

The Discovery of The Dikika Baby Fossil as Evidence for Australopithecine Growth and Development

When scientists discovered a 3.3 million-year-old skeleton of a child of the human lineage (hominin) in 2000, in the village of Hadar, Ethiopia, they were able to study growth and development of *Australopithecus afarensis*, an extinct hominin species. The team of researchers, led by Zeresenay Alemseged of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, named the fossil DIK 1-1 and nicknamed it Dikika baby after the Dikika research site. The Dikika fossil preserves much of the skull, including the jaw and teeth, which enabled scientists to study the teeth microstructures and to reconstruct the pace at which individuals of the hominin *A. afarensis* developed.

Researchers study fossils of juvenile hominins because those fossils illustrate the slow rate at which humans grow. One of the ways humans differ from their closest living relatives, chimpanzees and gorillas, is by their comparatively long childhood period, or period before they acquire the ability to reproduce. Researchers can study this extended childhood through the microstructures of teeth, which preserve the timing of when humans pass through stages such as weaning and tooth eruption. Scientists can reconstruct the life histories of human ancestors to learn when the evolution of the extended childhood appeared in the hominin lineage.

Alemseged recovered the partially exposed fossil in December 2000 from a block of sandstone within the Hadar Formation at a site called Dikika, located in northern Ethiopia. Part of the fossil's face was exposed from the three-million-year-old strata, whereas the majority of the specimen's skull remained surrounded by rock. Alemseged spent five years removing the solid material surrounding the fossil, material called matrix, to expose the complete fossil. In addition to the braincase and face, the Dikika baby fossil includes elements such as the shoulder blades and several vertebrae. When much of the fossil had been exposed, Alemseged and his coauthors published the discovery in a 2006 article titled "A Juvenile Early Hominin Skeleton from Dikika, Ethiopia."

In this publication, Alemseged's team argued that the Dikika baby was especially useful for explaining the growth patterns of fossil hominin because the specimen included both the head and parts of the body (crania and post-crania). The discovery of many *A. afarensis* fossils enabled scientists to identify the Dikika baby as a member of that species. The Dikika fossil often referred to as Selam, or Lucy's baby, referring to the specimen of *A. afarensis*, discovered in Hadar in 1974, called Lucy. The Dikika baby was the first relatively complete *A. afarensis* juvenile studied in detail. The authors claimed that Dikika was the first non-Neanderthal juvenile hominin preserved enough to study in order to explain *A. afarensis* development.

In the 2006 article, Alemseged and his team noted that their findings of the teeth led them to claim that the Dikika baby was around three years old. They first noted that the baby teeth, or milk teeth (deciduous teeth), were all erupted. They then used computer-processed X-rays to produce virtual images or slices of a specific area of a scanned object, called computed tomography (CT) scan, which revealed that the first molar crowns were not erupted but were fully formed.

The research team also noted the presence of unerupted teeth such as the canine and incisor crowns, which appeared to be at differing stages of development. The scientists then examined the microstructures of the erupted deciduous teeth, based on the methods of Timothy Bromage of the University of Toronto in Toronto, Canada, and of Christopher Dean of the University College London in London, UK. Those methods count striations on the surface of the tooth crowns, which form the molars, in order to estimate growth periods. Then, following the work of Bromage and Dean,

Alemsefad and his team compared these dental developmental stages to a model of African ape molar formation. Bromage and Dean demonstrated that hominins likely had shorter growth periods than humans. They based their estimates on African apes, which develop faster than humans.

In addition to providing information on hominin growth and development, the Dikika fossil raised questions about behavior and possible arboreal habits in Australopithecines. In 2002, Alemseged, along with David J. Green from Midwestern University in Downers Grove, Illinois published an article titled "Australopithecus afarensis Scapular Ontogeny, Function, and the Role of Climbing in Human Evolution." They argued that the preserved shoulder blades, or scapulae, of the Dikika baby indicated that members of the species spent a lot of time climbing. This result contributed to a debate on how much time Australopithecines spent climbing versus walking. Based on the Dikika baby shoulder blades, some scientists suggested that Australopithecines may have climbed in trees to forage or to make nests to sleep.

In the early decades of the twenty-first century, the Dikika baby was the oldest hominin fossil found that provided information on early hominin growth and development. It provided a detailed example of tooth development in a juvenile. In addition to fossils that approach *Homo sapiens* more closely, such as *Homo erectus* and *Homo neanderthalensis*, this fossil helps scientist to reconstruct the evolution of humans' extended developmental period.

Sources

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