

# THE GEOLOGICAL SOCIETY OF MINNESOTA

## News

*Volunteer  
opportunities,  
field trips,  
lectures, and  
public service,  
since 1938*



GSM President, Dave Wilhelm

### From the President's Desk...

Almost three years ago, I started my second term as GSM President. This is my 12th and final column before my term ends December 31, 2020. I have very much enjoyed serving as your president, and I hope you feel you were well served. GSM by-laws limit Board membership to two consecutive two-year terms to encourage new Board members with new ideas. My second four-year stint on the Board is at an end. But rest assured, I will continue to be active in GSM. I continue as Video Librarian and with **Joe Newberg** continue as Field Trip Coordinator. As I write this, the November Board meeting is still two weeks away, so my successor has not yet been elected. By the time you read this, you will likely know who our new officers are.

Besides my term, the second term of Vice President **Deborah Naffziger** ends in December, as well as first terms of **Wolf Bielefeld**, **Roxie Janezich**, and **Frank Janezich**. Wolf, Roxie, and Frank agreed to run for second terms; **Nancy Jannik** and **Pete Hesse** stepped up to join the Board for the first time. Normally, we elect new and continuing Board members at our Fall Banquet in September, but not this year. With Secretary **Dave Kelso's** assistance, I conducted the balloting by e-mail. As you already saw, all five candidates were elected unanimously, and start their terms January 1. I am confident that our organization remains in capable leadership.

Our lecture series has gotten off to a good start, virtually. **Randy Strobel** led a members-only seminar on COVID-19 on August 31, to help us work out the details of conducting seminars remotely over Zoom. (Randy also sets up the Zoom webinar for each lecture.) Our official lecture schedule started September 21; as I write this, we have held three seminars with an average attendance of 67. Most seminars are recorded and I have sent out links for the recordings when they become available. We don't know how many watch the recordings; the attendance includes only those watching or listening live. One thing we have not figured out is having cookie break remotely. ☺ One advantage of remote lectures is that **Steve Erickson** can schedule presenters who are not local. Two of our early presenters are from U of M Duluth, which would be too far to travel for a one-hour lecture. As always, our lectures are free and open to the public, with registration for non-members done through our website. Feel free to invite friends or family who might be interested to register that way. A few holes still remain in the schedule, but Steve has leads on filling them. If you have an idea for a lecture, or a presenter, contact Steve with the information, or submit it using the "contact us" form on our website. Steve always appreciates new leads.

A few of us continue to meet socially via Zoom at 7 PM, on non-lecture Mondays. If you might like to join a session, drop me an e-mail, and I'll send you a link and instructions. We've had lots of fun meeting this way and would like to see more members join us.

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from the GSM archives:  
Jay Cooke, St. Louis River, dry bed, 1941.



The pandemic greatly limited our field trips for this year, but **Kate Clover** did not one, but two, editions of a well-researched trip highlighting the Platteville Formation in the Twin Cities, especially its use as a building material. She will likely lead another in 2021, as there was more demand than availability. See **Deborah Naffziger's** report in this issue.

In lieu of field trips and other in-person activities, I continue sending occasional e-mails with seminars and articles that can be accessed online. I hope you find these informative. If you learn of something that our members might like, let me know and I'll pass it on; that is the way I have gotten most of this material. **Theresa Tweet, Mark Ryan,** and I also post articles related to earth sciences on the GSM Facebook page, so check that occasionally. Stay informed, connected, & healthy, and enjoy the upcoming holidays.

Dave Wilhelm

### GSM

#### Officers:

Dave Wilhelm, President  
Deborah Naffziger, Vice President  
Dave Kelso, Treasurer  
Dave Kelso, Secretary

**Board Members:** Wolf Bielefeld; Frank Janezich; Dave Kelso; Roxy Janezich; Deborah Naffziger; Joe Newberg; Patrick Pfundstein; John Westgaard; Dave Wilhelm

**Editors:** Kate Clover; Mark Ryan; Harvey Thorleifson; Rich Lively

**Programs/Lectures/Labs:** Steve Erickson

**State Fair:** vacant

**Video Library:** David Wilhelm

**Webmaster:** Alan Smith

**Membership:** Joanie Furlong

**Field Trips:** David Wilhelm; Joe Newberg

**Outreach:** Joel Renner

**Geological Markers:** Rebecca Galkiewicz

**Lecture Recording:** Joe Wright

**Web Site:** [gsmn.org](http://gsmn.org)

The Geological Society of Minnesota is a 501(c)3 nonprofit organization.

**GSM Mail Address:** Send all GSM membership dues, change of address cards, and renewals to: Joanie Furlong, GSM Membership Chair, P.O. Box 141065, Minneapolis, MN 55414-6065

#### Membership categories and dues:

|                            |       |
|----------------------------|-------|
| <b>Student</b> (full time) | \$10  |
| <b>Individual</b>          | \$20  |
| <b>Family</b>              | \$30  |
| <b>Sustaining</b>          | \$50  |
| <b>Supporting</b>          | \$100 |
| <b>Guarantor</b>           | \$250 |

Individual and Family memberships can be renewed for 1, 2, or 3 years. Members donating at the Sustaining, Supporting or Guarantor levels will have their names highlighted in the GSM membership directory.

**GSM News:** The purpose of this newsletter is to inform members and friends of activities of interest to the Geological Society of Minnesota. GSM News is published four times a year during the months of February, May, August and November.

#### Newsletter contributions welcome:

GSM enthusiasts: Have you seen interesting geology while traveling? If so, please consider sharing your experiences with others through our GSM Newsletter. Write a short article, add a photo or two and send it in. Deadline for submission is the first of the month before the publication date. Send your story to newsletter editor: Kate Clover, [kclover@fastmail.fm](mailto:kclover@fastmail.fm) Thank you in advance.

#### GSM Board Membership:

The GSM Board consists of members who have a special interest in advancing the goals of the society, including lectures, field trips, and community outreach. The Board currently has ten members, and our bylaws limit terms to four years to encourage turnover, and a change of perspectives and ideas.

The Board meets quarterly, on the second Thursdays of February, May, August, and November, or on a different date if conflicts arise. Meetings are from 7-9 PM at the Minnesota Geological Survey at 2609 W. Territorial Rd, St. Paul, MN 55114.

Board meetings are open to all GSM members. If you are a new or long-time member and Board membership is of interest to you, please consider attending a meeting. If you have a topic you would like the Board to consider, please contact Dave Wilhelm, [dewilhelm53@msn.com](mailto:dewilhelm53@msn.com)



### New GSM Members:

Ann Robbins, Ypsilanti, MI  
 Lorenze Francisco, St. Paul  
 Bill & Mari Wittenbreer, St. Paul  
 Nils Nordstrom, Minneapolis  
 Ney Nature Center, Henderson  
 James & Marlene Voita, Afton

### GSM Member Spotlight



#### Becky Galkiewicz

I have been a GSM member since 1979. I went to State Fair as usual that year and found the GSM booth. The friendly people inspired me to attend a lecture! About 3 years later, I was invited to join the Board of Directors and served on the board for 2 terms. In my experience, getting involved as a volunteer is a fast way to get to know people. I have stayed involved with the board now that I'm a committee chair.

