

ANNE HOLLAND MENEFFEE

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EDUCATION

University of Michigan, Department of Civil and Environmental Engineering Ann Arbor, MI
Dissertation: Carbon Mineralization in Fractured Basalt
Ph.D., Environmental Engineering 2020
M.S.E., Environmental Engineering 2016
University of Virginia, School of Engineering and Applied Science Charlottesville, VA
B.S., Civil & Environmental Engineering | Minor, Global Sustainability | Highest Distinction 2015

EXPERIENCE

Assistant Professor Aug 2021 – Present	Penn State Department of Energy and Mineral Engineering <i>Co-funded faculty in the Institutes of Energy and the Environment</i>
Director's Postdoctoral Fellow Aug 2020 – Aug 2021	Los Alamos National Laboratory <i>Project: Geochemical-Geomechanical Feedback in Stressed Fracture Systems</i>
Graduate Research Assistant Aug 2015-2020 Advisor: Dr. Brian Ellis	Michigan Department of Civil and Environmental Engineering <i>Integrated high-pressure experiments and reactive transport modeling to evaluate geochemical controls on CO₂ mineralization in fractured basalts.</i>
Graduate Research Fellow Jan-May 2019 Advisor: Dr. Bill Carey	Los Alamos National Laboratory <i>Conducted triaxial shear experiments to evaluate how fractures generated under subsurface stress conditions respond to penetration of reactive fluids.</i>
Research Assistant May 2015-July 2015 Advisor: Dr. Andres Clarens	Virginia Environmentally Sustainable Technologies lab (UVa) <i>Applied life cycle assessment and techno-economic analysis to evaluate the sustainability of systems-level carbon management strategies.</i>

PUBLICATIONS (Google scholar: 128 total citations; h-index 6; i10-index 6)

- Menefee, A.H.**; Ellis, B.R. Carbon mineralization in reactive silicate zones. *ACS Environmental Science and Technology - Engineering* **2021**, 1(8), 1193-1204.
- Menefee, A.H.**; Welch, N.J.; Frash, L.P.; Hicks, W.; Carey, J.W.; Ellis, B.R. Rapid mineral precipitation during shear fracturing of carbonate-rich shales. *Journal of Geophysical Research: Solid Earth* **2020**, 125(6).
- Menefee, A.H.**; Ellis, B.R. Regional-scale greenhouse gas utilization strategies for enhanced shale oil recovery and carbon management. *Energy & Fuels* **2020**, 34(5), 6136-6147.
- Menefee, A.H.**; Ellis, B.R. Wastewater management strategies for sustained shale gas production. *Environ. Res. Lett.* **2020**, 15 (2), 024001.
- Menefee, A.H.**; Giammar, D.E.; Ellis, B.R. Permanent CO₂ trapping through localized and chemical gradient-driven basalt carbonation. *Environmental Science & Technology* **2018**, 52 (15), 8954–8964.
- Bielicki, J.M.; Langenfeld, J.K.; Tao, Z.; Middleton, R.S.; **Menefee, A.H.**; Clarens, A.F. The geospatial and economic viability of CO₂ storage in hydrocarbon depleted fractured shale formations. *International Journal of Greenhouse Gas Control* **2018**, 75, 8–23.
- Xiong, W.; Wells, R.K.; **Menefee, A.H.**; Skemer, P.; Ellis, B.R.; Giammar, D.E. CO₂ mineral trapping in fractured basalt. *International Journal of Greenhouse Gas Control* **2017**, 66, 204–217.
- Menefee, A.H.**; Li, P.; Giammar, D.E.; Ellis, B.R. Roles of transport limitations and mineral heterogeneity in carbonation of fractured basalts. *Environmental Science & Technology* **2017**, 51 (16), 9352–9362.
- Adeoye, J.T.; **Menefee, A.H.**; Xiong, W.; Wells, R.K.; Skemer, P.; Giammar, D.E.; Ellis, B.R. Effect of transport limitations and fluid properties on reaction products in fractures of unaltered and serpentinized basalt exposed to high P_{CO2} fluids. *International Journal of Greenhouse Gas Control* **2017**, 63, 310–320.

