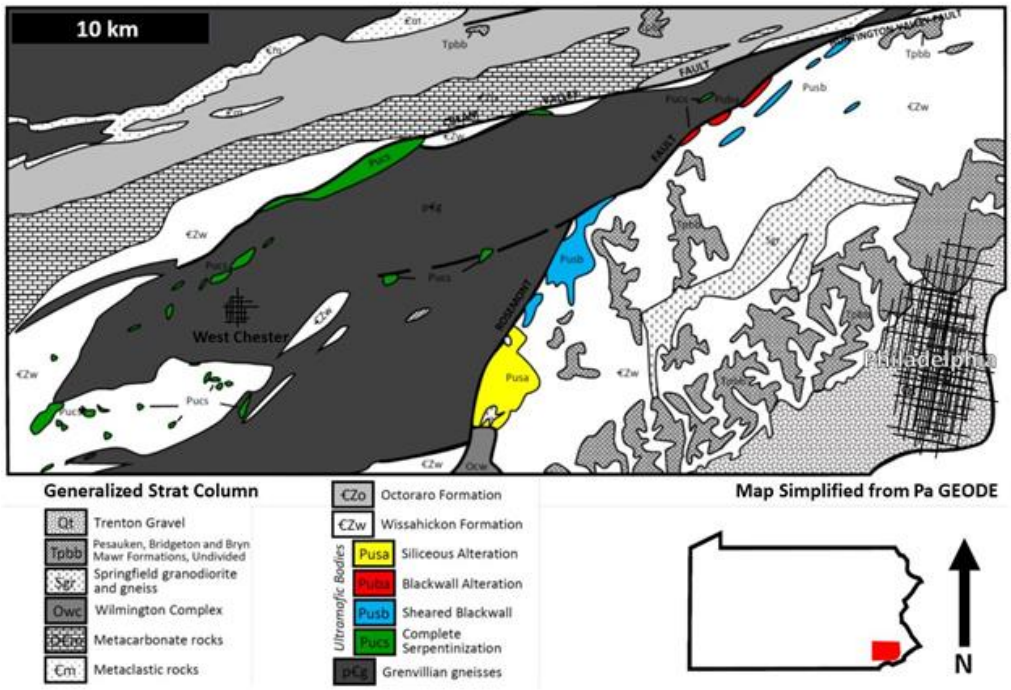
SEPTEMBER 2021 PGS NEWSLETTER VOL LXXIV NO 1

PITTSBURGH GEOLOGICAL SOCIETY

Using Petrologic, Geochemical, and Structural Analyses to Unravel the History of the Ultramafics of Southeastern Pennsylvania



Ryan Kerrigan, Ph.D. PG

Associate Professor of Energy & Earth Resources
University of Pittsburgh at Johnstown

Make Reservations by Wednesday, September 8

September 15, 2021

MEETING TIMES

Social Hour	**5:30 PM**
Dinner	**6:30 PM**
Speaker	**7:30 PM**

DINNER COSTS

$35.00 regular member
$15.00 student member
$40.00 non-member

RESERVATIONS

Email your name and number of attendees to: pgsreservations@gmail.com

Or reserve and use PayPal: https://www.pittsburghgeologicalsociety.org/

MEETING LOCATION

Cefalo's Banquet & Event Center, Carnegie PA

COVID19 POLICY

Members must wear masks and maintain social distance at the meeting.

Speaker Abstract

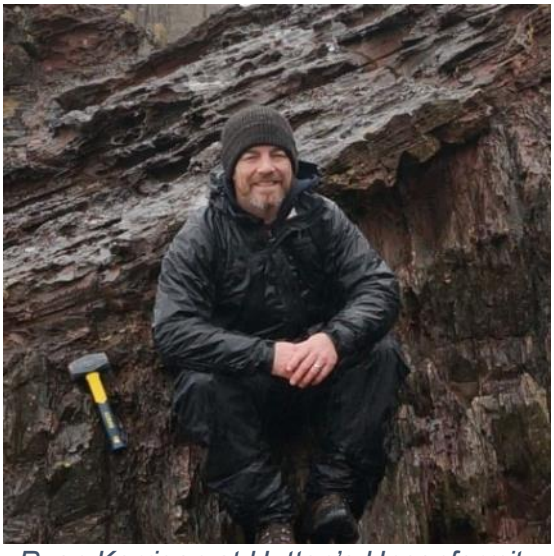
An examination of ultramafic bodies in southeastern Pennsylvania using field mapping, petrography, and geochemistry has revealed four distinct styles of alteration. The ultramafic bodies are lenticular in shape ranging from 0.5 km to 6 km along their long axis. The bodies are generally adjacent to major shear zones in the region and are considered to have been emplaced during the Taconic Orogeny (470 Ma). Trace elements indicate that the ultramafic protoliths are likely related to the collided island arc rather than ophiolitic or mantle upwelling settings.

