



# THE NORTHERN VIRGINIA MINERAL CLUB INC



## The Mineral Newsletter

**Meeting: April 28 Time: 7:45–9:00 p.m.**

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



### **Coastal Plain Basement Rock and GigaPan Computer Technology April 28 Meeting**

We are fortunate to have two speakers!

Mr. Mercer Parker and Ms. Robin Rohrback will describe their joint undergraduate research on the basement rock underlying Virginia's Coastal Plain. Their research is based on samples taken from the Chesapeake Bay impact structure—a crater left by a huge extraterrestrial body that struck the Earth at what is now the mouth of Chesapeake Bay some 35 million years ago.

Through Northern Virginia Community College's (NOVA's) Annandale campus, the two students are studying the bottom 28 feet of a drill core taken near the crater's central rim. The core contains pre-Cambrian basement rock about 625 million years old, evidently part of a pluton.

**Volume 55, No. 4**

**April 2014**

You can explore our club website:

<http://www.novamineralclub.org/>

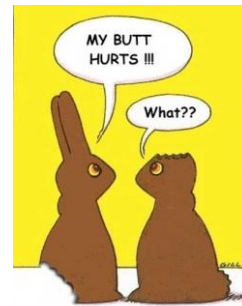
### **Northern Virginia Mineral Club members,**

Please join our April 28 speakers, Mr. Mercer Parker and Ms. Robin Rohrback, for dinner at the Olive Garden 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](mailto:kshrechka@msn.com).

The students are analyzing the basement rock in order to describe the mineralogical and chemical weathering processes that have affected it. They hope to correlate the basement rock with other plutons of similar age and composition in our region. Their work will be part of a larger USGS project classifying the basement rock of the Atlantic Coastal Plain.



The students' research is based in part on the Mid-Atlantic Geo-Image Collection, known as M.A.G.I.C., a growing repository of gigapixel-resolution geological imagery located online at <http://gigapan.com/groups/100/galleries>. The GigaPan medium provides a unique combination of context and detail, with images that maintain a high level of resolution through every level of magnification.

Ms. Rohrback is a NOVA student majoring in geology. For the past 2 years, she has been working with Professor Callan Bentley on M.A.G.I.C., principally in maintaining and operating a GIGA-macro robotic camera rig that produces GigaPans of hand, sediment, and mineral samples. She has taken every geology class that NOVA's Annandale campus has to offer. This semester, she is working as a teaching assistant at NOVA while designing interactive lab materials. She hopes to transfer to James Madison University to study igneous and metamorphic petrology.

Mr. Parker is majoring in marine geology at NOVA. In spring 2015, he will transfer to the College of William and Mary's geology department and its Virginia Institute of Marine Sciences program. He hopes to attend graduate school at Oregon State University or Oregon University's School of Volcanology to study seafloor volcanism and mineral resources. ➤

## President's Thoughts

*by Wayne Sukow*

How many times have I sat at a keyboard to begin the task of writing The President's Thoughts or Thoughts From The President or The Prez Sez? Let's see ... St Croix Valley Rockhounds (4 years × 10 President's Thoughts) ... Moscow Star Garnet Club (3 years × 10 Thoughts From the Prez + 3 in summer) ... NVMC (4 years going on 5 or 6 [4 years × 10 Prez Sez]) ... that adds up to about 113 times. Wow! What's left to say or share? IS ANYBODY OUT THERE? DOES ANYONE CARE?

## Celebrate Science! 3<sup>rd</sup> USA Science and Engineering Festival

*Thanks to Kathy Hrechka for the link!*

The annual expo will take place on April 26 and April 27 from 9 a.m. to 6 p.m. at the Walter E. Washington Convention Center, 801 Mt. Vernon Place (on L Street NW, between 9<sup>th</sup> and 7<sup>th</sup> Streets NW). Entrance is free. Come enjoy hundreds of exhibits featuring science, technology, engineering, and math. ➤

<http://www.usasciencefestival.org/>

In the many opportunities I had to say and share, I tried a variety of approaches, such as the plumbum "It was a great club show" or "Our speaker gave a great presentation and I/we learned a lot" or "Did you have a great summer collecting" or "How do we get more volunteers for club officers?" You get the idea.

Sometimes I'd take a somewhat more aggressive tack, like: "No, no, I won't let the club die because no one will accept a nomination for club president" or "No volunteers, no show" or "Last-minute auctioneers." Again, you get the idea. Wow! Dare I say, "What's left to say or share?" IS ANYBODY OUT THERE? DOES ANYONE CARE?

I believe club officers function best when they get feedback from club members and other club officers. That philosophy developed during my 10 consecutive years on the River Falls (Wisconsin) Board of Education, 9 as president, and yes, everyone is out there and someone cares.

Hurray! Just this month I got an answer ... SOMEBODY IS OUT THERE ... SOMEBODY CARES. My thanks go to our newsletter editor, Hutch Brown, who after 2 months and no Prez Sez comments from me said, "The Prez Sez stuff for the newsletter seems to be something that every president handles differently. I've experienced it so far with two—Sue Marcus, who wrote whole essays, and Rick Reiber, who wrote a few sentences." His e-mail was more than that and my reply follows. You may get some new insights into your Prez. Enjoy!

“Hi Hutch,

I’m not ignoring you or anyone else in the NVMC. It’s a matter of being busy with other things, some related to minerals and some not, e.g., the family. I will try to get you a few President’s Thoughts by Friday, April 4, before we leave for Lexington, VA, for family activities ... e.g., grands who have a birthday and a starring role in a school play.

I also have a magazine editor after me to get a lengthy article fine-tuned for the next issue, plus he’s waiting for a draft of its datolite crystal equivalent. I’m also working with a photographer to fine-tune some new photos for these articles and future ones. It’s a slow process via e-mail.

I also owe you and the club a summary of the 2014 EFMLS annual meeting and the associated show.

Oh yes, then there’s the 2014 Virginia tax forms to fill out. The federal and Wisconsin nonresident are done. Whew!



*NVMC April auction. All photos: Hutch Brown.*

You get the feel of what causes my tardiness: >)

On the topic of “eminence grise” [Hutch had referred to me as such], I’m not sure that I am either a confidential agent, exercising unsuspected or unofficial power, or a respected authority such as an elder statesman. Perhaps the gray monk has some applicability. For starters, I am an old Wisconsin farm boy who left the dirt-poor farm, where I could not abide the annual week-long activity of picking rocks off fields so crops might grow. My dad was always puzzled by my choice of hobbies.

