



# 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  
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June 2021  
Volume 10, Issue 6

## ESM OUTREACH UPDATE

Mardy Zimmermann, Outreach Coordinator

While in Forest Lakes, Lynne Wheeler and I completed all of the student bags for the project with the Marana School District. I transported them down to Apache Junction and will connect with DaNel Hogan before school starts in Sept.

On June 14<sup>th</sup>, 37 scouts and their leaders were treated to Lynne & Terry Dyer's amazing rock, mineral and fossil displays at R-C Scout Ranch in Payson, AZ.



Terry examining a specimen from an attendee for identification



Scouts and leaders in line for an up close view of the many interesting specimens Lynne explained in her presentation.



Terry explaining a geological process to attendees



## Arizona Rocks 97

Text & Photos by Ray Grant

See dinosaurs in Springerville! The Chamber of Commerce in Springerville has a display of dinosaurs by Doug Wolfe. He has worked extensively on dinosaurs in that area and has plans for a dinosaur museum, but for the present time he has his exhibits in the Chamber of Commerce Visitor Center. He has concentrated on rocks of middle Cretaceous Age, around 80 to 90 million years ago. This time has been called the middle Cretaceous dinosaur gap because rocks of this age are rare in the world. He has found a number of new dinosaur species.

One of these new dinosaurs is *Zuniceratops christopheri* named after Doug's son Chris, who found the first bones in 1996 when he was 7 years old. It is a horned dinosaur related to triceratops. Other new dinosaurs Doug has found include a sickle clawed therizinosaur, *Nothronychus mckinleyi* and a new small tyrannosaur, *Suskityrannus hazelae*. He has also found giant crocodile fossils and other animals. Many volunteers, visiting scientists and especially the Southwest Paleontological Society at the Arizona Museum of Natural History in Mesa, have supported his projects.

To learn more about Doug and his work and ways that you can join in the dinosaur hunt, go to his website [www.zdig.org](http://www.zdig.org) (Zuni Dinosaur Institute for Geosciences, ZDIG). The goals of this organization are given as "to share those discoveries with the local Community and visitors through Museum exhibits, educational programs, field tours, and participation in community events. Much of our program involves taking educational programs and travelling exhibits to schools and educational groups that have little access to science education or museums."



Mural in entrance to Springerville Chamber of Commerce with three of the new dinosaurs found in the area



Model and skeleton of *Zuniceratops christopheri* in Springerville Chamber of Commerce Visitor's Center



***Zuniceratops christopheri*** (Wolfe & Kirkland, 1998)  
 The Oldest Horned Dinosaur in North America  
 Age: 90 million years old (middle Cretaceous)  
 Size: Approx. 8-10 ft long and 700lbs  
 Diet: Herbivore  
 Discovery: Christopher (7yrs old) & Douglas Wolfe  
 Notes: Changed the understanding of Ceratopsian Evolution on North America



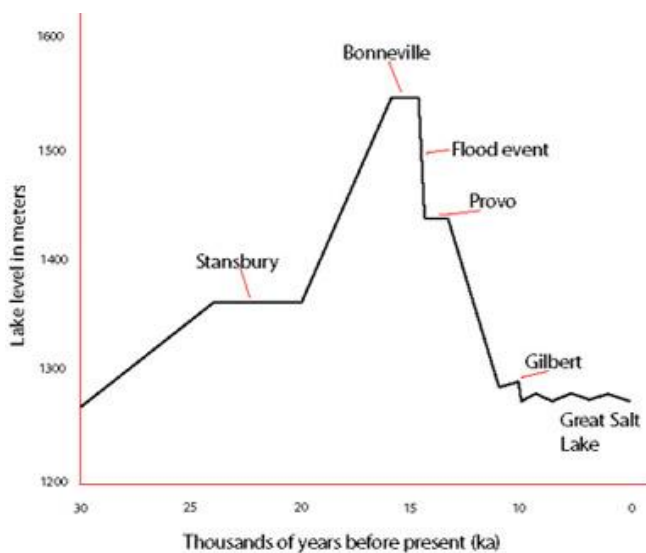
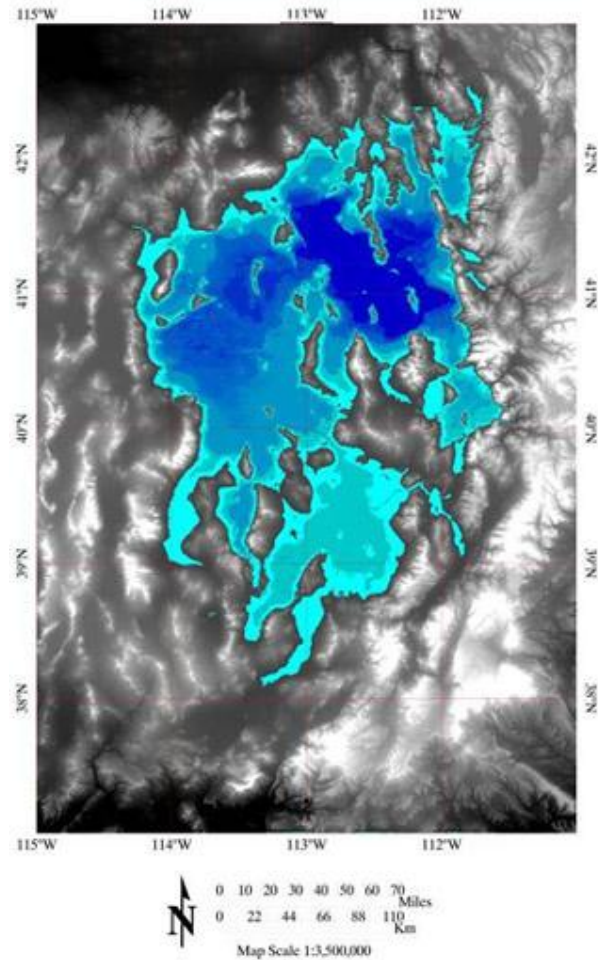
## History of Lake Bonneville



"The following article is one of the 15 modules of the Digital Geology of Idaho website

([geology.isu.edu/Digital\\_Geology\\_Idaho/index.htm](http://geology.isu.edu/Digital_Geology_Idaho/index.htm)). This site is part of a project funded by an NSF grant awarded to Dr. Paul Link (Idaho State University) and Dr. Shuhub Khan (University of Houston)."

The history of Lake Bonneville is also the history of the Great Salt Lake. The modern lake is a small residual of Bonneville, a pleistocene lake that at its peak covered 52,000 sq km (32,000 sq mi) in what is now northwestern Utah and Southern Idaho. Several distinct stages have been identified at which lake levels remained constant for periods of one thousand years or more; these are called Stansbury, Bonneville, Provo, and Gilbert. The highest stage, Bonneville, was cut short by a massive flooding event through the Red Rock pass area near Zenda, Idaho, which released about five thousand cubic kilometers of water - the second largest flood in the geologic history of the world.



