



# Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

[cedarvalleyrockclub.org](http://cedarvalleyrockclub.org)

CEDAR VALLEY GEMS

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**Next CVRMS Meeting**  
**Tues. Sept. 17**  
**7:15 pm**

Hiawatha Community Center  
101 Emmons St., Hiawatha - 7:15 pm

*featured presentation*

**“Solar, Lunar  
and Other Eclipses;  
the History, Science and  
Discoveries Connected to Them”**  
by **Rick Austin**

*CVRMS resident astronomer, Rick Austin, will be discussing the science and history of eclipses and what they have taught us about our universe as well as*



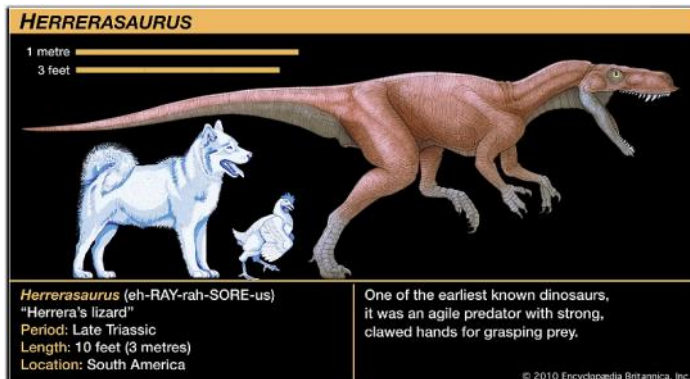
*sharing his experiences while viewing the April 8 eclipse from the zone of totality in Texas. Rick suggested an alternative title for his presentation; “My Favorite Rocks and How they Play Together”*

**Earth's Days Were Once 2 Hours Longer, and That May Have Triggered One of the Biggest Evolutionary Explosions in History**

Earth's days were once **more than two hours longer** than they are now, thanks to the moon drifting thousands of miles farther away in its orbit *over two periods*, researchers have discovered. The extra hours of sunlight, in turn, may have led to oxygenation events that ushered in a period when life's complexity exploded, the study suggests. Nowadays, the moon orbits at an average of 238,855 miles from Earth. But our satellite hasn't always been where it is now. Earth's days are currently around 24 hours long, but that wasn't always the case. Over time, the moon tugs on our planet. As it does so, it migrates away from Earth, siphoning away its kinetic energy. As a result, our planet's spin around its axis slows, thus lengthening Earth's days. Modeling changes in how Earth wobbles as it spins can give a rough picture of this slowdown over the planet's history. But this estimate is clearly flawed, because it leads to a prediction that Earth and the moon would have collided around 1.5 billion years ago, the study noted. The new study examined eight datasets that captured rock layers from marine environments dating to roughly between 700 million and 200 million years ago. These **tidalites**, as they're called, can record the strength of the tides over time. The team combined these datasets with models of the tidal forces acting between the moon and Earth to map how quickly Earth spun around its axis over the half-billion-year study period. They found that there was a *"staircase"* pattern in Earth's spin, with two periods where the planet's rotation quickly and dramatically changed, followed by periods of stability. Over the study period, days were 2.2 hours longer than they are now. One of these time periods, roughly 650 million to 500 million years ago, encompassed the **Cambrian explosion**, a period when life diversified dramatically and radiated into new niches. The second *"step"* in the staircase of Earth's spin occurred roughly 340 million to 280 million years ago, which corresponded to a period when massive glaciers covered the planet. The study suggests that by increasing the day length, and, therefore sun exposure, the moon may have triggered great oxygenation events that led to life's diversification. However, those results *"need to be interpreted with care,"* the authors wrote in the study. <https://www.livescience.com/space/the-moon/earth-s-days-were-once-2-hours-longer-and-that-may-have-triggered-one-of-the-biggest-evolutionary-explosions-in-history-study-suggests?>

## Heavy Rains Expose One of the Oldest Dinosaur Skeletons Ever Discovered

Heavy rains in southern Brazil have exposed the remains of one of the world's oldest dinosaurs. Paleontologists found the fossils next to a reservoir in the municipality of São João do Polêsine in May, and it was reported on July 17. The team claims that the dinosaur, which has yet to be formally identified, is around 233 million years old and belonged to a family of Triassic predators called *Herrerasauridae*. The oldest undisputed dinosaur fossils are around 231 million years old and



Artist's illustration of *Herrerasaurus*, and a comparison of its size to a huskie dog and a chicken.

