



EARTHQUAKE

e-Newsletter about what's movin' and shakin' at the Earth Science Museum

Earth Science Museum, 3215 W. Bethany Home Rd., Phoenix, AZ 85017
www.earthsciencemuseum.org, scote@earthsciencemuseum.org, 602-973-4291

ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

The month of April was a very busy one for ESM's Outreach Program. I finished the 24 sets of teacher kits and 42 jars of material to be used for a mini-egg carton project for Ray Grant's outreach efforts in Pinal County. (See opposite)

I met with DaNel Hogan from the Pima County Superintendent of Schools Office. She came to get 45 rocks and fossils teacher kits and 315 student bags for a new program for fourth graders in the Marana School District. I need to finish 135 more student bags of the 12 rocks and fossils in the teacher kit. I ran out of material for four of the items and will complete them in Forest Lakes this summer. I have a lot of the needed material and a rock crusher at our cabin. The entire project will be ready for the start of school in the fall. ESM member Tony Occhiuzzi is doing a project with third graders and we are completing sets of egg cartons for them in my garage.

Over the years ESM's Outreach program has moved from providing teacher kits along with in-classroom presentations for third grades and presentations at school science fairs in the Phoenix area to our more recent efforts in helping outlying school districts. The coronavirus has affected schools and our outreach program will respond, especially with providing materials to support earth science efforts.

Mardy made 24 teachers kits and a collection of specimens to use for egg cartons that we are working with the Pinal County Educational Service Agency to get to teachers in Pinal County.

We have not finalized what is next; I have offered to set up classes at the Museum for the teachers to get the kits. Will let you know how it works, but may take until fall with the current situation with schools.

Ray Grant



Ray and Mardy loading the material for transport



Material stacked on the museum floor.

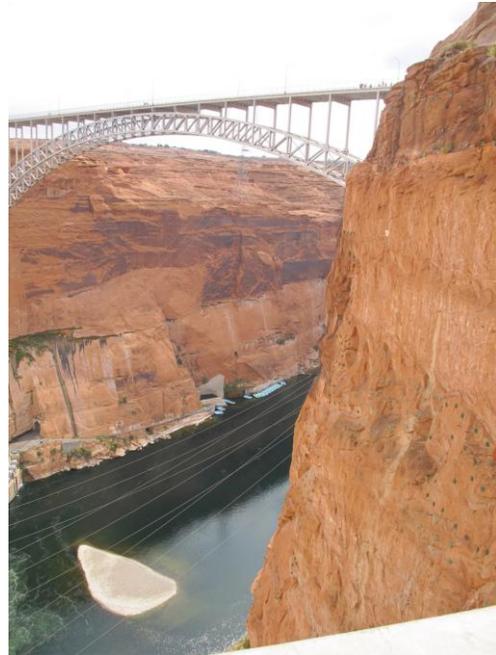
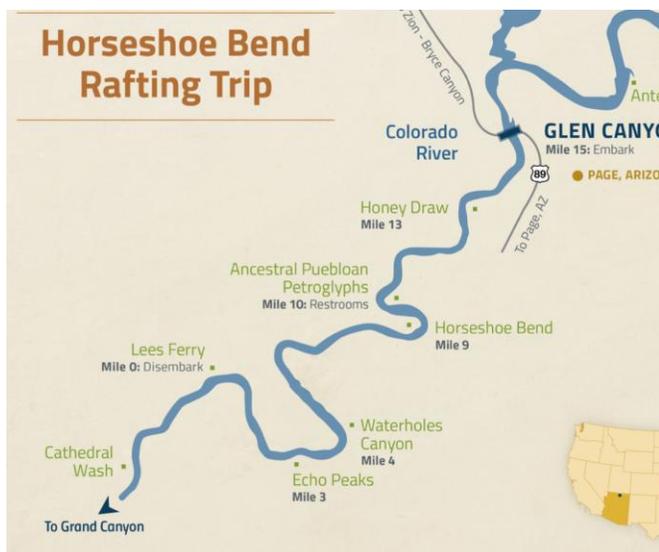


Arizona Rocks 95

Text & Photos by Ray Grant

In Page, you can take a short raft trip down the Colorado River. It goes 15 miles from the base of Glen Canyon Dam to Lees Ferry with a stop to see some petroglyphs. The trips are half a day although there were also trips in the past with lunch. They pick you up in Page and take you to the start and then transport you back to Page from Lees Ferry. It is not a Grand Canyon raft trip, but you don't need to reserve a year ahead. I have taken some of our guests from Australia and it gives them an idea about the river and they can say they rafted down the Colorado.

