

Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS

NOVEMBER 2023

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

Next CVRMS Meeting

Mon. November 13

7:15 pm

Hiawatha Community Center

101 Emmons St., Hiawatha - 7:15 pm

featured presentation

“Devonian Fossils From Independence Iowa”

by Jim Preslicka

Black Hawk Gem & Mineral Society

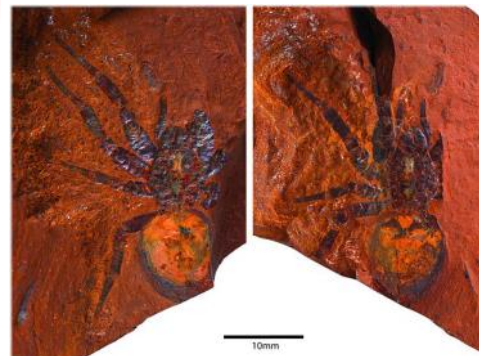


A limestone slab of the “Brooks Hardground Bed” displaying 4 different kinds of cephalopods

The Brooks Quarry in Independence, Iowa, has yielded an unusually abundant and diverse assemblage of Middle Devonian fossils. First discovered by members of the Black Hawk Gem & Mineral Society in 2007, the Society has partnered with the University of Iowa Geoscience Repository to collect and catalog as many of the unusual specimens as possible before the site became inaccessible in 2017.

Fossil of a 'Giant' Trapdoor Spider Found in Australia

Even millions of years ago, Australia was a paradise for spiders. In the arid heart of the continent, scientists have found an exquisitely preserved fossil of a fascinatingly large spider that roamed and hunted in what was once a lush rainforest. It's not just any fossilized spider, either. It's only the fourth spider fossil ever to be found in Australia, and the first, worldwide, of a spider belonging to the large brush-footed trapdoor spider family, Barychelidae. The new species, which lived in the Miocene 11 to 16 million years ago, has been officially named *Megamonodontium mccluskyi*. "Only four spider fossils have ever been found throughout the whole continent, which has made it difficult for scientists to understand their evolutionary history. That is why this discovery is so significant, it reveals new information about the extinction of spiders and fills a gap in our understanding of the past," says palaeontologist Matthew McCurry of the University of New South Wales and the Australian Museum. "The closest living relative of this fossil now lives in wet forests in Singapore through to Papua New Guinea. This suggests that the group once occupied similar environments in mainland Australia but have subsequently gone extinct as Australia became more arid." The spider was discovered among a rich assemblage of Miocene fossils, which were found in a grassland region of NSW known as McGraths Flat. The assemblage is so exceptional that it has been classified as a Lagerstätte – a sedimentary fossil bed that sometimes preserves soft tissues. In some fossils from McGraths Flat, even subcellular structures can be seen. <https://www.sciencealert.com/fossil-of-a-giant-trapdoor-spider-found-in-australia-and-just-look-at-it>



The two parts of the fossil. *Megamonodontium mccluskyi* was preserved between the rocks like the filling of a spider sandwich

Wales and the Australian Museum. "The closest living relative of this fossil now lives in wet forests in Singapore through to Papua New Guinea. This suggests that the group once occupied similar environments in mainland Australia but have subsequently gone extinct as Australia became more arid." The spider was discovered among a rich assemblage of Miocene fossils, which were found in a grassland region of NSW known as McGraths Flat. The assemblage is so exceptional that it has been classified as a Lagerstätte – a sedimentary fossil bed that sometimes preserves soft tissues. In some fossils from McGraths Flat, even subcellular structures can be seen. <https://www.sciencealert.com/fossil-of-a-giant-trapdoor-spider-found-in-australia-and-just-look-at-it>

CVRMS Meeting October 17 – Minutes –

Tonight's meeting was held at the Grant Wood Area Education Agency's Van Allan Science Teaching Center at 1120 33rd Ave SW, Cedar Rapids in conjunction with a tour of the facility.

MEETING CALLED TO ORDER: at 7:15p.m. by Marv Houg

MINUTES OF LAST MEETING: no changes or additions; motion for approval by Bill, second by Lisa, minutes approved

TREASURE'S REPORT: not discussed at this meeting

2024 ROCK SHOW: Show venue contract signed and deposit made. **14 of 28** dealers have registered and paid. **Several dealers at Denver Show** expressed interest in dealing at our show.

NEW BUSINESS: name badges are now available. Contact Dale if interested. Next meeting on November 13 is our official "Annual Meeting" so Board members will be elected. If you are interested in joining the board you can put your name in nomination at the meeting.

MEETING ADJOURNED: Lisa moved that the meeting be adjourned, Matt seconded, Meeting adjourned at 7:30.

Respectfully submitted,
Ray Anderson, Acting Secretary



CVRMS Board Meeting Oct. 24 – Minutes –

MEETING CALLED TO ORDER by Marv at 7:12 pm. Board members present: Jay Vavra, Marv Houg, Dale Stout, Ray Anderson, Sharon Sonneleitner, Matt Burns, Kim Kieckner, Dell James

SECRETARIES MINUTES from previous meeting reviewed as published. Motion to accept by Jay, seconded by Matt. Minutes approved.

TREASURER'S REPORT: Checking account \$17,687.26. The final report on auction profits \$10,200.08. Good job everyone. Motion to approve by Ray. Seconded by Matt. Treasurer's report approved.

TIM MURPHY our Rock Show flint knapper died this week. Condolences to his family.

2024 ROCK SHOW: We have decided upon Coral as our theme. Now we need a catchy name. Ray suggested "Coral, an Iowa Bedrock Fossil." Board decided to wait until nearer to show to decide. **Sharon reported** that we have 16 contracts returned out of 29. With the flint knappers spot open we need to identify a new person for that slot.

