



Laetoli Footprints

HOW TO USE THIS RESOURCE

The image for this resource shows fossil footprints at Laetoli, which can serve as a phenomenon to explore the key concepts described below.

The pedagogical practice of using phenomena to provide a context for understanding science concepts and topics is an [implementation practice](#) supported by the Next Generation Science Standards (NGSS). Phenomena are observable occurrences that students can use to generate science questions for further investigation or to design solutions to problems that drive learning. In this way, phenomena connect learning with what is happening in the world while providing students with the opportunity to apply knowledge while they are building it.

The “Implementation Suggestions” and “Teaching Tips” sections provide options for incorporating the image into a curriculum or unit of study, and can be modified to use as a standalone activity or to supplement an existing lesson. The student handout includes reproductions of the image and the “Background Information” section.

Additional information related to pedagogy and implementation can be found on [this resource’s webpage](#), including suggested audience, estimated time, and curriculum connections.

KEY CONCEPTS

- Fossils can be used to infer biological information about past organisms.
- Fossils include not only preserved body remains but also traces (such as footprints) left behind by past organisms.
- It is possible to reconstruct evolutionary history by comparing the fossils of extinct organisms with each other and organisms living today.

BACKGROUND INFORMATION

This image shows footprints estimated to be about 4 million years old. They come from **Laetoli**, a paleontological site in northern Tanzania. Laetoli is famous for its fossil footprints of **hominins**: a taxonomic group that includes humans and their extinct ancestors. In addition to hominin footprints, Laetoli also has fossil footprints of other mammals and birds.

In the 1970s, scientists at Laetoli discovered the footprints of three hominin individuals. In 2015, the footprints of two more individuals were found, some of which are shown in the image. It’s believed that the footprints were left by hominins walking over the ash from a volcanic eruption.

Scientists can use these footprints to estimate the heights of the hominin individuals who made them. They can also use the footprints to infer other biological information about these hominins, such as how they moved, how quickly they moved, and how individuals of the same species varied.

IMPLEMENTATION SUGGESTIONS

The following suggestions outline several options for incorporating the image into a unit of study as a phenomenon:

Engagement, establishing prior knowledge, and providing context:

- Begin the lesson by telling students that they will be examining a photograph of fossil footprints, taken at a specific site in northern Tanzania. It may be helpful to show students where Tanzania is located on a map to orient them.
- Show students the image and ask them to make observations using the sentence stems “I notice...”, “It reminds me of...”, and “I wonder...”
- Use a think-pair-share protocol to have students share their observations and questions about the image. Record class observations, noting when students make similar observations and drawing attention to the range of student-generated questions.
 - Students may observe that:
 - The image shows holes, markings, and impressions in rock or dirt.
 - Some parts of the rock/dirt show more signs of weathering/damage than others.
 - Some of the impressions look like human footprints, with both heel and toe tracks visible.
 - The footprints are relatively evenly spaced, maybe about a walking stride length apart.
 - The footprints look relatively deep compared to the other markings.
 - Students may ask:
 - Who left these footprints and under what circumstances?
 - Were the footprints left by modern humans or organisms related to modern humans?
 - What did the organisms who left these footprints look like? What were their lives like?
 - How were these footprints preserved? Why aren’t other sets of footprints preserved similarly?
- Have students read the “Background Information” for the image.
- Transition to the “Exploration, investigation, and assessment” section by telling students that they’ll be investigating some of their initial questions about these fossil footprints.

Exploration/Investigation:

- Watch the animated short video [Animated Life: Mary Leakey](#) from the beginning to 5:32 (up to the “Interpretation” section). This video discusses the work of paleoanthropologist Mary Leakey, who discovered hominin footprints at Laetoli in the 1970s.
 - While students are watching, it may be helpful to turn on subtitles or provide a transcript, which can be downloaded from the resource’s webpage. An [audio descriptive version](#) is also available.
 - Ask students to note the following:
 - In Leakey’s time, what was the prevailing hypothesis about human origins among Western scientists?
 - What were Leakey’s other discoveries prior to the Laetoli footprints?
 - How were the Laetoli footprints discovered?
 - Who left the Laetoli footprints and under what circumstances?
 - Ask students to consider their original list of questions about the image of the Laetoli footprints.
 - Which questions have been answered by the video?
 - Which questions still remain?
 - Which questions would they like to revise in light of the information in the video?
 - Transition to the next activity by telling students that they’re going to explore how scientists find and analyze fossil evidence of human ancestors.
- Have students do the hands-on activity [“Human Feet Are Strange,”](#) in which they create and analyze their own footprints. They then use a set of observation and inference tables to determine what information

