Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS **JANUARY 2024** **VOL. 50, ISSUE 01**

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

Next CVRMS Meeting
Tues. January 16
7:00 pm

Hiawatha Community Center

101 Emmons St., Hiawatha - 7:15 pm

featured presentation

Undergraduate Field and Research Experiences at the University of Iowa in 2023

by Professor Bill McClelland

U of IA Dept. of
Earth & Environmental Sciences

and 3 Geoscience Students

Three University of Iowa geoscience students will present short summaries of their field and research projects in Earth & Environmental Sciences. The students completed their field camp education in June 2023 with generous support from the CVRMS and then went on to projects varying from hydrology to sedimentology and structural geology. Also, Professor Bill McClelland will give a short presentation on geological mapping with undergraduate students in Alaska.

Dino Bones in Space!

Last year, David Willetts hit a sour note when he unveiled his vision of improving science education in Great Britain. *"The two best ways of getting young people into science"* the Minister of State for Universities and Science said, *"are space and dinosaurs. So that's what I intend to focus on."* Researchers, writers and science fans quickly jumped on the comment. And rightly so. Space and dinosaurs are popular, but they don't appeal to everyone. Not every child dreams of becoming an astronomer or paleontologist. But my favorite response to the British official's comments was the genesis of **#spacedino** on Twitter. If only spacedino were real, critics joked, we would have a perfect outreach tool. Who wouldn't love dinosaurs in space? What I didn't know at the time was that dinosaurs had already been beyond our planet. The first dinosaur to venture into space was a species that greatly influenced our understanding of dinosaur lives, the hadrosaur *Maiasaura peeblesorum*. This 76-million-year-old *"good mother lizard"* cared for its young in large nesting colonies, and small bits of bone and eggshell found at a nesting site were carried by astronaut Loren Acton during his brief mission to SpaceLab 2 in 1985. This was a glamorous time for the dinosaur; *Maiasaura* was made Montana's state dinosaur the same year. Dinosaurs didn't return to space until 1998. In January of that year, the shuttle *Endeavor* borrowed the skull of the small Triassic theropod *Coelophysis* from the Carnegie Museum of Natural History for its mission to the Mir space station. Like the remains of *Maiasaura* before it, the fossil skull was returned to earth after the mission was over. I guess I was wrong about spacedino. The simple combination of space and dinosaurs isn't very exciting at all. Dinosaurs on spacecraft amounts to nothing more than trivia. It was not as if the dinosaurs were going to be included in some kind of time capsule, like the Golden Record on the Voyager spacecraft, to teach whoever might eventually discover it about past life on our planet. Real space dinosaurs just can't compete with their science fiction counterparts.
https://www.smithsonianmag.com/science-nature/dinosaurs-in-space-3945429/

RARE DISCOVERY: FOSSIL FIND IS ONE OF A KIND FOR IOWA

Tyler McDonald keeps his eyes open for any unusual items when unloading rock onto buildings during roofing jobs. Little did the Sanborn, Iowa, roofer know he'd made not only an unusual, but a one-of-a-kind discovery, when he fished an odd-looking item from the rocks during a job back in 2015. *"I picked it up and looked at it a little. It looked like a bone,"* McDonald said. *"I just wanted to know what it was from."* He'd just found three fused vertebrae. At nearly 4 inches long, the fossil isn't that big, but its discovery is a pretty big deal. The vertebrae come from a mosasaur, a pre-historic marine reptile, and until McDonald's sharp eyes spotted them, a mosasaur fossil had never before been discovered in Iowa. *"I didn't expect to see something like that*," MacDonald said. His discovery eventually was brought to the attention of Morningside College associate anatomy professor Kurt Spearing, whose research during the past two years determined the fossil is indeed from a mosasaur. In October he presented his findings at the annual meeting of the Geological Society of America. "*If my assertion is correct that this is the first mosasaur discovered in Iowa, that would be significant in itself,"* said Spearing, whose research focus is paleontology. Thus far no one has challenged his claim, increasing the probability that the fossil, quarried from a gravel pit near Ashton in Osceola County, is the first evidence of mosasaurs found in Iowa. It makes sense, given that Northwest Iowa was on the edge of a large inland sea millions of years ago. When he first saw the fossil in 2021, it was obvious they were vertebrae. Doing comparisons, he quickly determined they likely were from a mosasaur, a large marine reptile that lived between 65 million and 99 million years ago. Not a dinosaur, a mosasaur is instead a marine reptile Spearing said that it looked like a lizard with a long skull and flippers instead of legs. It was considered an apex predator that would have eaten anything smaller than itself. The mosasaur vertebrae specimen has been donated to the University of Iowa Paleontology Repository and is on loan to Spearing for a year while he continues his research. Spearing said it's unlikely he'll be able to determine which species of mosasaur the fossil came from. But, its rounded edges have some experts thinking it could have gone through another animal's digestive system, theorizing the tail could have been bitten off and eaten by another prehistoric predator. Sediments could be scratched away from the fossil and analyzed to determine what type of rock it came from. *"There's almost always something you can try to find out,"* Spearing said. Fossil find in northwest Iowa is one of a kind (siouxcityjournal.com)

