

Dear Educators and others, Hopefully you know that the JAMBs are one of the rarest geologic features and are only easily seen in Massachusetts! For science and history, we must "save" and celebrate these Jurassic treasures by making them an official Massachusetts "Sedimentary Structure". See <u>HTTPS://ARMOREDMUDBALLS.ROCKS</u> for a short movie and more. These activities can develop and use various skills with various abilities and grade levels. There are graphics and text additions at the end of this document. Please contact me, Prof. Richard D. Little, with any questions and keep me posted of your work and developments. I will follow up with you and your contacts. (<u>ArmoredMudBall@gmail.com</u> or <u>RDLittle2000@aol.com</u>). Thank you for your valued support. It will likely take many hundreds of letters from supporters to have this pass. And now is the time to save and celebrate these amusing and unique features from the Dinosaur Age.

Rock On!....Richard. Richard D. Little, Prof. Emeritus, Greenfield Comm. College, along with Tom Vaughn (adjunct Prof. Northeastern, <u>T.Vaughn@neu.edu</u>) are co-promoters to "save" the JAMBs. See <u>Https://ArmoredMudBalls.rocks</u> -- more information and a movie, too. <u>RDLittle2000@aol.com</u> or <u>armoredmudball@gmail.com</u>, (413) 527-8536

1. CLASS ACTIVITY: CONTACT LEGISLATORS to co-sponsor

House Bill HD 548 & Senate Bill SD 830

# *"make Jurassic Armored Mud Balls the official Massachusetts Sedimentary Structure"* (2025 – 2026 Legislative session)

 $\bigstar$  2. Educational materials including photos and graphics are <u>at the end</u>.

## **"CONTACT LEGISLATORS ACTIVIES"**

internet research: identifying <u>your</u> local legislators and their contact information

This is easy to do. All Mass. Legislators have easy to find email and mail addresses and they are keen to hear from their constituents.

### 2. composing an email or letter

This can obviously be modified to fit your students' abilities. A sample letter is included below.

### 3. artwork or text to enhance your letter

A letter with personal art or text will certainly be an effective communication technique. Who doesn't like to draw a dinosaur with an armored mud ball?! There are some images for public use at the end of this document.

4. expanding the activity Besides your <u>local</u> representatives, contact other members of Massachusetts government such as, <u>all the legislators who supported the Podokesaurus</u> <u>"State Dinosaur" bill</u> that passed the Legislature in 2022. They are listed below. All of these people should certainly support the JAMBs because besides being so rare, they are in the same geologic layers as Podokesaurus! These Legislators need encouragement to **become co-sponsors** as they did with Podokesaurus. The Governor needs to know about the JAMBs, too!

# The list below has all the legislators that were co-sponsors of the successful bill to have a State Dinosaur (Podokesaurus holyokensis).

A Sample Letter is below: [Please note -- it is really easy to email your legislators.]

Of course, you can just have a simple statement such as **"I love the JAMBs. Please be a co-sponsor for Bill SD.830 & HD.548."** or...something more comprehensive

Dear \_\_\_\_\_,

Please join Lead Sponsors Rep. Whipps and Sen. Comerford and be **a co-sponsor** of **HD.548** and **SD.830** to designate the rare and unique Jurassic Armored Mud Balls ("JAMBs") as our official State "Sedimentary Structure". Two Massachusetts State Geologists (Drs. S. Mabee and B. Yellen) confirm: **"The Jurassic armored mud balls are one of the rarest sedimentary structures in the world, representing a unique geologic environment... and are only easily seen in Massachusetts. That alone makes this feature worthy of recognition."** 

These rare and interesting features can be found in Greenfield, Turners Falls, Gill, and Deerfield in the same geologic layers as Podokesaurus (State Dinosaur) and Dinosaur Footprints (State Fossil). The best-in-theworld JAMB specimens are displayed in large "monument-sized" rocks along the Geology Path at Greenfield Community College and at Great Falls Discovery Center, Turners Falls. Smaller examples are in Franklin County town museums plus Amherst College's Beneski Museum, the Springfield Science Museum and Dinosaur State Park, Rocky Hill, Connecticut. Occasionally specimens are discovered in rock outcrops near the Connecticut River.

If our Massachusetts Jurassic Armored Mud Balls are not officially recognized and celebrated, they will likely be neglected and their significance forgotten. That will be a great loss to the world of science as well as our Massachusetts heritage.

Please be a **co-sponsor** and thank you very much for your support.

