Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS | MARCH 2021 | VOL. 47, ISSUE 03

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

Next CVRMS Meeting
Tues. March 16
7:15 pm

<<VIRTUAL MEETING>>

Join the Zoom Meeting
https://us02web.zoom.us/j/85715517714

featured speaker

Jim Preslicka

Cedar Valley Rocks & Minerals Society

"Report on the Fauna from the Brooks Hardground Bed of Independence, IA"

A horizon yielding abundant molluscan fossils near the base of Solon Member (Little Cedar Formation/Middle Devonian) was discovered in 2007 by members of the Black Hawk Gem & Mineral Society (BHGMS) at the Brooks Quarry in Independence, Iowa. This bed produces an unusually diverse fauna of cephalopods and bivalves, as well as placoderm arthrodire fish plates, along with other more typical Devonian fossils such as corals, gastropods, brachiopods, trilobites, & bryozoans. Members of the BHGMS partnered with the University of Iowa Geoscience Repository to systematically recover specimens from this locality and donate a large collection of them to the UI for further study. This report will summarize some of the more important/rare finds, as well as some of the stratigraphy & geology seen in the Brooks Quarry exposures.

Geologists Discover Bacteria That Turns Small Bits of Gold Into Solid Nuggets

Geologists have discovered bacteria on a patch of earth in regional Queensland that takes natural traces of gold and turns them into nuggets. Special "**nugget-producing" bacteria** may hold the key to more efficient processing of gold ore, mine tailings and recycled electronics, as well as aid in exploration for new deposits. For more than 10 years, University of Adelaide researchers have been investigating the role of microorganisms in gold transformation. In the Earth's surface, gold can be dissolved, dispersed and reconcentrated into nuggets. This epic "*journey*" is called the biogeochemical cycle of gold. Now they have shown for the first time, just how long this biogeochemical cycle takes and they hope to make it even faster in the future. In the natural environment, primary gold makes its way into soils, sediments and waterways through biogeochemical weathering and eventually ends up in the ocean. On the way bacteria can dissolve and re-concentrate gold – this process removes most of the silver and forms gold nuggets. Scientists have known that this process takes place, but for the first time they've been able to show that this transformation takes place in just years to decades – that's a blink of an eye in terms of geological time. These surprising results may lead the way for many interesting applications such as optimizing the processes for gold extraction from ore and re-processing old tailings or recycled electronics, which isn't currently economically viable. Researchers analyzed numerous gold grains collected from West Coast Creek using high-resolution electron-microscopy. Published in the journal *Chemical Geology,* they showed that five "episodes'" of gold biogeochemical cycling had occurred on each gold grain. Each episode was estimated to take between 3.5 and 11.7 years – a total of under 18 to almost 60 years to form the secondary gold. The scientists say that initial attempts to speed up these reactions are looking promising. The researchers say that this new understanding of the gold biogeochemical process and transformation may also help verify the authenticity of archaeological gold artifacts and distinguish them from fraudulent copies. http://www.geologyin.com/2018/04/geologists-discover-bacteria-that-turns.html

CVRMS Feb. 16 Virtual Meeting

7:22 p.m. **THE MEETING WAS CALLED TO ORDER** by Marv Hoag via Zoom. 17 participants.

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

TREASURE'S REPORT: Dale reported Checking account balance $1849.00. Contract for Hawkeye Downs November show signed. Motion to approve by Ray, 2nd by Jay. Motion passed.

PROGRAM: by Dr. John Hill (Central Iowa Club) presentation on **Tucson shows and pietra dure** (*Italian for hard rock)*. Very enjoyable and we will watch the thrift stores and auctions for some finds. Learned something new and lots of questions. Thank you!

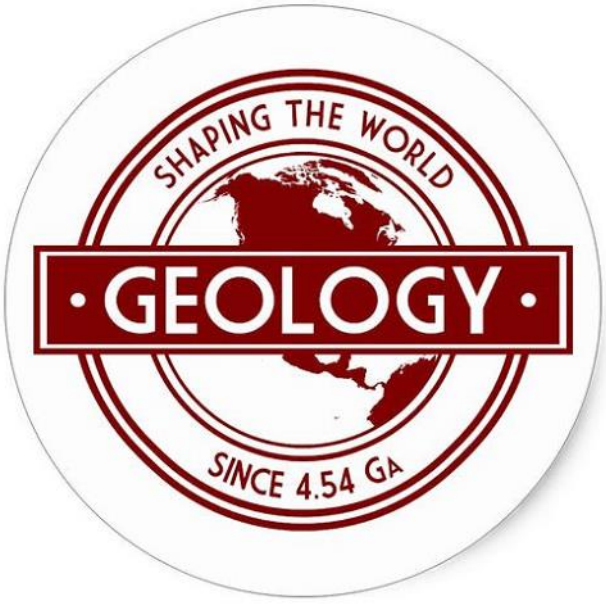
AUCTION: Still set for September 18, and maybe 19. Marv thinks that we have enough for two days.

CRINOIDS AS STATE FOSSIL: Legislation is still in process. Ray will look into getting in touch with our contact.

RIVER PRODUCTS DISPLAY: still needs our attention and more at Board meeting.

9:08 MOTION TO ADJURN: by AJ; 2nd by Ray. Meeting adjourned.

Respectfully Submitted,
Dell James, Secretary



CVRMS Board Minutes Feb 23

7:10 P.M. THE MEETING CALLED TO ORDER by Marv, President, via Zoom.

MEMBERS PRESENT: Ray Anderson, Sharon Sonnleitner, Marv Houg, Dale Stout, Bill Desmarais, Dell James, Toby Jordan, Jay Vavra Other members present AJ Johnson

MINUTES reviewed as published. Motion to approve by Ray, 2nd by Jay. Minutes approved. Treasurer's report by Dale. Nothing has changed from last report at membership meeting.

AUCTION: Discussion regrading the number of lots already lined up. Between 1000 and 1200. It will be a two-day auction for sure. There are still some potential contributors who have not responded. Jay will send out a reminder notice.

FOOD. Dale will talk to some Kalona Food trucks that he knows. Our contract does not allow us to sell food unless we are licensed, etc.

ADVERTISING: Dell will handle Collectors Journal. Dale will get all the free advertising he can. Kim will handle Facebook and other social media. Security: AJ and Bill will handle.

VAST: We need to get the flyers out in the summer so they can get into the kits. There should be 2 separate flyers one for the show in March and one for November show. Dale will get to the Boy sScouts and any other places where we can post them.

SHOW: Our annual show is set for November 6-7, 2021. The status of the gem sluice is unknown at this time.

DEALERS: One dealer has retired. Dale made a motion to invite Eugene Fletcher with his 3D printer and his objects he has created to be an exhibitor. Second by Sharon. Motion approved. Dell will let him know.

THEME FOR NEXT SHOW: Since the March show is so close, we must plan on a theme. Various ideas were tossed around. Jay mentioned sphalerite or marcasite. New fossil discoveries, famous discoveries. We will bring it up to the club membership to see if they have any ideas.

OLD BUSINESS Ray reported on the crinoid and it has not been drafted into a bill yet. Dale still working on 501C.

Respectfully submitted,
Dell James, Secretary

Martian Mineral, Rare on Earth, Found Locked in Antarctic Ice

Scientists boring more than a mile deep into Antarctic ice have unearthed a mineral that's rarely seen on Earth but found in abundance on Mars. An international team of researchers has found evidence of the mineral **jarosite** [$KFe_3(SO_4)_2(OH)_6$] in ice cores extracted from Antarctica. In their paper published in the journal *Nature Communications*, the researchers describe how the discovery came about and why they believe it could bolster theories regarding the presence of the same mineral on the surface of Mars. Jarosite is very rarely found on Earth—it is generally seen in mining waste that has been exposed to air and rain. The researchers with this new effort were not looking for it in their ice cores—they were focused on minerals in deep ice cores that might help to better understand ice age cycles. But when they came across the yellow-brown mineral, their interest was piqued. X-ray absorption testing and electron microscopy showed it be jarosite. The researchers suggest the mineral formed in ice pockets that also held small amounts of dust. Under the ice, they had eroded, the researchers noted. The finding brought to mind another site where jarosite is found—the surface of Mars. It was found there by the Opportunity rover back in 2004 and has been found to be abundant. Finding jarosite on Mars created a lot of excitement at NASA and around the world, because prior research had shown that water must be present for jarosite formation. The discovery of jarosite on Mars led scientists to come up with theories to explain how it might have originated. Some suggested it might have been left behind as salty water evaporated. Others suggested that Mars might have been covered by a massive ice blanket billons of years ago. They further suggested that jarosite could have formed in ice pockets. That would have been possible, they noted, if the ice blanket grew slowly with dust blowing onto it. At the time the theory was formulated, it was difficult to test because it had never been found to form that way anywhere else, including Earth. Now that jarosite has been found deep in Antarctic ice, the latter theory will likely become the most prominent. The researchers note that the theory still has one glitch—the ice in Antarctica contains very small amounts of jarosite—on Mars, the mineral is found in large slabs. The researchers suggest that the difference might be explained by the huge amounts of dust on the Martian surface.

http://www.geologyin.com/2021/01/mineral-often-found-on-mars-discovered.html

Spotlight Gemstone: Aquamarine

Aquamarine, the blue variety of the mineral Beryl and birthstone of March, is a rich, medium to dark-blue colored stone produced in Brazil, Madagascar, Russia, and the USA, and it has long been a symbol of youth, health and hope. Recently, aquamarine from China and Columbia has come on the market, but it is generally a little bit more yellow. Aquamarine is a highly sought-after semi-precious gem, which for centuries has been used in the creation and encrustation of jewelry and everyday items. Sailors of legend believed that mermaids' tails were made of Aquamarine. The lucky stone was thought to protect the sailors from drowning and ensure their safe return. The gem was believed to aid in digestion, and Roman physicians would employ Aquamarine to treat overeating and reduction of body fluid retention. Aquamarine was thought to possess the ability to reawaken the love in married couples. Roman legend also tells that it absorbs the atmosphere of young love; '*When blessed and worn, it joins in love, and does great things.*' It is also considered an appropriate gift for a groom to give to his bride following the consummation of their marriage. To the Sumerians, Egyptians, and Hebrews, Aquamarine was the symbol of happiness and everlasting youth. Legend says that you should place your Aquamarine under a full moon, to help restore its look and renew its energy. Aquamarine colors range from very light blue all the way through to a deeply saturated Ocean blue. The best color is often called Santa Maria Blue and recently there has been a new find in Madagascar called Double Blue. The name Aquamarine comes from the Latin words 'aqua' (Water) and 'marina' (Sea). The largest stone ever found is from Minas Gerais, Brazil; It weighed 242 pounds and measured 19 inches x 17 inches. The largest cut Aquamarine is the ***Dom Pedro*** which now sits in the Smithsonian Institute. It finished weighing in at 10,363 cts and measured 14 x 4 inches.

https://www.gemrockauctions.com/learn/a-z-of-gemstones/aquamarine-information-the-blue-bery

What in the World?

What in the World? Is this unusual landscape and where can it be found??

February's Photo

Last month's "*What in the World*" photo showed a life-size model of a Great White Shark swimming between the fossil jaws of its ancestor, the giant Megaladon Shark. Megaladons reached lengths of 50-60 feet (about the size of a school bus and lived during the Early Miocene to Pliocene (~36 to 2.6 million years ago) and were the top predator of their age.

ROCK CALENDAR
CVRMS EVENTS OF INTEREST
2021

Mar. 5 — Central Iowa Mineral Society
MONTHLY VIRTUAL MEETING - 7:30 pm
speaker Ray Anderson
"Not of the World; 9 meteorites in Iowa's history"

Mar 9 — Blackhawk Gem & Min. Soc.
MONTHLY VIRTUAL MEETING - 7:15pm
https://us02web.zoom.us/j/86898422650
speaker Ray Anderson
"The Crinoid; Iowa's State Fossil ??"

Mar. 10 — M.A.P.S. Monthly Meeting
MONTHLY VIRTUAL MEETING
speaker Colin Sumrall
"A new look at Mississippian brittle star diversity"

Mar. 16 — CVRMS Monthly Meeting
MONTHLY VIRTUAL MEETING - 7:15 pm
https://us02web.zoom.us/j/85715517714
speaker Jim Preslicka
"Report on the Fauna from the Brooks Hardground Bed of Independence, IA"
More details on Page 1

Mar 22 — 3 Rock Clubs Monthly Program
MONTHLY VIRTUAL PROGRAM - 7:15 pm
https://us02web.zoom.us/j/82936114830
speaker Dr. Chad Heinzel, UNI
Geology and Natural History of Ireland
with similarities to Iowa

