Lake George Gem & Mineral Club

Club News,

December, 2022

The December meeting will be held at the Lake George Charter School at 10AM on December 10 (note winter time change)

It's going to be a grownup "Show & Tell"!

LGGMC will supply water and light snacks.

Due to rapidly spreading flu, covid, and RSV, we will forego our normal pot-luck affair.

We'll have a traditional LGGMC "Towel Show", which is essentially a grownup "show & tell". That means bring one or more minerals, fossils, or cut stones that you'd like to show to the rest of the members. It might be something like "Here's a rock I found in my driveway, what is it?"; or it could be as complex as showing a collection of Chinese fluorite specimens that you bought. Just plan on putting them on the table on top of a towel or other piece of cloth with any labeling you think might is appropriate. Restricting the size of your display to that of a folded towel (2 feet by 3 feet) keeps displays a reasonable size.

This would be a great time to show off what you found last summer! You can explain as much or as little as you feel comfortable doing about your specimens. Or bring your "unknown" specimens to try to get them identified. We hope the Pebble Pups/Earth-Science Scholars and their families will feel welcome to come to this meeting also.

We'll have a short business meeting, including election of 2023 officers. We still lack candidates for President and Secretary. After the business meeting, it's snack time while we are viewing and talking about the minerals, fossils, or cut stones on display.

As always, during the meeting, we will continue a silent auction for some cool specimens donated by Club members. The way this works is that the specimens will be displayed at the back/side of the room with "bid sheets". Each item will

have a minimum starting bid. You write your bid and initials in a blank space on the sheet and then watch to see if others outbid you. You can keep on bidding until the President says bidding is closed. In addition, Club logo hats and shirts will be available for sale. So, bring some CASH and be prepared for the fun!

- **Candidates for 2023 Officers**:
  President:
  Vice President: John Rakowski
  Treasurer: Cathy McLaughlin
  Secretary:
  Editor: Bob Carnein

Please contact one of the current officers (listed at the end of this newsletter) if you would consider running for a 2023 office.

- **January LGGMC Meeting: Drilling, "fracking", earthquakes and our energy bills**
  John Rakowski will discuss the advantages of horizontal drilling and the evolution of "fracking" from post-Civil War times to the present. He will discuss the advantages of fracking as well as the downsides of the process. We'll learn about the increased earthquake activity in the Mid-Continent region and why we've had a sudden increase in that activity. We'll also discuss how horizontal drilling and fracking impact our energy bills.

- **ADDITIONAL COMING EVENTS OUTSIDE THE LGGM CLUB: (**Nearby gem, mineral, fossil, and geology events that you may enjoy.)
- **Cañon City Geology Club**, **Bob Carnein** will talk about **"Cripple Creek "Eye Candy": The Minerals of the Victor/Cripple Creek District"** on Nov. 14. The club meets on the 2nd Monday of the month at 6PM in the United Methodist Church, Cañon City
- **Columbine Gem & Mineral Society**, meets on the 2nd Thursday of each month, 6:30PM in the meeting room, Mt. Shavano Manor, 525 W. 16th (at J St.), Salida
- **Colorado Springs Mineralogical Society**, meets on the 3rd Thursday of each month at 7PM in the Mt. Carmel Veteran's Service Center, 530 Communication Circle, Colorado Springs;
- **Pueblo Rockhounds**, meets on the 3rd Thursday of each month at 6:30PM in the Westminster Presbyterian Church, 10 University Circle, Pueblo.

Thanks to **Pete Modreski** for sending the following event announcements:

- **Thurs., Dec. 1,** 7:00 p.m., "**Evaporite minerals of Searles Lake, San Bernardino County, California**", by Dan Zellner, at the bimonthly meeting of the Colorado Chapter, Friends of Mineralogy. Berthoud Hall Room 109, Colorado School of Mines campus, Golden. This will be a "live" in-person meeting only (no Zoom). All are welcome; the room will open for social chat at 6:30. Parking on campus is free after 5:30 p.m.

- **Sat., Dec. 3,** 1:30-7:00 p.m., **WIPS Annual Auction**, Lakewood Clements Community Center, 1580 Yarrow St, Lakewood, CO. Free to attend, all welcome. Attendees are encouraged to contribute to the potluck dinner. Silent auction will include numerous items of paleontological - and geological - interest including items from the Covington collection. Verbal auction (later in the afternoon) to include big-ticket items. Anyone can bid, but only WIPS members can bring items to the auction.

