Green Lecture, University of Leeds
2015 VGP Daly Lecture, AGU Fall Meeting
2014 Distinguished Lecturer, Mineralogical Society (UK)
2012 Shell Lecture, Geological Society of London
2012 Keynote speaker, meeting on Magmatic Rifting and Active Volcanism, Addis Ababa, Ethiopia

2011 Keynote speaker, William Smith meeting, Geological Society of London
2011 Keynote speaker, Chapman Conference on the Galapagos
2010 Keynote speaker, Geoscience Society of New Zealand Annual Meeting
2010 Distinguished Lecturer, Mineralogical Society of America
2010 Woodford-Eckis Lecturer, Pomona College
2006 VGP Bowen Lecture, AGU Fall Meeting
2003 Union speaker, International Union of Geology and Geophysics, Sapporo, Japan
2002 Keynote speaker, 100th Anniversary of Mont Pelee eruption, Martinique

APPOINTMENTS AND ELECTED POSITIONS

2021	Chair, Royal Society Young Science Book Award committee
2020	Chair, Royal Society Library Committee
2018	Co-editor, Philosophical Transactions of the Royal Society, special issue on Magmatic Systems
2017-	Royal Society Committees on Section 5 election, Dorothy Hodgkin grants, Collaboration Awards, Newton funds, Library Committee
2017-2022	Chair, ERC Starting grant panel
2016-2019	Member, Ion Probe Steering Committee (NERC)
2016-2017	Chair, Scientific Program, 2017 IAVCEI meeting, Portland, OR
2016-2017	Member, National Academy Committee on Improving Understanding of Volcanic Eruptions
2016-	Advisory Committee to the Earth Observatory of Singapore (Chair 2018)
2015-	Associate Editor, Bulletin of Volcanology
2015, 2019	Board of Electors to the Professorship of Mineralogy and Petrology, Cambridge University
2014	Review Committee, Earthquake Research Institute, Univ Tokyo,
2014	External Member, Hiring Committee, University of Iceland
2011	Guest Editor, Bulletin of Volcanology, special issue on Cerro Galan, Argentina
2011-2014	Governance Committee, American Geophysical Union
2009-2010	Nominating Committee, American Geophysical Union
2008	Guest Editor, Journal of Volcanology and Geothermal Research, special issue on Volcanoes and Human History
2007-2008	Advisory Board, Earth and Planetary Science Letters
2006-2011	Scientific Advisory Committee for Soufriere Hills Volcano, Montserrat,
2002	Chair, Committee to review the Earth and Environmental Science Program, Wesleyan University
2000-2004	President VGP section of American Geophysical Union

PUBLICATIONS

203. Berry H.C., **Cashman K.V.,** Williams C.A. (in press) The 1902 Plinian eruption of Santa María volcano, Guatemala: A new assessment of magnitude and impact using historical sources. *Journal of Volcanology and Geothermal Research.* https://doi.org/10.1016/j.jvolgeores.2020.107167

202. Jarvis P.A., Pistone M, Secretan A., Blundy J.D., **Cashman K.V.**, Mader H.D., Baumgartner L.P. (in press) Crystal and volatile controls on the mixing and mingling of magmas. *AGU Books.*

201. Berry H.C., **Cashman K.V.**, Williams C.A. (2021) Data on the 1902 Plinian eruption of Santa María volcano, Guatemala. *Data in Brief* 35:106734. https://doi.org/10.1016/j.dib.2021.106734

200. Johnson E., **Cashman K.V.** (2020) Understanding the storage conditions and fluctuating eruption style at a young monogenetic volcano: Blue Lake crater (<3 ka), High Cascades, Oregon. *Journal of Volcanology and Geothermal Research* 408:107103. https://doi.org/10.1016/j.jvolgeores.2020.107103

199. Liu E.J., **Cashman K.V.**, Miller E., Moore H., Edmonds M., Kunz B., Jenner F., Chigna G. (2020) Petrologic monitoring at Volcán de Fuego, Guatemala. *Journal of Volcanology and Geothermal Research* 405:107044. https://doi.org/10.1016/j.jvolgeores.2020.107044

198. Lapins S., Kendall J-M, Ayele A., Wilks M., Nowacki A., **Cashman K.** (2020) Lower crustal seismicity on the Eastern Border Faults of the Main Ethiopian Rift. *Journal of Geophysical Research* 125:e2020JB020030. https://doi.org/10.1029/2020JB020030

197. **Cashman K.V.** (2020) Crystal Size Distribution (CSD) analysis of volcanic samples: advances and challenges. *Frontiers in Earth Sciences*. https://doi.org/10.3389/feart.2020.00291

196. Boreham F., **Cashman K.V.**, Rust A. (2020) Hazards from lava-river interactions during the 1783-1784 Laki fissure eruption. *Geological Society of America Bulletin* 32:2651-2668. https://doi.org/10.1130/B35183.1

195. Buckland H.M., **Cashman K.V.,** Engwell S.L., Rust A.C. (2020) Sources of uncertainty in the Mazama isopachs and the implications for interpreting distal tephra deposits from large magnitude eruptions. *Bulletin of Volcanology* 82:23. https://doi.org/10.1007/s00445-020-1362-1

194. Saxby J., Rust A., Beckett F., **Cashman K.**, Rodger H. (2020) Estimating the 3D shape of volcanic ash to better understand sedimentation processes and improve atmospheric dispersion modelling. *Earth and Planetary Science Letters* 534:116075. https://doi.org/10.1016/j.epsl.2020.116075

193. Lapins S., Roman D.C., Rougier J., DeAngelis S., **Cashman K.V.**, Kendall J.-M. (2020) An examination of the continuous wavelet transform for volcano-seismic spectral analysis. *Journal of Volcanology and Geothermal Research* 389. https://doi.org/10.1016/j.jvolgeores.2019.106728

192. Saxby J., **Cashman K**., Rust A., Beckett F. (2020) The importance of grain size and shape in controlling the dispersion of the Vedde cryptotephra. *Journal of Quaternary Science* 35:175-185. https://doi.org/10.1002/jqs.3152

