

# Front & Center!

## Quarterly Science Newsletter

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

### Center Director Note

Welcome to the twelfth issue of the USGS Geology, Energy & Minerals Science Center (GEM or GEMSC) quarterly newsletter. I am thrilled to share that our Science Center had an incredibly busy fall season marked by numerous exciting publications and impactful scientific contributions. The dedication and hard work of our teams have truly been remarkable. Since the last issue, GEM staff have released 12 professional manuscripts, 10 scientific data releases, 1 software release, and have presented at several scientific meetings or conferences around the world. We also are advertising several new positions (*see page 4 for more information*).

Additionally, I am delighted to announce a new research opportunities for students. Starting in the Summer Internship Program. This program aims to interested in contributing to cutting-edge research open positions available, offering a chance to work around energy and mineral resource exploration. The focus generated from these exploration and production activities, as endeavors. This initiative aligns with our commitment to scientific leaders and innovators.



initiative that will hopefully provide some exciting summer of 2024, we will be launching a GEM provide valuable opportunities for individuals within our labs and projects. We currently have 10 closely with our research teams on projects centered will extend to the beneficial reuse of waste products well as the environmental impact associated with such crucial outreach, partnerships, and fostering the next generation of

For more information on the GEM Summer Internship Program, or if you have any comments, questions, or ideas for collaboration, please reach out to me directly ([troberts-ashby@usgs.gov](mailto:troberts-ashby@usgs.gov)). To explore more about what we do in our Science Center, 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](#).

~ Tina Roberts-Ashby Ph.D., GEMSC Science Center Director

### Science Spotlight

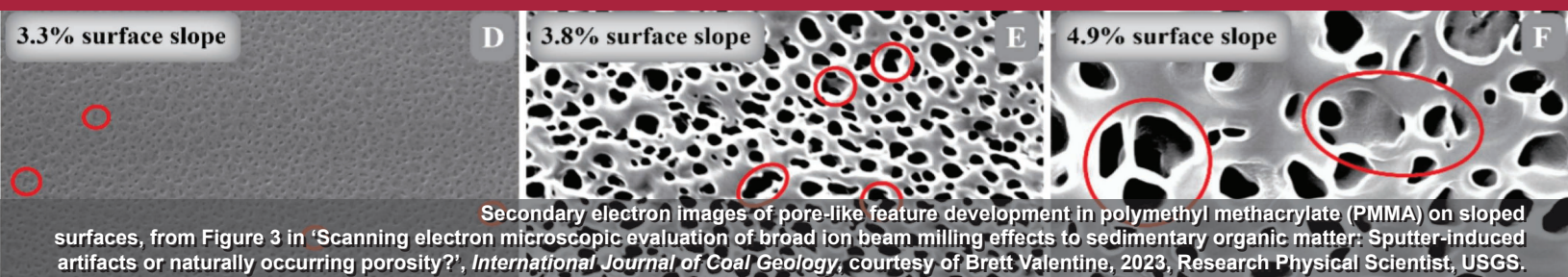
#### The U.S. Large-Scale Solar Photovoltaic Database (USPVDB) and Viewer



'USPVDB' logo, 2023.

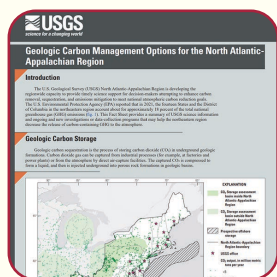
GEMSC Cartographer Chris Garrity was a USGS principal investigator on the release of the [United States Large-Scale Solar Photovoltaic Database \(USPVDB\)](#) which provides the locations and array boundaries of U.S. ground-mounted photovoltaic (PV) facilities with capacities of 1 megawatt or more. This database includes corresponding PV facility information, including panel type, site type, and initial year of operation. The creation of this database was jointly funded by the U.S. Department of Energy (DOE) Solar Energy Technologies Office (SETO) via the Lawrence Berkeley National Laboratory (LBNL) Electricity Markets and Policy Group, and the USGS Energy Resources Program (ERP). The PV facility records are collected from the U.S. Energy Information Administration (EIA), position-verified and digitized from aerial imagery, and checked for quality. EIA facility data are supplemented with additional attributes obtained from public sources. The [USPVDB Viewer](#), funded by the USGS ERP, allows users to visualize, inspect, interact, and download the most current

