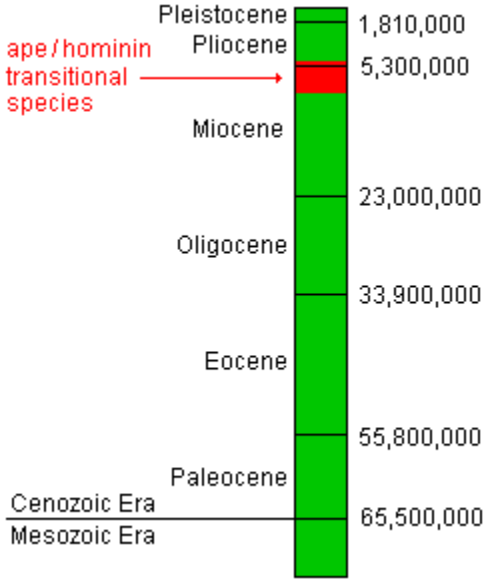
*Discovery of Early Hominins*

The immediate ancestors of humans were members of the genus ***Australopithecus***. The **australopithecines** (or australopiths) were intermediate between apes and people. However, both australopithecines and humans are biologically similar enough to be classified as members of the same biological tribe--the ***Hominini***. All people, past and present, along with the australopithecines are **hominins**. We share in common not only the fact that we evolved from the same ape ancestors in Africa but that both genera are habitually **bipedal**, or two-footed, upright walkers. By comparison, chimpanzees, bonobos, and gorillas are primarily **quadrupedal**, or four-footed.




Over the last decade, there have been a number of important fossil discoveries in Africa of what may be very early transitional hominins, or **proto-hominins**. These creatures lived about the time of the divergence from our common hominid ancestor with chimpanzees and bonobos, during the late Miocene and early Pliocene Epochs. The fossils have been tentatively classified as members of three distinct genera--***Sahelanthropus***, ***Orrorin***, and ***Ardipithecus***. However, all of their fossil remains are still fragmentary and far from being complete. *Sahelanthropus* was the earliest, dating 7-6 million years ago. *Orrorin* lived about 6 million years ago, while *Ardipithecus* remains have been dated to 5.8-4.4 million years ago. At present, the vote is still out as to whether any of these three primates were in fact true hominins and if they were our ancestors. The classification of *Sahelanthropus* has been the most in question.

The earliest australopithecines very likely did not evolve until 5 million years ago or shortly thereafter (during the beginning of the Pliocene Epoch) in East Africa. The primate fossil record for this crucial early transitional period leading to australopithecines is scanty and somewhat confusing at present. However, by about 4.2 million years ago, unquestionable australopithecines were present. By 3 million years ago, they were common in both East and South Africa. Some have been found dating to this period in North Central Africa also. As the australopithecines were evolving, African forests were progressively shrinking and grasslands, or savannas, were advancing. In this sort of environment, bipedalism would very likely have been an advantage.

By 2.5 million years ago, there were at least 2 evolutionary lines of hominins descended from the early australopithecines. One line apparently was adapted primarily to lake margin grassland environments and had an omnivorous diet that increasingly included meat. Among them were our early human ancestors who started to make stone tools by this time. The other line seems to have lived more in mixed grassland and woodland environments, like the earlier australopithecines, and was primarily vegetarian. This second, more conservative line of early hominins died out by 1 million years ago or shortly before then. It is likely that all of the early hominins, including humans,

supplemented their diets with protein and fat rich termites and ants just as some chimpanzees do today.

## History of Discovery

In an 1871 publication, Charles Darwin speculated that fossils of the earliest humans and their primate ancestors ultimately would be found somewhere in Africa. He based this on the fact that the natural range of our nearest living relatives, chimpanzees and gorillas, is limited to Africa. He concluded that we ultimately must have shared a common ancestor with those apes in Africa. This view was mostly rejected by the scientific world of the time. Before the 1920's, knowledge of our fossil ancestors only went back to the Neandertals in Europe and some presumably earlier human-like forms from Java, in Southeast Asia. Few researchers were willing to estimate the time period of the earliest hominins at much more than 100,000 years, and there was no inkling of anything older from Africa. In addition, there was a bias among the predominantly European paleoanthropologists against accepting early Africans as the ancestors of all humanity.