Illustration from the *Encyclopedia Britannica*.

include bones from a few different groups, including *Herrerasauridae*. The skeleton of the newly discovered dinosaur is almost entirely preserved. If the specimen is indeed a 233-million-year-old *Herrerasaurid*, then it will help researchers decipher the base of the dinosaur family tree, and help scientists better understand the first wave of predatory dinosaurs to occupy the top of the food chain. The individual would have been around 8.2 feet long, but its species may have grown even larger. "It's a carnivorous, bipedal animal, so it walked on its hind legs and probably had its hands free to handle prey," researchers said. "We can't say it had reached its maximum size. Although he was 8.2 feet long, some individuals in this group could reach 16.5 to 19.5 feet." Researchers uncovered the fossils after rains sped up natural erosion in the state of Rio Grande do Sul. This region experienced a record amount of rainfall earlier this year, which created floods that killed at least 182 people. The site is part of the Quarta Colônia Geopark and is known for dinosaur fossils. The rains mean the researchers are now racing to recover exposed fossils before they are lost or destroyed, Agência Brasil reported. "If there's a lot of rain, small materials are sometimes lost before we can get to them, so now we are rushing to rescue all the materials that have been uncovered." <https://www.livescience.com/animals/dinosaurs/heavy-rains-expose-one-of-the-oldest-dinosaur-skeletons-ever-discovered-researchers-claim>

## CVRMS Board Meeting August 27 — Minutes —

**MEETING CALLED TO ORDER:** 7:11 pm by Marv Houg at his house. Board members present, Marv, Dale, Sharon, Bill, Ray, Jay and Kim

**MINUTES FROM PREVIOUS MEETING** reviewed and motion made to approve by Bill; seconded by Dale. Motion approved.

**TREASURERS REPORT** by Dale. Checking account balance \$4,759.80. Motion to accept by Bill seconded by Ray. Treasurers report approved.

**SHOW THEME IDEAS.** Already decided; *ICE AGES*. Short discussion of Show dealers.

**CVRMS ROCK AUCTION:** We will have about 1200 lots available for auction. Will have a food truck on Saturday and Sharon will supply the food on Sunday. Dell will supply the food for workers on Friday. **Darren will not be at the auction. JJ will not** be available for computer clerking of successful bids; Kim and Dale will help.

**FLINT KNAPPING CLASS:** Class was considered a success by attendees. Might ask Terry Carter to present a second class.

**MEETING PROGRAM IDEAS:** Several possible speakers for our monthly meetings were discussed. Dale suggested Steven Bloom (U of IA) to discuss pearls. Marv suggested Phil Abbot, Dubuque microphotographer.

**BILL'S BIG BAD BUS BOOGIE 2024:** Bill announced that we have 26 members signed up for our bus trip for Saturday, October 5th. Leave at 6:30am and return about 6:00pm. Bring a sack lunch. Stops include the **Calkins Nature Area** near Alden and the **Grotto of the Redemption in West Bend**. **Deadline for signing up is September 27.** Bill moved that the club provide a \$200 tip to the driver; Ray seconded; motion passed.

**JUNE PICNIC:** Discussion of dropping rock polishing as the June picnic activity. No alternative has yet been chosen.

**OUTREACH:** Ray presented program "Linn County geological history" at Center Point Museum. He also has presentations scheduled at the Swisher library for September and October.

**CVRMS CHRISTMAS PARTY:** No date had been chosen for the December Christmas Party at the Hiawatha Community Center. **Update:** Dale booked Tuesday Dec 10 for the party. Details in future Newsletters.

**MOTION TO ADJOURN** by Bill, second Kim. Meeting adjourned at 8:32pm.

Respectfully submitted

*Ray Anderson*, Acting Secretary

## Fossils from Greenland's Icy Heart Reveal It Was a Green Tundra Covered in Flowers Less Than 1 million Years Ago

Today, nearly 98% of Greenland is covered in ice, but new research suggests it was virtually ice-free less than a million years ago. Over the years, opinion has shifted about whether Greenland has been continuously covered by ice since the start of the Pleistocene epoch, roughly 2.7 million years ago. But a new fossil discovery provides the first direct evidence that the center, not just the edges, of Greenland's ice sheet melted away in the recent geological past. The new data is the strongest confirmation yet that the ice in the center of the island vanished and was replaced by a tundra ecosystem. To make the discovery, the research team reexamined a sample of an ice core extracted in 1993. They found a plethora of fossils, including willow, fungi and insect body parts. But the most spectacular find was an impeccably preserved Arctic poppy seed. The original research plan with the sample was to measure [carbon-dating] isotopes, but they didn't know they were going to find fossils. One key piece of evidence was a specimen of rock spike moss (*Selaginella rupestris*), which today survives only on sandy and rocky places. "They need the things all plants need to grow, and they can't get those on top of an ice sheet," a researcher said. A 2016 study of the core suggested that the current Greenland ice sheet was a maximum 1.1 million years old, and that the loss of the ice at a site would mean that 90% of Greenland would have been ice-free at that time. Another core, extracted from Greenland's northwest coast in 1966 found several fossils, including seeds, twigs and insect body parts, hinting that this part of Greenland was ice-free within the past 500,000 years. The latest study reveals the center of Greenland was also free of ice at some point in the last 1 million years. The landscape that is now covered by a layer of ice 2 miles thick hosted an entire tundra ecosystem, with flowers and potentially even small trees. The reexamined 1993 core had been kept at the National Science Foundation Ice Core Facility in Colorado for over 30 years and was almost ignored. The ice part of the core has been extensively analyzed, and the people who were extracting the ice cores weren't thinking much about what was beneath. After one set of analysis on the sediment, it was put in a bag on a shelf. The finding that Greenland was once ice-free has implications for the present day. An ice-free Greenland happened at lower levels of atmospheric carbon dioxide than present-day levels, so there's potential for Greenland to be ice-free again, which would raise sea levels drastically. It will take decades, if not centuries, to lose its ice completely, but most of the current episode of sea level rise is coming from melting Greenland ice. There may be hope, however. "Nature has taken this ice sheet away in the past, and it has come back," researchers said. <https://www.livescience.com/planet-earth/plants/fossils-from-greenland-s-icy-heart-reveal-it-was-a-green-tundra-covered-in-flowers-less-than-1-million-years-ago?>