- **Fri.-Sun., Dec. 9-11, Flatirons Gem & Mineral Show**, Boulder County Fairgrounds, Longmont, CO. See https://flatironsmineralclub.org/about/annual-fmc-gem-and-mineral-show-2/ .

- **Tues., Dec. 13,** Colorado Scientific Society Potluck Dinner, Annual Meeting, and President's Address, **Who owns the Arctic? – the politics of plate tectonics in a melting world,** by **Ned Sterne.** New Terrain Brewing Company, Terminus Room, 16401 Table Mountain Parkway, Golden. All are welcome to attend, no charge; dinner at approx. 6 p.m., meeting & presentation at 7 (please check CSS website to confirm exact times).

As usual, Wayne Orlowski sent some interesting links:

- Utah's Great Salt Lake is one of the world's largest saline lakes. Over the past 4 decades the lake has shrunk under growing population pressure from residents of Salt Lake City and environs and because of declining snowfall in the Wasatch Mountains.
  NASA's Earth Observatory has a great post on the state of Great Salt Lake. (Landsat images courtesy of NASA EO.) https://earthobservatory.nasa.gov/.../the-great-shrinking...

  https://earthobservatory.nasa.gov/images/150187/the-great-shrinking-lake?fbclid=IwAR0yYKU5A1CPH5jLqPtEpyHBwWUzd5xehWDhFqf-n4ICu3f6jHWX814J39M

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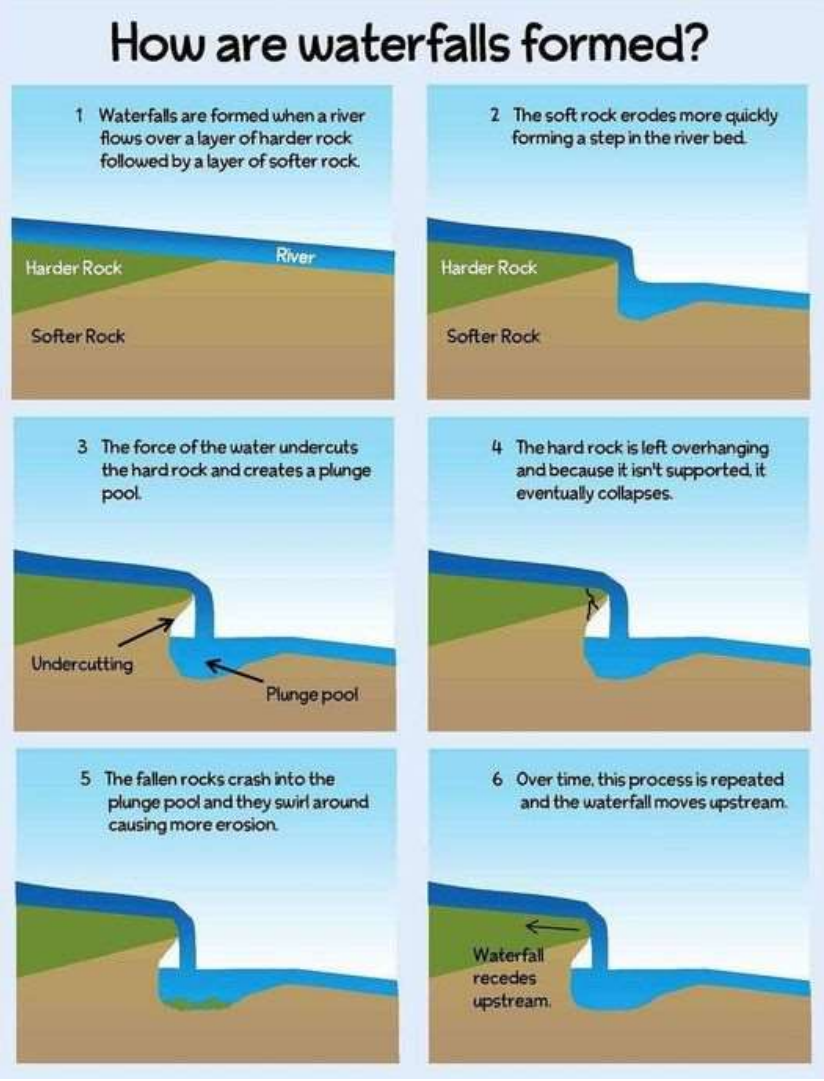