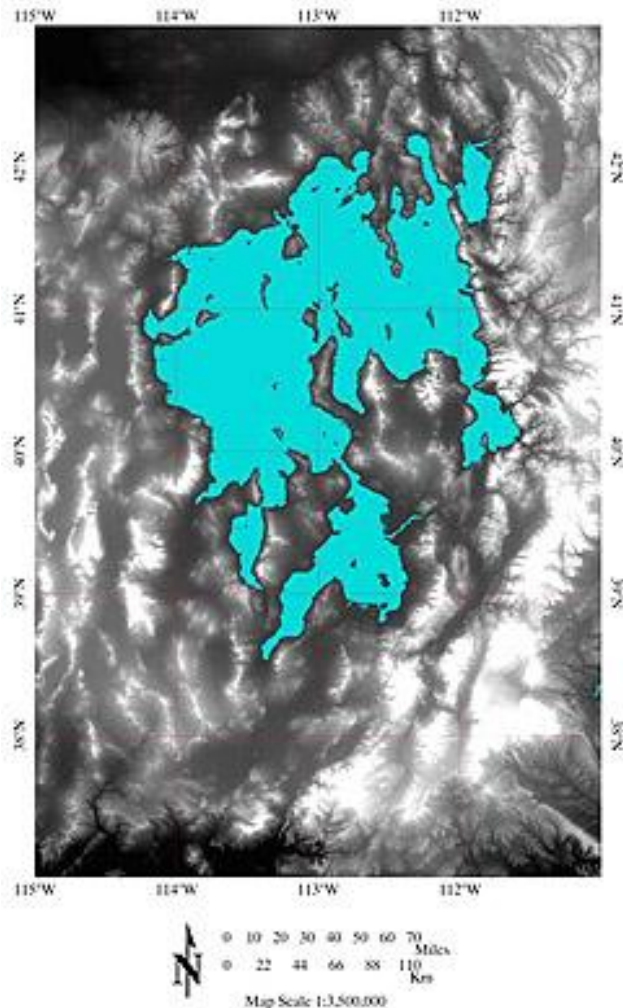
The map shows all of the lake stages from the past 23,000 years. The levels, from lightest to darkest, are Bonneville, Provo, Stansbury, Gilbert, and the contemporary Great Salt Lake. The chart to the left shows the changes in lake levels over time.

### Stansbury level 23-20 ka

(More recent dates can be expressed in ka (*kilo-annum*); for example, the last cycle of glaciation ended at approximately 11.7 ka or 11,700 years ago.)

The initial advent of drainage into the Bonneville basin was well in progress by about 25 thousand years ago, but stalled out about 23 thousand years ago, apparently due to climate rather than topography. This

event created the Stansbury beach at 1372m (4500 ft) above sea level, and held it there for 3000 years. This level covered approximately 9300 square miles.

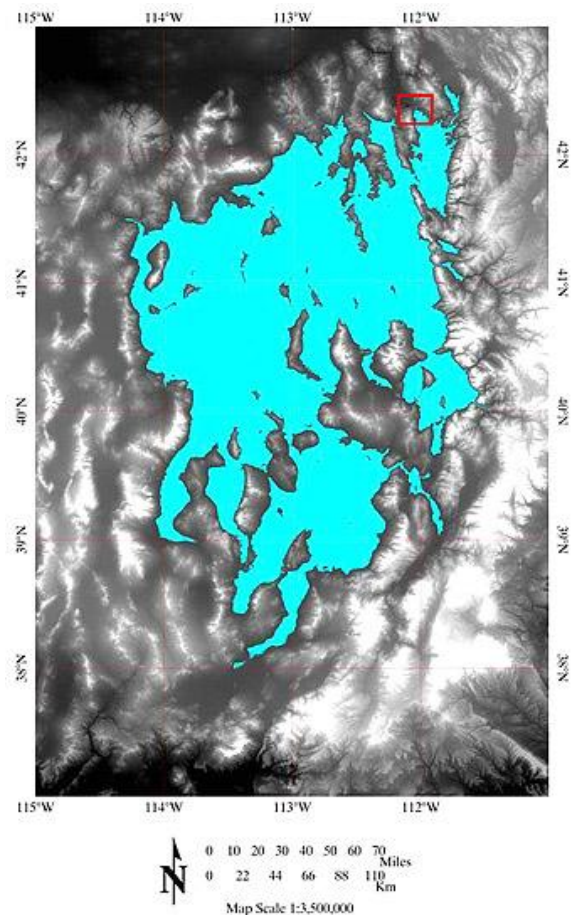


The above map shows the outline of the lake at the Stansbury level, from 23-20 thousand years ago.

### Bonneville level 16 - 14.5 ka

The shoreline levels rose until about 16 thousand years ago when, at 1552m (5090 ft), the water reached the rim of the basin at Red Rock Pass. For roughly a thousand years the lake level oscillated, forming the highest shoreline covering 19,800 square miles. Principle control was probably through overflow at Red Rock Pass, but leakage through the alluvium and karsts through the limestone as well as a balance between precipitation and evaporation stalled the lake level at this stage. Shortly

before its break out, a short regression occurred that created the Keg Mountain oscillation. Between 15 to 14 thousand years ago a catastrophic failure of the alluvium fan at Red Rock Pass released a surge of floodwaters and lowered the overall lake level approximately 105m (350 ft.) Isostatic rebound has raised the shoreline left by the Bonneville level unevenly, and its current level varies by 61m (200 ft) of elevation.



This image shows the size and shape of the lake at the Bonneville stage, about 16 thousand to 14.5 thousand years ago. The red rectangle indicates the location of Red Rock Pass, where the floodwaters escaped.

### THE FLOOD EVENT

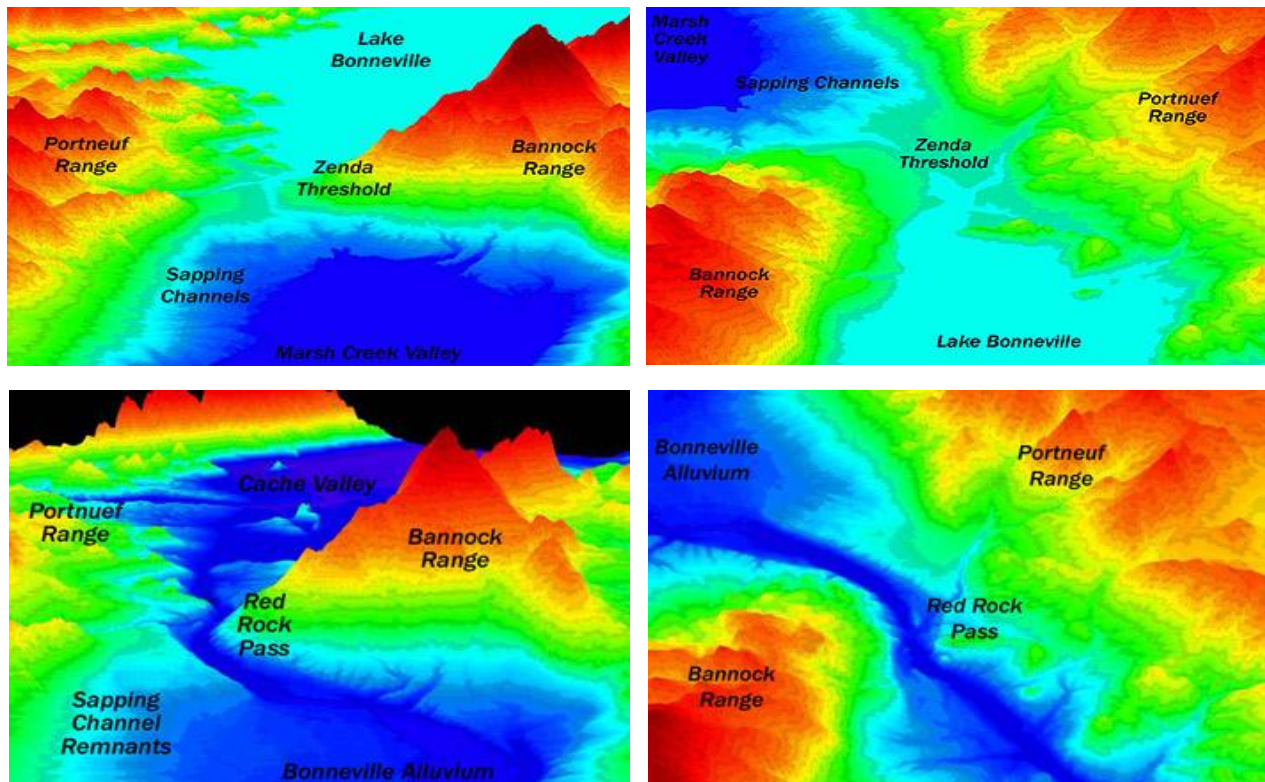
Red Rock Pass is a narrow valley just north of Cache Valley and directly south of Downey Idaho. It is bounded by two mountain ranges; the Portneuf to the East and the Bannock to