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

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

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

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

more details to follow

Ask a Geologist

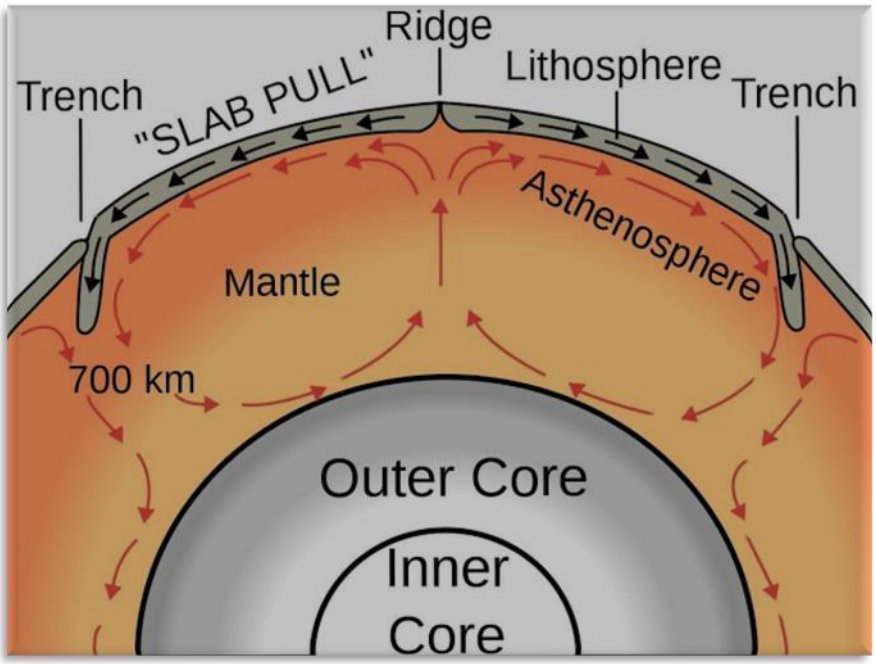
by Ray Anderson aka "Rock Doc", CVRMS Vice President

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

Plate Tectonics is the Earth process that moves giant pieces (plates) of the crust around, moving some away from one another at spreading ridges, sinking some into the mantle at subduction zones, crashing others into one another and pushing up great mountain ranges, and just sliding some past one another. People who are learning about plate tectonics usually ask "*what powers these plate movements.*" There seems to be two schools of thought about the driving forces, that are generally characterized as **slab push** and **slab pull**. The slab push model is driven by the large convection cells that form in the mantle where mantle material is pushed down towards the core by the dense subducting ocean crust and mantle materials flow upward to fill in the voids where the plate moves away at the spreading ridges. The slab pull model is powered by the sinking of the cold, dense leading edge of the plate pulling the entire slab along with it. A recent article describes a French computer modeling experiment that suggests both mechanisms might be at play.

What Makes Earth's Surface Move?

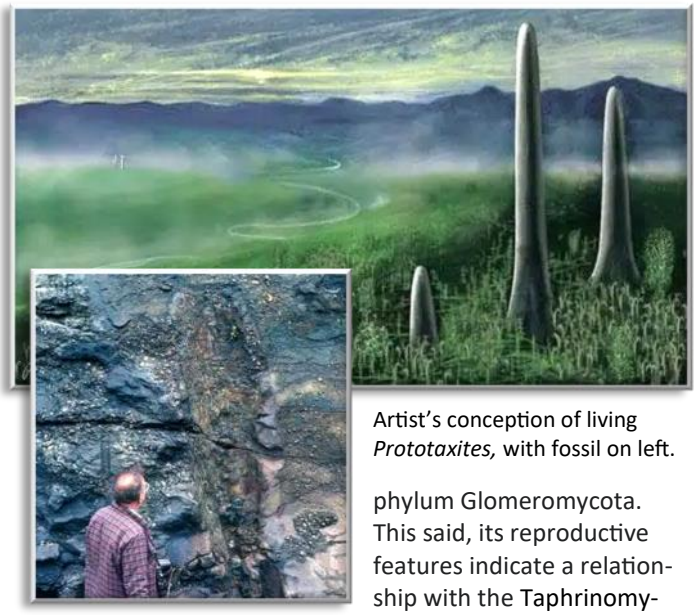
Do tectonic plates move because of motion in the Earth's mantle, or is the mantle driven by the movement of the plates? Or could it be that this question is ill-posed? This is the point of view adopted by scientists at the École Normale Supérieure -- PSL, the CNRS (the French National Centre for Scientific Research) who regard the plates and the mantle as belonging to a single system. According to their simulations, published in Science Advances, it is mainly the surface that drives the mantle, although the dynamic balance between the two changes over supercontinent cycles. Which forces drive tectonic plates? This has remained an open question ever since the advent of plate tectonic theory 50 years ago. Do the cold edges of plates slowly sinking into the Earth's mantle at subduction zones (**slab pull**) cause the motion observed at the Earth's surface? Or alternatively, does the mantle, with its convection currents, (**slab push**) drive the plates? For geologists, this is rather like the problem of the chicken and the egg: the mantle apparently causes the plates to move, while they in turn drive the mantle. To shed light on the forces at work, scientists from the Geology Laboratory of the École Normale Supérieure and collaborators treated the solid Earth as a single indivisible system and carried out the most comprehensive modelling to date of the evolution of a fictional planet very similar to the Earth. The scientists first had to find the appropriate parameters, and then spend some nine months solving a set of equations with a supercomputer, reconstructing the evolution of the planet over a period of 1.5 billion years. Using this model, the team showed that two thirds of the Earth's surface moves faster than the underlying mantle, in other words it is the surface that drags the interior (slab pull), while the roles are reversed (slab push) for the remaining third. This balance of forces changes over geological time, especially for the continents. The latter are mainly dragged by deep motion within the mantle during the construction phases of a supercontinent, as in the ongoing collision between India and Asia: in such cases, the motion observed at the surface can provide information about the dynamics of the deep mantle. Conversely, when a supercontinent breaks up, the motion is mainly driven by that of the plates as they sink down into the mantle. The computation contains a wealth of data that remains largely unexploited. The data obtained could help us to understand how mid-ocean ridges form and disappear, how subduction is triggered, or what determines the location of the plumes that cause vast volcanic outpourings.



http://www.geologyin.com/2019/11/what-makes-earths-surface-move.html?