OLD BUSINESS: Kim is working on regulations for Facebook page. 501c3 no report.

SHOW TABLE COVERS: Sharon says she has purchased them.

ADVERTISING FOR SHOW: Tid Bits, Gazette, Collectors Journal, were discussed. Get all the free advertising we can.

BILL'S BUS TRIP 2023: from all reports it was a good trip. Where should we go next year?

NAME TAGS: Dale will put notice on email about how to order new club name tags; cost \$5.00 (pin), \$5.50 (magnet).

FLUORESCENT DISPLAY: Ray still has club's fluorescent rocks and lights in his garage.

CORNELL COLLEGE IS CLEARING MAP ROOM: The club has collected 7.5' maps of Iowa and surrounding states. Cornell offered to host an open house for CVRMS members to pick out any maps they wish. Ray will contact Cornell to set up a date and time, then Dale will send out an email regarding the maps' availability and open house date and time.

NOMINATING COMMITTEE: Sharon, Matt, Ray, and Jay are this year's nominating committee. Jay is the only Director up for re-election, and all the other officers are up as well. All officers except the 2024 and 2025 Directors will stand for reelection at the next meeting. Marv will ask for nominations for others who wish to run from the floor.

Memorial of \$200 will be donated to Wickiup Hill Learning Center in memory of CVRMS members who have passed. Dale will handle the donation.

Motion to adjourn by Ray, seconded by Jay. Meeting adjourned at 9:10 p.m.

Respectfully submitted,
Dell James, Secretary



CVRMS

ELECTION OF CVRMS 2024 OFFICERS AT NOVEMBER ANNUAL MEETING

The November 13 CVRMS meeting is our official **Annual Meeting for 2023**, which means that it is time for members to elect club officers. The Nominations Committee suggest electing Jay Vavra to another term as **Director**, The Committee also suggested that all other incumbent officers be reelected. The Nominations committee suggests officers for 2024-2025 include:

President *	Marv Houg
Vice President*	Ray Anderson
Treasurer *	Dale Stout
Secretary *	Dell James
Editor *	Ray Anderson
Liaison *	Kim Kleckner
Director 24	Bill Desmarais
Director 25	Matt Burns
Director 26 *	Jay Vavra
Webmaster *	Sharon Sonnleitner

*** indicate officers to be elected this year**

Anyone interested in serving in one of these offices may enter their name at the November 13 meeting, and club members present will vote to elect club officers for 2024-25.



Spotlight Gemstones: Citrine & Topaz

November's Birth Stones



citrine



topaz

Citrine is a member of the large quartz family (SiO₄), which, with its multitude of colors and structures, offers gemstone lovers almost everything their hearts desire in terms of adornment and decoration, from absolutely clear rock crystal to black onyx. The name citrine is derived from its color, the yellow of the lemon (although the most sought-after stones are a clear, radiant yellowish to brownish red). Like all crystal quartzes, the citrine has a hardness of 7 on the Mohs scale and is relatively resistant to scratches. With no cleavage, it is also resistant to fracturing. Although citrine's refractive index is relatively low, the yellow stones have a mellow, warm tone that seems to have captured the last glow of autumn. Natural citrines are rare, and most good quality stones are found in Minas Gerais, Brazil, Madagascar, and Hasawarka in the Ural mountains of Russia. Most commercial citrines are heat-treated amethyst or smoky quartz.

Topaz (Al₂SiO₄(F,OH)₂) is one of the few gem minerals that contains fluorine. The gem can be found in many varieties; colorless, pink, and shades of yellow to sherry-brown are most common, but blue and green-blue stones can resemble aquamarine, and natural red and pink colors are extremely rare. Sherry colored crystals can be heat-treated before cutting, producing pink topaz, a process called "pinking." Its hardness of 8 makes it very resistant to scratching. **Orange topaz**, also known as **precious topaz**, is the traditional November birthstone (and the state gemstone of Utah), while blue topaz is the birthstone for December. Topaz is commonly associated with silicic igneous rocks (granite and rhyolite.) It typically crystallizes in granitic pegmatites or in vapor cavities in rhyolite lava flows including those at Topaz Mountain in western Utah. The American Golden Topaz is the largest piece of cut yellow topaz in the world. It is sized at 22,892 carats (10 lbs) and has 172-facets (flat-faced cuts applied to gems, in order to help them reflect light.) The gem was cut from a piece of yellow topaz that was 26 lbs in size, discovered in the Minas Gerais, Brazil. It was donated to the Smithsonian Institute, and put on display in the National Museum of Natural History in Washington, D.C.

What in the World?



What in the World is this layer of lens-shaped rocks and how does it form??

October's Photo



Last month's *What in the World* photo is the world's longest petrified tree trunk log, found in Tak, a northern province of Thailand. The gigantic fossilized log, petrified about 120,000 years ago, was measured to be about 230 feet meaning it would have stood as tall as a 20-story building.

ROCK CALENDAR CVRMS EVENTS OF INTEREST

2023

Dec. 7 (Thu)— CVRMS Christmas Party

Hiawatha Community Center 7:15 pm
Details to be announced

2024

Jan. 16 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Program to be announced

Feb. 20 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Program to be announced

Mar. 19 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Program to be announced

Mar. 23-24 — CVRMS Rock Show

Hawkeye Downs, Cedar Rapids
Show Theme: FOSSIL CORALS

Apr. 16 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Program to be announced

May. 21 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Program to be announced

June. 18 — CVRMS Monthly Picnic

Elis Park, Cedar Rapids 6:30 pm
Show & Tell, Rock Polishing

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.

