Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS | MAY 2020 | VOL. 46, ISSUE 5

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

Next CVRMS Meeting
Tues. May 19
7:15 pm

<<VIRTUAL MEETING>>

Join the Zoom Meeting
https://us02web.zoom.us/j/86198220601

featured presentation:

Rockdoc Ray's First Zoom Talk

(only 15 minutes long)

"Where was the Mississippi River During the Early Illinois Glaciation 160,000 Years Ago??"

Also During the Meeting:

Short Business Meeting

"Show Us Your Favorite Rocks"

"Tell Us What You Have Been Up To"

Named after the Greek word for unstable (*astatos*), **Astatine** is a naturally occurring semi-metal that results from the decay of uranium and thorium. Astatine is so rare, there's just 1 ounce (30 grams) **TOTAL** in Earth's crust. In its most stable form (astatine-210) it has a half-life of just 8.1 hours, which means even if you did happen to stumble on some of it, half of it would be gone by the end of a work day. Depending on how it decays, it will turn into either isotopes of bismuth-206 or polonium-210. This instability, combined with its actual scarceness, means that at any one time, **with less than 1 ounce (30 grams) of it in the entire Earth's crust**. If scientists need to use it, they have to produce it from scratch. That said, only 0.05 micrograms (0.00000005 grams) of astatine have been produced to date. No one's ever seen it in its elemental state, because if you had enough of it to see it with the naked eye, it would have already been ***vaporised*** by the heat of its own radioactivity. However, scientists assume it would take on a dark or metallic appearance if you could see it. According to Quarks to Quasars, astatine is the rarest naturally occurring element that isn't a **transuranic element** (the strange elements on the periodic table that have an atomic number greater than that of uranium [92] and are super-unstable, decaying quickly into a variety of other elements). So how can astatine be the rarest naturally occurring element if transuranic elements are technically even rarer? "*Because the transuranic elements have half-lives much shorter than the age of our planet, so if any of these elements naturally occurred on Earth, they have long since gone, decaying into other things.*" http://www.geologyin.com/2017/05/meet-rarest-natural-element-on-earth.html

CVRMS Apr. 21 Virtual Meeting

7:10p.m. Meeting called to order by Marv after some technical issues -16 members signed on.

2020 SHOW: review of the cancellation of the 2020 Rock Show because of virus quarantine. They discussed possibility of holding the show later in the year. Decision was to not even consider it because of too many concerns and lack of time. A motion made by Tom to proceed with 2021 show keeping the same theme as this year-meteorites. Motion approved. There will be a 2021 show if all is well.

SCHOLARSHIPS: Since we did not have income from the show, out scholarships must be reduced. As published in newsletter, the board recommendation was for:

U of I -$2500
Cornell - $2000
VAST - $1000.

Tom seconded the recommendation. Some discussion regarding the funds available which we have enough. Approved.

AUCTION: Marv has received some feedback from contributors. One has pulled out with 200 lots assigned. Another said to go ahead. Concerned with whether there would be enough bidders present with the uncertainty of the quarantine issues. Since there is a relatively low amount for reserving the building, ($250) we can wait and see for another month or so. All agreed.

BUS TRIP: Decision to wait and see since reservations were not to be taken until May 1. We have time to cancel if need be.

PICNICS: Since parks are closed and maintaining social distancing is a little difficult at picnics, we will wait and see. Doubtful that June picnic will be held. No park reservations have been made yet anyway.

SHOW AND TELL: Various members shared some of their treasures.

CONDOLENCES to Tom Whitlatch whose dad died this week. Virtual funeral will be held on Friday April 24. Condolences may be left at Stewart Baxter funeral services website.

MOTION TO ADJOURN: by Dell, 2nd AJ.

8:25 MEETING ADJOURNED.

Respectfully submitted
Dell James, Secretary

CVRMS Board Minutes Apr 28

Virtual Meeting

MEETING CALLED TO ORDER: by Marv Houg 7:02 p.m.

MEMBERS PRESENT: Marv Houg, Dale Stout, Ray Anderson, Sharon Sonnleitner, Kim Kleckner, Jay Vavra, Bill Desmarais, Del James, and Toby Jordan .

2020 AUCTION: what to do?? Concern is that we have fewer bidders than normal. $250 to cancel the venue. After discussing what we have heard from dealers the board decided to postpone a decision on the Auction. We will discuss the topic again at the May club meeting and Board Meeting.

2020 PICNICS: The City Parks will be closed at least thru May 15, so we have time to discuss it again with the members at the May 19 meeting. Sharon suggested that we could bring our own food and practice social distancing.

IDEAS FOR FUTURE SOCIETY MEETING ACTIVITIES: board members discussed some ideas for activities at future club Zoom meetings.

- ***Wire Wrapping Demonstration***
- ***Virtual Geode Cracking***—get geodes from people in advance and crack them on zoom.
- ***Have participants provide personal updates and stories***
- ***Show and Tell***
- ***Have Ray Give a Short PowerPoint Talk***—Ray agreed to present next month.