CVRMS Board Meeting Dec. 12 — Minutes —

MEETING CALLED TO ORDER: 7:15p.m. Marv called the meeting to order at his house. Members present included Marv, Dale, Kim, Bill, Matt, Ray, Jay, and Dell. Sharon was present via ZOOM.

MINUTES FOR LAST MEETING: Secretary's minutes reviewed as published. Motion to accept by Kim with second by Ray. Minutes approved as written.

TREASURER'S REPORT: The hat collection at the Holiday party totaled $850, to be divided between HACAP and Linn County food bank. **Matured cds** were cashed and renewed. Checking account balance is $11,547.80. Motion to approve treasurer's report by Ray, second by Bill. Report approved.

2024 ROCK SHOW-MARCH 23 & 24: The show will be upon us before we know it. The theme will be ***Coral: One of Iowa's Bedrock Fossils***. **Sharon reported** about the new dealers. With one remaining pending hearing back from a Des Moines flint knapper. **Raffle prizes** acquired so far include a geode, dinosaur package (books, bone, coprolite, and puzzle), Kim has a geode, we still need an amethyst cathedral (Marv will work on finding one). **Dell will do lunch** on Friday for the workers. **Pot luck on Friday** to thank the vendors. **Catered dinner on Saturday** from HyVee. Everyone is welcome.

2024 CVRMS AUCTION SEPTEMBER 21 & 22: List of consigners reviewed to keep the numbers down. Dale will contact the food truck owner about providing food on Saturday. Kim has lots of flats and more coming.

TAKO: Take **A K**id **O**utdoors program at Klein Quarry is scheduled for Saturday May 18, 2024 . CVRMS members will be assisting.

OLD BUSINESS: We ran out of hot food at the potluck Christmas party. Never has that happened before. Generally with the ability to chit-chat we were able to ignore the games. All in all a good party. **Name tags,** Dale has orders but has not ordered yet. **Field trip guidelines** that Kim has been working on were discussed. Lots of corrections and suggestions. Kim will email finished product to Board members.

NEW BUSINESS: Freeze Fest program in Cedar Rapids, Ray and Bill have signed up to show rocks and dinosaur fossils. We have two tables reserved. **Teacher Chamaine Snell** requested a speaker for her 4th grade to provide details on geology. Bill will handle.

MOTION TO ADJOURN by Bill second by Jay. Meeting adjourned at 8:30 p.m..

Respectfully submitted,
Dell James, Secretary

World's Oldest Known Wooden Structure Pre-Dates Our Species

Archaeologists in Zambia have uncovered a wooden structure dating back about **476,000 years to the Early Stone Age or Pleistocene Epoch**. It represents the earliest known use of wood in construction by human ancestors. The discovery at Kalambo Falls expands scientists' understanding of the technical abilities early hominins must have had in order to shape tree trunks into large combined structures. The findings are detailed in a study published September 20 in the journal *Nature*. The structure itself predates the evolution of our own species (*Homo sapiens*) by potentially over 120,000 years. Kalambo Falls is a 772-foot-tall waterfall that sits on the border of Zambia and Tanzania and is the second highest uninterrupted waterfall on the African continent. The wooden structure found there in 2019 includes two preserved interlocking logs joined side-to-side by an intentionally cut notch. The upper log appears to have been purposefully shaped and tool marks were found on both logs and a collection of wooden tools was also found. The find is the earliest known evidence of humans deliberately shaping two logs to fit together. The authors believe that the logs may have been used to build a raised platform, walkway, or the foundation for dwellings constructed in the region's periodically wet floodplain. Previous research has shown evidence that wood use at this time was limited to its use for digging, as spears, and in making fire. The other earliest example of a clearly modified wood object was collected in South Africa in 1952 and dates back to the Middle Stone Age. *"This find has changed how I think about our early ancestors. Forget the label 'Stone Age,' look at what these people were doing: they made something new, and large, from wood,"* study co-author and University of Liverpool archaeologist Larry Barham said in a statement. *"They used their intelligence, imagination, and skills to create something they'd never seen before, something that had never previously existed."* Additionally, the authors say that this discovery challenges the view that Stone Age humans were nomadic. Kalambo Falls would have provided them with a constant source of water, and the forest around them would have supplied enough wood to help them make more permanent or semi-permanent structures. The team used new luminescence dating techniques to reveal an object's age. It can estimate the last time that minerals in the sand surrounding the wood were exposed to sunlight. The analysis estimates that the artifact is close to half a million years old. The archaeological site Kalambo Falls was first excavated in the 1950s and 1960s, long before dating techniques could allow archaeologists to understand the significance of the findings. The area is currently on a tentative list to become a UNESCO World Heritage site due to its archaeological significance. [World's oldest known wooden structure found in Zambia | Popular Science (popsci.com)]

