

Quarters 2 & 3, 2023

# Front & Center!

Quarterly Science Newsletter

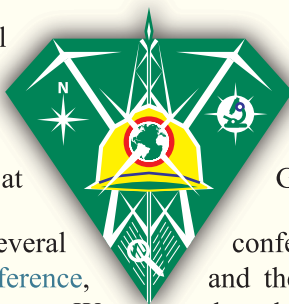
Double Issue:  
Issues #10 & #11

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

## Center Director Note

Welcome to the first double issue of our USGS (U.S. Geological Survey) Geology, Energy & Minerals Science Center (GEM or GEMSC) quarterly newsletter. Stakeholder engagement is a crucial piece of disseminating our science, so thank you for taking the time to read through what we have been working on. I always think of engagement as a two-way street; I encourage you to reach out if you are interested in starting a dialog regarding research collaborations, job opportunities, or newsletter content.

As you may have heard, there is a push for the Federal D.C. area) to report in-person more frequently. nature of our work and our extensive set of already. Utilizing telework and a "hybrid" model has considering the future of science and collaboration at



workforce in the National Capital Region (greater Because of the collaborative, interdisciplinary laboratories (20+), we are often in the office allowed us to maintain a high level of impact while GEM.

In the past two quarters, we were represented at several [Environmental Microbiology Gordon Research Conference](#), We have released 20 publications and 18 data releases. We advertising 2 open positions (*see page 10*).

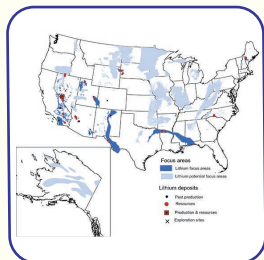
conferences, including [Goldschmidt](#), the [Applied and](#) and the [European Geophysical Union General Assembly](#). onboarded 17 new employees and contractors and are currently

To explore more about what we do, please visit our [USGS GEMSC website](#). If you know anyone who may be interested in receiving this newsletter, or if you would like to adjust your subscription status, please refer to the [online subscription form](#). As always, please reach out to our Center Director directly ([troberts-ashby@usgs.gov](mailto:troberts-ashby@usgs.gov)) with any comments, questions, or ideas for collaboration.

~ Evan Bargnesi, Associate Science Center Director of the GEMSC, on behalf of Tina Roberts-Ashby Ph.D., Center Director of the GEMSC

## Science Spotlight

### Earth Mapping Resources Initiative (Earth MRI)



Map showing lithium focus areas and deposits, courtesy of Jane M. Hammarstrom, USGS, 2023.

The USGS launched the [Earth Mapping Resources Initiative \(Earth MRI\)](#) to modernize the surface and subsurface geologic mapping of the United States, with a focus on identifying areas that may have the potential to contain critical mineral resources. Using readily available geologic, geophysical, geochemical, and mineral deposit data, teams of USGS scientists worked with representatives of State geological surveys to outline focus areas that contain evidence of key features for one or more mineral systems. The newly released USGS Fact Sheet ([Hammarstrom and others, 2023](#)) is the first national map of focus areas classified by mineral systems based on the data compiled in [Dicken and others \(2022\)](#). In addition, information on mineral deposits that produced critical minerals in the past and/or have identified critical mineral resources was compiled from USGS databases, industry reports, and literature sources. Deposits are classified by mineral system, deposit type and focus area. More than 200 deposits have documented critical mineral resources that have not been mined.

Geology, Energy & Minerals Science Center ~ Quarterly Science Newsletter



## Science Spotlight (Continued)

### North American Helium Conference



Official Rocky Mountain Association of Geologists logo.

GEMSC Research Geologist Sean Brennan was one of the organizers for this [Rocky Mountain Association of Geologists](#) meeting, which had over 40 technical presentations on topics such as exploration methods, plays, reservoir characterizations and case studies. Technical sessions featured topics including helium mid-stream, markets, regulation, and financing. In addition, Dr. Brennan gave the first presentation at the meeting, which covered the [USGS helium resources assessment](#). GEMSC Research Geologists Matt Merrill and William Craddock gave talks related to the production and exploration of helium natural resources from lands under Federal, State, and private mineral ownership. More info on the meeting's importance can be seen in the [American Association of Petroleum Geologists \(AAPG\) Explorer](#) and more on the meeting can be found [HERE](#).

### Geoheritage Workshop II



Attendees of the USGS Geoheritage Workshop II.

The [USGS Geoheritage Sites of the Nation Project](#) is funded by the [USGS National Cooperative Geologic Mapping Program \(NCGMP\)](#) and was kicked off in Fiscal Year (FY) 2023 after a geoheritage pilot project in FY2022. This project, led by GEMSC Physical Scientist Christina DeVera, hosted the USGS Geoheritage Workshop II in April 2023 to gather feedback from other Federal agencies, State geological surveys, academia, non-profit organizations, and Tribal communities and collaboratively develop an initial methodology outlining the data standards for geoheritage site selection based on scientific, educational, cultural, economic, and aesthetic values of unique geological features. The geoheritage geospatial product (GGP) will be incorporated into the [USGS U.S. GeoFramework Initiative \(USGI\)](#) to provide an educational and outreach tool to raise awareness of significant geologic sites, communicate the role of geology in our natural heritage, and make geologic mapping and geoscience topics more accessible and relevant to the public. If you are interested in learning more about the project, please contact Christina DeVera at [cdevera@usgs.gov](mailto:cdevera@usgs.gov).

