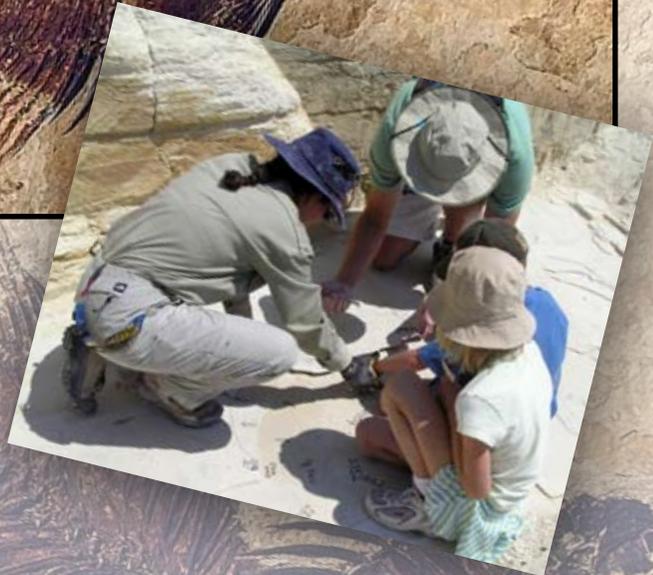
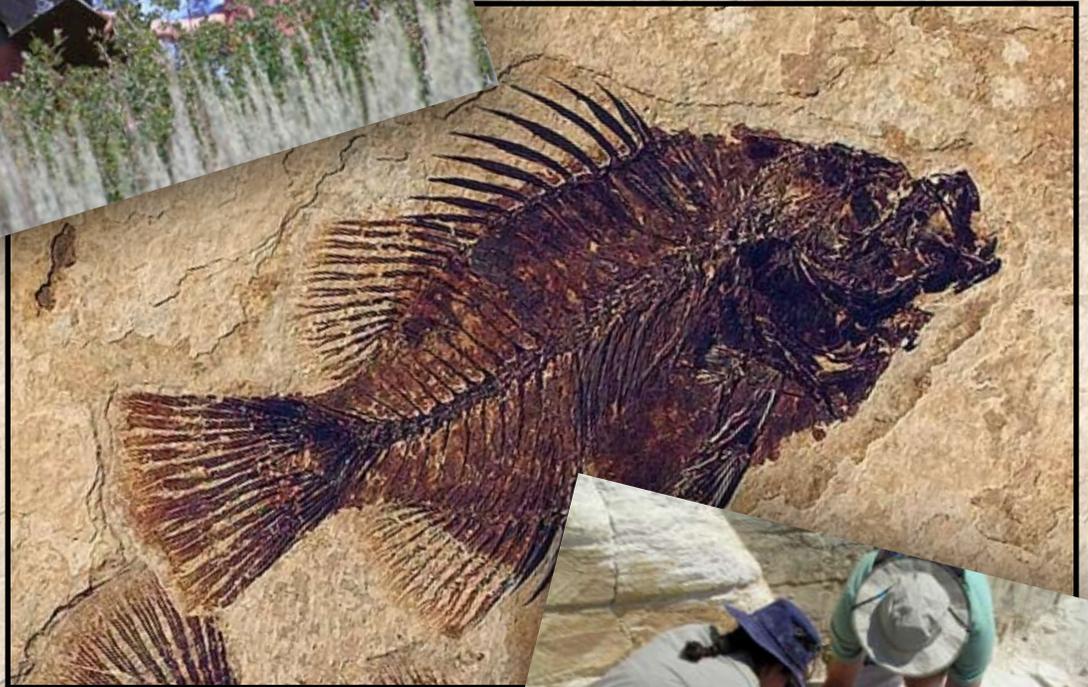
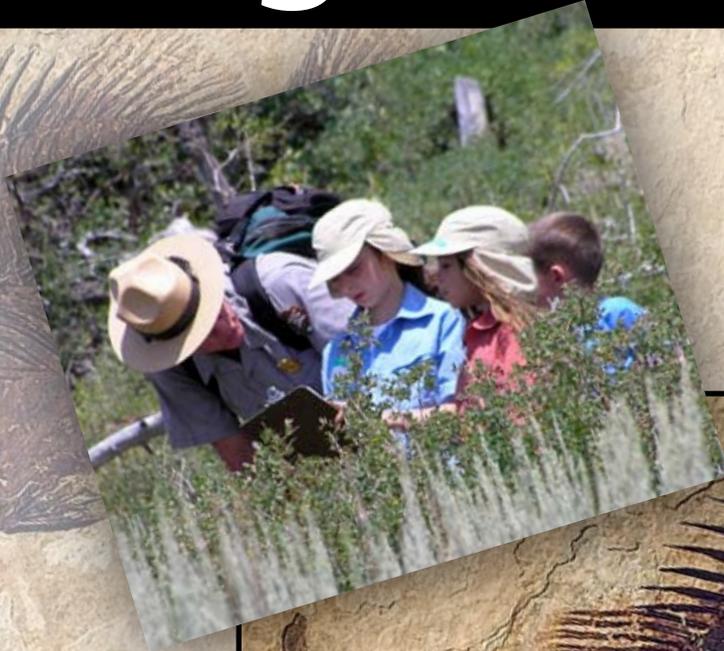


Junior  
&  
Senior

# Ranger

National Park Service  
U.S. Department of the Interior  
Fossil Butte National Monument



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# Welcome to Fossil Butte National Monument!

