What can fossil footprints tell us?

Teaching and Learning Focus

Trace fossils are useful for paleontologists because they tell about the activity of ancient organisms. For example, the study of dinosaur footprints has contributed significantly to our understanding of dinosaur behavior. In fact, paleontologists have learned much more about dinosaur behavior from footprint trace fossils than from dinosaur body fossils. From many sets of dinosaur footprints or tracks, scientists have learned that some types of dinosaurs traveled in large groups or herds. Sets of tracks have also shown that some herds protected their young by keeping them in the centers of migrating groups. Other tracks show that dinosaurs did not drag their tails when they walked. Paleontologists can also estimate dinosaur gait and speed from some footprint track ways. If the footprints are close together, this might show they were running. If the footprints are spaced farther apart, the dinosaurs may have been walking. These are just a few of the insights that can be gained from studying trace fossils.
In this investigation, students examine an image of multiple fossil footprint tracks. They try to construct an explanation for the events that created the pattern of tracks. Even though students come up with different explanations for the tracks, they see that tracks provide valuable information for dinosaur behavior.

Materials Needed

For the class:

- overhead transparency of the Footprint Puzzle
- blank piece of paper to cover parts of the puzzle when it is put on the projector

Images to be viewed by the class:

- Images of Sauropod Track ways

For the instructor:

- overhead projector
- flip chart or whiteboard
- markers

Safety

Review the investigation for your specific setting, materials, students, and conventional safety precautions.

Setting the Scene

In the last investigation, students developed ideas about what dinosaurs were like based on their fossilized footprints. They considered their size, what kind of feet they had, how many legs they had, and how they walked. In this investigation, students broaden their examination of fossil footprints and consider dinosaur behavior. Begin the investigation by having students reflect on the previous investigation.

1. **What did you learn about what dinosaurs were like from their fossil footprints?**
2. **What kind of information can you get from studying footprints?**

Have your students discuss these questions, first in pairs, then groups and then as a whole class. Record their answers on a flipchart that you can refer to throughout the investigation.

Presenting the Investigation question

After the scene is set, introduce your students to the investigation question:

1. **What can fossil footprints tell us?**

Have your students discuss the question in pairs, then in groups, and then as a whole class. Record their answers on a flipchart.

Assessing What Your Students Already Know

In the last investigation, students developed ideas about what dinosaurs were like based on their fossilized footprints, but they did not consider dinosaur behavior in their analysis.
Here are some initial questions that your students can discuss, in pairs, then in groups:

1. **What can a set of dinosaur footprints tell us about the dinosaurs?**
2. **What would the footprints of a running dinosaur look like? A walking dinosaur?**
3. **What dinosaur behaviors could you see in a set of fossilized footprints?**

Have your students share their ideas with the class and record them as a list on a flipchart.
Ask students the following:

4. **What would you like to learn about what fossil footprints can tell us?**

Record their ideas on the flipchart as a list called “Questions we have about what fossil footprints can tell us.” This list will provide further insights into what your students know, and also what they would like to know. By the end of the investigation, some of these questions will probably be answered.

Exploring the Concept

- Footprint Puzzle Word Document (723 KB)
- Footprint Puzzle Adobe PDF (148 KB)

1. Explain to students that you will be showing them a drawing of fossilized dinosaur footprints. Their job is to interpret the footprints and try to explain what the dinosaurs may have been doing when the footprints were produced.
2. Put students into groups.
3. Show students Position 1 of the Footprint Puzzle (above) on an overhead projector by covering the other two positions with a blank piece of paper. Explain to students that this is a drawing of fossil footprints that were found in a partially exposed, flat-lying section of ancient rock. Ask groups to consider the following:
    - **Can you tell anything about the size of the dinosaurs?**
    - **Were all the tracks made at the same time?**
    - **How many animals were there?**
    - **In what directions did the animals move?**
    - **Did they change their speed and direction?**
    - **What may have changed the footprint pattern?**
    - **What happened to create this set of fossil tracks?**
4. Have groups share their ideas with the class and record them as a list on a flipchart. Show students Position 2 of the Footprint Puzzle. Tell them that as more rock was excavated or uncovered by scientists, more footprints were found in the rock. Ask students to consider the following:
    - **How does this new information change your ideas about the dinosaurs?**
5. Have groups share their ideas with the class and record them as a list on a flipchart.
6. Show students Position 3 of the Footprint Puzzle. Tell them that this last section was discovered with the removal of more layers of rock, soil, and vegetation. Ask students to consider the following:
    - **How does this new information change your ideas?**
7. Have groups share their ideas with the class and record them as a list on a flipchart.
8. Discuss students’ findings as a class. Help students to understand that there are several possible explanations. Perhaps the tracks were made by dinosaurs of different size. The dinosaurs began running, met, and fought. Possibly the bigger dinosaur attacked and ate the smaller one. Another explanation is that the bigger dinosaur was a mother and carried away

its smaller offspring. It might also be that the tracks were made at different times: one dinosaur passed by and left, and then the other arrived. The intermingling of the tracks in the middle might just be a coincidence.

Applying Students' Understanding

Show students the **Images of Sauropod Trackways**. These track ways were made by Sauropod dinosaurs. Ask them to answer the following questions:

- Images of Sauropod Trackways Word Document (1.93 MB)
- Images of Sauropod Trackways Adobe PDF (220 KB)

1. **Describe what you see in the images.**
2. **What explanation can you give for the many track ways close together?** (Sauropod track ways in close proximity indicate that they probably traveled in herds.)

Revisiting Investigation Question 5

Complete this investigation by asking your students the following:

1. **How have your ideas about what fossil footprints can tell us changed as a result of this investigation?**

As a result of this investigation, students should be able to recognize that much information can be learned from the fossilized footprints of an ancient organism. This includes not only what the organism was like physically, but also some of its behavior patterns.

Digging Deeper

The following passage provides more detailed information related to this investigation that you may choose to explain to your students.

Glen Rose Dinosaur Tracks

In the 1930s, a scientist named Roland T. Bird made a magnificent discovery of dinosaur footprints along the Paluxy River in Glen Rose, Texas. The rock at this location contains two track ways that are parallel to each other and were made by two very different dinosaurs. The first track way shows broad footprints from a Sauropod’s back feet, as well as narrower footprints made by its front feet. Scientists estimate that the dinosaur may have been 40 to 50 feet long and weighed 30 tons. A second track way shows three-toed prints made by a smaller Theropod dinosaur. The Theropod, walking on hind legs, was perhaps 30 feet in length. There are no tail-drag marks in the rock, leading scientists to believe that the Sauropod and Theropod held their tails off the ground when walking.

Some scientists believe the footprints document shows an attack sequence between the Theropod and the Sauropod. They think the predator was probably the smaller Theropod and the prey was the larger Sauropod. At first, the Theropod footprints run parallel to the Sauropod footprints, indicating the Theropod was stalking the Sauropod. The Theropod prints then get closer and closer to the Sauropod prints, until the Theropod attacked the Sauropod. Two consecutive right footprints suggest that the Theropod clung to its victim for a short distance, hopping on one leg. After the attack, the tracks indicate the Sauropod dragged its back right foot as if injured.

The tracks were such an incredible find that they were hammered out of the rock and transported by truck and train to a new destination that was less prone to weathering. Today, the tracks are on display in a small building and are maintained by the Texas Natural Science Center. They are considered among the finest examples of dinosaur track ways ever discovered!

Images of the tracks can be viewed at the following sites:

- Photo of the Paluxy River trackways before being removed from the Paluxy River site.
- Drawing by R.T. Bird of Paluxy River trackways.

Fossil Unit Sections