Raymond Dart (1893-1989)

In 1924, **Raymond Dart**, an Australian anatomy professor at the University of Witerwatersrand in Johannesburg, South Africa, obtained a fossil skull that had been blasted out of a nearby limestone quarry at **Taung**. It took him 73 days to chisel the skull free from its surrounding stone matrix and ultimately 4 years of spare time to free the jaw and the fossilized brain. However, long before then, Dart recognized the importance of this find. In 1925 he named it ***Australopithecus africanus*** (literally "southern ape from Africa"). Because of its small size, he called it the "Taung baby." In fact, it was a child of 3-4 years old. Despite its relatively small brain, he concluded that this species was intermediate between apes and humans. He based this mainly on the shape and position of the base of the brain. It indicated that the **foramen magnum**, or hole in the skull through which the spinal cord passes, pointed downward and was nearly at the central balance point of the skull. This meant that the Taung child must have been bipedal. In addition, the canine teeth were relatively short. In both of these traits, the Taung child was much more like a human than an ape. Most paleoanthropologists in the 1920's rejected Dart's claims that *Australopithecus africanus* was intermediate between apes and humans in favor of the view that it was just an ape. Dart's claims were not widely accepted until the late 1940's.


"Taung Child" reconstruction (*Australopithecus africanus*)

MAJOR EARLY HOMININ SITES


Robert Broom (1866-1951)

Following Dart's discovery, several other caves were investigated in South Africa. Most of the work was done by **Robert Broom** from 1936 through the 1940's. Broom was a medical doctor and an enthusiastic amateur paleontologist from Scotland. In 1903, he was appointed professor of geology at the University of Stellenbosch in South Africa and became internationally respected for his studies of early mammal-like reptiles. His insistence on the correctness of the theory of evolution led to his dismissal from this conservative religious university in 1910. Consequently, he returned to being a medical doctor in a relatively remote part of South Africa but continued paleontological research in his spare time. In 1934, at the age of 68, he retired from his medical practice and joined the staff of the Transvaal Museum in Pretoria as a paleoanthropologist. The rest of his life was spent searching for early hominin fossils.

Robert Broom's most important discoveries were made in the Sterkfontein valley of South Africa. It was there in 1936 that he found the first known adult *Australopithecus africanus* while excavating in **Sterkfontein** cave. In 1938, he discovered more fossil remains of *africanus* and other early hominins in **Kromdraai** cave. Some of these fossils were larger boned and more muscular with powerful jaws. Broom named them ***Paranthropus robustus*** (*Paranthropus* means "parallel to man"). Significantly, these robust hominins also differed in having a **sagittal crest**, or ridge of bone extending from front to back, along the midline of the top of the skull. A sagittal crest serves as an anchor attachment for exceptionally large, strong jaw muscles. This skeletal feature is also present in large apes but not in *africanus* or humans.

*Australopithecus africanus*


*Paranthropus robustus (Australopithecus robustus)* (see note below)

*NOTE: Most paleoanthropologists discarded the name Paranthropus robustus by the 1960's in favor of Australopithecus robustus. However, some researchers in recent years have returned to the original genus designation. Paranthropus will be referred to as Australopithecus here.*

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In 1948, Robert Broom found more *Australopithecus robustus* fossils at **Swartkrans** cave in South Africa. Following that excavation, he dedicated the rest of his life to writing everything known about all of the early hominins. He completed this compendium work in 1951. He was 85 years old and ill. As he finally finished his writing, he reportedly said "now it is done and so am I". He died a few minutes later.

Between 1965 and 1983, **Swartkrans** cave was carefully reinvestigated by **C. K. Brain** using more thorough field and laboratory techniques than had been used by Robert Broom a generation earlier. Many thousands of bone fragments, including the remains of 130 individual hominins, were recovered by Brain. These bones were from both species of early hominins identified before as well as members of our genus, *Homo*. Because many of the bones had chewing marks and at least one of the skulls had peculiar depressions reminiscent of punctures made by the canine teeth of a leopard, Brain hypothesized that some of the Swartkrans hominins had been eaten by these big cats. The early hominin fossil-bearing strata in the cave also contained 195 stones that were from another location distant from the cave. Brain believed that 30 of them may have been used as tools or weapons. In any case, the presence of these stones suggests that not all of the early hominins in the cave were there as a result of being the victims of carnivores.Unfortunately, most of the South African sites where early hominin fossils have been found are not easily dated because they lack association with volcanic deposits that would readily allow radiometric dating. That is not the case with most of the early hominin sites in East Africa.

