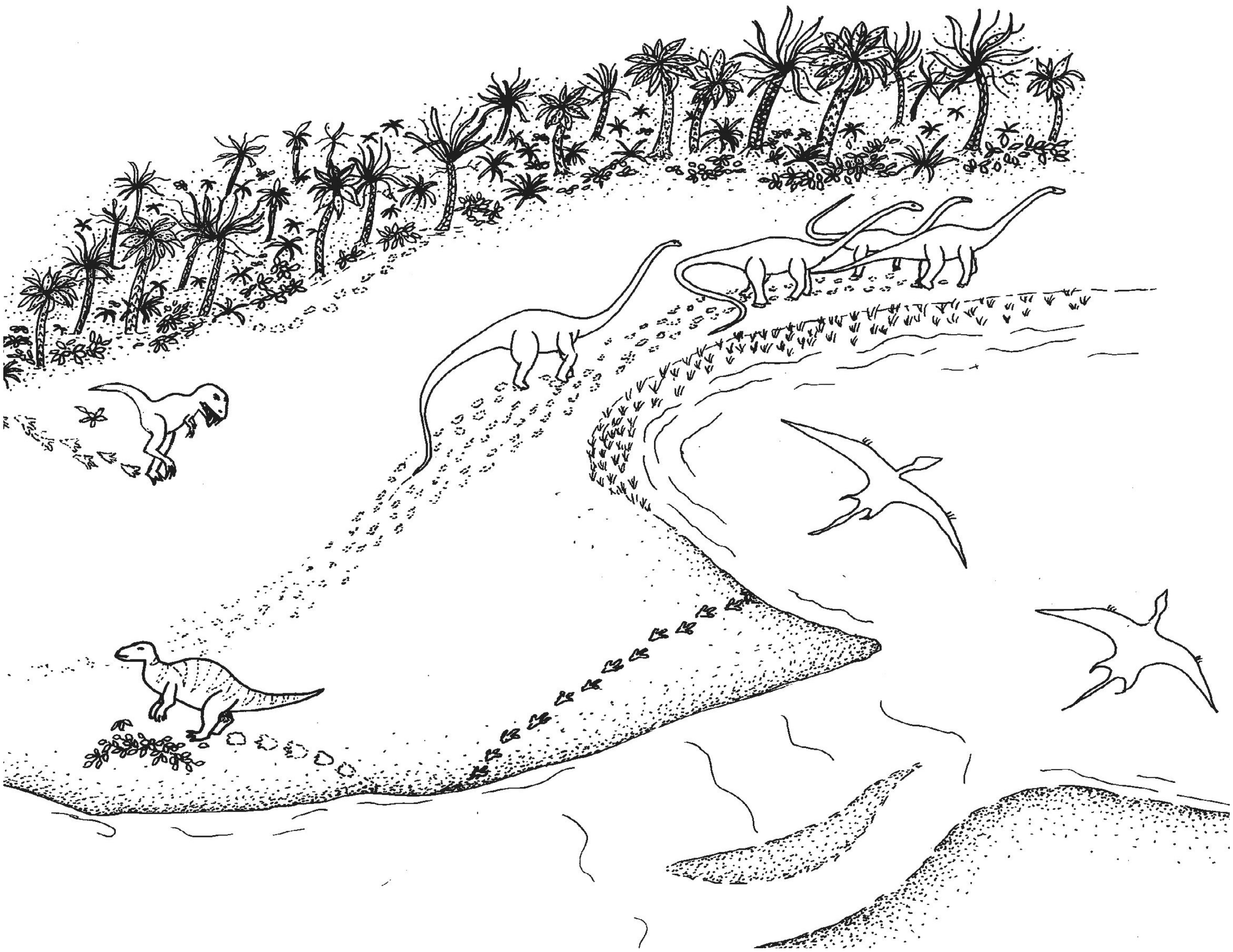
United States Department of Agriculture

# THE STORY OF
# DINOSAUR LAKE
## THE PURGATOIRE VALLEY DINOSAUR TRACKSITE

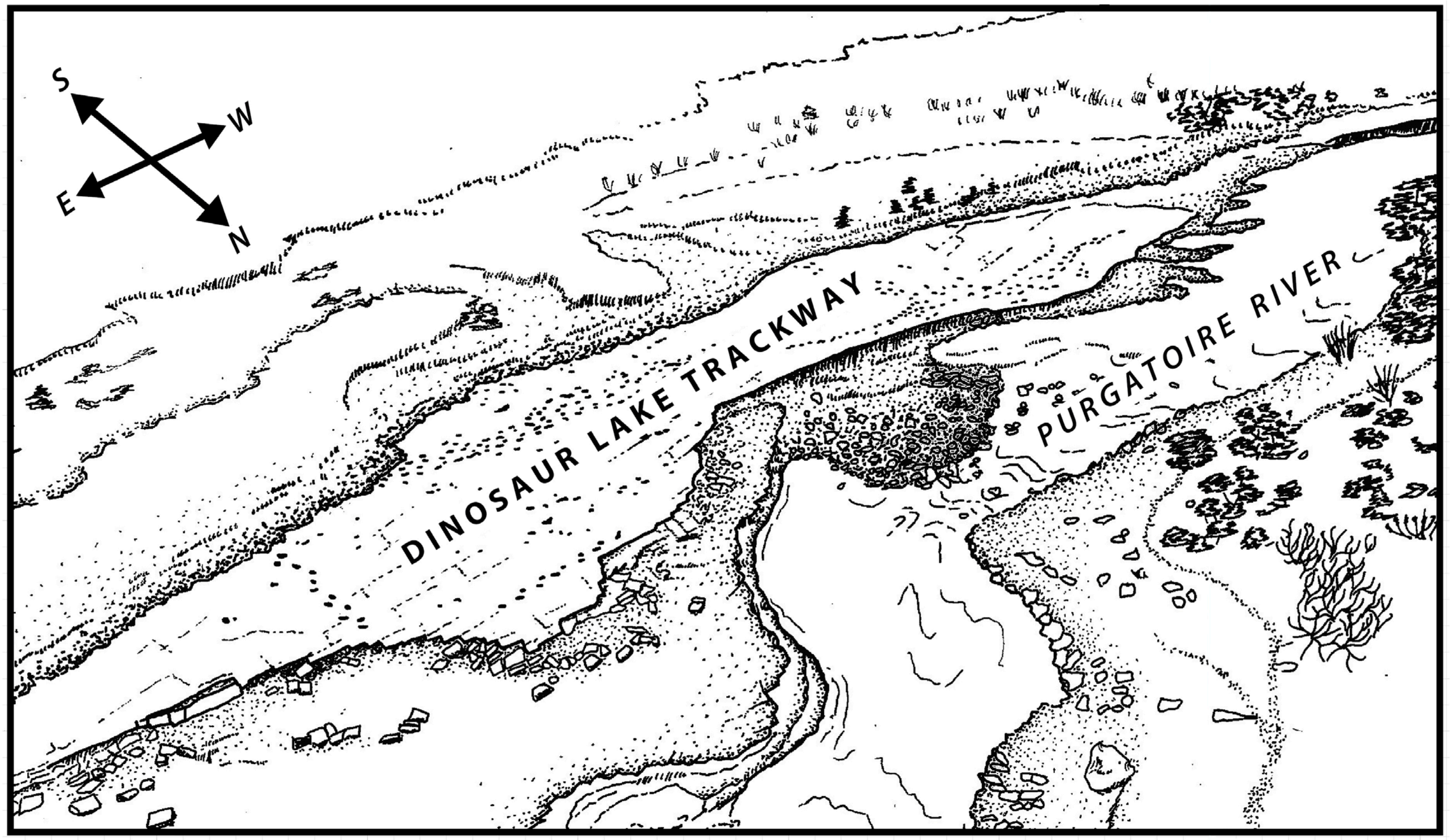


## SEE, LEARN, EXPLORE!
### FOOTPRINTS OF DINOSAURS FROZEN IN STONE

ILLUSTRATIONS BY NANCY LAMM

Forest Service FS-1157 May 2020

# DINOSAUR LAKE
## THE PURGATOIRE VALLEY DINOSAUR TRACKSITE



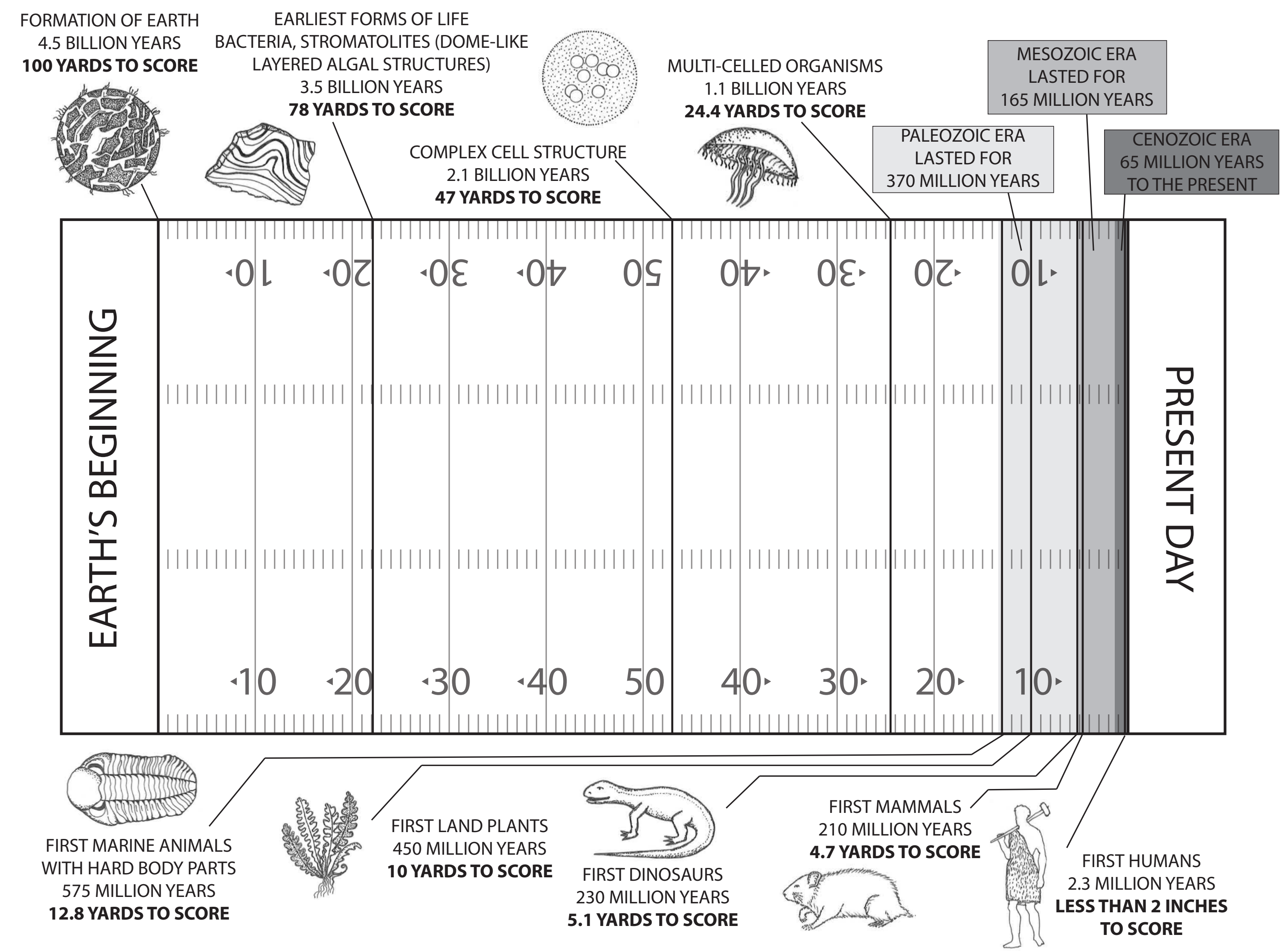

A bird's eye view of "Dinosaur Lake", the Purgatoire Valley Dinosaur Tracksite at the Comanche National Grassland in southeastern Colorado

