Indiana Rocks!

Bicentennial Nature Center Network



Middle Elementary Curriculum; 1 hour program Written By: Aubrey Blue, Cope Environmental Center

Recommended Grades: Middle Elementary (2nd and 3rd); can be adapted to other grade levels

Indiana Standards Covered:

2nd Grade:

Science

• **2.PS.1** - Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

Writing

• **2.W.2.1** - Form letters correctly and space words and sentences properly so that writing can be read easily by another person.

Speaking and Listening

- **2.SL.1** Listen actively and adjust the use of spoken language (e.g., conventions, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- **2.SL.2.1** Participate in collaborative conversations about grade-appropriate topics and texts with peers and adults in small and larger groups.
- **2.SL.2.3** Listen to others, take one's turn in respectful ways, and speak one at a time about the topics and text under discussion.
- **2.SL.3.2** Ask and answer questions about what a speaker says to clarify comprehension, gather information, or deepen understanding of a topic or issue.

Geography

• **2.3.2** - Locate the equator and the poles on a globe and identify the local community, state and the United States on maps.

3rd Grade:

Science

• **3.ESS.3** - Observe the detailed characteristics of rocks and minerals. Identify and classify rocks as being composed of different combinations of minerals.

Writing

• **3.W.2.1** - Write legibly in print or cursive, leaving space between letters in a word, words, in a sentence, and words and the edges of the paper.

Speaking and Listening

- **3.SL.1** Listen actively and adjust the use of spoken language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- **3.SL.2.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) on grade-appropriate topics and texts, building on others' ideas and expressing personal ideas clearly.
- 3.SL.2.5 Explain personal ideas and understanding in reference to the discussion.
- **3.SL.3.2** Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

Geography

• **3.3.13** - Identify and describe how human systems and physical systems have impacted the local environment. Example: List examples of changes in land use in the local community.

Purpose:

To connect the students to an important Indiana natural resource. To help students understand why the study of geology is an important step in understanding land conservation. To introduce students to the concept of land conservation using the Children of Indiana Nature Park as a tool.

Overview:

Students will learn about the geology of Indiana, the difference between rock types, the way these rocks "shape" our everyday lives, and how important this resource is to Indiana.

Outcomes:

Students will:

- 1. Identify what state we live in and where it is located.
- 2. Explain the three major rock types: metamorphic, igneous and sedimentary.
- 3. Discuss limestone and explain one way to identify this rock.
- 4. Relate limestone and its uses to our everyday life.
- 5. Create lists.
- 6. Become better stewards of the land through an understanding of its building blocks.

Materials Needed:

Crayon Rock Cycle:

- Wax crayons at least two different colors
- Source of very hot water (we use a plug-in electric kettle)
- Aluminum foil
- Container to hold hot water
- Simple scrapping device (i.e. a plastic knife)

Rock Cycle Song:

• A poster with the words written out on it

Testing for Limestone:*

- 5 rock collections, 10 stones each (one in each collection MUST be limestone!)
 (http://www.hometrainingtools.com/rock-study-kit)
- 5 glass measuring cups
- Vinegar (each measuring cup will be filled with ½ cup vinegar)

My Home:

- Flip chart paper
- Non-permanent markers (one for each group and yourself)
- Informational facts listed at the end of this curriculum.

^{*}When scheduling this program, ask the teacher to have their students sitting in 5 groups for your program. As soon as you arrive, place the "Testing for Limestone" materials out with each group.

The Program

Welcome/Introduction (5 minutes):

***Interpretation Note: Many parts of this document are written as speech and will appear in a grey box.

Please feel free to adapt and change as necessary. It may be helpful to write out exactly what you want to say (at least in the introduction), but this document is really an outline, not a script.

Introduce yourself and your organization. Introduce yourself, your organization, and the topic of the day: rocks!

(The following wording is the SAME wording as featured in the field trip program. PLEASE ADAPT THIS BASED ON THEIR KNOWLEDGE OF THE CHILDREN'S PARK PROJECT. This should be used the FIRST TIME the children are introduced to the project. If this outreach is performed AFTER the field trip, simply remind the students of the gift and ask if they have their deeds! You might even "autograph" the deeds for them as an important person in their environmental education journey!)

