Making Tracks

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Introduction

Fossils are evidence of ancient life (usually) preserved in stone. When most people think about fossils, they think about bones and skeletons. Not all fossils, however, are the body parts of ancient organisms. A very important type of fossil is called a trace fossil (scientifically termed an "ichnofossil"). Trace fossils are the tracks or trails an organism leaves behind. In this activity, students will make trackways by running across sheets of paper, and then their classmates will determine what they can interpret from the trackways.

Grade Level : 4-8

Time : 15-30 minutes to make the tracks and then 30 minutes to interpret and discuss the tracks

Materials

- 100 feet of rolled paper. Can be black or white art paper, or meat-wrapping paper from grocery store. Any roll will do that is not waxy so that paint or chalk will stick to it, and that is firm enough not to tear when a student or students walk or run across the paper.
- Tape (to hold down the paper)
- Chalk (powdered and colored works best) or water-color paint to make footprints. Choose a color or colors that will contrast with the color of the paper chosen
- Marker (for highlighting and labeling footprints)

Background

Dinosaur tracks are probably the most famous examples of trace fossils, but less famous creatures, such as worms and snails also leave behind tracks and trails. Fossil tracks and trails provide very useful information for interpreting the earth's past.

Identification

In the modern world, tracks and trails of organisms can be matched to the organisms that made them. Modern tracks and trails are useful for finding organisms in the field, which might be shy or hiding during the day. Similarly, paleontologists (scientists who study fossils) can match fossil tracks and trails to the ancient animals that made them. This can help a paleontologist determine that an organism was living in a particular area or time, even if hard-part or body fossils of the organism have not yet been found. Likewise, trace fossils of soft-bodied organisms (like worms), may be the only evidence that these creatures existed, since they don't have body parts that would normally be fossilized.

Direction

If you can determine what type of organism made a track or trail, you can generally determine the front-end of the track or trail and determine the direction in which the organism was moving. This might help identify a behavior (for example moving toward a watering hole) or aid in finding the actual organism that made the tracks (or in the case of fossils, body parts or hard-part fossils of the organism that made the tracks).

Posture and gait

The footprints a walking or running animal makes in the mud are controlled by the position of the animal's legs beneath its body. From fossil footprints, paleontologists can determine how an ancient animal's legs were positioned relative to the rest of the skeleton, as well as how those legs moved. For example, in dinosaur trackways the tracks are always close together. This told paleontologists that dinosaur's moved with feet very close together. This meant their legs could not be sprawling, out to the side, like a modern lizard's, but rather were close beneath the body. Also, investigations of dinosaur trackways showed that they never have a tail drag mark. This meant that dinosaurs walked with their tails carried off the ground. For years, skeletons of dinosaurs had been mounted with tails on the ground. In fact, tail and backbones of some dinosaurs had to be broken or separated to make the tails drag on the ground. Only after scientists realized that the trackways show that dinosaurs walked with tails in the air, did they understand why the fossil bones didn't seem to fit correctly when the tails were on the ground.

Relative weight

Footprints are a function of the weight of an animals and the sturdiness of the material being walked on. To some extent, the depth of a trackway provides information about the relative weight of an organism. For example an elephant will tend to leave a deeper track in the mud then a deer. Likewise, some large dinosaurs left very deep tracks in the ancient muds, which are now fossils.

Running vs. Walking, and Speed

Many animals leave different types of footprints when they walk or run. For example, if you walk you will tend to leave an impression of your entire foot with some set distance between footprints, which is called your "stride." If you run, your stride will increase and the shape of your footprints may change. Some people run on the balls of their feet, so that only the front of their foot is left as an impression. Likewise, the force at which your foot hits the ground when you run may make a deeper or wider "impact" impression, as compared to when you walk. Scientists have studied the strides of modern animals, so that the speeds of animals can be compared to their footprints. If the limb length of an ancient animal is known, the tracks it leaves behind can be used to determine the speed at which the ancient animal was moving. This has been calculated for many dinosaurs. What is important about this calculation, is that the trackways are critical for determining speed; you couldn't make the calculation from the bones alone.

Behavior

One of the most important features about fossil trackways is that they can provide clues to animal behaviors in the modern and fossil record. Groups of dinosaur tracks on a single bedding plane (rock surface) may indicate herding. Herding is a social behavior that would be difficult to determine from fossil bones, but can be demonstrated by fossil trackways. Likewise, some invertebrate (lacking a backbone, and generally soft-bodied) organisms make different types of trails when they are feeding, or moving, or building a home. Paleontologists can compare modern invertebrate tracks and trails to ancient fossils, to determine the activity or behavior of the ancient invertebrates. Some behaviors are related to environment. In the modern world, some invertebrate organisms make different depth or size homes in fresh water than salt water. Others have different feeding behavior in estuaries vs. the open seas. When scientists find similar traces in rock, they can use the modern observations to interpret ancient water salinity, oxygen content, sedimentation rates, and environments of deposition (rivers, estuaries, lakes, etc.).

Activity:

Prior to the activity, discuss trackways. Explain how we can identify different animals from the tracks they leave behind. This is also true for ancient animals and the fossil tracks they left behind. Decide if you want to do this activity as a class demonstration where the entire class participates in making and viewing the tracks, or

as an activity where a few students make tracks prior to class, and then the class interprets the trackways in class without seeing how they were made.

1. Unroll approximately 20 feet of paper in the hallway. Tape the paper down in several spots so it won't slip.

2. Use powdered, colored, chalk (or water color paint) to cover the bottom of a student's feet or shoes. Shoes sometimes work better with chalk. Obviously, you have to be more careful of using paint on shoes and the floor.

3. Have a student walk across the paper.

4. If using chalk, teacher or student should use a marker to outline the shape of the chalk footprints when the trackway is complete.

5. Pull the tape. If using paint, let the paint dry. Label this trackway 1.

6. Repeat steps 1-5, but have a student run (or jog so they don't slip) rather than walk across the 2 nd sheet of paper. Label this trackway 2.

7. Repeat steps 1-5, but have a student hop (like a rabbit), rather than walk across the paper. Label this trackway 3.

8. Repeat steps 1-5, but have a student crab-walk (on hands and feet), rather than walk across the paper. Remember to chalk or paint the student's hands as well as their feet. Label this trackway 4

9. Repeat steps 1-5, but have two or three students walk across the paper (have at least one walk in a different direction). Label this trackway 5.

10. You can be creative and have students try other motions or activities for additional trackways, depending on how much paper you want to use, and how much time you want to spend in class analyzing the trackways.

11. Have the entire class gather around the trackways or tape up the trackways in class. Lead the students through a series of observations to show what we can learn from tracks.

Sample questions for each trackway.

1. Was this track made by one organism? Why?
2. If more than one organism, is there anything distinctive about the tracks that you can use to determine which tracks were made by which organism?
3. How many organisms made these tracks?
4. Was the organism a biped (2-legged) or a quadrupeds (4-legged)?
5. What direction was the organism(s) moving? Why?
6. Is this a big organism or small organism? An adult or infant? Why?
7. Is the organism(s) running or walking? Is some other type of movement or behavior indicated?