Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS **JANUARY 2023** **VOL. 49, ISSUE 01**

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

Next CVRMS Meeting

Tuesday Jan. 17

Hiawatha Community Center

101 Emmons St., Hiawatha - 7:15 pm

featured presentation

GOLD

"its origins, history, and uses"

By Ray Anderson

Cedar Valley Rocks and Minerals Society

What is Crazy Lace Agate?

Crazy lace agate is a banded chalcedony (microcrystalline quartz) that's infused with iron and aluminum and is often brightly colored and complexly patterned. This produces the creamy browns, blacks, greys and golds (and occasional pinks or reds) swirled together in this stone. This stone is found exclusively within the area known as Chihuahua, in Northern Mexico. Crazy lace agate is believed to have been created in the cretaceous period, about 65-90 million years ago. Agate is the most famous chalcedony variety, recognized by its concentric color bands, formed by the remains of iron and manganese. The chemical composition of agate is the same as quartz, but with a different physical structure. Instead of forming as large crystals, it is composed of tiny fibers and crystals whose shapes give rise to diagrams or drawings that acquire different names: as in this case "agate crazy." This mineral is formed in rock cavities of different types, especially lava. Most agates occur as nodules in volcanic rocks or ancient lavas, in former cavities produced by volatiles in the original molten mass, which were then filled, wholly or partially, by siliceous matter deposited in regular layers upon the walls. Agate has also been known to fill veins or cracks in volcanic or altered rock underlain by granitic intrusive masses. Such agates, when cut transversely, exhibit a succession of parallel lines, often of extreme tenuity, giving a banded appearance to the section. The first deposit on the wall of a cavity, forming the "skin" of the agate, is generally a dark greenish mineral substance, like *celadonite*, *delessite* or "*green earth,*" which are rich in iron probably derived from the decomposition of the augite in the enclosing volcanic rock. Agates can also be found in sedimentary rocks. They need a cavity to form, so they are typically seen in limestone, dolomite, and shale which may have shells, tree branches, or roots in them that later decay away. https://www.geologyin.com/2019/07/what-is-crazy-lace-agate.html#:.

An AI Found an Unknown 'Ghost' Ancestor in The Human Genome

Nobody knows who she was, just that she was different: A teenage girl from over 50,000 years ago of such odd uniqueness she appeared to be a 'hybrid' ancestor to modern humans that scientists hadn't seen before. Only recently, researchers have uncovered evidence she wasn't alone. In a 2019 study analyzing the tangled mess of humanity's prehistory, scientists used artificial intelligence (AI) to identify an unknown human ancestor species that modern humans encountered, and shared dalliances with, on the long trek out of Africa millennia ago. "*About 80,000 years ago, the so-called Out of Africa occurred, when part of the human population, which already consisted of modern humans, abandoned the African continent and migrated to other continents, giving rise to all the current populations,*" explained evolutionary biologist Jaume Bertranpetit. As modern humans forged this path into the landmass of Eurasia, they forged some other things too, breeding with ancient and extinct hominids from other species. Up until recently, these occasional sexual partners were thought to include Neanderthals and Denisovans, the latter of which were unknown until 2010. But in this study, a third ex from long ago was isolated in Eurasian DNA, thanks to deep learning algorithms sifting through a complex mass of ancient and modern human genetic code. Using a statistical technique called **Bayesian** inference, the researchers found evidence of what they call a "**third introgression**," a '*ghost*' archaic population that modern humans interbred with during the African exodus. *"This population is either related to the Neanderthal-Denisova clade or diverged early from the Denisova lineage,"* meaning that it's possible this third population in humanity's sexual history was possibly a mix themselves of Neanderthals and Denisovans. In a sense, from the vantage point of deep learning, it's a hypothetical corroboration of sorts of the teenage girl **"hybrid fossil"** identified in 2018. *"Our theory coincides with the hybrid specimen discovered recently in Denisova, although as yet we cannot rule out other possibilities,"*. That being said, the discoveries being made in this area of science are coming thick and fast. Also in 2018, another team of researchers identified evidence of what they called a ***"definite third interbreeding event***" alongside Denisovans and Neanderthals. There's a lot more research to be done here yet. Applying this kind of AI analysis is a decidedly new technique in the field of human ancestry, and the known fossil evidence we're dealing with is amazingly scant. But according to the research, what the team has found explains not only a long-forgotten process of introgression, it's a dalliance that, in its own way, informs part of who we are today. "*We thought we'd try to find these places of high divergence in the genome, see which are Neanderthal and which are Denisovan, and then see whether these explain the whole picture,*". *"As it happens, if you subtract the Neanderthal and Denisovan parts, there is still something in the genome that is highly divergent."*

https://www.sciencealert.com/an-ai-found-an-unknown-ghost-ancestor-in-the-human-genome

CVRMS Board Meeting Dec. 13 — Minutes —

MEETING CALLED TO ORDER: by Pres. Marv Houg 7:10 p.m

MEMBERS PRESENT: Kim Kleckner, Marv Houg, Bill Desmarais, Ray Anderson, Sharon Sonnleitner, Matt Burns, Dell James

MINUTES FROM PREVIOUS MEETING: reviewed. Motion to approve by Kim. Second by Bill. Minutes approved.

2023 SHOW: "*Wonderful World of Agates."* **Sharon reviewed** dealer status; 6 are still out but have reassured us they are coming. **Sharon is** still working on fluorescent booth. **Displays** planning work is still on-going. **RAFFLE PRIZES** still need. Running out of ideas.

2023 AUCTION: List of consigners. Discussion about who and how many lots.

FIELD TRIPS: Discussion about winter trips. Or next spring. **Kim and Kim Hanna** had picked up material from several donors and wrote thank you notes to them.