Dinosaur skeletons capture the imagination of everyone. Images of fearsome Allosaurus and gigantic Apatosaurus allow us to imagine what these dinosaurs once looked like. Bones, however, are not the only fossil remains of the dinosaurs. Just as importantly, fossilized footprints left by dinosaurs allow us to learn how these creatures moved and how they lived. The image of a herd of massive Apatosauruses with adults and juveniles plodding along in a group while being trailed by carnivores tells a story of survival, of hunting techniques, and how these creatures lived their lives 150 million years ago. This is the story of the tracksite at Dinosaur Lake in the Purgatoire Valley.

## THE AGE OF THE EARTH AS THE LENGTH OF A FOOTBALL FIELD

Imagine the age of the Earth as the length of a football field. The Earth was formed at the left end zone and the history of the Earth proceeds to the right, down the 100-yard length of the field. Every yard line represents 45 million years (45,000,000 years). Major events in the history of the Earth are shown with the yardage left to score a touchdown at the PRESENT DAY goal posts.

The ages of the geologic eras are shown as shaded portions at the far end of the field. The Dinosaur Lake activity book addresses the incredible history of the Mesozoic Era, the Age of Dinosaurs, in southeast Colorado. The Mesozoic Era lasted for 165 million years, from 230 million years ago to 65 million years ago when the dinosaurs became extinct and the Cenozoic Era, the Age of Mammals, began. Man appeared on the scene just inches from the goal line.



## THE PHANEROZOIC EON "TIME OF REVEALED LIFE"

The Phanerozoic Eon is the last 13.3 yards to score on the football field shown on the previous page. It is divided into three eras, which are further divided into periods as shown in the table below. We know more about the Phanerozoic Eon than any other time in Earth's history. Why? Mainly because during the Phanerozoic Eon, animals with hard body parts first appeared on the Earth and more readily left behind fossil remains. Soft-bodied animals lacking hard body parts before the Phanerozoic are rarely preserved. Fossils are the primary means to provide an accurate estimation of the age of rock layers.

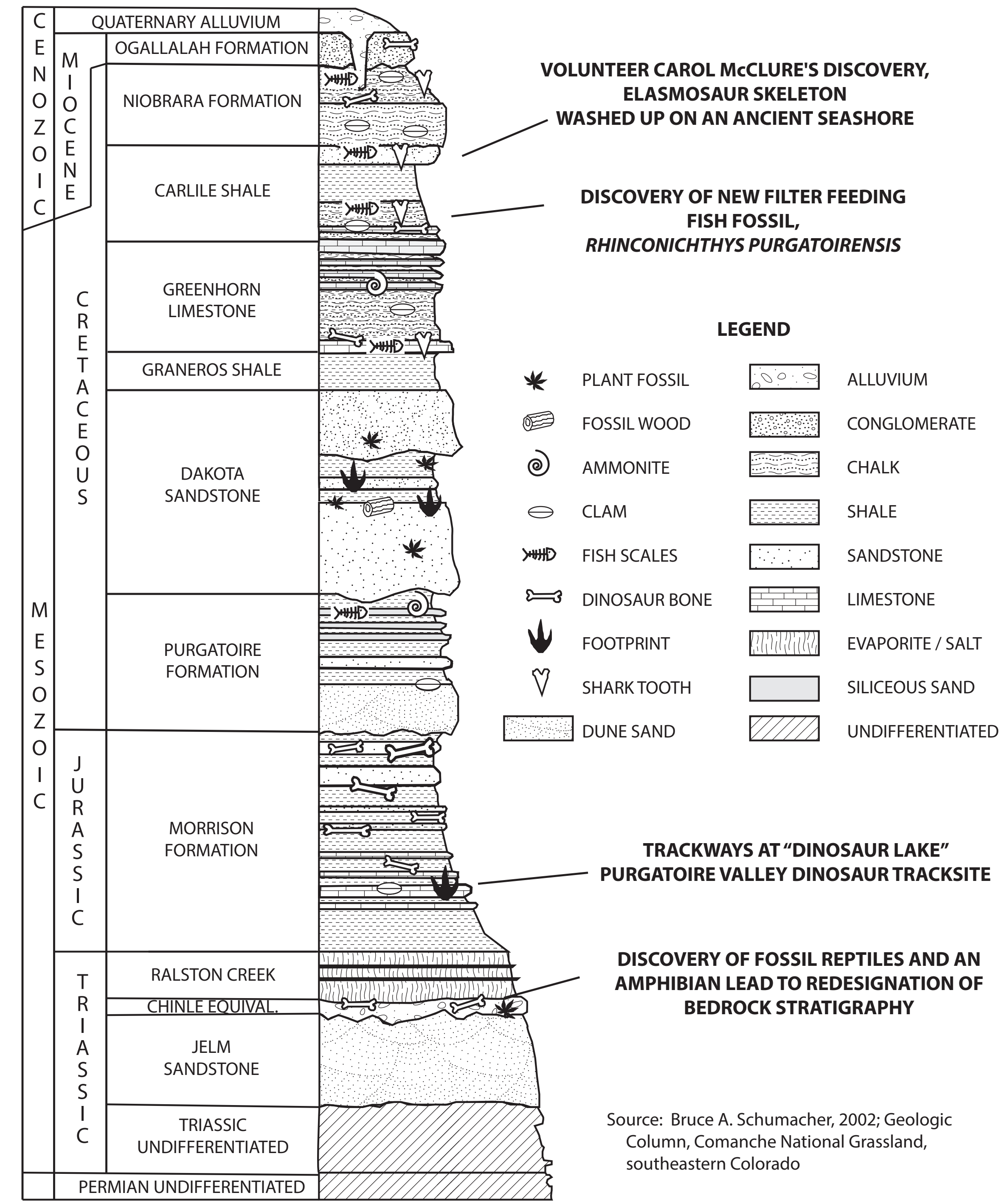
Geologists have put together the history of the Earth by studying the rock layers and the fossils in them. Geologists know that limestone is often deposited on ocean floors, sand collects on a beach or desert, coal is formed in swamps, and ash and lava are ejected from volcanoes. Younger sediments are deposited on top of older rock layers and layers of various ages contain their own distinctive kinds of fossil evidence. From this and other information, geologists have recreated the history of the Earth. The history of the area that is now southeastern Colorado is summarized below.

| ERA | PERIOD / EPOCH | SYMBOL | APPROXIMATE AGE | GEOLOGIC EVENTS IN SOUTHEAST COLORADO |
|---|---|---|---|---|
| CENOZOIC (MEANS NEW LIFE) AGE OF MAMMALS | QUATERNARY | Qu | | |
| | HOLOCENE | | PRESENT TO 10,000 | THE "RECENT", COMING OF MAN IN N. AMERICA |
| | PLEISTOCENE | | 10,000 TO 2 M.Y. | THE ICE AGE, GLACIATION IN THE MOUNTAINS TO THE WEST, DEPOSITION ON THE PLAINS |
| | TERTIARY | T | | VOLCANIC ERUPTIONS TO THE WEST |
| | PLIOCENE | | 2 M.Y. TO 6 M.Y. | EXTENSIVE DEPOSITION IN EASTERN COLORADO FROM EROSION OF MOUNTAINS TO THE WEST |
| | MIOCENE | | 6 M.Y. TO 22.5 M.Y. | REGIONAL UPLIFT, MOUNTAIN BUILDING TO THE WEST, DEPOSITION AT COMANCHE N. G. |
| | OLIGOCENE | | 22.5 M.Y. TO 36 M.Y. | IGNEOUS INTRUSION, FORMATION OF THE SPANISH PEAKS TO THE WEST |
| | EOCENE | | 36 M.Y. TO 58 M.Y. | EROSION OF OLDER SEDIMENTS |
| | PALEOCENE | | 58 M.Y. TO 65 M.Y. | LARAMIDE OROGENY - EPISODE OF MOUNTAIN BUILDING THAT CREATED THE PRESENT DAY STRUCTURE OF THE ROCKY MOUNTAINS |
| MESOZOIC (MEANS MIDDLE LIFE) AGE OF DINOSAURS | CRETACEOUS | K | 65 M.Y. TO 141 M.Y. | COASTAL AND MARINE DEPOSITION FROM A SHALLOW SEA |
| | JURASSIC | J | 141 M.Y. TO 195 M.Y. | DEPOSITION OF MARINE, NEAR SHORE, LAGOON LAKE, AND TERRESTRIAL DEPOSITS |
| | TRIASSIC | T | 195 M.Y. TO 230 M.Y. | TERRESTRIAL DEPOSITION FROM THE MOUNTAIN HIGHLANDS TO THE WEST |
| PALEOZOIC (MEANS ANCIENT LIFE) TERRESTRIAL LIFE | PERMIAN | P | 230 M.Y. TO 280 M.Y. | EROSION OF LAND SURFACE TO THE WEST WITH DEPOSITION ON FLOODPLAINS TO THE EAST |
| | PENNSYLVANIAN | IP | 280 M.Y. TO 310 M.Y. | STRUCTURAL UPLIFT OF LAND SURFACE TO THE WEST WITH DEPOSITION OF SAND AND GRAVEL |
| | MISSISSIPPIAN | M | 310 M.Y. TO 345 M.Y. | MARINE DEPOSITION IN A SHALLOW SEA |
| FISH | DEVONIAN | D | 345 M.Y. TO 395 M.Y. | LOW ELEVATION LAND SURFACE |
| | SILURIAN | S | 395 M.Y. TO 435 M.Y. | LOW ELEVATION LAND SURFACE |
| LIFE EXPLODES IN THE SEAS | ORDOVICIAN | O | 435 M.Y. TO 500 M.Y. | LOW LAND SURFACE AND NEARBY SHALLOW SEA |
| | CAMBRIAN | € | 500 M.Y. TO 600 M.Y. | MARINE DEPOSITION |
| PRECAMBRIAN | | p € | | |



