

Dr. Alexander Sehlke

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Space Sciences & Astrobiology Division, Planetary Systems Branch
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EDUCATION AND PROFESSIONAL TRAINING

- 2016-2019 **Postdoctoral Researcher,**
NASA Ames Research Center, Moffett Field, CA
- 2015 **Ph.D. in Geology with Minor in College Teaching,**
University of Missouri, Columbia, MO
- 2011 **Diplom in Geosciences**
Leibniz Universität Hannover, Germany

POSITIONS HELD

- Since 2019 Research Scientist at NASA Ames Research Center/ Bay Area Environmental
Research Institute, Moffett Field, CA

RESEARCH INTERESTS

Application of the following to Earth, Planetary, and Material Sciences:
Physical and Thermal Properties of Silicate Melts and Solids, Thermodynamics, Volcanic
Hazards, Magma/Lava Rheology, Lava Morphology, Remote Sensing, Thermoluminescence,
Spectroscopy and Technology Development

RESEARCH EXPERIENCE

- Since 2016 **NASA Ames Research Center, Moffett Field, CA**
- Lava Flow Morphology and Surface Roughness through Remote Sensing,
 - Measurements of Physical and Thermal Properties of Basalts,
 - Thermoluminescence of Lunar Regolith, Meteorites, and terrestrial Basalts,
 - Portable VNIR, XRF, and LIBS spectrometers in Human Space Flight,
- 2015-2011 **Dept. of Geological Sciences, University of Missouri, Columbia, MO**
Doctoral research thesis conducted with Dr. Alan Whittington. Rheological
evolution of terrestrial and planetary basalts during cooling and crystallization.
- Experimentally constructed pāhoehoe to `a`ā transition for Hawaiian lavas
 - Rheology of lavas on Mercury supports flood basalt hypothesis on Mercury's
northern hemisphere, lavas are not unusually fluid
 - Configurational entropy modeling of tholeiitic lavas, planetary lava viscosity
model

- 2010-2007 **Institut für Mineralogie, Leibniz Universität Hannover, Germany**
Diplom thesis research conducted with Dr. Harald Behrens. Investigation of H₂O diffusion in natural Beryl and Cordierite by micro-Raman spectroscopy.
- H₂O diffusion profiles measured by micro-Raman spectroscopy
 - Quantification of volatile contents by micro-Raman spectroscopy possible

LABORATORY EXPERIENCE

- Since 2016 **NASA Ames Research Center, Moffett Field, CA**
- Established the PLANETAS (Planetary Exploration Through Analog Science) laboratory at NASA Ames Research Center,
 - Measurements of physical and thermal properties of basaltic rocks,
 - Natural and induced thermoluminescence,
 - Evaluating handheld spectrometers (VNIR, XRF, LIBS) for future human space flight
- 2015-2011 **Dept. of Geological Sciences, University of Missouri, Columbia, MO**
- Rheology measurements of terrestrial basalt and planetary analogs
 - Heat capacity, thermal diffusivity, and enthalpies of fusion measurements of terrestrial basalts and planetary analogs
 - Developed lab technique to measure Fe-redox state of silicate materials by wet chemistry and UV/Vis spectroscopy
- 2011-2007 **Institut für Mineralogie, Leibniz Universität Hannover, Germany**
- Developed technique to investigate H₂O diffusion in natural beryl and cordierite by micro-Raman spectroscopy.
 - Measuring electrical conductivity of H-bearing orthopyroxenes by impedance spectroscopy and D₂O tracer diffusion by transmission FTIR spectroscopy.
 - Measuring H₂O content of glasses and rock samples by Karl-Fischer titration and transmission FTIR spectroscopy, synthesizing volatile bearing glasses in CSPV and IHPV apparatus.

FIELD WORK EXPERIENCE

Sampling of volcanic products (unaltered and alteration products).

Field measurements and field mapping.

In-situ geochemical and mineralogical measurements.

Western United States of America

- Basaltic Lava Flows and Rhyolitic Ash Deposits in the Eastern Snake River Plain
- Basaltic Volcanism associated with (southern) Cascade Volcanic Arc

Big Island of Hawaii, HI

- Kilauea Iki and Keanakakoi, Kilauea volcano
- Muliwai a Pele lava channel at Mauna Ulu, Kilauea volcano
- Pu'u'Ō'ō (active flows), Kilauea volcano
- Mauna Loa

Central America

- Pacaya Volcano (active flows), Guatemala
- Fuego volcano, Guatemala
- Santiaguito at Santa Maria volcano (active flows), Guatemala
- Arenal volcano, Costa Rica

Europe

- Iceland

UNIVERSITY TEACHING EXPERIENCE

Dept. of Geological Sciences, University of Missouri, Columbia, MO

- 2015 Course Instructor, *The Moon*
- 2015 Logistical Support and Assistance for Regional Geology Field Trip (GEOL 2500)
- 2013-2011 Teaching Assistant, *Mineralogy*

PEER-REVIEWED PUBLICATIONS

- Sehlke, A.**, Hofmeister, A. M., & Whittington, A. G. (2020). Thermal Properties of Glassy and Molten Planetary Candidate Lavas. *Planetary and Space Science*, (Special Issue in Volcanic Analogs, in review.
- Sehlke, A.**, & Whittington, A. G. (2020). Rheology of a KREEP Analog Magma: Experimental Results Applied to Dike Ascent through the Lunar Crust. *Planetary and Space Science*, Special Issue in Volcanic Analogs, accepted with minor revisions.
- Morrison, A. A., Whittington, A., Smets, B., Kervyn, M. and **Sehlke, A.** (2020) “The Rheology of Crystallizing basaltic lavas from Nyiragongo and Nyamuragira volcanoes, D.R.C.”, *Volcanica*, 3(1), pp. 1-28. <https://doi.org/10.30909/vol.03.01.0128>
- Sehlke, A.**, Mirmalek, Z., Burt, D., Haberle, C. W., Santiago-Materese, D., Kobs Nawotniak, S. E., Hughes, S. S., Garry, W. B., Bramall, N., Brown, A. J., Heldmann, J. L., & Lim, D. S. S. (2019). Requirements for Portable Instrument Suites during Human Scientific Exploration of Mars. *Astrobiology*, 19(3), 401–425. <https://doi.org/10.1089/ast.2018.1841>
- Hughes, S. S., Haberle, C. W., Kobs Nawotniak, S. E., **Sehlke, A.**, Garry, W. B., Elphic, R. C., Payler, S. J., Stevens, A. H., Cockell, C. S., Brady, A. L., Heldmann, J. L., & Lim, D. S. S. (2019). Basaltic Terrains in Idaho and Hawai‘i as Planetary Analogs for Mars Geology and Astrobiology. *Astrobiology*, 19(3), 260–283. <https://doi.org/10.1089/ast.2018.1847>
- Cockell, C. S., Harrison, J. P., Stevens, A. H., Payler, S. J., Hughes, S. S., Kobs Nawotniak, S. E., Brady, A. L., Elphic, R. C., Haberle, C. W., **Sehlke, A.**, Beaton, K. H., Abercromby, A. F. J., Schwendner, P., Wadsworth, J., Landenmark, H., Cane, R., Dickinson, A. W., Nicholson, N., Perera, L., & Lim, D. S. S. (2019). A Low-Diversity Microbiota Inhabits Extreme Terrestrial Basaltic Terrains and Their Fumaroles: Implications for the Exploration of Mars. *Astrobiology*, 19(3), 284–299. <https://doi.org/10.1089/ast.2018.1870>

- Kobs Nawotniak, S. E., Miller, M. J., Stevens, A. H., Marquez, J. J., Payler, S. J., Brady, A. L., Hughes, S. S., Haberle, C. W., **Sehlke, A.**, Beaton, K. H., Chappell, S. P., Elphic, R. C., & Lim, D. S. S. (2019). Opportunities and Challenges of Promoting Scientific Dialog throughout Execution of Future Science-Driven Extravehicular Activity. *Astrobiology*, 19(3), 426–439. <https://doi.org/10.1089/ast.2018.1901>
- Brady, A. L., Kobs Nawotniak, S. E., Hughes, S. S., Payler, S. J., Stevens, A. H., Cockell, C. S., Elphic, R. C., **Sehlke, A.**, Haberle, C. W., Slater, G. F., & Lim, D. S. S. (2019). Strategic Planning Insights for Future Science-Driven Extravehicular Activity on Mars. *Astrobiology*, 19(3), 347–368. <https://doi.org/10.1089/ast.2018.1850>
- Lim, D. S. S., Abercromby, A. F. J., Kobs Nawotniak, S. E., Lees, D. S., Miller, M. J., Brady, A. L., Miller, M. J., Mirmalek, Z., **Sehlke, A.**, Payler, S. J., Stevens, A. H., Haberle, C. W., Beaton, K. H., Chappell, S. P., Hughes, S. S., Cockell, C. S., Elphic, R. C., Downs, M. T., & Heldmann, J. L. (2019). The BASALT Research Program: Designing and Developing Mission Elements in Support of Human Scientific Exploration of Mars. *Astrobiology*, 19(3), 245–259. <https://doi.org/10.1089/ast.2018.1869>
- Sears, D. W. G., **Sehlke, A.**, Friedrich, J. M., Rivers, M. L., & Ebel, D. S. (2018). X-ray computed tomography of extraterrestrial rocks eradicates their natural radiation record and the information it contains. *Meteoritics and Planetary Science*, 53(12), 2624–2631. <https://doi.org/10.1111/maps.13183>
- Sears, D. W. G., Sears, H., **Sehlke, A.**, & Hughes, S. S. (2018). Induced thermoluminescence as a method for dating recent volcanism: Hawaii County, Hawaii, USA. *Journal of Volcanology and Geothermal Research*, 349. <https://doi.org/10.1016/j.jvolgeores.2017.09.022>
- Sears, D. W. G., Sears, H., **Sehlke, A.**, & Hughes, S. S. (2017). Induced thermoluminescence as a method for dating recent volcanism: Eastern Snake River Plain, Idaho, USA. *Journal of Geophysical Research: Solid Earth*, 122(2). <https://doi.org/10.1002/2016JB013596>
- Hofmeister, A. M., **Sehlke, A.**, Avard, G., Bollasina, A. J., Robert, G., & Whittington, A. G. (2016). Transport properties of glassy and molten lavas as a function of temperature and composition. *Journal of Volcanology and Geothermal Research*, 327. <https://doi.org/10.1016/j.jvolgeores.2016.08.015>
- Sehlke, A.**, & Whittington, A. G. (2016). The viscosity of planetary tholeiitic melts: A configurational entropy model. *Geochimica et Cosmochimica Acta*, 191. <https://doi.org/10.1016/j.gca.2016.07.027>
- Soldati, A., **Sehlke, A.**, Chigna, G., & Whittington, A. G. (2016). Field and experimental constraints on the rheology of arc basaltic lavas: the January 2014 Eruption of Pacaya (Guatemala). *Bulletin of Volcanology*, 78(6). <https://doi.org/10.1007/s00445-016-1031-6>
- Sehlke, A.**, & Whittington, A. G. (2015). Rheology of lava flows on Mercury: An analog experimental study. *Journal of Geophysical Research E: Planets*, 120(11). <https://doi.org/10.1002/2015JE004792>
- Hofmeister, A. M., **Sehlke, A.**, & Whittington, A. G. (2014). Thermal diffusivity of Fe-rich pyroxene glasses and their melts. *Chemical Geology*, 384. <https://doi.org/10.1016/j.chemgeo.2014.06.018>

- Sehlke, A.**, Whittington, A. G., Robert, B., Harris, A., Gurioli, L., Médard, E., & Sehlke, A. (2014). Pahoe to aa transition of Hawaiian lavas: An experimental study. *Bulletin of Volcanology*, 76(11). <https://doi.org/10.1007/s00445-014-0876-9>
- Robert, B., Harris, A., Gurioli, L., Médard, E., **Sehlke, A.**, & Whittington, A. G. (2014). Textural and rheological evolution of basalt flowing down a lava channel. *Bulletin of Volcanology*, 76(6), 1–21. <https://doi.org/10.1007/s00445-014-0824-8>

In Preparation

- Sehlke A**, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, Heldmann JL. The Anatomy of the Blue Dragon, Part 1: Changes in Morphology and Physical Properties of Lava Flowing Down a Channel. *Journal of Geophysical Research: Solid Earth*. In Preparation.
- Sehlke A**, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, Heldmann JL. The Anatomy of the Blue Dragon, Part 2: Correlations Between Physical Properties and Surface Roughness of Open Channel Lava Flows. *Journal of Geophysical Research: Solid Earth*. In Preparation.

ABSTRACTS AND PRESENTATIONS

51 referable conference abstracts at the following meetings:

American Geophysical Union (AGU), Geological Society of America (GSA), Lunar and Planetary Science Conference (LPSC), Lunar Exploration Analysis Group (LEAG), Meteoritical Society (MetSoc), NASA Exploration Science Forum (NESF),

Recent First-Author Presentations (Past 5 Years) - Oral:

- Sehlke A**, and Sears DWG, (2020) Looking Backwards to Looking Forwards: A Fifty-Year Experiment in the Kinetics of Thermoluminescence of Lunar Samples and the Apollo Next Generation Sample Analysis Program (ANGSA). 51st Lunar Planetary and Science Conference, Houston TX, USA
- Sehlke A**, (2019) Rheological and Thermal Evolution of Magmatic Systems: Insights into the Volcanic Past on Earth and other Planets and Moons in our Solar System. GeoMünster Conference, Münster, Germany - *Invited Keynote*
- Sehlke A**, Mirmalek Z, Burt D, Haberle CW, Santiago-Materese D, Kobs Nawotniak SE, Hughes SS, Bramall N, Garry WB, Brown A, Heldmann JL, Lim DSS. (2018) Requirements for portable instrument suites during human scientific exploration of Mars. NASA Exploration Science Forum, NASA Ames Research Center, Moffett Field CA
- Sehlke A**, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). The anatomy of the Blue Dragon: Changes in Lava Flow Morphology and Physical Properties Observed in an Open Channel Lava Flow as a Planetary Analogue. American Geophysical Union Fall Meeting, New Orleans LA
- Sehlke A**, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). The anatomy of the Blue Dragon: Changes in Lava Flow

Morphology and Physical Properties Observed in an Open Channel Lava Flow as a Planetary Analogue. Geological Society of America Annual Meeting, Seattle WA – *Invited*

Sehlke A, Sears DWG, Friedrich JM, Rivers ML, Ebel DS (2017). Synchrotron X-ray Computed Tomography and the Radiation History of Meteorites. Annual Meeting of the Meteoritical Society, Santa Fe NM

Sehlke A, Lim DSS, Heldmann JL (2017). Designing Future Human Spaceflight. Sensors Expo 2017 San Jose CA - *Invited Keynote*

Sehlke A, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). Inferred Thermo-Physical Properties of Lava Flows---Implications for Remote Sensing of Planetary Terrains. National Association of Geoscience Teachers Symposium, Idaho Falls ID

Sehlke A, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). Straight outta morphologies: Understanding the magmatic history of lava terrains on Earth and other rocky worlds in our Solar System. San Jose State University, CA - *Invited*

Sehlke A, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2016). The morphological transition from pāhoehoe to ‘a‘ā of basaltic lavas: Combining field studies and experimental work to interpret the volcanic past on Earth and other planets and moons. USGS Menlo Park, CA - *Invited*

Recent First-Author Conference Abstracts (Past 5 Years) - Poster:

Sehlke A, Hofmeister AM, and Whittington AG (2019). Thermal Properties of Glassy and Molten Planetary Candidate Lavas. American Geophysical Union Annual Fall Meeting, San Francisco, CA.

Sehlke A, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). The anatomy of the Blue Dragon: Changes in Lava Flow Morphology and Physical Properties Observed in an Open Channel Lava Flow as a Planetary Analogue. Lunar Explorations Analysis Group Annual Meeting, Columbia MD.

Sehlke A and Sears DWG (2017). Similarities between ejecta blocks from Kings Bowl crater (Idaho) and boulders on NEA Eros: Some Preliminary Results. NASA Exploration Science Forum, NASA Ames, Moffett Field, CA.

Sehlke A, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). Inferred Thermo-Physical Properties of Lava Flows---Implications for Remote Sensing of Planetary Terrains. NASA Exploration Science Forum, NASA Ames, Moffett Field, CA.

Sehlke A and Whittington AG (2017). Rheology and thermal budget of lunar basalts: an experimental study and its implications for sinuous rille formation on the Moon. NASA Exploration Science Forum, NASA Ames, Moffett Field, CA.

Sehlke A, Mirmalek Z, Cohen B, Kobs Nawotniak SE, Hughes SS, Brown A, Heldmann JL, and DSS Lim (2017). The Ultimate Geologic Tricorder? Handheld Science Instruments and Requirements for Future Human Exploration Missions on Other Worlds. Lunar and Planetary Science Conference 48, The Woodlands TX.

Sehlke A, Kobs Nawotniak SE, Hughes SS, Sears DWG, Downs MT, Whittington AG, Lim DSS, and Heldmann JL (2017). Inferred Thermo-Physical Properties of Lava Flows - Implications for Remote Sensing of Planetary Terrains. Lunar and Planetary Science Conference 48, The Woodlands TX.

Sehlke A and Whittington AG (2016). The viscosity of planetary tholeiitic melts: A configurational entropy model. American Geophysical Union Fall Meeting, San Francisco CA

Sehlke A and Whittington AG (2016). The viscosity of planetary tholeiitic melts: A configurational entropy model. Lunar and Planetary Science Conference 47, The Woodlands TX.

Sehlke A and Whittington AG (2015). Rheology and thermal budget of lunar basalts: an experimental study and its implications for rille formation of non-Newtonian lavas on the Moon. American Geophysical Union Fall Meeting, San Francisco CA

MENTORING EXPERIENCE

- 2018 Caleb Renner, NASA ARC Summer Intern (2 months). Research planning and advising laboratory measurements for project “Porosity and Permeability of Basaltic Rocks and their Alteration States: Implications for the Habitability of Microbial Life in Volcanic Rocks on Earth and Mars” as part of the BASALT research program.
- 2017 David Burt, NASA-ARC Intern (6 months). Research planning and advising to evaluate data quality of handheld XRF and vis-NIR spectrometers. Now Ph.D. student at Stony Brook, NY
- 2015-2014 Aaron Morrison, MS in Geology. Mentoring lab work, research planning and data interpretation to study lava rheology of Mt. Nyiragongo, DR of Congo
- 2014-2013 Anthony Bollasina, MS in Geology. Mentoring lab work, research planning and data interpretation to study lava rheology of Pacaya volcano, Guatemala.
- 2013-2012 Sarah Smith, undergraduate student in Chemistry. Mentoring lab work, research planning and data interpretation to study viscosity of Fe, Mg, Ca-bearing pyroxene glasses.

OUTREACH AND PUBLIC ENGAGEMENT

- 2019 **Silicon Valley Comic Con, San Jose, CA**
Panel Discussion: The Artemis Generation: NASA’s Journey Forward to the Moon.
- 2017 **Fremont Peak Observatory Annual Member Meeting, San Juan Bautista, CA**
Public lecture titled “Volcanism Across the Solar System”
- 2017 **NASA Total Solar Eclipse Event, Arco ID**
Science demonstration related to volcanism
- 2015-2012 **Rockbridge High School, Columbia MO**
Volunteering at the STEM expo. Engaging elementary school students in activities related to volcanology, including rock and mineral samples, microscopy and lava flow rheology with food analog.

- 2014 **Dept. of Geological Sciences, University of Missouri, Columbia, MO**
Volunteering at the Boy Scout Night. Presentation about Volcanology with question and answer section, as well as rock sample demonstration.
- 2014 **Dept. of Physics and Astronomy, University of Missouri, Columbia, MO**
Volunteering at ‘Science quest’. Engaging 5th grade students from Columbia area in science in demonstration about volcanic eruptions and lava rheology with food analogs.
- 2013 **Dept. of Physics and Astronomy, University of Missouri, Columbia, MO**
Presentation in science outreach for lecture series ‘Cosmic Conversations’ with talk titled “Volcanoes of the Solar System”.

AWARDS AND GRANTS

- 2020 RILLES – Rheological Investigations of Lunar Lava Emplacement Scenarios.
NASA ROSES NASA ROSES Solar System Workings (SSW)
PI: Alexander Sehlke, Co-I: Alan Whittington **pending** (\$798,904)
- 2020 BASALT 2.0 – Biologic Analog Science Associated with Lava Terrains
PI: Darlene Lim, Co-I: Alexander Sehlke and 12 others **pending** (\$>2,000,000)
- 2019 Thermoluminescence Studies on Frozen Apollo 17 Samples: Temperature Estimates of Shaded and Illuminated Lunar Surfaces. NASA ROSES Apollo Next Generation Sample Analysis (ANGSA)
PI: Alexander Sehlke, Co-I: Derek Sears \$344,409
- 2019 *Fast and/or Furious? Nature and Emplacement History of Lavas Erupted on Mars.* NASA ROSES Solar System Workings (SSW)
PI: Alexander Sehlke, Co-I: Alan Whittington \$490,705
- 2018 *IceCrystal: Portable instrument protocol to delineate ancient ice and water on Mars using microcrystallinity of volcanic products.* NASA ROSES PSTAR (Planetary Science and Technology from Analog Research)
PI: Erika Rader, Co-I: Alexander Sehlke, Janice Bishop \$874,012
- 2018 NASA Postdoctoral Fellowship 3rd-year extension, NASA Ames Research Center, Moffett Field, CA. \$86,866
- 2017 Orbit to Core Research Grant for Collaboration between NASA/USGS Menlo Park, CA \$2,800
- 2016 NASA Postdoctoral Fellowship, NASA Ames Research Center, Moffett Field, CA. \$129,248
- 2012 Travel award for attending and presenting research poster at the AGU Chapman Conference on Hawaiian volcanoes in August 2012. \$977

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| 2012 | Graduate Student Association of the University of Missouri – Columbia, Travel Award for attending and presenting research poster at the AGU Chapman Conference on Hawaiian volcanoes in August 2012. | \$150 |
| 2012 | Graduate Professional Council (GPC) at the University of Missouri – Columbia, Travel Scholarship for attending and presenting research poster at the AGU Chapman Conference on Hawaiian volcanoes in August 2012. | \$400 |

PROFESSIONAL DEVELOPMENT

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| 2017 | 2-Day Grant Writing Workshop, Universities Space Research Association, NASA Ames Research Center, Moffett Field CA. |
| 2015 | Entering Mentoring, 8-week seminar at the University of Missouri – Columbia, about training and mentoring students in the laboratory. |
| 2014 | alphaMELTS workshop at CalTech, Pasadena CA. |