USPVDB through a dynamic web application. Data-driven styling and dynamic filtering capabilities allow users to access information quickly and more efficiently. For more information email [gs-uspvdb@usgs.gov](mailto:gs-uspvdb@usgs.gov) or [uspvdb@lbl.gov](mailto:uspvdb@lbl.gov).



## Science Spotlight (Continued)

### Geologic Carbon Management Options for the North Atlantic-Appalachian Region Scientific Report USGS Fact Sheet 2023-3038



USGS Fact Sheet 2023-3038  
report cover page.

GEMSC Research Geologist Peter Warwick authored a [Fact Sheet on Carbon Management in the Northeast Region](#). The U.S. Geological Survey (USGS) North Atlantic-Appalachian Region is developing the regionwide capacity to provide timely science support for decision-makers attempting to enhance carbon removal, sequestration, and emissions mitigation to meet national atmospheric carbon reduction goals. The U.S. Environmental Protection Agency (EPA) reported that in 2021, the fourteen States and the District of Columbia in the northeastern region account for approximately 18 percent of the total national greenhouse gas (GHG) emissions. This Fact Sheet provides a summary of USGS science information and ongoing and new investigations or data-collection programs that may help the northeastern region decrease the release of carbon-containing GHG to the atmosphere.

### Trilateral Embassy Science Fellowship



Allan Kolker visits a coal-fired  
power station in Vietnam, 2023.

USGS Scientist Emeritus Allan Kolker traveled to Hanoi, Vietnam in October 2023 to participate with scientists from the [Vietnam Institute of Geosciences and Mineral Resources \(VIGMR\)](#) and the [Korea Institute of Geoscience and Mineral Resources \(KIGAM\)](#) to sample Vietnam coal mines and coal-fired power stations to evaluate coals and coal combustion products for their content of critical elements. During his visit to Hanoi, Allan presented lectures at VIGMR on his [USGS work on coal geochemistry](#), and on [critical elements](#), including the rare earth elements in coal-related materials. He also briefed U.S. Ambassador Knapper, and participated in the KIGAM-sponsored ribbon-cutting ceremony for the "Korea-U.S. Embassy Science Fellows Program Center" at VIGMR. The fellowship consisted of one month in Vietnam plus two months of continued collaboration, and perhaps future work as well.

### Northeast Region Science Outreach Event for Congressional Staff



GEMSC Research Scientists  
Bonnie McDevitt and Jane  
Hammarstrom, 2023.

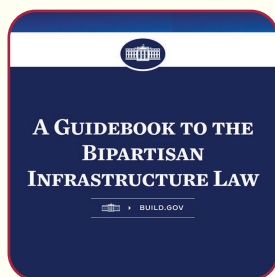
The GEMSC participated in an outreach event for Congressional staff in October 2023. The event took place on the grounds of the USGS Patuxent Wildlife Research Center in Laurel, MD. Dozens of Congressional staffers attended the event that presented 10 concurrent sessions on significant science activities in the Northeast Region. GEMSC Research Scientists Bonnie McDevitt and Jane Hammarstrom presented on "Critical Minerals in Your Neighborhood". They discussed focus areas for critical minerals in the Northeast Region, critical minerals in oil and gas produced water in NY and PA, and critical minerals in coal mine waste in Appalachia.





## Science Spotlight (Continued)

### Investigating the Effects of Coal and Coal Wastes on Environmental Health in the Appalachian Region



'Bipartisan Infrastructure Law (BIL)' website, 2023.

