Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS DECEMBER 2022 VOL. 48, ISSUE 12

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

Next CVRMS Meeting

Tues. December 6

2022 CVRMS HOLIDAY PARTY

Hiawatha Community Center
101 Emmons St., Hiawatha

Bill and Sharon Sonnleitner and family at 2002 CVRMS Holiday Party

Eat at 6:30 pm

CVRMS will provide
Turkey Breast, Baked Ham (thanks Jeff)
Stuffing, Mashed Potatoes, and Drinks

Please Bring Pot Luck Dish or Dessert and Bring Your Own Table Service

DONATIONS WILL BE COLLECTED FOR
Linn County Food Bank
HACAP

Since the emergence of the first humans in Africa over 2 million years ago, the world's population has ballooned, with only fleeting pauses to the increasing number of people sharing planet Earth. As the global population reached 8 billion, a milestone, in mid-November, what were main chapters in the growth of humanity? The oldest fossils from the earliest known humans date back 2.8 million years and were found in east Africa. But estimates of the number of people that populated the Earth remained highly unreliable until the 19th century. What we do know is that our ancestors were hunter-gatherers, who had few children compared to later settled populations in order to maintain their nomadic lifestyle. The planet's population was sparse also partly because hunter-gatherers needed a lot of land to feed themselves, around 4 square miles per person. The globe's population did increase over time but very, very slowly. The introduction of agriculture in the Neolithic era, around 10,000 BCE, brought the first known major population leap. With agriculture came the ability to store food, which caused birth rates to soar. Mothers were able to feed infants gruel, which sped up the weaning process and reduced the amount of time between births, meaning more children per woman. However, with the domestication of animals, humans contracted new deadly diseases. Child mortality rates were particularly high, with a third of all children dying before their first birthday, and another third before they turned 18. From around 6 million in 10,000 BCE, the global population leapt to 100 million in 2000 BCE and then to 250 million in the first century CE. The Black Death brought the population to a sudden halt in the Middle Ages. The pandemic, reached Europe in 1346, and in just eight years, it wiped out up to 60 percent of the populations of Europe, the Middle East, and North Africa. As a result the human population dropped between 1300 and 1400, from 429 to 374 million. From the 19th century on, the population began to explode, due largely to the development of modern medicine and the industrialization of agriculture, which boosted global food supplies. Since 1800, the world's population has jumped eight-fold, from an estimated 1 billion to 8 billion. The development of vaccines was key, with the smallpox jab particularly helping zap one of history's biggest killers. The 1970s and 1980s brought another small revolution, in the form of treatment for heart disease, which helped reduce mortality among over-60s. https://www.sciencealert.com/earths-population-explodes-to-8-billion-humans-this-month?

CVRMS Annual Meeting, Nov. 15 — Minutes —

MEETING CALLED TO ORDER: by Pres. Marv Houg 7:50 p.m.

Guests Present: Dan Protz and Bill LaRue who brought some interesting rocks, fossils to share.

MINUTES OF LAST MEETING: were reviewed as published. Julie made motion to approve, Kim seconded. Minutes approved.

TREASURER'S REPORT: checking account $19,810.65 motion to approve by Kim and seconded by Ray.

DALE WILL ORDER agate calendars, so let him know if you are interested.

PROGRAM: 2 video presentations from the 2016 Agate Expo Symposium in Cedarburg, Wisconsin.

DISCUSSION OF AGATES, the theme of our 2023 Show, we will need some good Agate displays.

ELECTION OF OFFICERS: one new Director. Matt Burns was nominated no other nominations from the floor. Ray made motion to close nominations, second by Dale. Matt Burns will be new Director.

NEW BUSINESS: Marv received a call from lady in Des Moines who 20 years ago attended our meetings. She wants to donate a labeled collection of fossils from the Rockford area to our club. Kim Kleckner will travel to Des Moines to collect the fossils. **On November 19** Paul Stults will have the Blairstown Rock Show, vendors and metaphysical displays. Open to everyone.

CVRMS HOLIDAY PARTY ON TUESDAY, DECEMBER 6: Meal will begin about 6:30. Potluck and bring your own dishes. Dell will make mashed potatoes, and Sharon the stuffing. Turkey, ham and drinks will be provided. And bring your favorite dish or whatever. Need door prizes. There will be a game or so.

DOOR PRIZE won by Jack Gilmore.

MOTION TO ADJOURN by AJ ,second by Dale. Meeting adjourned at 9:30.

Respectfully submitted,
Dell James, Secretary

CVRMS Board Meeting Nov. 22 — Minutes —

MEETING CALLED TO ORDER: by Marv at his home 7:07pm.

MEMBERS PRESENT:- Kim Kleckner, Marv Houg, Dale Stout, Ray Anderson, Matt Burns, Sharon Sonnleitner, Jay Vavra.

MINUTES FROM PREVIOUS MEETING REVIEWED. Motion to accept by Ray, second by Dale. Approved as published.

TREASURER'S REPORT: presented and approved on Oct. 18 at Monthly Meeting.

