Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS **MAY 2021** **VOL. 47, ISSUE 05**

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

Next CVRMS Meeting
Tues. May 18
7:15 pm

<<VIRTUAL MEETING>>

Join the Zoom Meeting
https://us02web.zoom.us/j/87289747880

Featuring Gem and Mineral Videos

"Top 15 Biggest Crystals"

"Denver Gem & Mineral Show Highlights 2020"

"Jonas Mine Tourmaline Discovery"

These polished stones collected in Wyoming may have been carried some 600 miles from Wisconsin inside the stomachs of sauropods

A group of polished, ancient stones found in Wyoming may have been carried more than 600 miles in the huge bellies of plant-eating dinosaurs. The findings, published in February in the journal *Terra Nova*, could provide a new line of evidence that dinosaurs may have undertaken long overland migrations. The stones were discovered in Wyoming's Bighorn Basin in a geologic unit called the Morrison Formation. The *gastroliths* (fist-sized rocks which are rocks swallowed by dinosaurs and some modern birds and reptiles to help grind up fibrous food) were identified because their size and shiny appearance looked *"out of place"* in the fine-grained mud-rock that dominates the Morrison Formation. To identify where the rocks may have come from the researchers examined tiny crystals of zircons within them. The zircon age spectra revealed a **maximum** depositional age of about 1.7 billion years ago. Along with their color, texture, and composition, they are indistinguishable from the 1.62 billion year old Baraboo interval quartzites present in Wisconsin, some 620 miles east. Researchers inferred that they were ingested by dinosaurs in Wisconsin, or somewhere along a stream that was flowing westward during that time, then carried and eventually deposited in the Morrison. The fact that the rocks were not found in the context of a fossil skeleton calls into question their identification as gastroliths. If proven, they will provide valuable new information on dinosaur activity in North America. https://www.smithsonianmag.com/smart-news/stones-hint-600-mile-dinosaur-migrations-180977493/

CVRMS Apr. 20 Virtual Meeting

7:15 MEETING CALLED TO ORDER by Marv Houg via Zoom. 26 participants.

MINUTES: Motion to approve as published by Jay, 2nd by Bill. Approved as published.

TREASURE'S REPORT: Dale gave treasurers report. Checking account balance $4258.31. Motion to approve by Ray, 2nd by Jay. Motion passed.

PROGRAM: Presented by Ray Anderson, *Iowa's Industrial Minerals.* The talk was followed by an extensive period of questions and answers.

TAKO: (Take a Kid Outside) will be postponed to October 2021.

AUCTION: Scheduled for September 18 and 19. Marv reports between 1022 and 1200 lots scheduled to be auctioned. Food is still being arranged, hopefully with a food truck.

ROCK SHOW: Nov 6 and 7. To date 13 vendors have signed contracts. Ray reported that the program speakers have been contacted and will be ready to go.

PICNICS: Picnics are still in limbo depending on COVID restrictions. We will discuss it further at the Board meeting.

HIAWATHA MEETING SITE: Dale will meet with the Hiawatha officials about resuming meetings in the meeting place. He will figure it out with them.

WICKIUP DISPLAY: Tom Whitlatch reported that when they cleared out the Wickiup display that they have a large rock left over. Ray said send him a picture and put it in the newsletter.

MOTION TO ADJOURN: by AJ, second by Dale.

9:00 p.m. **MEETING ADJOURNED**.

Respectfully submitted
Dell James, secretary

CVRMS Board Minutes Mar. 23

7:15 p.m. THE MEETING CALLED TO ORDER by Marv, President via Zoom.

MEMBERS: Ray Anderson, Sharon Sonnleitner, Marv Houg, Dale Stout, Bill Desmarais, Dell James, Toby Jordan, Jay Vavra , Kim Kleckner

MINUTES REVIEWED as published. Motion to approve by Dale, 2nd by Jay. Minutes approved.

TREASURER'S REPORT by Dale. Nothing has changed from last report at membership meeting. Checking account balance $4258.31. Motion to approve by Toby, 2nd by Bill. Treasurer's report accepted.

AUCTION: General discussion as to how many and who will be there. Wes Greenfield has opted out. Food. Dale will recontact the Kalona food truck. Jay will send out contracts and encourage contributors to send pictures of items for sale.

PICNICS: Since there has been some relaxing of rules about masks and outside activities, we will be resuming our picnics this summer. It seems that May 1 is deadline for parks to be open and the pavilions.

June 15: Ellis Park—*activity*: showing and identifying rocks

July 20: Wanatee (formerly Squaw Creek) Geode cracking

August 17: Morgan Creek Park—*activity:* Bingo??

Masks will be encouraged and rather than having a pot luck each family can bring their own food. Gather at 6 :00 eat at 6:30p.m. Dale and Marv will reserve pavilions.

SHOW: Our annual show is set for November 6-7, 2021. Friday Nov. 5 will be set up day. We have 8 tables not yet reserved; Sharon and Marv will check the request list from the past shows and contact the possible additional vendor. Dale will get flyers to the Boy Scouts and any other places where we can post them. 4H club members also.

Programs: Ray has 4 of 5 speakers lined up. Meteorite posters from previous planned Show already done.

Pot luck for Friday night cancelled this year.

Raffle prizes: Sharon will put together a list of potential gifts. Dale will check on Raffle permit and insurance as well. Sharon will print up flyers and cards for passing out. Egg cartons rock sample kits are all prepared.

TAKO (take a kid outside) will be planned for later in the fall.

FIELD TRIPS: Marv will work on one sometime is May at one of the quarries. Also had someone contact him from Cordova, Illinois, for a limited amount of people. He will check for more information and get back to the Board.

Motion to adjourn by Dale, 2nd by Bill. Motion approved.

Adjourned at 8:35p.m.

Respectfully submitted
Dell James, secretary

Earth's Continental Crust Emerged 500 Million Years Earlier Than Thought

The first emergence and persistence of continental crust on Earth during the Archaean (4 billion to 2.5 billion years ago) has important implications for plate tectonics, ocean chemistry, and biological evolution, and it happened about half a billion years earlier than previously thought, according to new research being presented at the EGU General Assembly.

Once land becomes established through dynamic processes like plate tectonics, it begins to weather and add crucial minerals and nutrients to the ocean. A record of these nutrients is preserved in the ancient rock record. Previous research used strontium isotopes in marine carbonates, but these rocks are usually scarce or altered in rocks older than 3 billion years.

Now, researchers are presenting a new approach to trace the first emergence of old rocks using a different mineral: "barite." Barite forms from a combination of sulfate coming from ocean water mixing with barium from hydrothermal vents. Barite holds a robust record of ocean chemistry within its structure, useful for reconstructing ancient environments. "The composition of the piece of barite we pick up in the field now that has been on Earth for three and a half billion years, is exactly the same as it was when it when it actually precipitated," says Desiree Roerdink, a geochemist at University of Bergen, Norway, and team leader of the new research. "So in essence, it is really a great recorder to look at processes on the early Earth."

Roerdink and her team tested six different deposits on three different continents, ranging from about 3.2 billion to 3.5 billion years old. They calculated the ratio of strontium isotopes in the barite, and from there, inferred the time where the weathered continental rock made its way to the ocean and incorporated itself into the barite. Based on the data captured in the barite, they found that weathering started about 3.7 billion years ago -- about 500 million years earlier than previously thought.

"That is a huge time period," Roerdink says. "It essentially has implications for the way that we think about how life evolved." She added that scientists usually think about life starting in deep sea, hydrothermal settings, but the biosphere is complex. "We don't really know if it is possible that life could have developed at the same time on land," she noted, adding "but then that land has to be there."

Lastly, the emergence of land says something about plate tectonics and the early emergence of a geodynamic Earth. "To get land, you need processes operating to form that continental crust, and form a crust that is chemically different from the oceanic crust," Roerdink says.

http://www.geologyin.com/2021/04/earths-continental-crust-emerged-500.html?

Spotlight Gemstone: Emeralds

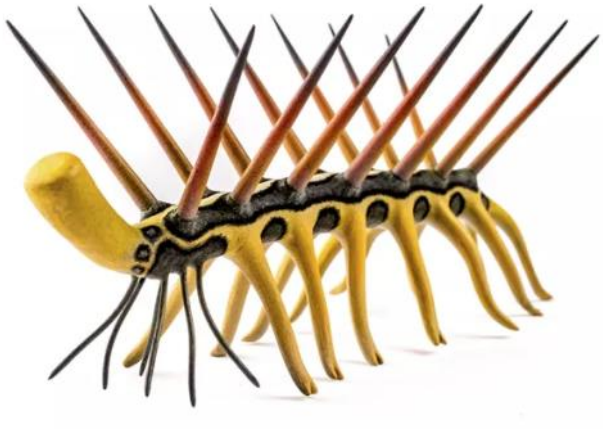
May's Birth Stone

May's birthstone, the emerald, is one of the most regal of all and one which denotes life and love. It is also one of the most valuable (the very highest quality emeralds can be more expensive than diamonds). Emeralds are the deep green variety of the mineral beryl [$Be_3Al_2(Si_6O_{18})$], colored by the element chromium. Emeralds are very hard, 7.5-8 on the Mohs scale. The best emeralds are found in South America, having been cherished by the Inca and Aztec peoples, who regarded emerald as a holy gemstone. In contrast, *"Cleopatra's Mines"* in Egypt had already been exhausted by the ancient Egyptians, so that when they were rediscovered in the 19th century, there was simply nothing left! These are only a few of the cultures which treasured this gemstone. In Roman times, emerald was associated with Venus, goddess of beauty and love. Its pigment was so venerated that Pliny remarked that green *"gladdened the eye without tiring it!"* It is also valued in the Catholic Church, green being considered the most elemental and natural of the colors used in their worship. The Vedas, Hinduism's oldest scriptures, acknowledge the healing powers of emeralds, promoting well-being as well as good fortune. Emeralds are also highly prized in Islam - green was the Prophet Muhammed's favorite color, and all dwellers of paradise are said to be dressed in green. In the 1960s, the

The world's largest uncut emerald

American jewelry industry changed the definition of "emerald" to include the green vanadium-bearing beryl as emerald. As a result, *vanadium emeralds*, purchased as emeralds in the United States, are not recognized as such in the UK and Europe. In America, the distinction between traditional emeralds and the new vanadium kind is often referred to as "*Colombian Emerald.*"

What in the World?



What in the World? Is this strange fossil (shown as an artists reconstruction) and when did it live??

April's Photo

Last month's "*What in the World*" photo was **Rainbow Falls** at ***Devil's Postpile National Monument*** in California. Columnar basalt (the monument's namesake) flanks the falls. The 80,000 year old basalt formed a 400 ft deep pool behind a natural dam. Its uniform composition and slow rate of cooling led to contraction and cracking in the form of vertical hexagonal columns. Glaciers that crossed the area about 15,000 years ago scoured out the valley which was later occupied by the Middle Fork of the San Juan River. Water plunges 101 feet over the basalt, its mist creating the many rainbows that gives the falls its name.