2020 BILL'S BUS TRIP: Plan to run the trip if "all clear". **Start sign-up on May 1,** non-members **on Sept 1.**

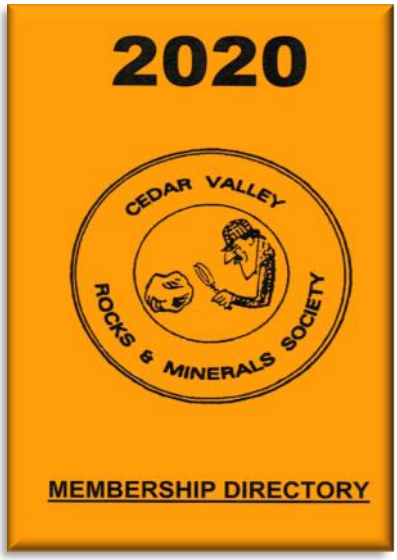
ADJOURNMENT: Dell moved to adjourn, Bill seconded, Meeting Adjourned 8:00 pm

Respectfully Submitted:
Dell James, Secretary

The 2020 CVRMS Membership Directory has been mailed to club members.
If you didn't get yours contact:

Sharon Sonnleitner
sonnb@aol.com
396-4016

(Apologies for a number of members at the end of the alphabet being left out)



The Largest Ammonite Ever Found?

Ammonites belong to the cephalopod subclass *Ammonoidea*. Living near relatives are coleoids, squid, octopus, and cuttlefish. Their name came from their spiral shape somewhat resembling tightly-coiled rams horns like the Egyptian godhood Ammon. The soft body of the creature occupied the largest segments of the shell at the end of the coil. The smaller earlier segments were walled off and the animal could maintain its buoyancy by filling them with gas. This shifting is achieved by repulsion power. They lived from the Devonian until Late Cretaceous (417 - 65 million years ago) in oceans all over the world. The ammonites became extinct at the end of the Cretaceous Period, about 66 million years ago at roughly the same time as the dinosaurs disappeared. There were about 30,000 - 40,000 species of ammonites, and they are very important for geology. They are main index fossils, and it is often possible to link the rock layer in which they are found to specific geological time periods. *Parapuzosia seppenradensis,* the largest known species of ammonite, lived during the Late Cretaceous period. A specimen found in Germany in 1895 measures 5.9 ft in diameter, although the living chamber is incomplete. It is estimated that if complete, this specimen would have had a diameter of approximately 8.4 ft to 11 ft. Its total live weight has been estimated at 3,210 lbs, of which the shell would have constituted 1,550 lbs. Many replicas of this Ammonite are displayed in various museum around the world and in the town, where it was found (Seppenrade, near Munich, North Germany). The original is standing in the foyer of the "LWL-Museum für Naturkunde" in Munich and it´s the logo of the museum.

The world's largest ammonite: *Parapuzosia seppenradensis.*

Ammonites make excellent guide fossils for stratigraphy because:

- they evolved rapidly so that each ammonite species has a relatively short life span
- they are found in many types of marine sedimentary rocks
- they are relatively common and reasonably easy to identify
- they have a worldwide geographical distribution

The rapidity of ammonite evolution is the single most important reason for their superiority over other fossils for the purposes of correlation. Such correlation can be on a worldwide scale. http://www.geologyin.com/2019/05/the-largest-ammonite-ever-found.html

Spotlight Gemstone: Emeralds

May's Birth Stone

May's birthstone, the emerald, is one of the most regal of all and one which denotes life and love. It is also one of the most valuable (the very highest quality emeralds can be more expensive than diamonds). Emeralds are the deep green variety of the mineral beryl [$Be_3Al_2(Si_6O_{18})$], colored by the element chromium. Emeralds are very hard, 7.5-8 on the Mohs scale. The best emeralds are found in South America, having been cherished by the Inca and Aztec peoples, who regarded emerald as a holy gemstone. In contrast, *"Cleopatra's Mines"* in Egypt had already been exhausted by the ancient Egyptians, so that when they were rediscovered in the 19th century, there was simply nothing left! These are only a few of the cultures which treasured this gemstone. In Roman times, emerald was associated with Venus, goddess of beauty and love. Its pigment was so venerated that Pliny remarked that green *"gladdened the eye without tiring it!"* It is also valued in the Catholic Church, green being considered the most elemental and natural of the colors used in their worship. The Vedas, Hinduism's oldest scriptures, acknowledge the healing powers of emeralds, promoting well-being as well as good fortune. Emeralds are also highly prized in Islam - green was the Prophet Muhammed's favorite color, and all dwellers of paradise are said to be dressed in green. In the 1960s, the

The world's largest uncut emerald

American jewelry industry changed the definition of "emerald" to include the green vanadium-bearing beryl as emerald. As a result, *vanadium emeralds*, purchased as emeralds in the United States, are not recognized as such in the UK and Europe. In America, the distinction between traditional emeralds and the new vanadium kind is often referred to as "*Colombian Emerald.*"

What in the World?

What in the World is this pastoral scene and

April's Photo

Last month's "What in the World?" photo shows a reconstruction of ***Elasmotherium sibiricum,*** also known as the **Siberian unicorn,** an extinct mammalian genus that lived in the Pleistocene (2.6 mya -29 tya). Looking like a creature out of Star Wars, this reconstruction is on display in the Ústí museum in Czechoslovakia. Even though it is very similar, the Elasmotherium is not a direct relative of the rhinoceros. The huge horn on top of its head, was anchored on the forehead rather than implanted on the muzzle, as is the case with rhinoceroses. This animal grazed in the vast grasslands of Siberia and Kazakhstan. Due to its impressive size — length of 15 feet, height of 6 feet, and weight of 4 tons — and huge horn, it would not have had trouble with carnivores. *Elasmotherium* would have interacted with early modern man.

