SNOW CANYON STATE PARK
SCHOOL PROGRAM

Rocky Rendezvous

Grade Level 2

Utah Core Curriculum Standards for Science[1]

- Standard I, Objective 2: Communicating effectively using science language and reasoning.
    a. Developing social interaction skills with peers.
    b. Sharing ideas with peers.
    c. Connecting ideas with reasons (evidence).
    d. Using multiple methods of communication reasons/evidence *(e.g. verbal, charts, graphs).*
- Standard II, Objective 1: Describe the characteristics of different rocks.
    a. Explain how smaller rocks come from the breakage and weathering of larger rocks.
    b. Describe rocks in terms of their parts *(e.g. crystals, grains, cement).*
    c. Sort rocks based upon color, hardness, texture, layering, particle size and type *(e.g. igneous, metamorphic, sedimentary).*

Theme

Our backyard in Southern Utah is considered one of the most unique landscapes in the world - the desert. Sandstone is the foundation to many types of desert landforms, such as arches, plateaus, and sand dunes. Once you can learn to interpret the natural forces that shape these landforms, you will be able to better appreciate this dry landscape, even down to the rocks.

Objectives

Students will:

- Be able to identify the two different rock types found in Snow Canyon State Park[2]
- Be able to identify physical characteristics between rock types
- Be able to explain the weathering and/or erosion process of the rock cycle

Materials

- Physical examples of the three rock types (durable enough to be passed around)

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[1] According to the Utah State Board of Education www.uen.org/core/
[2] Igneous and sedimentary rock. While present, metamorphic rock is not commonly visible in the park

    - Igneous - basalt (Pāhoehoe and ʻAʻā), obsidian, granite, (could include some crystals to better explain crystallization)
    - Sedimentary - sandstone, coal, gypsum, (limestone with a fossil would be a fun addition)
    - Metamorphic *(optional)* - schist, marble, slate, gneiss
- Laminated pictures with volcanoes and volcanic explosions
    - Preferably one of Santa Clara Cinder Cone volcano
- Handkerchiefs for blindfolds
- Sugar cubes
- Uncooked beans or small pebbles
- 2 Tupperware containers w/ lids
- Water
- Whiteboard w/ dry-erase markers

Duration

- PART I: 20-30 minutes - lawn lecture + activity (rocks)
- PART II: 20 minutes - lawn activity + activity (weathering/erosion)
- PART III: 40 to 45 minutes - Hidden Pinyon Hike

Background

Much of Snow Canyon State Park's unique landscape is due to a combination of common geologic events usually seen in desert environments - wind, water, and time. However, unlike most deserts, volcanic eruptions have also played an important role in the formation of the canyon. Two rock types, sedimentary and igneous, can be observed in the park simply by looking at the canyon walls or scrambling over a petrified sand dune. Sandstone is a type of sedimentary rock that was deposited by lake and river beds that covered the region millions of years ago. Water and wind forces dug deep into the sandy rock, and more sandstone layers were deposited, and this pattern continued for several more thousand years.

Around one million years ago, one of the first volcanic events marked this area and the landscape was forever altered. Cinder cone volcanoes, found north and east of the park, violently erupted and pushed forth rivers of lava (three lava flows are represented in the canyon). Visitors can see where the lava cooled around ancient sandstone formations to form basalt, a type of igneous rock, by following the lava flows from south of the park up towards the cinder cone. Over time, wind and water forces ate away at the basalt and sandstone through a process called erosion, and has slowly created the Snow Canyon visitors and wildlife enjoy today. By using this new knowledge, and a little bit of imagination, visitors can look for geologic clues around the park to travel back in time to a different landscape.

PART I

ROCKS - Lecture

1. Initiate a discussion with students about what they see around the park, particularly "non-living things". By this time in their school year, students should have already covered "living things" in their curriculum, so they may mention trees, bugs, or animals. Encourage their enthusiasm with these answers, but if they have not mentioned rocks yet, you could try a game of "I-Spy." Identify an obvious rock formation nearby that is visible to the students, and list characteristics of the formation in your "I-Spy" guesses. Once they have mentioned rocks, congratulate them and begin your lecture.
2. At this point, you will ask a student to point out a rock formation they see around them, or to explain a rock they may have seen on the drive to the park. It will most likely be sedimentary or igneous, and depending on the answer you will take out the samples of that rock type and begin laying them on the table.
    a. **Igneous -** Begin passing out rock samples to the students. Gently remind them to be careful when holding and passing them over to classmates. Have students pay attention to how these rocks look and feel (bumpy, smooth, black, shiny, etc.). Discuss how all igneous rocks come from lava, and then ask the students if they know where lava comes from? You could give a hint with a popular kid's movie, like *Moana.* Students will most likely answer with volcanoes by this point, and you can now take out the laminated pictures of volcanoes. Mention how there is even a volcano in Snow Canyon State Park (and show the picture of the Santa Clara cinder cone). Discuss how when the hot lava begins to cool, it forms into the rocks they are holding today. Explain how there are two types of lava, called Pāhoehoe and ʻAʻā, and have the students try to pronounce these terms correctly with you. Further explain that, depending how lava cools, it will create different kinds of rocks. Some will be like the lava rocks (basalt) we see all around the park - bumpy, rough, black/red rocks with bubbles in them, and make it very hard to walk on. Other lava cools to obsidian - shiny, black, and sharp. Have the students who are holding the obsidian rub their fingers on the smooth side and note the softness. Lastly, lava that takes a *long* time to cool will form beautiful, shiny crystals (granite). You could relate this to granite countertops in kitchens. Circling back to basalt and relevance to the park, explain how roughly over 26,000 years ago, the cinder cone volcano in Snow Canyon State Park exploded with lava and debris that flowed through the park. As it cooled, the result is the black, bumpy rock (basalt) found in the park. You could also point to nearby examples, as well as mention to the students they will see a lot of basalt while on the hike. Ask if there are any questions. Ask students if they are finished looking at the igneous rocks and retrieve them to put back on the table.
    b. Metamorphic *(optional)* **-** This rock type may be more complicated to explain