Did you know that YOU have been chosen to receive a special gift? Let me ask you something. What do you think of when you hear the word "park"? Slides? Swings? Playgrounds? Well, we have a NEW way to think about a park. When you hear that word, we want you to think of trees, birds, insects, and presents. Wait, presents?! Yes, presents. The State of Indiana has decided to give you a gift, but it's not one that you unwrap, it's one that you protect, just like a special birthday gift. Indiana created The Children of Indiana Nature Park in Centerville, Indiana in honor of you. It doesn't have swings or slides; instead, it has trees, trails, tracks, and turtles. Indiana thinks you are so important, that each one of you can claim a "deed" for a piece of this land. What's a deed? It means that you are in charge of protecting something special. Your teacher is going to help you claim your deed, and you can learn about your piece of land and all of the ways it is growing and changing by visiting a special website listed on your deed. But how can we protect this land or the land that we live on without learning why it is important? Well, we are going to start today! Today's program is called "Indiana Rocks!". Once I leave today, you will know why!

Begin your program by getting out the crayon shavings and foil. Does anyone know why I have these crayon shavings and the foil? How in the world does it relate to land, and more specifically, rocks? (This is to demonstrate how rocks are formed and to help show how long it takes for these rocks to be formed.) Well, let me show you!

Crayon Rock Cycle¹:

To make a "sedimentary crayon":

- 1. You need to make small particle sized sediments out of your crayons. These can be scraped from new crayons (this represents the weathering of a rock). Scrape crayons with knife.
- 2. Gather a pile of sediments collected from various scraped crayons (several different colors).
- 3. Pressing down on this pile will allow the particles to stick together.
 - a. Encasing the sediments between sheets of paper, foil, etc. will help keep the sediments together.
 - b. Using a utensil or stepping on the sheets will help this process along, too.
- 4. Your coherent bunch of crayon sediments is now representative of a sedimentary rock.

To make an "igneous crayon":

- 1. Place a small pile of sedimentary crayons (since you already have these available) into piece of aluminum foil.
- 2. Float this crayon containing foil on hot water.
- 3. Watch as the heat from the water transfers to the foil and to the crayons. The crayons should start to melt.
- 4. The crayons should be allowed to melt until a smooth liquid forms.
- 5. Carefully remove molten crayon wax and let cool. Your totally melted and cooled crayons are now representative of igneous rocks (*The flowing, liquid crayon represents magma flow.*).

To make a "metamorphic crayon":

- 1. Place a small pile of sedimentary or igneous crayons into piece of aluminum foil.
- 2. Float this foil on hot water.
- 3. Watch as the heat from the water transfers to the foil and to the crayons. The crayons should start to melt.
- 4. Remove the foil when the crayon wax is soft to the touch and then compress it again (this represents both heat and pressure).
- 5. Let your crayons cool.
- 6. Your partially melted and cooled crayons are now representative of metamorphic rocks.

Summary: Igneous rocks are formed when magma (or molten rocks) have cooled down and become solid. Sedimentary rocks are formed by the accumulation of other eroded substances. Metamorphic rocks are formed when rocks change their original shape and form due to intense heat or pressure.

¹ Adapted from: http://www.exo.net/~emuller/activities/Crayon-Rock-Cycle.pdf

Do you think these rock formations happen overnight? No! It takes thousands of years! So, if we use up lots and lots of rock (such as limestone), can we "grow" or make more overnight?

Think about plastic. Most plastic is made out of oil. Did you know that? Oil is like rock in that it has been around for a very, very long time. We can't produce it as much as we want. We use plastic for some very important things that even help save people's lives. But, we also use it for unimportant things that people just throw away (have the children brainstorm things that are disposable plastic). We shouldn't treat plastic that way and we shouldn't treat rocks that way either!

In this program, we are going to talk about all of the cool things that are made from rocks. I want you to continue thinking about why it is important to take care of this awesome resource and habitat.