Rock Calendar
CVRMS EVENTS OF INTEREST

2020

May 17 —CVRMS Monthly Meeting

<< VIRTUAL MEETING >>
on ZOOM
7:15 pm
link to be sent email

June. 18 - CVRMS Pot Luck Picnic
Ellis Park Overlook Shelter
???? CANCLED ????
decision announced soon

Sept. 19-20—CVRMS Rock Auction
Amana RV Park and Event Center
Amana, Iowa
https://www.cedarvalleyrockclub.org/auction.html

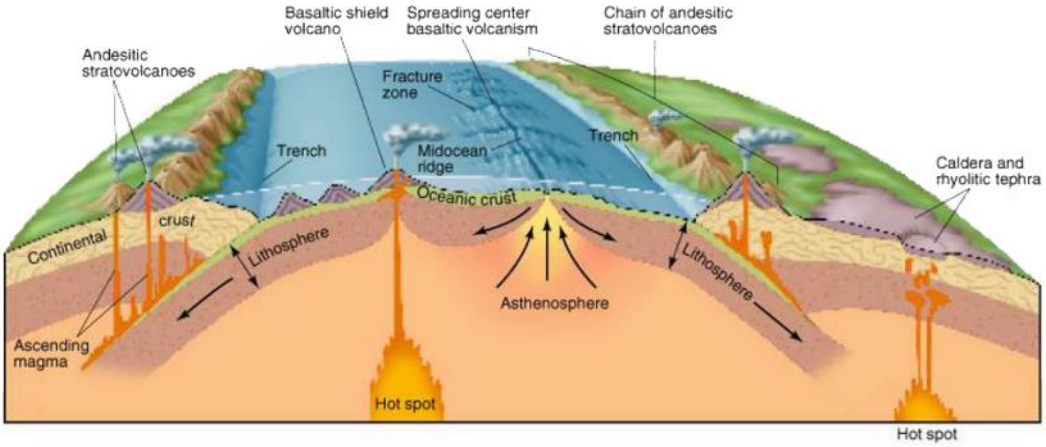
Sept. 27-29 - Geode Fest and Rock Show
Chaney Creek Boat Access
Illinois Highway 96 N
Hamilton, Illinois
http://www.keokukiowatourism.org/

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.

Isolation means that I didn't get any geologic questions last month, so I thought I would expand on something I learned a couple of weeks ago**. Plate Tectonics is Older than We Thought.** Today the Earth's continents are constantly on the move, it's a key feature of our planet, but that wasn't always the case. From a molten Earth, the oceanic plates had to cool enough to be semi-rigid and had to have developed sufficient density contrast to allow them to sink into the underlying mantle. While some scientists think Earth's tectonic plates began pushing and pulling only a billion years ago, others think the whole process started nearly four billion years ago, when our planet was but an infant. That's quite the discrepancy, and as usual, general agreement lies somewhere in between. Today, it's commonly thought Earth's tectonic plates began moving around **2.8 billion years ago,** when the interior of our planet was just the right temperature to allow for the formation of 15 rigid plates. Even still, disagreement reigns. Direct evidence from this time is hard to come by, and now some of the oldest rocks on Earth suggest we may have been more than 400 million years off the mark. Analyzing magnetism in ancient rocks from Australia and South Africa, researchers at Harvard and MIT claim tectonic plates were moving at least **3.2 billion years ago** and **maybe earlier.** "*Basically, this is one piece of geological evidence to extend the record of plate tectonics on Earth farther back in Earth history,*" says Alec Brenner, who researches paleomagnetics at Harvard University. "*Based on the evidence we found, it looks like plate tectonics is a much more likely process to have occurred on the early Earth and that argues for an Earth that looks a lot more similar to today's than a lot of people think.*" The Pilbara craton in Western Australia is one of the oldest slices of Earth's ancient crust and contains fossils for some of the earliest organisms on our planet. Stretching nearly 300 miles, this chunk of primordial crust was formed as early as 3.5 billion years ago. Drilling into a portion of this craton, known as the Honeyeater Basalt, researchers used state of the art magnetometers and demagnetising equipment to uncover the region's magnetic history. Roughly 3.2 billion years ago, their data reveals a shift from one point to another, a latitudinal drift of 1¼ inches a year. Or, as one researcher put it, "*a velocity comparable with those of modern plates.*" "*It's also the oldest example that we know of in which a piece of Earth's crust drifted long distances over the surface.*" But that's about all they can say for now. While it's clear these rocks experienced some sort of horizontal movement, it's unclear if that shift was due to local effects or the rotation of the Pilbara craton as a whole. It could even be a combination of both. There's actually a hypothesis that, in the beginning, Earth's tectonic plates moved in episodes of stops and starts that lasted for several billion years before more modern tectonic movements began. This could be an explanation for the movement in Pilbara between **3.35 and 3.18 billion years ago**, although the authors think the timing hints otherwise. Still, while it's true the data could support episodic movements rather than gradual plate motion, geophysicist Stephan Sobolev, who was not involved in this study, told *Science News* there is another explanation. Some regions of crust may have started to move and subduct earlier than other areas, broken apart by meteorites or some other powerful force. Given how quickly East Pilbara was moving, however, even Sobolev admits "*large-scale subduction must have been involved*." There was clearly something big happening there, and if that something was widespread tectonic movement, that has important repercussions for the formation of habitats and life on Earth. It also could apply to other planets out there. "*Currently, Earth is the only known planetary body that has robustly established plate tectonics of any kind,*" explains one researcher. "*It really behooves us as we search for planets in other solar systems to understand the whole set of processes that led to plate tectonics on Earth and what driving forces transpired to initiate it.*" That hopefully would give us a sense of how easy it is for plate tectonics to happen on other worlds, especially given all the linkages between plate tectonics, the evolution of life and the stabilization of climate.