Spotlight Gemstones: Garnet

January's Birth Stone

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

What in the World?

What in the World is this beautiful rock and what was it thought to be for many years??

December's Photo

Last month's *What in the World* image is a sphere of **Pinolith** (also known as pinolite), a black and white metamorphic rock composed of dolomite, magnesite, and graphite. It is a graphite-pigmented dolomitic marble that contains small (mostly 0.2 to 0.8 inch) lath-shaped crystals of white to yellowish brown magnesite. Pinolith is used as an ornamental stone and as a gemstone.

ROCK CALENDAR
CVRMS EVENTS OF INTEREST

2024

Jan. 16 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Undergraduate Field and Research Experiences at the University of Iowa in 2023
by Professor Bill McClellend and students

Feb. 20 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program to be announced

Mar. 19 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program to be announced

Mar. 23-24 — CVRMS Rock Show
Hawkeye Downs, Cedar Rapids

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

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

June. 18 — CVRMS Monthly Meeting
Picnic (location to be announced)
Rock Show and Tell and Polishing

July. 16 — CVRMS Monthly Meeting
Picnic at Wanatee Park, Marion
Rock Show and Tell and Geode Cracking

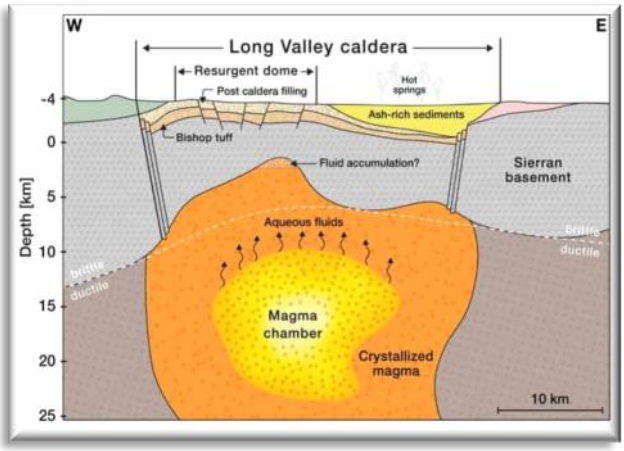
Ask a Geologist

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.

We are all familiar with the most famous "hot spot" in the U.S, Yellowstone, but a second-such supervolcano at Long Valley in California has been showing signs of activity lately. A recent article published in *Geology Page* says that this activity is apparently cooling off. So I thought I would pass this information on to you.

California Supervolcano is Cooling Off but May Still Cause Quakes



A diagram depicting the magma chamber beneath the Long Valley Caldera. The diagram was developed from tomographic imaging using seismic waves.

Since the 1980s, researchers have observed significant periods of unrest in a region of California's Eastern Sierra Nevada mountains characterized by swarms of earthquakes as well as the ground inflating and rising by almost half an inch per year during these periods. The activity is concerning because the area, called the **Long Valley Caldera**, sits atop a massive dormant supervolcano. Seven hundred and sixty thousand years ago, the Long Valley Caldera was formed in a violent eruption that sent 156 cubic miles of ash into the air (a volume that could cover the entire Los Angeles area in a layer of sediment 3,000 feet thick). What is behind the increased activity in the last few decades? Could it be that the area is preparing to erupt again? Or could the uptick in activity actually be a sign that the risk of a massive eruption is decreasing? To answer these questions, Caltech researchers have created the most detailed underground images to date of the Long Valley Caldera, reaching depths up to 6 miles within the Earth's crust. These high-resolution images reveal the structure of the earth beneath the caldera and show that the recent seismic activity is a result of fluids and gases being released as the area cools off and settles down. The work was conducted in the laboratory of Zhongwen Zhan, Professor of Geophysics. A paper describing the research appears in the journal Science Advances on October 18. *"We don't think the region is gearing up for another supervolcanic eruption, but the cooling process may release enough gas and liquid to cause earthquakes and small eruptions,"* says Zhan. *"For example, in May 1980, there were four magnitude 6 earthquakes in the region alone."* The high-resolution image shows that the volcano's magma chamber is covered by a hardened lid of crystallized rock, formed as the liquid magma cools down and solidifies. To create underground images, the researchers infer what the subsurface environment looks like by measuring seismic waves from earthquakes. Earthquakes generate two types of seismic waves: primary (P-waves) and secondary (S-waves). Both kinds of waves travel at different speeds through different materials (waves are slowed down by elastic materials like liquids but travel quickly through very rigid materials like rock). Using seismometers at various locations allows one to measure discrepancies in the timing of the waves and determine the characteristics of the materials (how elastic or rigid) they traveled through. In this way, researchers can create images of the subsurface environment. Though there are several dozen seismometers placed throughout the Eastern Sierra region, Zhan's technique utilizes fiber optic cables (like those that provide internet) to make seismic measurements in a process called distributed acoustic sensing (DAS). The 65 mile stretch of cable used to image the Long Valley Caldera was comparable to a stretch of 10,000 single-component seismometers. Over a year and a half, the team used the cable to measure more than 2,000 seismic events, most too small to be felt by people. A machine learning algorithm processed those measurements and developed the resulting image. This study is the first time that such deep, high-resolution images have been created with DAS. Previous images from local tomography studies have either been confined only to the shallow subsurface environment at depths of about 3 miles, or covered a larger area in lower resolution. *"This is one of the first demonstrations of how DAS can change our understanding of crustal dynamics,"* says Ettore Biondi, DAS scientist at Caltech and the paper's first author. *"We're excited to apply similar technology to other regions where we are curious about the subsurface environment."* Next, the team plans to use a 125 mile length of cable to image even deeper into the Earth's crust, to around 10 to 12 miles deep, where the caldera's magma chamber (its *"beating heart")* is cooling.

https://www.geologypage.com/2023/10/california-supervolcano-is-cooling-off-but-may-still-cause-quakes.html

The Remains of an Ancient Planet Lie Deep Within Earth

In the 1980s, geophysicists made a startling discovery: two continent-sized blobs of unusual material were found deep near the center of the Earth, one beneath the African continent and one beneath the Pacific Ocean. Each blob is twice the size of the Moon and likely composed of different proportions of elements than the mantle surrounding it. Where did these strange blobs (formally known as large low-velocity provinces or LLVPs) come from? A new study led by Caltech researchers suggests that they are remnants of an ancient planet that violently collided with Earth billions of years ago in the same giant impact that created our Moon. The study, published in the journal *Nature* on November 1, also proposes an answer to another planetary science mystery. Researchers have long hypothesized that the Moon was created in the aftermath of a giant impact between Earth and a smaller planet dubbed Theia, but no trace of Theia has ever been found in the asteroid belt or in meteorites. This new study suggests that most of Theia was absorbed into the young Earth, forming the LLVPs, while residual debris from the impact coalesced into the Moon. The research was led by Qian Yuan, O.K. Earl, Research Associate in Caltech's Seismological Laboratory. Scientists first discovered the LLVPs by measuring seismic waves traveling through the earth. Seismic waves travel at different speeds through different materials, and in the 1980s, the first hints emerged of large-scale three-dimensional variations deep within the structure of Earth. In the deepest mantle, the seismic wave pattern is dominated by the signatures of two large structures near the Earth's core that researchers believe possess an unusually high level of iron. This high iron content means the regions are denser than their surroundings, causing seismic waves passing through them to slow down and leading to the name "*large low velocity provinces.*" Yuan, a geophysicist by training, was attending a seminar about planet formation given by Mikhail Zolotov, a professor at Arizona State University, in 2019. Zolotov presented the giant-impact hypothesis. Zolotov added that no trace had been found of the impactor that must have collided with the Earth. Then Yuan had a 'eureka *moment'* and realized that the iron-rich impactor could have transformed into mantle blobs. He worked with multidisciplinary collaborators to model different scenarios for Theia's chemical composition and its impact with Earth. The simulations confirmed that the physics of the collision could have led to the formation of both the LLVPs and the Moon. Some of Theia's mantle could have become incorporated into the Earth's own, where it ultimately clumped and crystallized together to form the two distinct blobs detectable today at Earth's core-mantle boundary; other debris from the collision mixed together to form the Moon. Given such a violent impact, why did Theia's material clump into the two distinct blobs instead of mixing together with the rest of the forming planet? The researchers' simulations showed that much of the energy delivered by Theia's impact remained in the upper half of the mantle, leaving Earth's lower mantle cooler than estimated by earlier, lower-resolution impact models. Because the lower mantle was not totally melted by the impact, the blobs of iron-rich material from Theia stayed largely intact as they sifted down to the base of the mantle, like the colored masses of paraffin wax in a turned-off lava lamp. Had the lower mantle been hotter (that is, if it had received more energy from the impact), it would have mixed more thoroughly with the iron-rich material, like the colors in a stirred pot of paints. Their next steps will be to examine how the early presence of Theia's heterogeneous material deep within the earth might have influenced our planet's interior processes, such as plate tectonics. "*A logical consequence of the idea that the LLVPs are remnants of Theia is that they are very ancient,*" Yuan says. *"It makes sense, therefore, to investigate next what consequences they had for Earth's earliest evolution, such as the onset of subduction before conditions were suitable for modern-style plate tectonics, the formation of the first continents, and the origin of the very oldest surviving terrestrial minerals."* https://www.sciencedaily.com/releases/2023/11/231101134924.htm