Leopard canines fit punctures in hominin skull from Swartkrans

The oldest fossil hominins have been recovered from sites in East Africa, especially in the Great Rift Valley. One of the most important sites there is **Olduvai Gorge**. It is an approximately 30 mile (48 km.) long, eroded canyon complex cutting into the Serengeti Plain in Northern Tanzania. It is only about 295 feet (90 m.) deep, but its neatly stratified layers of dirt and rock interspersed with easily datable volcanic ash and lava layers cover the last 2.1 million years of geological and evolutionary history. The remains of many australopithecines and early humans have been found at Olduvai. When these ancient hominins lived there it was a grassland that probably had abundant food sources.

Mary and Louis Leakey with the "*Zinjanthropus boisei*" palate and a modern human skull in 1959

*Zinjanthropus boisei (Australopithecus boisei)*

Early hominin fossils from Olduvai Gorge are known mostly as a result of the many expeditions of **Louis and Mary Leakey** . Louis began searching there in 1931, and his second wife Mary joined him in 1935. However, it was not until 1959 that they found their first early hominin fossil. Louis gave it a new genus and species designation, ***Zinjanthropus boisei*** (literally "East African man"). Subsequently, it was recognized to be only a super robust species of australopithecines. It is now generally referred to as ***Australopithecus boisei***. Using the then new potassium-argon dating method, the fossil was determined to be 1.75 ± .25 million years old. This was a startlingly early date when it was made public over four decades ago. Louis Leakey and *Zinjanthropus* instantly became international media stars, and both of their pictures were on the front page of newspapers around the world. Louis was also the focus of several television documentary programs. In the years after his death in 1972, Mary became well known as a paleoanthropologist in her own right.

Lucy (*Australopithecus afarensis*)

In 1974, a team of paleoanthropologists, under the direction of an American, **Donald Johanson**, found an even more ancient species of australopithecine at the **Hadar** site in the Afar Desert region of Northern Ethiopia. It was a 40% complete skeleton of an adult female who they named **Lucy**. She had been only 3 feet 3 inches (1 m.) tall with a slender body weighing only about 60 pounds (27 kg.). She lived 3.2-3.18 million years ago. Johanson concluded that Lucy was from a different species than had been previously discovered. He classified her as an ***Australopithecus afarensis*** (named for the Afar region). Many other specimens of this species and later ones were found in Ethiopia since 1974, but none is as complete as Lucy.

Laetoli early hominin footprints

About 30 miles south of Olduvai Gorge in Northern Tanzania is the **Laetoli** site. It was investigated in the late 1930's by Louis and Mary Leakey, but no fossil hominins were found at that time. Mary Leakey returned to Laetoli with Tim White, an American paleoanthropologist in 1978. They found bones of what were likely *Australopithecus afarensis* dating in the range 3.7-3.5 million years ago. They also found 59 footprints of bipedal hominins (presumably *afarensis*) in a now hardened volcanic ash layer. These individuals walked in two close parallel tracks across volcanic dust at least 3.5 million years ago. The footprints look almost like those of modern humans. They are narrow with an arch, and they clearly show that the big toe was in line with the others. These are all traits of humans but not of apes. Based on the characteristics of the footprints, Mary Leakey concluded that their makers were adults who were 4 feet 9 inches and 4 feet 1 inch tall and that they walked parallel to each other in a strolling fashion with relatively short strides. In addition, there are a child's footprints within those of the larger adult.

"Black Skull"
(*Australopithecus aethiopicus*)

In northern Kenya and southern Ethiopia, there is an arid region around **Lake Turkana** in the Great Rift Valley that has exposed geological deposits dating to at least 4.3 million years ago. **Richard Leakey**, the son of Mary and Louis Leakey, began looking for hominin fossils there in the late 1960's. During the 1970's, his team of field researchers from the National Museum of Kenya made a number of important finds, including fossils of early humans who will be described in the next tutorial of this series.

While working on the western side of Lake Turkana in 1985, an American paleoanthropologist named **Alan Walker** made an important discovery. This was a nearly complete robust australopithecine skull with an unusually large sagittal crest and some features reminiscent of the more ancient *Australopithecus anamensis* (described below). Manganese in the soil deposit where it was located stained it black. As a result, this unusual fossil has become known as the "**black skull**." It has been classified as ***Australopithecus aethiopicus*** (named after Ethiopia). Since it dates to 2.5 million years ago, it is a prime candidate for being the earliest robust australopithecine species.