Hutch, I have an idea. Perhaps this e-mail would work as fodder for my first President’s Thoughts column. What does Your Eminence think? Now, I’m being overwhelmed by ideas. How about if we just spread my vitae out over an 11-month period???

Cheers,

Wayne” ♫

## **Previous Meeting Minutes Club Auction, March 24, 2014**

*by Laurie Steiger, Secretary*

President Wayne Sukow called the meeting to order at about 7:30 p.m. He presided over a quick business meeting before the real fun began: our semiannual club auction. Wayne noted that there were some very good minerals and gems up for auction.

Wayne asked visitors to announce themselves and name their favorite mineral. Linda Benedict introduced herself and said she loves everything.

The club acknowledged six past presidents in attendance: Rick Reiber, Rob Robinson, Wayne Sukow, Sue Marcus, Barry Remer, and George Loud (visiting from South Carolina).

A motion was made and carried to approve the minutes from the last meeting, as published in the March *Mineral Newsletter*.

Vice-President Kathy Hrechka made a motion to approve John Culpepper, a student at George Mason University (GMU), for a \$250 scholarship from the club’s Fred C. Schaefermeyer





*A full house for the club auction (standing room only).*



Scholarship Fund. As described in the March newsletter, Julia Nord, a GMU geology professor, nominated John for the scholarship. The motion was approved.

Co-Treasurer Rick Reiber announced that the club has about \$15,000 in funds. He said that dealer fees for the club GMU mineral show in the fall will not be raised. Jim Kostka inquired whether the club's budget could conceivably incur a deficit, and Rick said no.

As part of his project for Eagle Scout, club member Conrad Smith has prepared an educational module, a set of poster presentation materials on geology. Jim Kostka, who supervised the project, announced that the posters are now available on disk. Mineral clubs can use them in their shows, and teachers can use them for geology instruction.

David Maclean announced that the MicroMineralogists of the National Capital Area are having a club meeting on Wednesday, March 26. The Atlantic Micromounters' Conference is coming up on April 4-5 at the Spring Hill Suites in Alexandria, VA; Joe Marty is coming from Utah.

In preparation for the club auction, Wayne Sukow asked club members to keep background noise to a minimum. He said it affects people's ability to hear the bidding, particular for people with hearing disabilities, and he thanked people in advance for their consideration.

Kathy Hrechka pointed out that 15 percent of the auction proceeds will go into the Fred C. Schaefermeyer Scholarship Fund and that additional donations placed in the hat will be gladly accepted. Rick Reiber noted that auction proceeds



*Vice-President Kathy Hrechka, with auctioneers Rob Robinson, Matt Charsky, and Mike Smith ready to begin.*



*Sue Marcus, Barry Remer, and Co-Treasurer Kenny Lovelless keeping the records and handling the money.*



### **Auctioneers in action!**

also go to cover field trips and club membership in the national and regional club federations (AFMS and EFMLS).

Members and visitors took a 10-minute break to look over the minerals up for auction and make bids. Before the break, Pat Flavin announced that she had brought fluorescent minerals from Sterling Hill for auction and would be happy to use her light to show them off.

Sue Marcus, Barry Remer, and Co-Treasurer Kenny Loveless supervised the auction and took notes and payments. The auctioneers included Rob Robinson, Matt Charsky, and Mike Smith; Cheryl Sims and Co-Secretary Laurie Steiger served as runners.

Items with bids placed, showing interest, were the first to be auctioned off. The minimum bid was \$2, raised in increments of \$1 up to \$20. After that, the bidding proceeded in increments of \$5.

The highest bid was for \$75. The auction went well and everyone had fun. ↗

## **EFMLS 2014 Annual Meeting**

*by Wayne Sukow, NVMC Delegate (and President)*

As you probably know, the Eastern Federation of Mineralogical and Lapidary Societies holds an annual meeting attended by delegates of member clubs. Most of the formal events associ-



ated with this year's meeting were held in the Doubletree Suites Hotel-West in Plymouth Meeting, PA, on March 28–30.

Usually, the Cracker Barrel session is on the first afternoon and evening and the formal delegate meeting is on the following morning. But this time, both meetings were held on the first afternoon and evening. The final EFMLS event, the Bulletin Editors Advisory Council (B.E.A.C.)



*The NVMC delegate (next to the aisle) hard at work.*



awards breakfast, was held as usual on the final morning.

The Cracker Barrel session opened with comments by Wendell Mohr on the junior programs that clubs have to stimulate meeting attendance and participation in club activities by younger club members. Various delegates spoke about their junior programs, the importance of which was generally acknowledged. There appears to be no surefire design for a junior member program, but an active junior program can have a long-term impact on club membership: although junior members might not regularly attend club meetings and other club activities, when they go to high school and college or begin their working careers with family responsibilities, they often return to mineral and lapidary hobby clubs, becoming active members.

After the formal Cracker Barrel session broke up, there were sidebar conversations on such thorny issues as getting speakers for club meetings, arranging field trips, and securing members for formal leadership roles (e.g., being a club officer).

Later on Friday, the formal delegate meeting was convened, and it was primarily a “ho-hum” event. Committee and EFMLS officer reports usually amounted to “The report is printed in the packet,” meaning the envelope containing all committee reports, the proposed budget, etc. Discussion was minimal—a club president’s dream! Surprisingly, a report on the EFMLS youth program appeared to be missing.

There was some discussion of the following items, although no actions were taken:

- The next EFMLS meeting will be held in late March 2015 in Hickory, NC.
- The terms of EFMLS officers are unusual if not unique. Officers are elected at the time that the local club that is sponsoring the EFMLS meeting has its annual show, but they do not take office until November of that year. So if the meeting is held in March, there is an 8-month hiatus before the elected officers actually take office.
- Steve Weinberger, who chairs the Wildacres Functioning Committee, noted that as of this



*Sheryl Sims receiving an award at the B.E.A.C. event.*

meeting only 9 people had signed up for the 2014 fall (September) session. The enrollment level is not enough to meet contractual obligations, so the EFMLS Fall 2014 session might have to be cancelled. Steve noted that there is often no mention of the Wildacres lapidary workshops in local clubs’ newsletters. He urged the delegates to become goodwill ambassadors and recruiters for the Wildacres Workshops. Cancelling the EFMLS fall 2014 session might mean that EFMLS will lose the opportunity to have fall sessions at all. That would be a major loss; let’s not allow that to happen.