2023 ROCK SHOW: theme "*Wonderful World of Agates".* All is well with vendors. Sharon noted that 6 contracts are still out. **Poster ideas** (1) Map showing Iowa agates and locations, (2) Images of various types of agates, (3) discussion of how agates form, (4) World Famous Agates. **Fluorescent booth** Mike and Diane Rose will do and are negotiating with Sharon for display and booth space. **Kim has lots of stuff** and organized for pebble pit, silent auction and door prizes.

2023 AUCTION SEPT 9-10, 2023: Ray said he would like to offer 15 lots for the auction; Kim offered 10 lots. Jay will ask for requested number of lots from previous sellers.

FIELD TRIPS: Ray will talk to River Products about a contact to discuss a trip to the S&G pit south of Iowa City.

OLD BUSINESS: Ray and or Bill will make arrangement to present a program on geology requested by Kalona HS for three morning classes on Monday Nov 28.

2022 HOLIDAY PARTY DEC 6: Club will supply turkey, ham, gravy and drinks. Sharon will prepare stuffing, and Dell will do mashed potatoes. The rest will be pot luck, such as: salads, rolls, cranberry sauce, vegetables, desserts. Whatever favorite recipe you choose. **Ray** will add note to newsletter that we will be taking donations for the Linn Co. Food Pantry and HACAP. **Kim** will bring name tags. **Dell** will bring games. **Kim** will organize door prizes. **Ray and others** will bring *show and tell* rocks.

NEW BUSINESS: No new information on 501 c.3 status or Officers' Insurance. **Kim and Sherrie** will work with Julie to get Tom's name removed from club's Facebook account. **Ray** got estimates on reprinting Tiffany's *Rusty and Dunky's Fossil Hunt Book*. Estimates were excessive, and Ray will talk to Tiffany about alternatives. **Dell** may have identified a person to teach wire-wrapping class. More info to come.

MOTION TO ADJOURN by Kim, second by Dale. Adjourned 9:10 pm.

Respectfully submitted,
Ray Anderson, Acting Secretary

ELECTION OF CVRMS OFFICERS FOR 2023

The November 16 CVRMS meeting was our official ***Annual Meeting for 2022,*** which means that it was time for members to elect club officers. The Nominations Committee submitted Matt Burns for a full term as **Director,** after he served the last year of Toby Jordan's term. All other officers are serving the first year of a 2-year term, except directors, who serve staggered 3-year terms:

President	Marv Houg
Vice President	Ray Anderson
Treasurer	Dale Stout
Secretary	Dell James
Editor	Ray Anderson
Immed. Past Pres.	Sharon Sonnleitner
Liaison	Kim Kleckner
Director '23	Jay Vavra
Director '24	Bill Desmarais
Director '25	Matt Burns
Webmaster	Sharon Sonnleitner

$$ TIME TO PAY $$
YOUR CLUB DUES
A BARGAIN AT ONLY
$15 PER YEAR

Pay at Meeting or Mail To:
Dale Stout, Treasurer
2237 Meadowbrook Dr. SE, Cedar Rapids, IA 52403

If you were born in December you may choose from 3 birthstones, zircon, tanzanite, turquoise

Zircon is a mineral belonging to the group of nesosilicates. Its chemical name is zirconium silicate and its corresponding chemical formula is $ZrSiO_4$. A common empirical formula showing some of the range of substitution in zircon is $(Zr_{1-y}, REE_y)(SiO_4)_{1-x}(OH)_{4x-y}$. Zircon forms in silicate melts with large proportions of high field strength incompatible elements. The crystal structure of zircon is tetragonal crystal system. The natural color of zircon varies between colorless, yellow-golden, red, brown, blue, and green. Colorless specimens that show gem quality are a popular substitute for diamond and are also known as "*Matura diamond.*"

Tanzanite is the blue/violet variety of the mineral zoisite (a calcium aluminium hydroxyl Sorosilicate—$Ca_2Al_3(SiO_4)_3(OH)$) belonging to the epidote group. It was discovered in Northern Tanzania in 1967, near the city of Arusha and Mount Kilimanjaro. Tanzanite is used as a relatively cheap gemstone, where it can substitute for the far more expensive sapphire after undergoing artificial heat treatment to form a deep blue coloration. Naturally formed tanzanite is extremely rare and is endemic only to the Mererani Hills. Tanzanite is noted for its remarkably strong trichroism, appearing alternately sapphire blue, violet and burgundy depending on crystal orientation. Tanzanite can also appear differently when viewed under alternate lighting conditions. The blues appear more evident when subjected to fluorescent light and the violet hues can be seen readily when viewed under incandescent illumination. Tanzanite is usually a reddish brown in its rough state, requiring heat treatment to bring out the blue violet of the stone.

Turquoise is an opaque, blue-to-green mineral that is a hydrated phosphate of copper and aluminium, with the chemical formula $CuAl_6(PO_4)_4(OH)_8{\cdot}4H_2O$. It is rare and valuable in finer grades and has been prized as a gem and ornamental stone for thousands of years owing to its unique hue. The substance has been known by many names, but the word *turquoise* dates to the 17th century and is derived from the French *turques* for "Turks" because the mineral was first brought to Europe from Turkey, from mines in the historical Khorasan Province of Persia. Pliny the Elder referred to the mineral as *callais* and the Aztecs knew it as *chalchihuitl*.

• • *information from Wikipedia*

What in the World?

