Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS AUGUST 2021 VOL. 47, ISSUE 08

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

Next CVRMS Meeting
Tues. August 17
6:00 pm (eat at 6:30)
Picnic!

Morgan Creek Park

Bingo Tonight!
We are having a POT LUCK dinner again this Month : so bring Plates, Silverware and Your Best Dish to Share

If you're looking for one of the most underrated places in Iowa, it's hard to top a visit to the **Devonian Fossil Gorge** just north of Iowa City. This prehistoric wonder is a spot that everyone in

the Hawkeye State should visit at least once in their lives, and it was recently recognized by NetCredit for being one of the ***most underrated spots in the Midwest***. The Devonian Fossil Gorge is consistently named one of the most underrated places in Iowa, and both historians and nature lovers flock to this wonder to learn about the Earth. The Gorge has interpretive signs that tell the tale of how this 375-million-year-old fossil bed was unearthed after a series of floods along the Iowa River near the Coralville Dam. When the water first receded in 1993, geologists were stunned to see the remnants of a prehistoric ocean floor absolutely packed with fossils from so long ago. https://www.onlyinyourstate.com/iowa/devonian-gorge-underrated-places-in-iowa-ia/

The Caspian Sea Exploded In A Towering Inferno, And The Cause Was Entirely Natural

A towering inferno, hundreds of feet tall, burned above the Caspian Sea on July 4 after a massive explosion in Azerbaijan's oil and gas fields. The culprit? A **mud volcano**, authorities now say. The blast occurred around 9:30 pm local time (12:30 pm Iowa time) around 6 miles from the Umid gas field, which is 45 miles off the coast of Azerbaijan's capital Baku, and it continued to burn into Monday morning, according to the BBC. Local authorities initially suspected an accident at one of the multiple oil and gas rigs in the area, but the state oil company SOCAR later announced that preliminary investigations had deemed the cause of the explosion to be a mud volcano, and that none of its platforms had been damaged, according to *The Guardian*. Mud volcanoes are a rare type of volcano that erupt a superheated slurry of mud and water instead of lava, which means they don't get as hot as regular volcanoes. However, they also contain high concentrations of natural gases that build up inside them, which can be ignited by sparks created by fast-moving rocks and boulders beneath the surface during eruptions. This is believed to be what caused the recent inferno in the Caspian Sea. Azerbaijan has around 400 of the roughly 1,000 mud volcanoes on Earth, which, along with its abundance of oil and gas reserves, has earned the country the nickname ***"Land of Fire,"*** according to the BBC. "*The mud volcanoes in Azerbaijan are some of the biggest and most violent in the world,"* said Mark Tingay, a geophysicist and mud volcano expert at the University of Adelaide in Australia. "*There are, on average, several large mud volcano eruptions each year, and many of them can have big fires."* Most mud volcanoes are situated on small islands created by their eruptions, but some are hidden below the surface and form temporary peaks above the water when active, Tingay said. The most recent explosion is now confirmed to have occurred at the Dashly Island mud volcano, also known as Ignatiy Stone Bank, Tingay said. https://www.sciencealert.com/a-rare-mud-volcano-just-exploded-into-a-towering-inferno

CVRMS Board Minutes July 27

MEETING CALLED TO ORDER: by Marv at 7:15 pm..
Members present: Mav Houg, Dale Stout, Dell James, Kim Kleckner, Jay Vavra, Sharon Sonnleitner, Ray Anderson,

MINUTES: Reviewed as published. Motion to accept by Jay 2nd by Dale. Minutes approved as published.

TREASURERS REPORT: by Dale. Checking account current balance $6131.54. Ray made motion to accept, 2nd by Jay. Treasurer's report accepted.

AUCTION: Kim and Kim will pick up Gil Norris stuff in Rock Island. Dale will help.
Larry Verdick has abput 1.200 lbs. of agates.
Kalona has food truck but only on Saturday. The club will take care of coffee, desserts, chips, drinks, and arrange for sandwiches on Sunday.

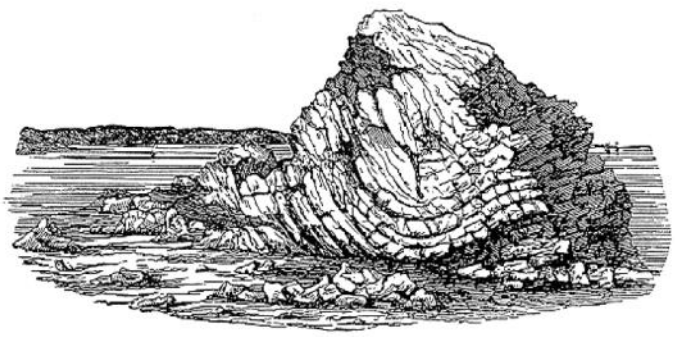
SHOW: Dell will send show announcement to *Collector's Journal*. Kim has notified social media sites. Dale will take care of other free publications.
No pot luck on Friday, but maybe a catered dinner on Saturday. Will need a volunteer list to serve food on Saturday to keep people from handling the serving utensils.

FUTURE MEETINGS: Picnics have both been a success.
August—Morgan Creek—Rock bingo. Marv will provide some bingo prizes. Anyone else with appropriate prizes should feel free to donate to cause.
What if someone cannot attend meetings in Hiawatha? Is there a way that we can make the program available via Zoom? It is being worked on

MISC: Displays for River Products cabinet are being worked on by Ray. Suggestions needed for what should be included in case in conjunction with Debbie from River Products.
Ray would like to update his computer to Microsoft 365 so he can have updated Power Point. Motion made By Dell that we approve the yearly fee of $100 as well as the initial set up fee of $100. Second by Kim. All approved.