191. Oppenheimer J.O., Capponi A., **Cashman K.V.,** Lane S.J., Rust A.C., James M.R. (2020) Analogue experiments on the rise of large bubbles through a solids-rich suspension: a "weak plug" model for Strombolian eruptions. *Earth and Planetary Science Letters* 531. https://doi.org/10.1016/j.epsl.2019.115931

190. **Cashman K.V.,** Rust A.C. (2020) Far-travelled ash in past and future eruptions: Combining tephrochronology with volcanic studies. *Journal of Quaternary Science* 35:11-22. https://doi.org/10.1002/jqs.3159

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187. deGraffenried R.L., Larsen, J.F., Graham N.A., **Cashman K.V.** (2019). The influence of phenocrysts on degassing in crystal-rich magmas with rhyolitic groundmass melts. *Geophysical Research Letters* 46:5127-5136. https://doi.org/10.1029/2018GL081822

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185. Bennett E.N., Jenner R.E., Millet M.-A., **Cashman K.V.**, Lissenburg C.J. (2019) Deep roots for mid-ocean ridge volcanoes revealed by plagioclase-hosted melt inclusions. *Nature* 572:235-239.

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183. McNamara K., Rust A.C., **Cashman K.V.**, Castruccio A., Abarzua A.M. (2019) Comparison of lake and land tephra records from the 2015 eruption of Calbuco volcano, Chile. *Bulletin of Volcanology* 81:10.

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181. **Cashman K.V.**, Edmonds M. (2019) Mafic glass compositions record conditions of magma storage and ascent. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 377:20180004. http://doi.org/10.1098/rsta.2018.0004

180. Sparks R.S.J., Annen C., Blundy J.D., **Cashman K.V.**, Rust A.C., Jackson M.D. (2019) Formation and dynamics of magma reservoirs. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 377:20180019. http://doi.org/10.1098/rsta.2018.0019

179. Qin Z., Soldati A., Velazquez Santana L.C., Rust A.C., Suckale J., **Cashman K.V.** (2018) Slug stability in flaring geometries and ramifications for lava-lake degassing. *Journal of Geophysical Research* 123:10431-10448.

178. Boreham F., **Cashman K.**, Rust A., Hoskuldsson A. (2018) Linking lava flow morphology, water availability and rootless cone formation on the Younger Laxa Lava, NE Iceland. *Journal of Volcanology and Geothermal Research* 364:1-19.

177. Saxby J., Beckett F., **Cashman K.**, Rust A., Tennant E. (2018) The impact of particle shape on fall velocity: Implications for volcanic ash dispersion modelling. *Journal of Volcanology and Geothermal Research* 362:32-48. https://doi.org/10.1016/j.jvolgeores.2018.08.006

176. McNamara K., **Cashman K.V.**, Rust A.C., Fontjin K., Chalie F., Tomlinson E., Yirgu G. (2018) Using lake sediment cores to improve records of volcanism at Aluto volcano in the Main Ethiopian Rift. *Geochemistry, Geophysics, Geosystems* 19:3164-3188. https://doi.org/10.1029/2018GC007686

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172. van Zalinge, M.E., **Cashman K.V.**, Sparks R.S.J. (2018) Causes of fragmented crystals in ignimbrites: a case study of the Cardones ignimbrite, Northern Chile. *Bulletin of Volcanology* 80:22. https://doi.org/10.1007/s00445-018-1196-2

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171. Rougier J., Sparks R.S.J., **Cashman K.V.,** Brown S.K. (2018) The global magnitude-frequency relationship for large explosive volcanic eruptions. *Earth and Planetary Science Letters* 482:621-629.

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167. **Cashman K.V.**, Sparks R.S.J., Blundy J.D. (2017) Vertically extensive and unstable magmatic systems: A unified view of igneous processes. *Science* 355. https://doi:10.1126/science.aag3055

166. Sparks R.S.J., **Cashman K.V.** (2017) Dynamic magmatic systems: Implications for forecasting volcanic activity. *Elements* 13: 35-40.

165. Liu E.J., **Cashman K.V.,** Rust A.C., Hoskuldsson A. (2017) Contrasting mechanisms of magma fragmentation during coeval magmatic and hydromagmatic activity: the Hverfjall Fires fissure eruption, Iceland. *Bulletin of Volcanology* 79:68. https://doi.org/10.1007/s00445-017-1150-8

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162. Sheldrake T.E., Sparks R.S.J., **Cashman K.V**., Wadge G., Aspinall W. (2016) Similarities and differences in the historical records of lava dome-building volcanoes: Implications for understanding magmatic processes and eruption forecasting. *Earth-Science Reviews* 160:240-263. https://doi.org/10.1016/j.earscirev.2016.07.013

161. Deligne N.I., Conrey R.M., **Cashman K.V.**, Champion D.E., Amidon W.H. (2016) Holocene volcanism of the upper McKenzie River catchment, central Oregon Cascades, USA. *Geological Society America Bulletin* 128:1618-1635. https://doi.org/10.1130/B31405.1

160. Lindoo A, Larsen JF, **Cashman, KV**, Dunn A.L., Neill O.K. (2016) An experimental study of permeability development as a function of crystal-free melt viscosity. *Earth and Planetary Science Letters* 435:45-54. https://doi.org/10.1016/j.epsl.2015.11.035

159. Suckale J., Keller T., **Cashman K.V**., Persson P.O. (2016). Flow-to-fracture transition in a volcanic mush plug may govern normal eruptions at Stromboli. *Geophysical Research Letters* 43:12071-12081.

158. Saxby J., Gottsmann J., **Cashman K.**, Gutierrez E. (2016) Magma storage in a strike-slip collapse structure. *Nature Communications* 7:12295. https://doi.org/10.1038/ncomms12295

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156. **Cashman K.V.**, Rust, A.C. (2016) Volcanic ash – generation and spatial variations. In: Mackie S., Ricketts H., Watson M., Cashman K.V., Rust A.C. (eds.) *Volcanic ash – Hazard Observations*.