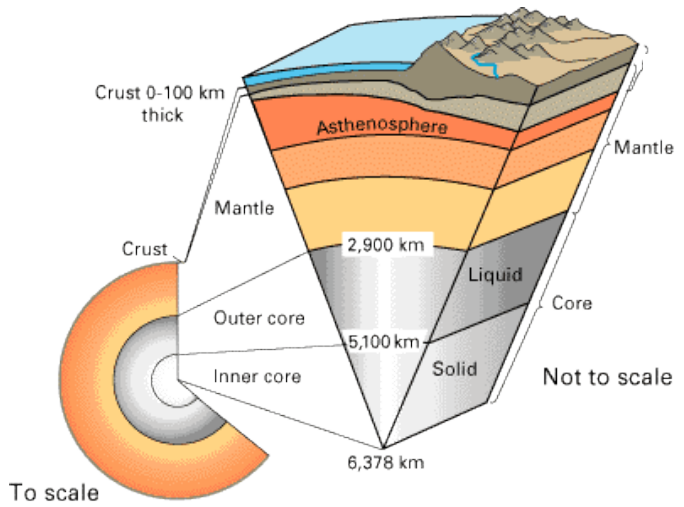
OLD BUSINESS: Bill did programs for Kalona Home school; 3 programs at 1 hour each. He received various thank you notes that Marv will forward to Ray for inclusion in the newsletter. **Officers insurance,** Marv will call an attorney friend of the club get his opinion. **Christmas party** got rave reviews for the variety of potluck foods and the turkey and ham.

FACE BOOK: Kim and Sherry Burns are now sole administrators of the page.

MISCELLANEOUS: Bill reported that Pete Larson will be willing to give a talk on dinosaurs for the cost of expenses only. Need to find a venue and open it up to public.

MOTION TO ADJOURN: by Bill, second by Kim. Meeting adjourned 7:55p.m.

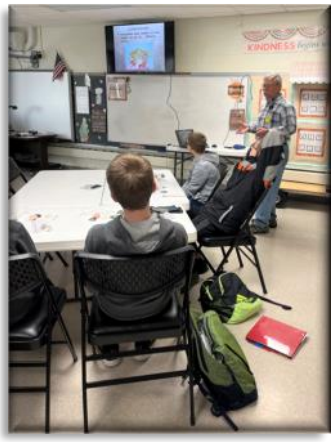
Respectfully submitted,
Dell James, Secretary



Bill Desmarais Teaches Rocks Minerals & Fossils to Kalona Home School Association Students

As a part of the CVRMS ongoing educational outreach program, Director Bill Desmarais presented several rock, mineral, and fossil programs for the Kalona Home School Association on Monday, November 28. He taught a total of 67 students during three sessions for a total of 3 ¾ hours-**whew!!!**! Thank you so much, Bill, for helping to educate the students to the wonders of rocks and fossils.

Below are some photos that were taken by the teacher (Crystal Gingerich) and Bill.



Spotlight Gemstones: Garnet

January's Birth Stone

Garnet, is the name used for a large group of rock-forming minerals. These complex minerals share a common crystal structure and a generalized chemical composition of $X_3Y_2(SiO_4)_3$. In that composition, "X" can be Ca, Mg, Fe^{2+} or Mn^{2+}, and "Y" can be Al, Fe^{3+}, Mn^{3+}, V^{3+} or Cr^{3+}. Despite their variable appearance, garnets are usually easy to identify by their hardness, crystal habit and occurrence in metamorphic rock. Garnets usually form at high temperature and pressure, so they typically occur in their crystal form as rounded dodecahedrons (twelve-sided) or twenty-four sided trapezohedrons with a Mohs hardness of 6.5 -7.5. The birthstone of **January**, garnets are mined in a rainbow of colors (except blue). From the fiery orange of *Mandarin Garnets* to the rich green of *Tsavorite Garnets* and to the most widely recognized color, the deep red of *Pyrope Garnets,* the garnet is considered a great gift to symbolize friendship and trust. Garnets have been used as gemstones and abrasives since the Bronze Age. All species of garnets possess similar physical properties and crystal forms, but differ in chemical composition. The different species are pyrope, almandine, spessartine, grossular (varieties of which are hessonite or cinnamon-stone and tsavorite), uvarovite and andradite. The garnets make up two solid solution series: pyrope-almandine-spessartine and uvarovite-grossular-andradite. These minerals are found throughout the world in metamorphic, igneous, and sedimentary rocks. Most garnets found near Earth's surface formed when a sedimentary rock with a high aluminum content, such as shale, was subjected to heat and pressure intense enough to produce schist or gneiss. Garnet is also found in the rocks of contact metamorphism, subsurface magma chambers, lava flows, deep-source volcanic eruptions, and the soils and sediments formed when garnet-bearing rocks are weathered and eroded. In the United States, the major industrial uses of garnet in 2012 were waterjet cutting (35%), abrasive blasting media (30%), water filtration granules (20%), and abrasive powders (10%).

What in the World?

What in the World is this interesting geologic feature found in Arizona??

December's Photo

Last month's **What in the World** photo is the Al Naslaa rock formation, a strange rock perfectly split down the middle with the precision of a laser beam supported by a natural pedestal that appears much too small for its purpose. The rock, at Saudi Arabia's Tayma Oasis, is about 20 feet high and 30 feet wide, and is covered on its south-east face with numerous petroglyphs

ROCK CALENDAR
CVRMS EVENTS OF INTEREST

2023

Jan. 17 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Gold (see page 1)

Feb. 21 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program to be announced

Mar. 21 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Cornell College Students

Mar. 25-26— CVRMS Rks, Fos, & Min Show
*Hawkeye Downs
Cedar Rapids, Iowa
"Wonderful World of Agates"

Apr. 18 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program To Be Announced

May. 16 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program to be announced

June 20 — CVRMS Pot-Luck Picnic
Ellis Park Overlook Shelter 6:30 pm
Rock Polishing

July 18 — CVRMS Pot-Luck Picnic
Wanatee Park Meadowlark Shelter 6:30 pm
Geode Cracking

Aug. 15 — CVRMS Pot-Luck Picnic
Morgan Creek Park Shelter 6:30 pm
Rock Bingo

Sept. 9 -10 — CVRMS Rock Auction
Amana RV Park and Event Center
Amana, Iowa

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

Have you ever wondered what it would be like to visit Earth's geologic past? That idea was addressed on the web site https://www.quora.com/ last month. I have modified their descriptions slightly for this discussion. The original question was *"If we could time travel to the Silurian period, could we cook and eat prehistoric fish from that time?"*

You have been selected as the first ever person to be sent back in time, to the **Silurian period**, **443 to 416 million years ago**.