In 1995, **Meave Leakey**, the wife of Richard Leakey, began discovering bones of a very early australopithecine species at several sites southwest of Lake Turkana. She named it ***Australopithecus anamensis*** ("anam" is "lake" in the Turkana language). The dentition of this hominin seems to be transitional between apes and later australopithecines. This fits with the 4.2-3.9 million year dates for the volcanic ash associated with the *anamensis* fossils. The shapes of the arm and leg bones of this species indicate that it was bipedal.

In 1996, Berhane Asfaw, an Ethiopian researcher, and Tim White found a 2.5 million year old hominin fossil in the Middle Awash Valley of Ethiopia that remains problematical. The skull characteristics are similar in some ways to *Australopithecus afarensis,* but it lived several hundred thousand years after that species had presumably ended. Asfaw named his new hominin, ***Australopithecus garhi*** ("garhi" is "surprise" in one of the languages of the Afar Desert region). Whether or not *garhi* was a late *afarensis*, a variant of *africanus*, or a distinct species is not clear. Associated with the remains of *garhi* were animal bones with what appear to be cut marks made by simple stone tools. If they were using such tools, this is remarkable because only early humans have heretofore been associated with stone tool making.

In 2001, Meave Leakey announced the discovery of a 3.5-3.2 million year old hominin skull from the west side of Lake Turkana. She suggested that this fossil may displace Lucy (*Australopithecus afarensis)* as the progenitor of humans. Meave named it ***Kenyanthropus platyops*** ("flat-faced man of Kenya"). This hominin lived during the same time period as Lucy. However, it had a comparatively large, flat face and smaller teeth. The latter characteristic suggests that *Kenyanthropus* regularly ate softer foods than did Lucy. However, it is not yet clear where this new discovery fits within our evolution. Some paleoanthropologists have suggested that it is only a variant of *Australopithecus afarensis*.

## Recent Discoveries

In 2006, Tim White of the University of California, Berkeley, announced the discovery of bones from at least 8 *Australopithecus anamensis* individuals dating to 4.1 million years ago in what had been a woodland environment in the Awash Valley of Ethiopia. White believes that anatomically they are direct descendents of *Ardipithecus ramidus* and direct ancestors of *Australopithecus afarensis.* In other words, he asserts that there was a single evolutionary line of the earliest hominins without branching out into other species and that this evolutionary development occurred in East Africa in an area that included at least the Great Rift Valley in Kenya and Ethiopia.

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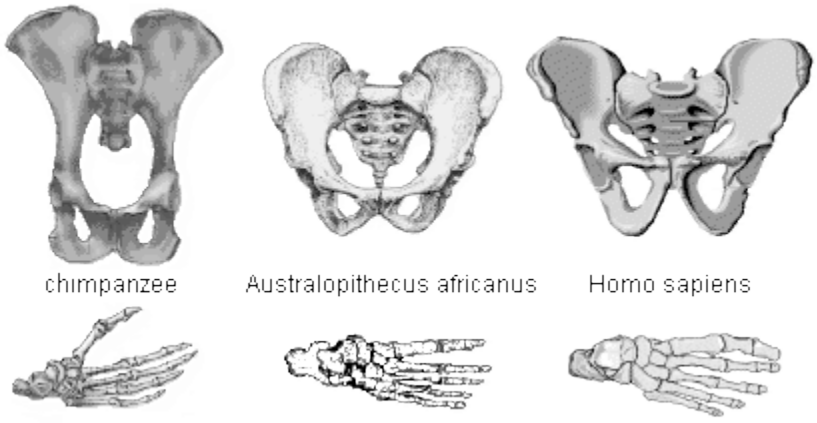
*NOTE: Our understanding of early hominins was led astray at the beginning of the 20th century as a result of the discovery by Charles Dawson in 1912 of a fossil skull in England that became known as the Piltdown man. It had a large brain case similar to modern humans but an ape-like jaw. This fit with the popular but incorrect assumption that our early ancestors would have ape-like bodies and human-like brains. The discovery of australopithecines in South Africa beginning in 1924 showed that the early hominins were actually just the reverse—they had almost human-like bodies below the neck but brains that were very little changed in size from those of apes. It was not until the early 1950's that the Piltdown man skull was exposed for what it really was, a clever fraud. This realization came as a result of close examination by independent researchers and fluorine analysis dating.*

