



Volume 66 ♦ Number 12 ♦ December 2020 ♦ A monthly newsletter for and by the members of MAGS

MAGS Plans

W. C. McDaniel, MAGS President



The last time I ate inside a restaurant was at a hamburger place in Arkansas, coming home from a show in Kansas City. It was March 16. On the same weekend, I did my last show and had my last meal inside a restaurant for the year. Enough about me. Here are the MAGS plans for the next few months:

December

- No Membership Meeting or

Holiday Party

- No field trips

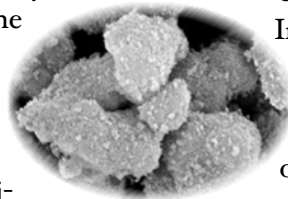
January/February 2021

- Membership Meetings most likely will be with ZOOM. Additional information on that process will be coming.
- In person meetings will be determined by Covid-19 status.
- Field trips will be announced soon. Charles Hill has re- *Continued, P. 3*

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DOUBLE SWEET

Recently, an Irish court ruled that Subway bread is not bread. The sugar content of the bread exceeds the stipulated limit in Irish law, so it should be classified as a confection. Many food products are loaded with sugar—just read the nutrition labels—which makes it harder for the many Americans (and people in other countries) who should limit



MATTHEW LYBANON, EDITOR
their sugar intake.

In 2015, the World Health Organization recommended that no more than 10%—ideally, less than 5%—of an adult’s daily energy intake should come from sugar. In other words, an average adult, with a daily consumption of 2,000 calories, ought to consume no more than six teaspoons of *Continued, P. 3*



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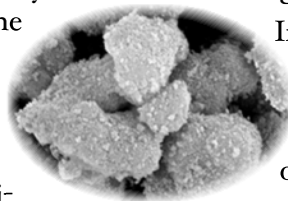
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MEMPHIS ARCHAEOLOGICAL AND GEOLOGICAL SOCIETY

MAGS Rockhound News ♦ A monthly newsletter for and by the members of MAGS

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MAGS AND FEDERATION NOTES

Memphis Archaeological and Geological Society,
Memphis, Tennessee

The objectives of this society shall be as set out in the Charter of Incorporation issued by the State of Tennessee on September 29, 1958, as follows: for the purpose of promoting an active interest in the geological finds and data by scientific methods; to offer possible assistance to any archaeologist or geologist in the general area covered by the work and purposes of this society; to discourage commercialization of archaeology and work to its elimination and to assist in the younger members of the society; to publicize and create further public interest in the archaeological and geological field in the general area of the Mid-South and conduct means of displaying, publishing and conducting public forums for scientific and educational purposes.

MAGS General Membership Meetings and MAGS Youth Meetings are held at 7:00 P. M. on the second Friday of every month, year round. The meetings are held in the Fellowship Hall of Shady Grove Presbyterian Church, 5530 Shady Grove Road, Memphis, Tennessee.

MAGS Website: memphisgeology.org

MAGS Show Website: www.theearthwideopen.com or <https://earthwideopen.wixsite.com/rocks>

We aren't kidding when we say this is a newsletter for and by the members of MAGS. An article with a byline was written by a MAGS Member, unless explicitly stated otherwise. If there is no byline, the article was written or compiled by the Editor. Please contribute articles or pictures on any subject of interest to rockhounds. If it interests you it probably interests others. The 15th of the month is the deadline for next month's issue. Send material to lybanon@earthlink.net.

The December DMC Field Trip has been cancelled. Clubs scheduled to host for the second half of this year, from July through December, have the option to preemptively reschedule to 2021. January and February 2021 are currently shown as "open" dates on the DMC Field Trips schedule.

Links to Federation News

- ➔ AFMS: www.amfed.org/afms_news.htm
- ➔ SFMS: www.amfed.org/sfms/
- ➔ DMC: www.amfed.org/sfms/dmc/dmc.htm

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MAGS Plans

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signed as field trip leader and that position is in the process of being filled.

March/April

- No plans as of now.

Web Tip

The website for Caldwell Stone Company in Danville,

Kentucky, has some nice pictures that show examples of specimens found there. Here is the link.

<https://www.caldwellstone.net/minerals-found-at-csc>

(Thanks for the tip, James Johnson.)

Estate Sale

Here is a collection of photos from the recent estate sale that MAGS conducted (see November issue for details). It was a sellout! (Photo credits: Mike Coulson)



Double Sweet sugar a day. Di-
Continued from P. 1 abetics (more than 10% of the U. S. population, and more than 25% of Americans over 65) need to limit their sugar intake even more.

By offering the taste of sweetness without any calories, artificial sweeteners seem like they could be the answer both to the craving for sweetness and as a weapon against obesity. But there is a problem: sugar isn't easy to replace. Despite

scientists' best efforts in the past century, none of the artificial alternatives that have been developed are quite as irresistible, let alone as versatile in the kitchen.

One concern is that people who use artificial sweeteners may replace the lost calories through other sources, possibly offsetting weight loss or health benefits. This can happen because we like to fool ourselves: "I'm drinking diet soda, so it's okay to have cake." The

American Heart Association and American Diabetes Association also added this caveat to their recommendation. And there are other health concerns.

