Lesson Plan: Geology of the Cumberland Plateau

Grades: 4-7

Stage 1: Desired Results:

Understandings:

Students will understand that…

- The geologic history of the Obed goes back 250 million years.
- The geologic deposits which can be seen at the Obed took place at different times in geologic history.

Essential Questions:

- When was the Cumberland Plateau formed?
- What can studying the geologic history of the Obed tell us about the environment surrounding the river?
- What periods of geologic time can be seen at the Obed?

Students will know…

- Obed Wild and Scenic River has been cutting through the Cumberland Plateau for millions of years.
- The different periods of geologic time can be studied at the Obed.
- National Parks such as the Obed WSR play an important role in preserving many of our country's important natural areas.

Students will be able to…

- Identify several periods of geologic time represented at Obed Wild and Scenic River.
- Describe how the Cumberland Plateau was formed.
- Identify ways in which the Cumberland Plateau has changed over the years and what environmental conditions lead to those changes.

Stage 2 – Assessment Evidence:

Performance tasks:

Pre-Assessment:

Teachers may want to use their own pre-assessment based on their students' abilities and needs. One fill-in sheet as a pre-assessment has been provided that may need to be modified for students (may also be used as a post-assessment.)

Stage 3—Learning Plan:

Learning Activities:

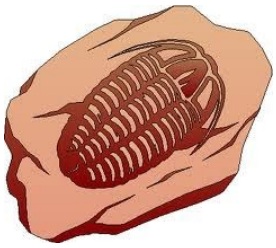
Preparation:

Materials: Obed WSR brochure, lesson plan, pre/post-assessment sheet, geologic time scale, KWL (know, what to learn, learned) chart, website for Obed/NPS.

Key Vocabulary:

Geology	the study of the origin, history, and structure of the earth.
Erosion	the slow wearing away of rocks or soil by natural processes, such as rain, wind, water, ice and snow.
Igneous rock	rock formed from hot magma which then cools and hardens
Limestone	a sedimentary rock consisting chiefly of mineral calcite, often containing marine fossils.
Metamorphic rock	rock that has been subjected to high heat and pressure, causing it to change chemically or physically from its original form.
Sedimentary rock	rock that is formed when deposits of loose materials are cemented together, usually by lime or silica, to form layers.
Geologic time scale	a scale that uses pictures and words to show the physical development of the earth

Shale	A sedimentary rock composed primarily of fine-grain materials such as silt and clay.
Sandstone	a type stone that is made up of grains of sand stuck together
Coal	a black or brownish-black hard substance within the earth that is used as a fuel
Fossil	the hardened remains or imprints of plants or animals preserved in stone or other material.
Plateau	an elevated area of flat land.



Procedures:

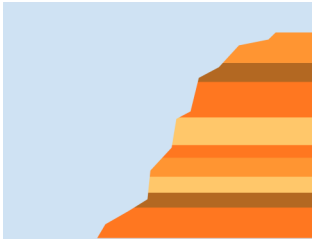
Teaching/Learning Sequence: This lesson plan is designed to be a stand alone lesson in the classroom, or to be used to help prepare your students for their field trip to Obed Wild and Scenic River. It can be used to teach about geology, geologic time scale periods, history of the Cumberland Plateau, and how erosion can dramatically change the surface of the earth over time. This lesson plan can take more than one day to complete, depending on the depth you chose to cover with your students, their abilities, and the number of activities you use .

1. Using a K-W-L (know, want to learn, learned) Chart, as a class, drawn on your whiteboard/technology board, ask the question(s): What is geology? How might studying geology tell us more about the history of the Obed? What geologic events took place to form the Cumberland Plateau?
   Record answers under the letter *K*. This is what the students know now.
2. **The Obed-** Next, pull up on your computer and/or technology board (Promethean or Smart) the following link https://www.nps.gov/obed/learn/photosmultimedia/multimedia.htm and play the short 2 minute video about the Obed. see if answers are different, and how they are different. Record answers alongside previous answers.
3. Moving on to the *W* section of your KWL Chart, asks students what they would like to learn/know about the National Parks and/or the Obed WSR. Record those answers under the letter *W*.
4. If you are using technological objects to record the chart be sure to save it for after the lesson plan or field trip to complete the *L* section, or what did you learn, with students at a later time.

