

July 31st, 2022

Issue #7

# Front & Center!

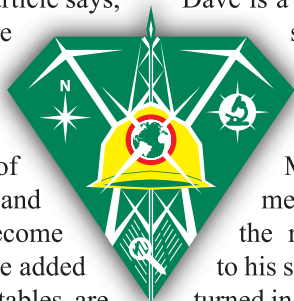
## Quarterly Science Newsletter

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

### Center Director Note

Welcome to the seventh issue of the USGS Geology, Energy & Minerals Science Center (GEM or GEMSC) quarterly newsletter. Since the last newsletter, GEM staff have released 11 publications, 7 data releases, and presented at several conference venues including Goldschmidt. We welcomed 4 new employees this quarter and are advertising 1 new position (see page 5 for more information)!

In this issue, we are proud to recognize Dr. David Houseknecht as the winner of the 2021 Eugene M. Shoemaker Award for Lifetime Achievement in Communications (see page 5). As the article says, Dave is a very productive researcher but possesses the additional talent of being an effective communicator on the years. He was my Master's thesis advisor at the teaching assistants for his introductory geology the science and his dedication to the work – and the fact advisees. After graduate school, at the U.S. Bureau of an evaluation of the effects of geology on coal mining and Oklahoma. In his 30 years with the USGS, Dave has become Arctic geology. His polished communication skills have added the role as Acting Center Director of GEMSC, the tables are support such a talented scientist and ambassador for the USGS and thrilled that the nomination I submitted for Dave was successful. Congratulations, Dave!



significance of his work. I have known Dave for over 40 University of Missouri, and I was one of his graduate classes. I was always impressed by his enthusiasm for that he adeptly handled a high number of graduate Mines, I worked with Dave on some projects, including methane gas production in the Hartshorne Coalbeds of the recognized expert on Alaska petroleum systems and to his stature as a technical expert. Now that I have stepped into turned in that I am technically Dave's supervisor. I am honored to

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 me directly ([cbrezinski@usgs.gov](mailto:cbrezinski@usgs.gov)) with any comments, questions, or ideas for collaboration.

~ Carla Kertis Brezinski, Acting Center Director of the GEMSC

### Science Spotlight

#### Goldschmidt Hawai'i 2022



Image: Goldschmidt Hawai'i 2022 official logo.

In mid-July, six GEMSC scientists traveled to Honolulu, HI, for the hybrid Goldschmidt conference. Rebecca Stokes and Aaron Jubb chaired a session titled "Hydrogen, hydrocarbons, and ores in the subsurface: Important reactions at geologic interfaces". Sarah Hayes also chaired a session titled "Advances in ore and gem mineral chemistry: Insights into mineral deposit formation and metal cycling in the Earth system". Clint Scott gave an oral presentation on his work on organic carbon mass balance in the Bakken Formation, and Bonnie McDevitt gave an oral presentation on the use of radium and strontium isotopic tracers for use in evaluating environmental impacts of oil and gas wastewaters. Aaron Jubb gave an oral presentation on the nanoscale mechanically driven chemical variations in ancient sedimentary organic matter using optical photothermal infrared (O-PTIR) microscopy. Rebecca Stokes presented a poster of her work on assessing micron-scale compositional variation of solid bitumen in hydrous pyrolysis residues as a function of mineral association. Isabelle Cozzarelli gave a talk about the mobilization of arsenic in accidental spills of hydrocarbons. Conference information can be found [HERE](#).