I became involved in the Marker Committee while on the Board. My husband and I have enjoyed exploring the state parks of Minnesota over the years and discovered that many of the markers are located in or near state parks. With guidebook in hand, we went out to find as many markers and state parks as we could, and traveled through most of Minnesota.

The Marker Committee was formed at that time — Alan Smith, Dan Japuntich, Dick Bottenberg, Lee Kaphingst, Kate Clover, and me. Alan redesigned the GSM web page and created the Marker Home Page which helps

people find the markers. Our goal has been to visit every marker in the state (there are about 70 markers, and this is a big state) to take photos, determine the GPS coordinates, and improve the driving instructions. Long term, the goal is to make the GSM Marker Web Page usable for the general public — science teachers, students, tourists, families, as well as children developing an interest in geology!

I have always been interested in science and concentrated on biology and public health during my career. But every time my family and I went on a vacation, we always seemed to find a geological wonder to enjoy — Hawaii, Alaska, Yellowstone, Devil's Tower, Taylor's Falls, Lake Superior, the Alps, etc. So, when I retired, it was time to explore my interest in geology. I am trying to improve my "geological eye", as Sue Leaf in her biography of Newton Horace Winchell describes it - the ability to read the landscape and imagine what caused it many, many years ago.

What I dig about the GSM is the people who share this love of geology. We have an amazing number of geology experts in Minnesota and nearby and they have been willing to share their work with us. The field trips are fun and a great way to learn geology. I urge people to volunteer and get to know the Board and committee members who make all this work.

My favorite place to travel for geology sights is Iceland and Oregon's Cascade mountains. I have found a number of films in the GSM library that have helped me learn.

To all GSM members, thanks for sharing your enthusiasm with others.

### NOTES FROM THE PAST

*From the December 1945 issue of the Minnesota Geologist, the Official Bulletin of the Geological Society of Minnesota*

#### A Fairy's Teardrop

Many, many years ago according to a legend of the hills, a fairy queen ruled over Patrick County, Virginia. The county was then known as Fairyland and it rivaled the Garden of Eden for beauty and happiness. One day, however, the enchantment was broken. From the far-away land of dawn, out beyond the sea, came the news that Christ had been crucified. A shudder of horror swept over the elfin company. And then stunned amazement gave way to tears; hundreds, thousands of tears, which fell on the ground and then crystallized into tiny crosses.

Centuries passed and the fairy tears were covered with layer upon layer of rock and soil. But even now occasionally, in one small mountainous area of Patrick County, one of these fairy stones, as they are called by unimaginative present-day Americans, is found.

In the rough stone, the strange formation of these little crosses is scarcely noticed, but close examination reveals the faint design. A few deft strokes with a file and the unmistakable form of a cross, teardrop of a fairy of long ago, emerges. Sometimes the cross is Roman, sometimes

Maltese. And it is said that the possessor of one of these treasured bits of stone thenceforth leads a charmed life – no harm can come to him and luck and good fortune are mysteriously attracted to him, all through the agency of the tiny fairy cross.

The encyclopedia bluntly defines these little objects as staurolites, from the Greek STAUROS, a cross, and LITHOS, a stone. It goes on matter-of-factly to something about “silicate of alumina,” “orthorhombic forms” and “gneisses and schists.” But all that, of course, is just the clumsy geological analysis of a fairy’s teardrop.

Staurolites are a product of metamorphism, sometimes referred to as “porphyritic mineral.” The crystals are often found in schist or slate, but may be found in gneiss, and are commonly associated with garnet and kyanite. They usually occur in well developed prismatic crystals of six sides, characteristically twinned in the form of a cross, some plus-shaped, some x-shaped. Color is reddish brown to black; specific gravity 3.75; hardness 7 to 7-1/2; mineral composition hydrous iron, aluminum, silicate. Sometimes the iron may be replaced by magnesium or other minerals. They are found in abundance at Little Falls, Minnesota.

### WINTER GSM LECTURE SERIES

Lectures are free and open to the public

Virtual Lectures 7:00 PM, CT. Mondays

Participation instructions and last-minute changes will be posted on our web site: [www.gsmn.org](http://www.gsmn.org)

2020:

**Nov 16 Minnesota’s Geologist: The Life of Newton Horace Winchell**

Sue Leaf, Ph.D., Author

**Nov 30 Mesozoic Vertebrates of Antarctica**

Peter Makovicky, Ph.D., Professor, Earth and Environmental Sciences, U. of MN

**Dec 14 The Glacial History of Iowa**

Phillip Kerr, M.Sc., Geologist, Iowa Geological Survey

2021:

**Feb 1 Presenter & title TBD**

**Feb 15 The Dawn of the Dinosaurs**

Kristi Curry Rogers, Ph.D., Professor, Vertebrate Paleobiology Dept., Macalester College

**Mar 1 Remediation of the Saint Paul Ford Plant**

Amy Hadiaris, M.Sc., Supervisor, Minnesota Pollution Control Agency

**Mar 15 Craton to Coast: National Park Paleontology from the Grand Canyon to the Channel Islands**

Justin Tweet, M.Sc., Owner of Tweet Paleo-Consulting

**Mar 29 Agate Hunting**

Jim Magnuson, Author, Owner of Minnesota Rocks

**Apr 12 Geo 3M: Mountains, Melting, and Metamorphism**

Donna Whitney, Ph.D., Professor, Earth and Environmental Sciences, U. of MN

**Apr 26 How Modern Geochronology is Transforming Our Understanding of Geological Rates: An Example from Alaska**

Cameron Davidson, Ph.D., Charles L. Denison Professor of Geology, Carlton College

**May 10 Minnesota Underground: A Guide Book to Exploring the Minnesota Underworld**

Greg Brick, Ph.D., MN Department of Natural Resources

### Mississippi River Drawdown

The U.S. Army Corps of Engineers occasionally lowers the Mississippi River in Minneapolis to conduct inspections of the Upper and Lower St. Anthony Falls Locks and Dams and surrounding structures. The most recent drawdown started October 3, 2020, with river level at its minimum on October 6<sup>th</sup> and 7<sup>th</sup>. Water levels dropped about 12 feet. The previous drawdown was in 2008, so these don’t occur often. Only about a half-mile stretch of the river was lowered - the pool between the upper and lower St. Anthony locks. The drawdown offered me and thousands of others a rare opportunity to see the riverbed between the two locks. It also allowed us to see the footings of the Stone Arch Bridge below the river’s usual water line. Coincidentally, the river would have flowed similar to this when the bridge was built in 1883, before the river was altered by the lock and dam.