Obsidian is a naturally occurring volcanic glass. It is formed during the eruption of felsic (granitic) lavas, which are distinguished by having high concentrations of the chemical element silica. Because of their high silica content, felsic lavas do not behave like the mafic (basaltic), or silica-poor, lavas we see on the island of Hawaii. **Green Obsidian** is glassy, volcanic rocks that contain impurities.

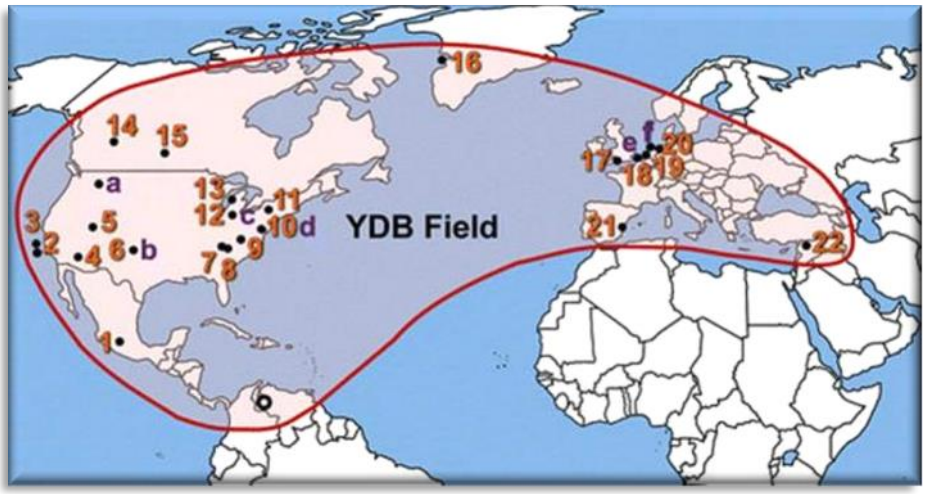
Iron and other transition elements can give a dark brown to black color to the obsidian. Most black obsidians contain magnetite, an iron oxide, nanoinclusions. Pure obsidian is usually **dark** in appearance, though the color varies depending on the impurities, sometimes including tiny microscopic inclusions of other minerals (feldspar, amphibole, biotite, quartz) called **microlites** (*not to be confused with the mineral of the same name*). They can be observed under a microscope as thin rectangular, often equant crystals that can sometimes form bands and give obsidian its characteristic color. In the case of dark **green obsidian** the coloration is caused by varying amounts of iron and magnesium. The green coloration can also be achieved by the presence of gas bubbles (vesicles) in the obsidian lava flow during cooling. Obsidian consists mainly of SiO_2 (silicon dioxide), usually 70% or more. Crystalline rocks with obsidian's composition include granite and rhyolite. Because obsidian is metastable at the Earth's surface (*over time the glass alters to clay mineral crystals*), no obsidian has been found that is older than Cretaceous age. Green Obsidian is also used for ornamental purposes and as a **gemstone**. It presents a different appearance depending on how it is cut: in one direction it is jet black, while in another it is glistening gray. "*Apache tears*" are small rounded obsidian nuggets often embedded within a grayish-white perlite matrix.
https://www.geologyin.com/2019/12/what-is-green-obsidian.html

In 1974, farmers digging a well in China's Shaanxi province stumbled upon fragments of a life-size clay figure crafted in the shape of a battle-ready soldier. Subsequent excavations revealed a stunning, now-iconic archaeological discovery: an army of "**terracotta warriors,**" each rendered with unique traits some 2,000 years ago (***many CVRMS members viewed a display of these soldiers at the Field Museum in 2016*****).** The clay army flanks the mausoleum of **Emperor Qin Shi Huang**, whose short but formidable reign lasted **from 221 to 210 B.C.** Archaeologists estimate that some 7,000 warriors (more than 2,000 of which have since been excavated) were interred alongside the emperor. Now, the state-run *Xinhua* news agency has announced the discovery of an additional 200 soldiers, as well as a large number of weapons, in the emperor's tomb. The finds were made over the course of the 10-year excavation of "***No. 1 Pit***," the largest of three major pits containing the fascinating figures. Most of the newly discovered warriors were sculpted into one of two positions: either clutching pole weapons, with their right arms bent and fists partially clenched, or carrying bows, with their right arms hanging at ease. This individuality is one of the soldiers' more remarkable qualities: all figures found thus far boast distinct expressions, hairstyles and physical features. Archaeologists also discovered a trove of other relics, among them 12 clay horses, the remains of two chariots, colored shields, bronze swords, bows, weapons stored in boxes and traces of building sites. The subterranean army was created at the behest of Qin Shi Huang shortly after his accession to the throne of the Qin state at age 13. He unified the Chinese empire, and enacted a number of measures to centralize his administration and bolster infrastructure. In addition to standardizing weights, measures and the written language, the young ruler constructed a series of fortifications that later became the basis for the Great Wall and built networks of roads and canals. His 20-square-mile funerary compound is presumably a facsimile of the court that surrounded him during his lifetime. An estimated 700,000 workers labored for three decades to build the elaborate burial complex. https://www.smithsonianmag.com/smart-news/200-more-terracotta-warriors-excavated-china-180973900/?