Artist's impression of the Giant Impact Hypothesis of the formation of the Moon.

Complete Stegosaurus Fossil Found With Skin Still On in Northern China

One of the great dinosaur centers on Earth has produced another marvel, as a complete *Stegosaurus* skeleton with fossilized skin imprints has been unearthed in China. The animal was discovered in 2017 in the Fengning Manchu Autonomous County in Northern China's Hebei Province along with a primitive ancestor of Triceratops. Years of painstaking excavations revealed their nearly complete skeletons. The Stegosaur measures around 15 feet in length, and is so well preserved that a mineralization of its skin was created alongside its bones. *"The hard parts, such as bones and teeth of dinosaurs, are relatively easy to form fossils, but the soft parts, such as skin and muscle, are easy to rot, and the conditions for forming fossils are extremely harsh,"* explained Zhang Fucheng, a professor at the Institute of Geology and Paleontology of Linyi University who also leads the research team. Gou Ying, an associate professor at the institute, said that their paper on the discovery details that the skin of the Stegosaur was scaley, and that this helped lock moisture in its body allowing it to adapt and survive in dry climates much the same as today's squamates like lizards and snakes. The climate of Hebei at the time of the mid-Cretaceous was favorable to life, and rich forests with riverine ecosystems dominated the area which today is mostly grassland. As is often the case with well-fossilized dinosaurs, remarkably serendipitous events marked its demise. It was probably drinking at the side of a lake or a river when it died. Then some force shifted its body from the exposed land into the deeper water, after which a nearby volcano seems to have erupted and buried the dino and the body of water in layer after layer of ash. Dating back to the Cretaceous period to around 130 million years ago, it's the first *Stegosaurus* discovered in Northern China, while the primitive triceratops ancestor will help fill gaps in the fossil record of China's ceratopsids. *"The well-preserved bones of this specimen will provide important evidence for further study of the evolution of the primitive ceratopsid dinosaurs,"* Zhang further noted.

Complete Stegosaurus Fossil Found With Skin Still On in Northern China (goodnewsnetwork.org)