A thumbnail history: Saint Anthony Falls was the only natural major waterfall on the Upper Mississippi River. The natural falls were replaced by a concrete spillway after the falls partially collapsed in 1869. Without this spillway, the falls would have eroded away to a series of rapids, as the hard, thin layer of Platteville Limestone overlying the soft St. Peter Sandstone thins to nothing in this area. Later, in the 1950s and 1960s, a series of locks and dams was constructed to extend navigation to points upstream. In 2015, the Upper Saint Anthony Falls Lock was closed permanently by an act of Congress for reasons that included minimal usage of the lock and to stop the upstream spread of invasive Asian carp.

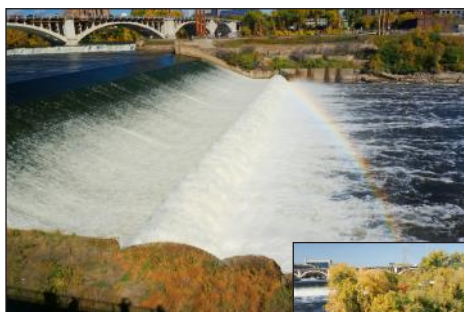
The Corps happened to pick one of the nicest weeks in the Twin Cities for their work, with mild temperatures, sunny skies, and brilliant fall colors. With camera in hand, I spent two hours October 7 exploring both banks of the Mississippi, and between these banks, the Upper St. Anthony Falls Dam, the retired lock that accompanies it, and the historic Stone Arch Bridge. I did not make my way down to the exposed riverbed, but fellow GSMer Mark Ryan did; the following photos from river level are his.

For more photos, visit <https://tinyurl.com/StAnthonyFalls2020>.

Dave Wilhelm



Photos by Mark Ryan



Rainbow formed at the spillway of the Upper Dam.



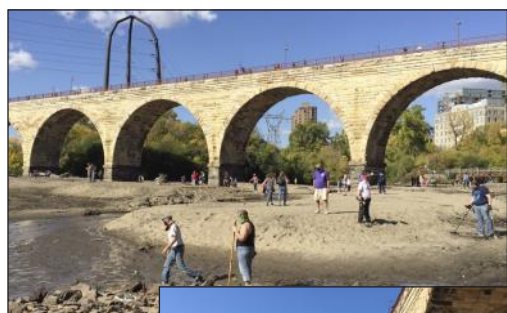
Outlet from St. Anthony Falls Lab, with people exploring riverbed that is usually submerged.



View from stone Arch Bridge overlooking the basin downriver of the Upper Lock; water lowered 12 feet.



Exposed parts of the riverbed usually seen, viewed from Mill Ruins Park.



Treasure seekers, some with metal detectors, explore beneath the Stone Arch Bridge.



The darker lower portion of the piers of the Stone Arch Bridge; usually under water.

Some debris removed from the riverbed.



Remnants of a long-gone support, usually below the water line; inset shows same support at normal river level.

### Platteville Field Trip

The fall day was wonderful, warm, and overcast with about 25% fall color. It was a joy to be outdoors and to see all my GSM friends again. Just getting out and about for something other than groceries was a treat.

The Platteville limestone lies above the St. Peter sandstone, the soft stuff you can carve with a teaspoon, and best seen at Minnehaha Falls Park, as well as many other places around town. The St. Peter Sandstone is a valuable industrial material, most famously used by Henry Ford to manufacture car windshields. But today was devoted to the Platteville Limestone, which is made up of several distinct layers or members of varying mineral composition and industrial usefulness.

We met at St. Peter's Church in Mendota off Highways 13 by 55. Kate Clover planned the trip and we all checked in, and generally milled around and visited. She displayed a map and other historic photos on the rear window of her car, and people came by and checked them out in a safe, socially-distant manner during the pandemic.

She explained about the Platteville Formation's different members and how they were used: stone blocks for buildings, and as crushed rock for roadbeds. The argillaceous (muddy) layers were used in buildings, but this particular layer erodes more readily along the mud lines. She also suggested we look at the doors and windows and notice how they were made and framed. The stone work reflects the skills of the masons and the end use of the building - church or house.

Old St. Peter's is a relatively small church by today's standards, 35' x 75', but it was well-built and is still very solid. Constructed in 1853, it uses the most solid layer of



limestone, which was quarried 'on site,' although the exact site is not known. The stone has held up remarkably well. Built by German stonemasons, the church has sophisticated windows, corners and a bell tower. The tower has dressed stone (cut, shaped and finished), but it has been renovated, so those are not original. The windows are arched with uniform smaller



The stained-glass windows at St. Peter's Church are fairly plain with just an inset panel with colored panes.

stones lining the openings. One side is better built than the other. The inferior side has more irregular size blocks and rows. The well-built side has regular-sized large



Stone blocks on the church were laid in various orientations. The stones vary in size.

blocks in orderly rows, and corners with sideways blocks with the top facing outwards as decoration. You can see some fossils in these stone blocks. It looks like they started building on what is now the substandard side; and as they learned, they were able to refine their techniques and do a better job on the nicer side.

The second stop had 4 features to see: Sibley House and accompanying icehouse, Faribault House and a railroad tunnel.

Sibley House, which dates to 1835, is the oldest stone house in Minnesota. Henry Sibley, (later Minnesota's first governor), supposedly built it, probably with help. The windows are the simplest construction, a long limestone block over the window opening. These stone blocks are less fine than at the church and with rougher texture. The icehouse has similar construction.

Faribault House, built in 1836, originally was a tavern, which was later converted to a warehouse. The stones in this house show some chisel marks, so it is more dressed than its neighbor. The windows have vertical dressed stones above, and are more decorative. The corners are also decorative, and it looks nicer and more 'civilized' than the Sibley House.

The stone on both houses has held up well and shows little weathering. However, the steps up from the street at the Faribault House were constructed with the argillaceous limestone and are weathering away.

From 1910 to 1996, the Minnesota Society of the Daughters of the American Revolution volunteered time, money and leadership to restore and care for the historical site. Since 1996, it has been managed and cared for by the Minnesota Historical Society.



Stonemasons framed the top of the windows on the Faribault House with vertical stone blocks.



Stones on the Faribault House are still solid after 185 years. The stones have been repointed

The stone for all three buildings was quarried on-site, though again, the quarry's exact location is unknown.