The length of the day was around 21 hours, significantly less than the 24 hours we experience in the modern world. Unless you and your new friends were disciplined and lived in 24 hours circadian rhythms, decades of irregular and too little sleep could have a significant impact on health; lower immune function could cause increased susceptibility to infections and cancer. With too little sleep, there is even a link to the increase in the chance of getting Alzheimer's in genetically susceptible individuals.

The oxygen levels were between 16 and 23%. If you landed when it was at the lower end, it would be better to stay near sea levels as at higher altitudes; it might be difficult to breathe. There wouldn't be much to explore far from seas, oceans, and rivers as the first plants and animals only began to conquer landmasses.

Spores of early plants would pose the danger of anaphylaxis, the dangerous allergic reaction after some time. We are more adapted to pollen which only appeared hundreds of millions of years later.

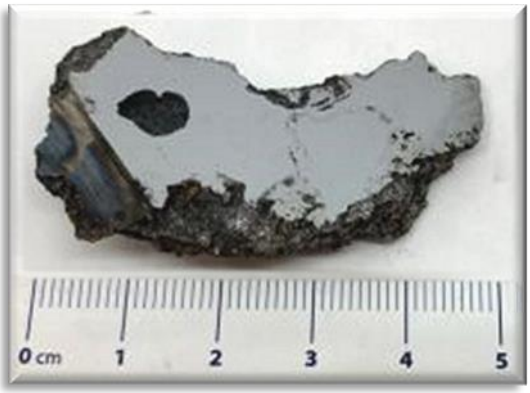
Infectious diseases might not be dangerous in the Silurian period except for some opportunistic pathogens of the digestive system or other impossible-to-foresee pathogens. Animal life and the contagious diseases that affected them might be too far away genetically from us. The microbes that we would bring from the future might be more dangerous for them.

Could you safely eat the fish that lived in the Silurian period? Yes, eating them should be possible, but care should be taken. Some fish accumulate toxic compounds from their food or are outright poisonous. Such animals are usually brightly colored to warn the predators of their toxic flesh. Such colorful organisms should be avoided. The diet of would-be travelers to the Silurian period would be somewhat monotonous, eating mostly fish. Still, there wouldn't be that much choice besides other food types available in aquatic environments. Travelers would be in danger of scurvy unless they ate non-cooked fish, which would be too dangerous. Some parasites that affect them could cause harm to humans even though we wouldn't be part of their usually complex life cycle.

Cooking would be problematic because there was no wood, no coal, and the tallest plants were only a few cm/inches tall. You would need to gather moss and other early plants and dry them to obtain cooking materials. At the end of the Silurian, the landscape was dominated by 3 foot wide and up to 26 feet tall fungus *Prototaxites* (pictured to the right, albeit somewhat inaccurately because other plants would not be that tall). It could even be lichen or something else entirely; we are not sure what this enigmatic organism was. Would it be structurally strong enough to build a shelter with? Would it help us generate heat and for cooking food by burning it? Could you eat it? We have no idea. Obtaining **vitamin C** from other sources would be difficult. Fruits evolved only hundreds of millions of years later. Even ferns didn't exist in the Silurian yet. You would need to eat moss or algae or absolutely revolting fish eyes. If you brought some seeds from the future, farming would be tricky. The soil was very poor and thin at the time. This is because plants didn't evolve long roots until the following Devonian period; only then did proper soil begin to emerge. Some locations on the shore would be dangerous from erosion due to storms and a bit stronger tides because the Moon was slightly closer to Earth. The beaches of oceans were not well protected from storms by plants with extensive root systems like today. Many other locations would be unstable to settle due to landslides, since there would be no plants to secure the loose soil. The largest fish, the *Megamastax*, was about 3 feet long. Similarly sized vicious sea scorpions were probably the most dangerous animals at the time; they looked terrifying and some had a mean, serrated spiky structure on the tail for brutally impaling prey. On land, there were many non-flying insects and arachnids, and some were quite large. They might be a severe nuisance, getting into every nook and cranny. They would have no fear of large animals like us as none existed on dry land yet. Although they wouldn't look tasty, a good idea would be to develop a taste for them to diversify the diet away from fish, mollusks, and algae.

