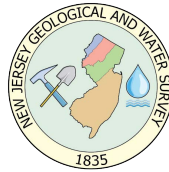




Dinosaur Footprints in New Jersey!

Grades K-5



2020 NJSLS Science Standards Referred

KESS2-1: Analyzing and Interpreting Data

KESS2-2: Engaging in Argument from Evidence

KESS2.E: Biogeology

1-PS4-1: Planning and Carrying Out Investigations

1-LS3-1: Constructing Explanations and Designing Solutions

2-ESS2-2: Developing and Using Models

3-LS4-1: Analyzing and Interpreting Data

4-ESS1-1: Constructing Explanations and Designing Solutions

5-LS2-1: Developing and Using Models

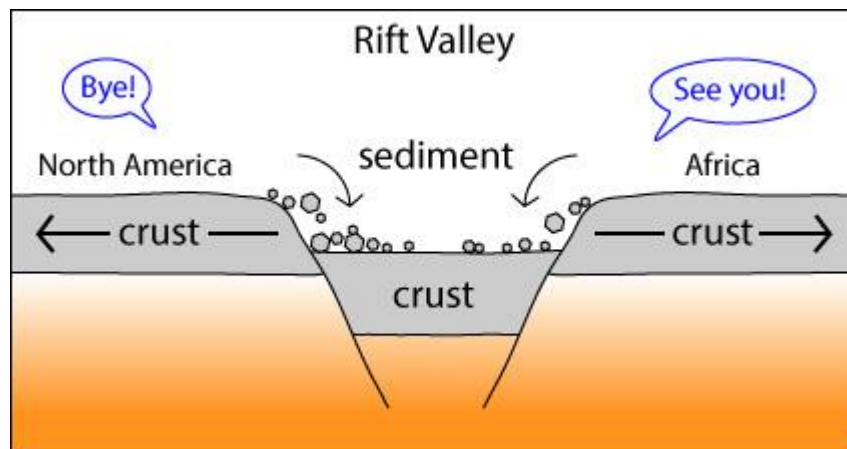
A long, long time ago – about 200 million years ago, actually – a dinosaur walked in soft mud and left its footprints in New Jersey! Someone found these footprints only a few years ago.

- How could dinosaur footprints last so long?
- What dinosaur made them?
- How were the prints found?
- How do we know how old they are?

Let's find out.

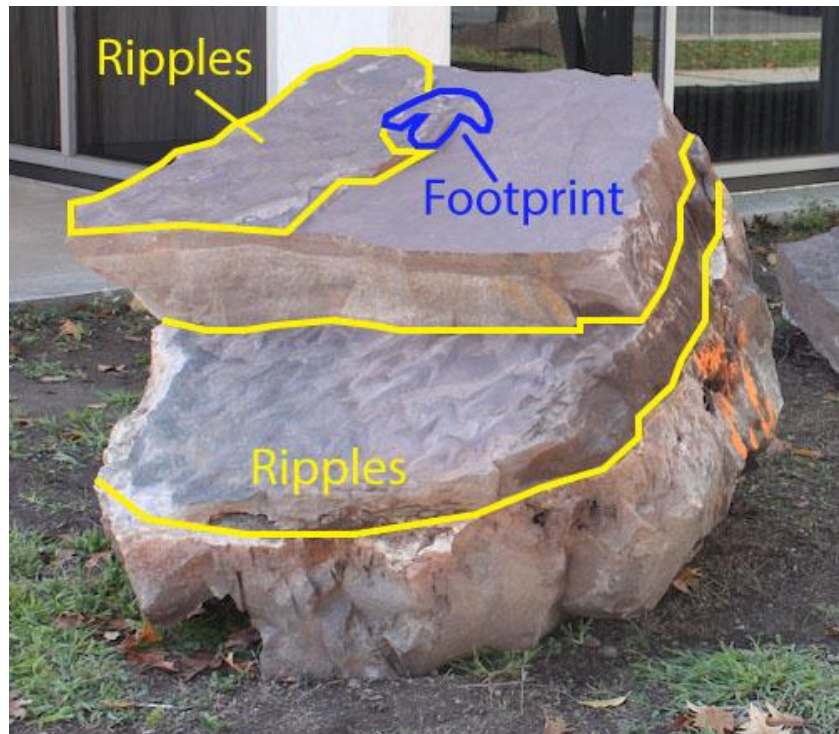
How did the rock get there?

Millions and millions of years ago, there was one giant land on Earth called Pangaea. Over time Pangaea began to pull apart. Africa pulled apart from North America (the continent we live on). A giant tear formed in the Earth's crust. That area is called a **rift valley**. A rift valley formed in the northern part of our own state of New Jersey! The rift valley area fell lower than the rest of the land.



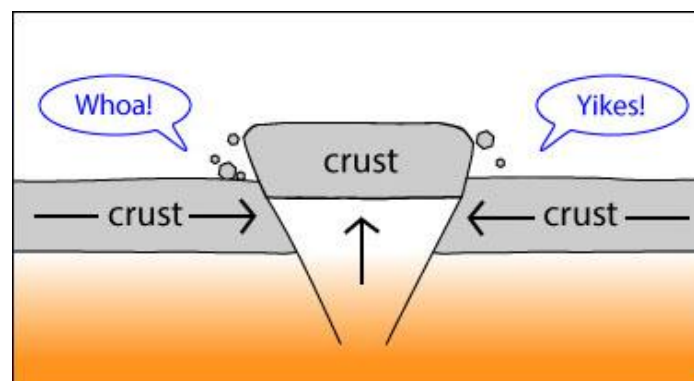
Sediment -- pieces of rock, sand, and minerals -- filled the rift valley, layer by layer, like a big sandwich. Sometimes, streams washed over the sediment and made ripples in mud. One day, a dinosaur stepped in that mud and left deep footprints behind. After that, more sediment filled in the footprints and built more layers. Finally, after a long time, all the sediment was pressed down by its own weight and it became hard rock.

- Can you see the different layers in the picture below?
- How many are there?
- Do you see the layers with the ripples?



How did the footprints survive?

A big event happened after the rock was made. Lava came out of the ground and covered the rock. The lava protected the dinosaur footprints. Then another big Earth event occurred – this time, instead of the land tearing apart, it got pushed back together! The rock with the dinosaur footprint was pushed up above the other rocks. The picture below shows the rock being pushed above the rest:



Then, because it was so high, the rock was worn down by water and weather. The dinosaur footprints came remarkably close to the surface where a human could find them.

How was this special rock found?

In northern New Jersey, construction workers were in the same place where the rock with the dinosaur footprints rested for millions of years. The rock split open and a worker saw the prints. Scientists came to save the rock. They brought it to the New Jersey State Museum where you can go to see it. After everything, the rock has been through, it is lucky that the footprints survived!

What kind of dinosaur made the footprint?

We do not know exactly what kind of dinosaur left the footprint. It is a mystery dinosaur! We do not have bones or other body parts to help us figure out what it looked like. Scientists used dinosaur footprints they already had to **compare** to the new footprint. Below left are footprints named *Eubrontes*:



Eubrontes prints are remarkably close in shape to the mystery dinosaur's tracks. Scientists decided that the new dinosaur prints are from a two-footed, meat-eating dinosaur that is like other dinosaurs we already know, like the *Anchisaurus* above right.

A little footprint was found on the rock, too. We do not know if it is a print from the small front leg of the same dinosaur, a younger dinosaur of the same kind, or a completely different dinosaur.

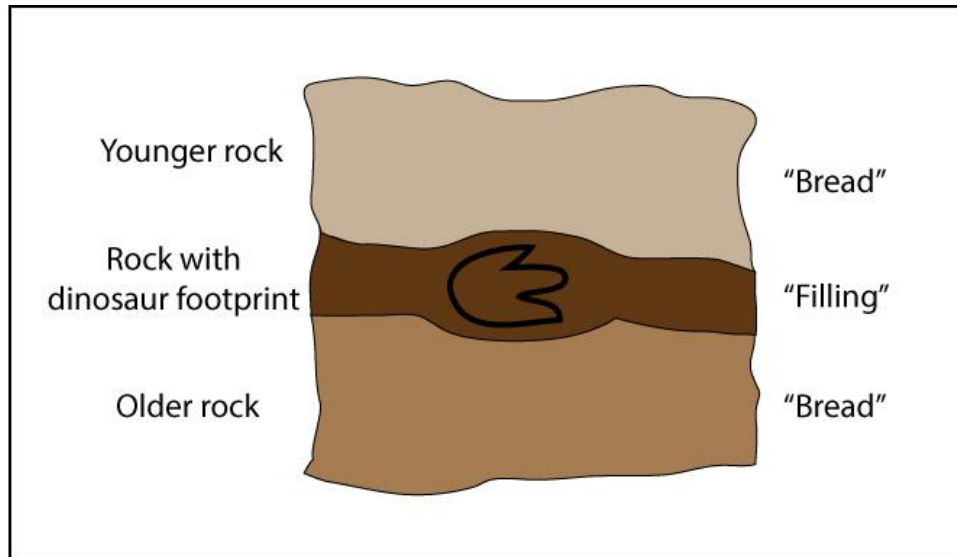
Why was the dinosaur there?