## THE "AGE OF THE DINOSAURS" AT DINOSAUR LAKE

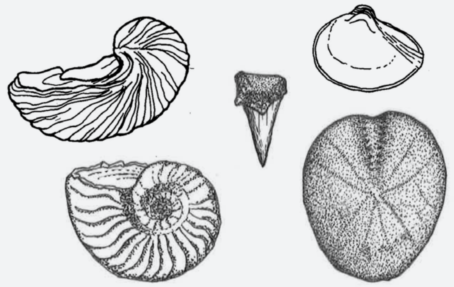
This image is what geologists call a stratigraphic column. It is a drawing of what rocks look like in an area along with the age, thickness, and appearance of the rocks. The legend shows what each symbol stands for. This stratigraphic column represents rocks from the Mesozoic era, the Age of Dinosaurs, found on the Comanche National Grassland. Many of the fossils found are shown by the symbols and include dinosaur bones, tracks, fish scales, clams, petrified wood, and plant fossils. The discoveries described in this activity book are shown on the stratigraphic column.

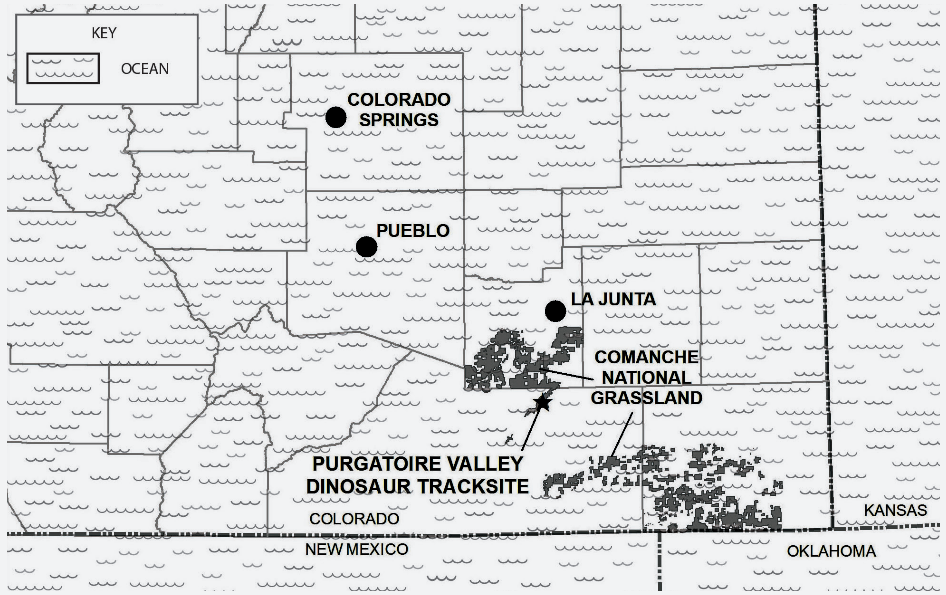



Source: Bruce A. Schumacher, 2002; Geologic Column, Comanche National Grassland, southeastern Colorado

# CRETACEOUS PERIOD
AROUND 93 MILLION YEARS AGO

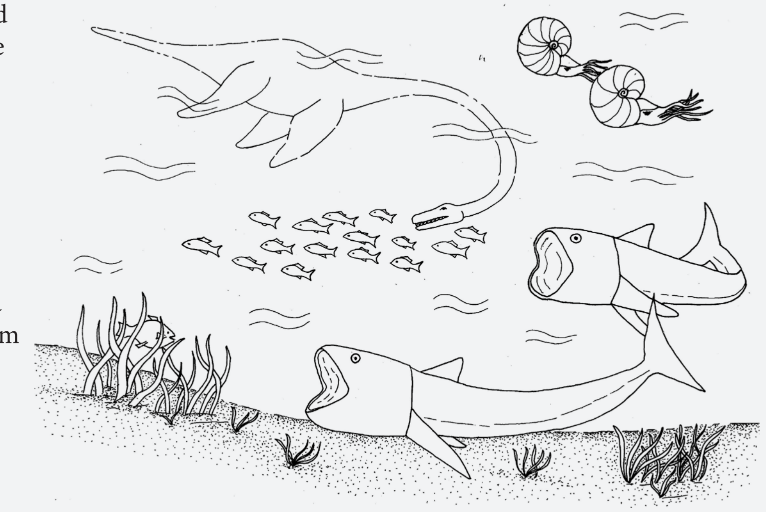
AN INLAND SEA IN COLORADO





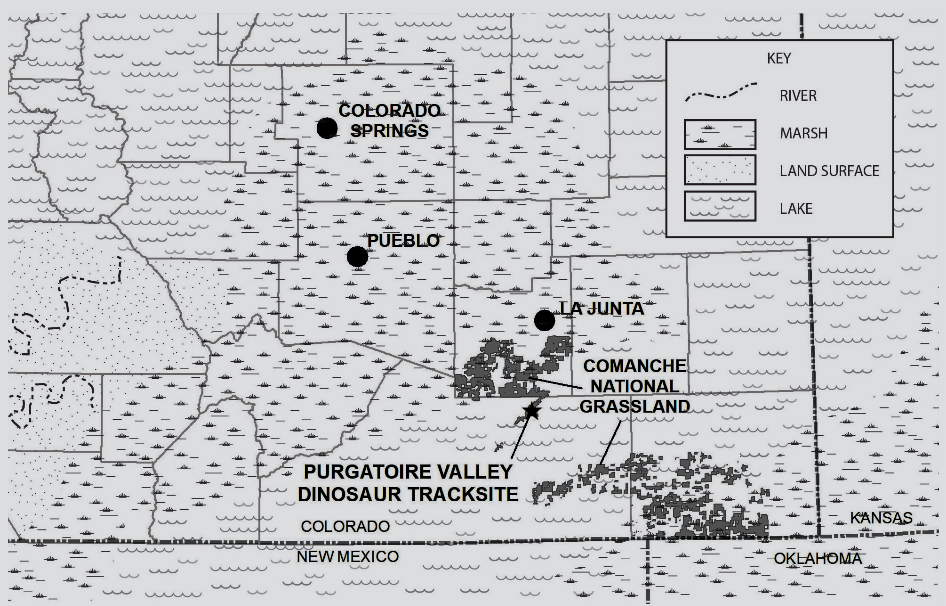

## AN INLAND SEA IN COLORADO

During the Cretaceous Period, a shallow sea completely covered what is now Colorado. Marine fossils like the ones shown above are found in Cretaceous sediments in the Purgatoire River area. Fossil remains of the long-necked elasmosaur, a type of plesiosaur, were found by a volunteer (see page 11) along with the squid-like ammonites. The fish swimming along with wide-open mouths were an especially important discovery. These big-mouthed fish are called Rhinconichthys and until recently only two other such fossils were known worldwide (one from England and one from Japan). Their wide mouths opened like a parachute and their gills served as a sieve to strain plankton from the water. Why is this discovery important? It ties in the fossil record globally and it stands as one of the few known examples of filter-feeding vertebrates (like modern manta rays and blue whales) in Mesozoic oceans. The complete name of the fossil is Rhinconichthys purgatoirensis which means "fish like a whale-shark from purgatory."



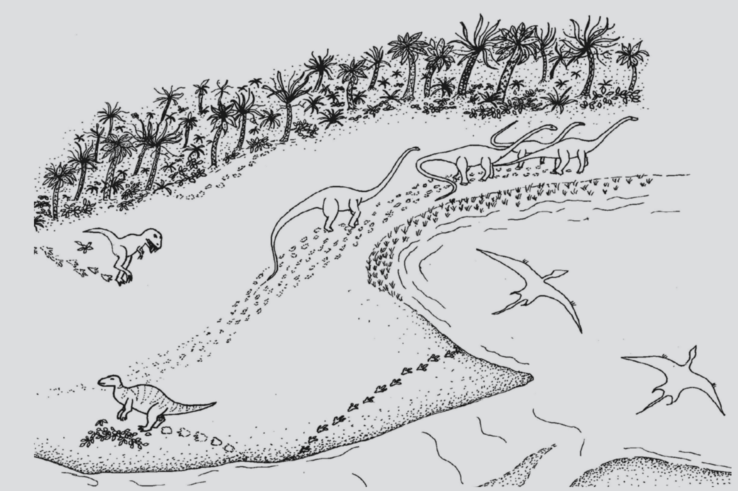
# JURASSIC PERIOD
AROUND 150 MILLION YEARS AGO

THE TRACKS OF DINOSAURS ON THE SHORELINE OF DINOSAUR LAKE



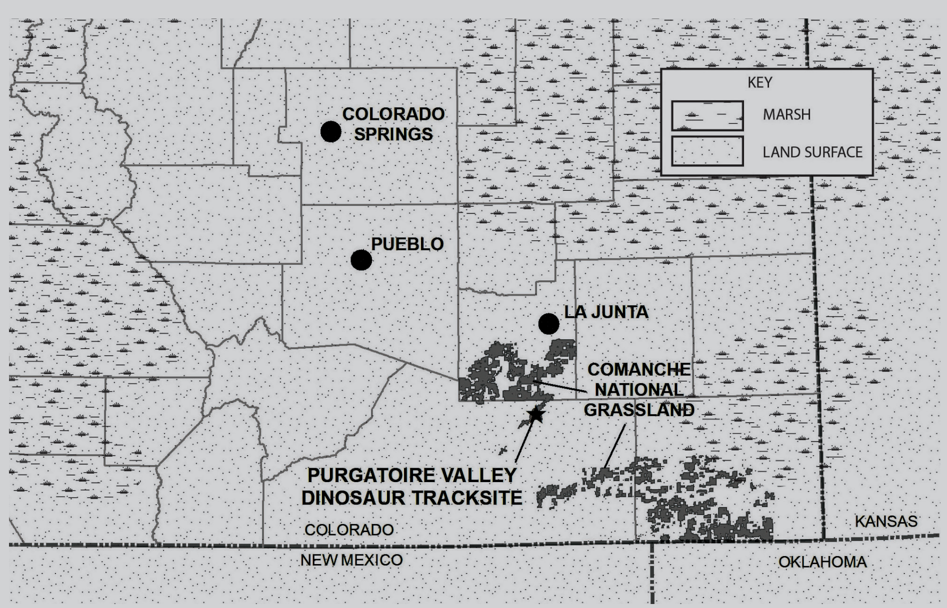

## THE TRACKS OF DINOSAURS ON THE SHORELINE OF DINOSAUR LAKE

The Purgatoire Valley Dinosaur Tracksite in southeast Colorado was once the shoreline of a vast lake fed by sluggish streams. This was during the Jurassic Period, and many different kinds of dinosaurs walked the land. The shoreline conditions at Dinosaur Lake were perfect for making and preserving tracks. Mud along the lake shore was soft, allowing dinosaurs to leave deep impressions with their heavy footfalls. The water level in the lake rose and fell, at times covering the tracks with layers of mud that, over the years, turned into limestone. Rivers flowing into the lake deposited fine clay that was compacted into shale. Soil formed on the exposed land surface and, over time, was compacted into colorful red, purple, gray, and green mudstones. These sediments are filled with fossil bones and tracks of the many kinds of dinosaurs that lived during the late Jurassic Period.



