EARTHQUAKE

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

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ESM YEAR IN REVIEW 2013-2014

By Harvey Jong, ESM President

The ESM held its Annual Meeting in May where we reviewed the key accomplishments for the past year along with electing the Board of Trustees. I would like to provide a brief summary of this review for members who were unable to attend the meeting.

The ESM continued to enhance and expand its successful educational outreach program. Our outreach efforts are on track to double the number of schools served over last year. A few of the new school visits were located in more outlying areas, such as Queen Creek.

The increase in outreach requests reflects the ESM's participation at the Arizona Science Teachers Association Conference and the EarthFest Educators Night. Our booth was well-received as teachers were excited to learn about our free, hands-on programs on rocks, fossils, and minerals.

To expand our outreach offerings, the ESM created a prototype for the properties of minerals kit and has piloted the new instructional materials in a few classrooms. The response has been very positive, and we anticipate that this program for middle and high school grade levels will be in high demand.

The museum participated in the initial Arizona Earth Science Outreach Consortium meeting that was held before the Minerals of Arizona Symposium. This meeting was facilitated by the Arizona Geological Survey and brought together various organizations that are involved with educational outreach. The groups included ASU's School of Earth and Space Exploration, EarthScope, Mesa Community College, Arizona Sonora Desert Museum, Arizona Historical Society, and the Tucson Gem and Mineral Society (TGMS). Immediate outcomes from this meeting involved the ESM sharing rocks and minerals with the Tucson groups and a decision by the TGMS to use the ESM kits.

To support the museum's efforts, the ESM maintained a good financial and mineral base. We received a second grant from the Staples Foundation's "2 Million & Change" program. Funds were used for developing new outreach kits and a traveling fluorescent mineral display. Contributions from clubs and individuals helped support general museum activities, while some donations were targeted for delivering outreach programs beyond the Phoenix Metro area or for our new building fund.

Rock and mineral samples are always in demand and represent a key resource. Donations included more materials from Russ Hart and the Archbold Economic Geology Collection from the Flagg Mineral Foundation. The Archbold Economic Geology Collection was packed in 35 beer bottle boxes, and several work days were required to unwrap and inventory the various samples that were used to teach the geology of ore deposits.

The ESM worked on building its community presence and engagement. The museum organized and was a co-sponsor of the first Earth Science Day with Mesa Community College. Although publicity was somewhat limited, the inaugural event was well attended, and plans are under way for a second Earth Science Day on October 18.

The museum debuted the first solar-powered fluorescent mineral display at the Flagg Gem and Mineral Show. Over 600 visitors enjoyed the colorful, glowing assortment of minerals. The fluorescent theme was extended to the ESM table at the Minerals of Arizona Symposium which featured the "Coals of Fire" - a calcite specimen from Arthur Flagg's collection.

The efforts of the ESM haven't gone unnoticed by the media. *Cronkite News* produced a story about our outreach program and highlighted a classroom visit to Queen Creek's Desert Mountain Elementary School. (Click to read the article and view a video...)

The past year has been an eventful one. It was made possible by your continuing interest and support. Thank you!!

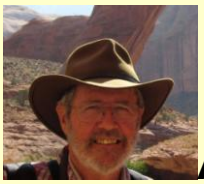
Terry Dyer of ESM Outreach, students & teachers of Foothills Elementary in Glendale, AZ in May (Lynne Dyer photo)

Terry Dyer, Shirley Cote, Doug Duffy & Mardy Zimmermann of ESM's Outreach with students at Foothills Elementary in Glendale, AZ in May (Lynne Dyer photo)

ESM booth at the 2014 Flagg Gem & Mineral Show
Doug Duffy and Dave Fanger staffed the ESM booth that featured the new solar-powered fluorescent mineral display. (H. Jong photo)

ESM booth at ASTA Conference in October

Harvey Jong & Mardy Zimmermann at Arizona Forward's EarthFest Educator's Night at the Phoenix Zoo in October.



Arizona Rocks 12

Text and photos by Ray Grant

This month we will start with Sedimentary rocks. A brief description will be given for each of the rock types, but the main goal is to talk about the rocks in Arizona. Again, you can go online to Stan Celestian's geology labs to learn more, pick sedimentary rocks lab at: http://www.asu.edu/courses/glg103/PDF%20labs/

Sedimentary rocks are formed from weathering products of other rocks. The rocks are weathered and broken down. The weathered products are then transported, deposited and turned into sedimentary rocks. There are two main types of sedimentary rocks, clastic or detrital and chemical. The clastic rocks are formed from pieces (clasts or detritus) formed during weathering. These include gravel, sand, silt, and clay. The chemical rocks generally form from material that has been dissolved in water and then precipitated out. There are also sedimentary rocks formed by biological action and from fossil material.

The first sedimentary rock to be covered is breccia, or perhaps better stated as sedimentary breccia as the term breccia is used for some explosive volcanic rocks (volcanic breccia) and for rocks broken up by faulting (fault breccia). Sedimentary breccia is a clastic rock, made up of angular pieces greater than 2mm in size. (Note: Geologists use the metric system for the size of clasts or pieces in the classification of sedimentary rocks. Two millimeters is about 1/12 of an inch and can be seen with the naked eye.) Most breccias have much larger pieces of rock as they are commonly formed as part of landslides or mud flows. If transport in a stream rounds the pieces, the rock is called conglomerate.

There are limited outcrops of breccia around Arizona as it is not a very common sedimentary rock. Examples can be found in Papago Park at Hole-In-The-Rock, Barnes Butte and other locations.

Breccia at Hole-In-The-Rock in Papago Park, these rocks are 20 to 25 million years old

Hole-In-The-Rock, notice the angular pieces of rock at the top.

Breccia in Box Canyon northeast of Florence, pieces of granite and metamorphic rock. Some pieces are slightly rounded indicating a short transport distance. This rock is older than 15 million years.

EXPLORE YOUR WORLD!

ARCHES NATIONAL PARK

Text & photos from Wikipedia and NPS.gov

World-famous Delicate Arch (NPS Photo by Tom Gray)
The base and pedestals are Slick Rock Member of the Entrada Sandstone. The upper part or bridge is the Moab Member of the Curtis Formation.

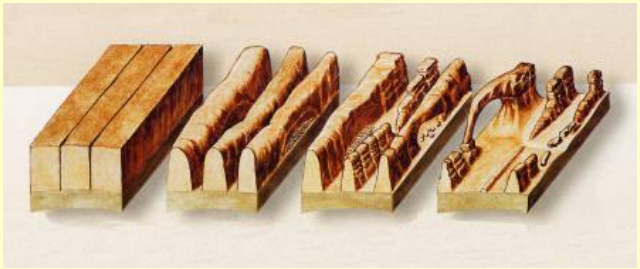
Arches National Park is located just north of Moab in east central Utah. The park is located in a "high desert," with elevations ranging from 4,085 to 5,653 feet above sea level.

Arches National Park has the densest concentration of natural stone arches in the world. There are over 2,000 documented arches in the park, ranging from sliver-thin cracks to spans greater than 300 feet. The sandstone from which these arches were formed was deposited during the Jurassic 208 to 144 million years ago.

The national park lies atop an underground evaporite layer or salt bed, which is the main cause of the formation of the arches, spires, balanced rocks, sandstone fins, and eroded monoliths in the area. This salt bed is thousands of feet thick in places, and was deposited in the Paradox Basin of the Colorado Plateau some 300 million years ago when a sea flowed into the region and eventually evaporated. Over millions of years, the salt bed was covered with debris eroded from the Uncompahgre Uplift to the northeast. During the Early Jurassic (about 210 Ma) desert conditions prevailed in the region and the vast Navajo Sandstone was deposited. An additional sequence of stream laid and windblown sediments, the Entrada Sandstone (about 140 Ma), was deposited on top of the Navajo. Over 5000 feet of younger sediments were deposited and have been mostly eroded away. Remnants of the cover exist in the area including exposures of the Cretaceous Mancos Shale (95 to 80 Ma). The arches of the area are developed mostly within the Entrada formation.

The weight of this cover caused the salt bed below it to liquefy and thrust up layers of rock into salt domes. The evaporites of the area formed unusual salt anticlines or linear regions of uplift. Faulting occurred and whole sections of rock subsided into the areas between the domes. In some places, they turned almost on edge. The result of one such 2,500-foot displacement, the Moab Fault, is seen from the visitor center.

As this subsurface movement of salt shaped the landscape, erosion removed the younger rock layers from the surface. Except for isolated remnants, the major formations visible in the park today are the salmon-colored Entrada Sandstone, in which most of the arches form, and the buff-colored Navajo Sandstone. These are visible in layer cake fashion throughout most of the park. Over time, water seeped into the surface cracks, joints, and folds of these layers. Ice formed in the fissures, expanding and putting pressure on surrounding rock, breaking off bits and pieces. Winds later cleaned out the loose particles. A series of free-standing fins remained. Wind and water attacked these fins until, in some, the cementing material gave way and chunks of rock tumbled out. Many damaged fins collapsed. Others, with the right degree of hardness and balance, survived despite their missing sections. These became the famous arches.



Stages of arch formation: Rainwater dissolves sandstone, widening cracks to form fins. An alcove eroded in the base of a fin might grow to form an arch before finally collapsing. (NPS photo)

ESM's Upcoming Meeting

The Earth Science Museum's next scheduled Board meeting on June 11th, 2014, at the Burton Barr Library, located near Central Ave. and McDowel in Phoenix at 6:30 p.m. in Rm. B. Everyone is welcome to attend.

BECOME A MEMBER!
Join the Earth Science Museum's

MANY THANKS TO OUR MAJOR DONORS!

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www.azleaverite.org

Flagg Mineral Foundation
www.flaggmineralfoundation.org

Friends of the AZ Mining & Mineral Museum

Maricopa Lapidary Society

Mineralogical Society of AZ
www.mineralogicalsocietyarizona.org

White Mountain Gem & Mineral Club
www.whitemountain-azrockclub.org

Wickenburg Gem & Mineral Society
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Staples Foundation
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Stan & Susan Celestian
Russ Hart
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Dennis & Georgia Zeutenhorst

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ESM Earth Science Investigation Team Membership Form

_____ New Member _____ Renewal

Membership levels:

_____ **ESI Family $20**

_____ **ESI Individual $10**

_____ **ESI Student (16 & under) $5**

Membership benefits:

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

_ _ _ _ _ _ _ _ cut here _ _ _ _ _ _ _ _ _

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We're on the Web!

Visit us on *and at:*
www.earthsciencemuseum.org

Mission
Establish an innovative, world-class destination museum in the Phoenix area dedicated to inspiring all generations about earth sciences.

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.

Please join us at the next ESM Board meeting Wednesday, June 11, 2014, at the Burton Barr Library in Phoenix at 6:30 p.m. Rm. B.

THANK YOU FOR YOUR CONTINUING INTEREST & SUPPORT!!!

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