the West. The pass is a tertiary normal faulted graben consisting of tuffaceous fine-grained clastics and carbonates of the Salt Lake formation overlain by unstable Quaternary Alluvial fan gravels carved out by a massive flooding event roughly 14.5 thousand years ago.

During the Quaternary, alluvial fan gravels from the two ranges coalesced to create a saddle shaped dam. The rising Lake Bonneville was halted by this alluvial dam at the Zenda threshold approximately 16 thousand years ago. The threshold was first breached to the east side of Red Rock Pass, at about 14.5 thousand years ago, eroding out the alluvial fan. Its base level was controlled by the resistant karstic limestone of the Blacksmith Formation.

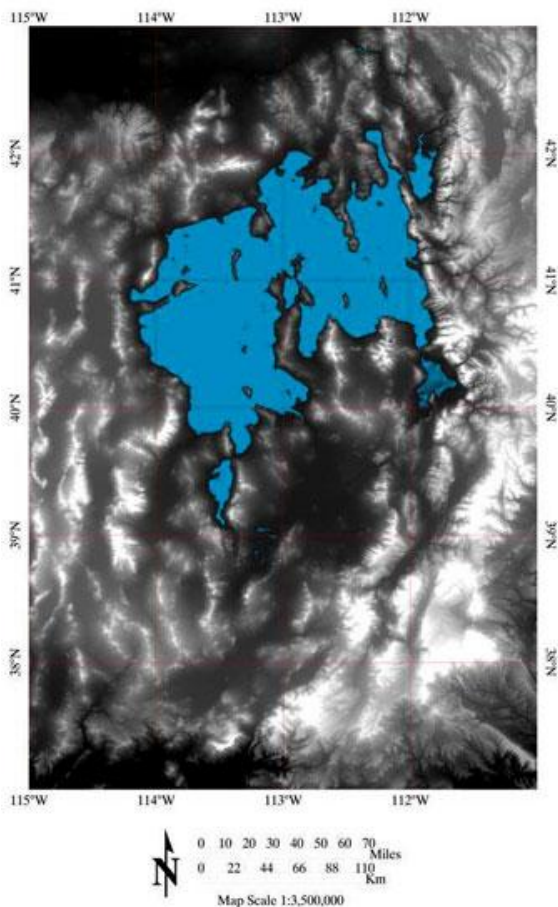
The outflow ultimately slid to the west undercutting the alluvium at the foot of the Bannock and prompting a 17 square kilometer (6.56 square mile) landslide. This landslide was then truncated by the flood causing massive flood deposits of alluvial gravel under what are now Downey and the surrounding valley. From the break point at Red Rock Pass, the flood route flowed into the Marsh Creek Valleys, through the Portneuf Narrows and into Snake River Plain just North of Idaho. From there it followed the Snake River Canyon into Michaud Flats and up to Lewiston, where confirmation of the Bonneville Flood is obscured by the effects of the Missoula Flood.



The bottom pair of images looks down upon Red Rock Pass. The upper pair of images is from an elevation model created for the damming event (Zenda Threshold), while the lower pair is from a present-day model for comparison. All model height (relief) has been stretched by a factor of 7. Blue color does not necessarily represent water, but elevation.

**PROVO LEVEL 14.5 - 13.5 KA**

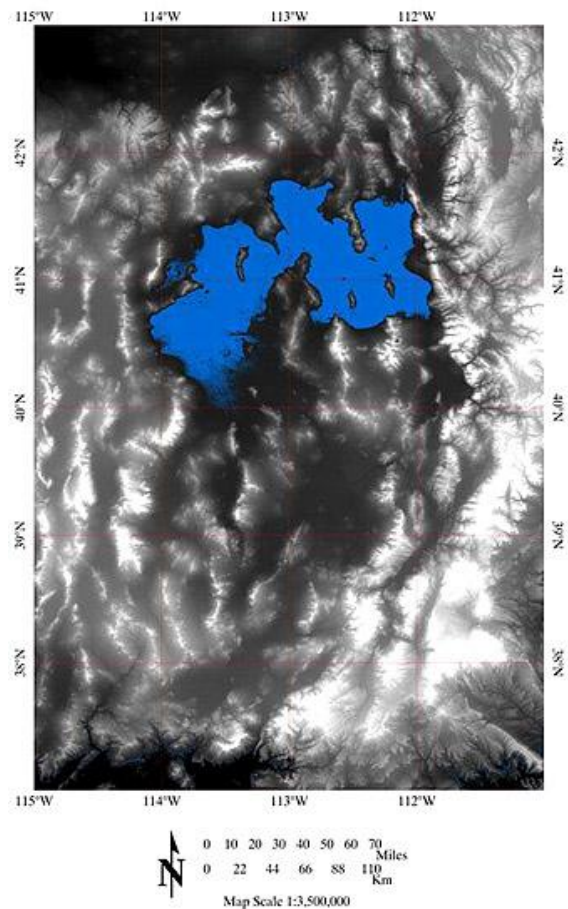
As the outlet channel stabilized it cut down through the alluvium to the underlying bedrock. The lake level stabilized when it was even with the resistant rock at an altitude of 1445m (4740 ft) and covered 23,175 sq km (14,400 sq mi.) The lake remained at this level with water flowing out of the basin through Red Rock Pass, into the Snake River and eventually the Pacific Ocean for roughly a thousand years. With the end of the last major ice age, the lack of water flowing into the basin caused the beginning of the gradual decline in the lake level to its current levels.



