



Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

cedarvalleyrockclub.org

CEDAR VALLEY GEMS

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Next CVRMS Meeting

Tuesday Feb. 15

Hiawatha Community Center

101 Emmons St., Hiawatha - 7:15 pm

featured video

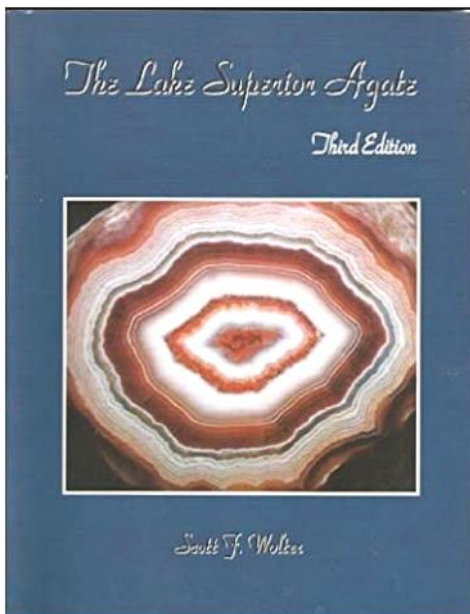
presentation by Scott Wolter

"The Lake Superior Agate"

from the 2008 Symposium

The Wonderful World of Agates

held in Wisconsin.



Blue Scorodite Crystals

Scorodite is a common hydrated iron arsenate mineral, with the chemical formula $\text{FeAsO}_4 \cdot 2\text{H}_2\text{O}$. It is the result of the oxidation of arsenious ores and is found in hydrothermal deposits and as a secondary mineral in gossans (iron-containing secondary deposits) worldwide. Scorodite was discovered in the Schwarzenberg area of Saxony, Germany. It was named from the Greek Scorodion, "garlicky" (when heated it smells of garlic, which gives it the name). Scorodite crystals can be green, blue-green, grey, grayish-green, blue, yellow-brown, violet, or nearly colorless. With a



hardness of only $3\frac{1}{2}$ - 4 it is too soft for most jewelry uses, but it is sometimes faceted and is prized by mineral collectors. The mineral is in the orthorhombic crystal system, and crystals are commonly pyramidal {111} (sometimes pseudo-octahedral), tabular {001}, or prismatic [010]. It is commonly aggregated into crusts or irregular groups and can be found as massive, crystalline or porous and sinter-like, or even earthy. Scorodite displays a sub-adamantine, vitreous, or resinous luster, and it alters to limonite.

<https://www.geologyin.com/2020/09/blue-scorodite-crystals.html>

—-Pandemic Precautions —-

to attend we recommend that you **BE VACCINATED**
in the building you **MUST BE MASKED**
and **PRACTICE SOCIAL DISTANCING**

If you have a cough or cold **STAY HOME**

CVRMS Monthly Meeting, Jan. 16 — Minutes —

Sad news first. Marv announced that two members had died this past week. Tom Whitlatch and Dave Rousch. Marv asked for prayers and condolences be extended to their respective families. Both will be missed.

MEETING CALLED TO ORDER: 7:25 by Marv at the Hiawatha Community Center.

MINUTES OF PREVIOUS MEETING: Bill made motion to accept as published. Seconded by AJ. Minutes accepted as published.

TREASURER'S REPORT by Dale. The Christmas collection for the food banks came to \$475, including check written directly to HACAP and Food Pantry. Checking account balance of \$19,143.68. This reflects higher balance than usual but some big bills have not yet been paid. Mainly the scholarships for last year. Motion to approve minutes by Kim and seconded by Jay. Treasurer's report accepted.

PROGRAM: Presented by Ray Anderson; *Where was the Mississippi River When Early Illinoian Glacial Ice was in Southeast Iowa?*

MARCH SHOW 2022: Sign up sheet for committees passed around and sign up sheet for display cabinets. Ray Anderson announced that most speakers are lined up. Catered meal and pot luck decisions will be made at Board meeting.

2022 ROCK AUCTION: Most of the lots for the auction have been allocated. We are almost full.

OLD BUSINESS: By-Laws have been updated and published in newsletter. Ray made motion to accept changes as published. Bill seconded. No discussion or questions. By-Laws accepted. Thanks to Jay and Sharon for revising the by laws.

SCHOLARSHIPS: The Board suggested that based on 2021 Rock Show profits 2021 scholarships be distributed as follows: University of Iowa (\$4000), Cornell University(\$3000), VAST (\$1500). These are our minimum contributions (as given in our By-Laws) that may be increased in years with more profitable shows using the formula in the By-Laws. Jay made motion to accept these payments for past year. Seconded by Ray. Scholarships accepted.

OTHER BUSINESS:

Freeze Fest will be held Feb 6 in Iowa City. Bill and Ray will display rocks and dinosaurs fossils for participating kids.

PBS Nova will be showing an interesting program tomorrow night (Jan 19) at 8p.m. on Alaskan Dinosaurs.

Kudos to Phil Curry, a friend of the club, for receiving the Ray Chapman Andrews award for Paleontology.

Motion to adjourn by AJ second by Bill. Meeting adjourned 8:40p.m. .

Respectfully submitted,
Dell James, Secretary

CVRMS Board Minutes Jan. 25

CALL TO ORDER: 7:09 pm by Marv Houg at his house.

MEMBERS PRESENT: Marv Houg, Bill Desmarais, Ray Anderson, Sharon Sonnleitner, Dale Stout, Kim Kleckner, Jay Vavra.

MINUTES OF LAST MEETING: Moved to approve by Ray and second by Bill. Minutes approved as published.

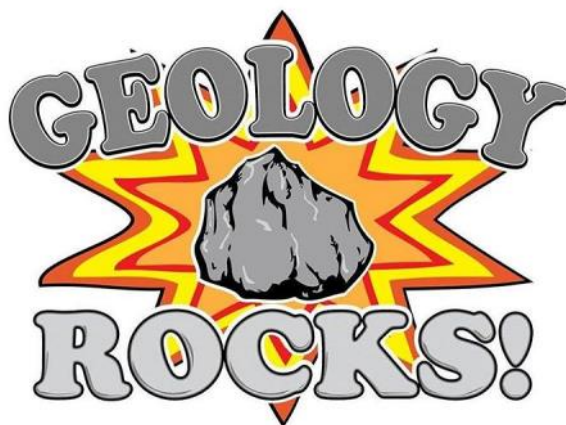
TREASURE'S REPORT: Only change from meeting is scholarship checks written as approved by members. Moved to approve by Bill, second by Ray. Motion passed.

SHOW 2022 MARCH 26-27: All but one of the **vendors** have paid fees. Volunteers to get **show flyers** to Nature Center, Wickiup Hill, etc.; ads in *Tidbits* and other advertising outlets; maybe Gazette. Friday **pot luck** and Saturday **catered dinner cancelled** due to Covid. Ray has most of the **speakers** lined up and all of the **posters** started. Discussion of updating **fluorescent booth**. Sharon will contact Rick Austin about bulbs and momentary button setup. We need a large van or truck with topper to transport **T-Rex model**—maybe Dean. We need to find a truck and driver to pull **club trailer** to show. Dale will send out request. Discussion of possible raffle prizes. Marv will provide **geodes** and **fossils**; and Marv will ask **Gary Peavy** and **ZRS** to donate.

AUCTION OCTOBER 8-9: Marv lists **24 consignors with 1015 lots**. Pretty much full, but still some tweaking of totals. Check on **outlet usage** as/per contract. Dale will check on **food truck** availability. Kim will find **flats** for auction. Discussion of how to help Julie dispose of **Tom Whitlatch's** equipment and supplies, such as separate auction. Need more information from Julie.

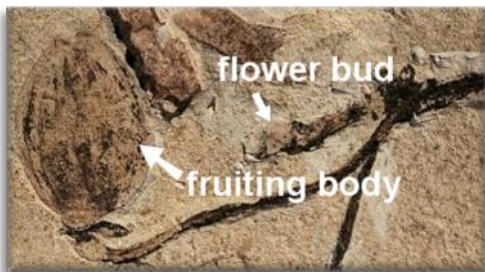
MOTION TO ADJOURN Mby Bill, seconded by Ray. Meeting Adjourned 9:16 pm.

Respectfully submitted,
Ray Anderson, Acting Secretary



A Newly Discovered Fossil Could Be The Answer to Darwin's 'Abominable' Mystery

Scientists in China say they have found the oldest flower bud in the fossil record, finally aligning the fossil evidence with the genetic data suggesting flowering plants, or angiosperms, evolved tens of millions of years earlier than we initially thought. The team hopes their discovery will help "ease the pain" around a nagging, centuries-old mystery that Charles Darwin once called "abominable." If the oldest unambiguous fossil flower is no older than 130 million years old, then **how come angiosperms began to dominate ecosystems just 20 to 30 million years later? How had they evolved such great diversity that quickly?** It was a puzzle that had bothered Darwin greatly, but he never found the answers he wanted. In the past few years, however, some crucial pieces have fallen into place. In 2016, scientists in China announced the discovery of a "perfect flower" dating back to the Jurassic, more than 145 million years ago. The fossilized plant, called *Euanthus*, not only had petals, but it also had sepals (the leafy bit at the base of a bud), as well as male and female reproductive parts, including an ovary similar to modern flowers. In 2018, another fossilized flower was found in China, and this one, called *Nanjinganthus*, was about 174 million years old. Like a modern flowering plant, its seeds were completely enclosed in an ovary. Not all botanists, however, are convinced these are true angiosperms. Some argue these plants are too primitive to be considered flowers, while others think their structures are too complex for a gymnosperm, an older type of plant with unenclosed seeds and lacking a flower, like a conifer. The



The new fossilized flower bud, found in China and dubbed *Florigerminis jurassica*, could be the transitional stage re-

searchers have been looking for. It was found at a deposit dated more than 164 million years ago, and it's still in excellent condition. The plant's stem is connected not only to a flower bud but also to a fruit and a leafy branch – a trio of data that is especially rare. Because flowers are such delicate structures, they are notoriously difficult to find in fossils preceding the Cretaceous. Previous attempts to uncover the origin of flowering plants have been described as an "unbroken record of failure". *F. jurassica* is a one-of-a-kind discovery. Not even *Nanjinganthus* has been found with an intact flower bud, just a flower. The fruit on *F. jurassica* adds even more support to the idea that this is, in fact, an early angiosperm, and not a gymnosperm. No doubt, there will be some experts who disagree, but the authors think their results demand a "rethinking of angiosperm evolution." <https://www.sciencealert.com/researchers-have-found-the-oldest-flower-bud-fossil-yet>