Two Minerals Never Before Seen on Earth Found Inside 17-Ton Meteorite

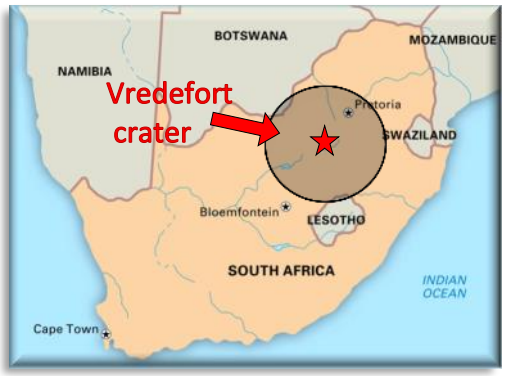
Two minerals that have never been seen before on Earth have been discovered inside a massive meteorite in Somalia. They could hold important clues to how asteroids form. The two brand new minerals were found inside a single 2.5 ounce slice taken from the 16.5 ton **El Ali meteorite**, which crashed to Earth in 2020. Scientists named the minerals **elaliite** after the meteor and **elkinstantonite** after Lindy Elkins-Tanton, the managing director of the Arizona State University Interplanetary Initiative. He is also the principal investigator of NASA's upcoming Psyche mission, which will send a probe to investigate the mineral-rich Psyche asteroid for evidence of how our solar system's planets formed. "*Whenever you find a new mineral, it means that the actual geological conditions, the chemistry of the rock, was different than what's been found before,*" Chris Herd, a professor at the University of Alberta, said in a statement. "*That's what makes this exciting: In this particular meteorite you have two officially described minerals that are new to science.*" The researchers classified El Ali as an **Iron IAB complex meteorite**, a type made of meteoric iron flecked with tiny chunks of silicates. While investigating the meteorite slice, details of the new minerals caught the scientists' attention. By comparing the minerals with versions of them that had been previously synthesized in a lab, they were able to rapidly identify them as newly recorded in nature. The researchers plan to investigate the meteorites further in order to understand the conditions under which their parent asteroid formed. *"That's my expertise, how you tease out the geologic processes and the geologic history of the asteroid this rock was once part of,"* Herd said. *"I never thought I'd be involved in describing brand new minerals just by virtue of working on a meteorite."* The team is also looking into material science applications of the minerals. However, future scientific insights from the El Ali meteorite could be in peril. The meteorite has now been moved to China in search of a potential buyer, which could limit researchers' access to the space rock for investigation. https://www.livescience. com/two-new-minerals-found-inside-meteorite



The 2.5-ounce slice which contains the two brand-new minerals.

Largest Asteroid Ever to Hit Earth Was Twice as Big as the Rock that Killed Off the Dinosaurs

The largest asteroid ever to hit Earth, which slammed into the planet around 2 billion years ago, may have been even more massive than scientists previously thought. Based on the size of the Vredefort crater, the enormous impact scar left by the gargantuan space rock in what is now South Africa, researchers recently estimated that the epic impactor could have been around twice as wide as the asteroid that wiped out the non-avian dinosaurs. The Vredefort crater, currently measures about 99 miles in diameter, making it the biggest visible crater on Earth. However, it is smaller than the Chicxulub crater buried under Mexico's Yucatán Peninsula, which measures around 112 miles in diameter and was left by the dinosaur-killing asteroid. But impact craters erode over time, which makes them appear to shrink. The most recent estimates suggest that the Vredefort crater was originally 155 to 174 miles across when it was formed. As a result, the Vredefort crater is considered the largest impact crater on Earth. In the past, scientists estimated that the Vredefort crater was originally much smaller, around 107 miles wide. Based on that estimate, researchers previously calculated that the asteroid responsible for the impact would have measured around 9.3 miles across. But in a new study, scientists have revisited the crater's measurements and gained new insight into the size of the enormous space rock. In the study, researchers recalculated the size of the Vredefort asteroid and estimate that the Vredefort asteroid was likely around twice as large as the dinosaur-killer and likely measured somewhere between 12.4 and 15.5 miles across, and it also may have been traveling much faster, possibly between 45,000 and 56,000 mph when it struck our planet. So its impact would have been even more severe, potentially the single largest energy-release event in Earth's history. However, because the impact happened so long ago, there is scant evidence of the blast's ground-shaking power and the effects of the collision on the planet. Unlike the Chicxulub impact, the Vredefort impact did not leave a record of mass extinction or forest fires, given that there were only single-cell lifeforms and no trees existed two billion years ago. However, the impact would have affected the global climate potentially more extensively than the Chicxulub impact did. Researchers will continue to study Vredefort crater to learn more about this cataclysmic impact. https://www.livescience.com/vredefort-asteroid-bigger-than-expected



Ancient Superpredator that Lived 328 Million Years Ago Was 'the T. Rex of Its Time'

Fangy *Whatcheeri*a measured up to 6.5 feet long, and more than 300 million years ago, it was the apex predator in the sinkholes-turned-lakes of what is now Keokuk County, Iowa.

A fangy, 6-foot-long carnivore that haunted the lakes of what is now the American Midwest would have been a top predator in its freshwater ecosystem, *"T. rex of its time,"* according to scientists who studied the creature. And it grew up fast, new research finds. The predator, an early four-legged vertebrate known as a tetrapod, lived around 328 million years ago during the early Carboniferous period. Its name is *Whatcheeria deltae*, after the town of **What Cheer, Iowa**, where many of its fossils are found. It lived at a time when the region was lushly vegetated and dotted with sinkholes that had turned into lakes. *W. deltae* would have lurked in these lakes, growing to 6.5 feet long and looking something like toothy, enormous salamanders. *"It would have made Whatcheeria the biggest thing in the lake: Go wherever you want, eat whoever you want,"* said Ben Otoo, one of the authors of a new study describing *W. deltae* published Monday (Nov. 28) in the journal *Communications Biology*. Otoo and colleagues were studying the Field Museum's collection of 375 *W. deltae* specimens, some bone fragments and some nearly complete skeletons, when they noticed that the limb bones of the animal came in different sizes. The size differences weren't based on when or where the fossils were found, so Otoo realized that they were looking at bones from animals of different ages. Smaller limb bones measured about 4 inches long, while the largest were 2.6 feet. That meant that Otoo and his colleagues had an opportunity to study how *W. deltae* grew. Early tetrapods like whatcheeriads were related to modern reptiles, amphibians and mammals but were in a different evolutionary lineage than the ancestor of those three groups. Modern-day birds and mammals tend to grow quickly in their youth and then stop growing, while reptiles tend to grow quickly at first and then continue growing, but more slowly. Meanwhile, some amphibians grow at a slow and consistent rate throughout their lives. Little was known about how early tetrapods may have grown. By looking at growth rings in the bones, the team found that *W. deltae* got big fast and then slowed to a more leisurely but steady growth rate. All of the nine specimens they studied were older juveniles and young adults, Otoo said, so it seems that the animals bulked up to around 3.3 feet (1 meter) in length as they neared sexual maturity and then grew larger more slowly in later adulthood. *"You have this animal that is racing to get to reproductive age to get to at least a decent size really quickly, because the best way to get yourself out of a predator's range of prey items is to get bigger,"* Otoo said. It was surprising to see this pattern in such an early tetrapod, he added, because scientists expected rapid early growth to be linked to a terrestrial lifestyle and restricted to mammals, birds and reptiles with higher metabolisms than those of early tetrapods. "*To find [rapid growth] in as old an animal as Whatcheeria and as primitive as Whatcheeria was really unexpected*," Otoo said. Other types of tetrapods from this era grew more slowly and steadily, Otoo explained, so it's clear that these early four-legged animals were trying a number of different evolutionary pathways to success. *"Early tetrapods, even those far away from the origin of the modern living lineages — they basically had a lot more going on than we thought,"* Otoo said.