## Spotlight Gemstone: Sapphire

### September's Birth Stone



Sapphire, the birthstone for September and the gem of the 5th and 45th anniversaries, is a gemstone variety of the mineral corundum, an aluminium oxide (Al<sub>2</sub>O<sub>3</sub>). It frequently contains traces of iron, titanium, chromium, copper, or magnesium. Typically associated with the color blue, sapphires can also naturally occur in a wide variety of other colors such as blue, yellow, purple, orange, green colors (which are also called "fancy sapphires"). "Parti sapphires" are those sapphires which show two or more colors in a single stone. The only color which sapphire cannot be is red (red colored corundum is called *ruby*). Commonly, natural sapphires are cut and polished into gemstones and worn in jewelry. They also may be created synthetically in laboratories for industrial or decorative purposes in large crystal boules. Because of the remarkable hardness of sapphires, 9 on the Mohs scale (the third hardest mineral, after diamond at 10 and moissanite at 9.5), sapphires are also used in some non-ornamental applications, including infrared optical components, wristwatch crystals and movement bearings, and very thin electronic wafers used as insulating substrates in special-purpose solid-state electronics. The sapphire is one of the three gem varieties of corundum, the other two being ruby (defined as corundum in a shade of red) and *padparadscha* (a pinkish orange variety). Although blue is their most well-known color, sapphires may also be colorless or shades of gray and black. Blue sapphires are evaluated based upon the purity of their primary hue. Purple, violet, and green are the most common secondary hues found in blue sapphires. Blue sapphires with up to 15% violet or purple are generally said to be of fine quality. Blue sapphires with any amount of green as a secondary hue are not considered to be fine quality. The 423-carat (84.6 g) Logan sapphire in the National Museum of Natural History, in Washington, D.C., is one of the largest faceted gem-quality blue sapphires in existence.



# What in the World?



What in the World are these spherical rocks from western British Columbia, Canada?

# August's Photo



August's What in the World photo showed a shelf of Lake Superior cobbles pushed up the beach by waves and frozen in place near Grand Marais, Michigan.

## ROCK CALENDAR CVRMS EVENTS OF INTEREST

### 2024

#### Sept. 17 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm  
"Solar, Lunar and Other Eclipses; the History, Science and Discoveries Connected to Them"  
by Rick Austin

#### Sept. 21-22 — CVRMS Rock Auction

Amana RV Park  
Saturday Sept. 21—9:00 am—8:00 pm  
Sunday Sept. 22 —9:00 am—3:30 pm

#### Sept. 27, 28, & 29 — Geode Fest

First Christian Church Parking Lot  
3476 Main Street, Keokuk, Iowa  
[Keokuk Area Convention & Tourism Bureau](http://Keokuk Area Convention & Tourism Bureau)  
[Official Website \(keokukiowatourism.org\)](http://Official Website (keokukiowatourism.org))

#### Oct 5 — Bill's Big Bus Boogy 2024

CVRMS Bus Trip to the Grotto of the Redemption and Calkins Nature area  
Details on page 10 of this newsletter

#### Oct. 15 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm  
Program to be announced

#### Nov. 19 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm  
Program to be announced

#### Dec. 10 — CVRMS Christmas Party (2nd Tuesday)

Hiawatha Community Center 6:00 pm  
Details in next month's Newsletter

## 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](mailto:rockdoc.anderson@gmail.com), and every month I will answer one in this column. Please let me know if you would like me to identify you with the question. I will also try to respond to all email requests with answers to your questions.

Since no one posed any questions to *Ask a Geologist* last month, I was free to choose a topic that I thought you would find of interest. This month I chose to share an article that reveals that life on Earth may be older than scientists previously believed.