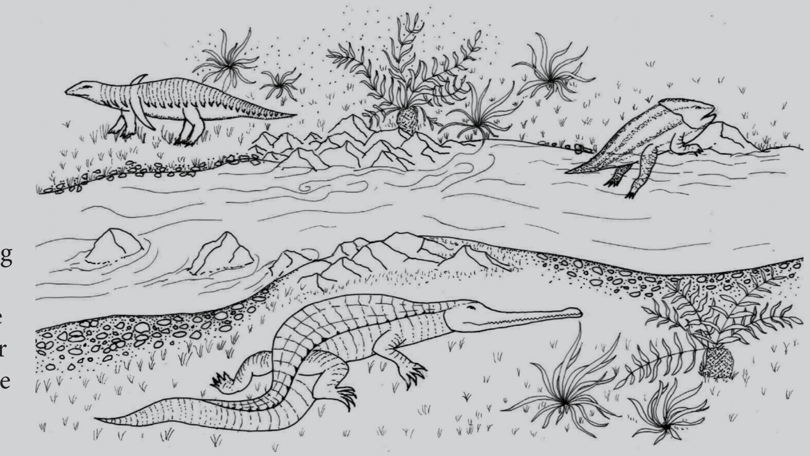
# TRIASSIC PERIOD
AROUND 200 MILLION YEARS AGO

MUDFLATS AND STREAMS




## MUDFLATS AND STREAMS

Sedimentary rock formations are often described as layers of a cake stacked on top of each other, with oldest on the bottom to youngest on the top. One challenge to geologists is that bedrock of a particular geologic formation can change horizontally; a sandstone might gradually grade over distance to a silty sand and then to a siltstone. This can make identifying bedrock in different locations challenging. Fortunately, if similar fossils can be found in different locations, we know the deposits are similar in age regardless of the character and color of the rock formations. Discovery of just fossil fragments of the three animals above (aetosaur, metoposaur, phytosaur) led to reclassifying the bedrock they were found in from Jurassic age to older Triassic age. Why is this important? Like explorers and map-makers, paleontologists work to clarify our knowledge of the Earth as it used to be thousands or millions of years ago.



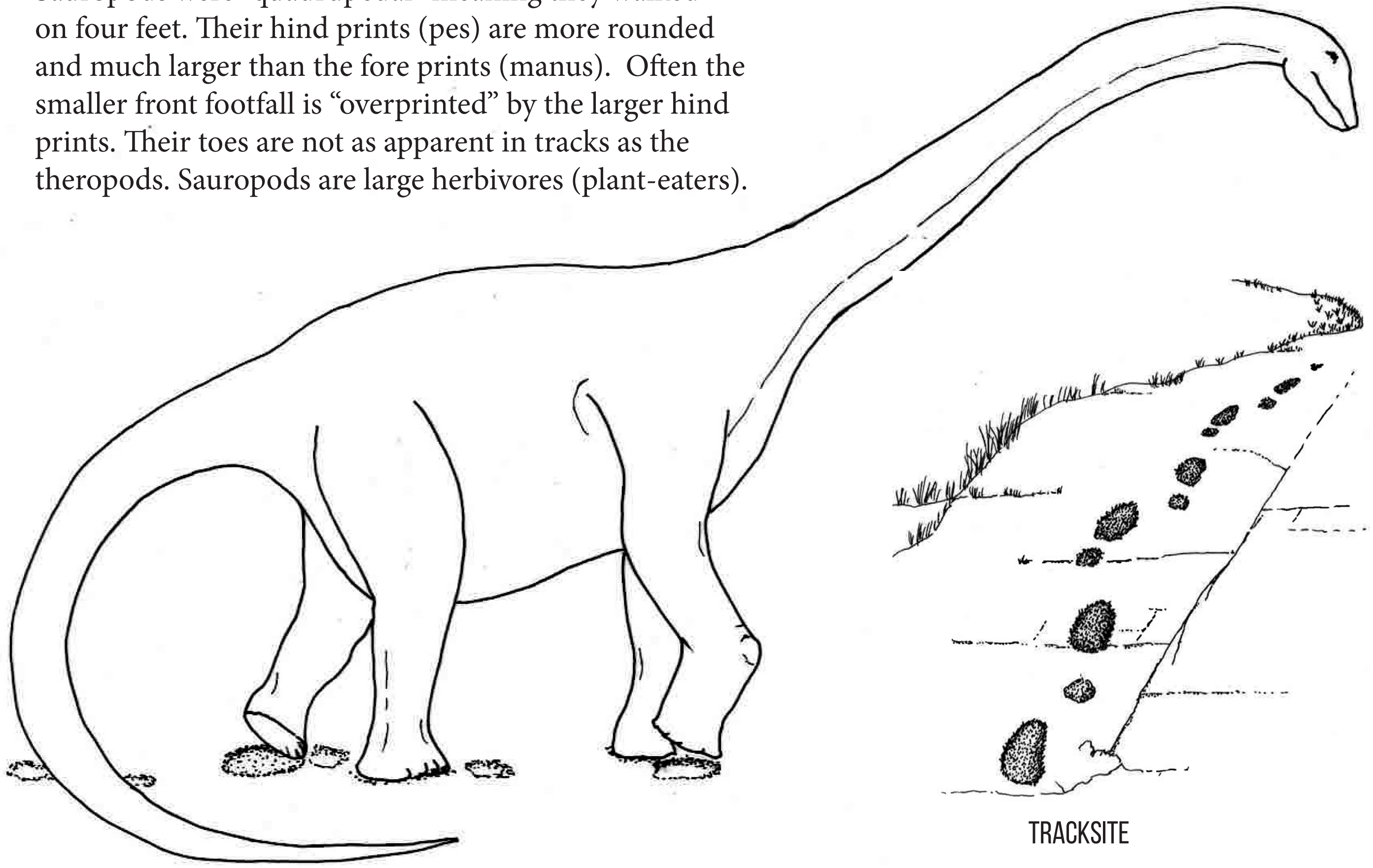
A trio of Triassic creatures is living along the banks of a stream in the drawing above. The crocodile-like reptile in the lower part of the drawing is a phytosaur, a predator that grew as long as 12 feet. Walking along the stream is an armored plant eater with long shoulder spikes, called an aetosaur. Crawling out of the stream is a metoposaur, a massive-headed amphibian that fed mainly on fish.

# MEET THE TRACK MAKERS
## AT THE PURGATOIRE VALLEY DINOSAUR TRACKSITE

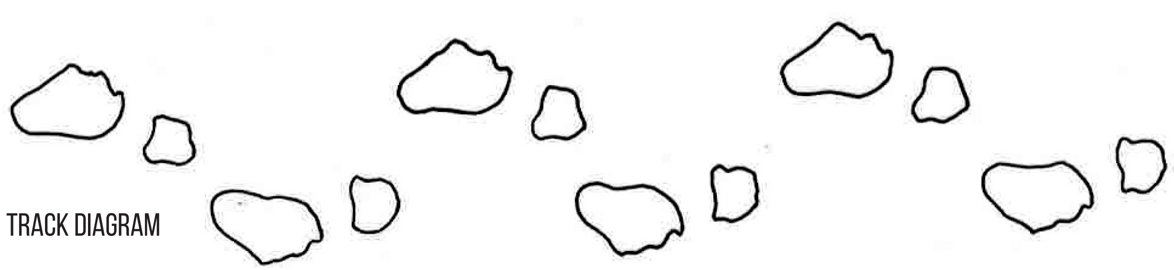
Fossil tracks present at the Purgatoire Valley Dinosaur Tracksite were made mainly by three types of dinosaurs: theropods, sauropods, and ornithopods. Meet the three dinosaur groups who left their tracks on this ancient lake shore.

### SAUROPODS

Sauropods were “quadrupedal” meaning they walked on four feet. Their hind prints (pes) are more rounded and much larger than the fore prints (manus). Often the smaller front footfall is “overprinted” by the larger hind prints. Their toes are not as apparent in tracks as the theropods. Sauropods are large herbivores (plant-eaters).



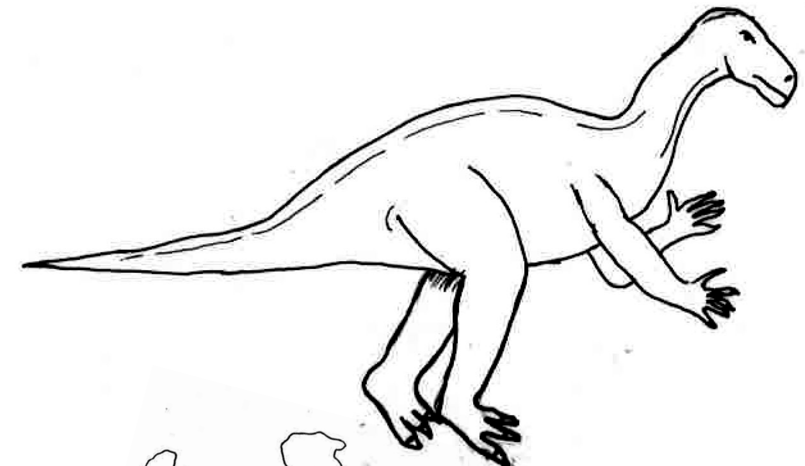
TRACKSITE



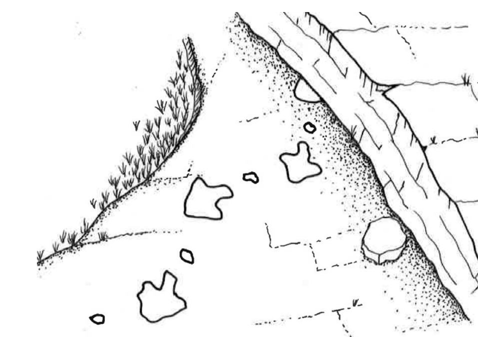
TRACK DIAGRAM

### ORNITHOPODS

Ornithopod tracks look a lot like theropod tracks with three toes. Ornithopod tracks, however, tend to be more round and pigeon-toed, with rounded toes lacking claw impressions. Ornithopod dinosaurs could rise up on their hind legs, but traveled mostly as quadrapeds using both arms and legs. As with sauropods, larger and more deeply impressed pes prints means that most of the weight was centered over the hips. The manus (front) prints are much smaller than the pes (hind) prints. Ornithopods are medium-sized herbivores (plant-eaters).