scientists could get from these footprints. They also evaluate the evidence that the Laetoli footprints were made by a fully bipedal human ancestor, and compare chimpanzee and human footprints.

- Following this activity, ask students to consider their observations of the original image of the Laetoli footprints. Have them revise and extend those observations based on their experience in the activity.
- As a possible extension, have students list inferences related to each of their observations.
- Have students do the Click & Learn [Human Origins](#). In this Click & Learn, students explore the fossilized skeletons, footprints, and/or stone tools of four different hominins. Students also compare the physical features of these hominins with those of modern humans and chimpanzees.
 - It may be helpful to provide students with a chart or other organizing tool to help them compare humans and the other hominins in the Click & Learn.
 - Consider having students focus on the sections of the Click & Learn comparing human and *Australopithecus afarensis* footprints, and human and *Ardipithecus ramidus* feet.
 - If you are using the *Great Transitions* video in the “Extension” section, it may be helpful to show the video from the beginning to 9:11 *before* doing this Click & Learn.
- Watch the rest of the [Animated Life: Mary Leakey](#) video (5:32 to the end). Ask students to note the following:
 - What did these footprints provide evidence for?
 - What other evidence did scientists use to conclude that hominins were bipedal?
 - What did being bipedal allow hominins to do?

Assessment:

- Introduce the figure from the Data Point activity [“New Laetoli Footprints and Hominin Body Size.”](#) The figure shows the estimated heights of hominin individuals based on either fossilized remains or footprints. Different symbols represent different hominin species.
 - This figure is from the same paper ([Masao et al. 2016](#)) in which the original footprint image in this Phenomenal Image activity was published.
- Have students use the figure, caption, and “Background Information” to address the following questions, which are also provided in the “Educator Materials” for the Data Point:
 - Which hypothesis — that hominins showed a linear progression of increasing stature over time, or that stature varied greatly, indicating sexual dimorphism — do these data support? Provide evidence from the graph.
 - Would your answer to the previous question have been different before specimens S1 and S2 were added to the graph? Use evidence from the graph to justify your answer.

Extension:

- Reveal that the Laetoli footprints are just one of many lines of evidence that early human ancestors were bipedal.
- Watch the short film [Great Transitions: The Origin of Humans](#), which discusses other fossil discoveries, including those of hominins’ bones and tools, that provided evidence that early human ancestors were bipedal.
- Have students either complete the accompanying [film activity](#) or use the [interactive assessment version](#) of the video with embedded questions.
 - Alternatively, use the review questions in the [film activity](#) for class discussions (or for forum/discussion board posts if the class meets asynchronously).

- Ask students to revisit their original questions about the Laetoli footprints and the individuals who left them. See which questions have been answered, which questions they would like to revise, and which questions still remain.
- Use students' questions to transition to additional explorations about evidence for evolution.

TEACHING TIPS

- Present students with the image first, before they read the background information.
- Encourage students to draw upon their prior experiences and knowledge to interpret the image and generate questions.
- Provide opportunities for students to explore outside sources to promote their independent explorations and discussions.
- Background information may be edited to support student proficiency, course sequence, etc.
- The image may be projected in lieu of handouts.
- Printed images can be laminated for use in multiple classes.
- Pair or group students to work through one or more of the implementation suggestions.

CREDITS

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Image from:

Masao, Fidelis T., Elgidius B. Ichumbaki, Marco Cherin, Angelo Barili, Giovanni Boschian, Dawid A. Iurino, Sofia Menconero, et al. "New footprints from Laetoli (Tanzania) provide evidence for marked body size variation in early hominins." *eLife* 5 (2016). <https://doi.org/10.7554/elife.19568>. Used under CC BY 4.0.