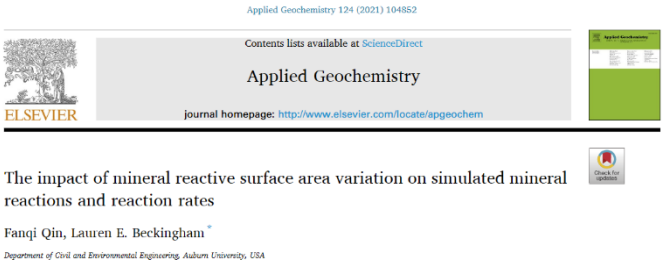
Emerging Investigator Series

International Association of GeoChemistry (IAGC)

Lauren Beckingham, January 2021

Lauren E. Beckingham is an Assistant Professor in the Department of Civil and Environmental Engineering at Auburn University. She holds a Ph.D. and MA in Civil and Environmental Engineering from Princeton University and a B.S. in Environmental Engineering from Michigan Technological University. Prior to joining Auburn, she was a Geochemical Postdoctoral Fellow at Lawrence Berkeley National Laboratory. Her expertise and interests are in understanding water–rock interactions in environmental systems, particularly in subsurface energy systems including geologic CO_2 sequestration and compressed energy storage. Her laboratory is currently supported by the NSF, including a 2019 CAREER award, ACS PRF, and DOE. Her recent paper entitled "The impact of mineral reactive surface area variation on simulated mineral reactions and reaction rates" was published in *Applied Geochemistry*, and is featured together with the Emerging Investigator Series.

Dr. Hang Deng, Lawrence Berkeley National Laboratory, serves as coordinator for her award, and interviews Dr. Beckingham below.



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The impact of mineral reactive surface area variation on simulated mineral reactions and reaction rates

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Hang: What excites you most about this work specifically published in Applied Geochemistry?

Lauren: I'm really excited about the potential for this work to improve reactive transport simulations of natural and engineered environmental systems. Reactive surface area is one of the largest uncertainties when it comes to simulating mineral reaction rates where estimates span several orders of magnitude. Accurately estimating reactive surface area is challenging where we recently found multi-scale imaging

Lauren Beckingham during set up of in-situ testing component for new NSF-MRI supported Zeiss 620 Versa nanoCT.

PhD student Parisa Asadi reconstructing CT images taken with NSF-MRI supported Zeiss 620 Versa nanoCT

of accessible mineral surface area provides good estimates of reactive surface area. However, this is time and resource intensive. In this work we consider the implications of variations in reactive surface area values on simulation results. We observe that refined estimates of reactive surface area may only be needed for some mineral phases, depending on the timescale of interest. This finding helps to focus characterization efforts and resources needed to parameterize simulations.

Hang: You were awarded an NSF early career grant, and it's on a related topic. Can you share with us the story behind this project or what went into developing this project?

Lauren: The topic for my NSF early career grant grew out of collaborative work from my postdoc at Lawrence Berkeley National Laboratory. In that work, we used a multi-scale imaging approach to quantify accessible mineral surface areas in porous media and found they improved simulation of mineral reaction rates observed in laboratory dissolution experiments in porous media. Based on that initial observation, we are now seeking to understand how surface areas evolve as reactions progress as a means towards improving reactive transport simulations of mineral reactions in porous media.

Hang: Can you tell us a bit about your team and share with us some of the ongoing research that your research group is working on?

Lauren: We focus on enhancing fundamental understanding of mineral reactions, reaction rates, and changes in flow properties in porous media in the context of subsurface energy systems including CO_2 sequestration and energy storage, for example. We use multi-scale imaging to enhance understanding of the properties of porous media systems and inform reactive transport simulations and laboratory experiments to consider reactions at conditions mimicking field sites. As such, our work is inherently interdisciplinary and requires multiple skills sets where

Lauren Beckingham, PhD students Fanqi Qin and Chidera Iloejesi, and MS student Olivia Brunhoeber at Fall AGU Meeting in San Francisco in December 2019.

PhD students, Fanqi Qin (left) and Md. Fahim Salek (right) in the lab with the Parr batch reaction system.

most students get experience with imaging, numerical simulations and laboratory experiments. Our team is equally diverse where differences in experiences and background really help to strengthen our group and work. I'm biased, but my students agree we have the best team! I'm always open to new graduate students and am really proud of the PhD, MS, and undergraduate students currently in the group!

Hang: As an early career investigator, any thoughts or advice you want to share with the audience of Applied Geochemistry, especially early career folks (e.g., your experiences of building your own research program, establishing collaborations, or how to make the best of conferences for professional networking)?

Lauren: In terms of developing your research program, I think it's important to find a balance between building on your strengths and developing new skills and expertise. This definitely takes time and can be strengthened through feedback and collaborations. While critiques can be challenging, they provide a valuable opportunity to grow and improve. Collaborations are also a great opportunity to think about your work from a different perspective. Balance here is also important as you need to ensure your independent work is also thriving.

WRISES (Water-Rock Interactions in Subsurface Energy Systems) group in January 2021. back row, left to right: PhD student Parisa Asadi, undergraduate research fellow Shelby Wales, undergraduate researcher Presleigh Wiley, PhD student Chidera Iloejesi, PhD student Md. Fahim Salek. Front row, left to right: PhD student Parisa Asadi, undergraduate research fellow Shelby Wales, undergraduate researcher Presleigh Wiley, PhD student Chidera Iloejesi, PhD student Md. Fahim Salek. Front row, left to right: undergraduate researcher Zitong Zhao, undergraduate research fellow Mollie Sabo, PI Lauren Beckingham, MS student Olivia Brunhoeber, PhD student Fanqi Qin. Not pictured: PhD student Mukseet Mahmood, undergraduate researcher Will Beattie, undergraduate researcher Kylie Moore, undergraduate researcher Hanzhao Li.

The aim of the **IAGC Emerging Investigator Series** is to highlight excellent work by independent researchers in their early career that bring new insights into the field of geochemistry or to promote geochemical applications. Multidisciplinary work related to applied geochemistry, biogeochemical processes, and environmental geochemistry are also highly welcomed. Featured articles as well as the authors as emerging investigators will be extensively advertised to diverse disciplines and communities through multiple platforms of the journal and the International Association of GeoChemistry.