Cedar Valley Gems

Cedar Valley Rocks & Minerals Society

Cedar Rapids, Iowa

CEDAR VALLEY GEMS **JANUARY 2017** **VOL. 43, ISSUE 1**

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

Next CVRMS Meeting Tues. Jan. 17

meeting at the Fairfax Library
313 Vanderbilt St. - Fairfax

Featured Speaker : **Dr. Emily Walsh**
Department of Geology
Cornel College

"Pressure-temperature histories of lower-crustal rocks exposed in Arizona"

Dr. Walsh's presentation will discuss the pressure and temperature histories of some rocks from the footwall of the Harcuvar metamorphic core complex in western Arizona. These rocks are Precambrian and Mesozoic crust that had been pushed deep to near-mantle depths, only

the Harcuvar metamorphic core complex, western Arizona

to be driven to the surface during formation of the Rocky Mountains. Dr Walsh's work indicates that the rocks have been buried more deeply and the tectonic activity that drove them to the surface lasted much longer than previously thought and how she reached that conclusion by studying minerals such as garnet (the subject of several articles in this month's newsletter).

The dinosaur and fossil hall at the Smithsonian's National Museum of Natural History closed in April, 2014, to allow the museum to completely renovate the halls and the exhibit from top to bottom and update its exhibitions to match what scientists now know. This process will take five years, and the new permanent exhibition will open in 2019. Five years is a long time, but working with priceless fossil specimens is a big job. A top-to-bottom renovation is in the best interest of the specimens themselves and the 7 to 8 million museum visitors each year. Many of the more than 2,000 specimens currently on display in the dinosaur and fossil hall need special conservation to ensure that they will be strong enough to remain on display for future generations of visitors (and accessible for future researchers). These specimens will be carefully removed, photographed, conserved, remounted and reinstalled. There are many components to the process, from modernizing the halls themselves to moving, conserving and remounting dinosaur fossils like the 90-foot-long *Diplodocus* (that has not been moved in more than 80 years). There are actually five "halls" that house the dinosaur and fossil exhibits. The space has never been completely renovated since the museum first opened in 1910. More than 65,000 square feet of mechanical systems, air handling, electrical systems, windows and lights will be removed and replaced. In all, more than 31,000 square feet of exhibit space (six basketball courts' worth) will be created. The centerpiece of the Museum's renovated fossil hall will be ***The Nation's T. rex,*** also known as the Wankel T. rex, a nearly-complete skeleton previously displayed in the Museum of the Rockies. See page 9 of this newsletter for more information on the Wankel T-Rex. The new fossil hall is made possible in part through the largest single gift in the history of the museum, a $35 million donation from philanthropist David H. Koch. It offers an opportunity to showcase the museum's unrivaled collection of 46 million fossils.

Live and time lapse camera of Smithsonian remodeling

Stay up-to-date on the **National Fossil Hall** with views from a construction camera and interactive archive calendar. Select any date and time to see what happened on the construction site that day. Choose your favorite image and share via email, Facebook and Twitter. Watch a time-lapse movie to see all the project progress to date. Images are updated every 15 minutes to provide a fresh look at the jobsite. To access camera click on the image or go to http://naturalhistory.si.edu/fossil-hall/camera/

CVRMS Board Meeting

December 20 Board Meeting

7:15 at the Home of Marv & Sue Houg

Members Present: Marv Houg, Dell James, Sharon Sonnleitner, Jay Vavra, Dale Stout, Rick Austin, Bill Desmarais

2017 Rock Show March 25, 26, 2017 : *"Calcite and Quartz, Two of Earth's Most Versatile Minerals Abundant in Iowa".* Overall discussion regarding the number of vendors who have paid their space rent. About 12 are unpaid. Deadline for payment is January 15. Display that Ray Garten may make available is a 200 million year old, 7 foot long Dimetrodon (a precursor to the dinosaur).

Raffle prizes include: Box of specimens-*Sharon,* Amethyst Plate-*Dave Malm*, Amethyst cathedral or someting-*Gary Peavy,* Amethyst Cathedral *ZRS Fossil*, Wooden Dinsaur– Jack *Neuzil*, Large geodes or something-*Marv*. All are suggested items and may be changed before the show. Guaranteed that the prizes will all be special. *Door prizes are needed and are the hourly give-away.* New tax forms that must be filled out by vendors anticipated to create some problems. Bill discussed the inclusion of a kids program to be given each day and the logistics of putting it on. He would like to have some quartz crystal points to demonstrate differences between calcite and quartz. Subject still up for grabs but it will be the first time that a kids program with hands on involvement would be presented at the show. There was enthusiastic support for Bill's project and creativity.

Displays: As usual, *we will need displays*. We are especially interested in calcite and quartz. Suggested items for display cases include Shells (calcite), Native American artifacts, agates, Diatoms, petrified wood. Jasper, flowstone (cave onyx), coprolites, onyx figurines, ***Show off your collection***. Dell showed a remembrance baggie she received from another rock show she attended. *Could we do something similar*? Include a piece of Quartz or calcite with info about club or a recipe for telling the difference between calcite and quartz? Marv will check into the price involved in such an endeavor. Dell volunteered to "stuff" the baggies. Do we sell them at the pebble pit or give them away? More discussion to follow.

Egg Cartons: Sharon will send Marv a list of specimens we have. February 25, with March 4 as back up date in case of bad weather, for assembling the cartons. All members welcome to help out at Sharon's place. More info to follow.