The suggestion that a meteorite or comet impact on Earth about 13 thousand years ago triggered the Younger Dryas, a period of sudden global cooling that corresponds to the death of the large Pleistocene mammals, has been circulating in the geological world for many years. This theory is based on numerous lines of evidence; however, no crater of the appropriate age has been identified. Following is one of the most recent papers to address this theory.

Comet Impact Sparked a Massive Change on Earth 13,000 Years Ago

By REBECCA DYER
October 2023

Imagine being a hunter-gatherer nearly 13 thousand years ago. You're minding your own business, gathering berries and hunting wild animals, when suddenly a giant ball of fire appears in the sky. It explodes with a deafening roar, sending shockwaves towards the ground and flattening trees and homes. New research suggests this is how the first seeds of agriculture were planted in Syria, a necessary adaptation to improve the community's chances of survival. After a comet's fragments slammed into Earth's atmosphere, the climate changed dramatically, with the plants and animals they relied on disappearing. A global team presented their case after analyzing sediment layers from Neolithic site **Abu Hureyra**, which was excavated in the 1970s before being submerged under Lake Assad by the construction of the Euphrates dam. Abu Hureyra is well-known as the site with the earliest evidence of a shift from hunter-gathering to farming. The group contributed four peer-reviewed papers to the study of the **Younger Dryas impact hypothesis**. This substantially disputed hypothesis proposes that a cosmic impact caused the Younger Dryas (YD) period – a rather sudden, severe, and lengthy interruption to the warming of Earth's climate. *"We present substantial new quantitative evidence and interpretations supporting the hypothesis that comet fragments triggered near-global shifts in climate ~12,800 years ago, and one airburst destroyed the Abu Hureyra village,"* the authors write. The sediment layers revealed many factors, including types of plants collected in warmer, humid days before the YD climate change and in the colder, drier days after. *"These data include changes in building architecture, diet, the early stages of persistent cultivation of domestic-type grains and legumes,"* the team adds, *"and the initial penning of livestock, marking the beginning of sustained agriculture and animal domestication."* Archaeologist Andrew Moore from the Rochester Institute of Technology and team's comprehensive analysis also identified shock-fractured quartz grains, which are consistent with impact, and evidence of a massive firestorm. *"Shocked quartz is well known and is probably the most robust proxy for a cosmic impact,"* said Earth scientist James Kennett of the University of California Santa Barbara. *"In the papers, we characterize what the morphologies are of these shock fractures in these lower-pressure events."* **Their initial study** confirmed low-shock fractures in the quartz rocks at Meteor Crater, created by the Barringer meteorite impact. Importantly, similar fractures occur in quartz exposed to nuclear explosions in the air, even if no impact crater forms. This has big implications, suggesting an asteroid or comet breaking apart close enough to Earth's surface could also cause these fractures via shockwaves across the world. *"For the first time,"* added Kennett, *"we propose that shock metamorphism in quartz grains exposed to an atomic detonation is essentially the same as during a low-altitude, lower-pressure cosmic airburst."* **The second study** is the first to identify shock-fractured quartz in the Abu Hureyra sediment layer from the boundary (the beginning) of the YD period. Detailed analysis showed some quartz grains in this layer are similar to those found in nuclear explosions and Meteor Crater. *"We wanted to compare it with what we have in the shock-fractured quartz in the YD boundary,"* Kennett says, *"to see if there was any comparison or similarities between what we see at the Trinity atomic test site and other atomic bomb explosions."* Most of these quartz grains have been exposed to temperatures at least 3,115 °F, which is the melting point of quartz, and most likely even higher than its boiling point of 4000 °F. Extremely high temperatures and pressures lead to fracturing and melting of quartz grains and introduction of molten silica into fractures. When this non-crystalline silica is found in fractured rocks, it's a clear sign of an impact, as opposed to slow tectonic movement. **The third study** found tiny diamonds, special crystals, and small balls made of silica and iron in the YD boundary layer sediment. Some of these substances could only have formed under higher temperature or pressure conditions than any human technology could produce at the time. One substance, tiny spherules called meltglass, makes up about 1.6 percent of the sediment and was discovered on tools, bones, and clay walls, suggesting the impact really disrupted life in the village. Pieces of meltglass even have detailed imprints of plants. Notably, the team didn't find similar material in thousands of years of human-deposited sediment above the YD boundary layer. **The final study** presents new evidence of a direct connection between cosmic impacts, environmental shifts, and major changes in human societies. *"Our investigation reveals slow changes in site utilization by humans for centuries up until and just after the YD onset,"* the authors write, *"punctuated by a significant, abrupt change immediately at the YD onset."* The team propose the changes came from a disintegrating large comet about 100 kilometers wide. This event likely set off major climate change in the northern hemisphere. *"There was a change from more humid conditions that were forested and with diverse sources of food for hunter-gatherers, to drier, cooler conditions when they could no longer subsist only as hunter-gatherers,"* said Kennett. *"The villagers started to cultivate barley, wheat and legumes. This is what the evidence clearly shows."* There's no doubt that something completely transformed the way people in Abu Hureyra lived. *"This change was a vital initial step in transitioning from exclusive hunting-gathering to sustained agriculture and herding,"* the authors concluded.

