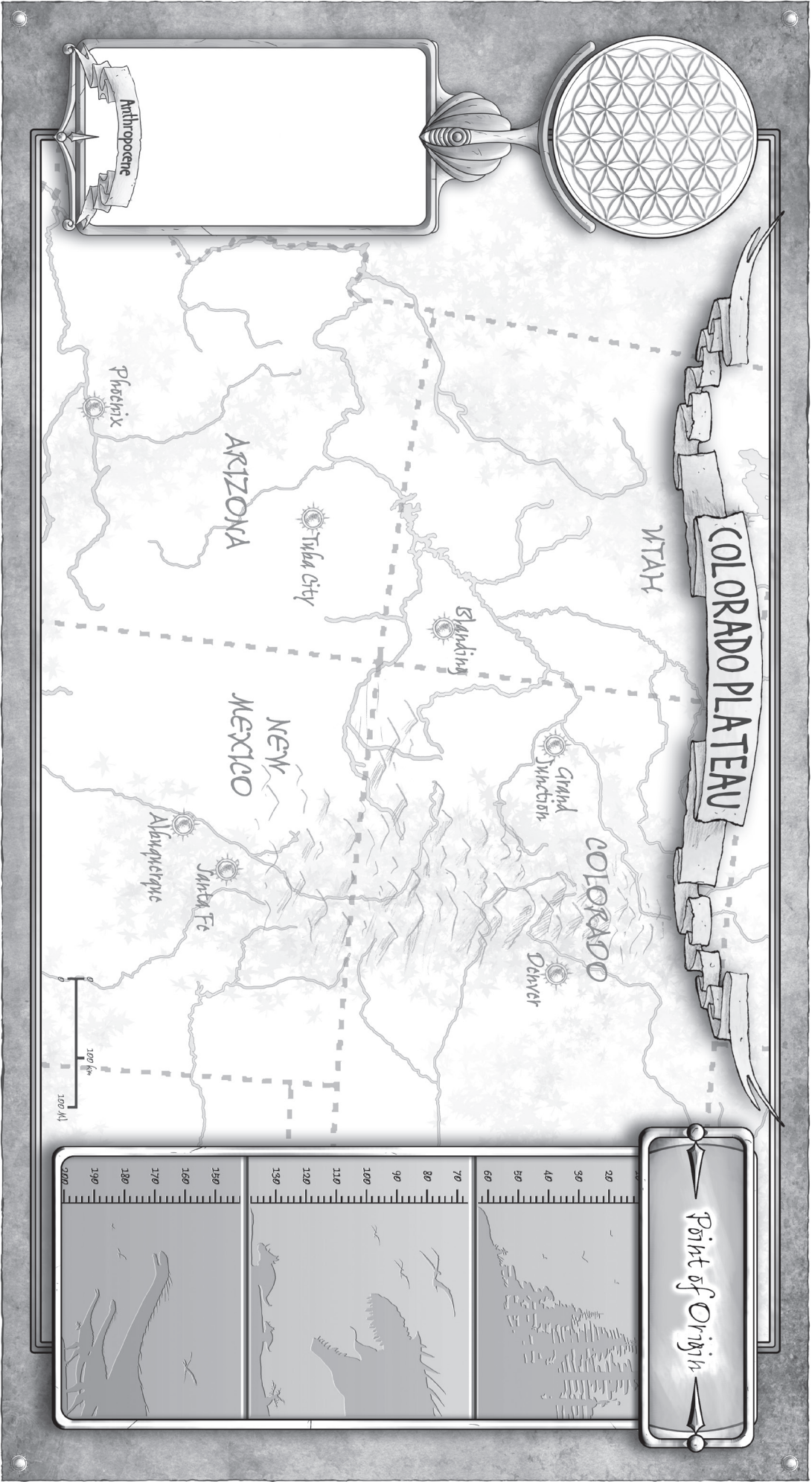


THIS BOOK BELONGS TO:





- ☐

Uranium
- ☐

Dinosaur Bones
- ☐

Coal
- ☐

Water
- ☐

Natural Gas/Shale Gas
- ☐

Petroleum

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Activities: Mini Graphic Novel/ Debate		

Keep a time travel journal as you follow time travelers Jenna, Caleb, and Ari across the corners of time.

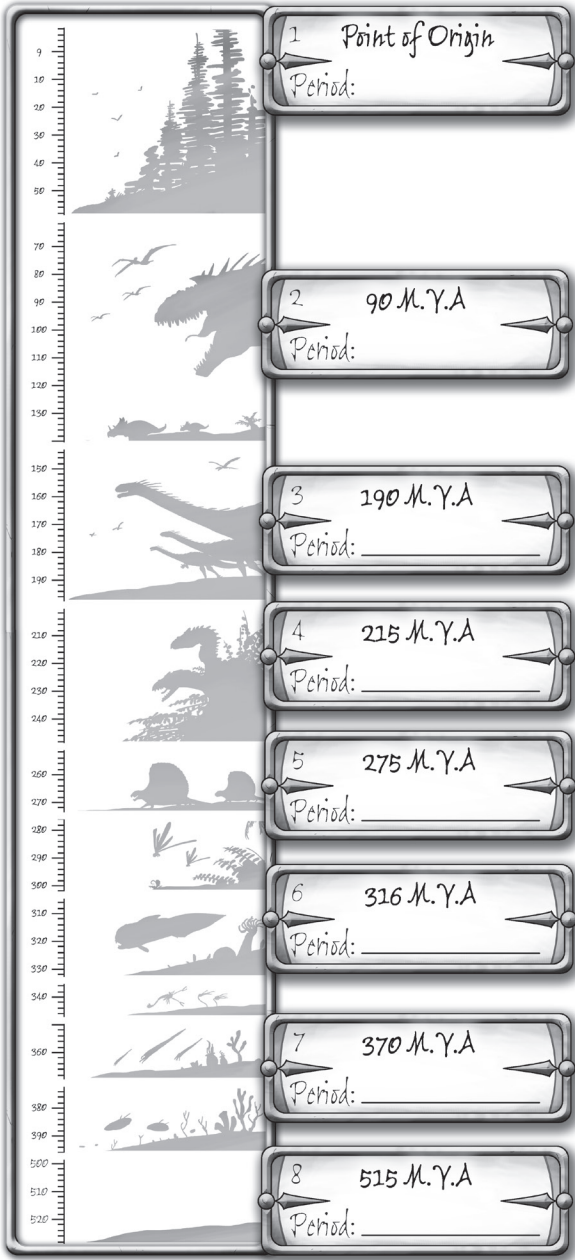
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Activity: Point of Origin

Label the Periods on your timeline. As you keep your own time travel journal you will learn about the periods Jenna, Caleb, and Ari travel to.

