

Front & Center!

Quarterly Science Newsletter

Frontline Geoscience within the Geology, Energy & Minerals (GEM) Science Center

Center Director Note...



Welcome to the second issue of our USGS Geology, Energy & Minerals Science Center (GEMSC or GEM) quarterly newsletter. The GEMSC has had a productive quarter, releasing 12 publications, 6 data releases, 2 software releases, and presenting at Southeast GSA, the AAPG Sustainability Symposium, and the 30th Global Methane Initiative Coal Subcommittee meetings. We have onboarded 3 new employees this quarter and plan to advertise 2 open positions that we hope you will check out (see herein for more information)!

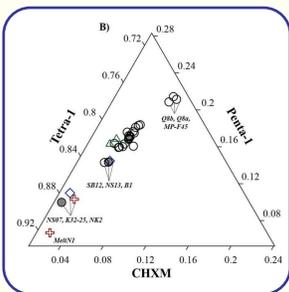
As always, subscribing to this quarterly newsletter is optional. If you know anyone who may be interested in receiving this newsletter on a quarterly basis, please refer them to the “[GEMSC Quarterly Newsletter](#)” online [subscription form](#). The form is easy to use and is the best way to maintain subscription status going forward.

To explore additional GEM science not found within this newsletter, please visit our [USGS GEMSC website](#). With the GEM Center merger complete, project and task leads now frequently update and improve website content with a focus on new publications, data, and project descriptions. I look forward to this ongoing communication of GEM science to you, as well as the opportunity to address any comments, questions, or concerns that you may have in regards to the innovative, “cutting edge” work showcased both within this newsletter and on the website.

~ Tina Roberts-Ashby, PhD, Center Director of the GEMSC

Science Spotlight...

Geochemical Advances in Arctic Alaska Oil Typing – North Slope Oil Correlation and Charge History



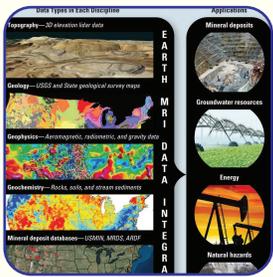
GEMSC scientists Palma Botterell, Dave Houseknecht, and co-authors recently published an article in *Marine and Petroleum Geology* investigating the integration of advanced geochemical and statistical tools to classify genetic relationships and characterize compositional properties of oils from numerous producing fields, new discoveries, and well tests across the North Slope, AK. Source-diagnostic biomarker parameters were used to correlate oils into five genetically distinct oil families by primary source rock, including oils from the giant Pikma-Horseshoe oil discovery (>1 billion barrels recoverable). Subsequent application of diamondoid analyses revealed several co-sourced and mixed-maturity oil accumulations with postmature charge contributions (diamondoid-rich and biomarker-poor). Variations in source organofacies also were recognized in the Shublik, Kingak, and Cretaceous oil families. Results identify complex charging histories and may be useful for anticipating oil charge composition in stratigraphic traps with low-permeability sandstone reservoirs, where oil gravity and other chemical parameters may influence economic viability. Full article [HERE](#)



Photo: Oil Field Separators, Jenna Shelton, Research Hydrologist, USGS.

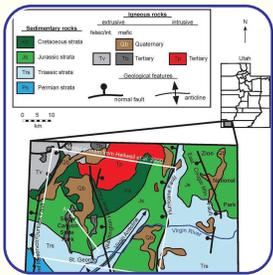
Science Spotlight (Continued)...

Earth Mapping Resources Initiative (Earth MRI)



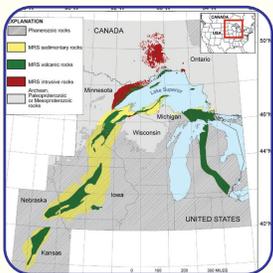
GEMSC scientists Jane Hammarstrom, Connie Dicken, Nora Foley, Bernard Hubbard, Joshua Rosera, and Laurel Woodruff are working in partnership with the Association of American State Geologists and USGS colleagues in other Centers to identify focus areas for acquisition of new geologic mapping, airborne magnetic and radiometric surveys, and lidar data. The goal of **Earth MRI** is to improve our knowledge of the geologic framework of the United States and to identify areas that may have potential to contain undiscovered critical mineral resources. To date, Earth MRI is supporting 80 projects [see [Earth MRI | Acquisitions Viewer map](#) (usgs.gov)]. A [report](#) and [data release](#) describing focus areas for 11 critical minerals throughout the conterminous United States for Phases 1 and 2 of the ongoing project are available.