## *Analysis of Early Hominins*

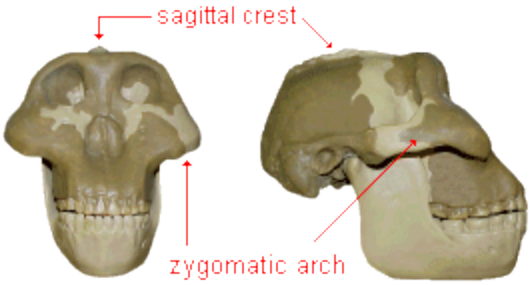
The bones of more than 500 early hominins have been found. From them, we have gained a broad understanding of these related species. While there were considerable anatomical differences between them, they also shared a number of important traits. By 3 million years ago, most of them probably were nearly as efficient at bipedal locomotion as humans. Like people, but unlike apes, the bones of their pelvis, or hip region, were shortened from top to bottom and bowl-shaped (shown below). This made the pelvis more stable for weight support when standing or moving bipedally. The longer ape pelvis is adapted for quadrupedal locomotion. Early hominin leg and foot bones were also much more similar to ours than to those of apes. This is consistent with the likelihood of early hominin bipedalism.

Comparison of Pelvis and Foot Bones




Bipedal locomotion may have been an adaptation to living in a mixed woodland and grassland environment. It has been suggested that bipedalism was selected for because it made it easier to see long distances when moving over areas covered with tall grasses. This would have been a useful advantage in scavenging for food and watching for big cats and other predators in open environments. An upright posture also potentially helps to dissipate excess body heat and reduces the absorption of heat from the sun because less skin has a direct exposure to ultra violet radiation during the hottest times of the day. There is evidence suggesting that bipedal animals usually can walk and run greater distances because less energy is expended with their longer strides. This would be useful for scavenging for food throughout vast areas. However, the legs of bipedal animals need to be sturdy enough to support at least 2.5 times their body weight while running. Over many generations, early hominin legs became longer and much stronger than their arms. Their feet developed arches for more efficient support of their bodies. In addition, their hands became more adept at carrying and manipulating objects such as tools and food. These adaptations to walking bipedally on the ground made it progressively more difficult to climb and travel through the canopies of trees.

While the late australopithecines were similar to humans anatomically below the neck, their heads were significantly different from ours in several key features. Their adult brain size was about 1/3 that of people today. As a result, the widest part of the skull of these early hominins was below the brain case. For modern humans, it usually is in the temple region. Early hominin faces were large relative to the size of their brain cases. They had comparatively big teeth with thick enamel, large jaws, and powerful jaw muscles. The size and shape of these muscles is indicated by flaring zygomatic arches and the presence of a sagittal crest, which was a jaw muscle attachment area in the robust species. In modern humans, the jaw muscles are much smaller and attach onto the skull in the temple region. From the side view, early hominin faces were concave or dish-shaped and projecting forward at the bottom due to their large teeth and jaws. In contrast, our jaws are relatively small and our faces are nearly vertical.




*Australopithecus boisei*

Modern human

Early hominin fossils have been found only in Africa. The majority of them were discovered in East and South Africa. However, some also were found recently in Chad, which is located in North Central Africa. Current evidence indicates that there were as many as 12 species of early hominins between 6 and 1.5 million years ago, but they did not all live at the same time. The following species are the most widely accepted ones:

1. *Australopithecus anamensis*
2. *Australopithecus afarensis*
3. *Australopithecus africanus*
4. *Australopithecus aethiopicus (or Paranthropus aethiopicus)*
5. *Australopithecus boisei (or Paranthropus boisei)*
6. *Australopithecus robustus (or Paranthropus robustus)*

The fossil record of early hominins is being added to by new important discoveries almost every year. As a result, it is not yet clear how many species of them actually existed nor is it certain what their evolutionary relationship was to each other.

## Early Australopithecine Species

***Australopithecus anamensis*** may have been the earliest australopithecine species. They lived about 4.2-3.9 million years ago in East Africa. Unfortunately, little is known about them due to the scarcity of their fossils and the fact that the ones that have been found are highly fragmentary. This species apparently was descended from ***Ardipithecus ramidus*** or an even earlier ape/hominin transitional species near the beginning of the Pliocene Epoch. *Anamensis* was bipedal but may still have been an efficient tree climber. The shapes of the arm and leg bones indicate that it was bipedal. The canine teeth are relatively large compared to later australopithecines and humans. The alignment of teeth in the jaw is somewhat rectangular, reminiscent of apes, rather than like the modern human parabolic dental arch (like the McDonald's golden arches sign).