Farther down the road, which was a main road up through the 1920's, there is

a railroad tunnel made from the argillaceous limestone. Even the parts on the inside, away from direct

weathering, show deterioration, and some repairs have been made here and there. Supposedly this stone was quarried elsewhere and transported by rail to the site. The railroad tracks were relocated, but the tunnel still stands. This limestone rail bridge dates to



The icehouse next to the Sibley House shows multiple renovations.



1864. It carried the Minnesota Central Railroad into Mendota after crossing the Minnesota River. The road under the arch carried horse and auto traffic to the Fort Snelling ferry until 1926.



*The rails over this 1864 bridge carried trains across the Minnesota River.*

The third stop was at Bielenberg Quarry, the present site of Cerenity Senior Center in the Cherokee Heights neighborhood of St. Paul. Here, a wall of limestone shows some of the Platteville

members. The high-grade yellow limestone was the primary material removed from the site. They left the less desirable blue limestone. Farther into the site are outcrops of argillaceous limestone, perhaps left as undesirable to quarry. This limestone does have fossils, and is easy to flake apart. The quarry was in operation in the early 1900's, and they crushed the yellow limestone for roadbeds. Elsewhere there were quarries of blue limestone 12-14 feet thick, so the formation varies quite a bit across the Twin Cities.



*The Bielenberg Quarry in Cherokee Heights covered five acres.*

The fourth stop, in downtown St. Paul, was the fanciest building we would see in the day. Assumption Church dates to 1871, and used dressed stone to make a fine sophisticated

building. The windows are rounded and ringed with dressed stones. The blocks are very uniform in size and coursed (in uniform horizontal rows), more like large bricks than quarried stones. Assumption is the oldest church in St. Paul, and was built at the same time as the school a block or so away. The church is made of finer dressed blocks and the school of plain-quarried limestone, though the school is still



*Window details of Assumption Church. Note the dressed stones framing the window.*

well-built and stands up well. The school has blocks of limestone over the windows, so they used less sophisticated techniques for that. But the corners are decorative with some dressed stone, so some special effort was made there.

On the parking lot side of the church you can see modern renovations, with concrete poured over the original limestone steps. The stained-glass windows are more traditional, with more scenes and decoration than the simpler ones at the old St. Peter's Church in Mendota.

The fifth stop was at the Alexander Ramsey House, built in 1872. It is nearly as elaborate as Assumption Church. The house has dressed stone and is coursed. The mortar between the stone is decorative and



*Stone around the windows on the Ramsey House was dressed and looks formal.*

raised (not flush). The windows have arches with keystones and spiral shaped side decorations. And the back of the house is less fancy than the front; these were the servant's quarters, so their windows were plainer and more utilitarian.

This neighborhood was built above the Upper Landing on the Mississippi River, the farthest the river boats could navigate before the river upstream was made navigable with the locks and dams.

We walked six blocks to the next stop and saw many interesting houses in the Irvine Park neighborhood. Most were wood framed or brick, but limestone was used in foundations. The neighborhood has been reclaimed and renovated and that shows what concerted neighborhood action and urban pioneers can do.

The sixth stop was the Schilliger-Briggs house, built in 1859 by a Swiss stonemason. It is two stories with wooden porches on either side off the back. It has been restored based on photographs and historical



*Bob Frame, the current owner of the 1859 Schilliger-Briggs house shared details about his house and its history. We remained socially distanced and masked.*

research. Made of limestone, it is a simple box, but not elaborately decorated. The windows have a block of limestone on top. It was moved to the present site in 1989. Its original site was where a United Hospital clinic





*A window at the Martin Weber house.*

now stands. By that time, the neighborhood association was active and insisted that the house be moved rather than being razed. About the actual move: the last, half block was downhill and the most difficult.



*Replacement lintels for the Martin Weber house.*

Up the street from the Schilliger-Brings house, an outcrop of Platteville shows how close to bedrock these houses were built. The last stop was the Martin Weber House, built in 1865 by a cooper (a barrel maker) for Funk's brewery. This

house is also limestone, and the stones were not dressed. It has nicely shaped blocks of limestone over the windows. The stones on this house have recently been repointed, and the stone lintels over the front door were replaced as well. It is a reminder that skilled trades have changed through the years, and while there may not be coopers anymore, there is still a need for skilled stone masons to maintain these historic buildings.

The churches were the fanciest buildings we saw, and the houses mostly more modest and basic. Square was the basic shape of all the buildings except the Assumption church. There were no extra alcoves or dormers or additions. Just basic stone buildings. But they were built solidly and to last the ages.

Although rain threatened all day, it held off until the last stops and then only sprinkled. We all dispersed back to the cars and went home. It was a long day, and we did not see all the sites, but it was a nice variety. Kate Clover made a nice handout listing the places we visited as well as many more to be explored on our own, allowing for further learning. A good time was had by all.

Deborah Naffziger; Photos by Dave Wilhelm

## MARY ANNING'S BONES

### A visit to Lyme Regis on the Jurassic Coast

By Mark Ryan

Last autumn my wife Marge and I traveled to Great Britain. On our way to visit relatives in Cornwall, we stopped for three days in Lyme Regis, a quaint, seaside town situated about 150 miles from London on England's southern coastal region near the border of Dorset and Devon. The popular resort destination is best known, even outside geology and paleontology circles, as a prime fossil hunting location, and the hometown of its most famous 19<sup>th</sup> century fossil collector, Mary Anning.

The town of nearly 3700 residents occupies a river valley amid the precarious slopes of the Jurassic Coast, a 95-mile span of Mesozoic

Era rock exposures across the southwestern coastline. This UNESCO Heritage Site - England's only natural one - is

celebrated for its beauty, steep landforms, geology, rocks, and fossils. It was in this environment that Mary Anning made her discoveries that determined not only her own fate but that of the nascent sciences of geology and paleontology.

Lyme is built upon the steep banks of a valley cut by a river the Romans called Lym Supra Mare ("Torrent of water over the sea"). In 746 AD King Cynewulf of Wessex gifted the area to the abbots at nearby Sherbourne Abbey to set up a salt boiling works, and the town grew up from there. In 1284, King Edward I granted to Lyme a Royal Charter thus adding "Regis" to its name.

Five centuries later, the town's most celebrated citizen,



*Map showing Lyme Regis location.*

*Mary Anning and her dog, Tray, by William Gray, ca. 1842.*



*View south on Broad Street from site of Mary Anning's fossil shop after 1826.*



*Lyme Regis from near The Cobb. The groyne in foreground prevents the beach beyond it from drifting eastward.*



Mary Anning, was born to parents Molly and Richard Anning on May 21, 1799, the same year William “Strata” Smith published his first geological map. By then Lyme Regis had endured civil war battles, the Spanish Armada, bouts of extreme poverty, and countless batterings by the sea especially when strong winds out of the south and south-southwest coursed across the English Channel.