Prototaxites: The Giant Fungi On The Ordovician Landscape

Prototaxites **(*proʊtoʊˈtæksɪˌti:z*)** is a genus of terrestrial fossil fungi dating from the Middle Ordovician until the Late Devonian periods, approximately 470 to 360 million years ago. *Prototaxites* formed small to large trunk-like structures up to 3 feet wide, reaching 26 feet in height, made up of interwoven tubes around 50 micrometers (0.0020 in) in diameter, making it by far the largest land-dwelling organism of its time. While it is traditionally very difficult to assign to an extant group of organisms, current opinion suggests a fungal placement for the genus. Recent discovery of what are likely algal symbionts would make it a lichen, rather than solely a fungus. Lichens are classified with the fungal not the algal component, and the main tubular cells of *Prototaxies* are most like those of the fungal



Artist's conception of living *Prototaxites,* with fossil on left.

phylum Glomeromycota. This said, its reproductive features indicate a relationship with the Taphrinomycotina fungi. *Prototaxites* fossils are remnants of by far the largest organism discovered from the period of its existence. Viewed from afar, the fossils take the form of tree-trunks, spreading slightly near their base in a fashion that suggests a connection to unpreserved root-like structures. Infilled casts which may represent the spaces formerly occupied by "*roots*" of *Prototaxites* are common in early Devonian strata. Concentric growth rings, sometimes containing embedded plant material, suggest that the organism grew sporadically by the addition of external layers. It is probable that the preserved "*trunks*" represent the fruiting body, or "*sporophore,*" of a fungus, which would have been fueled by a mycelium, a net of dispersed filaments. This organism would have been the **tallest living thing in its day by far**; the plant *Cooksonia* only reached 3 feet, and itself towered over the "*moss forests;"* invertebrates were the only other land-dwelling multi-cellular life. https://www.newscientist.com/article/dn11701-mystery-prehistoric-fossil-verified-as-giant-fungus/

Thai Fisherman Finds Rare Orange Pearl Worth $330k

It's rare enough to find a pearl in a shell, so to happen upon an extraordinary orange pearl — **worth more than $330,000** — was like winning the lottery for one Thai fisherman. Brothers Hatchai Niyomdecha, 37, and Worachat Niyomdecha, 35, were walking the shore of Nakhon Si Thammarat in the Gulf of Thailand on Jan. 27 when they spotted an abandoned buoy, dotted with shellfish, according to Viral Press. The siblings plucked three snails from the apparatus with plans to have them for a snack. But what their father

The pearl is about the width of a dime and weighs 7.68 grams.

Bangmad Niyomdecha, 60, found while cleaning the shells was worth much more than fresh escargot. The tangerine-hued pearl, which is about the width of a dime and weighs 7.68 grams, was found in the Melo melo sea snail, as opposed to typical oyster pearls. These exceedingly rare pearls, formed in a gastropod native to Asian waters, can be found in shades from tan or brown to the more coveted orange color, and take many more years to form than standard pearls. Hatchai, whose family hails from an impoverished fishing community, believes it may have been destiny that led him to the treasure. *"An old man in white with a long mustache told me to come to the beach so I can receive a gift. I think he led me to finding the pearl,"* he said of a dream he had just days before the discovery. *"I want to sell the pearl for the highest price,"* he told Viral Press. *"The money won't just change my life, it will change my destiny. My whole family will have better lives."* He was since approached by at least three buyers, two of whom low-balled the pearl's value. The family, including wife Worachat Niyomdecha, 35, and their two sons, is negotiating with a buyer from China who is allegedly offering **$10 million Baht (about $332,000)** following a live appraisal, scheduled for later this month. http://www.geologyin.com/2021/02/thai-fisherman-finds-rare-orange-pearl.html?

In a feat right at the limits of our scientific capabilities, an international team of geneticists has recovered and sequenced the oldest DNA to date. From the teeth of three ancient mammoths that roamed Siberia between 700,000 and 1.2 million years ago, the researchers extracted extremely degraded DNA, and pieced it back together to reveal a previously unknown genetic mammoth lineage. Previously, the oldest recovered DNA sample was from a horse bone found in the Yukon permafrost, dating back to between 560,000 and 780,000 years ago. "*This DNA is incredibly old,*" said evolutionary geneticist Love Dalén of the Centre for Palaeogenetics in Sweden. "*The samples are a thousand times older than Viking remains, and even pre-date the existence of humans and Neanderthals.*" Around a million years ago, even woolly mammoths (*Mammuthus primigenius*) didn't exist yet. The well-known and beloved beasts didn't start to emerge until around 800,000 years ago, living in Earth's frozen climates until they finally went extinct around 4,000 years ago. Because this is relatively recent, in geological time, and because they preferred cold habitats (which better preserve remains), we know a fair bit about these ancient creatures. Woolly mammoths existed alongside Columbian mammoths (*M. columbi*), which inhabited North America and died out around 11,500 years ago. Their predecessors, the mammoths that woolly mammoths evolved from, are less well known. We know that woolly mammoths are descended from steppe mammoths (*M. trogontherii*), which roamed over most of Eurasia up until about 200,000 years ago. We also thought that Columbian mammoths were descended from steppe mammoths that had crossed over into North America around 1.5 million years ago. In an attempt to learn more about this ancestor, the scientists turned mammoth genealogy on its head. The three mammoth teeth from which they extracted DNA were excavated decades ago, and had been carefully kept in a museum collection. The youngest, at 700,000 years old, belonged to a woolly mammoth - one of the earliest known. The older two, at over 1 million years old, were expected to belong to the steppe mammoth. Through painstaking restoration and comparative efforts, the researchers were able to piece together and sequence the DNA that had been preserved inside the hard enamel of the animals' teeth. The second-oldest of the three specimens, found in Adycha, bore this out: it was very close to steppe mammoth in morphology and DNA. The oldest specimen, found in Krestovka and dating from around 1.6 million years ago, was more surprising. It turned out to belong to a previously unknown genetic mammoth lineage that diverged from a common ancestor more than 2 million years ago. *"This came as a complete surprise to us,"* said geneticist Tom van der Valk of Uppsala University in Sweden. "*All previous studies have indicated that there was only one species of mammoth in Siberia at that point in time, called the steppe mammoth. But our DNA analyses now show that there were two different genetic lineages, which we here refer to as the Adycha mammoth and the Krestovka mammoth. We can't say for sure yet, but we think these may represent two different species.*" It gets even more interesting. By comparing the DNA of these ancient mammoths to those that came later, the researchers found it could have been the Krestovka mammoth that crossed the Bering Land Bridge into North America 1.5 million years ago, not the steppe mammoth. The Columbian mammoth's DNA has a mixture of Krestovka and woolly mammoth, suggesting that the two bred when woolly mammoths migrated to North America, producing a hybrid. *"This is an important discovery,"* said palaeogeneticist Patrícia Pečnerová of the University of Copenhagen in Denmark. "*It appears that the Columbian mammoth, one of the most iconic ice age species of North America, evolved through a hybridisation that took place approximately 420 thousand years ago.*" The Adycha mammoth, although more in line with expectations, also had some secrets to reveal. By comparing its genome to that of woolly mammoths from 700,000 to a few thousand years ago, the team sought to understand how the woolly mammoth became adapted to a frozen Arctic environment. The traits associated with that adaptation - genes associated with thermoregulation, hair growth, circadian rhythm, and white and brown fat deposits - were already present in the Adycha genome, well before the woolly mammoth emerged. But the animals continued to evolve, too; the gene involved in sensing temperature, for example, had more variants in later woolly mammoths. The team's techniques won't work for all remains. The cold temperature of the permafrost slows the degradation of DNA, so remains of a similar age from other locations would likely be too degraded; and, within the permafrost, there is a limit to how far back that DNA is recoverable. *"One of the big questions now is how far back in time we can go. We haven't reached the limit yet*," said molecular archaeologist Anders Götherström of the Centre for Palaeogenetics. *"An educated guess would be that we could recover DNA that is 2 million years old, and possibly go even as far back as 2.6 million. Before that, there was no permafrost where ancient DNA could have been preserved."* A lot of preserved creatures have been excavated from Earth's permafrost. The research demonstrates what remarkable discoveries may be lurking in bones previously considered too ancient to try to study. https://www.sciencealert.com/scientists-have-sequenced-mammoth-dna-that-s-over-a-million-years-old

Where Does All Earth's Gold Come From?

