3-D Statements

Key

Practices Disciplinary Core Ideas Crosscutting Concepts

Unit Level

Students analyze data about plates, plate boundaries, and the patterns of geologic activity characteristic of plate boundaries (patterns)—through the use of physical and digital models and articles and videos featuring real-life scientists—in order to construct explanations about how the fossils of *Mesosaurus* (a population of extinct reptile that once lived all together) were separated by thousands of kilometers of ocean as a result of slow plate movement over millions of years (scale, proportion, and quantity).

Chapter 1: Introducing Earth's Outer Layer

Students use a digital model of plate motion and analyze evidence, including patterns of geologic activity and images of core samples, in order to learn that Earth's outer layer is made of hard solid rock divided into moving plates (patterns).

Chapter 2: Understanding Plate Boundaries

Students analyze data about patterns of plate-mantle interactions at convergent and divergent plate boundaries (patterns) and gather information about geologic activity and the processes that create landforms as a result of the interactions (cause and effect).

Chapter 3: Investigating the Rate of Plate Movement

Students analyze and interpret data to determine current rates of plate motion (scale, proportion, and quantity) and evaluate evidence about the distribution of fossils (patterns) in order to construct explanations that the *Mesosaurus* fossils were separated by slow divergent plate motion over hundreds of millions of years.

Chapter 4: Science Seminar

Students analyze evidence and make oral and written arguments, using what they have learned about plate motion, to determine whether convergent plate motion or divergent plate motion best explains patterns of geologic activity (patterns) near Jalisco, Mexico.

Lesson Level

Lesson 1.1: Pre-Unit Assessment

Lesson 1.2: Using Fossils to Understand Earth

Students are introduced to the mystery of the *Mesosaurus* fossils and watch a documentary video in order to obtain information about how scientists use fossils as evidence to understand Earth's history (patterns). Students then analyze data from core samples drilled from four very different places on Earth's surface to learn that the entire outer layer of Earth is made of hard solid rock (patterns).

Lesson 1.3: Exploring Earth's Plates

Students obtain information from an animation and by exploring a digital model of plate motion to learn about the structure of Earth's outer layer. They then analyze a map of Earth's plate boundaries and a map showing where earthquakes have occurred to determine that earthquakes occur in patterns along plate boundaries (patterns).

Lesson 1.4: Analyzing Patterns at Plate Boundaries

Students use the Simulation to gather evidence to support a claim about the causal relationship between plate motion and earthquakes (cause and effect). They then construct visual models of the plate boundary between South America and Africa to explain what the land is like where the *Mesosaurus* fossils were found.

Lesson 2.1: Considering What's Underneath Earth's Plates

Students use physical and digital models to gather information about the properties of Earth's mantle (patterns) and the interactions between the hard solid plates and the soft solid mantle (cause and effect).

Lesson 2.2: "Listening to Earth"

Students ask questions and obtain information as they actively read "Listening to Earth," an article about how scientists investigate plate-mantle interactions at convergent and divergent plate boundaries (patterns).

Lesson 2.3: Explaining Plate-Mantle Interactions

Students reread a part of the "Listening to Earth" article to obtain information about how plate movement occurs at convergent and divergent boundaries (patterns). They then construct physical models of plate movement at each boundary type (systems and system models), based on what they have read.

Lesson 2.4: Modeling Plate-Mantle Interactions

Students use the Simulation to analyze data about plate-mantle interactions. They then develop models to explain that rock is added to plates at divergent boundaries and that rock sinks into the mantle at convergent boundaries (cause and effect).

Lesson 2.5: Identifying Plate Motion at a Plate Boundary

Students analyze and interpret evidence about the relationships between geologic activity and landforms (patterns) at the plate boundary between the South American Plate and the African Plate. They do this in order to explain how the *Mesosaurus* fossils got so far apart. Students also create visual models showing how the plates move and the effect of this movement on rock from the mantle (cause and effect) at this divergent plate boundary.

Lesson 2.6: Critical Juncture Assessment

Lesson 2.7: Exploring Iceland's Plate Boundary

In a lesson with activities that are differentiated based on the results of the Critical Juncture Assessment, students learn about an aspect of Iceland's geology by reading a short article to obtain information about plate motion and geologic activity (cause and effect) in Iceland. They then make visual models to explain how the plates and the mantle interact (systems and system models).

Lesson 3.1: Considering Rates of Plate Movement

Students gain an understanding about the rate and direction of current plate movement (scale, proportion, and quantity) by obtaining information from a video and by calculating the rate that two plates are spreading apart in the Simulation.

Lesson 3.2: "A Continental Puzzle"

Students ask questions and obtain and evaluate information as they actively read "A Continental Puzzle," an article about how Alfred Wegener used patterns in fossil evidence to develop his theory of continental drift (patterns). For homework, students read "Steno and the Shark" to learn about the geologic timescale that can be interpreted from layers of rock (scale, proportion, and quantity).

Lesson 3.3: Reconstructing Gondwanaland

Students obtain information about how fossil evidence supports scientists' understanding of past plate motion (patterns) by rereading "A Continental Puzzle" in order to construct a paper model of the ancient supercontinent Gondwanaland, using puzzle pieces representing the modern-day plates.

Lesson 3.4: Writing About Mesosaurus

Students analyze and interpret evidence—including GPS data showing current rates of plate motion (scale, proportion, and quantity) and evidence from the digital model—to construct scientific arguments about how plate motion separated the *Mesosaurus* fossils (cause and effect).

Lesson 4.1: Plate Motion Near Jalisco, Mexico

In preparation for constructing arguments for the upcoming Science Seminar, students look for patterns in landforms and geologic events (patterns) in order to determine which kind of plate motion best explains the observed geologic activity near Jalisco, Mexico (cause and effect) and analyze and interpret evidence associated with the geologic activity in this area.

Lesson 4.2: Participating in a Science Seminar

Students engage in a class discussion in which they make and evaluate arguments about whether divergent or convergent plate motion (cause and effect) between the Jalisco Block and surrounding plates explains patterns of geologic activity near Jalisco, Mexico (patterns).

Lesson 4.3: Writing a Scientific Argument

Students construct written arguments based on their analysis of the evidence and their understanding of plate motion and geologic activity (cause and effect) in order to communicate their explanations about which type of plate motion (cause and effect) best explains the patterns of geologic activity near Jalisco, Mexico (patterns)

Lesson 4.4: End-of-Unit Assessment