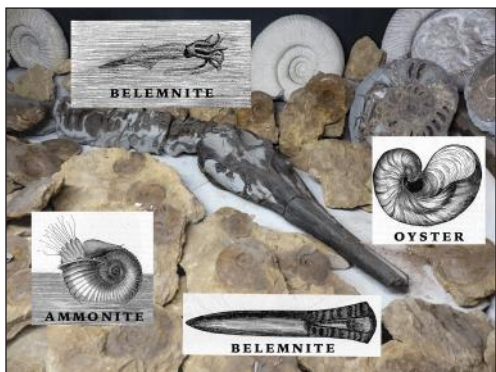
Even “The Cobb,” the town’s longstanding breakwater dating back to the 13<sup>th</sup> century suffered damage and repairs many times over the centuries. The curving barrier was constructed in Lyme Bay to create an artificial harbor that allowed larger ships to port there. Originally built of stone and timber, the famous landmark is now reinforced and covered in concrete. The Cobb was featured in Jane Austen’s novel *Persuasion*, and in John Fowle’s *The French Lieutenant’s Woman*.



*The Cobb, town beach, and seaside promenade from Langmoor Gardens.*

Of the Annings’ ten children, only Mary and her older brother, Joseph, survived into adulthood. Mary nearly didn’t make it beyond 15 months. One humid August afternoon in 1800, a

neighbor offered to take Mary to watch a traveling equestrian show. When a thunderstorm blew in, the neighbor swept the youngster into her arms and sought shelter under a tree with two other women. A sudden crack of lightning split the tree killing them all except Mary. The lifeless child was somehow revived after being submerged in a tub of warm water. While Mary seemed physically unscathed, her mother claimed the event changed her daughter’s personality. Prior to the tragedy, Mary had been a dull and lackluster toddler who ate little and fussed much, but afterwards was



*Some common Lyme Regis fossils.*

suddenly transformed into a child who was “bright, lively, and inquisitive.” Richard Anning, Mary’s father, was a carpenter who added to the

family’s sparse income by selling “curiosities” he collected from the beaches below the nearby rugged and dangerous cliffs. He shared his avocation with his children although the activity rattled their mother who was “wont to ridicule the pursuit of such things.” Unfazed, Richard taught his children not only where to find the fossils but also how to clean and make them more desirable for sale. The prettier fossil were offered to visitors from a small, round table set in front of the Annings’ seaside cottage.

The fossils remained as mysterious to the Annings as they had to anyone before their time. Ammonites (coiled cephalopod shells) were thought to be the petrified remains of headless snakes possessing magical powers to relieve snakebites, and a host of other ailments. The large, curled shells of oysters were called “Devil’s Toenails,” and any kind of fossil vertebrae, whether fish or otherwise were simply “verteberries”.



*View from Monmouth Beach on west side of Lyme proper showing debris apron in foreground and dipping Blue Lias layer. The Blue Lias strata reappears above sea level on Lyme’s east side.*

Mary’s father died at age 41, leaving the family without income, weighted with debt, and forced to seek parish relief. Mary, only 11, and her brother continued collecting fossils in hopes of bringing in some money. One afternoon, as Mary headed home with a newly found and particularly beautiful ammonite in hand, a passing woman offered her half-a-crown for the fossil. Mary happily accepted the offer, and the lucrative sale set in motion her future of “going to the beach” as often as she could.

The coastal cliffs around Lyme Regis are comprised of strata historically called the Lias Group. The bottom layer, the Blue Lias formation is



*View of Black Ven east of Lyme. Early Jurassic marls lay unconformably over by Early Cretaceous cherts and greensands (brown from oxidation). The dark Blue Lias strata disappears below sea level here just before Charmouth.*

an easy-to-trace sequence of early Jurassic-aged limestones. It is interbedded with shales and soft marls and exposed across the Devon-Dorset border in an undulating series of synclines and anticlines between Pinhay Bay in the west to Charmouth in the east where they dip below sea level. The same sedimentary rocks, laid down in a shallow sea roughly 200 million years ago, cut diagonally and continuously across England and are exposed on the northeast shores of the country near Whitby in Yorkshire. Outlying exposures can be seen in South Wales and Somerset, and in outcrops on the Continent. The name Lias is derived either from the old quarrymen's regional pronunciation of "layers" or from Gaelic meaning "flat stone," or perhaps from both. The Lias is overlain unconformably by Lower Cretaceous deposits of chert and greensands, the latter appearing brown from oxidation. The famous Chalk beds are atop these but hidden beneath alluvial drift and vegetation. The cliffs are notoriously unstable and landslips are common. Blue Lias limestone has long been quarried along the base of the cliffs, providing much of the construction material used for buildings in Lyme. It's estimated some 90 feet of shoreline has been removed since Mary Anning's time.

Click the following link to view geologist Ian West's CROSS SECTION graphic, then click image to enlarge it: <http://www.southampton.ac.uk/~imw/jpg-Lyme/11LYM-West-Dorset-Cliff-Section.jpg>

Eastward between Lyme Regis and Charmouth, the steep exposures have names like Church Cliffs, East Cliffs, the Spittles, and Black Ven, all place names that would have



View east from Church Cliffs showing East Cliffs, The Spittles, and Black Ven beaches.

been familiar to Mary Anning.

The beaches fronting these steep cliffs are prime fossil hunting grounds, especially for ammonites, and cigar-shaped cephalopods

called belemnites. Crinoids and oysters are common, too, while vertebrae and other remains of fish, crocodilians, ichthyosaurs, and plesiosaurs are rarer. Pyritized ammonites are prized fossils that spill out from the crumbling top Black Ven deposits, especially in the Spittles area. The shiny, coiled fossils are easy to spot among the dull rocks littering the beachfront.

The west end of Church Cliffs, which in Mary's time was much more exposed and just a few steps from the Anning house, is where a 4-foot skull had fallen to the beach and was found in 1811 - not by Mary - but by her older brother, Joseph. Mary helped remove the fossil, then spent the next year searching for the rest of the skeleton, most of which she finally located in an upper ledge some 30 feet above the shoreline. Joseph thought

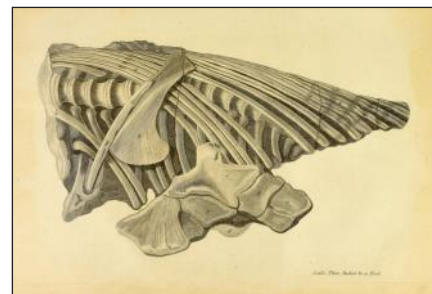
the skull belonged to some sort of crocodile, but time would prove it to be a new creature later named Ichthyosaur, meaning "fish lizard." These large marine reptiles resembled a porpoise in shape with a long snout, crocodile-like teeth and huge saucer-sized eyes. Their biconcave vertebrae were common on Lyme beaches, but a full skeleton had never been found.