If you are not up for the raft trip perhaps take a hike to the Horseshoe Bend. The Horseshoe Bend trail is 1.4 miles round trip from the parking area to the overlook. The question is how does the Colorado cut a canyon in this shape? It is thought that the river was flowing on flat land and was meandering over the area when the land was uplifted and the river started cutting down with the pattern it had on the flat surface.



Boats in the Colorado River below Glen Canyon Dam, where the Horseshoe Bend Trip starts



Horseshoe Bend from the lookout on the 1.4 mile hike.

Colorado River map showing float trip from Glen Canyon Dam to Lees Ferry from riveradventures.com

Study sheds light on Earth's first animals

Scott Evans, UC-Riverside



Dickinsonia, which lived more than 550 million years ago, were flat, soft-bodied creatures that moved along the sea bed to eat microbes and algae.

Researchers at the University of California, Riverside are studying the Ediacaran-era fossil animal *Dickinsonia* to unlock the secrets of early life. *Dickinsonia* lived more than 550 million years ago, when the oceans were teeming with these flat, soft-bodied creatures that fed on microbes and algae and could grow as big as bathmats.

Research by Scott Evans, a graduate student in the Department of Earth Sciences, and Mary Droser, a professor of paleontology, both of UC-Riverside's College of Natural and Agricultural Sciences, shows that *Dickinsonia* developed in a complex, highly regulated way using a similar genetic toolkit to today's animals. The study helps place *Dickinsonia* in the early evolution of animal life and shows how the large, mobile sea creature grew and developed.

Paleontologists are particularly interested in *Dickinsonia* because they are the first animals to become large and complex and to move around and form communities. These flat, oval-shaped creatures ranged in size from less than an inch to several feet and

are characterized by a series of raised bands -- known as modules -- on their surface.

Scientists have debated the taxonomic status of *Dickinsonia* for years, placing it with fungi, marine worms and jellyfish, to name a few, but now, it is generally accepted as an animal (now extinct).

"Part of this study was trying to put *Dickinsonia* in context in the development of early life. We wanted to know if these creatures were part of a group of animals that survived or a failed evolutionary experiment. This research adds to our knowledge about these animals and our understanding of life on Earth as an artifact of half a billion years of evolution," said Droser.



Researchers at the University of California, Riverside are studying the world's oldest fossil animal, *Dickinsonia*, to learn more about the evolutionary history of animals.

For the study, the researchers travelled to South Australia's desert outback (Flinders Ranges), once underwater and now filled with an abundance of Ediacaran fossils, where they measured the size, shape and structure of almost 1,000 specimens

of *Dickinsonia costata*, paying particular attention to the number and size of modules. The study showed that *Dickinsonia's* development -- particularly that of the modules -- was complex and systematic to maintain the animals' oval shape. New modules accumulated by a process called terminal addition, suggesting, *Dickinsonia* developed in a related way to bilaterians, a complex group that display bilateral symmetry. But the researchers don't believe *Dickinsonia* was ancestrally related to bilaterians, since it lacked other features that most bilaterians share, most notably a mouth, gut and anus.

"Although we saw some of the hallmark characteristics of bilateral growth and development, we don't believe *Dickinsonia* was a precursor to today's bilaterians, rather that these are two distinct groups that shared a common set of ancestral genes that are present throughout the animal lineage," Evans said. "*Dickinsonia* most likely represents a separate group of animals that is now extinct, but can tell us a lot about the evolutionary history of animals."