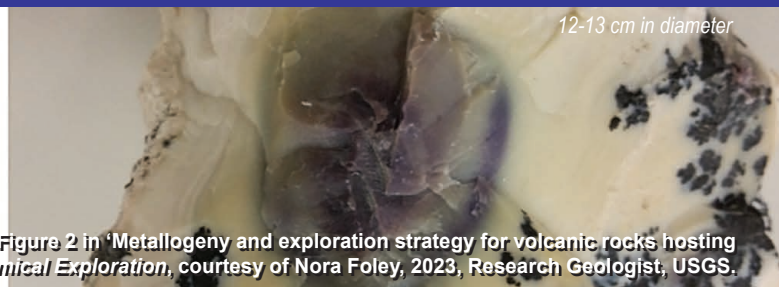
### 2023 Goldschmidt Conference in Lyon, France



Official 2023 Goldschmidt Lyon, France logo.

In mid-July, six GEMSC scientists traveled to Lyon, France, for the Goldschmidt conference. Isabelle Cozzarelli and Bonnie McDevitt co-convoked a session titled: "Anthropogenic contaminants in the environment: geochemical fate, transport, modelling, and novel remediation approaches". Isabelle Cozzarelli gave a talk on the application of waste materials on farmed lands from agriculture, livestock and the oil and gas industries. Bonnie McDevitt discussed the impact of radium in drainage precipitates on remediation of mine lands in Appalachia. Bryan Killingsworth delivered a presentation on the dynamics of sulfide oxidation and its implications for understanding and tracing pyrite oxidation mechanisms via oxygen isotope techniques. Rebecca Stokes chaired a session titled "Critical raw materials for the renewable energy revolution" and discussed her work on strain-induced graphitization. Sarah Jane White chaired a session titled "Bioavailability, toxicity, and environmental behavior of trace metals, and their mechanistic pathways and utility in disease diagnostics" and presented her [Environmental Health Program](#) work on prioritizing critical minerals for study based on data availability and gaps in our understanding of each element's geochemistry, bioavailability, and toxicity. Nadine Piatak gave a talk on the enrichment of germanium and other trace elements in sphalerites from Mississippi Valley-type (MVT) deposits in the United States, and their potential for recovery as byproducts. Kathryn Hobart presented on a portion of her postdoctoral research on critical mineral concentrations in tailings from volcanogenic massive sulfide deposits, focusing on trace cobalt in pyrite and pyrrhotite. Conference information can be found [HERE](#).





Opal nodule showing a core of mainly fluorite plus bertrandite, from Figure 2 in 'Metallogeny and exploration strategy for volcanic rocks hosting world class Be-U-F mineralization at Spor Mountain, Utah, U.S.A.', *Journal of Chemical Exploration*, courtesy of Nora Foley, 2023, Research Geologist, USGS.

## Science Spotlight (Continued)

### Field Work to Retrieve Research Cores in the North Slope of Alaska



Dramatic skies over the remote Slope Mountain #1 core site, 2023.

In June and July, staff from the [Alaska Basins and Petroleum Systems Project](#) conducted field work on the North Slope of Alaska. The major focus of this year's effort was the retrieval of two research cores. This was a joint effort between the [USGS Energy Resources Program](#), [USGS Research Drilling Program](#), and the [State of Alaska Division of Geological & Geophysical Surveys \(DGGS\)](#). The first of these cores (USGS/DGGS Slope Mountain #1) targeted the Cretaceous Nanushuk Formation and was sited behind the Slope Mountain outcrop—one of the best exposures of the formation in the region. The Nanushuk Formation hosts several of the recent, large oil discoveries in this province (the largest U.S. onshore discoveries in >30 years) and remains a focus of active exploration. The core will help to constrain reservoir properties in recent discoveries and inform ongoing exploration efforts. The second core (USGS/DGGS Landslide #3) targeted the Cretaceous Seabee Formation. The Seabee Formation is not only an important petroleum source rock in the region, but also contains a stratigraphic record of a recent greenhouse climate event. Drilling activities will resume in the summer of 2024. After coring activities wound down, a team of USGS scientists spent an additional week working mostly in Arctic National Wildlife Refuge. The objectives of this work included characterization of a) Cretaceous/Paleogene strata, with applications ranging from petroleum reservoir prediction to paleoclimate reconstruction, and b) the active tectonics of the Arctic Alaska province, which are a key to understanding the structural and geodynamic history of the province at longer time scales pertinent to regional petroleum systems.

### Publications on South Texas Coastal Plain Roll-front Uranium Deposits



South Texas rock cores. Photo courtesy of Bernard Hubbard, USGS.

GEMSC scientist, Bernard Hubbard, recently published two lead-authored papers and a data release describing work on critical and industrial minerals related to sandstone-hosted uranium deposits in the south Texas Coastal Plain, also known as roll-front uranium deposits. Between 1955 and 2013, about 8% of U.S. production of uranium was extracted from an estimated 92 sandstone-hosted (i.e., roll-front uranium) mines in Karnes, Live Oak and Atascosa Counties, Texas. Prior to the use of in situ recovery methods, open-pit mine extraction left numerous waste piles and pit craters, some filled with water as lake features on the landscape. Today, some of the host rocks formerly mined for uranium (e.g., Jackson Group) also host bentonite and zeolite deposits which are still mined today in neighboring counties. One of the two papers in the journal *MDPI-Minerals* describes remote sensing methods developed for inventorying uranium mines and mine waste and determining their reclamation status based on land-use and land-cover patterns revealed from image interpretation. The second paper in press in the *Journal of Geochemical Exploration* summarizes the spectral characteristics of these rocks including abundances of critical ore minerals (e.g., coffinite) and industrial minerals (e.g., Ca-bentonite, Na-bentonite, and zeolites). A separate USGS data release provides access to original spectral measurements conducted on representative [Texas Bureau of Economic Geology](#) cores.