As you read *Terra Tempo: The Four Corners of Time*, add a key fact and life form or symbol to each of the periods.



1

Key fact: _____

2

Key fact: _____

3

Key fact: _____

4

Key fact: _____

5

Key fact: _____

6

Key fact: _____

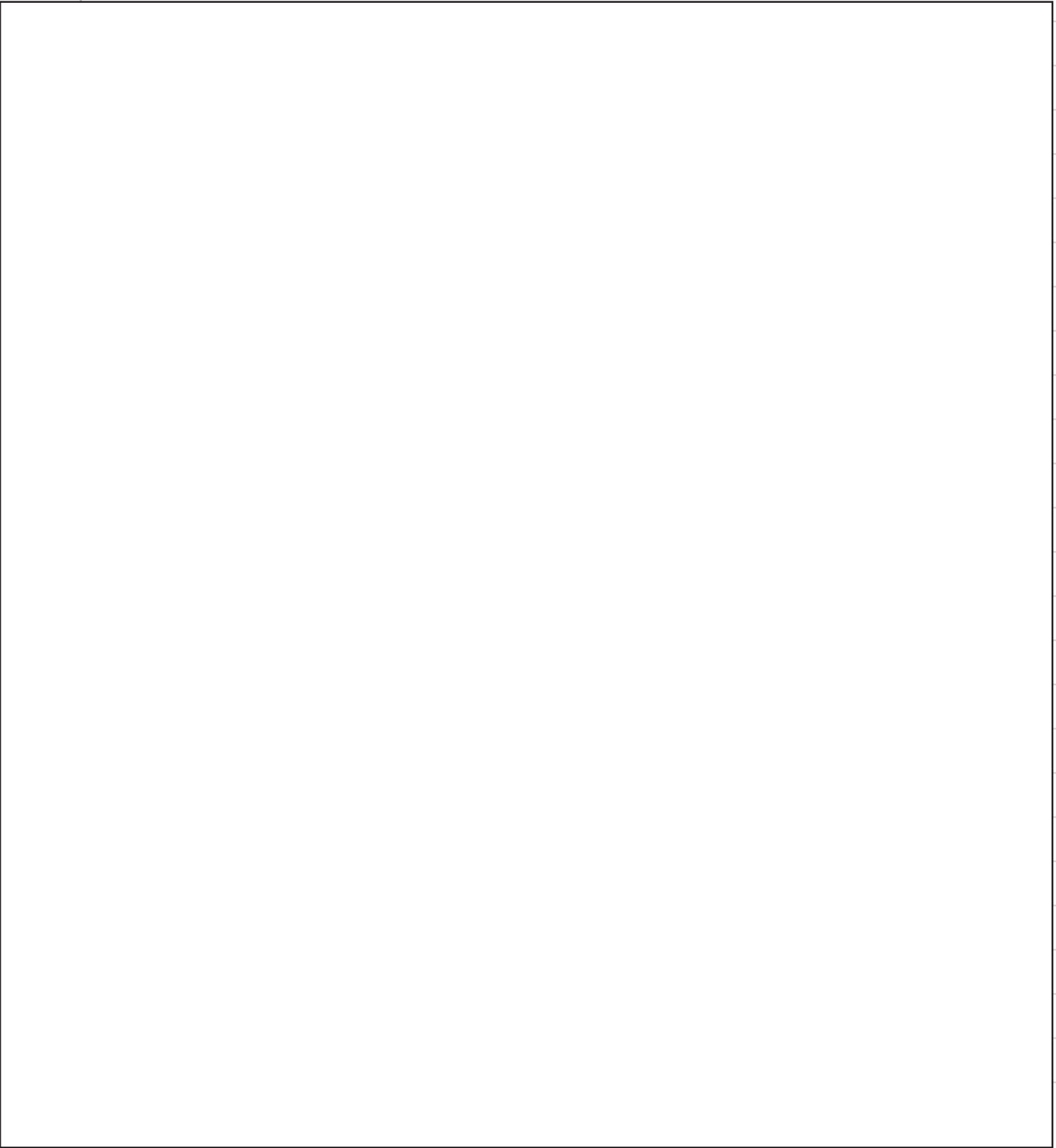
7

Key fact: _____

8

Key fact: _____

Fulfill Jenna’s wish and draw a scene from the Cretaceous. Be sure to label the plants and animals in your scene for future time travelers.



Ponder: Why can't Jenna, Caleb and Ari make it back to Monument Valley from the Cretaceous?

How do you think the kids will get back to Uncle Al and Aunt Maddie?

Read Chapter 1.

On the next page is a map of the Colorado Plateau (present day).

Get oriented by labeling the points of the compass.

**LESSON 2:
CHAPTER 1 – FOUND IN THE PAINTED DESERT**

“The Last 550 million years of life on Earth have had some really intense time zones. We’re gonna have to be really prepared for this one.” –Ari

Your record of your travels begins here. As any good traveler knows, you need a good map to guide you.