This research was supported in part by the National Science Foundation (grant OISE 14-14911).



A specimen of *Dickinsonia costata*, one of the first mobile animals to exist on Earth, from the South Australia Museum in Adelaide



Folding a Mountain

Story by Kasha Patel

Mountains can be formed in many ways. Some form when lava spills from a volcano, and piles up on Earth's surface as it hardens. Others form when pieces of Earth's crust pull apart from one another, a process called "rifting." Most commonly though, mountains form when tectonic plates collide, folding and pushing layers of land into mountain ranges. The Flinders Ranges—the largest range in South Australia—is a classic example of a folded mountain range.

The many curves and folds of the Flinders Ranges are visible in the image at,

<https://earthobservatory.nasa.gov/images/145002/folding-a-mountain>

which the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite acquired on April 12, 2019. The range spans 430 kilometers (270 miles), with nearly all the peaks exceeding 300 meters (1,000 feet). One of the most notable features is the Wilpena Pound, an orange-tinted sandstone valley surrounded by high rock walls. The mountains are surrounded by low-elevation flat lake systems such as Lake Frome and Lake Torrens, which drain from rivers in the Northern Flinders Range.

The Flinders Ranges began forming about 800 million years ago, when an ancient sea deposited sediments in a basin known as the Adelaide Geosyncline. Around 300 million years later, the basin sediments were folded into mountains during an orogeny, or mountain-building period. The mountains have since eroded. However, the folded and faulted rocks remained and were uplifted in the last five million years to create a rugged landscape filled with sandstone, mudstone, limestone, and quartzite.

The Flinders Ranges contain the fossils explained in the previous article.



**AZ Mining, Mineral & Natural
Resources Education Museum
Update April 2021**

<https://ammnre.arizona.edu/>

Catie Carter Sandoval

cscarter@email.arizona.edu

703.577.6449

Help support the museum at:

<http://tinyurl.com/SupportMM-NREMuseum>

We are moving forward with initial plans for displays at City Hall and the AZ House of Representatives.

In other news, last year during the height of the pandemic a water pipe in the museum leaked and caused damage in the old Rose Mofford gallery and the adjacent hallways. Luckily, the damage was covered by insurance and we were able to have repairs made.



Old Mofford gallery



Front hallway approaching the old Rose Mofford gallery



Back hallway leading to the restrooms and Mofford gallery

Parent/Teacher Resource Page 1



EARTH SCIENCE WEEK UPDATE
American Geosciences Institute
Vol. 19, No. 4: April 2021

NRCS OFFERS RESOURCES FOR SOIL EDUCATION

The National Resource Conservation Service (NRCS) operates an [Education Resources page](#) featuring a treasure trove of teaching materials dealing with natural resources — including backyard conservation lesson plans, a database of standardized information about plants, and links to agricultural education sites.

For example, check out NRCS's [soil science education website](#), where teachers can dig up a treasury of resources designed for both science educators and K-12 students. Also, teachers can sign up for [email updates](#) on soil education. Dig in!

FIND NEW WAYS TO ENSURE 'NO CHILD LEFT INSIDE'

Find your geoscience inspiration in the great outdoors! Any day can be "No Child Left Inside" Day — a time for outdoor activities allowing young people to experience Earth science firsthand. And the NCLI Day Guide now offers lots of learning activities to help you do just that.

This free online guide provides everything you need to start planning your own NCLI Day event, including activities designed specifically for elementary, middle, and high school students.

Begin now to plan your NCLI Day event for Tuesday, October 12, during Earth Science Week 2021, when educators and young people nationwide will be wading into creeks, climbing hills, and searching the skies to learn Earth science. Or plan your own NCLI Day whenever it's most convenient for you!

Find AGI's [NCLI Day Guide](#) on the Earth Science Week website. Have a great NCLI Day!

GLOBE OBSERVER: LINK TO OCEANS, SOIL, AIR, MORE

Want to get involved in citizen science? Through the Global Learning and Observations to Benefit the Environment (GLOBE) program, you can take part in GLOBE Observer, an international network of professional scientists and citizen scientists collaborating to promote education about environment and climate.