New Business

Next meeting will be held at the Fairfax Library. January 17, 2017 at 313 Vanderbilt St. Fairfax. The Rockwell Collins cafeteria is still under construction and the Nature Center is out of our price range so we are having to move our meeting site.

Marv received a thank you note from the AAPG which is the geology club at University of Iowa. Various members donated material for their annual fund raiser sale. Because of the club's donations, they doubled the amount they usually raise. These are the students who participate in our show and help run the bone dig.

continued ➡

The trip to the Field Museum was such a success that now we are craving more. Bill will work on another one, but suggestions are welcome. Lazzadro Museum?, Wheaton College? Milwaukee Public Museum? Let Bill know if you have an idea.

MSHA training will again be held the Thursday before the show-March 23. More info to follow.

Auction: Sharon is receiving contracts.

Adjournment: Motion to adjourn by Rick, 2nd by Bill, meeting adjourned 9:15 pm.

Respectfully submitted: *Dell James, Secretary*

CVRMS Dec. Meeting and Christmas Party

December 13 was our annual CVRMS Christmas Party and monthly meeting. A record 59 members and friends were present to enjoy the evening at the new Indian Creek Nature Center building on Otis Road in Cedar Rapids. The large attendance may have been the beautiful new facilities at the Nature Center, but we prefer to think the attraction was the wonderful food contributed by attendees and the club. The fare included 2 full turkeys and a breast, 10 pounds of ham, 20 pounds of mashed potatoes, multiple bean or corn casseroles, 6 dozen deviled eggs, miscellaneous dips, appetizers, and other seasonal favorites, and of course an incredible variety of deserts. It was particularly heartwarming to see new faces and new members join in. Everyone who wanted one went home with a door prize, and everyone received lots of smiles. Additionally, our Christmas Charity Collection raised $422 which will be split between HACAP and Linn County Food Bank. Thanks for caring,

We wish you all a very Merry Christmas and Hope you will have a Happy and Prosperous 2017.

Petrified Forest National Park Conscience Pile

Near a private service road in Arizona's Petrified Forest National Park sits a pile of rocks. It is not an official attraction, nor is it marked on any map. About the size of a pickup truck, it is a jumble of chunks of petrified wood, the fossils of trees that fell more than two hundred million years ago, the cells of their bark and wood slowly replaced with minerals of every color—purple amethyst, yellow citrine, smoky quartz. These are all rocks that have been stolen and subsequently returned by light-fingered visitors who came to regret their crime. Park employees call it the "***conscience pile***." In the 1930's, visitors to the Petrified Forest began to report that after taking a piece of petrified wood from the park, they were seemingly cursed with bad luck. This curse continues to today, and is now a part of the park's history. Unfortunately once the rocks are moved, they cannot be put back in the park because they are out of "scientific context". The park is a thriving site for archaeological, geological, and paleontological research. Moving rocks and other artifacts affects the value of the scientific study. So wood that is picked up by tourists then returned to the park ends up in one of several "conscience piles."

One of several Conscience Piles of petrified wood stolen then returned to Petrified Forest National Park

Horse Tail Demantoid Garnet with Chrysotile Inclusions

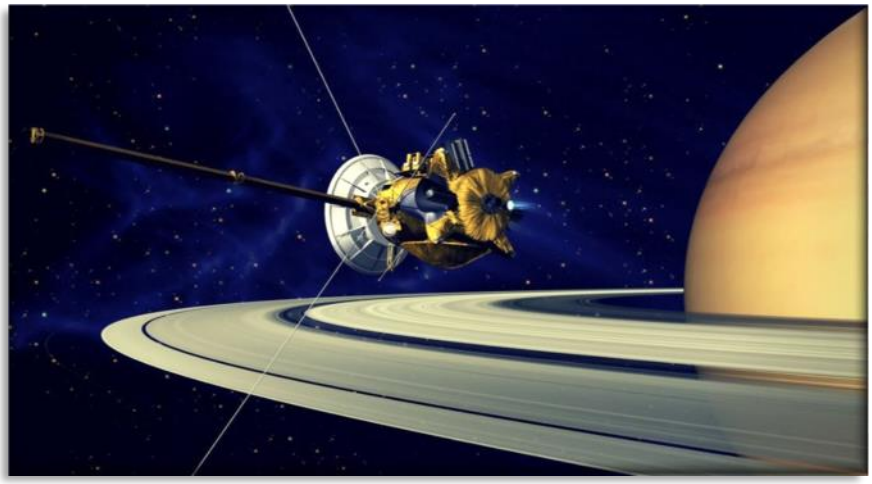
This beautiful stone below is a "Horse Tail" Demantoid Garnet, with inclusions of fibrous chrysotile (asbestos) crystals radiating from included chromite crystals. These stones are mined in the Ural Mountains in Russia , and the inclusions are interpreted as produced during the metamorphism of serpentine. The garnets are pure andradite. Fe and Cr control their coloration.

Spotlight Gemstones: Garnet

Garnet, is the name used for a large group of rock-forming minerals. These complex minerals share a common crystal structure and a generalized chemical composition of $X_3Y_2(SiO_4)_3$. In that composition, "X" can be Ca, Mg, Fe^{2+} or Mn^{2+}, and "Y" can be Al, Fe^{3+}, Mn^{3+}, V^{3+} or Cr^{3+}. Despite their variable appearance, garnets are usually easy to identify by their hardness, crystal habit and occurrence in metamorphic rock. Garnets usually form at high temperature and pressure, so they typically occur in their crystal form as rounded dodecahedrons (twelve-sided) or twenty-four sided trapezohedrons with a Mohs hardness of 6.5 -7.5. The birthstone of **January**, garnets are mined in a rainbow of colors (except blue). From the fiery orange of *Mandarin Garnets* to the rich green of *Tsavorite Garnets* and to the most widely recognized color the deep red of *Pyrope Garnets,* the garnet is considered a great gift to symbolize friendship and trust. Garnets have been used as gemstones and abrasives since the Bronze Age. All species of garnets possess similar physical properties and crystal forms, but differ in chemical composition. The different species are pyrope, almandine, spessartine, grossular (varieties of which are hessonite or cinnamon-stone and tsavorite), uvarovite and andradite. The garnets make up two solid solution series: pyrope-almandine-spessartine and uvarovite-grossular-andradite. These minerals are found throughout the world in metamorphic, igneous, and sedimentary rocks. Most garnet found near Earth's surface forms when a sedimentary rock with a high aluminum content, such as shale, is subjected to heat and pressure intense enough to produce schist or gneiss. Garnet is also found in the rocks of contact metamorphism, subsurface magma chambers, lava flows, deep-source volcanic eruptions, and the soils and sediments formed when garnet-bearing rocks are weathered and eroded. In the United States, the major industrial uses of garnet in 2012 were waterjet cutting (35%), abrasive blasting media (30%), water filtration granules (20%), and abrasive powders (10%). Read about Horse Tail Demantoid garnets in the article to the left, and learn more about the minerals on the page 7 column, "**Ask a Geologist**."

Cassini Makes First Ring-Grazing Plunge

NASA's Saturn-orbiting Cassini spacecraft has made its first close dive past the outer edges of Saturn's rings since beginning its penultimate mission phase on Nov. 30. Cassini crossed through the plane of Saturn's rings on Dec. 4 at 8:09 a.m. EST at a distance of approximately 57,000 miles above Saturn's cloud tops. This is the approximate location of a faint, dusty ring produced by the planet's small moons Janus and Epimetheus, and just 6,800 miles from the center of Saturn's F ring. About an hour prior to the ring-plane crossing, the spacecraft performed a short burn of its main engine that lasted about six seconds. About 30 minutes later, as it approached the ring plane, Cassini closed its canopy-like engine cover as a protective measure. "With this small adjustment to the spacecraft's trajectory, we're in excellent shape to make the most of this new phase of the mission," said Earl Maize, Cassini project manager at NASA's Jet Propulsion Laboratory, Pasadena, California. A few hours after the ring-plane crossing, Cassini began a complete scan across the rings with its radio science experiment to study their structure in great detail. "It's taken years of planning, but now that we're finally here, the whole Cassini team is excited to begin studying the data that come from these ring-grazing orbits," said Linda Spilker, Cassini project scientist at JPL. "This is a remarkable time in what's already been a thrilling journey." Cassini's imaging cameras obtained views of Saturn about two days before crossing through the ring plane, but not near the time of closest approach. The focus of this first close pass was the engine maneuver and observations by Cassini's other science instruments. Future dives past the rings will feature some of the mission's best views of the outer regions of the rings and small, nearby moons. Each of Cassini's orbits for the remainder of the mission will last one week. The next pass by the rings' outer edges is planned for Dec. 11. The ring-grazing orbits -- 20 in all -- will continue until April 22, 2017, when the last close flyby of Saturn's moon Titan will reshape Cassini's flight path. With that encounter, Cassini will leap over the rings, making the first of 22 plunges through the 1,500-mile-wide (2,400-kilometer) gap between Saturn and its innermost ring on April 26. On Sept. 15, the mission will conclude with a final plunge into Saturn's atmosphere. During the plunge, Cassini will transmit data on the atmosphere's composition until its signal is lost. Launched in 1997, Cassini has been touring the Saturn system since arriving there in 2004 for an up-close study of the planet, its rings and moons. During its journey, Cassini has made numerous dramatic discoveries, including a global ocean with indications of hydrothermal activity within the moon Enceladus, and liquid methane seas on another moon, Titan. For details about Cassini's ring-grazing orbits, visit: **https://saturn.jpl.nasa.gov/news/2966/ring-grazing-orbits**. The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency) and the Italian Space Agency. NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, manages the mission for NASA's Science Mission Directorate, Washington. JPL designed, developed and assembled the Cassini orbiter. http://www.jpl.nasa.gov/news/news.php?feature=6690



Lapis Lazuli : "Blue Gold"