### Complex Life on Earth May Be 1.5 Billion Years Older Than We Thought

By DAVID NIELD

There's still some scientific debate over when exactly complex life forms appeared on Earth, and the latest research suggests previous estimates need to be revised – by about 1.5 billion years, in fact. That's based on a new analysis of marine sedimentary rocks in the Franceville Basin off the west coast of Africa that were deposited some 2.1 billion years ago. The general consensus is that animals first showed up around 635 million years ago. Now, an international team of researchers has discovered that the rock samples indicate increased phosphorus and oxygen in the seawater, which has previously been linked to accelerations in evolution. "We already know that increases in marine phosphorus and seawater oxygen concentrations are linked to an episode of biological evolution around 635 million years ago," says Earth scientist Ernest Chi Fru from Cardiff University in the UK. "Our study adds another, much earlier episode into the record, 2.1 billion years ago." An unusually substantial number of fossils large enough to be seen without a microscope has been discovered in the Franceville Basin, and it's not clear what we're to make of them. Earlier studies have also suggested these macrofossils point to the first complex life on the planet. Here, the researchers link the nutrient enrichment of the water to the collision of two ancient continents, which then created a shallow inland sea and the conditions for cyanobacterial photosynthesis, a chemical process that would've led to an underwater environment more conducive to biological complexity. This would have created a natural laboratory for organism diversity and evolutionary leaps in size and structure, the researchers contend. However, because the body of water was isolated, these more sophisticated forms of life wouldn't have spread elsewhere or survived to the next jump forward. "We



Macrofossils recovered from the Franceville Basin.

think that the underwater volcanoes, which followed the collision and suturing of the Congo and São Francisco cratons into one main body, further restricted and even cut off this section of water from the global ocean to create a nutrient-rich shallow marine inland sea," says Chi Fru. These findings may point to complex life on Earth evolving in two steps: once following the first major atmospheric oxygen rise 2.1 billion years ago, and again following a second rise 1.5 billion years later. In fact, complex life might have arisen several times over the millennia, as has been suggested by other studies. Scientists are still working to pin down which types of life evolved when, and there's no guarantee that all evolutionary jumps would've stuck. Delving this far back into the past isn't easy, of course; it involves some careful analysis of ancient fossils and environments that may have harbored conditions suitable for what these researchers describe as "macrobiological experimentation." "These observations make it possible that the appearance of macrofossils in Franceville may mark a unique window into our understanding of conditions that enabled and restricted the evolution and disappearance of Earth's earliest macrobiological life forms," write the researchers in their published paper. <https://www.sciencealert.com/complex-life-on-earth-may-be-1-5-billion-years-older-than-we-thought>



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



## What was the first animal on Earth?

Today, Earth is home to animals of all shapes and sizes, from nearly microscopic creatures like tardigrades to 80-foot-long blue whales. These organisms have arisen and evolved over millions of years of evolution. But what was the first animal on the planet? The answer to this question is heavily debated by scientists. Dozens of different studies using everything from chromosome evolution over time to ancient fossils have boiled it down to two candidates: **sponges** and **comb jellies**. Some of the best information about early animals comes from fossils dating back to the Cambrian period, which started around **541 million years ago**. During this time, Earth experienced a burst of new species during the *Cambrian explosion*: In just 10 million years, hundreds of thousands of animal species suddenly sprung into being. Almost every type of animal body plan that exists today evolved during the Cambrian explosion, including early arthropods, mollusks and even chordates, which later gave rise to vertebrates. Exquisitely preserved specimens from a rock formation known as the **Burgess Shale** in British Columbia give us a window into what these early animals looked like. But all of those species didn't just come out of nowhere. In the 1950s, previously discovered fossils were identified as animal remains from the Ediacaran period, which extended from around 635 million years ago to the dawn of the Cambrian 541 million years ago. Unlike the hard exoskeletons found in many of the Cambrian fossils, the animals that lived during the Ediacaran were mostly soft-bodied, blob-shaped animals like cnidarians, a group that includes animals like jellyfish and sea anemones, worms, and possibly sponges. Soft tissues are extremely difficult to preserve because they degrade more easily than bones or exoskeletons. This means that Ediacaran animals' fossil remains are not only scant, but a lot more difficult to parse. Perhaps the best known of these is a wormlike animal called *Dickinsonia*,



Imprint left by *Dickinsonia* from the Ediacaran period.

which looks like a large dinner plate with ribbed segments emanating from its center. Before then, things start to get murky. Part of the problem is that scientists don't really know what to look for; the earliest animal fossils probably had little or no recognizable pattern. In a 2021 paper in the journal *Nature* researchers presented what they propose as the oldest known animal, a fossil specimen of an 890 million-year-old sponge. A 2023 study using chromosomal data from modern ctenophores, otherwise known as comb jellies, argues they were the first known animals, emerging around 600 million to 700 million years ago. Elizabeth Turner, a paleobiologist at Laurentian University in Ontario noted that *"The simplest way of being an animal is to be a sponge-like filter feeder. That's how you have to start off."* She also said that the earliest animal wouldn't have won any beauty pageants. *"It would have looked like a microscopic bit of slime."* <https://www.livescience.com/animals/what-was-the-first-animal-on-earth>