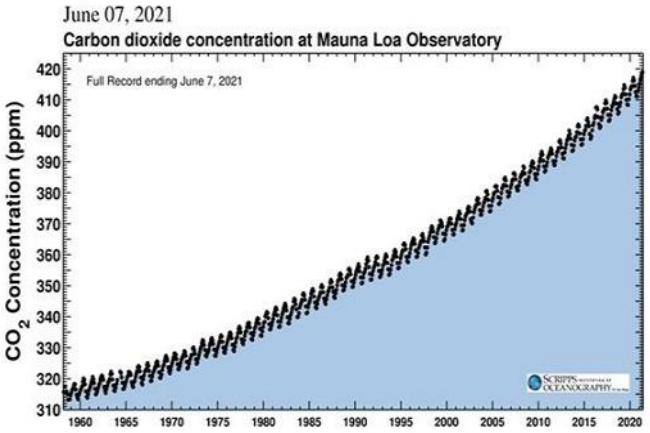
8:15p.m. Motion: to adjourn by Dale 2nd by Jay. Meeting adjourned.

Respectfully submitted,
Dell James Secretary



Atmospheric CO2 Just Hit a Peak Not Seen on Earth in 4 Million Years

Despite slim hopes that global shutdowns during the pandemic might bring respite from the climate crisis, yet more evidence confirms that no such silver lining exists. Newly released measurements of atmospheric **carbon dioxide (CO_2) levels** in fact show that concentrations of the heat-trapping chemical have surged to record levels not seen by scientists in the era of modern readings. The month of May saw the highest levels of CO_2 so far in 2021, NOAA announced. *"We are adding roughly 40 billion metric tons of CO_2 pollution to the atmosphere per year,"*



say scientists from the NOAA's Global Monitoring Laboratory. ***"If we want to avoid catastrophic climate change, the highest priority must be to reduce CO_2 pollution to zero at the earliest possible date."*** The new 419.13 ppm peak is the highest monthly average since accurate atmospheric measurements began over 60 years ago. But to appreciate the true scale of this result you'd have to go much, much further back in time to ever find Earth's atmosphere as overloaded with CO_2 as it is now. How far back? Well, roughly to around the time of the Pliocene, specifically about **4.1 to 4.5 million years ago**. At that time Earth's polar regions were so warm there was no ice, but they were over-grown with forests, and the sea level was over **65 feet higher** than it is today. We may be only hundreds of years away from a return to those conditions, scientists fear, once the now-comparable levels of CO_2 have enough time to warm up the planet again. Even before we get there, projected sea-level rise by the end of this century alone could threaten to displace hundreds of millions of people. The last decade has seen the most rapid CO_2 increase of any decade in human history. It's despairing. But it needn't be. "*The solution is right before our eyes*," according to senior climate scientist Pieter Tans from the NOAA's Global Monitoring Laboratory. *"Solar energy and wind are already cheaper than fossil fuels and they work at the scales that are required. If we take real action soon, we might still be able to avoid catastrophic climate change*." .
https://www.sciencealert.com/carbon-dioxide-just-hit-a-peak-not-seen-on-earth-in-4-million-years

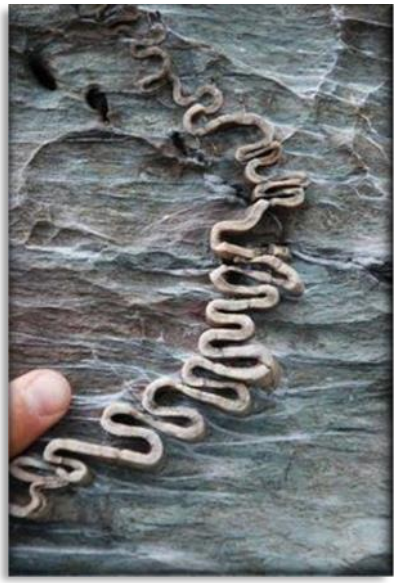
Spotlight Gemstone: Peridot

August's birthstone, **peridot**, is gem-quality olivine, a silicate mineral with the formula of $(Mg, Fe)_2SiO_4$. As peridot is a magnesium-rich variety of olivine (forsterite), the formula approaches Mg_2SiO_4. Its green color is dependent on the iron contents within the structure of the gem. Peridot occurs in silica-deficient rocks such a volcanic basalt as well as in pallasite meteorites. Peridot is one of only two gems not formed in the Earth's crust, but in molten rock of the upper mantle. Gem-quality peridot is rare to find on Earth's surface due to its susceptibility to weathering during transportation from deep within the mantle to the surface. With a hardness of 6.5 -7, peridot is one of the few gemstones that occur in only one color: an olive-green. The intensity and tint of the green, however, depends on the percentage of iron in the crystal structure, so the color of individual peridot gems can vary from yellow, to olive, to brownish-green. In rare cases, peridot may have a medium-dark toned, pure green with no secondary yellow hue or brown mask. Inclusions are common in peridot crystals but the variety depend on the location it is found at. Stones from Pakistan contain silk and rod like inclusions as well as black chromite crystal inclusions surrounded by circular cleavage discs resembling lily pads, and finger print inclusions. Brown Mica flakes are more evident in Arizona gems. Peridot's apple-green hue has been treasured for over 4,000 years. The Ancient Egyptians so adored Peridot that the location of its fog-shrouded volcanic mines on the Red Sea island of Zabargad were a closely guarded secret. The Romans dubbed it "*evening's emerald*" because unlike the deep-green emerald, Peridot's citrus tones remain constant even by candlelight. In the Middle Ages, Europeans adorned cathedrals with fine Peridot stones, and today many large fine peridots can be viewed in the world's museums. The largest cut peridot olivine is a 310 carat (62 g or 2.2 ounce) specimen in the Smithsonian Museum in Washington, D.C.

What in the World?

What in the World? Is this unusual, quarter-sized Iowa fossil??

July's Photo



Last month's **What in the World?** photo showed a beautiful *ptygmatic fold* in a gneiss host rock. A ptygmatic fold is an irregular, lobate fold, usually found where a single competent layer is enclosed in a matrix of low competence. Typically, ptygmatic folds are series of similar folds, with its axial plane characteristically curved. They usually form in *migmatites* (igneous rocks injected into gneisses), and are caused by the high-temperature and high-pressure during the injection process.