The B.E.A.C. breakfast on Sunday was a relaxed time for spirited conversations with members of various EFMLS clubs. Newsletter awards in various categories were announced and award certificates received. I was privileged to accept awards for members of the NVMC, who will be recognized at our April meeting. ♪

## **Coming in April: Dinosaurs! Natural History Museum**

*Thanks to Sue Marcus for the link!*

*Tyrannosaurus rex* is coming to the Fossil Hall at the Smithsonian Museum of Natural History. To help welcome *T. rex*, the museum is planning several special events for April, after which the Fossil Hall will be temporarily closed for a complete renovation. ♪

<https://mail.google.com/mail/u/0/?tab=wm#inbox/14527fab7fab7abc1e0>

## The Cullinan Blue Diamond Necklace

*Editor's note: The piece is adapted from the Website of the Smithsonian National Museum of Natural History. Thanks to Sue Marcus for the link!*

<http://mineralsciences.si.edu/collections/cullinannecklace.htm>

The Cullinan Blue Diamond Necklace, now on display in the Gem Gallery at the Smithsonian National Museum of Natural History, features a double-ribbon bow motif with nine sparkling and extremely rare blue diamonds. The necklace contains a total of 5.57 carats of blue diamonds, along with 243 colorless diamonds. It has an interesting story.

The legendary South African diamond magnate Thomas Cullinan promised his wife Annie that he would find her the largest diamond in the world. In 1905, Cullinan did discover a massive, nearly flawless blue diamond, the 3,106-carat Cullinan Diamond; but it went to his sovereign, King Edward VII of Great Britain. Instead, Cullinan presented his wife with the strikingly beautiful Cullinan Blue Diamond Necklace.

In the years that followed, the necklace was passed down to the first daughter in each successive generation, ending with Thomas Cullinan's great-granddaughter, Anne Robinson. In 1992, she sold the family heirloom to Stephen Silver of Stephen Silver Fine Jewelry in Menlo Park, CA. Silver's aspiration was to see the necklace on display as part of the National Gem Collection. He finally realized his goal in September 2010, when the Cullinan Blue Diamond Necklace went on exhibit in the Harry Winston Gallery, adjacent to the Hope Diamond at the National Museum of Natural History.

"I'm proud to have given this gift to the National Gem and Mineral Collection," said Silver, "to allow visitors to the Museum the opportunity to view and learn the history of this extraordinary necklace."

As of March 2014, the Cullinan Blue Diamond Necklace was still on display in the Winston Gallery near the Hope Diamond. At some point, it will move to its permanent home in the National Gem Gallery. ↗



*The Cullinan Blue Diamond Necklace features a detachable bow-shaped pendant with inlaid diamonds, both blue and clear. Photos: C. Clark.*

## Bizarre New Dinosaur Found

*Thanks to Sue Marcus for the link!*

The Smithsonian Museum of Natural History reported that its scientists and collaborators pieced together a previously unknown species of oviraptorosaur—a birdlike dinosaur 11 feet long. Sporting feathers, the dinosaur resembles a cross between a cassowary and a lizard. The bones were found in 66-million-year-old rocks in the Northern Great Plains. ↗

[http://nmnh.typepad.com/smithsonian\\_fossils/2014/03/anzu-wyliei-a-bizarre-new-dinosaur.html](http://nmnh.typepad.com/smithsonian_fossils/2014/03/anzu-wyliei-a-bizarre-new-dinosaur.html)



## Extreme Makeover New Life for the Vulcan Quarry

by Fairfax Water

*Editor's note: John Kress submitted the following article, taken from the Fairfax County newsletter Straight from the Tap (Winter 2014). Lightly edited, it is reprinted below.*

One thing is certain in the drinking water profession—the demand for water will continue to grow. Studies project that Fairfax Water will need additional water storage by 2040 to meet growing customer demand. One way is to turn an abandoned rock quarry into a reservoir.

The concept behind water supply storage (or water “banking”) is to make a water “deposit” when water is abundant so you can make a water “withdrawal” when water is needed. The Vulcan Quarry, located next to the Fairfax Water’s Griffith Water Treatment Plant, is perfect for the purpose.

The quarry’s proximity to the water treatment plant will slash the cost of developing it as a water storage facility. It will also minimize the cost of infrastructure such as pipelines or dams while reducing community and environmental impacts, particularly on wetlands.

If the proposed plans are approved by Fairfax County, the quarry will provide storage in two stages for the overflow from the Occoquan Reservoir. The northern portion of the quarry will be built by 2035 and hold about 1.7 billion gallons of water. The southern portion, to be completed

in 2085, could increase overall water storage to 17.6 billion gallons.

Thanks to this extreme makeover, our great-grandchildren can count on having water at the touch of a tap. ➤

## Fellow Rockhounder and Northern Virginia Mineral Club Member ...

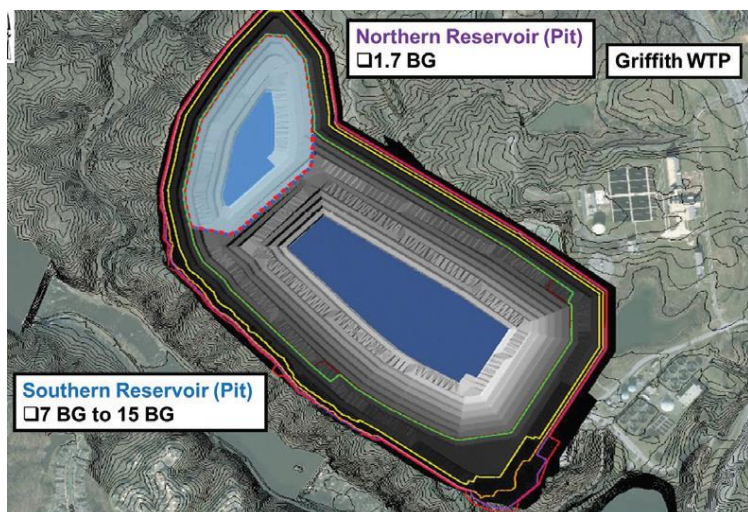
If you have not yet submitted your dues for 2014, it is time! The club appreciates your continued support!

Being a fully paid club member not only benefits the club and shows your support, but also provides you with club insurance during field trips. Your access to the quarry depends on your fully paid membership!