On the GLOBE Observer website, you'll find teaching activities and resources on soil, air, oceans, weather, and other topics. For example, [Mosquito Habitat Mapper](#) provides materials on mosquito prevention and control, such as a guide to retrieving precipitation data, an educational activity, and lists of resources to learn more about properly identifying and eliminating potential mosquito breeding sites.

GLOBE Observer invites you to make environmental observations that complement NASA satellite observations to help scientists studying Earth and the global environment. By using the GLOBE Observer app, you are joining the GLOBE community and contributing important scientific data to NASA and GLOBE, your local community, and students and scientists worldwide.

To begin, all you need to do is download the [GLOBE Observer app](#) and use it to observe the environment wherever you are. Visit [online](#) for more information.

SEE NEW CLIMATE, ENERGY RESOURCES AT CLEAN

CLEAN — the Climate Literacy & Energy Awareness Network — encourages you to register for a new free webinar: "Teaching Climate Change in a Community That Does Not Want to Hear It," April 21.

Learn more about webinars and register [online](#). In addition, you can access CLEAN's [Guidance on Teaching About Climate & Energy in Spanish](#) as well as new pages on [teaching about the National Climate Assessment](#).

PARTNERS TEACH KIDS ABOUT SCIENCE OF CONSERVATION

Partners in Resource Education (PRE), an Earth Science Week partner, provides programs and activities to get young people excited about the geoscience of conservation. Focusing on national resource priorities such as pollinators, wetlands, oceans, invasive species, endangered species, fire, and climate change, PRE teaches people about sustaining and safeguarding living resources in their own backyards.

PRE is a consortium of several federal agencies — Bureau of Land Management, Fish and Wildlife Service, Forest Service, National Park Service, Natural Resources Conservation Service, National Oceanic and Atmospheric Administration, and Environmental Protection Agency — and the National Environmental Education Foundation (NEEF). By combining staffs and resources, the agencies educate young people, introduce them to natural resource careers, and cultivate the next generation of land and water stewards.

PRE's signature project, Hands on the Land, connects students, teachers, and parents to public lands and waterways. Education specialists work closely with teachers to develop programs that meet state standards and engage students in hands-on activities. Students to take part in environmental monitoring and other activities through distance learning and the [project website](#).



Pinal Museum and Club News

351 N. Arizona Blvd., Coolidge, AZ
Pinal Gem and Mineral Club meeting

May 19, 2021, live on YouTube

www.pinalgeologymuseum.org

Ray Grant raycyn@cox.net.

Pinal Geology and Mineral Museum will be closed until further notice due to the health emergency.

We are continuing to work on our exhibits and make new ones in anticipation of a grand reopening event in the fall.

Crystal Systems Exhibit

The smooth-faced angular shapes assumed by minerals are known as *crystals*. The crystal's many-sided form is the expression of the regular internal atomic arrangement of the atoms making up any given mineral. A wide variety of crystal shapes exists; however, all crystals can be classified into six broad groups known as crystal systems. These crystal systems are defined by the relative lengths and inclinations of imaginary internal lines called axes that run from opposite face centers, parallel to edges of the crystals.



**ALL ARIZONA CLUB MEETINGS ARE LIKELY CANCELED
DUE TO HEALTH CONCERNS!**



Apache Junction Rock & Gem Club

Meetings are on the 2nd Thursday

Next Meeting: 2021, 6:30 pm

www.ajrockclub.com

@ Club Lapidary Shop

2151 W. Superstition Blvd., Apache Jct.



Daisy Mountain Rock & Mineral Club

Meetings are on the 1st Tuesday

(unless a Holiday then 2nd Tuesday)

Next Meeting: May 3, 2021, 6:30 p.m.