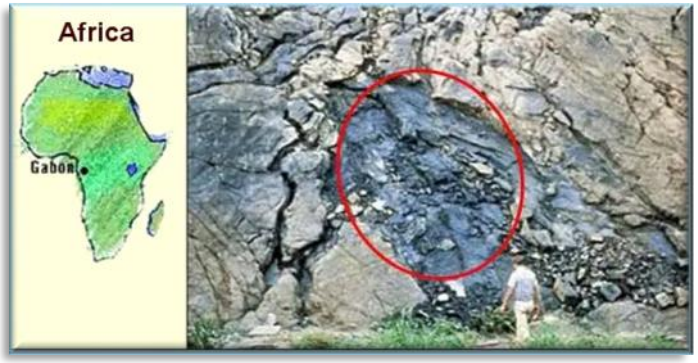
Fossil skull of Whatcheeria deltae, showing off the tetrapod's numerous sharp teeth..

Whatcheeria deltae attacks in this artist's impression of the enormous ancient tetrapod.

https://www.livescience.com/tetrapod-predator-growth

Is the 1. Billion Year Old Okla Structure in Gabon a Natural Nuclear Reactor?

Yes. Calling it a reactor might be a tad bit of a stretch, but there is clear evidence of ancient uranium fission occurring in a manner quite similar to that that occurs a modern light-water reactor. A nuclear reactor is a mechanism to induce and sustain a controlled nuclear fission reaction, usually for the purpose of generating heat use to produce electricity or neutrons for use in research or production of rare radioisotopes used in medicine and industry. This is typically done using uranium enriched with an isotope less stable than most found in nature on Earth. This isotope has the property that when struck by neutrons, its atoms can fission into smaller atoms, releasing more neutrons in the process. These neutrons strike nearby atoms and cause more fissioning and so on. To start the chain reaction, a certain quantity of this fissile uranium must be brought into close proximity, and steps must be taken to slow the neutrons so they have time to interact with the atoms they strike. It's a delicate balance that's hard to achieve by chance, but in 1956 physicist Paul Kuroda showed that nuclear fission can in fact occur by chance, given certain naturally occurring conditions where a large enough deposit of the right fissionable material is concentrated and pushed upward into a zone saturated with water (which acted as a moderator). This is what appears to have happened in Okla, Gabon, some 1.7 billion years ago, when uranium deposits formed deep in the Earth were pushed up by geologic processes into contact with groundwater. Three conditions must have been met for natural fission reactions to occur: **1)** The thickness of the uranium layer should be above 1 meter, **2)** U235 concentration should be above 1% (currently the world average of U235 in nature is not more than 0.7%), and **3)** there should be a moderator to inhibit the speed of neutrons; a sustainable water source in the uranium layer can act as a moderator. The reactor ran for hundreds of thousands of years, and it is estimated to have averaged under 100 kW of thermal power during that time This article was modified from https://www.quora.com/.

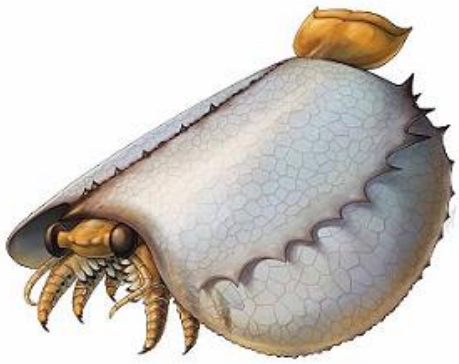


Rocks (circled in red) that were melted about 1.7 billion years ago by the Okla natural nuclear reactor in Gabon.

Likeness of Cambrian Critter Finally Revealed, and It Looks Like a Taco

Since its discovery more than 100 years ago, ***Tuzoia,*** a weird little arthropod that swam close to the seafloor during the **Cambrian period** (**541 million to 485.4 million years ago**), has befuddled paleontologists. Now, a new look at nearly a dozen remarkable fossils reveals details about this enigmatic creature and its uncanny resemblance to a taco, a new study finds. For the investigation, researchers waded knee-deep into the invertebrate paleontology collection at the **Royal Ontario Museum (ROM)**. While there have been hundreds of recorded specimens worldwide, the preservation of their soft tissues, including their stalked eyes, multiple legs, tail fans and carapaces (the hard upper shells that give the creatures their taco-like look), has been nonexistent, thus offering only partial clues to the arthropod's appearance. *"**Tuzoia** was widespread [and] found in China, Australia, the Czech Republic and Canada,"* Alejandro Izquierdo López, the study's lead author. *"The 11 specimens we studied have small details, like the soft tissues of the carapace, that other remains lack. Individuals with eyes and legs are also hard to find." Tuzoia* can range in size from about 0.3 to 7 inches long, according to the study, published Dec. 7 in the journal Royal Society Open Science. While ROM has about 400 examples of *Tuzoia* in its collection, researchers culled the selection to 11 arthropods exhibiting soft-tissue preservation. *The carapace isn't like the hard shell of a clam, so finding one still intact is rare."* The specimens used in the study were so well preserved because of their location in western Canada, particularly in the fossil-bearing deposits of the Burgess Shale, where layers of mudbanks that were once a marine environment "*entombed the animals,"* Izquierdo López said. The researchers think *Tuzoia* was a predator or scavenger that feasted on the remains of dead smaller creatures littering the seafloor. The arthropod could likely flex its carapace outward as it moved, enabling its legs to touch the ground and scuttle across it, according to the study. *"These animals have been known for over 100 years, but I had never seen the tails, eyes and legs before,"* Izquierdo López said. *"I kept looking at the [ROM] collection again and again, and it was unexpected to find all of these well-preserved soft materials years later."*