TRACK DIAGRAM



TRACKSITE

### THEROPODS

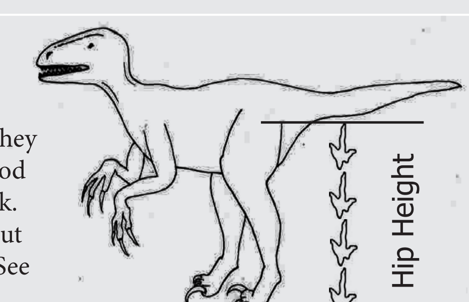
Theropods were “bipedal” meaning they walked on two feet. Their hind feet had three toes and their tracks tended to be long and narrow with sharp claw impressions. Theropods are carnivores (meat-eaters).

TRACKSITE

TRACK DIAGRAM

## TRACK FACTS

- Paleontologists have found that they can calculate the height of a theropod dinosaur from the length of its track. The hip height of a theropod is about 4 to 5 times the length of its track. See the illustration on the right.




- How would you calculate how fast a dinosaur moved? The speed (velocity) of a walking or running dinosaur is calculated from the height of the dinosaur (determined from the length of its track), the length of the stride (measured at the track site), and the acceleration due to gravity, a constant factor.

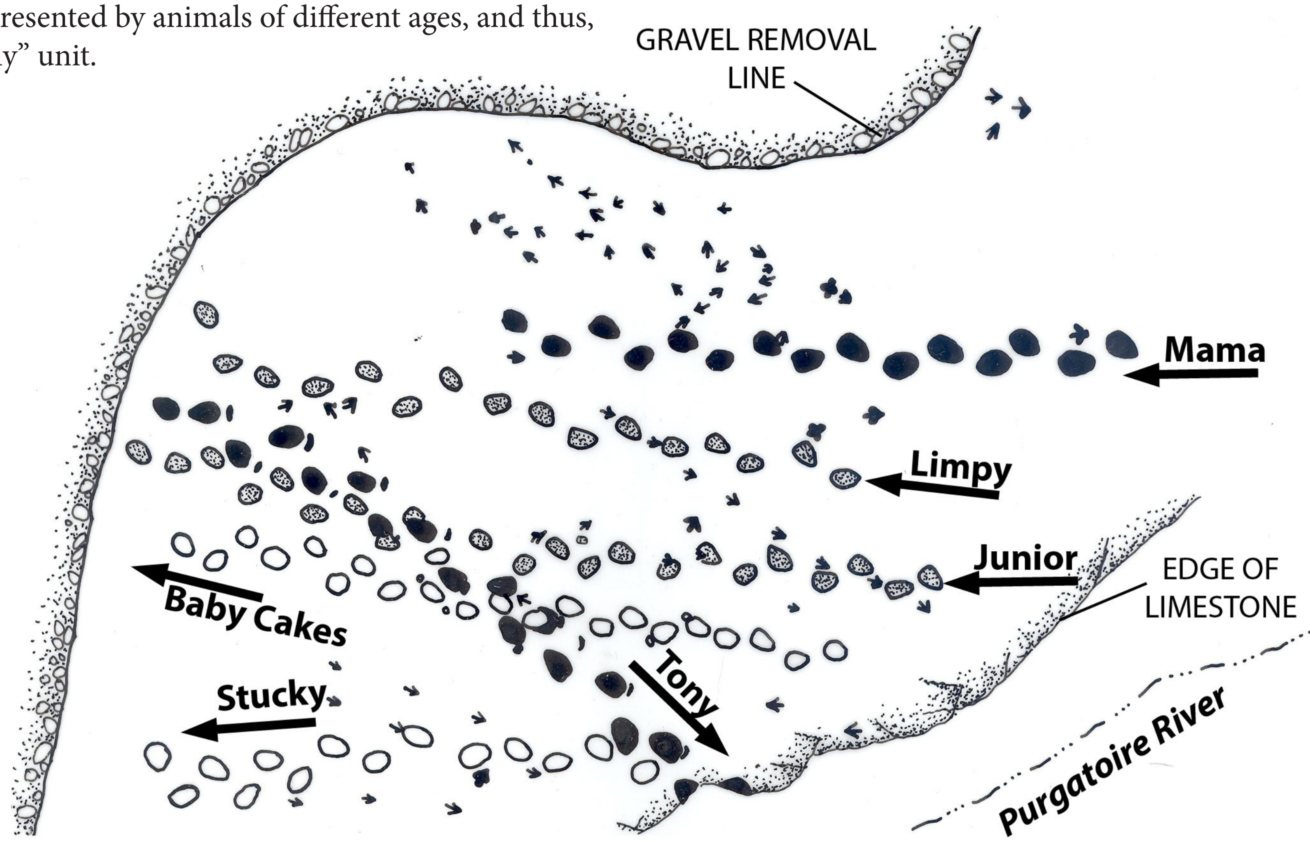
## WHAT THE TRACKS AT DINOSAUR LAKE TELL US

The Purgatoire Valley Dinosaur Tracksite is the largest such tracksite in North America and is among the largest dinosaur tracksites in the world. Over 1,600 footprints representing at least 120 different dinosaurs have been discovered so far. Erosion along the Purgatoire River first exposed the tracks, and later deposition of sediments by the river covered them. Excavation of the river gravel by paleontologists is revealing more and more tracks, and the site is getting bigger. Trackways are important because they give us insight into the lives of the dinosaurs. From tracks, we learn how dinosaurs moved, if they ran or only walked, and if they lived solitary lives or in herds. From the sediments in which the tracks were made, we gain understanding of the environment in which the dinosaurs lived.

The newest trackways unearthed at the Purgatoire site include a group of five parallel sauropod trackways. Parallel and subequally spaced trackways are strong indicators of animals moving together in a group, or a herd. This group of five parallel trackways includes both large (pes length 70 cm) and relatively small animals (pes length 55 cm), indicating that the herd was represented by animals of different ages, and thus, a "family" unit.

In one remarkable instance, the tracks of an Allosaurus have been discovered right on top of one of the sauropods, a track pattern called "overprinting." This Allosaurus was not alone, there are many other Allosaurus tracks moving in the same direction. We can speculate that a group of allosaurs were trailing the sauropods, similar to lions stalking a herd of elephants today.

Some sauropod tracks have become so familiar that they have been given nicknames by the volunteers excavating them: Mama, Junior, and Baby Cakes suggests a family of sauropods walking along the shore together. Tony is a much larger sauropod traveling alone, so this may represent a different species or a different gender. Limpy implies a dinosaur with a sore leg and a pronounced limp which is reflected in its trackways, with left to right steps always shorter than right to left steps. Stucky's imprints begin shallow, and gradually become so deeply impressed in the limestone that volunteers jokingly suggested they might find the bones of Stucky—stuck in his or her last footsteps.






## THE PRESENT IS THE KEY TO THE PAST

Colorado looked very different during the Mesozoic Period. It's hard to imagine that our home, characterized by lofty mountains, rugged canyons, and open prairies, was once covered by an ocean and, before that, by a broad, shallow lake with a fluctuating shoreline where dinosaurs strolled and, even before that, a vast dune sea (like the planet Tatooine in Star Wars). How do we know what conditions were like 100 to 200 million years ago? Geologists know that "the present is the key to the past."

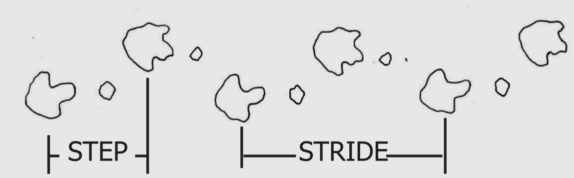
What this means is that the geologic events we observe today also took place in the past and shaped our world in a manner similar to what we see today. Volcanoes, floods, winds, oceans, and rivers behave in the same manner throughout time and leave recognizable deposits. Geologists can study a rock formation and determine the environment in which it was deposited, based upon similar environments present on the Earth today.

Fossils preserved in rocks provide the best clues about what ancient environments were like and what kinds of life existed. As you have learned from this activity book, dinosaur fossils don't always mean just bones. Fossils are any evidence of previous life, such as the footprints of long extinct creatures in the sands of time. Geologists compare fossils from various bedrock formations all over the world and from this, can build a picture of what our changing world was like over millions of years.

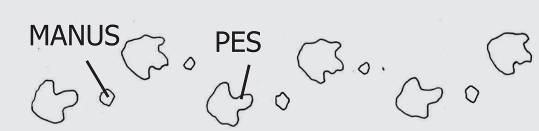
Why does the Earth continue to change throughout time? The major driving force is "plate tectonics," the movement of large plates of the Earth's crust, driven by the molten "internal heat engine" of the Earth's core. Plate tectonics results in the changing shapes and global positions of continents and oceans over geologic time. As the Earth's plates slowly move across our globe, volcanoes and earthquakes bear witness to the immense powers at play. Mountains are thrust upward and then eroded down by wind and water until they are flat and valleys are filled with rock and debris washed down from highlands. Change is truly constant in our world!

### TRACK FACTS

- Tracks are measured by steps, the distance measured from one foot to the next, and by strides, the distance measured from the same foot. This is illustrated in the ornithopod tracks on the left. Juvenile dinosaurs can be identified in a herd by the size of the track and the length of the stride.