Spotlight Gemstones: Amethyst

February's Birth Stone



February's birthstone, **amethyst**, is the purple variety of the mineral quartz, its most famous and valuable gem variety. Quartz in other colors include gemstones such as **citrine** (yellow), **rose quartz** (pink), and **smoky quartz** (gray). The purple of amethyst is most often caused by iron impurities, though it can also be colored by natural radiation exposure. Amethyst is sometimes heat treated to deepen the color, or to transform it into citrine. Some forms of amethyst may also change to a light green color upon heat treatment (called **prasiolite** or "**green amethyst**"). Amethyst is mined in many locations, some of which produce distinct color styles. For example, amethyst from Uruguay has a deep purplish-blue color, as does amethyst from Arizona. Amethyst from deposits that have since been exhausted in Russia, is known as "**Siberian amethyst**," a very deeply reddish and bluish colored stone which commands a high price. African amethyst is generally more deeply colored than the South American variety. Some amethyst from a few locations may slightly fade in color upon prolonged exposure to light. The color distribution of amethyst is sometimes uneven, and this is often taken into account when cutting a stone. Due to the abundance of amethyst, it is usually clean and free of flaws or inclusions. Because of this, amethyst with any visible flaws or inclusions should be avoided. Amethyst can occur in huge flawless crystals, and gems of all sizes have been faceted. Many rock hounds in this area have collected amethyst at the mines located just east of Thunder Bay, Canada. Amethyst from this locality is frequently found in fractures in granitic rocks. Although there are numerous natural sources of amethyst, synthetic amethyst gems are also produced, using the hydrothermal method. A natural mixture of purple amethyst and golden citrine has been coined with the trade name "**Ametrine**." Amethyst is faceted into many cuts, and is used in all forms of jewelry including rings, necklaces, earrings, bracelets, and pendants. Many large gems weighing several hundred carats have been cut from amethyst. Ornamental objects are also occasionally carved from large pieces. Lower quality amethyst is an important bead gem and can also be cut into cabochons. Tumbled beads of purple amethyst mixed with white quartz are also used as necklaces and bracelets.

http://www.minerals.net/gemstone/amethyst_gemstone.aspx

What in the World?



Where in the World? can you find this collection of sculpted and pedestalled rocks (hint: in an Arizona wilderness area)?

January's Photo



January's **What in the World?** photograph shows a haboob (sandstorm) encroaching on Phoenix, Arizona on July 9, 2018. This storm towered about a mile high and traveled nearly 200 miles, carving a path from the Arizona desert into southeastern California

ROCK CALENDAR CVRMS EVENTS OF INTEREST

2022

Feb. 15 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
the featured **video**
"The Lake Superior Agate"
by Scott Wolter

Mar. 15 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Cornell College Students

Mar. 26-27 — CVRMS Rks, Fos, & Min Show

Hawkeye Downs
Cedar Rapids, Iowa
"Iowa's Industrial Minerals"
(see Show Flyer on page 10)

Apr. 19 — CVRMS Monthly Meeting

Hiawatha Community Center 7:15 pm
Program to be determined

Sept. 23-25 — Geode Fest

First Christian Church Parking Lot
3476 Main Street
Keokuk, IA
<http://keokukiowatourism.org/event-calendar/geode-fest>

Oct. 2 — Sunday At The Quarry

BMC Morgan Quarry
About 1 mile west of Dewer, Iowa
10:00 am — 4:00 pm

Oct. 8-9 — 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 the question. I will also try to respond to all email requests with answers to your questions.

I hadn't heard much about the K-P impact site recently discovered in North Dakota. This article came by just before the February newsletter went to press, and I thought you would find it interesting

The dinosaurs were killed by a meteorite impact on the Earth some 66 million years ago in what has become known as the **Cretaceous-Paleogene extinction event**. At what time of the year this occurred has long generated debate among paleontology enthusiasts. A recent study published in *Nature* builds on earlier evidence to suggest the dinosaurs probably met their demise in June. The fact that researchers have been able to pinpoint the timing of an event that happened millions of years ago is a remarkable feat of science, but more on that later. The latest evidence comes from a site called **Tanis**, located in the **Hell Creek Formation in North Dakota**. Tanis is one of several geological locations around the world where scientists have observed the Cretaceous-Paleogene boundary in the succession of sediments. Tanis has yielded wonderful fossils of dinosaurs, early mammals, fish, plants and other things. Many of these fossils are exceptionally well preserved, with some showing remains of soft tissues, such as skin, as well as bones, which can offer valuable scientific insights. The Tanis site was first identified in 2008 and has been the focus of fieldwork by paleontologist Robert DePalma since then. In a 2019 paper, DePalma and his colleagues argued that Tanis captured the moment of the asteroid's impact, due to three factors. **The first** was the presence of dinosaur fossils occurring in the Cretaceous sediments right up to the Cretaceous-Paleogene boundary, and exactly at the boundary at the time of impact. **The second** was a layer of melt spherules: tiny glass balls that cooled in flight from molten rock. When the asteroid struck Earth in the region of what is now the Yucatán Peninsula in Mexico, it spread debris and melt spherules for thousands of kilometers. **The third** was evidence of seiche waves (see-saw-like standing waves) in deep channels. The Tanis site is well inland today, but at the end of the Cretaceous period it was located on the coast of the western interior seaway that divided North America at that time, with sea levels some 650 feet



One riverbed in North Dakota sheds thousands of fossil clues on the timing and circumstances around the asteroid that caused dinosaurs (like these Caudipteryx) to go extinct

higher than they are today. The site was estuarine, which means fresh and salt waters were mingling. We can imagine that as they floundered in the violently oscillating waters of the river channel, they could have swallowed melt spherules coming from above. The seiche waves were generated by the distant impact in Mexico, which set off seismic waves that shook the Earth and caused water to flow in and out of the river channels at a fast rate, estimated as beginning one hour after the impact. As well as melt spherules within the fossil-bearing rocks, the researchers found abundant spherules in the gill skeletons of some of the fish they examined. We can imagine that as they floundered in the violently oscillating waters of the river channel, they could have swallowed melt spherules coming from above. Looking more closely at the fish

In December 2021, DePalma and his colleagues published an important paper about the timing of the Cretaceous-Paleogene extinction event. In this study, they analyzed some of the exceptionally well-preserved fish bones, looking at how the cycle of seasons, from summer to winter, were documented in the structure and chemistry of the

bones. By comparing living sturgeon to sturgeon fossils from Tanis, they found that in a fin spine, regular layering at a scale of millimeters shows the fish died when it was seven years old. The growth rings confirm the fish alternated between fresh waters in summer months and saline waters in winter. In this and other specimens analyzed in the same study, the last growth increment matches the transition from spring to summer. Taken together, this suggests the meteorite struck in May or June, being the cusp of spring and summer in the northern hemisphere. Importantly, these findings confirm earlier evidence based on fossil plants, which suggested **the extinction event took place in early June**. Paleobotanist Jack Wolfe identified a location in Wyoming that showed the effect of the meteorite on a freshwater lake. At the point of impact, the lake froze, preserving fossil plants in exquisite detail. By comparing the fossil plants to similar modern water lilies *Nuphar* and *Nelumbo*, he showed that the latest Cretaceous water lilies in the lake had been halted in their growth at a point in their trajectory of producing summer leaves, flowers, and fruit which indicated freezing in early June. Paleontologists often say they would need a time machine to understand the details of past life, such as the month the dinosaurs died out. But here we see extraordinary conclusions can emerge from careful analysis and rational comparison with the modern day.

<https://www.popsci.com/animals/when-dinosaurs-went-extinct/>

The Largest Known Flying Animal Was Even Weirder Than We Thought

The pterosaur *Quetzalcoatlus northropi* is the largest known flying animal to have ever existed, living on Earth more than 67 million years ago. Now new research on the creature and its newly discovered smaller relative, *Quetzalcoatlus lawsoni*, gives us a better idea of how *Q. northropi* flew and got airborne to begin with. Our knowledge of *Q. northropi* is based on hundreds of fossils discovered in modern-day Texas, and its take-off method has been a matter of some dispute: It has been suggested that it ran to build up speed like an albatross before flying, or rocked on its wingtips like a bat, or perhaps that it didn't get up into the air at all. The new study suggests that the

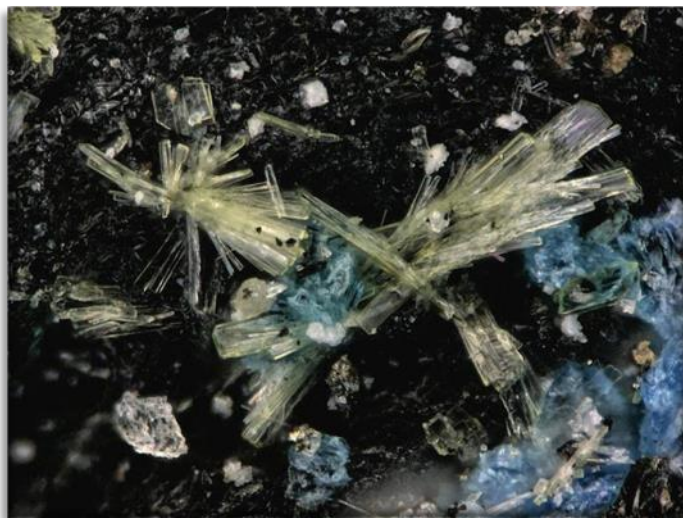


pterosaur used a leap of about 8 feet into the air, followed by flaps of its 36-foot wings, to take to the sky. It would have landed like an airplane, slowing up in the air before touching down on terra firma and taking a hop for stability. By jumping 8 feet (twice their hip height) the wings would be able to clear the ground, and they could execute a deeper flight stroke. This may be the best theory for taking off, though it depends on sufficient power from the legs. The animal had to flap its wings to stall and slow its descent before it landed on its back feet with a little hop. It would then put down its front feet, assume a four-legged posture and walk away. Evidence for this unconventional landing and walking style also comes from fossilized tracks previously discovered in France. When on the ground, the scientists suggest, the creature would have used its 'chopstick-like' beak to catch and gulp down fish, invertebrates, and small amphibians from the water, much like a heron does. In the air, *Q. northropi* would have been much more like a condor, soaring in the air and using its relatively large head to help complete turns. The researchers think that the wings were most likely only attached to the front limbs, like the birds we know today. The new findings, spread out over six published papers, give us a better understanding of these prehistoric beasts, and there are likely more species to find. Further study should also be able to answer remaining questions about *Quetzalcoatlus*, including the shape of its wing membrane.

<https://www.sciencealert.com/the-largest-ever-flying-animal-was-a-condor-in-the-skies-and-a-heron-on-the-ground>

New Mineral Described from Uranium Mine in Utah

A new mineral named **oldsite** has been verified and accepted by the International Mineralogical Association. Carnegie Museum of Natural History announces the naming of the new mineral Oldsite after Dr. Travis Olds, the museum's Assistant Curator of Minerals. The International Mineralogical Association (IMA) verified the mineral, which was accepted in October 2021 by an international team of scientists. Oldsite is named in recognition of Olds' contributions to uranium mineralogy. Collected at



Yellow oldsite blades with blue stanleyite and white szomolnokite on asphaltum. Horizontal field of view is 0.7 millimeters.

