Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS | NOVEMBER 2024 | VOL. 50, ISSUE 11

Ray Anderson, Editor: rockdoc.anderson@gmail.com

Next CVRMS Meeting
Tues. Nov. 19
7:15 pm

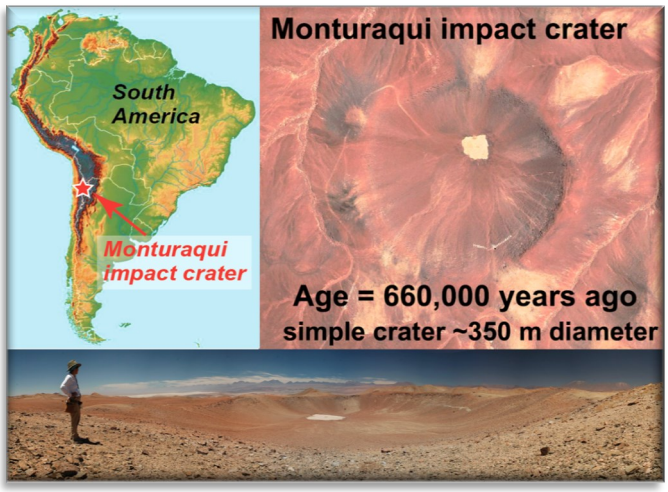
Hiawatha Community Center
101 Emmons St., Hiawatha

featured presentation

Monturaqui crater – the impact of an iron meteorite in the Atacama Desert, Chile.

by **Dr David Peate**

U of IA Dept. of Earth & Environmental Sciences



Solar system objects continually fall to Earth as meteorites, and the larger objects have enough energy to form craters at the Earth's surface. In this talk, I will focus on research done on the Monturaqui impact crater in Chile. I will discuss why we know it is an impact crater and not a volcanic crater, and what we have learned about the impact process and the object that formed .

CVRMS

ELECTION OF OFFICERS AT THE NOVEMBER ANNUAL MEETING

The November 19 CVRMS meeting is our **Annual Meeting**, which means it is time for the membership to elect club officers. The full Board is up for election every 2 years. In the intervening years, only the expiring Director position is up for election. Bill Desmarais has declined to run for another term, so a new 3-year Director will be elected. The Nominations Committee has nominated Laura Halladay for **Director to 2027**. Anyone else interested in serving as Director to 2027 may enter their name at the November 19 meeting, and club members present will vote to elect the new Director. Continuing officers are:

President	Marv Houg
Vice President	Ray Anderson
Treasurer	Dale Stout
Secretary	Dell James
Editor	Ray Anderson
Liaison	Kim Kleckner
Director 25	Matt Burns
Director 26	Jay Vavra
Director 27★	
Webmaster	Sharon Sonnleitner
Imm. Past Pres.	Sharon Sonnleitner

★Indicates Officers up for Election

A huge thank-you to Bill for his great service on the Board!!!

CVRMS Meeting October 15 — Minutes —

MEETING CALLED TO ORDER: 7:45 pm by Marv, president. who immediately apologized for having late start. Guest introduced: Bonnie Moses.

MINUTES FROM LAST MEETING IN NEWSLETTER: Motion for approval by Bill and 2nd by Matt. Approved.

TREASURER'S REPORT: Checking account balance $7,911.99. Dale also gave a report about the auction. What we made, highest bid item, etc. Ray moved to approve. Second by Mary Ebert. Approved.

PROGRAM: Due to Ray having the dog eating his presentation, we had to resort to YouTube videos, which everyone enjoyed. Mohawk Mineral Society (in case you want to look it up). Herkimer diamonds and finding them, followed by a Thunder Bay amethyst video.

2024 AUCTION:-Julie asked about why it cost so much for mailing? Sharon responded. Marv thanked everyone who helped make it a success.

BILL'S BIG BUS BOOGIE 2024: Bill reported on the bus trip to the Caulkins Nature Area and the Grotto of the Redemption at West Bend. If anyone has any ideas for places to go next year let Laura know. Remember that it has to be within 4 hours of Cedar Rapids which leaves few options. Think about it! Everyone. Participants agreed that the trip was a blast

2025 GEM, MINERAL, AND FOSSIL SHOW: The 2025 show will be next March 22 and 23 our ***60th show.*** Theme of the show is *The Ice Age* Everyone will be expected to help out like we always do. A.J. asked if we had an agate dealer lined up for the show; yes, several.

2024 MAPS SHOW: Marv announced that the MAPS show will be this weekend at the Illinois State Fair grounds in Springfield Illinois ,with additional rocks and fossils for sale in area motel rooms.

NEW BUSINESS: Bill announced that a comet was now visible to the naked eye in the western sky about 45 minutes to an hour after the sun goes down. **Julie announced** that the Des Moines show is this weekend.

MOTION TO ADJOURN: by AJ; 2nd by Bill.

Meeting adjourned 9:30 pm.

Respectfully Submitted.
Dell James, Secretary

CVRMS Board Meeting Oct. 22 — Minutes —

MEETING CALLED TO ORDER: 7:15 pm by Marv Houg at his house. Board members present, Ray Anderson, Marv Houg (president), Dale Stout, Bill Desmarais, Matt Burns, Kim Kleckner, Dell James, Sharon Sonnleitner.

SECRETARY MINUTES FROM LAST MEETING. Correction made. Kim Hanna volunteered to be in charge of arranging for the scheduling of the security for the show at Hawkeye Downs. Minutes passed as corrected.

TREASURERS REPORT. Same as club meeting report.