What in the World is this unusual geologic feature, and how did it get this way??

November's Photo

Last month's **What in the World** photo is the last image of the asteroid Dimorphos, before it was impacted by NASA's D.A.R.T. probe on September 26. The collision was part of NASA's efforts to develop a system to deflect asteroids that threaten to impact Earth.

ROCK CALENDAR
CVRMS EVENTS OF INTEREST

2022

Dec. 6 — CVRMS Holiday Party
Hiawatha Community Center—Eat at 6:30 pm
CVRMS will provide Turkey Breast, Ham, Stuffing, Mashed Potatoes, and Drinks
Please Bring Pot Luck Dish or Desert and Bring Your Own Table Service
See page 1 for more details.

2023

Jan. 17 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Program to be announced

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

Mar. 21 — CVRMS Monthly Meeting
Hiawatha Community Center 7:15 pm
Cornell College Students

Mar. 25-26— CVRMS Rks, Fos, & Min Show
*Hawkeye Downs
Cedar Rapids, Iowa
"Wonderful World of Agates"

Apr. 18 — 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

Sept. 9 -10 — CVRMS Rock Auction
Amana RV Park and Event Center
Amana, Iowa

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

A few weeks ago I came across some information that piqued my interest. The article, "*They-made-a-material-that-doesn't-exist-on-earth; and-that's-only-the-start-of-the-story*," published on the **NPR News** web page, noted that researchers recently announced that they managed to manufacture, in a lab, a material that does not exist naturally on Earth; until now it has only been found in meteorites. That caught my attention because I knew that the mineral **tetrataenite** was first discovered in Iowa's Estherville meteorite. Sure enough, the article was referring to the manufacturing of tetrataenite in a laboratory. Tetrataenite is a native metal composed of atoms of iron and nickel (FeNi). It is a relative of the iron mineral **taenite,** that was chemically reordered to form a tetragonal crystal structure (for which the mineral was named.) Tetrataenite was named in a paper by R.S. Clark and E.R.D. Scott (1980) for specimens found in the Estherville meteorite (making that area of Emmet County the type area for the mineral). Scientists originally thought it formed in iron meteorites containing taenite that were slow-cooled at a rate of a few degrees per million years, allowing for the ordering of the Fe and Ni atoms. The taenite and its face centered cubic crystal structure deformed to form the tetragonal $L1_0$ structure of tetrataenite . The $L1_0$ phase can be synthetically produced by neutron- or electron-irradiation of FeNi below 593 °K, by hydrogen-reduction of nanometric $NiFe_2O_4$, or by crystallization of Fe-Ni alloys in the presence of traces of phosphorus, producing a highly ordered crystal structure. Now the researchers say that phosphorus, which is present in meteorites, allows the iron and nickel atoms to move faster, enabling them to form the necessary ordered stacking without waiting for millions of years. By mixing iron, nickel and phosphorus in the right quantities, they were able to speed up tetrataenite formation by between 11 and 15 orders of magnitude, such that it forms over a few seconds in simple casting. *"What was so astonishing was that no special treatment was needed: we just melted the alloy, poured it into a mold, and we had tetrataenite*," said Professor Lindsay Greer from Cambridge University's Department of Materials Science & Metallurgy, who led the research. *"The previous view in the field was that you couldn't get tetrataenite unless you did something extreme, because otherwise, you'd have to wait millions of years for it to form. This result represents a total change in how we think about this material."* The mineral is metallic silver in color and is distinguishable from taenite, which is dark gray with low reflectivity. Tetrataenite displays permanent magnetization with a particular, high coercivity (the ability of a ferromagnetic material to withstand an external magnetic field without becoming demagnetized). This makes it a potentially valuable material for the production of high performance magnets. Such magnets are a vital technology for building a zero-carbon economy, and the best permanent magnets currently available contain rare earth elements. Despite their name, rare earths are plentiful in Earth's crust, but are present in economically viable concentrations in only a few places. One such place is China, which currently has a near monopoly on global production. In 2017, 81% of rare earths worldwide were sourced from China. Other countries, such as Australia, also mine these elements, but the United States has only limited production. As geopolitical tensions with China increase, there are concerns that rare earth supply could be at risk. The ability to manufacture tetrataenite commercially could guarantee the future availability of high performance magnets. While the researchers have found a promising method to produce tetrataenite, more work is needed to determine whether it will be suitable for high-performance magnets. The team are hoping to work on this with major magnet manufacturers.