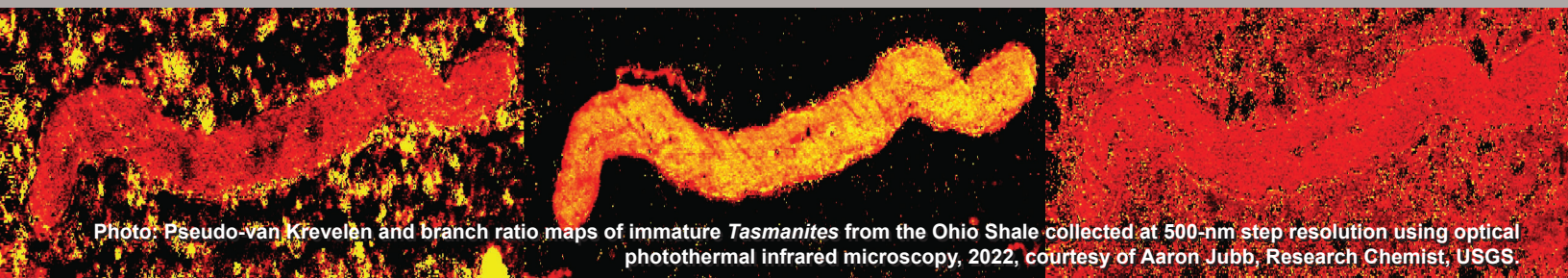


Photo: Pseudo-van Krevelen and branch ratio maps of immature *Tasmanites* from the Ohio Shale collected at 500-nm step resolution using optical photothermal infrared microscopy, 2022, courtesy of Aaron Jubb, Research Chemist, USGS.

## Science Spotlight (Continued)

### Groundwater Monitoring and Remediation Paper

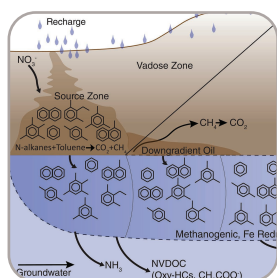


Image: From *Evolution of groundwater-contaminant plume chemistry*, 2022.

GEMSC scientist, Isabelle Cozzarelli, recently published a paper in *Groundwater Monitoring and Remediation* with current and former USGS Water Mission Area colleagues. This study of reactions at the site of a 1979 crude-oil pipeline spill is the first comprehensive look at the evolution of the groundwater chemistry in the residual hydrocarbon source zone over the past 40 years. The authors documented spatial and temporal heterogeneity of hydrocarbon source-zone processes with dynamics that need to be accounted for in natural attenuation studies. These data can help water managers plan the duration needed for monitoring and control of non-aqueous phase liquid (LNAPL) plumes in order to protect water resources. Although some hydrocarbons in the LNAPL were rapidly depleted, others, such as branched alkylbenzenes, can persist for a long time in groundwater. This research was funded by the USGS Ecosystems Mission Area's Environmental Health Program, as part of the Energy Life Cycle Integrated Science Team. Full article can be found [HERE](#).

### Alaska North Slope Field Work: Investigating Sediments to Better Define Framework Geology



Image: Scientists look out over the North Slope. Photo courtesy of John Counts, USGS.

A science team from the USGS Alaska Petroleum Systems project including Bill Rouse, Christina DeVera, Rebecca Smith, John Counts, Richard Lease, and Jared Gooley traveled to the North Slope of Alaska for field work during July 2022. The goals of this trip were to investigate the Cretaceous (and younger) sediments of the Alaskan North Slope and Brooks Range to better define the framework geology. Additional goals included determining relevant analog units for petroleum exploration, paleoclimate assessments, and source rock characterization. For the first two weeks, the team stayed at the Kavik Camp hosted by Sue Aikens of National Geographic's Life Below Zero TV show, then moved on to Happy Valley on the Dalton Highway for the remainder of trip. Trip highlights include great weather, bear sightings from the helicopter and up close in town, as well as other wildlife sightings of caribou, moose, and distant wolves. At the end of the trip, several scientists visited the Geologic Materials Center managed by the [Alaska Division of Geological and Geophysical Survey](#) to log and sample core.