***Australopithecus afarensis*** lived about 3.7-3.0 million years ago in East Africa. Skeletally, they were still somewhat transitional from earlier ape species. This can be seen in their legs which were relatively shorter than those of the later australopithecines and humans. *Afarensis* also had slender curved fingers reminiscent of chimpanzees. Because of these anatomical characteristics, it has been suggested that they were less efficient bipeds and more efficient tree climbers than the later australopithecines. *Afarensis* canine teeth were relatively large and pointed, reminiscent of apes. They projected somewhat beyond their other teeth but not as much as in chimpanzees. Some of the male afarensis had small sagittal crests.

*Australopithecus afarensis*
(Lucy)

Tim White and some other paleoanthropologists believe that there was considerable physical variation within the species *Australopithecus afarensis*. They suggest that the recently discovered fossils classified as ***Kenyanthropus platyops*** (3.5-3.2 million years ago) was a variant form of *afarensis* but with somewhat smaller teeth. White discounts the flattened face of *platyops* as being due to the deformation of the bones by ground pressure after death. Meave Leakey disagrees. She believes that *platyops* was a separate species and that it was more likely to have been the progenitor of humans. Additional hominin fossils from the crucial time period of 4-3 million years ago must be discovered to conclusively determine the place of *platyops* in our evolution.

***Australopithecus africanus*** lived about 3.3-2.5 million years ago in South and possibly East Africa. Skeletally, they were less ape-like than earlier species of australopithecines but were still usually small and light in frame like *afarensis*. However, the teeth of *africanus* were in some ways more like humans than like *afarensis*. Specifically, the front teeth of *africanus* were relatively large like ours and their canine teeth did not project beyond the others. Microscopic wear patterns on africanus teeth suggest a diet consisting of relatively soft foods, which very likely included meat along with plants. This does not necessarily imply efficient hunting skills. More likely, they obtained much of their meat by scavenging what remained on the corpses of animals killed by lions and other predators. It is possible that they also did some hunting of small animals in much the same inefficient manner of chimpanzees today.

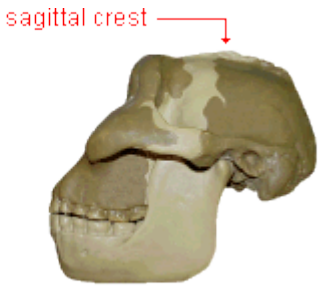

*Australopithecus africanus*

The classification of ***Australopithecus garhi*** is still very problematical. This Ethiopian fossil has been dated to 2.5 million years ago, which makes it contemporaneous with late *africanus*. Largely for that reason, some paleoanthropologists have suggested that *garhi* is a variant of *africanus*. However, several features of the head of *garhi* look more like a holdover from the older *afarensis* species. On the other hand, the relative lengths of the arms and legs of *garhi* are more reminiscent of the first humans. The discovery of butchered animal bones with *garhi* suggests that their diet included at least some meat, as was the case with *africanus*.

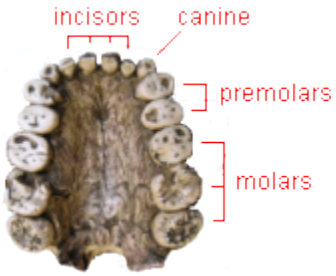
## Late Australopithecine Species

The early australopithecines have been referred to collectively as **gracile species** (literally "gracefully slender"). Most of them were relatively small, slender, and delicate boned compared to the somewhat more muscular, **robust species** of australopithecines that mostly came later. However, this is not always a reliable descriptive distinction because the range of variation in physical appearance of the two groups of species overlaps. Subsequently, some individual graciles were bigger than some of the robust ones. However, the robust species shared some characteristics of their heads that dramatically show that they had diverged from the evolutionary line that would become humans. The late australopithecines, which were all robust species, had larger jaws accompanied by pronounced sagittal crests in the case of males. They also had much larger back teeth and smaller front ones compared to those of the early humans who were present at that time.

gracile Australopithecine




robust australopithecine




robust australopithecine teeth (upper)

human teeth (lower)

Little is known about ***Australopithecus aethiopicus*** (the "black skull") other than it apparently was one of the earliest robust species--it lived about 2.5 million years ago. So far, this species has been found only in East Africa. Since it had a smaller brain than the other robust species and it was early, *aethiopicus* is thought to be a transitional form from one of the gracile species that came before. It had an unusually large sagittal crest (shown below).