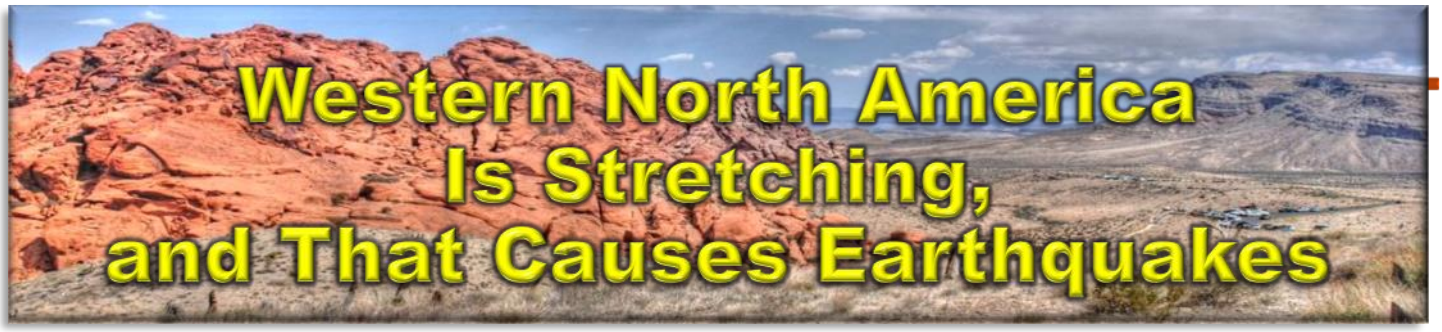
No two warriors are the same.

The Younger Dryas Impact Debate - Is It Settled Yet?

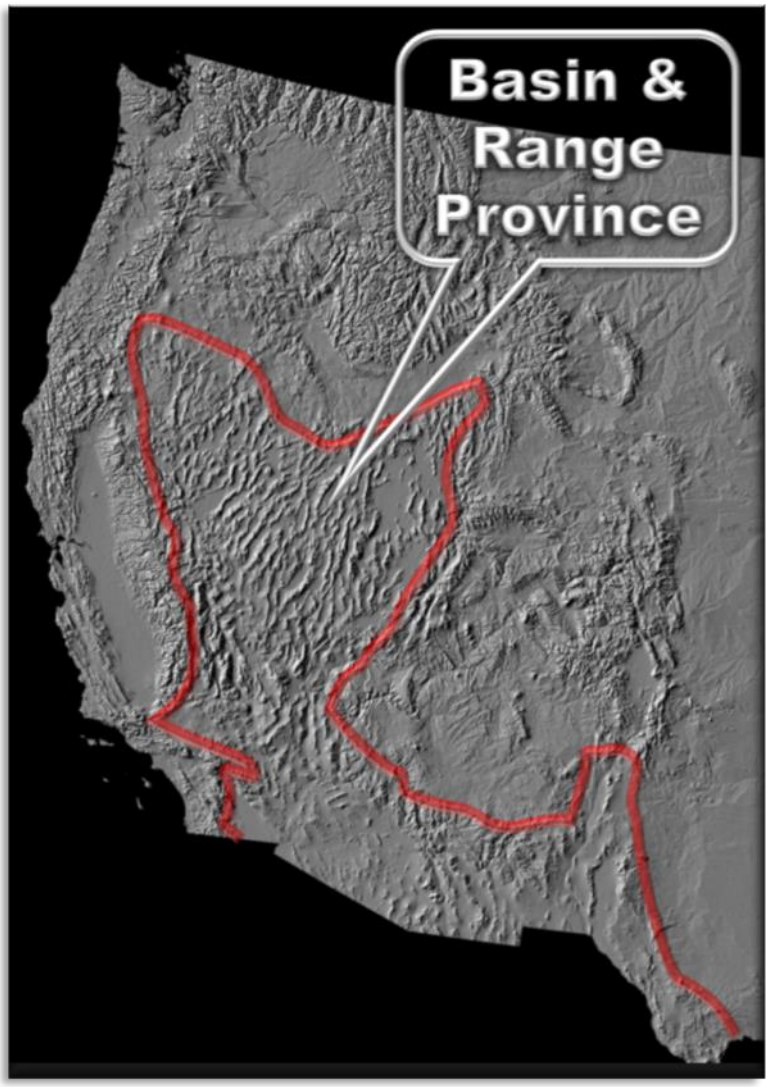
The **Younger Dryas** (between **10,800 to 10,900 BP-***years before present*) was a period marked by the return to glacial conditions after the **Late Glacial Interstadial,** a time of climatic warming following the **Last Glacial Maximum** around 20,000 BP. It has recently been proposed that the Younger Dryas cooling might have been caused by the Earth colliding with a swarm of comet debris from the **Taurid meteor stream**. The impact was so devastating and covered such a wide area, that it is thought to be responsible for an entire geological age, the Younger Dryas (a **mini ice-age** lasting 1,300 years when temperatures in the northern hemisphere were 27 degrees Fahrenheit lower than they are today). The event may have caused the extinction of many large animals, especially in the Americas, such as the mastodon and sabre-tooth tiger. The research debate surrounding this impact event has been very contentious. Some experts point to dramatic climate shifts at the end of the Pleistocene that pared back the elephant's favored habitat. Dissenting opinion convicts human depredation, invoking waves of voracious people who ate the world's megafauna out of existence as *Homo sapiens* moved out of Africa and beyond. But ultimately, it is not evidence of large animal extinctions or rapid climate change that determine whether a **cosmic impact** event occurred at this time, as these effects can also be generated by other mechanisms. To discover whether a cosmic impact occurred at the beginning of the Younger Dryas period, or the ***YD 'boundary'*** as it is known, we should instead consider the geochemical evidence, which consists of unusual chemicals or materials generated by the impact remaining in the ground, as this is diagnostic. Normally, a large asteroidal impact will leave a crater, even if the impact occurs into an ocean – the crater will be in the sea bed in this case. No crater has yet been confirmed for the YD event, although one, and perhaps two, geologically young but very large impact craters under the Greenland ice sheet, discovered in only the last year, appear to be good candidates. Nevertheless, because the ages of these craters are not yet established, we should instead consider the kind of geochemical signals left behind by Tunguska-like airbursts at the YD boundary. In fact, many types of exotic material, potentially of impact origin, have been found at this boundary, which appears as a conspicuous band of discolored sediment, or '**black mat**', at many sites across North America and beyond. Arguably, the three most convincing types of evidence are an abundance of iridium-enriched magnetic grains, nanodiamonds, and high levels of platinum group metals, such as platinum itself or iridium, at the base of the YD black mat. This boundary layer of strange chemicals, which was most likely produced by a swarm of comet debris, has been found spanning three continents. There is really no alternative mechanism for producing a platinum group metal enriched layer of dust over a large patch of Earth's surface, **other than** via a cosmic event like a comet impact, especially if it coincides with an abundance of nanodiamonds and magnetic grains. Indeed, an iridium abundance at the dinosaur-ending 66 million year-old Cretaceous-Palaeogene boundary helped to close that debate out. One of the clearest geochemical signals of the impact is recorded in a Greenland ice core, which displays a substantial platinum anomaly precisely at the beginning of the Younger Dryas cold period (corresponding to when the oxygen isotope trace, a proxy for temperature, plummets). This suggests that this mini ice-age was, very likely, triggered by a cosmic impact, and the ice-core date for this event translates to about **10,870 BC**. A 2015 statistical analysis of radiocarbon ages for Younger Dryas sediments date the event at 10,835 BC, to within 50 years at the level of 95% confidence, was established. This means the geochemical evidence is consistent with a single event, most likely between 10,785 and 10,885 BC, in excellent agreement with the platinum spike in the Greenland ice core. A cosmic impact, therefore, seems to be able to provide the conditions needed for both the megafaunal extinctions and sudden climate change at this time. Perhaps it was the trigger for all these effects. https://www.ancient-origins.net/history-important-events/younger-dryas-0012216