This image shows the size and shape of the lake at the Provo stage, about 14.5 thousand to 13.5 thousand years ago.

**GILBERT LEVEL 11 - 10 KA**

Following a 2.5 thousand year period of decline, between 11 and 10 thousand years ago, the lake rose once more to 1295m (4250 ft) above sea level before continuing to decline. This event formed the Gilbert shoreline. This minor rise in lake level covered 10,622 sq km (6,600 sq mi) and marked the end of the Lake Bonneville cycle.



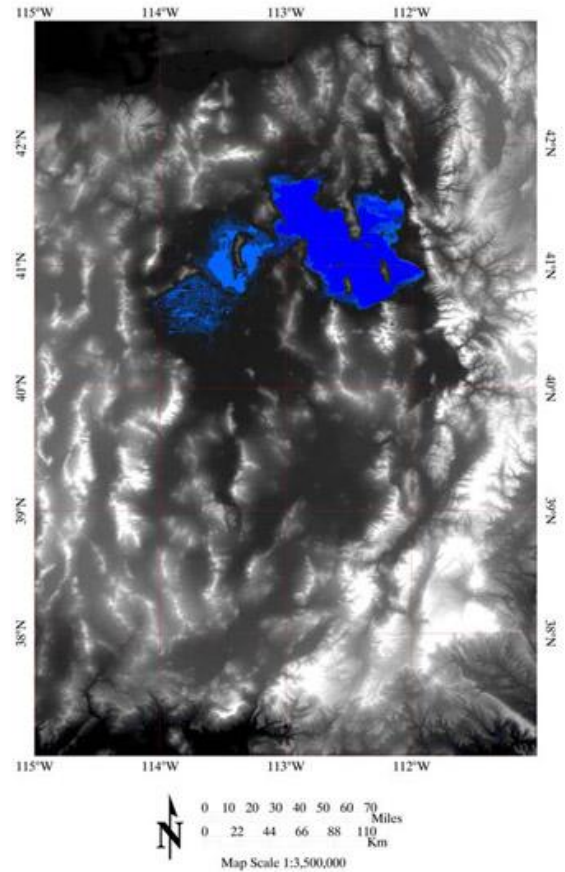
The Gilbert shoreline, approximately 11 to 10 thousand years ago



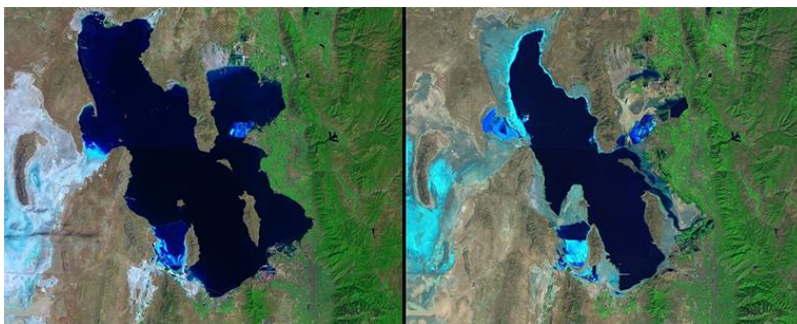
**CONTEMPORARY - THE GREAT SALT LAKE**

Since the last Lake Bonneville stage (Gilbert), the Great Salt Lake has fluctuated between lows of 1277m (4191 ft) and highs of 1285m (4217 ft) above sea level. Low levels within the lake have been found by shallow-water sediments in cores from the bed of the lake, and by polygonal networks of giant desiccation cracks which cover extensive areas of the lake bottom. The 1285m high stand level is controlled by a pair of low topographic divides that separate the Great Salt Lake (GSL) and the GSL Desert basin to the west. At the 1285m elevation the area of the GSL increases from its average 4506 square km (2800 sq mi) to 5955 sq km (3700 sq mi.)

Because the GSL basin is topographically closed the only outlet for water when it was at its highest stages was through the Red Rock Pass, now the only outlet is through evaporation.

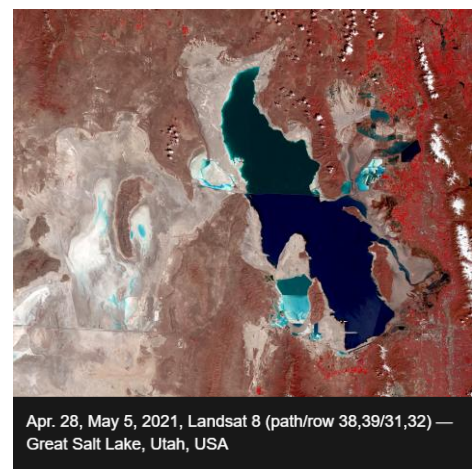


This image shows the outlines of the Great Salt Lake at its low of 4191 feet above sea level and high of 4217 feet above sea level, in dark and light blue respectively. Salt Lake City is 4226 feet above sea level.



**Great Salt Lake**

Landsat satellite imagery shows the dramatic changes in the area of the Great Salt Lake over the 25 year span between 1985 (left) and 2010 (right).



Apr. 28, May 5, 2021, Landsat 8 (path/row 38,39/31,32) — Great Salt Lake, Utah, USA



## AZ Mining, Mineral & Natural Resources Education Museum Update June 2021

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

Catie Carter Sandoval

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Help support the museum at:

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

Text and photos by Charlie Connell and Shirley Coté

On June 11<sup>th</sup>, nine volunteers joined Catie at the museum to make repairs on the stamp mill, incline and crusher outside and prepare for contractors to undertake some renovations inside.

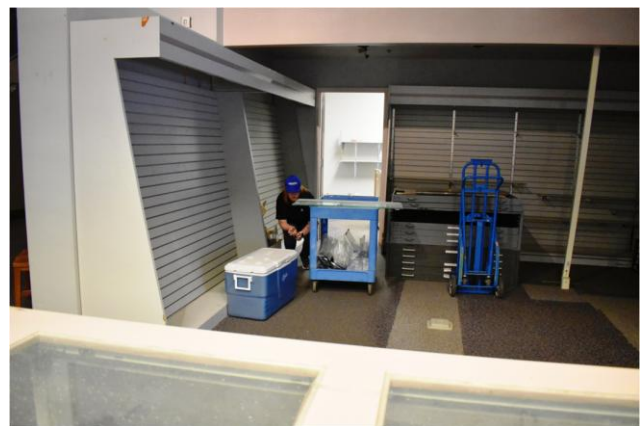
Everyone arrived by 08:30. We had a brief safety meeting and we formed two groups. The outside group consisted of Roger Camplin, Charlie Connell, Bill Lytle, and Don Richardson. The inside group comprised of, Shirley Cote, Doug Duffy, Stuart Harrah, Bill Yedowitz and Denny Zeutenhorst with Catie helping both inside and outside.

Denny, Doug, Bill Y. and Stuart promptly started removing the temporary walls allowing quick access between the old gift shop, front desk and the copper gallery areas.

Next the cases and a mine model from the gift shop area were moved to the main gallery.



Meanwhile Catie transferred glass shelving and hardware from the slat wall to a cart and wheeled them toward the old lapidary shop for storage. Later Stuart & Denny stored them in the shop.