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SUPERVISION

Postdoctoral scholars
Byron Adams (2019 - present)
Julia Eychenne (2013-2015)
Laura Pioli (2006-2008)

PhD students (graduation year)

University of Oregon

Hannah Dietterich (2014)
Daniele McKay (2012)
Natalia Deligne (2012)
Nicholas Deardorff (2011)
Isolde Belien (2011)
Heather Wright (2006)
Alison Rust (2003)
Diana Roman (2004)
Adam Soule (2003)
Charlene Montierth (1999)
Anita Ho (1999)
Jonathan Castro (1999)
Julia Hammer (1998)
Caroline Klug (1997)

University of Bristol

Sacha Lapins (2021 anticipated)
Hannah Buckland (2021 anticipated)
Claudio Contreras Hidalgo (2020)
Frances Boreham (2020)
Jennifer Saxby (2019)
Keri McNamara (2018)
Julie Oppenheimer (2017)
Irving Mungaia Gonzalez (2017)
Emma Liu (2016)
Paul Jarvis (2016)
Alvaro Guevara-Murua (2016)

Masters students (graduation year)

University of Oregon

Elizabeth Erlund (2008)
Emily Gottesfeld (2007)
Jenny Riker (2005)
Katherine Wearn (2002)
Diana Roman (2001)
Carrie Brugger (2001)
Martha Folley (1999)
Sarah Hoover (1999)
Renee Bourgeois (1998)
Melissa Katz (1997)
James Rogers (1996)
James Schick (1994)

University of Bristol

Jessica Rawlings (2021)
Lilli Day (2021)
Emily Aspinall (2020)
Katie Daly (2020)
Jade Evans (2020)
Lovisa Gudmundsdottir (2020)
Elysia Hayward (2020)
Bei Bei Morrison-Evans (2020)
Anais Vásconez Muller (2020)
Charles Wells (2020)
Ashley Savelkouls (2019)
Phoebe Meredith (2019)
Ruby Coats (2019)
Arthur Adams (2019*)*
Beth Garner (2018)
Hannah Berry (2018)
Magdalena Chmura (2018)
Finley Gilchrist (2018)
Ross Hassard (2018)
Hannah Moore (2018)
Dan van Helden (2018)
Eveanjelene Snee (2017)
Eleanor Tennant (2017)
Joshua Lucas (2017)
Yannick Withoos (2017)
Megan Sanderson (2017)
Hannah Buckland (2016)
Rebekah Wright (2016)
Chelsea Neylan (2016)
Sacha Lapins (2016)
Kayleigh McGeoch (2015)
Camilla Bailey (2015)
Catherine Honor (2015)
Robyn Edwards (2015)
Lillias Hopkinson (2015)
Robbie Trevelyan (2015)
Jennifer Saxby (2015)
Ginevra Chelli (2014)
Thomas Jones (2014)
Keri McNamara (2014)
Allie Hutchison (2013)
Annabel Gray (2012)

To: Alex Speer, Dennis Newell, Amanda B. Clarke and MGPV Management Committee
From: Alan Whittington, Chair MGPV ECA Award Committee
Date: June 27, 2022
RE: Selection of 2023 MGPV Early Career Awardee

There were six complete and eligible nomination packages submitted for the **2023 MGPV Early Career Award:**

Alison Jolley (PhD 2017) – University of Waikato, New Zealand
Shaunna Morrison (PhD 2017) - Carnegie Institution for Science, USA
Carolina Muñoz-Saez (PhD 2016) - University of Nevada-Reno, USA
Elizabeth Niespolo (PhD 2019) – Princeton University, USA
Fabian Wadsworth (PhD 2017) - Durham University, UK
Christopher Yakymchuk (PhD 2014) – University of Waterloo, Canada

Early Career Award Committee members for the 2023 award were:

Alan Whittington, chair (alan.whittington@utsa.edu)
Tracy Gregg (tgregg@buffalo.edu)
Dina Lopez (lopezd@ohio.edu)
David Peate (david-peate@uiowa.edu)
Mary Reid (Mary.Reid@nau.edu) – unable to participate due to illness
Karen Bemis (bemis@marine.rutgers.edu)
Loÿc Vanderkluysen (loyc@drexel.edu)

Compelling reasons were submitted by nominators and supporting letter-writers that each of the nominees is worthy of consideration for the MGPV early career recognition.

The initial Borda Count from the 5 committee members who attended the meeting was as follows:

Morrison: 20, two top votes
Wadsworth: 17, one top vote
Muñoz-Saez: 13, one top vote
Yakymchuk: 9, one top vote
Jolley: 8, no top votes
Niespolo: 8, no top votes

The three highest ranking candidates were then discussed at some length, and then ranked from 1 to 3. Muñoz-Saez had 4 first-place votes, and Morrison had 1. The committee agreed that this vote constituted sufficient consensus in favor of Muñoz-Saez to declare her the awardee. Jolley, Morrison, Niespolo and Wadsworth all have remaining eligibility beyond this year.

Comments from the committee regarding Dr. Muñoz-Saez's contributions are summarized here.

Dr. Muñoz-Saez's published work demonstrates field-based multidisciplinary geologic accomplishments of a ground-breaking nature, spanning all four of the MGPV disciplines and reaching beyond to geobiology, geophysics, and planetary science. Her expertise includes field and laboratory techniques, analog experiments and even a large-scale experiment on an active geyser system. She recently obtained funding to continue and expand work at El Tatio, leading a multidisciplinary international team. She has overcome numerous barriers including being a first-generation student, a minority woman in STEM, and spending 4 months in the field with an infant during the pandemic. She has clearly demonstrated a commitment to mentoring future generations of scientists, and to outreach, including to the indigenous communities living in and around her field area.