## The Mysterious Origins of Sapphires Have Finally Been Deciphered

Glittering blue **sapphires**, so suggestive of piercing cold, have remarkably hot origins deep beneath the surface. For years, sapphires have turned up in volcanic deposits such as the Volcanic Eifel, where magma from Earth's mantle wells up into the crust over a long period of time, producing melts that are rich in sodium and potassium. Yet others are found in river beds, the robust crystals scoured clean of their source rocks. While volcanism clearly seems to play some kind of role, the exact provenance of these sapphires deep in our planet's ovens was something of a mystery, with geologists unable to determine with certainty whether they form solely in the mantle itself or are baked out of other minerals on the magma's ascent. New research has found evidence that the azure gems can be forged in the fire and fury of volcanic upheaval as extreme processes heat and compress aluminum oxide within the crust into a crystalline form called **corundum**; the main mineral that makes up sapphires. *"One explanation is that sapphire in the Earth's crust originates from previously clayey sediments at very high temperatures and pressure and the ascending magmas simply form the elevator to the surface for the crystals,"* explains geologist and petrologist Axel Schmitt of Curtin University in Australia. The researchers wanted to know if the sapphires formed in the upper mantle or lower crust and were picked up and borne upward by magma pushing its way towards the surface. To do this, they had to study the sapphires themselves. They collected 223 microscopic sapphires from Eifel, Germany, and subjected them to secondary ion mass spectrometry. They were looking at two different characteristics: inclusions of rutile and zircon trapped in the sapphires as they formed, and the ratios of oxygen isotopes in the aluminum oxide. Sapphires are predominantly made up of aluminum oxide in the form of corundum, but other elements can become mixed in. The deep blue hue that sapphires are known for comes from titanium and iron tinting the corundum, for example. Iron on its own makes yellow sapphires, and can also give us green stones. Chromium turns the corundum pink or red, and that's how we get rubies. What's more, whole other minerals, such as rutile and zircon, can get trapped within sapphires as they form. Scientists can then use these minerals to determine when the crystal formed, because as rutile and zircon form, they incorporate uranium, which then undergoes radioactive decay at a known rate. Scientists can study the ratios of uranium to lead inside the rocks to determine how long that uranium has been decaying. In addition to the uranium, the researchers studied the sapphires' oxygen isotope ratios. An isotope is a form of an atom with a different number of neutrons, and there were two isotopes relevant to the study. By studying the ratios of these isotopes, the researchers were able to determine that the Eifel sapphires had oxygen ratios that could be traced both to the mantle and to the crust. Meanwhile, the uranium-lead dating showed that they formed at the same time as volcanism that delivered them to the surface. This suggests that the sapphires formed in the upper crust, no more than 4.3 miles below the surface. Some of this formation was from mantle magma melting the rock as it moved through, transferring mantle isotope ratios to the corundum. Other sapphires formed as melt permeated the rock around it, triggering sapphire formation via heat, resulting in gems with isotope ratios more typical of a crustal origin. <https://www.sciencealert.com/the-mysterious-origins-of-sapphires-have-finally-been-deciphered>

## Huge 13,600-Year-Old Mastodon Skull and Bones Unearthed in Iowa

An ancient and mighty tusked beast has been exhumed from the mud of an Iowa creek bed. It took enthusiasts from the local community and University of Iowa archaeologists 12 days to carefully unearth several skull bones after a resident reported remains of an oversized leg on private property to the Office of the State Archaeologist back in 2022. The 13,600-year-old fossil remnants belong to a mastodon (*Mammut sp.*), a long-extinct, distant relative of today's elephants. *"This is the first-ever well-preserved mastodon (primarily the skull) that has been excavated in Iowa,"* the archaeologists explain in a Facebook post. The discovery of a juvenile mastodon tooth indicates there may be more remains in the area. Stone tools were also among a number



An archaeologist from the University of Iowa carefully excavates the mastodon skull.

of recovered artifacts that were dated to within a few thousand years of the mastodon's death. The archaeologists hope a detailed analysis of their finds may provide further clues to the ancient relationship between the two species. *"We're really hoping to find evidence of human interaction with this creature – perhaps the projectile points and knives that were used to kill the animal and do initial butchering,"* says state archaeologist John Doershuk.

*"There's also potential evidence on the bones themselves – there could be identifiable cut marks."* While mastodons were around the same height as modern elephants, they were likely bulkier, estimated to weigh up to 6 tons. Like other megafauna, including South America's giant sloths and Australia's mega wombats, they slowly faded from the landscape soon after humans arrived in North America around 14,000 years ago. The last known mastodon was recovered from peat near Pleasant Lake in Michigan. Dated to nearly 10,500 years ago, it shows signs of butchery and evidence of having been hunted. While the exact cause of their extinction is unknown, researchers suspect a combination of human activity and climate change likely played critical roles, with a tuberculosis pandemic also being implicated. Both mammoths and mastodons roamed North America for millions of years, through the last ice age, although mammoths arrived on the continent much later whereas mastodons are believed to have originated in the Americas. Despite their similar appearance they last shared a common ancestor around 20 million years ago. Unlike their larger, distant cousins, mastodons were forest dwellers. Their teeth had adapted to grinding tougher trees and shrubs, rather than slicing herbs and grasses like the plains-dwelling mammoths. Mastodons roamed all the way into Alaska during warmer climatic periods. We're now witnessing today's species like moose and beaver make similar northern expansions in their distribution. In total, the archaeological team found 20 different parts of what they suspect are remains of the same animal, including fragments of a rib, its spine, another leg bone, and a knee cap. Analysis of its tusk should reveal additional biological details of the giant mammal, such as its age, sex, and diet. *"I never thought, in a million years, that I would get the experience of excavating the skull of a mastodon,"* Dan Clark wrote in a Facebook comment. *"I cannot wait to see the final product when it has been all cleaned and restored."* Once the university finishes its analysis the bones will be exhibited at the Prairie Trails Museum.