PHOTO #11 & CAPTION: "Rest of skeleton discovered by Mary Anning in 1812"]

The magnificent 17-foot-long specimen not only brought much needed income to the Anning family but its near completeness ignited a sensation across the European scientific community at a time when fossils and geology were still considered by some as "dangerous to the truth of revelation" and when many early adherents to the science such as Adam Sedgwick, William Conybeare, and William Buckland, were also clergymen and strict creationists.



Figure of the ichthyosaur skull discovered by Joseph Anning in 1811.



Rest of skeleton discovered by Mary Anning in 1812

It was also an era when educating girls

- especially lower-class ones like Mary - was considered a waste of time by most of society, but the Annings were "Dissenters," members of a Christian sect that didn't practice the state-sanctioned faith of the Church of England. Mary's Sunday School at Independent Chapel on Coombe Street taught both boys and girls - in mixed classes - with an emphasis on reading and writing rather than theology. Early in her schooling, Mary's brother gave her a bound volume of the church's *Theological Magazine & Review*, which among its subjects contained both an essay insisting God created the universe in six 24-hour days, and a curriculum guide urging Dissenters to study the new science called geology.

Her formal schooling was minimal, as Dissenters weren't allowed to attend university, and being a lower-class female didn't help. But Mary was "a being of imagination" and consumed any books or scholarly articles she could acquire, sometimes copying



Mary Anning's copy of George Roberts' geology dictionary inscribed with her signature



both text and illustrations, as books were scarce and expensive. Within a few years, she became well-versed in geology, animal morphology, and scientific illustration, and an expert in the local geology and fossils. She dissected modern fish and squids to better understand their anatomy and relate it to the fossils she found. She even taught herself French so she could correspond with comparative anatomist Georges Cuvier in Paris.

While Joseph set aside collecting to apprentice in a trade, Mary became the go-to expert for locating fossils in the Lyme region. Two later discoveries – the first a near-complete skeleton of a plesiosaurus in 1823, and then the first fossil pterosaur in Britain a few years later, further bolstered her reputation. As recorded in the diary of her friend Anna Maria Pinney: “[S]he has been noticed by all the cleverest men in England... and she has the proudest and most unyielding spirit I have ever met with. Much “learning has made her mad.” She glories in being afraid of no one, and in saying everything she pleases.”



*Drawing of Mary Anning by Henry De la Beche. She often wore a stiff top hat to guard against rock falls.*

The bigwig scholars of early paleontology sought Mary's expertise and assistance. Men such as paleontologists Buckland and Conybeare, anatomist Richard Owen, and Swiss geologist Louis Agassiz would visit her shop, maybe purchase some of her fine specimens, or enlist her to lead field trips to Lyme's beaches. Confident and articulate, Mary held her own against the best of them. After visiting Mary's shop, Lady Harriet Silvester, a woman of some standing marveled at how “this poor, ignorant girl” had managed through her own edification to be interacting with learned men who “all acknowledge that she understands more of the science than anyone else in the kingdom.”

Mary's remarkable story and Dorset's spectacular coastal geology were two reasons we visited Lyme Regis; fossil hunting was another. But regrettably, our time there coincided with high tide. This was unfortunate (and unforeseen - I'm a landlubber) because it meant much of the shoreline at the base of the eastern cliffs was underwater during daylight hours. It also forced any fossil hunting to take place much closer to the foot of the treacherous cliffs. The coastline around Lyme Regis is some of the most unstable in England and considered very dangerous. Rockfalls and landslides are frequent

and unpredictable. Fossil hunters and beachcombers are warned to stay clear of any cliff base. Normally, you'd be able to walk the beach from Lyme to Charmouth (about a mile east) and look for fossils in the shingle (beach coverings). But even during low tide you always have to keep an eye on the encroaching sea; you don't want to get stranded by rising tide and have to be rescued by the rarely amused lifeboat service or even air-lifted out.

Seafront erosion has long been a major concern in Lyme and in recent years there's been extensive work done in preserving the town's beaches and coastline. A mile-long addition of the seaside promenade along Church Cliffs to East Cliffs was completed in 2015, serving both as a protective seawall and walkway to the eastern fossil beaches.

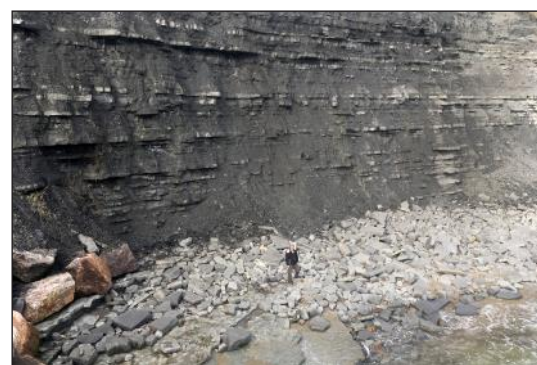


*Marine Parade near Church Cliffs. East Cliffs, Black Ven, and the town of Charmouth are in the distance.*

A stairway at the end of the promenade descends to the beach at East Cliffs. The sea was already lapping at the bottom step when we got there, but I was able to hop across the barely visible tops of a couple larger rocks to the beach and spend a short time taking photos and looking for fossils. No fan of wet shoes, Marge remained on the stairs.

Because of the rising tide, I didn't venture too far but quickly found two ammonites; one small enough to bring home. Ammonites are often found embedded in Lias

nodules scattered across the beach. The nodules are flattened and sometimes display a hint of shell. A few good whacks on the edge with a rock hammer



*Blue Lias at East Cliffs looms over author. Photo by Marge Ryan.*

splits the nodule and if you're lucky reveals both the cast and mold of an ammonite (sometimes several). Since we were traveling with only carry-on luggage, I left my rock hammer at home. But someone had split the smaller rock and left it for me to find. The fist-sized ammonite impression was preserved in a soft shale, and the perfect size souvenir to bring home.





