

Nathan G. Limbaugh

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Research Interests

Investigating terrestrial and extraterrestrial magma systems through petrology, geochemistry, and geochronology of igneous rocks (ultramafic cumulates, basalts, meteorites). Exploring the evolution of planetary magmas and the petrogenesis of plutonic, volcanic, and hydrothermal systems via compositional analyses of minerals and inclusions.

EDUCATION

University of Alabama

PhD in Geology (in progress, expected graduation: Fall 2025)
(Focus: Planetary Geology / Cosmochemistry)

Tuscaloosa, AL

Aug. 2021 - present
GPA: 3.8 / 4.0

Missouri University of Science and Technology

M.S in Geology
(Focus: Igneous Petrology & Geochemistry)

Rolla, MO

July 2021
GPA: 3.9 / 4.0

B.S. Geology & Geophysics

(Emphasis in Geochemistry)

May 2020

GPA: 3.6 / 4.0

GRADUATE COURSEWORK

PhD Coursework

Tuscaloosa, AL

- Preparing Future Faculty and Scholars Fall 2023
- Metamorphic Petrology Fall 2023
- Thermal Ionization Mass Spectrometry Spring 2023
- Cosmochemistry Fall 2022
- Volcanology Fall 2022
- Critical Minerals Spring 2022
- Geodynamics Spring 2022
- Introduction to Planetary Science Fall 2021
- Geostatistics Fall 2021
- Communicating Geology Fall 2021

Masters Coursework

Rolla, MO

- Professional Geology Spring 2021
- Electron Microscopy – Lab Spring 2021
- Electron Microscopy – Lecture / Theory Fall 2020
- Isotope Geology (Radiometric and Stable Isotope Geochemistry) Fall 2020
- Advanced Geochemistry Spring 2020

PUBLICATIONS

- (In progress, to be submitted to *Geochimica et Cosmochimica Acta*), Limbaugh, N.G., Cartwright, J.A., Hames, W.E., COMPOSITIONAL COMPARISONS OF PLANETARY MAGMAS FROM OLIVINE- AND CLINOPYROXENE-HOSTED MELT INCLUSIONS IN NAKHLITES AND TERRESTRIAL MAFIC ROCKS.
- (In progress, to be submitted to *Lithos*) Limbaugh, N.G., Hogan, J.P., Hames, W.E., MULTIPLE PHLOGOPITE GENERATIONS IN AN ALNÖITE DIATREME: INSIGHTS INTO THE MAGMATIC EVOLUTION OF THE AVON ALKALINE IGNEOUS PROVINCE, MISSOURI.

TEACHING EXPERIENCE

Term Lecturer – Northwest Missouri State University

Maryville, MO

- Mineralogy
- Geochemistry
- General Earth Science

Fall 2024

Fall 2024

Fall 2024

Teaching Assistant

Tuscaloosa, AL

- Introduction to Mineralogy – Optical Mineralogy Lab
- Igneous and Metamorphic Petrology Lab
- Field Geology

Fall 2022, Fall 2023

Spring 2023, 2024

Summer 2023

Guest Lecturer

- Introduction to Mineralogy – “An Introduction to Topics in Mineralogy” University of Alabama, Fall 2023
- Introduction to Geology – “Careers in the Geological Sciences” University of Alabama, Fall 2023
- Fall Geology Field Trip – “Magma and Minerals in the Rockies” Northwest Missouri State University, Fall 2024

TECHNICAL AND PROFESSIONAL EXPERIENCE

Collaborations

- California Institute of Technology and Agricultural University of Athens 2022 – Present
Project: Examining phosphorus-rich rims in xenolith olivine at the nanometer-scale
Contribution: Focused ion beam sample preparation and atom probe tomography
- University of Alabama Radioisotope Laboratory 2024 – Present
Project: Constraining peak temperature of formation/metamorphism of graphite
Contribution: Raman spectroscopy of graphite, applied as a geothermometer

Analytical Research and Laboratory Experience

2021 - Present

- Scanning Electron Microscopy
JEOL 7000 FE-SEM, Apreo FE-SEM, TESCAN Lyra3 FIB-SEM
FEI Helios 600, RAITH e-line
Tuscaloosa, AL
Rolla, MO
- Electron Probe Micro-analyzer
JEOL JXA-8230 FE-EPMA at Johnson Space Center
JEOL JXA-8600 at Auburn University
Houston, TX
Auburn, AL
- Atom Probe Tomography
Cameca LEAP 6000 XR Local Electrode Atom Probe
Tuscaloosa, AL
- Thermal Ionization Mass Spectrometry
Isotopx Phoenix TIMS at University of North Carolina
MLA Column Chromatography (Nd, Sm)
Chapel Hill, NC
Tuscaloosa, AL
- Raman Spectroscopy
Horiba JOBNVYON–LabRamHR Raman Spectroscop
Tuscaloosa, AL
- Modeling Software Experience
Petrolog-3
Rhyolite-MELTS
Theriak-Domino
Tuscaloosa, AL

Undergraduate Research in Igneous Petrology & Geochemistry

Rolla, MO

- Performed petrographic and compositional data analysis of diatreme-facies minerals

May 2019 – 2020

Roadmaps into the Geosciences (RiGs) Program

Rolla, MO

- NSF-funded undergraduate research and professional development program
- Gained experiential learning from job shadowing local USGS and DNR geologists

May – August 2019

PRESENTATIONS

- Geological Society of America North-Central South-Central Joint Regional Conference** **Springfield, MO**
• **N.G. Limbaugh**, J.A. Cartwright, L.J. Hallis, W.E. Hames (oral presentation):
Magma between two worlds: A comparison of Martian and terrestrial parent melt compositions from primary melt inclusions hosted in nakhlites and terrestrial mafic analogs
Apr. 2024
- Meteoritical Society Annual Meeting 2023** **Los Angeles, CA**
• **N.G. Limbaugh**, J.A. Cartwright, L.J. Hallis, W.E. Hames (poster presentation):
Martian and terrestrial parent melt compositions, diffusion, and nucleation from micro- and nanometer-scale investigations of primary melt inclusions
Aug. 2023
- Meteoritical Society Annual Meeting 2022** **Glasgow, UK**
• **N.G. Limbaugh**, J.A. Cartwright, L.J. Hallis (poster presentation):
Martian and HED melt inclusion analyses: Comparisons of Martian and Vestan achondrite parent melt compositions to terrestrial mafic analogs.
Aug. 2022
- Geological Society of America North-Central South-East Joint Regional Conference** **Cincinnati, OH**
• **N.G. Limbaugh**, J.A. Cartwright, L.J. Hallis (poster presentation):
Cumulate eucrite, diogenite, and nakhlite melt inclusion analyses: Investigating parent melt characteristics of achondrites from 4 Vesta and Mars.
Apr. 2022
- Lunar Planetary Science Conference 2022** **Woodlands, TX**
• **N.G. Limbaugh**, J.A. Cartwright, L.J. Hallis (poster presentation):
Nakhlite, cumulate eucrite, and diogenite melt inclusion analyses: Investigating parent melt characteristics of achondrites from Mars and 4 Vesta.
Mar. 2022
- Geological Society of America North-Central South-Central Joint Regional Conference** **Springfield, MO**
• **N.G. Limbaugh**, J.P. Hogan, W.E. Hames (oral presentation):
Two phlogopite generations in an alnöite diatreme: Insights into the magmatic evolution of the Avon Alkaline Igneous Province, Missouri.
Apr. 2021
- Geological Society of America Annual National Conference** **Phoenix, AZ**
• **N.G. Limbaugh**, J.P. Hogan (poster presentation):
Olivine and phlogopite in an alnöite diatreme: Insights into the magmatic evolution of the Avon Alkaline Igneous Province, Missouri
Sept. 2019

SERVICE AND LEADERSHIP

- Diversity and Inclusion Committee Member and Liaison** **Tuscaloosa, AL**
• Collaborated with faculty and students towards improving department inclusivity
Fall 2023 – present
- Open House Representative – Department of Geological Sciences Graduate Student Group** **Tuscaloosa, AL**
• Organized student lunches and presentation logistics for visiting professors
Fall 2023 – present
- Rockfest at Rock Quarry Elementary – Volunteer** **Northport, AL**
• Co-lead activities for pre-K students learning about the solar system
Oct. 2023
- Workshop Leader – Leaders Exploring Academic Possibilities (LEAP) Program** **Tuscaloosa, AL**
• Designed / lead a volunteer workshop showcasing microscopy in geology for high schoolers
Summer 2022, 2023
- Graduate Representative** **Tuscaloosa, AL**
• Served as a graduate student liaison to the faculty of the Department of Geological Sciences
Fall 2022 - 2023
• Lead efforts to enhance graduate student social life and interviews for potential faculty hires
- Sigma Gamma Epsilon (Earth Science Honors Society) – Alpha Chi Chapter** **Tuscaloosa, AL**
• Secretary (2021), Treasurer (2021-2022), Graduate Liaison (2023), Diversity Liaison (2023)
Fall 2021 – present
• Active member since 2018, re-charter founding president of Eta Chapter
Rolla, MO

GRANTS AND HONORS

- Geological Society of America Student Research Grant (Spring 2023)
- NASA Student Travel Award (to attend the Meteoritical Society Conference, Summer 2023)
- Richard Norton Travel Award (to attend the Meteoritical Society Conference, Summer 2022)
- Graduate Council Fellowship (University of Alabama, Fall 2021 – present)
- Mines & Metallurgy Academy Scholar Award (Missouri University of Science & Technology, Spring 2020)
- Sigma Gamma Epsilon Tarr Award – Eta Chapter (Missouri University of Science & Technology, Spring 2020)
- Geosciences and Geological and Petroleum Engineering Department Undergraduate Service Award (Fall, 2019)