Label the states: Colorado, New Mexico, Arizona, Utah

Next, label the cities:

- A: (Phoenix)
B: (Tuba City)

C: (Blanding)
D: (Grand Junction)
E: (Denver)

F: (Albuquerque)
G: (Santa Fe)
- Label the key formations:

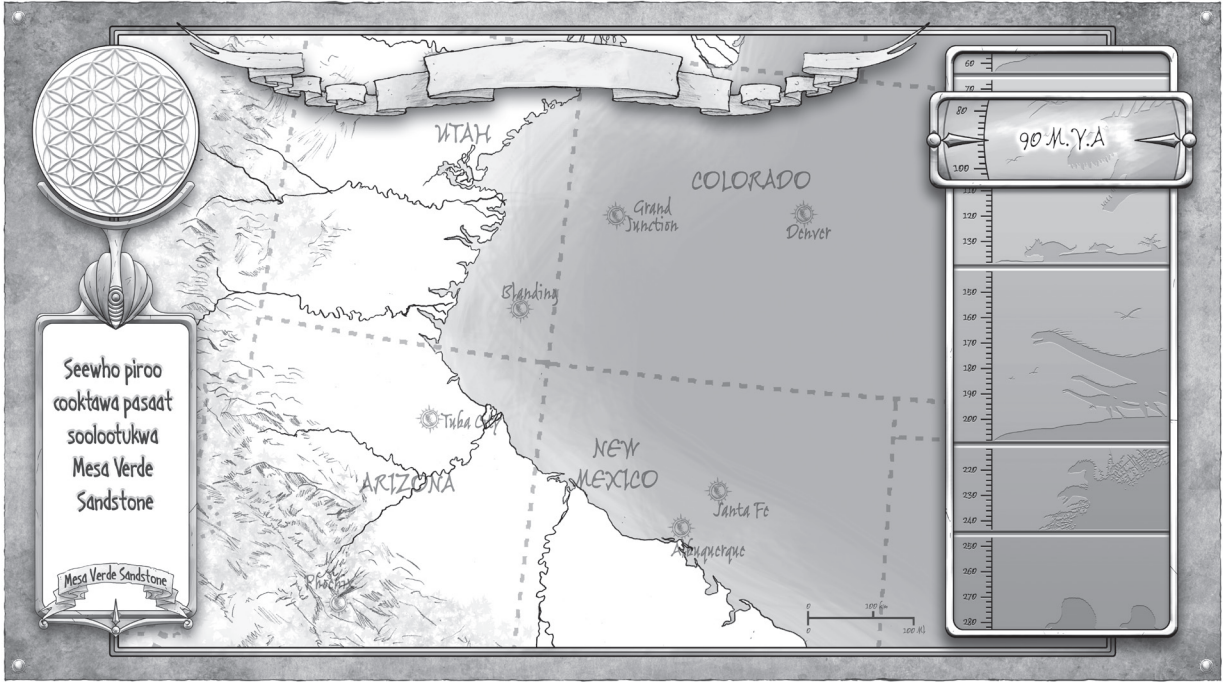
1: (Grand Canyon)
2: (Monument Valley)

3: (Rocky Mountains)
4: (Chaco Canyon)
5: (Petrified Forest)



LESSON 9
CHAPTER 9 - CREEPY CRETACEOUS

“We need to know the territory if we are to understand the map.” -Jenna



Read Chapter 9, then complete the notes. Formation: Mesa Verde Sandstone;
Period: _____ Monument Valley

Describe the characteristic plants and animals (3):

- 1 _____
- 2 _____
- 3 _____

Describe the environment (climate/landscape):

- _____
- _____

Identify a key fact after reading:

- _____

LESSON 3
CHAPTER 2 AND 3 - GRAND IMPACT

“It is by learning to read the geologic record that a person can become a real-life time traveler.” - Park Ranger

Read Chapters 2 and 3.

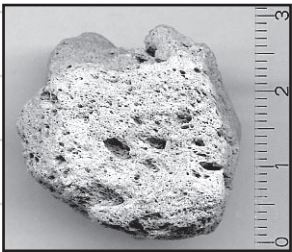
Understanding Rocks:

The three main types of rock are sedimentary, metamorphic, and igneous. The differences between them have to do with how they form.

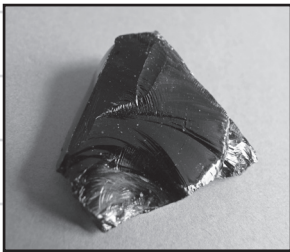
Igneous

Igneous rocks are formed when magma (molten rock deep within the earth) cools and hardens. Sometimes the magma cools inside the earth, and other times it erupts onto the surface from volcanoes as lava. When lava cools very quickly, the rock looks shiny and glasslike. Sometimes gas bubbles are trapped in the rock during the cooling process, leaving tiny holes and spaces in the rock.

Examples of this rock type include pumice and obsidian.



Pumice



Obsidian

Pantoum Activity

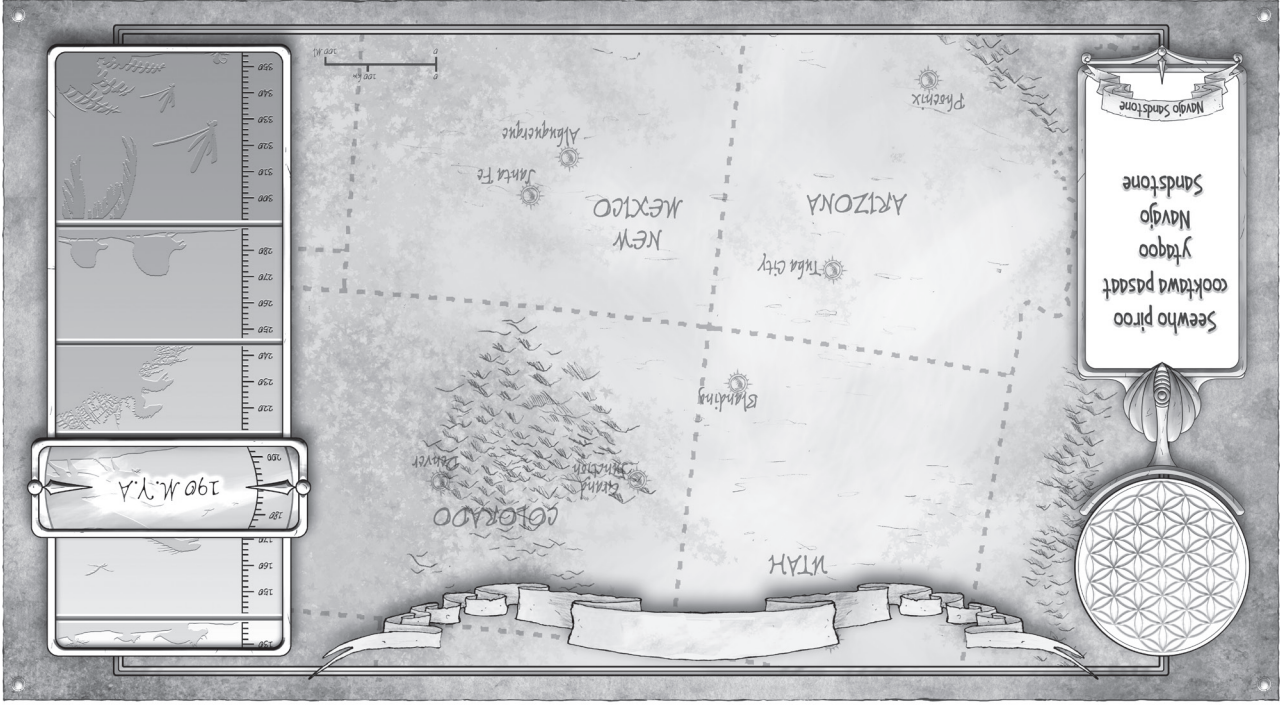
A pantoum in an ancient form of poetry originating in southeast Asia. It is often used in poems describing nature.

