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Jackie M Wrage

Education

2018–current PhD student | Dept. of Earth and Environmental Sciences, University of Michigan, Ann Arbor
Research themes: Experimental Petrology, Economic Geology

2012–2015 B.S. Geosciences | North Dakota State University, Fargo
GPA - 3.95/4.0 (Summa Cum Laude); chemistry minor

Honors

Mar 2019 Selected as the Graduate Student Representative for the UM Earth Dept. Diversity, Equity, & Inclusion Committee

Mar–Dec 2016 Awarded a Student Fulbright Research Grant: Universidad de Chile in Santiago

Dec 2015 Selected as the NDSU Winter Commencement Speaker

Fall 2015 NDSU Dept. of Geosciences Allan C. Ashworth Scholarship

2014 – 2015 NDSU College of Science & Math Ambassador

Travel, field experience

Summer 2019 Conducting experiments at Leibniz University in Hannover, Germany

May 2019 Nipigon area and Coldwell Alkalic Complex field trips, ON, ILSG conference

Oct/June 2018 S-XANES analyses, Advanced Photon Source, Argonne National Lab, IL

Summer 2017 Field work for the Fort Steele 1:24,000-scale quadrangle, south-central WY

Nov 2016 Field work in the El Tatio geyser field, Atacama Desert, northern Chile

Nov 2016 Toured four ore deposits in north-central Chile on the University of Chile Economic Geology field trip

Oct 2016 Toured the Los Pelambres giant porphyry Cu-Mo mine, central Chile

Sept 2015 Eastern North Dakota geology field course

Sept 2014 Field Geology geological mapping course, southwest of Dickinson, ND

Oct 2013 Southeast Minnesota/Iowa Paleontology field course

Sept 2013 North Shore Lake Superior field course, northeast MN and Ontario, Canada

Outreach

2018/2019 Director of Outreach – U. Michigan Association for Women in Science chapter: Young Scientists' Expo at Forsythe Middle School in Ann Arbor, MI

- Organize volunteers and demonstrations, co-lead after school mentoring program, write grants for supplies, order materials, plan science fair expo

June 2018 Organized and led a two-day geology field trip for middle schoolers from my hometown in rural North Dakota, southeast ND

Conferences

May 2019	Poster presentation–Institute on Lake Superior Geology conference, Terrace Bay, ON
Mar 2019	Poster presentation – Prospectors & Developers Association of Canada Student Minerals Colloquium, Toronto, ON [poster won 3rd place]
Aug 2018	Poster presentation – Gordon Research Conference, Waterville Valley, NH
Nov 2015	Oral presentation – GSA conference, Baltimore, MD
Mar 2015	Poster presentation – ACS conference, Denver, CO
Oct 2014	Attended GSA conference, Denver, CO

Professional memberships

- * Geochemical Society
- * American Association of Petroleum Geologists (AAPG)
- * Society of Economic Geologists (SEG)
- * Geological Society of America (GSA)
- * Association of Women in Science (AWIS)

Coursework

- * Mineralogy & petrology
- * Structure
- * Sedimentology/stratigraphy
- * Intro to GIS
- * Organic chemistry
- * Inorganic chemistry
- * Physical chemistry
- * Geochemistry
- * Soil genesis
- * Field geology
- * Calculus (I, II, III)
- * Isotope geochemistry
- * Determinative methods
- * Renewable Energy Policy

Skills

Language: English, fluent Spanish

Analytical/experimental equipment

- * Electron probe microanalysis (EPMA)
- * Scanning electron microscopy (SEM)
- * Internally heated pressure vessels (IHPV)
- * X-ray fluorescence & diffraction (XRF, XRD)

Computer programs

- * ArcGIS
- * Neuralog, Petra – well log visualization & management
- * Adobe Illustrator
- * Geochemists Workbench
- * PHREEQC – aqueous geochemistry modelling
- * Python, R, Java, HTML experience

Relevant work & research experience

PhD research

Aug 2018 – current | Advisor: Dr. Adam Simon – University of Michigan, Ann Arbor, MI

Project I: Extending the sulfur-in-apatite oxybarometer for intermediate magma compositions: Reconstructing redox processes in subduction zones.