10. Wilkins, R.; **Menefee, A.H.**; Clarens, A.F. Environmental life cycle analysis of water and CO₂-based fracturing fluids used in unconventional gas production. *Environmental Science & Technology* **2016**, *50*(23), 13134-13141.

CONFERENCE PROCEEDINGS

1. Welch, N.J.; Frash, L.P.; Meng, M.; Li, W.; **Menefee, A.H.**; Wigand, M.; Carey, J.W. Live oil and methane production from fractured shale cores. Proceedings of the Unconventional Resources Technology Conference, Houston, TX, USA, July 26-28, 2021.
2. Welch, N.J.; Frash, L.P.; **Menefee, A.H.**; Carey, J.W. Triaxial direct shear fractured Marcellus (MSEEL) shale- Peak and residual shear strength, permeability, and hydroshear potential. Proceedings of the Unconventional Resources Technology Conference, Denver, CO, USA, July 22-24, 2019.
3. **Menefee, A.H.**; Giammar, D.E.; Ellis, B.R. Controls on mineral carbonation reactions in basalt fracture networks. Proceedings of the 14th International Conference on Greenhouse Gas Control Technologies (GHGT-14), Melbourne, Australia, October 21-25, 2018.
4. **Menefee, A.H.**; Ellis, B.R. Regional-scale GHG utilization strategies for enhanced shale oil recovery and sustained carbon management. Proceedings of the 14th International Conference on Greenhouse Gas Control Technologies (GHGT-14), Melbourne, Australia, October 21-25, 2018.
5. Langenfeld, J.K.; Bielicki, J.M.; Tao, Z.; Middleton, R.S.; **Menefee, A.H.**; Clarens, A.F. Response of integrated CO₂ capture and storage systems in saline aquifers and fractured shale formations to changes in CO₂ capture costs. *Energy Procedia* **2017**, *114*, 4099–4105.

CONFERENCE PRESENTATIONS [Oral presentations unless noted otherwise]

1. **Menefee, A.H.**; Carey, J.W.; Welch, N.J.; Frash, L.; Ellis, B.R. Geochemical-geomechanical feedback in stressed fracture systems. American Geophysical Union Fall Meeting, virtual, December 2021.
2. **Menefee, A.H.**; Welch, N.J.; Frash, L.P.; Hicks, W.; Carey, J.W.; Ellis, B. R. Rapid mineral precipitation during direct shear fracturing of carbonate-rich shales. American Geophysical Union Fall Meeting, San Francisco, CA, December 9, 2019.
3. **Menefee, A.H.**; Welch, N.J.; Frash, L.P.; Hicks, W.; Carey, J.W.; Ellis, B. R. “Decarbonizing energy through engineered subsurface systems.” Association of Environmental Engineering and Science Professors (AEESP) Conference, Phoenix, AZ, May 16, 2019. [*Poster presentation*]
4. **Menefee, A.H.**; Ellis, B. R. “Impact of reactive silicate zones on CO₂ trapping in natural basalt.” American Geophysical Union Fall Meeting, Washington, D.C., December 14, 2018. [*Poster presentation*]
5. **Menefee, A.H.**; Giammar, D.E.; Ellis, B.R. “Controls on mineral carbonation reactions in basalt fracture networks.” 14th International Conference on Greenhouse Gas Control Technologies (GHGT-14), Melbourne, Australia, October 24, 2018.
6. **Menefee, A.H.**; Ellis, B. R. “Regional-scale GHG utilization strategies for enhanced shale oil recovery and sustained carbon management.” 14th International Conference on Greenhouse Gas Control Technologies (GHGT-14), Melbourne, Australia, October 23, 2018. [*Poster presentation*]
7. **Menefee, A.H.**; Giammar, D.E.; Ellis, B.R. “Hyper-localized carbon mineralization in diffusion-limited basalt fractures.” American Geophysical Union Fall Meeting, New Orleans, Louisiana, December 14, 2017.
8. **Menefee, A.H.**; Giammar, D.E.; Crandall, D.; Ellis, B.R. “Reaction fronts associated with mineral carbonation of fractured basalts.” Association of Environmental Engineering and Science Professors (AEESP) Conference, Ann Arbor, MI, June 22, 2017.
9. **Menefee, A.H.**; Li, P.; Giammar, D.E.; Ellis, B.R. “CO₂ storage in fractured basalt: Coupling experimental analyses with reactive transport modeling.” Goldschmidt Conference, Yokohama, Japan, June 29, 2016.
10. **Menefee, A.H.**; Ellis, B.R. “Unconventional approaches to unconventional resources: Regional-scale waste management strategies for sustainable shale gas development.” Session ENVR010G, American Chemical Society National Meeting, San Diego, CA, USA, March 17, 2016.
11. **Menefee, A.**; Murray, J.; Parekh, S.; Twum-Acheampong, K. “Optimizing Nutrient Recycling of Hydrothermal Algae-to-Biofuel Production Processes.” University of Virginia Civil & Environmental Engineering Research and Design Symposium, Charlottesville, VA. Dec. 2014. [*Poster; first place for "Outstanding Presentation."*]