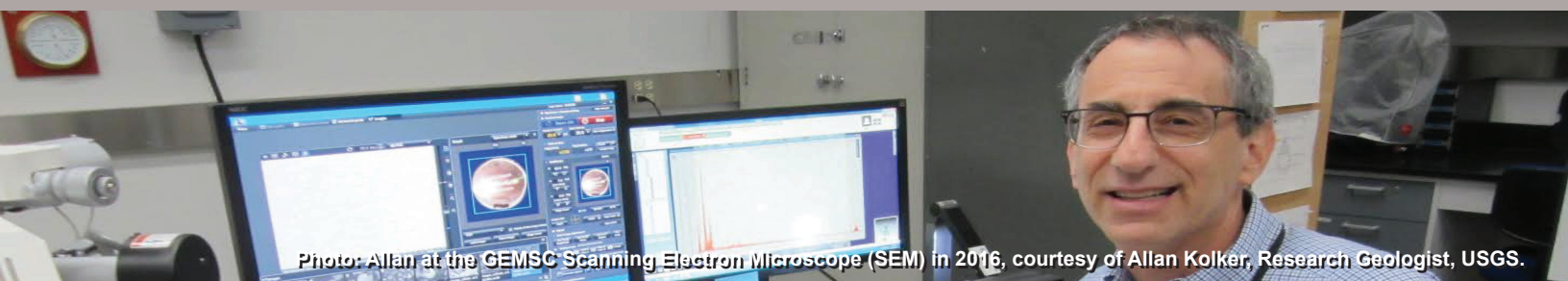
### GEMSC Scientists Interviewed by *Inside Climate News*



Image: From *Inside Climate News*, *Something in the Water* article, 2022.

GEMSC scientists Madalyn Blondes and Isabelle Cozzarelli were recently interviewed about their research on oil and gas wastewater reuse in California's San Joaquin Valley by *Inside Climate News*, a nonprofit news organization focusing on climate- and environment-related issues. The San Joaquin Valley provides a significant amount (12%) of U.S. agricultural production and is also a major oil and gas producer. Both industries require vast amounts of water; consequently, recovery and reuse of produced water from oil and gas extraction has been approved and expanded by the Central Valley Water Board. More than 14 billion gallons of produced water from several Kern County oil companies now saturate ~100,000 acres (~11%) of the county's farmland in the San Joaquin Valley. Blondes and Cozzarelli served as subject matter experts on the reuse of oil and gas wastewaters, and highlighted the potential, and likely negative impacts on the environment, existing water reservoirs, and agricultural products. Impacts include issues derived from naturally occurring toxic elements (e.g., radium and arsenic) in the produced water in addition to the more widely known toxicity issues associated with fracking fluid. Such insights provide readers with a more well-rounded understanding of the issues facing the environment, industries, and people. A link to the article can be found [HERE](#). Questions can be directed to Madalyn ([mblondes@usgs.gov](mailto:mblondes@usgs.gov)) or Isabelle ([icozzare@usgs.gov](mailto:icozzare@usgs.gov)).





## Scientist Profile ~ Allan Kolker

My connection to GEMSC began, indirectly, with a phone call. It was 1988. I was finishing my Ph.D. in high-temperature geochemistry at Stony Brook University and looking for postdoctoral opportunities. The call, to one of my Stony Brook faculty advisors from nearby Brookhaven National Laboratory, was seeking a postdoc to use high energy radiation at the [National Synchrotron Light Source](#) to study trace elements in coal. My advisor confirmed that I could do that. It was a career-changing opportunity. And it began a career-long pattern of using innovative analytical approaches and being among the first to apply these to coal. Brookhaven had hopes of building a coal research program modeled after the one at the USGS. The contacts I made as a postdoc included future USGS colleague and mentor, Bob Finkelman.

After Brookhaven, I found a faculty opportunity at the University of Nebraska-Lincoln, in my original field, high-temperature geochemistry. Although temporary, I was allowed to supervise graduate students. I taught an undergraduate course in igneous and metamorphic petrology, a graduate course in trace element and isotope geochemistry, and more than 2,000 students in introductory physical geology, including a future Olympic gold medalist and a future member of the Pro Football Hall of Fame. Nebraska had a new inductively coupled plasma mass spectrometer (ICP-MS), and I used it to determine rare earth elements in geologic samples. This proved to be less painstaking, but nearly as precise as the isotope dilution method I used at Stony Brook for rare earth determination in my dissertation work. Little did I know that 30 years later, the world would be abuzz with interest in rare earth elements as resources essential to modern life!