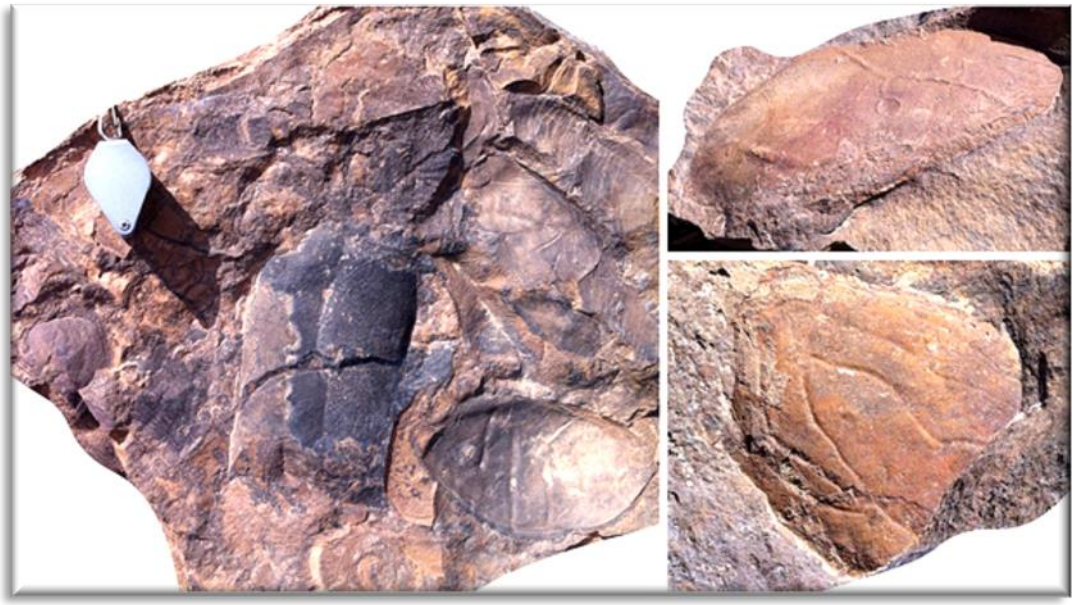
https://www.livescience.com/taco-lookalike-arthropod-tuzoia



What resembled a taco and foraged the sea floor? *Tuzoia*, a genus of Cambrian arthropod

Newly Discovered Fossils Give a Whole New Meaning to Jumbo Shrimp

Morocco is making headlines for more than just its incredible run at this year's World Cup. A new fossil find at **Taichoute** in the country's fossil-rich **Fezouata Shale formation** in southeastern Morocco's Zagora region is filling in some gaps in evolutionary history. **Fezouata Biota** is a the name of a unique assembly of fossilized animals from the **Early Ordovician** period found in this area which includes radiodonts, lobopodians, nektaspidids, and marrellomorphs. The greater Fezouata Shale formation is home to the remains of numerous large "*free-swimming*" arthropods that dominated the Earth's seas about **470 million years ago**. These are the relatives of present day shrimp, insects, and spiders. A study published in December in the journal *Scientific Reports* describes the early evidence found at the site. While more research is needed to analyze these fragments, the giant arthropods could be up to **six and a half feet long**, a new meaning to the term jumbo shrimp. The team says the findings at Taichoute open up new avenues for studying paleontology and ecology. *"Everything is new about this locality—its sedimentology, paleontology, and even the preservation of fossils—further highlighting the importance of the Fezouata Biota in completing our understanding of past life on Earth,"* lead author Farid Saleh, a paleontology at the University of Lausanne and Yunnan University. This site and its fossil record are very different from other previously described and studied Fezouata Shale sites, according to the research team that represents multiple countries. At the other sites, located about 50 miles away from Taichoute, researchers have found fossils from after the Cambrian Explosion. *"While the giant arthropods we discovered have not yet been fully identified, some may belong to previously described species of the Fezouata Biota, and some will certainly be new species,"* Xiaoya Ma, a co-author . *"Nevertheless, their large size and free-swimming lifestyle suggest they played a unique role in these ecosystems."* The fossils discovered in this rocks include harder shells and some well-preserved soft body parts such as internal organs. These discoveries help scientists investigate the anatomy of early animal life on Earth and how it has changed over time. The animals here lived in a shallow, stormy, and wavy sea that buried their remains and preserved them in place. However, the free-swimming (or nektonic) animals are actually a relatively minor component overall in the Fezouata Biota. This new study finds that the Taichoute fossils are preserved in sediments that are a few million years younger than other discoveries from the Zagora area and are dominated by fragments of the giant arthropods. Underwater landslides further delivered the carcasses of these animals to the deeper marine environment. "*Animals such as brachiopods are found attached to some arthropod fragments, indicating that these large carapaces acted as nutrient stores for the seafloor dwelling community once they were dead and lying on the seafloor,"* said Allison Daley, a co-author paleontologist. Even for seasoned paelentologists, these new species are a surprising find, according to the team. "*The Fezouata Biota keeps surprising us with new unexpected discoveries,"* Bertrand Lefebvre, the paper's the senior author and a palentologist at the University of Lyon, concluded.

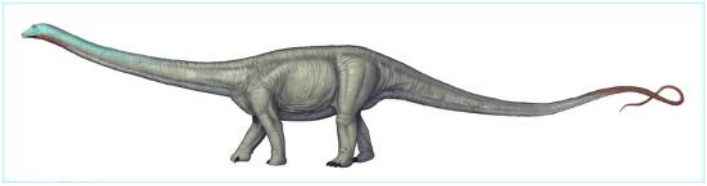


Large fossilized fragments of free swimming arthropods, relatives of modern shrimp and insects.

https://www.popsci.com/science/giant-shrimp-morocco/

Did Long-Necked Dinosaurs' Whip-Like Tails Really Break the Sound Barrier? Not So Fast.

Similar in length to a semi-truck, **diplodocid** dinosaurs could whip their long, sinuous tails as fast as a big rig cruising down the highway at 62 mph, a new study reveals. The investigation, published last December in the journal *Scientific Reports*, contradicts a previous claim that the long-necked dinosaurs, which are a group of sauropods that lived during the **Middle Jurassic to the Lower Cretaceous periods (174 million to 101 million years ago)**, could crack their bullwhip-like tails as fast as the speed of sound at sea level (about 761 mph). Instead, their tails' true speed would have been closer to that of a motor vehicle. To investigate, scientists examined the fossils of five separate diplodocids and created a digital model of a tail using measurements they took of the remains. The resulting model tail measured approximately 39 feet long, weighed 3,188 pounds and contained 82 cylinders, which represent its vertebrae, according to a statement. *"There are only a few specimens available, and of those, only two had complete tails that we could use for our purposes,"* Simone Conti, the study's lead author. *"After gathering data from the specimens and adjusting the dimensions of their tails, we created a model and tried to replicate the [speed of sound] results from the other study."* However, instead of cracking the sound barrier, the tail in the new model crumbled under the sheer velocity of being forced to thrash back and forth at such high speeds. *"Most likely the failure was caused by the soft tissues that connect each of the vertebrae in the tail, which include the different muscles, tendons, ligaments and skin,"* Conti said. "*Whenever the simulation failed, we noticed that the model tail couldn't simulate the joints between the vertebrae and would overstretch. Achieving such high speeds had its limitations, and they couldn't handle moving that fast and we would lose pieces of the tail."* Conti called the model simulation a "new approach" that combines his academic work straddling aerospace engineering and paleobiology. *"Not many studies have been done using these methods,"* Conti said. *"In aerospace engineering, it's common to test parts of airplanes to see how much stress the structures can sustain. We wanted to test the same approach but on the organic materials of animals. It's not common to see aerospace engineering and paleontology working together."* While the purpose of the dinosaur's whip-like tail is unknown, researchers speculate that *"from the shape of it, it has always been compared to a whip,"* Conti said. *"From a morphological point of view, it probably was used as a weapon or a way to communicate between one another."*



An artist's illustration of *Diplodocus longus*, a species of sauropod dinosaur from the Late Jurassic of North America .

https://www.livescience.com/diplodocids-bullwhip-tails

Megatsunami swept over Mars After Devastating Asteroid Strike

Around 3.4 billion years ago, when Mars was a warm, wet world, an asteroid several kilometers wide tore through its thin air and crashed into a shallow sea, leaving an expansive crater on the seafloor. The impact sent a wave of water up to 800 feet high surging inland for hundreds of miles, leaving behind a layer of debris hundreds of feet thick. That's the scenario outlined in a paper published last December in the journal *Scientific Reports* by a team of researchers who think they have identified the impact crater that the asteroid left behind. Their analysis points to **Pohl,** a 68-mile-wide crater lying on the plains of **Chryse Planitia**, as the source of this catastrophic event, a Martian analog to the famous Chicxulub impact off the Yucatan Peninsula that spelled the beginning of the end of the dinosaurs. What's more, we may have already explored the remains of this **megatsunami**. The team's analysis indicates that the Viking 1 lander, which became the first spacecraft to successfully touch down on the Red Planet on July 20, 1976, landed right on top of the deposit from this megatsunami. The new findings help explain the landscape Viking 1 found, and suggest that it has a much more interesting history of water than scientists initially thought. Viking 1's landing site was chosen because earlier orbiter photos showed that the area was marked by massive channels, thought to be carved out during megafloods that sprung forth from underground aquifers and rushed downhill to fill a vast northern sea. Viking 1 landed near terrain that, from orbit, includes features that were clearly once islands, streamlined by the water that flowed past them. But when Viking 1 landed, there were none of the streamlined features or channels that would have indicated fast flows of water. Instead, Viking was surrounded by mostly flat, boulder-strewn terrain. Scientists wondered if perhaps the craft had landed atop a blanket of ejecta thrown out from an impact crater, or perhaps on a field of lava flows. But there weren't enough craters around to support the hypothesis of an ejecta, which would likely have to be several meters thick. And from the lander's limited viewpoint, there was no clear evidence of lava deposits, either. So, Viking 1's landing site was "**an enduring mystery**." But these features can be explained by a massive tsunami caused by an impact. In a 2016 study, researchers argued that the waves from ***two*** megatsunamis, perhaps caused by impacts just a few million years apart, had reshaped the shorelines of an ancient Martian ocean. In between the impacts, the Martian ocean had receded as sea levels fell by about 1,000 feet. The younger megatsunami, the team had found, was likely linked **to Lomonosov,** a 90-mile-wide crater on the northern plains of Mars. But the impact that triggered the older megatsunami, the one that had swept over the Viking 1 site, remained in question. In their new study, the team identify a fitting candidate: Pohl Crater, located roughly 660 miles northeast of the Viking 1 landing site. The timeline matches up, too. Pohl lies on top of sinuous terrain that was formed by the megaflood outflows (which in turn formed the northern ocean). But Pohl itself is covered by a wave of debris from the younger megatsunami.

https://astronomy.com/news/2022/12/megatsunami-swept-over-mars-after-devastating-asteroid-strike

A Unique Piece of Mars

Following the pioneering Mars Exploration Rovers, NASA's Curiosity rover is actively exploring the crustal rocks of Mars. Despite the exciting results returned by the rovers, there is no substitute for a hand sample of crustal rock. Because such samples will not be returned to Earth anytime soon, geochemists who want a piece of Mars in their labs must satisfy themselves with Martian meteorites. These comprise a group of igneous rocks with telltale signs of Martian alteration products and have provided ground truth for the information returned by the rovers. Oddly, however, the hundred or so known Martian meteorites are chemically unrepresentative of the Martian crust determined by missions. On page 780 of this issue, Agee et al. put an end to this conundrum with the finding of a new Martian meteorite, Northwest Africa (NWA) 7034, a basaltic breccia unique among known Martian meteorites with respect to age, oxygen isotopes, and petrology. One might wonder whether such a rock should even be construed to be of Martian origin. Oxygen isotopes are the meteoritic equivalent of DNA fingerprinting, each unique signature implying a different planetary reservoir. One of the big surprises in NWA 7034 is that its oxygen isotopes are shifted to greater 16O depletion, and to heavier isotopic compositions, than those of the SNC (shergottite, nakhlite, and chassignite) Martian meteorites. Had it not been for the alertness of Agee et al., NWA 7034 would likely have been classified as a unique achondrite (an asteroidal sample) on the basis of its distinct oxygen isotope composition. However, they showed that the mineral chemistry of pyroxenes from NWA 7034 plot on the distinct FeO versus MnO trend defined by other Martian meteorites. Another distinguishing characteristic of Martian meteorites over achondrites is their young radiometric ages [<4 billion years ago (Ga)]; NWA 7034 has been dated about 2 Ga, older than SNC meteorites but younger than ALH 84001. What makes NWA 7034 so exciting is that its major element composition is a close fit with the chemical data returned by the Mars rovers, as well as with the global chemical composition of Mars' crust returned by the orbiting gamma ray spectrometer onboard Mars Odyssey. NWA 7034 appears to be a chemical analog of rocks from Gusev Crater. Given that the other known Martian meteorites are a poor match for crust exposed at the Martian surface, what can we learn from a meteorite that resembles just about any rock from Mars? The first important discovery is that the new meteorite has a distinctly greater deficiency of the ^{16}O isotope among its oxygen isotopes than the other Martian meteorites, which are bunched so close together on an oxygen isotope plot that they can be classified as a group on the basis of a single measurement of their $\Delta\ ^{17}O$. That this should be the case was anticipated by pioneering studies that found the Martian hydrosphere and atmosphere to have mass-independent isotope fractionations driven by the penetration of ultraviolet light through the thin atmosphere of Mars. Further, on Earth such processes would be wiped out by plate tectonics, but the absence of subduction on Mars resulted in the preservation of mass-independent isotope anomalies. Ever since the Viking mission in 1976, it has been known that Mars' atmosphere is escaping the planet's gravitational grasp with attendant mass fractionation, but that carbon and oxygen isotopes did not exhibit the extreme mass-dependent fractionation observed in nitrogen. Therefore, a reservoir on Mars must be buffering the C and O isotopes. Agee et al. now show that the lithosphere may be part of the buffering (at least for oxygen) because the bulk oxygen isotope composition of NWA 7034 has been shifted toward the atmospheric end relative to other Martian meteorites (see the figure). Incidentally, this is one of the questions Curiosity is designed to tackle on Mars, but Agee et al. may have beaten the rover to the punch line. Another interesting aspect of NWA 7034 is its clastic nature, whereby numerous fragments of rock and mineral are bound together. It is unknown whether these clasts all originate from a single (pyroclastic) volcanic eruption, or whether multiple clasts are introduced by impact or some other external agent. Experience with lunar rocks revealed a wealth of information in 2- to 4-mm rock fragments; is this an opportunity to repeat that exercise on Mars? Agee et al. measured 0.6 weight percent water in NWA 7034 with a distinct oxygen isotope composition from the bulk rock, effectively a sample of the Martian hydrosphere or permafrost trapped within the matrix of NWA 7034. What are the host minerals? As a rock that appears to have originated at the Martian surface, NWA 7034 may contain the elusive hydrous minerals that host water on Mars and their mineralogy might now be determined in the laboratory, with important inputs into directing Curiosity or designing the next generation of Mars probes. And, finally, there is macromolecular organic carbon (MMC) recognized in inclusions within feldspar crystals. It is tempting to wonder whether the volcanic activity associated with the igneous clasts in NWA 7034 provided a warm haven for Martian life. If so, this is the place to start a search. Because NWA 7034 is a desert find and not a fresh fall (even though it appears rather fresh by Saharan meteorite standards), an important question is whether the organic matter in NWA 7034 is actually from Mars. This can be settled by measurement of the D/H (deuterium/hydrogen) ratio for the MMC because the Martian hydrogen is characterized by a high D/H ratio relative to terrestrial organics. If an extraterrestrial origin is indeed confirmed, it may yet prove to be meteoritic organics associated with micrometeorite in fall on the Martian surface. Anyway, the hunt for life on Mars in another meteorite will then be on. If one were to wish for a single Martian meteorite, it would be NWA 7034, the first known archetypal crustal rock from Mars. When other such rocks are found, they may help to clarify many remaining questions about the Martian surface. For example, has hydrothermal activity occurred on Mars? Have ore mineralizations occurred? Is there evidence of soil (aeolian dust) in the breccia? Is trapped ancient atmosphere (nitrogen, noble gases) present in the amorphous material? Stay tuned for more exciting discoveries.

Martian meteorite, Northwest Africa (NWA) 7034

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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 3rd Tuesday 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:

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JANUARY 17
Hiawatha Community Center
GOLD
by Ray Anderson

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