

# **GARY S. MICHELFELDER**

Assistant Professor of Geology

Department of Geography, Geology and Planning, Missouri State University

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## **EDUCATION**

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**Doctor of Philosophy in Geology, 2015**, Montana State University, Bozeman, MT

**Area of Focus:** Trace Element and Isotope Geochemistry/Igneous Petrology/ Volcanology

**Dissertation Title:** The Magma Chamber Evolution of Cerro Uturuncu, Central Andean Volcanic Zone, southwest Bolivia, **Advisor:** Dr. Todd Feeley

### **Research Interests**

General geochemistry, radiogenic and stable isotope geochemistry, volcanology and petrology. I have a particular interest in the application of in-situ trace element and isotope ratio microanalysis to petrologic problems.

**Masters of Science in Geology, 2009**, New Mexico State University, Las Cruces, NM

**Thesis Title:** Geochemistry and Petrology of the Sierra Cuchillo Laccolith, Sierra County, New Mexico **Advisor:** Dr. Nancy McMillan

**Bachelors of Science in Geology, 2007**, Eastern Michigan University, Ypsilanti, MI

Minor: Military Science

**Diploma, 2007**, U.S. Army Engineer School, Ft Leonard Wood, MO

### **Short Courses:**

- Getting Started in Undergraduate Research for New, Future and Current Faculty. GSA Short Course, 2013
- FEMA Volcano Crisis Awareness Course, 2012
- Diffusion in Minerals and Melts, Mineralogical Society of America Short Course, 2010
- Arizona State University's Secondary Ionization Mass Spectrometry Workshop, Feb. 2010
- AAPG Practical Salt Tectonics, Instructor- Mark Rowan, Rowan Consulting, April 2009

## **TEACHING/ RESEARCH POSITIONS**

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2014- Present | *Assistant Professor of Geology*- Missouri State University, Springfield, MO

2013-2014 | *Visiting Assistant Professor of Geology*- Missouri State University, Springfield, MO

2009-2013 | *Graduate Assistant*- Montana State University, Bozeman, MT

2008-2009 | *Graduate Assistant*- New Mexico State University Las Cruces, NM

## **PROFESSIONAL EXPERIENCE**

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2008-2009 | *Geosciences Intern*- Kegan Geochemical Consulting, Las Cruces, NM

2004- Present | *Commissioned Officer*- Army National Guard

2006-2007 | *Environmental Scientist Level I*- The Mannik and Smith Group, INC Canton, MI

### **Certifications**

- FEMA Volcanic Crisis Awareness (AWR-233)- 2012
- Composite risk management certification- 2009
- 100-400 level FEMA Emergency Response Coordinator Course – 2008
- 40 hour OSHA HAZWOPER (Hazardous Waste Operations and Emergency Response) Course - 2006

## **COURSES TAUGHT**

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GLG 110 Physical Geology; GLG 171 Environmental Geology; GLG 332 Mineralogy with lab; GLG 333 Igneous and Metamorphic Petrology; GLG 340 Structural Geology with lab; GLG 397 Volcanology; GLG 765 Isotope Geochemistry

ERTH 101 Topics in Geology- Military Geology (Montana State University)

**PUBLICATIONS (Peer Reviewed; \*Student Author)**

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- Pritchard, M.; Feeley, T.C.; de Silva, S.; West, M., **Michelfelder, G.S. in review**. PLUTONS: Imaging Deep Active Magma Intrusions in the Central Andes. Manuscript submitted to PLUTONS Special Issue of Geosphere.
- Wilder, A.D.\*; **Michelfelder, G.S.**, Mogk, D. and Feeley, T.C. *in review*. Petrology and Geochemistry of the Lauzufre Volcanic Complex, Chile. Submitted to Geosphere, PLUTONS Special Issue.
- **Michelfelder, G.S.**; Feeley, T.C.; and Wilder, A.D. *in review*. Crustal Differentiation Processes at Cerro Uturuncu, Andean Central Volcanic Zone, SW Bolivia: Insights from In situ Sr Isotopic Analysis of Plagioclase Phenocrysts. Submitted to Geosphere, PLUTONS Special Issue.
- Karfunkel, J.; Hoover, D.B.; Fernandes, A.F.; Sgarbi, G.N.C.; Krambrock, K.; Walde, D.; **Michelfelder, G.S., 2015**, Origin of Diamonds Southeast of Coromanel (Minas Gerais, Brazil): A Different Hypothesis. *Neues Jahrbuch für Geologie und Paläontologie (Journal of Geology and Paleontology)* 277, 2, 237-250.
- **Michelfelder, G.S.**; Feeley, T.C. and Wilder, A.D., **2014**, The Volcanic Evolution of Cerro Uturuncu: A High-K, Composite Volcano in the Back-Arc of the Central Andes of SW Bolivia. *International Journal of Geosciences*, 5, 1263-1281. <http://dx.doi.org/10.4236/ijg.2014.511105>
- **Michelfelder, G.S.**; Feeley, T.C.; Wilder, A.D., and Klemetti, E.W. **2013**, Modification of the continental crust by subduction zone magmatism and vice-versa: across-strike geochemical variations of silicic lavas from individual eruptive centers in the Andean Central Volcanic Zone. *Geosciences*, 3, 633-667; doi:10.3390/geosciences3040633.
- **Michelfelder, G.S.**; and McMillan, N.J.; **2012**, Geochemistry, origin, and U-Pb zircon ages of the Sierra Cuchillo laccolith, Sierra County, New Mexico. *New Mexico Geological Society Fall Field Conference Guidebook vol. 63 Geology of the Warm Springs Region*, Lucas, S. G., McLemore, V. T., Lueth, V. W., Spielmann, J. A., and Krainer, K. [eds], 249-260.

**Publications In Preparation**

- Sholtis, M.\*; Cousins, J.\*; **Michelfelder, G.S.**; and Hoover, D. Structure and twinning in Mg- and Mn-rich zoned garnet from the Tocantins rhodolite garnets, Tocantins State, Brazil. Manuscript in preparation to be submitted to *Gems and Gemology*.
- Masner, W.\*; **Michelfelder, G.S.**; VanTongeren, J.; McKay, M.; and Chapman, A. Detrital zircon geochronology of the upper Cambrian-Ordovician passive-margin strata of midcontinent strata: Implications for the evolution of the Laurentian passive margin and the timing of rifting. Manuscript in preparation to be submitted to *Lithosphere*.
- **Michelfelder, G.S.**; Sikes, E.\*; Salings, E.D.\*; Rentz, S.P.\* Locating a missing arc front in a hidden continental arc: Across strike geochemical variation in Oligocene to Miocene New Mexico arc. Manuscript in preparation to be submitted to *Geoscience Frontiers*.
- **Michelfelder, G.S.** Enclaves, Inclusions and Xenoliths in the Magmatic Record: A Review. Manuscript in Preparation to be submitted to *Frontiers in Earth Science*.
- **Michelfelder, G.S.** Sr and O Isotope Geochemistry of Volcán Uturuncu, Andean Central Volcanic Zone, Bolivia: Resolving Crustal and Mantle Contributions to Continental Arc Magmatism. Manuscript in preparation to be submitted to *Cont. to Mineralogy and Petrology*.
- **Michelfelder, G.S.** Quantification of Magma Migration Pathways and Timescales Using Trace Elements and Radiogenic Isotopes in Plagioclase: An Example from Cerro Uturuncu, SW Bolivia. Manuscript in Preparation.
- de Silva, S.; **Michelfelder, G.S.**; and Schmidt, A. SHRIMP U-Pb Dating of the Pre-eruption Growth History of Zircons from Cerro Uturuncu: A Comparison to Zircon Residence Times of APVC Ignimbrites. Manuscript in Preparation.

- **Michelfelder, G.S.**, Healy, S.\*, Evans, K.R., Hannibal, J.T., and Chandler, A. The effect of terrain on troop movement in the American Civil War: An example of geologic influence from the Battle of Pea Ridge. Manuscript in preparation to be submitted to Critical Military Studies.

### **Extended Abstracts/ Peer Reviewed Conference Presentations**

- Feeley, T.C; and **Michelfelder, G.S.**, 2014. Across-strike geochemical variations of silicic lavas erupted from individual eruptive centers in the Andean Central Volcanic zone: evidence for modification of the continental crust by subduction zone magmatism and vice-versa. Resumes Expandidos XIX Congreso Geológico Argentino, 2 -6 June 2014, Córdoba, Argentina.
- **Michelfelder, G.S.**, Sadler, T.J., and Keegan, C.R., 2008, Evaluating Petroleum Fluid Distributions in Sedimentary Basins Using Headspace Cuttings Gas Data, 11<sup>th</sup> Norwegian Meeting of Organic Geochemistry, p. 5-7.

### **Abstracts/ Conference Presentations**

- Masner, W. and **Michelfelder, G.S.** 2015. U-Pb Detrital Zircon Geochronology and Provenance of the Ordovician Sandstones near Mt. Ida, Arkansas. GSA North Central Section Meeting, Abstract #275402. April 18-19, 2016.
- **Michelfelder, G.S.**, Wilder, A.D.\*, and Feeley, T.C., 2015, Sr and O Isotope Geochemistry of Volcán Uturuncu, Andean Central Volcanic Zone, Bolivia: Resolving Crustal and Mantle Contributions to Continental Arc Magmatism. AGU Fall Meeting, 11-14 December.
- Pritchard, M.; Feeley, T.C., de Silva, S., West, M., **Michelfelder, G.S.** PLUTONS: Imaging Deep Active Magma Intrusions in the Central Andes. AGU Fall Meeting, 11-14 December.
- Rentz, S.\*, **Michelfelder, G.S.**, Salings, E.\*, and Sikes, E.\* 2015, Examining ash fall sequences in calk-alkaline subduction related volcanism, southern New Mexico. AGU Fall Meeting, 11-14 December.
- Salings, E.\*, **Michelfelder, G.S.**, Rentz, S. \*, Sikes, E. \*, 2015, Preliminary Geochemical and Petrologic Assessment of the Fanney Rhyolite and the Bloodgood Canyon and Apache Springs tuffs, Mogollon-Datil Volcanic Field, New Mexico, AGU Fall Meeting, 11-14 December.
- Salings, E.\*, **Michelfelder, G.S.**, and Sikes, E. \*, 2015, Trace element variation in plagioclase phenocrysts from ignimbrites from the Mogollon-Datil volcanic field, southern New Mexico, USA: Insights into the processes and timescales of magmatism. GSA Fall Meeting, Baltimore, MD, 1-4 November.
- Sikes, E. \*, **Michelfelder, G.S.**, Salings, E. \*, and Rentz, S. \*, 2015 Modification of the Continental Crust by Subduction Zone Magmatism and Vice-Versa: Across-Strike Geochemical Variations of Silicic Lavas from the Mogollon-Datil Volcanic Field, SW New Mexico, GSA Fall Meeting, Baltimore, MD, 1-4 November.
- **Michelfelder, G.S.**, Wilder, A.D.\*, and Feeley, T.C., 2015, Crustal Differentiation Processes at Cerro Uturuncu, Andean Central Volcanic Zone, SW Bolivia: Insights from In situ Sr Isotopic Analyses of Plagioclase Phenocrysts. GSA Fall Meeting, Baltimore, MD, 1-4 November.
- **Michelfelder, G.S.**, Karfunkel, J., Hoover, D.B., Fernandes, A.F., Sgarbi, G.N.C., Krambrock, K., and Walde, D., 2015, Surface source of Coromandel diamonds (Minas Gerais State, Brazil) and their possible origin from the Serra Negra/Salitre Supervolcano. GSA Fall Meeting, Baltimore, MD, 1-4 November.
- Cousins, J. \*, Sholtis, M. \*, and **Michelfelder, G.S.**, 2015, The effects micro-inclusions on internal structure of zoned garnet: an example from the Tocantins rhodanite garnets, Tocantins State, Brazil. GSA Fall Meeting, Baltimore, MD, 1-4 November.
- Sholtis, M. \*, Cousins, J. \*, and **Michelfelder, G.S.**, 2015, Structure and twinning in Mg- and Mn-rich zoned garnet from the Tocantins rhodolite garnets, Tocantins State, Brazil. GSA Fall Meeting, Baltimore, MD, 1-4 November.

