Geology Field Investigations at Blandy Experimental Farm

NOTE: This lesson is place-based and was developed for use at Blandy. To modify for your teaching needs, get familiar with the geology at your schoolyard or field location!

Investigative Questions:
What rocks are found at Blandy? What are their physical features? How are rocks formed?

Goal: Develop science process skills and conduct field geology experiments and explorations.

Objectives
Knowledge: Students examine rocks to identify Blandy's native rock and at least one other rock. (Students can also sort rocks into the three main types.)
Skills: Students use observation skills to examine rocks' physical properties. Students identify rocks using a dichotomous key.
Values: Students appreciate that rocks have various forms, colors, and uses. Students realize rocks are formed from a variety of substances over large spans of geologic time.

Grade: 5th

Special Safety: Rocks can be slippery, use rock wall area if Lake Georgette area is slippery.

VA Standards addressed: Science 5.1, 5.7; English 5.1 and 5.5k

Materials:

- Large whiteboard & markers (use for T- chart)
- Clipboards, datasheet, pencils (one per student)
- Snail Shell Experiment (Optional; as time allows)
    - Snail shells
    - Small plastic bag
    - Pipettes
    - Cotton balls
    - Sharpie
- Iapetus Ocean Salt (from J K Dickinson Saltworks)
    - Salt in small plastic bag
    - Small popsicle sticks
    - Bottled water (or use designated Nalgene bottle for this purpose)
- Rock ID kits (6 per class). In each box:
    - One each of: limestone, marble, obsidian, coal, granite, gneiss, sandstone, quartzite, pumice, slate, shale.
    - One each of: white ceramic streak plate, black streak plate, magnet, nail, penny, vinegar vial
    - Laminated Rock Identification Key

Instructional Strategy:

1. Guided observation and journaling. Students sit on the large rocks at Lake Georgette (A large limestone outcropping). *Ask*: What do you observe about the rocks beneath you? Use your senses to explore and record observations on your data sheet. (You may draw or write your observations. Label your drawings as needed.)
2. Discuss observations and develop questions.
   a. *Discuss:* Based on your observations, what do you now KNOW about this rock? (Record responses on whiteboard with "I observed" side of T-chart with observations.) Common responses:
      - layers or stripes (follow-up: Do the layers/stripes feel the same? How is the rock layered? Think about why it may be layered.)
      - color (is it all one color?)
      - texture (guide the students to specificity and to use adjectives and descriptors)
      - weathering
      - bedrock

I observed:	I wondered:

   b. Once observations are made, ask students for questions they now have and for which they can find an answer to or investigate further. Did your observations trigger any questions? How could we find the answers to our questions? What tools can we use to help answer your questions? (Record on "I wonder" side of t-chart.) [Listen, draw conclusions, share responses in subject related group learning activities.] Eng 5.1
3. Rock ID investigation. Working in small groups (4 or less), student groups use a rock ID kit, their data sheet, and rock ID key to identify the native stone. Then, they choose **one** rock from the kit to identify using the dicot key. Sci 5.1, 5.7
4. Document new discoveries and questions. Bring the class back together to discuss their discoveries. What type of rock is found at Blandy? How does this rock compare to other rocks in the kits? As time allows, refer to the T-chart to discuss what additional information can be written. [Make, confirm, or revise predictions.] Eng 5.5k
5. BEF Rock Formation. http://geology.blogs.wm.edu/valley-ridge/ and https://www.nps.gov/shen/learn/nature/geologicformations.htm Sci 5.7
   a. *Limestone*. Limestone was formed about 400 million years ago when the Shenandoah Valley was part of a large shallow inland sea. What are some organisms that were in the sea? (Microscopic shelled creatures that looked similar to this snail shell.) As the organisms died, their shells would sink to the bottom of the seafloor. Over time, billions upon billions of shells were deposited on the seafloor. These were compacted over time, eventually forming the limestone seen today.
   b. *Salt from the Iapetus Ocean*. Ask: If this was a shallow inland sea, what would the water taste like if you took a sip? (Salty!). Some of this water from the shallow inland sea became trapped in rocks. Over time, the water precipitated out. Ask: What was left when the water left the

saltwater? (SALT) Do you want to see what the seawater tasted like 400 million years ago? http://www.jqdsalt.com/our-salt/ Offer a taste of ~400 million year old sea salt to the students. To adults, distribute craft sticks, water and bag of sea salt. Instruct students to get a craft stick from designated adult, dip in the water bottle and then dip in the salt baggie. (Safety: No double dipping! And do not litter with the craft sticks.) This quick activity provides a sensory connection to understanding geologic history, the formation of limestone, and tectonic plate movements.