\_\_\_\_\_signed\_\_\_\_\_See <u>Https://ArmoredMudBalls.rocks</u> for more information and a movie, too.

## Legislators who were <u>co-sponsors</u> for the successful Podokesaurus bill! **They need to be contacted and** encouraged to be <u>co-sponsors</u> of the JAMB legislation: House Bill <mark>HD.548</mark> and Senate Bill <mark>SD.830</mark>

Jack Patrick Lewis	7th Middlesex
Mindy Domb	3rd Hampshire
Christina A. Minicucci	14th Essex
Tackey Chan	2nd Norfolk
David Paul Linsky	5th Middlesex
Carmine Lawrence Gentile	13th Middlesex
Jacob R. Oliveira	7th Hampden
Patricia A. Duffy	5th Hampden
Danillo A. Sena	37th Middlesex
Maria Duaime Robinson	6th Middlesex
Natalie M. Higgins	4th Worcester
Kay Khan	11th Middlesex
Brendan P. Crighton	Third Essex
Brian W. Murray	10th Worcester
Thomas M. Stanley	9th Middlesex
Natalie M. Blais	1st Franklin
Colleen M. Garry	36th Middlesex
Tram T. Nguyen	18th Essex
Lindsay N. Sabadosa	1st Hampshire
Steven C. Owens	29th Middlesex
Adrian C. Madaro	1st Suffolk
Michael P. Kushmerek	3rd Worcester
Edward R. Philips	8th Norfolk
David M. Rogers	24th Middlesex
Joseph D. McKenna	18th Worcester
David Henry Argosky LeBoeuf	17th Worcester
James B. Eldridge	Middlesex and Worcester
Kate Lipper-Garabedian	32nd Middlesex
Jeffrey N. Roy	10th Norfolk
Brian M. Ashe	Room 160 722-2304 2nd Hampden
Harriette L. Chandler	First Worcester
Patrick M. O'Connor	Plymouth and Norfolk
Erika Uyterhoeven	27th Middlesex
Sonia Chang-Diaz	Second Suffolk
Tricia Farley-Bouvier	3rd Berkshire
Meghan Kilcoyne	12th Worcester
Bruce J. Ayers	1st Norfolk
Jay D. Livingstone	8th Suffolk
Josh S. Cutler	6th Plymouth
Norman J. Orrall	12th Bristol
Julian Cyr	Cape and Islands
Christine P. Barber	34th Middlesex

Bill Numbers: House Bill HD.548 and Senate Bill SD.830. Also – Don't forget to contact your LOCAL LEGISLATORS. They might not be on this list.

### **GRAPHICS AND PHOTOS**

1. For a "Cartoon" page that illustrates the Jurassic Armored Mud Ball story, see this site

https://armoredmudballs.rocks/%22origins%22-cartoon

There is also a FAQ page on the rear.

2. Podokesaurus holyokensis, our Mass. State Dinosaur (Photo by Michael B. H.)

Meet the Massachusetts State Dinosaur: Podokesaurus holyokensis; and why you won't find dinosaur fossils in Boston - masslive.com



"The carnivorous dinosaur was first discovered near Mt. Holyoke in 1910 by Mignon Talbot, the first woman to name and describe a dinosaur. The species was 3 to 6 feet in length, weighing approximately 90 pounds, and estimated to run 9 to 12 mph.

The carnivore lived during the <u>Mid Jurassic</u>, which was about 195-180 million years ago, according to the <u>Natural History Museum</u>. And its name means "swift-footed lizard of Holyoke." (from masslive web site listed above)

3. 1970's photo of a quarried stone with armored mud balls, Unity Park, Turners Falls. This piece is part of the suspension bridge foundation anchor, and is now in the Geology Path at Greenfield Community College. Ruler is 6 inches.



Prof. Little and Armored Mud Balls at the Greenfield Comm. College Geo Path. From Deerfield MA.



NEXT PAGES: SOME OTHER CLASS ACTIVITIES ....

# ARMORED MUD BALL CLASS ACTIVITIES & INFORMATION

# A. <u>Introduce students</u> to the formation and significance of armored mud balls, rare geologic structures from the Age of Dinosaurs that are found in the Western Massachusetts.

**DISCUSSION TOPIC 1.** What are armored mud balls? Terminology to discuss: "mud" a sediment, not sand and not gravel. It is fine-grained and (with a little wetness) will hold together, like a snow ball. In the natural world, hard mud rolling down a stream will get sticky on the outside and pebbles can attach (the armor).