ROCK CALENDAR
CVRMS EVENTS OF INTEREST

2021

Aug. 17 — CVRMS Monthly Meeting
August Picnic - 6:00 pm (eat at 6:30)
Morgan Creek Park Shelter
"Bingo Night"
More details on Page 1

Aug. 23 — 3 Rock Clubs Monthly Program
Virtual - 7:15 pm
https://us02web.zoom.us/j/89524404665
Ithial Cateri

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

Sept. 24-26 — Geode Fest
First Christian Church Parking Lot
3476 Main Street
Keokuk, Iowa
http://www.keokukiowatourism.org/event_calendar/geode_fest/index.php

Oct. 22-24 — MAPS 2021 Fossil Expo
Illinois State Fair Grounds
Springfield, Illinois
http://www.midamericapaleo.org/content/news/2021_Jan_Prelim_Announce.pdf

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

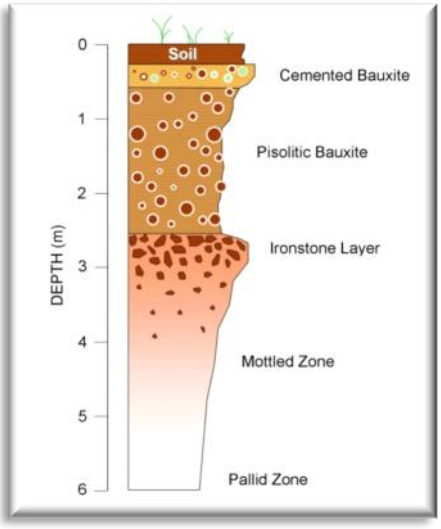
Ask a Geologist

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

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

Jack was over working in the rock lab with me a few days ago when I completed polishing a very nice **bauxite** specimen. We got to examining and discussing how it might have formed. We knew the basics (formed in a deeply-weathered laterite soil and was the principal ore of aluminum) but none of the details, so I researched them and will share that information with you here. The dictionary describes **bauxite** as "*a sedimentary rock with a relatively high aluminium content. It is the world's main source of aluminium and gallium. Bauxite consists mostly of the aluminium minerals* ***gibbsite*** *($Al(OH)_3$),* ***boehmite*** *(γ-AlO(OH)) and* ***diaspore*** *(α-AlO(OH)), mixed with the two iron oxides* ***goethite*** *(FeO(OH)) and hematite (Fe_2O_3), the aluminium clay mineral kaolinite ($Al_2Si_2O_5(OH)_4$) and small amounts of* ***anatase*** *(TiO_2) and* ***ilmenite*** *($FeTiO_3$ or $FeO.TiO_2$). Bauxite appears dull in luster and is reddish-brown, white, or tan in color."* Bauxite is formed by the thorough weathering of many different rock types. They break down into laterite soils, rich in aluminum and iron, in tropical climates where heavy rainfall results in intense weathering. They are severely leached of silica and other soluble materials. Clay minerals commonly represent intermediate stages, but some bauxites appear to be reworked chemical precipitates rather than simple alteration products. With the weathering of silica-rich rocks, the relatively mobile elements such as **calcium**, **sodium, potassium** and **magnesium** are washed away, while the immobile metals including **aluminium**, **iron**, **titanium**, and **zirconium** remain. After many millions of years what is left is called a "*laterite,*" which can be either iron-rich, or in extreme cases, aluminium-rich (i.e. bauxite). Most lateritic bauxites were formed in a period from the mid-Cretaceous to the late-Tertiary, that is, 100 million to 2 million years ago. During this time, laterite formation was not continuous. Instead, they formed during relatively short periods of intense weathering separated by long periods of less intense weathering. Many lateritic bauxites are *pisolitic*. The word pisolitic comes from the Greek meaning pea-sized rock particles. When cut or broken open their inside surfaces reveal concentric bands of different mineral compositions. A typical bauxite soil profile consists of a relatively thin soil layer overlying a horizon consisting of cemented pisolitic bauxite. The main mineral within this cemented layer is boehmite (or "*monohydrate*" as the miners call it). It is one of the most aluminium-rich in the lateritic bauxite, however the layer is normally stripped off and discarded during mining because it is typically cemented and would therefore require crushing. In addition, the caustic soda solution that is used to extract aluminium from bauxite needs to be much hotter to leach boehmite than gibbsite, so processing costs would be correspondingly higher. Underlying the cemented bauxite is a layer of loose pisolitic bauxite 1-2m thick. The main mineral in the pisolitic bauxite is the aluminium-rich mineral gibbsite or "*trihydrate*" as it is commonly referred to. Pisolitic bauxite ore is an ideal ore for various reasons. It is located close to the surface so very little cover is needed to be removed to expose it. The bauxite is loose and easily mined with front-end loaders. Beneficiation of the ore before it is shipped out of port involves simple screening and washing. Selective mining ensures that only the highest grades are mined. Below the pisolitic bauxite horizon is a nodular ironstone layer. At this level, the bauxite becomes increasingly iron and kaolin-rich. **Kaolinite**, which contains a great deal of silica, is also much lower in aluminium content than bauxite. Kaolinite tends to dissolve relatively easily in the caustic soda solution during aluminium extraction so it uses up this valuable chemical. For this reason, mining has to be done very carefully as the ironstone layer is approached because kaolinite in the ore significantly reduces its value. Beneath the ironstone layer the profile becomes increasingly less nodular and more mottled in appearance. The mottled zone has reddish colored patches containing **hematite** and **goethite,** within a pale colored kaolin-rich mass. At greater depths below this zone the white mineral kaolinite dominates, hence the name pallid zone given to the lowest part of the weathering profile. Laterite bauxite can be found in many locations around the world. An occurrence in the Minnesota River Valley near Redwood Falls is currently being mined for the kaolinite clay in the Pallid Zone. Bauxite rocks from this area and from other sporadic occurrences scattered across much of central and western Minnesota were transported into Iowa by the Pleistocene continental glaciers and are often found by rock collectors in our area, as this specimen was.

