MEMPHIS ARCHAEOLOGICAL AND GEOLOGICAL SOCIETY

MAGS Rockhound News

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Archaeology Of The Reelfoot Basin

Bill Lawrence, Tennessee Division of Archaeology

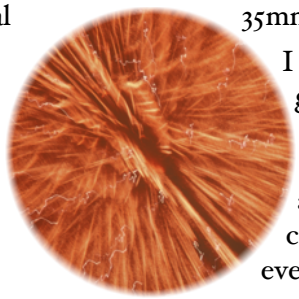
In-Person Presentation

Reelfoot Lake in northwest Tennessee was created by the New Madrid seismic events of 1811 and '12. Well known for its nesting and wintering population of bald eagles, Reelfoot Lake is also home to a dense concentration of prehistoric archaeological sites. This presentation will examine the archaeological record of this unique area and discuss the role that the New Madrid seismic events played in the preservation of small prehistoric earthworks.

In this issue

ROADCUT—MINERALS EXPLODED AND THE CROWD CHEERED — W. C. MCDANIEL

Years ago, I had two good eyes, several 35mm Nikon cameras, a bunch of NIKKOR lenses, and rolls and rolls of Kodachrome 25 and 64 slide films. Every year I would go to the local firework shows and haul three camera bodies with varying focal length lenses, ranging from 21mm to 600mm, and rolls and rolls of 35mm slide film.



I would arrive early, stake out my place, organize my equipment, and get ready for the explosions of color. The fireworks announced their arrival with a loud boom and the cameras would start clicking. I clicked throughout the entire show, rarely ever watching the whole show. *Continued, P. 3*

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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.

All 2021 DMC field trips have been cancelled and rescheduled to 2022. The next MAGS-sponsored trip is currently scheduled for October 2024.

Links to Federation News

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

Editor's Note: *In May 2016 Bill Lawrence (this month's adult program presenter) led a MAGS field trip to Reelfoot Lake. MAGSters can see a field trip report in our June 2016 issue, which is available on the MAGS website, http://www.memphisgeology.org.*

President's Message

MAGS looking ahead:

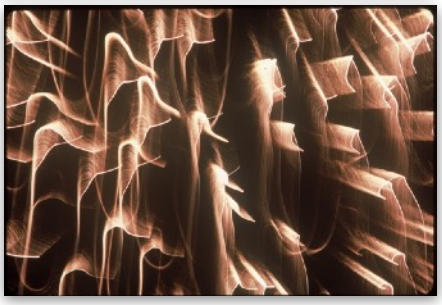
1. Meetings—Current plans are for all Membership Meetings to held in person and at the church.
2. Junior programs return in July.
3. Masks are optional for those fully vaccinated.
4. Field trips are paused for July and August.
5. Future trips include Hot Springs, Memphis Stone & Gravel, and Coon Creek.
6. Rock swap in August.
7. Plans are being finalized for Fall Holiday Show.
8. Bring those exhibits.

W. C.

Roadcut *Continued from P. 1* I not only focused on the exploding shells but also the trail of colors streaming through the. night sky. I called it "color in motion." Using all cameras, I would take pictures of the exploding shell, and as the colors meandered down I would take pictures of those, sometimes moving the camera and lens around the sky like painting with a brush. The results were unknown until Kodak sent my slides back in about a week. This was back in the '80s and '90s, before instant digital. The results were made possible by the use of minerals, chemistry, and craftsmanship. This section, copied from. www.usgs.gov/media/images/what-minerals-produce-colors-fireworks, provides a good overview of those minerals.

"Mineral elements provide the color in fireworks. Barium produces bright greens; strontium yields deep reds; copper produces blues; and sodium yields yellow. Other colors can be made by mixing elements: strontium and sodium produce brilliant orange; titanium, zirconium, and magnesium alloys make silvery white; copper and strontium make lavender. Gold sparks are produced by iron filings and small pieces of charcoal. Bright flashes and loud bangs come from aluminum powder."

Red	Sr–Strontium
Orange	Sr–Strontium Na–Sodium
Yellow	Na–Sodium
Green	Ba–Barium
Blue	Cu–Copper
Purple	Sr–Strontium Cu–Copper
Grays and White	Ti–Titanium Zr–Zirconium Mg–Magnesium



All fireworks pictures were taken along the Mississippi Riverfront.