"Armor" -- a protective coating. A knight will put on metal armor. A rolling mud ball will get stick-on pebble armor.

**DISCUSSION TOPIC 2.** How do armored mud balls (AMB) form? Hard mud chunks / pieces fall into a stream, tumble in the water current, get round and sticky on the outside, then pebbles attach from the stream bed. This will protect the mud so it will roll further downstream. Eventually, the AMB must be buried in the stream's sand and gravel (or it will dry, crack, and crumble).

# See RDL's AMB 5 minute video: https://youtu.be/P38Qa0mYpLk?si=qdrM99R3bI5HWrQy

**ACTIVITY 1** (not student tested): (demonstration, perhaps, or as groups -- get ready for a lot of dirty hands) Mud, collected locally perhaps. [NOTE: use play dough – much cleaner!] There is a lot of exposed Glacial Lake Hitchcock lake bottom mud along riverbanks of local rivers and streams in the Conn. River Valley. Sand / gravel for burial and armor. It may be useful to use grainy cereal for a "gravel" substitute.

**To Do:** 1. make mud balls. 2. Roll in sand / gravel or perhaps grainy cereal. This simulates the armor process. 3. Deposition, both on top surface and buried. Perhaps use a plastic "shoe box". Bury some in damp sand and leave some exposed on the surface. The main point is to show how burial is necessary for geologic preservation. The surface AMBs will dry and crumble.

Conclusion: exposed AMBs will not be preserved as compared to buried AMBs.

# B. Promote Armored Mud Balls as an official Massachusetts "Sedimentary Structure"

ACTIVITY 1 Discover how many State "symbols" Massachusetts has. How many are geology or science related? For example, State Rock, State Fossil, State Dinosaur, State Mineral, State Gem

ACTIVITY 2 Who are your State Representatives and Senators?

ACTIVITY 3 Making educational promotional materials. How would you explain and publicize Jurassic Armored Mud Balls? Perhaps: poster, postcard,

ACTIVITY 4 Make contact with your State Legislators (including the Governor) using your educational materials and enthusiasm for preserving these unique features that are only (in the whole world)....only easily seen in Greenfield, Gill, and Turners Falls. This can be done by mail, email, phone message, or office visit.

**C.** Finding the armored mud balls (on the picture) . The picture below of Jurassic armored mud balls seen in a bridge foundation (now dismantled) along the Conn. River (Unity Park) Turners Falls MA. Note: armored mud balls can still be observed in some quarried stones at this site. The ruler, for scale, is 6 inches.



**Can you find 7 armored mud balls in this rock?** Number them on the picture below with #1 = biggest, 7 = the smallest. What rock name would you give this sedimentary rock? Choose from Sandstone, Conglomerate, Limestone, Shale



### ANSWERS



There are 7 armored mud balls seen here...1, 2, and 7 are noted. (x) This is a rather large rock that was tumbling down stream along with the AMBs Some of these AMBs are small, but it could be that they extend *into* this quarried stone block and are much bigger. Actually, this is true of all the specimens. You are only seeing one surface. What is happening inside? (We don't know.)

**D.** Finding Jurassic Armored Mud Balls in "the field" (In science "the field" means "outdoors, in nature" not actually in a field)

The best place in the world to see AMBs is Greenfield Community College's Geology Path located at the S end of the Main (brick) Building. It is easy to find and visitor parking is adjacent. Wheelchair accessible. There is a short video about the Geo Path on You Tube (address below). The Path has a great display of AMBs plus other local rocks. There is an online Geo Path Guide here: https://www.gcc.mass.edu/oll/geology-path/

## https://youtu.be/\_qyinmJ5P6c?si=bFgKjmbNO65X29cW

# You can also find Jurassic AMBs at the Turners Falls Great Falls Discovery Center (outdoor display coming in 2024)

E. ---- <u>ADVANCED</u> GEOLOGY OBSERVATIONS (especially see graded beds, #3 below) -

1. What is the name of the metamorphic rock of the foundation cap? Note the light and dark mineral layers. [GNEISS]

2. Why is gneiss used as a cap rock on this bridge foundation? Gniess is a very hard rock that is resistant to weathering and erosion. The foundation here was for suspension cables of an old suspension bridge between Turners Falls and Gill, MA. The bridge was dismantled in 1942. Quarried blocks of this anchor, some with AMBS, can still be seen on site. <u>https://commons.wikimedia.org/wiki/File:Suspension\_Bridge, Turners\_Falls, MA</u>

3. **Graded Beds** are illustrated in this quarried rock face and this photo is an excellent example of this phenomenon! The AMBs came downstream in a flood event. Fast flowing currents carry larger sizes than slow flow. Floods will gradually diminish and drop their load in a set way: large sediment sizes are deposited first and then gradational to small sizes. That's "graded bedding".