Rocks of Indiana (15 minutes):

What am I holding? (You should be holding a globe.) A globe! Let's go over the basics of a globe. Where are the North and South Poles? What about the equator? In which country do we live? (Have a student point to the United States.) Here is the MOST important question: in which state do we live, and where is it located? (Have another student point to Indiana.) Right, Indiana! If possible, use a pen to show where the Children of Indiana Nature Park is located, too (Centerville, IN- directly east of Indianapolis on the Ohio border). Let's think about the layers of the earth at the Park. Can you name some things that might be growing on the land? (Trees, plants, grass, etc.) What is below these growing things? (Soil!) What is below THAT? (Rock!) Right! Today, we are going to be talking about Indiana and one of its special rocks. Sometimes we forget to protect the parts of the environment that we can't see! Rocks are one of these important things!

²Has anyone ever heard of bedrock? What is bedrock? And no, the bedrock we are talking about is not Fred Flintstone's home town! Anyone have any guesses? Well, bedrock is the hard, solid rock beneath surface materials such as soil and gravel. Bedrock is also found under sand and other sediments on the ocean floor. Bedrock is "consolidated" rock, meaning it is solid and bound together tightly. Overlying material is often "unconsolidated" rock, which is made up of loose particles.

² Taken from: http://education.nationalgeographic.org/encyclopedia/bedrock/

Does anyone remember the 3 major types of rocks we just discussed? Here is a quick little song to remember the three major types of rocks: metamorphic, igneous, & sedimentary.

Rock Cycle Song³

(Sing to the tune of "Row, Row, Row Your Boat")
SEDIMENTARY rock
Has been formed in layers
Often found near water sources
With fossils from decayers.

Then there's IGNEOUS rock
Here since Earth was born
Molten lava, cooled and hardened
That's how it is formed.

These two types of rocks
Can also be transformed
With pressure, heat and chemicals
METAMORPHIC they'll become.

⁴The entire bedrock surface of Indiana consists of sedimentary rocks. Indiana's major kinds of sedimentary rocks are limestone, dolomite, shale, sandstone and siltstone.

Today, we are going to focus on just one of those rocks...LIMESTONE! Limestone is by definition a rock that contains at least 50% calcium carbonate in the form of calcite by weight. All limestones contain at least a few percent other materials. These can be small particles of quartz, feldspar, clay minerals, pyrite, siderite and other minerals. It can also contain large nodules of chert, pyrite or siderite. One type of limestone even has fossils in it!

Interpreter's Note: The following list is not intended to be read to the students. It is, instead, meant to be used as a reference to help children better understand this valuable natural resource. Simply choose a few from this list! (It can even be made into a game or quiz!)

Random facts about Limestone (See end of program for more limestone information.):⁵

³ Taken from: http://cmase.uark.edu/teacher/workshops/GEMS-lessons/Rock Cycle Song.pdf

⁴ Taken from: http://earthsciences.iupui.edu/indiana-geography-and-geology-facts

⁵ Taken from: https://igs.indiana.edu/MineralResources/Limestone.cfm and

- Nearly 2.7 million cubic feet of Indiana Limestone is quarried each year.
- Although a relatively small industry, the Indiana Limestone industry generates about \$26 million annually in revenue.
- Indiana Limestone can be quarried and milled with greater efficiency, in terms of energy consumed, than most competing building materials.
- The Indiana Limestone industry employs stone cutters and carvers whose skills in working limestone into complex shapes and into art forms remain world class.
- Indiana Limestone has stood the test of time in structures all over the world where its strength, beauty, and durability have made it the material of choice in many older load-bearing structures as well as cladding stone in the modern context.