<https://www.sciencealert.com/comet-impact-sparked-a-massive-change-on-earth-13000-years-ago>

First Look at Pristine Asteroid Dust Reveals Abundance of Water And Carbon

A sample collected from the 4.5-billion-year-old **asteroid Benu** contains abundant water and carbon, NASA revealed, offering more evidence for the theory that life on Earth was seeded from outer space. The discovery follows a seven-year-round-trip to the distant rock as part of the **OSIRIS-REx** mission, which **dropped off its precious payload** in the Utah desert last month for painstaking scientific analysis. *"This is the biggest carbon-rich asteroid sample ever returned to Earth,"* NASA administrator Bill Nelson said. Carbon accounted for almost five percent of the sample's total weight, and was present in both organic and mineral form, while the water was locked inside the crystal structure of clay minerals, he said. Scientists believe the reason Earth has oceans, lakes and rivers is because it was hit with water-carrying asteroids 4 to 4.5 billion years ago, making it a habitable planet. All life on Earth meanwhile is based on carbon, which forms bonds with other elements to produce proteins and enzymes as well as the building blocks of genetic code, DNA and RNA. The findings were made through a preliminary analysis involving scanning electron microscopy, X-ray computed tomography and more. *"This stuff is an astrobiologist's dream,"* said scientist Daniel Glavin, adding there was much more work to be done and the sample would be shared with labs around the world for further study. OSIRIS-REx wasn't the first probe to rendezvous with an asteroid and bring back samples for study, Japan succeeded in the feat twice, returning celestial dust in 2010 and 2020. But the amount collected, an estimated 250 grams, dwarfs that returned by the Japanese missions (with Hayabusa2 managing only 5.4 grams). Named after an ancient Egyptian deity, Benu is a *"primordial artifact preserved in the vacuum of space,"* according to NASA, making it an attractive target for study. Its orbit, which intersects that of our planet, also made the journey easier than going to the Asteroid Belt, which lies between Mars and Jupiter. In addition to scientific insights, better understanding of Benu's composition could prove useful if humanity ever needs to steer it away. While there is no risk of it hitting Earth through the mid 2100s, the chances rise to around 1 in 1,750 between then and the year 2300, NASA says. Data gathered by the OSIRIS-REx spacecraft revealed the particles making up Benu's exterior were so loosely packed that if a person were to step onto the surface, they might sink in, much like a pit of plastic balls in children's play areas. Researchers have so far focused their efforts not on the main sample itself but on "bonus particles," that lay on top of the sample collecting mechanism. An inspection of the remainder of the sample will follow later. NASA says it will preserve at least 70 percent of the sample at Houston for future study, a practice first started in the Apollo era with Moon rocks. *"The samples are then available for new questions, new techniques, new instrumentation far into the future,"* said Eileen Stansbery, division chief of astromaterials research at the Johnson Space Center. Additional pieces will be sent for public display at the Smithsonian Institution, Space Center Houston, and the University of Arizona.

<https://www.sciencealert.com/first-look-at-pristine-asteroid-dust-reveals-abundance-of-water-and-carbon>

75 Million-Year-Old 'Forgotten Lord of the Oasis' Titanosaur Fossils from Egypt Fill a 'Black Hole' in Dinosaur History

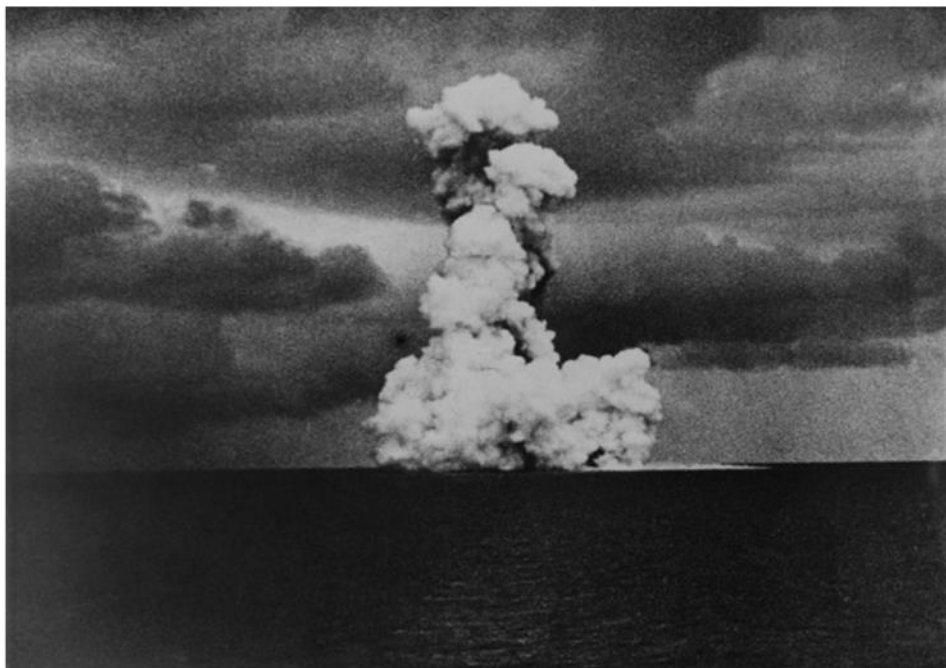
A strange species of **tiny titanosaur** has finally been given a name, nearly 50 years after its bones were unearthed from the Egyptian desert. The newly described species, called ***Igai semkhu***, lived **75 million years ago** in what is now the Kharga Oasis. The name *Igai semkhu* translates to *"Forgotten Lord of the Oasis"* in ancient Egyptian and can be represented in hieroglyphics. It's named after a deity the Ancient Egyptians would have worshipped in the oasis it came from. The relatively diminutive titanosaur, which was a "mere" 33 to 50 feet long, was described July 2023 in the *Journal of Vertebrate Paleontology*.