### Critical Mineral Assessment with AI-Support (CriticalMAAS) Program



Official logos of DARPA and ARPA-E.

In August, the USGS, [Defense Advanced Research Projects Agency \(DARPA\)](#), and [Advanced Research Projects Agency-Energy \(ARPA-E\)](#) teamed up to launch the [Critical Mineral Assessment with AI-Support \(CriticalMAAS\)](#) program. Participants from across the Federal government, academic institutions, and private research sector met at the National Conservation Training Center in Shepherdstown, West Virginia to kick off the 12-month effort geared toward accelerating critical mineral resource assessment workflows. Novel machine learning applications to geoscientific problems include automated georeferencing and feature extraction from geologic maps, extracting geospatial and descriptive information for mineral occurrences using large language models to aid in their classification, and multi-scale data fusion across geological, geochemical, and geophysical modalities to enhance predictive mapping. These tools and techniques under development promise to help the USGS achieve its mission objectives related to [mapping critical mineral resources in the United States](#), make legacy data more useful and accessible, and inform decisions on securing critical mineral supply chains for the United States.

Optical Photothermal Infrared (O-PTIR) chemical distribution maps, courtesy of Aaron Jubb, 2022, Research Chemist, USGS.

## Science Spotlight (Continued)

### Assessment of Rare Earth Elements and Critical Minerals in U.S. Gulf Coast

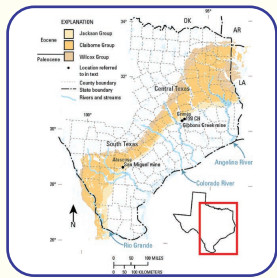
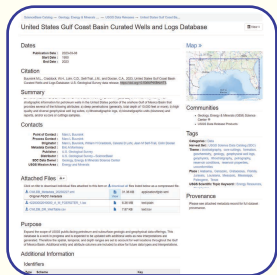


Figure 1 from Hower and others, 2023.

GEMSC Research Geologist Peter Warwick released a publication as part of cooperative work with the [University of Texas at Austin, Bureau of Economic Geology](#) on the project "Assessment of Rare Earth Elements and Critical Minerals in U.S. Gulf Coast," funded by the [Department of Energy, National Energy Technology Laboratory, Carbon Ore, Rare Earth and Critical Minerals \(CORE-CM\) Initiative](#) for U.S. Basins. Coal is increasingly evaluated as a source of rare earth elements (REEs) in the United States to address the Nation's over-reliance on imported REEs. The objective of this study was to assess the distribution of REEs in lignites from selected mining areas in the Texas Gulf Coastal Plain region. This publication presents new REE and critical mineral analytical data obtained from thirty lignite and rock samples previously collected by the USGS. REEs are essential in the manufacture of electronics, magnets, catalysts, optics, ceramics, and numerous other products necessary for the functioning of modern society. Policy makers and the mineral production industry may be interested in the results contained in this publication. Full article can be found [HERE](#).

### Gulf Coast Wells and Logs Database



Landing webpage for CWLDB data release.

The [United States Gulf Coast Basin Curated Wells and Logs Database \(CWLDB\)](#) is an online repository with stratigraphic information for petroleum wells in the United States portion of the onshore Gulf of Mexico Basin. It provides several of the following attributes: a) deep penetrations (generally, total depth of 10,000 feet or more), b) high-quality and diverse geophysical well-log suites, c) lithostratigraphic logs, d) biostratigraphic units (biozones) and reports, and/or e) core or cuttings samples. This data release expands the scope of USGS public-facing petroleum and subsurface geologic and geophysical data offerings. This database is a work in progress and is expected to be updated with additional wells as new interpretations are generated. Therefore, the spatial, temporal, and depth ranges are set to account for well locations throughout the Gulf of Mexico Basin. Additional entity and attribute columns are included to allow for future data types and interpretations. The dataset is being compiled by GEMSC Research Geologists Marc Buursink and William Craddock. See the data release [HERE](#).

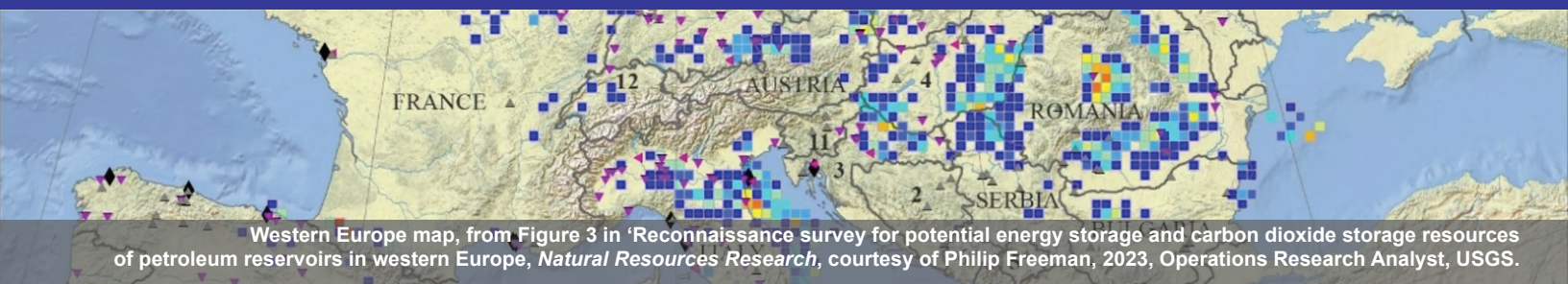
### Bemidji Fieldwork



Photo of the 2023 Bemidji field team. Photo courtesy of Jared Trost, USGS.

