

Office

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SUMMARY

- Specializes in structural-petrology, Raman spectroscopy, petrochronology, high-pressure high-temperature experimentation [DAC], and mineral physics.
- Research interests include Raman elastic geobarometry, mineral stress/strain analysis, X-ray diffraction, spectroscopic micro-analysis, mid-crustal structural geology, metamorphic petrology, and mineralogy.

EDUCATION**Doctoral Degree in Geological Sciences, expected Fall 2021**

- *University of Nevada, Las Vegas*
- **Geology Courses included:**

Igneous Petrology	Advanced Topics: Field Tectonic Analysis
Directed Reading: Raman Spectroscopy	Topics in Advanced Geochemistry
Strain and Microstructural Analysis	Advanced Topics: Structural Mapping
Independent Study: Geologic Mapping	Advanced Geochronology
Research Methods	Water-Rock Interaction
X-Ray Analysis/Adv. Crystallography	Instrumental Techniques in Geology
Hydrogeology	Indpt. Study: Advanced Metamorphic Petrology
Geologic Evolution of W. North America	Plate Tectonics
Stable Isotope Geochemistry	X-ray Spectroscopy and Adv. Crystallography

Bachelor of Science in Geological Sciences, May 2016

- *Indiana University, Bloomington, Indiana.*

Executive Dean's List: Spring 2013, Summer 2013, Summer 2014, Spring 2015

Short Course: Using Laser Ablation Split Stream (LASS) Geochronology and Petrochronology to Address Tectonic and Petrologic Questions

- *Geological Society of America National Conference, 2016*

Professional and Work Experience**Materials and Chemistry Institute Intern**

05/26/2020-08/15/2020

Lawrence Livermore National Laboratory- Materials Science Division

- Carried out high-pressure diamond anvil cell compression experiments for remote data collection at the Advanced Photon Source of the Argonne National Laboratory
- Focused on vibrational and X-ray spectroscopy under pressure, rotational-DAC shear stress studies, and synchrotron XRD for EoS determination
- Supervised by Dr. Elissaios Stavrou

Synchrotron X-ray Diffraction Project

Spring 2020

University of Nevada, Las Vegas

- Learned the basic theory of synchrotron X-ray diffraction, carried out exercises in simulated microLaue diffraction data collection, and analyzed angular dispersive synchrotron X-ray diffraction data collected at the HPCAT 16-idb of the Advanced Photon Source of Argonne National laboratory using UnitCell, Dioptase, Endeavor, and Powdercell
- Supervised by Dr. Oliver Tschauner

Assisted in the UNLV High-PT Spectroscopy Laboratory

Summer 2019

University of Nevada, Las Vegas

- Learned the theory of diamond anvil cell compression experimentation
- Assisted with and carried out successful high-pressure diamond anvil cell experiments while collecting in-situ Raman spectroscopy
- Supervised by Dr. Ashkan Salamat

Raman Spectroscopy Projects

Fall 2018-present

University of Nevada, Las Vegas

- Tested the developing method of elastic quartz-in-garnet geobarometry by collecting spectra on numerous quartz inclusions on a variety of Raman systems and settings
- Used Raman spectroscopy to identify unknown minerals, helped to characterize newly discovered high-pressure minerals, and aided students in collecting spectra on fluid inclusions for characterizing mantle olivine
- Aided students in collecting Raman spectra on carbonaceous material for RSCM thermometry

Hourly Employee- Rewriting Mineralogy Laboratory Exercises

Summer 2019

University of Nevada Las Vegas, Dept. of Geoscience

- Worked with the instructor to incorporate optical mineralogy into the course by rewriting labs, obtaining thin sections for students, and preparing lectures on physical and optical properties of minerals
- Supervised by Dr. Rodney Metcalf

Graduate Research Assistant- Funeral Mountains

Fall 2018

University of Nevada Las Vegas, Dept. of Geoscience

- Participated in geologic mapping, geochemistry, detrital zircon geochronology, and petrochronology in the Funeral Mountains metamorphic core complex
- Evaluated the extent of Jurassic, Cretaceous, and Miocene deformation in mid-crustal rocks from Monarch Canyon to reconstruct the polyphase deformational history
- Supervised by Dr. Michael Wells.

Geology Lab Analysis, Temporary Staff

9/13/2014-7/1/2016

Indiana Geological Survey, Bloomington, Indiana.