It's also possible that these products change the way we taste food. "Non-nutritive sweeteners are far more potent than table sugar and high-fructose corn syrup. A minuscule amount produces a sweet taste comparable to that

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Double Sweet of sugar, with-
Continued from P. 3 out comparable
calories. Over-
stimulation of sugar receptors
from frequent use of these hyper-
intense sweeteners may limit tol-
erance for more complex tastes,”
explains Dr. David Ludwig, an
obesity and weight-loss specialist
at Harvard-affiliated Boston Chil-
dren’s Hospital.

Today, the average American
ingests more than 19 teaspoons of
added sugar every day (compare
that to the recommended limit!).
Not only does most of that never
come into contact with our taste
buds; our sweet receptors are also
less effective than those for other
tastes. Our tongues can detect bit-
terness at concentrations as low as
a few parts per million, but for a
glass of water to taste sweet, we
have to add nearly a teaspoon of
sugar.

That makes sense. Humans
evolved in an environment filled
with substances that might make
us sick or even kill us, and are
therefore highly sensitized to un-
pleasant tastes that may signal
danger. But the sweetest thing
that early hominids would have
been likely to come across was
fruit or, occasionally, honey. So
although we’re now surrounded by
cheap, plentiful sources of sweet-
ness, our sugar receptors are still
tuned to the level of a ripe banana.

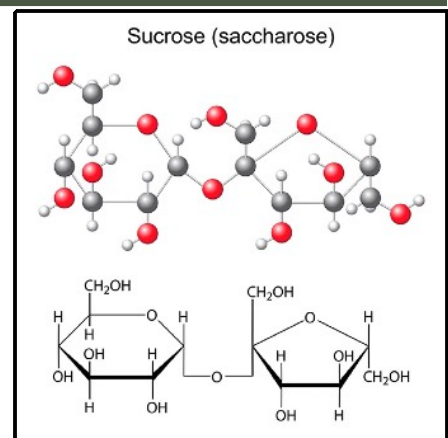
Saccharin is sweeter than sug-
ar, and aspartame is almost 200
times as sweet, but they’re not a
precise match for sugar. “Uncon-
sciously, we all know the time pro-
file of sucrose,” Russell Keast, a
food scientist at Deakin Universi-
ty, in Australia, explains. “The on-

set of sweetness, how long the
peak intensity lasts, exactly how
long the aftertaste lingers.” With
Splenda, say, that pattern is differ-
ent, and not in a way that most
people enjoy. Many non-nutritive
sweeteners also have metallic or
bitter notes, which have to be dis-
guised with other ingredients.

Furthermore, none of sugar’s
artificial replacements offer any-
thing close to the same range of
functionality. Sucrose reduces ice-
crystal formation in ice cream; it
adds crispness to baked goods,
volume to dough, and a mouth-
filling viscosity to drinks; it im-
proves emulsion stability in dress-
ings, reduces grittiness in choco-
late, and even increases shelf life.

Now some people are trying a
different approach. Instead of re-
placing sugar with artificial substi-
tutes, how about finding ways to
make sugar taste sweeter, so you
need less of it? One of these new
efforts is being developed at an
Israeli company named DouxMa-
tok. The name means “double
sweet”—or, at least, it does if you
know that *matok* means “sweet” in
Hebrew and that *doux*, the French
for “sweet,” sounds like the He-
brew *du*, which means “double.”

This is all very interesting, but
what does it have to do with rocks
and minerals, fossils, or archaeolo-
gy? Are you ready for this, MAGS
Members? The way that DouxMa-
tok fools your taste buds is by
mixing sugar with tiny grains of
silica, a common ingredient in the
food industry (it’s a trace mineral
that may promote bone health).
We’re very familiar with silica
(SiO₂). It’s quartz. It occurs as
sand grains in sedimentary rocks,



as crystals in both igneous and
metamorphic rocks, and in veins
that cut through all rock types.

Each silica grain is less than
2% of the diameter of human hair.
DouxMatok’s production process
embeds them throughout each
sugar crystal. Even though the re-
sulting crystal is 99% sugar, the
addition of silica has two outsized
effects: the bond between the sili-
ca and the sugar comes apart in
the mouth, exposing a vastly ex-
panded surface area of sucrose to
the liquefying powers of saliva; and
the sucrose immediately surround-
ing each silica grain changes form.
The atoms in a sucrose molecule
are usually stacked in a well-or-
dered lattice, but when this struc-
ture becomes amorphous, it dis-
solves on the tongue much more
quickly. You don’t taste the silica,
but the sugar taste becomes more
intense. You can use 40% less sug-
ar and get the same taste.