Biologist Bridgette Polite and Research Microbiologist Denise Akob joined [USGS Water Mission Area, Upper Midwest Water Science Center \(WSC\), California WSC](#), and university colleagues on a successful sampling campaign in June to collect groundwater samples from the [National Crude Oil Spill Fate and Natural Attenuation Research Site](#) near Bemidji, Minnesota, USA. The site was contaminated by a crude oil pipeline rupture in 1979 and has been a long-term USGS study site since 1983. Over the past ~40 years, the research at the site has improved our understanding of the mobilization, attenuation, transport, fate, potential health effects, and remediation of petroleum hydrocarbons in the subsurface. The main goals of the sampling were to 1) monitor fate and transport of hydrocarbons, degradation byproducts, and trace metals in the aquifer; 2) understand microbial processes contributing to contaminant degradation; and 3) expand upon historical water quality data sets that document evolution of the contaminant plume. The team collected water samples from 24 groundwater wells for biogeochemical analyses. The samples are currently being analyzed to help understand processes controlling hydrocarbon natural attenuation. For more information contact Bridgette Polite ([bpolite@usgs.gov](mailto:bpolite@usgs.gov)) or Denise Akob ([dakob@usgs.gov](mailto:dakob@usgs.gov)).





## Science Spotlight (Continued)

### Arctic Extended Continental Shelf International Workshop



Map from U.S. Department of State, Office of Ocean and Polar Affairs.

Delegations from four Arctic nations (Canada, Denmark, Norway, and USA; Russia has been excluded) met in Stavanger, Norway in April of 2023. GEMSC Senior Research Geologist David Houseknecht attended this review of pertinent data and national submissions to the United Nations Law of the Sea, [Extended Continental Shelf program](#), Arctic region. The U.S. delegation included Arctic policy and technical specialists from the State Department, National Oceanic and Atmospheric Administration, USGS, and universities. Houseknecht presented “North Chukchi Basin and Southern Chukchi Borderland: Geology, Tectonic Origin, and Direct Hydrocarbon Indicators in Seismic Data.” This presentation pertains to the region of the northernmost maritime boundary between the U.S. and Russia as well as the region farther north, beyond the U.S. and Russia Exclusive Economic Zones. This work has clear and direct implications to Extended Continental Shelf claims by Arctic Nations and represents a significant contribution to understanding the geology and tectonic origin of a large region within the Arctic Ocean. Results also will contribute to the Energy Resources Program – [National and Global Assessment project](#) by providing the framework for future assessments in the area.

## Employee Corner

### Adam Parol – National Association of Geoscience Teachers (NAGT) Intern



**Education:** Finishing B.S. in Geology at Colorado State University.

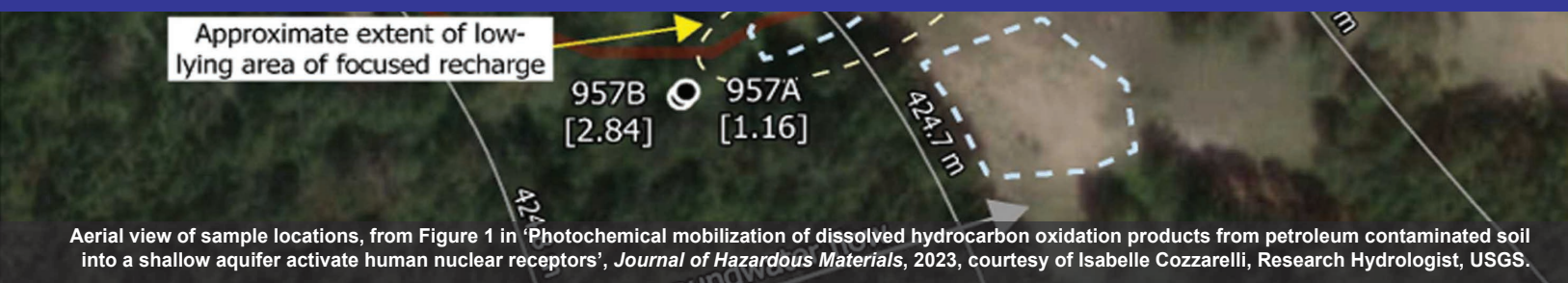
**Hobbies:** Hiking.

### Alex Taylor – Student Contractor



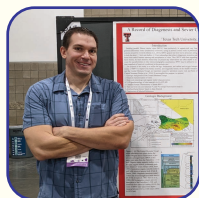
**Education:** Double-majored in Geology and International Relations for his B.A. at Colgate University. M.S. in Geology from the University of Maryland.

**Hobbies:** Enjoys hiking, exercise, rock collecting, and recently has taken up painting.



## Employee Corner (Continued)

### Alex Washburn – Postdoctoral Geologist



**Education:** B.S. in Geology from Texas Tech University, M.S. in Geology from Brigham Young University, and Ph.D. from Texas Tech University where he is a postdoctoral researcher.

**Hobbies:** Taking care of his wife and daughter, hiking, camping, mountain biking, riding motorcycles, competing in road bike events, throwing axes, reading history books, and barbecues.

### Alexis Painter – Biologist in Reston Microbiology Lab



**Education:** B.S. in Microbiology from Northern Arizona University.

**Hobbies:** Enjoys reading (especially fantasy novels) and hanging out with her cat.

### Aya Schneider-Mor – Visiting Researcher



**Education:** B.S. from the Hebrew University of Jerusalem, M.S. degree from the Tel-Aviv University, and Ph.D. from the Weizmann Institute in Rehovot.

**Hobbies:** Enjoys spending time with her family (husband and three kids), visiting museums and national reserves, painting and art and crafting with her kids.

### Delaney Kirr – Contractor - Reston Biological Process in Groundwater Laboratory



**Education:** B.S. in Chemistry with a Geology minor from William and Mary.

**Hobbies:** Enjoys taekwondo, skiing, hiking, and being outside with her dog and her family.

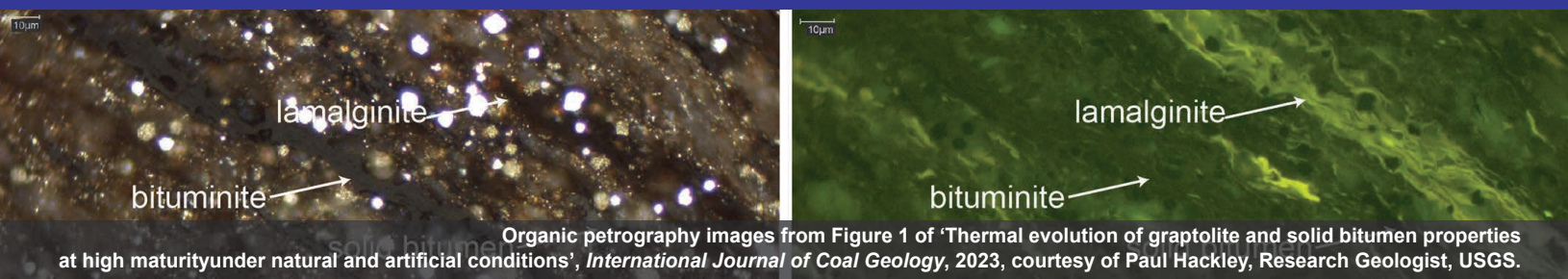
### Denise Levitan – Research Geologist



**Education:** B.S. from Yale University in Geology and Ph.D. from Virginia Tech.

**Hobbies:** Enjoys making (and eating) ice cream, playing pub trivia, and wandering around fairs and festivals.





## Employee Corner (Continued)

### Elizabeth (Beth) Tomaszewski – Research Chemist



**Education:** B.S. in Chemistry from Georgia Tech. Ph.D. from the University of Wisconsin in Environmental Chemistry and Technology.

**Hobbies:** Enjoys swimming, yoga, baseball, baking and, most of all, spending time outside with her cat, dog, and husband.

### Jacob Murchek – Pathways Intern (Geophysicist)



**Education:** B.S. in Chemistry from Purdue University, M.S. in Earth Science from Wright State University, and currently working on a Ph.D. in Geophysics at Michigan Technological University.

**Hobbies:** Spending time with my dog.

### Jeremy Ray – Data Scientist



**Education:** B.S. in Environmental Studies with a second major in Biology from the University of Maine at Fort Kent and has completed George Washington University's Data Analytics Boot Camp.

**Hobbies:** Enjoys hiking with his wife and dog "Tuck", cooking and eating, skiing in the winter, floating in the summer, and live music.

### John Fisher – Data Scientist



**Education:** B.S. in Geology (Invertebrate Paleontology) from Baylor University.

**Hobbies:** A board and tabletop game fanatic, enjoys spending time with his wife and daughters in the garden, visiting museums, and attending jazz and folk concerts.

### Kuljit "Cole" Singh – Student Contractor



**Education:** B.S. in Geology from George Mason University, and an Undergraduate Certificate in Information Technology.

**Hobbies:** Enjoys spending time outdoors, visiting new places and seeing new sights, spending time with family and friends, reading, and going for walks.



First Solar assembly line from Figure 2 in 'CdTe-based thin film photovoltaics: Recent advances, current challenges and future prospects', *Solar Energy Materials and Solar Cells*, 2023, courtesy of Sarah Hayes, Research Chemist, USGS.

## Employee Corner

### Natasha Tagle – Science Technician I



**Education:** B.A. in Geology from George Mason University. Currently looking for schools to apply to for an M.S. in Planetary Geology.

**Hobbies:** Enjoys reading, being outdoors, walking with her dogs, tending to her family's mini-farm, trying new coffee shops, and traveling.

### Owen Alfaro – Student Contractor



**Education:** B.S. in Geology, and minor in Astronomy from George Mason University. Looking for schools to apply for an M.S. in Planetary Geology.

**Hobbies:** Enjoys reading, playing board games, and keeping up with all things space-related.

### Ross Salerno – Mendenhall Research Geologist



**Education:** Ph.D. in Geochemistry from Washington State University.

**Hobbies:** Enjoys canoeing, camping, and cooking with his partner and dog in his free time.

### Sydney Allen – Student Contractor



**Education:** Finishing Ph.D. at Rice University.

**Hobbies:** Playing trombone and knitting.

### Terri Zach – Student Contractor



**Education:** B.S. in Geology from William & Mary and currently working on acquiring a Master's in Geological Sciences from University of Kentucky.

**Hobbies:** Enjoys mentoring undergraduate students and going out in the field for field trips or research.





A few examples of the extensive work and collaborations of Dan Hayba, Research Geologist, USGS.