5. **Plateaus—**Write the word Plateau on the board. Begin a discussion with your students, ask them what the word means. Write down their answers. Using your SMARTboard, or computer look up the word as a class. Write down or highlight the correct definition. A plateau is an elevated area of flat land. It can also be described as having steep sides or slopes and a flat top. Using a search engine, find several photos to show your class as examples. Use these photos to show your students the major characteristics of plateaus and how they are unique landforms found in many areas of the world.

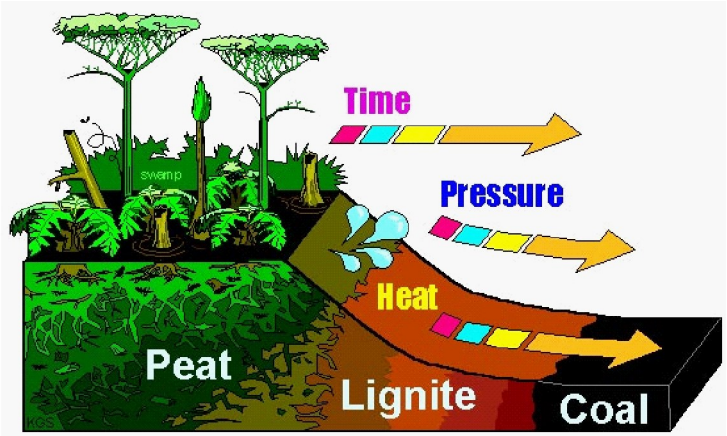
6. **The Cumberland Plateau**— Many of your students may not realize that a very large plateau (the Cumberland Plateau) goes through Tennessee where they live. A large portion of the Cumberland Plateau can be seen by visiting the Obed Wild and Scenic River. Stretching across eastern Tennessee from Alabama north into Kentucky, the Cumberland Plateau rises more than 1,000 feet above the Tennessee River Valley to a vast tableland of sandstone and shale dating as far back as 500 million years. The Plateau was formed from materials transported from the ancient Blue Ridge Mountains which were formed as a consequence of continental collision (plate tectonics). It might be worth describing to your students that the Blue Ridge Mountains were once as high as the alps, but have eroded over time to their present status. That erosion, is what formed the Cumberland Plateau. The materials were transported by water as soils and then hardened over geologic time into rocks. In fact, it is still slowly being formed today by free flowing water. The Cumberland Plateau is a subdivision of the larger Appalachian Plateau, which is called the Allegheny Plateau in West Virginia, Ohio, Maryland, and Pennsylvania. In the south, it is referred to as the Cumberland Plateau. Using a map, highlight the area of the United States in which the Cumberland Plateau passes. Next, show your students where the Obed is located. Using the same map, locate your school. Is your school also on the Cumberland Plateau?

7. **Geologic Time Scale—** Explain that geology is the study of the origins or history of the structure of the earth. If we use the Cumberland Plateau as an example we can use geology to uncover the history of the plateau and draw conclusions as to how it was formed and when that might have taken place. Next, introduce your students to the geologic time scale. Thousands and millions of years are used on a geological time scale. Geologic time is the chronology of the Earth's formation, changes, development, and existence. The Grand Canyon began forming 5 million years ago. The rocks that now form the cap of the Cumberland Plateau were laid down in a ancient shallow sea over 350 million years ago (much older than the Grand Canyon), during the Mississippian (360-320 million years ago) and the Pennsylvanian (320 -296 million years ago) periods of geologic time. The Earth is 4.6 billion years old. These events are measured on a geological time scale. Scientists do not measure geologic time on a clock or calendar. They use a linear timeline based on the age of rocks and their corresponding fossils, as well as the change in life that occurred over millions of years. The Geologic Time scale included in this lesson shows an accepted time scale for the Earth based on current science. The time scale is subject to change as new discoveries are made. Using the geologic time scale, have your students locate the correct periods of geologic time in which the Cumberland Plateau began. What else was happening according to the geologic time scale during this time? How many more years would it be until dinosaurs roamed the earth?



