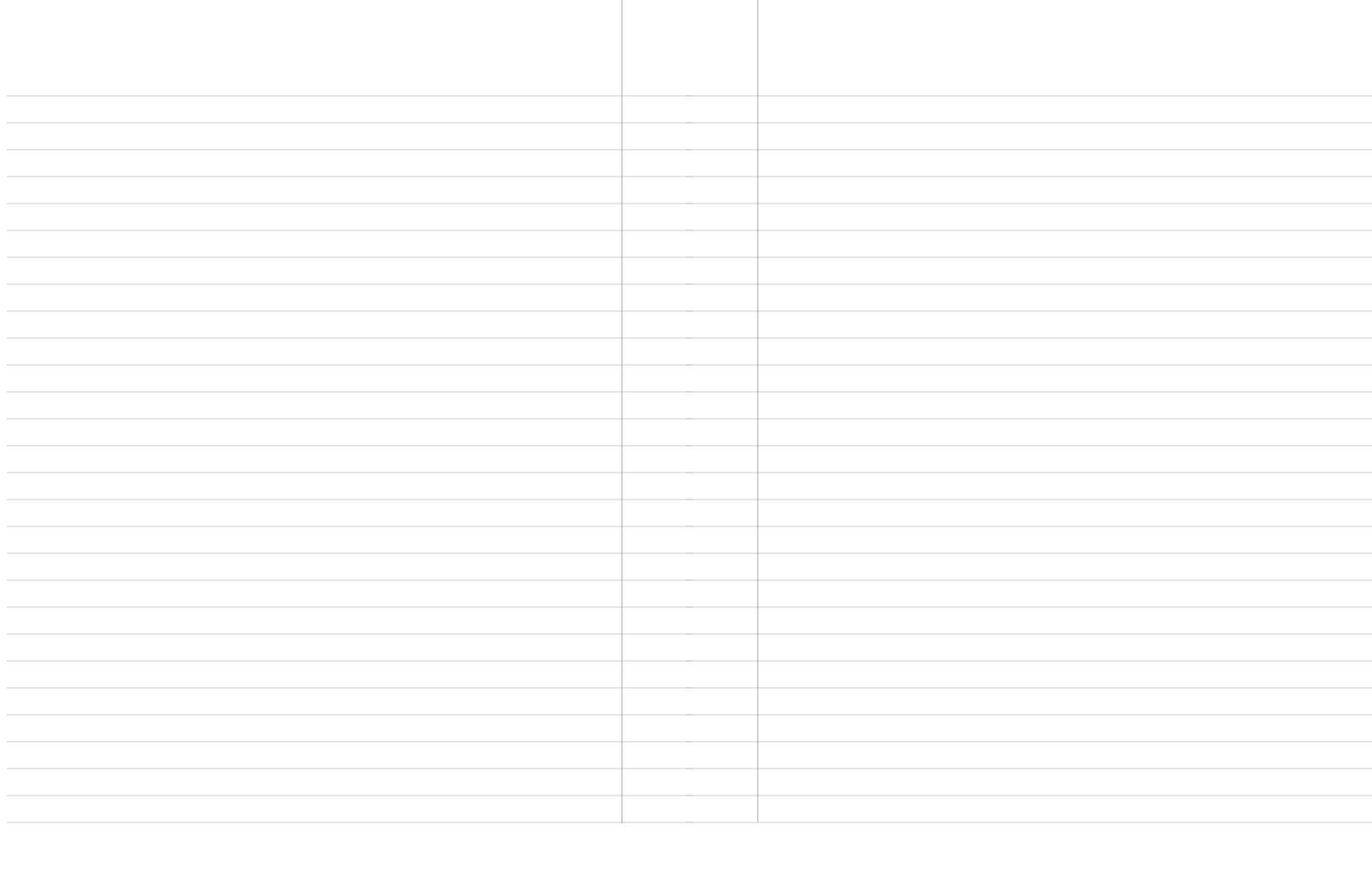


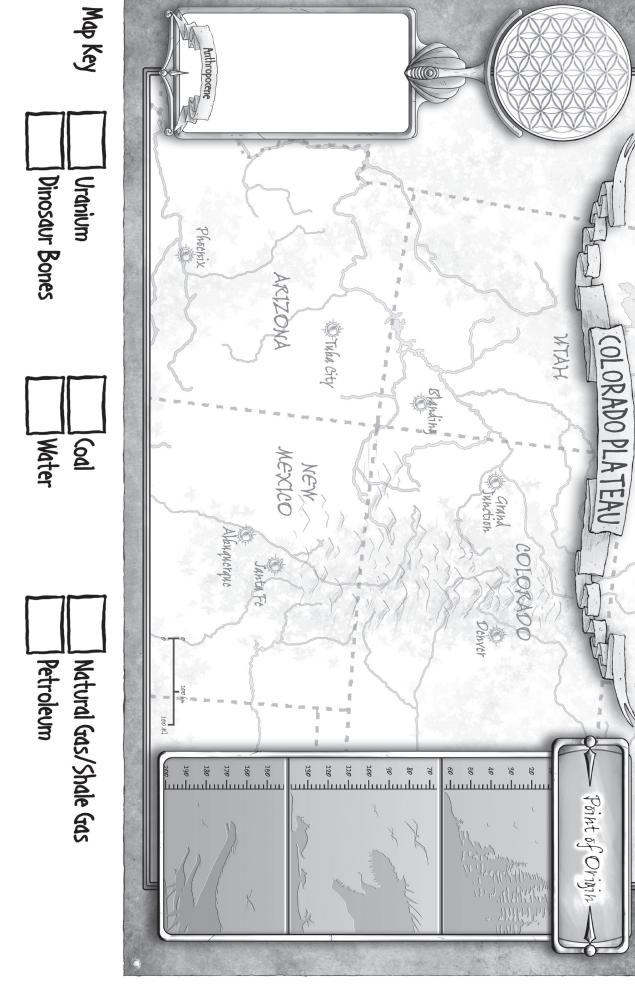
THIS BOOK BELONGS TO



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

### atnathos ao ajaat

	Activities: Mini Graphic Novel/ Debate	
	differing perception and use of landscapes	
17	Understand the "Great Dying" Understand people's	
16	Lesson 5: Chapter 5 - The Permian Post	
	Activity: Illustrating/Sketching	
/\	Compare/Contrast: Understand changing environments across time periods	
<i></i>	Lesson 4: Chapter 4 - Paleozoic Pursuit	
	slizzo7: YivityA	
	Understanding Geologic Unconformity	
	Activity: Rock Layers	
8	Understanding Rocks	
U	Lesson 3: Chapter 2 and 3 - Grand Impact	
	Activity: Extinction events	
4	Understanding a Map: The Colorado Plateau	
	Lesson 2: Chapter 1 - Found in the Painted Desert	
_		
٤	Understanding Geologic Time	
	Lesson 1: Before you Start	
	SINAINOS TO STARI	



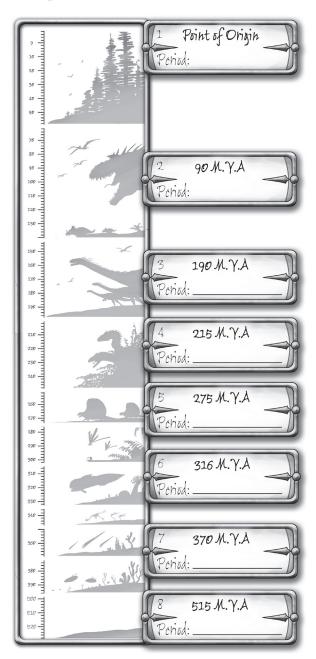
Lesson 6: Chapter 6 - Tse' Bii'Ndzisgaii		Lookup each of the resources below and mark at least one location on the map on the
Activity: Weathering and erosion experiment	25	next page where that resource can be found. Be sure to complete a key for your map. You
		may choose to use different colors or different symbols for each resource.
Lesson 7: Chapter 7 - Triassic Times		
Understand divergent evolution (synapsid, anapsid, diapsid)	30	Resources:
		1. Uranium – Atlas Uranium Mill and/or Denison mines
Lesson 8: Chapter 8 - Mobilis in Mobili		2. Dinosaur bones – Morrison Formation
Activity: Pantoum (poetry)	32	3. Coal – Black Mesa (Peabody Western Coal Company)
		4. Water – Navajo aquifer (Black Mesa) or Colorado River (Hoover Dam)
Lesson 9: Chapter 9 - Creepy Cretaceous	35	5. Natural gas/shale gas – Manning Canyon Shale
		6. Petroleum
Lesson 10: Chapter 10 - Home from the Range		
Natural Resources Research Project	38	