A sketch of *Igai semkhu*, a 75-million-year-old titanosaur unearthed in an oasis in Egypt

It is helping fill in this black hole in our understanding of the final 30 million years of the Age of Dinosaurs on one of the largest landmasses on Earth. German researchers first chipped *Igai semkhu* from rocks in the Western Desert in Egypt in 1977, but the specimen was forgotten for decades until researchers took a second look. It turned out *I. semkhu* was a previously unknown genus and species of titanosaur, which is a subgroup of sauropods. Sauropods were plant-eating dinosaurs with small heads, long necks and big, elephant-like bodies. But 75 million years ago, when *Igai semkhu* was likely to be alive, most sauropods were already extinct, leaving titanosaurs as the only existing sauropod lineage in the Cretaceous era (145 million to 66 million years ago). Despite their name, titanosaurs weren't all titanic. Titanosaurs range from some of the smallest sauropods ever found, about the size and weight of a cow, all the way up to the size of a humpback whale. They were the largest land animals to have ever existed. *Igai semkhu* sits somewhere in between these extremes. The researchers estimated *I. semkhu*'s size from a pair of leg bones, the tibia and fibula. The upper estimate, about the length of a school bus, would place it slightly below average in size. Because all that remains of *I. semkhu* is a few leg bones and some vertebrae, it is impossible to know exactly what it looked like, Lamanna said. But despite the scant fossils available, *I. semkhu* is one of the most complete dinosaur fossils ever unearthed in Africa, where known dinosaur fossils are relatively rare, in part because paleontologists haven't been digging in Africa for as long as they have in other places. In addition, while the continent harbors many Cretaceous-era rocks, very few are easily accessible. Many potential fossil sites are either covered by thick vegetation or deep desert sands. This rarity makes the newly described titanosaur important. *Igai* is, although still fragmentary, complete relative to the rest of the record. <https://www.livescience.com/animals/dinosaurs/75-million-year-old-forgotten-lord-of-the-oasis-titanosaur-fossils-from-egypt-fill-a-black-hole-in-dinosaur-history>

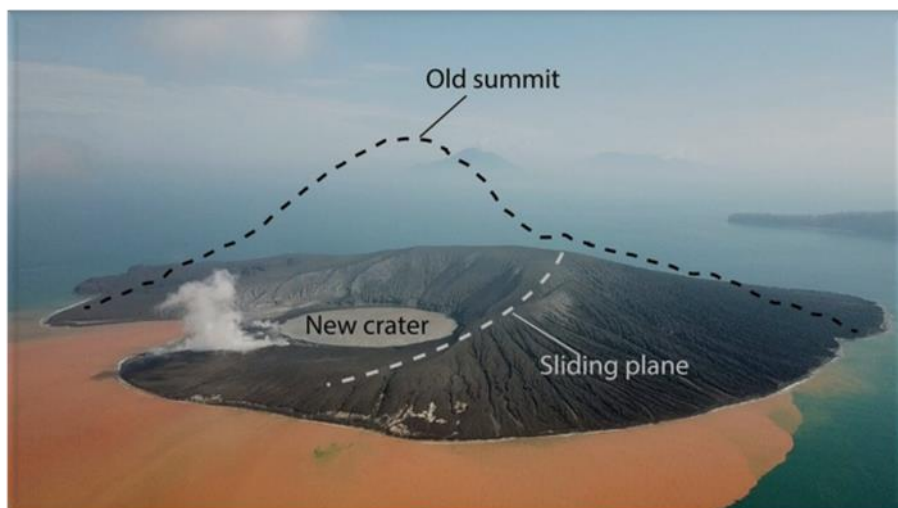
What if the 1883 Mt Krakatoa Eruption Happened Today?



Krakatoa is a volcano in Indonesia, between Java and Sumatra. It used to be a big island with three peaks, but in 1883 it went **kaboom** and destroyed most of itself and everything around it. It was one of the worst volcanic eruptions ever, killing more than 36,000 people and causing huge tsunamis, ash clouds, and climate changes. How bad was it? Well, imagine a blast so loud that you can hear it thousands of miles away. That's what happened on August 27, 1883, when Krakatoa exploded with the force of **200 megatons of TNT**. That's like 13,000 times more powerful than the atomic bomb that hit Hiroshima. The sound was so loud that it shattered windows and burst eardrums in places like Australia and Mauritius. Some people even thought it was the end of the

world. But that was not the only thing that Krakatoa did. The eruption also sent a massive wave of water crashing into the coasts of Java and Sumatra, wiping out hundreds of villages and drowning tens of thousands of people. The wave was so high that it lifted a steamship and threw it inland for almost a mile. Some survivors said they saw corpses floating in the sea for months after the disaster. And then there was the ash. Krakatoa spewed out tons of ash and dust into the air, covering the sky with a dark cloud that blocked out the sun for days. The ash also traveled around the world, creating colorful sunsets and weird halos around the moon. But it also had a downside: it cooled down the planet by reflecting some of the sunlight back into space. The average temperature dropped by about half a degree Celsius for a year, causing crop failures and famines in some places. **Now if this event happened today it would be pretty bad, but not as bad as before.** Krakatoa is not as big as it used to be. After the 1883 eruption, most of the island sank into the sea, leaving only a small remnant called **Anak Krakatau** (which means "Child of Krakatoa").

Anak Krakatau is still active, and has erupted several times since then, but none of them were as violent as the 1883 one. However, that doesn't mean we can relax. Anak Krakatau is still growing, and could erupt again at any time. And even if it doesn't, there are other volcanoes in Indonesia that could pose a threat to millions of people living nearby. Indonesia is part of the Ring of Fire, a zone of volcanic and seismic activity that circles the Pacific Ocean. It has more than 120 active volcanoes, some of which are overdue for an eruption. <https://www.quora.com/What-if-the-1883-Mt-Krakatoa-eruption-happened-today>



Why are Rare Earth Elements so Rare?