Ancient Stars Forged Elements Heavier Than Anything Ever Found in Nature

Stars at the very dawn of time must have been capable of creating elements far heavier than anything that has ever been found naturally occurring on Earth. That's the conclusion a team of astronomers led by Ian Roederer of the University of Michigan has drawn after examining 42 stars in the Milky Way, the chemical abundances of which can only be explained by the previous production of elements with atomic masses greater than 260. Most of the elements in the Universe, pretty much anything heavier than hydrogen, have been created by stars. At the core of a star is basically an engine that mushes atoms together to create heavier elements. The heaviest element this process can produce is iron. The **fusion** of iron into heavier elements requires way more energy than it generates, and so at that point the star self-destructs. Another way has to do with that self-destruction. In supernova explosions as a star dies, and kilonova explosions where two neutron stars slam into each other, conditions become just right for **rapid neutron-capture** process. This is when there are so many loose neutrons floating around that they schloop onto available nuclei, forming a heavier element. It needs a really extreme, energetic environment to happen, such as a supernova. And it happens really quickly, too, hence the '*rapid*' part in the name. This is the process that produces elements like gold, platinum, thorium, and uranium. But there's still a lot we don't know about how elements are created. *"We have a general idea of how the r-process works, but the conditions of the process are quite extreme,"* Roederer explains. *"We don't have a good sense of how many different kinds of sites in the Universe can generate the r-process, we don't know how the r-process ends, and we can't answer questions like, how many neutrons can you add? Or, how heavy can an element be? So we decided to look at elements that could be made by fission in some well-studied old stars to see if we could start to answer some of these questions."* Another way we know that elements can be formed is by nuclear fission. This is when, rather than fusing together, an atom splits apart, and the result is a less massive element. The stars the team studied are known to have elements produced by the r-process during supernova explosions. But the researchers weren't looking for r-process elements. They were looking for elements that could be products of fission, such as ruthenium, rhodium, palladium, and silver. And, they found a pattern. The presence of certain other elements is expected in certain abundance ratios if the metals the team looked at were produced by the r-process. Those ratios were not present. This suggests, the team concluded, that the elements in question were produced by fission. That means the early stars from whence these metals came must have produced elements far heavier, greater than an atomic mass of 260, that subsequently split to form lighter, more stable elements. We've never observed those elements naturally occurring, anywhere. We've seen them in the lab, but their half-lives are so short that they decay almost immediately. However, the research shows that looking for their potential fission products could tell us how likely or common their formation might be, out there in the wider Universe. *"That 260 is interesting because we haven't previously detected anything that heavy in space or naturally on Earth, even in nuclear weapon tests,"* Roederer says. *"But seeing them in space gives us guidance for how to think about models and fission – and could give us insight into how the rich diversity of elements came to be."* Ancient Stars Forged Elements Heavier Than Anything Ever Found in Nature : ScienceAlert

First-Ever: 3.5 Million-Year-Old Megalodon Tooth Found Undisturbed on Deep-Sea Floor

A shark sheds up to 40,000 teeth in its lifetime, and megalodon, the greatest predator of them all, was no different. As this fearsome beast roamed the world's oceans between 4 and 20 million years ago, it dropped teeth that are still washing up on beaches, found sticking out of whale bones, or rising out of once-submerged landscapes. But until now, none have been discovered in much the same position that they fell into all those millions of years ago. A team of intrepid researchers has just described one such find: a fossilized *Otodus megalodon* tooth partially embedded in the ocean floor, some 1.9 miles below the surface, in the vastness of the Pacific Ocean. The tooth was hard to spot amongst the rocky outcrop, but researchers viewing footage from a remotely operated submersible spotted it sticking straight up out of the sand, as if it had plonked down just moments ago. When they inspected the ancient tooth back on dry land, they found it had a broken tip and serrated edges that look almost as sharp as the day they last sliced through fresh meat. Megalodon's fearsome physique, large enough to eat up modern-day sharks in a few bites, is known almost exclusively by its teeth, (which can be as big as a human hand) and scattered vertebrae. Unlike these robust pieces of anatomy, the rest of *O. megalodon's* soft tissue and cartilage haven't survived the 3.6 million years since the beast went extinct. Based on that departure, this particular tooth is thought to be at least that old. It was found in a remote location southwest of Hawaii, a few hundred miles from a US military outpost called Johnston Atoll, on the edge of an ocean '*desert*'. Researchers aboard the Exploration Vessel (EV) Nautilus had been surveying the area to understand more about its deep-sea geology and biology. *"There are areas of the seafloor, especially deep ocean basins far from the mainland, where little to no sediment deposition occurs for long periods of time,"* Tyler Greenfield, a paleontologist at the University of Wyoming, explains. *"It's also possible for teeth to be eroded out and reworked into younger sediments, but that probably didn't happen in this case."* The tooth was found on the crest of a ridge, where ocean currents are thought to be strong enough to stop sediment from accumulating. The serrated edge of the tooth was also exceptionally well preserved, which suggests the tooth hasn't been tossed and tumbled, and therefore eroded. While not the biggest of its kind, the newfound tooth (which measures a modest 2.5-2.6 inches) adds to a growing number of specimens that are tracing megalodon's movements across oceans. Looking back at historical records of past deep-sea expeditions, Jürgen Pollerspöck, of the Bavarian State Collection of Zoology in Germany, and colleagues identified numerous other megalodon teeth that have been scooped up from depths of 1,100 to 18,000 feet. But they say this was the first one documented in its final resting place, as it was found. "*The first in situ documentation of a megatooth shark fossil from the deep sea highlights the importance of using advanced deep-diving technologies to survey the largest and least explored parts of our ocean,"* the team concludes.
https://www.tandfonline.com/doi/full/10.1080/08912963.2023.2291771