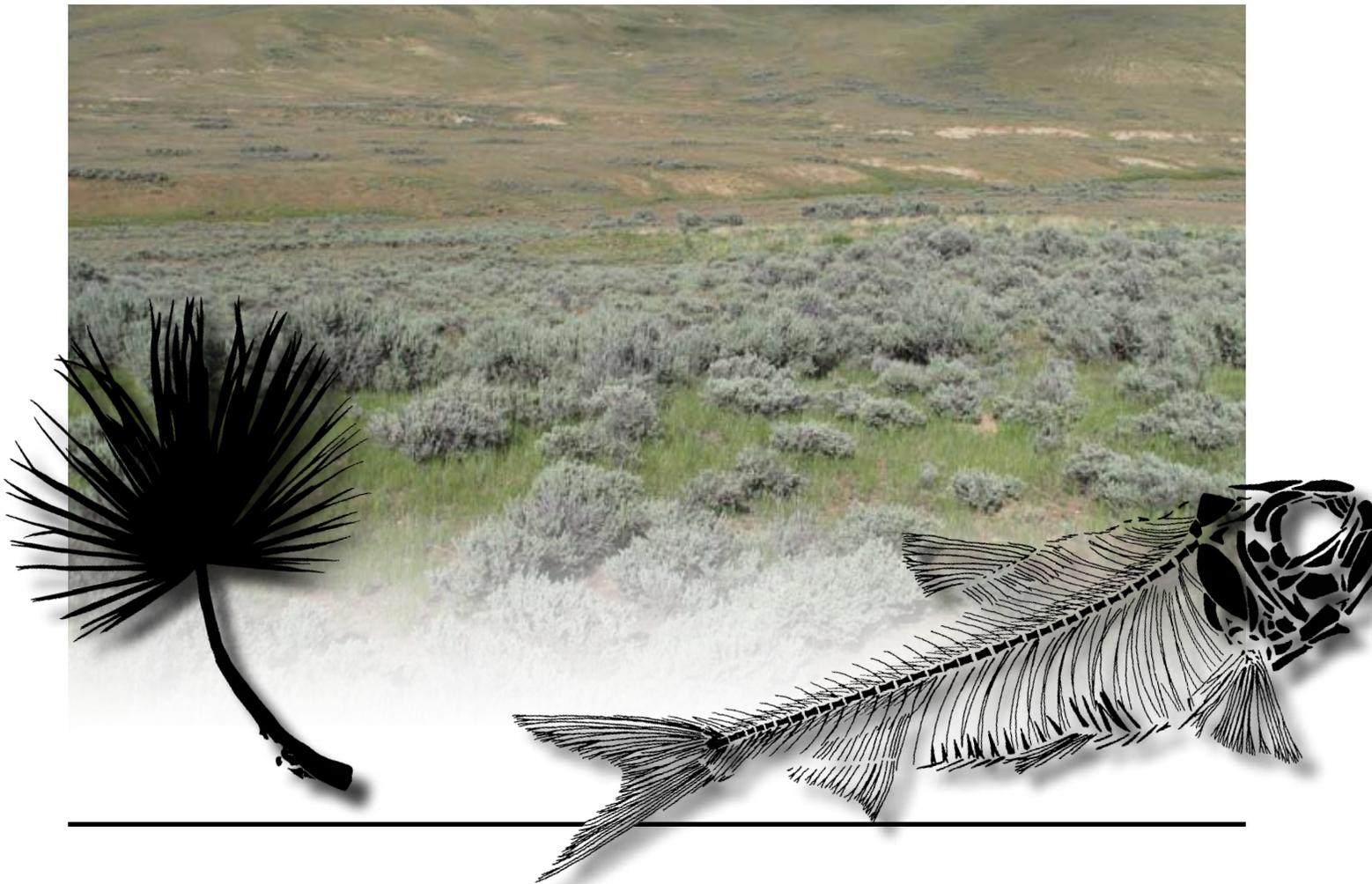
Fossil Butte is one of many special places cared for by the National Park Service. As you complete the activities in this Junior / Senior Ranger book, you will learn what makes this National Monument unique.

To become a Junior or Senior Ranger at Fossil Butte:

1. Complete as many activities as you can. Each page is marked with tabs indicating whether it is recommended for ages 5-7 8-11 12-15 or 16+
2. Show your book to a ranger.
3. Take the Junior / Senior Ranger pledge.



Most importantly,  
*have fun* exploring and learning about Fossil Butte National Monument!



# Walk through Time



Geologists calculate the age of the earth as 4.567 billion years. That's a big number! To gain a better sense of the scale of geologic time, start at the parking lot and count the number of steps it takes to walk between these events.

<i>Event</i>	<i>Million Years Ago</i>	<i>Number of steps</i>
Ediacaran species went extinct; first small shelly fossils appeared	542	0
83% of genera went extinct	250	_____
First dinosaurs	220	_____
Dinosaurs went extinct	65	_____
<i>Choose your own event</i>	_____	_____
A basin began filling with water here, creating Fossil Lake	52	_____
Fossil Lake dried up	50	_____
<i>Choose your own event</i>	_____	_____
First <i>Homo sapiens</i>	1.6	_____
Beginning of recorded human history	0.006	_____



Circle the species or feature that was around for a longer period of time.

Dinosaurs or humans

Fossil Lake or humans

Geologists divide time into categories based on the first occurrence of new species. The Paleozoic, Mesozoic, and Cenozoic Eras began 542, 250, and 65 million years ago, respectively.

What happened just before the start of all of these time periods?



\_\_\_\_\_

# How Big Was Fossil Lake?

Fifty-two to fifty million years ago, a large lake—what we now call Fossil Lake—filled this corner of Wyoming. Geologists have determined it was nearly 50 miles long and 20 miles wide. How does that compare with modern lakes?

Caspian Sea

Russia / Central Asia  
Area: 143,000 sq miles

Fossil Lake  
932 sq mi



Circle any lakes you've visited.  
Put a star on the second-smallest lake.