- Rentz, S., **Michelfelder, G.S.**, Salings, E., and Sikes, E. 2015, Examining ash fall sequences in calc-alkaline subduction related volcanism, southern New Mexico. GSA Fall Meeting, Baltimore, MD, 1-4 November.
- **Michelfelder, G.S.**, Wilder, A.D.\*, and Feeley, T.C., 2015, Sr and O Isotope Geochemistry of Volcán Uturuncu, Andean Central Volcanic Zone, Bolivia: Resolving Crustal and Mantle Contributions to Continental Arc Magmatism. GeoPRISMS Theoretical and Experimental Institute on Subduction Zone Processes, Redondo Beach, CA, October 12-14, 2015.
- **Michelfelder, G.S.**, Salings, E.\*, and Sikes, E. \*, 2015, Trace element variation in plagioclase phenocrysts from ignimbrites from the Mogollon-Datil volcanic field, southern New Mexico, USA: Insights into the processes and timescales of magmatism. AGU Joint Assembly in Montreal, Quebec, Canada.
- Cousins, J.\*, Sholtis, M.\*, and **Michelfelder, G.S.**, 2015, The effects micro-inclusions on internal structure of zoned garnet: an example from the Tocantins rhodanite garnets, Tocantins State, Brazil. To be presented at the North Central GSA Section Meeting, Madison, WI.
- **Michelfelder, G.S.**, Wilder, A.D., and Feeley, T.C., 2014, Geochemical and Isotopic Data from Micron to Across-Arc Scales in the Andean Central Volcanic Zone: Applications for Resolving Crustal Magmatic Differentiation and Modification Processes. AGU Fall Meeting, Abstract# V31E-4797.
- Karfunkel, J., Hoover, D.B., Fernandes, A.F., Sgarbi, G.N.C., Krambrock, K., Walde, D., and **Michelfelder, G.S.**, 2014, Diamantes da região de Coromandel (MG) e sua possível origem do supervulcão Serra Negra/Salitre. 6<sup>th</sup> Brazilian Symposium of the Geology of Diamonds. Abstract# T19.
- Karfunkel, J., Hoover, D.B., Fernandes, A.F., Sgarbi, G.N.C., Krambrock, K., Walde, D., and **Michelfelder, G.S.**, 2014, Origin of Diamonds Southeast of Coromandel (Minas Gerais, Brazil): A Different Hypothesis. Latin American Colloquium 2014.
- Healy, S. \*, and **Michelfelder, G.S.** 2014. Using Terrain to Win Wars: An Example from the Battle of Pea Ridge, American Civil War. GSA South Central Section Meeting Program with Abstracts. Abstract #235702.
- Evans, K.R., Hannibal, J.T., Chandler, A., and **Michelfelder, G.S.** 2014. Slaughter on the rocks and other geologic aspects of the Battle of Pea Ridge. GSA South-Central Section - 48th Annual Meeting Program with Abstracts. Abstract #235727.
- **Michelfelder, G.S.**, and Feeley, T.C. 2013. Multi-Stage Mixing Following Assimilation-Fractional Crystallization At Cerro Uturuncu, Andean Central Volcanic Zone, SW Bolivia As Revealed From In Situ Laser Ablation Isotopic Analyses Of Plagioclase. Geological Society of America 2013 Annual Meeting. Abstract# 233599.
- **Michelfelder, G.S.**, Feeley, T.C., Wilder, A.D., and Thacker, J. 2013. Mixing following assimilation-fractional crystallization at Cerro Uturuncu, Andean Central Volcanic Zone, SW Bolivia as revealed from in situ laser ablation isotopic analysis of plagioclase. International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) 2013 Scientific Assembly: Forecasting Volcanic Activity. Abstract 1847-1.
- Wilder, A.D., Feeley, T.C., and **Michelfelder, G.S.** 2013. Preliminary petrologic and geochemical observations of volcanic rocks associated with an area of active surface uplift in the Lazufre region, Andean Central Volcanic Zone. International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) 2013 Scientific Assembly: Forecasting Volcanic Activity. Abstract 1219-1.
- Pritchard, M.; Henderson, S.; Jay, J.; and 18 others. 2012. PLUTONS: Imaging Deep Active Magma Intrusions in the Central Andes. XIII Congreso Geológico Chileno, Antofagasta, Chile.
- **Michelfelder, G.S.**, Feeley, T.C., Klemetti, E., and Wilder, A.D.\* 2011. Observations on the Origin of Across-Strike Geochemical Variations in Quaternary Silicic Lava Flows From the Andean Central Volcanic Zone: Comparison of Data from Individual Eruptive Centers. American Geophysical Union 2011 Fall Meeting.