Four styles of alteration can be identified: complete serpentinization, blackwall alteration (i.e., nominally anhydrous cores surrounded by “onion-skin” alteration zones of increasing hydration), sheared blackwall alteration, and siliceous alteration. The westernmost bodies trending west-southwest are encompassed in the Grenvillian (1.0 Ga) mafic Baltimore Gneiss and exhibit complete serpentinization. The serpentine is mainly mesh texture lizardite with relict olivines indicating an olivine-rich protolith. However, the close association with the mafic Baltimore Gneiss may indicate Si-poor fluids reducing the possibility of the anthophyllite-talc alteration seen in the blackwall altered bodies.

The remaining three alteration styles are found on the eastern side of the Piedmont within the Taconic (470 Ma) Wissahickon Schist trending south-southwest. Two sets of parallel trending bodies closest to northern Philadelphia and adjacent to the Rosemont Shear Zone exhibit blackwall alteration. Counterintuitively, the set closest the Rosemont Shear Zone show little shear deformation and retain their “onion-skin” alteration zones typically with cores of orthopyroxenite. The set slightly further (~1 km) from the Rosemont Shear Zone shows significant shear deformation (strain shadows, unit duplication, etc.). The two largest ultramafic bodies show a mix of blackwall alteration, serpentinization, and siliceous alteration. Siliceous alteration is most significant in close proximity with intruding granitic intrusions.

The Philadelphia-area ultramafic bodies may represent a dismembered layered mafic complex below an island arc with the olivine-rich stratigraphic bottom to the west and the upper orthopyroxenites to the east.

Speaker Biography



Ryan Kerrigan at Hutton’s Unconformity at Siccar Point, Scotland

Dr. Ryan Kerrigan graduated from Bridgewater State University with a B.S. in Geology and B.A. in Chemistry before attending the University of Minnesota for his M.S. in mineralogy/petrology. He moved to the University of Maryland to complete his Ph.D. in experimental petrology. After his Ph.D., Dr. Kerrigan spent four years in the private sector completing environmental site assessments and remediation projects where he earned his Professional Geologist’s license. In the Fall of 2014 Dr. Kerrigan joined the faculty at University of Pittsburgh at Johnstown. His current research interests include the hydrothermal alteration of ultramafic/mafic rocks, the petrogenesis of granitic and pegmatitic bodies, provenance of orogenic emplacement formations, geology of the central Appalachian Piedmont, and pedagogy in the geological sciences.

UPCOMING PGS MONTHLY MEETINGS

Next month's PGS Dinner Meeting will be held on October 20, 2021.

Dr. Thomas Jordan

FORENSIC GEOPHYSICS AND THE DELINEATION OF CLANDESTINE GRAVES

Department of Geological and Environmental Sciences
Youngstown State University

Meeting Date	***Scheduled Speaker***	***Presentation Topic***
November 10, 2021	T.A. Anderson, University of Pittsburgh	TBA
December 15, 2021	TBA	TBA
January 19, 2022	Darcy Lecturer	TBA
February 16, 2022	David King, Auburn University	Chicxulub Crater Geology
March 16, 2022	Jamie Farrell Utah State University	Geology of Yellowstone
April 20, 2022	19th Annual Student Research Night	
May 11, 2022	TBA	Oil and Gas Industry Topic

The Pittsburgh Geological Society welcomes a new student member:

- Jasmine L. Davis, CalU

PRESIDENT'S STATEMENT

Hello all and welcome to the 2021-2022 PGS program year! I hope that you all have had a chance to relax and potentially even get outside for a bit this summer to do some hiking, field work, or reconnect with friends and family. I sincerely hope you have all remained well both mentally and physically and are looking forward to another great PGS year, we have some amazing speakers lined up.

I've spent a lot of time this summer reminiscing about past years of PGS activity and am optimistic about the potential to resume in-person meetings to reconnect with close friends and to meet new members. I look forward to social interaction at our monthly meetings and to working with the Board of Directors on new opportunities for our members and the community. This year should bring some exciting new events and it will be my great pleasure to share our decisions with the membership. As webmaster, I'm also working on new ways to demonstrate value to our corporate sponsors and better ways to advertise geologic events, news, and career opportunities.