my polished bauxite specimen

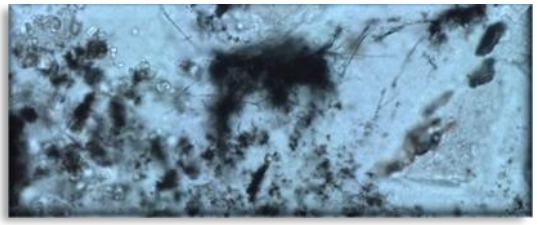


"Typical" bauxite laterite section

Ancient Microfossils of Primordial Microbes Found in 3.4 Billion Year-Old Rocks

Newly discovered microfossils some **3.42 billion years old** are the oldest evidence yet of a particular type of methane-cycling microbe life, and they could help us understand how life got started in the first place. These life forms would have originally existed just below the seafloor in pockets of a rich liquid soup, created from the mixing of cooler seawater from above and the warmer hydrothermal fluids rising up from the depths. The new findings may answer some of the questions about how and where life first began during the Paleoarchean era (3.2-3.6 billion years ago), or whether indigenous microorganisms like this were around even earlier in Earth's history. The rocks that yielded the fossils were collected from the Barberton Greenstone Belt in South Africa, near the border with Eswatini and Mozambique, a place where some of the oldest and most well-preserved sedimentary rocks on the entire planet can be found. Researchers found *exceptionally well-preserved* evidence of fossilized microbes that appear to have flourished along the walls of cavities created by warm water from hydrothermal systems a few meters below the seafloor. Analysis of the retrieved sediment showed microfossils with a carbon-rich outer covering around a core that was both chemically and structurally distinct, indicating microorganisms with cellular material wrapped in a wall or membrane. Further study revealed most of the major chemical elements needed for life, plus other supporting evidence that these microfossils were once microbes: concentrations of nickel similar to those found in modern-day archaea prokaryotes, microbes which use methane rather than oxygen like their distant ancestors did. Their findings could extend the record of archaea fossils for the first time into the era when life first emerged on Earth. Scientists continue to make progress in figuring out how life on Earth got started, and how the inorganic became organic, but we still don't know exactly what happened and in what order. https://www.sciencealert.com/scientists-have-found-the-oldest-known-microfossils-of-methane-cycling-microbes?

The outcrop from which a sample was taken. (Cavalazzi et al., Science Advances, 2021)

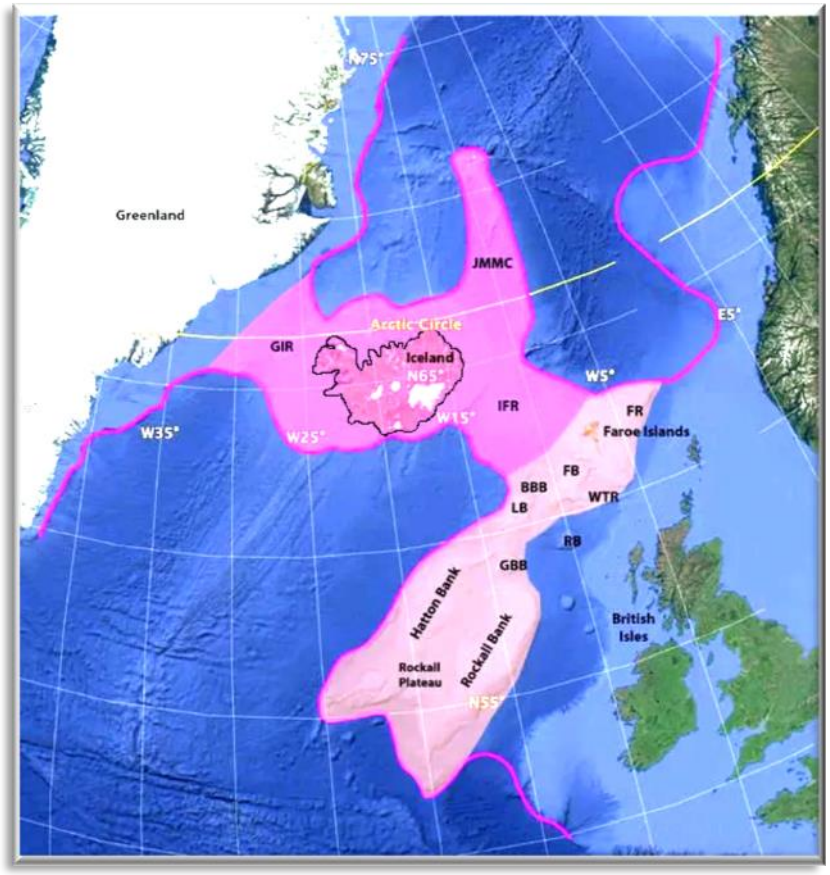


Optical microscope image of the microfossils

How many atoms are in the observable universe?