TEACHING EXPERIENCE

- Instructor, PNG 405/406 (*Rock and Fluid Properties*)** Fall 2021
- Fundamental course introducing students to reservoir rock properties and mechanics; fluid behavior; and fluid-rock interactions, including both lecture (405) and lab (406) components.
- Graduate student instructor, CEE 501 (*Subsurface Energy Systems*)** Winter 2020
- Co-developed and co-taught (with Dr. Brian Ellis) a course covering reservoir geology, flow through porous and fractured media, and fluid-rock interactions in the context of engineered subsurface systems relevant to the energy sector, including energy production and carbon storage.
- Graduate student instructor, CEE 265 (*Sustainable Engineering Principles*)** Fall 2017 & 2018
- Developed homework assignments and exams; held weekly office hours; taught two lectures
- Teaching assistant, CE 2100 (*Intro to Environmental Engineering*)** Spring 2014 & 2015
- Held weekly office hours; assisted students in lab sessions; graded homework assignments
- Undergraduate grader, CE 3710 (*Intro to Geotechnical Engineering*)** Fall 2014

AWARDS AND HONORS

- ProQuest Distinguished Dissertation Award, University of Michigan** 2021
- “Recognize highly accomplished graduate students who have produced exceptional dissertations of outstanding scholarly quality” (10 selected from >800 dissertations submitted each year)
- Director’s Postdoctoral Fellowship, Los Alamos National Laboratory** 2020
- Selected based on strength of accomplishments, proposed research, and potential impact at LANL
- Lamont-Doherty Earth Observatory postdoctoral research fellowship (declined)** 2020
- Richard & Eleanor Towner Prize for Outstanding Ph.D. Research nominee** 2019
- Nominated by the CEE department for the Towner award, a competition across all College of Engineering departments at Michigan that honors creative and outstanding research achievement
- Department of Energy Office of Science Graduate Student Research Award** 2018
- Received funding to work under Dr. Bill Carey at Los Alamos National Lab (appointment Jan-May 2019)
 - Proposal title: “Reaction-driven changes in fracture permeability and geomechanical stability”
- National Science Foundation Graduate Research Fellowship** 2017
- Graduate Support Fellowship, UM Dept. of Civil & Environmental Engineering** 2015
- Rader Award, UVa Dept. of Civil and Environmental Engineering** 2015
- Awarded annually in each engineering department to “fourth-year students who have excelled academically, who have demonstrated a capacity for hard work, and who have shown a willingness and ability to get along with their colleagues.”
- Furman W. Barton Scholarship, UVa Dept. of Civil and Environmental Engineering** 2014
- American Society of Civil Engineers, Richmond Branch Scholarship** 2014
- Chi Epsilon, Civil Engineering Honors Society** 2014
- Shope-Kinnier Scholarship, UVa Dept. of Civil and Environmental Engineering** 2013