Additional information about the nominee:

Dr. Carolina Muñoz-Saez
Assistant Professor
Nevada Bureau of Mines and Geology
University of Nevada Reno
Email: cmunozsaez@unr.edu
https://www.unr.edu/geology/people/carolina-munoz-saez

Summaries from the nominating letters include the following:

"Carolina is bright, passionate, motivated and has a natural curiosity that drives her research. She is familiar with many research methods, is enthusiastic about making detailed observations in the field, and she has a broad knowledge that allows her to carry out impactful research on a variety of topics… Carolina's papers present results and interpretations from geologic mapping, radiocarbon dating, analog laboratory experiments, laboratory measurements of siliceous sinter mineralogical, chemical and mechanical properties, analyzing the role of thermophile bacteria in the diagenesis of sinter deposits, numerical modeling of groundwater flow and heat transport, time-series analysis, application of geophysical methods, aqueous geochemistry, and thermodynamic modeling of temperature-dependent water-rock reactions. Combined, this multidisciplinary approach has provided an improved understanding of a range of process taking place in magma-hydrothermal systems such as geyser dynamics, multiphase heat and mass transport, sinter diagenesis, and the structure, geometry, and evolution of thermal basins… In addition to her prolific research, Carolina has been engaged in outreach with the historically marginalized native communities who own and operate the land at the El Tatio geyser field." **Nominator Dr. Shaul Hurwitz, Research Hydrologist, U.S. Geological Survey; Fellow of the Geological Society of America**

Dr. Muñoz-Saez "has established herself as a global leader in studies of geysers and the surface expression of hydrothermal systems, from their mechanics to the deposits they create and the life they host. Her papers embody the "geologic and multidisciplinary approach . . . based on solid field observations" called out in the award description... this is an impressive number of "firsts" for material in a single dissertation … She is the most resilient scientist I have ever worked with … and remains dedicated to communicating her science to the indigenous communities in the Chilean Andes" **Michael Manga, Professor, University of California at Berkeley; Fellow of the American Geophysical Union, Member of the National Academy of Sciences**

"Carolina has a unique combination of experience in field work (including conventional and aerial drone mapping), mineralogy, geochemistry, volcanology, tectonics and geophysics. At last but not least, Carolina has a strong commitment for outreach and science communication." **Martin Reich, Professor, University of Chile**

"Carolina is an expert in magmatic hydrothermal systems whose work powerfully combines field-based measurements and laboratory techniques. She is an incredibly disciplined and thoughtful researcher whose careful dedication to observation drives the excellence of her science … Carolina's work sits at the nexus of magmatic, hydrologic, and climatic systems… field work is an integral component of what Carolina does, and she is very, very good at it. She has also built strong connections with local communities near the El Tatio geyser field… She is also an excellent mentor. In our group she was dedicated to guiding diverse graduate and undergraduate students, sharing her experiences navigating and thriving in U.S. academic culture." **Ben Black, Assistant Professor, Rutgers**

Sincerely,

Alan Whittington
Professor
alan.whittington@utsa.edu

Checklist for
GSA MGPV Division Early Geological Career Award

****

Nominee:

Carolina Munoz-Saez
Nevada Bureau of Mine and Geology
University of Nevada Reno
Mackay School of Earth Sciences and Engineering
Mailstop 0178
1664 N. Virginia Street
Reno, NV 89557-0178

Phone: (775) 682-7844
e-mail: cmunozsaez@unr.edu

****

Nominations will be from the Division membership at large, and should consist of:

A 1-2 page letter (with name and address of nominator) summarizing the Nominee's most important accomplishments in geologic approaches to mineralogy, geochemistry, petrology, and/or volcanology. Special attention should be paid to describing how the Nominee's published work demonstrates field-based multidisciplinary geologic accomplishments of a ground-breaking nature.

[x] Nominator(s): Shaul Hurwitz, U.S. Geological Survey

****

Three letters of support. These letters of support can be either from members or non-members of GSA or the MGPV Division.

[x] Co-Sponsor 1: Michael Manga, University of California-Berkeley

[x] Co-Sponsor 2: Martin Reich, University of Chile, Santiago

[x] Co-Sponsor 3: Benjamin A. Black, Rutgers University

****

[x] Curriculum Vita of the nominee.

[x] GSA's Code of Ethics & Professional Conduct statement

****

United States Department of the Interior
GEOLOGICAL SURVEY
345 Middlefield Road, MS 439
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650-329-4441
shaulh@usgs.gov
https://www.usgs.gov/staff-profiles/shaul-hurwitz

1 February 2022

Dear GSA-MGPV Early Career Award committee members,

It is a pleasure for me to nominate Carolina Muñoz-Saez, an Assistant Professor at the Nevada Bureau of Mines and Geology, Mackay School of Earth Sciences and Engineering, University of Nevada, Reno for the GSA Mineralogy, Geochemistry, Petrology, and Volcanology Early Career Award. Carolina received her PhD at the University of California, Berkeley in 2016, so she is within the eight years of receiving her final degree. She completed postdoctoral fellowships at the University of Chile, and then at Lamont-Doherty Earth Observatory and at the City College of New York. Included in the nomination package are letters of support from Prof. Michael Manga (UC Berkeley), Prof. Martin Reich (U. Chile) and Prof. Ben Black (Rutgers U.). All have closely worked with Carolina and are very familiar with her research. Their letters provide more specific details on the various scientific contributions that Carolina has made in the fields of Mineralogy, Geochemistry, Petrology, and Volcanology. Included in the package is also Carolina's Curriculum Vita that includes an impressive list of her publications.

I have known Carolina for about a decade, mainly working together on projects related to geyser dynamics and hydrothermal activity in the El Tatio geyser field in the Northern Chilean Andes. We have co-authored several peer-reviewed journal papers, spent several weeks together doing field work, and have ongoing collaborative research. Carolina is bright, passionate, motivated and has a natural curiosity that drives her research. She is familiar with many research methods, is enthusiastic about making detailed observations in the field, and she has a broad knowledge that allows her to carry out impactful research on a variety of topics related to magma-hydrothermal activity. Carolina's accomplishments are even more incredible considering that she had to overcome substantial barriers that most of her early career academic peers did not. In her first few years in at Berkeley as a foreign student, she struggled with the language, with the quantitative analysis that was expected from her, and with the intensity of a highly competitive graduate program. She then was on maternity leave during her postdoc fellowship, and when the COVID pandemic begun, she was "stuck" in a remote part of Chile for several months while doing field work. The pandemic also limited her ability to carry out field work and laboratory analyses that are essential to her research. Thus, Carolina's many scientific accomplishments are a manifestation of her tenacity,

motivation, and hard work. *To my knowledge Carolina Muñoz-Saez has not breached GSA's Code of Ethics & Professional Conduct nor is this person under investigation for any action that would be a breach of GSA's Code of Ethics & Professional Conduct.*