We have planned for a full program season at our venue in Cefalo's Banquet and Event Center in Carnegie and have high hopes that we will be able to continue with in-person meetings the entire year. To achieve that goal, we will all need to remain diligent in our efforts to reduce the potential spread of COVID-19 and newly developing variants. At meetings, we must follow all CDC-recommended procedures, wear masks, and maintain social distancing to protect ourselves and our colleagues. I humbly ask for the membership to be respectful of these recommendations and to help us all remain safe. PGS will continue to monitor the situation nationally and in Allegheny County and will keep the membership informed regarding any potential changes to meeting format.

I'm also hopeful that PGS will be able to revisit some of the plans we had for the 2020-2021 program year and will again be able to offer exciting activities like field trips, volunteer activities, and workshops. I think this will be a big year for PGS and know there are exciting times ahead. The board also welcomes any suggestions and ideas for ways that PGS can enrich your professional and personal lives through field trips, professional development, or community events.

Don't forget to renew your membership for the 2021-2022 year either through mail or the convenient PayPal link on our society webpage.

I look forward to seeing you all again soon.

Dan

LOCAL GEOLOGICAL EVENTS

SOCIETY OF WOMEN ENVIRONMENTAL PROFESSIONALS (SWEP)

September 11, 2021 **8:00 AM-1:00 PM**

" Connoquenessing Creek Cleanup Project"

Lick Hill Volunteer Fire Department, 122 McClellan Dr., Butler, PA 16001

Details and RSVP link: https://swep3rivers.org/event-4460395

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS (PCPG)

September 14, 2021 **1:00 - 2:00 PM**

"Karst Site Characterization, Focusing on Geophysics for Geotechnical Projects" by Mia A. Painter, P.G., Schnabel Engineering

Webinar (60 minutes)

Details and registration: https://pcpg.org/event-4384733

September 23, 2021 **1:00 - 2:00 PM**

"A New Approach to Urban and Semi-Urban Watershed Hydrologic Characterization for Stormwater Management" by Emily Mercurio, PhD, P.G.Civic Mapper

Webinar (60 minutes)

Details and registration: https://pcpg.org/event-4386354

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

September 17, 2021 **8:00 AM-4:30 PM**

"PDH Boot Camp"

Engineers' Society of Western Pennsylvania, 337 Fourth Ave, Pittsburgh, PA 15222

Details: https://eswp.com/annual-events/bootcamp/boot-camp-program/

Registration: https://eswp.com/annual-events/bootcamp/

NEW PGS BOARD MEMBERS

The Pittsburgh Geological Society welcomes two new faces to our Board of Directors this year, along with a returning veteran and past president of the society, Albert Kollar.

Albert Kollar

Albert Kollar, the Head of Section and Collections Manager for the Section of Invertebrate Paleontology at the Carnegie Museum of Natural History, has contributed much to PGS and the geologic community at large during his career. With the PGS, Albert served as President three consecutive terms (2011-2014), the first member ever to do so. As a Director At Large (2004–2011 & 2015-current) Albert served the PGS Board in many capacities that included organizing field trips and chairing the Awards Committee. Albert has also received recognition as the recipient of the Eastern Section AAPG George V. Cohee Public Service Award (2017) and the GSA GSIS Award for Best Guidebook (co-authored with fellow PGS member John Harper) for “Geology of the Early Iron Industry in Fayette County, Pennsylvania” (2018).

Wendy Noe

Wendy (True) Noe is a Licensed Professional Geologist at the Pennsylvania Department of Environmental Protection’s (PADEP) California District Mining Office. She reviews bituminous coal mining permits, evaluating impacts to water resources that may be adversely affected by underground mining operations, coal preparation plants, and coal refuse disposal facilities.

Wendy started her career as a field geologist at SCS Engineers in Bellevue, Washington then moved to Baltimore to work in the Federal Facilities section of the Maryland Department of the Environment (MDE). She moved to Pittsburgh and worked as a geologist and project manager at American Geosciences (AGI) for over 20 years. She spent much of her time inspecting buildings and properties while conducting Phase I Environmental Assessments and other types of due diligence primarily in Western Pennsylvania. She also managed groundwater remediation at a Resource Conservation and Recovery Act (RCRA) site in Idaho, handled multiple underground storage tank (UST) remediation sites for a Fortune 500 transportation company, managed investigation and remediation of PA Act 2 (Land Recycling Program) sites, and served as a PG on the PPP/Mariner East II pipeline installation. She is interested in student mentoring and outreach having participated in the PGS drilling workshops and helping organize the PGS 75th Anniversary field trip prior to it being postponed due to Covid-19.

Wendy received degrees in Geology from Muskingum (BS) and Miami University (MS) where she was fortunate to meet her husband. She has two children and enjoys jogging and playing the flute in the East Winds Symphonic Band.