Instructions:

1. Number eight lines on a separate piece of paper (1–8.)
2. Think about the kids’ time travel experience, especially in the Jurassic.
3. Brainstorm and write down eight things that come to mind (on lines 1–8.) These can be words, phrases, or sentences.
4. Transfer your words onto your pantoum form on the next page, matching the numbered lines on the brainstorm to the numbered lines on the form. (Note, there are repeating lines!)
5. You can revise, add, or take away.
6. Read your Jurassic Time Travel Pantoum aloud!

LESSON 8
CHAPTER 8 - MOBILIS IN MOBILI

“I move within movement and I get where I need to go.” -Everett Ruess



Read Chapter 8, then complete the notes. **Formation:** Navajo Sandstone; Monument Valley **Period:** _____

Describe the characteristic plants and animals (3):

1

2

3

Describe the environment (climate/landscape):

Identify a key fact after reading:

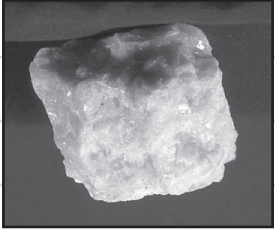
Metamorphic

Metamorphic rocks are formed under the surface of the earth from the metamorphosis (change) that occurs due to intense heat and pressure (squeezing). The rocks that result from these processes often have ribbon-like layers and may have shiny crystals, formed by minerals growing slowly over time, on their surface.

Examples of this rock type include gneiss and marble.



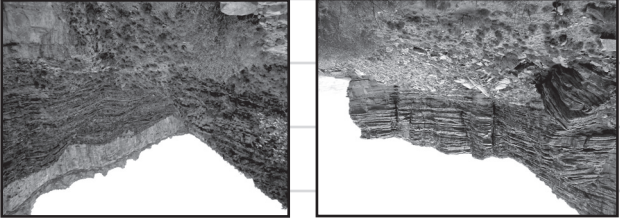
Gneiss



Marble

Sedimentary

Sedimentary rocks are formed from fragments of other materials like sand, shells, and pebbles. Together, all these particles are called sediment. Over time sediment accumulates and hardens into rock. Generally, sedimentary rock is fairly soft and may break apart or crumble easily. It is usually the only type that contains fossils.



Sedimentary Rock

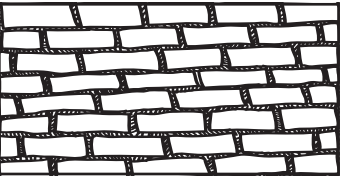
The layers of rock that Jenna, Caleb and Ari see in the Grand Canyon with Uncle Al are all layers of sedimentary rocks. Let's take a look at the rock layers of the Grand Canyon.

Activity: Rock Layers

Know The Canyon’s History, Study Rocks Made By Time!

Look up the rock layers and give a brief description. Also draw a small picture or symbol to represent each rock.

Kaibab Limestone



Ex: The layer at the top of the canyon that is made up of sedimentary rock found at the bottom of seas and often includes fossils of sea critters.

Toroweap Limestone



Coconino Sandstone



Hermit Shale



Early Mammals: Divergent Evolution

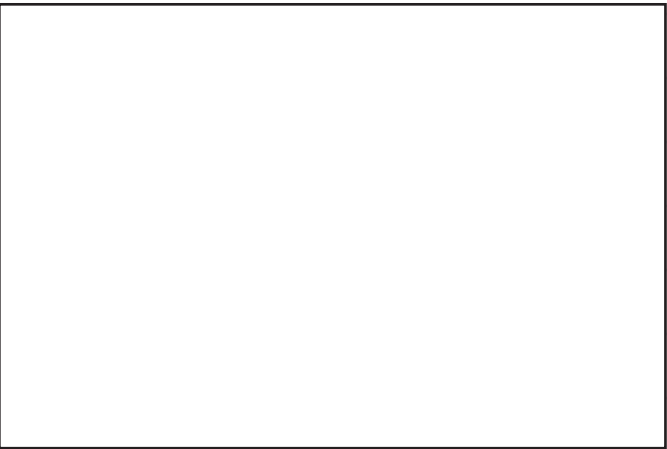
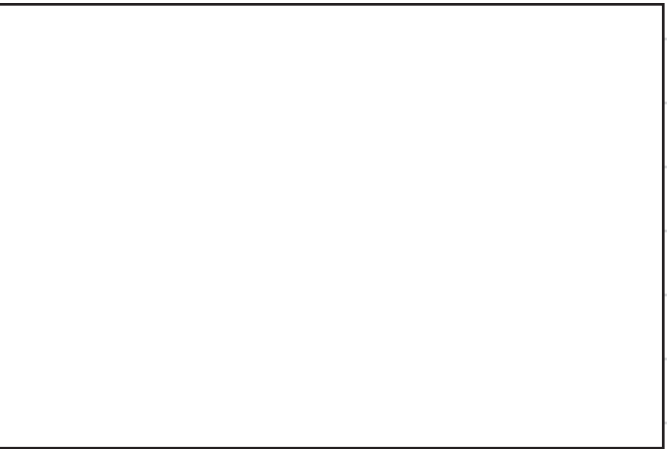
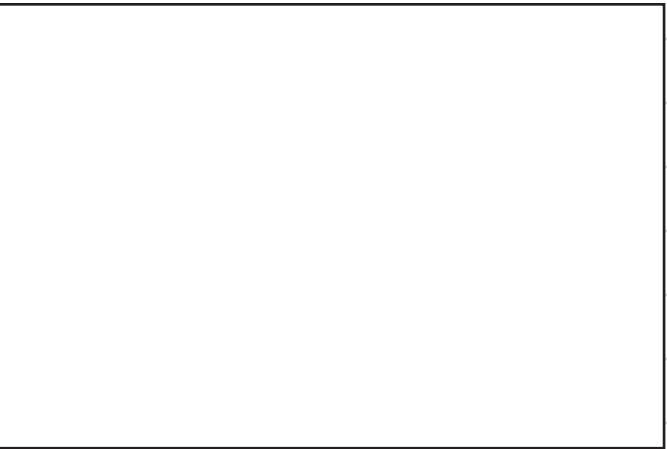
Connect these life forms of the past to their descendants in the present:

Diapsid – Vertebrates that possess skulls with two major fenestrae, or openings near the temple.

Synapsid – Vertebrates that possess skulls with one major fenestra in the region of the temporal bone

Anapsid –Vertebrates that possess skulls with no major fenestrae

Research each type of animal above. Choose an animal for each and draw their skulls. Be sure to label your drawing with the animal’s name.



LESSON 7
CHAPTER 7 - TRIASSIC TIMES

“It’s most dangerous to have the map and not understand it.” - Peregrina Sandoval



Read Chapter 7, then complete the notes.

Period: Mesozoic – Late Triassic

Formation: Chinle Formation

Describe the characteristic plants and animals (3).

1

2

3

Describe the environment (climate/landscape):

Identify a key fact after reading:

Supai Group

Redwall Limestone

Muav Limestone

Bright Angel Shale

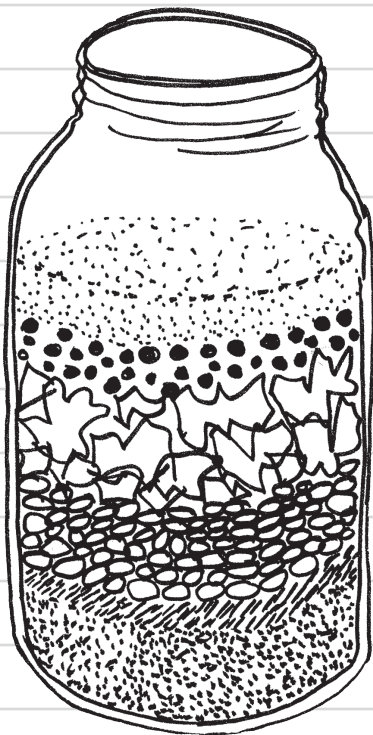
Tapeats Sandstone

Make a Mini-Canyon of Your Own!

Find materials to represent each rock layer (keep in mind color and composition). For the example given, Kaibab limestone, try using rice. It could have small shells or beads mixed in to represent the fossils!

Suggested materials: colored sand, dirt, pine needles, crumpled dried leaves, flour, small beans, beads, etc.

In a mason jar, or other clear container layer the materials in the same order they occur in the Grand Canyon to create a mini canyon of your own.



Now experiment by introducing the water by way of different containers. Formulate a new hypothesis:

If... _____

Then... _____

Conclusion:

Using the experiment above explain how you think weathering and erosion agents like water have shaped the landscape in places like Monument Valley.

Activity: Weathering and Erosion

Materials:

Sugar cubes (recommended variety brown and white sugar!)

glue

eye dropper, squeeze bottles like those used for contact solution, spray bottles, etc

plastic base (tupperware lid)

Create a landscape inspired by the formations of Monument Valley by stacking and arranging your sugar cubes. Experiment with different shapes, groupings, and levels. See the pictures above for inspiration!

Question: What will happen to your (sugar) landscape when water is introduced?
Hypothesis:

Fill the eye dropper with water and focus the droplets on a few places in your sugar landscape.
What is happening? Record your observations.

“Nowhere on Earth is the book of time complete.” – Uncle Al



After observing the kids’ travels through geologic time, complete the notes:

Period: Cambrian

Formation: Bright Angel Shale

Describe the characteristic plants and animals (3). *You may have to do some additional research!*

1

2

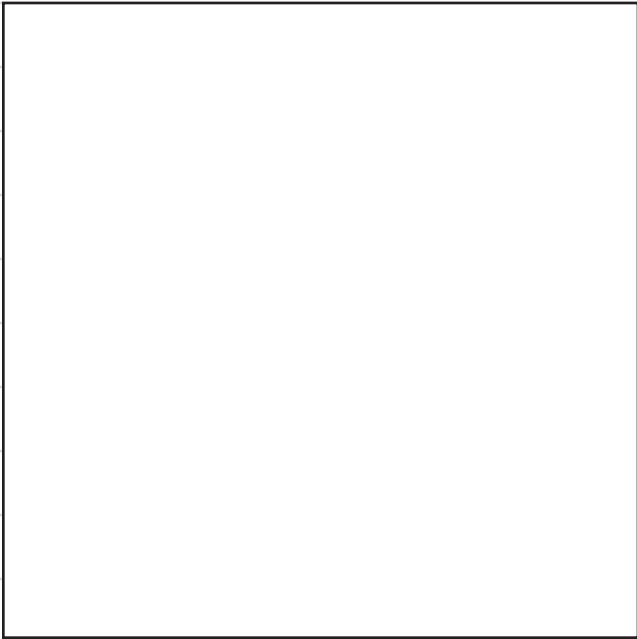
3

Describe the environment (climate/landscape):