The Younger Dryas boundary (YDB) nanodiamond field



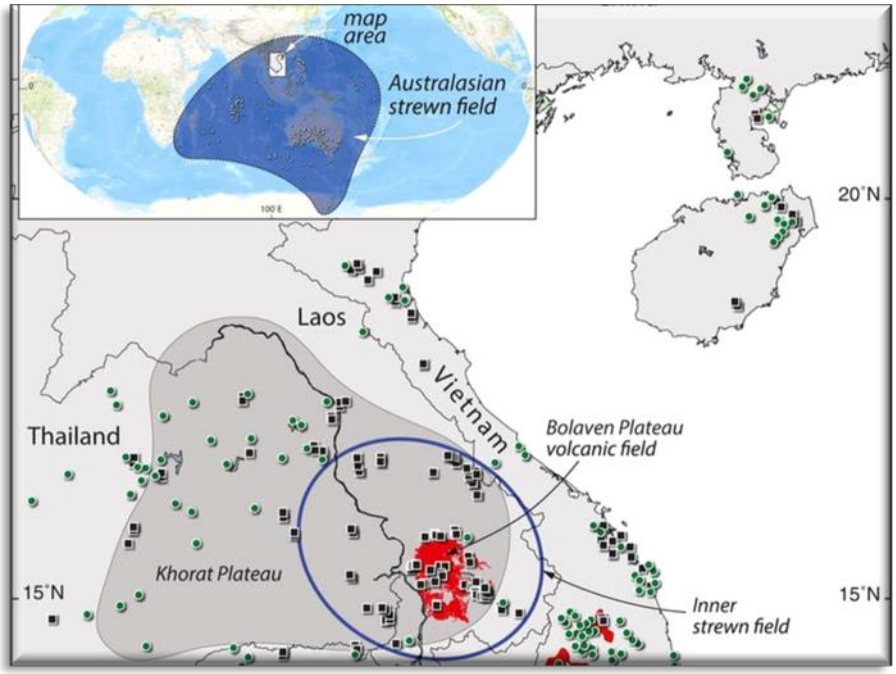
During mid-March, the Western U.S. was shaken by two earthquakes in what might seem like unexpected places. The first was an **M5.7 earthquake** just outside of Salt Lake City (followed by an M4.5 aftershock), and then an **M4.5 temblor** hit outside of Reno and Carson City, both in Nevada. These earthquakes were felt by many people around these cities, but luckily resulted in no deaths or injuries. Some of the older structures in Salt Lake City were damaged by the shaking. So why was Earth shaking in the middle of the Western U.S.? This whole region is known as the **Basin and Range**. Anyone who has driven across states like Nevada and Utah might be able to imagine why. The landscape alternates from west to east from tall mountain ranges to wide, flat valleys. This shows up on topographic maps (*see map on left*) as the "*marching caterpillars*" of the Great Basin. This succession of mountains and valleys is caused by Earth's crust stretching and breaking. As it does, parts of it move downward, making valleys that fill with sediment. In doing so, they leave mountains on each side. This pattern is also known as "***horst and graben***" after the German words for valleys and ranges. Some of these valleys represent miles of dropping of the surface, with faults running on each side of the valley, including the lowest spot in the continent, Badwater Basin in Death Valley. The faults, which are formed by the extension of the crust, are called "*normal faults.*" As North America continues to stretch across the Basin and Range, these faults can generate earthquakes as the valleys continue to drop. Both of the earthquakes that happened in Nevada and Utah recently were on one of the normal faults that bounded a valley. If you can imagine, North America may have **doubled in width** across the Basin and Range over the past 17 million years. This stretching has also made the crust under Nevada and Utah thinner than other parts of North America. This means we do get occasional volcanoes in these states as well, caused by basalt rising up along these faults, including places like the Southwestern Nevada Volcanic Field and Marysvale Volcanic Field in Utah. Why exactly the Western U.S. is stretching is complicated and controversial. The mantle underneath that part of North America appears to be especially warm, causing the rising and stretching of the continent. However, the Cascade Range, the Sierra Nevada, the Yellowstone hotspot track, the San Andreas Fault System and the Columbia River Basalt Province may have all played a role in why the mantle is as hot as it is. These days, the Basin and Range is continuing to ***stretch at rates of around a quarter of an inch per year***. That might not seem like much, but add that over thousands to millions of years, and that's enough to cause faults to move. That movement gives us the earthquakes like we just saw in Salt Lake City. The shaking was felt widely across Utah. The earthquake there happened on the Wasatch Fault Zone that stretches all through the Basin and Range. Historically, there have been almost a dozen earthquakes as big as the March 18 event over the past 120 years. Nevada has also felt dozens of large earthquakes over the past few centuries, many on its western border with California, some of them as large as M7. Earthquakes like these will continue to happen across the Basin and Range as North America continues to stretch. https://www.discovermagazine.com/planet-earth/western-north-america-is-stretching-and-that-causes-earthquakes