Lake Superior  
United States / Canada  
31,820 sq mi



Great Salt Lake  
Utah, US  
1,800 sq mi



Bear Lake  
Utah / Idaho, US  
109 sq mi



400 miles



12-15 16+

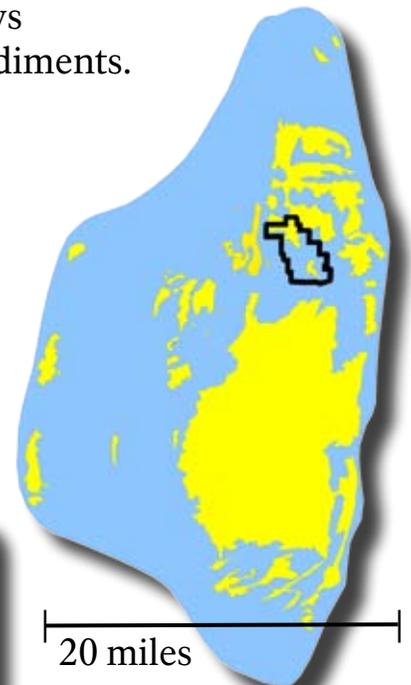
This map of Fossil Lake shows (in yellow) remaining lake sediments.

Estimate the percentage of sediment remaining, compared with the size of the original lake: \_\_\_\_\_ %

Fossil Butte National Monument is outlined in black.  
About what percentage of the remaining sediments does that protect?

\_\_\_\_\_ %

Thinking point: Note the position of Fossil Butte National Monument within Fossil Lake. Many important discoveries are made by scientists and commercial quarriers on land outside of the Monument.



# Reading the Rocks

Geologists learn about Fossil Lake by studying the sediments that were deposited and lithified (turned into rock). When you look at Fossil Butte, can you see differences in the layers? Draw lines from the chart to label the rocks in the image.

Green River Formation	Angelo Member Pale dolomite and softer, silty limestones
	Fossil Butte Member Steep, yellow limestone cliffs interbedded with volcanic ash
	Road Hollow Member Limestone cliffs, dark shale, and sandstone
	Wasatch Formation Soft, red muds and clays



Which is the oldest layer? (Hint: which was deposited first?) \_\_\_\_\_

Which member of the Green River Formation contains the fossil-rich “18-inch layer” and the “sandwich beds”? \_\_\_\_\_

Sediments of the \_\_\_\_\_ Formation were deposited by streams, while sediments of the \_\_\_\_\_ Formation settled to the bottom of Fossil Lake.

Now draw lines from Fossil Butte on the left side of the image to connect with the same limestone outcrops on the other side of the valley.



What happened to the rock layers and fossils that once lay between the ridges?

\_\_\_\_\_  
\_\_\_\_\_

Thinking point: “Stratigraphy” is the scientific description of strata, or layers. Stratigraphers identify and sequence units by studying the composition and relative position of rock layers.

# Fossils, Fossils Everywhere!

Paleontologists are scientists that study fossils—evidence of ancient life. The first step to paleontology is finding fossils. Here at Fossil Butte, researchers look for specimens by carefully turning over layers of rock in a scientific quarry. Each time they find a fossil, they take notes on its location within the quarry.

Use these notes to sketch out a quarry layer on the next page. Then answer the questions.

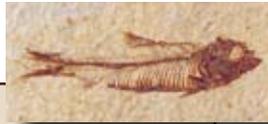
Specimen #1 (Example)  
Species: *Knightsia eocaena*  
Size: 5 cm  
Location: A1-B1  
Orientation: NE



Specimen #2  
Species: *Knightsia eocaena*  
Size: 6 cm  
Location: D1-E1  
Orientation: E



Specimen #3  
Species: *Knightsia eocaena*  
Size: 5 cm  
Location: E1-E2  
Orientation: SW



Specimen #4  
Species: *Diplomystus dentatus*  
Size: 10 cm  
Location: B2-B3  
Orientation: S



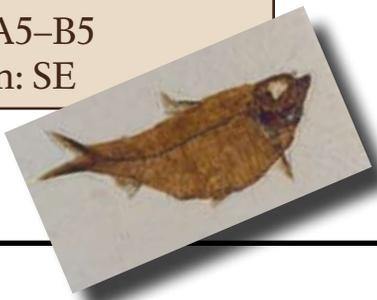
Specimen #5  
Species: *Knightsia eocaena*  
Size: 4 cm  
Location: C3  
Orientation: NW



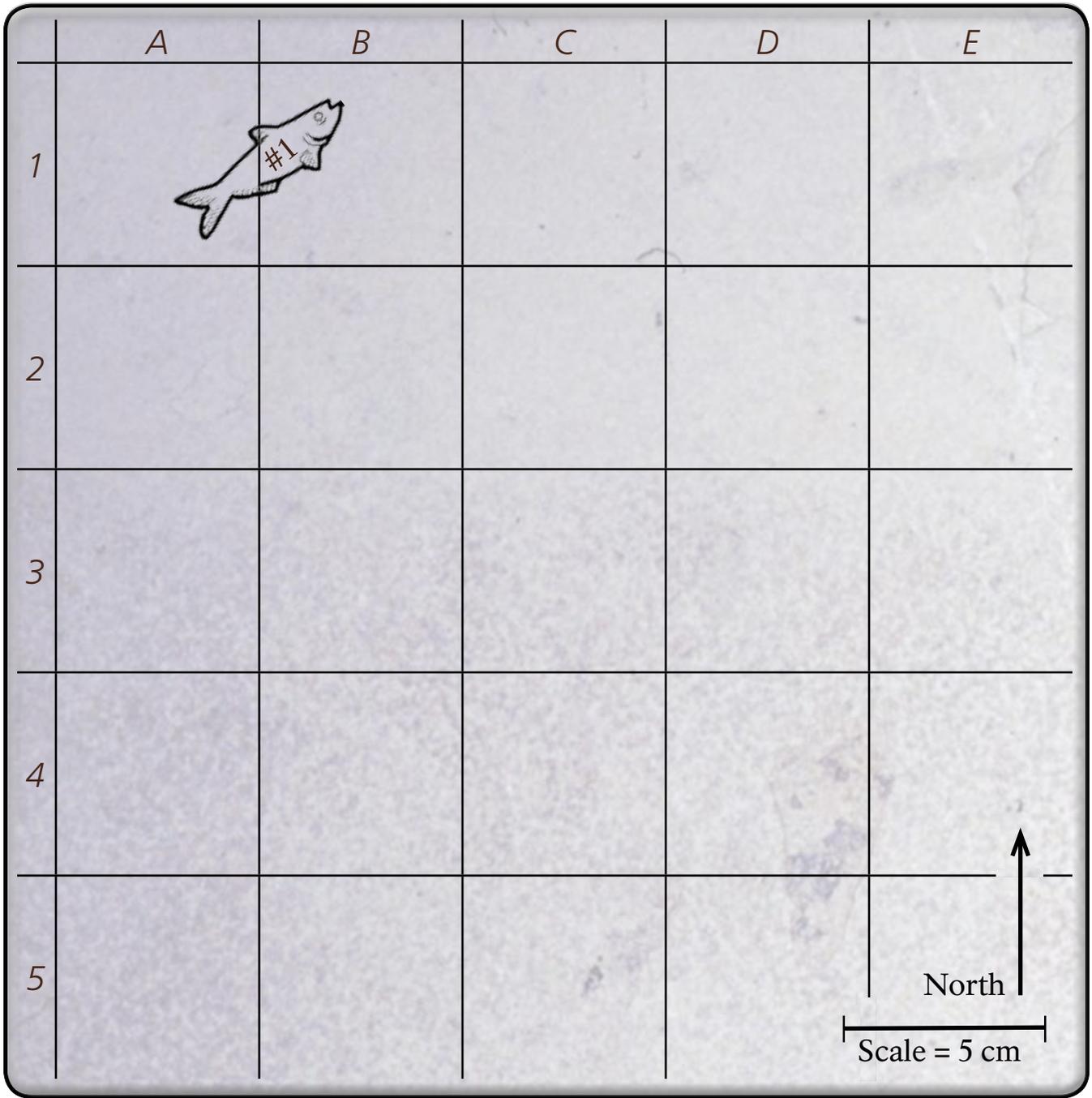
Specimen #6  
Species: *Phareodus testis*  
(Partial: head and some spine)  
Size: 13 cm  
Location: C4-E4  
Orientation: W



Specimen #8  
Species: *Knightsia alta*  
Size: 6 cm  
Location: A5-B5  
Orientation: SE



Specimen #7  
Species: Something rare! Have you found an insect? A seed? Part of a turtle? Or is it just a fish scale or coprolite?  
Location: C5-D5



Which species is the most abundant? \_\_\_\_\_

Why are some types of fossils common while others are rare?

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Thinking point: Why do paleontologists take the time to record the exact location and orientation of each fossil?

# What Is It?

After finding a fossil, paleontologists have to identify it. What do you think these fossils are? (Note: they are not to scale. If you need help, you can look at the exhibits in the visitor center.)



Thinking point: Science is a self-correcting process. As paleontologists find more fossils and develop better techniques for analysis, they frequently reassess previous hypotheses. In so doing, they enhance overall understanding of ancient ecosystems.

# Find the Fossil

Connect the dots to reveal the fossil.



Now search the visitor center to find the fossil. What kind of fish is it? Fill in the letters below.

\_\_\_\_\_

What shape are the fish's scales? Circle the correct shape below. If you'd like, you can draw scales on the dot-to-dot fossil.



Why would a fish have such thick scales?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Fossil Preparation

Can you see the spine of a fish in this rock? This is what fish often look like when found in Fossil Butte's scientific quarry. The specimens you see on exhibit in the visitor center look very different because a preparator has carefully removed layers of rock from the spine, head, tail, ribs, and fins.

Put the following images in order from #1-6.



#



#

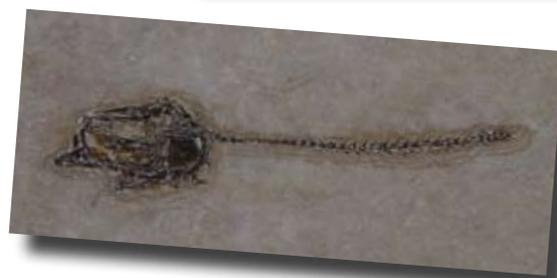


#

#



#



#

It may look easy, but preparators have to be careful not to damage delicate parts. Ask a ranger at the information desk to teach you a method for preparing a fossil.

Thinking point: For every hour that paleontologists spend hunting for fossils in the field, they have to spend many, many more inside preparing and studying specimens.

# Fossil Collector Biography

Complete the story about one of the first fossil collectors in Fossil Basin using the hints in parentheses or by referring to the word bank.

52,000,032	40	coal
museums	wheelbarrow	penknife
Kentucky	prepared	tent
Fossil Butte National Monument		

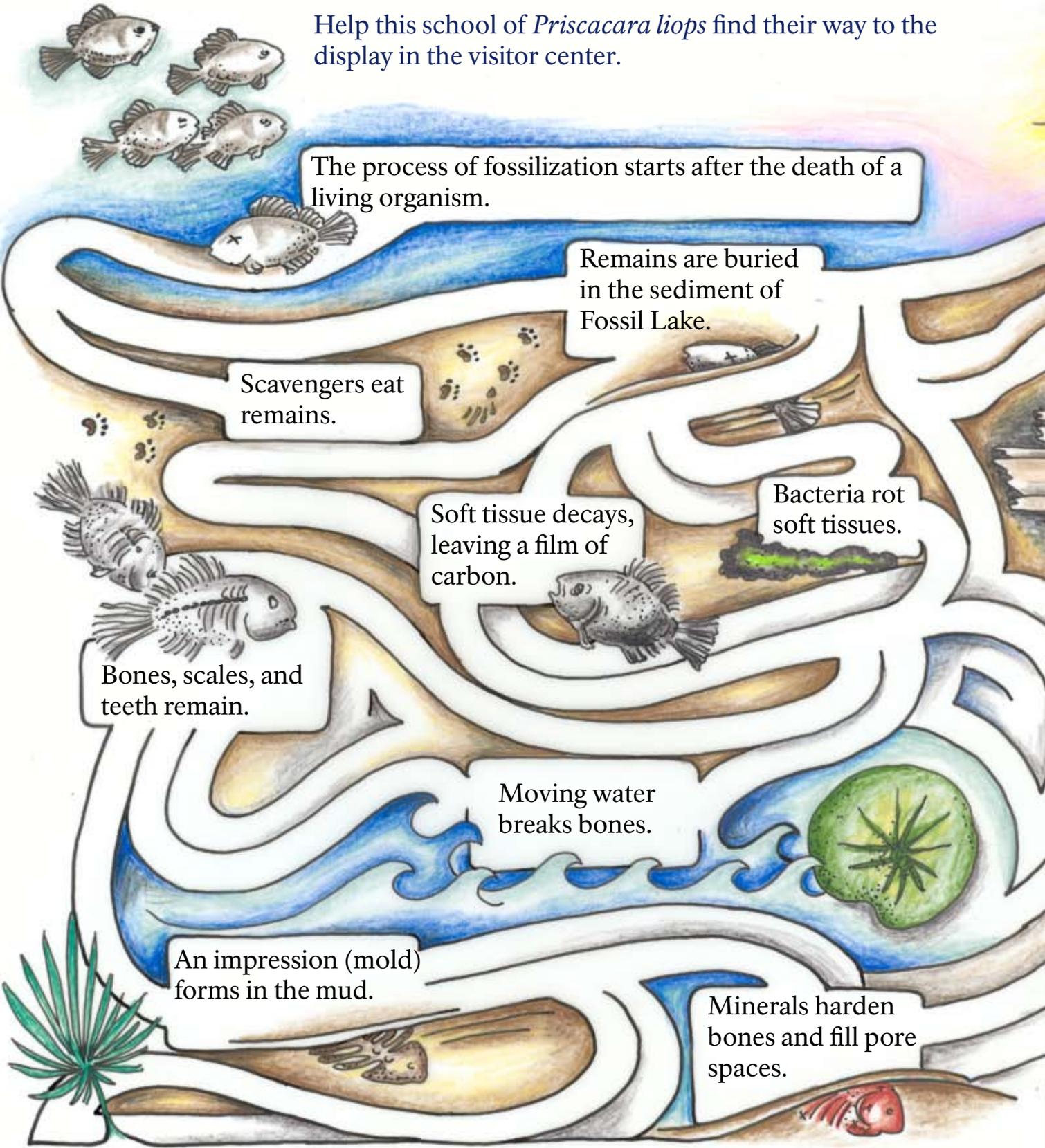


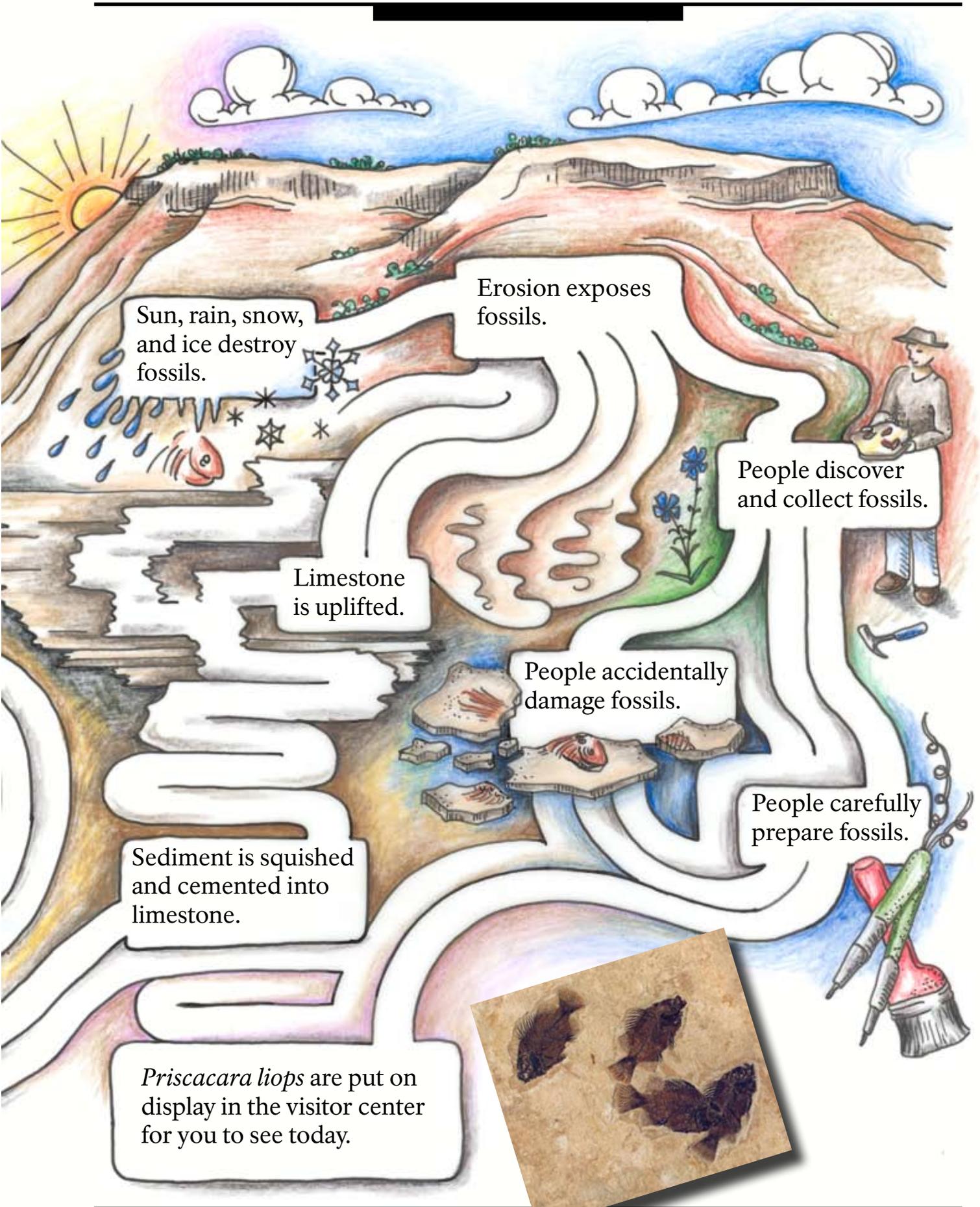
Robert Lee Craig came to Wyoming from \_\_\_\_\_ [state] in 1886. After losing his right leg while working in a \_\_\_\_\_ [fossil fuel] mine in nearby Diamondville, he decided to become a fossil collector. Every day for the next \_\_\_\_\_ [number] years, he pushed a \_\_\_\_\_ [noun] up the cliff to his quarry and dug for fossils by hand. In the evenings, he sat in his \_\_\_\_\_ [shelter] and used a \_\_\_\_\_ [tool] to remove layers of rock from the fossils. When his specimens were ready, he sent them to universities and \_\_\_\_\_ [type of place] all over the world. He once sent a fish to the Smithsonian Institute in Washington, D. C. with a label saying it was 750,032 years old—he had been collecting for 32 years, so he added that to the hypothesized age of the fossil. Scientists today know that the fish were alive 52,000,000 years ago, so Robert Lee Craig would label them as \_\_\_\_\_ [number] years old. In working so hard and sharing his discoveries, Robert Lee Craig helped the world recognize the abundance, diversity, and exceptional preservation of fossils at what is now \_\_\_\_\_ [a very special place].

Thinking point: To see firsthand where an early fossil collector lived and worked, hike the 2.5-mile Historic Quarry Trail up to David Haddenham's cabin and an old dig site. Be sure to wear sturdy shoes and bring lots of water!

# A-mazing Fossilization

Help this school of *Priscacara liops* find their way to the display in the visitor center.





Sun, rain, snow, and ice destroy fossils.

Erosion exposes fossils.

People discover and collect fossils.

Limestone is uplifted.

People accidentally damage fossils.

People carefully prepare fossils.

Sediment is squished and cemented into limestone.

*Priscacara liops* are put on display in the visitor center for you to see today.



# Species Past and Present

Paleontologists find and identify fossils to learn about ancient ecosystems. Which of these plants and animals lived here 52–50 million years ago?

Search the list below for fossils that have been found here, then circle them in the word search.



crocodilian

mountain lion

damselfly

palm frond

elk

prairie dog

gar

pronghorn antelope

horse

red-tailed hawk

jackrabbit

sagebrush

*Knightsia eocaena*

softshell turtle

lily pad

stingray

magpie

wheatgrass



g e r c r o c o d i l i a n d  
a n e a c o e a i t h g i n k  
r h s s p e m o l i c r o t a  
l m e c a s s t i n g r a y l  
k v a j e d p e t a f h l i o  
r s d l t r y d i m n o s s d  
s o f t s h e l l t u r t l e  
v l e d t y r a a o l s t a d  
y v l i l y p a d s h e p n c

Describe the environment in which these fossil species lived.

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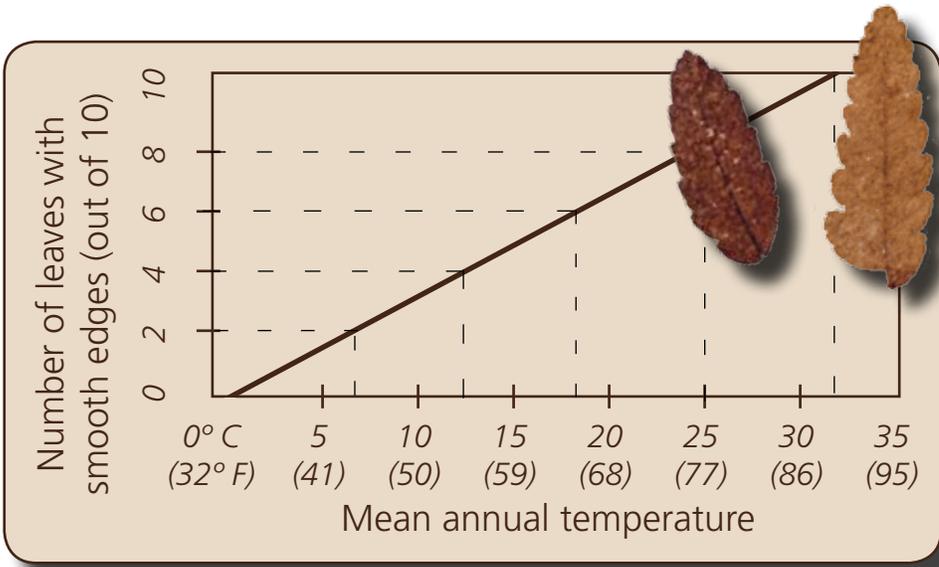
The remaining plants and animals are part of the modern ecosystem at Fossil Butte. How is it different?

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Thinking point: The natural processes that drive environmental change continue today. How are humans influencing these processes?

# Leafy Thermometers and Rain Gauges

Scientists can learn about past and present climates by studying leaves from flowering trees and shrubs. In areas with high temperatures, leaves have smooth margins rather than serrated (toothed) edges. In places where it rains a lot, leaves grow larger. Use the images of fossil leaves and the charts to determine what the climate was like here 52-50 million years ago.



Number of leaves with smooth edges: \_\_\_\_\_

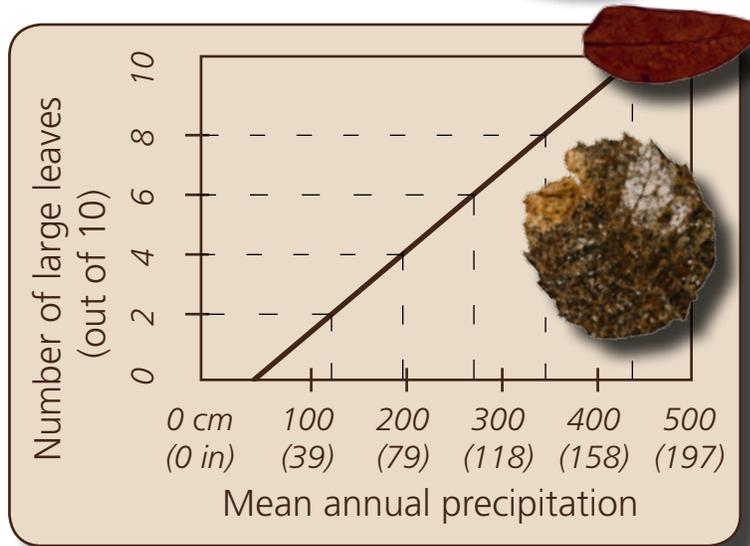
Mean annual temperature: \_\_\_\_\_



Number of large leaves: \_\_\_\_\_

Mean annual precipitation: \_\_\_\_\_

Today, Fossil Butte has a mean annual temperature of 4° C (39° F) and annual precipitation of 27 cm (10.7 inches).

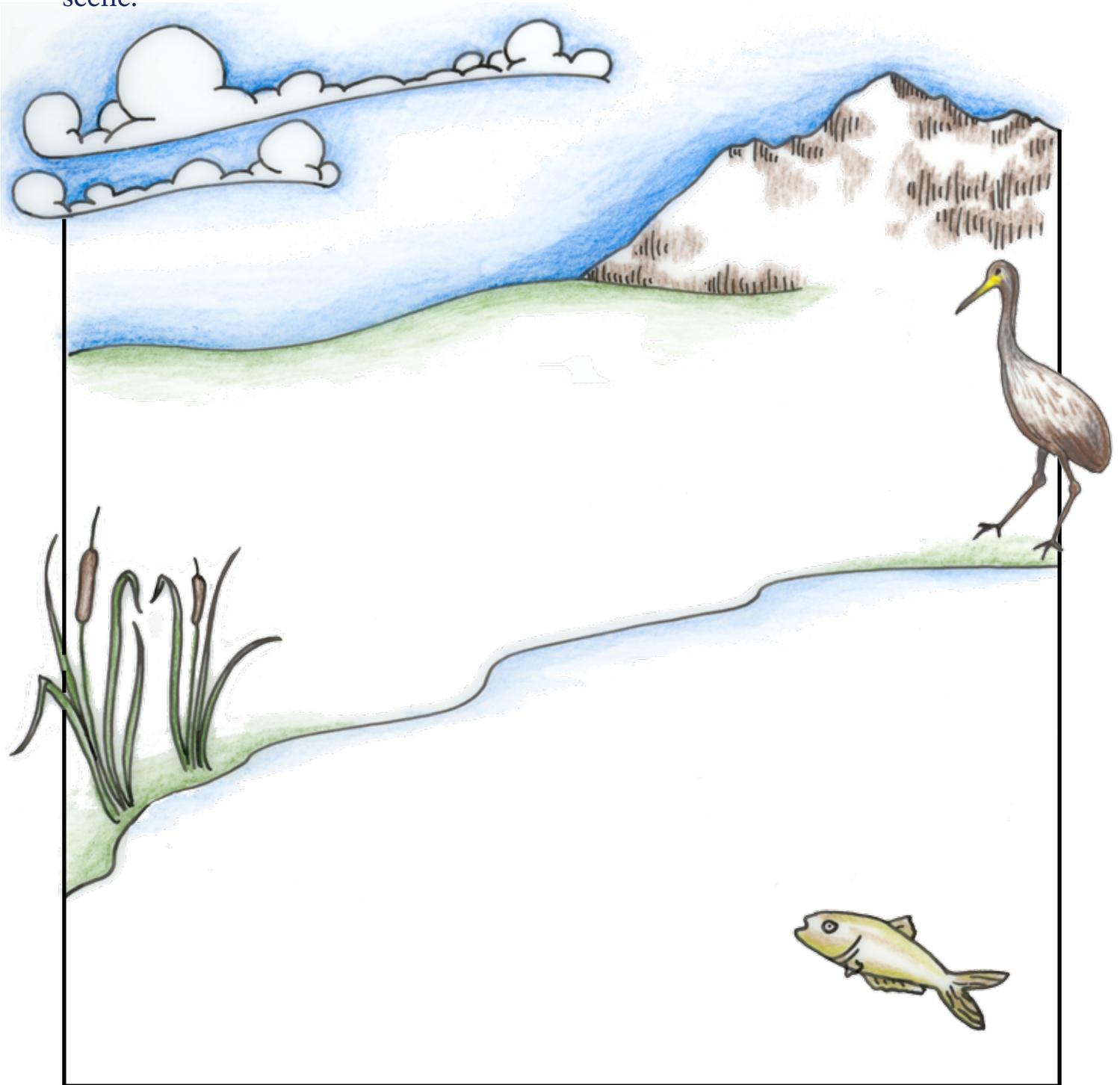


Was the past climate (circle one): colder or warmer? wetter or drier?

# A Scene from Fossil Lake

Although fossils here are well preserved, there are still many questions about how these ancient organisms lived. For example: What did animals eat? Where did plants grow? How were they colored and patterned?

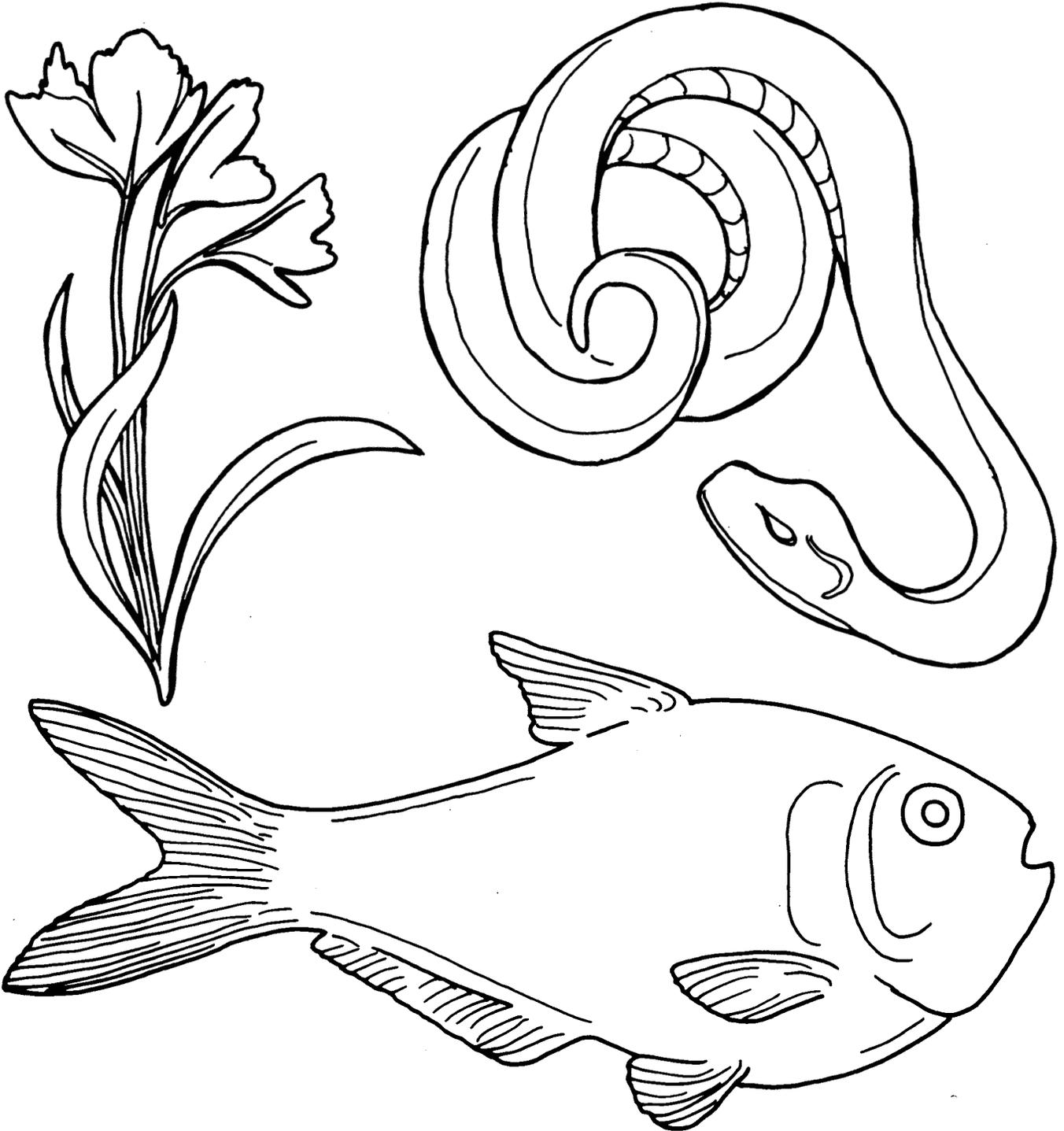
Bring some of the fossils in the visitor center back to life by drawing them in this scene.



# Coloring the Past

Even if paleontologists find fossils complete with scales, feathers, or leaves, it is hard for them to tell what plants and animals used to look like.

Choose colors and patterns for this flower, snake, and fish.



# The National Park Service Mission



The National Park Service was established in 1916 “...to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

Hike one of the trails, watch the orientation video, and/or listen to a ranger presentation, then answer the following questions:

What *scenery* did you enjoy at Fossil Butte?

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What did you learn about a *natural object*?

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*A historic object?*

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Name any *wild life* you saw.

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How will you help us conserve Fossil Butte for future generations?

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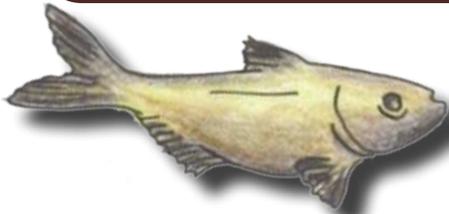
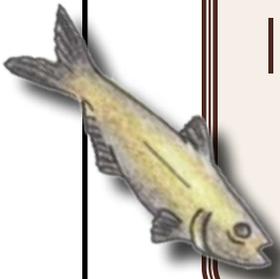
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Thinking point: Fossil Butte National Monument was established on October 23, 1972 “...to **preserve** for the benefit and enjoyment of present and future generations outstanding paleontological sites and related geological phenomena, and to provide for the display and interpretation of scientific specimens...” [emphasis added]. Why is the word “preserve” used instead of “conserve”?



As a Junior Ranger,  
I, \_\_\_\_\_, promise  
to have fun exploring,  
learning about, and protecting  
special places like Fossil Butte  
National Monument.



Confirmed by Ranger \_\_\_\_\_

on this, the \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_





Fossil Butte National Monument  
Kemmerer, Wyoming

15 miles west on Highway 30

(307) 877-4455

<http://www.nps.gov/fobu>