2025 ROCK SHOW: Theme ***ICE AGE.*** **Tiffany Adrain** had an advertisement for student assistance in cleaning new mastodon fossils. Ray will talk to her about getting some for display at the show. **Ray said** that he talked to a Luther College instructor about the eurypterid model and will see about getting it for display at the show. **Sharon has** a group of pictures related to the ice age (not taken by her personally.) **Mike Sullivan** will bring a Columbian Mammoth tooth.

RECAP OF 2024 ROCK AUCTION: Sharon reported that we could saved 1.5 hours from auction time by merely cutting five seconds from each offering. Larry Krohn's suggestions for cutting time will be discussed later.

BILLS BIG BUS BOOGIE: Bill announced that it was a huge success, except for the number of people who did not show up.

Bill made a motion to donate $200 each to Grotto of the Redemption and Caulkins Nature Area since they both live on donations. Kim seconded. Lots of discussion. Motion approved. Matt will send out the thank you cards. Bill said we should look for new places to visit in future years. Paul Stolz suggested that we look into the C.L Dake Geological Society rock auction at the University of Missouri for possible bus trip? He also suggested we need dates from the Mineral Ridge Auction which displays crystals and druze.

OLD BUSINESS: The Holiday party will be held on December 10th at the Hiawatha City Center. Will eat at 6:30 p.m The meal will be a potluck, so bring your dish in time to eat and make a lot. Sharon will cook turkey and make gravy. Dell will do the stuffing and mashed potatoes. Jeff willl do the ham. We need salads, vegetables and, of course, desserts. Bring your own place setting if you want something to eat on. Ray has been on a mission to collect pictures to make a bus trip slide show. Always a hit. Send him some pictures.

MOTION TO ADJOURN: by Bill; second by Matt.

Meeting adjourned at 8:30 pm.

Respectfully submitted
Dell James, Secretary

Alligator Gar: The 'Living Fossil' that Has Barely Evolved for 100 Million Years

Name: Alligator gar (*Atractosteus spatula*)
Where it lives: Rivers, reservoirs and coastal bays in southwestern U.S. states, down to Veracruz, Mexico
What it eats: Crabs, fish, birds, mammals, turtles, and carrion
Why it's awesome: With its long snout, thick armored scales, and two rows of piercing teeth, this huge fish could easily be mistaken for a ferocious gator, hence their common name: **alligator** gar.

This enormous fish is *a truly prehistoric monster,* said biologist Jeremy Wade. Fossils have shown that these ancient animals existed 100 million years ago during the Cretaceous period (145 million to 66 million years ago), when dinosaurs roamed Earth. *Their survival is in part because of their unique defense system, scales made of a super hard enamel called ganoine,* said Wade. *This armor plating has seen them survive predatory dinosaurs.* These hard, interlocking flexible scales protect them from threats. Once gars are more than a meter long, their only predator is the alligator. And alligator gars grow fast. They start as tiny toxic eggs but reach up to 2 feet long in their first year. They keep growing their entire lives, and can live to 100 years old. Alligator gars are also among the ultimate *living fossils* species that have barely changed for millions of years. A 2024 study found gars have the slowest rates of evolution of all jawed vertebrates. They have evolved so slowly that alligator gars and longnose gars (*Lepisosteus osseus*), two species separated by 100 million years of evolution, can still produce fertile hybrid offspring. By contrast, that's about the same amount of evolutionary time that separates wombats and people, two wildly different species that could never reproduce, study author Chase Brownstein, a first year graduate student at Yale, previously told Live Science. Although their needle-sharp teeth are capable of causing a nasty bite, these ambush predators prefer eating crabs, fish, and birds. Yet, in the 1930s, the Texas Game Fish Commission created a *gar destroyer* to try to electrocute the fish by shooting 200-volts into the water. Today, the fish is protected in Florida and fishing caps are in place in Texas.

https://www.livescience.com/animals/fish/alligator-gar-the-living-fossil-that-has-barely-evolved-for-100-million-years

Spotlight Gemstones: Citrine & Topaz

November's Birth Stones

Citrine is a member of the large quartz family (SiO4), which, with its multitude of colors and structures, offers gemstone lovers almost everything their hearts desire in terms of adornment and decoration, from absolutely clear rock crystal to black onyx. The name citrine is derived from its color, the yellow of the lemon (although the most sought-after stones are a clear, radiant yellowish to brownish red). Like all crystal quartzes, the citrine has a hardness of 7 on the Mohs scale and is relatively resistant to scratches. With no cleavage, it is also resistant to fracturing. Although citrine's refractive index is relatively low, the yellow stones have a mellow, warm tone that seems to have captured the last glow of autumn. Natural citrines are rare, and most good quality stones are found in Minas Gerais, Brazil, Madagascar, and Hasawarka in the Ural mountains of Russia. Most commercial citrines are heat treated amethyst or smoky quartz. Topaz ($Al_2SiO_4(F,OH)_2$) is one of the few gem minerals that contains fluorine. The gem can be found in many varieties; colorless, pink, and shades of yellow to sherry-brown are most common, but blue and green-blue stones can resemble aquamarine, and natural red and pink colors are extremely rare. Sherry colored crystals can be heat-treated before cutting, producing pink topaz, a process called pinking. Its hardness of 8 makes it very resistant to scratching. Orange topaz, also known as precious topaz, is the traditional November birthstone (and the state gemstone of Utah), while blue topaz is the birthstone for December. Topaz is commonly associated with silicic igneous rocks (granite and rhyolite). It typically crystallizes in granitic pegmatites or in vapor cavities in rhyolite lava flows including those at Topaz Mountain in western Utah. The American Golden Topaz is the largest piece of cut yellow topaz in the world. It is sized at 22,892 carats (10 lbs) and has 172-facets (flat-faced cuts applied to gems, in order to help them reflect light.) The gem was cut from a piece of yellow topaz that was 26 lbs in size, discovered in the Minas Gerais, Brazil. It was donated to the Smithsonian Institute, and put on display in the National Museum of Natural History in Washington, D.C.