Carolina's "*field-based multidisciplinary"* research accomplishments and her "*geologic approaches to mineralogy, geochemistry, petrology, and/or volcanology*" are presented in her in-depth journal papers on active magma-hydrothermal systems. Her publications present a nice mix of field and laboratory measurements and quantitative analysis that collectively are of "*ground- breaking nature".* I can't think of any early career scientist in the MGPV community that emphasizes a multidisciplinary approach as much as Carolina does. Because her research is based on understanding systems (magma-hydrothermal systems) rather than on method application, she has established cross-disciplinary, international collaborations with hydrologists, geophysicists, geochemists, sedimentologists, microbiologists, and planetary scientists from many research institutes to obtain a broader and more wholistic understanding of these complex systems. Carolina's papers present results and interpretations from geologic mapping, radiocarbon dating, analog laboratory experiments, laboratory measurements of siliceous sinter mineralogical, chemical and mechanical properties, analyzing the role of thermophile bacteria in the diagenesis of sinter deposits, numerical modeling of groundwater flow and heat transport, time-series analysis, application of geophysical methods, aqueous geochemistry, and thermodynamic modeling of temperature-dependent water-rock reactions. Combined, this multidisciplinary approach has provided an improved understanding of a range of process taking place in magma-hydrothermal systems such as geyser dynamics, multiphase heat and mass transport, sinter diagenesis, and the structure, geometry, and evolution of thermal basins.

Carolina is now branching into a completely new and exciting research project that was recently (January 2022) approved for funding by the National Science Foundation. The large-scale interdisciplinary study that she will be leading with experts from across several Earth science disciplines from US and Chilean institutions includes glaciologists, experts in exposure dating using cosmogenic isotopes and volcanologists. The study's goals are to quantify hydrothermal responses in the El Tatio volcanic-hydrothermal field to glacial unloading in the Chilean Andes. El Tatio is an ideal natural laboratory to investigate these interactions because based on Carolina's research (Muñoz-Saez et al., GRL 2020) it preserves exceptional morpho-stratigraphic evidence of volcanic, glacial, and hydrothermal activity since the last deglaciation. The new study has significant potential to provide important information because it has implications for hazard assessments (phreatic eruptions and hydrothermal explosions), for regional climate reconstructions, and for the exploration of mineral deposits and geothermal energy resources.

In addition to her prolific research, Carolina has been engaged in outreach with the historically marginalized native communities who own and operate the land at the El Tatio geyser field. She spent a significant amount of time and energy explaining the research that she and her colleagues have carried out, its relation to their operations, and

how they can become more involved in the science and the preservation of the unique geyser field.

In summary, for her significant accomplishments leading cutting-edge, multidisciplinary research, Carolina Muñoz-Saez is a highly deserving candidate for the GSA MGPV Early Career Award.

Sincerely,

Shaul Hurwitz Ph.D.
U.S. Geological Survey

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO

SANTA BARBARA • SANTA CRUZ

MICHAEL MANGA
PROFESSOR AND CHAIR
DEPARTMENT OF EARTH AND PLANETARY SCIENCE
307 McCONE HALL, MC4767
BERKELEY, CALIFORNIA 94720

January 28, 2022

Dear GSA MGPV Early Geological Career review committee,

I am very enthusiastic about **Carolina Muñoz-Saez** for your award. She has established herself as a global leader in studies of geysers and the surface expression of hydrothermal systems, from their mechanics to the deposits they create and the life they host. Her papers embody the "geologic and multidisciplinary approach . . . based on solid field observations" called out in the award description.

Dr. Muñoz-Saez's research has focused on hydrothermal systems and their deposits. Why did she start studying geysers? Four reasons. First, they are a window into hydrothermal and epithermal processes. Second, they provide an opportunity to study eruption phenomena and processes in ways that are not possible at magmatic volcanoes. Third, geysers are fascinating natural phenomena and there remain many fundamental questions about their dynamics. Last, their deposits record unique information about paleohydrology and biology (and it is this community that makes up the greatest readership of her papers).

She made the first continuous measurements of pressure and temperature within geysers over many cycles and hence could document the thermodynamic conditions before, during and after eruptions (Munoz-Saez JVGR 2015). In so doing, she could address a long-standing debate (back to Bunsen, 1847): do eruptions begin from the surface or initiate at depth? She showed that boiling occurs at the surface and how this sustains the eruption but, at the same time, how cavities at depth accumulate enthalpy in steam and its release allows boiling to occur at the surface. She documented and explained how geysers interact with each other (Munoz-Saez et al., JGR 2015). She was the first to confirm in situ that flow in these natural multiphase eruptions is choked to the sound speed. Her lab experiments showed how preplay (small eruptions) allow large eruptions to occur (Adelstein et al., 2014). Munoz-Saez et al. (2016) provided the first set of integrated physical properties measurements on silica sinter (seismic velocity, electrical resistivity, porosity and permeability, XRD, and 3D microtexture characterization with XRay Computed microtomography). I think this is an impressive number of "firsts" for material in a single dissertation.

Munoz-Saez et al. (2018) is a comprehensive paper in which she used stable isotopes, water chemistry, temperature, and discharge from ~100 geysers and hot springs in the El Tatio, Chile basin to create a water and energy budget for the region. She also pursued some related studies on imaging geothermal deposits in Iceland and followed up on microbe-sinter interactions with colleagues in Paris (Gong, Munoz-Saez et al., 2020, 2022).

Munoz-Saez et al. (GRL 2020) is the most comprehensive analysis of the evolution of a hydrothermal system based on radiocarbon data. She recognized that radiocarbon ages can be biased when organisms incorporate old dissolved carbon in water (which may mean that many or possibly most previous studies

have unrecognized uncertainty). Importantly, she also identified a way to recognize contaminated ages using carbon 12 and 13 isotopes.

Munoz-Saez et al. (JVGR 2020) used drones, mapping, mineralogy, water isotopes, geochemistry and radiocarbon dating to characterize a new hydrothermal field in the Southern Chilean Alps. She identities how topography changes the surface expression of hydrothermal systems.

Her published work was widely covered in the popular media. It was the banner story on the US National Science Foundation homepage, the subject of a Discover documentary, and covered by the Washington Post, Daily Mail, Scientific American, and others. This testifies to the general interest in geysers but also to the new insights she obtained. Her PNAS paper published last year was covered by most major media outlets (altmetric score of 517). The Wall Street Journal and NY Times articles stand out.