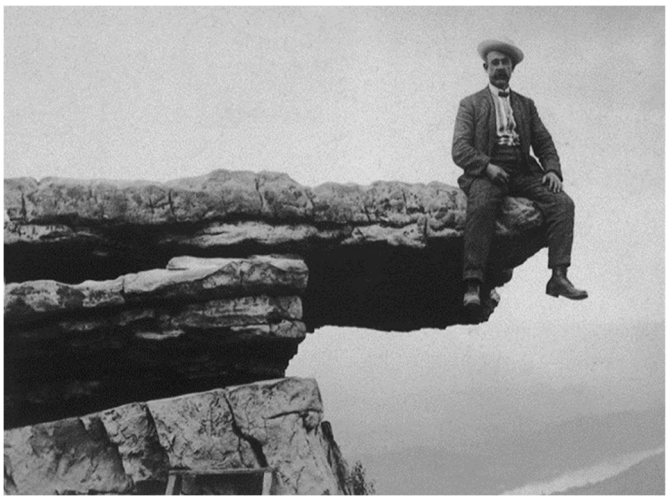
- Have you seen Yellowstone's famous Obsidian Cliff?
  Here is a nice summary that explains the details without being too technical.
  Geology professor Shawn Willsey takes you up close and personal with the famous Obsidian Cliff in Yellowstone National Park. Learn more about how the silica-rich lava flow that formed this interesting rock.

  https://www.youtube.com/watch?v=VppNtD3DkMY

- And here is the latest installment of **"Bench Tips" by Brad Smith:**
  (www.BradSmithJewelry.com)

  Brad must have had too much turkey this month—no Bench Tips were received.

Smart Solutions for Your Jewelry Making Problems:
Amazon.com/author/bradfordsmith



Notes from the Editor

Bob Carnein

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As promised last month, here's an interesting article from Paul Combs for you paleontologists and historical geologists! Thanks, Paul.

EXCUSE ME, YOUR WATCH IS .002 SECONDS OFF

Paul Combs
Paleontology Study Group, Lake George Gem & Mineral Club

There is a pesky and persistent stereotype that paleontologists live in a private world and seldom interact with other people. Meteorologists often work with the architects who design skyscrapers because winds can have a powerful effect on a tall building. Chemists seem to collaborate with everybody. But who talks to paleontologists, really, aside from a few Hollywood movie-makers? Plenty of people, as it turns out. Here is an example of a case where physics, paleontology, astronomy, marine biology, math, and other disciplines converged on a single goal. A series of overlapping, mutually-supporting discoveries is called *serendipity* and serendipity always makes a good story.

Let's begin with the **PHYSICS** and **ASTRONOMY**. In the 19th century, German and British physicists developed what we now know as the *Law of Conservation of Energy.* It says that *the total amount of energy in any closed system remains constant, and that energy cannot be created or destroyed, although it may be transferred.*

NOTE: If that one-sentence explanation of "conservation of energy" gives you a headache, don't reach for the aspirin. I have two familiar examples that will work better, and faster:

(1) Imagine that you are playing pool. You hit the cue ball, which rolls across the table and smacks into another ball. The cue ball stops and the second ball begins to roll at about the same speed that the cue ball had. The cue ball stopped because its energy was *transferred to the second ball.*

(2) Many physics teachers love to use the "ice skater" example because we have all seen it. In this example, you are an ice skater, spinning fast in the center of the rink. Your arms are folded tightly against your body. If you hold your arms straight out from your shoulders, the spinning slows down. Then, if you bring your arms back to your body, you will speed up again. Energy was transferred out to your arms and back to your body again. Your arms move more slowly when they are held away from your body because they are accomplishing the same amount of **work**, but over a longer **distance**. There is a formula for that: **Work = force x distance**

You are now a qualified physicist. To receive your diploma, simply print your name in pencil on a $50 bill and mail it to me. Now, let's return to our story and see how those different branches of science converged at the same idea.

Many early thinkers, including the German Immanuel Kant, wondered about possible variations in the Earth's 24-hour rotation. Here is my translation of the title of a paper he wrote about that topic: "*Investigation of the question: Whether the earth, in its rotation on its axis, which brings about the alternation of day and night, has undergone some changes since the earliest times of its origin; what is the cause of it, and how can one be assured of it?"* (Kant, 1754).