*Lyme Regis souvenir*

Generally, fossils on the Dorset coast are delivered to the beaches via rockfalls and landslips. Waves, raking the debris piles, wash away the soft clay and marls leaving behind the heavier fossil-bearing rocks. Each new storm and landslide replenishes the beaches with a new cache of fossils, which brings out the fossil hunters. That's why Mary Anning was often seen at the seashore in the wake of winter storms. Modern fossil collectors know this, too. When a recent landslide on the Black Ven was broadcast on the news, within a couple hours 500-1000 people showed up to search for fossils. Several of them, fully clothed and wearing backpacks, were seen swimming around the fallen mudflow searching for newly released treasures (talk about unstable)! Landslips also bring danger, as sudden rockfalls and landslides can occur without warning. Some have resulted in death. Mary Anning learned the hard way in 1833 when her companion dog, Tray, was buried under a sudden rockfall that missed Mary by just inches. "[T]he Cliff fell upon him and killed him in a moment before my eyes, and close to my feet, it was but a moment between me and the same fate," she wrote to a friend. On our second day, we ambled west of town out to Monmouth Beach. This section of shoreline was less affected by the tides so we spent a little more time

dinner plates. The Blue Lias formation is prominent in the Ware Cliffs just beyond Monmouth Beach where the solid limestone layers stand out in contrast to the muted, interbedded marls and shales shaping the cliff face. Piles of broken slabs and masses of sticky marl and mud form aprons along the cliff base. Because of the tide, the famous Ammonite Pavement - a long stretch of wave-smoothed Blue Lias littered with hundreds of ammonite fossils - was unfortunately under water. I



*Fossil hunter cracking nodules on Monmouth Beach.*



*Rock hound emulating Mary Anning's dog, Tray, stands guard over one of the many large ammonites found in the shingle on Monmouth Beach.*



*Debris pile from recent rockfall beneath Blue Lias formation on Monmouth Beach.*



*Signs warn beach combers of the dangers of sudden rockfalls*

examining the beach rubble – greensand chert mixed with the argillaceous limestone boulders. In the shingle, we observed several large ammonites, many the size of

should mention that fossil hunting is very much allowed on the beaches around Lyme Regis. All they ask is that you don't hammer into the cliff faces, and that you leave the larger ammonite fossils for others to enjoy. You're also free to collect vertebrae and other bone fragments but if you discover something really big, say a 5-foot ichthyosaur skull, you're requested to report it via a special Fossil Hotline. Walking on the uneven and slippery rocks littering the beaches can be tricky and you have to be careful. If you prefer to find your fossils already prepared, and displayed on shelves and tables in a dry and maybe more comfortable environment, there's no



*Blue Lias exposures and rockfall debris at Ware Cliffs.*





Close-up of cliff base detritus.

shortage of fossil shops in Lyme. Besides the usual rock shop fare, they sell and display local fossils which can give you an idea of what can be found in the area. Some shops and museums sponsor fossil walking tours. The proprietor of the Lyme Fossil Shop on Bridge Street kindly provided me with some fossil location guidance and a look at the handy tide-table he had in his back office.



Fossil shop on Bell Cliff renamed "Anning's Fossils" for a movie about Mary Anning recently shot in Lyme Regis.

At Bell Cliff on the lower end of Broad Street, we visited Anning's Fossils, a small shop that stood in for Mary's fossil depot in a movie about her shot in Lyme Regis in 2016. The owner kept the name after the production ended. Mary's actual storefront (after 1826) burned down in 1889. The owner also mentioned he had recently shipped a large ammonite to someplace in Minnesota but couldn't remember offhand where exactly.



Lyme Regis Museum, built on the site of Mary Anning's home and birthplace.

The Lyme Regis Museum on Bridge Street is built on Mary Anning's original homesite on Cockmoile Square where she was born and first sold fossils. The museum houses an abundance of exhibits of local and natural history. Writer John Fowles, a chronicler of Lyme history and Mary Anning fan, served as a curator in the 1960s. We spent the afternoon looking over some of the fossils collected by Mary,

and artifacts related to her. In one case, a large section of Ichthyosaurus skull and paddle bones set under a shelf holding a geology book once owned by Mary and inscribed with her signature. Next to it were tools similar to the kind Mary would have used in collecting and preparing fossils. William Buckland's oddball tabletop



Artifacts and fossils the the Lyme Regis Museum. Top L-R: Mary Anning's geology book; ichthyosaurus paddle; info panel for Henry De la Beche. Middle L-R: ichthyosaurus skull; Mary Anning display; model of Anning's original home on museum site. Lower L-R: William Buckland's coprolite tabletop; fossil ammonite; 19<sup>th</sup> century fossil preparation tools.

inset with fish coprolites sat against the back wall. It was Mary who determined and convinced Buckland that the "bezoar" stones she found on the beaches and sometimes in the abdominal cavity of ichthyosaurs were actually fossilized feces loaded with bones and fish scales. In 1829, Buckland described and named them coprolites, then he had the table made as a joke. A few scant remains of Scelidosaurus extracted from the Black Ven marl in 1859 were on display. This armored quadruped is the only dinosaur found in the local marine sediments and in Jurassic times probably drowned near the shoreline and floated out to sea.

One item that really caught my eye was a one-inch brass token discovered at Church Cliffs during construction of the new sea wall and promenade in 2014. The medallion is stamped on one side with the name "Mary Anning" and the Roman numerals "MDCCCX". The reverse side show the words "Lyme Regis" and "Age XI". Mary would have turned 11 in 1810. Speculation is that it was made by her father or brother in honor of her 11<sup>th</sup> birthday. An academic paper explored its possible provenance, and its characteristics seems to align with what technology and material would have been available in Dorset in the very early 19<sup>th</sup> century. It certainly appeared authentic to me.



Mary Anning token dated 1810

The Lyme Regis Museum was originally built in 1901 in



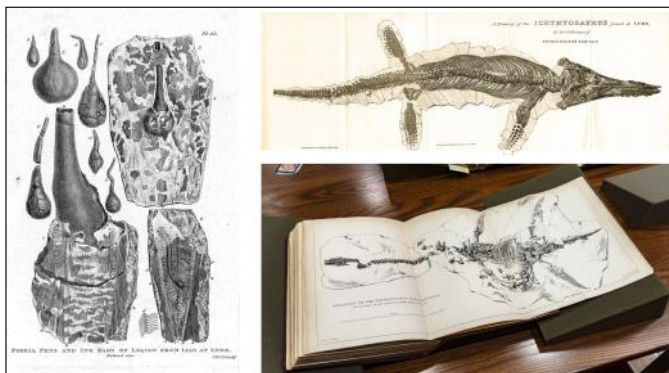


Elizabeth Philpot's ichthyosaur skull drawing created using reconstituted belemnite ink

honor of the three Philpot sisters by their nephew, then mayor Thomas Philpot. Elizabeth Philpot and Mary were close friends and collaborators, and were often seen together staking the beaches at Black Ven. When Mary discovered preserved ink sacs in some fossil belemnites, Elizabeth

thought to reconstitute their scrapings with water and used the ink to make illustrations of their fossils. Their collections of fossil fish impressed paleontologist Louis Agassiz so much he later named new species after each woman. The Philpot fossil fish collection ended up at Oxford University's Museum of Natural History.