Please consider doing one of the following:

1. Go to <http://www.novamineralclub.org> and print out a membership form. Fill out the form and send it with your 2014 dues to Northern Virginia Mineral Club, P.O. Box 10085, Manassas VA 20108—*or* submit your dues at the next club meeting.
2. If you are inclined to take a year off but wish to continue receiving the club newsletter electronically, please send an e-mail to [news.nvmc@gmail.com](mailto:news.nvmc@gmail.com) indicating that you wish to be FRIENDS for 2014. You will continue to get our wonderful newsletter! We also ask you to consider helping at our upcoming GMU club show on November 22–23. To volunteer, please go to <http://vols.pt/fmg5iM> to sign up.
3. If you wish to be removed from the club rolls altogether, please notify us by sending an e-mail to [news.nvmc@gmail.com](mailto:news.nvmc@gmail.com).

As always, our meetings are open to everyone, and you are most welcome to attend, even if you are no longer a fully active member.





## Where Is the Fall Line?

*Editor's note: I submitted a short piece to my local neighborhood newsletter about the bedrock along Four Mile Run in Arlington, VA. The newsletter editor followed up with questions about the Fall Line, which I forwarded to club members for a response. They, in turn, forwarded the questions to USGS geologist Dr. Gilpin R. Robinson, Jr., who was kind enough to reply. The exchange, lightly edited, is shown below.*

I have two questions that you might be able to answer. The Arlington Forest 1991 Neighborhood Conservation Plan says that the Fall Line (the boundary between the Piedmont and Tidewater) crosses Four Mile Run between Arlington Forest and Glencarlyn at a location once known as Huffmans Rapids. First, is it more accurate to say that the Fall Line is more of a broad zone than just one small stretch of river? Second, do you know where Huffmans Rapids is and who Huffman was?

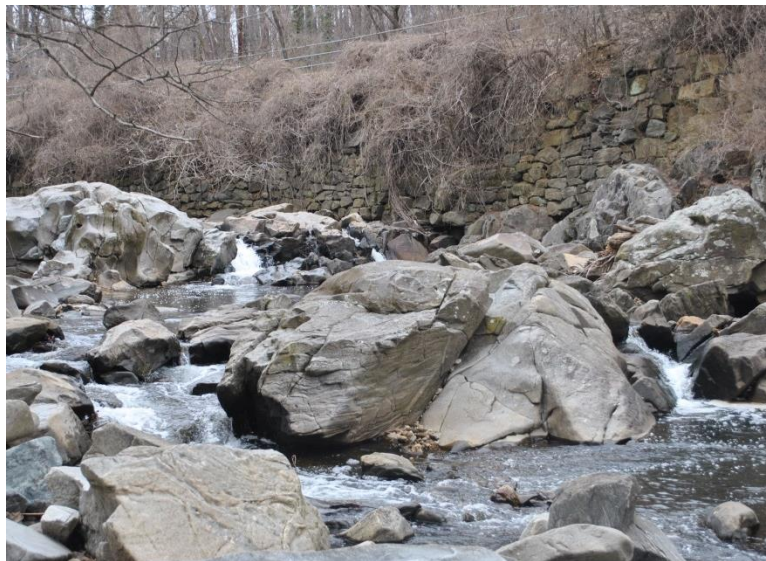
John Naland, Editor  
*The Arlington Forester*

The short answer is that the Fall Line is best characterized as a zone rather than as a precise line. It is a series of small waterfalls and rapids that separates the Piedmont Province from the Coastal Plain Province.

The Fall Line generally corresponds to an erosional strand line developed in response to higher sea level from the late Tertiary Period to the last interglacial period. Lower sea levels since then have led to stream downcutting along the Fall Line.

Gilpin R. Robinson, Jr.  
U.S. Geological Survey

In response to Mr. Naland's second question, Sue Marcus located a document online describing a workshop in May 2001 called "Experience Four Mile Run!" USGS geologists attended the workshop to talk about the geology of Four Mile Run. One of them was Dr. Curtis Huffman, who mapped the Fall Line along Four Mile Run. In his honor, the rapids and small waterfalls associated with the Fall Line along Four Mile Run are variously known as Huffman's Falls, Huffmans Rapids, and Huffmans Whitewater.



*Falls below the confluence of Four Mile Run with Long Branch—part of the Fall Line zone known as Huffman's Falls? Photo: Hutch Brown.*

So where is the Fall Line? Mr. Naland's information suggests that it includes a stretch of rapids in the southeastern corner of Glencarlyn Park, just below the confluence of Four Mile Run with Long Branch (the stream outside the nature center where our club meets). The zone might then continue through some larger rapids and waterfalls just downstream.

If you know anything more about the Fall Line along Four Mile Run, please let me know! Send me an e-mail at [hutchbrown41@gmail.com](mailto:hutchbrown41@gmail.com) ↗.

## Giant's Causeway A Geological Formation in Ireland

*Thanks to Kenny Loveless for the link!*

Check out this link to a short video describing Ireland's remarkable basalt formation known as Giant's Causeway. The video describes both the mythology and the geology associated with Ireland's first World Heritage Site. Enjoy! ↗.

<http://www.bing.com/videos/search?q=Giant's+Causeway&FORM=hphot3#view=detail&mid=34987653B230001B1AAA34987653B230001B1AAA>



## No More Moh!

*Editor's note: The piece is adapted from Goldrush Ledger (newsletter of the Charlotte Gem and Mineral Club, Charlotte, NC), April 2007, p. 9. The original article is credited to Herb Whittington and Frank Foster, editors of Rockhounds Flimflam Journal.*

The Moh's Hardness Scale could be facing some dramatic changes, now that a longstanding court case is finally decided.

The Moh's Scale was created to help identify minerals according to hardness. In 1922, Friedrich "Leroy" Moh, a German mineralogist, devised a crude but practical method of comparing mineral hardness in terms of scratch resistance, on a scale ranging from 1 (talc) to 10 (diamond).

Moh, born in Gernrode, Germany, studied chemistry, mathematics, and physics at the University of Halle. After serving as foreman at a German mine, Moh moved with his extended family to Alabaster, AL, where he was employed in identifying the minerals in a large private collection belonging to a wealthy gentleman farmer.

Moh's father had long since passed away, but his mother, Sophronia "Betsy" Moh, married a hard-working "carnie" who bit the heads off chickens while working for P.T. Barnum across the South. To say that she was the matriarch of a dysfunctional family is an understatement. Money they made; commonsense they had none.

Sophronia had an eccentric third cousin twice removed, by her former father-in-law's aunt, who by chance had inherited several million dollars from a great-grandfather. The cousin's name was Larry.