A slab of Estherville meteorite, a stony-iron mesosiderite displaying silver-colored tetrataenite

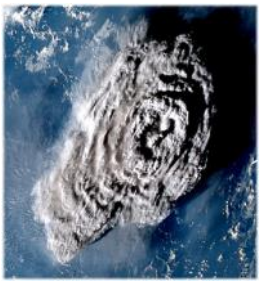
New Quartz v. Amethyst "Grape Agate" Specimens from Mamuju Area, West Slulawes Province, Indonesia

Collector's Edge Minerals, Inc. has just acquired some fantastic new quartz v. amethyst specimens from the Mamuju Area of West Sulawesi Province, Indonesia. These specimens are well known for their deep, rich purple colors and nice luster. The botryoidal amethyst aggregates look similar to grapes in shape and color and often receive the nickname "*grape agate*." However, "*agate*" is not an entirely correct term here, as most of the crystals have a drusy surface rather than a microcrystalline texture. We land on a better suited name of

"*quartz v. amethyst*" for these specimens, giving the most accurate description to the specimens' mineralogy. These "*grape agates*" first started showing up on the American mineral market in 2016. While the majority of the quartz produced from the area is purple, there are also specimens with other shades including blue-green, grey, and pale brown. Intensity of color in these is inversely related to the diameter of the individual spheres, with the most intense occurring generally in spheres averaging 4mm in diameter. The botryoidal amethyst is found by miners in the area hosted in small pockets of calcium- and magnesium-rich blue-green clay. It is likely that the amethyst is formed in the clay, settles down within it, and becomes loosely attached with time. Many of these new Quartz v. Amethyst clusters are available on the Collector's Edge website. These specimens have keystone prices starting as low as $75.00. All are great additions to any mineral collection, display well from multiple orientations, and are spectacular examples of the mineral species from this locality.
https://collectorsedge.com/legacy/new-quartz-v-amethyst-grape-agate-specimens-from-mamuju-area-west-sulawesi-province-indonesia/

Tonga Eruption's Towering Plume Was the Tallest in Recorded History

Researchers have accurately measured the height of the eruption plume from the undersea volcano that erupted in Tonga in January. The results confirm that it is the tallest of its kind ever recorded. The enormous underwater volcanic eruption in Tonga earlier this year spat out the tallest plume of its kind ever recorded, a new study shows. The looming tower of ash, dust and water vapor reached 35.4 miles above sea level, and was the first plume to make it into the mesosphere, the third layer of Earth's atmosphere. On Jan. 15, the Hunga Tonga-Hunga Ha'apai volcano, a submarine cone 40 miles north of Tonga's main island Tongatapu, suddenly erupted. The blast was the most powerful explosion on Earth for more than 30 years, with an equivalent force of 100 Hiroshima bombs. The energetic event sparked a tsunami that reached as far as Japan and generated atmospheric shockwaves that caused the atmosphere to ring like a bell. The colossal eruption has already shattered a number of records: The earth-shaking explosion generated the fastest atmospheric waves ever recorded, as well as triggering a record-breaking 590,000 lightning strikes. The volcano also spat out more water vapor than any other eruption on record, which could potentially weaken the ozone layer and warm the planet for years. Now a new study, published Nov. 4 in the journal *Science*, has found that the volcano's plume was the tallest ever recorded, peaking at a lofty 35.4 miles. The previous record holder was the 1991 eruption of Mount Pinatubo in the Philippines, which extended 24.9 miles above sea level at its highest point. The Tonga plume was also the first one to exceed the stratosphere, the atmosphere's second layer that spans between 7.5 and 31 miles, and into the mesosphere, which spans between 31 and 50 miles. Volcano experts were already confident that the Tonga eruption was the tallest of its kind. However, determining the eruption plume's exact height proved to be very challenging. The researchers used aerial images from three different geostationary weather satellites, which each captured images of the plume at 10-minute intervals, to triangulate the exact height of the plume's summit. This enabled the team to not only work out the maximum height of the plume but also see how it grew over time. Researchers hope to apply this technique to other eruptions and develop a dataset of plume heights that can be used by volcanologists and atmospheric scientists to model the dispersion of volcanic ash in the atmosphere Understanding the heights of volcanic plumes will help researchers figure out how they impact climate change.

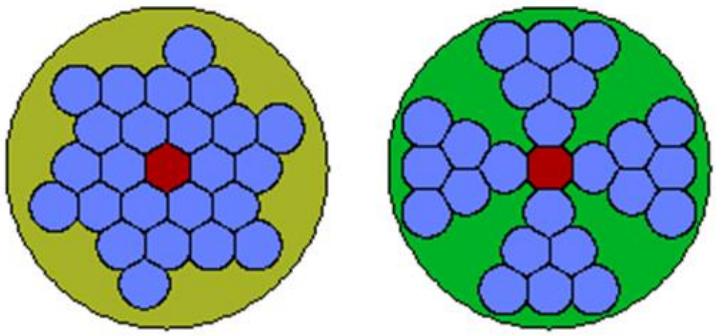


A zoomed-in view of the eruption, taken by Japan's Himawari-8 satellite at 05:40 UTC on 15 January 2022, about 100 minutes after the eruption started.

https://www.livescience.com/tonga-eruption-tallest-plume-ever?