(*continued on next page*)

Nancy Slater

Nancy Slater is a native of Pittsburgh and currently lives in Plum Borough with her husband Dave. She is a past PGS Board member who took time off from the Society while working and raising their two children, Deanna and Will. Nancy is pleased to re-join the PGS Board of Directors and participate in its many activities.

Nancy has worked her entire career in the Pittsburgh area as a Certified Professional Geologist. She was appointed by the former Governor to serve on the Act 220 Water Board to develop water policy for the State of Pennsylvania. Over the years she has gained extensive experience in the areas of Underground Storage Tank (UST) investigation and remediation; geotechnical drilling for all types of construction projects; environmental sampling and remediation and permitting/compliance for many types of projects. Most recently she provided permitting and compliance work for the exploration and production of a major Pennsylvania Marcellus gas field.

In May, 2021, Nancy retired from Cabot Oil and Gas Corporation but will resume her career working part-time for Atlas Technical Consultants as a Senior Environmental Scientist. She plans to spend the remaining part of her time traveling with her husband, hanging out with Demelza, her dalmatian, reading, stitching, beekeeping and spoiling her three grandchildren, Kali, Colton and Wes.

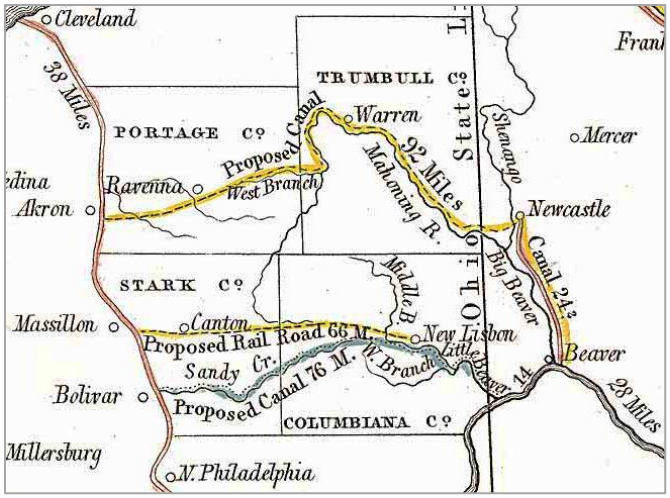
THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

A rural portion of Ohioville Borough in Beaver County near the Ohio-Pennsylvania state line.

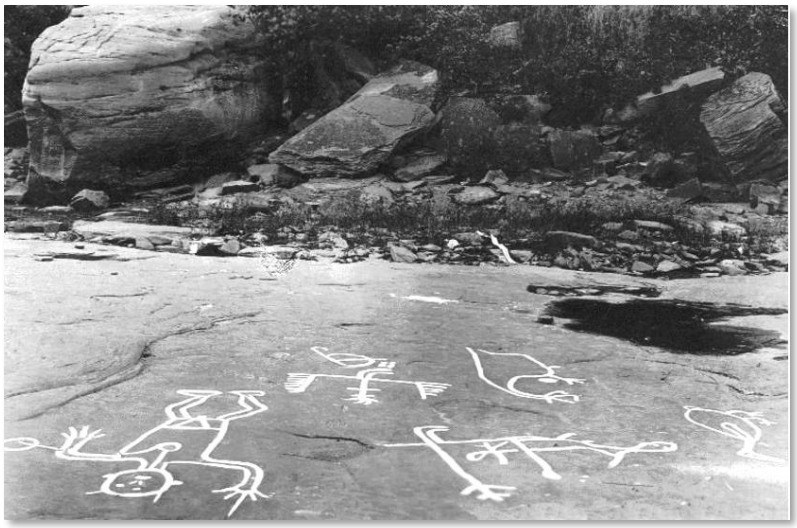
Ohioville Borough in western Beaver County originally was a township, created from part of South Beaver Township in 1805 and named Ohio because it was adjacent to the Ohio River. Prior to being reincorporated as a borough in 1960, the township included several villages, including Ohioville, Glasgow, and Smith's Ferry.

The village of Ohioville, near the center of the township, established its first post office in 1828. Today, the village is little more than a crossroads near the center of the borough.

1834 U.S. House of Representatives map showing the route of the Sandy and Beaver Canal in blue.



Glasgow, at the intersection of Little Beaver Creek and the Ohio River near the Pennsylvania/Ohio boundary, was established in 1836 and incorporated as a borough in 1854. The village was laid out in the hope that construction of the Sandy and Beaver Canal, which ran 73 miles from Bolivar, Ohio, to the river, would have given the village an important role in Pennsylvania commerce. The canal was abandoned after four years, due to increasing competition from railroads and the collapse of the Cold Run Reservoir Dam outside of Lisbon, Ohio.



Historical photo of petroglyphs that used to be visible in the sandstone bed of the Ohio River at Smith's Ferry in Beaver County. The carvings were enhanced with chalk for photographic purposes.

The village of Smith's Ferry originated as the northern end of a ferry operated by a family named Smith that, at the time, was one of the only ways to cross the Ohio River in western Beaver County. The terminus became an official town in 1834 when a post office was established. At one time, Smith's Ferry had a hotel, train station, school, and several businesses. In 1860, less than a year after the completion of the Drake Well in Venango County, oil was discovered in Smith's Ferry and, over time, the small oil field expanded throughout most of the township and even westward into Ohio.

Smith's Ferry was also the location of a series of petroglyphs carved into the sandstone in the riverbed that used to be visible at low water level. Construction of the Stratton Dam at New Cumberland, West Virginia, in the 1950s, however, permanently raised the water level and now the petroglyphs are under 10 feet of water. Nothing of Smith's Ferry remains today, but its place in history is sealed because of the petroglyphs and the fact that it was the central point of business for the first oil field in Pennsylvania outside of Venango County.

DID YOU KNOW . . . ?

It is possible that Pennsylvania's next big energy industry might be the production of hydrogen that, when coupled with carbon-capture technology, would be a carbon-free energy source. Hydrogen represents a significant reduction in carbon intensity. 'Green' hydrogen, which is derived from renewable sources, would have no carbon footprint at all. 'Blue' hydrogen, which is derived from natural gas, would provide a powerful fuel source without the methane emissions that plague the current natural gas industry, and any carbon derived from 'blue' hydrogen production could be stored underground.

Both current natural gas production and the region's subsurface geology place Appalachia, and Pennsylvania in particular, in a strong position in the developing hydrogen energy field. One company named KeyState is constructing a plant in Clinton County that will convert natural gas into hydrogen, ammonia, and urea for industrial uses. Like other projects under way in Appalachia, the plant will also use carbon capture technology and storage in subsurface oil and gas reservoirs. Another company called Long Ridge Energy currently is working to combine hydrogen and natural gas for power generation.

The future of the oil and gas industry just might be the production of hydrogen, a clean, carbon-free energy source.

At the moment, both ‘blue’ and ‘green’ hydrogen are more expensive than existing fuel sources but, based on cost, ‘blue’ hydrogen is an easier and more cost-effective transition than ‘green’ hydrogen, and it makes the existing oil and natural gas industry relevant into the future because production and pipeline infrastructure can be maintained. Acceptance of the existing oil and gas industry with its expertise, skill, and technology for ‘blue’ hydrogen is the practical and realistic way to go. ‘Green’ hydrogen is not likely to be built to scale in Appalachia for many years, but ‘blue’ hydrogen is in reach as long as the industry focuses on what resources are available to be able to do that, and natural gas is a perfect solution.

https://www.bizjournals.com/pittsburgh/news/2021/04/08/pennsylvania-hydrogen-conference.html

Australian and Chinese scientists have determined that small amounts of gold can be trapped inside pyrite. Their study supplies an in-depth analysis that will help us to understand better the mineralogical location of the gold locked in the pyrite. This might lead to more environmentally friendly gold extraction methods. This is especially important because the discovery rate of new gold deposits is waning worldwide and the quality of the gold ore is degrading while the value of gold has been increasing.

This new type of previously undetected gold is only observable using atom probe tomography. Until recently, companies extracting gold were only able to find the gold in pyrite as either nanoparticles or a pyrite-gold alloy. The new study discovered that gold can also be hosted in nanoscale crystal defects 100K times smaller than the width of a human hair. The more deformed the crystal is, the more gold that can be locked up in the defects.

The team also explored gold-extraction methods and potential ways to obtain the trapped gold with less adverse impacts on the environment. Gold typically is extracted using a method similar to cooking called pressure oxidizing technique, but this process uses large amounts of energy and the team wanted to find an eco-friendlier method of extraction. They came up with a process called selective leaching that uses a fluid to selectively dissolve the gold from the pyrite. The crystal defects not only trap the gold; they also provide fluid pathways enabling the gold to be leached without affecting the pyrite as a whole.

Gold trapped in nanoscale defects in pyrite crystals can now be extracted and added to the world’s market.

https://scitechdaily.com/scientists-discover-fools-gold-is-not-so-foolish-after-all/

Plate tectonics during the Middle Miocene, about 12 ma ago, didn’t just create new mountains in central Europe. It also produced the largest lake the world has ever known. The Paratethys Sea was a vast body of water, large enough to host species found nowhere else in the world. Two recent studies uncovered the origins of this ancient lake and how the changes to the surrounding area helped the evolution of elephants, giraffes, and other large mammals that wander the planet today. Researchers from Brazil accumulated clues from geological and fossil records to help build that scenario.

At its largest, the Paratethys (some geoscientists consider it to have been an inland sea, rather than a lake) stretched from the eastern Alps into what

is now Kazakhstan, covering more than 1 million mi^2, an area larger than the Mediterranean Sea is today. They also estimated that the Paratethys must have held more than 425,000 mi^3 of water, greater than 10 times the volume found in all of the fresh- and saltwater lakes found on the planet today combined.

The world's largest known lake, the Middle Miocene megalake Paratethys, extended from the eastern Alps in Europe to Kazakhstan in Asia.

Climate change, however, caused the lake to shrink considerably during at least four periods in its 5-ma lifetime. Water levels fell as much as 820 ft during the Late Miocene, between 7.65 ma and 7.9 ma ago, when the lake lost as much as 1/3 of its water and more than 2/3 of its surface area. As a result, salinity in the lake's central basin (essentially the same as today's Black Sea) rose steeply to as high as seawater. The changes in the lake exterminated many aquatic species, including numerous species of algae and other small free-floating organisms.

Only those aquatic species that could survive the brackish water, like certain mollusks, survived to repopulate the lake when it expanded during wetter times. Before long, the Paratethys supported a wide variety of mollusks, crustaceans, and marine mammals found nowhere else in the world. Many of the aquatic mammals – whales, dolphins, and seals – that lived there were dwarfed versions of those found in open seas. One such species was a 10-ft long whale, called *Cetotherium riabinini,* that was 3 ft shorter than the modern-day bottlenose dolphin. It is considered to be the smallest whale ever found in the fossil record. Some paleontologists believe that such dwarfism might have helped these animals adapt to a shrinking Paratethys.

Miocene climate change also influenced the evolution of land animals. As the water levels fell, newly exposed shorelines became grasslands, and perfect places for terrestrial evolution to take place. North of the Paratethys, the fossil record indicates that the ancestors of modern-day sheep and goats roamed side by side with primitive antelope. South of the lake, in what is now western Iran, ancestors of today's giraffes and elephants prospered along with other creatures. Four long Late Miocene dry episodes, between 6.25 ma and 8.75 ma ago probably were responsible for driving them southward into Africa where they evolved into the highly diverse fauna found in today's African savanna. The Paratethys ceased to exist in the Late Miocene sometime between 6.7 ma and 6.9 ma ago when erosion produced an outlet at the lake's southwestern edge. This outlet probably existed as a short river that flowed to the Mediterranean.

https://www.sciencemag.org/news/2021/06/rise-and-fall-world-s-largest-lake

We've all been informed that a >6-mile-wide meteorite crashed into Earth near what is now the town of Chicxulub, Mexico, around 66 ma ago and purportedly wiped 75% of life on Earth including the non-avian dinosaurs. It is also known that another meteorite struck the planet near the current town of Bovtyshka in Ukraine either shortly before or shortly after the Chicxulub impact, but the temporal relationship of the events was uncertain. It was thought that the Ukraine impact occurred 2 ka to 5 ka prior to the mass extinction. Now, new research suggests that it actually occurred 650 ka AFTER the end-Cretaceous mass extinction when Earth's climate was

recovering from the effects of both the Chicxulub impact and Deccan Trap volcanism.

The Boltysh impact structure, as the Ukrainian area is known, is approximately 15 mi in diameter with a central uplift 3.7 mi in diameter. The structure is located in the Ukrainian province of Kivorohrads'ka oblast, buried beneath more than 1,640 ft of post-impact sediments. The older dates (2 ka to 5 ka prior to Chicxulub) for the Boltysh structure were determined decades ago, but many questioned whether the Ukrainian impact might have occurred close enough in time to the Mexican one to have had a significant effect on the end-Cretaceous extinction.

Photo of part of the Boltysh impact structure near Bovtyshka in Kivorohrads'ka oblast, Ukraine.

The new analysis (650 ka after Chicxulub) was based on four samples from two cores taken from the Boltysh crater that contain rocks generated during the impact event, as well as lake sediments deposited over time following crater formation. The researchers used argon-argon dating to suggest that the Ukrainian impact occurred about 65.39 ma ago, well after Chicxulub and the Cretaceous-Paleogene boundary.

In addition, the researchers drew a link between the new Boltysh impact date and evidence for a known hyperthermal event known from the sedimentary record called the lower C29N hyperthermal. Around that time, the Deccan Traps were releasing large amounts of greenhouse gases into the atmosphere, accelerating a period of global climate change.

Paleoclimatologists help us understand and adapt to climate change by studying how Earth's atmosphere responded to environmental stresses in the past. Linking the Boltysh lake sediments to the lower C29N hyperthermal will help us form a clearer picture of how Earth has responded to climate change in the past.

http://www.sci-news.com/paleontology/boltysh-meteorite-ukraine-09785.html

There's a relatively new plant fertilizer on the market called Bloom. It costs about 50¢/lb, but the technology and investment needed to develop the product took about $450 million. Bloom is considered a "biosolid" fertilizer, i.e., fertilizer made from human excrement! Despite that, it is supposed to be a great fertilizer. Many people use animal manure on their plants, and believe it or not, processed human waste is even used in industrial agriculture and landscaping.

Bloom, a biosolid fertilizer made at a sewage treatment plant in Washington, D.C.

Bloom is made by a Washington, D.C. wastewater-treatment facility, which has the traditional large tanks filled with brown water being filtered for oils and solids. As with every other treatment facility, there's always leftover sludge. The facility uses thermal hydrolysis to turn what gets flushed down the toilet into usable fertilizer. The process is basically a giant pressure cooker, which is key to getting both very high-quality biosolids and a lot of gas production and reduce the volume of waste by two-thirds. The process creates up to 40% more biogas that can be used to generate electricity to be used elsewhere in the

wastewater-treatment plant or even sold to the local electric utility. The biogas generated at the D.C. plant produces about 8 megawatts of electricity, more than enough to run the process.

The process is not cheap, of course. An installation may cost only $3 to $15 million but the infrastructure around it requires a huge investment. The D.C. facility was paid for with $450 million in municipal bonds that will be paid back over about 15 years. But it is also making money by selling Bloom fertilizer and renewable energy credits, so the bonds will be paid back a little sooner than originally anticipated. The facility produces about 450 tons of Bloom every day, so it earned about $200,000 in 2020 selling just a portion of it. They also saved between $10 and $15 million a year in trucking costs, and the extra energy the process generates helps power the rest of the facility.

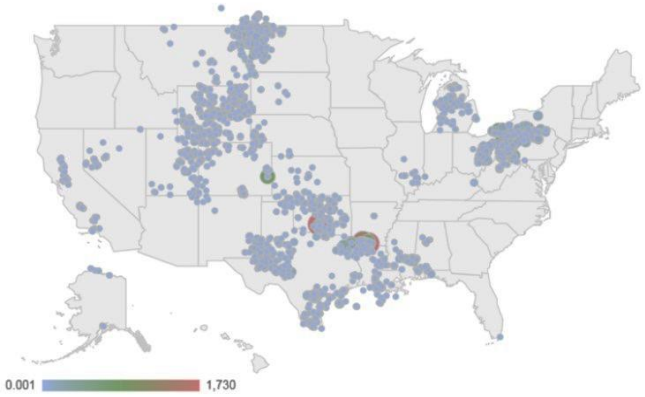
The technology to do all this was created by a Norwegian company called Cambi, which claims to control 90% of the global thermal hydrolysis processing market with facilities in dozens of countries. There are about 20,000 sewage-treatment plants in the U.S. that attract about $60 billion a year in investment. Cambi's system and similar ones tend to only be economical for larger waste-treatment systems. Although there is some consolidation of smaller wastewater utilities, getting them to do it is a very slow process. In addition, it is difficult to get public support and financing for something people prefer not to think about. We're all preprogrammed to be leery of our own waste – there's a bit of an "ick" factor that we need to get over.

The Cambi process doesn't remove all harmful waste such as industrial chemicals that can persist in biosolids. For example, the Sierra Club recently found that high residues of polyfluoroalkyl substances such as Teflon chemicals contaminate milk and are permanently contaminating farmlands where these products were applied. What is needed, therefore, is to prevent more chemicals from entering the water system in the first place. Bloom, though, supposedly is safe, has fewer chemicals than house dust, and exceeds standards set by the Environmental Protection Agency. Bloom looks like Iowa farm dirt, sequesters carbon in the garden soil, and avoids the use of inorganic fertilizer, which requires lot of energy to produce.

https://www.marketplace.org/shows/marketplace-tech/how-technology-is-changing-what-happens-after-you-flush/

The U.S. Department of Energy's Pacific Northwest National Laboratory has developed a new technology using magnetic nanoparticles to capture valuable materials from brines. This technology has been licensed exclusively by Moselle Technologies, a start-up business directing the technology in U.S. and international locations. It has blossomed into trial industrial-scale projects that may help make the U.S. a producer of the kinds of critical minerals used in electronics and energy production.

Lithium, nickel, cobalt, and rare earth elements



Potential lithium sources from water produced in mining and petroleum operations in ppm.

(REEs) are in great demand by semiconductor and wind turbine manufacturers, for batteries used in electric vehicles, and in other green energy technologies. But the global supply chain for these elements currently relies heavily on old extraction processes that are energy intensive, use a lot of water, and create toxic waste. In addition, 100% of the U.S. supply of 14 of 35 critical materials, and more than half of 17 others, are obtained from international sources, many of which are in high-conflict regions. This has made domestic supply a top priority. The new technology hopefully will put the U.S. in a more stable position for high-tech development.

The new process uses the core of the nanoparticle, magnetite, to anchor the adsorbent shell that selectively binds the compounds of interest. This is the key to the new technology. When introduced into brines from geothermal plants, produced water, mining effluent, or seawater, the nanoparticles latch onto free floating target compounds. Then, when the nanoparticles' iron cores are exposed to a magnet, they migrate toward the magnet along with the critical material to which they are bound. They can then be filtered from the brine.

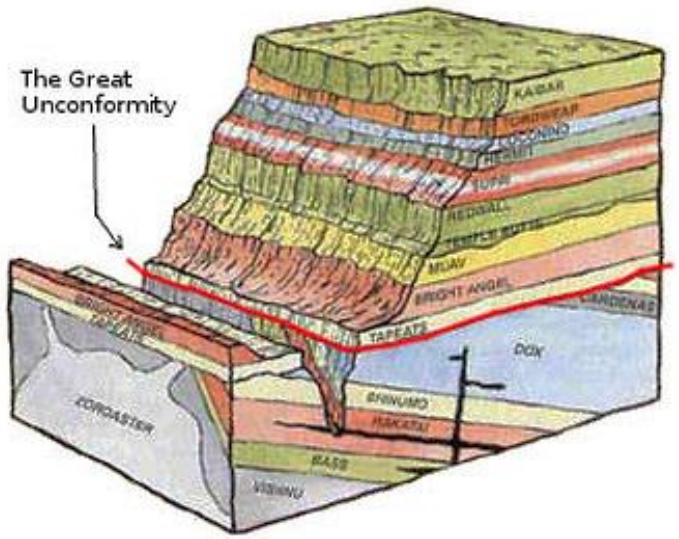
The technology is being tailored for the capture of lithium, an important metal needed in batteries and other items. With the new technology, virtually all of the lithium will be removed from the solution by molecular collisions with a sorbent. It can then be removed with a magnet, easily collected, and purified. As a result, subsequent concentrate should be in a purer form, thereby reducing the cost of further processing and eliminating more than half the total cost because, unlike existing processes, this new process miniaturizes everything and eliminates the need for massive ion exchange separators.

One of the planned pilot projects will be using brines from oil and gas production. Lithium is present in much of this wastewater and occurs over a wide range of locations. The research team has estimated that if just 25% of the lithium in oil and gas brines were collected, it would equal current annual worldwide production. Other projects will attempt to extract lithium from mines in the U.S. and Canada and cesium from geothermal well brines in New Zealand.

https://www.pnnl.gov/news-media/magnetic-nanoparticles-pull-valuable-elements-water-sources

Each layer of rock at the Grand Canyon represents a considerable period of the Earth's geological history. However roughly one-quarter of the Earth's geological history, about a billion years' worth of rocks, are missing. This loss is due to the "Great Unconformity," a noticeable gap that can be found in many different parts of the world.

Scientists have proposed several ideas to explain the Great Unconformity. One of the popular ones suggests that the Earth underwent a glaciation event known as "Snowball Earth" about a billion years ago, which covered several areas with ice. And when the glaciers eventually melted, they eroded sediments from the underlying rocks.



But a recent study published in *Geology* has come up with another plausible explanation using thermochronology, or the study of the thermal evolution of a region by measuring the heat stored in rocks at the time of their formation. It links the Great Unconformity to the supercontinent Rodinia, which was formed about a billion years ago and broke up about 600 to 700 million years back. Researchers at the University of Colorado Boulder speculate that the break-up of Rodinia caused violent tectonic movements across many regions, including the Grand Canyon. This led to rocks and sediments being washed away into the ocean — a billion years' worth of rocks disappearing without a trace.

https://pubs.geoscienceworld.org/gsa/geology/article/doi/10.1130/G49116.1/606722/Zircon-U-Th-He-thermochronology-reveals-pre-Great

WEBSITE OF THE MONTH:

https://www.weforum.org/agenda/2021/01/coal-demand-asia-decarbonize-emissions/

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Fun Fact Having Nothing to Do with Geology

If you are looking to lose weight, just bang your head against a wall for an hour and you will burn 50 calories.

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