All matter in the universe is made up of atoms. Each of these building blocks consists of a positively charged nucleus, made up of protons and neutrons, and negatively charged orbiting electrons. The number of protons, neutrons and electrons an atom has determines which element it belongs to on the periodic table and influences how it reacts with other atoms around it. Everything you see around you is just a configuration of different atoms interacting with one another in unique ways. So, if everything is made of atoms, do we know how many atoms are in the universe? To start out "small," there are around **7 octillion**, or **$7x10^{27}$ (7 followed by 27 zeros),** atoms in an average human body. Given this vast sum of atoms in one person alone, you might think it would be impossible to determine how many atoms are in the entire universe. And you'd be right: Because we have no idea how large the entire universe really is, we can't find out how many atoms are within it. However, it is possible to work out roughly how many atoms are in the *observable* universe (the part of the universe that we can see and study) using some cosmological assumptions and a bit of math. Because the universe is **13.8 billion years old** and the observable universe stretches as far away from us as light can travel in the time since the universe was born, you might assume that the observable universe stretches only **13.8 billion light-years** in every direction. But because the universe is constantly expanding, this isn't the case. When we observe a distant galaxy or star, what we are really seeing is where it was when it first emitted the light. But by using cosmic microwave background radiation, we can work out how fast the universe is expanding, and because that rate is constant. That means that the observable universe actually stretches **46 billion light-years** in all directions. But knowing how big the observable universe is doesn't tell us everything we know about how many atoms are in it. We also need to know how much matter, or stuff, is in it. Matter makes up only about **5%** of the universe. The rest consists of dark energy and dark matter, but because they are not made up of atoms, we don't need to worry about them for this calculation. According to Einstein's famous $E=mc^2$ equation, energy and mass, or matter, are interchangeable, so it is possible for matter to be created from or transformed into energy. But on the cosmic scale of the universe, we can assume that the amount of matter created and uncreated cancel each other out. This means matter is finite, so there are the same number of atoms in the observable universe as there always have been. This is important because our picture of the observable universe is not a single snapshot in time. For simplicity we assume that all atoms are contained within stars (most are), and we must assume that all atoms in the universe are hydrogen atoms, (about 90% are). On average, a star weighs around $2.2x10^{32}$ pounds, so the universe is around $2.2x10^{55}$ pounds On average, each gram of matter has around 10^{24} protons, This gives us **10^{82} atoms** in the observable universe. That is **10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000 atoms**. This number is only a rough guess, but it is unlikely to be too far off the mark. https://www.livescience.com/how-many-atoms-in-universe.html?

Academics believe they have identified a remarkable geological secret: A sunken continent hidden under Iceland and the surrounding ocean, which they have dubbed "**Icelandia.**" An international team of geologists, led by Gillian Foulger, Emeritus Professor of Geophysics in the Department of Earth Sciences at Durham University (UK), believe the sunken continent could stretch from Greenland all the way to Europe. It is believed to cover an area of ~230,000 mi^2 but when adjoining areas west of Britain are included in a "*Greater Icelandia*," the entire area could be ~400,000 mi^2 in size. If proven, it means that the giant supercontinent of Pangaea, which is thought to have broken up over 50 million years ago, has in fact not fully fragmented. This new theory challenges long-held scientific ideas around the extent of oceanic and continental crust in the North Atlantic region, and how volcanic islands, like Iceland, formed. They proposed that the crust forming Icelandia is hybrid continental-oceanic material, possibly consisting of >75% continental material and it may be considered to comprise a *third kind of crust* (in addition to *continental* and *oceanic*). The presence of partial continental—rather than totally oceanic—crust could also spark discussions about a new source of minerals and hydrocarbons, both of which are contained in continental crust. The revolutionary new theory was born from an innovative series of expert meetings held in Durham and is included in a dedicated chapter of In the *Footsteps of Warren B. Hamilton: New Ideas in Earth Science* (published 29 June 2021 by the Geological Society of America). Speaking about the new theory, Professor Foulger said, "*Until now Iceland has puzzled geologists, as existing theories that it is built of and surrounded by oceanic crust are not supported by multiple geological data. For example, the crust under Iceland is over 40 km thick—seven times thicker than normal oceanic crust. This simply could not be explained. However, when we considered the possibility that this thick crust is continental, our data suddenly all made sense. This led us immediately to realize that the continental region was much bigger than Iceland itself—there is a hidden continent right there under the sea. There is fantastic work to be done to prove the existence of Icelandia but it also opens up a completely new view of our geological understanding of the world. Something similar could be happening at many more places. We could eventually see maps of our oceans and seas being redrawn as our understanding of what lies beneath changes.*" This work could involve electrical conductivity surveys, and the collection of zircon crystals in Iceland and elsewhere. Other tests such as seismic profiling and drilling would need millions of pounds to fund, but such is the importance of this work that funding may well be forthcoming. Professor Foulger is a world-leading geologist whose research has contributed to mapping the geological composition of the seabed in relation to continental land masses. This work has important legal and political ramifications, as under certain conditions, the United Nations Convention on the Law of the Sea grants coastal states exclusive rights to the non-living resources of their adjacent seabed if scientists can prove that the seabed is a submerged extension of the continental landmass. Professor Philip Steinberg, Director of IBRU, Durham University's Center for Borders Research, noted, "*Countries around the world are spending enormous resources conducting subsea geologic research in order to identify their continental shelves and claim exclusive mineral rights there. Research like Professor Foulger's, which forces us to rethink the relationship between seabed and continental geology, can have far-reaching impact for countries trying to determine what area of the seabed are their exclusive preserve and what areas are to be governed by the International Seabed Authority as the 'common heritage of humankind.*" https://www.geologyin.com/ 2021/07/icelandia-is-iceland-tip-of-vast-sunken.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+GeologyIn+%28Geology+IN%29



Bathymetric map of the NE Atlantic Ocean. Magenta line—boundary of continental crust; magenta—Icelandia; magenta + beige—Greater Icelandia

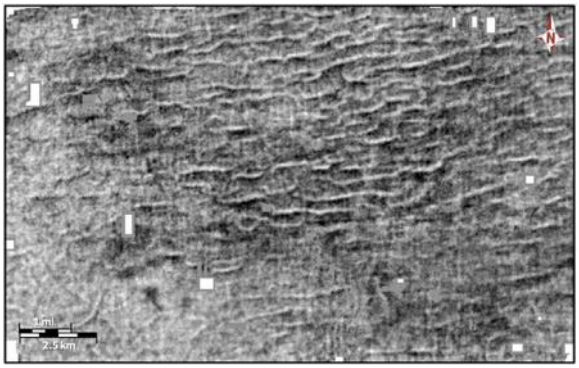
Rare Diamonds Show Life-Giving Elements Present on Earth Soon After It Formed