Sci 5.7

6. Connect: Sinkhole formation. *Ask*: What do you notice about the shape of the land here? If limestone is the bedrock and dissolves with acidity, why do you think the land dips down here? For use in the classroom, use a photo of a sinkhole and typical karst topography.
7. Use of Rocks by humans: If time allows, walk to the chimney or rock wall to inquire about how rocks at Blandy have been used historically (For building materials, railroad construction, etc.)
    a. When using this lesson in your schoolyard/field location, instruct students (in teams of 2-3) to record their observations of rock-based materials on the grounds and buildings. For example, is brick a rock? The concrete? Explain your reasoning? Is the gravel native to the area? Can you find an exposed native stone at your site? What type of rock do you think it is? (Sedimentary, metamorphic or igneous?) Close with a class discussion of how humans used rocks in various engineering applications.
8. Extensions.
    a. *Use of limestone in buildings*. Observe the limestone stairs on the east side of the Quarters, observe and inquire about the limestone in the NPT woodland…why are the layers not laid down horizontally? (Plate tectonics.)
    b. S*nail Shell*. As time allows, you may choose to conduct a small experiment with snail shells to solidify a connection with the formation of limestone from millions of microscopic sea creatures.
        i. Ask parents to help distribute to each student: a snail shell, cotton ball, and baggie. Ask students to choose how many drops of vinegar to put into the bag and record this number on the bag or data sheet.
        ii. Guide students to understand that the fizzing is a reaction between an acid (vinegar) and a base (limestone) (similar to baking soda and vinegar volcanoes). What do students predict will happen when a snail shell is put in a bag with vinegar?

Geology Field Investigations

Field Geologist: _____

1. OBSERVE and RECORD: Use your senses to explore the rocks and then answer these questions by drawing or writing.

·What do you OBSERVE and now KNOW?

·What do you WONDER and how can you figure it out?

2. Flip this page over to identify Blandy's rock & one other rock.

4. LAY OF THE LAND: How did the rock here form? What evidence do you have?

How might this rock shape the landscape?

5. USE OF ROCKS BY HUMANS: How do we change the land? How do we use the rocks around us?

6. What do you now know about rocks at Blandy?

7. (OPTIONAL)SNAIL SHELL NECKLACE: Place a snail shell and a ball of cotton in a small plastic bag. How many drops of vinegar did you add? _____What do you predict will happen to the shell?

3. Compare a rock sample from the box to the Blandy rock you observed.

Characteristic	Blandy's Rock	Rock Sample
Color of Rock		
Can you feel or see any sand grains or mineral particles? How large are they?		
Is it shiny or dull?		
Does it look like it was broken in parallel layers? (look at the edges)		
What color does it leave on the white streak plate?		
What color does it leave on the black streak plate?		
Can you scratch it with a nail?		
If the rock can be scratched with a nail, does a drop of vinegar create tiny bubbles? (use a magnifier to see)		
Using the ROCK IDENTIFICATION KEY, identify the rock.		

After a discussion, we'll finish up the other side.

Rock Identification Key

Start with #1 for each rock sample. Carefully read each description:

1. Does the rock look like it is made of **crystals, mineral particles** and/or **sand grains**?
- a. Yes, I see sand grains or mineral particles… Go to 2
- b. No, I do not see sand grains or mineral particles… Go to 6

2. Does the rock appear to have **two or more minerals** of different colors **or mostly one mineral** of the same color?
- a. Many minerals… Go to 3
- b. **One** mineral… Go to 4

3. Does the rock have **stripes of different colors**, or are the **blobs and particles** of colors all mixed up?
- a. Stripes of colors… Gneiss
- b. Mixed up blobs and particles… Granite
- c. I can see grains of sand… Go to 5

4. Carefully scratch the rock hard with a nail and place a drop of vinegar on the scratched spot. **Does it fizz** with tiny, tiny bubbles? (use a magnifier to see)
- a. Yes… Marble
- b. No, but I can see grains of sand… Go to 5

5. Does the rock feel like sandpaper and can you **scrape grains of sand off** with a nail?
- a. Yes… Sandstone
- b. No… Quartzite

6. Does the rock have **holes (like a sponge and light weight)** or is it solid?
1. Holes… Pumice or Scoria
2. Solid… Go to 7

7. Carefully scratch the rock with a nail and place a drop of vinegar on the scratched spot. **Does it fizz** with tiny, tiny bubbles? (use a magnifier to see)
- a. Yes… Limestone
- b. No… Go to 8

8. Is the rock gray and does it look like it was **broken in parallel layers**? (the rock is thin and mostly flat with layers on edges)
- a. Yes… Go to 9
- b. No, the rock is black and lumpy… Go to 10

9. When you turn the flat, gray rock in the light, does it have an **oily shine (luster),** or is it **dull**?
- a. Oily shine… Slate
- b. Dull… Shale

10. Does the black, lumpy rock leave a **mark on paper**?
- a. Yes… Coal
- b. No… Obsidian (looks like black glass)