***Australopithecus robustus*** was a South African robust species that lived about 2.0-1.4 million years ago. They had strong jaws and very large molar and premolar teeth with thick enamel. Males also had pronounced sagittal crests, though not as large as the next species listed below.

***Australopithecus boisei*** was a super-robust East African species that lived about 2.0-1.4 million years ago. They tended to be more massive and beefy-looking even than *Australopithecus robustus*. While they were only a few inches taller, they averaged 20 pounds heavier. Male boisei were especially muscular. Like their South African cousins, *robustus*, they had prominent sagittal crests and very large grinding teeth with thick enamel. These teeth would have been capable of cracking hard nuts and dry seeds. However, such food items may not have been important in their diet. Recent microscopic analysis of dental wear patterns, done by Peter Ungar at the University of Arkansas, indicates that what *boisei* predominantly ate was soft foods such as fruit.

*Australopithecus aethiopicus*
(the "black skull")

*Australopithecus robustus*

*Australopithecus boisei*
(formerly known as
*Zinjanthropus*)

### Early Hominin Body Size

The early hominins were significantly smaller on average than modern humans. Adult male australopithecines were usually only about 4.3-4.9 feet tall and weighed around 88-108 pounds. Apparently, females were much smaller and less muscular. They were usually 3.4-4.1 feet tall and weighed only 64-75 pounds. This is greater sexual dimorphism than is found in human populations today. In some australopithecine species, sexual dimorphism may have been nearly as great as among the great apes. Female gorillas weigh about 61% that of males, while modern human females are about 83% the weight of males.

| | BODY WEIGHT | | | STATURE | | |
|---|---|---|---|---|---|---|
| SPECIES | males | females | females as % of males | males | females | females as % of males |
| *Australopithecus afarensis* [1] | 99 lbs (45 kg) | 64 lbs (29 kg) | 64% | 59 in (151 cm) | 41 in (105 cm) | 70% |
| *Australopithecus africanus* | 90 lbs (41 kg) | 66 lbs (30 kg) | 73% | 54 in (138 cm) | 45 in (115 cm) | 83% |
| *Australopithecus robustus* | 88 lbs (40 kg) | 70 lbs (32 kg) | 80% | 52 in (132 cm) | 43 in (110 cm) | 83% |
| *Australopithecus boisei* | 108 lbs (49 kg) | 75 lbs (34 kg) | 69% | 54 in (137 cm) | 49 in (124 cm) | 91% |
| earliest humans (*Homo habilis)* | 114 lbs (52 kg) | 70 lbs (32 kg) | 61% | 62 in (157 cm) | 49 in (125 cm) | 79% |
| modern humans [2] *(Homo sapiens)* | 144 lbs (65 kg) | 119 lbs (54 kg) | 83% | 69 in (175 cm) | 63 in (161 cm) | 92% |

Source: H. M. McHenry, "How Big Were Early Hominids?", *Evolutionary Anthropology* 1 [1992] p. 18.

1 *A farensis* may have been somewhat less sexually dimorphic than indicated by McHenry's data presented here (Phillip Reno *et al.*, "Sexual Dimorphism in *Australopithecus afarensis* was Similar to that of Modern Humans, *Proceedings of the National Academy of Sciences* [2003] pp. 9404-9409).