A unique study of ancient diamonds has shown that the basic chemical composition of the Earth's atmosphere which makes it suitable for life's *explosion* of diversity was laid down at least **2.7 billion** years ago. Work reported at the Goldschmidt Geochemistry conference revealed that volatile gases trapped in diamonds found in ancient rocks were present in similar proportions to those found in today's mantle. This indicates that there has been no fundamental change in the proportions of volatiles in the atmosphere over the last few billion years, and that one of the basic conditions necessary to support life, the presence of life-giving elements in sufficient quantity, appeared soon after Earth formed, and has remained fairly constant ever since. Volatiles, such as hydrogen, nitrogen, neon, and carbon-bearing species are light chemical elements and compounds, which can be readily vaporized due to heat, or pressure changes. They are necessary for life, especially carbon and nitrogen. Not all planets are rich in volatiles; Earth is volatile rich, as is Venus, but Mars and the Moon lost most of their volatiles into space. Generally, a planet rich in volatiles has a better chance of sustaining life, which is why much of the search for life on planets surrounding distant stars (exoplanets) has focused on looking for volatiles. On Earth, volatile substances mostly bubble up from the inside of the planet, and are brought to the surface through such things as volcanic eruptions. Knowing when the volatiles arrived in the Earth's atmosphere is key to understanding when the conditions on Earth were suitable for the origin and development of life, but until now there has been no way of understanding these conditions in the deep past. The study diamonds were recovered from 2.7 billion year old rocks from Wawa, on Lake Superior in Canada. This means that the diamonds are at least as old as the rocks they are found in - probably older. It's difficult to date diamonds, so this gave us a lucky opportunity to be sure of the minimum age. These diamonds are incredibly rare, and are not like the beautiful gems we think of when we think of diamonds. Researchers heated them to over 2000° C to transform them into graphite, which then released tiny quantities of gas for measurement. https://www.geologyin.com/2021/07/rare-diamonds-show-life-giving-elements.html?

One of the 2.7 billion year-old diamonds used in this study.

Fossilized Tsunami 'Megaripples' Reveal the Devastation from the Chicxulub Asteroid

In what's probably the most dramatic mass extinction in Earth's history, an asteroid collided with our planet 66 million years ago, extinguishing 75 percent of living species - including all non-avian dinosaurs. Over the last few years, scientists have discovered many more traces of this cataclysmic impact, providing us with ever greater details of its extreme aftermath - from world-encircling dust to wildfires up to 930 miles from the impact site. In 2019, a team found fossil records of the immediate hours after, including evidence of debris swept up by the resulting tsunami. Now, researchers have discovered enormous ripples, engraved by the tsunami in sediments 5,000 feet below what is now central Louisiana. "*The water was so deep that once the tsunami had quit, regular storm waves couldn't disturb what was down there,*" University of Louisiana geoscientist Gary Kinsland told *Science News*. So there the imprint of the tsunami ripples remained, coated with a fine layer of air-fall debris previously chemically linked back to the asteroid crater in the Gulf of Mexico, near what is now the village of Chicxulub on the Yucatan Peninsula. The **megaripples** were eventually preserved beneath deep water shale during the Paleocene epoch that followed.

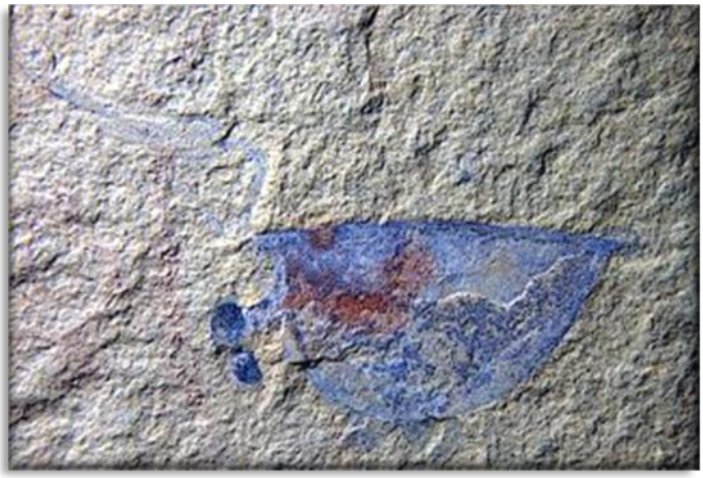


Seismic image of the megaripples. (Egedahl, 2012)

Kinsland and colleagues found them by analyzing seismic imaging data for central Louisiana, gained from a fossil fuel company. They determined the imprinted ripple crests form a straight line right back to the Chicxulub crater and their orientation is consistent with the impact. "*These megaripple features have average wavelengths of 2000 feet and average wave heights of 50 feet making them the largest ripples documented on Earth*," the team wrote in their paper. Previous modelling of this monstrous tsunami suggests its waves would have reached a staggering **5000 feet high** (nearly 1 mile) after the **megaearthquake** triggered by the collision, greater than ***11 on the Richter scale***. The aftereffects would have been particularly devastating in the regions surrounding the impact site, sweeping sea life onto land and land life into the sea. *"Tsunami continued for hours to days as they reflected multiple times within the Gulf of Mexico while diminishing in amplitude,"* the team wrote. What carved out the ripples we can still detect today were the forces from the massive walls of water smashing into the shallow shelf near the shores, and reflecting back towards their source. While the hellish waves would have wrought devastation for thousands of miles, it was the global effects of climate-disrupting atmospheric changes from the impact that wiped out so many species, abruptly ending the Mesozoic. Kinsland and team suspect plenty more evidence of these post-impact tsunami ripples exists within seismic data around the Gulf of Mexico. Future studies could provide even more details about this dramatic event, piecing together the long history of life on our planet. https://www.sciencealert.com/tsunami-megaripples-from-the-dinosaur-killing-asteroid-impact-discovered-in-louisiana

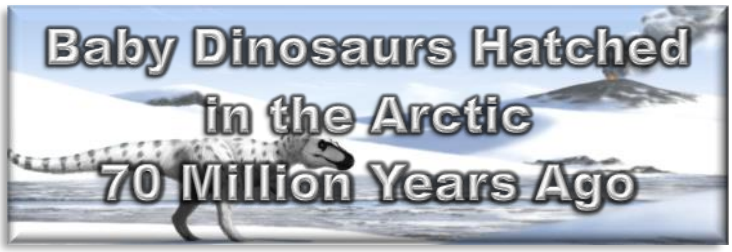
Mysterious 'catastrophe' turned this nursery into a graveyard 500 million years ago