Larry, who was a loafer, preferred not to waste his valuable time working for a living. While enjoying his inheritance, he piddled away the days helping his cousin Leroy establish what would become his lifetime legacy—his famous hardness scale.

Not long after Leroy's death due to food poisoning (an underdone schnitzel), Larry decided he wanted a piece of the action from the royalties earned from all the use the Moh's Scale was now getting. Larry wanted to be remembered, and he wanted his share of the money.

Mohs Hardness Scale	
1. Talc	6. Microcline Steel tool
2. Gypsum Fingernail	7. Quartz
3. Calcite Copper coin	8. Topaz
4. Fluorite	9. Corundum
5. Apatite Knife-Glass	10. Diamond

That was awkward enough, but Mrs. Sophronia Moh had now taken the last name of her roustabout husband, Mr. Sean Kurlie. Upon her son's early and unexpected passing, she too decided she was due some of the financial rewards from Leroy's life's work.

And so the legal battles began, and they lasted for decades. At long last, the case reached the federal courts in Washington, DC, where a decision has finally been made.

The estates of both Mrs. Kurlie and her cousin Larry were seeking their share of the proceeds from use of the famous Moh's Scale. But they were also demanding something more: name recognition—a place in the history books.

On April 1, the courts finally decided in their favor. In the future, the Moh's Scale shall no longer be known by the name we rockhounds love so well.

Instead, the hardness of minerals shall henceforth be measured on the Kurlie, Moh, and Larry Scale.

Please be advised accordingly and ...

*April Fool's!*

(With apologies to Friedrich Mohs and the Mohs Hardness Scale.) ➤



## Why Is the Chesapeake Bay Sinking?

by Hutch Brown, Editor

Even a casual observer will notice erosion along the Chesapeake Bay and the estuaries that feed it. Homes built for their bay or river views are sometimes threatened by eroding banks, and valuable marsh and other habitat faces obliteration. In 40 years, for example, Dyke Marsh on the Potomac River in Virginia could be gone.

Estuarine erosion is normal and natural. But is there more to this particular erosion than meets the eye?

### Coastal Subsidence

Dredging from 1940 to 1972 began the destruction of Dyke Marsh. Wave action has carried it on, reducing the wetland to about a third of its size in 1937, when the marsh was stable.

Other forces are also at work. Rising global temperatures are melting polar and glacial ice; sea levels are rising accordingly, although local impacts vary. The good news for the Chesapeake Bay is that local sea levels are rising by only about 0.07 inches per year—roughly half the world average.

The bad news is that lands around the bay are sinking more rapidly than elsewhere, especially in Hampton Roads, the area at the mouth of the Chesapeake Bay. Subsidence accounts for more than half of the sea level rise in the Chesapeake Bay. As the land subsides, the estuarine waters rise, causing more flooding during storms and more erosion from pounding waves.

So why are coastal areas sinking?

### Groundwater Loss

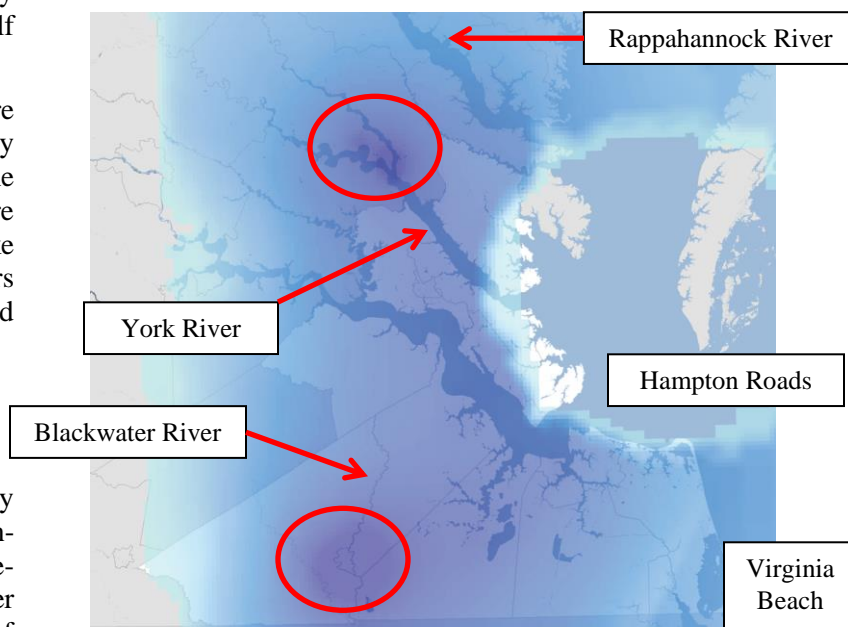
The Coastal Plain of Virginia, with its highly permeable layers of unconsolidated rock, contains enormous stores of groundwater. This region alone accounts for half the groundwater used in the entire state. People tend to think of wells as used for drinking water, but most groundwater is not withdrawn for public use. Industry and agriculture account for 61 percent of the groundwater withdrawals on the Coastal Plain.



*Dyke Marsh on the Potomac River (above) suffers from shoreline erosion (right), which has reduced the marsh to one-third of its original size and threatens its very existence. Sources: NPS (n.d., 2014).*



Those withdrawals have long exceeded natural recharge, especially in southeastern Virginia. From the Rappahannock River south to Virginia Beach, groundwater levels have fallen by up to 213 feet since presettlement times, with the highest declines around West Point on the York River and around Franklin on the Blackwater River to the south (fig. 1).



**Figure 1**—Declining groundwater pressure (deepening shades of blue/purple) due to groundwater withdrawals in southeastern Virginia. Groundwater levels have fallen the most near West Point and Franklin (circled). (The circular area on the right is the impact crater at the mouth of the Chesapeake Bay.) Source: Eggleston and Pope (2013).





*Flooding caused by Hurricane Floyd (1999) in downtown Franklin, VA, where groundwater withdrawals have lowered the water table by almost 200 feet. Source: Eggleston and Pope (2013); photo: J.H. Sheally, II.*

The result has been compaction of the underlying unconsolidated rock. Extensive groundwater pumping has caused the land to subside at measurable rates—from 0.06 to 0.15 inches per year, depending on location. Compaction due to groundwater withdrawals accounts for more than half of the subsidence in the entire region, contributing to severe floods during storms.