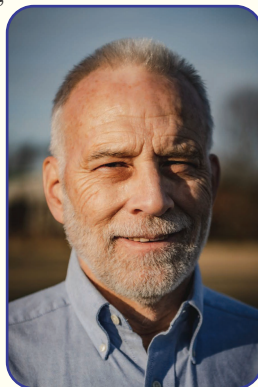
## Scientist Profile ~ Dan Hayba

I have been extremely fortunate to have worked at the USGS for the past 43 years. While I was very happy to join the Survey in 1980, little did I appreciate how lucky I was to be hired by Phil Bethke and Paul Barton. They were remarkable scientists, wonderful mentors, and most importantly, terrific human beings. Working with them was the best education I could ever hope for. They taught me, and scores of other scientists (including Nora Foley, Bob Seal, Geoff Plumlee, and Tom Casadevall), the value of collaborative science. They never argued but were not afraid to disagree, probe, and challenge each other's thinking (or anyone else's). Together they were amazingly creative and productive - I came to see them as the "Lennon and McCartney" of Economic Geology.

My interest in Geology began with my first class at the College of Wooster - Geology 101 at 8:00 a.m.! I loved the prospect of combining science and working outside. I was drawn to ore deposits and for my senior thesis used a 12 ft<sup>3</sup> tank to model bedded sulfide deposition in a sabkha environment. As fate would have it, I first met Phil when my advisor brought him to the dusty Geology Department basement to view my experiment (Phil had brought one of his sons for a college visit). Next, I headed to grad school at Penn State, where I was fortunate to get Hu Barnes for my advisor; he was a giant in the field of Economic Geology - the editor of *Geochemistry of Hydrothermal Ore Deposits*. He required his students to subscribe to *Economic Geology*, and fortuitously, the first paper in the first issue I received was Barton et al.'s seminal paper on the Creede epithermal deposit. As a green graduate student struggling at a high-powered university, I was also very fortunate to be mentored by Don Rimstidt (a postdoc at that time). I credit him with helping turn my research on the Salton Sea geothermal system into an acceptable Master's thesis. In 1978, Exxon Production Research Co. hired me to develop computer block models to estimate ore reserves (Exxon owned several prospects at that time). In those early days of mainframe computers, "big jobs" needing 256K memory had to run overnight! While I enjoyed my job, I decided that the USGS would be a better

fit. Leaving Houston was an added benefit.

At the USGS, I joined the "Environment of Ore Deposition" (a.k.a., Creede) project to conduct research on epithermal deposits. I analyzed fluid inclusions to better understand fluid movement and ore deposition. A few years later with Phil's encouragement, I applied for and was accepted into the long-term graduate training program to study numerical flow modeling at the University of Illinois with Craig Bethke (Phil's son). As part of my Ph.D. thesis, I developed the USGS computer program, HYDROTHERM, to simulate high temperature/pressure, two-phase fluid flow in hydrothermal systems. In the 1990s, my journey took some unexpected and interesting turns. I received a USGS Gilbert Fellowship to spend a year in New Zealand working on geothermal and volcanic systems. Upon my return, I was transferred to the Eastern Energy Resources Science Center (EERSC) to begin modeling basin-scale evolution and fluid migration as part of oil and gas assessments.



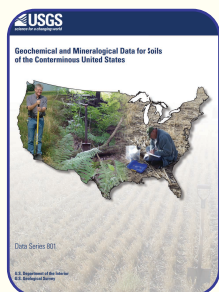
**Dan Hayba,**  
Research Geologist,  
USGS GEMSC.

After 25 years of happily working as a project scientist, I was encouraged to take on a leadership role. I began that part of my journey as the Associate Center Director for EERSC. Being a "people-person," I found that I enjoyed the day-to-day interactions that leadership requires. In 2008, I was selected as the Center Director for the Eastern Mineral and Environmental Resources Science Center, and a couple of years later was "asked" to also take on the directorship of EERSC (note: no doubling of salary). In 2014-15, I also served as the Acting Associate Director for the Energy & Minerals and the Environmental Health Mission Areas. Three years ago, I stepped down as Center Director. I currently work half-time as a senior advisor for the Core Science Systems Mission Area and half-time on NCGMP and Minerals projects. Throughout my career, I have been blessed to work alongside gifted and dedicated people, to conduct research on interesting projects, to lead a terrific group of scientists, and most importantly, to have a wonderful wife and family—6 children (including 2 adopted) and 4 grandchildren so far!

Scanning electron microscopy cathodoluminescence image showing differences in germanium concentrations in hemimorphite and sphalerite grains within a sample collected from mine tailings (300-350 µm). Taken 2020, courtesy of Ryan McAleer and Nadine Piatak, Research Geologists, USGS.

## Center Achievements & Recognition

### 10-year Anniversary of the Landmark Publication, *'Geochemical and Mineralogical Maps, with Interpretation, for Soils of the Conterminous United States'*



Prior to 2013 knowledge about the concentration and spatial distribution of naturally occurring chemical elements in soils of the conterminous United States was remarkably limited. This began to change in 2007 when the USGS initiated a low-density (1 site per 1600 km<sup>2</sup>) geochemical and mineralogical soil survey across the lower 48 States. Three soil samples were collected from different depths from the nearly 5,000 randomly selected sites. The < 2 mm fraction of each sample was analyzed for a suite of 45 major and trace elements and as well as major mineralogical components. Sampling took 3 years to complete, and chemical and mineralogical analyses were finally completed in 2013, with all data released in [USGS Data Series 801](#). Now, 10 years later, the report and its accompanying data have been cited nearly 400 times by a wide variety of national and international researchers across an amazing array of topics from environmental and human health to forensic geology to mineral exploration. The USGS also created a [series of derivative maps](#) showing the spatial distribution of each element or mineral with an accompanying interpretive section—these maps often show up in papers and presentations and have been an excellent avenue into the larger geochemical and mineralogical dataset.

