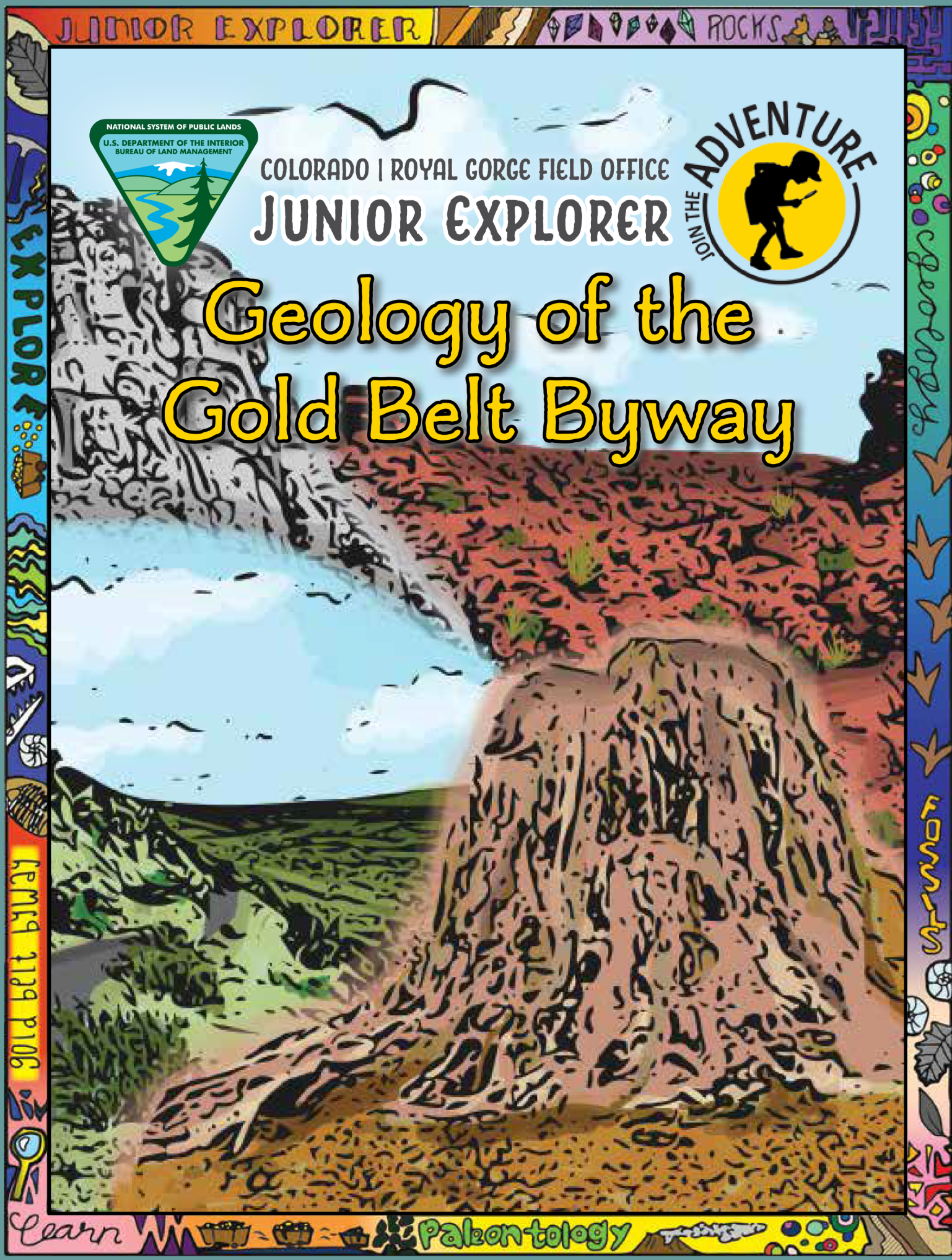
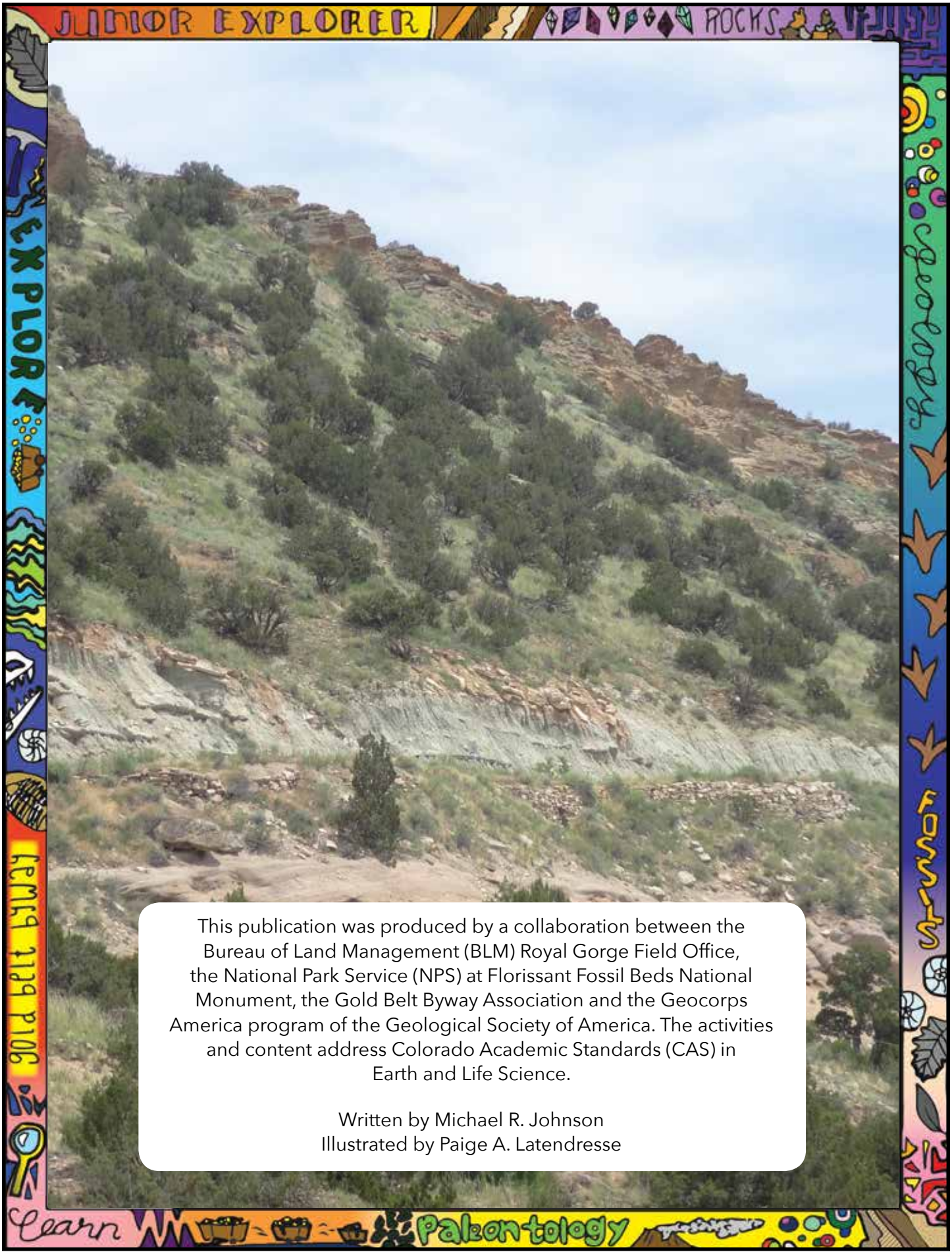

JUNIOR EXPLORER
ROCKS
NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
COLORADO | ROYAL GORGE FIELD OFFICE
JUNIOR EXPLORER
JOIN THE ADVENTURE
Geology of the Gold Belt Byway
EXPLORE
Geology
Gold Belt Byway
FOSSILS
Learn
Paleontology



This publication was produced by a collaboration between the Bureau of Land Management (BLM) Royal Gorge Field Office, the National Park Service (NPS) at Florissant Fossil Beds National Monument, the Gold Belt Byway Association and the Geocorps America program of the Geological Society of America. The activities and content address Colorado Academic Standards (CAS) in Earth and Life Science.

Written by Michael R. Johnson
Illustrated by Paige A. Latendresse

Public Lands Belong to You!

The BLM is a federal government agency that takes care of more than 245 million acres of land. Most of these lands are in the western part of the United States. These lands are America's public lands, and they belong to all Americans. These public lands are almost equal in area to all the land in the states of Texas and California put together.

The BLM manages public lands for many uses. The lands supply natural resources, such as coal, oil, natural gas and other minerals. The lands provide habitats for plants and animals. People enjoy the big open spaces on public lands. BLM lands also contain evidence of our country's past, ranging from fossils to Indian artifacts to ghost towns. On BLM lands, fossil bones, teeth, turtle shells and other vertebrate fossils must be left where they are, but clams, snails and other invertebrates may be collected. When it doubt, leave it be!

Junior Explorers

The BLM's Junior Explorer program helps introduce young explorers like you to the lands and resources the BLM manages. This guide to the Gold Belt Tour National Scenic Byway will help you to understand what rocks and fossils tell us about Earth's past. You will also visit several spectacular locations, and learn where to find even more.

Earning Your Junior Explorer Badge

You can work through the activities with an older sibling, parent, or an adult you know.

If you are 9-12 years old, you can try them on your own.
If you are 10 to 12 years old, complete fifteen activities.
If you are 8 to 9 years old, complete nine activities.
If you are 4 to 7 years old, complete five activities.

At least one activity should be a special Onsite Activity (at Florissant or Skyline Drive). When you complete the activities, check them against the Answer Key in the back of the booklet. Then say the Junior Explorer pledge on page 28 and sign the certificate. You can take the certificate to the Visitor Center at Florissant Fossil Beds National Monument, or bring it or mail it to: BLM Royal Gorge Field Office | 3028 E Main St., Cañon City, CO 81212 | phone: 719-269-8500.

Be a Scientist!

Rocks and fossils are a record of the past. Geologists are scientists who know how to read rocks like a book to learn about the ancient surface of the Earth. Paleontologists are scientists who find fossils, and learn about life on Earth long ago. In this guide, you will learn how to read the rocks and study fossils just like those scientists, and then you can tell the story of how Colorado has changed through time!

