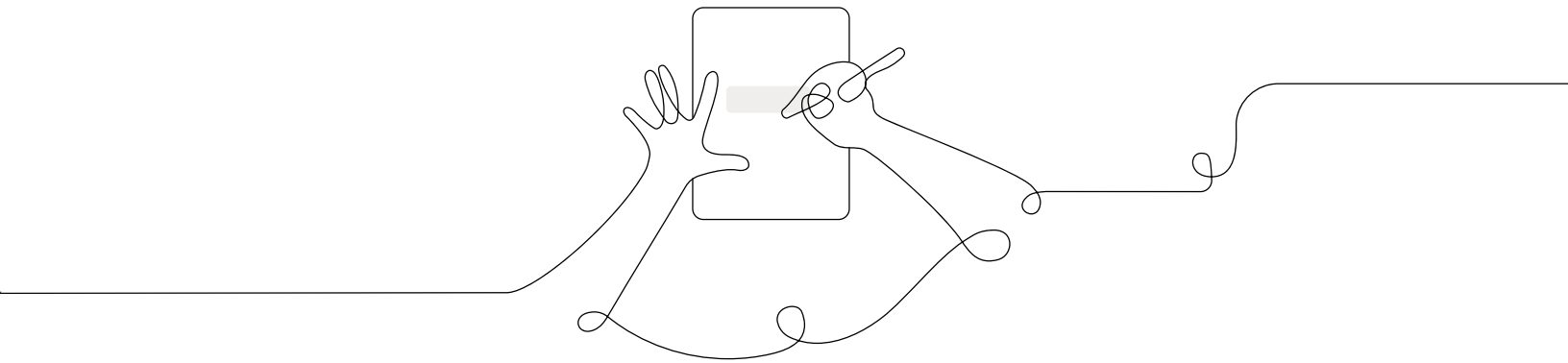


Participant Notebook

Grade 4: Earth's Features
Unpacking the Phenomenon



Unit Guide resources

Once a unit is selected, select **JUMP DOWN TO UNIT GUIDE** in order to access all unit-level resources in an Amplify Science unit.

Planning for the unit

Unit Overview	Describes what's in each unit, the rationale, and how students learn across chapters
Unit Map	Provides an overview of what students figure out in each chapter, and how they figure it out
Progress Build	Explains the learning progression of ideas students figure out in the unit
Getting Ready to Teach	Provides tips for effectively preparing to teach and teaching the unit in your classroom
Materials and Preparation	Lists materials included in the unit's kit, items to be provided by the teacher, and briefly outlines preparation requirements for each lesson
Science Background	Adult-level primer on the science content students figure out in the unit
Standards at a Glance	Lists Next Generation Science Standards (NGSS) (Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts), Common Core State Standards for English Language Arts, and Common Core State Standards for Mathematics

Teacher references

Lesson Overview Compilation	Lesson Overview of each lesson in the unit, including lesson summary, activity purposes, and timing
Standards and Goals	Lists NGSS (Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts) and CCSS (English Language Arts and Mathematics) in the unit, explains how the standards are reached
3-D Statements	Describes 3-D learning across the unit, chapters, and in individual lessons
Assessment System	Describes components of the Amplify Science Assessment System, identifies each 3-D assessment opportunity in the unit
Embedded Formative Assessments	Includes full text of formative assessments in the unit
Books in This Unit	Summarizes each unit text and explains how the text supports instruction
Apps in This Unit	Outlines functionality of digital tools and how students use them (in grades 2-5)

Printable resources

Copymaster Compilation	Compilation of all copymasters for the teacher to print and copy throughout the unit
Investigation Notebook	Digital version of the Investigation Notebook, for copying and projecting
Multi-Language Glossary	Glossary of unit vocabulary in multiple languages
Print Materials (8.5" x 11")	Digital compilation of printed cards (i.e. vocabulary cards, student card sets) provided in the kit
Print Materials (11" x 17")	Digital compilation of printed Unit Question, Chapter Questions, and Key Concepts provided in the kit



Progress Build

A Progress Build describes the way in which students' explanations of the central phenomenon should develop and deepen over the course of a unit. It is an important tool in understanding the design of the unit and in supporting students' learning. A Progress Build organizes the sequence of instruction, defines the focus of the assessments, and grounds inferences about students' understanding of the content, specifically at each of the Critical Juncture Assessments found throughout the unit. A Critical Juncture Assessment guides the instruction designed to address specific gaps in students' understanding. This document will serve as an overview of the *Earth's Features* Progress Build. Since the Progress Build is an increasingly complex yet integrated explanation, we represent it below by including the new ideas for each level in bold.