Fountains of Diamonds Erupt from Earth's Center as Supercontinents Break Up

The breakup of supercontinents may trigger explosive eruptions that send fountains of diamonds shooting up to Earth's surface. Diamonds form deep in Earth's crust, approximately 93 miles down. They are brought up to the surface very quickly in eruptions called kimberlites. These kimberlites travel at between 11 and 83 miles per hour, and some eruptions may have created Mount Vesuvius-like explosions of gases and dust, said Thomas Gernon, a professor of Earth and climate science at the University of Southampton in England.

Researchers noticed that kimberlites occur most often during times when the tectonic plates are rearranging themselves in big ways, Gernon said, such as during the breakup of the supercontinent Pangaea. Oddly, though, kimberlites often erupt in the middle of continents, not at the edges of breakups (and this interior crust is thick, tough, and hard to disrupt).

"The diamonds have existed at the base of the continents for hundreds of millions or even billions of years," Gernon said. *"There must be some stimulus that just drives them suddenly, because these eruptions themselves are really powerful, really explosive."*

Gernon and his colleagues began by looking for correlations between the ages of kimberlites and the degree of plate fragmentation occurring at those times. They found that over the last 500 million years, there is a pattern where the plates start to pull apart, then 22 million to 30 million years later, kimberlite eruptions peak. (This pattern held over the last 1 billion years, but with more uncertainty given the difficulties of tracing geologic cycles that far back.)

For example, the researchers found that kimberlite eruptions picked up in what is now Africa and South America starting about 25 million years after the breakup of the southern supercontinent Gondwana, about 180 million years ago. Today's North America also saw a spike in kimberlites after Pangaea began to rift apart around 250 million years ago. Interestingly, these kimberlite eruptions seemed to start at the edges of the rifts and then marched steadily toward the center of the land masses.

To figure out what was driving these patterns, the researchers used multiple computer models of the deep crust and upper mantle. They found that when tectonic plates pull apart, the base of the continental crust thins as the crust up top stretches out and forms valleys. Hot rock rises, comes into contact with this now-disrupted boundary, cools and sinks again, creating local areas of circulation.

These unstable regions can trigger instability in neighboring regions, gradually migrating thousands of miles toward the center of the continent. This finding matches the real-life pattern seen with kimberlite eruptions starting near rift zones and then moving to continental interiors, the researchers reported July 26 in the journal ***Nature***.

But how do these instabilities cause explosive eruptions from deep in the crust? It's all in the mixing of just the right materials, Gernon said. The instabilities are enough to allow rock from the upper mantle and lower crust to flow against each other.

This churns together rock with lots of water and carbon dioxide trapped within it, along with many key kimberlite minerals — including diamonds. The result is like shaking a bottle of champagne, Gernon said: eruptions with a lot of explosive potential and buoyancy to drive them to the surface.

The findings could be useful in searching for undiscovered diamond deposits, Gernon said. They might also help explain why there are other types of volcanic eruptions that sometimes occur long after a supercontinent breakup in regions that should be largely stable.

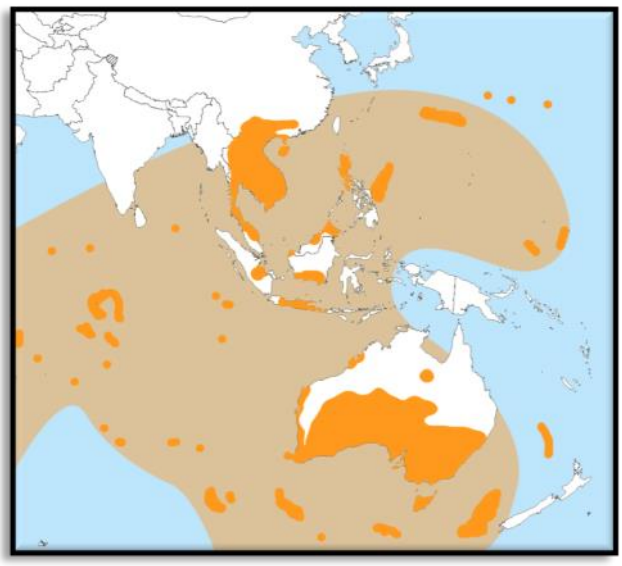
"It's a fundamental and highly organized physical process," Gernon said, *"so it's likely not just kimberlites responding to it, but it could be a whole array of Earth system processes that are responding to this as well*."