Shaded relief map of western North America
with the Basin and Range Province labeled

Australasian Tectites' Source Crater Discovered

About 800,000 years ago, a monster space rock struck the Earth hard and fast. The impact of the 1.2 mile-wide meteorite flung debris across 10% of the planet's surface Scientists have found this ancient debris, mostly in the form of glass blobs known as tektites, in Asia, Australia, and Antarctica, an area referred to as the "**Australasian strewn field**." But until now, researchers had never found the site where the meteorite hit, and they'd been searching unsuccessfully for more than a century. In a new study published in the journal Proceedings of the National Academy of Sciences, scientists describe the location where they think this massive rock crashed: a volcanic field in southeastern Laos. "*There have been many, many attempts to find the impact site and many suggestions, ranging from northern Cambodia, to central Laos, and even southern China, and from eastern Thailand to offshore Vietnam," according to* Kerry Sieh, the lead author of the study. Sieh's team's research offers strong evidence that the crater is buried underground — which explains why researchers couldn't find it before. When a meteorite hits, it super-heats rocks at the point of impact and catapults them into the sky. These liquefied rocks then cool into tektites. By examining where tektites are strewn, scientists can trace the origin of the meteorite that created them. In the case of this strike, the tektites told scientists that a massive meteorite struck Earth's surface 800,000 years ago, somewhere between the three continents where they found the glass bits. The greatest density of tektites has been found in Indochina — the peninsula that consists of Cambodia, Laos, and Vietnam — making that the most logical place to search for the crater. But a meteorite that big should have left a mile-wide scar on the Earth and plunged 300 feet into the ground, according to the study authors. "*That's a very difficult size hole to make go away*," said Aaron Cavosie, an Australian planetary scientist who was not involved in the study. Impact craters can, however, get buried under shifting tectonic plates or scraped away by erosion (though Indochina is a relatively stable part of our planet). In his hunt for the crater, Sieh first looked at three ancient impact sites in Cambodia, central Laos, and southern China. But each crater was tens of millions of years older than the crash site has was searching for. Then, in a region of southern Laos called the Bolaven Plateau, the researchers found lava flows that fit the age bracket: They were between 51,000 and 780,000 years old. Eruptions on that 2,300-square-mile plateau had created a bed of layered lava 1,000 feet deep — a volcanic field big enough to hide a meteorite crater. "This thick pile of volcanic rocks does indeed bury the site of the impact," Sieh and his co-authors wrote. To arrive at their conclusion, Sieh's team compared the chemistry of the rocks in the volcanic field to that of the tektites. They matched. Then they measured gravitational fields around the Bolaven Plateau. Sure enough, the researchers found an underground, elliptical area 300 feet thick, 11 miles long, and 8 miles wide where gravity got weird. Because craters are filled with less dense material than the surrounding rock, they have a slightly weaker gravitational pull. The gravity signals in the Laotian volcanic field indicated the presence of a subterranean crater. What's more, the lava on top of the potential impact crater was less than 800,000 years old. The final piece of evidence sat 12 miles away from the summit of the volcanic field: A patch of sandstone looked to be battered with debris. The sandstone outcrop contained fractured quartz grains, which the geologists think were proximal ejecta from the meteorite — the term for material that gets pushed out from an impact site into nearby rocks. According to Cavosie, the new study does not determine unambiguously that the impact crater is buried in Laos, but he told The New York Times that "*it's a great lead on a new site worthy of investigation*." Scientists will need to drill deeper into the lava bed — likely a few hundred meters down — to find the evidence they need to put this geological mystery to rest.



