THE NORTHERN VIRGINIA MINERAL CLUB INC

The Mineral Newsletter

Meeting: April 27 Time: 7:45–9:00 p.m.

Long Branch Nature Center, 625 S. Carlin Springs Rd., Arlington, VA 22204

Volume 56, No. 4
April 2015

You can explore our club website:
http://www.novamineralclub.org/

Happy Easter!

Northern Virginia Mineral Club members,

Please join our speaker Mike Wise for dinner at the Olive Garden on April 27 at 6 p.m.

Olive Garden, Baileys Cross Roads (across from Skyline Towers), 3548 South Jefferson St. (intersecting Leesburg Pike), Falls Church, VA
Phone: (703) 671-7507

Reservations are under Kathy Hrechka, Vice-President, NVMC. Please RSVP to my cell at 703-407-5393 or kshrechka@msn.com.

Dr. Michael Wise, Smithsonian

Granitic Pegmatites: Patterns of Distribution—A Global Perspective

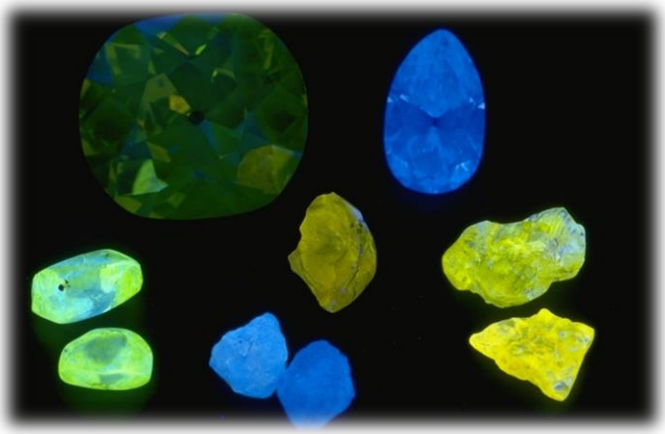
April 27 Program

Dr. Michael Wise has agreed to join us again for another sterling presentation on pegmatites! Mike is a geologist in the Department of Mineral Sciences at the Smithsonian Institution's National Museum of Natural History. He has been studying pegmatites all over the world for the past 30 years.

Mike's research focuses on the chemistry of rare minerals to understand how pegmatites form and evolve. These same rare minerals can also be used to help locate potential new deposits of economic significance. Mike's research has included studies of pegmatites in

Diamond

April birthstone



Cut and uncut diamonds from the Smithsonian National Gem Collection flouresing under ultraviolet light. Photo: Chip Clark.
http://geogallery.si.edu/index.php/en/1107810/diamond

Pegmatitic granite. Note the relatively large crystals. Source: Wikipedia.

the New England states, California, Colorado, Nevada, North Carolina, and Virginia. He has also visited sites with pegmatites in Brazil, Canada, the Czech Republic, Italy, Madagascar, and Namibia.

Mike is heavily involved in managing the Smithsonian's Gem and Mineral Collections. He is also very active in the museum's education and outreach.

The Prez Sez

by Wayne Sukow

BALANCE is important; refer back to the January 2015 The Prez Sez …

How would you like to be president of the Eastern Federation of Mineral and Lapidary Societies (EFMLS), become president of the federation in November, and 4 months later attend and lead the last meeting of the federation during your term in office? Talk about rapid acclimation and what your departing legacy was! No thanks!

But that describes what Merrill Dickinson, the 2015 EFMLS president, had to do.

Merrill Dickinson, President of the EFMLS.

As I said in my March 2015 The Prez Sez comments, "BALANCE is important." The EFMLS directors, who are current local club presidents and vote at the annual federation meeting, worked with other delegates to make the meeting on March 28–29 a success.

Part of the challenge was dealing with a contentious issue: whether EFMLS presidents and vice-presidents should be allowed to serve for 2 consecutive years. Arguments were made, both pro and con. But when the motion was called, it failed.

Success should be balanced against the time it takes to achieve it. During the lengthier reports that droned on and on, I found myself wondering and thinking about an organization known by the acronym NESTA (National Earth Science Teachers Association). Hmm, I thought. What do NVMC, EFMLS, and the American Federation of Mineralogical Societies do for Earth science teachers? Hmmm.

In this issue …

Deadline for Submissions

May 1

We need to send out our newsletter on time, so please make your submission by the 1st of the month! Late submissions might go into a later newsletter.

Other business, such as passing a budget and hearing committee reports, went smoothly. The federation's finances are healthy.

Committee reports had no surprises, although a recurring item was the plea for broader volunteer participation by clubs and club members throughout the federation. For a club to be successful, balance is needed between older leaders with procedural knowledge about getting the job done and newer leaders with a desire to contribute to the club's health. Think about the volunteers for 2016 who will step forward to be local club officers—including at NVMC! ☺

My 800-mile round trip drive from Fairfax, VA, to Hickory, NC, was made tolerable by light traffic on I–81. I always enjoy looking into forests in the spring, when there are no leaves and bushy undergrowth to prevent you from really seeing the trees. Such a collection of straight lines of varying widths, heights, and shades of gray and black is a visual treat. Add a mix of rain, sleet, and large rags of snow—which drivers experienced at Fancy Gap, NC, just before heading down the long 7- to 8-mile grade as

you leave the mountains—and the grays and blacks became more intense and lustrous, with thick coats of pristine white snow. It's inspiring!

Seeing nothing but blue sky on the return drive was quite a contrast. I couldn't help but think that balance is nice!

For you newer NVMC members, the annual federation meetings, including the EFMLS's, are hosted or cohosted by local clubs and invariably include a gem and mineral show. At Hickory, NC, the Catawba Valley Gem and Mineral Club hosted both the meeting and the show.

The star of the show was a large glass case filled with superb jewelry that featured the beautiful emerald-green hiddenite faceted gems from Hiddenite, NC. There was no field trip scheduled for that particular locale, although there was one for North Carolina amethyst.

Members of eastern clubs had set up both competitive and noncompetitive exhibits. They drew a good crowd, as usual. Barb Sky, an NVMC member who now lives in Missouri, asked me to help judge a case of lustrous crystals, mostly different metallic oxides. It's always enjoyable to polish the judging skill, which I learned by taking the judging class at the EFMLS Wildacres workshops for 5 or 6 years.

At least seven NVMC members were at the meeting and show, most representing other local clubs in our area. Those "old friends" are always balanced by the "new friends" you meet from clubs as far away as

Mary Bateman, BEAC coordinator.

Florida and Maine. You're seldom alone at a gem and mineral club show or meeting!

Speaking of the gem and mineral show—for me, it really had the feel of a jewelers' trade show. One jewelry dealer had all the tables on one side of the large Merchandise Mart Building in town, where the show and exhibits were housed. I hope the photos show what I mean.

Before driving back to Fairfax on Sunday morning, I attended one final revered part of the federation meeting: the traditional breakfast for the Bulletin Editors' Awards Ceremony (BEAC). The awards are for excellence of gem and mineral articles in local EFMLS newsletters and for the newsletters themselves.