THE Gold Belt Byway

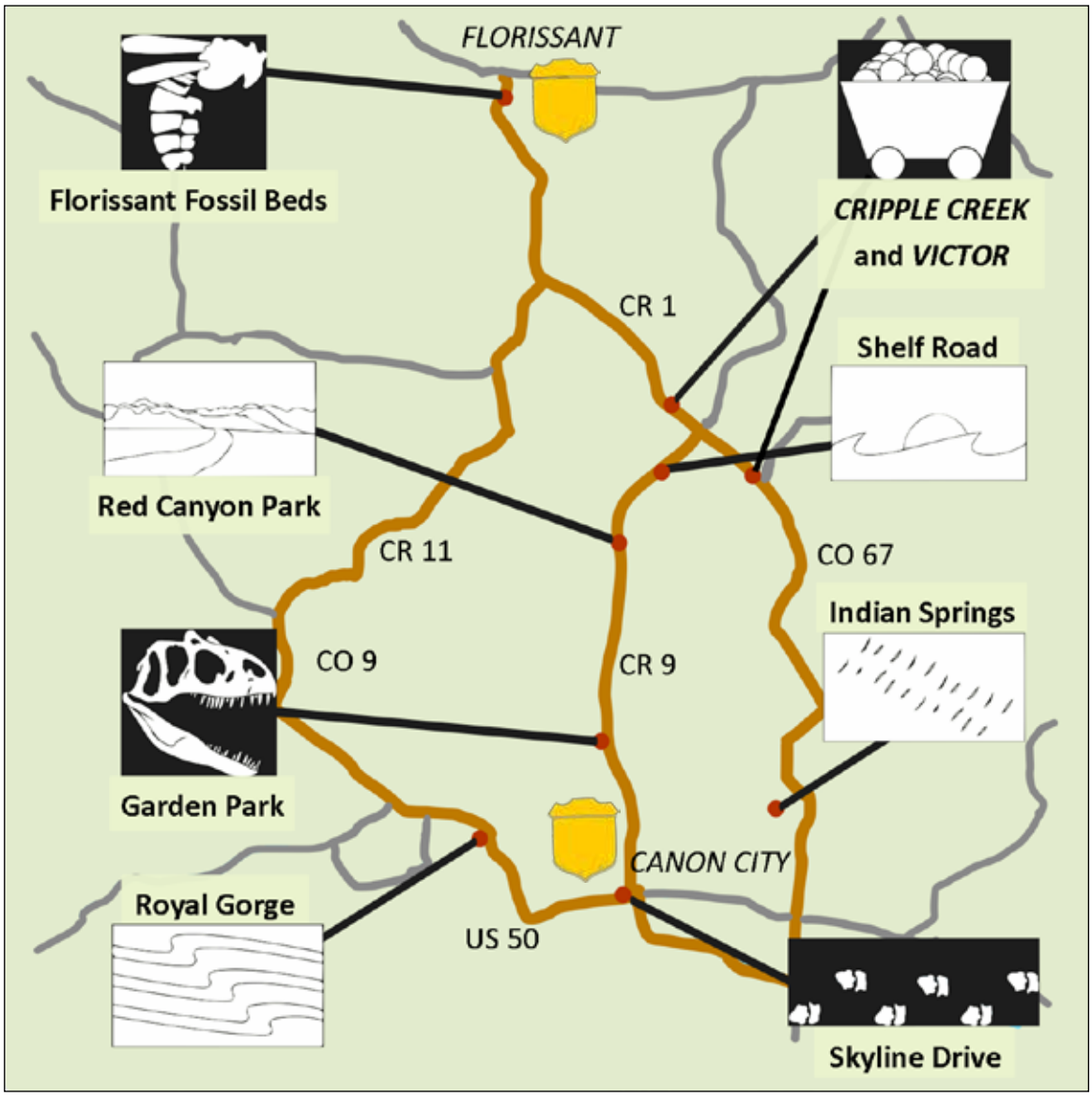
You will visit seven different places in this book that you can also see in person. These sites are part of the Gold Belt Tour National Scenic Byway, which is named for Colorado's rich mining history. But these rocks have more than just gold to offer!

Visiting BLM Lands

Many of these locations are on public lands managed by the BLM. You are welcome to visit, but please remember that these lands belong to all of us! As you read this book, you will learn that there are rules for collecting fossils on public lands. Be sure to follow those rules so others can enjoy the land too!

Maps can show not just where to go, but also what you'll find there. Each site in this book has a certain color that matches the age of the rocks at that site. **Color each site with its special color as you read about it.**

***Adults!** Detailed directions to each location can be found in the back of this book.



FUN FACTS

Each of the seven places in this book has its own story to tell.

Florissant National Monument

The Florissant Fossil Beds were discovered in the 1860s, but only became a National Monument in 1969 after a campaign led by scientists and environmentalists like Estella Leopold, Beatrice Willard, and Vim Wright.

Cripple Creek and Victor

When first mined in the late 19th to early 20th Centuries, the mines near Cripple Creek produced 22 million ounces of gold. That's more than 100 elephants, and it would take 28 semi-trucks to move all that gold! Mining for gold continues in the area today!

Shelf Road

The narrow, winding, Shelf Road was the first road connecting Cripple Creek to the Arkansas River Valley. Imagine traveling that road with just a horse and wagon!

Garden Park Area

The Marsh-Felch Quarry and the Cope Quarries were discovered in the late 19th Century as part of the "Bone Wars," a race between Othniel Charles Marsh and Edward Drinker Cope to find the most dinosaurs.

Skyline Drive

The rocks at the top of Skyline Drive were formed on an ancient beach. If you looked to the east in the Cretaceous Period (150 to 65 million years ago), you would be looking across a sea!

Royal Gorge

Royal Gorge was discovered in 1806 by Lt. Zebulon Pike, who thought the gorge was completely impassable. Today the gorge can be crossed by bridge, train, cable car, or zipline.

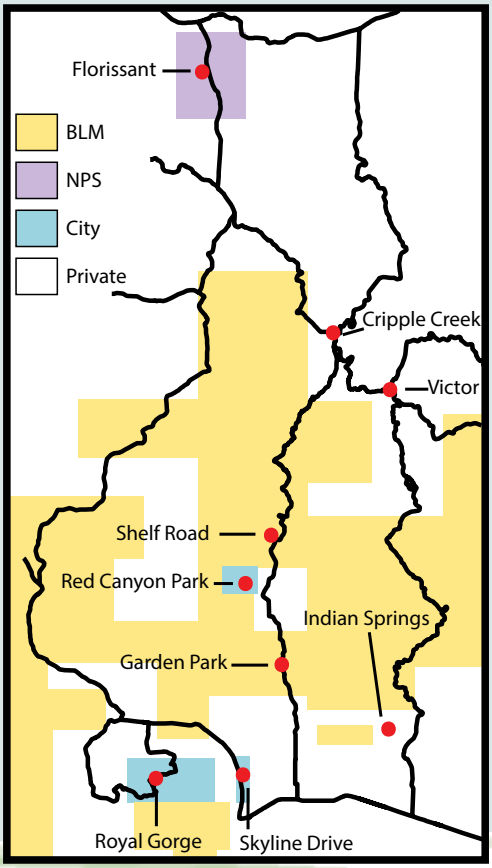
Indian Springs

The trace fossils at Indian Springs are the best in North America! Because they are so unique, the site was made a National Natural Landmark in 1979.

Activity - Public and Private Lands

This book takes you to lands owned by many different agencies and people. There are different rules and laws for collecting fossils on public lands (BLM), national parks (NPS), city property and private land. **Read the chart to learn the different rules, and look at the colors on the map to see who owns what land. Then, match each location in this book to its owner and rules.**

OWNERSHIP	RULES	LOCATIONS
BLM	You must have a permit from the BLM to collect fossil bones and teeth, but you may collect fossil shells and plants.	_____
NPS	You may not collect fossils or even rocks.	_____
City of Cañon City	You must have a permit from the city to collect fossil bones and teeth, but you may collect fossil shells and plants.	_____
Private	You must ask the landowner's permission.	_____



This map is a simple picture of land ownership for the places in this book. Check an official map if you want to visit other places.

Geologic Time

When a geologist studies a rock, it is like reading one chapter in a very long book. Usually, a geologist can only read one or two chapters at a time. How do they figure out what order the chapters go in? They use the **Geologic Time Scale**! The Geologic Time Scale is like a table of contents that allows geologists to figure out which rocks are older and which rocks are younger. Each location that you visit in this book has its own **Geologic Age** that you can use to put them in order.

Words to Know

Geologic Time Scale – How geologists order Earth's vast history into smaller periods of time. It acts like a huge calendar.

Geologic Age – A particular period of time on the Geologic Time Scale. Each Geologic Age has its own special color.

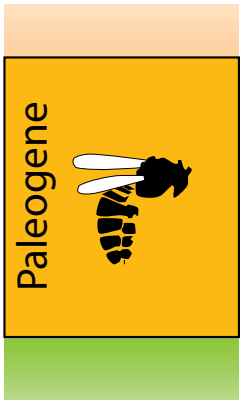
Ga – An abbreviation that means "billions of years ago."

Ma – An abbreviation that means "millions of years ago."

Eon	Era	Period	
Phanerozoic	Cenozoic	Quaternary	Today
		Neogene	
		Paleogene	65 Ma
	Mesozoic	Cretaceous	
		Jurassic	
		Triassic	251 Ma
	Paleozoic	Permian	
		Pennsylvanian	
		Mississippian	
		Devonian	
		Silurian	
		Ordovician	
		Cambrian	542 Ma
Precambrian			4.6 Ga

Florissant Fossil Beds National Monument

Paleogene (34 Ma)



Florissant Fossil Beds National Monument is famous for its **fossils**. These fossils belong to a smaller geologic age in the Paleogene called the Eocene Epoch. Some of the fossils you can find include spiders, wasps, birds, and even giant **petrified** tree stumps. Fossils are very difficult to make. An animal or plant has to be buried before anything comes along to eat it or step on it, and then survive millions of years of **weathering** and **erosion**. Even then, we usually only find the "hard parts:" bones, teeth and shells. The Florissant Fossil Beds are a very special kind of fossil discovery called a **lagerstätten** (LAH-ger-SHTAH-ten). This means they contain many fossils that are very well-preserved, and even include fragile insect wings, leaf impressions and feathers!