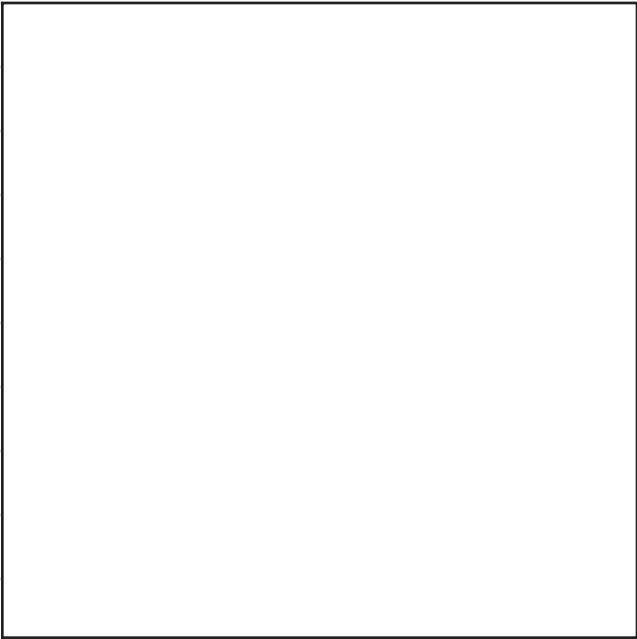
Identify a key fact after reading:

Sketchbook: Then/Now

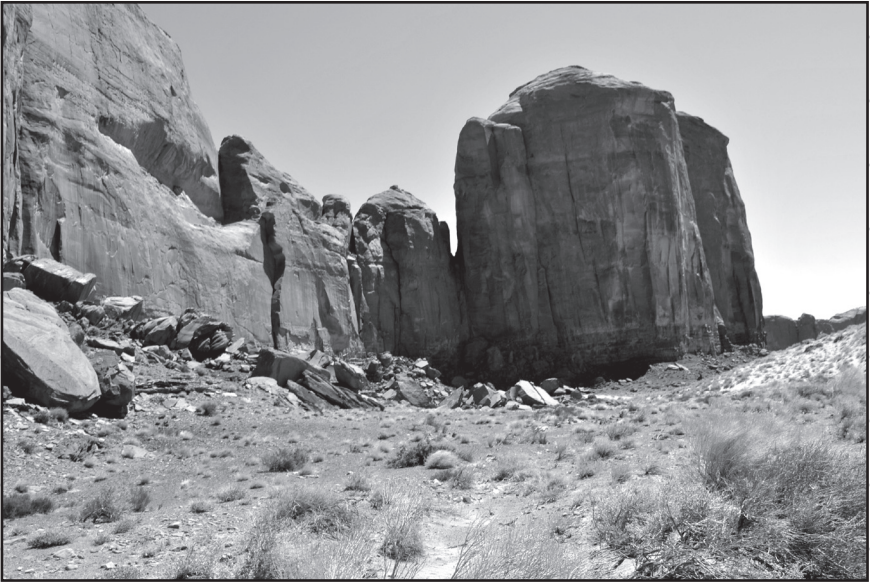
Draw the Cambrian as it was and the Bright Angel Shale as it is now.



Cambrian Then



Bright Angel Shale Now



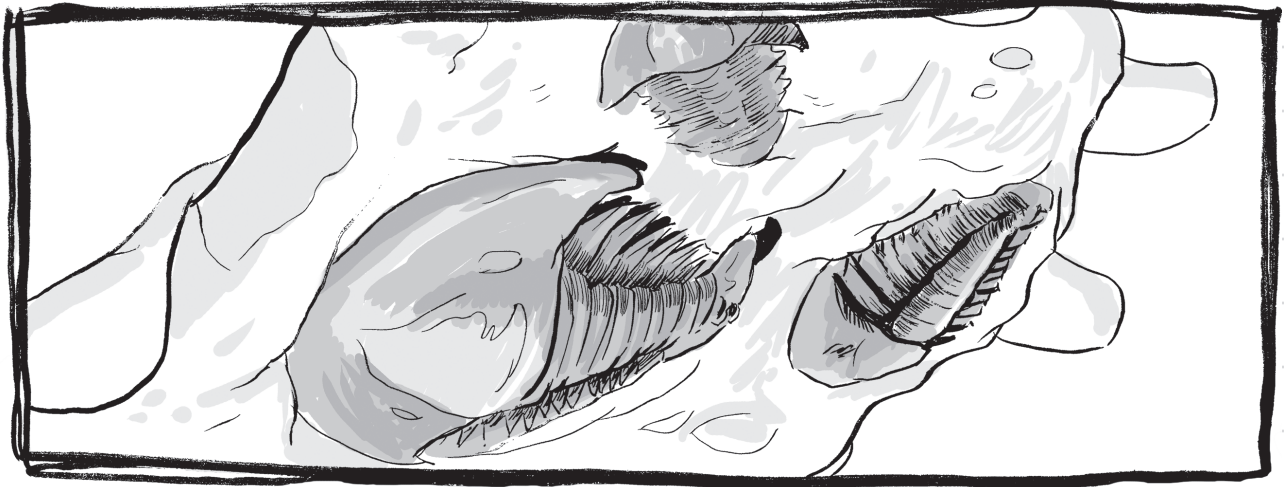
Monument Valley, AZ

Ye Bi Chei

Monument Valley is characterized by its iconic rock formations. These formations are colored red by iron oxide and are clearly stratified into three different layers, and were formed by weathering and erosion. The Ye Bi Chei and other landforms have significance to the Navajo People that relate both to their mythological history as well as their modern history. Today Monument Valley is a Tribal Park and the interior is only accessible with an official Navajo guide.



Activity: Make Your Own Fossils



Uncle Al points out a trilobite fossil. Its body was covered by a layer of mineral-rich sediment on the bottom of a shallow sea. Its shell was slowly replaced by the minerals encasing it until a cast, or impression, remained. These outlines can remain in or on rock for millions of year and preserve clues to the past.

- Materials:**
- ½ cup cold coffee - for coloring. Water may be substituted. Can add coffee grounds or sand for texture.
 - 1 ½ cup flour
 - ½ cup salt
 - mixing bowl and spoon
 - objects

Directions:

Mix ingredients together, adding the flour slowly (more flour can be used if the dough is too sticky). Roll dough into small rounds or sections. An object can be pressed into each section. Sample objects: leaves, shells, plastic play animals, or any object from the present day that signifies what would be laid down in our own geologic time for future geologists and archaeologists to ponder.