## Crustal Shifts

Another cause of subsidence has to do with the region's underlying geology. Scientists have long known about a realignment of crustal weight in connection with glaciation during the Pleistocene Epoch (from 2.6 million to 11,700 years ago). At the height of glaciation (about 19,000 years ago), the Laurantide ice sheet reached as far south as what is now northern New Jersey. The ice sheet was up to 2 miles thick, and its great weight pushed down the underlying rock. When the ice retreated, the rock slowly rebounded. Geologists call it glacial isostatic adjustment, a process that is still continuing today to the north of our area.

But some geologists maintain that the effects of glacial isostatic adjustment extend to areas of the mid-Atlantic coast that the Laurantide ice sheet never actually covered (Boon and others 2010; fig. 2). They note that subsidence is far greater along the mid-Atlantic coast than along coastal areas to the north and south.

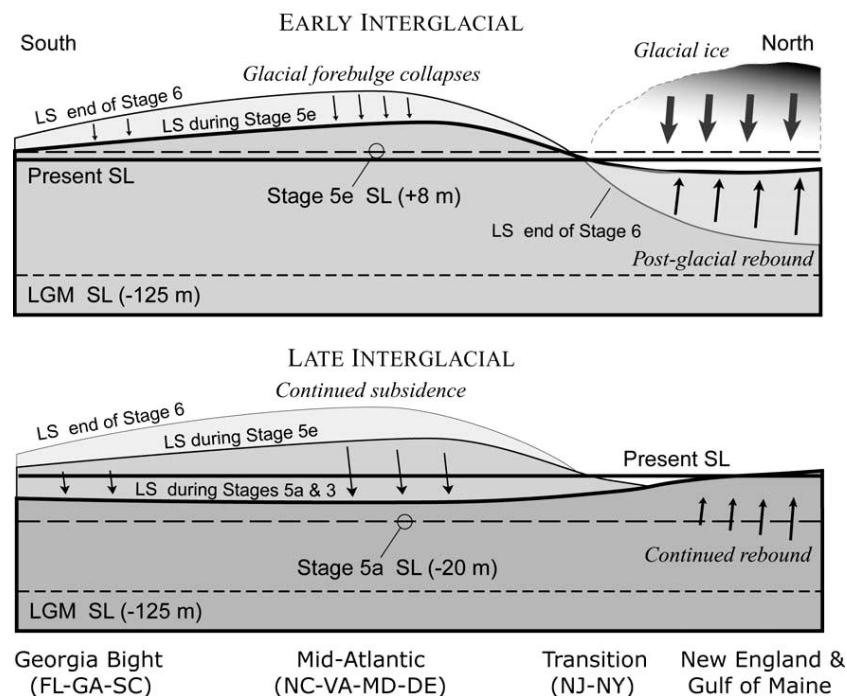
### Levels of subsidence:

- Maine: < 0.03 inches per year
- Delaware: 0.07 inches per year
- Carolinas: < 0.04 inches per year

In fact, the mid-Atlantic coast is subsiding about twice as fast as areas to the north and south.

The reason might be flexing of the Earth's crust in response to glacier formation and melting ahead of the actual ice sheet (fig. 2). Picture a thick pool of mud: if you push down on one part of it, the adjacent area will rise as the underlying mud shifts position; as you raise your hand again, the mud underneath will rise and the adjacent area will sink.

Similarly, the Laurantide ice sheet exercised enormous pressure on the underlying rock, forcing it down. As the underlying magma shifted position, it forced up the ice-free rock ahead, forming a so-called glacial foreedge (fig. 2). When the ice retreated, the underlying rock rose again as the continent gradually rebounded. At the same time, the glacial foreedge gradually collapsed, a process still going on today.



**Figure 2**—Glacial isostatic adjustment following the last ice age. The great weight of the northern ice sheet pushed down the underlying rock, causing the land ahead of it in the mid-Atlantic region to rise. As the ice melted, the underlying rock rebounded, causing the land in the mid-Atlantic region to subside. Source: Boon and others (2010).

Accordingly, glacial isostatic adjustment might partly account for coastal subsidence in our area. But if formerly ice-covered areas are rebounding, then why is there any subsidence at all in Maine? Clearly, other factors are also at play.

One factor might be a shift in crustal weight from the continental interior to the ocean floor. Virginia's western areas have been rising over the past 45 million years. Some scientists have speculated that the ocean floor, loaded with sediments, is subsiding while floating up the continental interior as the mantle shifts in response (Fichter and Baedke 1999). As the continental shelf subsides, could it be taking coastal areas down with it?

## Impact Crater

Another contributor to coastal subsidence in our area, especially near Hampton Roads, was only recently discovered. In 1983, a drilling core taken off Atlantic City, NJ, turned up an 8-inch layer of fused glass beads and shocked quartz grains, evidence that a “bolide”—an asteroid or a chunk of comet ice—had struck the Earth, forming a crater somewhere in the region. In 1993, data from oil exploration confirmed that the crater lay under the mouth of Chesapeake Bay (fig. 1).

In 1999, a team of scientists from USGS and the Virginia Department of Environmental Quality described the Chesapeake Bay impact crater in detail. They theorized that a bolide slammed into the continental shelf of North America tens of millions of years ago, sending clouds of debris

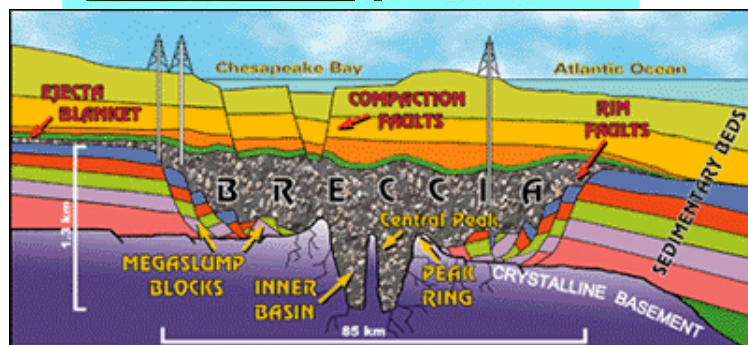
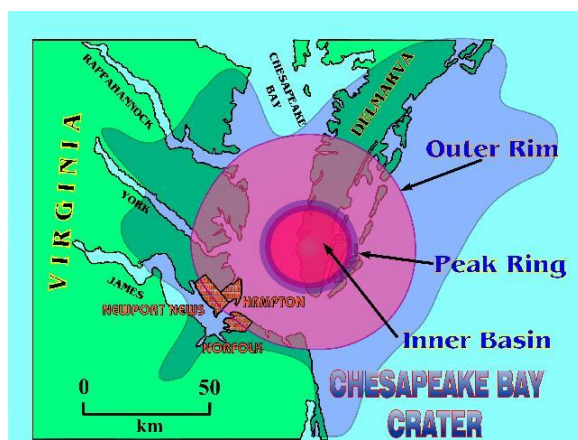


Artist's rendition of the bolide impact off the coast of North America that created the Chesapeake Bay impact crater. Source: N. Rager-Fuller, National Science Foundation.

into the sky and enormous waves of water hundreds of miles inland. The collision left a huge hole at the mouth of what is now the Chesapeake Bay—the lower Susquehanna River valley, carved during the Pleistocene Epoch, when sea levels were much lower than today.