DouxMatok has partnered
with Lantic, Inc., part of Rogers
Sugar Inc., the largest refined sug-
ar distributor in Canada, to manu-
facture commercial quantities of
DouxMatok’s “more efficient”
sugar. Over the past two years,
Lantic and Doux-
Matok have

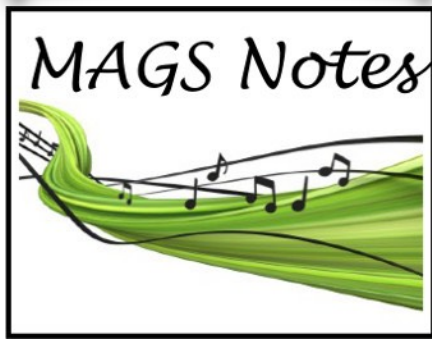
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Double Sweet worked together to transition this innovation from pilot testing to successful commercial scale manufacturing within Lantic's existing sugar refining business. The first products containing this sugar are expected to hit the market early in 2021.

Other companies are working on different ways of using smaller amounts of natural sugars to deliver the same taste. But the Doux-Matok method is the only one that gives a new meaning to "rock candy."



🎵 Meetings

December: No meeting

January and February 2021: Zoom meetings. Details TBD

🎵 Field Trips

December: No field trip.

2021: Field trips will be announced soon. Charles Hill has resigned as field trip leader. The position will be filled ASAP.

🎵 December Birthdays

- 1 Riley Collins
- 5 Tracey Thomas
- 6 David McAlister
- 7 Mitchell Childress
- Juliette Browning
- 8 Tina Wallace

- 11 Alan Schaeffer
- 12 Jared Robbins
- 13 Marc Mueller
- 13 Hongbing Wang
- 15 Kathy Baker
- Liam Collins
- Jerry Seamans
- 16 Adam Wilson
- 19 Paula Gunter
- 20 Racheal Mitchell
- Wingfield Bouchard
- 23 Jim McNeil
- 24 Michael Browning
- Jocelyn Ashurst
- Allen Grewe
- 29 Bebe Buck
- Brandon Mayer

Jewelry Bench Tips by Brad Smith

TEMPLATES

Whenever I have to make more than 2-3 exact copies of a sheet metal component, I think of making a template. Templates let me easily draw the shape of an item to cut out.

Art stores or online sources like cooltools.us/ and kings-leynorth.com/ sell templates for common shapes like circles, ovals, hearts, etc. but for nonstandard shapes, I make my own out of a scrap of sheet plastic or sheet metal. My preference is brass. I carefully lay out the shape using a steel ruler, a set of dividers, a scribe, and a fine center punch.

One example is the brass template in the pic below that lets me quickly trace the design of ginko leaf earrings onto silver sheet. Another is the nickel template which makes it easy to drill a pattern of

holes for pin inlay into wooden handles.



OCHRE APPLICATOR

Yellow ochre is used when you want to be sure the solder won't flow on an area of your piece while you're soldering another area. The only problem with ochre is coming up with a good way to store and apply it.

I use recycled nail polish bottles. They seal well and have a built-in brush applicator. Just clean them out with a little acetone or nail polish remover, and they're ready to go.



Wishing you happy holidays. I hope 2021 will be a better year.

Expand Your Jewelry Skills With Brad's "How To" Books at <http://amazon.com/author/bradford-smith>.

Fabulous Tennessee Fossils

Dr. Michael A. Gibson,
University of Tennessee at Martin

FTF 71

Diadochite Phosphate Fossil Replacement



Most marine organisms with hard parts have shells (composed mostly of CaCO_3 in the form of calcite or aragonite, which we looked at earlier) or bone and teeth (consisting of the mineral apatite that has picked-up a hydroxyl). One interesting mineral group that produces replacement minerals for the original calcite or aragonite of an organism during fossilization is the phosphate group, to which the mineral apatite belongs (the generalized formula for apatite is $\text{Ca}_5(\text{PO}_4)_3(\text{OH},\text{F},\text{Cl})$ where various combinations of a hydroxyl (OH), fluorine (F) and/or chlorine (Cl) bond with the complex-anion PO_4 . It is not odd for phosphate to be a replacing mineral in fossilization because phosphate is such an important mineral in life to begin with. Phosphate is a primary component of your ATP cycle (ATP = *adenosine triphosphate*), which I am sure that all of you remember from your formal biology classes is the chemical pathway for energy production and cycling in your cells. Specifically, it is in the mitochondria of your cells that this cycle determines whether-or-not you will have enough energy to keep your eyes open long enough to read the rest of this article!

Phosphate is also part of the composition of bone and teeth construction, which compose the most solid and durable parts of

chordate organisms in particular. Teeth and bone are composed primarily of the hydroxyapatite, $(\text{Ca}_{10}(\text{PO}_4)_6 \cdot 2(\text{OH}))$. Another important observation to make about phosphate in understanding phosphate as a replacing mineral in fossilization is the abundance of phosphate in the settings in which it is to be used. The occurrence and cycling of phosphate is drastically different in terrestrial versus marine settings. Chordates, like fish, reptiles, amphibians, mammals, etc., use phosphate for bone and teeth, but no invertebrate uses phosphate to construct a hard part. Marine invertebrates only use phosphate in their ATP cycle, but during fossilization, phosphate can become a replacement mineral and is a common composition for many steinkerns (internal casts). It is also important to remember that phosphate can also be in the sediments in a marine setting, hence inorganically formed from precipitation, with grain size ranging upward to nodules 10s of centimeters in size. The famous "megalodon" shark fossil pits of Aurora, North Carolina, are an example of a phosphate-rich seafloor (Pliocene age).