Words to Know

Fossil – The remains or signs of a living thing that have been turned to stone.

Petrified – Turned to stone.

Weathering – Breaking apart a rock. May happen by cracking and shattering the rock, or dissolving it.

Erosion – Carrying away sediment by wind, water, or ice.

Lagerstätten – A rich deposit of very well-preserved fossils.

ONSITE

Activity 1 – Visiting the Visitor Center

The Visitor Center can show you a lot of fossils, and explain what they tell us about the past. As you explore the center, **answer these questions about Florissant:**

How old are the Florissant Fossil Beds?

What are "diatoms?"

How was the climate of Lake Florissant different from today?

What clues do paleontologists use to figure out past climate?

What is a "regurgitalite"?

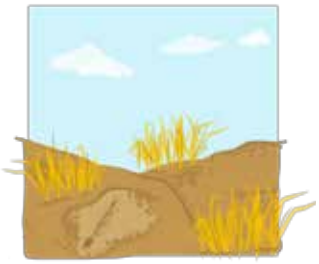
What kinds of rocks preserve the fossils at Florissant?

How Do You Make a Fossil?

The fish dies and sinks to the bottom of the lake.

Its flesh rots away, but the bones stay behind.

The bones are buried, and turn to stone over a very long time.



The bones are later exposed by wind and rain, and can be discovered by paleontologists.

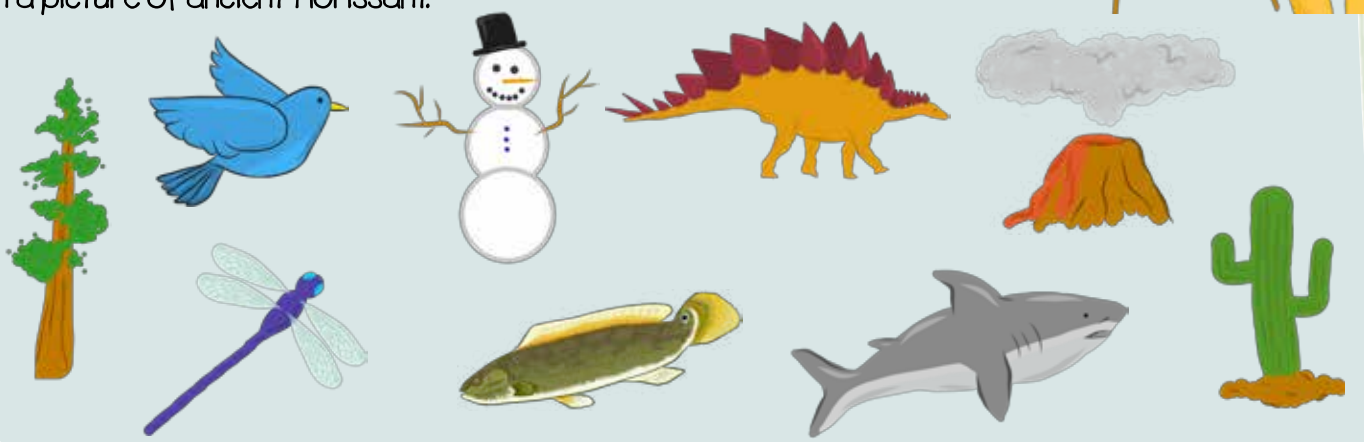
ONSITE

Activity 2 – Amazing Fossils

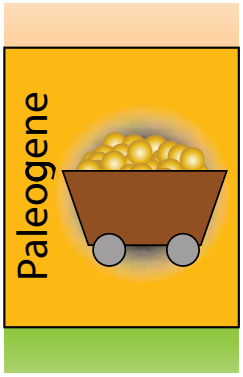
Usually, big, tough bones become fossils more easily than small, delicate bones. But at Florissant we find incredible fossils of fragile things like plant leaves and insects that leave paleontologists in awe. Which Florissant fossil is your favorite? **Draw it to the right!**

Activity 3 – Going Back in Time

The mix of insects, leaves and trees tells paleontologists that there was once a tall forest here, and the climate was warmer than today. The thin layers of rock tell geologists that there was a lake next to the forest with a volcano very nearby. Look at the pictures below, and **cross out what doesn't belong in a picture of ancient Florissant.**



Cripple Creek and Victor
Paleogene (33 Ma)



Cripple Creek and Victor are famous for their gold mines. Some of the historic mines went as deep as 3,350 feet below the surface. You can see the historic mining structures throughout the area, many of them accessible by hiking trails. To learn more about mining history of the area visit the Victor Lowell Thomas Museum or go to the Independence Mill Site to walk multiple interpretive trails and see historic buildings.

Words to Know

Granite – A type of rock that forms when magma cools underground. It is usually pink and white with smaller black spots.

Gneiss – A type of rock that forms when granites are squeezed and heated deep underground. They usually have pink and black stripes.

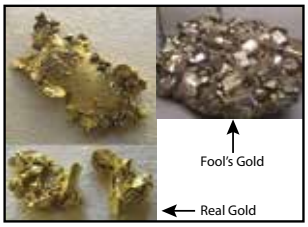
Magma – Hot, molten rock found deep underground. If it comes to the surface, it is called lava.

Breccia – A type of sedimentary rock made of big, sharp pieces of rock that have been squeezed and fused together.

Dike – A type of intrusion that comes up in a narrow sheet like a wall.

Vein – A narrow line of valuable metal like gold.

Pyrite – Fool's Gold! Where do you think it gets this nickname?

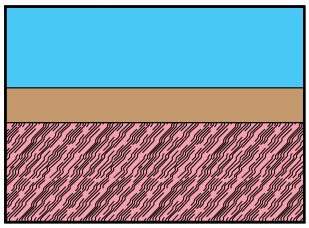


These volcanoes also produced a mineral that geologists call **pyrite**. Miners called it "Fool's Gold."

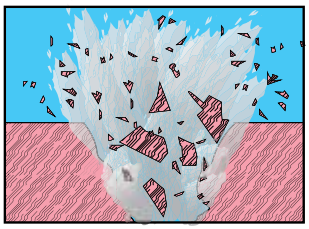
In the mining district take care and stay on the trails!
Historic mining openings can be dangerous!

How Did the Gold Get There?

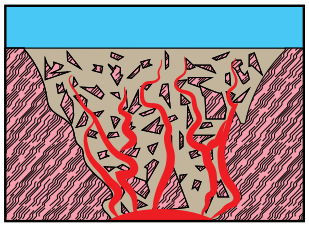
The rocks here come from two different times in Earth history. The oldest rocks are pink, black and stripey rocks called **granite** and **gneiss** (pronounced "nice") from the Precambrian (1.7 Ga). The youngest rocks, called **breccia**, come from violent, explosive volcanoes in the Paleogene (33 Ma).



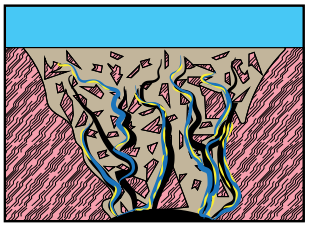
Granite and gneiss form deep underground.



Eruptions blast the granite and gneiss into small, sharp fragments.



Hot magma **dikes** force their way into the cracks left by the eruption.



Hot water seeps into these cracks, and deposits gold in **veins**.

Activity 1 – Geologic Word Search

Geologists and paleontologists use a lot of special words to describe rocks, fossils and minerals. **Find some of these words here.** Do you know what each of these words mean?

BRECCIA
CONGLOMERATE
DIKE
FORMATION
GNEISS
GOLD
GRANITE
LAGERSTATTEN
MUDSTONE
PYRITE
SANDSTONE
SHALE
TRACE FOSSIL
VOLCANO
LIMESTONE

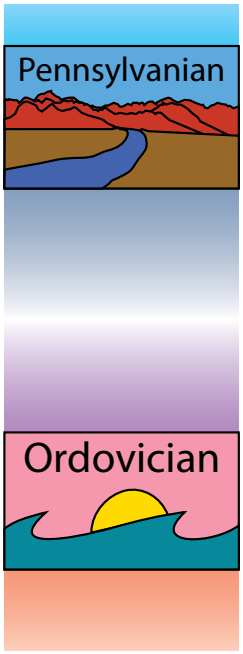
L	A	G	E	R	S	T	A	T	T	E	N
C	O	N	G	L	O	M	E	R	A	T	E
S	J	E	R	D	S	D	J	A	P	V	L
A	J	I	A	D	V	H	D	C	Y	O	I
N	B	S	N	M	H	F	E	E	R	L	M
D	B	S	I	G	E	N	S	F	I	C	E
S	O	R	T	A	O	N	E	O	T	A	S
T	C	Q	E	T	S	L	O	S	E	N	T
O	I	X	S	C	A	N	D	S	O	O	O
N	C	D	V	H	C	O	D	I	K	E	N
E	U	W	S	S	E	I	H	L	I	D	E
M	W	H	F	O	R	M	A	T	I	O	N

Activity 2 – Nobody's Fool

Miners can use geology to help them find gold, but they still need a bit of luck. Enter the mine from the top to find a gold vein, but don't waste time by digging for Fool's Gold!

Red Canyon and Shelf Road

Ordovician to Pennsylvanian (450 to 300 Ma)



Red Canyon Park gets its name from the bright red **sedimentary** rocks of the **Fountain Formation**. Sedimentary rocks can be made up of bits of older rocks that were broken up by weathering, or made from the remains of ancient life. The Fountain Formation was made by breaking down the Ancestral Rocky Mountains, a chain of mountains that grew and were eroded away long before the mountains you can see today!

The Shelf Road Climbing Area has even older **dolostone** rocks from the Ordovician Period. These rocks are the remains of an ancient coral reef. In fact, you can even see the corals still in the rock! Fossil corals look like honeycombs or beehives in the rock. In the picture below, some of the corals have been colored in. Can you see the rest? Where do you find coral reefs today? What does that mean for ancient Colorado?

Fossil Coral

Red Canyon Park

Shelf Road

Words to Know

Sedimentary rock – A rock that forms when sediment is deposited and squeezed together until it is no longer loose.

Sediment – Broken bits of rock or shell, like sand, gravel and mud.

Fountain Formation – A thick layer of red sand and gravel that was formed by ancient rivers. It can be traced all across Colorado!

Dolostone – A type of rock that formed in ancient oceans.