In pursuing these studies she had to undertake geological mapping, design and test field instruments, perform lab experiments, do time series analysis, analyze isotope and geochemical data, make geophysical and physical properties measurements, perform X-ray Computed Tomography on a synchrotron beamline, and develop models for the fluid mechanics and thermodynamics of the geysers. In recent years she has expanded the tool set she uses to include aerial drones and field geophysics. She also had to coordinate field expeditions in a remote setting and establish a productive and constructive relationship with indigenous communities. Combined with her previous work in structural geology, she has developed a very broad range of skills and has a demonstrated record of accomplishment in the form of published papers (excellent for a 2016 PhD with a year of maternity leave and major COVID disruptions to field work and lab analyses).

I would also like to highlight her resilience and ability to pursue science under challenging conditions. In mid-March 2020 she flew to Chile to do some field work. Her field partners were recalled to the USA a couple days later. She stayed behind and for the next ~4 months lived in a somewhat remote cabin with a cell phone to connect to the internet and a 2-year old child to take care of. During that time, she submitted a couple papers, did a number of new calculations, and led an international effort via zoom to almost complete another paper. All of these papers are now in print, with the third published in PNAS in 2021, a paper nominated for the National Academies Cozzarelli Prize. As a graduate student she had to deal with two major setbacks including being hit by a car that ran a red light. 2020 has taught us the importance of resiliency for doing science. She is the most resilient scientist I have ever worked with (and I have published with several hundred scientists).

She has been engaged in outreach. As a native Spanish speaker and Latina she was able to reach out to a large community of our students in ways that I cannot. She was and remains dedicated to communicating her science to the indigenous communities in the Chilean Andes. These are attributes not directly relevant to your award but will be relevant for her future success and suggest that she will be influential in the future.

She is already a successful scientist, an effective mentor, and a leader. I am sure GSA wants those selected for early career awards to remain leaders. She has everything needed to continue to be successful.

Sincerely,

Michael Manga
Professor, Earth and Planetary Science

UNIVERSIDAD DE CHILE

DEPARTMENT OF GEOLOGY
FACULTY OF PHYSICAL & MATHEMATICAL SCIENCES

Santiago, January 26, 2022

Selection Committe
MGPV Early Geological Career Award
Geological Society of America (GSA)

Dear Committee Members,

I write this letter to give Carolina Muñoz-Sáez a high recommendation in support of her application to the 2023 MGPV Early Geological Career Award. I have known Carolina for almost 15 years, first as an undergraduate student at the University of Chile, and more recently as her postdoc advisor in the same institution. Therefore, I am very familiar with her capabilities. Carolina got her Ph.D. at UC Berkeley in 2016 working under Mike Manga, and shortly afterwards she joined my research group with a Postdoctoral Fellowship from ANID, our local funding agency. These are very competitive fellowships; it was Carolina's merit to contact me, develop a solid proposal, and put together a successful application.

During her stay in my group (late 2016 to mid 2019), Carolina was involved in various research projects related with hydrothermal systems and geyser fields in the Chilean Andes. In particular, her main postdoc project focused on the long-term evolution of hydrothermal activity at the El Tatio geothermal system, one of the world's largest geyser fields. El Tatio is located in the Chilean Altiplano at an altitude of 4,200 m a.s.l., and is associated with extreme environmental conditions including high evaporation rates and daily temperature oscillations that can reach up to 40ºC. This unique setting motivated Carolina to undertake a multi-disciplinary investigation that focused on: 1) detailed mapping and geophysical monitoring of the geyser field, 2) geochemical analysis of geothermal fluids, and 3) radiocarbon (^{14}C) dating and LA-ICP-MS analysis of the siliceous sinter deposits to unravel the longevity of the geyser field, and variations in trace metal contents over time. It is relevant to note that Carolina's work at El Tatio also had an important outreach component: she was involved in communicating with local native-Chilean communities in the Altiplano, and developed strategies for effective dissemination of her scientific results at the El Tatio's community and visitor centers, aimed at the general public.

Academically, Carolina's career is beginning, but her impressive CV already shows clear signs of scholarly distinction. She has published papers in prestigious journals including *Journal of Geophysical Research, Journal of Volcanology and Geothermal Research and G*^{3}. She participated as a second author in a paper on the high-impact journal *Geology*, which focused on radiocarbon dating of sinter deposits in the El Tatio geothermal system (Slagter et al. 2019; *Geology*, 47, 330-334). I rate this paper high since it encompasses the work that Carolina developed in my group as a postdoc. It is important to note that Carolina has also published two papers in tectonics/structural geology, as a result of her master's degree at UChile: her (first authored) paper in *Andean Geology* analyze the structural evolution of the Abanico basin in the Andes of central Chile,

Dr. Martin Reich • Professor • Department of Geology • Universidad de Chile • Plaza Ercilla 803, Santiago, Chile • +56 2 29784986 • mreich@ing.uchile.cl • www.martinreich.org

while her second authored paper in the *Journal of Structural Geology* focused on the role of sedimentation during basin inversion, using an analogue modeling approach. This is proof of Carolina's versatility as a geoscientist.

Carolina has shown great skills in fostering international collaborations, has actively participated in conferences, fieldtrips and workshops. Also, she tutored several of my undergraduate (honors) and graduate students, and she was well-respected among her postdoc peers. She was a key member in our weekly group meetings, which included presentations and paper discussions in topics related to economic geology, hydrothermal deposits and geothermal systems.

My group here at UChile is considered by many to be the top group in Latin America working in hydrothermal systems and economic geology, and I demand excellence from my graduate students and postdocs. As such, Carolina exceeded all my expectations. She is a hard-working and independent researcher that accomplished a lot in a short time.

I would encourage you to give Carolina serious consideration for this award. Carolina is a well-trained geologist, energetic, resourceful and practical. She is a dedicated scientist with a strong work ethics, has a very pleasant personality and excellent social skills, and has a very good sense of how to apply academic research to important problems in geoscience. Carolina has a unique combination of experience in field work (including conventional and aerial drone mapping), mineralogy, geochemistry, volcanology, tectonics and geophysics. At last but not least, Carolina has a strong commitment for outreach and science communication, which stemmed from her relations with local communities during her Ph.D. studies and postdoc research.