Stuart and Bill Y. prepare the last case for transport and moved it and the conference table top to the main gallery.



The storage drawers stacked and stored on carts in the main gallery.



Now all that is left in the old gift shop area are the flat map cases belonging to the AZ Geologic Survey. They will have to move these so that new carpeting can be installed.



Next we moved all the chairs and several tables from the copper gallery to the main gallery.



The next project was to transport all of the storage drawers from the copper gallery to the main gallery.



Denny and Stuart moving a cart full of chairs in the main gallery.

Meanwhile the outside group worked on the stamp mill, incline and crusher.

Roger removed the old deteriorating screen from the stamp mill mortar box. We got a good 18 years out of the screen and it did its job.

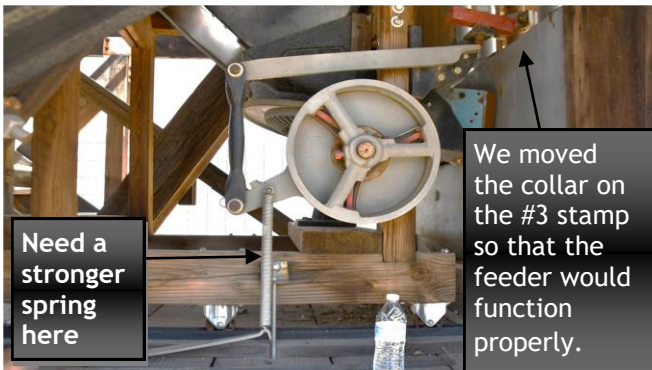


Roger and Charlie removed the buildup of the excess material in the mortar box and installed the new screen.



Roger with the new screen in place.

Next Roger and Charlie reset the collar on the #3 stamp so that it was about 6" higher. This cut back on the stroke of the feeder that could be damaged if the collar were to be left in the current position. They are going to install a stronger spring on the feeder ratchet to better control the strokes on the actuator arm.



The primary crusher has had problems with the "V" pulley that appears to be loose. The inspection confirmed that the pulley needs to be removed and repaired.



Inspection of the crusher pulley revealed that it was slipping. Roger and Charlie removed the screen and the drive belt to get at the pulley.



Further inspection of the drive pulley identified that there was no keyway on the shaft, only on the pulley. To make up for the missing keyway, Allen screws installed through the pulley have since loosened up. A bearing puller is needed to remove the pulley for repair. This job will be completed at a later date.

Meanwhile Bill L. & Don worked on replacing the cross ties on the incline. The original ties were installed in 2003, it is about time to replace the (18) year old timbers.





Bill L. and Don remove old ties from the incline.



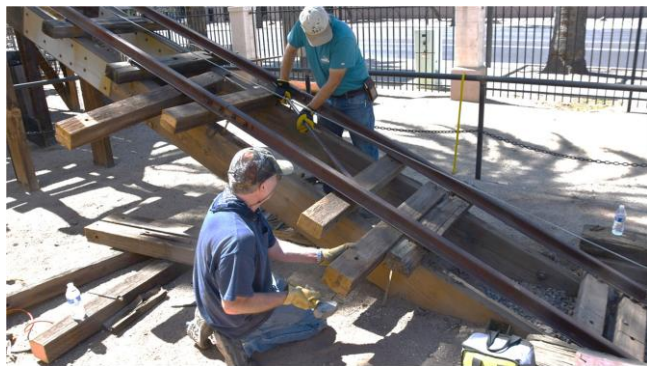
Don & Bill L. align a new timber on the incline. They did very well, replacing (5) of the cross ties. All of this was performed in 100° F weather.



Bill L. had to cut the old lag bolts.



Catie taking a load of cross tie pieces to our trash staging area. This waste was due to the need to cut up the ties to get the lag bolts out.



Bill L. and Don worked together to replace a cross tie.

Then it was time for a well deserved break and a group picture.



From left to right, Bill L, Stuart, Shirley, Catie, Doug, Roger, Denny, Bill Y & Don (Charlie took the picture)

## AZGS Arizona Geology Blog

[A century of Fossil Discovery and Research at Grand Canyon](#)

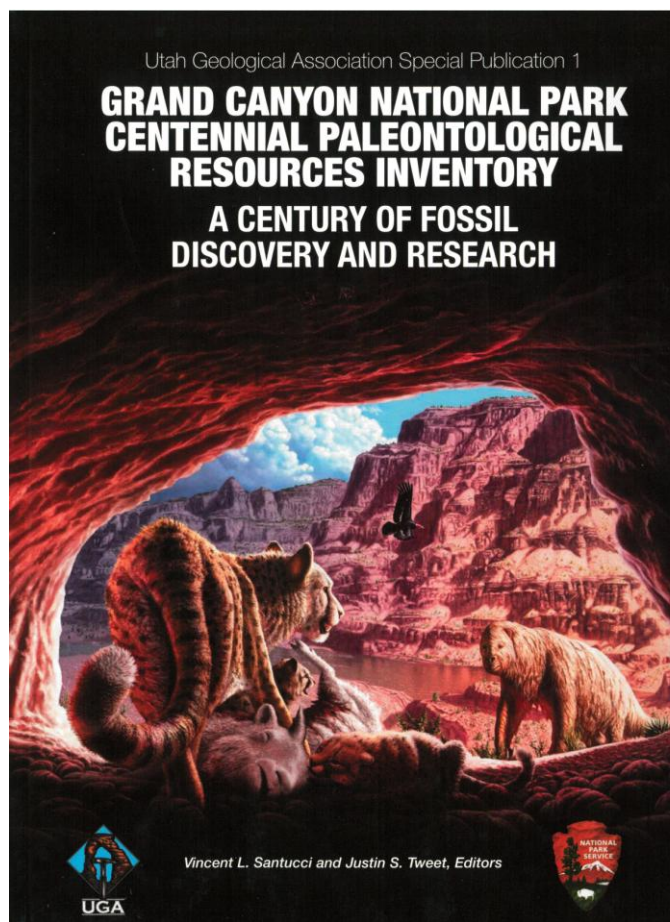
Grand Canyon National Park has a remarkable 160-year history of fossil investigations. The Utah Geological Association in cooperation with the National Park Service just released a 343-page document (463 pages including appendices) with 13 papers summarizing fossil discoveries and paleontology research from the Precambrian to the Pleistocene. There is a heavy emphasis on Paleozoic fossiliferous strata.

Today's post includes a brief description of the book and a listing of article titles, author(s), and page numbers.

The manuscript was edited by Vincent L. Santucci and Justin S. Tweet, both of the U.S. National Park Service.

Citation: Santucci, V.L., and Tweet, J.S., editors, 2021. [Grand Canyon National Park Centennial Paleontological Resources Inventory — A Century of Fossil Discovery and Research](#): Utah Geological Association Special Publication 1, 343 p.