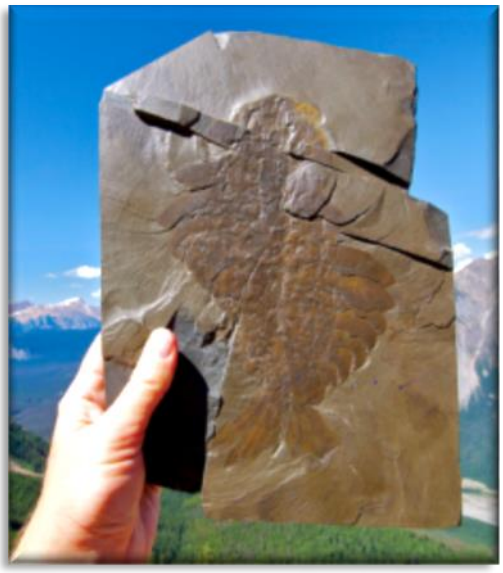
Lapis lazuli. or **lapis** for short, is a deep blue semi-precious stone prized since antiquity for its intense color. Unlike most other gem materials, lapis lazuli is not a mineral. Instead, it is a rock composed of multiple minerals. The blue color of lapis lazuli is mainly derived from the presence of lazurite, a blue silicate mineral of the sodalite group with a chemical composition of $(Na,Ca)_8(AlSiO_4)_6(S,Cl,SO_4,OH)_2$. Most lapis lazuli also contains calcite (white) and pyrite (metallic yellow). Other possible constituents: augite; diopside; enstatite; mica; hauynite; hornblende, and nosean. Some lapis lazuli contains trace amounts of the sulfur-rich löllingite variety *geyerite*. It usually occurs in crystalline marble as a result of contact metamorphism. Lapis lazuli was mined in the Badakhshan province in northeast Afghanistan as early as the 7th millennium BC. Lapis was highly valued in the Indus valley civilization (3300–1900 BC). Lapis beads have been found at neolithic burials in the Caucasus. It was used for the eyebrows, among other features, on the funeral mask of Tutankhamun (1341–1323 BC). In Biblical times the word "sapphire" was often used as a name for lapis lazuli. For that reason, many scholars believe that at least some of the references to sapphire in the Bible are actually references to lapis lazuli. Some modern translations of the Bible use the word "lapis" instead of "sapphire." At the end of the Middle Ages, lapis lazuli began to be exported to Europe, where it was ground into powder and made into ultramarine, the finest and most expensive of all blue pigments. It was used by some of the most important artists of the Renaissance and Baroque, including Masaccio, Perugino, Titian, Vermeer, and Von Gogh (most famously in *Starry Night – see* below) was often reserved for the clothing of the central figures of their paintings, especially the Virgin Mary. Today mines in northeast Afghanistan and Pakistan are still the major source of lapis lazuli. Important amounts are also produced from mines west of Lake Baikal in Russia, and in the Andes mountains in Chile. Smaller quantities are mined in Italy, Mongolia, the United States and Canada. Much of the area where the lapis lazuli mining occurs is occupied by the Taliban and local members of the Islamic State. They operate illegal mines, attack other mines to capture their production, and demand protection payments from intimidated mine operators. Revenue from these activities is used to fund war and terrorism.

Lapis Lazuli egg

Ultramarine, made from ground lapis lazuli, was a major blue pigment used by Van Gogh to paint "Starry Night"

This lapis lazuli nef entered the collection of Louis XIV in about 1673. The nef itself is an Italian work dating from the 16th century. The mount was made in Paris in about 1670. It is now on display at the Louvre Museum in Paris.

What in the World?



What in the World is this weird fossil (not a fish)

December Photo

I know Bill D. got this one right, and probably others of you too. It is columnar basalts at the ***Devil's Postpile*** National Monument in the Sierra Mts. of California. The basalt lava erupted less than 100,000 years ago from volcanic vents in the valley of the Middle Fork of the San Joaquin River. The lava filled the valley near the postpile to a depth of 400 feet. As it cooled it shrunk and cracked, sometimes forming vertical columns. The well-developed columns resulted from a homogeneous lava cooling at a uniform rate. At Devil's Postpile the rock columns have from three to seven sides.

Rock Calendar

2017

February 21 - CVRMS Monthly Meeting
Fairfax Library
313 Vanderbilt St. - Fairfax

March 15 - CVRMS Monthly Meeting
Fairfax Library
313 Vanderbilt St. - Fairfax

March 25-26 - CVRMS Gem, Mineral, and Fossil Show
"Calcite and Quartz, Two of Earth's Most Versatile Minerals Abundant in Iowa"
Hawkeye Downs, Cedar Rapids

2017

March 31-April 2—MAPS National Fossil Expo 39
"The Silurian"
Sharpless Auctions Facility, Iowa City

Sept. 16-17—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, regardless of if it is chosen.

***No one asked**: but since January's birthstone is garnet, and I think garnets are especially interesting minerals, I will take this opportunity to tell you why garnets are so neat ! !*

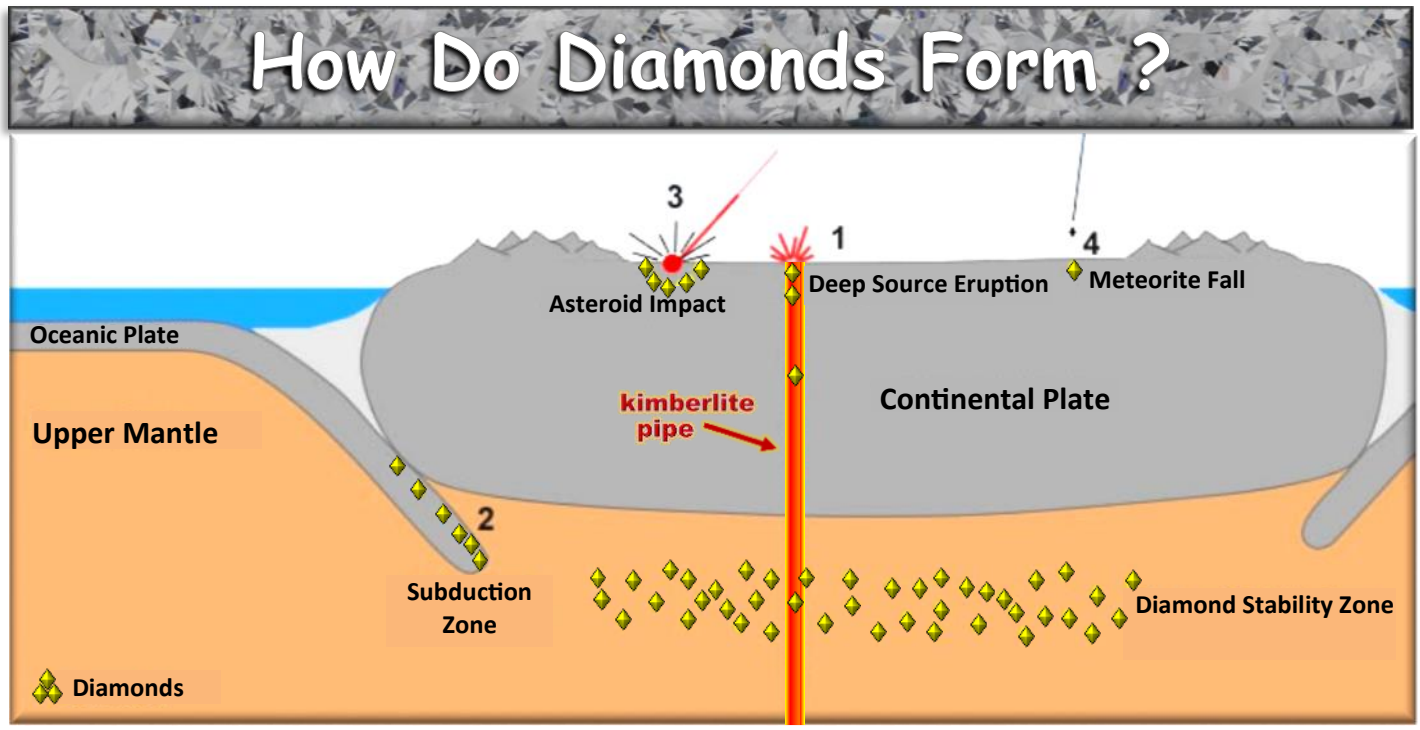
***Rock Doc replied**: When but a young tyke I remember seeing one of those beautiful deep purplish-red Pyrope dodecahedrons (12-sided crystal) and thinking that this garnet must be a very special mineral. The more geology I learned, the more I grew to appreciate how cool garnets are. They form when shale, siltstone, and limestone get caught up in the mountain building processes and heated almost to the melting point. Heat and pressure cause the atoms to migrate out of their old minerals and recombine in many interesting ways. Many interesting minerals are formed in this way, but garnet is one of the most interesting. Garnets can have any of a number of chemical formulas, all silicates (SiO_4), most including calcium or magnesium and aluminum (or maybe iron or vanadium or zirconium or other elements). Garnets also form as an igneous magma cools. They sometimes form in pegmatites, for instance the big red almandine garnets that can be seen in some granite countertops. Garnets can sometimes be found included in basalts (which is a pretty weird looking rock), but the neatest occurrence of garnets, in my opinion, is when they are found with green pyroxenes (omphacite) in rocks called ecolgites. Eclogites are from the Earth's mantle; they form in pressures in excess of 1.2 GPa (28 mi depth) at >750–1800 °F and usually in excess of 1100-1200 °F. Ecologites are sometimes pushed to the surface as a part of the mountain building process or they may be blasted to the surface in a kimberlite diatreme (sometimes with diamonds). Garnets are chemically and physically resistant and often survive the erosion, becoming loose garnet grains. These garnet sands can be concentrated by wave and current action into 'heavy' mineral sand deposits.*

natural pyrope garnet dodecahedron crystals

pyrope garnet in eclogite (above) and in kimberlite from a diamond pipe 9(below)

Just a few of the many minerals that comprise the garnet group.

Mineral name	Formula	Color
Almandine	$Fe^{2+}_3Al_2(SiO_4)_3$	deep red
Andradite	$Ca_3Fe^{3+}_2(SiO_4)_3$	black, green, green-yellow
Calderite	$Mn^{+2}_3Fe^{+3}_2(SiO_4)_3$	dark red to yellow
Goldmanite	$Ca_3V^{3+}_2(SiO_4)_3$	green to green-brown
Grossular	$Ca_3Al_2(SiO_4)_3$	green, brown, red, yellow
Henritermierite	$Ca_3Mn^{3+}_2(SiO_4)_2(OH)_4$	clove, orange-brown
Hibschite	$Ca_3Al_2(SiO_4)_{(3-x)}(OH)_{4x}$	colorless, pale-yellow
Katoite	$Ca_3Al_2(SiO_4)_{(3-x)}(OH)_{4x}$	colorless
Kerimasite	$Ca_3Zr_2(Fe^{+3}O_4)_2(SiO_4)$	colorless, lt to dk brown
Kimzeyite	$Ca_3Zr_2(Al^{+3}O_4)_2(SiO_4)$	dark brown
Knorringite	$Mg_3Cr_2(SiO_4)_3$	bluish-green
Majorite	$Mg_3(Fe^{2+}Si)(SiO_4)_3$	purple, pale yellow, green
Menzerite-(Y)	$Y_2CaMg_2(SiO_4)_3$	brown
Momoiite	$Mn^{2+}_3V^{3+}_2(SiO_4)_3$	green, green-yellow
Morimotoite	$Ca_3(Fe^{2+}Ti^{4+})(SiO_4)_3$	black
Pyrope	$Mg_3Al_2(SiO_4)_3$	violet, deep purple
Schorlomite	$Ca_3Ti^{4+}_2(Fe^{3+}O_4)_2(SiO_4)$	black
Spessartine	$Mn^{2+}_3Al_2(SiO_4)_3$	orange-yellow
Toturite	$Ca_3Sn_2(Fe^{3+}O_4)_2(SiO_4)$	yellow
Uvarovite	$Ca_3Cr_2(SiO_4)_3$	green