During the formation of Earth, molten iron sank to its center to make the core. This took with it the vast majority of the planet's precious metals -- such as gold and platinum. In fact, there are enough precious metals in the core to cover the entire surface of Earth with a **four-meter thick** layer. The removal of gold to the core should leave the outer portion of Earth bereft of bling. However, precious metals are tens to thousands of times more abundant in Earth's silicate mantle than anticipated. It has previously been argued that this serendipitous over-abundance results from a cataclysmic meteorite shower that hit Earth after the core formed. The full load of meteorite gold was thus added to the mantle alone and not lost to the deep interior. To test this theory, geologists from the Bristol Isotope Group in the School of Earth Sciences analyzed rocks from Greenland that are nearly four billion years old. These ancient rocks provide a unique window into the composition of our planet shortly after the formation of the core but before the proposed meteorite bombardment. The researchers determined the tungsten isotopic composition of these rocks. Tungsten is a very rare element (one gram of rock contains only about one ten-millionth of a gram of tungsten) and, like gold and other precious elements, it should have entered the core when it formed. Like most elements, tungsten is composed of several isotopes, atoms with the same chemical characteristics but slightly different masses. Isotopes provide robust fingerprints of the origin of material, and the addition of meteorites to Earth would leave a diagnostic mark on its tungsten isotope composition. Researchers observed a 15 parts per million decrease in the relative abundance of the isotope 182W between the Greenland and modern day rocks. This small but significant change is in excellent agreement with that required to explain the excess of accessible gold on Earth as the fortunate by-product of meteorite bombardment. Extracting tungsten from the rock samples and analyzing its isotopic composition to the precision required was extremely demanding given the small amount of tungsten available in rocks. In fact, this was the first laboratory that had successfully made such high-quality measurements. The impacting meteorites were stirred into Earth's mantle by gigantic convection processes. A tantalizing target for future work is to study how long this process took. Subsequently, geological processes formed the continents and concentrated the precious metals in the ore deposits which are mined today. This work shows that most of the precious metals on which world economies and many key industrial processes are based were added to our planet when the early Earth was hit by about 20 billion billion tons of asteroidal material. http://www.geologyin.com/2016/07/does-gold-come-from-outer-space.html

Stunningly Preserved 220-Million-Year-Old Dinosaur Footprint Discovered by 4-Year-Old

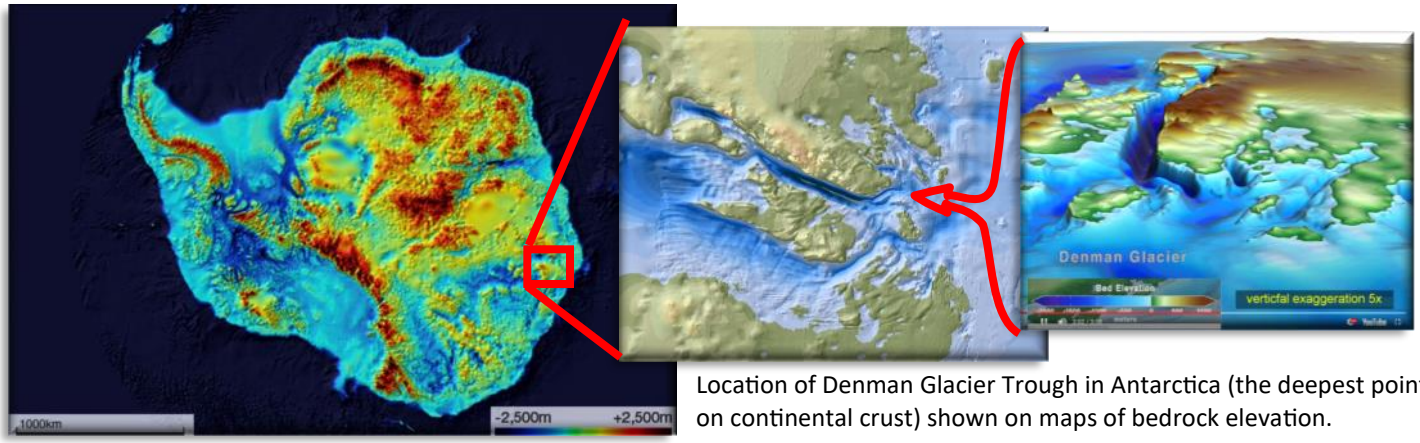
A four-year-old girl stunned paleontologists after she found a perfectly-preserved dinosaur footprint that dates back 220 million years. Lily Wilder made the discovery on January 23 while walking along a beach in South Wales with her father and dog. The family was on their way to the supermarket when Wilder saw the footprint imprinted on a rock. "*It was on a low rock, shoulder height for Lily, and she just spotted it and said, 'look, Daddy,' her mother, Sally Wilder, told NBC News. "She is really excited but doesn't quite grasp how amazing it is."* At first, the family thought the print, which is just over 4 inches long, was scratched out on the rock by an artist. But mother Sally was aware that similar footprints had been found along that piece of the coast before, so she posted about their discovery on social media. "*I found this fossil identification page on Facebook and I posted it on there and people went a bit crazy."* Shortly after, The National Museum of Wales was in touch with the Wilder family, and officials have since retrieved the print and put it in the museum. Experts believe the footprint was most likely left by a dinosaur that stood about 29.5 inches tall and about 8 feet long and walked on its two hind feet. It is impossible to identify exactly what type of dinosaur left it, although experts typically classify the print as a Grallator. Welsh scientists are calling the girl's discovery *"the finest impression of a 215 million-year-old dinosaur print found in Britain in a decade." "It's so perfect and absolutely pristine. It's a wonderful piece,"* said Karl-James Langford from *Archeology Cymru*. *"I would say it's internationally important and that is why the museum took it straight away. This is how important it is. I would say it's the best dinosaur footprint found in the UK in the past 10 years,"* he added. The family says their daughter's interest in dinosaurs has been ignited since the discovery and that she's been playing with a collection of dino toys and models. The National Museum in Cardiff, which is currently closed due to the COVID-19 pandemic, said that Lily and her classmates would be invited to the exhibition once it reopens. *"What's amazing is, if her name goes down as the finder in the museum, it could be her grandchildren going to visit that in the museum one day, and for years and years and generations to come, which is quite amazing,"* mother Sally said.