No one knows why the dinosaur was there! That is okay – we can guess a lot of things. The dinosaur might have been walking from one place to another. Maybe the dinosaur was running from an enemy! The area was wet, so perhaps the dinosaur was there to drink water. Plants like to grow where there is dirt and water, so dinosaurs may have gone there to eat plants. But remember – scientists think the mystery dinosaur was a meat-eater.

- What do you think it would have eaten?

How do we know how old the footprints are?

Scientists have special tests to find the age of rocks. Think of the rock as a sandwich – the rock *under* the footprint is the first slice of bread; the rock *with* the footprint is the filling; and the rock *above* the footprint is the second slice of bread. Scientists test each slice of “bread” to find their ages – the bottom slice is older, and the top slice is younger. Then they can guess how old the “filling” is, somewhere between the ages of the bread slices. See the “sandwich” below”:

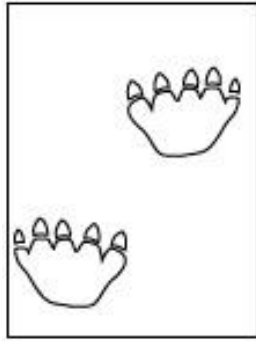


Let us say that the younger rock layer was about 190 million years old. Find 190 on the number line below and circle it. Now let us say that the older rock layer was about 210 million years old. Find 210 on the number line and circle that, too. What number comes between 190 and 210? Scientists say that the rock with the dinosaur tracks is about 200 million years old! If that is what you got, you are right.

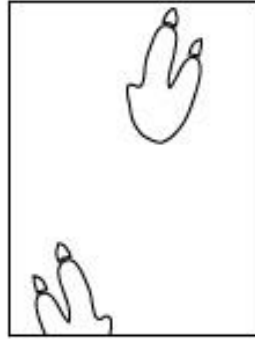
150 – 160 – 170 – 180 – 190 – 200 – 210 – 220 – 230 – 240 – 250

Use what you learned!

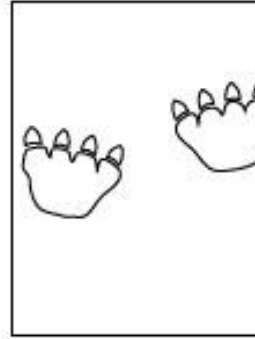
1. What do we call a giant tear in the Earth’s crust where land pulls apart?
2. When a big Earth event pushed the land together, what two things happened to the rock with the dinosaur tracks?
3. You have just found a new rock with dinosaur footprints! You test the rock *above* the footprint, and you know it is about 170 million years old. Then you test the rock *under* the footprint, and you know it is about 190 million years old. So, about how old is the “filling” or footprints of your new rock? (Hint: use the number line above.)
4. Now you compare the new footprints to dinosaur tracks that you already know. What type of dinosaur prints did you find? Use the pictures below:



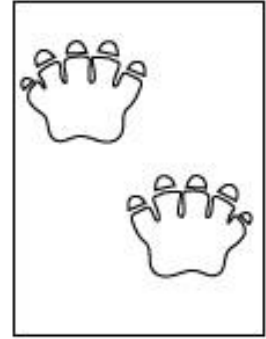
Your dinosaur print



Velociraptor



Stegosaurus



Triceratops

Answers

1. Rift valley.
2. First, it was pushed up higher than the other rocks. Then it was worn down by water and weather.
3. 180 million years old.
4. Your dinosaur prints belong to stegosaurus. The new prints are from its front feet! The stegosaurus prints that you already had are from the back feet. They have different numbers of toes, but the sharp claws and foot shapes are alike.

Select material taken from "What's in a Rock? A Dinosaur Track from New Jersey at the State Museum in Trenton", New Jersey Geological Survey Information Circular, 2017.

Anchisaurus image by Nobu Tamura (<http://spinops.blogspot.com>) - Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=19459098>

Thanks to David Parris and Dana Ehret of the New Jersey State Museum for supplying images of the rock and dinosaur tracks.