Formation – A layer or set of layers of rock that can be followed for long distances.

Activity 1 – What is a Formation?

Geologists divide rocks into groups called **formations** that can be followed over long distances. You can follow the Fountain Formation to many other famous places in Colorado. **Unscramble these other locations!**

Word bank: **FLATIRONS, GARDEN OF THE GODS, RED ROCKS PARK, ROXBOROUGH STATE PARK**

DRE ORCSK RPAK _ _ _   _ _ _ _ _   _ _ _ _

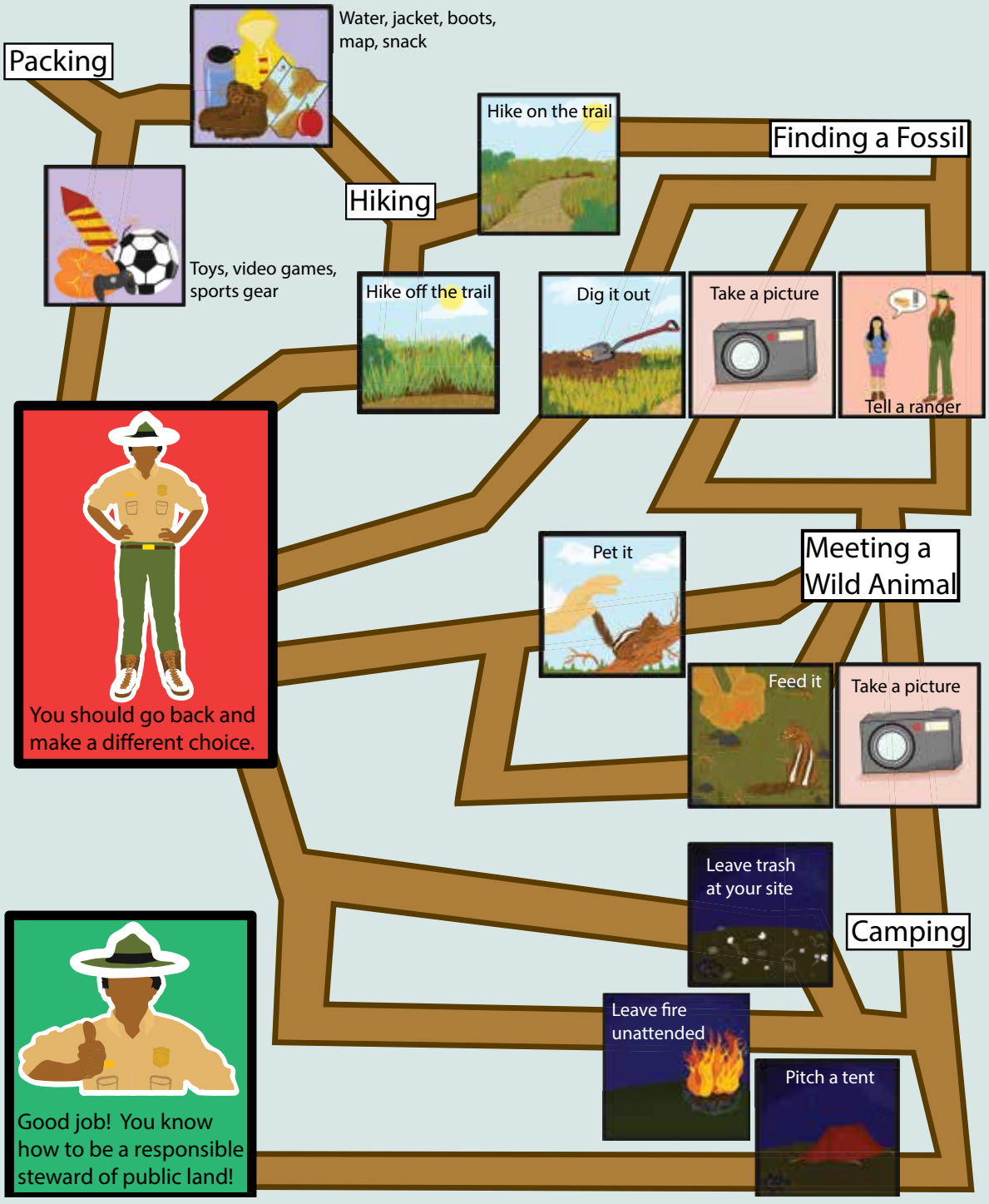
ROTINSLAF _ _ _ _ _ _ _ _ _

BOOXORRGUH ETATS AKPR _ _ _ _ _ _ _ _ _ _   _ _ _ _ _   _ _ _ _

DRANGE FO HET ODSG _ _ _ _ _ _   _ _   _ _ _   _ _ _ _

Activity 2 – Being a Good Steward

Being a good steward means helping to keep the land preserved so that the people who come after you can have the same experience that you had. Stewardship means planning carefully for your trip, and then following the hiker's motto: Take only pictures, leave only footprints. **Make choices on the hike below to be the best possible steward!** The rangers will let you know if you need to make different choices.



Garden Park Area

Jurassic (150 Ma)

The Garden Park Area has produced a lot of dinosaur fossils from the Jurassic Period. You might say this is the real Jurassic Park ©! The Marsh-Felch Quarry and the Cope Quarries were discovered at about the same time by two rival paleontologists, Othniel Charles Marsh and Edward Drinker Cope, during the "Bone Wars." They competed to see who could find the most dinosaurs, and fought each other with words, ideas and money. Although they made great contributions to science with all the fossils they found (136 new species of dinosaurs!), they weren't very good stewards; they destroyed many fossils that they couldn't collect just so no one else could find them.

O. C. Marsh

E. D. Cope

Words to Know

Outcrop – Exposed layers of rock.

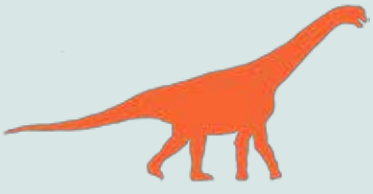
Environment – The land, climate, water and living things in a particular place.

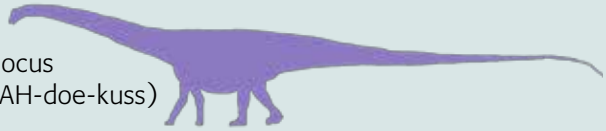
Activity 1 – Dinosaurs of Garden Park

Paleontologists know where to dig for fossils because they can usually see bones sticking out of the rock face or **outcrop. Circle the skeletons of some of Garden Park's most famous dinosaurs hidden in the outcrop on the next page!** Once you find all the dinosaurs, you can color the outcrop.

Allosaurus
(AL-oh-SORE-us)

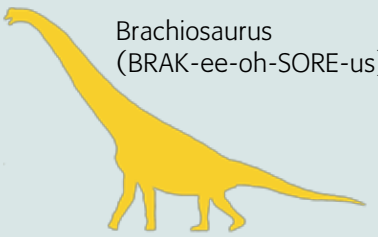
Camarasaurus
(cam-AIR-ah-SORE-us)





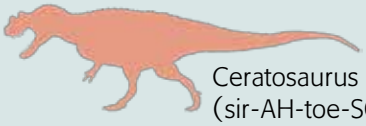
Diplodocus
(dip-LAH-doe-kuss)

Camptosaurus
(CAMP-toe-SORE-us)

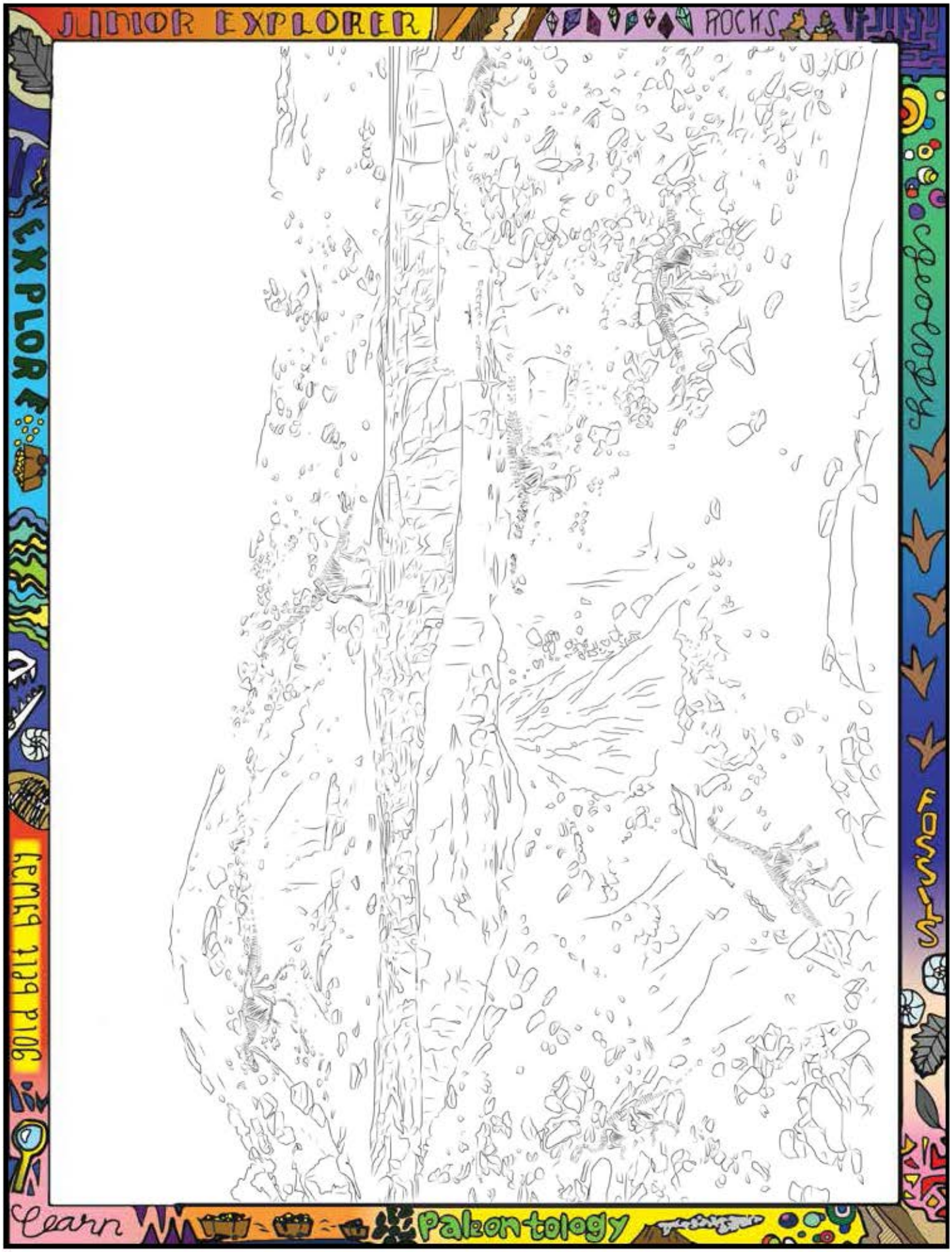


Brachiosaurus
(BRAK-ee-oh-SORE-us)

Stegosaurus
(STEG-oh-SORE-us)



Ceratosaurus
(sir-AH-toe-SORE-us)


JUNIOR EXPLORER
ROCKS
EXPLORE
Geology
Learn
Paleontology

Activity 2 – Written in the Rocks

When a geologist looks at an outcrop, she sees a story set in stone. Different types of rock tell of different **environments** in Earth's history. **Look at the chart below to learn what each type of rock means. Then, read what the geologist has to say about the Garden Park Area on the next page, and tell the story that is written in the rocks!**

ROCK NAME	WHAT A GEOLOGIST OBSERVES	THE STORY IN THE STONE
Conglomerate	"Pebbles are pretty heavy and hard to move."	"There was probably a strong river here!"
Mudstone	"Mud gets left behind by floods, but then cracks as it dries."	"This spot used to be a floodplain!"
Coal	"This rock is soft, black, sometimes shiny, and burns very easily. I'd better keep it AWAY from flames."	"Coal forms from buried plants, so I bet I am looking at a swamp!"
Shale	"This rock feels like a mudstone, but it has thin layers."	"Those layers mean the water was calm and deep, far from shore. This is the ocean!"
Limestone and Dolostone	"Limestone and dolostone form big, blocky rock walls. Sometimes I can see corals or shells in the rock."	"Coral reefs today are found in quiet ocean waters far from shore. That means that limestone and dolostone are the remains of ancient oceans!"
Sandstone	"I can easily see sand grains, but this is tricky. Beaches are made of sand, but so are river beds."	"I might be on an ancient beach, or in an ancient river. I should look at some of the other rocks for more clues."
Ash	"This might look like mud or sand, but look at these chunks of other rocks stuck in it!"	"This rock is a sure sign of a volcano!"
Granite	"This rock has big pink and black crystals in it."	"It used to be hot melted rock like lava, but because it was underground we call it 'magma.' The big crystals grew as the magma cooled slowly."

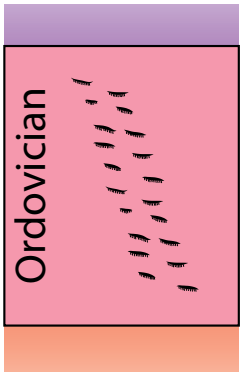
Activity 2 – Written in the Rocks continued…

Here's what the geologist observes about the rocks and fossils at Garden Park.

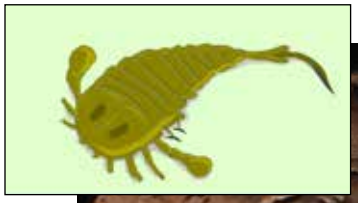
"The dinosaur bones in the Garden Park Area are usually found in sandstone. But there are also a lot of very colorful mudstones."

What did Garden Park look like in the Jurassic? Tell the story with words or by drawing a picture.

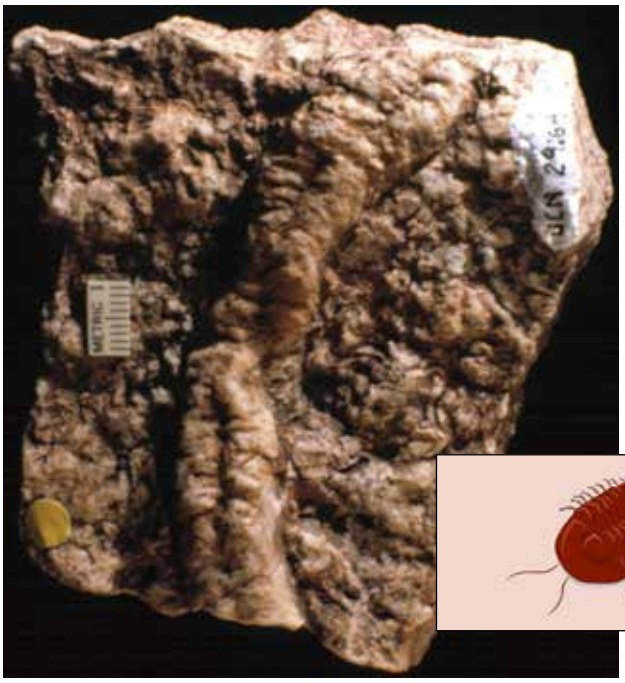
Indian Springs Trace-Fossil Site
Ordovician (450 Ma)

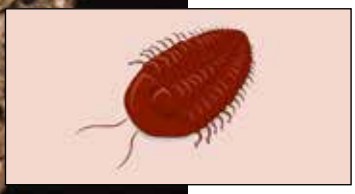


Fossils like those from Florissant and Garden Park are called **body fossils** because they are a part or the whole of an animal's body. Living things can leave other signs behind for paleontologists to discover, like footprints or burrows. These marks are called **trace fossils**, and Indian Springs has some truly remarkable examples. The trace fossils here were made by **jawless fish**, and **arthropods** like **sea scorpions**, **horseshoe crabs** or the famous **trilobites**.

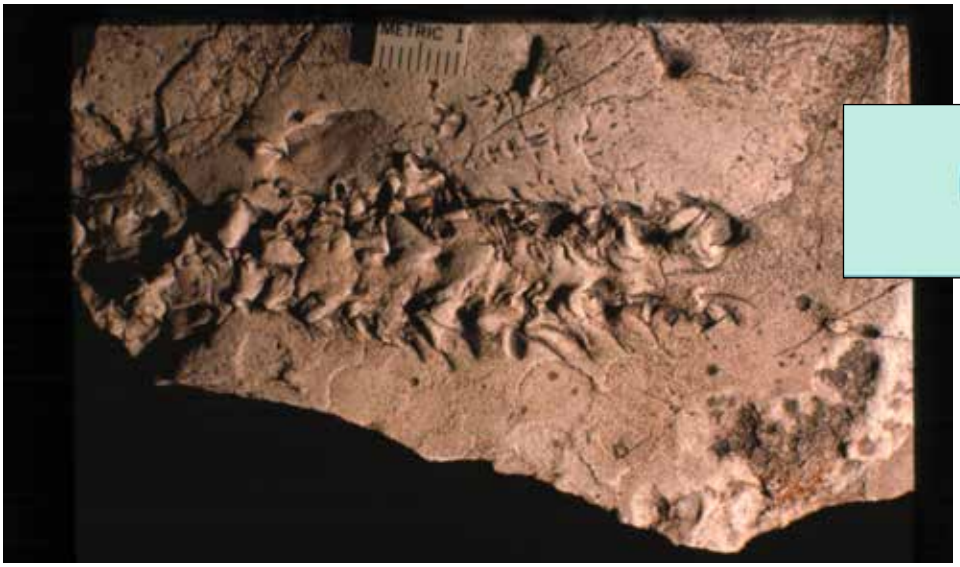


Sea scorpion





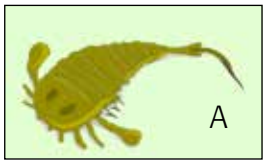
Trilobite

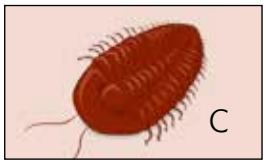


Horseshoe crab

Activity 1 – They Went That Way!

Different types of animals leave different marks in the sand or mud that can eventually become trace fossils. **Match these tracks to the animals that made them!** Look at the pictures on the previous page for hints.





Words to Know

Body fossil – A fossil that represents a part of a living thing, like a shell, bone or leaf.

Trace fossil – A fossil that represents a sign of a living thing's life, like a footprint or burrow.

Jawless fish – Very early fish that had not yet evolved jaws. They ate by sucking in food.

Arthropod – Any animal with a shell and jointed legs, like insects, spiders or crabs.

Sea scorpion – An extinct arthropod that looked like a scorpion, but didn't have a stinger. Some were bigger than a full grown person! They all died out 251 Ma.

Horseshoe crab – An arthropod that has a dome-shaped head and a long, pointy – but not poisonous – tail. They are still alive today!

Trilobite – An arthropod that came in all shapes and sizes. Some swam, some ate plants, and some ate other animals. They all died out 251 Ma.

Activity 2 – Fossils Are Signs of Life

From trace fossils, paleontologists can learn things that body fossils can't teach. Trace fossils can show how an animal moved, where it made its home, and even what it ate. Look at these fossils, and circle the trace fossils.

Footprint

Burrows

Leaf

Trilobite

Snail shell

Royal Gorge
Precambrian (1.7 Ga)

The Royal Gorge was carved by the Arkansas River beginning about five million years ago. The river now cuts as deep as 1,200 feet into the rock! The walls of the gorge are made of granite and gneiss, just like some of the rocks from Cripple Creek and Victor. These are the only rocks you will see at Royal Gorge today because the Arkansas River completely eroded all the layers that used to be on top.

What does erosion mean again?
see page 7

Words to Know

Fold – A bend in rock.

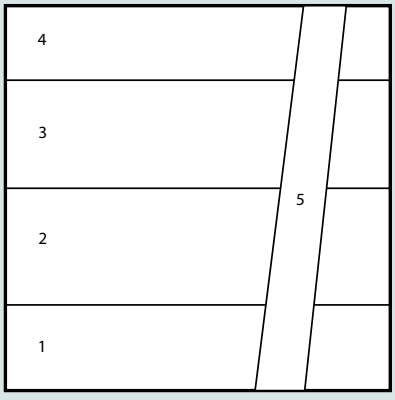
Fault – When rock layers break and move.

Cross-section – A picture that shows something from the inside as though it has been sliced in half.

Intrusion – Magma that has forced its way into another rock.

Activity 1 – Folds, Faults and Erosion

The strong forces that raised the Rocky Mountains also jumbled up the rock layers by **folding** and **faulting** them. Wind and water have also removed parts of some rock layers by eroding them. It is not always easy to read the story in the rocks when they have been damaged in these ways. Fortunately, geologists have a set of rules to help them sort things out.

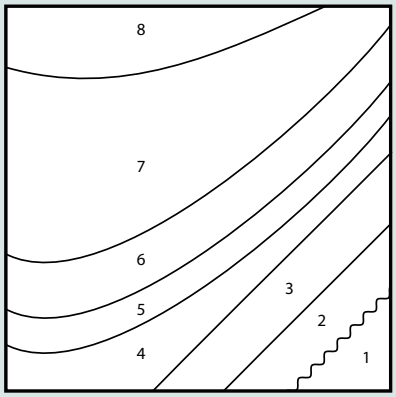


1. The oldest rocks are on the bottom.
2. Sedimentary rocks always form in flat, wide layers.
3. **Intrusions** and faults are younger than the layers they cut.

These drawings show several rock formations in **cross-section**. If we could slice into the Earth and look at it like layers in a cake, this is what we would see. The numbers show the order in which the rocks formed, from oldest (1) to youngest (5). Only after they form can the layers be folded or cut by an intrusion or fault.

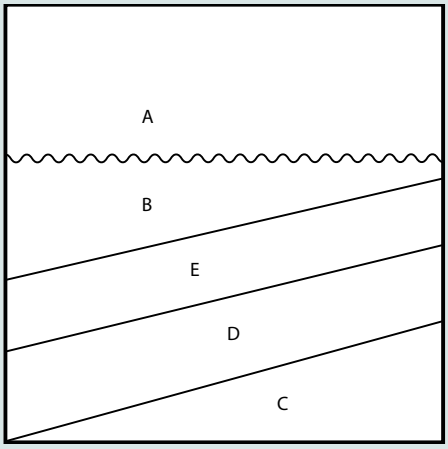
Activity 1 – Folds, Faults, and Erosion continued . . .

In this diagram, the layers are all tilted and folded. Since rocks usually form in flat, wide layers (rule 2), the folding must have happened last.



Practice reading the rocks by ordering the layers in these next drawings from youngest to oldest.

Block 1



Youngest

_____

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_____

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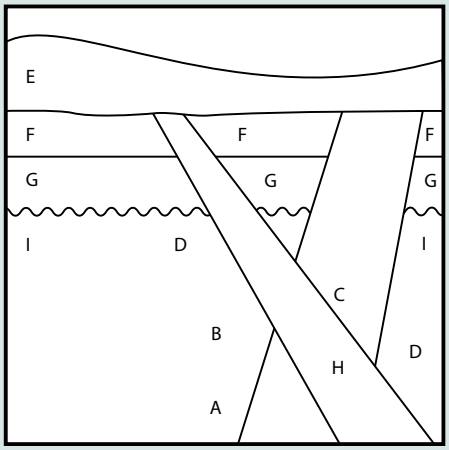
Oldest

Block 2



Youngest

_____

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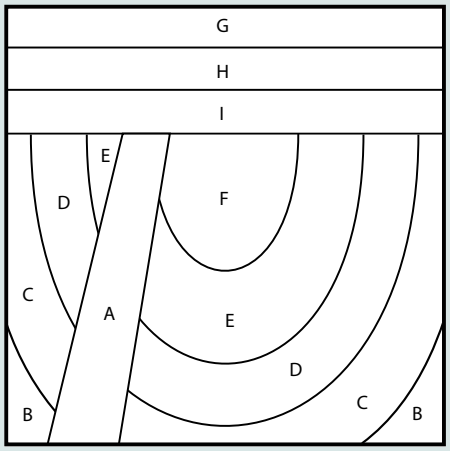
Oldest

Block 3



Youngest

_____

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_____

_____

Oldest

Skyline Drive

Precambrian to Paleogene (1.7 Ga to 60 Ma)

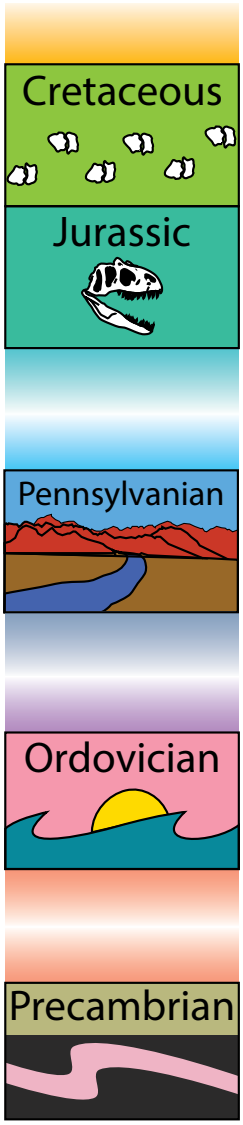
Skyline Drive wraps around a narrow ridge of rock called a **hogback**. At the top of this hogback you can look west at mountains made of Precambrian rock, or east across the Cañon City **Basin.** There are two smaller hogbacks in the basin that are made of limestone. Limestone rocks form underwater, which means Cañon City (the red dot in the map below) used to be in the middle of an ocean! Geologists call this ocean the **Western Interior Seaway** because it covered the middle of North America during the Cretaceous Period.

Words to Know

Hogback – A high narrow ridge of rock.

Basin – A low area where sediment can collect, often surrounded by mountains.

Western Interior Seaway – A warm, shallow sea that covered the middle part of North America in the Cretaceous Period (100 to 75 Ma).



Activity 1 – The Story of Colorado

Geologists can put an order to the story told by rocks by looking at big stacks of rock formations. When you look at all the layers exposed at Skyline Drive, you are looking at exactly such a stack. **Use the stack of rocks to help the geologists put their stories in order.** Look back at the chart on page 16 if you need a hint.

STORIES

ROCKS

1) "These rocks tell me there was strong river here, carrying some pretty big **pebbles** downstream."

_____

2) "Ooh, I wish I could have been here in the past. I would have been floating in a nice **warm ocean**. And look at these neat **corals**!"

3) "I think I'm in the sea, too! But this rock has a lot of **muddy layers** in it."

_____

4) "I'm on dry land here. See these **cracks in the mud**? Oh, there might have been a **river** nearby, too!"

5) "It's a good thing I packed sunscreen, because I'm on a nice **sandy beach**! I can tell because some of these other rocks are from **deeper water**."

_____

6) "Even though this rock is on the surface now, it formed **deep underground**. I'm glad it isn't still **melted**. Ouch!"

_____

In the rocks at the top of the hogback you can see some very exciting trace fossils: dinosaur footprints! The dinosaurs left their prints on an ancient muddy beach just like you might do walking along the shore or a riverbank. You can also find tracks and burrows from worms, arthropods and clams nearby. Remember you are on the road. **WATCH OUT for cars!**

ONSITE

Activity 2 – Following in Their Footsteps

Footprints may not be as unique as fingerprints, but paleontologists can still tell a lot about the animal that made them. We can count its toes, look at the shape of its foot, and even tell how heavy it was by how deep its print is. **Draw the dinosaur that made the footprints at Skyline Drive.**

ONSITE

Activity 3 – More Than Meets the Eye

Geologists and paleontologists will spend hours and even days studying a single outcrop. There are a lot of clues they might miss if they aren't careful about their observations. **Make these special observations at the top of Skyline Drive!** Be sure you observe any CARS COMING UP THE ROAD!

1._____A dinosaur footprint

2._____A dinosaur handprint (Hint: The hand is smaller, and shaped like a crescent moon.)

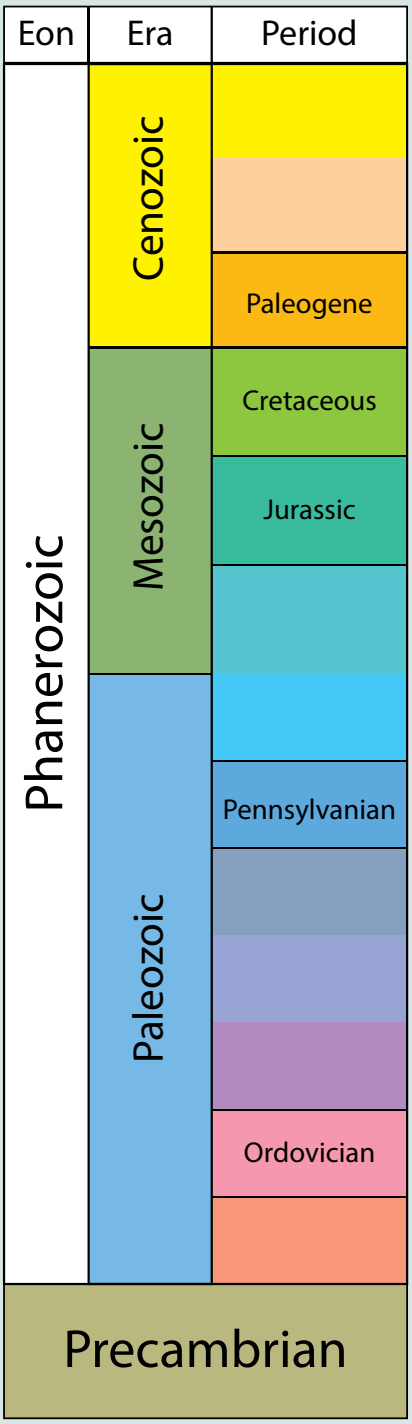
3._____A dinosaur that stepped in another dinosaur's footprint

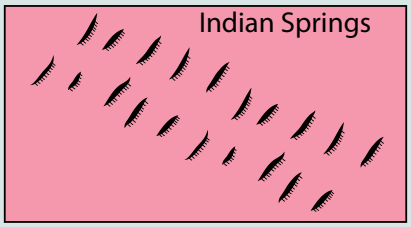
4._____A track that wasn't made by a dinosaur at all

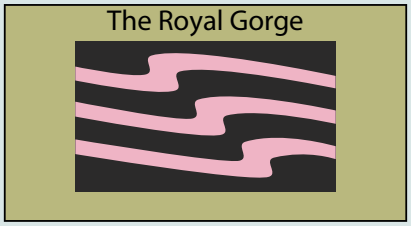
5._____A conglomerate (Pebbly rock - Remember what a geologist observes?)

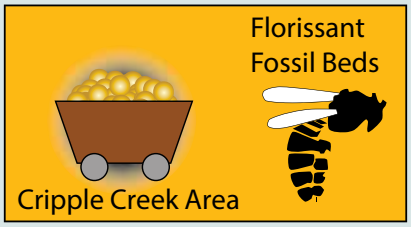
Activity - Geologic Time in the Gold Belt Byway

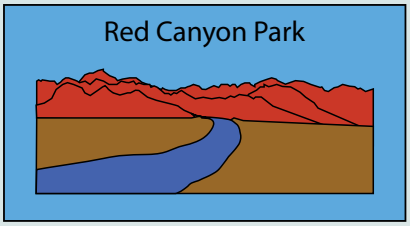
We have now finished our trip along the Gold Belt Tour National Scenic Byway, and seen rocks from many – but not all – geologic ages. What do you think happened to the rocks from those missing ages? **Put the sites in order by matching their colors to the Geologic Time Scale on the left.** Flip back to each site in the book if you need a hint. **Which site has the youngest rock? Which site has the oldest rock? How do you know?**

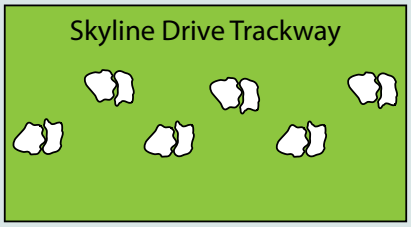






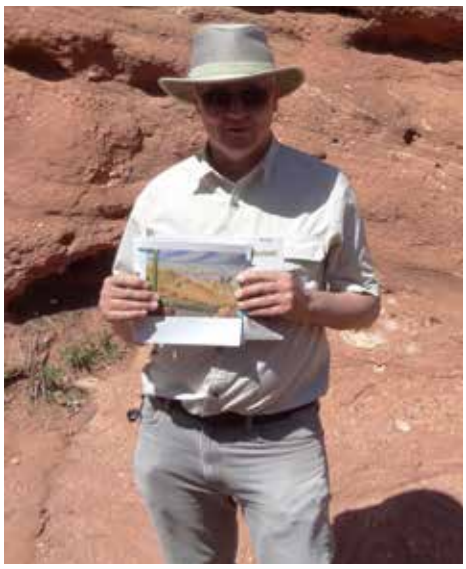


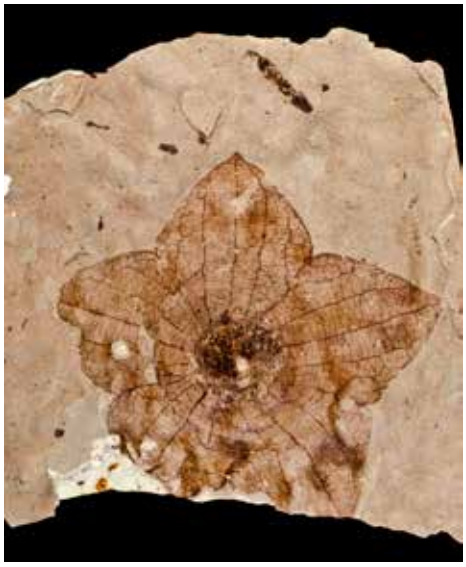




Career Profile: Herb Meyer

Paleontologist, Florissant Fossil Beds National Monument





What does a paleontologist do?

As a paleontologist, I study fossils to learn more about ancient life on Earth and what it tells about climate change and evolution. Paleontologists excavate fossils to make new discoveries, and we try to find new ways to protect the fossils so they won't fall apart.

What are some of your favorite parts of your job?

I like writing about fossils, and one of my books is called The Fossils of Florissant. I also like working with paleontologists in other parts of the world, and working with university student interns, even though my job is not at a university. And of course it's always exciting to split a rock to expose a fossil that has been hidden for the past 34 million years.

Why did you become a paleontologist?

I became interested in collecting rocks and minerals when I was in grade school, and knew I wanted to be a geologist. Paleontology is a part of geology, and by the time I was in high school, I was working on a project to study fossil leaves.

What did you do in school?

The most important classes for a career in paleontology are geology and biology. I earned three degrees from the Paleontology Department at the University of California at Berkeley: a bachelor's, master's, and Ph.D., all in the field of paleontology.

What skills are important for your career?

I think that writing and photography are two of the most important skills. These are needed so that the information we learn can be written and illustrated for scientific papers and books.

What advice do you have for Junior Explorers?

I started by joining a rock and mineral club for kids. Our club was sponsored by adults who took us on field trips to collect fossils. You can also visit museums and sites such as national parks and monuments where fossils are found. There are also summer camps that teach paleontology, geology and biology.

What do you like to do when you aren't at work?

I've always like to go on camping trips, and when you're out camping you're often close to the places where fossils are found. I also like to travel to places all over the world.

What other careers are there in paleontology?

Other places where paleontologists work are for universities, museums and different government agencies. Paleontologists also work for oil companies, where they use fossils to help discover oil, and for consulting companies, where they help determine whether activities such as digging pipelines will affect fossil resources.

Career Profile: Tim Brown

Exploration Manager, Cripple Creek and Victor Gold Mining Company

What does an exploration manager do?

I direct the Exploration Program in an historic and active gold mining district. My responsibilities include promoting a safe working culture, guiding the direction of the program, working closely with the other geologists and developing the program's budget.

What are some of your favorite parts of your job?

My work has led me and my family around the country and around the world. I really enjoy working with the other geologists as we share a common passion about rocks and minerals. It is really enjoyable to watch young geologists grow, develop and learn about the district's geology. We have also added several million ounces of gold to the reserves in the Cripple Creek District.

Why did you become a geologist?

I took an entry level geology class during my first semester of college and never looked back because I enjoyed it so much. This was not planned, but not unexpected either, as I grew up around old mines and miners in Montana.

What did you do in school?

I received a Bachelor's Degree in Geology from Southern Methodist University in Dallas, Texas. I decided to attend graduate school at the University of Minnesota in Duluth where I received a Master's Degree in Geology. I really enjoy learning and I completed a Master of Business Administration Degree at the University of Colorado after attending night school in Colorado Springs.

What skills are important for your career?

There are several skills that have helped including a passion for geology, flexibility in working environments and a good attitude. It is also important to have good skills in technical writing and a solid understanding of business principles.

What advice do you have for Junior Explorers?

Follow your passion! There will be times when it is hard and things don't go as you might want, but be flexible and stay the course. You'll be glad you did.

What do you like to do when you aren't at work?

I am involved with a couple different geologic groups and I love taking field trips and learning new things about geology. I also enjoy fly fishing, especially in areas that are geologically interesting!

What other careers are there in geology?

There are several different fields of geology where geologists can work. I would really enjoy looking for oil and gas as a petroleum geologist. Hydrology, the study of water resources, is a very big field that continues to grow in importance as well. Finally, teaching geology to other students would be very enjoyable.

Bureau of Land Management
JUNIOR EXPLORER

Junior Explorer Oath

I promise to help protect the Gold Belt Tour National Scenic Byway, public lands, my community, and the Earth by being an active and responsible steward of the environment.

I promise that I will not feed wild animals.

I promise to respect the laws and rules of the land when I find fossils, rocks, plants, artifacts, or historic objects so that everyone may enjoy them.

I promise to explore, learn about, and respect the world wherever I go.

I promise that I will share what I learn with others.

Signed_____

Date_____

COLORADO Department of Transportation

THE GOLD BELT TOUR

NATIONAL PARK SERVICE

THE GEOLOGICAL SOCIETY OF AMERICA®

Cripple Creek & Victor Gold Mining Company
www.ccvgoldmine.com

NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

GEOCORPS™ AMERICA

ROYAL GORGE BRIDGE & PARK
CAÑON CITY, CO

Travel Guide (for driving adults)

Florissant Fossil Beds National Monument – West off of Teller County Road 1, 2.3 miles south of US 24. Open nearly every day, but hours vary seasonally. Free admission for kids 15 and under. Visit www.nps.gov/flfo/index.htm or call (719) 748-3253 for more information.

Cripple Creek and Victor – The Cripple Creek Heritage Center and Cripple Creek Overlook are on CO 67, just northeast of Cripple Creek. The Victor Lowell Thomas Museum is located in Victor at the corner of 3rd and Victor Ave. Open daily Memorial Day through Labor Day. The Independence Mill site is located off County Road 81 across from the Battle Mountain Kiosk Interpretive Site.

Red Canyon – Red Canyon Park is located about 10.5 miles north of Cañon City on Fremont County Road 9. The park is administered by Cañon City. The Shelf Road Climbing Area is located 2.7 miles north of Red Canyon Park. Follow the sign for "The Bank." Shelf Road itself is a narrow, winding dirt road that offers few places to pull over or turn around before reaching Cripple Creek 14 miles to the north.

Garden Park Area – The Cleveland and Marsh-Felch Quarries are located about 6 to 7 miles north of Cañon City on Fremont County Road 9. Each has an interpretive site marking an overlook of the quarry. The Cope Quarries can only be viewed from the road at a distance, further north along County Road 9.

Indian Springs Trace-Fossil Site – Indian Springs is located on private land off Phantom Canyon Road (Fremont County Road 67), 3.6 miles north of the junction with US Highway 50. Because the site is protected, you cannot visit the fossil site without first contacting the Thorson Family for guidance and supervision. Tours of the trace fossil site are $10 per person. Please visit www.indianspringsranchcampground.com or call (719) 372-3907 for more information.

Royal Gorge – Follow US Highway 50 to Fremont County Road 3A, 9 miles west of Cañon City. The gorge is a public park, and there are fees to cross by bridge or gondola. However, there are picnic areas on the rim from which the gorge can be easily viewed for free.

Skyline Drive – Take US Highway 50 west from Cañon City for about 3 miles. The entrance to Skyline Drive is clearly marked. The road is narrow, one-way, and has no guardrails. A parking area can be found at the top of the hogback just past the interpretive signs.

Answer Key

Public and Private Lands page 5
BLM – Garden Park, Shelf Road
NPS – Florissant
City of Cañon City – Red Canyon Park, Royal Gorge, Skyline Drive
Private – Indian Springs, Cripple Creek, Victor

Going Back in Time page 8
Cross out the snowman, dinosaur, cactus and shark

Geologic Word Search page 10

L	A	G	E	R	S	T	A	T	T	E	N	
C	O	N	G	L	O	M	E	R	A	T	E	
S	J	E	R	D	S	D	J	A	P	V	L	
A	J	I	A	D	V	H	D	C	Y	O	I	
N	B	S	N	M	H	F	E	E	R	L	M	
D	B	S	I	G	E	N	S	F	I	C	E	
S	O	R	T	A	O	N	E	O	T	A	S	
T	C	Q	E	T	S	L	O	S	E	N	T	
O	I	X	S	C	A	N	D	S	O	O	O	
N	C	D	V	H	C	O	D	I	K	E	N	
E	U	W	S	S	E	I	H	L	I	D	E	
M	W	H	F	O	R	M	A	T	I	O	N	

Nobody's Fool page 10

What is a Formation? page 12
RED ROCKS PARK
FLATIRONS
ROXBOROUGH STATE PARK
GARDEN OF THE GODS

Written in the Rocks page 17
Mudstone tells that there is a floodplain. The sandstone AND the mudstone tell that there is a river, too. The dinosaurs were either buried or washed into the river.

They Went That Way! page 19
A-2, B-3, C-1

Fossils Are Signs of Life page 19
Circle the footprints, the leaf, and the burrow. All the other fossils are body parts.

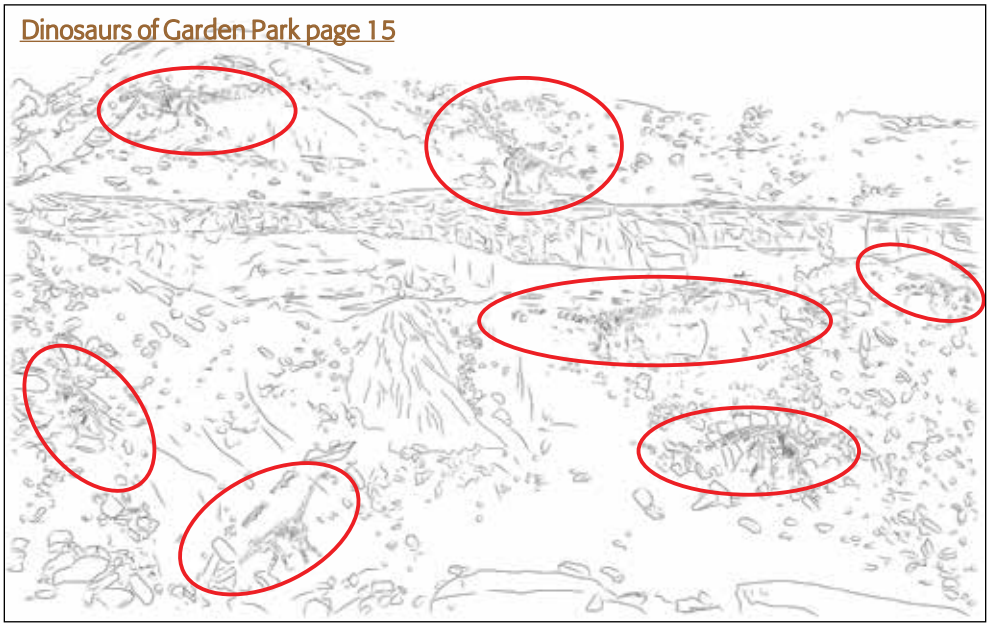
Folds, Faults and Erosion page 21
Block 1: A, B, E, D, C
Block 2: E, H, C, F, G, I, D, B, A
Block 3: G, H, I, A, F, E, D, C, B

The Story of Colorado page 23
3, 5, 4, 1, 2, 6

Geologic Time in the Gold Belt Byway page 25
Florissant Fossil Beds and Cripple Creek, Skyline Drive, Garden Park Area, Red Canyon Park, Indian Springs, Royal Gorge

Cripple Creek Area has the youngest rocks because they are on top. Royal Gorge has the oldest rocks because they are on the bottom.

Dinosaurs of Garden Park page 15



Colorado Academic Standards for Science

Activities and Content

Geologic Time (7th Grade 3.2.a)
Florissant Fossil Beds National Monument (3rd Grade 3.1.a,b; 4th Grade 2.2.a)
Visiting the Visitor Center (4th Grade 2.2.a,b)
Going Back in Time (4th Grade 2.2.a,b)
How Did the Gold Get There? (3rd Grade 3.1.a,b; 5th Grade 3.1.a,b)
Red Canyon (3rd Grade 3.1.b; 5th Grade 3.2.a,b; 6th Grade 3.1.a,b)
Written in the Rocks (1st Grade 3.1.a,b; 3rd Grade 3.1.a; 5th Grade 3.2.a,b)
Indian Springs Trace-Fossil Site (4th Grade 2.2.a)
They Went That Way! (4th Grade 2.2.a)
Fossils Are Signs of Life (4th Grade 2.2.a)
Royal Gorge (3rd Grade 3.1.b; 5th Grade 3.2.a,b; 6th Grade 3.1.b)
Folds, Faults and Erosion (7th Grade 3.2.d, CAS 3rd Grade 3.1.a; 5th Grade 3.2.a,b)
Skyline Drive (3rd Grade 3.1.a; 5th Grade 3.2.a,b)
The Story of Colorado (1st Grade 3.1.a,b; 3rd Grade 3.1.a,b; 5th Grade 3.2.a,b; 7th Grade 3.2.d)
Following in Their Footsteps (4th Grade 2.2.a)
More Than Meets the Eye (1st Grade 3.1.a; 5th Grade 3.2.a)
Geologic Time in the Gold Belt Byway (7th Grade 3.2.a,d)

Academic Standards

1st Grade	3.1.a – Identify materials by texture, size and color
	3.1.b – Sort and classify materials
3rd Grade	3.1.a – Investigate ways rocks can be broken down or formed
	3.1.b – Explain processes that break down or form rocks
4th Grade	2.2.a – Explain what fossils say, the similarities between fossil and living organisms
	2.2.b – Interpret evidence for past environments
5th Grade	3.1.a – Explain how Earth resources are generated
	3.1.b – Understand origins of Earth resources
	3.2.a – Identify how forces change Earth's surface
	3.2.b – Explain factors that change Earth's surface
6th Grade	3.1.a – Explain the interaction between constructive and destructive forces
	3.1.b – Explain the formation of surface features
7th Grade	3.2.a – Describe the Geologic Time Scale
	3.2.d – Determine the sequence of geologic events

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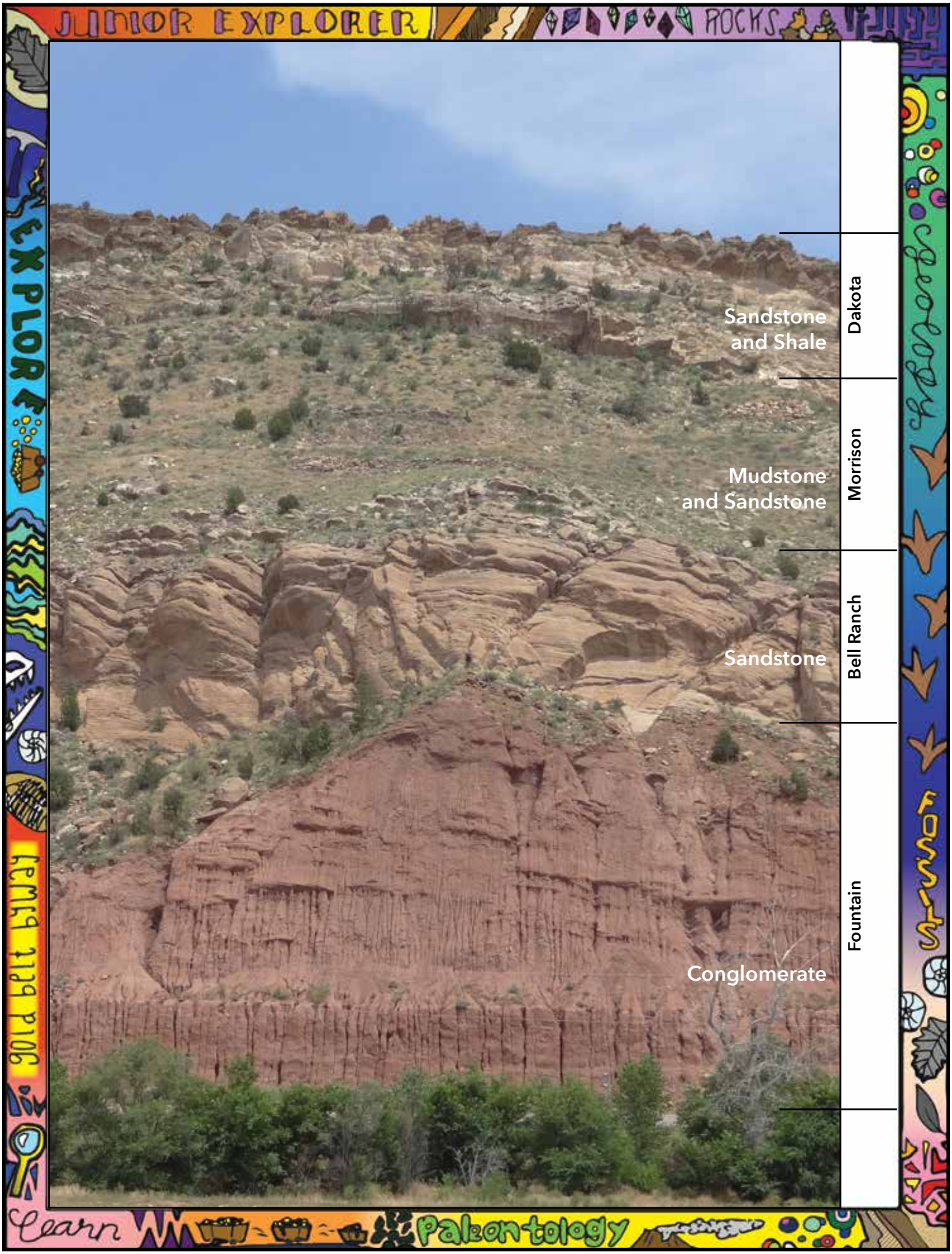
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ROCKS
EXPLORE
Sandstone and Shale
Dakota
Mudstone and Sandstone
Morrison
Sandstone
Bell Ranch
Conglomerate
Fountain
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Paleontology

Notes

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