I finally arrived at the USGS in the Fall of 1996, under the sponsorship of Bob Finkelman. I soon learned that Bob generated a wealth of ideas. And while my new title was Research Geologist, I also became a filter for Bob's many project suggestions. At that time in the late 90s, there was considerable interest in hazardous air pollutants from coal combustion, so-called HAPs elements, such as

Hg, Se, As, and Cr. More than a decade later, these emissions would become regulated under the [EPA Mercury and Air Toxics Standards](#). To better understand how mercury in coal occurs, I had the idea to study mercury-enriched coals in the Donbas region of Ukraine, sadly, now a debilitated war zone. With funding from the NATO Science Programme, and then the U.S. Civilian Research and Development Foundation, we made two exchange visits to Ukraine in the early 2000s. This led to my first Mendenhall

Postdoctoral Fellow, Mark Engle, who investigated atmospheric mercury deposition, and the question of why this deposition was greater along the U.S. Gulf Coast than in more northerly coastal regions. A second Mendenhall Postdoc, Amrika Deonarine, was motivated by prominent coal ash spills along waterways in the Southeast. Her project addressed controls on mobility of toxic elements, such as As and Cr, from coal ash, under conditions that replicated those expected in natural systems.

With adoption of the EPA MATS Standards, interest in HAPs elements lessened. Support by the U.S. Department of Energy turned to the potential for coal and its byproducts to provide valuable resources apart from power generation. It was known for decades that among coal-related materials, fly ash was most enriched

in the rare earths, as these are strongly retained in solids remaining after coal is burned. But little was known about how these elements occur in fly ash. With GEMSC Research Geologist Clint Scott, we used the [Stanford/USGS SHRIMP-RG ion microprobe](#) to analyze fly ash glasses, the largest constituent of fly ash. We found that rare earths are present in these glasses at levels like those of bulk fly ash samples. This observation explained why these elements can be difficult to extract, as their glassy host is not easily decomposed. Today, the effort to identify coal-related sources of rare earths and other critical elements continues with our participation in the [DOE CORE-CM initiative](#), which seeks to identify portions of U.S. coal basins that are most promising for non-energy resource recovery.

All this in a USGS career that started with a phone call!



**Photo: Allan Kolker,  
Research Geologist,  
USGS GEMSC.**



Photo: A cinder cone from the dormant Mauna Kea volcano, Hawai'i, 2022, courtesy of Bonnie McDevitt, Research Engineer, USGS.

## Employee Corner

### Stefan Anthopoulos



Stefan joined the GEMSC in July 2022 as an intern through the [ESA/USGS Cooperative Summer Fellowship Program](#). He graduated in May 2022 from Eckerd College with a B.S. in Marine Science and minors in Chemistry and French. Stefan is an intern in the [Reston Biogeochemical Processes in Groundwater Lab](#), where he contributes to research on the processes and impacts of organic contaminants in surface and groundwater environments. Outside of the USGS, Stefan's interests include soccer, filmmaking, and freediving.

### Debora "Deb" Farley



Deb recently joined the GEMSC as the Administrative Officer. She comes to GEM with over 20 years of experience working for the Federal Government. Her previous positions focused on finance, auditing, and public health, and included roles in several Department of Interior agencies (including the Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, Bureau of Reclamation, and other USGS Centers in Reston and Denver) as well as the Department of Agriculture's Natural Resources Conservation Service and the Smithsonian Air and Space Museum. Prior to joining the Federal Government, she worked at The Children's Hospital in Denver and the Jefferson County Health and Human Services. Outside of work, Deb enjoys hiking, kayaking, birding, biking, and is a bit of a rockhound.