Rare earth elements have a number of useful properties that make them highly sought after by the tech and energy industries. This collection of 17 metals includes the 15 metallic elements found at the bottom of the periodic table, as well as the elements **yttrium and scandium**. The most valuable of these are **neodymium, praseodymium, terbium and dysprosium**, which act as superstrong miniaturized magnets, a vital component of electronics, including smartphones, electric car batteries and wind turbines. However, their limited global supply is a big worry for governments and corporations that need these metals to continue manufacturing all sorts of modern essentials. But why are the rare earth elements so rare? It turns out, they're not really that rare. A U.S. Geological Survey study on the "crystal abundance" of different elements (meaning how much is available if you average out Earth's crust) found that most of the rare earths "are in the same order of magnitude as common metals like copper and zinc," said Aaron Noble, a professor at Virginia Tech. "They're certainly not as rare as metals like silver, gold and platinum." The "troublesome earths" would have been a better name. The problem is, they're just not that concentrated in one place. There are around 0.005 ounces per pound of rare earths across all shale in the United States. Typically, metals concentrate within Earth's crust due to different geological processes, such as lava flow, hydrothermal activity and mountain formation; however, the unusual chemistry of the rare earth elements means that these metals don't. Consequently, traces of these elements are spread across the planet, making mining for these materials particularly inefficient. Occasionally, extremely acidic conditions underground can slightly increase the amount of rare earth elements present in certain areas. But finding these elusive enriched sites is only the first challenge. In nature, metals exist as compounds called ores, which contain metal particles linked to other nonmetal substances (called counterions) by strong ionic bonding. To obtain the pure metal, these bonds must be broken and the counterions must be removed, but the difficulty of this separation depends on the metal and the counterion in question. The rare earth metals naturally have three positive charges and form incredibly strong ionic bonds with phosphate counterions, each possessing three negative charges. The extraction process must therefore overcome the very strong attraction between the positive metal and the negative phosphate, no small task. You have to put a lot of energy and chemical intensity into them to break them down. Oftentimes, that process uses a very low pH, very aggressive conditions and very high temperatures, because those bonds holding the ores together are so strong. It's this difficulty of extracting the pure element that gives the rare earth elements their name. Some researchers are trying to reproduce the unusual magnetic and electronic properties in new compounds that behave like rare earth elements. For the time being, though, there's no substitute for the troublesome rare earths, even as demand skyrockets.

<https://www.livescience.com/planet-earth/geology/why-are-rare-earth-elements-so-rare>

Asteroid 33 Polyhymnia is So Dense it May Actually Contain Elements Never Before Seen on Earth, According to a New Study



An asteroid in the solar system's asteroid belt is so dense that scientists believe it could contain elements never before seen on Earth, according to a study published in *The European Physical Journal Plus* in September. All known chemical elements on Earth are documented in the Periodic Table. There are 118 elements that make up the Periodic Table, organized by their atomic number, the number of protons in the element's atomic nucleus. Over the years, scientists have been jamming more protons into nuclei to create new elements. But how many protons you can ultimately pack into one space is a scientific mystery. Some experts argue the threshold is 164. For their new study, researchers from the University of Arizona, suggest that asteroid 33 Polyhymnia might contain never-before-seen material that reaches that exact threshold. They calculated what the density of an element with a whopping atomic number of 164 would be - generally speaking, the higher the atomic number of an element, the denser it'll be, though there are definitely exceptions. The researchers found that the density of an element with atomic number 164 was roughly the same density as what other experts have already measured for asteroid Polyhymnia. *It "would have a density between 36.0 and 68.4 g/cm³: a range that approaches the expected value for asteroid Polyhymnia,"* according to a press release. Asteroid 33 Polyhymnia might be what's called a compact ultradense object, or CUDO. These objects are thought to have densities far greater than the density of anything on Earth and therefore contain elements scientists have yet to discover. For example, the densest element on Earth, Osmium, contains 76 protons packed into each atomic nucleus. If the scientists' new calculations are correct, it would mean CUDOs like asteroid Polyhymnia could be made of material that contains elements with as many as 164 protons per atomic nucleus. One of the study's authors, Jan Rafelski, said in the press release: "The idea that some of these might be stable enough to be obtained from within our solar system is an exciting one."

<https://www.businessinsider.com/asteroid-so-dense-could-contain-never-before-seen-elements-2023-10>