Five-hundred million years ago, an enclave of ancient crustaceans, worms and other creepy-crawly creatures of the deep were tending to their newborn babies when disaster struck. An avalanche of sediment rushed downhill, burying thousands of the creatures and their offspring in an instant. What was once an undersea nursery became a graveyard — and, for some of the hundreds of species that had been living there, an untimely extinction site. Now, researchers digging near the city of Kunming, China, have uncovered that Cambrian-era graveyard for the first time in half an eon, revealing one of the oldest and most diverse fossil troves ever found. The site, named the **Haiyan Lagerstätte** (from a German word meaning "*storage place*"), contains more than 2,800 fossil specimens from at least 118 species, including the ancestors of modern-day jellyfish, insects, crustaceans, worms, trilobites and sponges. Seventeen of these species are new to science, according to a study published June 28 in the journal *Nature Ecology and Evolution* — and more than half (about 51%) of the specimens are juveniles, the researchers wrote, including many larval creatures with their soft tissues remarkably intact. "*It's just amazing to see all these juveniles in the fossil record,*" study co-author Julien Kimmig, collections manager at the Earth and Mineral Sciences Museum & Art Gallery at Penn State University, said in a statement. "*Juvenile fossils are something we hardly see, especially from soft-bodied invertebrates*." The fossil trove dates to about 518 million years ago during the Cambrian period (540 to 490 million years ago), when all life on Earth lived in the oceans. (*For comparison, the Triassic period, which saw the evolution of the dinosaurs, began about 251 million years ago*). This time was an era of biodiversity boom and bust, seeing an explosion of new species that set the stage for all modern animal groups, as well as devastating extinction events. The Haiyan Lagerstätte may be a microcosm of the Cambrian's boom/bust story, according to the researchers. This thriving seabed colony had the right stuff to attract many diverse animal groups, inviting them to settle down and raise their babies in apparent peace (in addition to the plentiful juvenile specimens, the researchers also found a plethora of preserved eggs at the site). This Lagerstätte may be a rare, ancient example of a "*paleo nursery*," the researchers wrote — or a habitat established just for nesting and offspring-rearing, with mature creatures swimming off to seek their fortunes elsewhere after reaching a certain level of development. Perhaps the area was safe from predators, or it offered plentiful nutrition for growing babies, the team wrote. Or, perhaps the area was occupied by a community of animals at all stages of development, before being "invaded" by another group that moved in and started reproducing *en masse*, the team wrote in their study. In any case, life at the Lagerstätte was apparently booming when catastrophe struck. It's unclear what exactly caused the mass death at the site — possibly a storm that surged sediment into the sea, or a sudden drop in oxygen availability, the researchers suggested. But whatever it was, the disaster left the area's inhabitants exceptionally well-preserved. In fact, some specimens are in such good shape that they contain structures the researchers have never seen before. "*The site preserved details like 3D eyes, features that have never really been seen before, especially in such early deposits,*" study co-author Sara Kimmig, assistant research professor in the Earth and Environmental Systems Institute at Penn State, said in the statement. Using CT scans, the scientists will be able to make 3D models of these structures to better understand the weird and varied creatures that called the Lagerstätte home so long ago. And with so many larval and partially developed specimens from the same animal groups preserved there, the site will also tell a story of animal development in incredible detail, the team said.



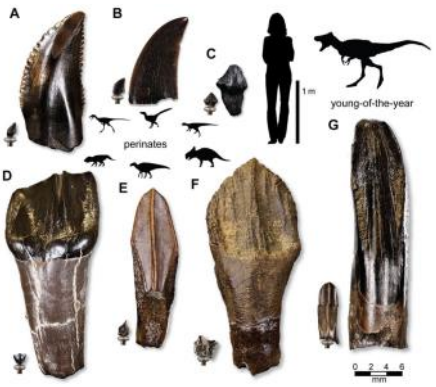
Fossil of a worm (left) and a juvenile arthropod *Isoxys auritus* (above), preserving the eyes and internal soft tissues (Images credit: Xianfeng Yang, Yunnan Key Laboratory for Paleobiology, Yunnan University)

https://www.livescience.com/cambrian-paleonursery-haiyan-lagerstatte.html



Baby dinosaurs toddled around the chilly region that is now the Alaskan Arctic about 70 million years ago, according to the "unexpected" discovery of more than **100 baby dinosaur bones and teeth** there, a new study reports. It was surprising to find evidence of a prehistoric nursery in such a cold place, the researchers said. Even during the warm Cretaceous period (145 million to 66 million years ago), Alaska had an average monthly temperature of about 43 degrees Fahrenheit, and for about four months of the year, the dinosaurs would have lived in permanent darkness and dealt with snowy weather, they said. The Prince Creek Formation of northern Alaska, where the fossils were found, is "*the farthest north that dinosaurs ever lived,*" study co-lead researcher Gregory Erickson, Florida State University, said. After analyzing the babies' teeth and bones, the research team determined that the remains belonged to seven different dinosaur species, including several herbivorous species of ***duck-billed dinosaurs***, ***ceratopsians*** (*horned dinosaurs*), ***thescelosaurids*** (*small, bipedal ornithopods*), ***pachycephalosaurids*** (*dome-headed dinosaurs*) and carnivores, including ***tyrannosaurids***, ***deinonychosaurs*** (*maniraptoran dinosaurs*) and ***ornithomimosaurians*** (*ostrich-like dinosaurs*). The discovery indicates that dinosaurs likely lived in this frigid region all year, as the babies would have been too small for annual migrations shortly after hatching, Erickson said. If these wee dinosaurs and their parents stayed in Alaska year-round, they were likely warm-blooded, or endothermic (a feature that would have allowed them to stay active even when temperatures dropped). The winter months in the Alaskan Arctic at the time were probably the toughest, especially for the herbivores, whose food would have been either covered in snow or dead. Based on knowledge of dinosaur life cycles, the researchers concluded that these baby dinosaurs stayed put after hatching, as they wouldn't have had time to mature before winter set in. That's partly because dinosaur eggs took a long time to incubate — anywhere from three to six months.