Mary Anning existed in a patriarchal society and often felt slighted by the upper-class, male-dominated scientific community, a feeling she shared with Anna Pinney, who wrote, "She says the world has used her ill and she does not care for it, according to her account these men of learning have sucked her brains, and made a great deal by publishing works of which she furnished the contents, while she derived none of the advantages." It was a valid complaint. Most scientific publishing then



Mary Anning's discoveries in publications. LEFT: Belemnite pens and ink sacs; TOP: Thomas Hawkin's Ichthyosaurus; BOTTOM: William Conybeare's illustration of Mary Anning's first plesiosaur.

was done by men of means and social stature, and fossil collections in museums were usually credited to donors. Mary was mainly a commercial fossil collector, a merchant who relied on customers - often men of science - to purchase her wares. After that she had no claim. The pressures of the English class system were forceful and kept her in place, but despite social strictures, many in the scientific community held her in high regard, a fact she must have known.

The Anning fossil business hinged on weather and luck,

resulting in cycles of good and bad years. A year of minimal storms meant fewer fossils eroding out of the cliffs and less income. In dire years, members of the scientific establishment often came to the family's aid. Thomas Birch, a wealthy fossil collector and customer put his entire collection of fossils up for auction to aid the family. Henry De la Beche, a childhood friend, created one of the first pieces of paleo-art called *Duria Antiquior* ("a more ancient Dorset") that portrayed living representations of all the extinct animals Mary had uncovered. Prints were sold and the profits given to the Anning family. After losing her life savings in



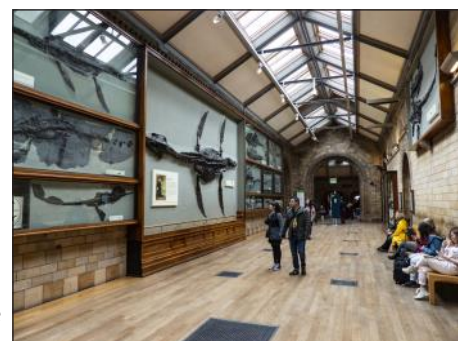
*Duria Antiquior* by Henry De la Beche

an unfortunate investment, the British Association for the Advancement of Science and the British government at the urging of William Buckland awarded Mary a £25 annual pension. Later, when she fell ill with breast cancer, members of the Geological Society pooled together money to help her through her struggle. Mary died on March 9, 1847 at age 47. In her last days, Mary had become a member of St. Michael's the Archangel Church atop Church Cliffs where she's buried with her brother, Joseph, in a single plot in the churchyard cemetery.

In the wake of her death, members of the Geological Society of London paid for a stained-glass window to be installed in the church to honor Mary's



Mary Anning memorial window



Fossil Marine Reptiles Exhibit Hall at the Natural History Museum in London has several of Mary Anning's fossil discoveries.





Skull and string of unrelated ichthyosaur vertebrae found by Mary Anning and her brother, Joseph. The large full skeleton above was found by Mary in 1832 and sold to collector Thomas Hawkins who prepared and sold it to the British Museum.

contributions to geology and the works of mercy she had performed for the people of Lyme during her lifetime. In an unprecedented move, Henry De la Beche eulogized her in his presidential address to the Geological Society of London.

Today, Mary Anning's many contributions to paleontology – a science she helped establish – can be seen in every major museum in the world. During the time she explored the beaches along Church Cliffs and the Black Ven, she rarely attained the academic recognition she felt she deserved from the scientific establishment. But in recent years things have changed. New discoveries have been named in her honor including invertebrate species and a genus of plesiosaur. The most fitting I think is *Ichthyosaurus anningae*, a new species named two hundred years after Miss Anning and her brother had dug out their first “fish lizard” from the



Original ichthyosaur skull found by the Anning siblings with a small portion of the neck still attached. The rest of the skeleton is lost.

marls of Church Cliffs, in Lyme Regis, the cradle of modern paleontology.

Earlier this year, a three-page letter written by Mary Anning to William Buckland sold at auction to a private collector for over £100,000 (\$140,000). And in Lyme Regis, there's a funding drive to erect a statue of Mary, initiated by a 11-year-old Dorset girl, and seeded by a

contribution from the producers of *Ammonite*, the locally shot film starring Kate Winslet (as Mary Anning) and Saoirse Ronan. The movie is scheduled for release November 2020, but with the COVID-19 pandemic that may have changed.

Not long after her burial, St. Michael's churchyard cemetery was closed off to further interments. Officials feared the property was unstable and too prone to landslips, as several coffins and tracts of land had already been claimed by the sea. For now, Mary's grave is in no danger of sliding away. But who knows, someday the fossilized bones of Miss Anning, the “Princess of Paleontology” could eventually make their way seaward and end up at the bottom of Church Cliffs, waiting in the Blue Lias marls for some future young fossil hunter to discover.



Flowers and fossils left at the Anning grave in St. Michael's the Archangel churchyard cemetery.

#### LINKS for further Lyme related information.

British geologist Ian West's extremely comprehensive geology website. Most images open large with click!  
<http://www.southampton.ac.uk/~imw/Lyme-Regis-to-Charmouth.htm>

Informative and well shot video on general Lyme geology and town fortification with geologist James Thomas

General geology and town fortification.

<https://youtu.be/LPwG5vZtmGs>

Mary Anning Rocks (Project to erect statue in Lyme Regis in Mary Anning's honor.

<https://www.maryanningrocks.co.uk>

Video of the Ammonite Pavement

<https://youtu.be/EBZKnI8mPAU>

Monmouth Beach Rockfall

<https://youtu.be/j7B7kDntmDM>

Black Ven Landslide AGU BLOG

<https://blogs.agu.org/landslideblog/2008/05/07/black-ven-landslide-in-dorset/>

Lyme landslip video

<https://youtu.be/eLvwr80KLHo>

Mark Ryan

**GSM Officers for 2021**  
*Latest News: November 13, 2020*

GSM members, I am pleased to announce the officers elected for 2021 at the GSM Board meeting on November 12<sup>th</sup>.

President: Joe Newberg  
Vice President: Patrick Pfundstein  
Secretary: Dave Kelso (continuing)  
Treasurer: Dave Kelso (continuing)

As you know, the terms of the current President (me) and Vice President (Deborah Naffziger) end on Dec 31, 2020, when our terms on the Board expire. Joe & Patrick assume those roles on January 1.

Beginning January 1, the full GSM Board will consist of:

|                          |                    |
|--------------------------|--------------------|
| Joe Newberg              | Dave Kelso         |
| Wolf Bielefeld           | Frank Janezich     |
| Roxy (Knuttila) Janezich | Patrick Pfundstein |
| John Westgaard           | Pete Hesse         |
| Nancy Jannik             |                    |

Thank you Joe, Patrick, Dave and the rest of the Board for stepping up to serve our organization in these roles. GSM depends on people like you for it to thrive.

I look forward to serving as your President 7 more weeks, then have full confidence that Joe and the rest of the Board will serve GSM well in 2021.

Dave Wilhelm, GSM President



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