The MGPV Early Geological Career Award goes to "an individual near the beginning of his or her professional career who has made distinguished contributions in mineralogy, geochemistry, petrology, and/or volcanology, with emphasis on multidisciplinary, field-based contributions". Given her wide array of scholarly experiences, I strongly believe that Carolina is a highly deserving candidate of the MGPV Early Geological Career Award. Her academic record is stellar for early-career scientist and I have no doubt that she will succeed and become a world leader in her field.

I am delighted to give Carolina Muñoz-Sáez's application ***my strongest possible support***, and would be happy to provide additional information upon request.

Dr. Martin Reich
Professor of Geology
University of Chile, Santiago

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DR. BENJAMIN A. BLACK
Assistant Professor
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THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

January 27, 2022

Dear colleagues,

It is a great pleasure to write in support of the nomination of Dr. Carolina Muñoz-Saez for GSA's MGPV Early Career Award. Carolina is an expert in magmatic hydrothermal systems whose work powerfully combines field-based measurements and laboratory techniques. She is an incredibly disciplined and thoughtful researcher whose careful dedication to observation drives the excellence of her science.

I first met Carolina when I was a postdoc at UC Berkeley and she was a graduate student there. I had the opportunity to observe her engagement with any kind of dataset and her desire to understand the processes shaping the data. I later served as Carolina's joint postdoctoral advisor in 2020-21, prior to her appointment at the University of Nevada Reno as an assistant professor. While her time in my group was atypical due to the COVID-19 pandemic and due to my own parental leave, I was impressed with Carolina's tenacity and independence. Our work together focused on terrestrial hot springs as analogs for hydrothermal activity and opaline silica deposits on Mars. Carolina's approach was rigorous, beginning with development of a hot springs facies model for Mars-like conditions (rather than relying on existing facies models based on Yellowstone, for example) that could provide a foundation for interpreting outcrops on Mars and the paleo-environments they record.

Overall, Carolina's work sits at the nexus of magmatic, hydrologic, and climatic systems. She is therefore uniquely positioned to address questions of broad interest across our community through her work in the Andean arc—as reflected in her nomination to join the SZ4D magmatic drivers of eruption working group this year. As an example, Carolina is developing new techniques to constrain magmatic heat flux through measurements of the chemistry of surface streams (and estimation of the contribution of hydrothermal flow). Her work thus has the potential to fill major gaps in our understanding of the energy budget of arcs and how it is reflected in hydrothermal activity.

Carolina also exemplifies the ideal of a 'geologic and multi-disciplinary approach,' using the Earth as a natural experiment. In one case, she very literally performed a unique,

highly successful experiment pouring cold water into El Tatio geyser to assess the impacts on the eruption tempo. To me, this is just one example of her creativity and inventiveness. More generally, field work is an integral component of what Carolina does, and she is very, very good at it. She has also built strong connections with local communities near the El Tatio geyser field.

She is an engaging speaker, weaving together drone imagery, maps, and above all data to tell compelling stories that reveal a flash of insight out of what had seemed to be conflicting observations. She is also an excellent mentor. In our group she was dedicated to guiding diverse graduate and undergraduate students, sharing her experiences navigating and thriving in U.S. academic culture.

In short, Carolina is without doubt one of the rising stars in her field. I recommend her most highly for this recognition of her past and future contributions to understanding how hydrothermal systems link and record the activities of volcanoes, water, and surface climate.

Sincerely,

Ben Black

Ben Black

Assistant Professor **cmunozsaez@unr.edu**
Nevada Bureau of Mine and Geology
University of Nevada Reno

Research Interest

Geological processes involving fluids, including problems in hydrothermal, hydrogeology, volcanology, life in extreme environments, quaternary deposits and paleoclimate.

Education

Ph.D., Earth and Planetary Science, University of California, Berkeley, CA **2016**
M.S., Geology, University of Chile, Santiago, Chile **2007**
B.S., Geology, University of Chile, Santiago, Chile **2005**

Work Experience

NBMG, University of Nevada Reno **2021 – Now**
Assistant Professor
LDEO, Columbia University and City College of New York **2020 – 2021**
Postdoctoral Researcher
CEGA Institute, University of Chile **2017 – 2020**
Postdoctoral Researcher
Punta del Cobre Mining Company, Chile **2009 – 2010**
Project Geologist: Field exploration, mapping and drilling of ore deposits
GEOVECTRA Mining Consultants, Chile **2008 – 2009**
Project Geologist: Field exploration, mapping and drilling of ore deposits
Fundación Chile - BGR Germany, Geothermal project **2005 – 2007**
Project geologist: Geothermal exploration and energy efficiency

Grants and Awards

Climate Center Grant, LDEO, Columbia University **2020 – 2021**
America Association for University Woman Postdoctoral Fellowship **2020 – 2021**
Conicyt - Chile: 4-year Research Grant **2020 – 2024**
The optimal geologic conditions that form high enthalpy, metal- rich volcanic-hydrothermal systems in the Andes: Thermodynamic and mechanical numerical approach. Puyehue-Cordon Caulle and Sollipulli Volcanoes.
Conicyt – Chile: 3-year Postdoctoral Fellowship **2017 – 2020**
Louderback PhD Thesis Award, UC Berkeley **2016**
Center for Latin American Studies: 1-year Research Grant, UC Berkeley **2014 – 2015**
Fulbright Ph.D. Fellowship **2010 – 2014**
Highest Distinction Graduation Award, University of Chile. **2007**
Amerique Latine Fellowship Award, University Paul Sabatier, Toulouse, France **2004**

Invited Talks

LDEO, Columbia University, Geochemistry Seminar **2021**

University of Nevada, Reno, GSE Department Seminar **2020**
American Natural History Museum (AMNH), EPS Seminar **2020**
Institute de Physique du Globe de Paris (IPGP), Silica workshop **2019**
LDEO, Columbia University, MGG/SGT Seminar **2019**
Cornell University, EAS Department Seminar **2019**
Sonoma State University, Geology Department Seminar **2018**
University of California Los Angeles, EPS Department Seminar **2017**
Colegio de Geólogos de Chile, Seminar **2016**

Teaching experience

University of Nevada Reno: Graduate Student Instructor **2022**

GEOL 407/607, Earth Resources and Energy

University of California, Berkeley: Graduate Student Instructor **2012, 2013, 2015**

EPS 50, The Planet Earth

University of Chile: Graduate Student Instructor **2003-2005**

General Geology, Andean Structural Geology, Sedimentology and stratigraphy, Mineralogy, Paleontology

List of Publications

Gong, J., **Munoz-Saez**, C., Wilmeth, D.T., Myers, K.D., Homann, M., Arp, G., Skok, J.R. and van Zuilen, M.A., 2022. Morphogenesis of digitate structures in hot spring silica sinters of the El Tatio geothermal field, Chile. Geobiology, 20(1), pp.137-155.