to students (because of the allotted time), so it may be best to discuss with teachers beforehand how acquainted their class is with metamorphic rocks. If you still choose to discuss this rock type, you will begin to take the samples out and pass them around to students. Have students pay attention to the lines and stripes in the rocks (foliated gneiss is a good example). Briefly explain how metamorphic rocks are (in a short sense) the result of other rocks that have become smashed together because of heat and pressure, and that's why you can see stripes in the rocks. You could use an example, such as gummy candy. Ask the students if they have ever left some gummies or candy out in the sun too long, or in the back of their pocket when they sat down. They will most likely answer yes, and either choose to ask or tell students what happens to the candy after that occurs (melting and mashing together). Like how a handful of candies melt together to form one candy, rocks can melt and mash together to form one new rock. You could also try a word-association with *metamorphosis* if the class is familiar with the term. Explain how a caterpillar turns into a butterfly through metamorphosis, and rocks will form new rocks, called metamorphic rocks. Ask students if they have any questions, and then retrieve the metamorphic rock samples.

c. **Sedimentary -** One of the most important and common rock types found in Snow Canyon State Park, Southern Utah, and deserts around the world. Begin by asking students if they have ever rubbed a kind of rock that leaves sand on your fingers. This is called sandstone, and is a type of sedimentary rock. Start passing out your sedimentary samples, noting to students to rub the rock and feel the sand, or look for evidence of smaller rocks in them. Discuss with students that sedimentary rock is the collection of small or large rocks that glue together by other small particles, like dirt and sand. Cement or conglomerate is a good example, especially if you have a physical example of all the stones cemented together. These rocks are different from metamorphic rocks because they do not need heat or pressure. Explain to students that these rocks will feel very rough (gritty), and usually be in red, yellow/tan, and grey colors. Ask the students what colors they can see in Snow Canyon (red, yellow, white). If students ask why there are different colors (and they likely will), simply explain that different minerals create different colors in rocks like the ones they see in the park. Ask the students if there are any more questions, and then retrieve the sedimentary rock samples.

ROCKS - Activity

1. After your lecture and showcase of the three types of rocks, ask the students if they would like to test their new knowledge. Repeat the names of the three rock types with students - igneous, metamorphic, and sedimentary (they may struggle with pronunciation). Have the students raise their hands, and pick a handful of students to join you at the front. You can choose as many students as you feel comfortable with the time frame.
2. Explain that you will be covering their eyes with handkerchiefs, and they will have to guess the rock you hand them. It does not need to be accurate; for example, they could say "lava rock" if it was a basalt igneous rock, or "sandstone" for sedimentary. You could attempt to use metamorphic rock if you feel they understand the stripes characteristic. Encourage them to really feel the texture of the rock and give their best guess - there are never any wrong answers.
3. If the student is struggling to guess the rock, you can have them remove the blindfold and try to guess based on the look of the rock. If they continue to struggle, you can have them "ring a friend" and have a classmate raise their hand if they know what it is.
4. After a few tries with the guessing game, thank the students and have them find their spots to sit down again. Pick up a sandstone rock and refer back to the sand you can rub off. Ask the students what they think would happen if you kept rubbing all the sand off the rock? Begin your transition to erosion and weathering.