What could have caused Kant to develop an idea like that? He didn't know it at the time, but he was trying to get his head around what we recognize now as *The Law of Conservation of Energy*. Today, we know that the Earth-Moon system works like this: The Moon's enormous gravitational attraction causes ocean tides. Those tides follow the Moon in its east-to-west movement. This is important because tidal motion is opposite the Earth's west-to-east rotation. The east-to-west movement of the tides creates friction that imparts a slight, but constant, braking effect on Earth's rotation (Brosche and Sundermann, 1982). As a qualified physicist, you know that *The Law of Conservation of Energy* says that the energy of Earth's rotation is not being lost – it is being transferred somewhere, but where?

At least as early as the 1950's, astronomers began to suspect that the Earth transferred energy to the Moon. If this were true, the extra energy would cause the Moon to very s-l-o-w-l-y recede from the Earth. This is just like the example where you imagined yourself as a spinning ice skater. I realize that I spoiled the plot by giving you the answer to Kant's question, but it is ***HOW*** scientists proved this is happening that makes the story. There was no way in the 1950's to prove that the Moon is gaining energy and retreating from the Earth, so we'll leave the astronomers scratching their heads while we see how marine biology fits into the story.

MARINE BIOLOGISTS know that corals grow by adding an extremely thin layer of mineral (calcium carbonate) to their skeleton each day. Scientists also know that corals reproduce during each full Moon. On those special days, most of the nutrition that would have been used to produce another daily growth layer is used instead to produce eggs and sperm (Berkowski and Belka, 2008). Diverting nutrition for reproduction creates a special, monthly layer (a dissepiment) in the series of daily growth layers. Modern corals have one dissepiment for every 28.5 daily growth layers. Annual changes in temperature or salinity usually cause one or two slightly unusual dissepiments for every 13 or so normal dissepiments. With a microscope and a little practice, a marine biologist can use the unusual dissepiments to determine a coral's age. We'll hit the "pause" button on this part of the story while we go see what Cornell University paleontologist John Wells was studying in the 1960's.

PALEONTOLOGISTS are essentially biologists who study fossil life. John Wells knew about growth layers in modern corals, so he decided to examine the fossil corals in his collection. He chose to use a "horn coral" (Figure 1). Horn corals are extinct today, but they were solitary and fairly large, and that makes them easier to study than tightly-packed, colonial corals. John cut a slice through a horn coral, polished both sides, and placed it under a microscope. He saw the monthly dissepiments we would expect in modern corals. But something unusual caught his attention: there were too many dissepiments for each year (Wells, 1963, 1965). Not only that, the older corals had more dissepiments per year than the younger ones! At first, this made no sense. John didn't know it, but those garbled numbers were the smoking gun in a detective story that would give this Cornell University paleontologist the answer to Kant's 1754 question AND BEYOND -- all the way to outer space.

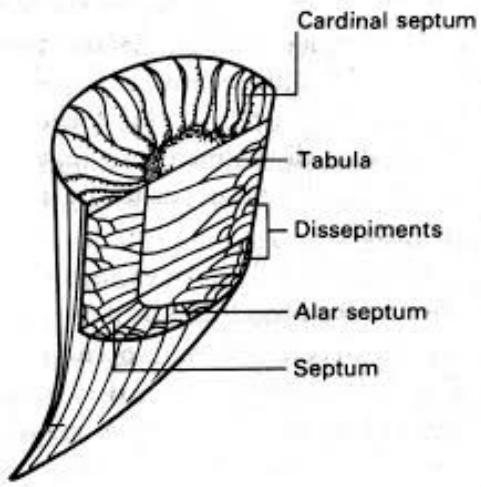

Figure 1. A cross section of a typical horn coral. Monthly growth layers (dissepiments) are labeled. Originally posted on: *http://faculty.chas.uni.edu/~groves/LabExercise09.pdf*

Figure 2. The Late Pennsylvanian-age fossil horn coral *Lophophyllidium spinosum* from Brownwood, Texas. Growth was from left to right. A paleontologist like John Wells would cut it lengthwise, polish it, examine it with a microscope and count the dissepiments that form during each full Moon. When this coral was alive, 290 million years ago, there were about 390 days in a year. Length of specimen: 27 mm or slightly over an inch. Photo: Paul Combs collection