10-cm long print found near Bendricks Bay, south Wales, 30 January 2021. (Amgueddfa Cymru/National Museum of Wales)

https://www.sciencealert.com/perfectly-preserved-dinosaur-footprint-discovered-by-a-4-year-old

Deepest Point on Earth's Continents Found in Antarctica

A trough beneath Denman Glacier is the deepest continent point in the world, measuring more than 2 miles beneath sea level. A University of California, Irvine-led team of glaciologists has unveiled the most accurate portrait yet of the contours of the land beneath Antarctica's ice sheet and, by doing so, has helped identify which regions of the continent are going to be more, or less, vulnerable to future climate warming. Highly anticipated by the global cryosphere and environmental science communities, the newly released Antarctica topography map, **BedMachine**, and related findings were published today in the journal *Nature Geoscience*. Among the most striking results of the BedMachine project are the discovery of stabilizing ridges that protect the ice flowing across the Transantarctic Mountains; a bed geometry that increases the risk of rapid ice melting in the Thwaites and Pine Island glaciers

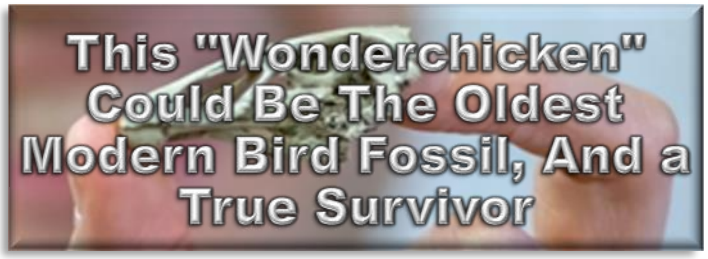


Location of Denman Glacier Trough in Antarctica (the deepest point on continental crust) shown on maps of bedrock elevation.

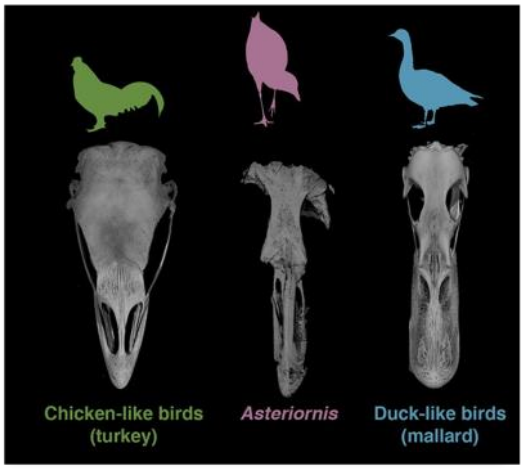
sector of West Antarctica. The bedrock under the Recovery and Support Force glaciers was hundreds of meters deeper than previously thought, making those ice sheets more susceptible to retreat. These data identified the world's deepest land canyon below Denman Glacier in East Antarctica. Lead author Mathieu Morlighem, UCI associate professor of Earth system science, noted that *"ultimately, BedMachine Antarctica presents a mixed picture: Ice streams in some areas are relatively well-protected by their underlying ground features, while others on retrograde beds are shown to be more at risk from potential marine ice sheet instability."* The new Antarctic bed topography product was constructed using ice thickness data from 19 different research institutes dating back to 1967, encompassing nearly a million line-miles of radar soundings. In addition, BedMachine's creators utilized ice shelf bathymetry measurements from NASA's Operation *IceBridge* campaigns, as well as ice flow velocity and seismic information, where available. Some of this same data has been employed in other topography mapping projects, yielding similar results when viewed broadly. *"Using BedMachine to zoom into particular sectors of Antarctica, you find essential details such as bumps and hollows beneath the ice that may accelerate, slow down or even stop the retreat of glaciers,"* Morlighem said. Previous Antarctica mapping methods relying on radar soundings have been generally effective, with some limitations. As aircraft fly in a straight line over a region, wing-mounted radar systems emit a signal that penetrates glaciers and ice sheets and bounces back from the point at which the ice meets solid ground. Glaciologists then use interpolation techniques to fill in the areas between the flight tracks, but this has proven to be an incomplete approach, especially with swiftly flowing glaciers. Alternatively, BedMachine relies on the fundamental physics-based method of mass conservation to discern what lies between the radar sounding lines, utilizing highly detailed information on ice flow motion that dictates how ice moves around the varied contours of the bed. This technique was instrumental in the research team's conclusion regarding the true depth of the Denman trough. "*Older maps suggested a shallower canyon, but that wasn't possible; something was missing,"* Morlighem said. *"With conservation of mass, by combining existing radar survey and ice motion data, we know how much ice fills the canyon -- which, by our calculations, is 3,500 meters below sea level, the deepest point on land. Since it's relatively narrow, it has to be deep to allow that much ice mass to reach the coast."* By basing its results on ice surface velocity in addition to ice thickness data from radar soundings, BedMachine is able to present a more accurate, high-resolution depiction of the bed topography. This methodology has been successfully employed in Greenland in recent years, transforming cryosphere researchers' understanding of ice dynamics, ocean circulation and the mechanisms of glacier retreat. Applying the same technique to Antarctica is especially challenging due to the continent's size and remoteness, but, Morlighem noted, BedMachine will help reduce the uncertainty in sea level rise projections from numerical models. He said that future bed topography mapping on land could be greatly enhanced by charting sea floor depth offshore and beneath floating ice, which is an area of active study right now. In the paper published today, Morlighem also suggests that the study of fast-flowing Antarctic ice sheets would benefit from soundings along flight tracks perpendicular to the flow direction, "*especially upstream of the Academy and Support Force glaciers, along the Gould Coast near the Ross Ice Shelf, and along the Wilhelm II Coast between the Denman and Lambert glaciers.*"