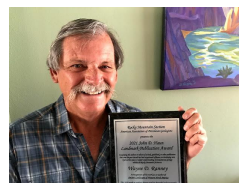
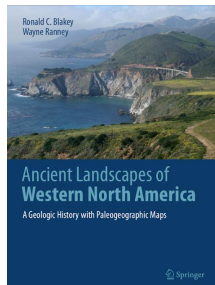
F. Michael Conway  
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## Earthly Musings - Wayne Ranney's Geology Blog

### “Ancient Landscapes of Western North America” Receives Award from the Rocky Mountain Section of AAPG (American Association of Petroleum Geologists)



On Tuesday, April 13, 2021 I received the following email message out of the blue:

*Hello Ron and Wayne,*

*The Rocky Mountain Section of AAPG annually awards its John D. Haun Landmark Publication Award to the authors or editors of a book, guidebook or other publication that over the past decade has had exceptional influence on developing new hydrocarbon plays or deeper understanding of fundamental geology within the Rocky Mountain area. This year the awards committee has chosen you both for your excellent book with paleogeographic maps, Ancient Landscapes of Western North America.*

*I live in Grand Junction, CO and so very many of the geologic presentations here at Colorado Mesa University by students or members of the Grand Junction Geologic Society include a reference or image of yours. I have worked at the Dinosaur Journey Museum in nearby Fruita where we collect fossils from area quarries and where the paleontologist curator uses your work to show folks attending talks or digs what this area looked like in the past. So many authors of papers presented at RMS meetings refer to your work. Your influence has indeed been exceptional.*

*Please take a look at the RMS-AAPG website ([aapgrms.org](http://aapgrms.org)) for more info about this award and past winners. We usually present a plaque to the winners in person at the annual RMS meeting or at the AAPG ACE meeting, but due to COVID the ACE meeting in Denver scheduled for May has been postponed or might be virtual. I would like to send each of you a plaque, so could you please give me a mailing address? We will be adding info onto our website about 2021 award winners and also sending out an email blurb to the 2100+ members of the RMS soon.*

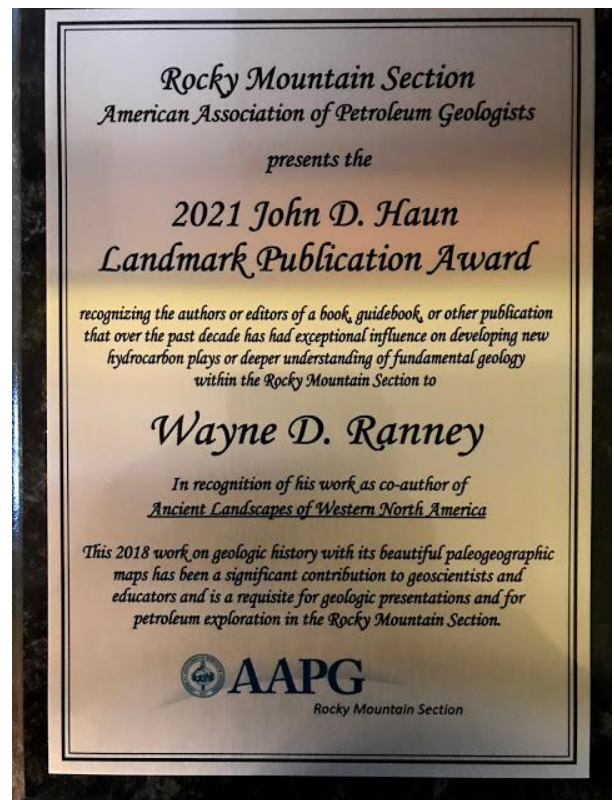
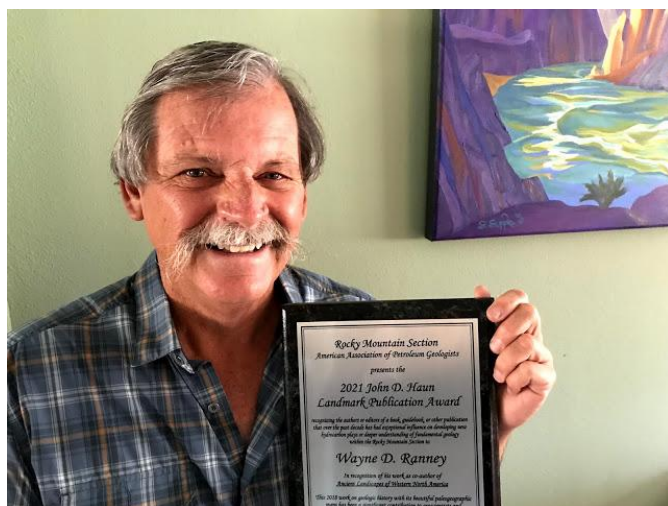
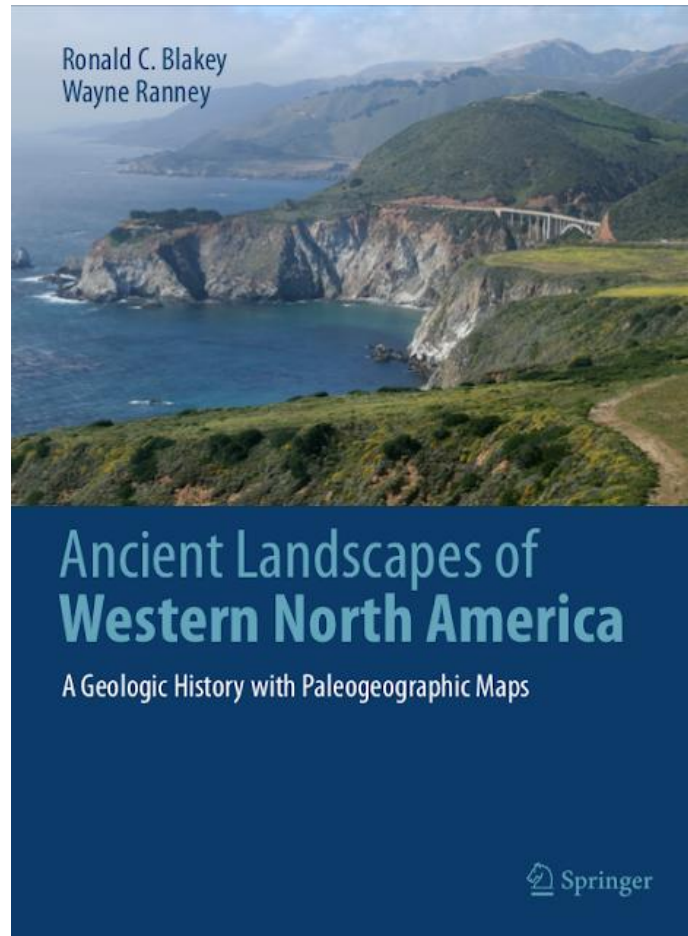
*Congratulations.*

*Best regards,*

*Heidi Schoenstein*

Of course, Ron and I were delighted to receive this surprising but welcomed news. ***Ancient Landscapes of Western North America*** was published in 2018 by Springer. [Here is a link](#) to the Amazon page for the book. The reviews here are quite good.

A description of the John D. Haun Award and a list of previous awardees [can be found here](#).







## Parent/Teacher Resource Page 1

<https://www.earthsciweek.org/>

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### EARTH SCIENCE WEEK UPDATE

American Geosciences Institute

Vol. 19, No. 6: June 2021

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#### (SELECTED TOPICS FROM THE JUNE UPDATE)

GO TO - [HTTPS://WWW.EARTHSCIWEEK.ORG/NEWSLETTER](https://www.earthsciweek.org/newsletter) FOR MORE INFORMATION)

#### EXPLORE GEOPHYSICS DURING EARTH SCIENCE WEEK 2021

The Society of Exploration Geophysicists (SEG), an Earth Science Week partner and AGI member society, offers programs for educators and students. For example, a distinguished lecturer series and an honorary lecturer series both enable students to meet professional geophysicists, learn about groundbreaking research in the field of seismology, and obtain valuable career information.

Short courses offered through SEG not only enable seismologists to continue their education, but also help teachers to study seismology with introductory courses on seismic data processing. Meetings, forums, and workshops are also available. Check online for availability.

SEG members have access to journals, an online digital library, reference publications, meetings, workshops, networking, and employment referral. To learn more, visit [SEG online](#).

#### GUIDEBOOK PDF ENSURES 'NO CHILD LEFT INSIDE'

Wouldn't it be great to dedicate a day to "No Child Left Inside," a time for outdoor activities enabling young people to experience the inspiration of Earth science firsthand? To help you do just that, the NCLI Day Guide is available in both online and PDF format for easy printing, viewing on a smartphone, and using outdoors.

This free guide provides everything you need to start planning your own NCLI Day event, including any of 17 outdoor learning activities recommended for elementary, middle, and high school students. Begin now to plan your NCLI Day event for summer or fall, when young people can wade into ponds, climb hills, and search the skies to learn Earth science. And remember to include appropriate safety measures.

Find the NCLI Day Guide, including the PDF version, at [No Child Left Inside Day](#). Have a great NCLI Day!

(THE AMERICAN GEOSCIENCES INSTITUTE IS A NONPROFIT FEDERATION OF GEOSCIENTIFIC AND PROFESSIONAL ASSOCIATIONS THAT REPRESENTS MORE THAN 250,000 GEOLOGISTS, GEOPHYSICISTS AND OTHER EARTH SCIENTISTS. FOUNDED IN 1948, AGI PROVIDES INFORMATION SERVICES TO GEOSCIENTISTS, SERVES AS A VOICE OF SHARED INTERESTS IN THE PROFESSION, PLAYS A MAJOR ROLE IN STRENGTHENING GEOSCIENCE EDUCATION, AND STRIVES TO INCREASE PUBLIC AWARENESS OF THE VITAL ROLE THE GEOSCIENCES PLAY IN SOCIETY'S USE OF RESOURCES, RESILIENCY TO NATURAL HAZARDS, AND INTERACTION WITH THE ENVIRONMENT. FOR CONTACT INFORMATION, PLEASE VISIT [ONLINE](#). TO SUBSCRIBE TO THIS NEWSLETTER, VISIT [ONLINE](#) AND SUBMIT YOUR EMAIL ADDRESS.)

## CHECK OUT THESE GREAT NASA LEARNING RESOURCES

Explore the Earth Science Week theme of "Water Today and for the Future" through a wealth of NASA education resources:

- [NASA's Earth Wheel: Water in the Earth System](#) — This interactive resource allows students to explore and compare data from four NASA satellite missions: Aquarius, GRACE, Terra, and TRMM. By considering questions and observing data on the wheel, students learn how NASA data sets, when used together, can provide a more complete understanding of water in our Earth system.
- [NASA Earth Observatory: How to Interpret a Satellite Image](#) — Satellite images are full of useful and interesting information. These tips come from the NASA Earth Observatory's writers and visualizers, who use them to interpret images daily. They will help you get oriented enough to begin to unlock the rich information in a satellite image.
- [NASA Mapping Our World Interactive](#) — The interactive visualization and poster allow you to explore data sets from over a dozen NASA Earth science missions for 25 unique views of our world.
- [NASA's EO Kids](#) — Check out this issue, "From School to NASA Earth Scientist." What do you want to be when you grow up? Find out what three NASA scientists wanted to be when they were young and discover what they do now. Then, be a scientist yourself. Learn how to use the [Globe Observer app](#) to collect your own scientific observations.
- [NASA on National Parks from Space](#) — This collection of stories and images was compiled from NASA's Earth Observatory. The IGES team worked with Earth to Sky (a NASA-National Park Service partnership) and NASA's Landsat mission outreach to create this curated collection and identified strategies and supplemental resources for educators to use the stories with middle and high school students.
- [NASA Educator Toolkit: Framing Phenomena-Based Student Investigations](#) — NASA Earth science research, observations, visualization tools, and education resources are available for learners of all ages to connect learning to real world science, across topics - including: Earth systems, climate and weather, global climate change, and natural hazards.

## EXAMINE NATURAL SYSTEMS IN 'WINDOWS ON EARTH'

Science teachers and students can gaze through "Windows on Earth," an online educational project that features photographs taken by astronauts on the International Space Station. Each day, astronauts take hundreds of photos for science research, education, and public outreach.

This website provides free public access to virtually all of these photos, updated at least weekly. The site is operated by TERC, an educational non-profit, in collaboration with the Association of Space Explorers (the professional association of flown astronauts and cosmonauts), the Virtual High School, and CASIS (Center for Advancement of Science in Space). Technical support is provided by NASA's Crew Earth Observation Program.

Windows on Earth also operates software on the International Space Station, as a window-side aide to help astronauts identify priority targets for photography. The images help show Earth from a global perspective. All images are in the public domain, credited to NASA. Visit [online](#).



### 'SWITCH ON' TO LEARN ABOUT ENERGY SCIENCE TODAY

Switch Energy Alliance presents "Switch On," featuring Dr. Scott Tinker. The film is now available to stream online.

Across developing Africa, Asia, and Latin America, billions of people experience a lack of safe and reliable energy — impacting education, food supply, healthcare, and the economy.

Join Tinker on a global adventure to meet people and communities as they "switch on." The film offers a new perspective on energy and the developing world. To learn more and stream the film, visit [Switch On](#).

### GEOLOGY.COM OFFERS NEWS AND INFO ON EARTH SCIENCE

[Geology.com](#), an Earth Science Week partner, provides a variety of geoscience materials including daily Earth science news, maps, an online dictionary of Earth science terms, and information on geoscience careers.

Also on Geology.com are resources for teachers, including links to lesson plans from major Earth science organizations such as the U.S. Geological Survey, the Geological Society of America, and NASA. In addition, view the classroom activities and lesson plans available on the [teacher page](#).

<https://geology.com/teacher/>



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## Teaching Earth Science

### A Collection of Classroom Activities and Lesson Plans

Here is a list of teacher resources that can easily be modified and incorporated into the Earth science classroom.

## Parent/Teacher Resource Page 2

<https://apod.nasa.gov/apod/archivepix.html>



### Astronomy Picture of the Day Archive

| [Index](#) | [Search](#) | [Today's Picture](#) |

This archive list links to previous daily APOD pages from the current date through January 1, 2015.  
An archive of all existing APOD pages (current date through June 16, 1995) can be found here: [APOD Full Archive](#).

