LESSON PREP

BEFORE YOU BEGIN

Prepare for your virtual reality adventure with our tips and guidelines.

SET-UP TIPS

1. Google Expeditions is a 360-degree experience. The only way students will be able to view the entire scene is by standing and rotating in a full circle while wearing their headsets. Make sure the classroom is prepped for this movement. NOTE: For safety, students should not walk around the room while using the consoles.

2. The first time that you use new technology in a lesson will always take longer than planned, but it will get easier as you and the students become familiar. If you're new to bringing VR technology into your lessons, visit edut.to/2kbkBQS for some great tips to help you get started.

3. Review each Expedition carefully before class so that you are prepared to answer any student questions.

NAVIGATION TIPS

EXPEDITION DETAILS

When you open an Expedition, you will see a white box with a gray bar on the right side. You can scroll within this box to read more and click on the details within the gray bar. Follow the arrows to find the pop-up detail boxes.

RETURN HOME

Return to the home screen by clicking the camera and then the house icon.

MAIN NAVIGATION

Point your viewer down and a navigation box will pop up. The tools in this section include:
- Arrows: Scroll between different sections (or “scenes”) of an Expedition.
- Camera: Navigate to a menu of all the sections of an Expedition.
- “I”: This opens and closes the text boxes.
- Sound: Turns the sound on/off.

GOOGLE EXPEDITIONS

Google Expedition
Earth Timeline
Precambrian Earth
- Molten Lava
- Cooled Lava
- Volcanoes
- Asteroids

Late Precambrian Earth
- Hardened Crust
- Moon
- Atmosphere
- Volcanoes

The Paleozoic Era
- Plant Life
- Water
- Vascular Trees

Late Paleozoic Era
- Atmosphere
- Plant life

Jurassic Period
- T. Rex
- Volcano
- Pterodactyl

Late Jurassic Period
- Climate
- Animal Life

Geological Timeline
- Precambrian
- Supereon
- Paleozoic Era
- Mesozoic Era
- Cenozoic Era

Google Expedition
Grand Canyon

The Colorado River
- Whitewater Rapids

Geological History
- Supergroup Rocks
- Volcanic Activity

Volcanic Activity
- River Debris

The Grand Canyon Skywalk
- The History of the Skywalk
- On Top of the Skywalk

Native Americans, Conservationists, and Tourists
- President Theodore Roosevelt
- Visiting the Grand Canyon

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EARTH’S HIDDEN HISTORY

KEY QUESTIONS
How far back can we trace the history of Earth?
Are there reliable ways to estimate the age of geological formations on Earth?
What were conditions like in Earth’s past and how do we know?

KEY STANDARDS
NGSS MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic timescale is used to organize Earth’s 4.6-billion-year-old history

INSTRUCTIONS

DAY ONE

ENGAGE (10 minutes)
1. Start by setting the scene for your students: “Congratulations, you’re all up for jobs as geologists with the United States Geological Survey! But the hiring manager wants to check your investigative skills and hands you two rocks. You can see by looking at them that one is igneous (volcanic) and the other is brittler sandstone. He wants to know which one is older.” (If possible, pass them that one is igneous (volcanic) and the other is brittler sandstone. He wants to know which one is older.” (If possible, pass
2. As a class, define any unfamiliar terms (such as geologist) and brainstorm a list of the types of data that you’ll need to collect to answer this question, including information about the difference between igneous and sedimentary rocks and where the rocks were found.

EXPLORE (35 minutes)
1. Tell students that this is a two-day investigation focusing on geologic time. Explain that they will be learning about the enormous number of years that Earth has existed.
2. Separate students into 10 teams. Distribute the Geologist’s Notebook activity sheet and review it with the class.
3. Give each team one VR console and provide 20 minutes for the following investigation:
   - One student should use the VR console to review the Precambrian and Late Precambrian sections and describe (aloud) what he or she is seeing. His or her partner(s) should use this information to complete the first part of the worksheet.
   - Students should switch jobs and review the Paleozoic and Late Paleozoic sections, completing the second worksheet section.
   - Students should switch jobs again and review the Jurassic and Late Jurassic sections, completing the third section of the worksheet.
4. Regroup to discuss the experience. As a class, answer the Discussion Questions, citing evidence from the Expedition, where all answers can be found.
5. Go back to the initial challenge. Students now know that geologic time is huge and both igneous and sandstone rocks have appeared throughout Earth’s history. What do they need to know to proceed?
   - Answer Where the rocks were found

DAY TWO

EXPLAIN AND ELABORATE (15 minutes)
1. Remind students of their investigation from Day One and tell them that the hiring manager has given them an additional piece of information: The two rocks came from the Grand Canyon. Explain that today students will be discovering how layers of rock can be like a time capsule.
2. Compare distinct layers of rock (strata) to a discard pile in a game of cards. The first card discarded is on the bottom. The most recent is on the top. Explain: “Because sedimentary rock layers accumulate one on top of another, the oldest layers are those at the bottom of the sequence. In some regions, a thick sequence of layers is visible. Layers of rock about 1 mile thick can be seen at the Grand Canyon. Climbing up from the bottom of the canyon, hikers pass rock layers that are more than 1 billion years old. As they continue up the trail, they hike past younger and younger sedimentary rock layers.”

EVALUATE (30 minutes)
Redistribute the VR consoles. Give students 20 minutes to find the answer to the hiring manager’s question using Google Expedition The Grand Canyon. They should be prepared to give evidence to show how rock strata help scientists organize their understanding of Earth’s 4.6-billion-year-old history.

Answer The igneous rock is part of the Vishnu Basement, the oldest rocks in the Grand Canyon. The sandstone is from a younger layer within the Supergroup rocks.

FINAL PROJECT
Explain that rock layers provide a time capsule of Earth’s history, but not all layers are the same depth. Why? (Some parts of Earth’s history lasted longer than others.) Give students a copy of this sheet from the U.S. Geological Survey: bit.ly/2FNIjNJ. Point out that although each supereneon, era, and period is clearly labeled, this timeline is not drawn to scale (the Proterozoic Eon should occupy 42% of the timeline.
Separate the class into five groups and give each a 4-foot piece of wrapping paper. Ask each group to use the paper and markers to create a scale timeline of Earth’s history. Provide help, if needed, from a website such as the following: bit.ly/2Hyu3Sc.

ADDITIONAL RESOURCES
Geographic timescale chart geology.com/time.htm
Grand Canyon geology geomaps.wr.usgs.gov/parks/province/coloplat.html
Rock strata article bit.ly/2BC6dNb
Videos and activities about rocks bit.ly/2odCY5p
**GEOLOGIST’S NOTEBOOK**

Scientists separate the history of the Earth into huge time spans called **supereons**. Each supereon is broken up into **eras**. Within each era are a series of **periods**. We currently live in the Phanerozoic eon, Cenozoic era, and Quaternary period.

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<tr>
<th><strong>SUPEREON</strong></th>
<th><strong>ERA</strong></th>
<th><strong>PERIOD</strong></th>
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<tr>
<td>PRECAMBRIAN</td>
<td>PALEOZOIC</td>
<td>JURASSIC</td>
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<td>AND LATE PRECAMBRIAN</td>
<td>AND LATE PALEOZOIC</td>
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**DISCUSSION QUESTIONS**

1. How far back can we trace the history of Earth?
2. Where did the gases for Earth’s Precambrian atmosphere come from?
3. What was Earth like when it was first formed?
4. When did recognizable landmasses appear?
5. Where does coal come from?
6. If the geologic timeline were compressed into a single day, how many seconds would humans have existed?
7. How do geologists describe the smallest segment of geologic time?
8. What event marked the start of the Cenozoic era?