- Assisted with lab and field work on various projects from cultural sites to glacial tills
- Photographed, sampled, and stored drill cores, ran grainsize analysis using laser diffraction, sampled cores for optically stimulated luminescence dating, and carried out heavy mineral separation and point counting

National Park Service Mt. Baldy Project, Temporary Staff

9/13/2014-7/1/2016

Indiana Geological Survey, Bloomington, Indiana.

- Carried out heavy mineral separation, grain mount preparation, X-Ray diffraction, and heavy mineral point counting to evaluate the cause for collapse at Mount Baldy of the Indiana Dunes State Park
- Supervised by Dr. William Monaghan

Glacier Project, Temporary Staff

9/20/2015-7/1/2016

Indiana Geological Survey, Bloomington, Indiana

- Characterized and sampled glacial till and outwash deposits in central Indiana
- Executed laser diffraction, heavy mineral separation, sample collection, and petrography
- Supervised by Dr. William Monaghan

Senior Thesis Research in the Rye Complex

10/10/2014 to 7/1/2016

Indiana University, Bloomington, Indiana

- Conducted detailed petrography, textural analysis, and microstructural analysis
- Discovered two previously unidentified stages of andalusite growth, with associated staurolite and cordierite, establishing a new interpretation for the metamorphic history and tectonic setting
- Supervised by Dr. Robert Wintsch

Internship with the Indiana Hoosier National Forest Service *12/17/2012-06/31/2014*
Bloomington, Indiana.

- Wrote, recorded, and edited podcasts about the German Ridge Heritage Geoarchaeology project that were broadcast by the Indiana Hoosier National Forest service

Assisted in Paleontology Laboratory *Fall 2013-Spring 2014*
Indiana University, Bloomington, Indiana

- Studied taphonomy, paleontology, and hominid evolution
- Supervised by Dr. Jackson Njau

Geology and Paleoanthropology at Olduvai Gorge Field School *June-August 2014*
Camp Leaky in Olduvai Gorge, Tanzania.

- Measured stratigraphic section, assisted with trenching, produced detailed cross sections, investigated metamorphic core complexes, and studied rift related magmatism during Indiana University's six-week field course
- Lived closely with the local Massai people and attended a multitude of traditional cultural ceremonies

TEACHING EXPERIENCE

Course Instructor *Spring 2020*
University of Nevada Las Vegas, Dept. of Geoscience

- During my Ph.D., I was the instructor of record for a section of the undergraduate course 'Physical Geography of Earth's Environment'
- Tasks included creating a lesson plan, preparing biweekly 90-minute lectures, writing and grading exams, and interacting with students

Guest Lecturer: Mineralogy *Fall 2019*
University of Nevada Las Vegas, Dept. of Geoscience

- Gave the Mineralogy course lectures on crystal symmetry and framework silicates for the Fall Mineralogy class

Teaching Assistant: Mineralogy Lab Section *Spring & Fall 2019*
University of Nevada Las Vegas, Dept. of Geoscience

- While teaching the laboratory section of the Mineralogy course, I aided the instructor in restructuring the layout of the course
- Independently developed and carried out weekly mineral identification quizzes and prepared weekly 'practice tests' to incentivize students to apply themselves

Undergraduate Supervisor *Spring 2019*
University of Nevada Las Vegas, Dept. of Geoscience

- Supervised undergraduate student Alison Corrales in an hourly position with lab work for detrital zircon geochronology
- Project involved bulk rock crushing, zircon mineral separation, data collection at the Arizona Laserchron Laboratory, and data analysis

Undergraduate Supervisor *Fall 2018-Spring 2019*
University of Nevada Las Vegas, Dept. of Geoscience

- Supervised undergraduate student Sarah Grove in an hourly position with lab work for geochemistry
- Project involved bulk rock crushing, fusing and powdering samples in preparation for ICP-MS geochemistry

Undergraduate Supervisor

Fall 2017-Spring 2017

University of Nevada Las Vegas, Dept. of Geoscience

- Supervised undergraduate student Ariel Wolfman during her senior thesis research project on resolving stratigraphic complexities in Monarch Canyon of the Funeral Mountains.
- Project involved detrital zircon separation, data collection at the Arizona Laserchron Laboratory, stratigraphic reconstruction, and provenance analysis

GRANTS AND AWARDS

Jack and Fay Ross Family Fellowship [\$27,000+]

Fall 2016- Fall 2018

University of Nevada Las Vegas, Dept. of Geoscience

- Fellowship awarded to one applicant to the Ph.D. program based on graduate school application, statement of purpose, C.V., and letters of recommendation.
- Funded two years of living expenses, travel, some research, health insurance, and tuition.

Lipman Research Grant [\$2500]

12June 2019

Geological Society of America

- Awarded for proposal on: Testing Raman-inclusion barometry across a contact aureole.

Jacobs Research Grant [\$1000]

26April 2019

Geosymposium Conference, University of Nevada Las Vegas, Dept. of Geoscience

- Award for grant proposal: Testing the applications and limitations of Raman-inclusion barometry.

Bernada French Scholarship [\$600+\$600+\$600]

Fall 2019, 2020 and Spring 2019

University of Nevada, Las Vegas

- Awarded a Department of Geosciences scholarship three semesters in a row

Geosymposium Best Oral Presentation Award [\$600]

26April 2019

Geosymposium Conference, University of Nevada Las Vegas, Dept. of Geoscience

- Awarded best oral presentation for: Comparing Raman Quartz-in-garnet Barometry with Thermodynamic Modeling Across a Barrovian Metamorphic Terrane: The Funeral Mountains Metamorphic Core Complex.

M.G.P.V. Travel Grant [\$500]

12June 2019

Mineralogy, Geochemistry, Petrology, and Volcanology Division GSA

- Awarded travel support for Geological Society of American National Meeting

Judson Mead Scholarship [\$500]

April 2015

Indiana University Field Camp

- Awarded grant to offset travel and tuition costs for field camp

Graduate and Professional Student Association Travel Grant [\$350]

December 2019

University of Nevada, Las Vegas

- Awarded grant to travel to the Lawrence Berkeley National Laboratory to collect synchrotron X-ray diffraction data at the Advanced Light Source

A.E.G. Oral Presentation Award [\$100]

15May 2019

Association of Environmental and Engineering Geologists

- Awarded best oral presentation for: Comparing Raman Quartz-in-garnet Barometry with Thermodynamic Modeling Across a Barrovian Metamorphic Terrane: The Funeral Mountains Metamorphic Core Complex.

First Place Award in Public Speaking Competition [Non-monetary]

Spring 2011

Skills USA Regional Conference

- Competed in career-based competition with the Area Career Center, a half-day learning center for career-driven high-school students.

MANUSCRIPTS IN PREPARATION

Geologic field evidence for overpressure recorded in the North American Cordillera hinterland, northeast Nevada. A.V. Zuza, Drew A. Levy, S.R. Mulligan, in review-Geoscience Frontiers
Production of trondhjemitic melts from fluid-present melting of upper amphibolite facies metapelites during channelized fluid flux, Funeral Mountains, Death Valley, California. S. Wright, T.D. Hoisch, M.L. Wells, S. Craddock Affinati, S.R. Mulligan, in review- Journal of Metamorphic Petrology

* Elucidating the protolith stratigraphy and northern extent of Pahrump Group basins using detrital zircon geochronology in amphibolite facies metamorphic rocks and migmatites from the Funeral Mountains and Bullfrog Hills metamorphic core complexes. S.R. Mulligan, M.L. Wells, A. Wolfman, C. Dehler, in prep- Precambrian Geology (Dissertation Chapter 1)

* Deviation between Quartz-in-Garnet elastic geobarometry and thermodynamic P-T modeling in Barrovian metamorphic rocks. S.R. Mulligan, M.L. Wells, T.D. Hoisch, C. Childs, A. Salamat, O. Tschauer, S. Craddock Affinati, M.A. Willis, in prep- Journal of Metamorphic Petrology (Dissertation Chapter 2)

*Top-southwest shear in the Funeral Mountains metamorphic core complex: implications for Laramide deformation in northwest Death Valley. S.R. Mulligan, M.L. Wells, T.D. Hoisch, S. Wright, in prep (Dissertation Chapter 3)

*Evaluating quartz-in-garnet elastic geobarometry using high-pressure high-temperature diamond anvil cell experimentation and microLaue synchrotron X-ray diffraction. S.R. Mulligan, M.L. Wells, A. Salamat, O. Tsauner, C. Childs, in prep

Stoefflerite: A high-pressure polymorph of plagioclase feldspar in terrestrial impact structures. J.G. Spray, S. Boonsue, O. Tschauer, C. Ma, S.R. Mulligan, J. Smith, in prep- American Mineralogist

**First Author*

PRESENTATIONS

Mulligan, S.R., Wells, M.L., A. Salamat. (2020), Quartz-in-Garnet barometry in Barrovian metamorphic rocks: overstepping or overestimation. *University of Nevada, Las Vegas Geosymposium Abstracts with Programs*

Mulligan, S.R. (2019), How petrochronology can provide tectonic context to age data: a case study in the Funeral Mountains metamorphic core complex. University of Nevada, Las Vegas seminar series.

Mulligan, S.R., Well, M.L., Hoisch, T.D., Craddock Affinati, S., Childs, C., Salamat, A. (2019), Comparing Raman-inclusion barometry and thermodynamic PT modeling in Barrovian metamorphic environments, *Geological Society of America Abstracts with Programs*, 40(3)

Mulligan, S.R., Craddock Affinati, S., Wells, M.L., Hoisch, T.D., Childs, C., Wright, S., and Salamat, A. (2018), Comparing Raman quartz-in-garnet barometry with thermodynamic modeling across a Barrovian metamorphic terrane: The Funeral Mountains metamorphic

core complex, *Abstract 369023 presented at 2018 Fall Meeting, AGU, Washington D.C., 10-14 Dec*

Mulligan, S. R., Wolfman, A., Wells, M.L., Hoisch, T.D. (2018), Using zircon and titanite geochronology to evaluate protolith stratigraphy and the timing of metamorphism and migmatization in Monarch Canyon, *Geological Society of America Abstracts with Programs*, 50(5)

Wolfman, A., Mulligan, S.R., Wells, M.L. (2017), Resolving stratigraphic complexities of the Pahrump group and migmatite protolith in the Funeral Mountains metamorphic core complex using U-Pb DZ geochronology, *Geological Society of America Abstracts with Programs*, 49(6)

Mulligan, S. R., Kane, P., Kunk, M.J., Stoesz, E., and Witsch, R. (2016), Multiple generations of Al₂SiO₅ polymorphs in a low-pressure metamorphic setting: The Rye complex, New Hampshire, *Geological Society of America Abstracts with Programs*, 48(7)

Mulligan, S. R., Kane P., Stoesz E., and Witsch, R. (2015), Three stages of andalusite growth in the Rye complex, New Hampshire, *Geological Society of America Abstracts with Programs*, 47(7)

PROFESSIONAL SKILLS

Raman Spectroscopy	Heavy Mineral Separation
Quartz-in-Garnet Barometry	X-Ray Diffraction
Diamond Anvil Cell Experiments	Structural Geology
Optical Mineralogy	Electron Microprobe Analysis
Grainsize Analysis	Scanning Electron Microscopy
Microstructural Analysis	LA ICP-MS Data Analysis
Geologic Mapping	Spectral Fitting OriginPro & Fityk
Mineral Point Counting	Modeling in EoSFit7-Pinc
Petrography	ICP-MS Geochemistry
Detrital Zircon Geochronology	P-T modeling Theriak-Domino
U/Pb Petrochronology	Thermobarometry

ACTIVITIES

Geosymposium silent auction coordinator	<i>Spring 2019 & 2020</i>
Founding Member, UNLV chapter of Association for Women Geoscientists	<i>Fall 2019-present</i>
Volunteer, UNLV inclusion rocks program	<i>Spring 2019</i>
Vice President, American Association of Petroleum Geologists	<i>Spring 2018-Fall-2018</i>
Logistics Coordinator, American Association of Petroleum Geologists	<i>Fall 2016-Spring 2017</i>
Member, American Association of Petroleum Geologists	<i>Fall 2016-Present</i>
Volunteer, Las Vegas Science Festival	<i>6 May 2017</i>
Member, Sigma Gamma Epsilon	<i>10/24/2014-Present</i>
Member, Society of Economic geologists	<i>2/15/2018-Present</i>
Member, Geology Club Indiana University	<i>2013-2016</i>
Member, Geological Society of America	<i>2014-Present</i>
Student Coach, Little 500 Women's Bike Race	<i>December 2013</i>
Member, Skills USA	<i>2011-Present</i>
Member, International Thespian Society.	<i>2008-Present</i>
Member, American Geophysical Union	<i>Fall 2018-Present</i>
Member, Mineralogical Society of America	<i>Spring 2018-Present</i>