Scientists Solve 100-Year-Old Mystery About How Plants Took Root on Land

A team of scientists, led by researchers at Yale University, think they have finally figured out why land plants evolved such complex vascular systems, a mystery that has stood for roughly a century. When land plants first sprung into being, roughly 500 million years ago, their vascular systems were extremely simple. The insides of their roots and stems looked sort of like bundles of straws, which would pull in water and nutrients from the surrounding environment. Around 420 million years ago, however, this straightforward system for sucking up water showed significant changes, gradually splitting up the 'straws' into more elaborate shapes, structures, and sizes. For close to 100 years, scientists didn't know why evolution favored these more intricate interiors, but a new analysis of the fossil record suggests a more modern vascular system holds greater drought tolerance. A lack of water, the authors conclude, might be what first shaped the insides of plants. The first land plants on Earth were small, uncomplicated, moss-like forms. They didn't have root systems, which meant they were confined to areas with plentiful water. As plants began to move further inland into more arid areas, they needed new ways to capture water, sunlight, and nutrients while protecting themselves from evaporation and dehydration. That's where branches and roots came in handy. And yet, at the same time, these structures also created new challenges. During drought, plants can easily dry out, creating a bubble of vapor, sort of like an embolism, that blocks water from flowing up through the roots. In a simple and primitive vascular system, an air bubble inside a plant can readily spread to other channels or 'straws', creating a blockade against further water and nutrients. The result can trigger tissue death, and it might even kill the entire plant. Modeling the various vascular systems of some modern and extinct plants preserved in the fossil record, researchers have now shown that a more elaborate vascular pattern can cordon off air bubbles. When the straws that make up a plant's vascular system are separated into patterns, simulations suggest air bubbles have fewer neighbors to spread to. The figures below illustrates the difference between an embolism spreading in the vasculature of a simple, primitive plant versus a more complex, modern one. The findings have researchers concluding that drought is a "theoretically sound" selection pressure for the vascular system of plants. "Every time a plant deviates from that cylindrical vascular system, every time it changes just a little bit, the plant gets a reward in terms of its ability to survive



The stem on the left represents a primitive plant, and its simple configuration allows the embolism to spread easily. The structure on the right is more complicated, and as a result, the embolism produces less damage.

drought," explains plant physiologist Craig Brodersen from the Yale School of the Environment. "And if that reward is constantly there, then it's going to force plants in the direction away from the ancient cylindrical vascular system toward these more complex forms. By making these very small changes, plants solved this problem that they had to figure out very early in the history of the earth, otherwise the forests that we see today just wouldn't exist. Not only do the findings reveal interesting aspects of Earth's past, but they also help explain how the vast array of vascular forms seen in modern plants today came to be and speak to future solutions. This new understanding of how plants cope with drought could one day help researchers prepare important flora for the rapid climate changes that lie ahead. If experts can figure out how to breed better root and vascular systems, some crops might be able to feed us long into the future.
https://www.sciencealert.com/scientists-solve-100-year-old-mystery-about-how-plants-took-root-in-land

Cross section through leaf of *Cheilanthes lanosa*, also known as Hairy lip fern, showing a heart-shaped vascular system in the xylem.

3.5 Billion-Year-Old Rock Structures Are One of the Oldest Signs of Life on Earth

Layered rocks in Western Australia are some of Earth's earliest known life, according to a new study. The fossils in question are stromatolites, layered rocks that are formed by the excretions of photosynthetic microbes. The oldest stromatolites that scientists agree were made by living organisms date back 3.43 billion years, but there are older specimens, too. In the **Dresser Formation** of Western Australia, stromatolites dating back **3.48 billion years** have been found. However, billions of years have wiped away traces of organic matter in these older stromatolites, raising questions about whether they were really formed by microbes or whether they might have been made by other geological processes. *"We were able to find certain specific microstructures within particular layers of these rocks that are strongly indicative of biological processes,"* said Keyron Hickman-Lewis, a paleontologist at the Natural History Museum in London. The findings could have implications for the search for life on Mars. The stromatolites in the Dresser Formation are encrusted in iron oxide from the reaction of iron with oxygen in the atmosphere. Mars' surface is similarly oxidized, thus the rusty orange color, but its rocks could hold similar structures left behind by ancient Martian life. Hickman-Lewis and his team examined Western Australian stromatolites first discovered in 2000. They used a variety of high-resolution 2D and 3D imaging techniques in order to peer into the layers of the stromatolite at a fine scale. What they saw hinted at biological growth in all its messy glory. The researchers observed uneven layers, including little dome shapes that are indicative of photosynthesis, since microbes with the most access to the sun will grow more vigorously than those not as high in the structure. They also saw columnar structures that are typical in modern stromatolites, which are still found in a few locations around the globe. Microbial mats give you layers that are uneven in their thickness and tend to be wrinkly or crinkly or go up and down on very small spatial scales. Putting all the structural clues together, researchers concluded, results in the characteristics of a microbial mat. The evidence that the Dresser Formation stromatolites are signs of ancient life doesn't make them the oldest life on the planet. That (possible) honor may go to **stromatolites** found in **3.7 billion**-year-old rock in Greenland, or possibly to **microfossils** from Canada that might be as old as **4.29 billion** years. It's very difficult to distinguish biological life from non-organic processes in these very old rocks, however, so these finds and others from a similar timeframe are controversial. Based on the minerals in the stromatolites, the Western Australia microbial mats probably formed in a shallow lagoon, fed by hydrothermal vents, that was also connected to the ocean, the researchers reported Nov. 4 in the journal Geology. The techniques used to study the Western Australian stromatolites could be useful for seeking life on Mars, Hickman-Lewis said, especially if Mars samples can be returned to Earth. Scientists should "consider some of the analyses here as a trial run of the analyses we will have to do in around a decade's time when we have materials from Mars."
https://www.livescience.com/oldest-stromatolites-australia