http://www.geologyin.com/2019/12/deepest-point-of-earths-continents.html

Researchers have discovered organic molecules trapped in incredibly ancient rock formations in Australia, revealing what they say is the first detailed evidence of early chemical ingredients that could have underpinned Earth's primeval microbial life-forms. The discovery, made in the *3.5-billion-year-old Dresser Formation* of Western Australia's Pilbara Craton, adds to a significant body of research pointing to ancient life in this part of the world – which represents one of only two pristine, exposed deposits of land on Earth dating back to the Archean Eon. In recent years, the hydrothermal rock of the Dresser Formation has turned up repeated signals of what looks to be the earliest known life on land, with scientists discovering "*definitive evidence*" of microbial bio signatures dating back to 3.5 billion years ago. Now, in a new study, researchers in Germany have identified traces of specific chemistry that could have enabled such primordial organisms to exist, finding biologically relevant organic molecules contained inside barite deposits, a mineral formed through various processes, including hydrothermal phenomena. *"In the field, the barites are directly associated with fossilized microbial mats, and they smell like rotten eggs when freshly scratched,"* explains geobiologist Helge Mißbach from the University of Cologne in Germany. *"Thus, we suspected that they contained organic material that might have served as nutrients for early microbial life."* While scientists have long hypothesized about how organic molecules could act as substrates for primeval microbes and their metabolic processes, direct evidence has to date proven largely elusive. To investigate, Mißbach and fellow researchers examined inclusions within barites from the Dresser Formation, with the chemically stable mineral capable of preserving fluids and gases inside the rock for billions of years. Using a range of techniques to analyses the barite samples – including gas chromatography-mass spectrometry, microthermometry, and stable isotope analysis, the researchers found what they describe as an "*intriguing diversity of organic molecules with known or inferred metabolic relevance.*" Among these were the organic compounds acetic acid and methanethiol, in addition to numerous gases, including hydrogen sulfide, that could have had biotic or abiotic origins. While it may be impossible to be sure of the precise links, the close proximity of these inclusions within the barite rock and adjacent organic accretions called stromatolites suggests that the ancient chemicals, once carried inside hydrothermal fluids, may have influenced primeval microbial communities. "Indeed, many compounds discovered in the barite-hosted fluid inclusions … would have provided ideal substrates for the sulfur-based and methanogenic microbes previously proposed as players in the Dresser environment," the researchers write in their study. In addition to chemicals that may have acted as nutrients or substrates, other compounds found within the inclusions may have served as 'building blocks' for various carbon-based chemical reactions – processes that could have kick-started microbial metabolism, by producing energy sources, such as lipids, that could be broken down by life-forms. "*In other words, essential ingredients of methyl thioacetate, a proposed critical agent in the emergence of life, were available in the Dresser environments,*" the team explains. *"They might have conveyed the building blocks for chemoautotrophic carbon fixation and, thus, anabolic uptake of carbon into biomass."*
http://www.geologyin.com/2021/02/researchers-find-ingredients-for.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+GeologyIn+%28Geology+IN%29



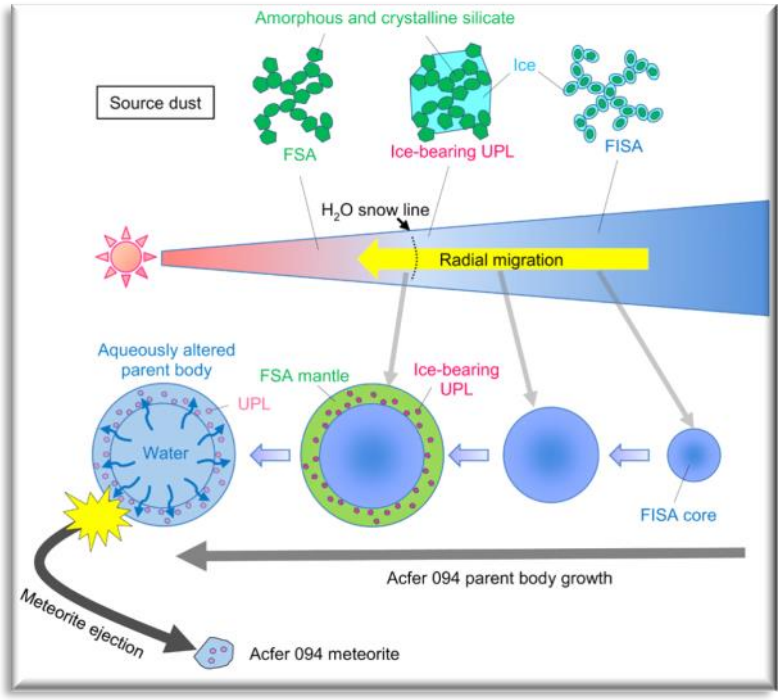
Back when fearsome dinosaurs roamed the land, an unimpressive avian, about the size of a very small duck, somehow survived alongside them - eking out a life along a prehistoric European seashore. It had the long slender legs of a shorebird, and a face like a chicken, according to the Cambridge University researchers, who found its ancient traces hidden away in rocks dug up at a Belgium quarry 20 years ago. *"The moment I first saw what was beneath the rock was the most exciting moment of my scientific career,"* said evolutionary paleobiologist Daniel Field. The skull and fragments of leg bones, revealed by CT scans, date as far back as **66.8 million years ago - the oldest evidence we have of a modern bird so far.** The researchers have named this newly discovered species *Asteriornis maastrichtensis*, after the Titan goddess of falling stars, Asteria. By analyzing the structures of the fossils, Field and colleagues found they had a combination of features now seen in modern waterfowl like ducks and landfowl like chickens and quails. This suggests *A. maastrichtensis* might be a common ancestor of both these groups. We've known for some time now that birds are descended from meat-eating dinosaurs called theropods, thanks to 'missing link' discoveries like 150 million-year-old *Archaeopteryx* - it had features such as teeth (like its dinosaur ancestors did), but also feathers and wrist bones shared by modern birds. But scientists don't know exactly when modern birds arose. When the asteroid fell from the sky, violently ending the Cretaceous period 66 million years ago, this slight "wonderchicken," or some of its relatives, must have managed to live on to produce the amazing spectrum of birds we know and love today. Meanwhile, its more dinosaurian neighbors - like the teethed *Icthyornis*-like bird ancestors found in the same quarry - did not. Previous research, which Field also worked on, suggests that small, non-arboreal birds not unlike *A. maastrichtensis* had an edge in a post-impact world stripped of trees. "*This is an incredibly informative specimen,*" Johns Hopkins University palaeontologist Amy Balanoff, who was not involved in the study, told *Science Magazine*. *"It gives us some clues about what characteristics were key in surviving that event."* https://www.sciencealert.com/oldest-modern-bird-fossil-holds-clues-to-how-birds-survived-when-other-dinosaurs-did-not



Comparison between skulls.