Examples include:

- The Pentagon: Located in Arlington, Virginia, the Pentagon serves as headquarters to the United States Department of Defense. On September 11, 2001 a hijacked plane crashed into the western side of the building. The reconstruction used Indiana Limestone fabricated by Bybee Stone Company in Ellettsville, Indiana. It was rededicated one year later on September 11, 2002.
- Lincoln Memorial: Look for Indiana limestone on the interior walls and columns of the Lincoln Memorial, dedicated in 1922 to honor Abraham Lincoln, the 16th president. Indiana limestone and other materials are representative of different regions of the United States.
- Empire State Building: Named after New York's state nickname, the "Empire State," and completed in 1931, the once-tallest building in the world is made of Indiana Limestone and remains one of the tallest and most impressive buildings in New York City.
- Monument Circle: The Indiana State Soldiers and Sailors Monument stands in the center of Indianapolis at almost 285 feet, just 15 ft. shorter than the Statue of Liberty. The monument was completed in 1889 to honor veterans from the Hoosier state and was among the first dedicated to common soldiers.

Can you believe how many neat things are built using limestone? Sounds like we need to make sure we protect this important resource, huh? But how do we protect something underground? When we need rocks for building materials, we usually dig it out of the ground. But what happens if we dig too much out of the ground? What happens to the soil, plants, and animals that were living on top of that rock? One way to protect this resource is to reuse the materials we already have, learn to use different types materials, be careful when removing the material

http://www.visitbloomington.com/limestone/around-the-world/

to ensure we don't harm other ecosystems, and work hard to ensure that SOME of the material stays in the ground!

⁶Testing for Limestone (20 minutes):

Believe it or not, there is a really easy way to test rocks to see if they are limestone (or at least contain calcium carbonate which is limestone's main ingredient). Other carbonate rocks include: marble, chalk, travertine, and dolostone (dolomite).

We are going to use vinegar to test our rocks to figure out which one is limestone! (The following should have been placed at the tables with the 5 groups: rock collections (http://www.hometrainingtools.com/rock-study-kit) and vinegar already poured in the glass measuring cup.)

Explain to students that in order to do this experiment, one person in each group will need to place "their" rock in the vinegar to see if it fizzes and wait until you, the interpreter, tell them to take it out and switch to another person's rock. Each person will get a chance to test "their" rock. The experiment is simple: which ever one fizzes is the limestone! (There should only be one sample of limestone per group. Make sure that no other rock reacts to the vinegar (or contains calcium carbonate!).

Once everyone has finished, explain that the reason it fizzes is because vinegar, an acid, dissolves bits of a material called calcium carbonate in the limestone. This releases carbon dioxide, a gas that rises to the surface as a stream of bubbles. Rocks that don't contain calcium carbonate won't fizz.

Who, in each group, had the limestone? Raise your rock! (Make sure they are correct!)

<u>Importance of Limestone (15 minutes):</u>

Why ELSE is limestone important? Well first off, it is the state stone of Indiana (Salem Limestone). Who lives in Indiana? We do! Indiana has been a state for 200 years. Has this limestone been here that long? Yes! Even longer! Around 300 million years! (Write that number on a chalkboard or smartboard so students can see how big that number really is!) But there are MANY more reasons we should love, appreciate and protect limestone!

⁶ Adapted from: http://kids.nationalgeographic.com/kids/activities/funscience/rock-on/

My Home:

Students should still be in their groups. Hand-out one sheet of flip chart paper and a marker to each group. Have students work together to make a list of all of the different parts of their house (i.e. roof, walls, paint, window, window frame, door, carpet, tile, pipes, cement foundation, etc.). Have one person in each group be the recorder who writes everything down. Explain that this person needs to be able to spell well and write legibly. Give groups around 5 minutes to do this part.

Next, explain to the groups that they are now going to record different things that people might do in their morning routine (i.e. take a shower, go to the bathroom, brush teeth, eat breakfast, get dressed, drive to work/school, etc.). Give them around 5 minutes to make this list, too.

Once everyone is done, go over the answers. Have each group read 5 things on their list aloud. Write everyone's answer on your own flip chart. Make sure to write "HOUSE" at the top of the house list and "MORNING ROUTINE" at the top of the routine list.

Once you have made the main list, go over how limestone is related to each item on the list (if it is). Please see limestone fact sheets at the end of this program so that you know how to do this (These lists should be studied before the program. Print out the sheets if you need a "cheat sheet").