<https://www.livescience.com/animals/extinct-species/huge-13-600-year-old-mastodon-skull-and-bones-unearthed-in-iowa>



## Dinosaur-killing asteroid likely came from deep space beyond Jupiter

The asteroid likely responsible for wiping out roughly 75-percent of all Earth's species, including non-avian dinosaurs, wasn't just one of the planet's rare mass extinction events, the culprit space rock was a cosmic rarity in itself. In a study published August 15 in the journal *American Association for the Advancement of Science*, an international research team reveals the famous Chicxulub impactor that separated the Cretaceous and Paleogene eras (the K-Pg boundary) was an incredibly uncommon carbonaceous asteroid originating from beyond Jupiter's orbit. Earth has hosted extinction-level events of varying sizes over its lifetime, but only the "Big Five" arguably qualify as truly "mass extinction" situations. In each of these events, at least 70-percent of marine and terrestrial life disappeared as a result of severe changes to climate, food sources, and other necessities for life as we know it. The most recent mass extinction—the one that paved the way for humanity's evolution, took place 66 million years ago after a roughly six-mile-wide asteroid slammed into the planet at a speed of about 12 miles-per-second. After crashing into the Gulf of Mexico in what is now the Yucatán Peninsula, the asteroid struck with the force of 100 teratons of TNT, or **over a billion times** the destructive force of the atomic blasts at Hiroshima and Nagasaki. Immediate aftermath included the creation of a 62-mile-wide, 19-mile-deep transient cavity, 620 mph winds, and a 2-mile-high tsunami that struck surrounding coastlines. Around 25 trillion metric tons of debris and ash also launched into the atmosphere, some of which soon fell back and ignited wildfires that destroyed 70-percent of the planet's forests. The initial years following Chicxulub then saw a rapid rise in global temperatures due to the greenhouse effect, followed by a prolonged era of cooler temperatures that continued to stifle life and eradicate species. It is during this time that many experts believe non-avian dinosaurs completely died out, leaving a human-sized job opening for the role of Earth's dominant species. But while researchers can reconstruct these terrifying details in recent decades through careful geological examinations, the exact composition of the Chicxulub impactor has remained uncertain. To investigate the lingering questions, researchers from around the world gathered samples from the K-Pg boundary. At the same time, they also examined samples from five other asteroid impacts that occurred over the past 541 million years, along with spherules from Archaean-age impact-related layers dating as far back as 3.5 billion years ago. Finally, they also obtained pieces of two carbonaceous, or C-type, meteorites. After comparing the collection, the team discovered a uniformity throughout the K-Pg boundary's ruthenium isotope signatures, which also closely aligned with those of the C-type meteorites originating outside the Solar System. In contrast, the other meteorites displayed Ru isotope compositions resembling more common siliceous (S-type) asteroids that originate within the inner Solar System. This new evidence, implies that deep space meteorites originating from far beyond Jupiter likely initiated the mass extinction.

<https://www.popsoci.com/science/dinosaur-asteroid-origin/>

## World's Largest Iron Ore Deposits Formed Over 1 Billion Years Ago in Supercontinent Breakup

The world's largest iron ore deposits formed when the ancient supercontinent **Columbia** broke up around 1.4 billion years ago, a new study suggests. The deposits, located in what is now Hamersley Province in Western Australia, sit on a chunk of Earth's crust known as the Pilbara Craton. The Pilbara Craton is one of only two pieces of crust known to date back to the Archaean Eon (3.8 billion to 2.5 billion years ago) and hosts some of the oldest rocks on our planet. Rocks in the Pilbara Craton