Paleoindian and Archaic Use of Novaculite

A useful toolstone from the Ouachita Mountains

Juliet E. Morrow and Mary Beth Trubitt
Arkansas Archeological Survey

Novaculite is a hard, fine-grained, silica-rich rock that breaks with a shell-like (conchoidal) fracture (Figure 1). It forms from marine sediments on the seafloor, which are comprised primarily of single-cell organisms (like *Continued, P. 4*

Paleoindian ... Novaculite
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diatoms) that secrete a hard shell composed of silicon dioxide. When these organisms die, their silicon dioxide shells fall to the seafloor. In some regions diatom shells are the main ingredient of the seafloor sediments. During the transformation from sediments to rock (called diagenesis) the silicon dioxide from the shells is transformed into the microcrystalline silicon dioxide known as chalcedony, or more commonly, chert. Some geologists (petrologists) consider chalcedony separately from chert due to its fibrous structure. Because many cherts contain both microcrystaline and microfibrous quartz, it is sometimes difficult to classify a rock as chalcedony, so it is generally considered to be a variant of chert.

Further diagenesis and low-grade metamorphism of chert recrystallizes it into novaculite. The main differences between chert and novaculite are that chert is composed mainly of chalcedony (a mostly fibrous form of silica) while novaculite is composed mainly of microcrystalline quartz grains, and, chert is a classified as a sedimentary rock. Novaculite is chert that has undergone more diagenesis along with low-grade metamorphism. Novaculite is technically classified as a metamorphic rock and occurs in primary deposits in the Ouachita (pronounced "wah sha taw") Mountains in Arkansas and western Oklahoma (Griswold 1892; Holbrook and Stone 1979; Scarr 2008). For more information, along with maps of various scales showing where novaculite

Figure 1. Novaculite

can be found, see the Arkansas Archeological Survey's (2021) Novaculite website at http://arkarcheology.uark.edu/novaculite/index.html?pageName=Arkansas%20Novaculite%20Home conceived by Mary Beth Trubitt.

William Henry Holmes was an artist, geologist, and archaeologist who had a long career at the Smithsonian Institution's U. S. National Museum and Bureau of American Ethnology. Holmes visited quarry sites across the nation and Arkansas. In 1891 he visited novaculite quarries in Garland County near Hot Springs (now known as Indian Mountain quarry, 3GA22, and Spanish Diggings, 3GA48). He and geologist W. P. Jenney described the size of quarry pits and estimated the amount of stone removed and noted the kinds of quarry debris and the igneous stone hammers that had been brought to the quarry (Figure 2).

In an 1892 *Science* article Holmes wrote: "The extent of this work is in several cases so vast as to fill the beholder with astonishment. In one place in Arkansas it is estimated that upwards of 100,000 cubic yards of stone have

William Henry Holmes, 1890
(Smithsonian Institution photograph, edanmdm:siris_arc_392802)

Figure 2

been removed and worked over." His 1919 *Handbook of Aboriginal American Antiquities: The Lithic Industries* included the Arkansas Novaculite quarries as one of its case studies. Holmes's (1891, 1892, 1919) publications brought these extensive sites to the attention of archeologists and to the American public.

We can use quarries—and the workshop and habitation sites away from the quarries—to learn about trade and interaction in the past. These quarries were the source areas for the raw material. Novaculite was used exclusively in the local area throughout the historical sequence, but raw material moved beyond the Ouachita Mountains, especially during the Archaic and Woodland periods (Etchieson and Trubitt 2013). Indians came to the quarries, broke out and tested blocks of rock, knapped it to a suitable size for transport, and carried shaped "preforms" home for finishing into tools such as dart points, knives, or scrapers.

With the "Arkansas Novaculite" website, we are sharing information about the

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Paleoindian ... Novaculite
Continued from P. 4

characteristics of this rock, and about the quarry sites that are found in the Ouachita Mountains. We are also gathering information about the distribution of novaculite tools at sites beyond the Ouachita Mountains. Novaculite artifacts have been found up to 400 miles away on archeological sites in Missouri, Oklahoma, Texas, Louisiana, and Mississippi, as early as 13,000 years ago.

At residential sites, such as Jones Mill, where we had our Arkansas Archeological Society Training Program in 2007-2008, there are smaller flakes, more heat treatment, more bifacial preforms discarded in various stages of manufacture, and more finished and used tools. We see different patterns in the chipping debris left at these different kinds of sites. There's a reduction in size of debris as we get farther from the quarries. There were also other activities conducted at Jones Mill besides chipped stone tool making—archeology shows evidence of fishing, hunting, nut gathering, plant processing, and cooking by the Archaic period residents (Trubitt 2019; Trubitt et al. 2011).

For millennia, Native Americans used novaculite to manufacture stone tools such as spear points, knives, scrapers, perforators and drills, among others. It is still used today as a stone, or "whetstone", for sharpening knives. The earliest known use of novaculite in the state of Arkansas was by late ice age foragers 13,000 years ago. http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=541&type=Time+Period&item=Pre-European+Exploration+(Prehistory+-+1540)&parent=&grandparent=.

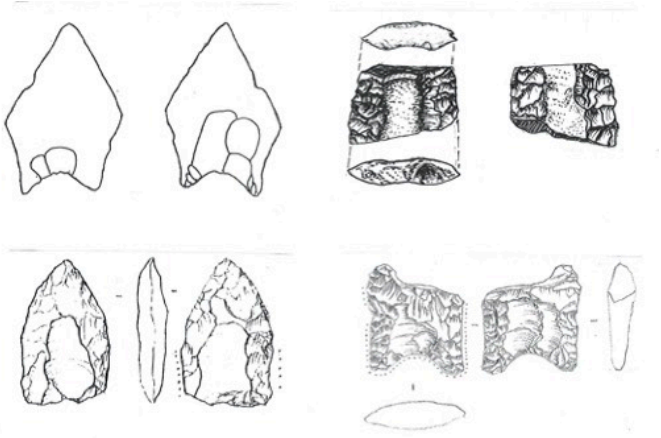

Figure 3. Upper left: Pelican point from Prairie County, AR, Upper right :fluted point midsection fragment from Randolph County, AR, Lower left: Clovis point from Arkansas County, Lower right: fluted point (Dalton?) fragment from Montgomery County, Arkansas

Fluted points functioned as spear tips for felling prey and knives for field dressing elk, deer and other large game. Using multiple attributes, fluted points have been classified into "types", though most archeologists agree that these types are on a continuum (Morrow 1996, 2015). One of the earliest point forms in the New World is named for the Clovis type site which was named after the town of Clovis, New Mexico. The Clovis site on Blackwater Draw contained layers of sediments within which were associated whole and fragmentary Clovis points and bones of mammoth and an extinct form of bison. Post-Clovis fluted point forms include Folsom, Gainey, Pelican, Barnes, Cumberland, Redstone. Some Dalton and Debert points also exhibit a flute or long, narrow flake that was detached from the base or haft end of the spear point/knife (http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=545&type=Time+Period&item=Pre-European+Exploration+(Prehistory+-+1540).

Four fluted points made of Novaculite have been documented from three regions of Arkansas. Two of the four known novaculite points were documented by John House, who recently retired from the Arkansas Archeological Survey. He measured and drew a sketch of a complete Pelican point from Prairie County and a heavily reworked Clovis point found on a late glacial terrace remnant of the Arkansas River Valley in Arkansas County. The third of the four known novaculite points is a midsection of a point fluted on both sides found in Randolph County near Pocahontas. One face may have been fluted twice and there is no remnant of margin grinding on bottom portion, close to the haft. In the illustration (Figure 3), dots along the haft portion of the points from Ar-

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Paleoindian ... Novaculite *Continued from P. 5*

kansas and Montgomery counties indicate margin grinding. The fourth fluted point (possibly a Dalton point) was found between 27 and 30 cm below the surface in a test excavation at site 3MN496 in Montgomery County.

A fifth possible Clovis point made of novaculite and reportedly found somewhere in southern Arkansas was brought to Morrow's attention in 2015. There should be more authentic fluted points of Novaculite and other Arkansas stone types in private and possibly in institutional collections. If you or someone you know has found a fluted point in the field or in a collection that's made of Novaculite or other rock type, you can share information by emailing jemorro@uark.edu.

For thousands of years, novaculite was quarried for toolstone in the Ouachita Mountains of west-central Arkansas. It was taken to workshops and habitation sites downstream along the Saline, Ouachita, Caddo, and Little Missouri rivers. Although it's difficult to obtain precise geochemical dates on Novaculite quarrying activity, the extensive distribution of novaculite suggests major use during the Archaic period (ca. 8000-1000 BC). There's great research potential in studying novaculite quarries, tracing novaculite from quarries to consumption sites and interpreting the organization of novaculite tool production and exchange.

For further reading on joining the Arkansas Archeological Society, our Training Program in Archaeological Field and Lab methods, Paleoindians, fluted points and novaculite in our region and beyond:

Arkansas Archeological Society https://arkarch.org/

Arkansas Archeological Society https://arkarch.org/activities/the-training-program/

Arkansas Archeological Survey, 2021 Arkansas Novaculite: A Virtual Comparative Collection. http://archeology.uark.edu/novaculite/index.html

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Continued, P. 7

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Continued from P. 6 Point Styles. *Central States Archaeological Journal* 52(2):79-82.

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Wormington, Hannah M. 1957 Ancient Man in North America, fourth Edition. *Denver Museum of Natural History Popular Series* No. 4.

Fabulous Tennessee Fossils

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

FTF 78

Biotic Interaction Terminology

In recent essays, I have written about biotic interaction analysis where paleontologists use the physical relationships preserved on and in fossils to infer behavioral interactions between organisms or to determine when physically associated fossils actually did not interact with one another. Each fossil specimen is different and must be interpreted based upon its individual physical features. There are many possible behaviors or interactions that organisms may display throughout their lifetime. The literature trail and names related to categories of interactions are numerous as well. I have used a few of the behavior terms in earlier essays, such as symbiosis, predation, commensalism, mutualism. Throughout my essays, I have also used many terms related to the physical relationships of potentially interacting organisms, such as sclerobiont, epibiont, endobiont, burrower, and borer. Terms can be tedious for the user but are important to accurately and precisely convey the true nature of interactions (and non-interactions). There is a long literature trail in biology/ecology on the definitions of many of these terms. Because paleontologists reconstruct interactions, rather than observe them directly like the modern ecologist, restrictions of many terms are necessary. Additionally, we need some way to convey our degree of confidence in these interpretations. Over the next couple of essays, I want to present and explain the schemes and terms used for various interactions that are possible to find. I will do this in the form of charts for this essay and will provide additional examples using Tennessee fossils as these essays continue to unfold.

Table 1 is the system of terms for substrate relationships devised by paleontologists Paul Taylor (Natural History Museum in London) and Mark Wilson (College of Wooster) in 2003 to describe organisms that are living in or on any kind of hard substrate, such as shells, rock, or wood. The scheme applies mostly to marine or aquatic organisms, whether they are plants or animals. The scheme does not infer a specific behavior interaction relationship such as symbiosis, predation, etc., but does describe the physical association that exists between the organisms Notice that the terms are combinations of a base word (e. g. "bionts" for any organism, "zoans" for animals, or "phytes" for plants) with prefixes that explain the substrate (e.g., "xylo" for wood, "litho" for rock, "phyto" for living plant, "zoo" for living animal and "skeleto" for any animal hard part (shell or bone). This is the first set of terms to understand to better understand the behaviors that may be preserved on your fossils. Once you categorize the substrate relationship, you can then begin working on the behav-

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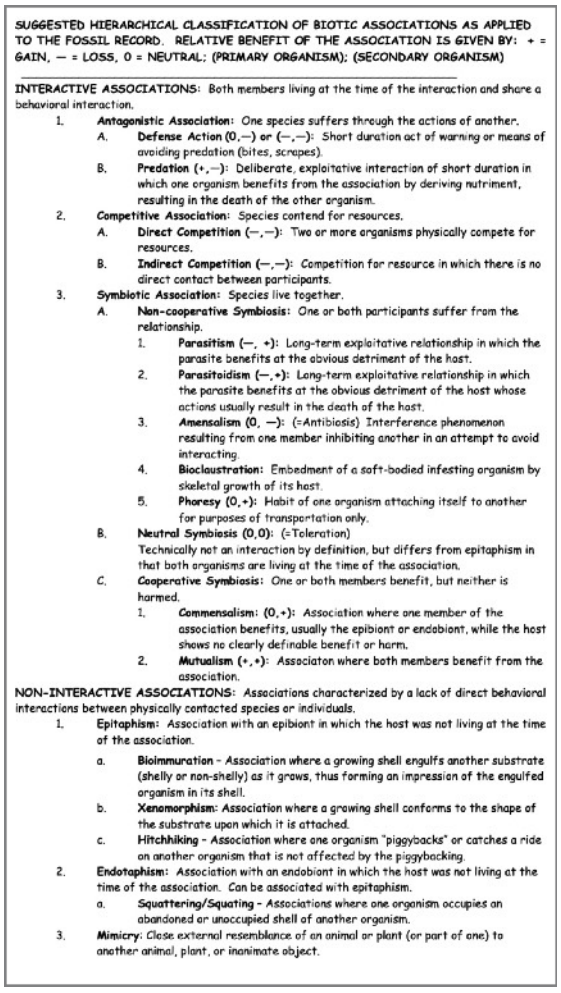
Fabulous Tennessee Fossils
Continued from P. 7

Substrate	Colonizing organism: Animal (sclerozoan)		Plant (sclerophyte)		Any organism (sclerobiont)	
Rock	lithozoan	epilithozoan endolithozoan	lithophyte	epilithophyte endolithophyte	lithobiont	epilithobiont endolithobiont
Wood	xylozoan	epixylozoan endoxylozoan	xylophyte	epixylophyte endoxylophyte	xylobiont	epixylobiont endoxylobiont
Plant (Living)	phytozoan	epiphytozoan endophytozoan	phytophyte	epiphytophyte endophytophyte	phytobiont	epiphytobiont endophytobiont
Animal (Living)	zoozoan	epizoozoan endozoozoan	zoophyte	epizoophyte endozoophyte	zoobiont	epizoobiont endozoobiont
Any Organic Hard Part (Dead or Alive)	skeletozoan	episkeletozoan endoskeletozoan	skeletophyte	episkeletophyte endoskeletophyte	skeletobiont	episkeletobiont endoskeletobiont

Table 1. Taylor and Wilson sclerobiont terminology chart that categories substrate position of organisms associated with hard substrates (from Taylor, P. D. and M. A. Wilson. 2002. A New Terminology for Marine Organisms Inhabiting Hard Substrates: *Palaios*, 17:522-525).

ioral relationships that may be preserved in the substrate relationship (Table 2).

One of my Ph. D. outcomes was to take the biotic interactions, behavioral interactions, that had been described in the literature and organize these into a hierarchical system that was friendly and useful to paleontology studies of behavioral interactions. Modern ecologists like to use a "cost-benefit" approach to characterize an interaction. Positive (+) interactions are beneficial to one or both of the organisms; negative (-) interactions are detrimental, neutral (O) interactions neither benefit or hurt the organism. Each interaction can then be graded by codified. The patter of host:sclerobiont is determined and then assigned to a specific behavior, for example (+, +) coding indicated that both host and sclerobiont benefit. I first used this system with the Ross Formation fossils in West Tennessee by developing a system for fossils. Table 2 is my table that lists the possible behavioral associations and interactions of fossilized organisms in a hierarchical way that allows the paleontologist to not only identify or infer a relationship, but to also be able to convey the certainty of that interpretation. Keep this handy when ready subsequent essays for easy reference in the future as I will refer to it. To get used to the table, you may want to reread a couple of my previous essays, especially FTF numbers 26 (biogeopetal features), 47 (coral-bryozoan mutualism), 49 (*Cliona* ichnofossils), 73 (*Mesoleptoshrophia*), 74 (*Leptaena*), 75 (scavenging on a horse bone), 76 (xenomorphism), and 77 (*Heliolites*-pelmatozoan-*Enterolasma*) to help you organize the myriad of possible behavioral associations preserved in fossils and how the various arguments for behavioral interactions are made. Certainty is part of the hierarchy. For example, if all you can say is two organisms lived together, you have an example of symbiosis, but if you can demonstrate that they both benefited from living together, then you also have mutualism. Remember, the paleontologist must reconstruct the relationship and make evidence-based assertions because we do not get to watch behavioral interactions in real time like the modern ecologist.



SUGGESTED HIERARCHICAL CLASSIFICATION OF BIOTIC ASSOCIATIONS AS APPLIED TO THE FOSSIL RECORD. RELATIVE BENEFIT OF THE ASSOCIATION IS GIVEN BY: + = GAIN, – = LOSS, 0 = NEUTRAL; (PRIMARY ORGANISM); (SECONDARY ORGANISM)

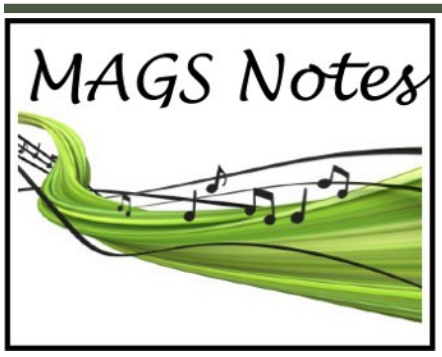
INTERACTIVE ASSOCIATIONS: Both members living at the time of the interaction and share a behavioral interaction.

1. **Antagonistic Association:** One species suffers through the actions of another.
   - A. **Defense Action (0,–) or (–,–):** Short duration act of warning or means of avoiding predation (bites, scrapes).
   - B. **Predation (+,–):** Deliberate, exploitative interaction of short duration in which one organism benefits from the association by deriving nutriment, resulting in the death of the other organism.
2. **Competitive Association:** Species contend for resources.
   - A. **Direct Competition (–,–):** Two or more organisms physically compete for resources.
   - B. **Indirect Competition (–,–):** Competition for resource in which there is no direct contact between participants.
3. **Symbiotic Association:** Species live together.
   - A. **Non-cooperative Symbiosis:** One or both participants suffer from the relationship.
     1. **Parasitism (–, +):** Long-term exploitative relationship in which the parasite benefits at the obvious detriment of the host.
     2. **Parasitoidism (–,+):** Long-term exploitative relationship in which the parasite benefits at the obvious detriment of the host whose actions usually result in the death of the host.
     3. **Amensalism (0, –):** (=Antibiosis) Interference phenomenon resulting from one member inhibiting another in an attempt to avoid interacting.
     4. **Bioclaustration:** Embedment of a soft-bodied infesting organism by skeletal growth of its host.
     5. **Phoresy (0,+):** Habit of one organism attaching itself to another for purposes of transportation only.
   - B. **Neutral Symbiosis (0,0):** (=Toleration) Technically not an interaction by definition, but differs from epitaphism in that both organisms are living at the time of the association.
   - C. **Cooperative Symbiosis:** One or both members benefit, but neither is harmed.
     1. **Commensalism: (0,+):** Association where one member of the association benefits, usually the epibiont or endobiont, while the host shows no clearly definable benefit or harm.
     2. **Mutualism (+,+):** Associaton where both members benefit from the association.

NON-INTERACTIVE ASSOCIATIONS: Associations characterized by a lack of direct behavioral interactions between physically contacted species or individuals.

1. **Epitaphism:** Association with an epibiont in which the host was not living at the time of the association.
   - a. **Bioimmuration** – Association where a growing shell engulfs another substrate (shelly or non-shelly) as it grows, thus forming an impression of the engulfed organism in its shell.
   - b. **Xenomorphism:** Association where a growing shell conforms to the shape of the substrate upon which it is attached.
   - c. **Hitchhiking** – Association where one organism "piggybacks" or catches a ride on another organism that is not affected by the piggybacking.
2. **Endotaphism:** Association with an endobiont in which the host was not living at the time of the association. Can be associated with epitaphism.
   - a. **Squattering/Squating** – Associations where one organism occupies an abandoned or unoccupied shell of another organism.
3. **Mimicry:** Close external resemblance of an animal or plant (or part of one) to another animal, plant, or inanimate object.

Table 2. Gibson hierarchical biotic behavioral interaction classification scheme (Gibson, M.A. 1996. Classification of biotic interactions in paleoecology: an evaluation of the existing paradigm and a proposed enhancement, In, Repetski, J.E., (ed.), *Sixth North American Paleontological Convention Abstracts with Papers, Paleontological Society Special Paper 8*:142).



🎵Adult Programs

Current plans are for all Membership Meetings to held in person and at the church.

July 9: Bill Lawrence, "Archaeology Of The Reelfoot Basin"

August 13: Indoor Rock Swap (tentative)

September 10: TBD

🎵Junior Programs

All programs presented by Mike Baldwin unless specified otherwise.

July 9: "Classifying Rocks As Igneous, Metamorphic, Or Sedimentary"

August 13: Indoor Rock Swap (tentative)

September 10: "Native American Arrowheads and Points

🎵Field Trips

Field trips are paused for July and August.

September: TBD

🎵July Birthdays

1 Patrick Cooper
Fred Solang
Francie Collins
Ashton Coulson

2 Sierra Ledbetter

3 Adam Featherston
Wayne Williams

4 Robyn Lasater
Dennis McGraw

5 DeeDee Goossens
Clay Crumpton

6 Gawang Lama

8 David Day

9 Christine McManus

10 Nannett McDougal-Dykes

11 Jonte Bouchard

13 Sally Coulson

14 Sue Nicholson

21 Susan Vaughn
Angelina Wang

22 James Johnson

23 Jack Lyles

25 Andrea Maki

26 Devin George
Renee Lasater

28 Drew Buchner

30 Leslie Davis
Misty Morphis

31 Daryl Wallace

🎵Want to Be a Member?

To become a MAGS Member, just go to our website at www.memphisgeology.org and print out an application form. There is a prorated fee schedule for new Members only. Mail the completed application along with the dues payment to the Membership Director shown on the form. If you are unable to print the application, you can pick one up at the sign-in desk at any of our Friday night Membership Meetings, or simply join at the meeting. Visitors are always welcome at our Membership Meetings but membership is required to attend our field trips.

The most important benefit of being a MAGS Member is getting to know and make friends with other members who have similar interest in rocks, minerals, fossils, and archaeology. All new Members will receive a New Member Packet, a MAGS ID card, and a monthly newsletter via email. Members are entitled to go on our monthly field trips and get free admission to our annual Show.

The Second Rock

Matthew Lybanon, Editor

The Phanerozoic (the current geologic eon, the one during which abundant animal and plant life has existed, covering 541 million years to the present, beginning with the Cambrian Period) has seen five major mass extinctions, most recently at the Cretaceous-Paleogene (K-Pg) boundary, 66.04 million years ago.

That most recent event is believed to have been caused by a large asteroid that struck the Yucatán Peninsula offshore near the present-day communities of Chicxulub Puerto and Chicxulub Pueblo, after which the crater is named, leaving an impact crater approximately 200 km in diameter. (In comparison, the Wells Creek impact crater, near Cumberland City, Tennessee, is 12 km in diameter.) It has been estimated that the K-Pg mass extinction resulted in a 50% loss of terrestrial species and a 75% loss of marine species and served as a biological filter that profoundly affected the nature and structure of modern ecosystems.

As if that's not bad enough, a second asteroid impact is also associated with the K-Pg boundary: the Boltysh impact structure in

Continued, P. 10

The Second Rock Continued from P. 9

Ukraine, discovered in 2002. It was caused by a smaller (but still large) impactor, which left an impact crater about 24 km in diameter. Previous studies inferred that the Boltysh impact event occurred 2-5 thousand years earlier than the Chicxulub impact. Sediments overlying the Boltysh impactites (structures produced by the impact of a large meteorite) suggest a short period of palynological (the scientific discipline concerned with the study of plant pollen, spores, and certain microscopic planktonic organisms) recovery followed by a "barren zone" that was hypothesized to correspond to the end-Cretacous extinction.

Scientists once thought both Boltysh and Chicxulub contributed to the mass extinction that doomed the dinosaurs. But according to a study published recently in the journal *Science Advances*, Boltysh likely impacted Earth long after the last victims of the extinction died out. But it still may have delayed Earth's recovery from the catastrophic extinction.

The researchers first analyzed samples from about 600-675 m underground, taken from two cores. The heat from the asteroid impact had melted the rocks, so dating them allowed them to piece together when Boltysh hit. Then, the team looked at samples from a layer of sediment in Montana that coincided with the Chicxulub impact. Using radiometric dating ($^{40Ar}/_{39Ar}$) ,the team determined the Boltysh rocks melted about 650,000 years after Chicxulub struck.

The updated age for the Boltysh crater coincides with a period of intense global warming known as the lower C29 hyperthermal (a *hyperthermal* event is a dramatic increase in temperature and perturbation of the carbon cycle), the study authors said. During a hyperthermal event, which can last up to 40,000 years, average global temperatures can increase by 3°C.

The Chicxulub impact kicked up a cloud of dust, sulfur, and carbon dioxide into the atmosphere. That gaseous haze blocked the sun for a couple of decades, one study suggests, cooling the Earth. During those few decades, most of Earth's land and marine species went extinct.

Eventually, the Chicxulub cloud dissipated and the remaining sulfur and carbon in the atmosphere—which trap heat on Earth's surface—started warming the planet. But once Boltysh hit, that impact may have released additional gases into the air and exacerbated that warming. This could have made it more difficult for Earth's species to recover following the mass extinction.

Research suggests it took 9 million years for the number of different species in North America to return to pre-Chicxulub levels. The study authors concluded that even a small impact event could disrupt recovery of the Earth system from catastrophic events.

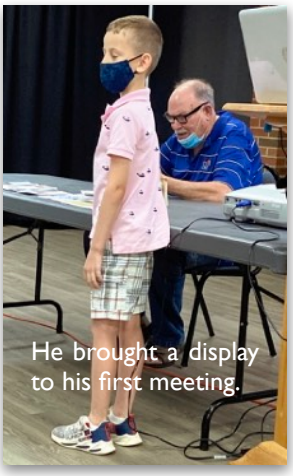
Ref: *A. E. Pickersgill, D. F. Mark, M. R. Lee, S. P. Kelley, D. W. Jolley, The Boltysh impact structure: An early Danian impact event during recovery from the K-Pg mass extinction. Sci. Adv. 7, eabe6530 (2021).*

June Meeting

Photos from our first meeting with an in-person speaker in over a year.

W. C.'s petrified wood display

Dr. Juliet Morrow



He brought a display to his first meeting.

May Board Minutes

Mike Coulson

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

Old Business: Club received a thank-you note from the Pink Palace for MAGS Fossil Fest participation.

New Business:

1. W. C. will talk to Angie Wagner about the church's opinion of a rock swap in the church parking lot and/or fellowship hall in the fall, possibly November, open to the public ,with vendors selling rocks, jewelry, etc.
2. Nannett suggested bringing in Girl and Boy Scouts to add people to the rock swap. Two tents could be set up in parking lot or back room (2800 sq ft).

Show: Still in a holding pattern.

Secretary: April minutes were distributed via email to the Board. Board approved minutes.

Treasurer: Deposited 2 checks for new memberships. Wrote 2 checks: Shady Grove Presbyterian Church for storage room rental for April-June and postage stamps. W. C. wants to pay for any usage of the fellowship hall or youth room on a separate check.He has not advised what the church charged us for the April Membership Meeting. 2020 tax return has been filed and accepted by IRS. May newsletter mailed out.

Membership: 1 renewal (Robert Neill) and 2 new memberships (Nicole Smithey & former Member Denny Baker).

Field Trips: Discussed several options for local field trips beginning in March: May 15, Blue Springs and Frankstown–Twenty-Mile Creek. June 19, Field Trip Hot Springs (crystal collecting). W. C. suggested a tour of the Pink Palace and behind the scenes tour of the collection.

Adult Programs: A cable has to be run from church office to the club room to have Internet for Zoom meetings. Matthew agreed to set up the connection in Dave's absence. Program schedule: May–Dr. Mike Gibson, Coon Creek (Zoom). June–Julie Morrow, Pleistocene megafauna fossils. July–Paul Edson-Lahm, Geology of the Portland Basin (Zoom). August–Indoor rock swap (tentative). September–Paul Brinkman, T-Rex Sue (at Field Museum) Later programs in the works. Dave will contact Luke Ramsey (Pink Palace) about a talk.

Junior Programs: On hold until further notice. A program may be scheduled for June.

Library: Library will be open for the May meeting. 22 new books.

Rock Swaps: Rock swap planned for May 29th in Lou White's driveway. Open to the public.

Editor: May newsletter has gone out. Please send reports, articles, pics, recipes, and book reviews, anything you can think of.

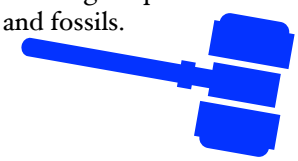
Web: Web site will be updated for May following this Board meeting.

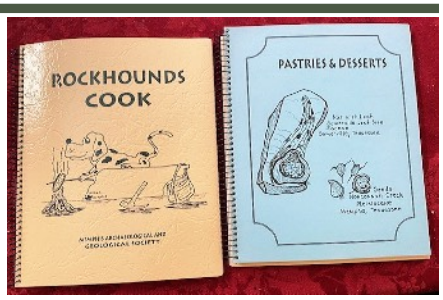
Adjourned 7:15.

May Meeting Minutes

Mike Coulson

Meeting began at 6:00 pm. Dr. Michael Gibson, The University of Tennessee at Martin Coon Creek Science Center, gave a presentation on Coon Creek. Signup sheets and directions to Blue Springs and Twenty Mile creek were available at the sign –in table. Plans are to visit Blue Springs in the morning, eat lunch, and then spend the afternoon at Twenty Mile Creek looking for petrified shark teeth and fossils.





Egg Drop Soup

INGREDIENTS

- 1 can cream style corn
- 3 cans chicken broth (you can add about 4 chicken bouillon cubes for more flavor)
- 8-10 eggs
- salt and pepper
- 1 can whole kernel corn
- INSTRUCTIONS

Mix cream style corn and chicken broth together and heat thoroughly. Crack eggs and put in a bowl. (8 eggs-3 cans broth, 10 eggs-4 cans broth) Add whole kernel corn to broth and heat to a rolling boil. Add little bits of egg mixture into the broth where rolls are until bowl is empty.

Mandarin Shrimp Salad

INGREDIENTS

- 1 lb cooked and peeled salad shrimp
- 1 large can mandarin oranges
- 2 tbsp mayonnaise
- 2 boiled eggs (chopped)

INSTRUCTIONS

Rinse shrimp with cold water. Drain mandarin oranges and add to shrimp. Add mayonnaise and chopped boiled eggs. Add Morton's seasoning (to taste). Mix thoroughly. Refrigerate.

Thanks, Stephanie Blandin, for both recipes.

MAGS At A Glance

July 2021

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
27	28	29	30	1 Zoom Board Meeting, 6:30 pm	2	3
4 	5	6	7	8	9 Membership Meeting, 7:00 pm, Bill Lawrence, "Archaeology Of The Reelfoot Basin"	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

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