GEMSC Research Physical Scientist Bonnie McDevitt and Research Chemist Beth Tomaszewski, in collaboration with other scientists, have a project with [Bipartisan Infrastructure Law \(BIL\)](#) funding to investigate the effects of coal and coal wastes on environmental health in the Appalachian Region. The project is focused on stream water quality, including quantifying the impacts of legacy mining on water geochemistry. The work includes monitoring and assessing reclamation sites, mountain top mining sites, and drainages adjacent to active or abandoned coal mines.

### Seminar on the Geology and Tectonic Origin of the North Chukchi Basin and Southern Chukchi Borderland



'National Academies' logo, 2023.

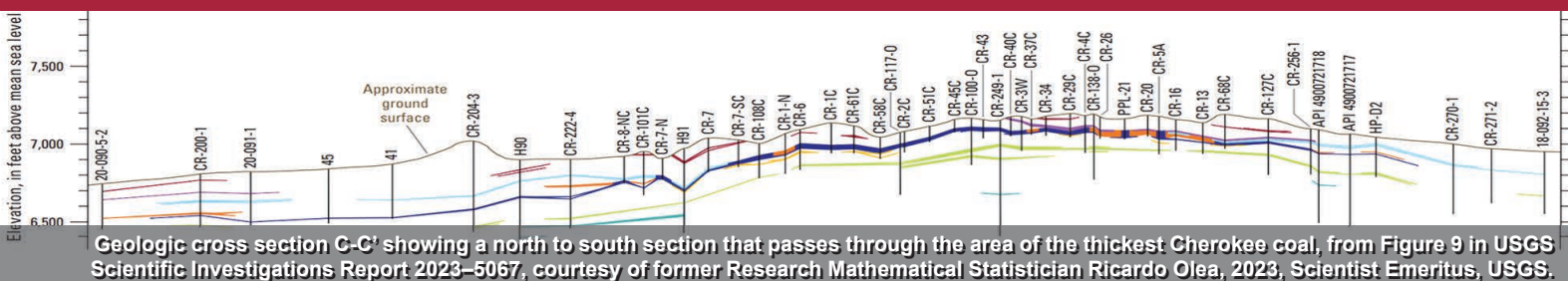
GEMSC Senior Research Geologist Dave Houseknecht gave a [National Academies of Science, Engineering, and Medicine \(NASEM\)](#) seminar entitled "North Chukchi Basin and Southern Chukchi Borderland: Geology, Tectonic Origin, and Implications for USA and Russia UNCLOS - Extended Continental Shelf Deliberations". The seminar described the geology and tectonic origin of the North Chukchi Basin and southern Chukchi Borderland and discussed the use of the results by the [U.S. State Department](#) in ongoing deliberations on the [United Nations Convention on the Law of the Sea \(UNCLOS\)](#) Extended Continental Shelf (ECS) program. Results of this research have contributed to U.S. State Department deliberations on UNCLOS-ECS in the Arctic Ocean. Results also are being used to inform ongoing research and assessments on the North Slope of Alaska.

### Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)



'SACNAS' logo, 2023.

GEMSC Research Geologist Bernard Hubbard and GEMSC Director Tina Roberts-Ashby attended the annual meeting for the [Society for Advancement of Chicanos/Hispanics and Native Americans in Science \(SACNAS\)](#) in Portland, OR in October. Attendance at this meeting is part of a larger effort by the USGS to provide inclusive opportunities for underrepresented students.



## Science Spotlight (Continued)

### Upcoming Ocean Discovery Lecture Series Talks



Ocean Discovery Lecture Series' website, 2023.