- Arnoux, G.\*, **Michelfelder, G.S.**, and Feeley, T.C. 2011. Analysis of mafic enclaves in lavas from Uturuncu Volcano, Bolivia. American Geophysical Union 2011 Fall Meeting.
- Wilder, A.D.\*; Feeley, T.C.; and **Michelfelder, G.S.** 2011. An Undergraduate Student's Perspective on Geoscience Research. American Geophysical Union 2011 Fall Meeting.
- **Michelfelder, G.S.**; and Feeley, T.C. 2010. Cerro Uturuncu SW Bolivia: Preliminary Observations from Field work, Geochemistry and Petrology. American Geophysical Union 2010 Fall Meeting Abstract #V23B-2441.
- **Michelfelder, G.S.**; and McMillan, N.J.; 2009, Volcanic and Igneous Stratigraphy of Sierra Cuchillo Range, Sierra County, New Mexico, New Mexico Geological Society Annual Spring Meeting 2009, p. 21-22.
- **Michelfelder, G.S.**; Sadler, T.J.\*; and Keegan, C.R.; 2008, Evaluating Fluid Type and GOR in Petroleum Systems Using Headspace Cuttings Gas Data, 2008 Geological Society of America Joint Annual Meeting Program with Abstracts, pg 222-6.
- **Michelfelder, G.S.**; and McMillan, N.J.; 2008, Petrologic and Geochemical analysis of the Cuchillo Mountain Laccolith, Sierra County, New Mexico, 2008 Geological Society of America Joint Annual Meeting Program with Abstracts, p. 193-2.

### **FUNDED GRANTS**

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- 2015- Pritchard, M.E.; McNutt, S.R.; Christensen, D.H.; West, M.; de Silva, S.L.; Finnegan, N.; and Feeley, T.C. NSF EAR- 0908140: Continental Dynamics: Collaborative Research: Investigating the relationship between pluton growth and volcanism at two active intrusions in the central Andes. \$405,236 Awarded to T.C. Feeley (Deceased), Completed by **Michelfelder G.S.** and Varrichio, D.J. 09/01/2009 to 08/31/2015.
- 2015- **Michelfelder, G.** Geochemical Variation of Basalts in the Mogollon-Datil Volcanic Field New Mexico: Faculty Research Grant. **\$7500**
- 2015- **Michelfelder, G.S.** and Brock, T. Integrating Innovative and Collaborative Technology in the Classroom: MSU FCTL Curriculum Innovation Grant . **\$3870**
- 2010- **Michelfelder, G.S.** Geochemical Evolution of the magma chamber beneath Cerro Uturuncu, Bolivia: Rocky Mountain Association of Geologist. **\$2500**
- 2008- **Michelfelder, G.S.** Petrology and Geochemistry of the Sierra Cuchillo laccolith, New Mexico: Geological Society of America. **\$1250**
- 2008- **Michelfelder, G.S.** U-Pb geochronology of the igneous rocks in the Sierra Cuchillo range, New Mexico: New Mexico Geological Society. **\$2000**