In the *Earth's Features* unit, students will construct scientific explanations and arguments about how the rocks and fossils in Desert Rocks National Park can be used to infer the environmental history of the area. Note that in addition to the ideas in the Progress Build, students extend their understanding of how Earth changes over time by investigating erosion in Chapter 4.

Prior knowledge (preconceptions): Students are expected to have had many everyday experiences with rocks and sediment. They are likely to have observed rocks and sediment of different colors and textures, but are unlikely to have considered how they formed or what makes them different. Some students might not live in areas with exposed sedimentary rock layers, and might think of rock only as the pieces of pebbles or boulders they see on the ground. Students are likely to have considered fossils in the context of dinosaurs, and understand that they represent organisms from the past. Students are not expected to have considered the fossils of other types of organisms, or to have thought about how fossils form. Students will understand that there are a variety of environments on Earth, and that different environments have different characteristics.

Progress Build Level 1: Sedimentary rock forms when sediment piles up and hardens over time. Fossils can form in the rock if organisms are buried in the sediment.

Rock forms as sediment sinks through water and builds up over a long period of time. As more and more sediment slowly builds up over a long period of time, sediment that is under other sediment compacts and cements to become a large flat layer of sedimentary rock. A rock layer gradually gets thicker as sediment builds up, compacts, and cements over time. When organisms die, their bodies can get trapped in the sediment. As the sediment slowly forms rock over time, the rock preserves the shape of the body or bones as fossils. The fossils preserved inside a rock layer can be used to make inferences about the organisms living in a place in the past when the rock layer was forming.

Progress Build Level 2: Different sedimentary rock forms in different environments.

Rock forms as sediment sinks through water and builds up over a long period of time. As more and more sediment slowly builds up over a long period of time, sediment that is under other sediment compacts and cements to become a large flat layer of sedimentary rock. A rock layer gradually gets thicker as sediment builds up, compacts, and cements over time. When organisms die, their bodies can get trapped in the sediment. As the sediment slowly forms rock over time, the rock preserves the shape of the body or bones as fossils. The fossils preserved inside a rock layer can be used to make inferences about the organisms living in a place in the past when the rock layer was forming. **Different sedimentary rocks are made of different-sized sediments. Different sediments build up in different environments. Therefore, different rock forms in different environments. When the environment of a place changes, the sediment**



that builds up in that place changes and forms a layer of a different type of sedimentary rock. This is why we can see layers of different sedimentary rocks in one place. A rock layer's kind and the fossils inside it can be used to make inferences about what the environment was like when the rock layer was forming.

Progress Build Level 3: The lowest layer of sedimentary rock formed first, and younger layers formed on top.

Rock forms as sediment sinks through water and builds up over a long period of time. As more and more sediment slowly builds up over a long period of time, sediment that is under other sediment compacts and cements to become a large flat layer of sedimentary rock. A rock layer gradually gets thicker as sediment builds up, compacts, and cements over time. When organisms die, their bodies can get trapped in the sediment. As the sediment slowly forms rock over time, the rock preserves the shape of the body or bones as fossils. The fossils preserved inside a rock layer can be used to make inferences about the organisms living in a place in the past when the rock layer was forming. Different sedimentary rocks are made of different-sized sediments. Different sediments build up in different environments. Therefore, different rock forms in different environments. When the environment of a place changes, the sediment that builds up in that place changes and forms a layer of a different type of sedimentary rock. This is why we can see layers of different sedimentary rocks in one place. A rock layer's kind and the fossils inside it can be used to make inferences about what the environment was like when the rock layer was forming. **Over long periods of time, newer rock layers form on top of rock layers that have already formed. This means that lower rock layers formed earlier and are older than higher rock layers, and that higher rock layers formed more recently. The order of rock layers can be used to infer which layers and fossils are older than others. This can be used to tell the order of the environments that existed in this place in the past.**



Unit Map

What was the environment of this place like in the past?

Playing the role of geologists, students help the director of Desert Rocks National Park explain how and when a particular fossil formed and how it came to be in its current location. Students figure out what the environment of the park was like in the past and why it has so many visible rock layers.

Chapter 1: How did the fossil get inside the rocky outcrop?

Students figure out: A fossil is the preserved remains of an organism that lived a long time ago. Fossils begin to form when the organism dies, and sediments sink through the water to completely cover its body. More and more sediment continues to build up over the body, compacting the sediment that was already there. That sediment cements and becomes rock. This process gradually makes a thicker and thicker rock layer. Parts of the organism are preserved in this rock layer.