Before impact, the bolide was traveling at a speed of more than a mile per second. It fractured the basement rock deep beneath the shelf's surface, forming a crater surrounded by a “peak ring” 24 miles across (fig. 3). The sedimentary walls of the crater slumped in, widening the opening and forming a ring trough with an outer edge of collapsed blocks and faults.

The slump blocks were covered with rubble from the impact, known as breccia, which extended many miles in all directions, forming a huge rubble bed or “ejecta blanket” (fig. 3). The entire crater is about 53 miles across and 0.8 miles deep, an area twice the size of Rhode Island and nearly as deep as the Grand Canyon. It



**Figure 3—Top:** Location of the impact crater at the mouth of Chesapeake Bay, showing the rings and the extent of the rubble bed (ejecta blanket). **Bottom:** Cross-section of the Chesapeake Bay impact crater, showing its main features and the boreholes that provided the information. Sources: Poag (1998, 2013).

is covered with layers of sedimentary rock that have accumulated since.

The Chesapeake Bay impact crater is smaller and shallower than the Chicxulub crater off the coast of the Yucatan peninsula in Mexico—the one that caused mass extinctions at the end of the Cretaceous Period some 66 million years ago. But it is the largest crater ever discovered in the United States and one of the few oceanic impact craters ever found.

The Chesapeake Bay bolide impact occurred during the Tertiary Period, about 35 million years ago, but the crater contains older sedimentary residues from the ocean floor. While drilling in southern Virginia to study the impact crater, scientists discovered the oldest large body of ancient seawater in the world, about half a mile under the Earth's surface. The seawater they found is twice as salty as today's seawater.

Testing revealed that it is a remnant body of early Cretaceous seawater that was apparently trapped under sedimentary rock. That would make the seawater somewhere between 100 million and 150 million years old!

The ancient seawater is now covered by rubble inside the Chesapeake Bay crater. According to USGS (2013), the seawater is “like a prehistoric fly in amber,” presenting direct information about ancient conditions on Earth.

### Crater Subsidence

The impact crater formed a lasting topographic depression, with rubble that continues to slump and compact, faulting the overlying sedimentary rock (fig. 3) and causing occasional small earthquakes. In fact, rubble slumping affected the flow of rivers in our area, shaping the Chesapeake Bay. The Susquehanna River naturally flowed toward the depression on its way to the sea, and its tributaries visibly chose the same course (fig. 4).

Accordingly, Hampton Roads has the highest rates of subsidence in the entire Chesapeake Bay area. In fact, Hampton Roads is sinking at a rate of from 5 to 7.5 inches per century, making it one of the most vulnerable spots in the United States to rising sea levels, flooding, and storms. Only New Orleans is more susceptible.

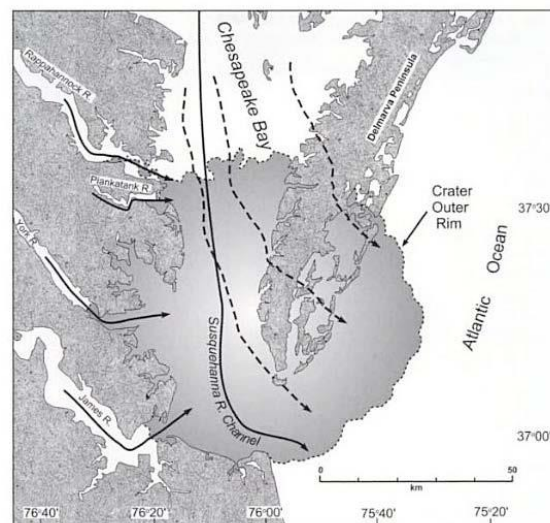
The implications are troubling. If unsustainable groundwater withdrawals continue, aquifer contamination could follow. Coastal areas around much of the Chesapeake Bay are at risk of saltwater intrusion into freshwater aquifers. In Hampton Roads, the risk comes not only from today's ocean waters, but also from the deep salty brine left by the early Cretaceous Atlantic Ocean, now covered by shifting rubble in the Chesapeake Bay impact crater.

The combination of rising sea levels and sinking coastal areas poses additional risks. Higher water levels exacerbate flooding from storms and threaten both homes and ecosystems with erosion and drowning. Inhabitants of islands like Smith Island and Tilghman Island in the Chesapeake Bay are already concerned about the fate of their homes, lands, and livelihoods. Subsidence imperils marsh habitat vital for a range of native fish and wildlife, putting the region's rich commercial fisheries and recreational industries at risk. Who wants to paddle through the waters of Dyke Marsh if the wetland is no longer there?

### The Upshot

So what can people do about it?

For all practical purposes, subsidence and sea level rise amount to the same thing: The impacts



**Figure 4**—Chesapeake Bay, showing the direction of flow of the Susquehanna River and its tributaries today (solid arrows) and at various points during the Pleistocene (dashed arrows). The direction is consistently toward and through the Chesapeake Bay impact crater. Source: Boon and others (2010).



are additive, putting more land underwater. The three major factors at play are subsidence due to groundwater withdrawals; sea level rise due to global warming; and subsidence due to the region's underlying geology.

State and local governments as well as farmers, businesses, and other water consumers can all take steps to conserve groundwater resources by reducing withdrawals. All it would take is the personal and political will.

However, the Chesapeake Bay region alone can do little to affect global warming. Nations are grappling with the issue worldwide, and international agreements have been tantalizingly close. But even if net greenhouse gas emissions fell to zero today, the genie is partly out of the bottle. Processes already underway will continue to raise sea levels for decades to come.

Similarly, subsidence due to the region's underlying geology, such as glacial foreedge collapse and breccia compaction in the Chesapeake Bay impact crater, is beyond human control. The most that people can do is to understand why it is happening, monitor its impacts, and adapt their actions accordingly.

Fortunately, there is hope. People are taking steps to protect and restore wetlands in the Chesapeake basin. In 2013, for example, the U.S. Department of the Interior announced plans



*Paddling in Dyke Marsh. Source: FODM (2014).*

for a project to restore Dyke Marsh, the largest remaining marsh on the Potomac River. The federal government has set aside funding for the project, and planning is well underway.

In January 2014, the National Park Service published its proposed restoration plans, followed by a 60-day public comment period. The next major step, after review of public comments, is a final decision on project plans.

You can review the Dyke Marsh restoration plans and find out about the process by going to <http://parkplanning.nps.gov/projectHome.cfm?projectID=20293>. ↗



*Dyke Marsh restoration planning area and restoration plan (alternative C). The red line extending into the Potomac River outlines the original area of the marsh (in 1937), before its destruction began. Gray areas are remaining marsh today. The green areas, orange bar, and cross-hatching indicate planned restoration measures under the most far-reaching proposal, alternative C. Source: NPS (2014).*

## Acknowledgments

Thanks to Sue Marcus and Roger Haskins for reviewing and commenting on the article. The author is solely responsible for any errors.

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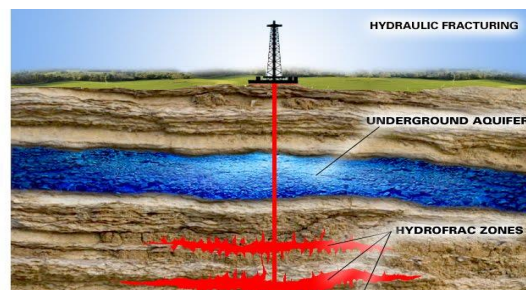
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## Could Fracking Put Coastal Plain Aquifers at Greater Risk? Virginian-Pilot Editorial

*Thanks to Pat Flavin for the link!*

A Texas company has leased lands for hydraulic fracturing in the Taylorsville Basin east of Fredericksburg, VA. The basin underlies enormous aquifers that provide drinking water for 900,000 people. ↗ <http://hamptonroads.com/2014/01/fracking-eastern-virginia>



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

### April

**17:** Field trip, 1:30–4:30 p.m., to Flag Ponds Nature Center Beach, Calvert County, MD; best beach in the country for Miocene megasharks' teeth; \$35 for total group, including educational tour; for info about Flag Ponds, go to <http://www.calvertparks.org/Parks/FlagPonds/FPhome.htm>; for more information on the field trip, contact Pat Flavin at 703-992-8345

**18–19:** Gem, Mineral, and Fossil Show North Museum of Natural History and Science; Fri. 10–6, Sat. 10–5; Farm and Home Center, 1383 Arcadia Rd (off Manheim Pike) Lancaster, PA; Educational programs, door prizes, food; contact: Alison Mallin, 717-358-7188; [amallin@northmuseum.org](mailto:amallin@northmuseum.org)

**26:** Sterling Hill Super Dig; ultraviolet event; registration fee: \$21  
<http://www.SterlingHillSuperDig.org>

**26–27:** 3rd USA Science and Engineering Festival; Walter E. Washington Convention Center, 801 Mt. Vernon Place, Washington, DC; 9–6, admission free  
<http://www.usasciencefestival.org/>

### May

**3–4:** Treasures of the Earth: 11th Annual Show and Sale; The Mineralogical Society of Northeastern Pennsylvania, Oblates of St. Joseph, 1880 Highway 315, Pittston, PA

**14:** Field trip, 1–4:30 p.m., to Flag Ponds Nature Center Beach, Calvert County, MD; best beach in the country for Miocene megasharks' teeth; \$35 for total group, including educational tour; for info about Flag Ponds, go to <http://www.calvertparks.org/Parks/FlagPonds/FPhome.htm>; for more information on the field trip, contact Pat Flavin at 703-992-8345

**16–18:** Smithsonian Magazine presents: The Future Is Here—Science Meets Science Fiction: Imagination, Inspiration, and Invention; featuring scientists, Star Trek stars, and others; Ronald Reagan Building, Washington, DC; for

more information and ticket sales, go to <http://www.smithsonian.com/future>

**17–18:** 46th Annual World of Gems and Minerals: Gemstone, Jewelry, Bead, Mineral and Fossil Show; Berks Mineralogical Society, Leesport Farmer's Market, Route 61, Leesport, PA

**24:** Ruhl Armory Show; Sat. 10–4; Chesapeake Mineral Club, Baltimore, MD  
<http://www.chesapeakegemandmineral.org/>

### June

**7:** 62nd Semi-Annual Mineralfest; Pennsylvania Earth Sciences Association; Macungie Memorial Park, Poplar Street, Macungie, PA

### July

**11–13:** 2014 AFMS/RMFMS Convention and Show; Central Park Hall, Tulsa Expo Square, 21<sup>st</sup> and Yale, Tulsa, OK; Theme: Rocks and Gems of the Indian Territory; Fri/Sat 9–6, Sun 10–5; \$6 for 1-day pass, \$10 for 2/3-day pass, children 12 and under free; Finis Riggs, 918-587-4400, [Lriggs1331@cox.net](mailto:Lriggs1331@cox.net)

### August

**15–17:** Gem Miners Jubilee; Fri. 10–6, Sat. 10–6, Sun 10–4; admission: \$6; Lebanon Expo Center, Lebanon, PA  
<http://www.gem-show.com>

### September

**1–7:** EFMLS workshops at Wildacres Geology Retreat; Fall classes, tuition \$390  
[www.amfed.org/efmls](http://www.amfed.org/efmls)

### November

**22–23:** Northern Virginia Mineral Club Annual Show; George Mason University; Braddock Rd. and Rte. 123, Fairfax, VA





## 2014 Club Officers

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PLEASE VISIT OUR WEBSITE AT:  
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## The Northern Virginia Mineral Club

You can send your newsletter articles to:

[hutchbrown41@gmail.com](mailto:hutchbrown41@gmail.com)

**Visitors are always welcome at our club meetings!**

**RENEW YOUR MEMBERSHIP!**

**SEND YOUR DUES TO:**

Kenny Loveless, Treasurer, NVMC  
PO Box 10085, Manassas, VA 20108

**OR**

Bring your dues to the next meeting.

**Purpose:** To promote and encourage interest in and learning about geology, mineralogy, lapidary arts, and related sciences. The club is a member of the Eastern Federation of Mineralogical and Lapidary Societies (EFMLS, <http://www.amfed.org/efmls>) and the American Federation of Mineralogical Societies (AFMS—at <http://www.amfed.org>).

**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 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.*