GEMSC Research Geologist Matt Jones is an Ocean Discovery Lecturer, one of a group of scientists who are highlighting a set of discoveries in the field of scientific ocean drilling and focusing on the topics of ocean anoxia, hydrocarbon source rock deposition, and extreme paleoclimate events in deep geologic time. The [Ocean Discovery Lecture Series](#) brings the scientific discoveries of the International Ocean Discovery Program (IODP) to geoscience audiences at academic research institutions across the United States. Matt's lecture will synthesize key findings on the Cretaceous oceanic anoxic events (OAEs) from over 50 years of scientific ocean drilling and describe the events' links to large igneous province eruptions and black shale deposition in many sedimentary basins globally. Marine drilling records of the Cretaceous OAEs provide some of the best geologic records of the sensitivity of Earth's oceans to rapid volcanic emission of CO<sub>2</sub>. This lecture will be presented at a total of six different colleges and universities across the United States from November 2023 through March 2024.

## Center Achievements & Recognition

### Sharon Bailey Branch Reaches 40-Year Milestone

Sharon Bailey-Branch completed 40 years of service to the Federal Government in December. Mrs. Branch has diligently performed important administrative functions throughout her career, including preparing procurement requests, assisting with personnel actions, and careful handling of bankcard records. In recent years with GEMSC, she has provided expert assistance with the logistics of office moves and renovations of laboratories and offices. Sharon also handles the operation of telephones, movement of furniture, and scheduling of GEMSC fleet vehicles. Congratulations and thank you for your dedicated service!

## Join Our Team! ~ Job Opportunities

The GEMSC frequently has opportunities for bringing in new staff. We are preparing advertisements for the following positions:

- Geologist, GS-9/11
- Physical Scientist Technician, GS 7/9/11 - Safety/Records Management
- Physical Scientist Technician, GS-7

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.





Photo(s): A few examples of the extensive work and collaborations of Bernard Hubbard, Research Geologist, USGS.

## Scientist Profile ~ Bernard Hubbard

My love of science began when I was five years old when members of my family would take turns in taking me to museums in New York City. The Hayden Planetarium was always my favorite. My elementary school and junior high school years were filled with evenings watching Carl Sagan in his “spaceship of the imagination” - I was in awe at seeing pictures of the surface of Mars and images of the moons of Jupiter. My high school years were challenging growing up in the projects of NYC during the 80s when poverty and drugs ran rampant in my community. However, I grew up in a large household with family members who protected and sheltered me, allowing me to pursue my dreams and focus on my education. I knew that this was the key to a better future and my mom, grandmother and aunts left no doubt in mind that this would be true.

So off I went to college and studied geology at Cornell University. I created my own minor in planetary geology and even took a course with Carl Sagan himself in 1991. I worked on various undergraduate projects with Professor Steve Squyres including use of impact cratering rates to help date planetary surfaces, identifying possible hydrovolcanic (i.e., palagonitic tuff) sources for Martian global dust, and mapping debris flows in large Martian craters. On the volcanology side, I got my first exposure to fieldwork by visiting geothermal areas on the island of St. Lucia with Professor William White. After graduating from Cornell in 1993 with a Bachelor of Arts, I took time away to figure out my next steps in life. At that time, I was still grieving the loss of my mom who had lived most of her life with several disabilities. After a year, I decided to pursue a graduate degree, but wasn’t accepted by any of the planetary science-focused departments that I applied to. My application did catch the attention of a volcanology professor at the State University of New York (SUNY) at Buffalo, Mike Sheridan who accepted me first as a M.S. candidate. However, this ended up leading to a Ph.D. degree as well.

While at Buffalo, I expanded on my growing interest in remote sensing sparked by my experience working with planetary imagery at Cornell. For my M.S. thesis I used airborne multispectral data to produce temperature maps of hot volcanic features at Kilauea volcano, Hawaii. These included lava lakes, cooling and crusted-over lava flows, skylights, incandescent cracks, and fumaroles. I enjoyed working the most with thermal infrared imagery despite the fact that high-temperature volcanic features emitted radiation at much shorter wavelengths (e.g., visible to shortwave infrared) and often saturated remote sensing imagery at long (i.e., thermal) infrared wavelengths. I realized that thermal infrared imagery was more useful for mapping primary rock-forming silicate minerals, as well as textures and compositions of volcanic rocks.