Closing (5 minutes):

After what we talked about today, how many of you now see the importance of not only rocks in general, but limestone in particular? I hope every one of you!

Let's review! What are the three main types of rocks? Sedimentary, metamorphic and igneous. What type of rock is Indiana's bedrock made of? Sedimentary rock! What is one type of sedimentary rock that Indiana has in its bedrock? Limestone! Finally, what are some items that are made from limestone?

Do you remember that limestone is one of the rocks underneath your piece of land at the Children of Indiana Nature Park? It is supporting the soil, trees, plants and animals that call this special piece of land home. Limestone (and other rocks) are also habitat for all kinds of critters. Can you think of a mammal that sometimes makes its home in caves? Bats! This important resource is something worth protecting! Can everybody now see WHY Indiana's state rock/stone is limestone? It is so important to our environment and state! Thanks for learning to be a ROCKin' conservationist today!

Activity Hot water switches on water is stored in dams made of concrete		Application of limestone limestone is used in cement and as aggregate to make concrete			
			water		hardness is adjusted and purity improved by adding lime
			water is transported in	metal pipes (iron or copper)	limestone is used as a flux to remove impurities when refining metals
	concrete pipes	see above			
	plastic pipes	limestone is used as a non-reactive filler to extend expensive resins in plastics			
water is heated by electricity	produced from coal	lime is used to remove (neutralise) polluting sulfur dioxide emissions from coal-fired power station gases			
		limestone used in coal mines to prevent explosions (keeps dust down and doesn't transmit sparks)			
	produced from oil / nuclear sources	lime used in refining processes (for oil and uranium)			
Alarm clock rings					
plastics / metals		see above			
Look out of window					
glass		glass is made of sand (silica), limestone and soda ash (sodium carbonate), which is itself made from limestone and salt			
lead (leaded lights)		limestone removes sulfur (as calcium sulfate) from lead ore (lead sulfide) and acts as a neutraliser for the flue gas, which contains sulfur dioxide			
Step onto carpet					
carpet backing		limestone is used as a filler to extend latex (expensive) and bulk it out			

Go to the bathroom	
wash basin / wall tiles (ieceramics)	ceramics are made from clays, sand and small amounts of limestone (eg in glazes)
Stand on	
rubber mat	limestone used as a filler to extend rubber (expensive)
Clean teeth	
toothpaste	fine limestone is used as a mild abrasive and also helps develop / maintain teeth which are made up of calcium compounds
Use the lavatory	
lavatory pan (ceramic material)	see above
waste water	treated with limestone before being recycled or returned to river / sea
Take a bath	
bath iron	see above
bath enamel	enamel contains limestone
soap	lime is used in soap making
Clean bath	
bath cleaner	contains fine limestone as a mild abrasive
Get dressed	
clothes	lime is used in preparing cotton and wool; dyes and washing powders use limestone
Go downstairs	
paint	limestone is used in pigment-making and as a filler in extending expensive pigments, polymers, resins, etc
	limestone is used in treating acid waste from making white titanium pigments

	vinyl floor in kitchen has limestone filler
Make a cup of tea	
cup / saucer / teapot	ceramics, metals, hot water (see above)
milk	cows have dietary calcium supplement derived from limestone
sugar	lime is used to raise pH, causing impurities to separate out
	for removal; carbon dioxide (also from limestone) is then used to remove the lime by reforming calcium carbonate (limestone)
Make toast	
wheat	limestone is used by farmers to neutralise soil
bread	limestone is added to flour to maintain our calcium levels (to reduce risk of the bone disease rickets)
Cook	
eggs	limestone is used in poultry grit
bacon	limestone is used in pig feed to provide essential calcium
salt	salt is made easier to pour by adding fine limestone
Take indigestion tablet	
indigestion tablet	contains limestone filler / extender and calcium salts (derived from limestone) as active ingredients (limestone is also used as a filler in many pharmaceuticals)
Clean up	
surface cleaners	contain limestone filler
unblock plug hole	caustic soda (sodium hydroxide) made from lime, salt and ammonia
Pick up mail	
brochures	paper contains limestone filler and also provides a smooth coating
Make phone call	

copper wire	limestone is used as a flux and to lubricate wire-drawing process
optical fiber	is high grade glass (see above)
Pick up school bag	
leather	tanning process uses calcium hydroxide (made from lime) to remove hairs and to plump up hides
pencils	limestone filler in the pencil 'lead'
paper	see above
typing corrector	limestone filler / extender / opacifier
adhesive	limestone filler and lime in processing
Blu-tack	limestone filler / extender