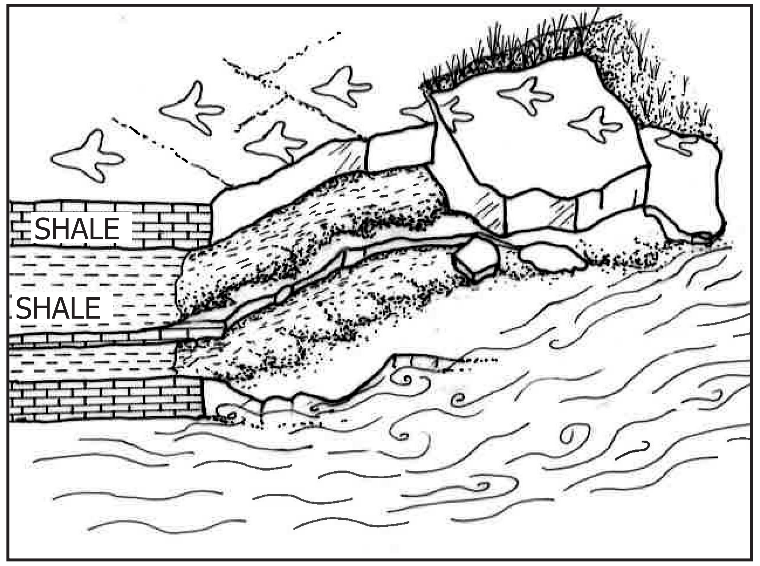

- Quadrupeds walk on four feet but their fore and hind prints look very different. Front footprints (manus) are smaller than back footprints (pes).

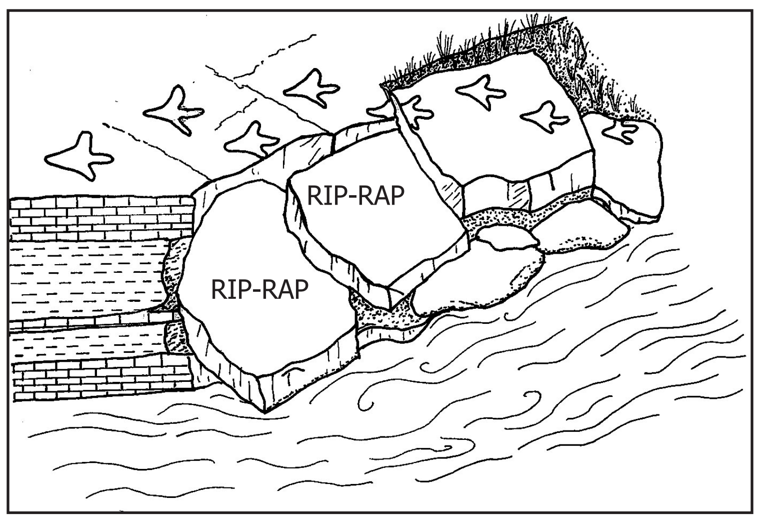


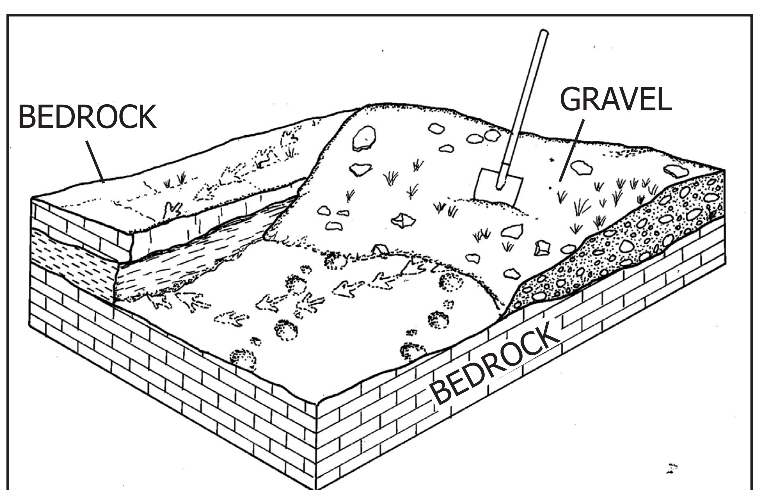

- Dinosaurs did not drag their tails. Notice that none of the three types of trackways shown in this activity book have any evidence of tail drags (as common with lizard or alligator tracks).

- A running dinosaur has a longer stride than a walking dinosaur. This is true of many animals including humans. Test this by walking a specified distance and counting your stride as you walk. Next run the same distance and count your strides. You will have fewer strides when you run. By studying the tracks, paleontologists can tell which dinosaurs mostly walked (quadrupedal sauropods) and which dinosaurs sometimes ran (bipedal theropods). The speed of dinosaur movement can even be calculated from measurements taken of the tracks. Sauropods walked about 4 to 6 miles per hour, while one theropod was estimated to run at 25 miles per hour.

## TAKING CARE OF THE TRACKS




The Dinosaur Lake Tracksite is part of a National Grassland, an outdoor museum, and a research site all rolled into one! How do you take care of such a unique site? Managing and preserving an "in situ" (meaning "in place") fossil site is quite a challenge, especially a site as large as the Dinosaur Lake Tracksite. People want to visit the tracksite, to view for themselves the 150-million-year-old footprints. The Purgatoire River, the same force which naturally exposed the footprints, is now beginning to permanently erode or bury portions of the site. Research at the Purgatoire Valley Dinosaur Tracksite requires hours of labor while being careful to preserve the bedrock environment containing the tracks. The Forest Service is tasked with all of these challenges at the Comanche National Grassland.

### PROTECTION FROM EROSION

The Purgatoire River in flood stage is a powerful force, sweeping away rocks and carving new channels. The force that once exposed the dinosaur tracks also threatens to destroy them by eroding the bedrock containing the tracks. "Rip-rap" is a funny term for rocks carefully placed along a stream bed to prevent erosion. Look at the drawings below to see how rip-rap will prevent erosion of the tracksite. In the drawing on the left, the river is eroding the soft shale and undermining the tracksite. In the drawing on the right, rip-rap serves as a barrier to stream erosion. By using eroded limestone blocks of the tracksite itself, the erosion prevention looks natural.

### REVEALING NEW TRACKS AND NEW SCIENCE

New dinosaur tracks are being excavated at the Purgatoire Valley Dinosaur Tracksite, but only tracks covered by modern stream gravel. The gravel is not part of the actual tracksite. The illustration on the right shows the difference between gravel and bedrock at a tracksite. The tracks are in bedrock.

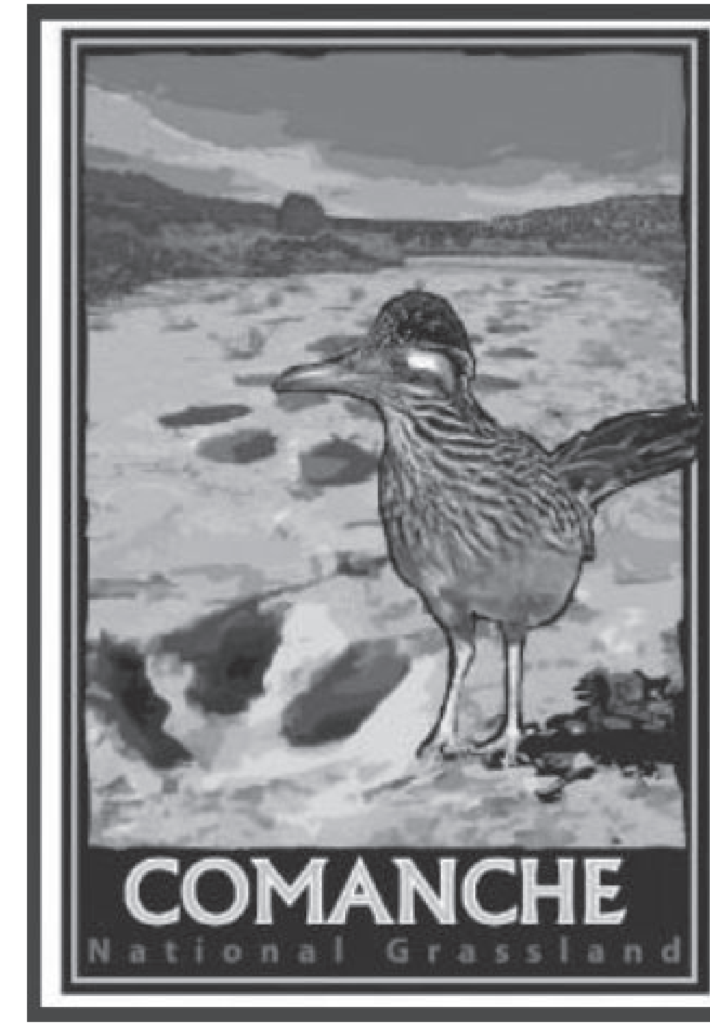
### EDUCATING THE PUBLIC

The Dinosaur Lake Tracksite is on public land at the Comanche National Grassland and belongs to the public. Furthering scientific knowledge by learning as much as we can about this unique resource ensures that it will never be lost, even after the Purgatoire River ultimately destroys portions of the site. The Forest Service Mission is "Caring for the Land and Serving People," which includes being stewards of all our natural resources, including fossils. Volunteer opportunities occur frequently to maintain the site, to assist in excavating trackways, and to allow the public to become part of the research process.



## VISIT THE PURGATOIRE VALLEY DINOSAUR TRACKSITE

Want to visit the Purgatoire Valley Dinosaur Tracksite? You can! The Purgatoire Valley Dinosaur Tracksite is located on the Comanche National Grassland, public land that is open for visitors. A visit requires some careful planning and scheduling. You can take a scheduled tour and drive to the site with a Forest Service guide. The road is rough and will require a 4-wheel-drive vehicle. Guided auto tours are offered on Saturdays in May, June, September, and October. Plan on spending all day on the tour. Bring your lunch and enough water for the day. Visit Recreation.gov and search for "Picket Wire Canyonlands" to learn more.




You can also hike, mountain bike, or horseback ride to the tracksite on your own starting at the Withers Canyon trailhead. The trail drops 250 feet into the Purgatoire River valley at Withers Canyon and follows the valley floor past an old Hispanic mission and cemetery. Except for the guided auto tour, there is no motorized access to the tracksite.

### CAUTION!

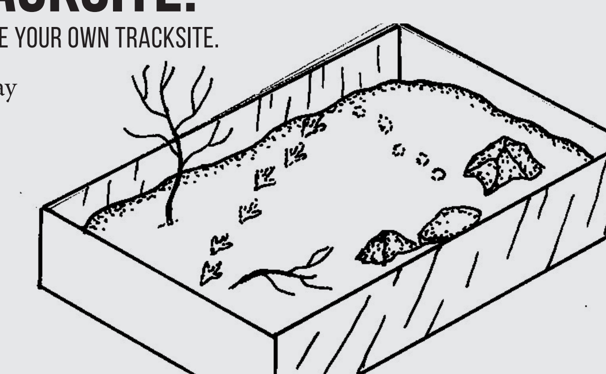
The hike to the dinosaur tracks is long, an 11.3-mile round trip, and there is no drinking water or other services in the canyon. You are responsible for your own safety! Know your abilities, pack enough water, and be prepared for changing conditions. Visit the Comanche National Grassland office in La Junta, Colorado, to learn all about making the hike or scheduling a tour. In addition, you can visit the USDA Forest Service website for more information: www.fs.usda.gov/goto/psicc/com.