- 2021 June 07: [A Bright Nova in Cassiopeia](#)
- 2021 June 06: [A Distorted Sunrise Eclipse](#)
- 2021 June 05: [The Shining Clouds of Mars](#)
- 2021 June 04: [Blood Monster Moon](#)
- 2021 June 03: [Millions of Stars in Omega Centauri](#)
- 2021 June 02: [The Galactic Center in Stars, Gas, and Magnetism](#)
- 2021 June 01: [Satellites over Orion](#)
- 2021 May 31: [Mimas: Small Moon with a Big Crater](#)
- 2021 May 30: [Aurora over Clouds](#)
- 2021 May 29: [Lunar Dust and Duct Tape](#)
- 2021 May 28: [Total Lunar Eclipse from Sydney](#)
- 2021 May 27: [Mid-Eclipse and Milky Way](#)
- 2021 May 26: [The Outburst Clouds of Star AG Car](#)
- 2021 May 25: [The Moon During a Total Lunar Eclipse](#)
- 2021 May 24: [Lightning Eclipse from the Planet of the Goats](#)
- 2021 May 23: [The Galaxy Tree](#)
- 2021 May 22: [Markarian's Chain](#)
- 2021 May 21: [Utopia on Mars](#)
- 2021 May 20: [M13: The Great Globular Cluster in Hercules](#)
- 2021 May 19: [The Jellyfish and Mars](#)
- 2021 May 18: [Jets from the Necklace Nebula](#)
- 2021 May 17: [NGC 4565: Galaxy on Edge](#)
- 2021 May 16: [NGC 602 and Beyond](#)
- 2021 May 15: [The Southern Cliff in the Lagoon](#)
- 2021 May 14: [M104: The Sombrero Galaxy](#)
- 2021 May 13: [The Comet, the Whale, and the Hockey Stick](#)
- 2021 May 12: [A Meteor and the Gegenschein](#)
- 2021 May 11: [Lightning and Orion Beyond Uluru](#)
- 2021 May 10: [Star Clusters M35 and NGC 2158](#)



Jets from the Necklace Nebula

Image Credit: [ESA](#), [Hubble](#), [NASA](#); Processing: [K. Noll](#)





## Pinal Geology & Mineral Museum

### Pinal Museum and Club News

351 N. Arizona Blvd., Coolidge, AZ

Pinal Gem and Mineral Club meeting

**September 2021**

[www.pinalgeologymuseum.org](http://www.pinalgeologymuseum.org)

Ray Grant [raycyn@cox.net](mailto: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.

The Coolidge department of Parks and Recreation is holding summer day camp in the rooms across from the Museum. They get up to 125 kids a day divided into 4 groups, two with 5 to 8 year olds and two with 9 to 12 year olds. We did a presentation on “What is a Fossil?” to each group on June 22 using the fossils shown so they could be passed around the room. Each kid also got a collection of four small fossils to take home. A few potential geologists here! We will also have a tour through the Museum for the kids.



What is a Fossil? Presentation by Ray Grant for kids at summer day camp in Coolidge (Photo by Coolidge Parks and Recreation)



Fossils passed around for kids to hold.

**ALL ARIZONA CLUB MEETINGS MAY BE CANCELED  
DUE TO HEALTH CONCERNS!**



### Apache Junction Rock & Gem Club

Meetings are on the 2<sup>nd</sup> Thursday  
Next Meeting: September 9, 2021, 6:30 pm

[www.ajrockclub.com](http://www.ajrockclub.com)

@ Club Lapidary Shop

2151 W. Superstition Blvd., Apache Jct.



### Pinal Gem & Mineral Society

Meetings are on the 3<sup>rd</sup> Wednesday  
Next Meeting: September 15, 2021, 7:00 pm

[www.pinalgemandmineralsociety.org](http://www.pinalgemandmineralsociety.org)

@ Artisan Village

351 N. Arizona Blvd., Coolidge



### Daisy Mountain Rock & Mineral Club

Meetings are on the 1<sup>st</sup> Tuesday  
(unless a Holiday then 2<sup>nd</sup> Tuesday)

Next Meeting: September 7, 2021, 6:30 p.m.

**Please go to their website for more info**

[www.dmrmc.com](http://www.dmrmc.com)

@ Anthem Civic Building

3701 W. Anthem Way, Anthem, AZ



### West Valley Rock & Mineral Club

Meetings are on the 2<sup>nd</sup> Tuesday

Next Meeting: July 8, 2021, 6:30 pm

**Zoom meeting**

[www.westvalleyrockandmineralclub.com](http://www.westvalleyrockandmineralclub.com)

@ Buckeye Women's Club

845 E. Monroe Ave., Buckeye, AZ



### Maricopa Lapidary Society, Inc

Meetings are on the 1<sup>st</sup> Monday  
(unless a Holiday then 2<sup>nd</sup> Monday)

Next Meeting: August 2, 2021, 7:00 pm

[www.maricopalapidarysociety.com](http://www.maricopalapidarysociety.com)

@ North Mountain Visitor Center

12950 N. 7<sup>th</sup> St., Phoenix



### White Mountain Gem & Mineral Club

Meetings are on the 1<sup>st</sup> Sunday  
(unless a Holiday then 2<sup>nd</sup> Sunday)

Next Meeting: TBA 2021, 1:00 pm

[www.whitemountain-azrockclub.org](http://www.whitemountain-azrockclub.org)

@ VFW Hall

381 N. Central, Show Low



### Mineralogical Society of Arizona

Meetings are on the 2<sup>nd</sup> Thursday  
(September meeting on the 3<sup>rd</sup> Thursday)

Next Meeting: September 15, 2021, 7:30 pm

[www.msaaaz.org](http://www.msaaaz.org)

Franciscan Renewal Center

5802 E. Lincoln Dr., Scottsdale



### Wickenburg Gem & Mineral Society

Meetings are on the 2<sup>nd</sup> Friday  
(February & December on the 1<sup>st</sup> Friday)

Next Meeting: October 9, 2021, 7:00 pm

[www.wickenburggms.org](http://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. 7<sup>th</sup> 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! 😊😊😊

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**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](http://www.flaggmineralfoundation.org)
- Friends of the AZ Mining & Mineral Museum
- Maricopa Lapidary Society  
<http://maricopalapidarysociety.com/>
- Mineralogical Society of AZ  
[www.msaz.org](http://www.msaz.org)
- Payson Rimstones Rock Club
- Sossaman Middle School
- White Mountain Gem & Mineral Club  
[www.whitemountain-azrockclub.org](http://www.whitemountain-azrockclub.org)
- Wickenburg Gem & Mineral Society  
<http://www.wickenburggms.org>  
[www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438](https://www.facebook.com/pages/Wickenburg-Gem-and-Mineral-Society/111216602326438)
- Staples Foundation  
[www.staplesfoundation.org](http://www.staplesfoundation.org)
- Anita Aiston
- Peter & Judy Ambelang
- Stan & Susan Celestian
- Russ Hart
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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

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*We're on the Web!*

*Visit us at:*

[www.earthsciencemuseum.org](http://www.earthsciencemuseum.org)

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**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](http://www.earthsciencemuseum.org).

**NOTICE:**

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

**THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!**

**EARTH SCIENCE MUSEUM  
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**Earth Science Museum**

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