Green River Formation Fossils

Rocks of the Green River Formation contain a story of what the environment was like about 50 million years ago in what is now parts of Colorado, Utah, and Wyoming. At that time, forces within the Earth were almost finished with the job of uplifting the Rocky Mountains, and the landscape consisted of rugged mountains separated by broad intermountain basins. Streams draining the steep mountains carried large amounts of sand, silt, mud and dissolved minerals into lakes that occupied the intermountain basin. Over time the sand, silt and mud began infilling the lakes. The dissolved minerals altered the chemistry of the lake waters. Abundant plants grew on broad swampy areas that developed around the margins of the lakes. In some parts of the lakes, sediments were deposited in very thin layers known as varves (thin layers of dark-colored sediment deposited during the growing season, and thin layers of light-colored sediment deposited in winter). Some of the most detailed and highly preserved fossils are contained in varved sediments composed of very fine-grained lime mud. When these thinly layered rocks are split, the smooth bedding surfaces often reveal a delicately preserved fossil. The rocks of the Green River Formation have been dated to within a few million years through the analysis of volcanic mineral grains from volcanoes in what is now Yellowstone and the San Juan volcanic field to the south produced ash that dropped into the calm lake waters. They indicate that the lakes are about 50 million years old and span a time interval of several million years during the early to mid Eocene Epoch. The Green River climate was moist and warm - perfect for rapid plant growth. This allowed a dense community of plants to spread across the swampy areas along the lake margins. These plants dropped a steady supply of leaves, branches, seeds and woody materials into the swamp waters. The water cover of the swamp protected the **plant debris** from decay and it accumulated rapidly. The plant debris layers grew thicker and more extensive over time. Eventually the layers of plant debris were buried and transformed into **coal** seams. Conditions in the lakes were also ideal for thriving blooms of blue-green algae. They spread over many parts of the lakes as a thick scum of green filaments and strands. For several million years enormous amounts of algal debris sank to the bottom and were incorporated into the lake sediments. Through time the algae-rich sediments were transformed into the largest **oil shale** resource on Earth. Millions of Green River fossils have been collected by amateur and professional collectors. They are now in collections, exhibits and museums around the world. Photographs of some specimens from the archive of the National Park Service are presented below.



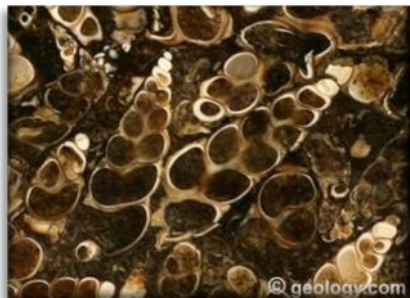
Green River Fossil Fish: Large teeth and rear-placed fins make *Phareodus encaustus* well suited for catching and eating other fish. View more Green River **fish fossils**.



Green River Fossil Bat: This 5.5 inch long bat is the most primitive bat known. Claws on each finger of its wings indicate it was probably an agile climber and crawled along and under tree branches searching for insects. View more Green River **animal fossils**.



Green River Fossil Insect: Many species of insects are found in the Green River Formation, including dragonflies. The wetland margins of Fossil Lake provided ideal breeding and foraging opportunities. View more Green River **insect fossils**.



Green River Fossil Leaf: Two hundred and seventy-six leaves, seeds, and flowers are known from the Fossil Lake deposits. Fossil plants are key in determining the climate of past environments. View more Green River **plant fossils**.



Turritella Agate: The Green River Formation is also the source of a fossil gem material known as Turritella Agate. It contains fossil gastropod shells.

<https://geology.com/articles/green-river-fossils/>

The Moon is 40 Million Years Older than We Thought, According to Rocks Collected

The moon is our closest neighbor in space and the only celestial body humans have set foot on, yet we are still learning about it. In fact, Earth's moon might actually be 40 million years older than scientists previously believed. By conducting an atom-by-atom analysis on crystals that were brought back by Apollo astronauts in 1972, a team of geochemists and planetary scientists now calculate that the igneous orb is at least **4.46 billion years old**. The findings are described in a study published today in the journal *Geochemical Perspectives Letters*. Based on samples recovered from the moon's surface, we know that it formed more than four billion years ago when a giant object the size of Mars crashed into a very young Earth. The largest piece of the planet that broke off during that collision became our moon, and has been intertwined with the solar system ever since. Earth's surface is much, much younger because there's so much geologic activity here from volcanism and weathering. In the recent study, the team looked at moon dust brought back by the Apollo 17 crew in 1972. These samples contain very small crystals that were created when the moon was formed. The energy created by the impact from the object that struck Earth and created the moon melted the rock that eventually became the lunar surface. **Zircon crystals** formed after the magma ocean cooled. Determining the age of these crystals can thus reveal the minimum possible age for the moon. The **atom probe tomography** used to determine the age started by sharpening a piece of the lunar sample into a very sharp tip using a focused ion beam microscope, almost like a very fancy pencil sharpener. Then, UV lasers were used to evaporate atoms from the surface of that tip. The atoms travel through a mass spectrometer, and how fast they move tells us how heavy they are, which in turn tells us what they're made of. This atom-by-atom analysis revealed how much of the uranium in the zircon crystals had undergone radioactive decay. Based on the amount of conversion and the known half-lives of different chemical isotopes, experts can estimate the age of the sample. The team working with the Apollo 17 sample found that the proportion of lead isotopes (the daughter atoms created during the decay) indicated that the crystals were about **4.46 billion years old**, so the moon must at least be that old too. While this puts the moon's age back 40 million years, that's still a very short time compared to the universe's roughly 13.7 billion-year history. In future studies, clues pulled from these decades-old samples could be pooled with samples taken by upcoming Artemis lunar missions. Artemis III is scheduled for 2025 and will land on and explore the lunar South Pole. The Apollo 17 mission collected samples from the Taurus-Littrow valley on the eastern edge of Mare Serenitatis, so crystals from a different region of the moon could yield unimaginable discoveries.