Giant Clam Shells: Unprecedented Natural Archives for Paleoweather

Giant Clam shell

Paleoclimate research offers an overview of Earth's climate change over the past 65 million years or longer and helps to improve our understanding of the Earth's climate systems. Unfortunately, our knowledge of weather-timescale extreme events (i.e., paleoweather occurring in days or even hours and minutes), such as tropical cyclones, cold/heat waves, and rainstorms under different climate conditions, is almost absent because current paleoclimatic reconstructions rarely provide information with temporal resolutions shorter than a month. A new Chinese study may remedy this problem, though. Recently, a research team led by **Prof. Yan Hong,** from the Institute of Earth Environment of the Chinese Academy of Sciences, have been studying the shells of the giant clam ***Tridacna,*** *(*the largest bivalve species in the ocean; up to 54 inches wide and weighing up to 582 pounds). *Tridacna* is a genus of large saltwater clams, marine bivalve molluscs in the subfamily Tridacninae, the giant clams. They have heavy shells, fluted with 4 to 6 folds. The mantle is brightly colored. They inhabit shallow waters of coral reefs in warm seas of the Indo-Pacific region. They live in symbiosis with photosynthetic algae (zooxanthellae). The researchers found that *Tridacna* shells have clear and continuous daily growth bands, from which they were able to develop several daily to hourly biological and geochemical records, including daily growth rate, hourly element/Ca ratios and fluorescence intensity shells. The researchers demonstrated that these ultra-high resolution records can clearly record, even quantitatively, the activities of past typical extreme weather events. *"This result indicated that Tridacna shells have the potential to be used as an unprecedented archive for Paleoweather reconstructions,"* said Prof. Yan. As a result, fossils shells from different geological epochs have the potential to provide paleoweather data from past warm and warming periods that can help improve the prediction of future extreme weather events under the expected global warming.
http://www.geologyin.com/2020/03/giant-clam-shells-unprecedented-natural.html

Scientists Uncover Evidence of What May Be Earth's First Mass Animal Extinction

Since the **Cambrian explosion 538.8 million years ago,** a time when many of the animal phyla we're familiar with today were established, five major mass extinction events have whittled down the biodiversity of all creatures great and small. Researchers from the US have uncovered evidence of one occurring earlier, around **550 million years ago** during a period known as the **Ediacaran**. Though the oceans teemed with a few familiar animals like sponges and jellyfish, most life during this early period of biological history would seem alien to us now. Many of the animals were soft-bodied. Some looked more like plant fronds stuck in place. Others had some form of shell. Virginia Tech paleobiologist Scott Evans and colleagues compiled data on rare fossils of the squishier kinds of animals from around the world dated to the Ediacaran. They found sudden shifts in biodiversity that had previously been detected weren't mere sampling biases. Because softer body parts typically don't fossilize as readily as harder, more mineralized bits of anatomy, researchers have typically suspected a relative absence of soft-bodied animals in the Ediacaran's later stages are simply the result of a failure to be preserved. But the global fossil record indicates otherwise. The team found that there was an overall increase in biodiversity between the earlier and middle stages of the Ediacaran, known as the Avalon (575 to 560 million years ago) and White Sea stages (560 to 550 million years ago). "*We find significant differences in the feeding mode, life habit, ecological tier, and maximum body size between the Avalon and White Sea assemblages,"* the team writes in their paper. Between these two time periods, more smaller mobile animals appeared that fed on the microbial mats that dominated the seafloors. Previously many of the animals were stuck-in-place (sessile) filter feeders. Feeding modes did not change in this way between the White Sea and the last stage, known as the Nama (550 to 539 million years ago). Rather, a staggering **80 percent of species** seemed to vanish between these two stages of the Ediacaran. Past research has suggested that this decline may have been the result of mobile animals that burrowed or left trace fossils, which profoundly altered the environment and slowly replaced sessile filter feeders. This new evidence suggests that was not the case. All types of feeding modes and life habits experienced similar losses, with only 14 genera still seen in the Nama out of 70 known groups from the earlier White Sea stage. If more newly evolved species had taken over, there also would have been temporal overlap between the new and the old species. This wasn't observed, the team argue, ruling out biotic replacement. *"The decline in diversity between these assemblages is indicative of an extinction event, with the percentage of genera lost comparable to that experienced by marine invertebrates during the 'Big 5' mass extinctions,"* Evans and colleagues write. Many of the White Sea animals that survived the extinction event and remained in the Nama period were large, frond-like organisms with a high surface area to volume ratio. This could be a sign these animals were adapting to deal with a reduction in oceanic oxygen. *"By maximizing the relative proportions of cells in direct contact with seawater, high surface-area taxa would have been comparatively better adapted to survive in low-oxygen environments,"* the team explains. There is also recent geochemical evidence to support this idea, with a 2018 study finding signs of extensive ocean anoxia that covered more than 20 percent of the seafloor at the end of the Ediacaran. *"Thus, our data support a link between Ediacaran biotic turnover and environmental change, similar to other major mass extinctions in the geologic record,"* the team concludes. It's become an all too familiar story.