PROFESSIONAL ORGANIZATIONS AND SERVICE

- AEESP Conference Student Delegate Co-Chair** Jan-June 2017
- Led the student delegation involved in planning and facilitating the 2017 AEESP (Association of Environmental Engineering and Science Professors) biennial meeting with 700+ attendees
 - Responsibilities included reviewing abstract submissions and organizing sessions; maintaining master databases of attendees; coordinating student efforts from multiple universities; instructing speakers and moderators; monitoring the list serve; registering attendees; and moderating sessions at the event
- Michigan Dept. of Civil & Environmental Engineering Recruitment Committee** 2016-2017
- Organized recruitment activities for visit weekends for accepted Master’s and PhD students

- Journal reviewer** 2017-Present
- *Environmental Science and Technology*
 - *Environmental Science and Technology Letters*
 - *Water Resources Research*
 - *Applied Geochemistry*
 - *International Journal of Greenhouse Gas Control*
- American Geophysical Union, member** 2016-Present
- American Chemical Society, member** 2015-Present
- Society of Women Engineers, member** 2012-Present
- Professional Development Chair, Graduate SWE at UMich 2017-2018
- American Society of Civil Engineers, member** 2012-Present
- Secretary, UVa student chapter, 2013-2014
 - First place, Marr Technical Paper competition, 2015 ASCE Virginia's Conference

RELATED OUTREACH AND PROFESSIONAL PROGRAMS

- Discover Engineering Instructor** 2018-2019
- Led hands-on workshops introducing high school students to the civil engineering profession
 - Chaperoned students funded through the Detroit Area Pre-College Engineering Program
- Graduate Environmental Engineering Network of Professionals, Educators, and Students**
 President, 2016-2017; Member, 2015-present
- Current member and former president of GrEENPEAS. Facilitated networking among EWRE faculty and students, collaboration with other departments, and organized recruiting events for new students
- NextProf Nexus Workshop, Berkeley, CA** Sept. 11-14, 2018
- Selected to participate in the annual NextProf workshop, which provides insight into the academic job market to a diverse cohort of engineering Ph.D. students and recent graduates seeking faculty positions
- IEAGHG Carbon Capture and Storage Summer School, Saskatchewan, Canada** July 17-23, 2017
- Selected as "most outstanding student" in a week-long summer school program on technical, social, economic, political, and environmental aspects of carbon capture and storage
- Research Experience in Carbon Sequestration (RECS)** June 12-20, 2016
- Selected to participate in an intensive 10-day interactive education and training program focused on all aspects of carbon capture, utilization, and storage (sponsored by the US DOE)
- Detroit Area Pre-College Engineering Program (DAPCEP)** Spring 2016
- Worked with a team of CEE graduate students to design and teach a course on water treatment for underrepresented 9th-to-11th grade students in Detroit area schools
- Females Excelling More in Mathematics, Engineering, and Science (FEMMES)** 2015-Present
- Organize activities exposing 3rd- to 6th-grade girls in underserved communities to STEM fields
- Global Water Brigades, UVa** 2013-2015
- Constructed gravity-based water distribution systems to provide safe and accessible drinking water to rural communities in Honduras; designed and led community educational workshops

PROFESSIONAL CERTIFICATION AND WORK EXPERIENCE

- Engineer-in-Training, Virginia Dept. of Professional and Occupational Regulation** 2015
- Draper Aden Associates, Charlottesville, VA – Surveying & Site Planning Intern** May 2014-May 2015
- UVa Facilities Management, Charlottesville, VA – Geospatial Resources Intern** May-Aug 2013
- Infilco Degremont, Inc., Richmond, VA – Municipal Sales and Marketing Intern** Jun-Aug 2011