## MAKE YOUR OWN DINOSAUR TRACKSITE!

WITH A LITTLE BIT OF IMAGINATION AND SOME DINOSAUR MODELS, YOU CAN CREATE YOUR OWN TRACKSITE.

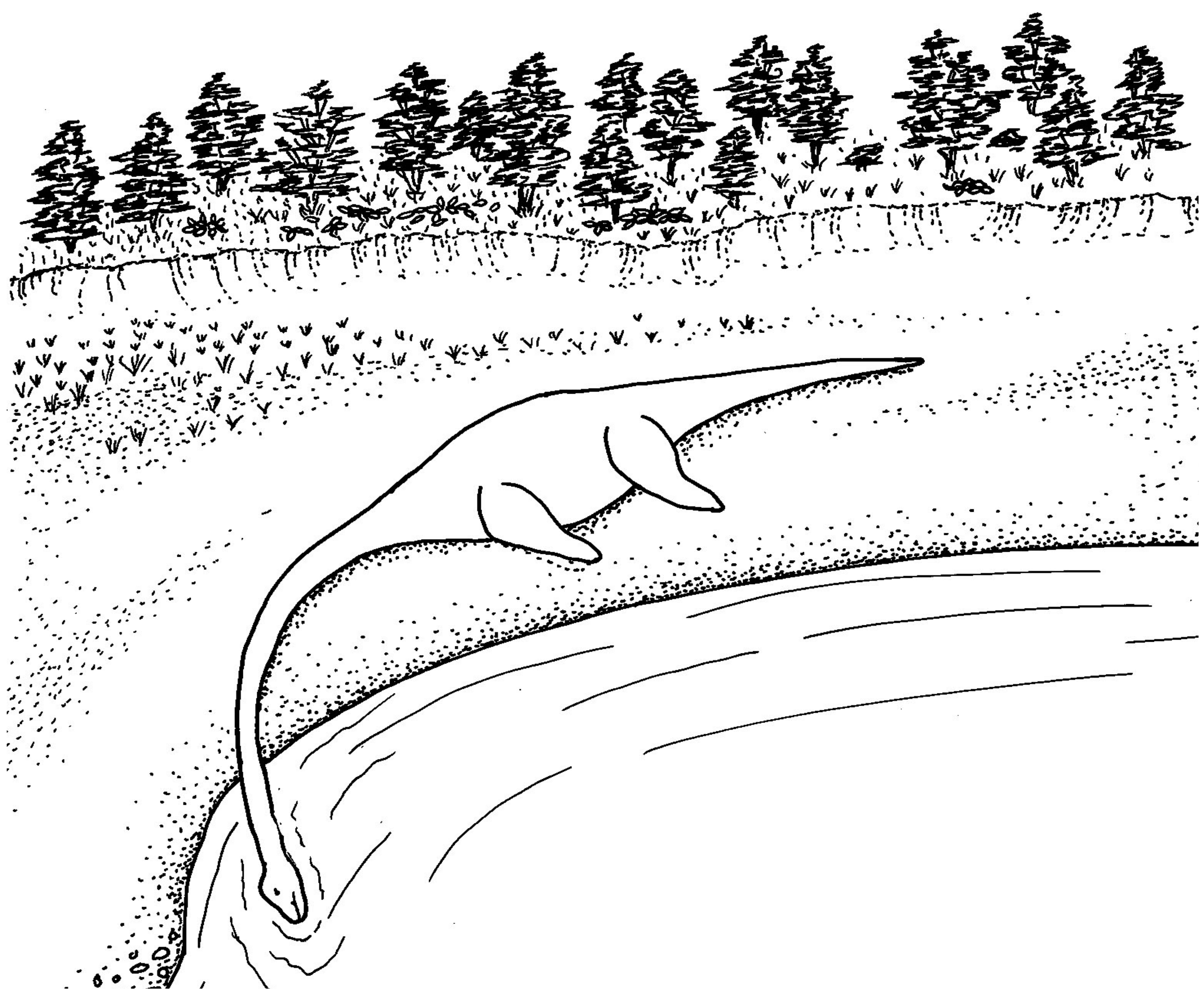
- In a shallow box or on a paper plate, spread some self-hardening clay (Mexican Clay found in craft stores is an example).
- Using twigs, rocks, and sand, create an ancient Jurassic landscape.
- Finally, think about the dinosaur activity you want to display---perhaps a carnivore out hunting or a family of sauropods strolling along a prehistoric beach.
- Using small plastic dinosaur models, make some tracks in the clay.

Congratulations! You have just created a prehistoric landscape!



# CAROL MCCLURE'S PLESIOSAUR
## A STORY ABOUT A VOLUNTEER AND HER DISCOVERY

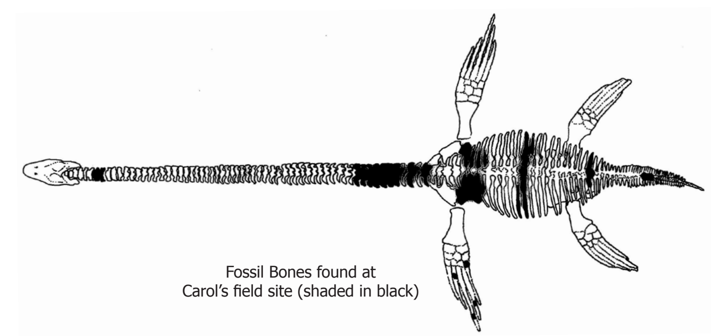
Carol McClure is a lady from La Junta, Colorado, and has volunteered at paleontological excavations on the Comanche National Grassland for over 20 field sessions. In her spare time, Carol also went exploring for fossils on her own. What Carol discovered made all of the exploring and hard work worthwhile. Carol found an Elasmosaur, a type of plesiosaur shown in the drawings below. Elasmosaurs were fearsome, amazingly long-necked marine reptiles, swimming and feeding on small prey in the shallow seaway that covered Colorado during the Cretaceous Period. Carol's plesiosaur died and was washed up on the shoreline of the ancient sea (drawing on the right). Its bones were scattered in the waves and fossilized, waiting to be discovered 90 million years later by a dedicated volunteer.

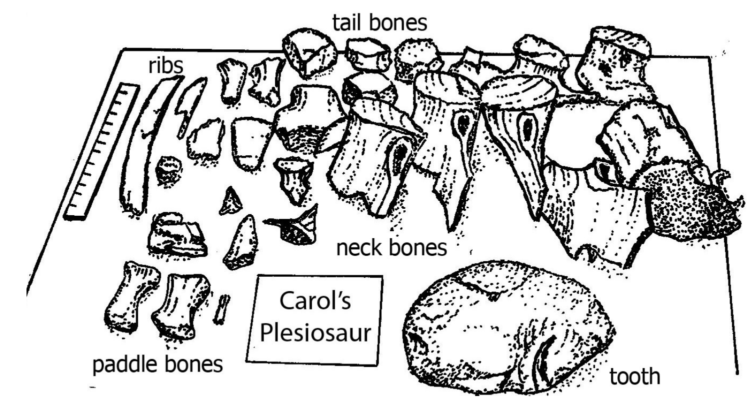




## FIELD OF FOSSILS

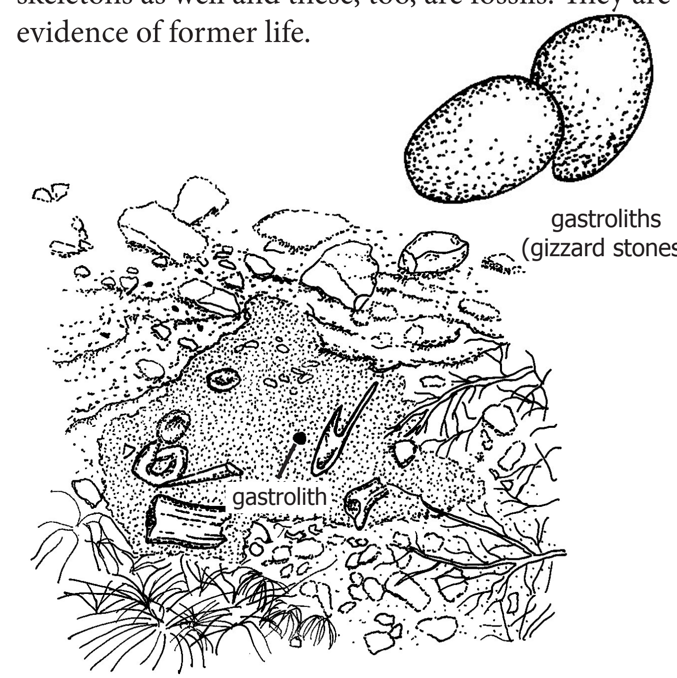
The drawings below shows what Carol identified in the field as fossil bones. The bones were excavated in the field and taken to a paleontological laboratory where they were cleaned and identified. Only a small number of  the total bones in the skeleton were found, as shown in solid black on the drawing below, but the discovery is scientifically important because elasmosaur skeletons are very rare. What kind of food do you think elasmosaurs might have hunted for?




## GASTROLITHS

Many "gastroliths" were found in the fossil assemblage of Carol's plesiosaur. What is a gastrolith? In the drawing above, look for the round object which is, in fact, a rounded pebble. Gastroliths are also called gizzard stones and served a similar purpose as gizzard stones ingested by modern chickens. Smooth stones are swallowed and lodged in the reptile's digestive system to help grind up food. Ocean deposits are made up of fine-grained mud, silts, and limestones. Where would an Elasmosaur that lived in the ocean, and couldn't travel over land, go to find large rounded pebbles? It is not unusual to find rounded stones along with some dinosaur skeletons as well and these, too, are fossils. They are evidence of former life.




# PALEONTOLOGISTS OR ARCHAEOLOGISTS...

## WHAT'S THE DIFFERENCE?

Many people don't know the difference between paleontologists and archaeologists, perhaps because the tools and techniques used in excavation are similar. The difference is simple. Archaeologists study evidence of human cultures, while paleontologists study evidence of prehistoric life (plants and animals) other than humans. The span of time studied by paleontologists is millions of years while the span of time studied by archaeologists is thousands of years. A paleontologist is both a geologist and a biologist, a scientist who strives to understand the Earth, its history, its life both past and present, and its resources.