Smithsonian Institute diorama of Ediacaran sea life.

https://www.sciencealert.com/scientists-uncover-evidence-of-what-may-be-earths-first-mass-animal-extinction

Rare Fossil of Extinct American Lion Discovered Thanks to The Mississippi Drying Up

At the end of October, a Mississippi resident made a rare discovery along the drought-stricken Mississippi River, a fossilized jawbone from an American lion that roamed the area roughly 11,000 years ago, according to McClatchy News. It's only the fourth fossil of the

This fossilized jaw likely belonged the large American lion (*Panthera atrox*)

ancient American lion found in Mississippi, according to the news outlet. Wiley Prewitt, a local resident, stumbled on what looked like a huge black tooth in the sand and decided to take the find to a Mississippi Fossil & Artifact Symposium and Exhibition event on October 29. "*I could tell from the teeth right away that it was a fragment of a carnivore's jaw, but I dared not hope it was from an American lion,*" Prewitt told McClatchy News. "*It certainly looked right, but I wouldn't let myself believe it.*" Experts confirmed it belonged to the species ***Panthera atrox***, more commonly known as the large **American lion**. Researchers believe it was the largest big cat on the continent at nearly 8 feet long, 4 feet tall, and could weigh up to 1,000 pounds, according to the National Park Service. It's been extinct for approximately 11,000 years. The Mississippi River is a vital transportation route, and its unusually low water levels disrupted shipping across several states in recent months. Some locations along the river reported their lowest water levels in 10 years, the National Oceanic and Atmospheric Administration said in its most recent climate report, adding that barges have been unable to clear parts of the river and have run aground. The fossil is the latest remnant of the past unearthed by the Mississippi River drought. In early October, low water levels revealed an old sunken ship along the river's banks. Archaeologists believe the remains are from a ferry that sunk in the late 19th or early 20th century after it was damaged in a storm, The Associated Press reported. Though this was the first time the ship has been fully exposed, small parts of the vessel emerged from low waters in the 1990s. "*At that time the vessel was completely full of mud and there was mud all around it so only the very tip tops of the sides were visible,*" Chip McGimsey, Louisiana's state archaeologist, told the AP when the shipwreck emerged in October. *"They had to move a lot of dirt just to get some narrow windows in to see bits and pieces,"* McGimsey said. According to a growing body of research, rising global temperatures due to burning of fossil fuels enhance evaporation, making droughts more severe. Experts previously told Insider that as human-caused climate change warms the planet and intensifies droughts, more remnants of the past may be unearthed by receding waters. https://www.sciencealert.com/rare-fossil-of-extinct-american-lion-discovered-thanks-to-the-mississippi-drying-up

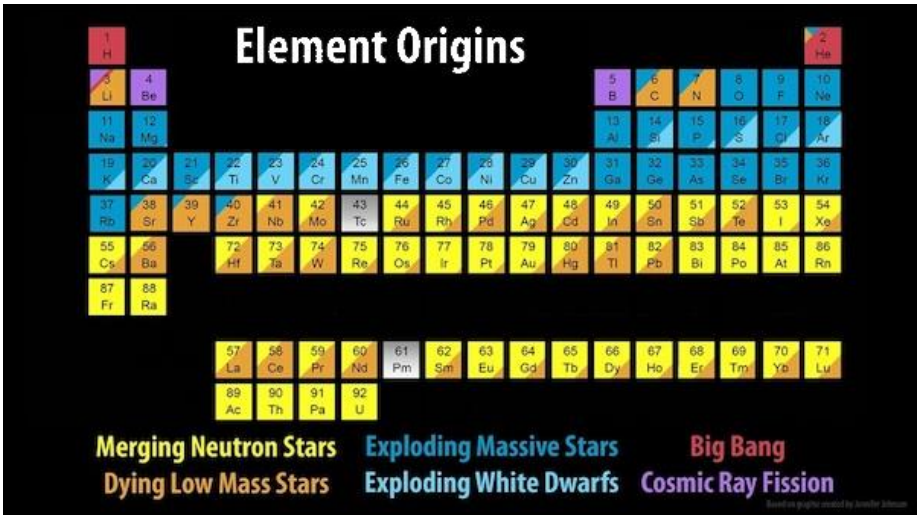
T. Rex Could Have Been 70% Bigger Than Fossils Suggest, New Study Shows