A little understanding of ocean water chemistry is useful at this point. First, phosphate can be abundant in the marine realm, especially in areas where the currents "upwell" along a coast to bring dissolved minerals from deeper

and colder ocean waters up onto the shallower and warmer shelf regions. Upwelling areas are well-known to fishermen and marine biologists because this infusion of phosphate increased the biological diversity of these areas tremendously. Geochemically, if we look at all of the necessary elements for life in the marine realm, we find that the most limited and limiting element for life to exist and thrive is phosphorous, in the form of phosphate. Areas of the ocean with low concentrations of phosphate have lower diversity and abundance of marine organisms. This is partly because the phosphate is necessary for construction of teeth and bone, but mostly because it is necessary for the ATP cycle in all organisms. Limit the phosphate, limit the organism. Upwelling thus brings phosphate that had been removed from the shallow waters along coastlines back up onto the shelves for available use by these organisms. Often gigantism can occur under these conditions, hence the 50 foot long "megalodon" sharks.

So, one way to think of life in the marine world is that it is a "sink" for phosphate. Organisms uptake the phosphate for use in tissues and hard parts, thus temporarily storing it and removing it from the sea. One other "refractory storage" for phosphate is in the sediment at the bottom of the sea. Teeth and bone

Continued, P. 7

Fabulous Tennessee Fossils from dead organisms accumulate in the seabed and can later fossilize with burial. Additionally, especially in these upwelling areas rich in dissolved phosphate, phosphate can inorganically precipitate out of the water and accumulate in the sediment in the form of little pellets, beads, and nodules. Additionally, the accumulation of fecal material in sediment becomes another of the pathways to concentrate phosphate in sediment.

What is the relationship between phosphate in marine organisms and in the sediment and fossilization by phosphate replacement (a. k. a., phosphatization)? Keep in mind that organisms concentrate phosphate in their tissues (and hard parts) to live, so it can be readily available in the immediate microenvironment area of a dead and decaying organism. Additionally, the decay process itself adds to the reducing nature of the immediate geochemical environment. As long as the chemical gradient to concentrate and nucleate phosphate is greater than the dissolution gradient to remove it, phosphate remains an available anion to bond cations to. This best works in the absence of oxygen (anoxic decay microenvironment). So, phosphate recrystallization or replacement works best in very small enclosed spaces, such as the insides of shelly organisms, where a micro-reducing environment can form and remain isolated from pore-water interactions and oxygenation for an extended period of time (provided by burial). Steinkerns are the internal casts of enclosed shells, so they are often

composed of phosphate, recognized by its black color and hardness (varies between 4 and 7). There are several phosphate minerals that have been associated with fossilization, including Francolite, Vivianite (which I will cover in a later essay), and one more that I will discuss below.

Are there instances of phosphate preservation in Tennessee fossil deposits? Yes! The Cretaceous Coon Creek Formation, exposed at the UT-Coon Creek Science Center in McNairy County, is probably the most recognized site for phosphatization, in the form of the steinkerns (see FTF #10) described above (Figure 1). Turritellid (high-spined) gastropods and bivalves, both mostly enclosed mollusks, are commonly found with black phosphate infillings. In some areas, such as where the upper micaceous shale lithofacies of the Coon Creek is preserved, leaching has occurred in the sediments as weathering progressed and the shelly material enclosing the phosphate has dissolved away leaving only the phosphate steinkerns to indicate any invertebrates existed (see Figure 1). The abundance of phosphate steinkerns allows us to infer that the Coon Creek seafloor, and overlying waters, were rich in phosphate during the Late Cretaceous. This should be expected as the abundance and diversity of organisms preserved in the formation is great. Remember that the Coon Creek Formation is considered a lagerstätte deposit; phosphate is one of the reasons.

There is an interesting aside to phosphate fossil preservation in

Tennessee. The late Arthur J. Boucot (1924-2017) was an invertebrate paleontologist who trained at Harvard University and became one of the world's leading experts on the Silurian and Devonian periods of geohistory, with special attention to his favorite organism, the brachiopod. I interacted with Art many times over my career and he was a frequent visitor to Tennessee because of our excellent record of marine invertebrates. Art became aware of the rich brachiopod faunas of Tennessee while he was working at the Paleontology and Stratigraphy Branch of the U. S. G. S from 1951-1956 and the collections of Gustav Cooper at the Smithsonian Institution. Art was studying the Silurian and Devonian strata near Bristol, Tennessee, during this time and identified specimens of brachiopod shell that were actually replaced, not just infilled, by a variety of phosphate mineral called diadochite, my third mineral from my discussion above, and with the scary chemical formula of $\text{Fe}_2(\text{PO}_4)(\text{SO}_4)\text{OH}\cdot 5\text{H}_2\text{O}$. Diadochite (also called destinezite), is a phosphate and sulfate-rich mineral that is also bonded with water (not just a hydroxyl). The name is derived from bonding of the double (di-) complex anion PO_4 and SO_4 . The replacement mineral is amorphous (no crystalline structure). The hydrated form also makes specimens somewhat fragile. The growth form of the individual diadochite centers within the shell give it the appearance of being like microscopic cauliflowers growing and replacing the original shell structure. Diadochite is an iron-rich phosphate, *Continued, P. 8*

Fabulous Tennessee Fossils which also attests to the reducing nature of the microenvironment that formed the mineral. Incidentally, although not related to fossilization, diadochite has also been reported from the modern soils from the weathering of phyl-lites that are from the Neoproterozoic exposed along Alum Cave Bluff, Great Smoky Mountains National Park. This more recent forming variety is easily collected from the soils along the trail due to the large size of the crystals.