What in the World?

Where in the World can these strange erosional features be found?

October's Photo

October's **What in the World** photo showed a rock displaying cone-in-cone structures, secondary sedimentary structures that form in association with deep burial and diagenesis. They consist of concentric inter-bedded cones that form in calcareous shales. How they are created is not well understood, but they are generally attributed to a displacive crystal growth mechanism.

ROCK CALENDAR
CVRMS EVENTS OF INTEREST

2024

Nov. 19 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Dr. David Peate
Monturaqui crater – the impact of an iron meteorite in the Atacama Desert, Chile

Dec. 10 — CVRMS Holiday Party
Hiawatha Community Center
We will eat at 6:30 pm
more details next month

2025

Jan. 21 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Dr. Ray Anderson
The Geology of the Saylorville Spillway
-this time for sure!

Feb. 18 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
University of Iowa Students and Faculty
Program to be announced

Mar. 18 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Cornell College Students and Faculty
Program to be announced

Mar. 22-23 — CVRMS Rock Show
Hawkeye Downs, Cedar Rapids
Show Theme: *The Ice Age*
more information in future newsletters

Apr. 15 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program to be announced

Ask a Geologist

by Ray Anderson aka Rock Doc , CVRMS Vice President

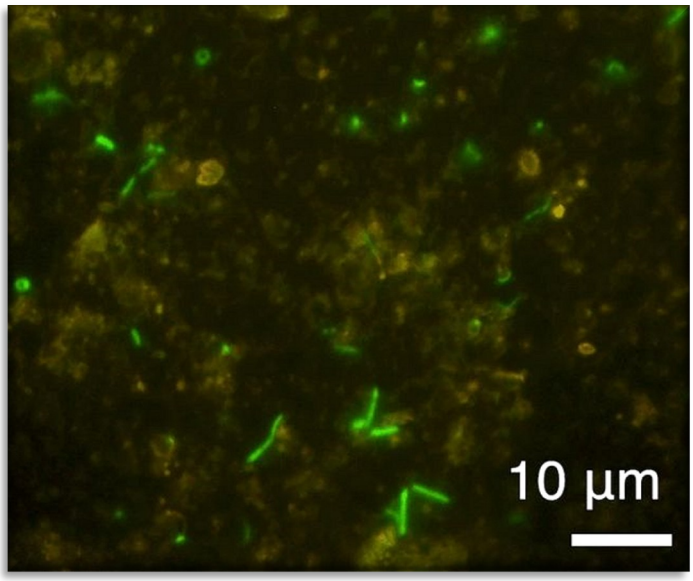
Ask a Geologist is a monthly column that gives CVRMS members an opportunity to learn more about a geologic topic. If you have a question that you would like addressed, please send it to rockdoc.anderson@gmail.com, and every month I will answer one in this column. Please let me know if you would like me to identify you with the question. I will also try to respond to all email requests with answers to your questions.

Since once again no one posed any questions to ***Ask a Geologist*** last month, I was free to choose a topic that I thought you would find of interest. Last month I read an article describing microbes that were discovered sealed within rocks for over 2 billion years, ***and they were still alive!***

Microbes Found Alive Sealed in Rock For 2 Billion Years

By MICHELLE STARR

Deep underground, in the darkness far below the bustling activity on the surface, a community of microbes has been living their best lives in isolation. What makes these organisms incredibly special is that they have been cut off for billions of years, far longer than any other community of subterranean microbes we've ever seen. This find **of living microbes in 2 billion-year-old rock** absolutely smashes the previous record of 100 million years. So this is a very exciting discovery, says geomicrobiologist Yohey Suzuki of the University of Tokyo. And it's a significant one: microbes in isolated underground pockets like these tend to evolve more slowly, since they're detached from many of the pressures that drive evolution in more populated habitats. This means that the microbe community can tell us things we might not have known about microbe evolution here on Earth. But it also suggests that there might be underground microbe communities still alive on Mars, surviving long after the water on the surface dried out. We didn't know if 2-billion-year-old rocks were habitable, explains Suzuki. By studying the DNA and genomes of microbes like these, we may be able to understand the evolution of very early life on Earth. The sample of rock was drilled from 50 feet underground from a formation known as the Bushveld Igneous Complex in northeastern South Africa. This formation is huge, a 25,500 square mile intrusion into Earth's crust that formed some 2 billion years ago from molten magma cooling below the surface. Suzuki and his colleagues thought that the rock's formation and evolution over time was likely to be conducive to long-term habitability for microbes. They enlisted the aid of the International Continental Scientific Drilling Program to extract a 1-foot long core sample from within the Bushveld Igneous Complex, and set about looking for signs of microbial life. First, they had to rule out that any microbes they found were indigenous to the habitat, and not the result of contamination from the extraction process. They used a technique they developed several years ago that involves sterilizing the outside of the sample before cutting it into slices to examine its contents. Then, they used a cyanine dye to stain the slices. This dye binds to DNA, so if there is any DNA in the sample, it should light up like a Christmas tree when subjected to infrared spectroscopy. And this is exactly what happened. The sample was also riddled with clay, which packed veins near the pockets in the rock near the microbial colonies. The result of this clay packing was multifold: it provided a resource for the microbes to live on, with organic and inorganic materials that they could metabolize; and it effectively sealed the rock, both preventing the microbes from escaping, and preventing anything else from entering – including the drilling fluid. The microbial community in the rock will need to be analyzed in greater detail, including DNA analysis, to determine how it has changed or not changed in the 2 billion years it has been sequestered away from the rest of life on Earth. The team will be retrieving more samples from the Bushveld Igneous Complex to help characterize the microbes that can be found therein, and fit them into Earth's evolutionary history. **And, of course, there are the implications for what we might find off Earth**. I am very interested in the existence of subsurface microbes not only on Earth, but also the potential to find them on other planets, Suzuki says. NASA's Mars rover Perseverance is currently due to bring back rocks that are a similar age to those we used in this study. Finding microbial life in samples from Earth from 2 billion years ago and being able to accurately confirm their authenticity makes me excited for what we might be able to now find in samples from Mars.