8. **The Power or Water—**Rivers and streams are powerful, ever-changing systems that can alter the surface of the Earth. The rivers and streams have been the major force that has created the often-dramatic landscape of the Cumberland Plateau. As the streams have cut downward into the sandstone, which caps the plateau, they have carved out gorges and canyons, leaving behind cliffs, natural arches, rock shelters and waterfalls. The Obed River is a great example of this. For thousands of years, it has slowly flowed and formed the deep gorge that now makes the Obed Wild and Scenic River such a beautiful place with its sheer bluffs that tower high above the river. But how does this happen? The river gorge was formed as the Obed River cut through the rock layers in the process called erosion. In addition to the river, other forces of erosion such as rain, snowmelt, and small creeks and streams from neighboring elevations also cause the river gorge to become wider and deeper. The weaker layers erode creating slopes whereas the strong layers form cliffs, giving Obed its recognizable landscape. Create a class experiment highlighting erosion and how it forms landforms. Several examples are provided in the support materials section of this lesson plan.

9. **The Layers of the Cumberland Plateau—** If you were to look at the cliffs and bluffs of the plateau, you can see distinct layers. Through time, layer upon layer deposited on top of another; compacting and cementing these once soft sediments into the rocks exposed today. These layers provide clues to the environments in which these rocks formed. The very top layer of the plateau is a hard conglomerate rock that caps the softer stones such as sandstone. One distinct layer often found in the Cumberland Plateau is coal. It is easily recognizable due to its dark black color. Explain that coal is an example of a fossil fuel. A fossil fuel is a fuel that has formed in the earth from the remains of plants or animals that lived as long as 400 million years ago. Coal is formed from a combination of plant material, heat, pressure, and time. The process of coal formation takes millions of years to complete and is still taking place today.



Source: Kentucky Geological Survey,

Closure:

After completing the chart for what was predicted and what actually occurred, discuss with students what they learned and complete the previous *KWL* chart that was began with students at beginning of this lesson.

Optional Activities: Teacher may choose to add some of these to the above lesson or use as assessment activities.

- Create a demonstration in which you show the effects of water and it's ability to cause erosion.
- Create a fossil with your students, there are simple examples in the on-line resources.
- Learn more about the geology of the Grand Canyon, how it was formed, and what it can tell us about the earth's history.

Enrichment Activities:

- Invite a park ranger to visit your classroom.
- Plan an outdoor learning experience, such as a field trip to the Obed and see first hand the power of the river has played in the geologic history of this area.
- Share other National Parks such as: Big South Fork and The Great Smokey Mountains with students by viewing on-line links and encouraging them to visit with family and/or friends. **www.nps.gov**

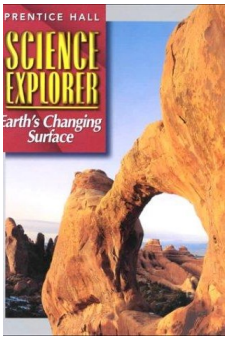
Post-Assessment:

- Use previous fill-in sheet pre/post-assessment to see what students answer now after the lesson and field trip.
- Use of teacher chosen pre-assessment as a post-assessment.
- Completion of Junior Ranger Booklet activities.

Additional Resources:

- Obed Wild and Scenic River brochure
- Junior Ranger booklets with activities
- Video is available for viewing at the Obed WSR Visitor Center in Wartburg for free to any visitors. It is also available for purchase.

Field Guides- (Your own classroom or school library may have some similar and wonderful examples too!)



- Earth's Changing Surface: Science Explorer. Prentice Hall (School Division). Upper Saddle River, New Jersey 07458 , ISBN 0131153889, 9780131153882
- A Field Guide to Geology: Eastern North America. Peterson Field Guides Series. Houghton Mifflin Harcourt. Boston, MA , ISBN-13: 9780618164387

On-line Resources:

https://www.nps.gov/biso/planyourvisit/upload/webgeo.pdf—Geology and History of the Cumberland Plateau

https://nature.nps.gov/Geology/parks/obri/index.cfm– Geology field notes for the Obed

https://www.nps.gov/common/uploads/teachers/lessonplans/Geology%20at%20the%20Grand%20Canyon.pdf—National Park Service lesson plans about the geology of the Grand Canyon. These include instructions on how to create a hands on experiment focusing on river erosion.

http://www.wikihow.com/Make-Fossils—instructions on how to make a fossil.

https://www.nps.gov/obed/index.htm National Park Service website for Obed WSR. This link may be shared with parents to give answers to questions they may have about the park. Also, this site has more information about the history of the park, events, and includes photos.

https://www.nps.gov/webrangers/teachers.cfm has many activities to learn about the parks and is aligned to standards.

http://www.nationalparks.org/ook/every-kid-in-a-park information about the president's initiative

https://www.nps.gov/obed/learn/kidsyouth/upload/Obed-Junior-Ranger.pdf online version of Junior Ranger Booklet

www.natureworkseverywhere.org maintained by the Nature Conservancy, provides educators with lessons and information on all things natural.

https://www.teacherspayteachers.com/ is a free membership that provides activities and other classroom useable items. Some are free to download; others have a small fee attached. This is a useful tool to supplement, and search for ideas to assist students in learning.

https://www.pinterest.com/ this site has many lesson plan ideas, activities, and is a place you may save or "Pin" ideas to assist in your teaching.

On-line Videos:

https://www.youtube.com/watch?v=tkxWmh-tFGs– 4 ways to understand the Earth's age from TED-ed

https://www.youtube.com/watch?v=r10oh1NHKv4– The geologic time scale

https://www.youtube.com/watch?v=DWq6-zaYvVw—Bill Nye The Science Guy - Erosion

http://www.edutoolbox.org/tntools "These resources are provided by the Tennessee Department of Education and include the materials formerly hosted at www.TNCore.org. The resources were created to align with the Tennessee academic standards and provide support regarding the academic content areas, college and career ready standards, and other department initiatives. Please note that this is a compilation of resources created over the past several years. In some instances, specific resources may reference standards or assessments that are no longer applicable in Tennessee; in that case, educators should use their best judgment to determine whether the materials still align with their content area and could benefit their students."

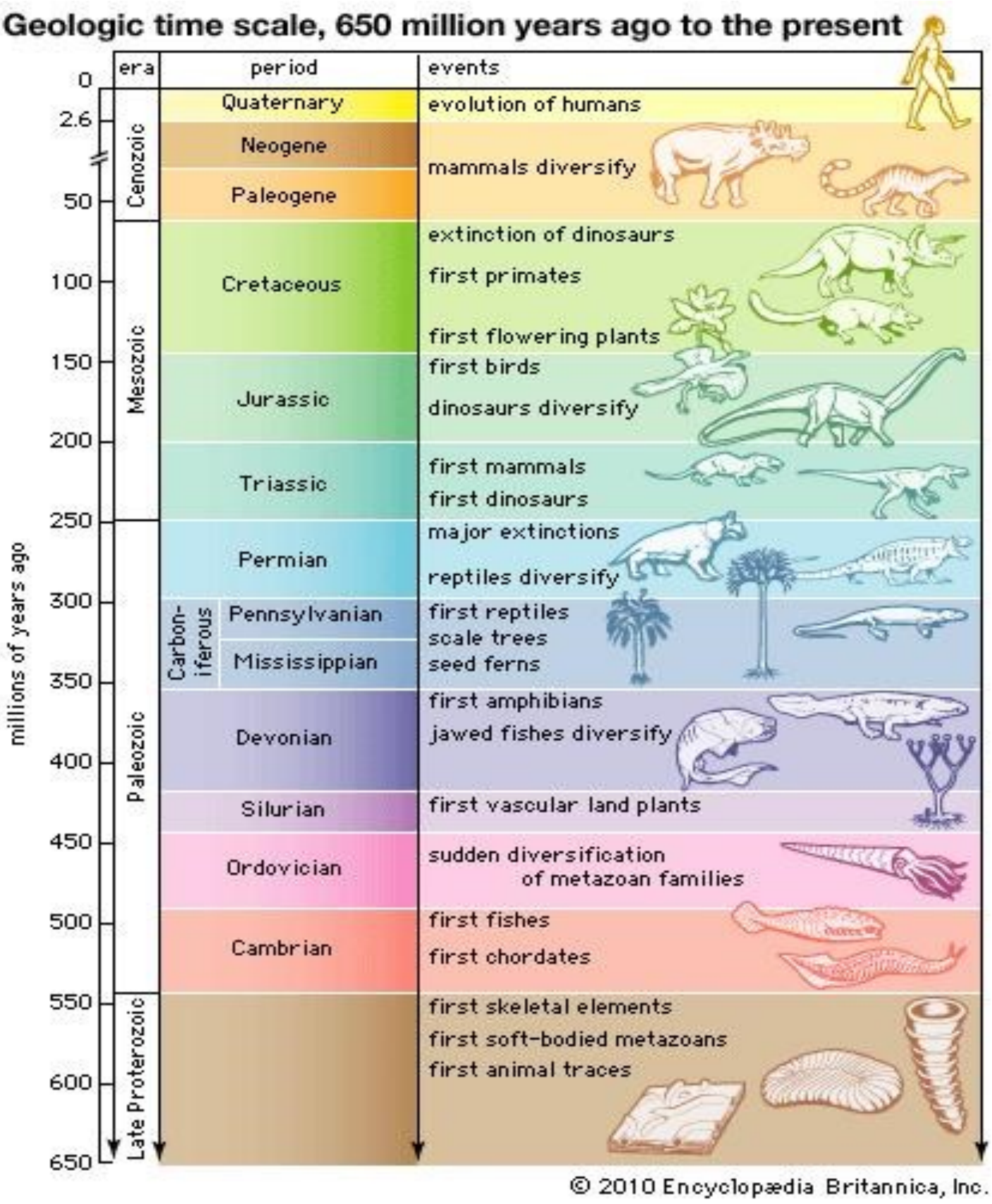
K-W-L Chart

Name _____

K= know now **W=want to know** **L=learned**

1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
Comments	Comments	Comments

Support Materials



Objectives/Standards: These are just some of the standards that may be used for this lesson. Please add to, or delete, as you the teacher need for your students with this lesson. These are chosen for use with *upper elementary* students with emphasis on *4h grade standards* in Science.

Science

Grade 4 : Standard 7 – The Earth Major geologic events that occur over eons or brief moments in time continually shape and reshape the surface of the Earth, resulting in continuous global change.

GLE 0407.7.1 Investigate how the Earth's geological features change as a result of erosion (weathering and transportation) and deposition.

SPI 0407.7.1 Design a simple model to illustrate how the wind and movement of water alter the earth's surface.

Grade 5 : Standard 7 – The Earth Major geologic events that occur over eons or brief moments in time continually shape and reshape the surface of the Earth, resulting in continuous global change.

GLE 0507.7.1 Compare geologic events responsible for the earth's major geological features.

SPI 0507.7.1 Describe internal forces such as volcanoes, earthquakes, faulting, and plate movements that are responsible for the earth's major geological features such as mountains, valleys, etc.

Alternative Assessment Indicators

Content Standard: Earth Science: The student will understand that the earth has many geological features that are constantly changing.

Alternate Performance Indicators (API) Gr. 3-5

1. Distinguish between land and water
2. Identify the earth's major geological features (e.g., land masses, mountains, oceans, lakes, and rivers)
3. Identify certain forces that cause changes in the environment (e.g., wind, water)