Many people believe that diamonds are formed from the metamorphism of coal. That idea continues to be the "*how diamonds form*" story in many science classrooms. Diamonds on Earth are formed in several ways, most commonly deep within the Earth's mantle where conditions create a "diamond stability zone". These zones occur only in limited locations in the Earth's mantle, about 90 miles below the surface where temperatures are at least 2000 degrees Fahrenheit. This critical temperature-pressure environment for diamond formation and stability is not present globally, but is thought to be present primarily in the mantle beneath the stable interiors of continental plates older than about 1.5 billion years. Carbon, in the form of organic material, limestone, etc., can be carried into these zones on subducting ocean crustal plates (**2**) where it can be transformed to diamond. Most commercial diamond deposits are thought to have formed when deep-source volcanic eruptions (called diatremes), travelling rapidly from deep within the mantle, pass through a diamond stability zone tearing pieces of rock from this zone and carrying them rapidly upwards to the surface. When rocks and minerals from the diamond stability zone are present in these erupted rocks they are called "kimberlites" and may contain diamonds as well as such high pressure minerals as pyrope garnet, chromium diopside, (see below) chromium spinels, and magnesian ilmenite. The diatremes that brought the kimberlite to the surface are called "kimberlite pipes" (**1**). This type of volcanic eruption is extremely rare, and none has not occurred since scientists have been able to recognize them. Microscopic diamonds are also formed by the high pressures and temperatures created by asteroid impacts (**3**) altering carbon-rich rocks, and microdiamonds may be created in space and carried in on smaller meteorites (**4**). Such microdiamonds are extremely small and often difficult to identify. Humans can also produce diamonds, in high pressure and temperature labs. Evidence that coal is not involved in the natural formation of diamonds lies in their ages. Almost every diamond that has been dated formed during the Precambrian Eon - the span of time between Earth's formation (about 4,600 million years ago) and the start of the Cambrian Period (about 542 million years ago). In contrast, the earliest land plants did not appear on Earth until about 450 million years ago - nearly 100 million years after the formation of virtually all of Earth's natural diamonds. Superman may be able to squeeze diamonds from coal, but apparently nature uses other sources of carbon when it creates the gems.

Typical kimberlite with (pyrope red), chromium diopside (green), calcite (white), and a green surpentenized matrix

for more information see http://geology.com/articles/diamonds-from-coal

Montana's Wankel T-Rex: Is Now the Nation's T-Rex

Rancher Kathy Wankel found a rare fossil in 1988 while hiking near the Fort Peck Reservoir in Montana and brought the bones to the Museum of the Rockies in Bozeman, Mont., for identification. Her discovery turned out to be the arm bones of a *T. rex*, remains so rare that Horner, the Museum of the Rockies' curator of paleontology—and technical advisor to the *Jurassic Park* movie series—led a team to excavate the site. The dig yielded 80 to 85 percent of the skeleton (including the skull), the most complete *T. rex* skeleton ever discovered. Named the "Wankel *T. rex*" the fossil was in an excellent state of preservation. Property of the U.S. Army Corps of Engineers, the Wankel *T. rex* was recovered and displayed as found in the Museum of the Rockies in Bozeman, MT. In June 2013, the Smithsonian Museum reached a 50-year loan agreement with the Corps of Engineers to transfer the *T. rex* skeleton to the Smithsonian where it was remounted, nicknamed "*the Nation's T-rex,*" and will become the centerpiece of the museum's new 31,000 square foot national fossil hall, that will open in 2019. The *T. rex* wasn't mounted just standing there, it's been posed in the act of ripping up a flattened triceratops. The pose carefully skirts the debate over whether *T. rex* was primarily a scavenger of dead animals or a hunter. It's not clear from this whether the triceratops is already dead or being killed. Smithsonian director Kirk Johnson said *"The entire Natural History Museum will be alive with excitement as we begin a journey to tell the story of prehistoric Earth by welcoming one of its most famous ambassadors, the Tyrannosaurus rex."*

The Wankel T-rex, displayed as found at the Museum of the Rockies in Bozeman.

A specially equipped truck was used to transfer the Wankel *T. rex* to Washington DC.

Photo of the final mount of the Nation's *T. rex* feasting on a triceratops. The inset shows the amount of fossil bone recovered (in blue).

How Will Life on Earth End?

Probably the closest that life has come to ultimate destruction was 250 million years ago, during the end-Permian mass extinction event, when 85% of all species living on land and 95% of all ocean-dwelling species disappeared from Earth. But what could totally end life on Earth?? This could happen with the impact of a giant meteorite that would totally melt the Earth or by a rogue star passing through the Solar System and disrupting the Earth's orbit, or by the Earth being blasted by a huge gamma-ray burst. While these disasters are possible, one life-ending disaster is sure to happen. About 5.4 billion years from now the Sun will exhaust the hydrogen fuel in the core, and the inert helium ash that has built up there will become unstable and collapse under its own weight. This will cause the core to heat up and get denser, and the Sun to grow in size and enter the Red Giant phase of its evolution. It is calculated that the expanding Sun will grow large enough to encompass the orbits of Mercury, Venus, and maybe even Earth. Even if the Earth survives, the intense heat from the red sun will scorch our planet and make it completely impossible for life to survive. Once it reaches the Red-Giant-Branch

phase, the Sun will haves approximately 120 million years of active life left. But much will happen in this amount of time. First, the core of helium will ignite violently in a helium flash, when approximately 6% of the core and 40% of the Sun's mass will be converted into carbon within a matter of minutes. The Sun will then shrink to around 10 times its current size but about 50 times its luminosity, with a temperature a little lower than today. For the next 100 million years, it will continue to burn helium in its core until it is exhausted. By this point, it will be in its Asymptotic-Giant-Branch (AGB) phase, when it will expand again (much faster this time) and become more luminous. Over the course of the next 20 million years, the Sun will then become unstable and begin losing mass through a series of thermal pulses, every 100,000 years or so, each larger than the previous. The Sun's luminosity will eventually increase to 5,000 times its current brightness and its radius to over 1 AU, swallowing the Earth. The sun will then become a white dwarf and will survive for trillions of years before fading to black

Oldest Animals on Earth—Corals

Coral genotypes can survive for thousands of years, possibly making them the longest-lived animals on Earth, according to researchers at Penn State, the National Marine Fisheries Service and Dial Cordy & Associates. The team recently determined the ages of elk horn corals (***Acropora palmate***) in Florida and the Caribbean and estimated the oldest genotypes to be more than 5,000 years old. The results are useful for understanding how corals will respond to current and future environmental change. "*Our study shows, on the one hand, that some **Acropora palmata** genotypes have been around for a long time and have survived many environmental changes, including sea-level changes, storms, sedimentation events and so on*," said Iliana Baums, associate professor of biology, Penn State. "*This is good news because it indicates that they can be very resilient. On the other hand, the species we studied is now listed as threatened under the U.S. Endangered Species Act because it has suffered such sharp population declines, indicating that there are limits to how much change even these very resilient corals can handle*." According to Baums, many people mistake corals for plants or even non-living rocks, but corals actually consist of colonies of individual invertebrate animals living symbiotically with photosynthetic algae. "*Previously, corals have been aged by investigating the skeletons of the colonies or the sizes of the colonies*," she said. "*For example, bigger colonies were thought to be older. However, many coral species reproduce via fragmentation, in which small pieces break off from large colonies. These pieces look like young corals because they are small, but their genomes are just as old as the big colony from which they broke. Similarly, the big colonies appear younger than their true age because they became smaller during the process of fragmentation*." Now, for the first time, Baums and her colleagues have used a genetic approach to estimate the ages of corals. The method determines when the egg and the sperm originally met to form the genome of the coral colonies. The researchers then tracked the number of mutations that accumulated in the genome since that time. Because mutations tend to arise at a relatively constant rate, the researchers were able to estimate an approximate age in calendar years of the coral genomes in their study. The results, which appear in print in the November 2016 issue of the journal Molecular Ecology, suggest that some ***Acropora palmata*** genomes have been around for more than 5,000 years. The researchers determined the ages of *Acropora palmata* corals in Florida and the Caribbean and estimated the oldest genotypes to be more than 5,000 old. http://news.psu.edu/story/439785/2016/11/30/corals-much-older-previously-thought-study-finds

6,000 Years Ago the Sahara Desert Was Tropical, So What Happened ?

As little as 6,000 years ago, the vast Sahara Desert was covered in grassland that received plenty of rainfall, but shifts in the world's weather patterns abruptly transformed the vegetated region into some of the driest land on Earth. A Texas A&M University researcher is trying to uncover the clues responsible for this enormous climate transformation, and the findings could lead to better rainfall predictions worldwide. Robert Korty, associate professor in the Department of Atmospheric Sciences, and colleagues reported in the current issue of Nature Geoscience. The researchers have looked into precipitation patterns of the Holocene era and compared them with present-day movements of the intertropical convergence zone, a large region of intense tropical rainfall. Using computer models and other data, the researchers found links to rainfall patterns thousands of years ago. They said that tropical

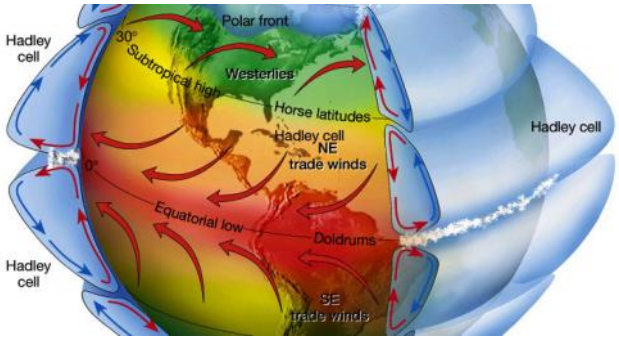


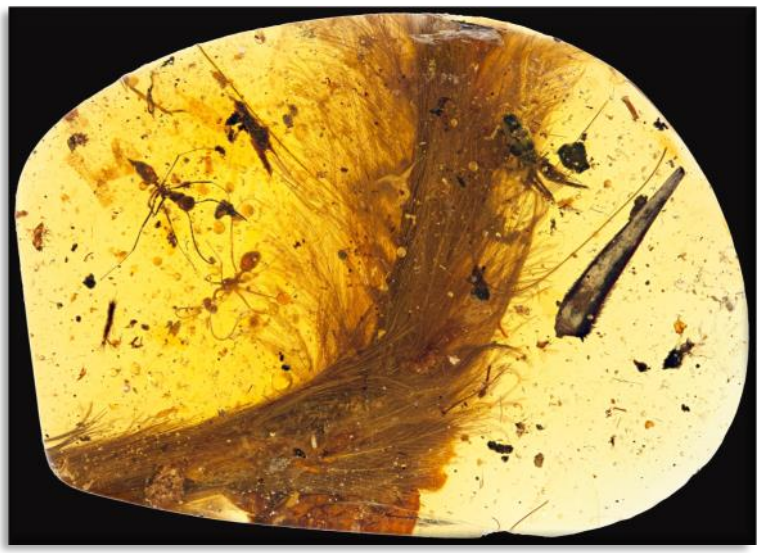
illustration of Hadley Cell circulation

rain belts are tied to what happens elsewhere in the world through the Hadley circulation, a tropical atmospheric circulation that rises near the equator. It is linked to the subtropical trade winds, tropical rain belts, and affects the position of severe storms, hurricanes, and the jet stream. Where it descends in the subtropics, it can create desert-like conditions. 6,000 years ago, what is now the Sahara Desert was a rainy place. It has been difficult to understand how the tropical rain belt moved so far north of the equator. Their findings show that that large migrations in rainfall can occur in one part of the globe even while the belt doesn't move much elsewhere. The findings could lead to better ways to predict future rainfall patterns in parts of the world. They were able to conclude that the variations in Earth's orbit that shifted rainfall north in Africa 6,000 years ago were by themselves insufficient to sustain the amount of rain that geologic evidence shows fell over what is now the Sahara Desert. Feedbacks between the shifts in rain and the vegetation that could exist with it are needed to get heavy rains into the Sahara.

https://www.sciencedaily.com/releases/2016/11/161130141053.htm

Dinosaur Tail & Feathers In Amber !

While most paleontologists dig up prehistoric bones from the ground, Lida Xing hunts for fossils in the amber markets of Myanmar. In 2015, he made a remarkable find: Trapped in what looked like golden glass was the feathered tail of a dinosaur. Along with the primitive plumage, the 99-million-year-old amber also preserved soft tissue and eight complete vertebrae. The tail bones indicated that the specimen belonged to a dinosaur, not a prehistoric bird, and also provided researchers with insight into the evolution of feathers. "This is the first time that skeletal material from a dinosaur has been found in amber," Dr. Xing, a paleontologist at China University of Geosciences. He and his colleagues published their findings Thursday in the journal Current Biology. The feathers most likely belonged to a baby non-avian theropod (that looked similar to a velociraptor) about the size of a sparrow. After death, the tiny dinosaur's body was most likely covered in tree resin. The resin is produced as a defense mechanism against insect infestations. When it dries it becomes a plastic-like substance that can survive for millions of years. After Dr. Xing found the amber, he sent it to Dr. McKellar, an amber expert, to further investigate the specimen. "I was blown away," Dr. McKellar said. "it's the closest you'll ever get to holding a fleshed-out dinosaur in your hands." Using a high-powered microscope, Dr. McKellar recorded images of the amber. He found that the underside of the feathers was white and the top was chestnut brown. But it was not the color that fascinated him the most. "I was seriously puzzled by the feather structure we're seeing in this sample," he said. Most modern bird feathers have a central shaft called a rachis; think of the ink rod in a quill pen. Branching from the rachis are smaller shafts called barbs, and then branching from the barbs are even smaller filaments called barbules. But this specimen lacked the rachis; it just had barbs and barbules down its ribbon-like tail. "They are more fuzzy than sleek," Dr. McKellar said. "It shapes our view of how feathers came to develop in modern birds, and it gives us a rare glimpse of what dinosaurs looked like and potentially what feathers were being used for in the mid-Cretaceous." The finding suggests that the barbs and barbules evolved before the rachis in feathers. That is interesting because the rachis seems to aid in flight. It could be that dinosaurs with more primitive feathers used them for temperature regulation, camouflage and visual signaling, rather than flight. "It's a spectacular specimen," said Mark Norell, a paleontologist from the American Museum of Natural History, who was not involved in the study. He added that because the feathers were found with the vertebrae, there was no question they belonged to a non-avian theropod dinosaur as opposed to a prehistoric bird. "This is a novel feather type that we haven't seen before." http://www.nytimes.com/2016/12/08/science/dinosaur-feathers-amber.html?rref=collection%2Ftimestopic%2FFossils&action=click&contentCollection=timestopics&region=stream&module=stream unit&version=latest&contentPlacement=1&pgtype=collection&_r=0



Dinosaur tail and feathers preserved in amber from Myanmar.

artist's drawing of a small coelurosaur

barbules on the feathers of the dinosaur tail in amber

2017 Officers, Directors, and Committee Chairs

President	Marv Houg (m_houg@yahoo.com)	364-2868
Vice President.	Ray Anderson (rockdoc.anderson@gmail.com)	337-2798
Treasurer	Dale Stout (dhstout55@aol.com)	365-7798
Secretary	Dell James (cycladelics@msn.com)	446-7591
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Liaison	Joy Cummings (joybelle28@live.com)	981-2482
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Sunshine	Dolores Slade (doloresdslade@aol.com)	351-5559
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Webmaster	Sharon Sonnleitner (sonnb@aol.com)	396-4016

Club meetings are held the 3rd Tuesday of each month from September through November and from January through May at 7:00 p.m., temporarily at a location to be announced. The December meeting is a Christmas dinner held near the usual meeting night. 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:

Dale Stout
2237 Meadowbrook Dr. SE
Cedar Rapids, IA 52403

CVRMS website:
cedarvalleyrockclub.org

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