### GEMSC Scientist Receives Special IAGC Leadership Award



GEMSC Research Hydrologist Isabelle M. Cozzarelli, Ph.D. recently received the Friend of Water-Rock Interaction & Applied Isotope Geochemistry award in 'Recognition of leadership in the field of geochemistry and many valuable contributions to the international symposium' from the International Association of Geochemistry (IAGC). Dr. Cozzarelli accepted the award from working group chairmen, professor Pierepaolo Zuddas and Dr. Romain Millot, during her attendance at the [International Symposium on Water-Rock Interaction & Applied Isotope Geochemistry](#) in Sendai, Japan, where she was an invited keynote speaker. Pictured here is Dr. Cozzarelli with Professor Zuddas and WRI-17 International Committee member Dr. Yousif Kharaka. Congratulations, Isabelle!

### GEMSC Team Members Embody Dedication, Passion, and Service

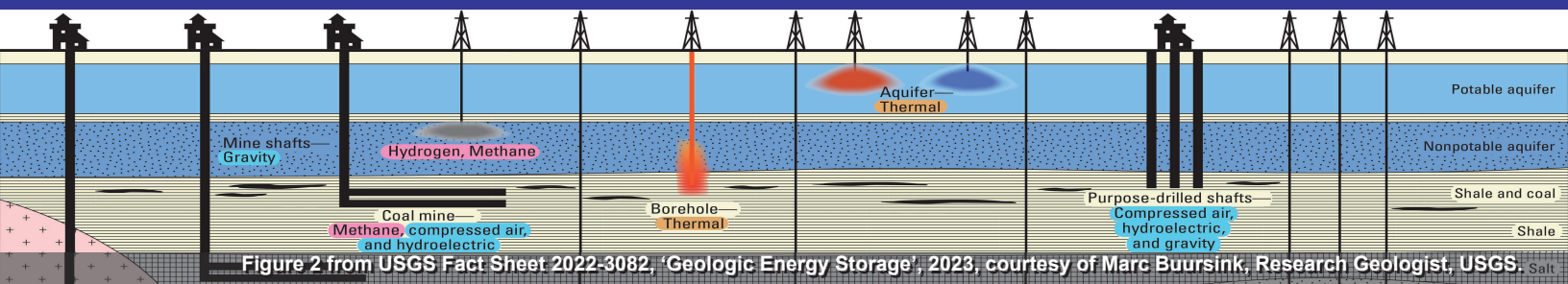
Many Federal workers demonstrate noteworthy dedication to public service. The GEMSC recognizes these team members who are marking significant length of service milestones for their unwavering devotion to serving the American people:

- Özgen Karacan, 20 years, June 25

## Join Our Team! ~ Job Opportunities

The GEMSC frequently has opportunities for bringing in new staff. We have two active Mendenhall postdoctoral opportunities available [here](#) and [here](#). Please apply on [USAJobs](#) before the deadline of November 1. These vacancies, as well as future GEMSC vacancies, are advertised in [USAJobs](#). Stay tuned to this space for news on future job opportunities with GEMSC.





## Quarters 2 and 3 Publications by GEMSC Authors

### Publications (USGS and External)

Analysis of the United States Documented Unplugged Orphaned Oil and Gas Well Dataset:

<https://doi.org/10.3133/dr1167>

Applications of Natural Language Processing to Geoscience Text Data and Prospectivity Modeling:

<https://doi.org/10.1007/s11053-023-10216-1>

Attenuation of Barium, Strontium, Cobalt, and Nickel Plumes Formed During Microbial Iron Reduction in a Crude-Oil-Contaminated Aquifer:

<https://doi.org/10.1021/acsearthspacechem.2c00387>

CdTe-based Thin Film Photovoltaics: Recent Advances, Current Challenges and Future Prospects:

<https://doi.org/10.1016/j.solmat.2023.112289>

Distribution of Rare Earth and Other Critical Elements in Lignites from the Eocene Jackson Group, Texas:

<https://doi.org/10.1016/j.coal.2023.104302>

Editorial: Micro-to Nano-analytical Challenges Towards Trace Element Characterization of Ore Minerals: New Perspectives and Applications for Sustainable Georesources:

<https://doi.org/10.3389/feart.2023.1227737>

Genesis of the Questa Mo Porphyry Deposit and Nearby Polymetallic Mineralization, New Mexico, USA:

<https://doi.org/10.5382/econgeo.5011>

Interlaboratory Study: Testing Reproducibility of Solid Biofuels Component Identification Using Reflected Light Microscopy:

<https://doi.org/10.1016/j.coal.2023.104331>

Mapping Abandoned Uranium Mine Features Using Worldview-3 Imagery in Portions of Karnes, Atascosa and Live Oak Counties, Texas:

<https://doi.org/10.3390/min13070839>

Mapping Ancient Sedimentary Organic Matter Molecular Structure at Nanoscales Using Optical Photothermal Infrared Spectroscopy:

<https://doi.org/10.1016/j.orggeochem.2023.104569>

Merging Machine Learning and Geostatistical Approaches for Spatial Modeling of Geoenery Resources:

<https://doi.org/10.1016/j.coal.2023.104328>

Metallogeny and Exploration Strategy for Volcanic Rocks Hosting World Class Be-U-F Mineralization at Spor Mountain, Utah, U.S.A.:

<https://doi.org/10.1016/j.gexplo.2023.107154>

National Map of Focus Areas for Potential Critical Mineral Resources in the United States:

<https://doi.org/10.3133/fs20233007>

Nitrifying Microorganisms Linked to Biotransformation of Perfluoroalkyl Sulfonamido Precursors from Legacy Aqueous Film-Forming Foams:

<https://doi.org/10.1021/acs.est.2c07178>

Photochemical Mobilization of Dissolved Hydrocarbon Oxidation Products from Petroleum Contaminated Soil into a Shallow Aquifer Activate Human Nuclear Receptors:

<https://doi.org/10.1016/j.jhazmat.2023.132312>

Predicting Methane Emissions and Developing Reduction Strategies for a Central Appalachian Basin, USA, Longwall Mine Through Analysis and Modeling of Geology and Degassification System Performance:

<https://doi.org/10.1016/j.coal.2023.104234>

Reconnaissance Survey for Potential Energy Storage and Carbon Dioxide Storage Resources of Petroleum Reservoirs in Western Europe:

<https://doi.org/10.1007/s11053-023-10218-z>

Reply to Comment by M.D. Lewan:

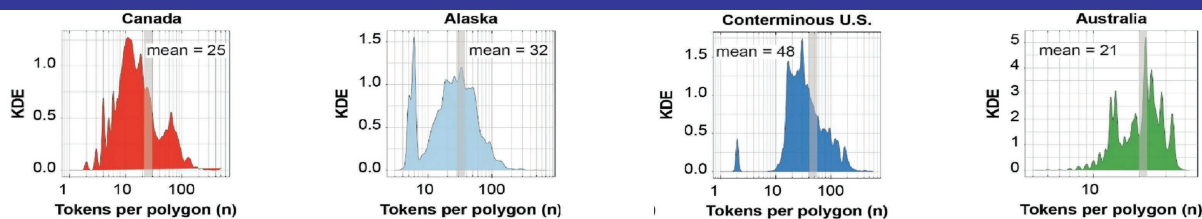
<https://doi.org/10.1016/j.orggeochem.2023.104627>

Thermal Evolution of Graptolite and Solid Bitumen Properties at High Maturity Under Natural and Artificial Conditions:

<https://doi.org/10.1016/j.coal.2023.104269>

Visualization of Petroleum Exploration Maturity for Six Petroleum Provinces Outside the United States and Canada:

<https://doi.org/10.3133/sir20235010>



Kernel density estimates (KDE) for the frequency of tokens, from Figure 4 of 'Applications of Natural Language Processing to Geoscience Text Data and Prospectivity Modeling', *Natural Resources Research*, 2023, courtesy of Graham Lederer, Physical Scientist, USGS.

## Quarters 2 and 3 Data Releases by GEMSC Authors

### USGS Data Releases

Analyses of Select Organic and Inorganic Data Collected from Lysimeters Installed at the Bemidji Crude Oil Spill Site, Minnesota, 2018, 2019, 2021:  
<https://doi.org/10.5066/P9BN4N8D>

Bulk Chemistry and X-ray Diffraction Results from Alaskan Stoker-Boiler Fly Ash:  
<https://doi.org/10.5066/P9M6ND11>

Bulk Chemistry Data from Alaskan Stoker-Boiler Fly Ash:  
<https://doi.org/10.5066/P9DXUKBZ>

Carbon and Nitrogen in Sediments from Hg-Contaminated Streams and Lakes in Texas, Virginia, and Tennessee:  
<https://doi.org/10.5066/P9DS5EFK>

Critical Mineral Deposits of the United States:  
<https://doi.org/10.5066/P9K1HBNT>

Evaluation of Pore-like Features in Sedimentary Organic Matter:  
<https://doi.org/10.5066/P97PBJYR>

Evidence for strain induced graphitization across a ductile fault zone:  
<https://doi.org/10.5066/P96B9NJV>

Geochemistry of the Leatherwood Coal in Eastern Kentucky:  
<https://doi.org/10.5066/P9JHIH4F>

Portable Raman spectroscopic analysis of bulk crushed rock:  
<https://doi.org/10.5066/P9CM1LL7>

Pre-mining Environmental Baseline Characterization of the Balkhab Copper Deposit: 2019 Field Season:  
<https://doi.org/10.5066/P9859JSM>

Produced Water Volatile Organic Compound Data Collected from Eight Oil Fields, 2016-2020, California:  
<https://doi.org/10.5066/P9KBI8ZO>

Reflectance Measurements for Eight Samples Submitted to the USGS Organic Petrology Laboratory in Reston:  
<https://doi.org/10.5066/P9QV9BPN>

SEM-CL Investigation of Sedimentary Organic Matter Samples:  
<https://doi.org/10.5066/P9FEZVJ6>

Thermal Evolution of Graptolite and Solid Bitumen Properties at High Maturity Under Natural and Artificial Conditions:  
<https://doi.org/10.5066/P9H915XD>

Total Neutron Scattering of Methane in Niobrara Formation Samples at the Wet-Gas Maturity Level:  
<https://doi.org/10.5066/P96XAVEO>

United States Gulf Coast Basin Curated Wells and Logs Database:  
<https://doi.org/10.5066/P95BNWT3>

Visible and Near Infrared (VNIR) and Short Wavelength Infrared (SWIR) Spectra of Select Rock Cores and Waste Material from Nine Uranium Mine Sites in Karnes and Live Oak Counties, Texas:  
<https://doi.org/10.5066/P9ZHH7WS>

X-ray Diffraction Results from Alaskan Stoker-Boiler Fly Ash:  
<https://doi.org/10.5066/P9OAYTIL>