Figure 1. Phosphate steinkerns of three mollusks from the Cretaceous Coon Creek Formation in the UT-Coon Creek Science Center collection at UT Martin. Left specimen is a phosphate steinkern of the internal spiral of a turritellid gastropod. Middle specimen is a phosphate steinkern of a Teredo “shipworm” (see FTF #66) with some calcite shell remaining along the middle (white). Right specimen is a steinkern of a Crassatella bivalve. Note the raised area on the far right (adductor muscle scar) and the pointed top of the filling within the beak. The posterior of the steinkern is broken off. Scale 1cm (Photo by MAG).



October Board Minutes

Mike Coulson

Called to order 6:30 (Zoom meeting). Present: W. C. McDaniel, Mike Baldwin, Carol Lybanon, Matthew Lybanon, Bonnie Cooper, Bob Cooper, Dave Clarke, James Butchko, Nannett McDougal-Dykes, Mike Coulson, Jane Coop.

Old Business: None.

New Business:

1. Planned Membership Meeting on Sunday October 11 at Freeman Smith Park. Pavilion reserved 1pm-3pm but contingent on weather. There are 10 picnic tables under the roof so there is plenty of room for club to meet. All present were in favor of moving forward with the meeting in the park. Social guidelines will be followed.
2. Alternative to Holiday Party: have two meetings so social distancing would be possible. Half of the Members would meet in November, half in December. A signup sheet would be available. Another option: a Spring Fling held outdoors in late spring, early summer.
3. Discussion of November Zoom Membership Meeting with Zoom speaker. Dave will research this and come back with alternative speakers. Looks promising.
4. Looking for volunteers to help with Estate Sale. Several Board Members volunteered. W. C. requested the latest mailing list for the club to send out info on the Estate Sale. Bonnie will send it to W. C.
5. Start reviewing the 2014 Standing Rules and offer any edits or changes to the document. One area that needs clarification is the reimbursement of expenses to the field trip director.

Secretary: Copies of the March minutes were distributed via email.

Treasurer: Report was emailed to Board members for review prior to

meeting. Prepaid rent payments to church:

The church did not charge us for the September outside meeting.

Membership: We’ve had a great response to the free 2021 renewal offer. No new memberships. 2020 Membership Directory and October newsletter mailed out.

Field Trips: October 21–Dale Hollow Lake and possibly Ledbetter Farm.

Adult Programs: Discussion centered around offering online/Zoom speakers that Members could watch from home. Dave is looking into what speakers and programs may be of interest to the group and will review with the Board.

Junior Programs: Junior programs on hold until further notice.

Library: Have several new books to add to the library.

Show: This is the time of year we send out contracts to vendors.

Rock Swaps: October meeting will be in a Bartlett park with rock swap and displays. Jane reserved the pavilion area.

Editor: Newsletter is out. Please send any photos, reports, or stories to Matthew.

Web: Website has been updated. Adjourned 7:30

October Meeting Minutes

Mike Coulson

Called to order 1:10 P. M. (Freeman Smith Park). Guidelines for social distancing followed. No sharing of food or drink.

Membership: Contact Bob Cooper to renew your 2021 membership. The club needs a headcount for insurance purposes.

Field Trips: November–Dale Hollow Lake for crinoids and fossils. Signup sheet at the front table. The Ledbetter

Continued, P. 9

October Meeting Minutes Farms geode portion of the trip

Continued from P. 8
has been cancelled. No trip in November due to prior engagements of the field trip director. Looking into a site for the December field trip.

No **Junior Program** scheduled. No **Library** report.

Adult Programs: Lou White gave a presentation on his interest in collecting for a lifetime. Among his interests are Native American artifacts, Civil War artifacts, old bottles and rocks, minerals and fossils.

Displays: Lou White brought a few displays of his collection for Members to view.

Estate Sale of fossil, rock and mineral collection at Melba Coles house. Adjourned 3:00P. M.



Universal Geometry of Geology

Matthew Lybanon, Editor

Geology is not usually as “mathematical” as sciences such as physics. But there are some interesting exceptions to this rule.

Suppose you were walking across a parking lot paved with gravel. Would you be surprised if the number of facets that each gravel piece has is around six? Is the world made of cubes?

Hungarian mathematician Gábor Domokos argued that any rocks that broke randomly would crack into shapes that have, on average, six faces and eight vertices. They would all be approximations converging on a sort of ideal cube. Domokos had proved it mathematically, and in 2016 he went to University of Pennsylvania geophysicist Douglas Jerolmack to

help him show that this is what nature does.

Thousands of years ago the Greek philosopher Plato hypothesized in the *Timaeus* that the classical elements were made of five regular solids. One of those classical elements, Earth, was associated with the cube. Could Plato have been right?

Rocks vary. Mica flakes into sheets; crystals crack on sharply defined axes. But Domokos came to his conclusion from mathematics alone.

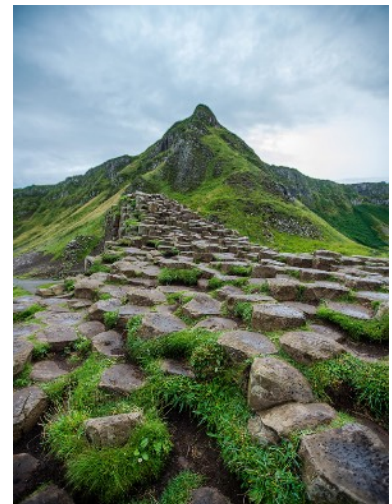
Over the next few years, the pair chased their geometric vision from microscopic fragments to rock outcrops to planetary surfaces. But they kept finding cuboid averages in nature, plus a few non-cubes that could be explained with the same theories. They ended up with a new mathematical framework: a descriptive language to express how all things fall apart. When their paper was published earlier this year, it had the intriguing title “Plato’s Cube and the Natural Geometry of Fragmentation.”

Here is an overview of how Domokos got started with the mathematics. Suppose you fracture something into many pieces. You now have a mosaic: a collection of shapes that could tile back together with no overlaps or gaps. Further suppose those shapes are all convex, with no indentations.

First Domokos wanted to see if geometry alone could predict what shapes, on average, would make up that kind of mosaic. The fact that they fit together with no overlaps or gaps limits the possible

shapes. Those interested in following this further should read the *Quanta* article (Ref. 2).

Several geophysicists contacted by *Quanta* (which reported this research) say the same mathematical framework might also help with problems like understanding erosion from cracked cliff faces, or preventing hazardous rock slides. One reviewer of the journal article, the Vanderbilt geophysicist David Furbish, said, “A paper like this makes me think: Can I somehow make use of these ideas?”



The Giant’s Causeway in Northern Ireland.

Refs:

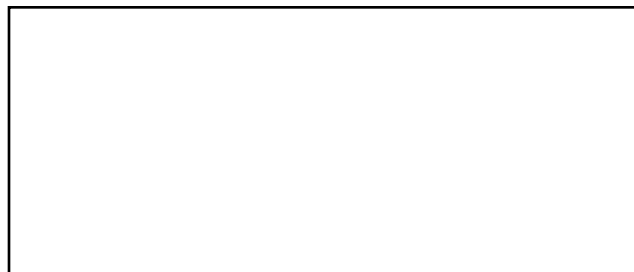
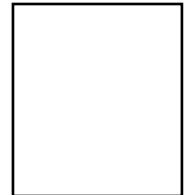
1. Gábor Domokos, Douglas J. Jerolmack, Ferenc Kun, János Török, Plato’s cube and the natural geometry of fragmentation, *Proceedings of the National Academy of Sciences* Aug 2020, 117 (31) 18178-18185; <https://doi.org/10.1073/pnas.2001037117>
2. Joshua Sokol, Scientists Uncover the Universal Geometry of Geology, *Quanta*, November 19, 2020, <https://www.quantamagazine.org/geometry-reveals-how-the-world-is-assembled-from-cubes-20201119/>

MAGS At A Glance

December 2020

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
29	30	1	2	3 Board Meeting (Zoom), 6:30 pm	4	5
6	7	8	9	10 	11	12
13	14	15	16	17	18	19
20 	21	22	23	24	25 <i>Merry Christmas</i>	26
27	28	29	30	31 	1	2

Memphis Archaeological and Geological Society
2019 Littlemore Drive
Memphis, TN 38016



MEMPHIS ARCHAEOLOGICAL AND GEOLOGICAL SOCIETY

MAGS Rockhound News ♦ A monthly newsletter for and by the members of MAGS

MAGS Plans

Continued from P. 1

signed as field trip leader and that position is in the process of being filled.

March/April

- No plans as of now.

Web Tip

The website for Caldwell Stone Company in Danville,

Kentucky, has some nice pictures that show examples of specimens found there. Here is the link.

<https://www.caldwellstone.net/minerals-found-at-csc>

(Thanks for the tip, James Johnson.)

Estate Sale

Here is a collection of photos from the recent estate sale that MAGS conducted (see November issue for details). It was a sellout! (Photo credits: Mike Coulson)



Double Sweet

Continued from P. 1

sugar a day. Diabetics (more than 10% of the U. S. population, and more than 25% of Americans over 65) need to limit their sugar intake even more.

By offering the taste of sweetness without any calories, artificial sweeteners seem like they could be the answer both to the craving for sweetness and as a weapon against obesity. But there is a problem: sugar isn't easy to replace. Despite

scientists' best efforts in the past century, none of the artificial alternatives that have been developed are quite as irresistible, let alone as versatile in the kitchen.

One concern is that people who use artificial sweeteners may replace the lost calories through other sources, possibly offsetting weight loss or health benefits. This can happen because we like to fool ourselves: "I'm drinking diet soda, so it's okay to have cake." The

American Heart Association and American Diabetes Association also added this caveat to their recommendation. And there are other health concerns.

It's also possible that these products change the way we taste food. "Non-nutritive sweeteners are far more potent than table sugar and high-fructose corn syrup. A minuscule amount produces a sweet taste comparable to that

Continued, P. 4

Double Sweet worked together to transition this innovation from pilot testing to successful commercial scale manufacturing within Lantic's existing sugar refining business. The first products containing this sugar are expected to hit the market early in 2021.

Other companies are working on different ways of using smaller amounts of natural sugars to deliver the same taste. But the Doux-Matok method is the only one that gives a new meaning to "rock candy."



🎵 Meetings

December: No meeting

January and February 2021: Zoom meetings. Details TBD

🎵 Field Trips

December: No field trip.

2021: Field trips will be announced soon. Charles Hill has resigned as field trip leader. The position will be filled ASAP.

🎵 December Birthdays

- 1 Riley Collins
5 Tracey Thomas
6 David McAlister
7 Mitchell Childress
Juliette Browning
8 Tina Wallace

- Alan Schaeffer
11 Jared Robbins
12 Marc Mueller
13 Hongbing Wang
15 Kathy Baker
Liam Collins
Jerry Seamans
16 Adam Wilson
19 Paula Gunter
20 Racheal Mitchell
Wingfield Bouchard
23 Jim McNeil
24 Michael Browning
Jocelyn Ashurst
Allen Grewe
29 Bebe Buck
Brandon Mayer

Jewelry Bench Tips by Brad Smith

TEMPLATES

Whenever I have to make more than 2-3 exact copies of a sheet metal component, I think of making a template. Templates let me easily draw the shape of an item to cut out.

Art stores or online sources like cooltools.us/ and kings-leynorth.com/ sell templates for common shapes like circles, ovals, hearts, etc. but for nonstandard shapes, I make my own out of a scrap of sheet plastic or sheet metal. My preference is brass. I carefully lay out the shape using a steel ruler, a set of dividers, a scribe, and a fine center punch.

One example is the brass template in the pic below that lets me quickly trace the design of ginko leaf earrings onto silver sheet. Another is the nickel template which makes it easy to drill a pattern of

holes for pin inlay into wooden handles.



OCHRE APPLICATOR

Yellow ochre is used when you want to be sure the solder won't flow on an area of your piece while you're soldering another area. The only problem with ochre is coming up with a good way to store and apply it.

I use recycled nail polish bottles. They seal well and have a built-in brush applicator. Just clean them out with a little acetone or nail polish remover, and they're ready to go.



Wishing you happy holidays. I hope 2021 will be a better year.

Expand Your Jewelry Skills With Brad's "How To" Books at http://amazon.com/author/bradford-smith.

Fabulous Tennessee Fossils

Dr. Michael A. Gibson,
University of Tennessee at Martin

FTF 71

Diadochite Phosphate Fossil Replacement



Most marine organisms with hard parts have shells (composed mostly of CaCO_3 in the form of calcite or aragonite, which we looked at earlier) or bone and teeth (consisting of the mineral apatite that has picked-up a hydroxyl). One interesting mineral group that produces replacement minerals for the original calcite or aragonite of an organism during fossilization is the phosphate group, to which the mineral apatite belongs (the generalized formula for apatite is $\text{Ca}_5(\text{PO}_4)_3(\text{OH},\text{F},\text{Cl})$ where various combinations of a hydroxyl (OH), fluorine (F) and/or chlorine (Cl) bond with the complex-anion PO_4 . It is not odd for phosphate to be a replacing mineral in fossilization because phosphate is such an important mineral in life to begin with. Phosphate is a primary component of your ATP cycle (ATP = *adenosine triphosphate*), which I am sure that all of you remember from your formal biology classes is the chemical pathway for energy production and cycling in your cells. Specifically, it is in the mitochondria of your cells that this cycle determines whether-or-not you will have enough energy to keep your eyes open long enough to read the rest of this article!

Phosphate is also part of the composition of bone and teeth construction, which compose the most solid and durable parts of

chordate organisms in particular. Teeth and bone are composed primarily of the hydroxyapatite, $(\text{Ca}_{10}(\text{PO}_4)_6 \cdot 2(\text{OH}))$. Another important observation to make about phosphate in understanding phosphate as a replacing mineral in fossilization is the abundance of phosphate in the settings in which it is to be used. The occurrence and cycling of phosphate is drastically different in terrestrial versus marine settings. Chordates, like fish, reptiles, amphibians, mammals, etc., use phosphate for bone and teeth, but no invertebrate uses phosphate to construct a hard part. Marine invertebrates only use phosphate in their ATP cycle, but during fossilization, phosphate can become a replacement mineral and is a common composition for many steinkerns (internal casts). It is also important to remember that phosphate can also be in the sediments in a marine setting, hence inorganically formed from precipitation, with grain size ranging upward to nodules 10s of centimeters in size. The famous “megalodon” shark fossil pits of Aurora, North Carolina, are an example of a phosphate-rich seafloor (Pliocene age).

