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WHAT THE FOSSIL RECORD TELLS US

As the ancient hominids walked across the volcanic ash at Laetoli, they left footprints, but no handprints. These hominids belonged to the species Australopithecus afarensis, the same species as Lucy, a small-brained early hominid. They were not, however, the only beings to walk across the slushy surface. Animals of all types left their footprints or, in the case of worms and snakes, trails of their bodies. The African sun at midday is like a clothes-iron pressing down on the land. It was this heat that baked the ash hard. When Mary Leakey discovered the footprints in 1976, they were a spectacular type of fossil. They proved without a doubt that these early humans walked upright like we do.

The term "fossils" refers to any trace of ancient activity, such as the footprints described above, or any remains of a part of the body. The most common body parts to become fossils are bones or teeth. Scientists generally consider something fossilized if much of the organic material has been replaced by minerals.

The source of these minerals is the sediment in which the fossil was deposited. For example, mammal bone is about 40 percent organic (this provides flexibility) and 60 percent inorganic (this provides strength and rigidity). During burial, the organic part often degrades. If the conditions are right, the organic part can be replaced by minerals in the sediment that give the stone-like character to the fossil. If the sediment conditions are not right, this replacement does not occur. The bone then disintegrates before becoming a fossil and is forever lost. This means that fossils are only found in special contexts.

What are these special contexts? To become a fossil, a skeletal element must be protected from natural forces of destruction. These include such animal activities as being eaten by bone-crunching, flesh-eating hyenas. They also include environmental factors, such as sun and rain. Rapid burial generally increases the likelihood of an element becoming a fossil. Rapid burial often occurs nears the shores of lakes, as at Olduvai Gorge, or from volcanic ash, as with the Laetoli footprints. Other important preservation contexts include lack of oxygen and very dry conditions. Both slow the loss of the organic part. If conditions are right, and this is rarely true, fossils will form.

Fossils can be studied in various ways. Scientists often reconstruct the origin of a fossil. They do this by analyzing how, when, where, and why it was buried. Scientists then spend time carefully studying the position and the characteristics of a fossil. Has the bone been gnawed by flesh-eating animals? Are there cut marks from stone tools? Is the skeleton in the proper anatomical position or has it been moved?

Scientists also spend time studying modern processes of fossil formation. In fact, today's scientists spend as much time studying modern processes, such as the manner in which hyenas destroy a carcass, as they do the ancient bones. However, they cannot do their job if the fossil has been removed. This is why you must not make collections of fossils when you find them. Photograph what you see, and bring the photograph to the attention of a local archaeologist, palaeontologist, or park authority. Leave the fossils untouched where you found them.

Careful study of the characteristics of a fossil can help us assign the fossil to a species, and this helps us understand evolutionary history. Further study can be used to reconstruct the way an ancient animal moved, and what it ate. For example, Lucy's pelvis is shaped like a bowl as with modern humans. We know from studies of modern people and apes (such as chimps and orangutans) that this bowl-shape is a design characteristic of walking on the two lower limbs. Scientists can study the surfaces of bones to help them understand the muscles. By analyzing the patterns of broken bones, they can learn more about the lifestyle.

Today's technology has greatly expanded the amount of information we can gain from studying a fossil. By analyzing scratch patterns on teeth we can reconstruct the diet of early hominids. Analyses of bone chemistry have allowed us to reconstruct the amount of meat in the diet. We can also reconstruct hominid DNA from the fossil bones.

Every year, new techniques are developed. The pace of new research and scientific advance in archaeology and palaeontology has never been as fast as it is now. The future promises even more impressive results that will inform us about the past, and you could be part of this process.

PHOTO (COLOR): A local Maasai looks at the re-excavated track of footprints at Laetoli before it was reburied.

PHOTO (COLOR): Uncovering hominid remains is slow work. Here at Laetoli, excavators carefully remove the roots of acacia trees that had spread across the area. A temporary shelter was set up over the site to protect it from direct sunlight and to shade the workers.

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By Curtis W. Marean