<https://www.popsci.com/science/moon-age-apollo-17-sample/>

This Jurassic-Era "Sea Murderer" was Among the First of its Kind

With its 19 feet-long torpedo-shaped body and long teeth the newly-described *Lorrainosaurus* was a fearsome mega predator. The fossilized remains of a 170-million-year-old marine reptile is the oldest-known **pliosaur** and dates back to the Jurassic era. Pliosaurus were members of a group of ocean-dwelling reptiles that are closely related to the more famous long-necked plesiosaurs. Unlike their cousins, these pliosaurs had short necks and massive skulls. From snout to tail, it was likely about 19 feet long, and very little is known about the plesiosaurs from this time. Famous examples, such as *Pliosaurus* and *Kronosaurus*—some of the world's largest pliosaurs—were absolutely enormous with body-lengths exceeding 32 feet. They were ecological equivalents of today's killer whales and would have eaten a range of prey including squid-like cephalopods, large fish and other marine reptiles. Pliosaurus first emerged over 200 million years ago and remained relatively small players in marine ecosystems. Following a landmark restructuring of the marine



The oldest megapredatory pliosaur, Lorrainosaurus, in the sea that covered what is now northern France 170 million years ago.

predator ecosystem in the early to middle Jurassic era (about 175 to 171 million years ago) they reached apex predator status. This event profoundly affected many marine reptile groups and brought mega predatory pliosaurs to dominance over 'fish-like' ichthyosaurs, ancient marine crocodile relatives, and other large-bodied predatory plesiosaurs. The fossils in this study were originally found in 1983 in northeastern France, but were recently analyzed by an international team of paleontologists who identified this new pliosaur genus called *Lorrainosaurus*. The teeth and bones represent what was once a complete skeleton that decomposed and was spread along the ancient seafloor by scavengers and ocean currents. *Lorrainosaurus* was one of the first truly huge pliosaurs. It gave rise to a dynasty of marine reptile megapredators that ruled the oceans for around 80 million years. Other than a short report published in 1994, these fossils remained obscure until researchers reevaluated the specimens. Finding *Lorrainosaurus'* remains indicates that the reign of gigantic mega-predatory pliosaurs likely began earlier than paleontologists previously thought. These giants were also locally responsive to the major ecological changes in the marine environments that covered present day Europe during the early Middle Jurassic. *Lorrainosaurus* is thus a critical addition to our knowledge of ancient marine reptiles from a time in the Age of Dinosaurs that has as yet been incompletely understood.

<https://www.popsci.com/environment/lorrainosaurus/>

Antarctica Has Lost 8.3 Trillion Tons of Ice Since 1997, a New Study Found. That's Enough to Cover the Contiguous US in 3 Feet of Water

Antarctic ice shelves lost about 8.3 trillion tons of ice in the last quarter-century, enough to cover the contiguous US in 3 feet of water. Put more specifically, four dozen ice shelves have shrunk by at least 30% since 1997, and 28 of those have lost more than half of their ice in that time, reports a new study. Of the continent's 162 ice shelves, 68 show significant shrinking between 1997 and 2021, while 29 grew, 62 didn't change and three lost mass but not in a way scientists can say shows a significant trend, according to a study in *Science Advances*. Ice shelves are the crucial "gatekeepers" between the frozen continent's massive glaciers and open ocean. All of that melted ice, which usually pens larger glaciers behind it, then goes into the sea. Scientists worry that climate change-triggered melt from Antarctica and Greenland will cause dangerous and significant sea rise over many decades



Antarctica saw temperatures 39 degrees Celsius above average last year.

and centuries. Sea level rise has already started to grip populated places like the Florida Keys, where people have begun losing homes and access to roads. "Knowing exactly how, and how much, ice is being lost from these protective floating shelves is a key step in understanding how Antarctica is evolving," said University of Colorado ice scientist Ted Scambos, who wasn't part of the study. Scambos said the study gives insight into fresh water that's melting into the Amundsen Sea, "the key region of Antarctica for sea level rise." that not only adds height to the ocean, but makes it less dense and salty. The biggest culprits were giant icebergs breaking off in 1999, 2000, and 2002 that were the size of Delaware, he said. The study also looks at ice melting from warm water below. Ice shelves are floating extensions of glaciers that act "like the gatekeepers" and keep the larger glacier from flowing more quickly into the water, the study's lead author said. All told, Antarctic ice shelves lost about 8.3 trillion tons of ice in the 25-year period, the study found. That amounts to around 330 billion tons a year and is similar

to previous studies. But the overall total is not the real story, said study lead author Benjamin Davison, a glaciologist at the University of Leeds in the United Kingdom. What's most important, he said, are the patterns of individual shelf loss. The new study shows the deep losses, with four glaciers losing more than a trillion tons on the continent's peninsula and western side. "Some of them lost a lot of their mass over time," Davison said. "Wordie is barely an ice shelf anymore." The Wordie ice shelf, which holds back four glaciers near the tip of the Antarctic Peninsula, had a big collapse in 1989, but has lost 87% of its remaining mass since 1997, Davison found. Neighboring Larsen A has lost 73% and Larsen B 57%. The largest of the Larsen ice shelves, Larsen C, has lost 1.8 billion tons of ice, about one-eighth of its mass. The biggest loss of all is in the Thwaites ice shelf, holding back the glacier nicknamed Doomsday because it is melting so fast and is so big. The shelf has lost 70% of its mass since 1997, about 4.1 trillion tons, into the Amundsen Sea. The ice shelves that grew were predominantly on the continent's east side, where weather patterns isolate the land from warmer waters, Davison said. The ice shelves on the east were growing slower than the shelves losing ice to the west. It's difficult to connect an individual ice shelf loss directly to human-caused climate change, but steady attrition is expected as the world warms, he said. In 2023 Antarctica saw its warmest temperature ever recorded, at 70 degrees above average. <https://www.businessinsider.com/antarctica-lost-enough-ice-cover-us-three-feet-water-2023->

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 Iowa City, Iowa 52240-9620



Next Meeting:
MON. NOVEMBER 13
Hiawatha Community Center
featured video:
“Devonian Fossils from Independence, IA”
 by Jim Preslicka
 Cedar Valley Rocks & Minerals Society

CEDAR VALLEY GEMS

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

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

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

CVRMS website:
<https://cedarvalleyrockclub.org>

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