A core of 1.3 billion-year-old deep blue iron ore from the Hamersley Province

have witnessed the birth and breakup of several supercontinents, meaning they hold clues about the origins of the region's rich mineral deposits, researchers said in the new study. In particular, the breakup of supercontinent Columbia, which existed between 1.7 billion and 1.45 billion years ago, and the subsequent amalgamation of Australia between 1.4 billion and 1.1 billion years ago, could explain how huge iron ore

reserves formed in the Hamersley Province. The team revealed its findings in a study published July 23 in the journal *Proceedings of the National Academy of Sciences*. "The energy from this epic geological activity likely triggered the production of billions of tons of iron-rich rock across the Pilbara," study lead author Liam Courtney-Davies, from the University of Colorado, Boulder, said in a statement. The Hamersley Province holds more than 55 billion tons of iron ore, which geologists previously thought formed around 2.2 billion years ago. But based on direct dating techniques, the new study found the deposits are actually much younger than that, forming between 1.4 billion and 1.1 billion years ago. To pinpoint the age of the deposits, Courtney-Davies and his colleagues dated minerals in eight banded iron formations, giant blocks of sedimentary rock that feature alternating layers of iron oxides, such as magnetite and hematite, and iron-poor minerals like chert. The researchers used a new geochronology technique that involved analyzing uranium and lead isotopes within iron oxides in the rock, which gave researchers the first ever direct age measurements for the Hamersley Province deposits. The measurements revealed the iron ore formed around the same time that supercontinent Columbia, also known as Nuna, was breaking up to give rise to a primitive Australian continent. Tectonic events would have taken place across the entire Pilbara Craton, providing the huge amounts of energy required and forcing enough mineral-rich fluid from deep underground to form the massive deposits, according to the study. "The discovery of a link between these giant iron ore deposits and changes in supercontinent cycles enhance our understanding of ancient geological processes and improves our ability to predict where we should explore in the future," Courtney-Davies said. [https://](https://www.livescience.com/planet-earth/geology/world-s-largest-iron-ore-deposits-formed-over-1-billion-years-ago-in-supercontinent-breakup)

[www.livescience.com/planet-earth/geology/world-s-largest-iron-ore-deposits-formed-over-1-billion-years-ago-in-supercontinent-breakup](https://www.livescience.com/planet-earth/geology/world-s-largest-iron-ore-deposits-formed-over-1-billion-years-ago-in-supercontinent-breakup)



## Large, Exceptional Gem Diamonds Formed from Metallic Liquid Inside Earth's Mantle



World's biggest and most-valuable diamonds like the Cullinan, Constellation, and Koh-i-Noor formed in deep mantle metallic liquid

To date, researchers have puzzled over the origin of large diamonds like the famous **Cullinan Diamond**, discovered in South Africa in 1905; the **Koh-i-Noor**, found in India in the 13th century; or the widely publicized **Lesedi La Rona** stone, uncovered in Botswana in 2015. Historically, research into such diamonds has been nearly impossible due to the high value of the jewels and the fact that they rarely contain inclusions that might shed light on their geological origin. *"Some of the world's largest and*

*most valuable diamonds exhibit a distinct set of physical characteristics that have led many to regard them as separate from other, more common diamonds,"* said study senior author Dr. Wuyi Wang, director of research and development at the Gemological Institute of America. *"However, exactly how these diamonds form and what they tell us about the Earth has remained a mystery until now."* Dr. Wang and co-authors studied large gem diamonds by examining their so-called 'offcuts,' which are the pieces left over after the gem's facets are cut for maximum sparkle. The researchers determined that these diamonds sometimes have tiny metallic grains trapped inside them. In addition to the metallic inclusions, some of these exceptional diamonds contain mineral inclusions that show the diamonds formed at extreme depths, likely within 224-466 miles in the convecting mantle. This is much deeper than most other gem diamonds, which form in the lower part of continental tectonic plates at depths of 93-124 miles. *"This new understanding of these large diamonds resolves one of the major enigmas in the study of diamond formation, how the world's largest and most valuable diamonds formed,"* said study first author Dr. Evan Smith, also from the Gemological Institute of America. *"The composition of the inclusions, however, provides the story."* The metallic inclusions are a solidified mixture of iron, nickel, carbon and sulfur, also containing traces of fluid methane and hydrogen in the thin tiny space between the metallic phases and the encasing diamond. Pure carbon crystallized in this mix of molten metallic liquid in Earth's deep mantle to form diamonds. Small droplets of this metallic liquid were occasionally trapped within the diamonds as they grew. During cutting and polishing, parts of the diamond that contain inclusions are often cut off or polished away to craft exquisite polished gems with minimal flaws. *"Previous experiments and theory predicted for many years that parts of the deep mantle below about 155 miles contain small amounts of metallic iron and have limited available oxygen,"* Dr. Smith said. *"Now, the metallic inclusions and their surrounding methane and hydrogen jackets in these diamonds provide consistent, systematic physical evidence to support this prediction."* The results are also important for understanding how volatile substances like carbon might cycle through Earth's interior over time.