Taken from: http://www.rsc.org/Education/Teachers/Resources/jesei/limeston/home.htm

Ways in Which Limestone Contributes to our Lives:⁷

Building our Homes and Cities: Limestone is one of the key ingredients in making cement, the powder that binds rock and water to make concrete. To make cement requires a nearby limestone deposit. Reliable and nearby sources of limestone, and consequently cement, make it possible to build and grow in a sustainable manner.

Improving our Farming: The calcium in limestone provides an important feed supplement for cattle and poultry to help produce milk, eggs, and meat products. It is also applied to soils to reduce acidity and improve crop yields.

Making Glass: Limestone is essential to glass-making, including windows, bottles, windshields, and the fiberglass insulating your home.

Cleaning our Air: Electric power plants rely on local supplies of limestone to keep plants clean and reduce air emissions. It is the scrubbing agent that removes sulfur dioxide, mercury and other gases from smokestacks.

Adding Nutrients: High quality limestone is a source of calcium in foods and vitamins. Foods where limestone adds calcium include breads, granola bars, cereal, infant formula, pasta, pet food, tofu, yogurt, graham crackers, baking mixes, waffles...the uses grow daily. It also has many uses in making antacids and medicine tablets.

Affordable Roofs: Asphalt roof shingles are the most economic roofing product available today, and limestone is a key ingredient. Limestone in roofing reduces the use of asphalt, adds fire resistance, and lowers cost

Cleaning Our Water: Limestone is used as a filter to purify drinking water and neutralize lakes subject to acid rain. It is also used to treat bio-solids in sewage, as well as industrial sludges and petroleum wastes. It does this by controlling the growth of pathogens in bio-solids and converting sludges into usable products.

Bringing Paper to Life: The many qualities of limestone improve paper by adding brightness, opaqueness, smoothness, strength, and dryness, as well as making environmentally friendlier paper products, such as non-acidic papers. It is essential in the making of graphic papers, paperboard for milk cartons and juice containers, magazines, annual reports, and pizza boxes.

⁷ Taken from: http://www.calcima.org/pdf/CalCIMA Limestone.pdf

Durable Paints: A paint product is about 20-30% limestone. Limestone provides durability, color, sheen, gloss, non-toxicity, weather resistance, and low abrasiveness. It is an important reason why paints can be made to adhere to such varying surfaces as walls, appliances, furniture, children's bikes and wagons, cars, bridges, and ships.

Everyday Products: Probably every day you are using a product that is stronger, more durable, warps less, dampens sound better, and less costly because of limestone. These are only a few of the applications: window frames, fences, home siding, PVC pipes, computer keyboards, automotive dials, car upholstery, electric wires, TV cables, automotive gaskets, clear packaging and food wrap, car exteriors and interiors, trash and garbage bags, large garbage cans, food containers, bathroom cleaners, shoe polish, and diaper film.

Joining and Sealing: Our Lives Limestone seals the gaps in our homes and cars to prevent moisture and gas seepage, and dampen sound. Adherents and sealants composed of limestone can be found under auto bodies, in insulated glass windows, between steel and glass in buildings, and between pre-cast concrete panels. They are commonly known as putty, caulk, joint compound, epoxy, urethane, silicone, acrylic, and vinyl acetate.

A Staple of Construction: Don't look now, but you may well be standing on carpeting, tile, or vinyl flooring made of limestone compounds. It is probably in the stucco on your home's exterior, in the tape sealing your home's sheet rock, the concrete and masonry work in your home, the lining of your swimming pool or spa, in shower stalls and in bathroom sinks, and throughout your home in pipe conduit, grout, and mortar!