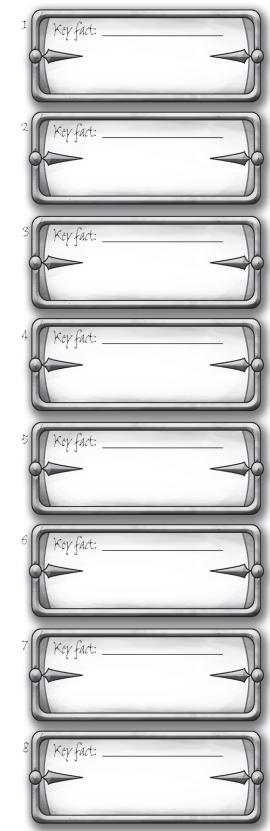
द भ्रवि	1 De 40 Fesson J	10 nozzad
		and Ari – to think about what we do with "the curious things in nature."
		The conflict spills off the page and into real life and it is up to you – just like Jenna, Calel
		the key to understanding, can also be the key to wealth.
	p	and important for study to better understand the Earth's history. These resources, which ho
		Earth's geologic past. These are important natural resources that people use in our society
		The present day Colorado Plateau holds resources that were laid down and formed by the
		with their knowledge.
the Earth.		understanding of the processes of change. The key difference is in what they intend to do
habitats, ecosystems, and life forms long dead have left clues from their time locked in		Both groups of time travelers, the treasure hunters and geosophists are after knowledge and
Did you know that clues to the long past can be found in the dirt? Literally! Different		There is a key conflict in this book regarding the reasons for time travel and exploration
IV 212/10		(Can be done in groups, pairs, or individually)
-Uncle Al		אוואי זכווז יוזאסטכוע זכוו ו
"True learning is in the dirt, found by rolling up the sleeves of your shirt."		vs. First discover, first claim
		Discover the curious nature of things and the curious things in nature
		Research Project
		timeline with a key fact and symbol (Lesson 1) before you begin the final activity.
		Read Chapter 10. Go through your time travel journal and be sure you have a completed
NNDEKSTANDING – GEOLOGIC TIME PRE-READING LESSON 1		CHAPTER 10 – Home From the Range Lesson 10

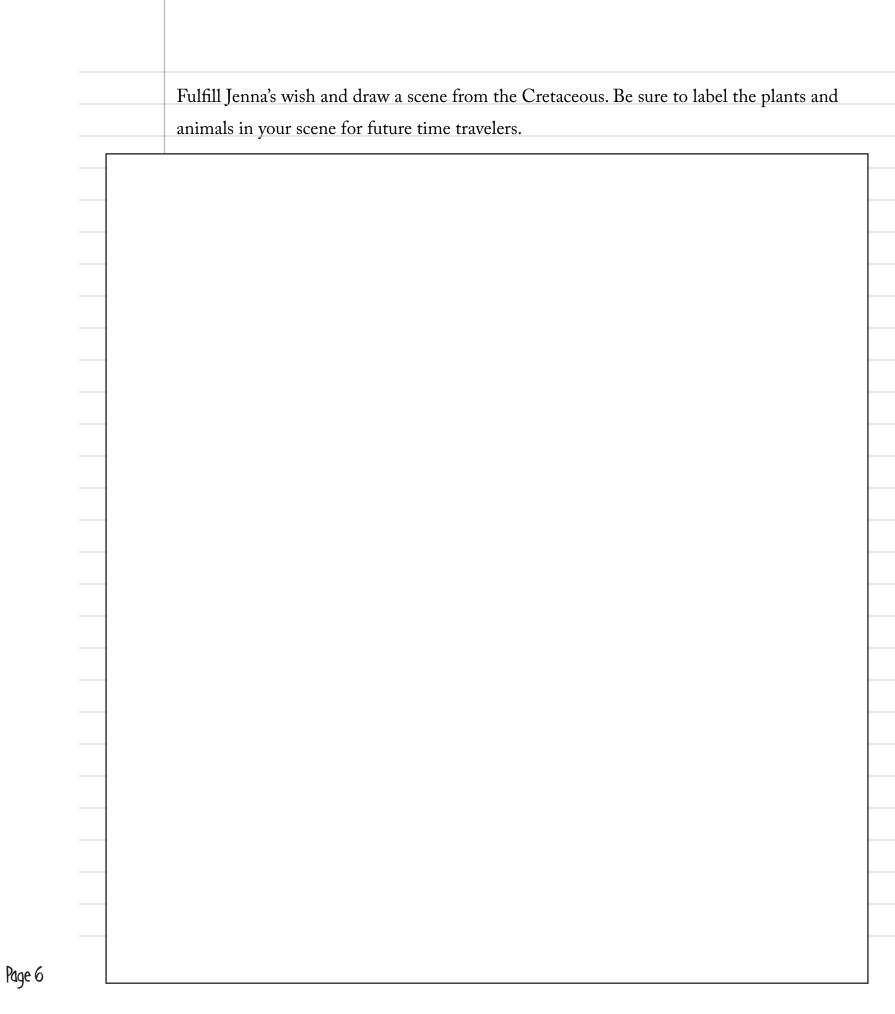
## Activity: Point of Origin

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.







7 aga9	lage 38 Lesson 1	Pesson 9
and device and a constant of a		
Get oriented by labeling the points of the compass.		
On the next page is a map of the Colorado Plateau (present day).		
(up tagger) unotald observed and the and all		
Read Chapter 1.		
		How do you think the kids will get back to Uncle Al and Aunt Maddie?
to guide you.		
Your record of your travels begins here. As any good traveler knows, you need a good map		
zones. We're gonna have to be really prepared for this one." -Ari		
"The Last 550 million years of life on Earth have had some really intense time		Cretaceous?
		Ponder: Why can't Jenna, Caleb and Ari make it back to Monument Valley from the
CHAPTER 1 – FOUND IN THE PAINTED DESERT		

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

Next, label the cities:

A: (Phoenix) B: (Tuba City)

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

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

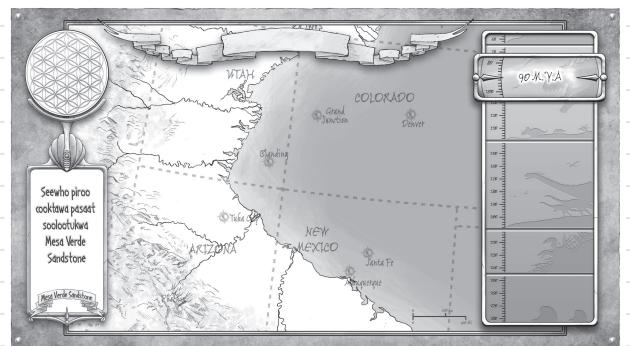
F: (Albuquerque) G: (Santa Fe)

Label the key formations: 1: (Grand Canyon) 2: (Monument Valley)

COLORADO PLATEAU C (7) B (2)

## 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 animal	s (3):
1	
2	
3	
Describe the environment (climate/landscape	e):

Identify a key fact after reading:

6 apps	lage 36 Lesson Z	Pesson 9	
		8	
		3	
		8	
		9	
		$\overline{\mathcal{L}}$	
Source(s):		S	
		9	
***20000200 111242 110112111212			
extinction event because		Σ 	
Mass extinction caused by		ζ	
make note of your sources.			
Pick one of the five extinctions illustrated in the book and research it online. Be sure to		<u> </u>	
Ari's parents have taught him about different ways mass extinctions happen.			
Activity: Extinction Events			
		Pantoum sequence:	

## 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.

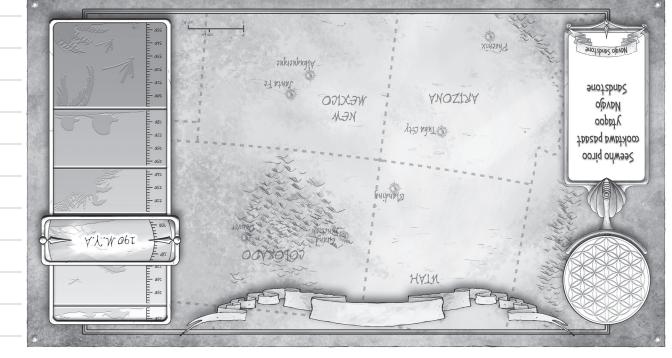
#### Instructions:

- 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 2 Page 10 Lesson 8 Page 3

### CHAPTER 8 - MOBILIS IN MOBILI 8 NOSS31

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



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

Describe the characteristic plants and animals (3):

Describe the environment (climate/landscape):

Identify a key fact after reading:

### Metamorphic

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



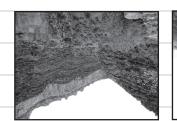


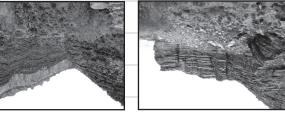
Examples of this rock type include gneiss and marble.

aneiss Marble

### Sedimentary

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





# Sedimentary Rock

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

Page 34

Activity: Rock Layers	Early Mammals: Divergent Evolution	
	Connect these life forms of the past to their decendants in the present:	
Know The Canyon's History, Study Rocks Made By Time!	Diapsid – Vertebrates that possess skulls with two major fenestrae, or openings near the	
Look up the rock layers and give a brief description. Also draw a small picture or	temple.	
symbol to represent each rock.		
	Synapsid – Vertebrates that possess skulls with one major fenestra in the region of the	
<b>K</b> aibab Limestone	temporal bone	
Ex: The layer at the top of the canyon that is made up of		
sedimentary rock found at the bottom of seas and often	Anapsid –Vertebrates that possess skulls with no major fenestrae	
includes fossils of sea critters.		
	Research each type of animal above. Choose an animal for each and draw their skulls. Be	
Toroweap Limestone	sure to label your drawing with the animal's name.	
Coconino Sandstone		
Hermit Shale		

Lesson 3 Page 12 Lesson 7 Page 33

- TRIASSIC TIMES	CHAPTER 7
	L NOSSAT

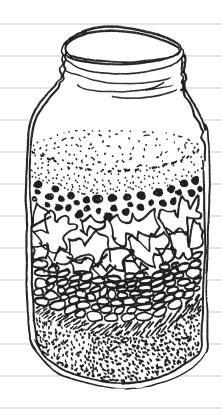
Identify a key fact after reading:	
Describe the environment (climate/landscape):	
	Tapeats Sandstone
3	
7	
Describe the characteristic plants and animals (3).	
	Bright Angel Shale
Period: Mesozoic - Late Triassic Formation: Chinle Formation	
Read Chapter 7, then complete the notes.	
cooktawd pdssddt brandtion brandtion cooktawd pdssdd brandtion cooktawd pdssdd brandtion cooktawd pdssdd brandtion cooktawd cookt	Muav Limestone
AYM SIC BE OOTHOLOS  OOTHOLOS  OOTHOLOS  OOTHOLOS  OOTHOLOS  OOTHOLOS  OOTHOLOS	Redwall Limestone
"It's most dangerous to have the map and not understand it." - Peregrina Sandov	
	Supai Group
CHAPTER 7 - TRIASSIC TIMES	

## 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!

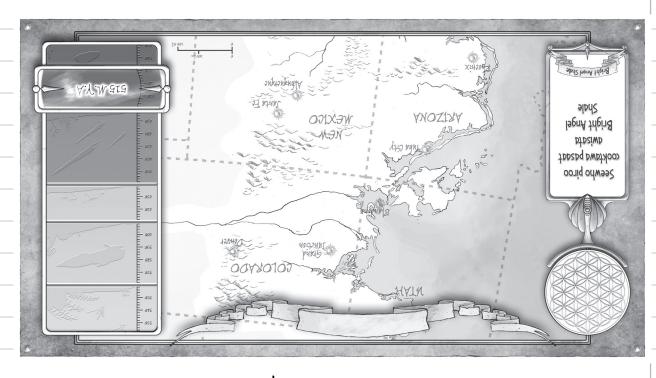
Suggested materials: colored sand, dirt, pine needles, crumpled dried leaves, flour, small beans, beads, etc.

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	ı new
hypothesis:	
If	
	_
Then	
Conclusion:	
Using the experiment above explain how you think weathering and erosion agents lik	e water
have shaped the landscape in places like Monument Valley.	

### "Nowhere on Earth is the book of time complete."- Uncle Al



Formation: Bright Angel Shale Period: Cambrian After observing the kids' travels through geologic time, complete the notes:

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

Describe the environment (climate/landscape):

Activity: Weathering and Erosion

### Materials:

gIne

Sugar cubes (recommended variety brown and white sugar!)

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

plastic base (tupperware lid)

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

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

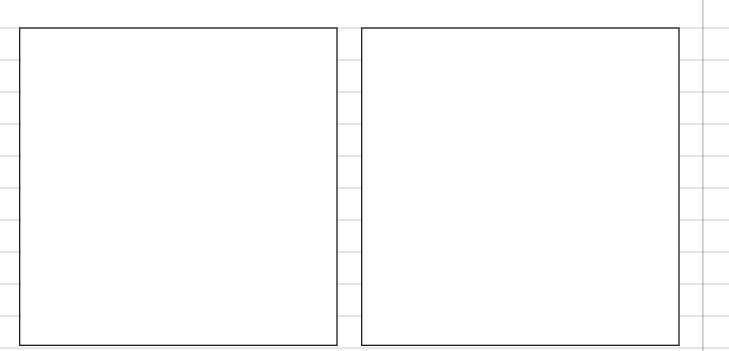
What is happening? Record your observations. landscape.

Identify a key fact after reading:

El appal

## Sketchbook: Then/Now

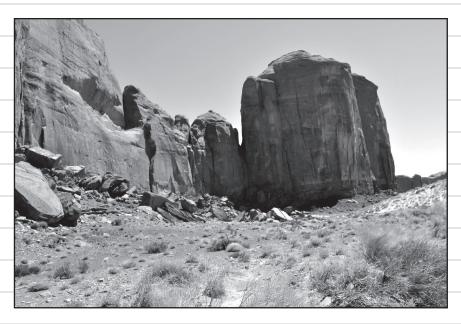
Draw the Cambrian as it was and the Bright Angel Shale as it is now.



Bright Angel Shale Now





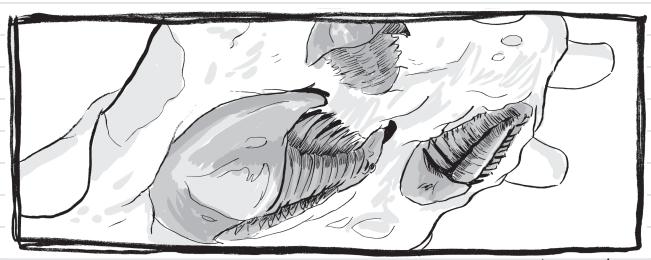


Monument Valley, AZ

Tionometre van

Cambrian Then

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 1/2 cup flour

the quo salt

nooqs bar Iwod zaixim

objects

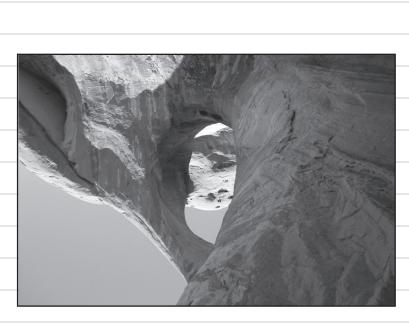
#### Directions:

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.

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.

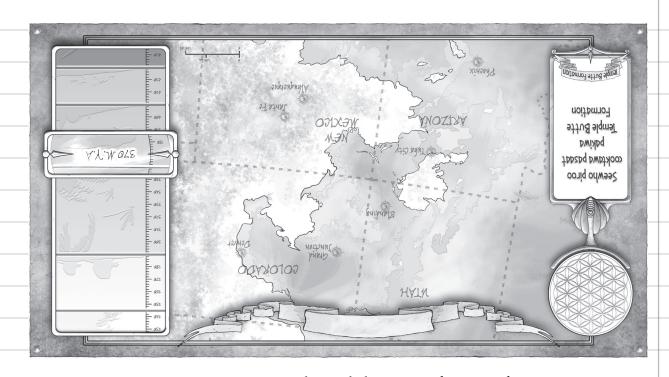




	LESSON 6 CHAPTER 6 - TSE'BII'NDZISGAII
Remove the object, leaving an impression. Let the dough dry overnight.	
If you were discovering this for the first time; what could your discovery tell you	"The Landscape is not just a place to live, it's a story we become a part of."
about the past?	- Robbie  Print of Origin  Colorado  Grand  Grand  Grand  Frint of Origin  Print of Origin  Reduction  Print of Origin  Anthropocene  ARIZONA  ARIZ
	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	Page 18 Lesson 6 Page 27

### CHAPTER 4 - PALEOZOIC PURSUIT H N09937

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



Read Chapter 4, then complete the notes.

Formation: Temple Butte Period:

Describe the characteristic plants and animals (3):

Describe the environment (climate/landscape):

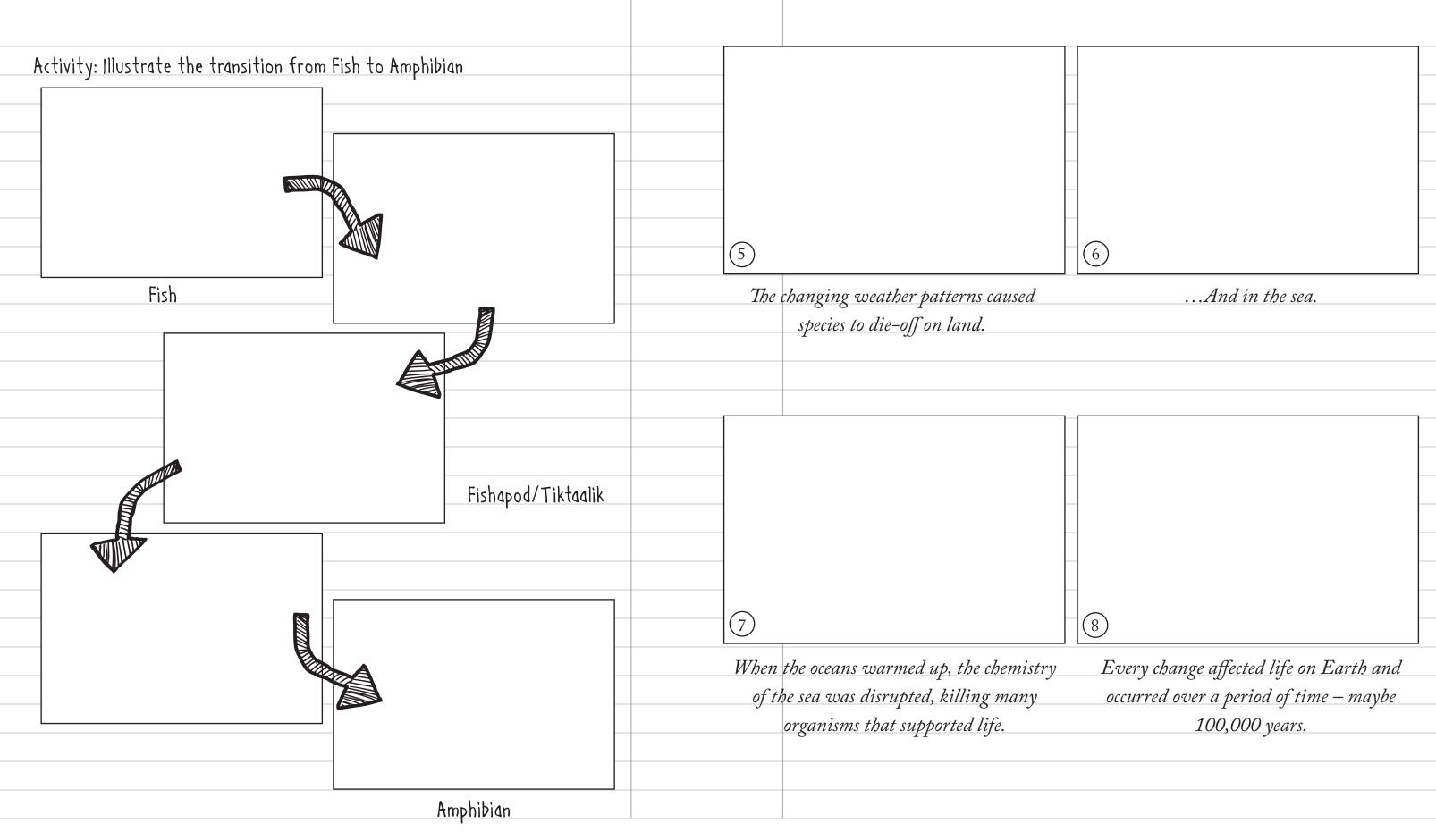
Identify a key fact after reading:



... sat to ngisr sat ot seir swig bno 19400391 of tonold odt 10t eroser aoillim not rovo doot ti – ofil gnitsixo fo %09 The most severe of all the extinctions killed

Dinosaursi

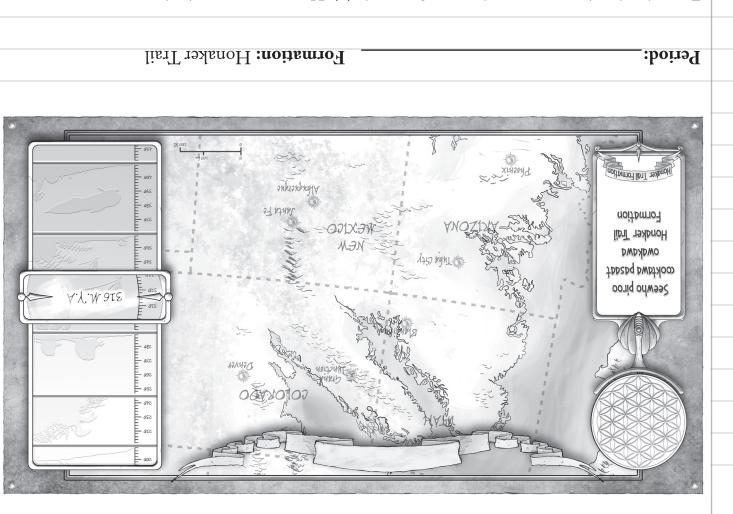
(1D)



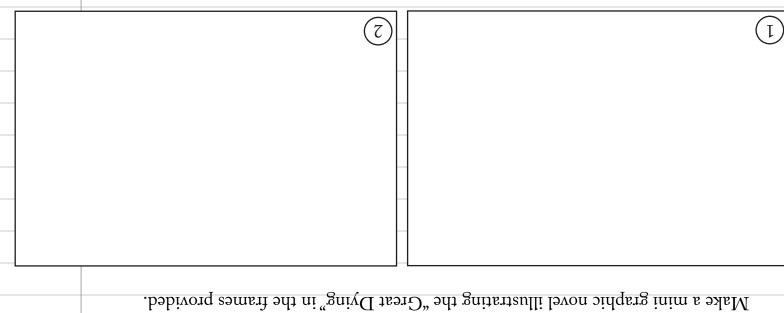
Lesson 5

Page 20

Lesson 6



Identify a key fact after reading	ng (also write this on your geologic timeline):
Describe the environment (clim	imate/landscape):
ε	
7	
Describe the characteristic plant	ants and animals (3). You may want to look some names up
Period:	Formation: Honaker Trail



borrusso swolf wan! sgud :enoitquro sinasloV ;ernoy to eborband rot gaitquro airodis ni !eslim rot wan! esam oredt

-An-Ansed Insnitnoorsque nsgnn<sup>A</sup>

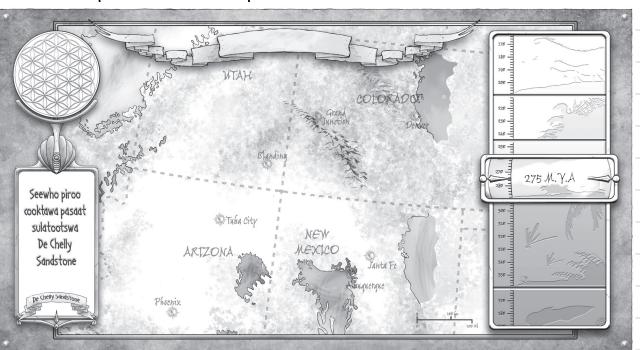
In mort erost son seat by the gas.

Ash from the volcanoes blocked out she sullight – like a cloud – and the tension of the sulling should be sulling the sulling should be supported to the substitution of the sulling should be supported to the sulling should be supported to the substitution of the substitution of the sulling should be supported to the substitution of the substitution

Activity: Illustrating the Pennsylvanian Carboniferous	
Now: Honaker Trail Formation	
Deposited in the Pennsylvanian Carboniferous Period by shallow seas. Comprised of dar	k
grey limestone with fossils forming rugged slopes and ledges.	
Then: Pennsylvanian Carboniferous	
Then: Pennsylvanian Carboniterous  After reading, illustrate how you imagine this area looked in your time travel journal; kee	p in
•	p in
After reading, illustrate how you imagine this area looked in your time travel journal; kee	ep in
After reading, illustrate how you imagine this area looked in your time travel journal; kee	ep in
After reading, illustrate how you imagine this area looked in your time travel journal; kee	ep in
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After reading, illustrate how you imagine this area looked in your time travel journal; kee	ep in
After reading, illustrate how you imagine this area looked in your time travel journal; kee	p in
After reading, illustrate how you imagine this area looked in your time travel journal; kee	ep in

# 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	s (3). You may want to look up some additional	
creatures!		
1		
2		
3		
Describe the environment (climate/landscape	).	
Describe the chivinonment (chimate) landscape	<i>,</i> •	

Identify a key fact after reading: