

Earth and Space Science:

Unit 1

Earth's Changing Landscape:

Introduction

Purpose: The Why, What, and How of This Unit

Essential Question: How is it possible that Lystrosaurus fossils were found on three continents?

Unit Storyline Synopsis: Scholars will analyze land formations, rock strata, and fossil records to understand what Earth looked like in the past and to investigate the mechanisms that have changed (and are still changing) the Earth. They will assess evidence from geologists and researchers, and they will debate the effectiveness of this information in supporting or refuting key geological theories. These new skills will help scholars unlock the secrets of a puzzling phenomenon: the discovery of ancient fossils from an extinct pig-sized reptile on three separate continents.

Why This Unit? The Earth as we know it today looks drastically different than it did millions of years ago! When most people think of Earth's past, they imagine dinosaurs roaming the land. However, there is evidence indicating that Earth's history began over 4 billion years before dinosaurs even existed! By looking into how Earth's geological features have changed over hundreds of millions of years as well as the fossil evidence left behind, geologists are able to get a glimpse into the past. This understanding of Earth's history also helps us to understand and predict our future.

What Is the Bottom Line?

Big Idea 1: Earth is a complex system of interacting subsystems that shape its changing features.

- The rock cycle is influenced by Earth's subsystems (the geosphere, hydrosphere, atmosphere, and biosphere) and explains many of the continual changes to Earth's landscape over time.
- Based on Earth's structure and fossil evidence, scientists theorize that tectonic plates have moved great distances, collided, and spread apart, causing continental drift over time.

Big Idea 2: Rock strata and fossil evidence hold clues of the history of Earth.

- The geologic timescale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.
- The fossil record allows us to understand what organisms and types of environments were present at different points in Earth's history.

How do NGSS practices and crosscutting concepts support mastery of the Big Ideas? Science and Engineering Practices highlighted in this unit:

- **Developing and Using Models**

- Develop and/or use models to describe and/or predict phenomena.
- Develop and/or use a model such as an analogy, example, or abstract representation to describe a scientific principle or design solution.

- **Analyzing and Interpreting Data**

- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.

Crosscutting Concepts highlighted in this unit:

- **Patterns**

- Patterns can be used to identify cause-and-effect relationships.

- **Systems and System Models**

- Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems.

Safety

Plan carefully for safety in all lessons. The top safety risks in this unit include:

- In Lesson 1, scholars use food products in the lab. Be conscious of the allergies your scholars have whenever using food products in the classroom. If scholars have severe allergies to any of the ingredients in the candy bars, you will need to find an alternative.
- In Lesson 8, on day two, teachers will do a demonstration with a hot plate and food products. If scholars have severe allergies to any of the ingredients in the candy bars, you will need to find an alternative.
- In Lesson 8, on day two, scholars will use a hot plate. Set up hot plate stations around your room and ensure that scholars are aware of how to work with hot materials safely to avoid accidentally burning themselves, as well as what to do should they burn themselves. All materials should be handled with oven mitts at the hot plate station, as there is no way to see whether materials are too hot to touch. Ensure that hot plates are turned off at the end of each section. Rheoscopic fluid is nontoxic and can be disposed of in a dump bucket or sink.

Important Note: These lesson plans highlight some of the safety risks you should be aware of while teaching these lessons. These safety suggestions are not meant to take the place of a formal science safety training. Please be sure to follow all safety rules from your district, as well as all local, state, and federal science safety guidelines.

Unit Storyline

Engage: Middle school science begins with a great mystery: How is it possible that fossils from pig-sized reptiles were found on three continents? Scholars begin to hypothesize, accessing their prior knowledge from elementary school.

- **Lesson 1: A Strange Discovery** Scholars learn of a puzzling discovery: identical fossils, from an animal that could not swim, found on three different continents. How is this possible? Scholars share their ideas and set off on a unit-long adventure to find the answer!
- **Lesson 2: Digging into Earth** Scholars jump into the shoes of a geologist and “dig” down into Earth’s surface to begin understanding how scientists have learned about Earth’s past. By looking at the cross-section of different candy bars, scholars understand that Earth’s history can be studied by looking into its rock layers.

Explore: What is a fossil, anyway, and how it is preserved? How does it make its way underground? By the end of the Explore, having eliminated most (if not all) of their initial hypotheses, scholars will seem to have more questions than answers.

- **Lesson 3: The Rock Cycle** Scholars now know that the Lystrosaurus fossils were trapped in Earth’s rock strata. But how did those layers form? Scholars investigate through a simulation of the rock cycle.
- **Lesson 4: Reading Rock Layers** Scholars jump into exploring Earth’s rock layers and their relative ages by creating sand-art models of real-world landforms. They will soon discover that their understanding of the concept of relative dating is a critical piece of the Lystrosaurus puzzle.

- **Lesson 5: Finding Fossils** Scholars get a glimpse into the past by “excavating” for fossils in Earth’s rock layers. They begin to understand the importance of index fossils by uncovering and identifying fossils from different rock layers in their sand art.

Explain: Just when all hope seems lost, enter Alfred Wegener. Scholars are introduced to some puzzling evidence about the fossil record and begin to notice patterns that suggest a seemingly unthinkable conclusion—the world’s continents are on a slow journey around the world! But how is this possible? Scholars study the underlying structure of the Earth’s geosphere to find out.

- **Lesson 6: The Geologic Timescale** After studying how fossils can be used to date rock layers in the previous investigation, scholars investigate the different eras in Earth’s history as characterized by major life-forms and events. This will help them to determine when the Lystrosaurus must have been alive on Earth.
- **Lesson 7: Putting the Puzzle Together—the theory of continental drift** Using what they know about rock layers and fossils, scholars investigate evidence that supports the theory that our seven continents were once joined together as a single landmass: Pangaea.
- **Lesson 8: Introducing Plate Tectonics** Over the course of two days, scholars look into the mechanisms that support Wegener’s theory of continental drift. On day one, scholars delve into the center of the Earth by studying its structure through a reading. On day two, scholars use their understanding of Earth’s structure to model the convection currents that pushed and pulled the continents away from each other.

Elaborate: Scholars have opportunities to apply their knowledge of rock strata, fossils, continental drift, and plate tectonics in new ways as they learn about seafloor spreading and predict the past and future of a planet in a faraway solar system.

- **Lesson 9: Seafloor Spreading** Building on the previous investigation, scholars examine the effects of convection currents within the Earth. By studying seafloor spreading, scholars learn more about the creation of new crust that allowed the continents to move such an astonishing distance over time.
- **Lesson 10: On a Planet Far, Far Away...** Using all that they have learned throughout the unit, scholars will investigate “evidence” from one of the seven newly discovered habitable planets to predict what that planet looked like in the distant past and what it will look like millions of years from now.

Evaluate: Applying their newfound understanding, scholars tackle a strange mystery: fossilized plants, found all over the planet!

- **Lesson 11: Putting the Puzzle Together** Scholars showcase their new knowledge by answering a letter they receive about another strange fossil phenomenon.

Extra Resources

In addition to the resources linked throughout the guide, use the following materials to help you prepare to launch this unit with scholars:

- [Printable Exit Tickets](#)
- [Printable Lab Notebook](#)