Potential Pb^{+2} mobilization, transport, and sequestration in shallow aquifers impacted by multiphase CO_2 leakage: A natural analogue study from the Virgin River Basin in Southwest Utah



GEMSC scientists Michelle Plampin, Madalyn Blondes, and Bill Craddock, along with a collaborator from Lawrence Berkeley National Laboratory, recently published a paper in a special issue of the journal *Petroleum Geoscience* about potential risks posed to groundwater resources by possible leakage of stored CO_2 and/or native brines from deep geologic storage formations into shallow aquifers. The paper investigated a natural analogue site in southwestern Utah where moderately salty and CO_2 -rich water is upwelling into a shallow aquifer system. Numerical modeling of multiphase flow and reactive transport at the site showed that introduction of CO_2 into the aquifer system could mobilize metals from naturally occurring subsurface accumulations by various mechanisms, but that re-precipitation can effectively sequester both the metals and the CO_2 . Please contact Michelle at mplampin@usgs.gov for a copy of the publication. Simulation input and output files are available as a USGS model archive data release, available [HERE](#).

Mineral deposits of the Mesoproterozoic Midcontinent Rift System in the Lake Superior region – Metallogeny of the prolifically mineralized Keweenaw LIP



Research by GEMSC scientists Laurel Woodruff, Klaus Schulz, Suzanne Nicholson, and Connie Dicken focusing on hydrothermal and magmatic mineral deposits associated with the Mesoproterozoic Midcontinent Rift System (MRS) in the Great Lakes region was recently published in *Ore Geology Reviews* and was featured as the “**LIP of the Month**” for February by the Large Igneous Province Commission. The Keweenaw large igneous province (LIP) of the MRS is the most prolifically mineralized LIP on Earth. MRS mineral deposit data from the [USGS Mineral Resources Data System](#) and the [Ontario Northern Development and Mines Mineral Deposit Inventory](#) were released in July as [Open-File Report 2020-1069](#). These data were then used to develop a space/time classification for MRS mineral deposits, many of which are significant past, present, and likely future providers of critical minerals.

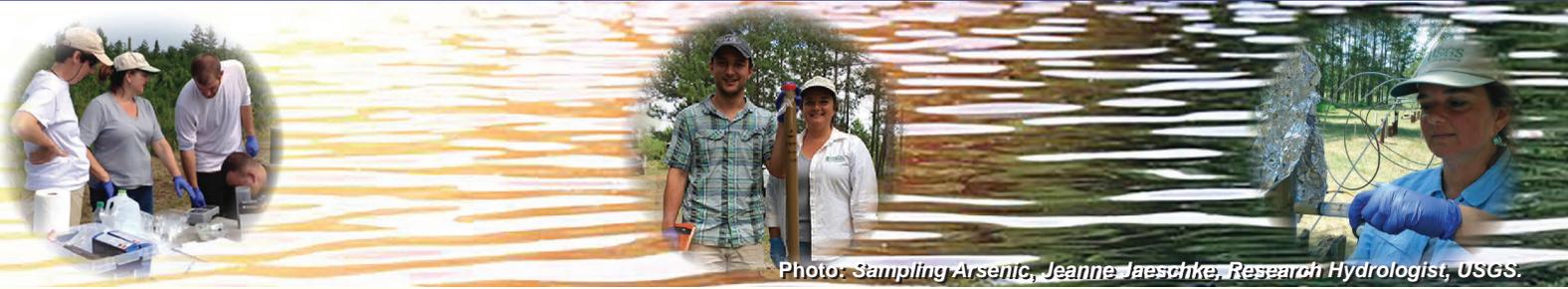


Photo: Sampling Arsenic, Jeanne Jaeschke, Research Hydrologist, USGS.

Scientist Profile ~ Isabelle Cozzarelli...

I am a research hydrologist with MS and PhD degrees in Environmental Sciences-Geochemistry from the University of Virginia (UVA) and a BS in Geomechanical Engineering from the University of Rochester. This interdisciplinary educational background prepared me well for a research career at USGS. My research focuses on how anthropogenic activities affect the health of the environment and humans. My most significant work has been my body of interdisciplinary research on the biogeochemical transformation of complex contaminant mixtures, such as of hydrocarbons, biofuels, oil and gas wastes, and landfill leachate, and how contaminants from these mixtures can affect water quality, ecosystems, and human health. Many of these studies are complex and require collaborations with large interdisciplinary teams across multiple DOI bureaus, other State and Federal agencies, academic institutions, and non-profit organizations. Working with these large teams of creative and innovative scientists is energizing and has allowed me to produce the most impactful science that informs our ability to predict and mitigate environmental impacts. To provide critical scientific knowledge and data to address the significant environmental challenges facing our society, we need the expertise of interdisciplinary teams of scientists and programs. Working with such teams is one of the aspects of my career that I most enjoy.

My research involves both field and laboratory work and employs an experimental approach aimed at answering fundamental science questions that have practical applications. My lab group is the [Reston Biogeochemical Processes in Groundwater Lab](#). Our approach focuses on quantifying rates and identifying biogeochemical processes with potential ecological and health impacts. Examples include the transformation of hydrocarbons to oxidized metabolites and the release of geogenic arsenic from sediments into groundwater during iron reduction. Some of the exciting places my team has worked include a gasoline spill site in New Jersey, a crude-oil pipeline rupture in Minnesota, a landfill in Oklahoma, and

oil and gas wastewater spills in West Virginia and North Dakota. Because natural processes take time, studies at these sites take years to decades. These long-term, interdisciplinary investigations conducted out of our research labs provide impartial scientific information to resource managers, policymakers, and the public, and contribute to finding solutions to scientific and environmental problems. Although my research doesn't take me to exotic and picturesque locations, seeing my research applied to real environmental problems is very gratifying.

I have felt lucky to have had strong female role models that helped shape my career, including my advisor Janet Herman at UVA and my first supervisor, who recruited me to USGS, Mary Jo Baedecker. Both of these incredible women are supporters and friends for life. Recently I was asked what my advice to early career scientists would be. My answer is to seek out mentors and role models wherever you can. Mentors can be helpful throughout the different stages of your career to help you network, find resources and career opportunities, and navigate career setbacks and challenges. You can benefit from multiple mentors during different phases of your career. And becoming a mentor yourself can be very rewarding and provides another opportunity to learn something new. By collaborating with university colleagues, I have been able to mentor many students, and I always learn something new from these interactions. Seeing students and postdocs I have mentored go on to be science leaders in their own right, in positions ranging from private environmental consulting and professorships at large research institutions and small teaching colleges to Dean of Sciences in academia, is extremely rewarding.

After 35 years in the Water Mission Area I am excited to have found a new home in the Geology, Energy & Minerals Science Center. It has been a great transition; I feel empowered to do my best science to help the Nation address the many environmental challenges that face us.



Photo: Isabelle Cozzarelli, Research Hydrologist, USGS GEMSC.

"Water plume sampling for arsenic at Bemidji oil spill field site, Minnesota"



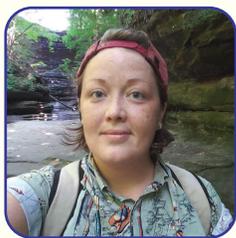
Photo: Organic Petrology Laboratory, Javin Hatcherian, Physical Science Technician, USGS.

Employee Corner ~ Cassandra Harris



Cassandra is from Atlanta, Georgia, and was hired as a Biologist through the USGS Recent Grad Pathways Program to work in the [Reston Microbiology Lab \(RML\)](#). She has a BS in Marine Science from Savannah State University and an MS in Marine Studies from the University of Delaware. Cassandra was an NSA contractor working at USGS RML from 2019-2021, where she focused on projects related to the environmental health effects of oil and gas development and per- and polyfluoroalkyl substances (PFAS) contamination. Cassandra likes gardening and watching anime.

Employee Corner ~ Amanda Herzberg



Amanda grew up in Iowa and moved to Reston from Lincoln, Nebraska. She joined the GEM Science Center as a Chemist for the Oil and Gas Waters project and the [Brine Research Instrumentation and Experimental \(BRInE\) Laboratory](#). Amanda received a BS in Chemistry from Northwest Missouri State University and worked at the Nebraska Department of Agriculture in the Feed, Fertilizer, and Agricultural Lime Laboratory. Amanda enjoys trying new foods and drinks, meeting new people, and exploring different parks and places throughout the country.

Employee Corner ~ Evan Bargnesi



Evan is from Connecticut and currently resides in California while he waits to relocate for his new position as [Associate Science Center Director for the GEM Science Center](#). Before joining the USGS, he worked as a geologist for 10 years on hydrocarbon exploration and development in California. Evan has an MS in Geology from the University of Kansas and a BS in Geology from Union College in upstate New York. Evan enjoys traveling, hanging out with his dog, wilderness backpacking, and playing games of all kinds - especially chess and poker.

Center Achievements & Recognition...

It's with great admiration and pleasure to announce that Jane Hammarstrom has recently achieved the unbelievable milestone of **50 Years of Government Service!**

Jane is an essential part of the GEM team - her mineralogical knowledge and expertise has been invaluable throughout her amazing USGS career. Congratulations Jane!

Join Our Team! ~ Job Opportunities...

The GEM Science Center often has opportunities for new hires. We currently are advertising a position for a GS-7 or 9 Physical Scientist who will collect samples of rocks, soils, and stream sediments and perform chemical analyses of these and other samples. The vacancy is advertised in USA-JOBS and closes on May 7. Additionally, we anticipate an available position in the near future for a Data Management Scientist at the GS-9 level. Watch USAJOBS for this and other job openings!

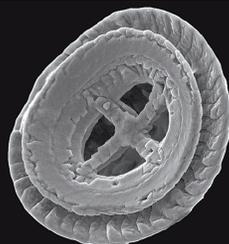


Photo: Scanning electron microscope image of a nanofossil (*Campylosphaera dela*) from the Eocene Nanjemoy Formation, courtesy of Jean Self-Trail, USGS.

Quarter 2 Publications and Data Releases by GEMSC Authors...

Publications (USGS and Outside)

Computational Methodology to Analyze the Effect of Mass Transfer Rate on Attenuation of Leaked Carbon Dioxide in Shallow Aquifers:

<https://doi.org/10.14311/AP.2021.61.0077>

Draft Genome Sequence of *Bordetella* sp. Strain FB-8, Isolated from a Former Uranium Mining Area in Germany:

<https://doi.org/10.1128/MRA.01035-19>

Enhanced Mobilization of Arsenic from Bituminous Coal Fly Ash in the Presence of Dissolved Organic Matter:

<https://doi.org/10.1016/j.apgeochem.2021.104950>

Geochemical Advances in Arctic Alaska Oil Typing – North Slope Oil Correlation and Charge History:

<https://doi.org/10.1016/j.marpetgeo.2020.104878>

Implications of Aggregating and Smoothing Daily Production Data on Estimates of the Transition Time between Flow Regimes in Horizontal Hydraulically Fractured Bakken Oil Wells:

<https://doi.org/10.1007/s11004-020-09909-7>

Organic Petrographic Evaluation of Carbonaceous Material in Sediments of the Kinnickinnic River, Milwaukee, WI, U.S.A.:

<https://doi.org/10.1016/j.scitotenv.2021.145704>

Permeability Determination for Potential Interaction between Shale Gas Wells and the Coal Mine Environment due to Longwall-induced Deformations:

<https://doi.org/10.1007/s11053-021-09859-9>

Potential Pb⁺² Mobilization, Transport, and Sequestration in Shallow Aquifers Impacted by Multiphase CO₂ Leakage: A Natural Analogue Study from the Virgin River Basin in Southwestern Utah:

<https://pubs.er.usgs.gov/publication/70219207>

Rapid-Response Unsaturated Zone Hydrology: Small-Scale Data, Small-Scale Theory, Big Problems:

<https://doi.org/10.3389/feart.2021.613564>

Syntrophotalea acetylenivorans sp. nov., a Diazotrophic, Acetylenotrophic Anaerobe Isolated from Intertidal Sediments:

<https://doi.org/10.1099/ijsem.0.004698>

The Role of Hydrates, Competing Chemical Constituents, and Surface Composition on ClNO₂ Formation:

<https://doi.org/10.1021/acs.est.0c06067>

UNSEEN ENEMY: It's Invisible, but the Mercury Assault on the Everglades is Beginning to have Visible Effects on Wildlife and Human Beings:

<https://naples.floridaweekly.com/articles/unseen-enemy/>

USGS Data Releases

Apatite and Zircon Fission Track Data from the Western Brooks Range of Arctic Alaska:

<https://doi.org/10.5066/F7GM86HD>

Data on the Enrichment and Isolation of the Acetylenotrophic and Diazotrophic Isolate *Bradyrhizobium* sp. strain I71:

<https://doi.org/10.5066/P9DUG9O3>

Geochemical Advances in Arctic Alaska Oil Typing – North Slope Oil Correlation and Charge History:

<https://doi.org/10.5066/P91VS1I8>

Geochemical Data for Illinois Basin Coal Samples, 2015–2018 (version 1.1, March 2021):

<https://doi.org/10.5066/P9GUURCK>

Environmental (Hydrogen, Oxygen, and Sulfur) Stable Isotope Data from the Elizabeth Copper Mine Superfund Site, Vermont, USA:

<https://doi.org/10.5066/P9LWA4T7>

Model of Groundwater Flow, Gas Migration, and Reactive Transport in the Virgin River Basin, SW Utah:

<https://doi.org/10.5066/P9ZSPA9D>

USGS Software Releases

Computer Programs for the Assessment of Coal Resources (version 2.0, April 2021):

<https://doi.org/10.5066/P971RL9L>

MapMark Shiny 4:

<https://doi.org/10.5066/P96MN574>