ROCK CALENDAR
CVRMS EVENTS OF INTEREST

2021

May. 7 — Central Iowa Mineral Society
MONTHLY VIRTUAL MEETING - 7:30 pm
speaker Ray Anderson
"a virtual tour of Iowa's Coldwater Cave"

May. 11 — Blackhawk Gem & Min. Soc.
MONTHLY VIRTUAL MEETING - 7:15pm
speaker John Catalani
"The Deicke and Millbrig K-bentonites: Upper Ordovician Time Markers"

May. 18 — CVRMS Monthly Meeting
MONTHLY VIRTUAL MEETING - 7:15 pm
https://us02web.zoom.us/j/87289747880
Featuring Rock and Mineral Videos
"Top 15 Biggest Crystals"
"Denver Gem & Mineral Show Highlights 2020"
"Jonas Mine Tourmaline Discovery "
More details on Page 1

May 24 — 3 Rock Clubs Monthly Program
MONTHLY VIRTUAL PROGRAM - 7:15 pm
speaker John Catalani
"Analysis of the Mifflin Member: The most fossiliferous unit of the Platteville Formation"

Sept 18-19— CVRMS Auction
Amana RV Park and Event Center
Amana, Iowa
more details to follow

Sept. 24-26 — Geode Fest
Chaney Creek Boat Access
Illinois Highway 96 N
Hamilton, Illinois

Oct. 22-24 — MAPS 2021 Fossil Expo
Illinois State Fair Grounds
Springfield, Illinois
more details to follow

Nov. 6-7 — CVRMS Rks, Fos, & Min Show
Hawkeye Downs
Cedar Rapids, Iowa
more details to follow

Ask a Geologist

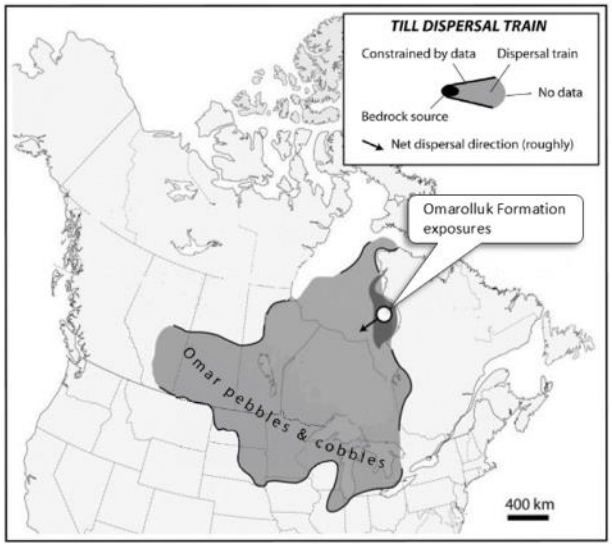
by Ray Anderson aka "Rock Doc", CVRMS Vice President

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.

Omar Who??

The topics of **Omars** came up in several recent discussions, so I thought this might provide an interesting topic for this column. Omars are glacial erratics that were sourced in the area of the Belcher Islands near the eastern shore of Lake Huron. They were eroded from the Omarolluk Formation, a Precambrian "greywacke" (an immature, fine-grained siliceous meta-sedimentary rock) that was formed from debris eroded from oceanic volcanic islands and swept into deep water by underwater landslides. As these rocks were lithified, carbonate nodules developed (relicts of cyanobacteria colonies that grew in the water that was between sand grains in the sediment), solidifying with the material around them, and then enduring low-grade metamorphism as they were crushed between two colliding continental crustal fragments and deeply buried about 1.8 billion years ago. During the intervening eons the overlying rocks were eroded away and many of the carbonate concretions dissolved by groundwater. Then, about 3 million years ago, the first of a series of continental glaciers swept southward over the rocks of the Omarolluk Formation, tearing off pieces, rounding them off in glacial rivers, and ultimately ferrying them into the north-central US. Omars were first reported by Robert Bell of the Geological Survey of Canada in the late 1800s. In 1879, he described the abundance of dark grey fine-grained quartzite [greywacke] in the country between James Bay and Lakes Superior and Huron. "*Well-rounded fragments of this rock… characterized by round spots, from the size of a pea to that of a cricket ball or larger, of a lighter color than the rest of the rock, which weather out into pits of the same form,*" wrote Bell. These "holey" greywacke erratics have been found in glacial tills from the area where they originated in Hudson Bay to northern Iowa and south into central Illinois (***see map*** published in 2011). They were deposited as one ice sheet melted then picked up and moved by subsequent ice advances. Researchers have used the occurrences of Omars to trace the paths of multiple glacial ice advances, across Manitoba and southern Canada. However, the record of earlier Pleistocene glaciation is not well preserved in south central Canada and Minnesota because their tills were eroded by and incorporated into the more recent ice sheet advances. So the Omar records, including the map shown here, usually only show the Wisconsinan (75-10,000 yrs) glacial advances (including the Des Moines lobe advances in Iowa). They are known from Illinoian (300-130,000 yrs) tills in Illinois. And, I have found them as far south as the Iowa City area in Pre-Illinoian tills (100,000-2.5 mil. yrs). So, it seems reasonable that future geoscientists will extend the range Omar distribution to the south into Missouri.