https://www.livescience.com/planet-earth/geology/fountains-of-diamonds-erupt-from-earths-center-as-supercontinents-break-up

800,000 Years Ago, a Meteor Slammed into Earth, Scientists Just Found the Crater

About 790,000 years ago, a meteor slammed into Earth with such force that the explosion blanketed about 10 percent of the planet with shiny black lumps of rocky debris. Known as **tektites**, these glassy blobs of melted terrestrial rock were strewn from Indochina to eastern Antarctica and from the Indian Ocean to the western Pacific. The **Australasian strewn field** ranges south from Southeast Asia, across Australia then south of Tasmania to East Antarctica, with a western extension that crosses over Madagascar and an eastern extension into the western Pacific Ocean. The tektites in this enormous field have been intensively studied using modern analytical methods. They are divided into a number of distinct types, ranging from meter-scale irregular masses of black glass called Muong Nong tektites, found in Laos, Vietnam, and Thailand, to submillimeter-scale microtektites that abound in deep-sea cores within the limits of the field. For more than a century, scientists searched for evidence of the impact that created these pitted blobs. But the crater's location eluded detection, until now. Geochemical analysis and local gravity readings told researchers that the crater lay in southern Laos on the Bolaven Plateau; the ancient impact was concealed under a field of cooled volcanic lava spanning nearly 2,000 square miles, the scientists reported in a new study. When a meteor hits Earth, terrestrial rocks at the impact site can liquefy from the intense heat and then cool into glassy tektites, according to the Jackson School Museum of Earth History at The University of Texas. Scientists can look at the abundance and locations of tektites to help locate an impact, even if the original crater is eroded or concealed, the study authors wrote. In this case, there were plenty of tektites, so where was the crater? The force of the impact is thought to have created a rim measuring more than 300 feet tall, according to the study. Tektites from the impact were at their biggest and most abundant in the eastern part of central Indochina, but because the tektites were so widespread, previous estimates of the crater's size ranged from 9 miles in diameter to 186 miles, and the feature's precise position remained uncertain even though scientists spent decades searching. For the new study, the researchers first investigated several promising eroded crater candidates in southern China, northern Cambodia and central Laos, but soon ruled out those spots. In all cases, the suspected crater-like features turned out to be much older and were instead identified as erosion in rocks dating to the Mesozoic era, about 252 million years ago to about 66 million years ago. Was the crater buried? On Laos' Bolaven Plateau, the scientists found a site where fields of volcanic lava might have hidden signs of an older meteor impact. In a region that the researchers targeted as a likely spot for a crater, most of the lava flows were also in the right age range: between 51,000 and 780,000 years old. The study authors peered below the lava's surface by taking gravity readings at more than 400 locations. Their resulting gravity map showed one area "of particular interest" with a gravitational anomaly, a subsurface zone less dense than the volcanic rock surrounding it. Their measurements hinted at an elliptical, "elongated crater" about 300 feet thick, about 8 miles wide and 11 miles long, according to the study. Together, all of these clues suggested that *"this thick pile of volcanic rocks does indeed bury the site of the impact,"* the scientists wrote. However, not all impact scientists find it plausible that the Australasian source crater lies beneath the Bolaven volcanic plateau. As with all possible impact craters, proof will rest on finding shock-metamorphosed rocks minerals, and melt. These findings were published online Dec. 30 in the journal *Proceedings of the National Academy of Sciences* This article was modified from 800,000 years ago, a meteor slammed into Earth. Scientists just found the crater. (nbcnews.com) and The Australasian tektite source crater: Found at last? | PNAS

Australasian tektites commonly have distinctive regular shapes like teardrops, dumbbells, and strangely flanged buttons.



Australasian strewnfield. Shaded areas represent tektite finds.

2023 CVRMS Holiday Party

photos by Lisa Blunt

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2155 Prairie du Chien Rd. NE
Iowa City, Iowa 52240-9620

Next Meeting:
TUESDAY JANUARY 16
Hiawatha Community Center
Undergraduate Field and Research Experiences at the University of Iowa in 2023.
by Professor Bill McClelland and Students
U of IA Dept. of Earth & Environmental Sciences

Dues are Due

CEDAR VALLEY GEMS JANUARY 2024 VOL. 50, ISSUE 1

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

CEDAR VALLEY ROCKS & MINERAL SOCIETY

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

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

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