### TOOLS OF THE TRADE

## WORD SEARCH

Try to find the following words in the grid below. Answers are on the last page.

| | | | | |
|---|---|---|---|---|
| GRAVEL | LIMESTONE | SHALE | BEDROCK | TRACKSITE |
| THEROPOD | ORNITHOPOD | SAUROPOD | STRATA | MESOZOIC |
| TRIASSIC | JURASSIC | CRETACEOUS | PURGATOIRE | RIP-RAP |
| PLESIOSAUR | MUD | STRIDE | STEP | TOE |
| EROSION | MANUS | PES | DINOSAUR | VOLUNTEER |
| BRUSH | TROWEL | SHOVEL | BONE | GASTROLITH |
| PALEONTOLOGY | ALLOSAURUS | CLAW | FOOTPRINT | FOSSIL |

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



## CODED MESSAGES

Try to decipher the messages below. Each letter in the alphabet represents another letter.
Write your answer below the code. A clue is given below. Answers are on the last page.

**MESSAGE #1:**

PDBFLRXH AHRVTL ZHFIDPN DBCFHSRADFB FB QFU PDBFLRXHL EDINP

**MESSAGE #2**

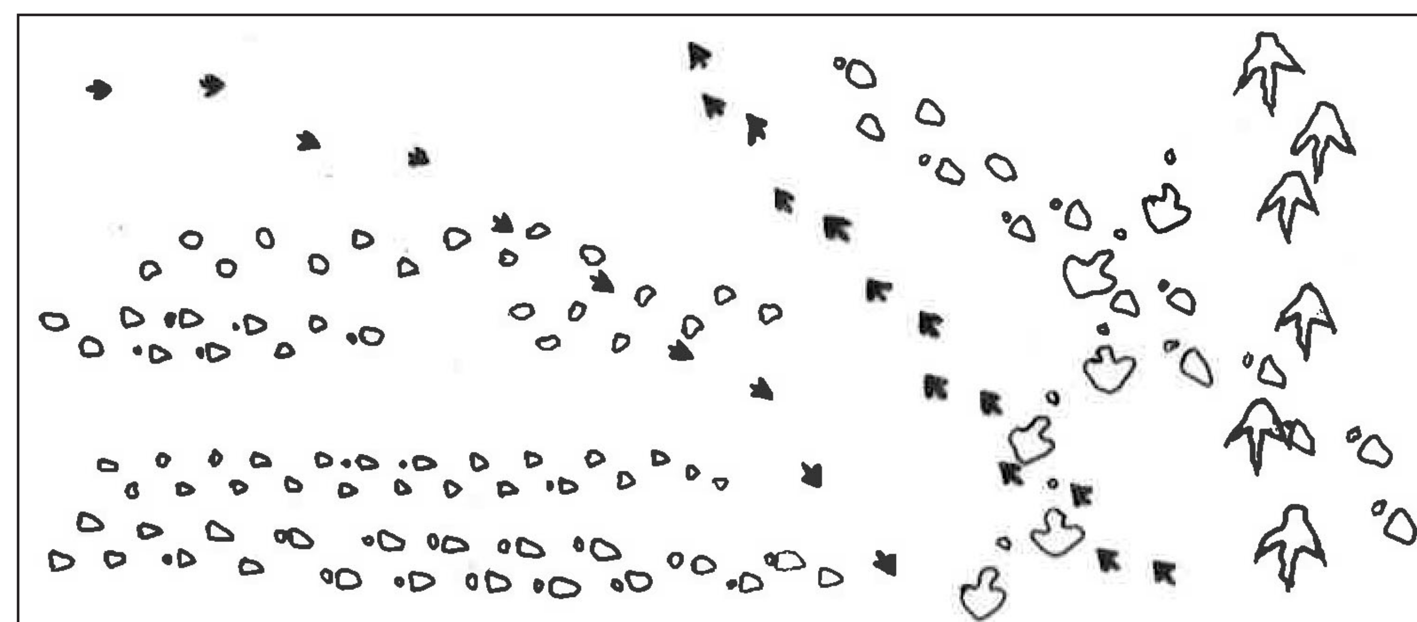
BKM DSWAMYB OQGTYSCW BWSNZYQBM QG GTWBK SEMWQNS QY DTNSBMO QG BKM FCWASBTQWM WQHMW HSDDMJ

MESSAGE #1 CLUE: P REPRESENTS THE LETTER D; MESSAGE #2 CLUE: B REPRESENTS THE LETTER T

## TRACKSITE PUZZLE

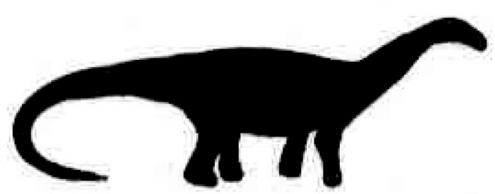
A lot of Jurassic dinosaurs have walked across the puzzle below and left their tracks in the soft sediment. See if you can identify the following track makers. Draw an arrow to show the direction that each one is traveling.. Answers are on the last page.

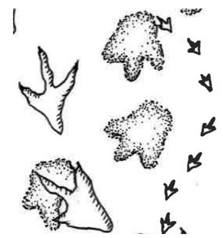
A. A SAUROPOD FAMILY
B. A RUNNING THEROPOD
C. A WALKING THEROPOD
D. A LARGE THEROPOD, POSSIBLY AN *ALLOSAURUS*
E. A SINGLE SAUROPOD
F. A WALKING ORNITHOPOD

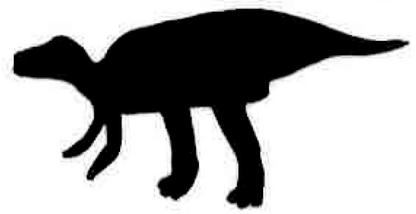


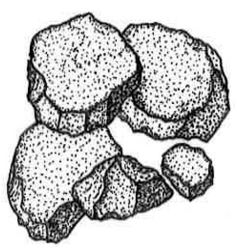
## SCRAMBLED WORDS

These words from the Dinosaur Lake activity book are scrambled. Try to spell the word. As a hint, there is a drawing of what each word is. Answers are on the next page.

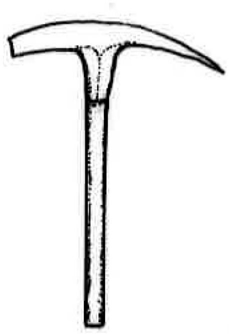


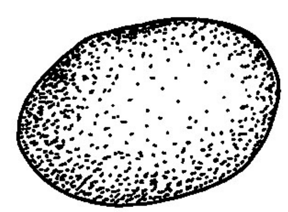


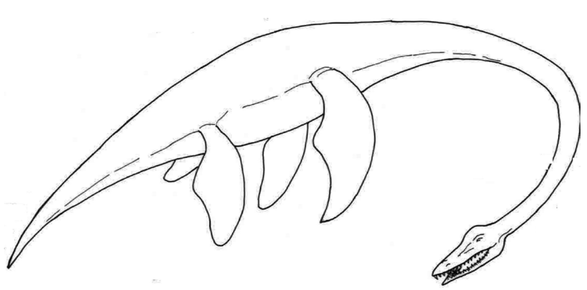


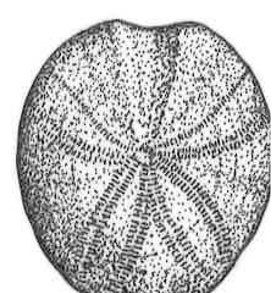


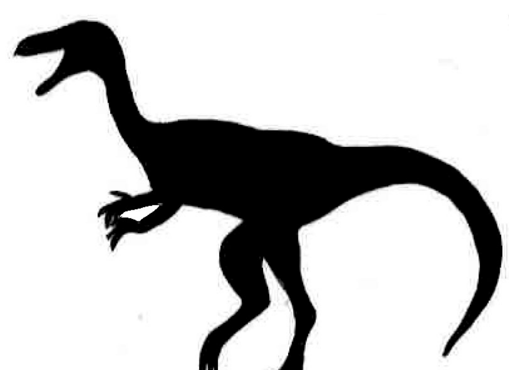
1. OOERDHPT ____________
2. RIPOOOTNHD ____________
3. DSUPAORO ____________
4. ASCTKR ____________
5. SSILRPUOAE ____________
6. PAPRRI ____________
7. TTLASGOHRI ____________
8. LWOERT ____________
9. OKCR MREMAH ____________
10. MRHENCIOED ____________









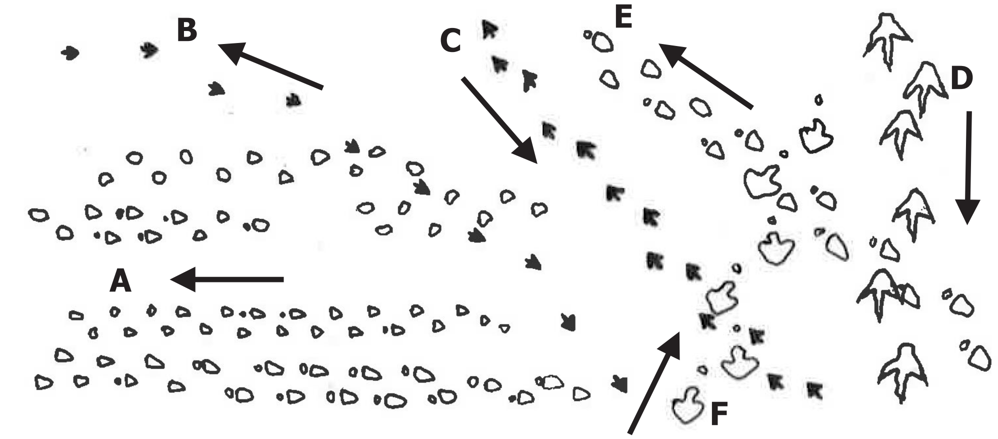




## ANSWER PAGE

**TRACKSITE PUZZLE**

A. A SAUROPOD FAMILY
B. A RUNNING THEROPOD
C. A WALKING THEROPOD
D. A LARGE THEROPOD, POSSIBLY AN *ALLOSAURUS*
E. A SINGLE SAUROPOD
F. A WALKING ORNITHOPOD




**WORD SEARCH:**

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

**CODED MESSAGES:**

1. DINOSAUR TRACKS PROVIDE INFORMATION ON HOW DINOSAURS LIVED
2. THE LARGEST DINOSAUR TRACKSITE IN NORTH AMERICA IS LOCATED IN THE PURGATOIRE RIVER VALLEY

**SCRAMBLED WORDS:**

1. THEROPOD
2. ORNITHOPOD
3. SAUROPOD
4. TRACKS
5. PLESIOSAUR
6. RIP-RAP
7. GASTROLITH
8. TROWEL
9. ROCK HAMMER
10. ECHINODERM