PART II

EROSION - Lecture

1. Begin a discussion with students about the characteristics of deserts. Now that you have discussed rocks found in the desert, like sandstone, ask some follow-up questions, such as, *"What kind of weather do deserts usually see? Are there a lot of trees in the desert? And why is there so much sand!"* Discuss how there must be something that shapes the desert rocks into the weird shapes you see, such as arches. You could either ask or tell students that there are two forces that shape the rocks - wind and water. If the group is from Saint George, you could ask the students if they have ever experienced a monsoon, or a very rainy and windy thunderstorm. Have the students imagine what 100 years of rain and wind would do to the sandstone rock in your hands. They should be responding with something relating to erosion. If they are struggling, begin noticeably rubbing the sand off the rock.
2. Refer back to what your group talked about sedimentary rocks - they are the glued pieces of other rocks, but those other rocks have to come from somewhere. Discuss with the students how strong winds and heavy rains will eat away at all kinds of rocks, and when the rock has been eaten away enough, the rock will break apart or fall off. As it tumbles, it may break off into smaller rocks.
3. If you are near a steep cliff with a noticeable rockfall, point it out to the students, and have them try to imagine what the rockfall may have looked like. How many rocks do

they think would break apart into smaller rocks? Explain how the process that breaks apart rocks is called erosion (or breakage, weathering, etc.). However, while it's sad to see rocks break and shrink, it is very important in the desert because that is how you get many of the cool rock formations, such as arches and slot canyons.

   a. As another example, you could ask students if they've ever washed their hands with a bar of soap (hopefully someone has). Explain how if you keep using water and rubbing that bar of soap, it will eventually continue to get smaller until it breaks apart or shrinks into nothing.

EROSION - Activity (based on "Will a Mountain Last Forever?" activity by Mystery Science)

1. As your last activity, begin asking if the students would like to see some erosion in action. **Prepping for this activity before your program is recommended.**
2. Explain to students that you would like a few volunteers to be your "rock tumblers." Select four students and have them join you up front. Pull out the (unaltered) sugar cubes, and explain how these will be your "rocks" to show how breakage and weathering affects them.
3. Pull out the whiteboard *(if time permits)* and ask student 1 to draw what the sugar cube looks like now, and show the class. Erase the drawing, and ask student 2 to draw what they think the sugar cube will look like after it gets tumbled around (like during a rockfall or rainstorm). If you do not have time for the whiteboard, ask students to raise their hands and tell what they think will happen while you are also doing the next step of the activity.
4. Take two cubes for the other two students (3 & 4), and have you or them color all six edges of the cube with the markers. Place one colored cube in a container with a handful of other sugar cubes, close the lid. Put the other colored cube in another container with a few sugar cubes and some uncooked beans (serving as "harder" rocks, like igneous rocks). Close with lids.
5. Have the two students rigorously shake the containers, possibly for up to 30 seconds. Remind them hold onto the container tight so it doesn't fly out of their hands. After the shaking has commenced, have the students open the lids and discuss what changes they see with the sugar cubes. The sugar cubes in both containers should have noticeably started eroding and breaking apart, especially the one with beans. Have them show their containers to the rest of the class. Thank them and have them find their seat.
6. Lastly *(if time permits)*, take one of the containers and your pitcher of water. Explain to students that the prior activity would be examples of wind and rockfall erosion, but now you will show how water affects rocks. Pour a small-medium amount of water over the sugar cube, within a few moments the sugar cube should start to dissolve and break apart even more. Show this process to the class. Explain to the students that what your group did to the sugar cubes would take rocks up to hundreds, if not thousands of years to form.
      a. If you find it appropriate, you could emphasize on this long process as why it's even more important to respect our lands because it takes a long time for nature to perform the neat formations we can enjoy today.
7. Discuss with the class how this is an example to how rocks will react to natural forces

(wind, water, gravity) and to other rocks. Mention to students that the next time they see evidence of what may have been a rockfall, look for clues of smaller rocks that may have broken off the bigger ones. Also, to think where the rockfall may have started (such as the top of a cliff) and what may have been the reason for the erosion and weathering.

8. Thank the class for their attention, and prepare to start the hike section of the program. Tidy up your presentation area, and make an extra note to cover the sugar water until you can properly clean the materials.

PART III

1. Prepare the students to go on the Hidden Pinyon hike across from the Visitor's Center. The goal of this hike is to give students an opportunity to identify different rock types and evidence of erosion and weathering.
2. The lava rock path across from the Visitor's Center is an excellent spot to stop and show the students examples of volcanic basalt (specifically ʻAʻā lava). This is also a good time to gently remind students to not pick up rocks and wildlife, but rather observe from a safe distance.
3. Near the beginning of the trailhead (if you're entering from the nearest trailhead), your group must scramble down a sandstone boulder. As you're preparing the group to be careful while descending, use this time to pose a question about erosion, such as, "As you're climbing down the rock, think how many people walk on this rock and wear it down everyday. What do you think this rock will look like in 100 years?"
4. There are many other examples of erosion and breakage along the hike, especially along steep slopes and cliffs. Have students look for large (and small) rocks that may have fallen and broken because they fell.

Wrap-Up

1. Return to the lawn from the hike, report with teachers that all students are accounted for.
2. Review the clues and evidence your group saw on the hike.
3. Remind students to use their new knowledge of rock types and erosion at home to find out what rocks make up their backyard, and how the landscape may be changing.