**Williamson Fellows Lesson Planning Template**

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| **Grade(s):** *What grade level(s) is this lesson appropriate for?* **6-8** | **Topic:** Sedimentary Rocks and Energy | **Lesson #** \_\_1\_\_ **in a series of** \_\_3\_\_ **lessons** |
| **Brief Lesson Description**: *Briefly describe what this lesson is about, what will happen throughout the lesson, and how the lesson fits into the bigger module.*This lesson will teach students how to identify sedimentary rocks, what depositional environments are, and what the depositional environment of the rock can tell us about the history of earth. Through the lesson, the teacher will build from one concept to the next, starting with identifying three sedimentary rocks (shale, sandstone, and conglomerate) and their characteristics. Then, students will learn about depositional environments and link the energy in each environment to the characteristics of the rocks that form there. In the exercise, students will use this knowledge to observe 3 mystery rocks and interpret where they formed. This lesson is the first of three, and explores the concept of sedimentary rocks and what they can tell you about the environment they formed in. The next lesson is stratigraphy, and in the final lesson, students will be asked to use skills from both these lessons.  |
| **Learning Outcome(s):** *List 3-6 learning outcomes. These are the big things that a student should* ***know*** *and/or* ***be able to do*** *by the end of the lesson.*1. SWBAT make observations of rocks and use them to identify sedimentary rocks.
2. SWBAT describe the characteristics of different depositional environments and how they relate to characteristics of rocks.
3. SWBAT use their observations to interpret the depositional environment of sedimentary rocks.
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| **Background Information**  |
| *Provide necessary background information about ideas or concepts that students need to know* ***before*** *beginning this lesson (e.g., students should know that CO2 is a major greenhouse gas, or students should understand the role that water plays in weathering and erosion, etc.). You may want to describe why these ideas are important.*Students should be familiar with the rock cycle and the concept of sedimentary rocks.Students should know that sedimentary rocks are formed from **sediments**: fragments of existing rocks that have been removed and transported away.Students should be familiar with differences in environments (speed of water, organisms that live there, etc) |
| **Science & Engineering Practices:** *List up to three Science & Engineering Practices that students will engage in during this lesson.*Developing and using modelsAnalyzing and interpreting data | **Disciplinary Core Ideas:** *List up to three Disciplinary Core Ideas that are addressed in this lesson.*ESS2: Earth’s SystemsPS1: Matter and its interactions | **Crosscutting Concepts:** *List up to three Crosscutting Concepts that are addressed in this lesson.*Cause and EffectPatternsEnergy and matter |
| **Possible Preconceptions/Misconceptions:** *Identify any common misconceptions that students might have about the subject. For example, students often think that the only source of carbon is the atmosphere, or that scientists disagree on the causes of climate change, or that the amount of water on the planet is declining due to climate change, or that all rocks with layers are sedimentary, etc.*Students may think that all rocks with layers are sedimentaryStudents may think that sedimentary rocks can form anywhereStudents may have thought about how sediment is moved from one place to anotherStudents may be confused about the difference between crystals and grains (crystals grow in igneous rocks, grains are eroded bits of other rocks). |
| **LESSON PLAN** *This template uses the “5E” model to help with planning: Engage, Explore, Explain, Elaborate and Evaluate* |
| **ENGAGE** *Describe how you will start the lesson. How will get students engaged? What prompts will you use to help students access prior knowledge? How will you stimulate their interest and generate questions? This could be an interesting picture, a video with background information, an activity, a game, or even just a series of questions that you ask the students. You can include a pre-assessment here as well – this could be a written “quiz” or just asking questions of the students to gauge what they already know about the subject.*The lesson will open with the teacher describing changes that the earth has gone through (in this case, that Salt Lake City was once on a beach, then in the middle of a desert, then underwater in a lake). This will intrigue students and prompt them to think about how we could know this. Then, show images of three different environments. Ask students to write in their handout their observations, focusing on similarities and differences they see, sediment, and how that sediment could have gotten there. Then, hold an open discussion and invite students to share their answers. Through the discussion, we are looking for ideas about how sediment ends up in each place… that is, in the ocean there isn’t much movement, in the mountain stream the water moves quickly, in the desert the wind moves the sand. Likewise, the ocean floor has a lot of mud, mountain streams have larger rocks, and desert dunes are made of sand. After thinking a bit about these concepts, students should be ready to dive into the lesson. |
| **EXPLORE Lesson Description** *This is the “meat” of the lesson. Give step-by-step instructions of what will be said (prompts) and done. Make sure to indicate what the teaching is doing AND what the students are doing. Include prompts or probing questions to get students thinking on the right track, troubleshooting tips, and what you expect to happen (e.g., students will struggle at first to come up with a model so it might help to show them a few simple examples). Identify the materials that you will be using during each step (there is a place for a detailed list of materials below) and include links for any online videos, maps, etc.*First, review a couple topics. Use the diagram from the Powerpoint to explain the relationship between grain size and transport energy. In particular, the big idea here is that the energy of the force carrying sediments is proportional to the grain size carried. Faster/ higher energey water can carry larger grains (like pebbles), while slow/lower energy water can only carry very small grains (like mud). So, different grain sizes will end up in different places/environments.Next, review sedimentary rocks. Start by discussing the categories of sedimentary rocks. Clastic rocks are composed of rock fragments transported from other places. Chemical rocks are composed of minerals that precipitate in place. This lesson focuses on clastic rocks, as chemical rocks can get pretty complex and we’re discussing clastic grain sizes.Move onto discussing characteristics of sedimentary rocks, particularly these: * Grain size: how big are the grains?
	+ gravel, sand, mud
* Sorting: are the grains the same size?
	+ poorly sorted to very well sorted
* Sedimentary structures: what kind of layers are in the rock?
	+ none, flat layers, or rippled layers