See some of the photos I took. It's a very festive breakfast with numerous awards. I had the pleasure and honor of accepting all awards to members of the NVMC, and I will distribute these at our April meeting. Come and enjoy the recognition and honors being given to your NVMC friends!

The drive back to Fairfax began immediately after the BEAC breakfast. The air was cool, the sky blue, the traffic on Sunday light, all the snow gone—adding up to a very pleasant drive.

THANK YOU to NVMC members for electing me as president of the club and thereby also making me a director at the 2015 EFMLS meeting! But let's balance that by sending some other club member in 2016!

Previous Meeting Minutes
March 23, 2015

by Dave MacLean, Secretary

President Wayne Sukow called the meeting to order at 7:50 p.m.

The minutes of the December 2014 meeting were approved as published in the January 2015 newsletter. (Due to inclement weather, the club canceled meetings in January and February 2015, so the latest minutes were from December.)

The business meeting was deliberately cut short because nothing was pressing. We wanted to get straight to the fun!

Guests were Kent, Kendra, and Karin Anderson; Heather Fischer; Ken Reynold; and Beverly Sanders. Welcome, folks ! We're wide open to new members!

Then the fun began—our spring auction of minerals, with enthusiastic bidding and lots of laughter, much of it generated by our wonderful auctioneers!

Fifteen percent of the proceeds from our club auctions go toward the Fred C. Schaefermeyer Scholarship Fund, designed to give grants to budding scholars in fields related to our hobby.

I don't know whether everyone will agree, but the most noteworthy item on sale that night was an 8-pound antique sledge hammer put up there by George Reimherr.

Thanks, George!

Items at the spring club auction.

The NVMC spring auction

Thanks to Sue Marcus for some great photos!

GeoWord of the Day

(from the American Geoscience Institute)

intergrowth

Interlocking of grains of two different minerals as a result of their simultaneous crystallization.

(from the *Glossary of Geology*, 5th edition, revised)

2015 Nominations
Fred C. Schaefermeyer Scholarship Fund

Each year, the Northern Virginia Mineral Club presents promising students in fields related to our hobby with $250 scholarships to help further their studies. Professors in fields related to geology typically nominate the candidates.

This year, we have two nominations to consider.

From Dr. Lance Kearns at James Madison University in Harrisonburg, VA:

"I have a perfect student for the scholarship. His name is Tyler Hanson and he is one of the most personable young men you would ever want to meet. He is going to Rochester with Cindy and me this year. He is willing to write an article for you about his experience of Niagara Falls and the Rochester Mineral Symposium. Tyler hopes to be a teacher of geology in the future. He will definitely succeed!"

From Dr. Shelly Jaye at the Annandale Campus of Northern Virginia Community College:

"I have conferred with both Ken Rasmussen and Callan Bentley and we have chosen Joshua Benton. All three of us have had Josh as a student in one of our classes. He took my honors Mineralogy class last fall and scored a very high A. He is involved with Callan's Gigapan program too. He is volunteering at the USGS. Josh is supporting himself throughout his education, so I know that the scholarship would be very helpful. Josh is planning on transferring to James Madison University or George Mason University to complete his geology degree.

Thanks so much for giving this wonderful opportunity to one of our students!"

Field Trip Coming Up!
National Limestone Quarry, April 25

by Ted Carver, Field Trip Coordinator

If you're an NVMC member in good standing, please join other club members on April 25 at the National Limestone Quarry in Middleburg, PA, to collect minerals and even fossils!

We will meet at 9 a.m. with mine owner Eric Stahl for a safety briefing at the Pleasant Mills mine office (on Quarry Road, Middleburg, PA 17842). Collecting will continue until early afternoon.

Directions from U.S. Route 15 as you approach Harrisburg, PA, from the south:

- At the Pennsylvania Turnpike intersection, head northeast on U.S. 15 — 5.3 mi
- Continue onto Camp Hill Bypass (signs for U.S. 11 N/U.S. 15 N/I-81/Marysville) — 0.6 mi
- Continue onto Walnut St. — 0.7 mi
- Turn left at N Front St. — 1.3 mi
- Continue onto U.S. 11 N/U.S. 15 N/S Enola Rd.
- Continue to follow U.S. 11 N/U.S. 15 N — 32.9 mi
- Turn left at PA 104 N — 8.5 mi
- Turn left onto PA 35 S — 0.4 mi
- Turn right onto Mill Race Rd. — 0.6 mi
- Slight left onto Quarry Rd. — 0.1 mi

The quarry is perhaps best known for its strontianite and wavellite. There are also fossils and large quantities of calcite.

Kids under the age of 18 must be accompanied by an adult. Dogs must be leashed.

Required: steel-toed boots, safety helmet, safety goggles, and heavy work gloves

Recommended: rock chisels, small sledge hammers, large sledge hammers, geologist picks, heavy plastic containers (for large specimens), egg cartons (for small specimens), first aid kit, snacks, water, and plastic sheeting (to protect the interior of your car)

SPECIAL NOTE: Our host, Eric Stahl, would enjoy it very much if you could bring along samples of stone as gifts for his grandchildren. He is particularly interested in tumbled or otherwise polished stone. FOSSILS TOO!

If the weather is poor, the event could be canceled. If in doubt or if you have any questions, please contact me at jtcarve@msn.com, 571-344-4958 (c), or 703-754-2050 (h).

Finally, signing a waiver will be required.

Membership Building and Retention through Your Bulletin (Part 1)

by Mark Nelson, BEAC Chair

Editor's note: The article is adapted from A.F.M.S. Newsletter *(December 2014/January 2015), p. 6.* The Mineral Newsletter *is* ***your newsletter****, and these are some great tips from an experienced editor! Does your newsletter reflect all of these suggestions? Are you willing to help out, perhaps by becoming a Sunshine Chair? Do you have other ideas for improvements? If so, please bring them to a club meeting or mention them to our President—or send them to me at hutchbrown41@gmail.com.*

One of the best tools a club has to attract new members and to motivate current members is its bulletin! The days of plain black-and-white publications are as over as the days of black-and-white television with only four stations. Today, we have Internet, Netflix, smartphones, Kindle, and 3D movies. We need to rise to the challenge!

Take *Rock & Gem Magazine*, for example—what attracts you? Certainly the first thing is the amazing cover photo! Today's readers are attracted to layout, color, and photos. Do you want to spice up your bulletin? Look to publications like *Rock & Gem Magazine* as a guide.

Here are this month's suggestions for a more interesting bulletin:

- On the cover, put a large color photo that makes an impression! A mineral? That's what many of us are looking for!
- Add a lead-in on the cover that makes the reader want to open it and read more about the cover photo inside.
- Keep the President's message short, upbeat, and to the point.
- Keep previous meeting minutes short, no more than a few sentences or bullets. If folks were there, they already heard it; if not, they probably don't care for a rehash (it's ancient history).
- Include the boilerplate stuff—time and location of meetings, mission statement, etc.—but keep it small and in a reference area.
- Include a "Sunshine" section where you report on who retired, won a contest, got a promotion, or is on the mend from an illness. Members like to know that we care! Make your Sunshine Chair an important part of your club!
- Congratulate new members by name, town of residence, and what they like to do in the hobby!
- Have a 5-minute Rock of the Month talk at your meetings and preview it in the bulletin. Use the member's photo, if possible.
- People are not attracted to the term "general meeting" (boring). Change the name of your general meeting to "program" (or some such) and highlight the interesting speaker or video for that meeting!
- Keep to a time limit at meetings to get people home on time. Start and end promptly.

If your regional federation has an experienced bulletin editor serving as its Bulletin Editors Advisory Chairman, take advantage! They can help improve your bulletin. Send him or her your bulletin and ask for a critique! You can also send it through me at mnelsonair@aol.com.

Sample Mineral of the Month: Crocoite

(adapted from The Rostrum *20(4), pp. 4–5)*

Crocoite (lead chromate, $PbCrO_4$) occurs in weathered zones of lead deposits in the presence of chromium-bearing rocks. Because lead and chromium tend to occur in different geological settings, crocoite is rare. By far the most important locality for crocoite is Dundas, Tasmania.

Mineral Collecting from the Ancients to the Renaissance

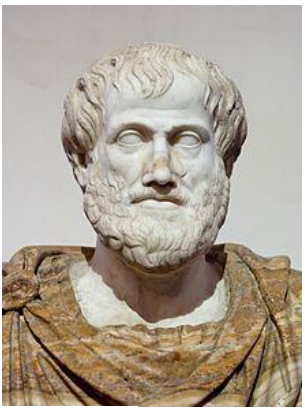
by Andy B. Celmer, EFMLS Historian

Editor's note: The article is adapted from EFMLS News *(January 2015), pp. 13–14.*

Let's chat about mineral collecting and where it all began.

The Ancients

Mineral collecting for medicinal and mystical purposes is recorded on clay tablets about 2100 BCE (before the common era). Ancient texts speak of treasures and items of wonder belonging to the rulers of the world. All those early collections have been lost in the sands of time.



Aristotle

We can credit lack of progress to Aristotle (384–322 BCE), who liked to figure things out using pure thought. A natural philosopher at the time saw no need for collecting plants, animals, or minerals, instead divining answers through pure intellect.

But what about Pliny the Elder? Pliny, who lived from 23 to 79 CE (common era), wrote an encyclopedic volume containing much of the knowledge of his time, including numerous inventions and natural processes. Nevertheless, in the area of natural philosophy, Aristotle continued to hold sway. Not much changed until the Renaissance, which lasted from the 14th to the 17th century.

Beginning in the 1300s, people of means wanted to study and understand nature. Collections of the natural world begin to bloom and detailed examinations slowly led to classification systems. What follows is a thumbnail version of some of the mineral collectors of the 16th century, during the Scientific Revolution.

Agricola

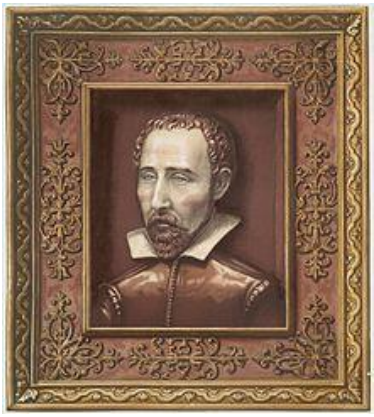
The German Georgius Agricola (1494–1555), born Georg Pawer (or *Bauer*, meaning farmer), latinized his name. Trained as a physician, he began his mineral collection for medical reasons. He served as city physician in St. Joachimsthal and later moved to Chemnitz, both German silver mining towns, adding to his collection. He also traveled and corresponded widely, acquiring new specimens.

Agricola

In 1546, Agricola published *The Nature of Minerals*, which classified minerals by physical properties such as density, color, luster, transparency, taste, odor, and shape. Agricola's work provided a systematic approach to mineral collecting. However, our current system of mineral classification is based on chemistry (sulfates, silicates, etc.), still relatively unknown at the time.

Palissy

The Frenchman Bernard Palissy (1510–90), a self-taught potter, started collecting minerals used in ceramics and glazes. To save money, Palissy self-collected, and his observational skills served him well, teaching him about geology and mineral formation. As a Protestant who believed in examining the Scriptures and coming to his own conclusions, Palissy approached the world with a critical eye oriented toward personal observation and deduction.



Palissy (self-portrait)

He moved to Paris and gave lectures using specimens from his personal museum, the first collection in Paris to be used for scholarly instruction. Many museums began from such personal collections, including the Smithsonian Institution. People who donated their collections to an institution include Conrad Gessner (1516–65), to the Natural History Museum in Basle; Francesco Calzolari (1522–1609), to the Miniscalchi Foundation in Verona; and Ulisse Aldrovandi (1522–1605), to the city of Bologna.

Agricola, Palissy, and others left behind systematic classifications of minerals based on physical properties, with samples for examination and testing. No longer would the natural world be explored by sheer conjecture. As scientists learned to collect, examine, and test rocks and minerals to plumb their secrets, the world turned away from Aristotle for good.

Wildacres Classes

by Hutch Brown, Editor

The *EFMLS News* February issue shows the Wildacres classes only for August, whereas the March issue shows both the May and the August offerings. You can find the classes for the August 24–30 session in the last issue of our club's newsletter and the ones for the May 18–24 session summarized below. Or you can look in the March issue of *EFMLS News* for full course descriptions, along with registration materials, at http://www.amfed.org/efmls/efmarch15web.pdf.

Coming to Wildacres in May 2015 …

Beadings and Findings (*Mia Schulman*): Learn to make a knotted bead necklace and use "findings" such as jump rings/clasps. If time permits, make a bracelet and/or earrings to match. 2-day class, 1st semester.

Knitted Wire/Bead Bracelet (*Mia Schulman*): Don't worry, you don't have to know how to knit. These bracelets are stunning and people are always surprised when told they are knitted. No experience needed. 2-day class, 2nd semester.

Cabochons, Basic (*Bernie Emery*): Turn a rock into a shiny, well-formed cabochon. Learn the trim saw as well as grinding, sanding, and polishing. Slabs are provided or bring your own with approval of instructor. Bring apron and safety glasses. No experience needed. 2-day class, 1st semester.

Cabochons, Intermediate (*Bernie Emery*): Learn techniques needed to cut different shapes. Slabs are provided or bring your own with approval of instructor. Bring apron and safety glasses. Prerequisite: Prior experience with cabbing and trim saw. 2-day class, 2nd semester.

Chainmaille, Basic (*Roger Campbell)*: Learn chainmaille using non-soldered copper jumprings, using different weaves on class projects. All tools provided; an optivisor or other magnifier helpful. No experience needed. 2-day class, 1st semester.

Chainmaille, Continued (*Roger Campbell)*: Review chainmaille and learn additional weaves. All tools provided; an optivisor or other magnifier is helpful. Prerequisite: Basic chainmaille. 2-day class, 2nd semester.

Faceting (*Larry Heath*): Learn to cut/polish a 57-facet round brilliant gemstone, identify well-cut stones, select rough material, and more. Bring a #7 or #9 optivisor and an apron. No experience needed. 4-day class.

Fused Glass, Advanced (*Becky Edmundson)*: Use a wet saw to cut shapes, a grinder to smooth glass, and a jewler's bit to cut a channel in the piece before fire-polishing it in a kiln. You will make at least two pieces of jewelry. Bring safety glasses and, if you can, a glass cutter and breaking pliers. No experience needed. 2-day class, 1st semester.

Fused Glass, Basic (*Becky Edmundson)*: Cut and layer glass and fire it in a kiln to make at least two pieces of jewelry. Bring safety glasses and, if you can, a glass cutter and breaking pliers. No experience needed. 2-day class, 2nd semester.

Photographing Small Mineral Specimens (*Bruce Gaber*): Set up, light, and photograph small mineral specimens to show off their beauty. No experience needed. 2-day class, 1st semester.

Modern Macrophotography (*Bruce Gaber*): Learn lens selection,lighting adjustment, choice of appropriate subjects, and digital techniques such as focus stacking and high dynamic range imaging. No experience needed. 2-day class, 2nd semester.

Basics of Scrimshaw (*Sandra Brady*): Using a hand scribe, learn attractive shading techniques on natural and man-made materials. Learn basic composition and tool sharpening as well as transfer methods. An optivisor or other magnification is recommended. No experience needed. 2-day course, 1st semester.

Scrimshaw, Color Basics (*Sandra Brady*): Working on natural and man-made materials, explore the beauty of color using modern scrimshaw methods. Bring an optivisor. Prerequisite: Basics of Scrimshaw. 2-day course, 2nd semester.

Silversmithing, Basic (*Richard Meszler*): Work silver sheet and wire to fabricate jewelry. Learn annealing and bending/shaping/texturing metals as well as soldering, piercing, and polishing. No experience needed. 2-day class, 1st semester.

Silversmithing, Intermediate (*Richard Meszler*): Make a bezel and bail, then set a cabochon to make a pendant. Basic silversmithing experience required, including soldering. 2-day class, 2nd semester only.

Wirewrapped Jewelry, Basic (*Jacolyn Campbell)*: Create your own jewelry! All tools and materials provided. #1: Beginners will make an adjustable ring, two bracelets, a pendant, and two pairs of earrings. #2: Those with experience will make a fitted ring, two pairs of earrings, a cabochon pendant, and a bracelet. 2-day class, 2nd semester.

Geology Lego Set Proposed

by Liz Duffy

Editor's note: The piece is adapted from OPB News Blog *(March 10, 2015). Thanks to Sue Marcus for the link!* http://www.opb.org/news/blog/newsblog/albany-geologist-hopes-to-inspire-young-scientists-with-geology-lego-set/

In an effort to inspire young scientists, research geologist Circe Verba created a 213-piece "Research Geology" Lego set that's currently vying for support on Lego Ideas, a Lego-owned submission Website for design ideas.

Verba noticed a lack of STEM-based toys on the market. "I wanted to find a way to stimulate young minds," she said.

The proposal includes female and male geologists along with the "obligatory geology dog," which together can explore a crystal cave. There's also a lab with an electron microscope.

Verba has just over 300 days to campaign for 10,000 supporters. Once she has the supporters, Lego will consider manufacturing her geology set.

"Lego may have inadvertently assisted me toward a science career," said Verba, "because Lego taught me critical thinking skills, to create designs." ⛏

Jake and the Bear

Editor's note: The story is adapted from The Corunduminium *at http://www.corunduminium.com/humor.htm.*

Jake, an avowed atheist, had been collecting minerals at his favorite collecting spot all day. Thirsty, he decided to take a break.

He was walking upstream to the beer holding pond when he heard a rustling in the bushes. He turned around to see a hungry grizzly bear come out and start to chase him up the trail.

As the bear was about to catch him, Jake tripped and fell. He rolled onto his back to see the bear about to strike a fatal blow. Involuntarily, he cried, "Oh my god!"

At that instant, the stream ceased flowing, the wind stopped blowing through the trees, the birds froze in the azure sky—and the bear did not strike!

A voice boomed out from above: "YES? CAN I HELP YOU?"

Now, Jake might have been an atheist but he was still a quick thinker.

"Well, I don't imagine I could become a Christian after a lifetime of not believing … but maybe you could make the *bear* a Christian!"

"IT SHALL BE DONE!"

The stream resumed its flow, the wind began to stir again, and the birds resumed their flight. But the bear did not strike!

Instead, he reverently raised his head toward the skies and pressed his massive paws together.

"Dear Lord, please bless this food which I am about to receive …" ⛏

The Kaali Meteorite Catastrophe

by Bill Coordura

Editor's note: The piece is adapted from Goldrush Ledger *(newsletter of the Charlotte Gem and Mineral Club, Charlotte, NC), April 2009, p. 8. The author is a professor of geology at the University of Wisconsin–River Falls.*

Past asteroid or comet impacts have caused mass extinctions such as that of the dinosaurs 65 million years ago. Movies and articles depict future catastrophic effects from such impacts. But such events are hard to grasp, perhaps because we have no record of great human suffering caused by them, other than portrayals in the Bible, for example, or in the old Norse Ragnarok.

However, researchers in Estonia and Sweden turned up evidence of a meteorite causing havoc in an Estonian island community (Veski et. al. 2001). A large iron meteorite, perhaps weighing 1,000 tons, fell on the island of Saaremaa, off the coast of Estonia, between 800 and 400 BC. Little is known of the inhabitants, who left no written record.

Scientists found an impact crater 350 feet across, called the Kaali Crater. It now forms a shallow pond. At least 8 satellite craters surround the main one. The impact released energy equivilant to 20 kilotons of TNT. Fragments of meteoritic nickel-iron are associated with the crater, as are beads of glass formed by shock-melting of rocks upon impact. High iridium concentrations in the pond sediments are also evidence of meteorite impact.

Before the impact, Saarema had been densely inhabited for thousands of years. Many Bronze Age artifacts are found there, as are the remains of towns, fields, and fortresses. Cattle and crops formed the basis for the economy.

Pollen deposited in nearby fens and bogs allow a detailed recreation of the vegetation before, during, and after impact. Before the impact, a number of pollen grains from a variety of cultivated cereals were present, along with tree and herb pollen. At the time of impact, a unique deposit formed—a layer of glass spherules, meteorite fragments, rock dust, charcoal, and burned stumps.

Sediment deposited for the 100 years following the impact was quite different from what went before. No cereal pollen and little tree pollen were found, only an increase of dwarf shrubs. Eventually, pollen populations returned to their pre-impact character.

Interpretations of the data paint a stark picture. The people were hit suddenly with the force of a Hiroshima-size explosion. No living thing likely survived within a mile of the crater. Flash burning of vegetation would have occurred up to 2 miles away, setting the stage for still wider wildfires.

All structures up to 6 miles away would have collapsed. That the culture itself collapsed is indicated by the fact that there was no sign of crop cultivation for 100 years after the impact, although there are signs that survivors used the edge of the crater in a fortification soon after impact.

One wonders what the survivors must have thought happened and how they would have described it to others. What influences might this event have on stories and legends down to this day?

Source

Veski, S.; Heinsalu, A.; [et al.]. 2001. Ecological catastrophe in connection with the impact of the Kaali meteorite about 800–400 B.C. on the island of Saaremaa, Estonia. Meteoritics and Planetary Science 36: 1367–1376.

The Kaali Crater. Source: Wikipedia.

The Rocks Beneath Our Feet
Virginia's Mountain Lake

by Hutch Brown, Editor

Editor's note: The "Rocks Beneath Our Feet" series is for short pieces about the structural geology of our area. This one is a rare longer piece.

I once thought that Virginia had no natural lakes. I knew that most U.S. lakes were formed by glaciers and that glaciers never reached Virginia.

Yet Virginia does have two natural nonglacial lakes. One, Lake Drummond, is in Great Dismal Swamp on the Coastal Plain. The other, Mountain Lake, is in the Appalachian Mountains near Blacksburg, VA. The lakes have very different origins.

Rock Slide

Mountain Lake formed when a rock slide dammed a small creek, now called Pond Drain. Most lakes formed in this way are relatively small; Mountain Lake has a surface area of no more than 50 acres. (By comparison, the Burke Lake reservoir in northern Virginia has a surface area of 218 acres.)

Small natural lakes tend to disappear within a few hundred years (fig. 1). The outflow stream gradually cuts through the dam; meanwhile, sediments fill the lake, turning its basin into a boggy meadow. The area finally returns to a forested valley drained by a stream.

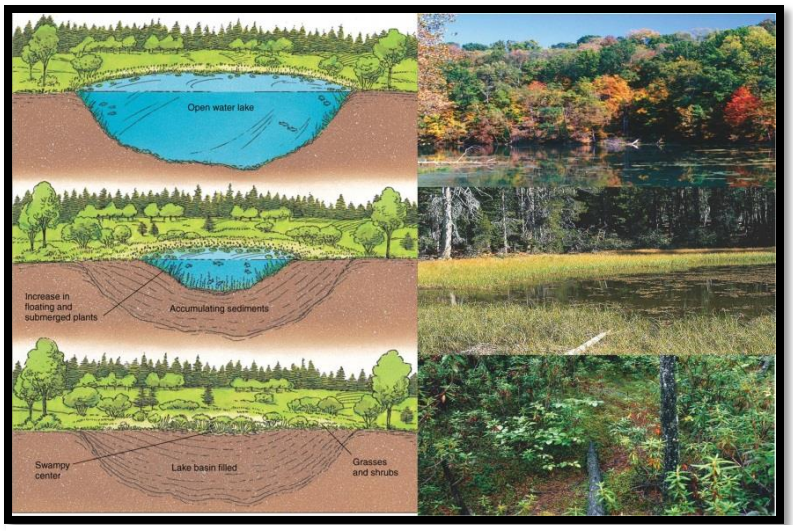


Figure 1—*Succession of a small lake from open water to forest. Mountain Lake in Virginia shows no similar signs of succession. Source: Allen (2013).*

Mountain Lake in southwestern Virginia, with the resort facilities where the movie Dirty Dancing *was filmed. Source: Bourne (2007).*

Mountain Lake is a remarkable exception. It is estimated to be more than 6,000 years old; and, although its water levels fluctuate, the lake shows no signs of succeeding to forest.

What caused the rock slide that formed Mountain Lake? And what keeps the lake in existence? The answers lie in the geology underlying Giles County, VA, where Mountain Lake is located.

Tectonic Processes

The rocks in the mid-Atlantic region are the product of two full Wilson Cycles—two cycles, over more than a billion years, of great oceans like the Atlantic closing and opening again. During that time, the proto-African continent collided repeatedly with proto-North America, as did island arcs.

Island arcs are island chains (like Japan or the Philippines) that form where one oceanic plate subducts under another. During the second Wilson cycle, the closing Iapetan Ocean—predecessor of the Atlantic—brought two island arcs into collision with proto-North America. Proto-Africa itself followed, slamming into the North American continental plate as the Iapetan Ocean completely closed.

Three separate orogenies (mountain-building events) resulted, interspersed with long periods of tectonic calm. The last orogeny, the Alleghanian, covered our entire area with a great mountain range up to 30,000 feet tall, as high as the Himalayas today. Each consecutive mountain range eroded away, leaving peneplains—flat and featureless plains drained by meandering rivers.

Two orogenies in particular formed and shaped the rocks underlying Mountain Lake: the Taconic and the Alleghanian, respectively caused by an island arc and by proto-Africa colliding with proto-North America.

Taconic Orogeny and Aftermath

About 450 million years ago, the so-called Taconic Terrane collided with proto-North America (fig. 2). A terrane is a land mass from a tectonic plate that grafts onto another plate after colliding with it. Today, the Taconic Terrane forms part of the metamorphic rock in our area's Piedmont Province.

Before the collision, vast shallow seas covered most of what is now the United States, including Virginia. As the Taconic Terrane struck the North American continental plate, it formed mountains along much of the continental margin (fig. 3). The oceanic subduction zone caused the island arc to ride up over the continental margin, pushing it down and forming broad shallow basins ahead of the rising mountains.

As the mountains eroded, the shallow foreland basins gradually filled with clastic sediments—eroded bits of preexisting rock. The sediments covered earlier sedimentary layers laid down in ancient seas from decomposing sea life and precipitated calcite. Over time, a sequence of sedimentary rock layers formed: carbonate rocks (limestones and dolomites) covered by layers of clastic rocks (conglomerates, sandstones, siltstones, mudstones, and various stages in between), all from the eroding Taconic Mountains.

Figure 2—*Taconic Terrane colliding with proto-North America. Before the collision, what is now Virginia (circled) was completely covered by shallow seas. Source: Harwood (2014).*

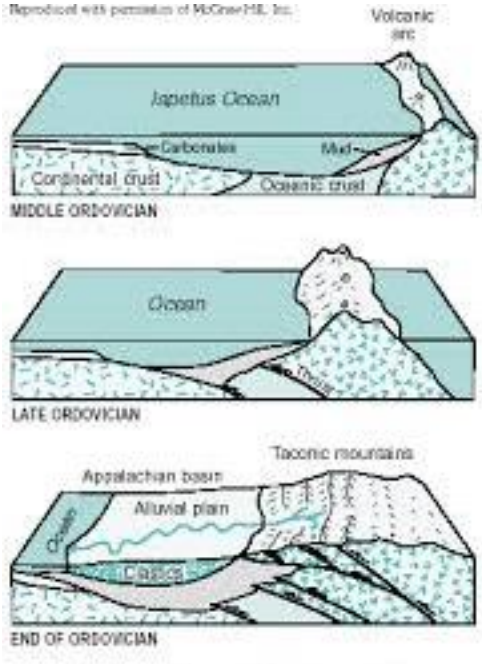


Figure 3—*The Taconic Orogeny. The island arc approaches proto-North America (top) about 480 million years ago. As the collision begins (middle), the oceanic plate rides up over the continental margin, and clastic sediments form at the base of the Taconic terrane, beginning to fill the foreland basin. After uplift ends (bottom), the Taconic Mountains erode away, filling the foreland basin and draining into the inland seas beyond. Source: Dott and Batten (1988).*

The sequence of clastic rocks began with sediments from materials that eroded relatively easily, such as shales and basalts. The sequence ended with one of the most erosion-resistant minerals: quartz. Pure quartz sandstones capped the rock sequence, interspersed with softer sediments laid down in lagoons when sea levels temporarily rose.

What is now southwestern Virginia was finally eroded down to an alluvial plain drained by meandering rivers flowing west into the great interior seas beyond (fig. 3). When sea levels rose again about 410 million years ago, carbonate sediments covered the newly formed clastic rocks across the entire area.

Table 1 shows the entire sequence of resulting rock formations, from the middle Ordovician carbonate rocks through the late Silurian Tonolaway limestone, which together bracket the Taconic Orogeny and its aftermath. All of the rocks shown in table 1 are exposed in Giles County, and three of them—the Martinsburg, Juniata, and Tuscarora rocks—underlie different parts of Mountain Lake.

Alleghanian Orogeny

How can that be? If the rock layers formed on top of each other, from oldest (Martinsburg) to youngest (Tuscarora), how can they be lying side by side at the bottom of Mountain Lake?

The answer has to do with folding and faulting caused by an even greater mountain-building event

Table 1—Rock layer sequence in Giles County, Virginia, middle Ordovician to late Silurian Periods.

Formation name	~Age (million years)	~Thickness (feet)	Component(s) (most to least)
Tonolaway	405–410	<100	Limestone
Keefer	410–420	100–230	Sandstone,[a] graywacke[b]
Rose Hill	420–430	100–270	Shale, siltstone, sandstone
Tuscarora	430–435	50–210	Sandstone,[a] graywacke[b]
Juniata	435–440	150–375	Shale, siltstone, graywacke,[b] limestone
Martinsburg	440–455	1,000–1,800	Shale, siltstone, mudstone, limestone
Middle Ordovician carbonates	455–490	600–1,200	Limestone, dolomite, shale

a. Pure and hard, sometimes compared to quartzite.
b. Sandy shale (intermediate between shale and sandstone).
Sources: Folk (1960); McDowell and Schultz (1990).

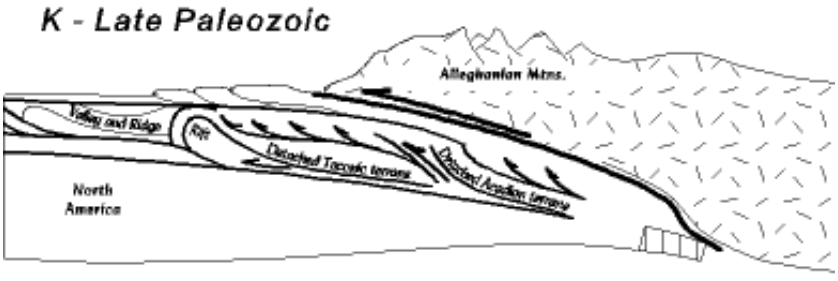


Figure 4—*The Alleghanian Orogeny, about 320 million years ago (during the late Paleozoic Era). As proto-Africa rides up over proto-North America, massive thrust faulting pushes the terranes and basement rock westward while folding the flat sedimentary rocks beyond. Source: Fichter and Baedke (1999).*

known as the Alleghanian Orogeny (fig. 4). It began about 320 million years ago, when proto-Africa collided with proto-North America, forming part of the supercontinent Pangaea. As the Iapetan Ocean closed, proto-Africa rode up over the North American continental margin, forming the great Alleghanian Mountain chain that once covered what is now Virginia.

Proto-Africa also scraped up parts of the North American continental crust and transported them far to the west on great thrust faults, laying the foundations for today's Blue Ridge Mountains (fig. 4). In addition, it transported and buckled the flat sedimentary layers laid down during the Taconic Orogeny and its aftermath. In short, the Alleghanian Orogeny shaped the landforms in most of Virginia today, from the Piedmont to the Allegheny Front.

Martinsburg shale (top) and Tuscarora sandstone (bottom), the latter at a contact point with rock from the Juniata Formation (right). All three rock types underlie Mountain Lake. Source: Wikipedia.

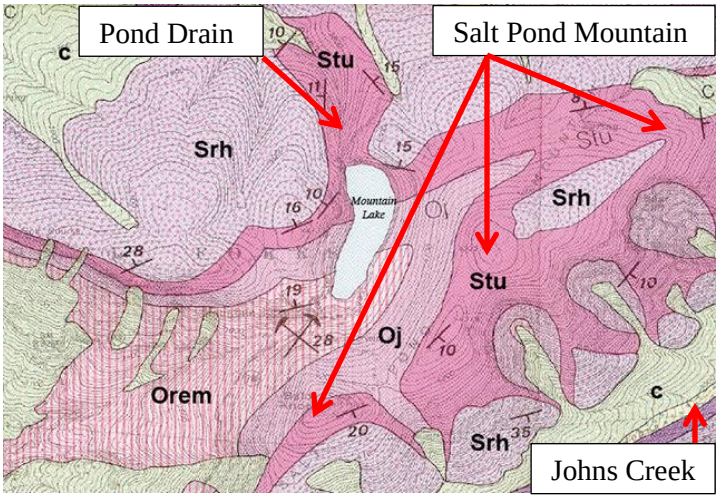
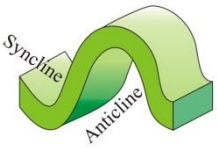


Figure 5—*Geologic map of the area in Giles County, VA, near Mountain Lake (blue). From youngest to oldest, the exposed formations are Rose Hill (***Srh***), Tuscarora (***Stu***), Juniata (***Oj***), and Martinsburg (***Orem***); lower slopes in the area (green) contain colluvium (***c***) from landslides and erosion. Parallel placement of the exposures suggests a "breached" anticline, as do the strike/dip symbols on the map (parallel strikes and opposite dips). Source: Radford University (2014).*

Under tremendous pressure from the tectonic forces associated with the Alleghanian Orogeny, the sedimentary layers laid down in the Ordovician and Silurian Periods (table 1) tended to crumple and fold. They formed a series of rounded humps and dips, much like a rug pushed together, with what geologists call anticlines (with downturned ends) and synclines (with upturned ends). Faulting and folding pushed the rock layers to the northwest along great thrust faults, severing their connection with the underlying basement rock (fig. 4). Their present locations might be dozens of miles away from their original positions.

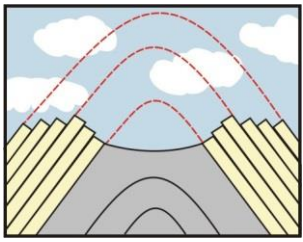


Salt Pond Mountain Anticline

And that is what happened to the rocks underlying Mountain Lake. The lake was originally known as Salt Pond, partly for its diminutive size and partly for the nearby salt lick used by wildlife and livestock. Like other Valley and Ridge landforms, the ridge just to the east of Mountain Lake runs from southwest to northeast (fig. 5); it is known as Salt Pond Mountain.

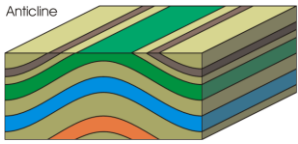
Rock mapping in the area has revealed exposures of four of the seven formations listed in table 1: Martinsburg, Juniata, Tuscarora, and Rose Hill (fig. 5). The first three formations underlie the lake bed; Tuscarora sandstone also caps nearby ridges, reaching elevations of more than 4,300 feet.

Farthest to the north and south are outcrops of the Rose Hill rocks (fig. 5, **Srh**). They are bordered by bands of Tuscarora rocks (**Stu**), which in turn border on Juniata rocks (**Oj**), with the Martinsburg rocks (**Orem**) lying in between. The parallel placement of the exposed rock formations suggests that tectonic forces associated with the Alleghanian orogeny folded the rock layers into an anticline, with the youngest rock (Rose Hill) on the outer edges and the oldest rock (Martinsburg) in the middle. Salt Pond Mountain forms the southeastern limb of the anticline (fig. 5).



The great Alleghanian Mountains buried the anticline for tens of millions of years, until they finally eroded away. Nothing remains of the mountains or of proto-Africa. Rivers carried the sediments to the west, filling the great inland seas.

Alleghanian folding and faulting fractured the sedimentary rock layers, making them more susceptible to erosion, particularly at the anticline arch. When finally exposed, the upper part of the Salt Pond Mountain anticline eroded away, "breaching" the anticline and leaving a flat surface. By about 230 million years ago, Virginia had eroded down to a nearly flat plain, drained to the northwest by slow meandering rivers.



One of those ancient rivers, its meandering course a tell-tale relic of the ancient Virginia peneplain, is the curiously named New River, which drains much of Giles County. About 45 million years ago, gentle uplift began in the western part of Virginia. The softer rock layers, such as limestones and shales, eroded faster than the harder sandstones, which gradually formed ridges running from southwest to northeast, the orientation of the underlying geology. Salt Pond Mountain, capped by the tough Tuscarora sandstone (fig. 5), is a perfect example.

The New River steadily cut through the rising ridges, forming a series of gaps on its northerly course across southwestern Virginia, and some of its tributaries did the same. Long before Mountain Lake formed, gentle uplift was raising the Salt Pond Mountain anticline. The stream that became Pond Drain originated in the rising Martinsburg and Juniata rocks and cut through

the softer Rose Hill rock, exposing the underlying Tuscarora sandstone, which now forms the bed of the stream (fig. 5).

As uplift continued, a continental divide formed. Pond Drain is part of the New River drainage to the northwest, flowing west into the Ohio River and ultimately into the Gulf of Mexico. Johns Creek, on the southeastern side of Salt Pond Mountain (fig. 5), is part of the James River watershed, flowing east into Chesapeake Bay.

Mountain Lake

And so it would have remained, with Salt Pond Mountain forming a continental divide between two small streams, if not for the landslide that dammed Pond Drain, forming Mountain Lake. What caused the slide?

Lake sediments going back more than 6,000 years suggest that the slide happened at least that long ago. Over time, weathering breaks up even the tough Tuscarora sandstone, which forms relatively steep slopes at the northern end of Mountain Lake overlooking its outlet drainage (fig. 5). Colluvium is common in the area, including sandstone talus (piles of rocks and boulders on hillsides) waiting to tumble downhill.

The area around Giles County is one of two seismic zones in Virginia (fig. 6). The largest earthquake in Virginia history, with a magnitude of about 6.0 on the Richter scale, rocked Giles County in 1897. Smaller earthquakes are routine in the Giles County Seismic Zone, which extends from the North Carolina border northeast to Blacksburg and beyond.

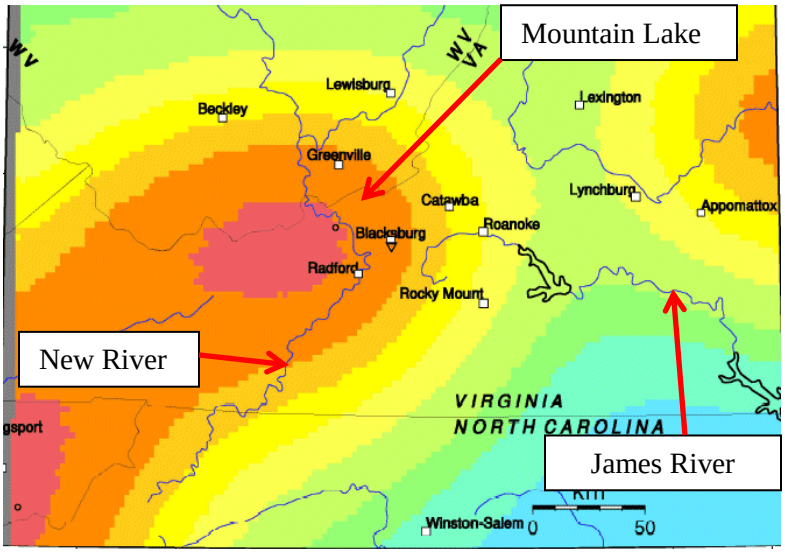


Figure 6—*Giles County Seismic Zone (the Central Virginia Seismic Zone is visible in upper right). The zone probably overlies a fault caused by continental rifting 570 million years ago. The New River (indicated by the arrow) roughly follows the zone's northeasterly orientation, then curves northwest toward the zone's center. Source: USGS (2002).*

Sandstone blocks dam the north end of Mountain Lake. They came from a rock slide more than 6,000 years ago. Source: Radford University (2014) (photo: R. Whisonant).

The seismic activity originates in the pre-Cambrian basement rock underlying the sedimentary layers laid down in the last half billion years. It has nothing to do with the Alleghanian Orogeny or with subsequent Atlantic rifting, which occurred well to the east. The most likely explanation is an ancient fault line in the Grenville basement rock due to rifting when the supercontinent Rodinia broke up about 570 million years ago, forming the Iapetan Ocean.

The New River roughly follows the seismic zone through North Carolina and Virginia (fig. 6). That raises a question: Did pre-Cambrian rifting influence the course of the New River, perhaps by causing depressions in the post-Alleghanian peneplain?

Mountain Lake is well inside the Giles County Seismic Zone (fig. 6). An earthquake apparently caused sandstone blocks loosened by weathering to drop down the slopes above what is now the outlet of Mountain Lake. A great rock slide ensued, carrying tons of earth and other debris into the valley below, damming the stream and forming Mountain Lake.

Drainage System

So how has the lake persisted for thousands of years? Why hasn't the outlet cut through the dam?

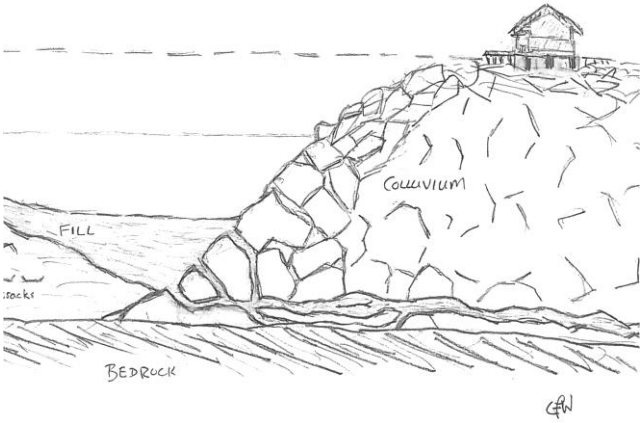
The answer is that Mountain Lake leaks. The lake is fed by "six fine Springs," according to the colonial explorer Christopher Dish, who in 1751 made the first written account of Mountain Lake. Actually, about 60 springs feed the lake, many emerging in the contact zone between the Martinsburg and Juniata Formations.

But the lake is rarely full enough to spill over its dam, so little erosion has taken place. Dish called its outlet "Sinking Creek," a reference to an underground passageway that emerges about half a mile north of the lake as the stream now called Pond Drain.

Nobody knows exactly how the drainage works, but it seems to change, because Mountain Lake periodically dries up, only to refill again. The lake has dried up six times in the past 4,500 years, and at least once it stayed dry for decades—long enough for a meadow to form and trees to grow.

When the lake is full, the water at the northern end is about 110 feet deep. The lake bottom there has four deep and narrow "piping holes" that seem to drain the lake. Local earthquakes, even if small, can shift the sandstone boulders in the colluvium dam, affecting the drains and altering the lake's hydrology.

That also explains why the lake is only slowly filling up with sediment. The piping holes are normally wide enough—and the lakewater turnover heavy enough,



Artist's rendition of the Mountain Lake drainage system. Upper line is water level with lake full; lower line is water level in June 2013. Colluvium is the dam, with leaky joints between sandstone boulders. Source: MLC (2013).

One of about 60 springs that feed Mountain Lake. Note the low lake level in the background.

with powerful currents—to wash most sediments out the drains. As a result, the lake shows few of the usual signs of succession, such as filling in at the edges, with reed beds and other wetland vegetation.

Dry Lake—for How Long?

The last time the lake went completely dry was in 2008. By June 2013, the lake was slowly refilling, but by August 2014 it remained half empty.

However, things can change overnight. In 1959, the lake was only half full when an earthquake shook the area, cracking the stone mantle over the fireplace in the lake hotel. The next day, the lake was full.

Empty or not, the lake is well worth a visit. Where else can you take an easy stroll around a lake bed over three different kinds of bedrock? It's worth it just to see whether you can pick out where one rock formation ends and another begins. (Hint: Acid-loving eastern hemlock thickens where you cross from Martinsburg shale onto the more acidic Juniata rocks.)

Or take an easy hike to the top of Salt Pond Mountain and stand on the eastern continental divide, with views of the New River valley to the west. You are in a special place, shaped by more than half a billion years of tectonic activity, from the breakup of the supercontinent Rodinia, to the Taconic and Alleghanian Orogenies, to the gentle regional uplift that is still shaping the landscapes around you.

Mountain Lake emptied in 2008 (top); by June 2013, the lake was slowly refilling (bottom). Sources: Radford (2014) (photo: J. Wawrzycka); MLC (2013).

And whether or not the lake is full, you are overlooking a unique geological feature. Mountain Lake has no equivalent anywhere else in the southern Appalachian Mountains. So take the time to enjoy!

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Upcoming Events
(of interest in the mid-Atlantic region)

April

10–11: Annual Atlantic Micromounters Conference; Micromineralogists of the National Capital Area; Springhill Suites Alexandria Marriott, 6065 Richmond Hwy, Alexandria, VA. Registration at www.dcmicrominerals.org/

11–12: The Annual New York Southern Tier Geology Club Show; Johnson City Senior Citizens Center, 30 Brocton Ave, Johnson City, NY; Sat 9–5, Sun 10–4; contact Tom Ogden, 607-967-8552, tandjodgen@stny.rr.com

18: Annual Jewelry Gem & Mineral Show; Patuxent Lapidary Guild, Inc.; Earleigh Heights VFC on Rte 2 in Severna Park, MD; 10–5; 10 and over $1, under 10 free.

18–19: 2015 Monongahela Rockhound's Gem, Mineral and Fossil Show; West Mifflin Volunteer Fire Co., #4 Skyview Hall, 660 Noble Drive, Pittsburgh PA; Sat 10–6, Sun 10–4; info Bret Howard (show coordinator) 724-327-8618, www.monongahelarockhounds.org

May

15–17: InterGem Show; Dulles Convention Center; Chantilly, VA.

16–17: 47th Annual World of Gems & Minerals Show; Berks Mineralogical Society; Leesport Farmers Market Banquet Hall, 312 Gernant's Church Rd, Leesport, PA.

16–17: Cape-Atlantic Rock Hounds Annual Spring Gem, Jewelry, Rock, Mineral and Fossil Show; 2641 Cologne Ave, Mays Landing, NJ; Sat/Sun 9–5; free parking/admission; info Billie Brockhum (show chair & VP) 609-879-1179, www.capeatlanticrockhoundsclub

18–24: Wildacres; Little Switzerland, NC; $390 plus materials fee; registration starts Jan 1; information at http://efmls-wildacres.org/

30: 26th Annual Chesapeake Gem & Mineral Show; Chesapeake Gem & Mineral Society; Ruhl Armory, I-695 exit 26 south, Towson, MD; Sat 10–4; Free admission & parking; info: http://www.chesapeakegemandmineral.org/club-show.html

June

6–7: GemFest 2015; Wayne County Gem and Mineral Club; Greater Canandaigua Civic Center, 250 N. Bloomfield Road, Canandaigua, NY; www.wcgmc.org

July

11–12: GemWorld 2015, 49th Annual Show; Gem & Mineral Society of Syracuse; SRC Arena and Events Center, Syracuse, NY; contact Dick Lyons show@gmss.us

25–26: 34th Annual Gem, Mineral & Jewelry Show; Long Island Mineral & Geology Society; Main Road (Rte 25), Cutchogue, NY; Sat 10–5, Sun 10–5; adults $6 (with flyer $5), children under 12 free; info: http://www.limineralandgeology.com

September

19–20: Cape-Atlantic Rock Hounds Annual Fall Gem, Jewelry, Rock, Mineral and Fossil Show; 2641 Cologne Ave., Mays Landing, NJ; Sat/Sun 9–5; info: capeatlanticrockhoundsclub or call Billie Brockhum at 609-879-1179

26-27: 59th Annual Franklin-Sterling Gem & Mineral Show; Franklin Mineral Museum; Franklin School, 50 Washington Ave, Franklin, NJ; Sat 9–5, Sun 10–4; Outdoor Swap: Sat 7:30–6, Sun 10–5; adults $7, children 6–16 $4; http://spmom3.wix.com/franklin-gem-mineral

October

23–25: AFMS Convention and Show, hosted by the Southwestern Federation; Austin, TX.

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Crystals are the flowers of the Mineral Kingdom

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Dues: Due by January 1 of each year; $15 individual, $20 family, $6 junior (under 16, sponsored by an adult member).

Meetings: At 7:45 p.m. on the fourth Monday of each month (except May, November, and December)* at **Long Branch Nature Center**, 625 Carlin Springs Road, Arlington, VA 22204. (No meeting in July or August.)

**Changes are announced in the newsletter; we follow the snow schedule of Arlington County schools.*