How they figure it out: Students gather evidence from fossils and rocks, read *Clues from the Past*, and use the *Earth's Features* Simulation to explain how fossils and rock form. They apply what they learned to create a model of the process of sedimentary rock formation. Finally, they construct an argument about what Desert Rocks National Park was like in the past.

Chapter 2: What was the environment of Desert Rocks National Park like in the past?

Students figure out: The environment was a floodplain when the lower rock layer formed and a deep ocean when the upper rock layer formed. The lower layer is made of siltstone and contains a *Lepidodendron* fossil. This is evidence that the environment was a floodplain because siltstone can form in floodplains and *Lepidodendron* lived in watery areas with a lot of plants. The upper layer is made of mudstone, and a *Mosasaurus* fossil was found in this rock layer. This is evidence that it was a deep ocean because mudstone can form in a deep ocean and a *Mosasaurus* was a large animal that swam in deep water.

How they figure it out: Students use digital and physical models to investigate how fossils and rock can be used to make inferences about past environments. They gather and analyze data from informational texts and observations as well as diagrams of an area to engage in arguments about what the area was like in the past.

Chapter 3: What is the order of the past environments of Desert Rocks National Park?

Students figure out: The siltstone layer is below the mudstone layer, which is below the shale layer. Lower rock layers form first, and new rock layers form on top of them, so lower rock layers are older than the layers above them. This means that the siltstone layer formed first, then the mudstone layer, and then the shale layer. Therefore, the environment was a floodplain first, then a deep ocean, and then a shallow ocean.

How they figure it out: Students use physical and digital models as well as analogies to discover that the lowest rock layers formed first. They obtain information from text and a digital model about which types of rock tend to form in particular environments, and they use this information to make an evidence-based argument about the order of past environments in Desert Rocks Canyon.

**Chapter 4: Why did more rock layers get exposed in Desert Rocks Canyon than in Keller's Canyon?**

Students figure out: More rock layers got exposed in Desert Rocks Canyon because its river is faster and has been there longer than the river in Keller's Canyon. Water can erode rock. The longer the time period that a river flows, the more the rock will erode, and a faster river can erode more rock than a river that flows slowly. Based on evidence about the speed and age of the river in Desert Rocks Canyon, this river eroded more rock because it has been flowing over the rock for a longer time and at a faster speed.

How they figure it out: Students plan and carry out investigations of the effects of water eroding rock using a model of a river as well as the Simulation. They observe that both the speed of the water and the flow of water over time affect how a rock formation can look. Students analyze evidence from models, maps, diagrams, and text to construct an argument that explains the factors that can cause more erosion in a canyon.

Applying conceptual understanding to explain the phenomenon

Use ideas from the Progress Build and Unit Map to make notes about the conceptual and explanatory builds in your unit.

	Science concepts	Explanation of the phenomenon
	<i>Students figure out...</i>	<i>So they can explain...</i>
Chapter 1		
Chapter 2		
Chapter 3		
Chapter 4		

Amplify Science@Home resources reference

Use this guide to keep track of the different resources available for remote and hybrid learning.

Instructional materials: Click Remote and hybrid learning resources, then select your grade level from the dropdown menu. Select your unit.	
@Home Unit resources: These will appear when you select your unit.	
Teacher Overview	General information for teaching with @Home Units, planning information, chapter and lesson outlines
Lesson Index	Lists the original Amplify Science lessons associated with each @Home lesson, and the Investigation Notebook pages, copymasters, and print materials associated with the @Home Unit Student Sheets
Family Overview	Information to send home to families to help them support students with remote learning
Student lesson materials for @Home Units	Printable or digital lessons condensed to be about 30 minutes long. You can access compilations of all student materials for your unit, or select from individual lessons.
@Home Video resources: After selecting your grade level and unit, select the @Home Videos tab below your unit title.	
@Home Video links	Links to video lessons that include all activities from the original units. Lesson playlists are on YouTube, and they autoplay in a playlist form.
Additional remote and hybrid instructional materials: These can be accessed from the tabs below your unit title.	
Hands-on investigations support	Videos of every unit's hands-on activities (note, these videos also appear in the student lesson materials).
Read-aloud videos	Link to a YouTube playlist of read-aloud videos of all books in your unit.
Orientation and Tutorials: Click Remote and hybrid learning resources, then select your grade from the dropdown menu. Click Orientation and Tutorials. You'll not only find videos to help you use the resources, but also videos you can share with students and caregivers.	

[illegible]