There's no denying that *Tyrannosaurus rex* was one of the biggest and baddest dinosaurs to ever walk the planet. But exactly how big could this ferocious dinosaur get? In a new investigation, researchers attempted to answer that question. Paleontologists from the Canadian Museum of Nature in Ottawa, Ontario, estimated that the largest *T. rex* may have tipped the scales at a whopping 33,000 pounds, making it heavier than an average school bus, which weighs about 24,000 pounds. The scientists presented their findings on Nov. 5 at the Society of Vertebrate Paleontology's annual conference in Toronto. Currently, the heftiest *T. rex* on record is a specimen nicknamed "Scotty," which weighed 19,555 pounds when it was alive, about as much as 6.5 Volkswagen Beetles. According to the new research, the largest *T. rex* would have been about 70% bigger than Scotty, . That almost doubles the size of *T. rex*. To reach this weighty conclusion, the scientists first examined the fossil record, which shows that approximately 2.5 billion *T. rexes* once lived on Earth. However, only a small fraction, just 32 adult fossils, have ever been discovered, giving the scientists a limited amount of information to pull from. The researchers also looked at population numbers and average life spans to create a model of the largest possible *T. rex*. They also considered variations in body size based on sexual dimorphism, size differences between the sexes of animals within a species. They created two models, one exhibiting zero dimorphisms and one with strong dimorphism. If *T. rex* was dimorphic, they estimated that it would have weighed up to 53,000 pounds, but they rejected that model because if it were true, scientists would have found even larger individuals by now. Using that data, the scientists were able to model *T. rex*'s growth curve throughout its lifetime, and estimate how big an adult might have grown. The researches cautioned that until a *T. rex* is found that is comparable in size to the one in the model, the model's conclusions are purely speculative. This reminds us that what we know about dinosaurs isn't much at all, since the sample sizes are so small. Right now, researchers are nowhere near the sample size needed, especially when compared to other species of animals. However, most scientists agree that it is plausible that *T.rex* may have been much bigger than any individual scientists have found so far. *"It's truly a stupendous animal,"* researchers said. *"To imagine a T. rex of that magnitude is extraordinary, and I think an animal of that size is within reach statistically."*

https://www.livescience.com/how-big-could-tyrannosaurus-rex-get

Cosmic Ingredients: How the Universe Forges Elements

Carl Sagan once famously said: ***"We are made of star stuff."*** He was referring to the origin of many elements, like the calcium in our bones and the iron in our blood, that are forged in the last breaths of dying stars. But while it's true we are star stuff, that's only half of the story. Some of the elements we know, like carbon and oxygen, are made in stars, but others, including all hydrogen, most helium, and a bit of lithium, were forged nearly 14 billion years ago through a process called Big Bang nucleosynthesis.



It wasn't until the first stars formed some 100 million years after the Big Bang that the universe began to diversify its element portfolio. And our understanding of exactly how it does that is only just being finalized. The idea that smaller, lighter pieces of matter could be forged into heavier ones dates back to at least the ancient Greeks. But it wasn't until the 1920s that scientists really began to understand the specifics. At the time, scientists were trying to figure out what powered the Sun. Astronomer Arthur Eddington first theorized that hydrogen atoms, the lightest element, could be squeezed together under immense temperature and pressure into helium, the second lightest element. This process, known as nuclear fusion, releases colossal amounts of energy. Over the following decades, scientists verified the mechanism, working out many of the details. And by the mid-20th century, astronomers had a good handle on how stars made elements lighter than iron. They deduced that during the prime years of their lives, stars steadily churn hydrogen into helium within their cores. And if a star is larger than about half the mass of the Sun, once it runs out of hydrogen in its core, it begins to collapse under its own uncontested gravity. This creates additional pressure in the star's core, which sparks helium burning and can ultimately produce by-products such as carbon and oxygen. Stars more than twice the mass of the Sun that also have carbon and oxygen from their forbearers can produce nitrogen as well. Stars up to roughly eight times the mass of the Sun eventually reach a phase of their lives known as the asymptotic giant branch. This is where their cores become inactive, and helium and hydrogen burning migrates to the stars' outer layers. At this stage, the stars begin the slow neutron-capture process. Also known as the **s-process**, this occurs in helium burning shells around stellar cores, which creates heavier elements like strontium, lead, and others. Eventually, these relatively low-mass stars collapse into dense objects known as white dwarfs. And as they do, they can expel supersonic winds, releasing shells of gas that create beautiful, albeit short-lived, planetary nebulae. This liberates the stars' elemental creations into interstellar space, where some of the enriched material will be recycled into new stars and planetary systems. However, when a more massive star (greater than about eight solar masses) reaches the end of its life, it can explode as a core-collapse supernova. Such supernovae can leave behind neutron stars that produce highly neutron-rich winds. In these winds, additional elements are formed through the rapid neutron -capture process, or **r-process**. When the nuclei of existing atoms capture extra free neutrons, the resulting product can be radioactive, meaning it will decay into a different version of itself or a new element entirely, or it can remain stable. The r-process is very similar to the s-process, except it's much quicker. The s-process can take decades or centuries to capture successive neutrons, with the entire elemental transformation taking tens of thousands of years. However, a supernova can produce roughly a billion billion billion neutrons per cubic inch, so the r-process is nearly instantaneous — at least in astronomical terms. For example, through the r-process, an iron atom can be transformed into uranium in less than a second. Astronomers also recently confirmed another suspected r-process site: merging neutron stars. Signatures of elements that are only created by the r-process were observed coming from the location of a confirmed neutron star merger picked up by gravitational waves. Even though such mergers are rarer than supernovae, astronomers now think that neutron star mergers are the primary sites of most heavy r-process elements. After all, this observed gravitational-wave event alone is expected to have produced an estimated three to 13 Earth-masses worth of gold. Now that astronomers know how the universe forges all (or at least most) of its elements, the next step is working to understand exactly how much of each element is produced through various processes, as well as where they tend to occur. By building on this knowledge, researchers ultimately hope it will allow them to easily probe the complex history of any galaxy by simply looking at the ratios of its elements

https://astronomy.com/news/2020/12/cosmic-ingredients-how-the-universe-forges-elements

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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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