On the other hand, visible to shortwave infrared imagery can be used to map minerals formed either by weathering or hydrothermal alteration. As I was pursuing my Ph.D. research topic, I met a USGS scientist, Jim Crowley, who was working on a project mapping hydrothermal alteration on Cascade volcanoes, such as Mount Rainier, which had produced the large debris avalanche-induced Osceola Mudflow in the past. We met at a NASA airborne geosciences workshop and from that point on I realized that I had a Ph.D. topic, especially since my Ph.D. advisor was interested in studying debris avalanche and lahar hazards in Mexico. My Ph.D. dissertation used a combination of airborne hyperspectral AVIRIS imagery, together with field-

and laboratory-based spectral analysis of downstream debris avalanche and lahar deposits. The goal was to compare the composition (i.e., alteration mineralogy) of past debris avalanches and lahar deposits with that of rocks collected from the summit area of the volcano, some of which represent at least two prior large edifice collapses.

Jim was instrumental in me joining the USGS, first as a post-doc in 2001. Jim found support from NASA which allowed me to continue my work on developing hyperspectral methods for mapping hydrothermal alteration on volcanoes around the world. I worked on some of this with one of my mentors, John “Lyle” Mars, and this led to several publications. While at the USGS, I have explored other remote sensing applications such as uncovering links between expansive clay soils on agricultural lands with downstream soil erosion and turbidity in the Chesapeake Bay. I have been able to secure external funding from NASA to study flood hazards in desert alluvial fans in prelude to the development and pre-launch of new hyperspectral sensors. As a result, my Denver colleagues, Ray Kokaly and Todd Hoefen, and I have built important relationships with program managers within the Earth Sciences Directorate of NASA. Together, we are sought after for advice on the utility of new sensors for USGS programmatic work.



**Bernard Hubbard,**  
Research Geologist,  
USGS GEMSC.

In the last 10 years, I switched my research focus to **applying hyperspectral data and developing spectroscopic methods for critical mineral exploration**. In particular, I collaborated with GEMSC scientists such as Nora Foley in exploring the detectability of rare earth elements in ion-adsorption-type REE deposits. I have worked with ERP-funded scientists such as Victoria Stengel and Tanya Gallegos to design methods for mapping uranium-bearing minerals, sandstone host rocks and mine waste in South Texas. The MRP-led **Earth MRI initiative** is funding the largest collection of new hyperspectral data in the country. This includes “district-scale” higher-resolution airborne data collection efforts focused on several areas of interest in Florida such as two phospho-gypsum active mining and waste areas and a heavy mineral sand mining area. In Puerto Rico, I designed new surveys with help from USGS scientists Graham Lederer and Floyd Gray to be flown in February. These will include limestone- and cement-producing areas around the city of Ponce, and areas near the city of Mayaguez which have the potential for Ni-Co laterite deposits in deeply weathered ultramafic rock exposures.

Finally, the greatest honor I received was giving the ONYX-sponsored Black History Month address to USGS leadership and fellow employees in February 2020 just prior to the pandemic. I was introduced by Director James F. Reilly and given a plaque that I will always treasure. As a result of this and other events, I have been active in promoting **diversity, equity, inclusion, and accessibility (DEIA) in the USGS**. This didn’t happen right away, but the tragic events of George Floyd three months after my Black History Month address led to several of us Black USGS scientists to come together to form an affinity group with the goals of not only promoting DEIA, but recognizing our own accomplishments as scientists, creating support networks among ourselves and allies, and using this as the basis to help recruit a more diverse workforce over time. I was nominated to co-lead Black USGS Science Staff (BUSS) ever since it became an official Employee Resource Group (ERG) in September 2022. Looking back, all I ever wanted while growing up was to make my family proud.



Three USGS scientists discover a spectacular view while conducting scientific field work in North Slope of Alaska, 2023, courtesy of John Counts, Research Geologist, USGS.