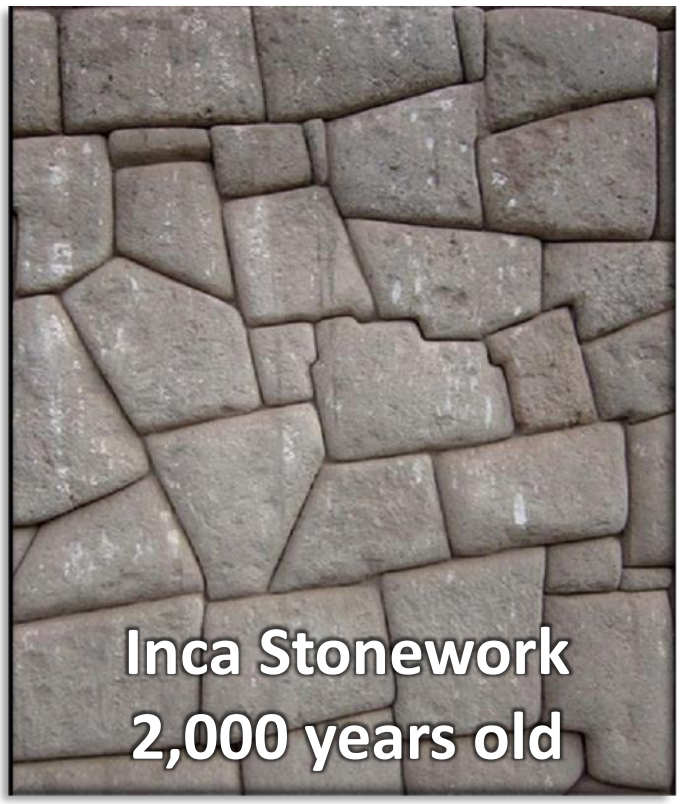
The Omarolluk Formation is named after Omarolluk, the Inuit hunter-guide and companion to Robert Flaherty, the famous filmmaker of the 1922 film, **Nanook of the North**, now considered the "*Father of Documentary Film*." According to *Macleans Magazine* (January 14, 1980) "*Omarolluk's hunting and guiding skills allowed Flaherty to be the first white man to cross the northern Ungava Peninsula.*"



map modified from Cummings and others, 2011, *Eskers as mineral exploration tools*

Is this your specimen of calcite?

Tom and Julie Whitlatch (CVRMS) recently removed the rocks display that the **CVRMS** had provided to the **Wickiup Hill Learning Center** many years ago. Most of the specimens were originally provided by Tom and Julie, however Tom said one specimen of calcite was not his. If this sample (above) is yours, you can reclaim it by contacting Tom at: whitlatcht@gmail.com,.

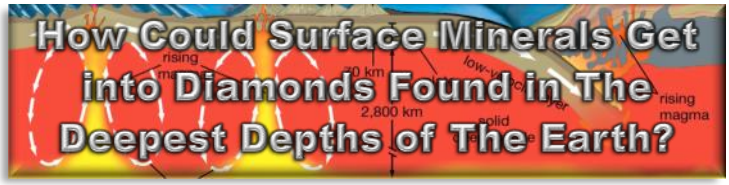


A small, flying reptile glides beneath the canopy of an ancient forest, scouring the trees for tasty bugs. She spots a cicada buzzing in the boughs of a ginkgo tree, then swoops down to snatch it up in her beak. The bug flees; the reptile follows, grasping swiftly along the branches with her sharp claws until – snatch! – she grabs the bug with her opposable thumbs. It's not your typical picture of a **pterosaur** – those iconic, winged reptiles that lived through most of the Mesozoic era (from about 252 million to 66 million years ago). But according to a new study published April 12 in the journal *Current Biology*, a newly-described Jurassic pterosaur appears to have lived its life among the trees, hunting, and climbing with the help of its two opposable thumbs – one on each of its three-fingered hands. Researchers have named the flyer ***Kunpengopterus antipollicatus*** (from the Greek word meaning "*opposite thumbed*") – but you can just call it ***Monkeydactyl***. Monkeydactyl is an interesting discovery that provides the earliest evidence of a true opposed thumb, and it is from a pterosaur, not known for having an opposed thumb. Indeed Monkeydactyl is the only known pterosaur with thumbs, proving that the reptiles were even more diverse and specialized than anyone knew. The researchers discovered the *K. antipollicatus* fossil in a slab of the middle Jurassic Tiaojishan Formation in Liaoning, northeastern China. The formation indicates a lush forest full of tall conifers and flowering ginkgo trees and has yielded more than 100 plant and animal fossils, including dozens of pterosaurs and small, bird-like dinosaurs. Monkeydactyl's remains were incredibly well-preserved and included several eggs and one near-complete skeleton, clearly showing the opposable thumb or "pollex" on each curled-up arm. The creature was relatively small, with a wingspan just shy of 3 feet, and likely lived a life among the trees, according to the researchers. Using micro-CT scans to "see through the rocks," researchers examined the complete shape and musculature of Monkeydactyl's forearms, Ma said. They concluded that the little reptile likely used its be-thumbed hands to grasp prey and tree branches — an arboreal lifestyle not commonly seen among similar pterosaurs. Monkeydactyl's unique hands reveal "unexpected and invaluable information on the evolutionary history of pterosaurs." Thumbs up to that! https://www.sciencealert.com/this-newly-described-flying-monkeydactyl-is-the-only-known-pterosaur-with-opposed-thumbs