The monthly dissepiments in John Wells's fossil corals from the Early Silurian epoch (445 million years ago) showed that there were almost exactly 13 lunar months per year, 32.4 days per month, and 421 days per year. So, an Early Silurian day would have been about 20.8 hours long (Wells, 1966). It didn't take Wells long to realize that the shorter days meant that the Earth rotated faster in the Early Silurian than it does today. **NOTE: As far as astronomers can tell, although the Moon's orbit and the Earth's rotation have changed, the period of the Earth's orbit around the Sun has remained the same over time.**

John also remembered *The Law of Conservation of Energy* from his physics classes. He realized that the slowing of the Earth's rotation would transfer energy to the Moon's orbit, causing it to move away (Wells, 1963, 1966). John saw that the Earth/Moon system behaves like our spinning skater. Just like the skater's hands, the Moon needs more time to complete an orbit when it is farther away from Earth. Slower rotation and wider orbits mean fewer days per month, which is what we have today.

Wells calculated that Earth's rotation has been slowing by about two milliseconds (0.002 second) per century. That doesn't sound like much, but a million years contain 10,000 centuries and Wells was accustomed to thinking in terms of hundreds of millions of years. It was all beginning to come together. After 200-plus years, Immanuel Kant was getting the answer to his nagging 1754 question. John wrote a paper announcing his discovery and, soon, other paleontologists were examining their fossil corals and other organisms.

Fossil corals from the Middle Silurian Epoch (about 430 million years ago) yielded about 419 days per year, which is a decrease of two days per year from the Early Silurian (Mazzullo, 1971).

The "growth increments" on fossil brachiopods (clam-like animals that still live in the oceans) from the Middle Devonian Epoch (about 370 million years ago) showed about 410 days per year, with 31.5 days per month. That would have made a Middle Devonian day about 22 hours long (Rosenberg, 1982).

By the Pennsylvanian Period (318 – 299 million years ago), fossil corals showed that there were about 390 days per year and a day was about 22.5 hours long (Runcorn, 1970).

Corals appear in the fossil record about 500 million years ago, so paleontologists needed to use a different fossil if they were going to go further back in time. Stromatolites are a life form that deposits daily layers of calcium carbonate, somewhat like a coral. A 1975 study revealed that there were about 461 days per year 534 million years ago, and each day was about 19 hours long (Mohr, 1975).

In 2020, Belgian scientist Niels de Winter and eight colleagues published a study that lends more support to Wells' discoveries. They studied 70-million-year-old fossil clams known as rudists (*Torreites sanchezi*) from the Arabian Peninsula. The Belgians cut and polished thin slices of the fossil clams' shells and found that there were 372 daily growth layers per year when the clams were alive and that each day was 23.5 hours long (de Winter, *et al*, 2020).

GEOPHYSICS AND SEDIMENTOLOGY: In September, 2022, Dr. Margriet Lantink of the University of Wisconsin, Madison, and three colleagues published a paper that reveals cyclic changes in 2.46-billion-year-old (Gya) banded iron formation. Banded iron formation is a type of sedimentary rock that consists of thin bands of iron oxides (magnetite or hematite) alternating with shale or chert. The researchers knew that 2.46 Gya fossil life forms are microscopic, so they decided to use the Milankovitch Cycles in a geophysical study without any need for fossils. **Background**: In 1941, Serbian mathematician Milutin Milankovitch published a study explaining that there are three major variations in Earth's orbit: climatic precession, obliquity, and orbital eccentricity. Their relative ratios change over time, depending upon the Earth's rotation rate and lunar distance. Using Milankovitch's formulas and the cyclic nature of the layers in the banded iron formation, Dr. Lantink and her coworkers discovered that the average Earth–Moon distance 2.46 Gya was about 321,800 km (193,080 miles), whereas it has

increased to about 384,400 km (230,400 miles) today. This means the Moon is about 62,600 km (37,560 miles) farther from Earth today than it was 2.46 Gya. They also calculated that there were about 518.7 days per year at that time, which means that day length was only about 16.9 hours. This paper reveals the relationship of the Earth-Moon system about one billion years earlier than any previous study, and it shows day length and number of days per year that are consistent with measurements based on later fossil life forms (Lantink, *et al.*, 2022).

That was a lot of numbers. Figure 3 shows, in a tidier form, how it appears on a graph.

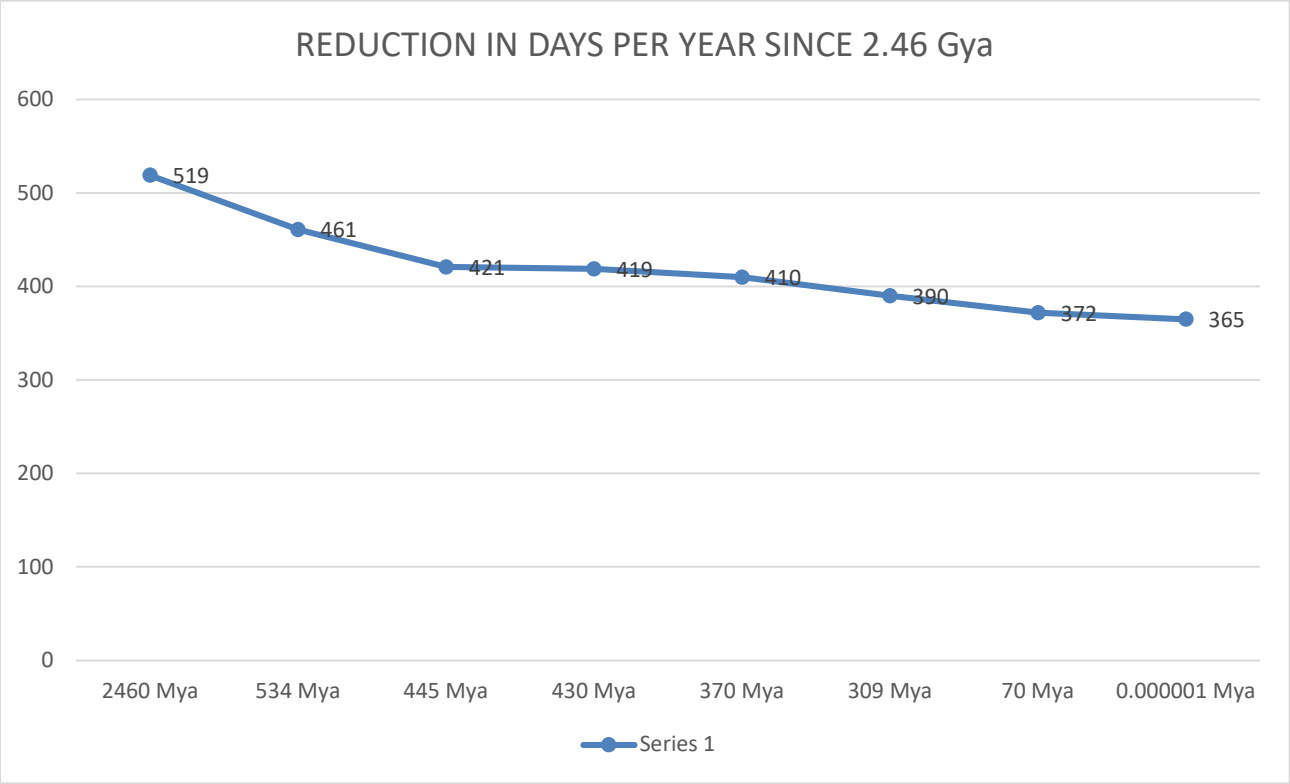

Figure 3. Vertical scale at left represents number of days per year. Horizontal scale at bottom shows the ages of various studies in millions of years. Blue horizontal line represents the number of days per year at each date. There has been a 154-day (154 Earth rotations) reduction in the number of days per year since 2.46 billion years ago. Earth was rotating very rapidly over halfway back in Earth history (each day was about seven hours shorter than today) but much of that rotational energy has since been transferred to the Moon through the *Law of Conservation of Energy*. Editor's note: Please note that the vertical scale is linear but the horizontal scale is not.)

BREAKTHROUGH! A radical idea that had begun as an astronomical curiosity in the 18th century, then advanced to an unproven, math-based theory, had elegantly been proven by studying fossil marine invertebrates, but only after marine biologists had conducted research on living animals.

More evidence has accumulated in the 60 years since John Wells counted the growth layers of fossil corals. Highly accurate "atomic" clocks tell us that the Earth's rotation is indeed slowing down, by about 2-3 milliseconds per century, exactly as John Wells had computed with no more evidence than a thin slice of fossil coral under a microscope (McCarthy and Seidelman, 2009). In 1969, Apollo 11 astronauts placed a laser reflector on the Moon. It allows us earthlings to measure the precise distance between the Earth and Moon, proving that the Moon is indeed retreating from the Earth at a rate of about 1.5 inches (3.8 cm) per year (Dickey, *et al.*, 1994). That doesn't seem very far, but my cheap

calculator tells me that, when the corals that Wells studied were living, the Moon was around 10,500 miles (16,800 km) closer to Earth than it is today.

Today, thanks to paleontologist John Wells and many other scientists from different fields who probably never met each other, the facts that (A) the Earth's rotation is slowing down and (B) the Moon is retreating in its orbit are taught in physics, Earth sciences, and astronomy classrooms around the world.

It isn't often that branches of science as unrelated as marine biology, paleontology, astronomy, geophysics, physics, mathematics, and sedimentology can produce discoveries that support each other so elegantly, but scientists love it when they do. And those fossil corals, clams, stromatolites, and brachiopods that you collected last summer? They have stories to tell you. You only need to know how to read them.

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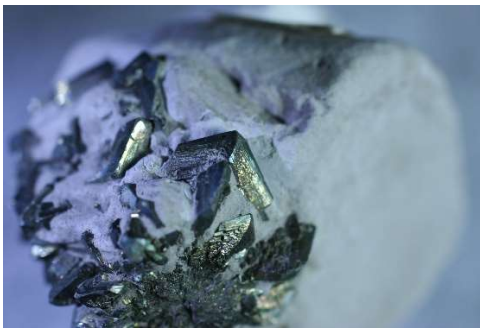
Monthly Mineral Quiz

The Monthly Mineral for December (Carnein photos and collection)



This month's mineral is very common—you may have collected specimens yourself! Crystals like those above are twinned and commonly exhibit a blunt spearhead or "cockscomb" habit. The specimen on the right (above) is a concretion (that's a brachiopod fragment at the center), which is another typical mode of occurrence. It may also be stalactitic, reniform (kidney-like), or form simple orthorhombic crystals. It occurs in a variety of low temperature ore deposits and, more commonly, in sedimentary environments. Hardness is 6 to 6 ½, SG is about 4.9, and it has a metallic or submetallic luster. This mineral, like last month's, is dimorphous with another common mineral. Like that mineral, it's often unstable and may break down, even in a collection drawer. Be careful—if this happens, gases emitted may damage other minerals nearby. What's this common mineral?

Last Month's Mineral: Acanthite, Ag_2S.
Acanthite is the low temperature dimorph of silver disulfide. Above 177ºC, the mineral crystallizes as *argentite*. If you have a specimen labeled argentite, change the label to acanthite (unless the sample is too hot to handle!). Argentite is isometric, while acanthite is monoclinic. As a result, most acanthite crystals are paramorphs—they look isometric (as in the sample to the left, from Morocco). Acanthite is the "tarnish" you have to periodically remove from silver objects. It is widespread in moderately low temperature hycrothermal deposits and is an important ore of silver. Mindat.org (accessed November, 2022) lists over 150 Colorado occurrences, including the Ajax mine, in the Cripple Creek mining district, where it is rare.

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The Lake George Gem and Mineral Club is a group of people interested in rocks and minerals, fossils, geology and history of the Pikes Peak/South Park area, Indian artifacts, and the great outdoors. The Club's informational programs and field trips provide opportunities to learn about Earth science, rocks and minerals, lapidary work and jewelry making, and to share information and experiences with other members. Guests are welcome to attend, to see what we are about!

The Club is geared primarily to amateur collectors and artisans, with programs of interest both to beginners and serious amateurs. The Club normally meets on the second Saturday of each month at the Lake George Community Center, located on the north side of US Highway 24 on the east edge of town, sharing a building with the county highway shops. **In the winter, we meet at 10:00AM. From April through October, we meet at 9:00AM, to allow more time for our field trips.**

Our organization is incorporated under Colorado law as a nonprofit educational organization, and is a member of the Colorado, Rocky Mountain, and American Federations of Mineralogical Societies. We also sponsor an annual Gem and Mineral Show at Lake George, where collectors and others may purchase or sell rocks, minerals, fossils, gems, or jewelry. Annual membership dues (Jan. 1 through Dec. 31) are $15.00 for an individual (18 and over), and $25.00 for a family (parents plus dependents under age 18). New memberships and renewals are only accepted Jan 1 through March 31 each year.

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