### Sanskruthi Sreepangi



Sanskruthi joined the GEMSC in July 2022 as an intern in the [Reston Microbiology Lab \(RML\)](#). She is pursuing a B.S. in Biology at George Mason University and plans to pursue a master's degree in molecular biology after graduating. Sanskruthi is contributing to RML research aimed at understanding how microbial communities are impacted by PFAS-contamination and oil and gas development. Apart from research, Sanskruthi loves drinking matcha, anything green in general, and animals.

### Luis Henry Vazquez



Luis joined the GEMSC as a Program Analyst after working at the Department of Defense for over 12 years. He is a systems engineer/project manager/image scientist who has worked on, and managed teams focused on each stage of the system engineering lifecycle, from conceptual development to the decommissioning of remote sensing technologies. Luis received his Master of Military Studies from the Marine Corps University – Command and Staff College, M.S. in Systems Engineering from George Washington University, B.S. in Imaging Science from Rochester Institute of Technology, and A.A.S. in Optical Systems Technology from Monroe Community College. He enjoys spending time with his family, practicing Brazilian Jiu-Jitsu, and 3D printing.





Photo: Papakolea Green Sand Beach, Hawai'i. Olivine sand beach seen from a hiking trail, 2022, courtesy of Bonnie McDevitt, Research Engineer, USGS.

## Center Achievements & Recognition

### GEMSC Staff Member Recognized with 2021 Shoemaker Award for Lifetime Achievement in Communications



The *Eugene M. Shoemaker Award for Lifetime Achievement in Communications* is presented annually to a scientist who creates excitement and enthusiasm for science among non-scientists by using effective communication skills. Each year, a broad-based committee that includes past *Lifetime Achievement Award* recipients, reviews the nominees and selects the winner. **Dave Houseknecht**, a senior research geologist at the Geology, Energy & Minerals Science Center has been selected as the recipient of the *2021 Shoemaker Award for Lifetime Achievement in Communications*.

Dave is a gifted and prolific researcher with an extraordinary ability to clearly articulate USGS science. Throughout his remarkable career, Dave has made numerous major scientific contributions and communicated the results and impact of his work in clear and understandable terms to a broad audience. His expertise in Arctic geology and petroleum resources—combined with his widely recognized ability to present objective scientific information—has resulted in hundreds of presentations to audiences spanning presidential administrations, Congress, the Alaska State administration and legislature, professional societies, public and private organizations, the media, and the general public. Perhaps his finest efforts have been in representing the USGS scientific perspective on such politically volatile issues as petroleum resources in the Arctic National Wildlife Refuge, the National Petroleum Reserve in Alaska, and the global Arctic.

Dave is especially adept at using interviews with geological magazines to generate expanded coverage of USGS scientific endeavors. More than twenty articles in the *AAPG Explorer*—the international magazine of the American Association of Petroleum Geologists—have featured substantial write-ups covering his USGS research over the past thirty years, including ten cover photos taken by Dave. One part of Dave's service is rarely visible. He holds a security clearance and regularly briefs the intelligence community regarding Arctic geology. His briefings invariably reflect positively on the USGS, largely because of his skill in effectively communicating highly technical content and its significance to a non-technical audience. Dave Houseknecht has forged a sustained career of excellence in research, scientific leadership, and scientific integrity that reflects the finest traditions of the USGS. Due to his impeccable skill in professional communication, Dave has become a highly trusted messenger of USGS science.

## Join Our Team! ~ Job Opportunities

The GEMSC frequently has opportunities for bringing in new staff. We are currently advertising for the following position:

- [Pathways Student Trainee \(Physical Science\)](#).

This position is for an undergraduate or graduate student working towards a degree in physical sciences, geology, geophysics, engineering, or mathematics to gain practical experience in collecting, processing, and interpreting geophysical, geologic, and physical property data and preparing reports. We anticipate that a few candidates could be selected for this trainee position. The area of study is the upper Midwest. 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: Fossil Butte National Monument, Wyoming, 2021, courtesy of Matthew Merrill, Research Geologist, USGS.

## Quarter 3 Publications and Data Releases by GEMSC Authors

### Publications (USGS and External)

A Novel Method for Conducting a Geoenvironmental Assessment of Undiscovered ISR-Amenable Uranium Resources: Proof-of-Concept in the Texas Coastal Plain:  
<https://doi.org/10.3390/min12060747>

Dissolved Organic Matter within Oil and Gas Associated Wastewaters from U.S. Unconventional Petroleum Plays: Comparisons and Consequences for Disposal and Reuse:  
<https://doi.org/10.1016/j.scitotenv.2022.156331>

Environmental Geology of Mineral Deposits: Introduction:  
<https://doi.org/10.5382/econgeo.4942>

Machine Learning and Data Augmentation Approach for Identification of Rare Earth Element Potential in Indiana Coals, USA:  
<https://doi.org/10.1016/j.coal.2022.104054>

Maturation Study of Vitrinite in Carbonaceous Shales and Coals: Insights from Hydrous Pyrolysis:  
<https://doi.org/10.1016/j.coal.2022.104044>

New Idria Serpentinite Protrusion, Diablo Range, California: From Upper Mantle to the Surface:  
<https://doi.org/10.2475/04.2022.01>

Porphyry Copper: Revisiting Mineral Resource Assessment Predictions for the Andes:  
<https://doi.org/10.3390/min12070856>

Possible Effects of Multiphase Methane Evolution During a Glacial Cycle on Underpressure Development in Sedimentary Basins: An Analysis with Application to the Northeast Michigan Basin:  
<https://doi.org/10.1029/2021JB023322>

Relating Systematic Compositional Variability to the Textural Occurrence of Solid Bitumen in Shales:  
<https://doi.org/10.1016/j.coal.2022.104068>

Structural Inheritance in the Chukchi Shelf, Alaska:  
<https://doi.org/10.1016/j.marpetgeo.2022.105812>

Understanding the Evolution of Groundwater-Contaminant Plume Chemistry Emanating from Legacy Contaminant Sources: An Example from a Long-Term Crude Oil Spill:  
<https://doi.org/10.1111/gwmr.12536>

### USGS Data Releases

Electron Microprobe Analyses of Sphalerite and Hemimorphite from Mine Wastes from the Tar Creek Superfund Site, Tri-State Mining District, Oklahoma, U.S.A.:  
<https://doi.org/10.5066/P9ALZZ3E>

Elemental Concentrations for Bulk and Size-Fractionated Mine Waste from the Tar Creek Superfund Site, Tri-State Mining District, Oklahoma, U.S.A.:  
<https://doi.org/10.5066/P92MXFIQ>

Mineral Abundances within Bulk and Size-Fractionated Mine Waste from the Tar Creek Superfund Site, Tri-State Mining District, Oklahoma, U.S.A.:  
<https://doi.org/10.5066/P9ZM36FG>

Molecular Speciation of Ge within Sphalerite, Hemimorphite, and Quartz from Mine Waste from the Tar Creek Superfund Site, Tri-State Mining District, Oklahoma, U.S.A.:  
<https://doi.org/10.5066/P9HI7VKH>

Porphyry Copper Deposits in the Andes Mountains of South America:  
<https://doi.org/10.5066/P9AVKJVV>

Solid and Aqueous Geochemistry for Mill Tailings and Other Ore Processing Materials:  
<https://doi.org/10.5066/P9GZKFUO>

Water-Quality Results from a Wastewater Reuse Study: Inorganic and Organic Compositions of Wastewater Effluent and Select Urban and Agricultural Water Types During Rain-Induced Runoff, Chickasha, Oklahoma, 2018-2019:  
<https://doi.org/10.5066/P9WEPT20>