Photo showing the baby dinosaur bones and teeth on a penny.



Sizes of baby and adult dinosaur teeth.

https://www.livescience.com/alaska-baby-dinosaur-nursery.html

A newly discovered quasicrystal that was created by the first nuclear explosion at Trinity Site, N.M., on July 16, 1945, could someday help scientists better understand illicit nuclear explosions and curb nuclear proliferation. In an instant, a metal-coated plutonium device named "***Gadget***" imploded, creating a gargantuan fireball that rose high into the sky, vaporizing everything it touched. Sand melted into radioactive glass, and a crater nearly as wide as a football field dented the planet. The test, codenamed ***Trinity***, was a success. But Trinity didn't just destroy; it also left something strange and new behind. In a study published in the journal *Proceedings of the National Academy of Sciences*, researchers have detected otherworldly crystals called ***"quasicrystals"*** trapped in the bomb-blasted rocks at the Trinity site. These odd gems, which lack the perfect symmetry of true crystals, are usually only seen in meteorites from the early solar system, and are thought to be forged only in the extreme heat and pressure of the universe's most powerful explosions. When the plutonium Gadget detonated on July 16, the resulting fireball was hotter than Earth's sun, and the heat and force of this explosion were so strong that the metal test tower and surrounding sand melted together into a new type of glass, later named ***trinitite***. Most trinitite samples are green, like a pale glass bottle. But rarer samples are red, presumably because they contain greater amounts of copper and other metals from the test tower and recording equipment at the site. The team detected a five-sided quasicrystal with an atomic structure never seen on Earth before. The crystal was made predominantly of silicon from the desert sand, but also contained proportionally high amounts of copper, plus some iron and calcium. The crystal, is "*magnificent in its complexity*," and it's still not clear exactly how or why it formed this way. One thing is clear, though: This quasicrystal has an "*unmistakable*" origin, based on its composition, radioactivity and discovery location, the researchers said. It's a unique crystal forged in the fires of America's first nuclear blast, and therefore is the oldest human-made quasicrystal on Earth. Unlocking that information will require a lot more study, but will help us to better understand the cosmic-level explosions that humans have learned to unleash here on Earth. http://www.geologyin.com/2021/05/worlds-first-nuclear-bomb-test-created.html


This sample of red trinitite, forged during the world's first nuclear bomb test, contains a crystal never seen before on Earth

Researchers Discover Why Gold is Concentrated Alongside Arsenic

Why are gold deposits found at all? Gold is famously unreactive, and there seems to be little reason why gold should be concentrated, rather than uniformly scattered throughout the Earth's crust. Now an international group of geochemists have discovered why gold is concentrated alongside arsenic, explaining the formation of most gold deposits. This may also explain why many gold miners and others have been at risk from arsenic poisoning. This work is presented at the **Goldschmidt conference**, after recent publication. Gold is prized for its purity and stability. It's also rare enough to retain its value—the World Gold Council estimates that ***all the gold ever mined in the world would fit into a 20 x 20 x 20-meter cube***. Additionally, because it is one of the most inert metals in the whole periodic table, it doesn't easily react with other substances. So why should gold come together in sufficient quantity to mine—in other words, why do gold deposits exist? Some gold is found as gold nuggets, but an appreciable amount is bound up with minerals. Gold is known to be related to iron, and arsenic-containing minerals, such as pyrite and arsenopyrite. These minerals act sort of like a sponge, and are capable of concentrating gold up to 1 million times more than is found elsewhere in nature, such as in the hot spring waters that transport gold. This gold becomes chemically bound in these minerals, so it is invisible to the naked eye. The scientific team studied the action of the gold-concentrating minerals using the intense X-rays beam produced by the European Synchrotron (ESRF) at Grenoble in France, which can probe the chemical bonds between the mineral and gold. They found that when the mineral is enriched with arsenic, gold can enter mineral structural sites by directly binding to arsenic (forming, chemically speaking, Au(2+) and As(1-) bonds), which allows gold to be stabilized in the mineral. However, when the arsenic concentration is low, gold doesn't enter the mineral structure but only forms weak gold-sulfur bonds with the mineral surface. Lead researcher, Dr. Gleb Pokrovski, University of Toulouse, said, "*Our results show that arsenic drives the concentration of gold. This arsenic-driven gold pump explains how these iron sulfides can massively capture and then release gold, so controlling ore deposit formation and distribution. In practical terms, it means that it will make it easier to find new sources of gold and other precious metals, which bind to arsenic-containing iron sulfides. It may also open the door to controlling the chemical reactions, and if we can improve gold processing, we can recover more gold.*" The new model identifies just why gold tends to be found with arsenic. Dr. Pokrovski said, "*It has been known for centuries that gold is found with arsenic, and this has caused severe health problems for gold miners. Now we know what happens at an atomic level, we can begin to see if there's anything we can do to prevent this.*" The noxious link between arsenic and gold is well-known in France and elsewhere in the world, including at the Salsigne mine near Carcassonne. This was one of Western Europe's largest gold mines, and the world's largest arsenic producer at one time. It closed in 2004, but the environmental consequences of the arsenic pollution still persist in the region. Dr. Jeffrey Hedenquist, University of Ottawa, said, "*Geologists as well as prospectors have long known that gold can be associated with arsenic-rich minerals, and over the past few decades, others have quantified this association. The findings of Dr. Pokrovski and his team now help to explain why we see this association, caused by an atomic-scale attraction between gold and arsenic, with this marriage arranged by the structure of certain minerals*."

A giant gold deposit in W. Australia (SuperPit). Pyrite and arsenopyrite are the major ore minerals concentrating invisible gold together with arsenic.

http://www.geologyin.com/2021/07/researchers-discover-why-gold-is.html

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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. During the COVID emergency meetings will be via ZOOM. When the emergency is over, meetings will return to 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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