This is a simplification, but it works for this lesson. Grain size and sorting can tell you about the energy level of the environment the rock formed in. Sedimentary structures can tell you about forces at work in the environment. And, if there are fossils in the rock, fossils can tell you about the ecosystem of the environment the rock formed in. Next, discuss the three rock types we will focus on in this lesson: conglomerate, sandstone, and shale. Use the images of the outcrops and the sketchfab links to look at these rocks at different scales (up close and from a distance). The biggest takeaway is that conglomerates form in high energy environments, sandstones form in medium energy environments, and shales form in low energy environments. Make sure the students know that these rock types can form in multiple depositional environments, so we need additional clues to figure that out.Next, cover the basics of a few different depositional environments. Depositional environments are, in essence, places where sediments accumulate. Some examples are rivers, lakes, and the ocean. Sediments are transported by water, wind, or ice, and the specific environment will produce specific rocks according to the energy level, transport distance, and chemical and biologic processes. When discussing specific environments, make sure to emphasize the energy level and transport distance, as well as additional facts that can help students diagnose the environment. After discussing each environment, ask students if they can think of any places like that environment, or if they’ve been somewhere like this. The environments discussed here will be options for the following activity. The activity for this lesson is to make observations of three unknown rocks to try to determine in which depositional environment they formed. The handout will guide students through the key observations. Rock A is a sandstone with ripples, Rock B is a conglomerate, and Rock C is a shale. In this exercise, students will note the grain size, sorting, and sedimentary structures. Then, based on these characteristics, the students will determine in which of the previously discussed depositional environments the rock formed. In addition, students will note what kind of fossils they might expect to see from an environment like that. While this is in progress, check in with students/groups to ensure they understand.When the students have finished the activity, discuss their observations and conclusions as a group, and reveal the depositional environments of each rock. |
| **EXPLAIN** **Concepts:** *Describe the major concepts that will be covered in this lesson.*Grain size is related to energy of the water carrying the particles. Different sedimentary rocks form in different environments based on the energy carrying sediments.Sedimentary rocks record the environment they form in, and these characteristics can be used to identify what environment a given rock formed in.**Vocabulary:** *List and define key vocabulary words for this lesson.*Depositional environment – places where sediments accumulateSediment – fragments that have been weathered from the original rock and transported to another locationDeposition – the laying down of sediment that was carried by wind, water, or ice |
| **ELABORATE:** *Here you can talk about applications of the concepts learned in the lessons or options for further exploration. This is where you can talk about some of the ideas you have that would be great to do but won’t fit into the time frame of this lesson. You may want to provide a list of websites, books, or articles to read for further information.*There are additional provided slides that cover a few more depositional environments and their characteristics. If you have time or wish to explore more depositional environments, you can add these in. These would also be neat to show the unique rocks that form there! |
| **EVALUATE:** **Formative Assessment:** *Explain how you will assess how things are going throughout the lesson. This is often a quick check-in to see if students are engaged and are grasping the big concepts. Some of the ways to do this include holding a discussion, doing a think-pair-share activity, or asking students to write down 1 thing that is confusing to them.*Throughout the lesson, prompt students if they know or have been to any places in the environments like the ones described. As in, when discussing beach environments, ask if anyone can think of a place with an environment like that.**Summative Assessment:** *Explain how you will assess if students met the learning outcomes. This is often a quiz, homework assignment, project, report, or even just a drawing.*The activity detailed in the handout will serve as an assessment, as the students should be able to use their knowledge to identify sedimentary rocks and depositional environments. The teacher should talk to each student / group during the activity ensure that they understand. |
| **Notes for Instructors:** *This can be anything from where to find more information, to troubleshooting activity problems, to where to find certain supplies.* |

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| **Materials Required for This Lesson/Activity** |
| *Insert any diagrams, handouts, pictures, or other materials that aren’t available online HERE.**Include any hyperlinks to online videos, maps and other resources in the “Explore” part of the lesson.**List any other materials, including quantity, potential supplier and price if it is significant.*[**https://sketchfab.com/3d-models/0401153-4b2bfd7803b140ebb0628814d611a769**](https://sketchfab.com/3d-models/0401153-4b2bfd7803b140ebb0628814d611a769)[**https://sketchfab.com/3d-models/mystery-sample1-75e946f80765434288c255daff92632e**](https://sketchfab.com/3d-models/mystery-sample1-75e946f80765434288c255daff92632e)[**https://sketchfab.com/3d-models/1501101-0c0c20b8d6594d7dba30fa332e82347e**](https://sketchfab.com/3d-models/1501101-0c0c20b8d6594d7dba30fa332e82347e)[**https://sketchfab.com/UofUGeo/collections/sedimentary-rock**](https://sketchfab.com/UofUGeo/collections/sedimentary-rock)**Note: If possible, having physical samples of these rocks would be very useful for students. If you can obtain samples of sandstone, shale, and conglomerate, it would be ideal to let students handle the rocks and observe the differences up close for themselves.**  |