Microbial cells highlighted with green dye in the rock sample. (Suzuki et al., *Microbial Ecology*, 2024)

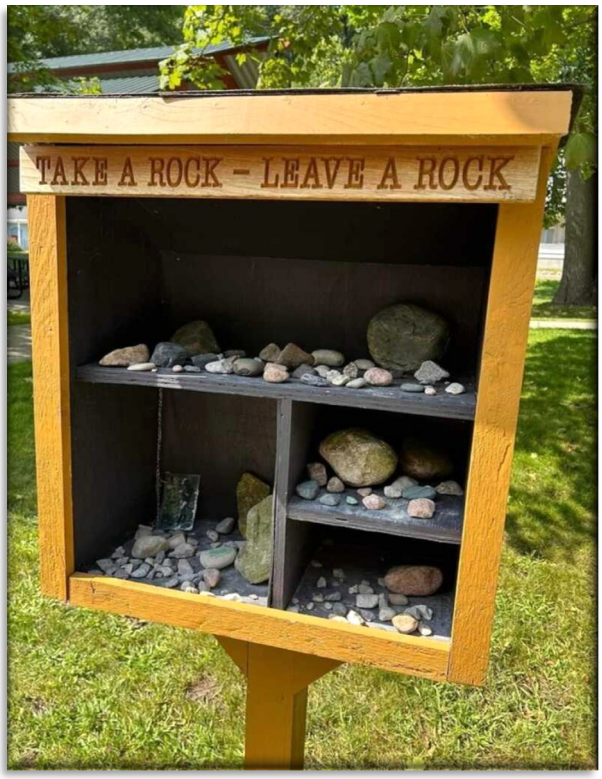
https://www.sciencealert.com/microbes-found-alive-sealed-in-rock-for-2-billion-years

The Bingham Canyon Mine Landslide of 2013

On April 10, 2013, a giant chunk of earth gave way and crashed into a huge pit created by copper mining at the Bingham Canyon Mine in Utah. About 85-90 million cubic yards of

debris thundered down the walls of the mine, reaching speeds of up to 160 km per hour. The event was so large that the tremors were detected by seismic sensors designed to record earthquakes. The intensity recorded by the instruments measured 2.5 on the Richter scale. The incident was the largest non-volcanic landslide in modern North American history and occurred in the largest man-made excavation in the world.

Take a Rock—Leave a Rock



Rutilated Quartz

Rutilated quartz is a **variety of quartz** which contains needle-like **inclusions of the titanium oxide mineral rutile**. These inclusions range in color from gold, to silver, copper-red, or black, and can be illuminated under light to spectacular effect. Sometimes the inclusions are dark enough to make the quartz appear nearly opaque, and sometimes they are distributed much more sparsely. The inclusions range from thin, sparse, and parallel, to thick, dense, and criss-crossed. The pattern of

rutile inclusions in each rutilated quartz stone makes it completely unique. Natural rutile may contain up to 10% iron and significant amounts of niobium and tantalum, accounting for the reddish tone of some of the inclusions - indeed, rutile derives its name from the Latin "rutilus," meaning *"red."* When the iron content is lower, it may appear darker, or even black in color. While many gemstones—including most varieties of transparent quartz—are valued most when they show no inclusions, rutilated quartz is valued specifically for the lovely patterns the golden needles of rutile can form. Rutilated quartz often has striking patterns and colors, and this combined with its affordability and excellent durability makes it perfectly suitable for jewelry. Most rutile quartz jewelry features cabochon gemstones, but faceted gems are available and are equally stunning. The main source of rutilated quartz is Brazil, with the other important source being India. It is encountered in other locations around the world but is much less common than in Brazil and India. Other names for rutilated quartz include *"Goddess's Tresses," "Cupid's Net*," and *Venus Hair,"* thanks to its hair-like golden inclusions. There is something almost supernatural about its glistening luster, which can be incorporated into jewelry for extra glamour and sparkle! https://gemstonesbrazil.com/en-us/blogs/news/our-rutile-quartz-collection

Stunning Fossil Reveals that Fireflies Glowed When Dinosaurs Ruled Earth

Flammarionella hehaikuni.