## Quarter 4 Publications and Data Releases by GEMSC Authors

### Publications (USGS and External)

A Residual Oil Zone (ROZ) Assessment Methodology with Application to the Central Basin Platform (Permian Basin, USA) for Enhanced Oil Recovery (EOR) and Long-Term Geologic CO<sub>2</sub> Storage:  
<https://doi.org/10.1016/j.geoen.2023.212275>

Evaluation of Portable Raman Spectroscopic Analysis for Source-Rock Thermal Maturity Assessments on Bulk Crushed Rock:  
<https://doi.org/10.1016/j.coal.2023.104374>

Exploring the Uncertainty of Machine Learning Models and Geostatistical Mapping of Rare Earth Element Potential in Indiana Coals, USA:  
<https://doi.org/10.1016/j.coal.2023.104419>

Geochemistry of the Leatherwood Coal in Eastern Kentucky with an Emphasis on Enrichment and Modes of Occurrence of Rare Earth Elements:  
<https://doi.org/10.1016/j.coal.2023.104387>

Geologic Carbon Management Options for the North Atlantic-Appalachian Region:  
<https://doi.org/10.3133/fs20233038>

Georectified Polygon Database of Ground-Mounted Large Scale Solar Photovoltaic Sites in the United States:  
<https://doi.org/10.1038/s41597-023-02644-8>

Hyperspectral (VNIR-SWIR) Analysis of Roll Front Uranium Host Rocks from Karnes and Live Oak Counties, Texas Coastal Plains:  
<https://doi.org/10.1016/j.gexplo.2023.107370>

Illegal Dumping of Oil and Gas Wastewaters Alters Semi-Arid Soil Microbial Communities:  
<https://doi.org/10.3897/aca.6.e109202>

Lead Isotopes in New England (USA) Volcanogenic Massive Sulfide Deposits: Implications for Metal Sources and Pre-Accretionary Tectonostratigraphic Terranes:  
<https://doi.org/10.1139/cjes-2023-0058>

Machine Learning Approaches to Identify Lithium Concentration in Petroleum Produced Waters:  
<https://doi.org/10.1007/s13563-023-00409-8>

Methane Pore Accessibility, Densification, and Accommodation by Organic Matter in the Niobrara Formation at Wet-Gas Thermal Maturity Conditions:  
<https://doi.org/10.1016/j.coal.2023.104349>

Scanning Electron Microscopic Evaluation of Broad Ion Beam Milling Effects to Sedimentary Organic Matter: Sputter-Induced Artifacts or Naturally Occurring Porosity?:  
<https://doi.org/10.1016/j.coal.2023.104348>

### 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>

Geochemical and Isotopic Data from Glendonites and Surrounding Sediment, Carter Creek, North Slope Alaska:  
<https://doi.org/10.5066/P9KTA1BH>

Geochemical Data for Coal Wastes from Bituminous Coal Mining in Pennsylvania, 2022:  
<https://doi.org/10.5066/P9V3S1RL>

Geochemistry and Microbiology Data Collected to Study the Effects of Oil and

Gas Wastewater Dumping on Arid Lands in New Mexico:  
<https://doi.org/10.5066/P9UDXNST>

Mofete and San Vito Geothermal Field Ore Mineralization Data:  
<https://doi.org/10.5066/P9HNDG4F>

Organic Compounds Identified via Gas Chromatography-Mass Spectrometry in Produced Water Samples Collected at the Marcellus Shale Energy and Environment Laboratory (MSEEL) 2015-2019, Morgantown Industrial Park (MIP), West Virginia:  
<https://doi.org/10.5066/P99BOJV6>

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

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

USGS Gulf Coast Source Rock Database (ver. 2.0, October 2023):  
<https://doi.org/10.5066/P9NV8H DU>

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>

### USGS Software Releases

R Code Supporting the Manuscript: Using Stochastic Point Pattern Analysis to Track Regional Orientations of Magmatism During the Transition to Cenozoic Extension and Rio Grande Rifting, Southern Rocky Mountains:  
<https://doi.org/10.5066/P9ONYGHN>