### **SUBMITTED GRANTS**

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- 2016- **Michelfelder, G.S.**; Gutierrez, M.; Pavlowsky, R.; and McKay, M., *in review*, MRI: RUI: Acquisition of a High Mass Resolution Inductively Coupled Plasma Mass Spectrometer at Missouri State University. Submitted to the National Science Foundation Major Research Instrumentation Program.
- 2016- **Michelfelder, G.S.**, *in review*, RUI: Stable Isotope ( $\delta^{18}\text{O}$  and D/H) and U-Pb Geochronology Studies of Continental Arc Magmatism: Magma Accumulation in the Mogollon-Datil Volcanic Field, southern New Mexico. Submitted to the National Science Foundation EAR Petrology and Geochemistry Program.
- 2015- Mickus, K.; **Michelfelder, G.S.**; and Unsworth, M. RUI: Insights into magma differentiation and storage beneath continental arc volcanoes: A geochemical and geophysical study of Volcán Putana, Central Volcanic Zone, Chile. Submitted to the National Science Foundation EAR Petrology and Geochemistry Program. Not Funded.
- 2014- **Michelfelder, G.S.** Investigating the Relationship between Active Magmatic Intrusion and Volcanism by Crystal Isotope Stratigraphy at Krafla Volcano, Iceland. Pre-Proposal submitted to the Krafla Magma Drilling Project. Not Funded.

## **CURRENT PROFESSIONAL AFFILIATIONS**

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- International Association of Volcanology and Chemistry of the Earth's Interior; American Geophysical Union- Member; Geological Society of America- Member; Mineralogical Society of America- Member; New Mexico Geological Society

## **SERVICE**

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### **Conference Sessions Organized**

- 2015 Fall AGU Meeting: Session 9834: Where Arc Magmas Reside: Comparing the Volcanic and Plutonic Records
- 2014 Fall AGU Meeting: Session 2264: Stow or Blow? Intrusions and Eruptions of Magma in the Continents

### **Other Service**

- Commissioned Officer Army National Guard 2003-present
- Guest Associate Editor- Geosphere PLUTONS Special Volume 2015-2016
- Science Olympiad Judge- 2014- present
- Outstanding Student Presentation Liaison Fall 2014 AGU Meeting: Session 2264: Stow or Blow? Intrusions and Eruptions of Magma in the Continents
- Reviewer for research papers to a variety of international journals, e.g., Lithosphere, Geosphere, about 2-3 reviews per year
- Reviewer for National Science Foundation proposals, about 2 per year
- University/College/ Department Committees: CNAS Budget Committee, Search committee for geology faculty hires

## **CURRENT STUDENTS**

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### **Graduate (M.S. in Geospatial Science)**

*William "Bo" Masner*- U-Pb Detrital Zircon Geochronology and Provenance of the Crystal Mountain Sandstone near Mt. Ida, Arkansas

*Shannon Rentz*- Petrology and Geochemistry of rhyolite ash flows from the western Mogollon Datil Volcanic Complex, New Mexico

*Max Hoffman*- Crustal contamination and magma sources of volcanic rocks from southern New Mexico: Insights from oxygen isotopes

*Grant Spoering*: U-Pb detrital zircon geochronology of glacial tills near St Louis, New Mexico (Co-Advised with Charles Rovey)

### **Graduate (MNAS)**

*Emily Salings*- Petrology and Geochemistry of rhyolite volcanic rocks from the western Mogollon Datil Volcanic Field, New Mexico

### **Undergraduate**

*Wesley Weisberg*- Trace Element Variation in Plagioclase Phenocrysts from Cerro Uturuncu

*Mike Sholtis*- Internal Structure of the Tocantins rhodonite garnets

*Eric Sikes*- Across-arc variation of the basalts of the Mogollon-Datil Volcanic Field, New Mexico

*Jeremiah Cousins*- Geochemical variation of inclusions and growth zones in the Tocantins rhodonite garnets

*Sourav Krishna Nandi*- Petrographic characterization of a mafic dike swarm within the Bursum caldera, New Mexico

## **FORMER STUDENTS**

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### **Undergraduate**

*Erica Gerweck*- Volcanic evolution of the Prairie Creek Lamproite, Arkansas

*Cody Gibson*- Petrology of Paleozoic Shales near Mount Ida, Arkansas

*Emily Salings*- Petrology and Geochemistry of the Ignimbrites of the Mogollon-Datil Volcanic Field, New Mexico

*Scott Healy*- Military Geology of the Civil War Battle at Pea Ridge 1862