**Stream bed (black line)** with flood deposit "graded bed" above. First, fast moving flood water brought pebbles and armored mud balls. Later, as the flood flow rate decreased, sand was deposited. This whole event may have taken only several hours. Then geologic lithification (turning to stone) is needed.

**4. The origin of "our" armored mud balls.** During Jurassic time, about 200 million years ago, the super continent of Pangea was splitting. A major rift valley opened along a faultline that runs from Keene, NH to New Haven, CT. The landscape would have looked

like the many rift valleys of the "Basin and Range" of the desert southwest USA, such as Death Valley National Park. The climate at the time was alternatively wet and dry. There were salt lakes and streams that occasionally flooded from the easterly mountains bringing sediment into the rift valley. If conditions were right, hard mud from old dry lake beds fell into stream channels, tumbled, became round, sticky on the outside and then armored as they rolled over the stream bed sandy gravel. A quick burial is needed to prevent drying and then some geologic time to cement the sediment into rock. That process is called "lithification".

The pictured rock came from a quarry in what is now downtown Turners Falls. Building now cover the old quarry site. However, AMBs have been found "in situ" ("in place") in nearby Jurassic-age bedrock outcrops along the Connecticut Riverbed below the Turners Falls Dam as well as in older rock (Late Triassic) found in Greenfield and Deerfield. Examples of all these, plus other monumental-sized specimens can be seen along the Geology Path, Greenfield Community College.

In the whole world only a few examples of AMBs have been noted, mostly from mud balls rolling into deep ocean deposits. These do not have distinct pebble armor. They are in remote locations (such as Ecuador, Trinidad, and Spitzbergen) plus they are not easy to see, do not have a variety of sizes, nor prominent armor. They probably are not visible today due to erosion. Therefore, it is safe to conclude that the Franklin County AMBs are unique, being the only easily seen lithified armored mud balls in the world! They also have the best variety of sizes and picturesque armor.

Please note that fragile, non-lithified armored mud balls from recent floods have been found in a number of locations. There are many pictures compiled on the https://armoredmudballs.rocks website. Also, these features are geologically known as "sedimentary structures". They are formed during the deposition of sediment layers and join other sedimentary structures such as mud cracks, raindrop impressions, plus dinosaur footprints and other fossils.

For more information including pictures of lithified and recent (non-lithified) armored mud balls, please see the <u>https://armoredmudballs.rocks</u> website and/or contact Prof. Richard D. Little at RDLittle2000@aol.com.

Another class exercise -- Can you imagine dinosaurs watching armored mud balls rolling downstream? Yes, this was possible! Write a creative story perhaps with drawings.



# ------ SAVE THE RARE JURASSIC ARMORED MUD BALLS -------

### MAKE JURASSIC ARMORED MUD BALLS A MASSACHUSETTS OFFICAL STATE "SEDIMENTARY STRUCTURE"!

Dinosaur age armored mud balls are geological rarities formed as hard mud pieces fell into a stream, rolled along, and had pebbles stick to their rim (the "armor"). With a lot of luck these delicate features turned to stone and 200 million years later were discovered in the Connecticut River Valley in Turners Falls, Greenfield, Gill, and Deerfield. They are so rare that no other place in the world has specimens like these. They need to be recognized and celebrated. Greenfield Community College Professor (Emeritus) Richard Little is spearheading the effort to have them designated an official State "Sedimentary Structure" to join the over 50 other Massachusetts symbols such as the Morgan Horse, Boston Crème Donut, Dinosaur Fossil, and many others. Prof. Little comments: "We must celebrate and appreciate these intriguing, rare, and photogenic specimens! If not, they will likely be forgotten and lost to history and science."

Find out more about armored mud balls and how you might join the effort to save them at this web site. <u>https://armoredmudballs.rocks</u>

Your comments and suggestions are always welcome! Thank you. -Richard D. Little\*

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PS. I also do presentations for classes and adult groups as my schedule permits.

\* Prof. Little has BA & MA geology degrees from Clark and the Univ. of Southern California, respectively. He has been teaching at Greenfield Community College for 50+ years. He is not yet a fossil. www.EarthView.rocks.

----- The end ------