One of the most beautiful sights in the summer twilight is the gentle glow of fireflies lighting up the crepuscular gloom. These twinkling insects are the most abundant bioluminescent beetles, with roughly 2,500 species known around the world. Their glowing abdomens serve multiple purposes – but what we don't really have a good handle on is how this trait evolved. According to a team led by paleontologist Chenyang Cai of the Chinese Academy of Sciences, a firefly magnificently preserved for eons in golden amber may have some answers. Some 99 million years ago, *Flammarionella hehaikuni* was already lighting up the dusk, suggesting its ancestors had well-and-truly evolved their characteristic glowing butt by the Mesozoic. It's the second such Mesozoic firefly found preserved in Myanmar amber. The first, *Protoluciola albertalleni*, also had a beautifully preserved firefly lantern. And a bioluminescent beetle from a different family was also found in the same amber deposit. What makes the new discovery so exciting is that the trapped specimen's lantern is different from the lanterns seen in its amber-trapped contemporaries, showing that by 99 million years ago, insect bioluminescence was already well developed and diverse. Bioluminescence in fireflies seems to serve two main functions, attracting other fireflies for courtship, and warning predators about any lucibufagin toxins they may be loaded with. Scientists have recently argued, however, that bioluminescence emerged in fireflies before lucibufagins did, which raises some questions about the early benefits of insect bioluminescence. Cai and his colleagues found their firefly in amber in Kachin State in northern Myanmar, the same region from which the other Mesozoic light-up insects hailed. The amber itself is remarkably clear, revealing the insect in exquisite detail. Based on its physical characteristics, the researchers were able to identify the specimen as a female belonging to Luciolinae, one of the largest subfamilies of fireflies whose members possess flashing lanterns in their abdomens. But there are some differences. The antennae of *Flammarionella* (named for French astronomer Camille Flammarion) are densely covered in hair-like appendages called setae, with deep, oval-shaped indentations on many of its segments. Although we've never seen this characteristic in living fireflies, similar features can be found in other bugs. Related to the insect's sense of smell, the indentations maximize surface area and aid recognition of sex pheromones. Male fireflies often have wackier antennae than females of their species, so finding a male *Flammarionella* would help us better understand these features. The fossilized specimen's lantern is also unmistakable, comprising two segments at the end of the insect's abdomen. A comparison with other species of Mesozoic bioluminescent insects may, hopefully, be the subject of future work. Meanwhile, the search continues for other fossilized fireflies and their insect relatives. *As the fossil record expands in the future,* the researchers write in their paper, *we anticipate further revelations that will broaden our knowledge of when, how and why bioluminescence evolved in these fascinating animals during the Mesozoic era.* https://www.sciencealert.com/stunning-fossil-reveals-fireflies-glowed-when-dinosaurs-ruled-earth

What Role Have Oceanic Manganese Nodules Played in the Evolution of Life

Q. *Do the manganese nodules at the bottom of the ocean, which some believed to have created oxygen on earth, change our understanding of the timeline of life, possibly opening the door to a progenitor eukaryotic scenario?*

A. What you're basically asking is whether these little metallic pebbles are going to rewrite the history of life as we know it, right? Like, did we get the timeline wrong? And are these nodules the key to some ancient, primordial Eve of eukaryotes? Well, it's not that simple. Manganese nodules are basically clumps of minerals (manganese, iron, and other goodies) that form over eons on the ocean floor. Think of them like underwater stalagmites, but instead of dripping water, they grow from the gradual accumulation of metals dissolved in seawater.

Manganese can play a role in oxidation reactions, and oxygen is kind of a big deal for life as we know it, but these nodules aren't exactly the oxygen factories you might be imagining. They grow incredibly slowly, like watching paint dry but on a geological timescale. So, it's not like they flipped a switch and flooded the planet with breathable air. As for the *"progenitor eukaryotic scenario,"* well, that's where things get a bit more speculative. Eukaryotes are organisms with complex cells, like you and me and that houseplant you keep forgetting to water. They have a nucleus and other organelles that distinguish them from simpler prokaryotes like bacteria. Could manganese nodules have played a role in the emergence of eukaryotes? Maybe. Some scientists have proposed that the unique chemical environment around these nodules could have provided a crucible for early cellular evolution. But remember that this is still a hypothesis, not a proven fact. So, do manganese nodules change our understanding of the timeline of life? Not really. They're a fascinating part of the deep-sea ecosystem and might offer clues about early Earth's chemistry, but they don't fundamentally alter the established narrative of life's history. And do they open the door to a "*progenitor eukaryotic scenario?*" Possibly, but it's a door that's still ajar, not wide open. More research is needed to determine whether these humble nodules played a starring role in the evolution of complex life or were merely bit players in a much larger drama.