Below you will find images from another fossil site in New Jersey that contain fossils of the same age as the fossil in the activity above. These fossils come from an area known as the “Red Beds” due to the reddish-brown rocks. Scientists refer to these rocks as the Newark Supergroup Formation. This formation extends from North Carolina to Nova Scotia and is named for the city of Newark, New Jersey.



Ripple marks (Ramsey, NJ)



Grallator print (Ramsey, NJ)

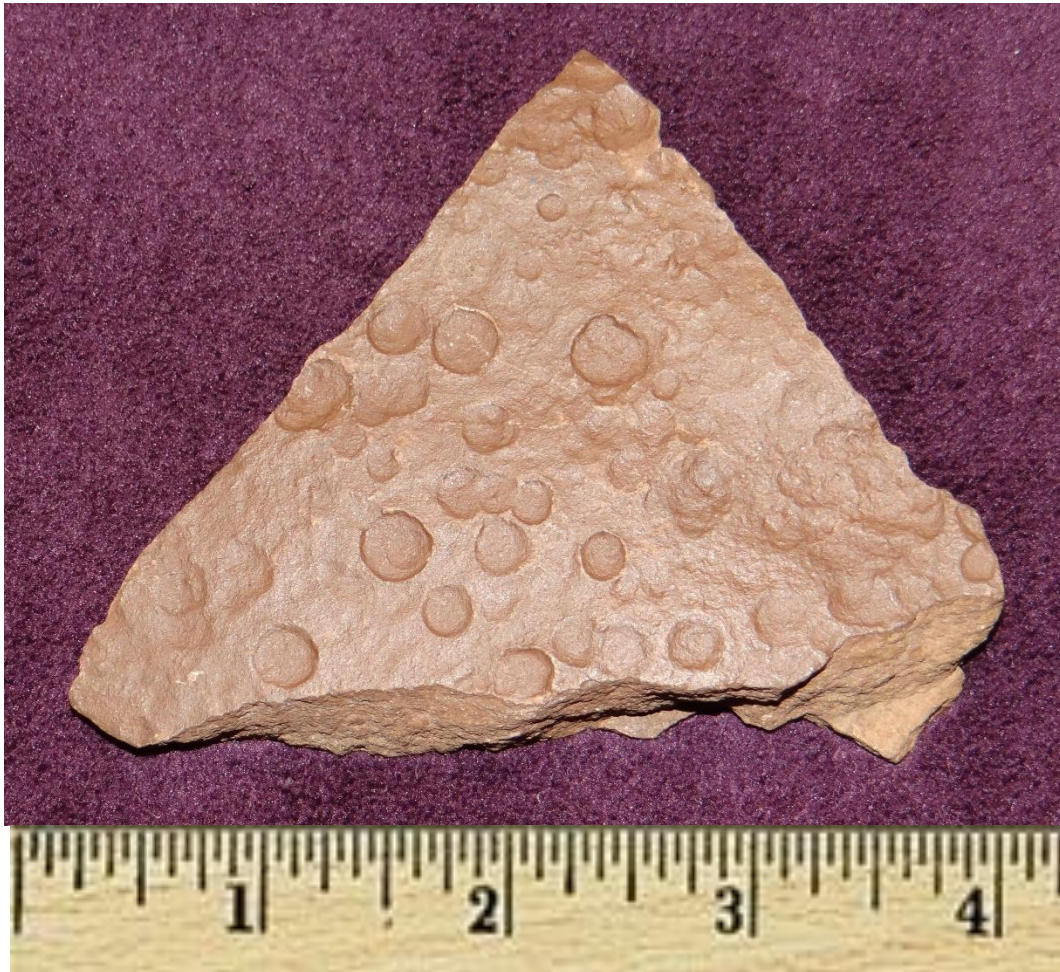


Baby *Grallator* prints
(Ramsey, NJ)



Tail drag - negative imprint from a *Grallator*
Note a portion of the footprint to the upper left
(Ramsey, NJ)

Not all the interesting things found at this location were dinosaurs, some were not even living things.



The small round depressions on this rock were not made by animals but are the result of something quite common. Can you guess what caused these to form?

If you said, "Someone playing with marbles." You would be wrong.

If you said, "Raindrops." You are correct.

A good paleontologist can tell from this single sample that rain fell 190 million years ago at this spot on a Tuesday!

Just kidding, they can't be sure of the year.

The above fossils were collected and photographed by
Marc Rogoff, Environmental Education Specialist,
New Jersey Department of Environmental Protection.