A little understanding of ocean water chemistry is useful at this point. First, phosphate can be abundant in the marine realm, especially in areas where the currents “upwell” along a coast to bring dissolved minerals from deeper

and colder ocean waters up onto the shallower and warmer shelf regions. Upwelling areas are well-known to fishermen and marine biologists because this infusion of phosphate increased the biological diversity of these areas tremendously. Geochemically, if we look at all of the necessary elements for life in the marine realm, we find that the most limited and limiting element for life to exist and thrive is phosphorous, in the form of phosphate. Areas of the ocean with low concentrations of phosphate have lower diversity and abundance of marine organisms. This is partly because the phosphate is necessary for construction of teeth and bone, but mostly because it is necessary for the ATP cycle in all organisms. Limit the phosphate, limit the organism. Upwelling thus brings phosphate that had been removed from the shallow waters along coastlines back up onto the shelves for available use by these organisms. Often gigantism can occur under these conditions, hence the 50 foot long “megalodon” sharks.

So, one way to think of life in the marine world is that it is a “sink” for phosphate. Organisms uptake the phosphate for use in tissues and hard parts, thus temporarily storing it and removing it from the sea. One other “refractory storage” for phosphate is in the sediment at the bottom of the sea. Teeth and bone

Continued, P. 7

Fabulous Tennessee Fossils which also attests to the reducing nature of the microenvironment that formed the mineral. Incidentally, although not related to fossilization, diadochite has also been reported from the modern soils from the weathering of phyl-lites that are from the Neoproterozoic exposed along Alum Cave Bluff, Great Smoky Mountains National Park. This more recent forming variety is easily collected from the soils along the trail due to the large size of the crystals.



Figure 1. Phosphate steinkerns of three mollusks from the Cretaceous Coon Creek Formation in the UT-Coon Creek Science Center collection at UT Martin. Left specimen is a phosphate steinkern of the internal spiral of a turritellid gastropod. Middle specimen is a phosphate steinkern of a Teredo “shipworm” (see FTF #66) with some calcite shell remaining along the middle (white). Right specimen is a steinkern of a Crassatella bivalve. Note the raised area on the far right (adductor muscle scar) and the pointed top of the filling within the beak. The posterior of the steinkern is broken off. Scale 1cm (Photo by MAG).



October Board Minutes

Mike Coulson

Called to order 6:30 (Zoom meeting). Present: W. C. McDaniel, Mike Baldwin, Carol Lybanon, Matthew Lybanon, Bonnie Cooper, Bob Cooper, Dave Clarke, James Butchko, Nannett McDougal-Dykes, Mike Coulson, Jane Coop.

Old Business: None.

New Business:

1. Planned Membership Meeting on Sunday October 11 at Freeman Smith Park. Pavilion reserved 1pm-3pm but contingent on weather. There are 10 picnic tables under the roof so there is plenty of room for club to meet. All present were in favor of moving forward with the meeting in the park. Social guidelines will be followed.
2. Alternative to Holiday Party: have two meetings so social distancing would be possible. Half of the Members would meet in November, half in December. A signup sheet would be available. Another option: a Spring Fling held outdoors in late spring, early summer.
3. Discussion of November Zoom Membership Meeting with Zoom speaker. Dave will research this and come back with alternative speakers. Looks promising.
4. Looking for volunteers to help with Estate Sale. Several Board Members volunteered. W. C. requested the latest mailing list for the club to send out info on the Estate Sale. Bonnie will send it to W. C.
5. Start reviewing the 2014 Standing Rules and offer any edits or changes to the document. One area that needs clarification is the reimbursement of expenses to the field trip director.

Secretary: Copies of the March minutes were distributed via email.

Treasurer: Report was emailed to Board members for review prior to

meeting. Prepaid rent payments to church:

The church did not charge us for the September outside meeting.

Membership: We’ve had a great response to the free 2021 renewal offer. No new memberships. 2020 Membership Directory and October newsletter mailed out.

Field Trips: October 21–Dale Hollow Lake and possibly Ledbetter Farm.

Adult Programs: Discussion centered around offering online/Zoom speakers that Members could watch from home. Dave is looking into what speakers and programs may be of interest to the group and will review with the Board.

Junior Programs: Junior programs on hold until further notice.

Library: Have several new books to add to the library.

Show: This is the time of year we send out contracts to vendors.

Rock Swaps: October meeting will be in a Bartlett park with rock swap and displays. Jane reserved the pavilion area.

Editor: Newsletter is out. Please send any photos, reports, or stories to Matthew.

Web: Website has been updated. Adjourned 7:30

October Meeting Minutes

Mike Coulson

Called to order 1:10 P. M. (Freeman Smith Park). Guidelines for social distancing followed. No sharing of food or drink.

Membership: Contact Bob Cooper to renew your 2021 membership. The club needs a headcount for insurance purposes.

Field Trips: November–Dale Hollow Lake for crinoids and fossils. Signup sheet at the front table. The Ledbetter

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