- Conducting apatite crystallization experiments in internally heated pressure vessels (IHPVs) at controlled redox (fO_2) conditions to study the behavior and partitioning of sulfur between dacite melt and apatite
- Quantifying sulfur content in apatite using EPMA, measuring $S^{6+}/\Sigma S$ ratios in apatite using S-XANES

Project II: Redox condition of Archean arc-magmatic systems: constraints from sulfur-in-apatite oxybarometry | Collaboration with Dr. Jeremy Richards and PhD student Xuyang Meng at Laurentian University, Sudbury, ON

- Measuring $S^{6+}/\Sigma S$ ratios in apatite inclusions in zircon using S-XANES
- Comparing the redox signals recorded in apatite inclusions in zircon between Proterozoic and Phanerozoic arc-related igneous rocks

Wyoming State Geological Survey

Oct 2017 – Jun 2018 | Supervisors: Dr. Ranie Lynds, PG, & Rachel Toner, PG – Laramie, WY

Contractor: Upper Cretaceous unconventional reservoir project

- Created the base map of the subsurface in the Powder River Basin for use in future WSGS unconventional oil and gas surveys and studies

May – Sep 2017 | Supervisor: Dr. Ranie Lynds, PG

Contractor: StateMap program – mapping the Fort Steele 7.5' quadrangle

- Conducted field work and assisted in publishing a 1:24,000-scale map

Student Fulbright Research Grant

Mar – Dec 2016 | Advisor: Dr. Martin Reich, Professor of Geology, Universidad de Chile, Santiago, Chile

- Implemented geochemical tools to investigate structural controls on geothermal fluid development in the Southern Volcanic Zone of Chile
- Published results as first author in the journal *Chemical Geology*

Hopkins Soil Lab

May – Nov 2015 | Advisors: Dr. David Hopkins & Dr. Tom DeSutter, Dept. of Soil Science, NDSU, Fargo ND

- Developed and implemented methods for making soil thin sections to analyze micromorphology of salt-affected soils

Grants/fellowships received

May 2019	Institute on Lake Superior Geology student travel grant
Apr 2019	National Science Foundation Graduate Research Fellow
Mar 2019	Graduate Student Fellowship – Society of Economic Geologists
Mar 2019	International Institute Fellowship for research abroad summer 2019
Mar 2019	U-Michigan Rackham pre-candidate graduate research grant
Feb 2019	U-Michigan Rackham travel grant
Dec 2018	Scott Turner Award in Earth & Environmental Sciences
Aug 2018	Rackham Merit Fellow at the University of Michigan

Publications

Perez-Moreno, R., Reich, M., Daniele, L., Morata, D., Held, S., Wrage, J. Stable isotope and anthropogenic tracer signature of waters in an Andean geothermal system. *Chemical Geology*, *under review*.

Lynds, R.M., and Wrage, J.M., 2017. Preliminary geologic map of the Fort Steele quadrangle, Carbon County, Wyoming. Wyoming State Geological Survey Open File Report 2017-5, 1:24,000-scale.

Wrage, J., Tardani, D., Reich, M., Daniele, L., Arancibia, G., Cembrano, J., Sanchez-Alfaro, P., Morata, D., Perez-Moreno, R., 2017. Geochemistry of thermal waters in the Southern Volcanic Zone, Chile—Implications for structural controls on geothermal fluid composition. *Chemical Geology* 466, 545–561.

Tardani, D., Reich, M., Deditius, A., Chryssoulis, S., Sánchez-Alfaro, P., Wrage, J., 2017. Cu-As decoupling in an active geothermal system: a link between pyrite and fluid composition. *Geochimica et Cosmochimica Acta* 204, 179–204.