Study Claims Life Tried to Evolve 1.5 Billion Years Earlier than We Thought

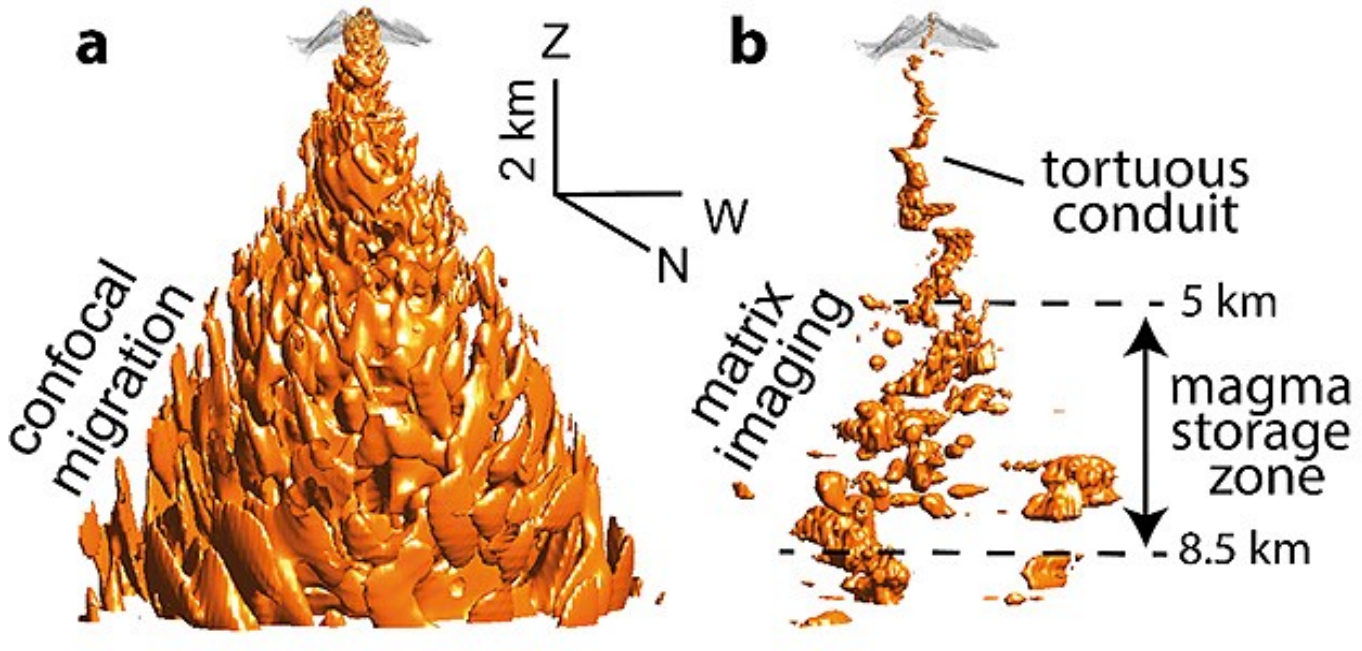
Most experts believe complex life on Earth can be traced back roughly 635-to-800 million years ago to the Cambrian Period, but some researchers say they now possess evidence that dramatically rewrites the evolutionary narrative. According to an international group led by Cardiff University's Ernest Chi Fru, the planet's very first (yet ultimately unsuccessful) **simple single-celled organisms arrived 2.1 billion years ago**, a full 1.5 billion years earlier than the current prevailing theory. Unsurprisingly, however, such a major assertion is already being met by skeptics. Evidence of the planet's first microbial life is dated 3.7 billion years ago, but it took at least another 1.3 billion years for oxygen-based cyanobacteria to arrive. Current fossil records indicate some of the earliest forms of animal life, like sea sponges, showed up around 800 million years ago. Meanwhile, researchers understand the Cambrian Period's increase in marine phosphorus and seawater oxygen levels 635 million years ago spurred the evolutionary track leading to today's biodiversity. But Chi Fru's team now argues that at least one other attempt at life occurred in the distant past. The theory, presented in a study published July 25 in the journal *Precambrian Research*, points to alleged fossils and rock formations located in present-day Gabon as proof. *"The availability of phosphorus in the environment is thought to be a key component in the evolution of life on Earth, especially in the transition from simple single cell organisms to complex organisms like animals and plants,"* Chi Fru said. According to Chi Fru, these necessary phosphorus and oxygen levels arose from rare underwater volcanic activity that followed the collision and suturing of the Congo and São Francisco cratons into a single body. A subsequently created, shallow inland sea then provided a nutrient-rich testing environment for the earliest trials in complex biological evolution. But don't expect complexity from the two-billion-year-old deep sea evolutionary experiments, according to the team, these life forms resembled slimy, single-cell mold cultures that reproduced with spores. And while these brainless organisms were allegedly capable of small movements, in the end, the inland water body's isolation and resultant nutrient deficiency ensured the proto-slime's eventual extinction. Such a bold claim is not without its skeptics. any experts don't think the alleged "fossils" cited by Chi Fru's team are actually fossils at all, but simply masses of (albeit still-unexplained) geological formations. Others, meanwhile, aren't opposed to the possibility that instances of higher nutrient levels occasionally occurred as far back as 2.1 billion years ago, but remain unconvinced it was enough to begin complex life. Either way, critics say much more evidence will be needed before they shift their evolutionary timelines back 1.5 billion years.

Artist's impression of the lobate macrofossils living 2.1 billion years ago in a shallow marine inland sea.

https://www.popsci.com/science/new-evolution-theory/

Medical Imaging Technique Reveals What Truly Lies Beneath a Volcano

We've never seen the inside of a volcano quite like this before. Researchers have developed a smart new imaging technique that lets us peer inside these gigantic natural tinderboxes to unprecedented levels of detail and depth. The research team, from the French National Centre for Scientific Research (CNRS) and the Paris Institute of Planetary Physics (IPGP), borrowed some ideas from medical imaging and optical microscopes to come up with their approach. It's a new take on an existing technique known as matrix imaging, and it helps overcome some of the difficulties of mapping volcanoes like this: not having many sensors (known as geophones) to log seismic waves reverberating through the Earth. As these waves ripple around, they can be interpreted to figure out the different types of materials and the



Imagery showing an internal view of the volcano and the magma beneath

different types of layouts in Earth's crust. With the help of matrix imaging, that interpretation should get significantly easier. *Volcanic eruptions necessitate precise monitoring of magma pressure and inflation for improved forecasting,* write the researchers in their published paper. *Understanding deep magma storage is crucial for hazard assessment, yet imaging these systems is challenging.* For a test subject, the researchers chose the La Soufrière volcano in Guadeloupe, in the Caribbean. The coverage offered by the network of geophones in use at this particular site is described as *sparse* by the researchers. The math and physics behind the innovative approach is rather dense, but essentially the team devised a new way of combining the data from multiple geophones to figure out details that individual geophones couldn't capture on their own. Part of the success of the technique lies in reducing distortions that occur as seismic waves bounce off different elements underground, using what's known as the memory effect to reverse-engineer distortions to figure out what the original signals were. *Using wave correlations resistant to disorder, matrix imaging successfully unscrambles wave distortions, revealing La Soufrière's internal structure down to 6.2 miles with 328-foot resolution,* write the researchers. The revelations coming from this particular study include the presence of multiple complex layers of magma storage underground, and the way these layers are connected to other deep-lying geological features. Of course, all this additional data means a better understanding of what's happening inside a volcano, which means being able to more accurately predict when an eruption might occur, potentially saving a large number of lives, in some parts of the world. What's promising is that no extra sensors are needed, because matrix imaging can work with the data that already exists. The researchers are confident that the methods they've used here can be applied at other sites too. *Matrix imaging can therefore become a revolutionary game-changer in the way scientists understand and model volcanic systems,* write the researchers. https://www.sciencealert.com/medical-imaging-technique-reveals-what-truly-lies-beneath-a-volcano