<https://www.sci.news/geology/diamonds-metallic-liquid-earths-mantle-04459.html>

# “Bill’s Big Bus Boogie” 2024

## Calkins Nature Area Museum & The Grotto of the Redemption

The 2024 edition of “Bill’s Big Bus Boogie” on Saturday, October 5 will take CVRMS members on two of the Iowa’s best *Rock Hound* attractions. First we will visit the Calkins Natural Area just east of Alden in Hamilton County and tour their exceptional Museum. Then, we will travel down the road to West Bend in Palo Alto County to visit the spectacular Grotto of the Redemp-



Calkins Nature Area Museum



**Deadline for Signing Up for Trip September 27**



Grotto of the Redemption

**Itinerary for Big Bus Boogie- 2024 Saturday October 5**

We will be riding on a 56 passenger bus

**6:30 am** Depart Cedar Valley World Travel (2602 29<sup>th</sup> St SW, CR)

**8:00 am** Arrive at Calkins Nature Area near Alden

**9:00 am** Program on Archaeology; *Iowa natives and artifacts*  
Tour Museum and other attractions

**11:00 am** Depart Calkins Nature Area and proceed to West Bend

**SACK LUNCH ON BUS**

**12:30 pm** Arrive at Grotto of the Redemption in West Bend  
Tour Grotto and Saints Peter and Paul Church

**2:30-3:00 pm** Depart West Bend and head for Cedar Rapids

**6:00 pm** Arrive at Cedar Valley World Travel

**You must sign up for the bus trip.** Signup sheets will be available at the August picnic and at the September regular meeting. If you cannot sign up at one of these events you **MUST** email Director Bill Desmarais at ([desmarais\\_3@msn.com](mailto:desmarais_3@msn.com)) with the names and contact information of phone number and email address for each person you sign up. Director Desmarais will not accept sign up by phone.

***It will be another great and memorable “Bill’s Big Bus Boogie” field trip!***

**Bill’s Big Bus Boogie 2024**  
will leave from Cedar Valley World Travel;  
6100 7th St. SW, Cedar Rapids  
Sat. Oct. 5 - **6:30 a.m. SHARP** and return ~6:00 p.m.  
**monitored parking available**



**The Bus will NOT stop for lunch, so bring a sack lunch !**







Cedar Valley Rocks & Minerals Society holds an annual 2-day consignment auction in September at the Amana RV Park. **The 2024 Auction will be held Saturday and Sunday, Sep 21-22.** The purpose of the auction is to help collectors or families of collectors dispose of their collections. Knowledgeable club members act as auctioneers. Since the auctioneers are also collectors, they bid openly on material that interests them. Auctions typically attract about 100 bidders and are limited to 800 lots for a 1-day auction and 1200 lots for a 2-day auction. Viewing is from 5:00-7:30 Friday night, at 7:30 Saturday morning and 8:00 Sunday morning. The 1st day runs from 9:00 a.m. to about 8:00 p.m. with hot food available during the day and a dinner offered from 5:30 to 6:00 p.m. The 2nd day runs from 9:00 a.m. to about 3:30 p.m., again with hot food available. Cash, credit card (with small service fee) or good check is accepted for payment. Iowa sales tax of 7% is also added to all items. Bidders who provide Iowa tax permits are exempt from paying it. If you can't stay for those special lots you want, you can leave a maximum bid, and a club member will bid for you up to your maximum. Motel rooms are available in Amana, but they are sometimes sold out. Motels are also available in Little Amana (15 minutes away), Cedar Rapids, & Iowa City (each about 25 minutes away, although motel rooms are scarce in Iowa City on home football weekends). Since each sale has multiple consigners, the sale rotates among the consigners. All lots are numbered, and an order of sale is available at viewing on Saturday morning. Equipment sells at 2:00 on Saturday. If you have a collection to dispose of, please contact Marv Houg ([m\\_houg@yahoo.com](mailto:m_houg@yahoo.com)) or Sharon Sonnleitner ([sonnb@aol.com](mailto:sonnb@aol.com)). The club does all the advertising and sets up the Friday before the auction. A 25% commission is charged for non-members, and 20% is charged for members or families of members who have belonged to the club for at least 2 years. As the date of the auction draws closer images of many of the items to be auctioned will be featured on the club website and the CVRMS Facebook page (<https://www.facebook.com/groups/Cedarvalleyrocks/>).



Images from the previous CVRMS Auction

Ray Anderson, Editor  
2155 Prairie du Chien Rd. NE



Next Meeting:  
**TUESDAY SEPT. 17**  
**Hiawatha Community Center**  
**“Solar, Lunar, and Other Eclipses; the**  
**History, Science and Discoveries**  
**Connected to Them”**  
by **Rick Austin**  
Cedar Valley Rocks and Minerals Society

CEDAR VALLEY GEMS

SEPTEMBER 2024

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## 2024 & 2025 Officers, Directors, and Committee Chairs

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Webmaster .....	Sharon Sonnleitner ( <a href="mailto:sonnb@aol.com">sonnb@aol.com</a> ).....	310-0085

Club meetings are held the 3rd Tuesday of each month from September through November and from January through May at 7:15 p.m. Meetings are held at the Hiawatha Community Center in the Hiawatha City Hall, [101 Emmons St., Hiawatha IA](https://www.google.com/maps/place/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:**

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

CVRMS website:  
[cedarvalleyrockclub.org](https://cedarvalleyrockclub.org)