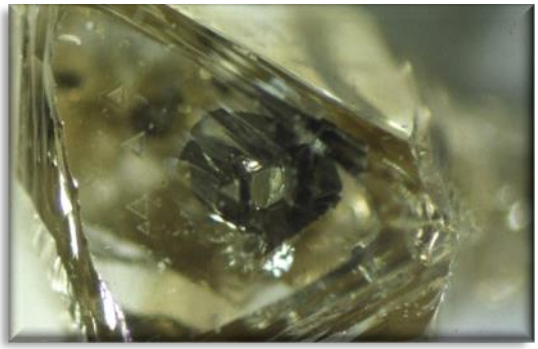
Earth Nearly Lost All Oxygen And Could Have Suffocated 2.3 Billion Years Ago

Earth's transition to permanently hosting an oxygenated atmosphere was a halting process that took 100 million years longer than previously believed, according to a new study. When Earth first formed 4.5 billion years ago, the atmosphere contained almost no oxygen. But 2.43 billion years ago, something happened: Oxygen levels started rising, then falling, accompanied by massive changes in climate, including several glaciations that may have covered the entire globe in ice. Chemical signatures locked in rocks that formed during this era had suggested that by 2.32 billion years ago, oxygen was a permanent feature of the planet's atmosphere. But a new study delving into the period after 2.32 billion years ago finds that oxygen levels were still "yo-yoing" back and forth until 2.22 billion years ago, when the planet finally reached a permanent tipping point. This new research, published in the journal *Nature* on March 29, extends the duration of what scientists call the *Great Oxidation Event* by 100 million years. It also may confirm the link between oxygenation and massive climate swings. The oxygen created in the Great Oxidation Event was made by marine cyanobacteria, a type of bacteria that produces energy via photosynthesis. The main byproduct of photosynthesis is oxygen, and early cyanobacteria eventually churned out enough oxygen to remake the face of the planet forever. The signature of this change is visible in marine sedimentary rocks. In an oxygen-free atmosphere, these rocks contain certain kinds of sulfur isotopes. When oxygen spiked, these sulfur isotopes disappear because the chemical reactions that create them didn't occur in the presence of oxygen. Researchers had noticed that the rise and fall of oxygen in the atmosphere seemed to track with three global glaciations that occurred between 2.5 billion and 2.2 billion years ago. But strangely, the fourth and final glaciation in that period hadn't been linked to swings in atmospheric oxygen levels. To investigate, researchers studied younger rocks from South Africa. These marine rocks cover the later part of the Great Oxidation Event, from the aftermath of the third glaciation up to about 2.2 billion years ago. They found that after the third glaciation event the atmosphere was oxygen-free at first, then oxygen rose and dropped again. Oxygen rose again 2.32 billion years ago, the time when scientists previously thought the rise was permanent. But in the younger rocks they again detected a drop in oxygen levels. This drop coincided with the final glaciation, the one that hadn't previously been linked to atmospheric changes. Scientists are still working out what caused all these fluctuations, but they have some ideas. One key factor is methane, a greenhouse gas that's more efficient at trapping heat than carbon dioxide. Today, methane plays a small role in global warming compared with carbon dioxide, because methane reacts with oxygen and disappears from the atmosphere within about a decade, whereas carbon dioxide sticks around for hundreds of years. But when there was little to no oxygen in the atmosphere, methane lasted a lot longer and acted as a more important greenhouse gas. So the sequence of oxygenation and climate change possibly went something like this: Cyanobacteria began producing oxygen, which reacted with the methane in the atmosphere at the time, leaving only carbon dioxide behind. This carbon dioxide wasn't abundant enough to make up for the warming effect of the lost methane, so the planet started to cool. The glaciers expanded, and the surface of the planet became icy and cold. Saving the planet from a permanent deep-freeze were subglacial volcanoes. Volcanic activity eventually boosted carbon dioxide levels high enough to warm the planet again. And while oxygen production lagged in the ice-covered oceans due to the cyanobacteria receiving less sunlight, methane from volcanoes and microorganisms again began to build up in the atmosphere, further heating things up. But volcanic carbon dioxide levels had another major effect. When carbon dioxide reacts with rainwater, it forms carbonic acid, which dissolves rocks more quickly than pH-neutral rainwater. This faster weathering of rocks brought more nutrients such as phosphorus into the oceans. More than 2 billion years ago, that nutrient influx drove the oxygen-producing marine cyanobacteria into a productive frenzy, again boosting atmospheric oxygen levels, driving down methane and starting the whole cycle again. Eventually, another geological change broke this oxygenation-glaciation cycle. The pattern seems to have ended about 2.2 billion years ago when the rock record indicates an increase in organic carbon being buried, which suggests that photosynthetic organisms were having a heyday. No one knows exactly what triggered this tipping point, but the researchers hypothesize that volcanic activity in this period provided a new influx of nutrients to the oceans, finally giving cyanobacteria everything they needed to thrive. At this point oxygen levels were high enough to permanently suppress methane's oversized influence on the climate, and carbon dioxide from volcanic activity and other sources became the dominant greenhouse gas for keeping the planet warm. There are many related rock sequences from this era around the world, including in western Africa, North America, Brazil, Russia and Ukraine. These ancient rocks need more study to reveal how the early cycles of oxygenation worked, particularly to understand how the ups and downs affected the planet's life.

https://www.sciencealert.com/scientists-say-earth-nearly-lost-all-its-oxygen-2-3-billion-years-ago

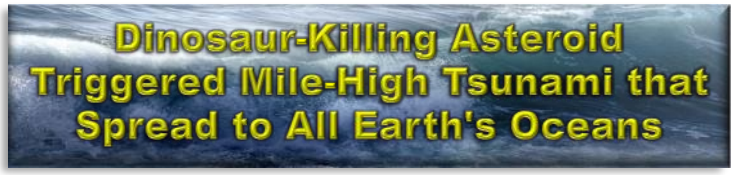


Diamonds that formed deep in the Earth's mantle contain evidence of chemical reactions that occurred on the seafloor. Probing these gems can help geoscientists understand how material is exchanged between the planet's surface and its depths. New work published in *Science Advances* confirms that **serpentinite** (a rock that forms from peridotite, the main rock type in Earth's mantle, when water penetrates cracks in the ocean floor) can carry surface water as far as 450 miles deep by plate tectonic processes. Serpentinite residing inside subducting plates may be one of the most significant, yet poorly known, geochemical pathways by which surface materials are captured and conveyed into the Earth's depths. The presence of deeply-subducted serpentinites was previously suspected (due to earlier research about the origin of blue diamonds and to the chemical composition of erupted mantle material that makes up mid-ocean ridges, seamounts, and ocean islands). But evidence demonstrating this pathway had not been fully confirmed until now. The research team found physical evidence to confirm this suspicion by studying a type of large diamonds that originate deep inside the planet. "Some of the most famous diamonds in the world fall into this special category of relatively large and pure gem diamonds that form between 220 and 470 miles down, at least as deep as the transition zone between the upper and lower mantle. Sometimes they contain inclusions of tiny minerals trapped during diamond crystallization that provide a glimpse into what is happening at these extreme depths. In this instance, the researchers were able to analyze the isotopic composition of iron in the metallic inclusions. Like other elements, iron can have different numbers of neutrons in its nucleus, which gives rise to iron atoms of slightly different mass, or different "*isotopes*" of iron. Measuring the ratios of "*heavy*" and "*light*" iron isotopes gives scientists a sort of fingerprint of the iron. The diamond inclusions studied by the team had a higher ratio of heavy to light iron isotopes than typically found in most mantle minerals. This indicates that they probably didn't originate from deep-Earth geochemical processes. Instead, it points to magnetite and other iron-rich minerals formed when oceanic plate peridotite transformed to serpentinite on the seafloor. This hydrated rock was eventually subducted hundreds of miles down into the mantle transition zone, where these particular diamonds crystallized.



Diamonds that formed hundreds of kilometers deep below Earth's surface contain traces of chemical reactions that took place on the bottom of the ocean

http://www.geologyin.com/2021/04/how-could-surface-minerals-get-in.html?



When the dinosaur-killing asteroid collided with Earth more than 65 million years ago, it blasted a nearly mile-high tsunami through the Gulf of Mexico that caused chaos throughout the world's oceans, new research finds. The 9-mile-across space rock, known as the Chicxulub asteroid, caused so much destruction, it's no wonder the asteroid ended the dinosaur age, leading to the so-called Cretaceous-Paleogene (K-Pg) extinction. Research first reported by *EOS*, was the first to globally model the tsunami, from impact to the end of wave propagation. The researchers knew that the asteroid hit shallow water in the Gulf of Mexico. But to correctly model its huge impact, they needed a model that could compute the large scale deformation of the Earth's crust as the crater formed, as well as the chaotic waves from the splash of the water and ejecta blown out of the developing crater. The group ran two models detailing what happened in the 10 minutes following the impact, when the crater was nearly a mile deep and the water had not yet surged back into the crater. According to the first model, sea water would rush into the crater and then back out again forming the *"collapse wave."* In the second model, the team studied how the tsunami propagated through oceans around the world. They did this by taking the results from the first model and the impact's waves with respect to resting sea level and water speeds. The results show the effects of the tsunami were felt all around the world, through every ocean basin. In the Gulf of Mexico, water moved as fast as 89 mph. Within the first 24 hours, the effects of the tsunami's impact spread out of the Gulf of Mexico and into the Atlantic, as well as through the Central American seaway (which formerly connected the Gulf to the Pacific). After the initial nearly mile-high wave, other huge waves rocked the world's oceans. In the South Pacific and North Atlantic, waves reached a whopping maximum height of 46 feet. In the North Pacific, they reached 13 feet. Meanwhile, the Gulf of Mexico saw waves as high as 65 feet in some spots and 328 feet in others. To put that in perspective, the largest modern wave ever recorded in the Southern Hemisphere was a "*measly*" 78 feet tall, which struck near New Zealand in May 2018. It can be hard to imagine such a cataclysmic tsunami, so the researchers compared it to the 2004 Indian Ocean tsunami that killed at least 225,000 people. The two tsunamis were as different as night and day, they found. Over the first 7 hours of both tsunamis, the Chicxulub tsunami was 2,500 to 29,000 times greater in energy than the 2004 Indian Ocean tsunami. The asteroid also triggered shock waves and sent a vast amount of hot rock and dust into the atmosphere, which rubbed together with so much friction that they started forest fires and cooked animals alive. These particles also hovered in the atmosphere and blocked the sun's rays for years, killing plants and the animals that ate them. https://www.livescience.com/64426-dinosaur-killing-asteroid-caused-giant-tsunami.html

A newly discovered species of dinosaur likely ruled ancient South America in the dinosaurs' *twilight period,* using its massive claws, powerful bite, and sharp teeth to earn its name "the one who causes fear." Paleontologists discovered the superbly-preserved skull of the new species in a famous fossil site called the Baja de La Carpa Formation in Northern Patagonia, Argentina. It gives insights into the biodiversity of the late Cretaceous period, about 85 million years ago, the last and longest period of dinosaurs, according to a new study published in the *Journal of Vertebrate Paleontology.* The new dinosaur has been dubbed ***Llukalkan aliocranianus*;** "**llukalkan**" meaning "*the one who causes fear*" in the Mapuche language indigenous to the region, and "**aliocranianus**" meaning "*different skull*" in Latin. The species reached about 16 feet in length and belonged to a diverse group of dinosaurs called abelisaurids. Quite unusually, the remains of the *L. aliocranianus* were discovered less than half a mile from the remains of another similarly sized, meat-eating dinosaur from the same time period, the *Viavenator exxoni*. This close proximity suggests a complex and unusual structuring of ecosystems between the top predators, where the two species likely went after the same prey—and maybe even each other. "*It is likely that these dinosaurs shared the same ecological niche and fed on the same type of prey, so they would have competed with each other and, why not, even eaten with each other,"* said study co-author Ariel Méndez in an email. "*This would not be very different from what is observed today, where predators of different species but of the same family coexist in the same ecosystem, such as lions, leopards and cheetahs.*" Though paleontologists dug up the bones in present-day Argentina, when the dinosaurs were around to roam the land, it was part of Gondwana, the ancient southern subcontinent that formed when Pangea split, and included much of today's southern hemisphere like Australia, Antarctica, and the Indian subcontinent. The abelisaurids were likely the top predator of Gondwana in the era, sitting comfortably atop the food chain just as the well-known Tyrannosaurus Rexes did in the northern continent. "*Certainly, finding yet another species of abelisaurids in that late Cretaceous time period we can say, 'Ok, they really were the dominant taxa,'*" says Peter Makovicky, a paleontologist and professor at the University of Minnesota who was unaffiliated with the study. "[This] *in turn tells a bit about biogeography* [on] *Gondwana, the southern continent. You look at the northern continent, it's the tyrannosaurs that are doing that, stepping in and showing out in the top predator niche."* A unique feature of *L. aliocranianus* compared to other members of its group is an air-filled pocket next to the ear entering the skull that would have given the species superior hearing abilities, comparable to the modern-day crocodiles, who have excellent auditory range and are just as chatty as birds. This confirms that *L. aliocranianus* was a predator rather than a scavenger, according to study co-author Rubén Juárez, since it used the adaptation to listen for living prey. Paleotontoglists want to focus future research on gathering more fossils to better understand these complex ecosystems, investigate the difference between male and female abelisaurids, and learn more about how quickly the species matured into full-sized predators. "*Understanding how long they spent at different sizes throughout their growth and development could also help us understand how you can pack multiple species into one ecosystem,"* Makovicky says. "*That's one thing we really don't have a grasp on yet*." https://www.popsci.com/story/science/new-dinosaur-species-llukalkan/

The T. rex 'dynasty' reigned for more than 125,000 generations

Tyrannosaurus rex was the apex predator of the **Cretaceous period, around 66 to 68 million years ago**. But scientists had never calculated the total number of *T. rexes* there ever were, until now. A new study estimates that about 2.5 billion of these tyrannical dinosaurs roamed the Earth over all of history, although only about 20,000 *Tyrannosaurus rexes* were alive at any given time. But these fearsome Goliaths occupied North America for an incredibly long span, between 1.2 and 3.6 million years. That means that approximately **127,000 generations** of *T. rexes* passed through this Earthly plane, leading scientists to that 2.5 billion estimation. "*That's a lot of jaws,"* said lead author Charles Marshall. Marshall is the director of the Museum of Paleontology at the University of California. "*That's a lot of teeth. That's a lot of claws*." This number is the first of its kind, but it's in no

way a definitive answer. Rather, 2.5 billion is an estimate with a wide margin of error. The total population could have been anywhere from 140 million to 42 billion. All this uncertainty stems from the fact that scientists are operating with a lot of unknowns. To reach their *T. rex* count, scientists first had to compile the existing research on the king of tyrant lizards. The best estimates suggest each *T. rex* lived about 28 years. With sexual maturity arriving at roughly 15.5 years, the authors calculated a generation time of about 19 years. Ecologists also know that the bigger an animal is, the smaller its population density tends to be. Using existing formulas to model that relationship—and the fact that a fully grown *T. rex* likely weighed about 15,000 pounds—the paper authors concluded that there was roughly one *T. rex* for every 42 square miles. That translates to about 3,800 *T. rexes* in an area the size of California, or just two individuals in a place like Washington, D.C, the study says. If the 2.5 billion total population statistic is accurate, then only one out of every 80 million *Tyrannosaurus rexes* made it into the fossil record. If the total were 2.5 *million*, instead of billion, Marshall said, we might never have discovered *T. rex* at all. https://www.popsci.com/story/animals/how-many-t-rex-ever-lived/

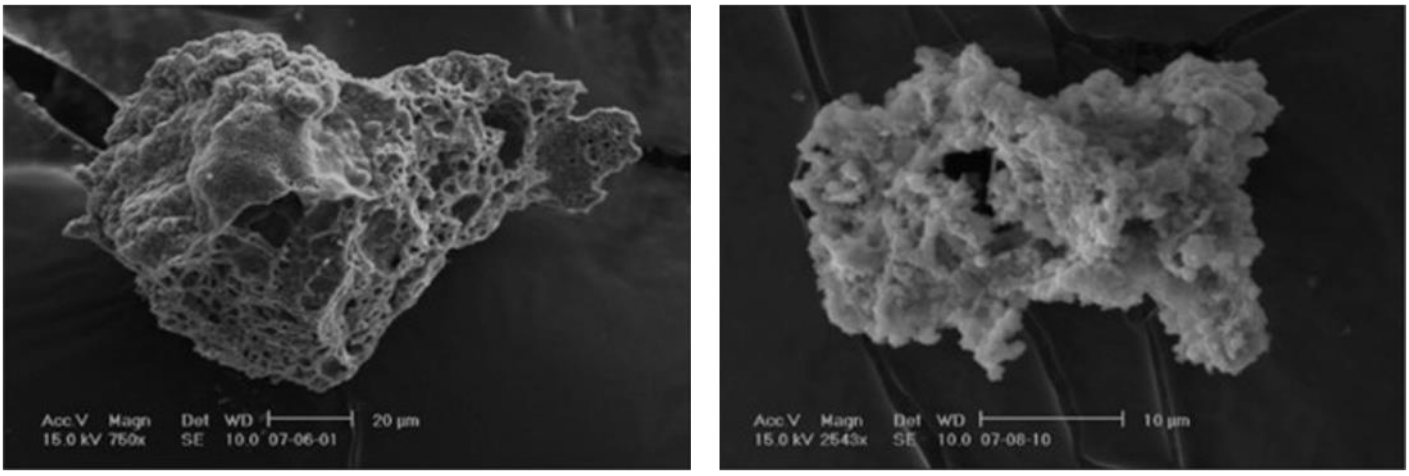
The Colorful Charm of Ametrine

A bicolor variety of quartz that is purple amethyst on one side and orange citrine on the other, **ametrine** occurs naturally only at the Anahí Mine in the Sandoval Province of eastern Bolivia. Ametrine is composed of silicon dioxide (SiO_2) and it is a tectosilicate, which means it has a silicate framework linked together through shared oxygen atoms. Ametrine is a mix of both Ametrine and Citrine producing a mixture of purple and yellow/orange crystal colors. It is produced under such exceptional and improbable conditions, requiring a perfect combination of iron presence and differing temperatures within a very confined area that it has occurred only once that we know of, in only one known place in the world: Santa Cruz, Bolivia. The Anahí mine is the one and only bolivianite mine known to exist anywhere on Earth. The mineralization is found in the northern part of a hill formed by limestones and dolomites, and has been generated by silicification of the limestones belonging to the Murcielago Group, deposited in the Precambrian, between 500 and 900 million years ago. Ametrine crystals are found in hydrothermal breccias. The Anahi ametrine crystals range in size from 10 to 30 cm in length and 4 to 12 cm in diameter. When sliced and polished, the interior of the crystals show the typical color zoning. The amethyst and citrine zones run from top to bottom, parallel to the crystal's c-axis. Ametrine in the low price segment may stem from synthetic material. Green-yellow or golden-blue ametrine does not exist naturally. This gem only exists in Bolivia, it comes from the Ricón del Tigre area, from the Anahí mine. http://www.geologyin.com/2021/04/the-colorful-charm-of-ametrine.html?

Rough Ametrine

Faceted Bolivian Ametrine Ametrine

We've known for a while that Earth is under a constant rain of space dust, and that it's copious. Given its microscopic size, however, it's been very hard to obtain an accurate estimate of the quantity. Such micrometeorites are no bigger than a fraction of a millimeter, shed like space dander from passing comets and asteroids. After two decades of collecting the stuff in Antarctica, an international team of scientists now has a number: around 5,200 tons of micrometeorites smaller than 700 micrometers (0.7 millimeters), every year. This, they said, makes micrometeorites the biggest source of extraterrestrial material delivered to Earth's surface. It's actually quite an achievement. Earth's atmosphere is filled with dust, of all kinds. A study last year found that around 17 million metric tons of coarse dust is blowing around in the atmosphere at any given time. To minimize this 'background' dust, the team turned to Antarctica at the Concordia station at Dome C. Terrestrial dust is pretty much absent there, and the snow accumulation rate is low, which means the snow that is already there can be melted to obtain the rate of



Micrometeorites from Antarctica. (Rojas et al., EPSL, 2021)

micrometeorite fall in the region. In six expeditions over the course of 20 years, the researchers did just that. They identified a total of 1,280 unmelted micrometeorites and 808 cosmic spherules (melted space rock) below 350 micrograms in mass, which allowed them to calculate the rate at which these particles rain down on the surface. According to their calculations, extrapolated across the globe and assuming that the rain is evenly distributed, roughly 1,600 tons of micrometeorites and 3,600 tons of cosmic spherules reach the surface every year. That's a total of 5,200 tons annually. The next part of the research was an analysis of the dust to determine its origin, based on the density of the grains. Lower density and higher porosity suggest a cometary origin, and higher density and lower porosity suggest a meteoritic origin. From this, the team extrapolated that roughly 80 percent of the cosmic dust that reaches Earth's surface is ejected from comets as they zoom by on their orbital journeys - a number consistent with previous estimates of the cometary input to space dust on Earth. The team's models, however, also showed that the total mass of cosmic dust input before atmospheric entry is around 15,000 tons. The reason for this discrepancy isn't clear, but there are a couple of major options. One is that a significant proportion of the dust evades our ability to detect it. Another is that some of the dust is removed prior to atmospheric entry. A third could be that there is significantly less dust in the space around Earth than we think there is. Figuring out which of these it is, the researchers said, could help us better constrain the role of cosmic dust in delivering water molecules and carbon to Earth, in the early days of the Solar System - in turn providing pieces of the puzzle that is the emergence of life itself.
https://www.sciencealert.com/5-200-tons-of-micrometeorites-are-raining-down-on-earth-s-surface-every-year

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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. During the COVID emergency meetings will be via ZOOM. When the emergency is over, meetings will return to 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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