The map on the upper left shows how far tektites from an 800,000-year-old meteor spread. The main image shows the Bolaven volcanic field in Laos (circled in blue).

https://www.insider.com/impact-crater-from-800000-year-old-meteorite-found-laos-2020-1

For years, paleontologists and dinosaur aficionados alike have debated what was the largest land-dwelling carnivore of all time. In the one corner, there's ***Tyrannosaurus rex,*** the terror of prehistoric North America. In the other, ***Giganotosaurus*** — an equally large dinosaur that stalked ancient Patagonia, and one of the last of an impressive lineage that ruled for tens of millions of years before tyrannosaurs rose to prominence. To paleontologists, *Giganotosaurus* and its relatives are classified as carcharodontosaurs. Their name means "*shark-toothed lizard*," established by the discovery of ***Carcharodontosaurus*** itself in 1931. But even as experts name new species from the U.S., Europe, South America, Africa, and Asia, these momentous meat-eaters can never quite seem to step out of the shadow of tyrannosaurs. That's a shame. For millions of years, the situation was the other way around. If you just glance at a *Carcharodontosaurus*, you might think it's a *T. rex*. Both walked on two legs, had small arms and were equipped with powerful jaws full of menacing teeth. But, inspected more closely, these carnivores are very different. The teeth of *T. rex*, for example, are relatively thick "**banana-shaped pegs**." But carcharodontosaurs got their name from teeth that were thinner from side-to-side and came to a sharper point, better for cutting flesh than pulverizing bone. Likewise, the skulls of carcharodontosaurs don't have as many air pockets inside — the shark-tooths' skulls seem to be a little stronger, letting them deliver powerful bites. Some differences in the neck vertebrae, too, indicate that the shark-toothed hunters had a little more neck agility than *T. rex*, perhaps using powerful neck muscles to help put extra power behind their chomps. This difference in agility extends to the general build of each dinosaur, too. *T. rex* is a bulkier, heavier dinosaur that probably wasn't able to move quite so fast, while carcharodontosaurs have skulls and body proportions that are a little more svelte and less burly. And while *T. rex* was a dinosaur suited to deliver bone-crushing bites and totally take apart carcasses, carcharodontosaurs may have been specialists in taking down and tearing apart the long-necked dinosaurs they lived alongside. These different carnivorous habits are on display among animals even today, such as those between spotted hyenas and lions. Over time, both tyrannosaurs and carcharodontosaurs thrived in the Mesozoic world, but in a back-and-forth dance that played out over time and space. The earliest tyrannosaurs were small, raptor-like animals that evolved around 160 million years ago. They lived under the feet of larger carnivores like ***Allosaurus***, a stand-in for what the ancestors of carcharodontosaurs were like. The shark-toothed dinosaurs, by contrast, continued the trend of their allosaur ancestors and became the dominant carnivores over much of the planet during the Early Cretaceous. To date, the earliest trace of the carcharodontosaurs comes from southeastern Romania. It's a tooth estimated to be more than 132 million years old, from the earliest part of the Cretaceous, and had previously been misidentified as that of a different carnivorous dinosaur. The same happened to a more complete find in Inner Mongolia. Paleontologists had uncovered the bones of a large carnivore that had something of an identity crisis — some experts saw it as an allosaur, others as a tyrannosaur, and some thought it was a raptor, until in 2009 the fossil was redescribed as the oldest definitive carcharodontosaur and named *Shaochilong*. Other finds have stacked up in recent years. Some of these carnivores were absolutely enormous, with *Giganotosaurus* and *Carcharodontosaurus* being comparable to *Tyrannosaurus* in size. Some were smaller but bore bizarre ornaments. ***Acrocanthosaurus*** from the U.S., and ***Concavenator*** from Spain, bore elevated spines along their backs that supported sail-like structures. No one is quite sure why these ornaments evolved. But one thing is clear: These dinosaurs lived large at a time when the ancestors of *T. rex* were meek and small, and they may have greatly influenced the history of other carnivores. It seems like tyrannosaurs exploded to huge size only after the carcharodontosaurs went extinct, or became much less common between 80 million and 66 million years ago. However, despite their importance to ancient food webs, paleontologists are just beginning to understand these titanic hunters. They must have hunted and fed in a different way than tyrannosaurs — their skeletons make that clear. But, did they hunt the colossal titanosaurian sauropods, the long-necked dinosaurs that occupied the same habitats. Even the large size of these animals raises a mystery: If carcharodontosaurs, tyrannosaurs, and some other theropods maxed out around the 40-foot mark, is this some kind of biological limit to how big giant carnivores can be? The story remains in the bones, of the most monstrous predators of all time.

Giganotosaurus skeleton mount, Fernbank Museum of Natural History, Atlanta

https://www.discovermagazine.com/planet-earth/how-shark-toothed-dinosaurs-came-to-rule-the-world?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Club meetings are held the 3rd Tuesday of each month from September through November and from January through May at 7:15 p.m., at the Hiawatha Community Center in the Hiawatha City Hall, 101 Emmons St., Hiawatha IA. The December meeting is a potluck dinner held on the 1st Tuesday at 6:30. June, July, and August meetings are potlucks held at 6:30 p.m. at area parks on the 3rd Tuesday of each month

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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.

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