Photo by Dr. Anthony Kampf.

Utah's North Mesa mines near Temple Mountain, Oldsite forms from the interaction of air and water with uranium and iron-sulfide ores in the humid underground environment, leading to crystalline deposits on the surfaces of mine walls. Oldsite occurs as tiny yellow, rectangular blades measuring up to 0.3 millimeters in length. The crystals are thin and brittle and dissolve in water. The holotype specimen of Oldsite (or original specimen to be named) is held in the collections of the Natural History Museum of Los Angeles County. Its chemical formula is $K_2Fe^{2+}[(UO_2)(SO_4)_2](H_2O)_8$. "I'm honored to be the namesake of such a fascinating mineral," said Olds. "My research focuses on descriptive mineralogy, particularly minerals containing uranium, which has been my passion since I knew I wanted to become a mineralogist. Oldsite is unique because it helps us fill in some puzzle pieces about how uranium behaves in the environment. The way its atoms connect to each other in the crystal structure tells us about the conditions that led to its formation. This information can be useful to help keep uranium out of drinking water, or to clean up nuclear waste." The research team that discovered and described Oldsite includes Dr. Jakub Plášil from the Czech Republic's Institute of Physics ASCR, Dr. Anthony R. Kampf of the Natural History Museum of Los Angeles County, Dr. Chi Ma of California Institute of Technology, and German mineralogist Joy Desor.

<https://www.geologyin.com/2022/01/new-mineral-described-from-uranium-mine.htm?>

55-sided, 555-carat 'Enigma' black diamond (possibly from space) goes on sale

One lucky millionaire, or billionaire, will soon be able to get their hands on a one-of-a-kind black diamond, known as the "Enigma," when the shadowy gem goes up for auction next month. But they might not be getting exactly what they paid for. The Enigma has been artificially cut to weigh exactly **555.55 carats (=111 grams, = 0.25lbs)** and has 55 black facets. It is currently the largest cut black diamond in the world, according to Guinness World Records. The shape of the diamond is based on the [five-fingered] Middle-Eastern palm symbol of the Khamsa, which stands for strength and protection Khamsa means "five" in Arabic.) The auction house Sotheby's unveiled the unique gemstone in Dubai, United Arab Emirates, on Jan. 17. The diamond will also be displayed in Los Angeles before arriving in London to be auctioned on Feb. 3. Sotheby's estimates the Enigma will eventually sell for **at least \$6.8 million**. Cryptocurrency bids will also be accepted by the auction house. In addition to the diamond's unusual color and unique weight and shape, one of the main selling points is that it may have originated from space. According to a statement from Sotheby's, the Enigma is "*thought to have been created either from a meteoric impact or having actually emerged from a diamond-bearing asteroid that collided with Earth.*" However, black-diamond experts have told Live Science that they are skeptical of the company's claim and said the gemstone probably originated on Earth. Black diamonds have high densities of opaque mineral inclusions, particularly graphite (a dark gray form of carbon with a hexagonal structure, unlike diamond, which is a form of carbon in a tetrahedral shape) and metal sulfides. Sotheby's describes the Enigma as a carbonado diamond, a Portuguese name given to black diamonds in the 19th century. However, not all black diamonds



are carbonados. Rather, a carbonado is a type of black diamond that is both polycrystalline, meaning multiple crystals fused into a single gem, and porous. Carbonado diamonds also contain uranium-rich phosphates, which generate "radiation halos" around the pores, or holes, on their surfaces. This trait makes them highly absorptive of white light, making them completely opaque and much darker than other black diamonds. Carbonados are super-hard and super-tough, due to their polycrystalline and porous properties. This makes them perfect for industrial use, such as drill bits used in the oil industry for penetrating hard igneous rocks. Considering its large size, the Enigma is most likely a true carbonado. After looking at magnified images on his computer, Peter Heaney, a geoscience professor at Penn State and a black-diamond expert, believes the Enigma is pitted (meaning it is porous), which is suggestive of a carbonado, but it is hard to tell for sure because the diamond has been cut. It is also hard to tell from the images if the diamond is truly opaque. All known carbonados have been found in either Brazil or the Central African Republic and date back to roughly 3.8 billion years ago. During this time, the two countries were part of the same supercontinent known as Rodinia, but exactly how and where the diamonds formed is still unclear. It is possible that carbonados do have an extraterrestrial origin, as the auction house claims. Scientists have found black diamonds created from the impacts of meteorites in the past, but these diamonds are normally very small, which makes it an unlikely origin for true carbonados as large as the Enigma. Other space-based theories speculate that fully formed carbonados could already exist in some asteroids that crash to Earth or even that the diamonds are

formed by powerful stellar explosions called supernovas, but there is not enough evidence to support either of those ideas. "*I believe the chances of carbonado specimens we've studied and seen data for being from outer space are low,*" said Richard Ketcham, a geoscientist at the University of Texas at Austin, who has also studied black diamonds. The idea of carbonados originating from space is the "*minority viewpoint among those who study them,*" he added. Instead, he believes the most likely origin of carbonados is here on Earth. However, the exact mechanism that forms these black diamonds isn't yet clear. Most diamonds form when high pressures in Earth's middle layer, or mantle, crush organic carbon. But the oldest carbonados potentially predate life on Earth (and, therefore, organic carbon) which makes it unlikely that they formed this way. After searching for a definitive origin of carbonados for close to a decade, scientists have come up "*empty-handed*" and, as a result, some believe that more research is needed. Because the Enigma has been cut, it is also much harder to be able to tell how it may have originated, Ketcham said. "*The outer surfaces of carbonados likely have clues bearing on their origin, which are now probably lost,*" in the Enigma, he added. The auction house's claim that the Enigma came from space, therefore, seems dubious. Regardless of how the diamond came into existence, scientists hope that whoever ends up buying the Enigma will put it on public display rather than hiding it away in a private collection. Many great diamonds have not seen the light of day for decades. Museums cannot compete with billionaires for the purchase of natural wonders.

<https://www.livescience.com/enigma-black-diamond-auction>

Ocean Temperatures Just Smashed a New Record For The Sixth Year in a Row

Ocean temperatures the world over are building at a relentless rate as humans continued to alter the atmosphere around them. In 2021, according to a new summary of two international datasets, the wave of warmth in our oceans hit a new peak, eclipsing the influence of cooler regional episodes. While last year's ocean warming is unprecedented, it was no exception. This is the **sixth year in a row** that the world's ocean temperatures have exceeded anything we've measured before. Since the late 1950s, when reliable recordings of climate change first began, each decade has hosted warmer oceans than the last. Since the 1980s, the authors of the summary say there has been an "**unambiguous**" increase in marine temperatures. The heat is being felt right across the board. Last year, the North Pacific Ocean, the North Atlantic Ocean, and the Mediterranean Sea all experienced the hottest marine temperatures on record. Altogether, the upper 6,500 feet in our oceans absorbed 14 more Zettajoules in 2021 than in 2020. The difference is equivalent to dropping about seven more Hiroshima bombs into the ocean per second. In 2019, scientists calculated human warming of the ocean was equivalent to dropping the equivalent of five Hiroshima bombs into the ocean per second. *"The oceans are absorbing most of the heating from human carbon emissions,"* says climate scientist Michael Mann from Pennsylvania State University. *"Until we reach net zero emissions, that heating will continue, and we'll continue to break ocean heat content records, as we did this year. Better awareness and understanding of the oceans are a basis for the actions to combat climate change."* Without cutting our emissions, not even short-term, regional fluctuations in temperature and circulation can change our current trajectory. During an episode of La Niña, for instance, when winds and ocean currents change, the northern parts of the Pacific Ocean tend to become cooler, while southern waters above Australia grow slightly warmer. Despite this minor cooling effect swinging into action in late 2021, warming in the North Pacific ocean has remained "*broad and deep-reaching.*" Last year, warming anomalies in the middle of the North Pacific were measured at ~2°C near the surface and 1°C ~1,000 feet deep. *"The relentless increases in [ocean heat content] have direct implications for the frequency, intensity, and extent of marine heat waves and other 'hot spots' within the ocean,"* the authors write. The Atlantic and Southern Oceans are absorbing the greatest amount of heat from our greenhouse gas emissions. When an ocean absorbs heat, sea water expands, leading to rising sea levels. If the marine heat in our southern oceans chips away at enough of the Antarctic ice sheet, it could destabilize the structure, adding more water to the ocean and sinking even more of our coastlines. Warmer oceans also supercharge weather systems, creating more powerful storms and hurricanes, as well as increasing precipitation and flood risk. We need to prepare for these disasters, and the best way to do that is to incorporate ocean temperatures into our climate models. Unfortunately, however, there are still major uncertainties and knowledge gaps in monitoring ocean warming. If we don't improve awareness and understanding of these dynamics, we will be missing out on a fundamental part of climate change. <https://www.sciencealert.com/ocean-warming-has-smashed-a-new-record-for-the-sixth-year-in-a-row>



Hornfels is a metamorphic rock formed when magma heats and recrystallizes the original rock. Pressure is not a factor in its formation. The name "*hornfels*" means "*hornstone*" in German, referring to the way the rock's texture and toughness resemble animal horn. The colors of hornfels are as variable as the source rock used to produce it. The most common color (biotite hornfels) is velvety dark brown or black, but white, yellow, green, and other colors are possible. Some hornfels are banded, but



Alternating layers of Tertiary horn-felonized sandstone and shale in Yamaguchi Prefecture, Japan

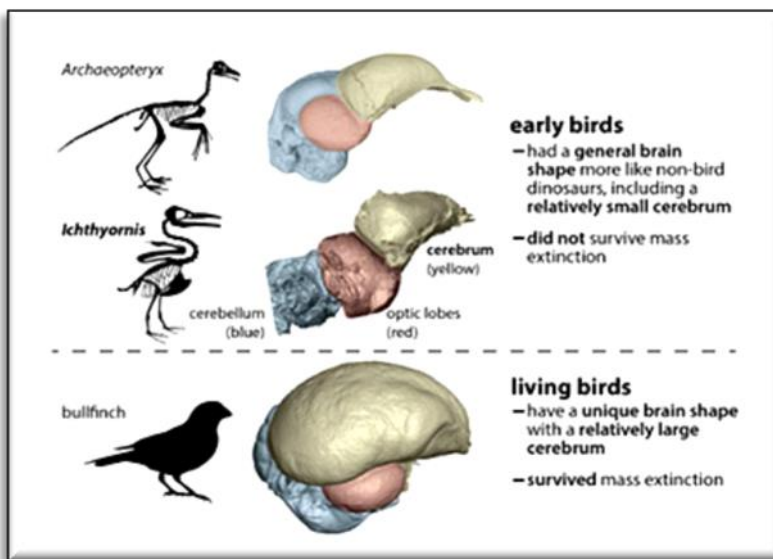
the rock may fracture as easily across a band as along it. Generally, the rock is fine-grained, but it may contain visible crystals of garnet, andalusite, or cordierite. Most of the minerals only appear as small grains that may not be visible to the naked eye, but form a mosaic-like

pattern under magnification. One notable characteristic of hornfels is that it rings like a bell when struck (even more clearly than shale). All hornfels is fine-grained and hard, but its toughness, color, and durability greatly depend on the composition of the original rock. Hornfels may be classified according to its source. **Pelitic hornfels**, the most common hornfels, comes from the heating of clay, shale, and slate (sedimentary and metamorphic rocks). The primary mineral in pelitic hornfels is biotite mica, with quartz, feldspar, and assorted aluminum silicates. Under magnification, the mica appears as dichroic red-brown scales. **Carbonate hornfels** are calcium silicate rocks made from heating impure limestone, a sedimentary rock. Higher purity limestone crystallizes to form marble. Limestone containing sand or clay forms a variety of minerals. Carbonate hornfels is often banded, sometimes with pelitic (biotite) hornfels. Carbonate hornfels are stronger and tougher than limestone. **Mafic hornfels** result from heating of igneous rocks, such as basalt, andesite, and diabase. These rocks exhibit varied compositions, but consist mainly of feldspar, hornblende, and pyroxene. Mafic hornfels is typically green in color. Hornfels occurs worldwide. The primary use of hornfels is in architecture. The hard, interesting-looking stone may be used to make interior flooring and decorations as well as exterior facing, paving, curbing, and decorations. The rock is used in the construction industry to make road aggregate. Historically, hornfels has been used to construct monuments, cemetery markers, whetstones, artworks, and artifacts. One noteworthy use of hornfels is to construct lithophones or stone bells. In South Africa, the rock may be called "*ring stones.*" The "*Musical Stones of Skiddaw*" refers to a series of lithophones made using hornfels mined from Skiddaw mountain, near the town of Keswick in England. In 1840, stonemason and musician Joseph Richardson built an eight-octave lithophone, which he played on tour. The lithophone is played like a xylophone. <https://www.thoughtco.com/hornfels-definition-and-formation-4165525>

How Did Birds Survive the Dinosaur-Killing Asteroid?

When the dinosaur-killing asteroid collided with Earth about 66 million years ago, it triggered a slew of horrific events — shock-waves, wildfires, acid rain, tsunamis, volcanic eruptions and nuclear winter-like conditions — that killed about 80% of all animal species. But, mysteriously, some dinosaurs survived: the birds. But why did some lineages of birds endure, while others perished? New research on a well-preserved ancient bird skull suggests that the bird species that survived the cataclysm had bigger cerebrums, or forebrains — the front region of the brain. Although it's not clear exactly *how* larger forebrains helped birds survive, as the forebrain is responsible for many processes, "it likely had to do with behavioral plasticity — the birds with bigger forebrains could probably modify their own behavior quickly enough to keep up with how quickly their environment was changing," reported

study lead researcher Chris Torres, a National Science Foundation postdoctoral research fellow in the Heritage College of Osteopathic Medicine at Ohio University. The study was published online July 30 in the journal *Science Advances* and was presented online Nov. 2 at the Society of Vertebrate Paleontology's annual conference, which was virtual this year due to the COVID-19 pandemic. Bird bones are delicate and rarely fossilize well or in three dimensions, meaning that scientists hardly ever get a good look at ancient bird braincases, the interior part of the skull where the brain sat. But a few years ago, researchers found a well-preserved, partially 3D fossil of *Ichthyornis*, an ancient toothy bird that lived during the Cretaceous period, in a rock formation dating to 87 million to 82 million years ago in Kansas. "It has a nearly complete skull, which is incredibly rare both for this particular species (*Ichthyornis*) as well as for fossil birds in general," said Torres, who did the research as a doctoral student in the Department of Integrative Biology at the University of Texas at Austin. "This new fossil preserves most of the bones that make up the skull, providing us with our first complete looks at many of those bones." So Torres and his colleagues used X-ray



The dinosaur-age birds *Archeopteryx* and *Ichthyornis* had brain shapes more similar to ancient dinosaurs than to those of living birds. Living birds have unique brain structures, including a large cerebrum, a feature that likely helped their ancestors survive the mass extinction. (Image credit: Chris Torres)

computed tomography (CT) scanning to digitally reconstruct *Ichthyornis*' facial skeleton and brain structure. An analysis of the brain shape revealed that ancient birds like *Ichthyornis* had a "old fashioned" brain; its brain was more like the brains of dinosaurs than the brains of living birds. Living birds have "enormous forebrains relative to the rest of their brains," Torres said. The forebrains of today's birds are large compared with the forebrains of ancient birds and dinosaurs that lived just before the end-Cretaceous mass extinction. Given that *Ichthyornis*, a very close relative of living birds, still didn't have a big forebrain like living birds do, "we can infer that those big brains evolved in the ancestor of living birds," Torres wrote in the email. Perhaps this big forebrain gave the ancestor of living birds an evolutionary advantage that helped them survive the "catastrophic global climate change that likely occurred during that mass extinction, which helps explain why only extant [living] birds, and not any other kinds of dinosaurs, managed to survive," Torres said. However, *Ichthyornis*'s brain did have a surprising feature: a wulst. This structure, previously known only from birds that lived after the mass extinction, is thought to be a visual and sensory processing center that plays a role in flight. The discovery of a wulst in a Mesozoic, or dinosaur-age, bird reveals that ancient bird brains were more complex than previously thought. The brain structure analysis shows that bird brains didn't evolve in a neat progression over time, but developed as a complex mosaic of brain structures. "It's not a clear linear progression of everything becoming more complex or better adapted," said Jack Tseng, an assistant professor of vertebrate paleontology at the University of California, Berkeley and an assistant curator at its Museum of Paleontology, who was not involved in the study. "There are actually bits and pieces that were added on over time, [in] different combinations." <https://www.livescience.com/how-birds-survived-asteroid-strike>

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A Nuclear-Test Monitor Calls Tonga Volcano Blast *'Biggest Thing That We've Ever Seen'*

The explosive volcanic eruption in Tonga last month appears to dwarf the largest nuclear detonations ever conducted, according to a global group that monitors for atomic testing. The shock wave from the blast was so powerful that it was detected as far away as Antarctica, says Ronan Le Bras, a geophysicist with the Comprehensive Nuclear-Test-Ban Treaty Organization in Vienna, Austria. In total, 53 detectors around planet Earth heard the low-frequency boom from the explosion as it traveled through the atmosphere. It was the loudest event the network had detected in more than 20 years of operation, according to Le Bras. As large as the explosion was, it was not nuclear in any way; radioactive fallout, the telltale sign of a true nuclear explosion, was not detected at any station. In the past, the network has picked up North Korea's underground nuclear tests and radioactive fallout from the Fukushima nuclear accident. This time, seismic, hydroacoustic and infrasound stations all picked up the violent, explosive eruption of the volcano, which took place on Jan. 15. According to Le Bras, atmospheric measurements in Austria, roughly 10,000 miles from the eruption site, detected a shock wave that was 2 hectopascals in strength. By comparison, the largest nuclear



weapon ever tested, the Soviet Union's Tsar Bomba, generated a shock wave of just 0.5-0.7 hectopascals in New Zealand, which sits at a comparable distance from Russia's nuclear test site in Novaya Zemlya. Even days after the eruption the network continued to detect the faint echo of the shock wave as it circled Earth's atmosphere again and again. Although Le Bras declined to estimate just how big the volcanic eruption in Tonga was, a physicist at the University of Western Ontario in Canada who uses infrasound to study meteors as they

enter the atmosphere, says she thinks it was at least as large as the 50 megaton Soviet test in 1961. *"A very rough back-of-the-envelope calculation suggests that the energy was around 50 megatons."* Initial estimate of the power of the blast by a team of NASA scientists put the explosion at perhaps 6-10 megatons, but Le Bras says he believes the infrasound data shows the explosion might be far larger. However, Jim Garvin, the chief scientist at NASA's Goddard Space Flight Center in Greenbelt, Md., who made the original estimate, is more cautious. *"We have to be careful to compare it to a nuclear explosion, because it's a different process,"* Garvin says. His team's calculations, based purely on the energy required to destroy the island around the volcano, are accurate for the energy required to obliterate it. But this does not include other forms of energy, such as the energy released by the water turning to steam as it touches molten rock, or magma. *"When the teams all get together and put these numbers together, the energy balance will come out,"* he says. The exact cause of the explosive eruption at the island, known as **Hunga Tonga-Hunga Ha'apai**, remains a mystery. Garvin and his team believe the root cause was a massive influx of seawater into a chamber filled with magma. The island had been growing rapidly as recently as December of 2021, and Garvin suspects that the "plumbing" beneath the surface shifted as the island expanded. But even that explanation requires a lot more fleshing out, says Ken Rubin, a volcanologist at the University of Hawaii at Manoa. Simply putting water and magma into contact won't always generate an explosion, he says. *"There's this kind of golden ratio where you have just the right amount of both,"* Rubin says. At that point, water flashing into steam can expose more molten rock, allowing more water to flow in, in what he describes as a "chain reaction." The eruption is especially puzzling because the explosion was so powerful given the amount of magma believed to be released by the volcano. Volcanologists suspect it was much smaller than the eruption at Mount Pinatubo in 1991. Gases released by that eruption changed the weather on a global scale, something that is not expected from the Tonga eruption. The extent of the eruption's effects on the island nation of Tonga are just now becoming clear. So far, the government has reported three deaths, but many dozens of homes and other structures were damaged by a tsunami. Ash has polluted the ground and water, raising fears of shortages. Relief flights have begun to arrive from Australia carrying drinking water, but so far the Tongan government is trying to limit contact because of fears about spreading COVID-19 among the nation's inhabitants. Rubin says that shallow ocean volcanoes like the one at Hunga Tonga-Hunga Ha'apai exist around the globe, but they are for the most part unmonitored. That's in large part because it's expensive to develop and maintain undersea instruments. He thinks the eruption in Tonga may focus new resources on studying and monitoring volcanic activity under the sea. *"The vast majority of volcanoes on the planet are in the ocean, not on land,"* Rubin says. *"Many of them are very deep, but there are enough of these submarine volcanoes in this right depth range ... that we should pay more attention to them."*

<https://www.npr.org/2022/01/21/1074438703/nuclear-test-monitor-calls-tonga-volcano-blast-biggest-thing-that-weve-ever-seen>

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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.

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