Hurwitz, S., Manga, M., Campbell, K.A., **Muñoz-Saez**, C. and Eibl, E.P., 2021. Why study geysers?. Eos, American Geophysical Union, 102.

Montecinos-Cuadros, D., Diaz, D., **Munoz-Saez**, C., Yogeshwar, P. Electromagnetic characterization of the shallow structure of El Tatio geothermal field (Central Andes, Chile) using TEM. Journal of Volcanology and Geothermal Research (*Under Review*).

Reed, M.H., **C. Munoz-Saez**, S. Hajimirza, S.-M. Wu, A. Barth, T. Girona, M. Rasht-Behesht, E.B. white, M.S. Karplus, S. Hurwitz and M. Manga (2021). The 2018 reawakening of Steamboat, Yellowstone National Park, the world's tallest geyser, Proceedings of the National Academy of Sciences, vol. 118, e2020943118.

Munoz-Saez, C., Perez-Nunez, C., Martini, S., Vargas-Barrera, A., Reich, M., Morata, D., and Manga, M., 2020. The Alpehue geyser field, Sollipulli Volcano, Chile. Journal of Volcanology and Geothermal Research. doi.org/10.1016/j.jvolgeores.2020.107065.

Wilmeth, D., Nabhan, S., Myers K., Slagter S., Lalonde, S., Sansjofre, P., Homann, M., Konhauser, K., **Munoz-Saez**, C., Van Zuilen, M. 2020. Depositional evolution of an extinct sinter mound from source to outflow, El Tatio, Chile. Sedimentary Geology

Munoz-Saez, C., Manga, M., Hurwitz, S., Slagter, S., Churchill, D.M., Reich, M., Damby, D. and Morata, D., 2020. Radiocarbon dating of silica sinter and postglacial hydrothermal activity in the El Tatio geyser field. Geophysical Research Letters, p.e 2020GL087908.

Gong, J., Myers, K., **Munoz-Saez**, C., Homann, M., Wirth, R., Schreiber, A., Van Zuilen, M., 2020. Formation and Preservation of Microbial Palisade Fabric in Silica Deposits from El Tatio, Chile. Astrobiology. DOI: 10.1089/ast.2019.2025

Slagter, S., Reich, M., **Munoz-Saez, C.,** Southon, J., Morata, D., Barra, F., Gong, J., Skok, J. R., 2019. Environmental controls on silica sinter formation revealed by radiocarbon dating. Geology, 47(4), 330-334.

Ardid, A., Vera, E., Kelly, C., Manga, M., **Munoz-Saez, C.,** Maksymowicz, A., Ortega-Culaciati, F., 2019. Geometry of geyser plumbing inferred from ground deformation. Journal of Geophysical Research. doi.org/10.1029/2018JB016454.

Munoz-Saez, C., Manga, M. and Hurwitz, S., 2018. Hydrothermal discharge from the El Tatio basin, Atacama, Chile. Journal of Volcanology and Geothermal Research, 361, pp.25-35.

Namiki, A., Ueno, Y., Hurwitz, S., Manga, M., **Munoz-Saez, C.,** and Murphy, F., 2016. An experimental study of the role of subsurface plumbing on geothermal discharge. Geochem. Geophys. Geosyst. doi:10.1002/2016GC006472

Munoz-Saez, C., Saltiel, S., Manga, M., Nguyen, C. and Gonnermann, H., 2016. Physical and hydraulic properties of modern sinter deposits: El Tatio, Atacama. Journal of Volcanology and Geothermal Research, 325, pp.156-168.

Munoz-Saez, C., A. Namiki, and M. Manga, 2015. Geyser eruption intervals and interactions: examples from El Tatio, Atacama, Chile, Journal of Geophysical Research, vol. 120, doi: 10.1002/2015JB012364

Munoz-Saez, C., Manga, M., Hurwitz, S., Rudolph, M., Namiki, A., Wang, C., 2015. Dynamics within geyser conduits, and sensitivity to environmental perturbations: Insights from a periodic geyser in the El Tatio geyser field, Atacama Desert, Chile. Journal of Volcanology and Geothermal Research, doi:10.1016/j.jvolgeores.2015.01.002.

Namiki, A., **Munoz-Saez, C.**, Manga, M., 2014. El Cobreloa: A geyser with two distinct eruption styles. Journal of Geophysical Research, 119, doi:10.1002/2014JB11009.

Adelstein, E., Tran A., **Muñoz-Saez, C.,** Shteinberg, A., Manga, M., 2014. Geyser preplay and eruption in a laboratory model with a bubble trap. Journal of Volcanology and Geothermal Research, vol. 285, 129-135.

Muñoz-Saez C, Pinto L, Charrier R, Nalpas T, 2014. Influence of depositional load on the development of a shortcut fault system during the inversion of an extensional basin: The Eocene-Oligocene Abanico Basin case, central Chile Andes (33°-35°S). Andean Geology, Vol 41, No 1.

Pinto L., **Muñoz C.,** Nalpas T., Charrier R., 2010. Role of sedimentation during basin inversion in analogue modeling. Journal of Structural Geology, vol. 32, Issue 4, pp. 554–565.

Olivier Ph., Gleizes G., Paquette J.L., **Muñoz C.,** 2008. Structure and U-Pb dating of the Saint-Arnac pluton and the Ansignan charnockite (Agly massif): a cross section from the upper to the middle crust of the Variscan Eastern Pyrenees. Journal of Geological Society, London; vol. 165; pp. 141-152.