The Dinosaur-Killing Asteroid Turned Ants into Farmers

Dinosaurs certainly didn't benefit from the Chicxulub asteroid impact, but that was a wholly different story for the ancestors of today's ants. In fact, the climatic upheaval that rocked Earth 66 million years ago may be the major reason some of the insect species learned to farm millions of years before humans even evolved. In a study published on October 3 in *Science*, an international team of researchers from Brazilian and US universities as well as the Smithsonian Institute examined genetic data from hundreds of ant and fungi species to trace their evolutionary trees. After comparing the two timelines, experts then pinpointed when the two began to truly intertwine—around the exact same era that followed the Chicxulub asteroid. *"The origin of fungus-farming ants was relatively well understood, but a more precise timeline for these microorganisms was lacking,"* André Rodrigues, a researcher at the Institute of Biosciences of São Paulo State University (IB-UNESP) and paper co-author, said in a statement. According to Rodrigues, the new analysis offers the *"smallest margin of error to date for the emergence of these fungal strains, which were previously thought to be more recent."* Researchers have long understood that debris ejected into the atmosphere by the six-mile-wide space rock created a low-light environment for generations. While a death sentence for 70 percent of

Leaf cutter ants don't actually eat their harvests, but feed them to fungi in their colonies.

all life on Earth, it served as the perfect incubator for certain fungi species that fed on organic matter. At the same time, the plant and animal die-off forced ancient ancestors of today's leafcutter ant group to rely on cultivating and harvesting the microorganisms. The key to understanding the origins of fungi-ant mutualism resided in looking at their ultraconserved elements (UCEs)—genomic areas that remain intact throughout the multiple evolutionary generations. *"In this case, we were interested in the regions close to these elements. They show the most recent differences between species and allow us to trace a fairly accurate evolutionary line,"* said Pepijn Wilhelmus Kooij, a IB-UNESP researcher and paper co-author. It would ultimately take almost 40 million years, however, for ant and fungal species to make the leap to a truly mutualistic relationship. As the Smithsonian explained, a period of rapid cooling approximately 27 million years ago resulted in ants transporting fungi species from wet climates to drier ones, isolating the microorganisms from their native populations. These fungi then became completely dependent on ants for their proliferation and survival. This led to what is known as higher agriculture, in which ants harvest fresh vegetation for their fungi to break down as the plant matter decays. The microorganisms then produce threadlike web structures called hyphae. During this time, the tips of these hyphae grow lipid- and carbohydrate-rich bulbs called gongylidia that the insects use for food. Essentially, ants figured out farming millions of years before humans learned their version of it, much less existed as a species. *"The ants domesticated these fungi in the same way that humans domesticated crops,"* Ted Schultz, the Smithsonian Institute's curator of ants and paper lead author, said in the institute's profile. *"To feed itself, the fungus decomposes the organic matter carried by the ants. In turn, the ant consumes substances produced by the fungus that it couldn't obtain from any other source,"* IB-UNESP professor Mauricio Bacci Junior added in a statement. *"It's as if the fungus were the insect's external stomach."* Today, ants' ability to farm has led to development of diverse fungi species that are both efficient at food production for colonies, as well as decomposing organic matter. These enzymes are so useful that other researchers are investigating how to harness them to safely break down harmful materials like plastics. In the future, humanity's sustainable recycling solutions may be owed in no small part to some of the planet's earliest, innovative ants. https://www.popsci.com/environment/dinosaur-asteroid-ants-farming/

Perseverance Found a Zebra-Striped Rock on Mars, and NASA Is Excited

If you haven't taken the time to look at a cool rock today, don't sweat it: we've got you covered. In fact, this particular rock may even be one of a kind. It was discovered by NASA's Perseverance rover exploring the Jezero Crater on Mars, and we've never seen anything like it up there on the red planet. To be fair, there's still a lot of Mars we're yet to explore in detail. Nevertheless, the zebra-striped chunk of rock is simultaneously surprising, fascinating, and, yes, you guessed it, *extremely* cool. The rock was imaged on 13 September by Perseverance as it climbed

Image of Freya Castle taken using Perseverance's Mastcam-Z on 13 September 2024.

the slope towards the crater rim. Like other interesting formations on Mars, the ground team here on Earth gave the rock a name: ***Freya Castle***. Freya Castle isn't very large; it's about 8 inches across, a little bit larger than the average length of an adult male hand. And its striking, zebra-like pattern of dark and light stripes poses an interesting mystery. Perseverance used its Mastcam-Z to take a multispectral image of the rock before continuing its journey up the slope. From those images, scientists have made a few guesses about what the rock might be. *"Our knowledge of its chemical composition is limited, but early interpretations are that igneous and/or metamorphic processes could have created its stripes,"* writes planetary scientist Athanasios Klidaras of Purdue University in a blog post for NASA. *"Since Freya Castle is a loose stone that is clearly different from the underlying bedrock, it has likely arrived here from someplace else, perhaps having rolled downhill from a source higher up. This possibility has us excited, and we hope that as we continue to drive uphill, Perseverance will encounter an outcrop of this new rock type so that more detailed measurements can be acquired."* For now, that's about as much as we know about Freya Castle. But we also know it won't be the last cool rock that NASA's Mars rovers have to show us. Earlier this year, Curiosity found pure sulfur just hanging out in the Gale Crater. And cheetah-like spots on a rock named Chevaya Falls are similar to mineral patterns here on Earth that are tied to biological activity. Chevaya Falls' pattern is more likely to be non-biological, but it's certainly fun to find something like that. Here's hoping Perseverance finds Freya Castle's parent rock, so we can learn more about geological processes on a world so very different from our own. https://www.sciencealert.com/perseverance-found-a-zebra-striped-rock-on-mars-and-nasa-is-excited

Scientists Peered Inside The Tiniest Dinosaur Egg Ever Found

A delicate, three-year analysis confirms the **'Ganzhou Mini Egg'** is the tiniest dinosaur egg ever known. At just about **1.18 inches** in length, this is much smaller than the previous record holder, the **1.75 inch**-long **Jinguo Micro Ellipsoid Egg**. This adorable discovery lay within a clutch of six almost completely intact eggs found in 2021 at a construction site near Ganzhou City in China. Researchers used electron microscopy and electron backscatter diffraction to gently peer at the approximately 80 million-year-old eggs' contents without harming them. Within them, geoscientist Rui Wu from the China University of Geosciences and colleagues found enough tiny clues to confirm what they were looking at was not a direct bird relative but a non-avian theropod dinosaur instead. This included details of the eggs' microstructures as well as what are likely limb bones within, allowing Wu and team to place the newly identified species, *Minioolithus ganzhouensis*, in its family tree. *"Minioolithus ganzhouensis is the smallest known dinosaur egg clutch till now and is significant for understanding the diversity of theropods in the Late Cretaceous,"* the researchers write in their paper. While the eggs are shaped like familiar bird eggs, all known bird eggs from the Cretaceous through to today have three shell layers. The Ganzhou mini eggshell has two layers, like other non-avian dinosaurs. The shell's thinness, type of pore system, and subtle worm-segment-like pattern on the eggs suggest *M. ganzhouensis* is related to the Ovaloolithus group. However, the shell's abundance of tiny fluid sacs makes the Ganzhou Mini Eggs distinct from other known ovaloolithus eggs, revealing the newly analyzed clutch belongs to another species within the group. Ovaloolithus eggs are tentatively thought to belong to herbivorous triceratops ancestors based on the limb anatomy of other finds. These protoceratopsids had the characteristic head frill of triceratops, but were relatively small dinosaurs, only 3-8 feet long from snout to tail. Their remains have only been found in Asia. Wu and team hope a new analysis of the discovery site will provide more clues on what laid these eggs and how these dinosaurs built their nests. https://www.sciencealert.com/scientists-peered-inside-the-tiniest-dinosaur-egg-ever-found

Dinosaur egg fossils discovered in the city of Ganzhou, east China's Jiangxi Province.

Ray Anderson, Editor
2155 Prairie du Chien Rd. NE

Next Meeting:
TUESDAY NOV 19
Hiawatha Community Center
Monturaqui crater – the impact of an iron meteorite in the Atacama Desert, Chile.
by Dr. David Peate
U. of Iowa School of Earth, Environment, and Sustainability

2024 & 2025 Officers, Directors, and Committee Chairs

President	Marv Houg (m_houg@yahoo.com)	(319)350-9435
Vice President	Ray Anderson (*rockdoc.anderson@gmail.com*)	530-2419
Treasurer	Dale Stout (*dhstout55@aol.com*)	365-7798
Secretary	Dell James (cycladelics@msn.com)	270-6854
Editor	Ray Anderson (rockdoc.anderson@gmail.com)	530-2419
Liaison	Kim Kleckner (ibjeepn2@gmail.com)	560-5185
Imm. Past Pres.	Sharon Sonnleitner (sonnb@aol.com)	310-0085
Director '24	Bill Desmarais (desmarais_3@msn.com)	365-0612
Director '25	Matt Burns (mlburnsmars@gmail.com)	329-4046
Director '26	Jay Vavra (vavrajj@gmail.com)	538-3689
Sunshine	Dolores Slade (doloresdslade@aol.com)	351-5559
Hospitality	Kim Kleckner (ibjeepn2@gmail.com)	560-5185
Webmaster	Sharon Sonnleitner (sonnb@aol.com)	310-0085

Club meetings are held the 3rd Tuesday of each month from September through November and from January through May at 7:15 p.m. Meetings are held at the Hiawatha Community Center in the Hiawatha City Hall, 101 Emmons St., Hiawatha IA. The December meeting is a potluck dinner held on the 1st Tuesday at 6:30. June, July, and August meetings are potlucks held at 6:30 p.m. at area parks on the 3rdTuesday of each month

CEDAR VALLEY ROCKS & MINERAL SOCIETY

CVRMS was organized for the purpose of studying the sciences of mineralogy, geology, and paleontology and the arts of lapidary and gemology. We are members of the Midwest (MWF) and American (AFMS) Federations. Membership is open to anyone who professes an interest in rocks and minerals.

Annual dues are $15.00 per family per calendar year. Dues can be sent to:

Dale Stout
2237 Meadowbrook Dr. SE
Cedar Rapids, IA 52403

CVRMS website:
cedarvalleyrockclub.org