Scientists Discover "Ice Fossils" in a 4.6 Billion-Year-Old Meteorite

A 4.6 billion-year-old meteorite landed in Algeria in 1990, the remnant of a larger asteroid born during the dawn of our solar system. A 2019 analysis of the meteorite, called **Acfer 049**, revealed ***ice fossils*** trapped inside, making it the first direct evidence of frozen water as a building block of early asteroids. Given the meteorite's age, it also preserves material that created our solar system, providing a unique look at our corner of the universe and how it formed. Scientists know that it was possible for asteroids to include ice as an ingredient in their structure, mainly due to the way water altered minerals in the asteroids. But they wanted to understand more about the amount of water, its distribution throughout the asteroid structure, called a matrix, and when it melted. Acfer 049 preserved tiny pockets that once contained the ice before it melted and researchers call these microscopic holes ice fossils. Like other solar systems, ours began with the formation of a star. The sun formed from a cloud of dust and gas and the leftover materials not used to create the star became the ingredients for the planets in our solar system. Then gas and elements formed into a flat planetary disk around the sun and that included hydrogen, ice, iron and silicates. Over time, the dust and elements stuck together, forming planets and other bodies, including asteroids. This is why asteroids and comets are considered to be the leftovers of material that formed the solar system. Ice, which could be found beyond the snow line of the planetary disk (where solid water ice can form), was also included in the mix. The snow line existed in the disk at a distance from the star where its heat couldn't maintain liquid water. "*This is starting material from which all the planets, including Earth, came from,*" said Epifanio Vaccaro, author of an article on the ice fossils. *"The matrix of these meteorites is therefore thought to be the starting material from which all the planets formed."* The rocky bits of dust and ice that became asteroids retained a pristine record of the ingredients that created them. But the planets formed by rearranging their ingredients through heat, when metals melted to form the core while silicates created a mantle and crust. This means that rocks found on Earth are different than the material found in asteroids. "*When this happens, all the starting material that we had in the protoplanetary disk is gone as it went through the process of melting and recrystallisation,*" Epifanio said. *"This means that if we want to understand what the dust was like as the solar system formed, we need to go back and grab some of the material that didn't go through this differentiation process. In some meteorites, we have that starting material preserved."* While dust and ice doesn't sound like the solid foundation for a rocky asteroid, its matrix is tightly constructed because of how its materials came together. *"The matrix itself is very fine-grained material that holds everything in the meteorite together,"* Epifanio said. But the matrix itself made the meteorite difficult to study because they didn't have the technology to peer through the fine grains until recently. The researchers used microscopes with high spatial resolution, which allowed them to finally see the tiny pockets that once contained ice. These microscopes could be used to look at other meteorites and possibly find more evidence of ice fossils, the researchers said. "*Based on this finding of asteroidial ice, we made a model that tells us how the asteroid grew and how the planets formed,*" Epifanio said. *"We think that fluffy ice and dust particles came together into bigger bodies beyond the snow line, and then migrated inwards. As they did so, the ice started melting, leaving the fossils in its place."* http://www.geologyin.com/2019/11/scientists-discover-ice-fossils-in-46.html#:~:text=A%204.6%20billion%2Dyear%2Dold%20meteorite%20landed%20in%20Algeria%20in,building%20block%20of%20early%20asteroids.



Schematic illustration of the Acfer 094 parent body formation model. The parent body grew by agglomeration of fluffy source dust with and without ice through its radial migration from the outer to the inner regions of the solar nebula across the H_2O snow line. The process produced a layered structure inside the parent body, with an ice-rich core and an ice-poor mantle. Around the H_2O snow line, ice-bearing UPLs (ultraporous lithologies) were incorporated into the mantle. Then, the melting of ice, mainly in the core, induced an aqueous alteration in the parent body. The Acfer 094 meteorite was subsequently ejected from the mantle of the parent body by some destructive processes. Note that we did not describe organics, which might have existed in ice in FISA and ice-bearing UPLs to make it easier to understand. FSA might also have contained some refractory organic

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

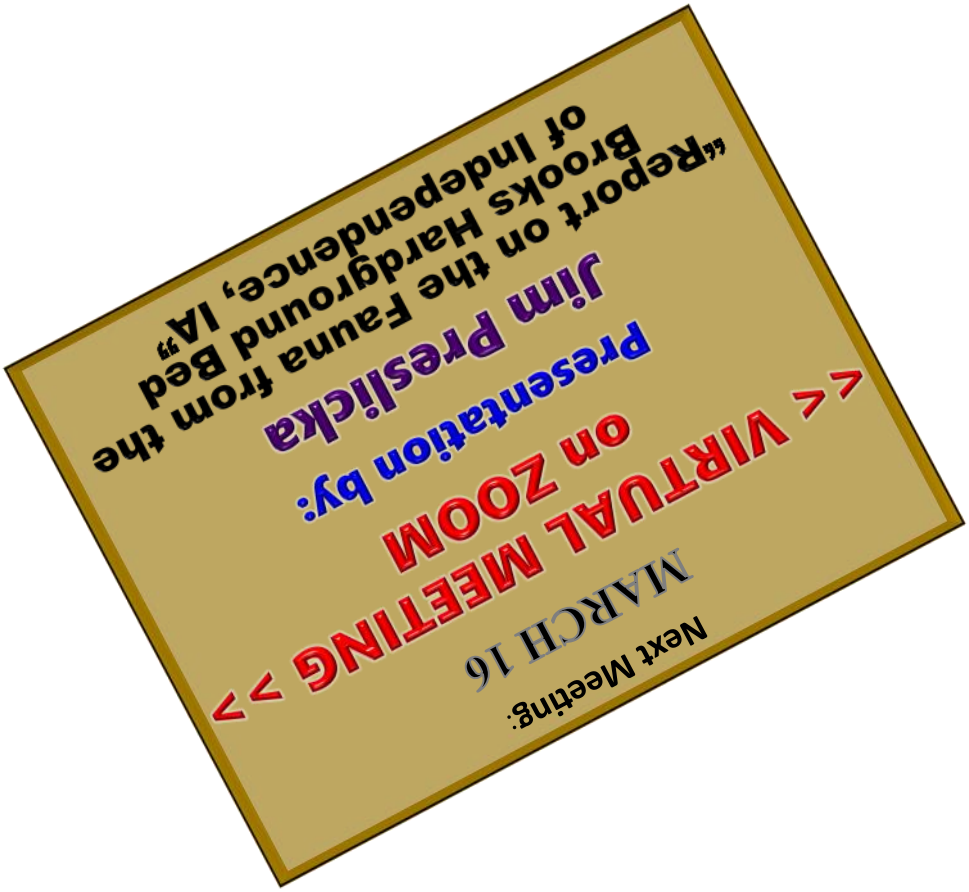
CEDAR VALLEY ROCKS & MINERAL SOCIETY

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

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

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

CVRMS website:
cedarvalleyrockclub.org



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