Please go to their website for more info

www.dmrmc.com

@ Anthem Civic Building

3701 W. Anthem Way, Anthem, AZ



Maricopa Lapidary Society, Inc

Meetings are on the 1st Monday

(unless a Holiday then 2nd Monday)

Next Meeting: May 3, 2021, 7:00 pm

www.maricopalapidarysociety.com

Zoom Meeting

@ North Mountain Visitor Center

12950 N. 7th St., Phoenix



Mineralogical Society of Arizona

Meetings are on the 2nd Thursday

(September meeting on the 3rd Thursday)

Next Meeting: May 13, 2021, 7:30 pm

www.msaaaz.org

Zoom Meeting - Register on MSA website



Pinal Gem & Mineral Society

Meetings are on the 3rd Wednesday

Next Meeting: May 19, 2021, 7:00 pm on

YouTube go to their website for more info

www.pinalgemandmineralsociety.org

@ Artisan Village

351 N. Arizona Blvd., Coolidge



West Valley Rock & Mineral Club

Meetings are on the 2nd Tuesday

Next Meeting: May 11, 2021, 6:30 pm

Zoom meeting

www.westvalleyrockandmineralclub.com

@ Painted Desert Academy

2400 S. 247th Ave., Buckeye, AZ



White Mountain Gem & Mineral Club

Meetings are on the 1st Sunday

(unless a Holiday then 2nd Sunday)

Next Meeting: 2021, 1:00 pm

www.whitemountain-azrockclub.org

@ VFW Hall

381 N. Central, Show Low



Wickenburg Gem & Mineral Society

Meetings are on the 2nd Friday

(February & December on the 1st Friday)

Next Meeting: 2021, 7:00 pm

www.wickenburggms.org

@ Coffinger Park Banquet Room

175 E. Swilling St., Wickenburg

ESM's Meeting Notice

ESM's next meeting will be at North Mountain Visitor Center, 12950 N. 7th St., Phoenix, on Tuesday, TBA 2021, at 6:30 p.m.

BECOME A MEMBER!
Join the Earth Science Museum's



IS IT TIME TO RENEW YOUR MEMBERSHIP?
Please renew today! 😊😊😊

----- cut here -----
**ESM Earth Science Investigation
 Team Membership Form**
 _____ **New Member** _____ **Renewal**

Membership levels:

_____ **ESI Family \$20**

_____ **ESI Individual \$10**

Membership benefits:

- ◆ Monthly e-newsletter *Earthquake*
- ◆ Official team membership card
- ◆ Knowledge that your contribution is making a difference in earth science education.

MANY THANKS TO OUR MAJOR DONORS!

- AZ Leaverite Rock & Gem Society
- Flagg Mineral Foundation
www.flaggmineralfoundation.org
- Friends of the AZ Mining & Mineral Museum
- Maricopa Lapidary Society
<http://maricopalapidarysociety.com/>
- Mineralogical Society of AZ
www.msaz.org
- Payson Rimstones Rock Club
- Sossaman Middle School
- White Mountain Gem & Mineral Club
www.whitemountain-azrockclub.org
- Wickenburg Gem & Mineral Society
<http://www.wickenburggms.org>
www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438
- Staples Foundation
www.staplesfoundation.org
- Anita Aiston
- Peter & Judy Ambelang
- Stan & Susan Celestian
- Russ Hart
- Will & Carol McDonald
- Debbie Michalowski
- Janet Stoepplmann
- Dennis & Georgia Zeutenhorst

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Earth Science Museum
 3215 W. Bethany Home Rd.
 Phoenix, AZ 85017

Phone:
 602-973-4291

Editor E-Mail:
 scote@earthsciencemuseum.org

Mission
 Our Mission is to excite and inspire all generations about earth sciences through educational outreach.

Vision
 We envision a community where students and the general public have curiosity about, passion for, and understanding of the underlying principles of earth sciences.

For more information about the ESM, how to become a member or how to arrange for a school visit or Community function, go to:
www.earthsciencemuseum.org.

We're on the Web!

Visit us at:

www.earthsciencemuseum.org

NOTICE:
 ESM's next meeting will be at North Mountain Visitor Center, 12950 N 7th St, Phoenix, on Tuesday, TBA 2021, at 6:30 p.m.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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