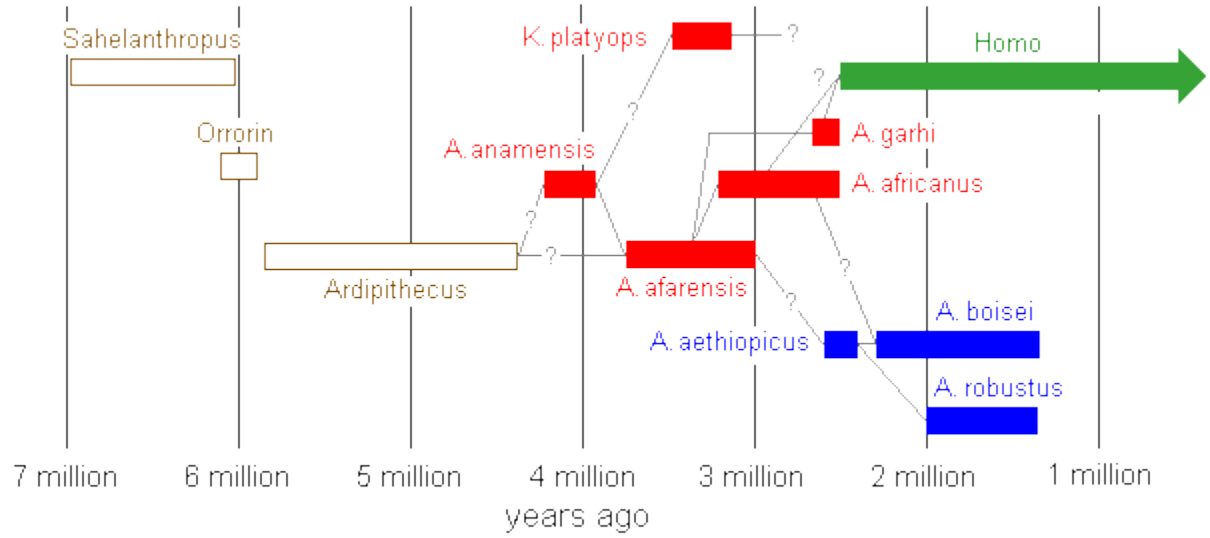
2 The relatively low weight and height of modern humans shown here is a rough average of all people around the globe. Some populations are significantly bigger (e.g., Europeans and Africans).

## Possible Evolutionary Links

There has been a gap in the fossil hominin record for the crucial period before 4.2 million years ago when *Australopithecus anamensis* appeared. New discoveries are now beginning to fill in the missing

picture of evolution leading to the australopithecines at that early time. Beginning in 1992, Tim White and several of his Ethiopian colleagues found fossils of what may be the immediate ancestor of the australopithecines at the Aramis site in the Middle Awash region of Northern Ethiopia. The teeth of these very early fossils seem to have been transitional between apes and *Australopithecus anamensis*. Among the living apes, they were most similar to chimpanzees, however, they were not apes as we usually think of them today. These Aramis fossils date to about 4.4 million years ago and may represent the first stage in the evolution of bipedalism. Because of their primitiveness, White has given them a new genus and species designation (*Ardipithecus ramidus*) rather than include them with australopithecines.

Based on body shape and dentition similarities, it is reasonable to conclude that some of the early hominin species were ancestors of our genus *Homo*. Most likely, some of the early australopithecines (shown in red below) were in our line of evolution, but the later robust ones (blue below) were not. The first humans (***Homo habilis***) were contemporaries of the late australopithecines. As a result, they could not be our ancestors. However, it is likely that *Australopithecus afarensis* and possibly even early *Australopithecus africanus*, *Australopithecus garhi,* or *Kenyanthropus platyops* were in our evolutionary line.




Beginning around 2.5 million years ago or a bit earlier, there was a major forking in the evolutionary path of hominins. The australopithecines diverged into at least two very different evolutionary directions. One led to the robust australopithecines and a genetic dead-end by about 1.4 million years ago. The other led to the first humans. It is likely that these diverging evolutionary paths were the result of exploiting different environmental opportunities. Coinciding with this hominin divergence was a shift in the global climate to cooler conditions. In East and South Africa, where most of the early hominins apparently lived, dry grasslands expanded at the expense of woodlands and forests. It has been suggested that the adaptive radiation that led to humans and robust australopithecines is connected with this change in the environment.

*NOTE: This is not the only possible model of early hominin evolutionary links that has been suggested in recent years. Some paleoanthropologists have proposed that neither africanus nor afarensis were ancestral to the robust australopithecines. In other words, the division between robust and gracile forms occurred earlier, perhaps at the time of anamensis or before. It is also possible that humans descended from anamensis through a still unknown intermediate gracile species instead of afarensis. On-going research will very likely sort out the relationships between the various hominin species in the near future.*

*NEWS: John Novembre et.al. reported in the October 1, 2007 issue of Nature Genetics that human saliva has significantly more of the enzyme amylase compared to chimpanzees. Amylase breaks down starches into glucose which can be readily used by the cells of the body. With more amylase, humans get more useable calories from starchy vegetable foods such as tubers, corms, and bulbs. The authors suggest that this would have been a distinct advantage for early humans because these foods are readily available. They believe that natural selection favored additional copies of the gene responsible for amylase production in our early hominin ancestors but not in apes.*