Remove the object, leaving an impression. Let the dough dry overnight.

If you were discovering this for the first time; what could your discovery tell you about the past?

LESSON 6

CHAPTER 6 - TSE'BII'NDZISGAI

“The Landscape is not just a place to live, it’s a story we become a part of.”

- Robbie



Read Chapter 6, then complete the notes.

Location: Monument Valley, 1986 CE (Common Era) **Formation:** Chinle Formation;
Period: _____ Monument Valley

Describe the characteristic plants and animals (3):

1 _____

2 _____

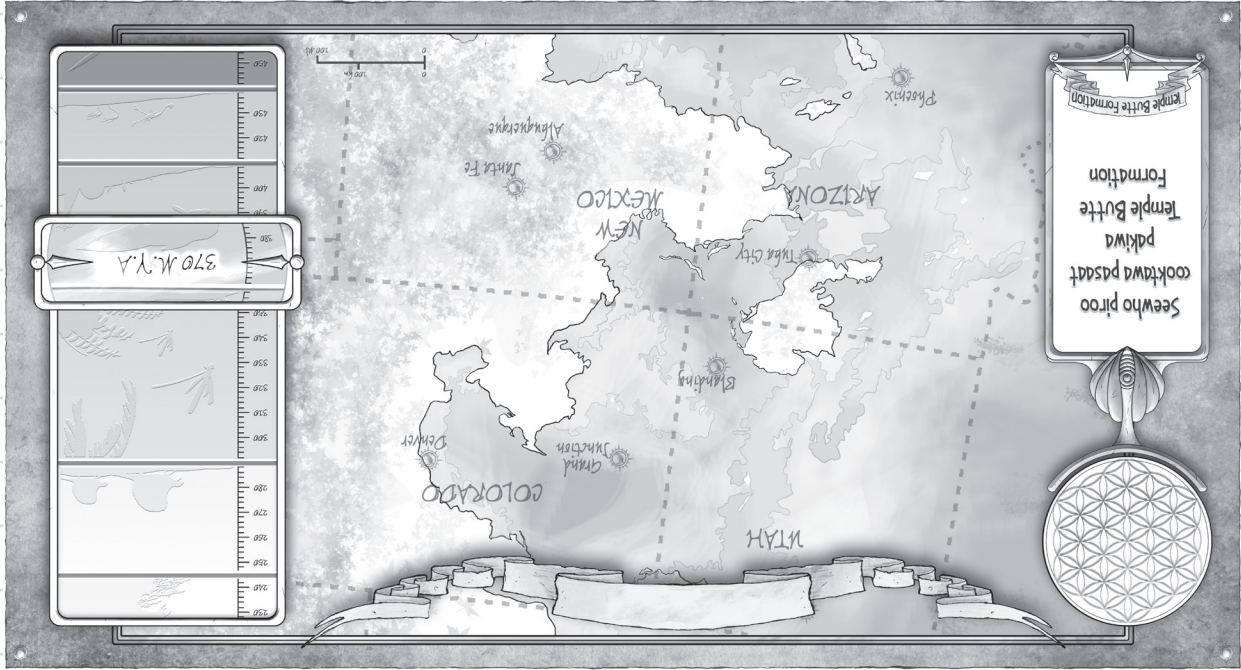
3 _____

Describe the environment (climate/landscape):

Identify a key fact after reading:

LESSON 4
CHAPTER 4 - PALEOZOIC PURSUIT

“You are well on your way to being geologic time travelers!” - Uncle Al



Read Chapter 4, then complete the notes.
Period: _____
Formation: Temple Butte

Describe the characteristic plants and animals (3):

1

2

3

Describe the environment (climate/landscape):

Identify a key fact after reading:

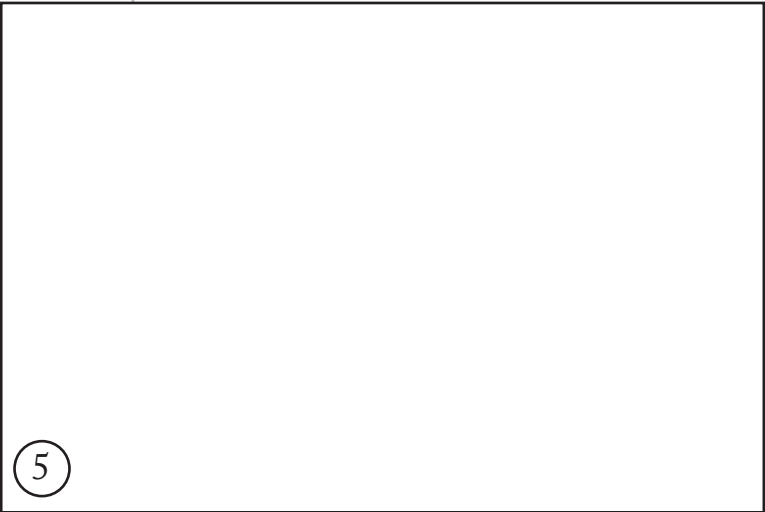
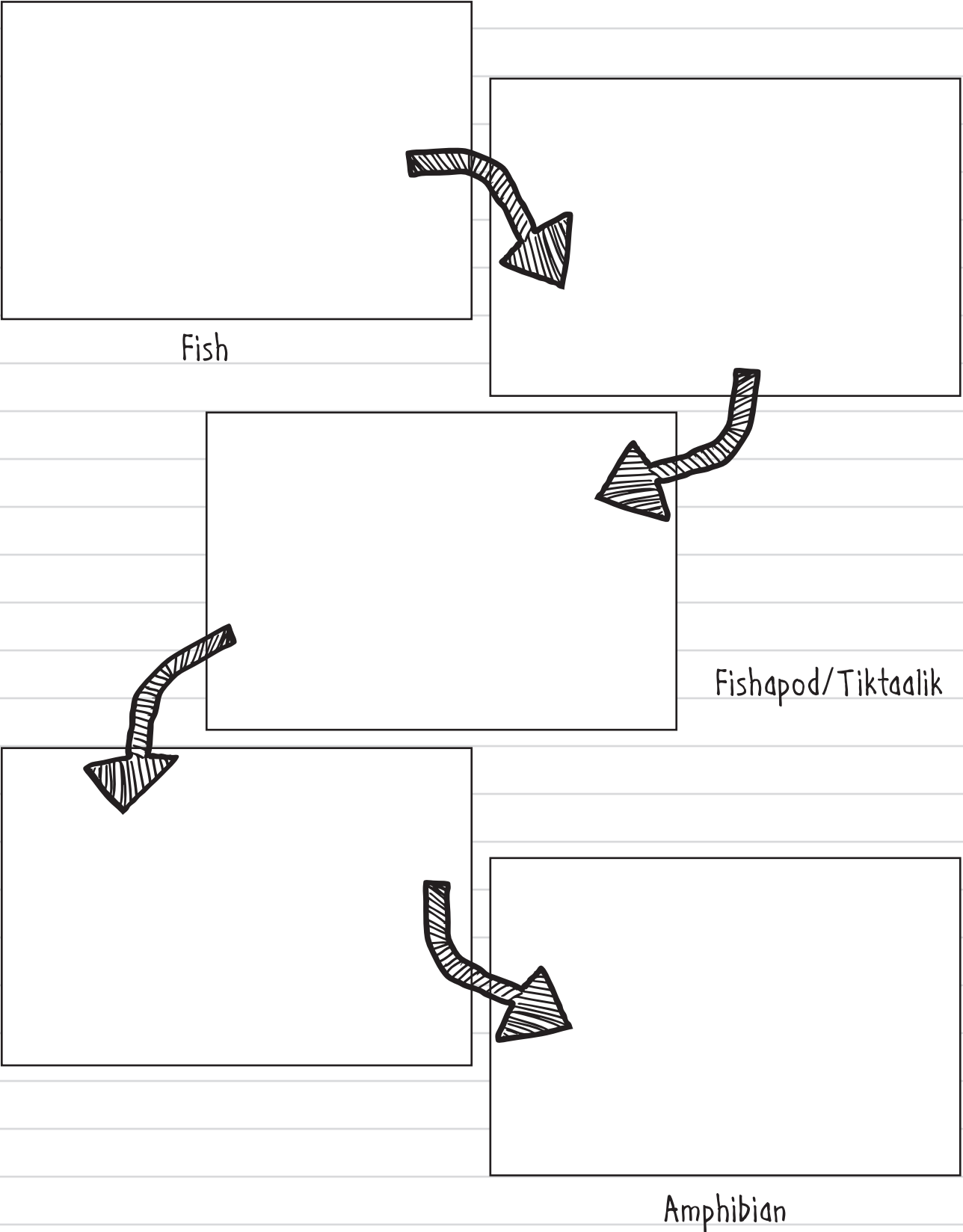
Dinosaurs!

10

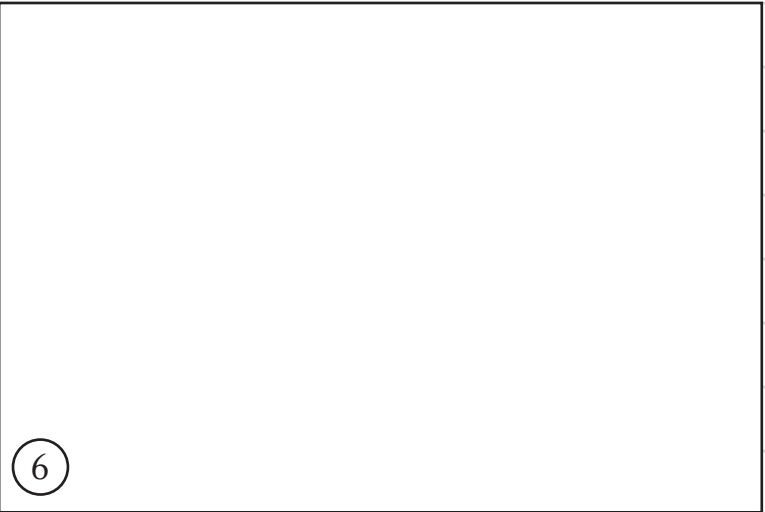
*The most severe of all the extinctions killed
90% of existing life – it took over ten
million years for the planet to recover and
give rise to the reign of the...*

9

Activity: Illustrate the transition from Fish to Amphibian



The changing weather patterns caused species to die-off on land.



...And in the sea.



When the oceans warmed up, the chemistry of the sea was disrupted, killing many organisms that supported life.



Every change affected life on Earth and occurred over a period of time – maybe 100,000 years.

Make a mini graphic novel illustrating the “Great Dying” in the frames provided.

1

2

Pangea Supercontinent break-up.

Volcanic eruptions: huge lava flows occurred in Siberia erupting for hundreds of years; there was lava for miles!

3

Ash from the volcanoes blocked out sunlight – like a cloud – and the temperature dropped.

4

Then, the temperature rose from all the gas caused by the eruptions.



Period: _____ Formation: Honaker Trail

Describe the characteristic plants and animals (3). You may want to look some names up!

1

2

3

Describe the environment (climate/landscape):

Identify a key fact after reading (also write this on your geologic timeline):

Activity: Illustrating the Pennsylvanian Carboniferous

Now: Honaker Trail Formation

Deposited in the Pennsylvanian Carboniferous Period by shallow seas. Comprised of dark grey limestone with fossils forming rugged slopes and ledges.

Then: Pennsylvanian Carboniferous

After reading, illustrate how you imagine this area looked in your time travel journal; keep in mind what you have learned about this period.

LESSON 5
CHAPTER 5 – THE PERMIAN POST

“The landscapes of time are a puzzle that I am dedicated to solve.”- Levi Wilson



Read Chapter 5, then complete the notes

Period: _____ **Formation:** De Chelly Sandstone, Monument Valley

Describe the characteristic plants and animals (3). *You may want to look up some additional creatures!*

- 1
- 2
- 3

Describe the environment (climate/landscape):

Identify a key fact after reading: