


## PRE-AUSTRALOPITHECINES

### Sahelanthropus tchadensis

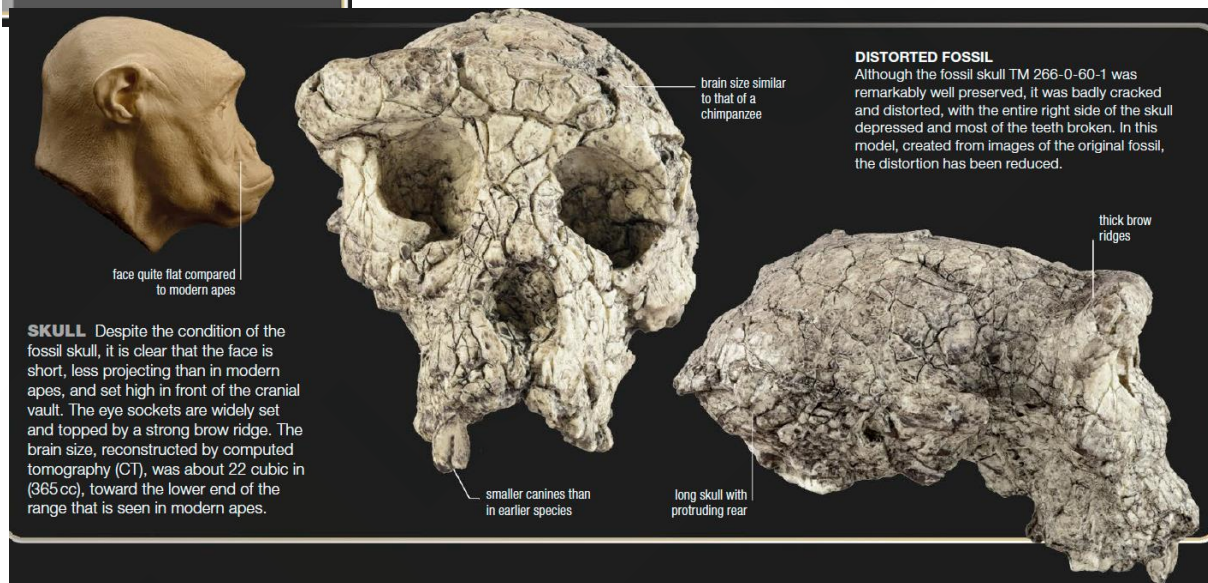
*Sahelanthropus tchadensis*, described in 2002, was found in Chad—far away from the East African Rift Valley and South Africa, where the search for early hominins had previously been concentrated.

#### Physical features

SAHELANTHROPUS TCHADENSIS	
► NAME MEANING	"The Sahel man from Chad"
► AGE	7–6mya
► HEIGHT	Unknown
► BRAIN SIZE	19–23 cu in (320–380 cc)
► LOCALITY	Toros-Menalla, Chad
	
► FOSSIL RECORD	Single skull, fragments of jaw and teeth

*Sahelanthropus* has several features in common with later hominins such as *Kenyanthropus* and *Homo*. The canines are relatively small and show wear at their tips, and the tooth enamel is thicker than is seen in apes. The face is also quite flat compared with apes, and the brow ridge is massive and continuous above the orbits.

In many other respects, however, *Sahelanthropus* does resemble living and extinct apes. The cranial capacity is small, and the shape of the rear part of the skull is a truncated triangle. It has been argued that because *Sahelanthropus* presents this mosaic of primitive and recently evolved characteristics, it probably should be placed on the human family tree close to the last common ancestor of humans and chimpanzees.



### Orrorin tugenensis

A contender for the title of the earliest bipedal hominin, *Orrorin tugenensis* may have inhabited ancient lakeside woodlands and wet grasslands.

#### Discovery

In 1974, a fossil molar tooth was unearthed by palaeontologist **Martin Pickford** from late Miocene deposits at Cheboit, Kenya. With low cusps on the chewing surface and thick enamel, it did not fit into any known species.

ORRORIN TUGENENSIS	
➤ <b>NAME MEANING</b>	"Original man of the Tugen Hills"
➤ <b>AGE</b>	6.2–5.6mya
➤ <b>HEIGHT</b>	Unknown
➤ <b>BRAIN SIZE</b>	Unknown
➤ <b>LOCALITY</b>	Cheboit in the Lukeino Formation at Tugen Hills, Kenya
	
➤ <b>FOSSIL RECORD</b>	Jawbone, teeth, fragmented arm, thigh, and finger bones

Pickford named it *Orrorin tugenensis* the following year, but it was nearly 30 years until the next major find. A French–Kenyan team led by Pickford and French palaeontologist Brigitte Senut returned to the region and in 2001 announced the discovery of teeth and fragments of the arms and legs of several individuals. This species may have been one of the earliest members of the human lineage to walk upright.

## Ardipithecus kadabba

Notable for its large, projecting canine teeth, *Ardipithecus kadabba* may be related to later hominin species such as *Australopithecus anamensis* and *Australopithecus afarensis*.

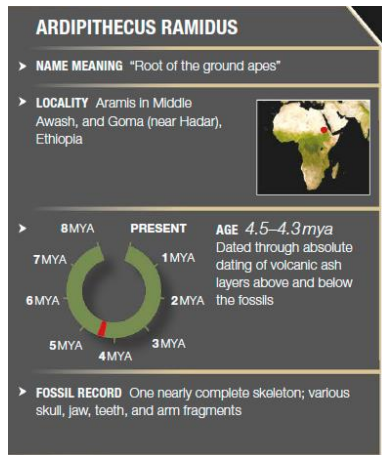
### Discovery

ARDIPITHECUS KADABBA	
➤ <b>NAME MEANING</b>	From the Afar word for "basal family ancestor"
➤ <b>AGE</b>	5.8–5.2mya
➤ <b>HEIGHT</b>	Unknown
➤ <b>BRAIN SIZE</b>	Unknown
➤ <b>LOCALITY</b>	Middle Awash, Ethiopia
	
➤ <b>FOSSIL RECORD</b>	Fragments of jaw, arm, hand, foot bone, and collarbone

In 2004, anthropologists **Tim White (USA)**, **Gen Suwa (Japan)**, and **Berhane Asfaw (Ethiopia)** renamed a small collection of fossil fragments from the Middle Awash River Valley, Ethiopia, as *Ardipithecus kadabba*. Excavated over the previous decade, the fossils were first thought to be an australopithecine species, and then a subspecies of *Ardipithecus ramidus*.

Now the material is seen as a species in its own right, largely on the basis of dental anatomy and geological date. The fossils were found with remains of extinct animals such as the four-tusked elephant *Deinotherium* and the threetoed horse *Hipparion*, as well as wetland and woodland species still alive today.

## Ardipithecus ramidus



Ardipithecus ramidus is known from the remains of many individuals, representing almost the entire skeleton, and it provides an insight into the appearance of bipedalism and habitat selection in early hominin evolution.

### Physical features

The partial remains of many individuals have been discovered and described —unusual for such an ancient species—and fossils of almost every part of the skeleton have been found. Analysis of these specimens has shown that

Ardipithecus ramidus was of modest stature and probably presented very little sexual dimorphism (size difference between the sexes). Many features of the arms, hands, and feet suggest that they employed a mixed pattern of movement, partially bipedal and partially arboreal. The dentition suggests a broad diet, and the brain is small compared to that of later hominins.

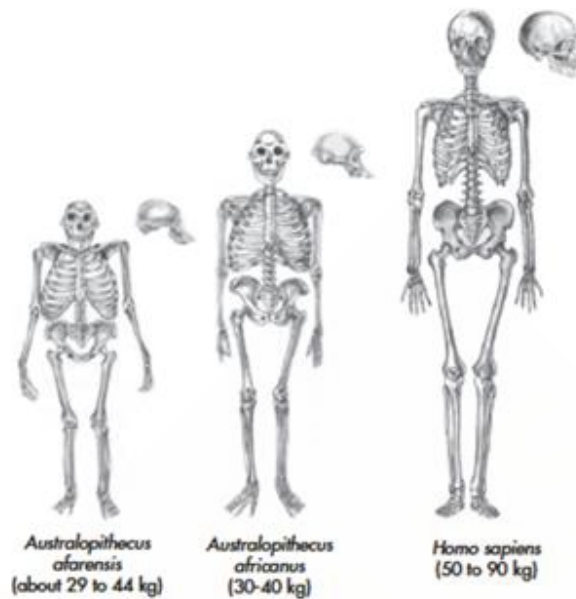
## AUSTRALOPITHECINES

The name Australopithecus, meaning “**southern ape**,” was coined by **Raymond Dart** in the 1920s for the very first specimen (**Taung Baby**) of the genus ever discovered. Since that time, fossil discoveries have revealed an adaptive radiation of Australopithecus species that filled a variety of habitat types in eastern, southern, and central Africa and are now known to have lived from 4.2 to about 1.0 million years ago.

They are often divided into two forms- **short, slender species** of the size of Chimpanzee called **Gracile forms (A. anamensis, A. afarensis, A. africanus)** and somewhat **larger species with bigger brain size and bigger molar** called **Robust forms (P. robustus, P. bosei)**. It is now clear that robust forms, which originated later and had larger brains, don't represent main line of hominid evolution but are aberrant side line.



The "Taung Skull," the first specimen of *Australopithecus*. Note the naturally formed indentation of the brain toward the back of the skull.



Comparison of hominid skeletons. The *Australopithecus* species were short bipedal primates, most with relatively long arms. Compared to modern humans (right) the *Australopithecus* torso was broad and funnel shaped.

## GEOGRAPHICAL DISTRIBUTION:

Distribution of Australopithecine outside Africa is doubtful. In Africa they are scattered in South and East Africa.

### 1. SOUTH AFRICA:

Taung (Cape Province) – *A. africanus*

Sterkfontein (Transvaal) – *A. africanus*

Kromdraai (Transvaal) – *P. robustus*

Makapansgat (Transvaal) – *A. africanus*

Swartkran (Transvaal) – *P. robustus*

The south African Australopithecines fossils are found in caves which are formed when water channels run through the limestone underground. Australopithecine, in most probability, did not occupy these caves. Australopithecine bones were probably introduced into the limestone caves by leopard and other cats. The hole in the skull of an Australopithecine match the lower canine of a leopard from the same deposit.

It is now generally agreed that Makapansgat, Sterkfontein and Taung which have *A. africanus* are older (about 3-2 million years age), while Kromdraai and Swartkrans with *Paranthropus* are Younger (2- 1.5 Mya).

Initially it was believed that gracile forms were aggressive predators. This was based on the recovery of broken animal bones associated with the gracile fossils of South Africa. The idea is now disputed



because the pattern of bone breakage indicate that activities are instead of non-primate predators. Thus in most probability Australopithecines did not hunt, they were hunted.

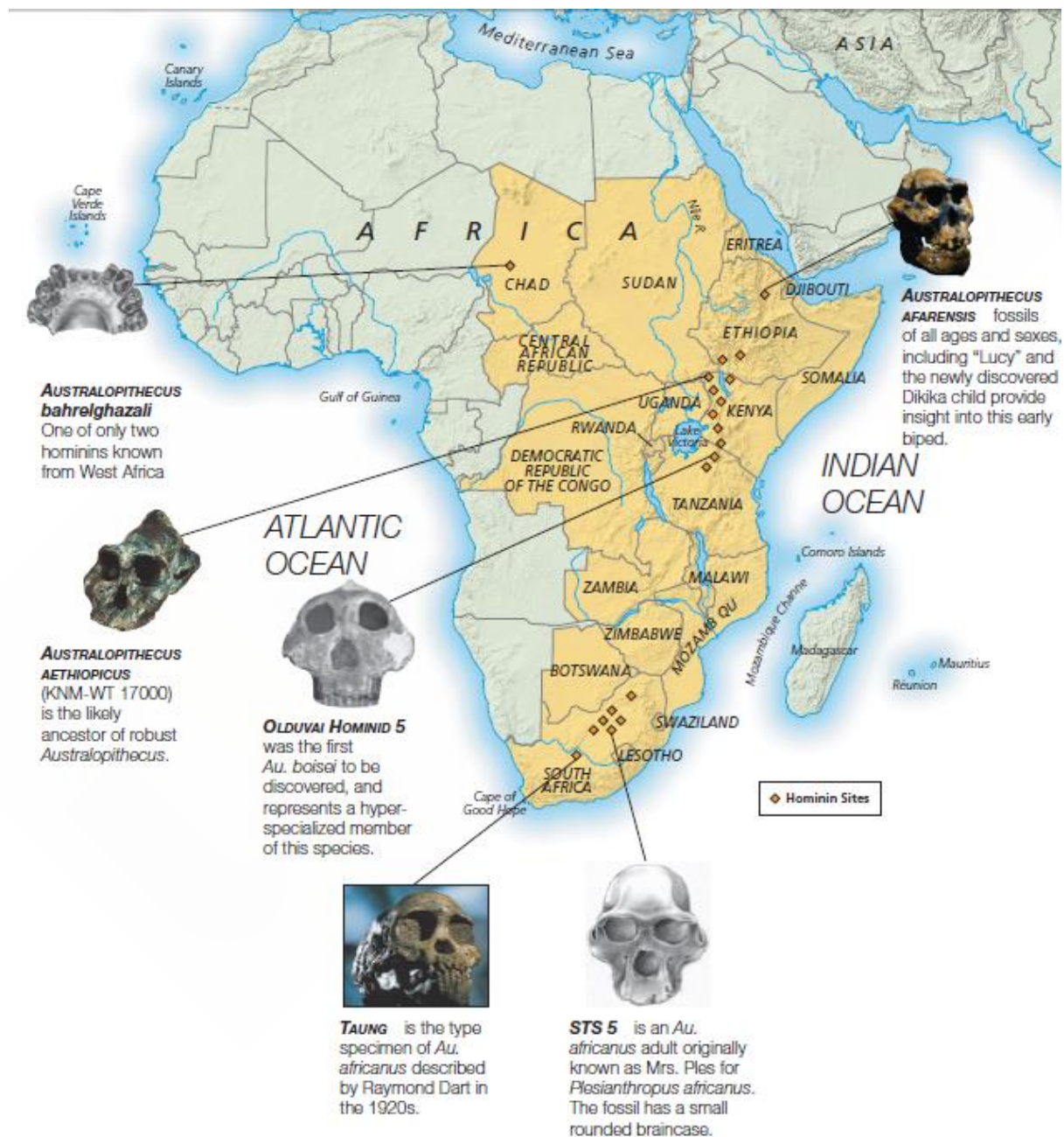
### THE EAST AFRICAN AUSTRALOPITHECINES:

Tanzania – *P. robustus*

Kenya – *P. robustus*

Ethiopia – *A. afarensis*, *P. robustus*

The East African are found in complete different settings. They are found on the shades of lakes, flood, plains, river-valley. Australopithecine sites in East Africa can be dated more accurately. The rift valley had considerable volcanic activity with eruption of lava containing isotopes of potassium, argon, and uranium and hence can be assigned definite age on basis of potassium argon methods.



## GRACILE AUSTRALOPITHECINE/ AUSTRALOPITHECUS

### GENERAL CHARACTERISTICS

- 1) Roughly 4 feet tall and weighed 50-100 pounds.
- 2) No sagittal crest
- 3) No canine diastema
- 4) Well developed forehead- suggest expansion of frontal lobes of brain
- 5) Bone structure less rugged than their robust relatives
- 6) Weakly developed supra orbital ridges
- 7) Elevated cranial vault- indicating major portion of brain above the level of the face.
- 8) Brain size 450-600 cc
- 9) Foramen magnum placed forward slightly
- 10) Parabolic dental arcade

### A. anamensis


- **Type Specimen:** KNM-KP 29281 [Mandible] (Leakey et al., 1995)
- **Location:** East Africa (Kenya, Ethiopia)
- **Age:** 4.17-3.9 Mya
- **Cranial Capacity:** Unknown
- **Estimated Size:** 47 kg – 55 kg

*Australopithecus anamensis* (anem is the Turkana word for lake) is the earliest and one of the most poorly known members of the genus *Australopithecus*. *Au. anamensis* ("southern ape of the lake") was discovered by a team led by Meave Leakey. This species is largely known from teeth and fragmentary pieces of maxillae and mandibles; very limited postcranial material has been recovered. It has been suggested that, based on the limited postcranial material available, *A. anamensis* exhibited a considerable degree of body size sexual dimorphism.

*Australopithecus anamensis* provides early incontrovertible evidence of bipedality. In particular, its tibia has thickened bone at its proximal and distal ends, where bipeds place stress on their lower legs.

### AUSTRALOPITHECUS ANAMENSIS

- ▶ **NAME MEANING** "Southern ape from the Lake"
- ▶ **AGE** 4.2–3.9mya
- ▶ **HEIGHT** Unknown
- ▶ **BRAIN SIZE** Unknown
- ▶ **LOCALITY** Lake Turkana and Kanapoi, Kenya; Aramis in Middle Awash and Omo basin, Ethiopia


- ▶ **FOSSIL RECORD** Jawbone, teeth, fragmented arm, thigh, finger bones



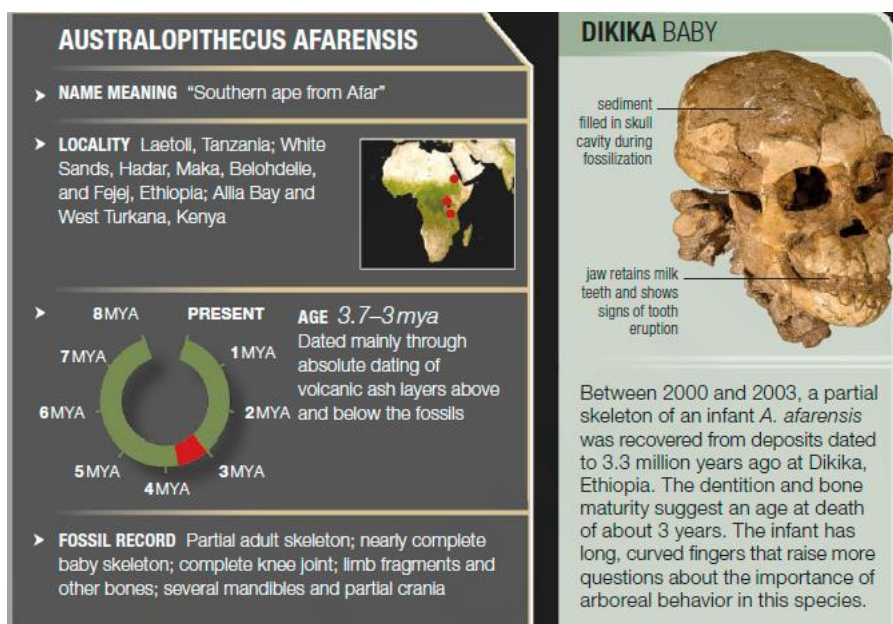
The remains of *Australopithecus anamensis* from Kenya date to about 3.9 to 4.2 million years old.

The *Au. anamensis* teeth and jaws are more primitive than those of later hominins but more derived than those of early hominins such as *Ardipithecus*. The dental arcade is U-shaped, with parallel sides and large anterior teeth, and the palate is shallow, all features that are more apelike than human. As in later *Australopithecus*, the molar enamel of *Au. anamensis* is distinctly thicker. In general, *Au. Anamensis* is more primitive than *Au. afarensis*, and based on its mandible and dentition, may be ancestral to later *Australopithecus* species.

### *Australopithecus afarensis*

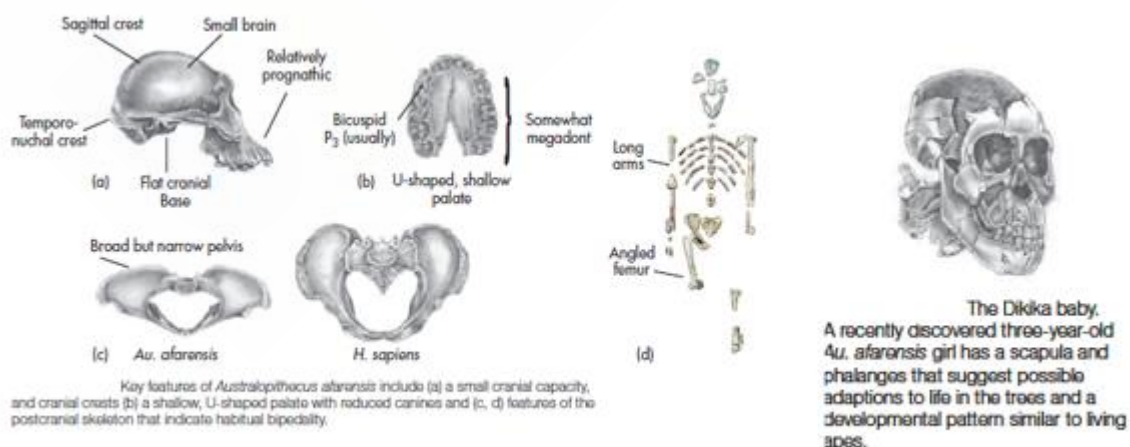
- **Type Specimen:** L.H. 4 [Mandible] (Johanson et al., 1978)
- **Location:** East Africa (Kenya, Ethiopia, Tanzania, Chad)
- **Age:** 3.7-3 Mya
- **Cranial Capacity:** 350 cc – 500 cc
- **Estimated Size:** 30 kg – 55 kg

In 1974 Donald Johanson and his team discovered Lucy, the famed skeleton of *Australopithecus afarensis*, at Hadar in the Awash Valley of the Afar Triangle of Ethiopia. (They named the specimen



after the Beatles song "Lucy in the Sky with Diamonds.") The discovery of the Lucy, was extraordinary for two reasons. **First**, her anatomy is more primitive than that of any hominin known up to that time, and it includes a clear mosaic of humanlike and apelike features. She stood a little over a meter tall and possessed a cranial vault suggesting a

modest brain size about equal to that of an adult chimpanzee. **Second**, her skeleton is more complete than that of nearly any other fossil human.





There are several key anatomical features of *Au. Afarensis*. The cranium and teeth of *Au. afarensis* are intermediate in appearance between those of a living ape and a modern human. The cranial capacity is small but slightly larger than that of earlier hominins and living apes (range 350–500 cc). The *Au. afarensis* face was prognathic, but not so much as in the living apes, and the cranial base was relatively flat, similar to that of living apes (Kimbel et al., 2004).

The dental arcade is U-shaped, with large anterior teeth, parallel rows of cheek teeth, and a shallow palate, all primitive, apelike traits. But as expected of a hominin, the canine teeth are much smaller than those of a chimpanzee or of the earlier hominins *Ardipithecus* and *Au. anamensis* but larger than those of more recent hominins or other *Australopithecus* species. They had thick molar enamel which suggests that small, hard materials made up a significant part of diet.

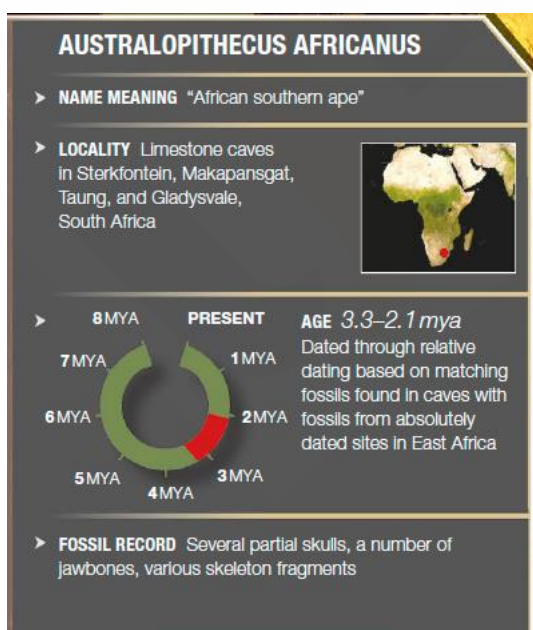
In its postcranial skeleton, *Au. afarensis* is clearly an **accomplished biped**. *Au. afarensis* possesses a pelvis with short, broad iliac blades that curve around the side of the animal. **The femur is angled** in toward the knee to keep the foot under the center of gravity and the condyles on the lower end of the femur are enlarged. The tibia is modified to bear more weight, and the big toe is in line with the other toes. Indirect evidence of bipedal walking in *Au. afarensis* comes from the Laetoli footprint track that, on the basis of its age and location, is thought to have been made by *Au. afarensis*.

The remarkably complete skull and skeleton of a 3-year-old *Au. afarensis* girl that were discovered from the site of Dikika in Ethiopia has a scapula similar to a gorilla and curved phalanges. These characters suggest that *Au. afarensis* may have retreated to the trees to escape from predators and to forage for fruits and leaves during the day and to sleep at night.

It is likely that *Au. afarensis* lived in groups, and because they were very sexually dimorphic, they probably were not monogamous. The largest adults from Hadar are, in some measures, nearly twice the size of the smallest *Au. afarensis* (Lucy is one of the very smallest).

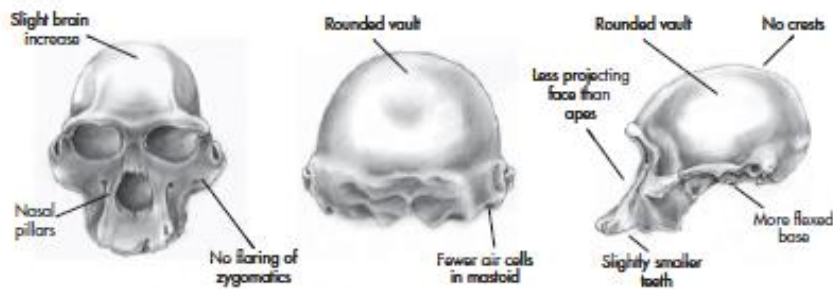
### ***Australopithecus africanus***

- **Type Specimen:** Taung Child [Complete Skull] (Raymond Dart, 1925)
- **Location:** Southern Africa (South Africa)
- **Age:** 3.3-2.1 Mya
- **Cranial Capacity:** 430 cc – 520 cc
- **Estimated Size:** 40 kg – 50 kg

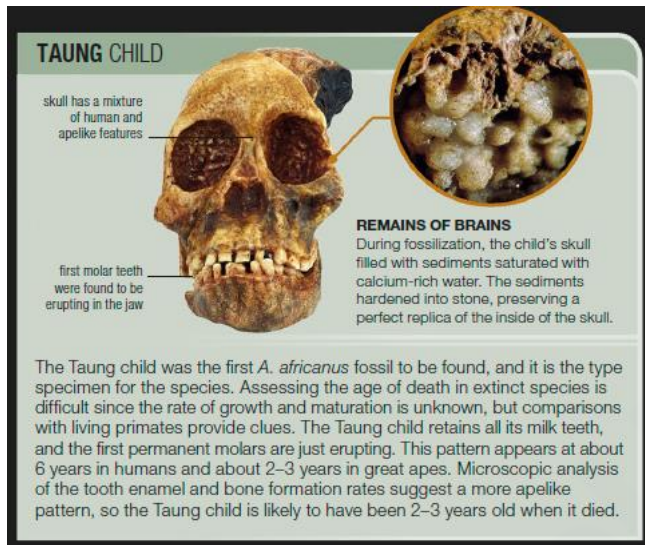


First *Australopithecus* ever discovered, the **Taung Child**, was found in southern Africa by Raymond Dart in 1925, which is why the genus is called *Australopithecus*, or "southern ape-man." There are a few key differences between the study of fossils in southern and eastern Africa. Unlike the open-air sites of East Africa, most South African fossil sites are in cave and cliff deposits. Other *Au. africanus* sites include Sterkfontein, Taung, Gladysvale, and Makapansgat, and most date between about 3.5 and 2.4 million years ago, although some may be about 1 million years old.





Key features of *Australopithecus africanus* include a rounded vault without cranial crests, a slightly flexed cranial base, and moderate facial prognathism.



*Australopithecus africanus* is more derived than *Au. afarensis* in several aspects of its cranial skeleton. *Au. africanus* has a larger braincase (about 450–550 cc, still quite small by modern standards), a rounded vault that lacks cranial crests, a less prognathic face, and a more flexed cranial base.

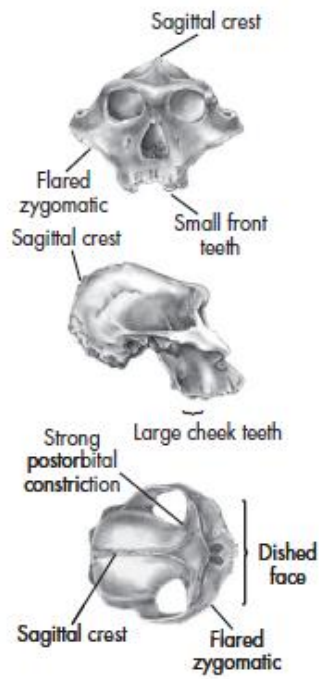
### “ROBUST” AUSTRALOPITHECUS (OR PARANTHROPUS)

The “robust” group of *Australopithecus* includes several species of early hominins that appear to have been an evolutionary dead end because of their extreme anatomical specializations. The group is united by a suite of cranial features related to their feeding adaptation that made them extremely efficient at producing a great deal of force at their molars.

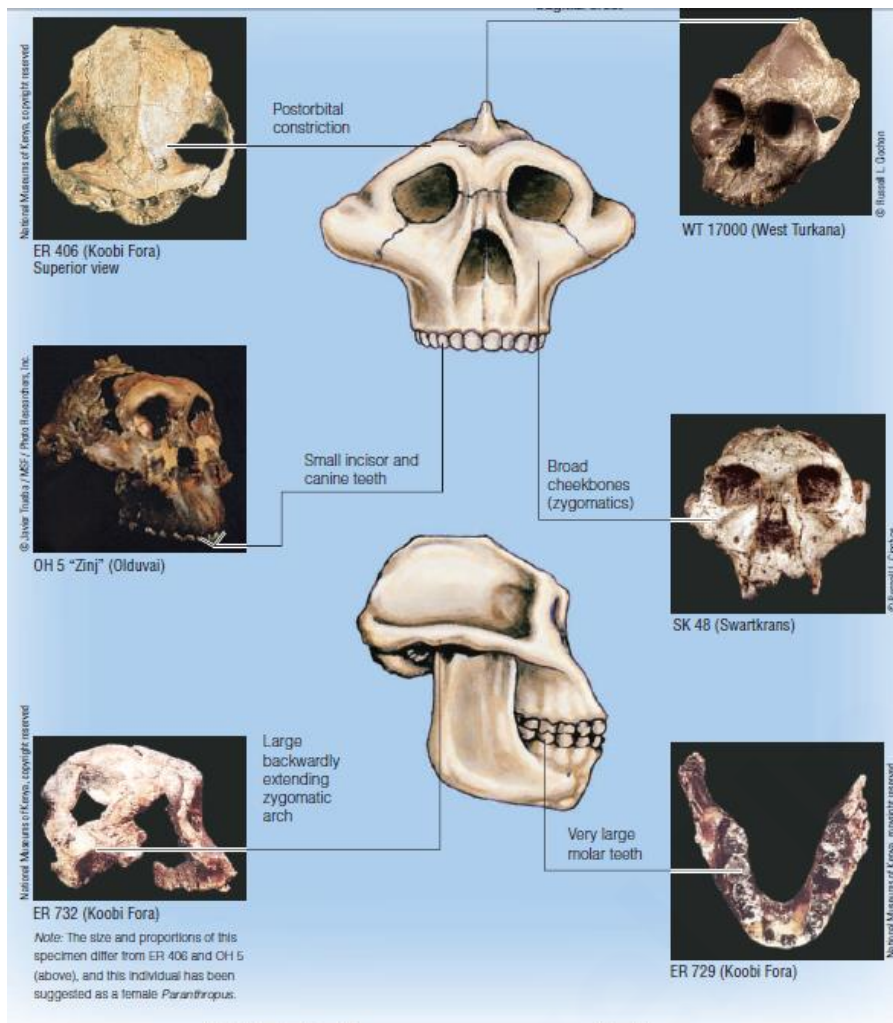
These cranial features often are thought of as an adaptation to hard-object feeding, chewing tough food items such as hard-shelled nuts or fibrous vegetation. In fact, early fossils were nicknamed “nutcracker man” for this reason. Scientists think that these cranial adaptations allowed the robust species to survive during times when not much food existed, because they were specialized for eating a kind of food that other hominins could not eat.

#### General Characteristics

- 1) Average height – 4 feet and weigh 120 pounds
- 2) Larger skull than *Australopithecus*
- 3) Cranial capacity- 400-600 cc (lower brain to body ratio than *Australopithecus*)
- 4) Large supraorbital ridges – no forehead
- 5) Massive jaws
- 6) Knuckle walking hand anatomy



Key features of robust *Australopithecus* include adaptations to heavy chewing such as a large sagittal crest and flaring zygomatics, a dished face, and strongly flexed cranial base.



### Australopithecus (P.) aethiopicus (2.7–2.3 MYA)

- **Type Specimen:** Omo-18-(1967)-18 [Mandible]
- **Location:** East Africa (Kenya, Ethiopia)
- **Age:** 2.7-2.3 Mya
- **Cranial Capacity:** 410 cc
- **Estimated Size:** Unknown

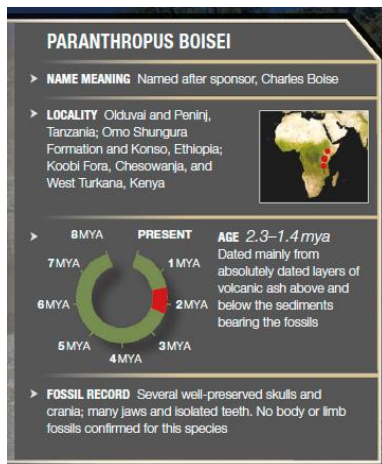
PARANTHROPUS AETHIOPICUS	
➤ <b>NAME MEANING</b> "Ape that lived alongside humans, from Ethiopia"	
➤ <b>AGE</b> 2.7–2.3mya	
➤ <b>HEIGHT</b> Unknown	
➤ <b>BRAIN SIZE</b> 25 cubic in (410cc)	
➤ <b>LOCALITY</b> Lake Turkana, Kenya; Omo, Ethiopia	
➤ <b>FOSSIL RECORD</b> Two skulls, sections of jaw, and various teeth fragments	

In 1985, **Alan Walker** and **Richard Leakey** found the skull of a very primitive robust species that is a good candidate for the ancestor of both later species, *Au. (P.) boisei* and *Au. (P.) robustus*. *Australopithecus (P.) aethiopicus* shares the suite of masticatory (chewing) characters described for the robust group generally but with some modifications and some more primitive characters as well. *Au. (P.) aethiopicus* has a sagittal crest, dished face, flared zygomatics, and huge molars that both *Au. (P.) boisei* and *Au. (P.) robustus* possess, although the sagittal crest is positioned more posteriorly in *Au. (P.) aethiopicus*.



### Australopithecus (P.) boisei (2.3–1.4 MYA)

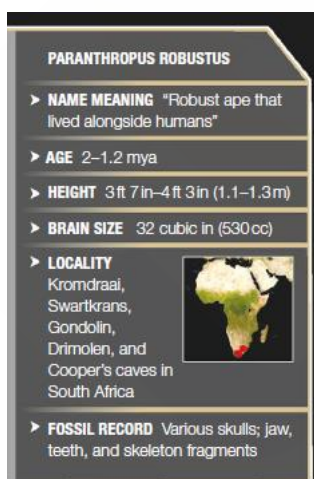
- **Type Specimen:** O.H. 5 [Cranium] (Leakey, 1959)
- **Location:** East Africa (Tanzania, Kenya, Ethiopia)
- **Age:** 2.3-1.4 Mya
- **Cranial Capacity:** 530 cc
- **Estimated Size:** 34 kg – 49 kg



The culmination of the lineage that started with *Au. (P.) aethiopicus* is *Au. (P.) boisei*. In 1959, the skull that Mary Leakey found while working alone one day at Olduvai became the type specimen for a new genus. The species spans the time period from about 2.3 to about 1.2 million years ago, based mostly on radiometric ages. The brain size is about the same as that of the robusts from South Africa, and the postcranial skeleton is large, with an estimated body size between 75 and 110 pounds.

### Australopithecus (P.) robustus (2.0–1.2 MYA)

- **Type Specimen:** TM-1517 [Cranium] (Broom, 1938)
- **Location:** Southern Africa (South Africa)
- **Age:** 2.0- 1.2 Mya
- **Cranial Capacity:** 530 cc
- **Estimated Size:** 32 kg – 40 kg



When Robert Broom discovered the first robust species in 1938 at Kromdraai in South Africa, most of the scientific community still doubted the presence of early hominins in Africa. However, Broom recognized that the forward location of the foramen magnum indicated a biped and thus a hominin rather than a robust ape skull. Its cranial capacity is between 500 and 550 cc, and the postcranial skeleton indicates a body size of about 70–90 pounds.

### **GRACILE VS ROBUST**

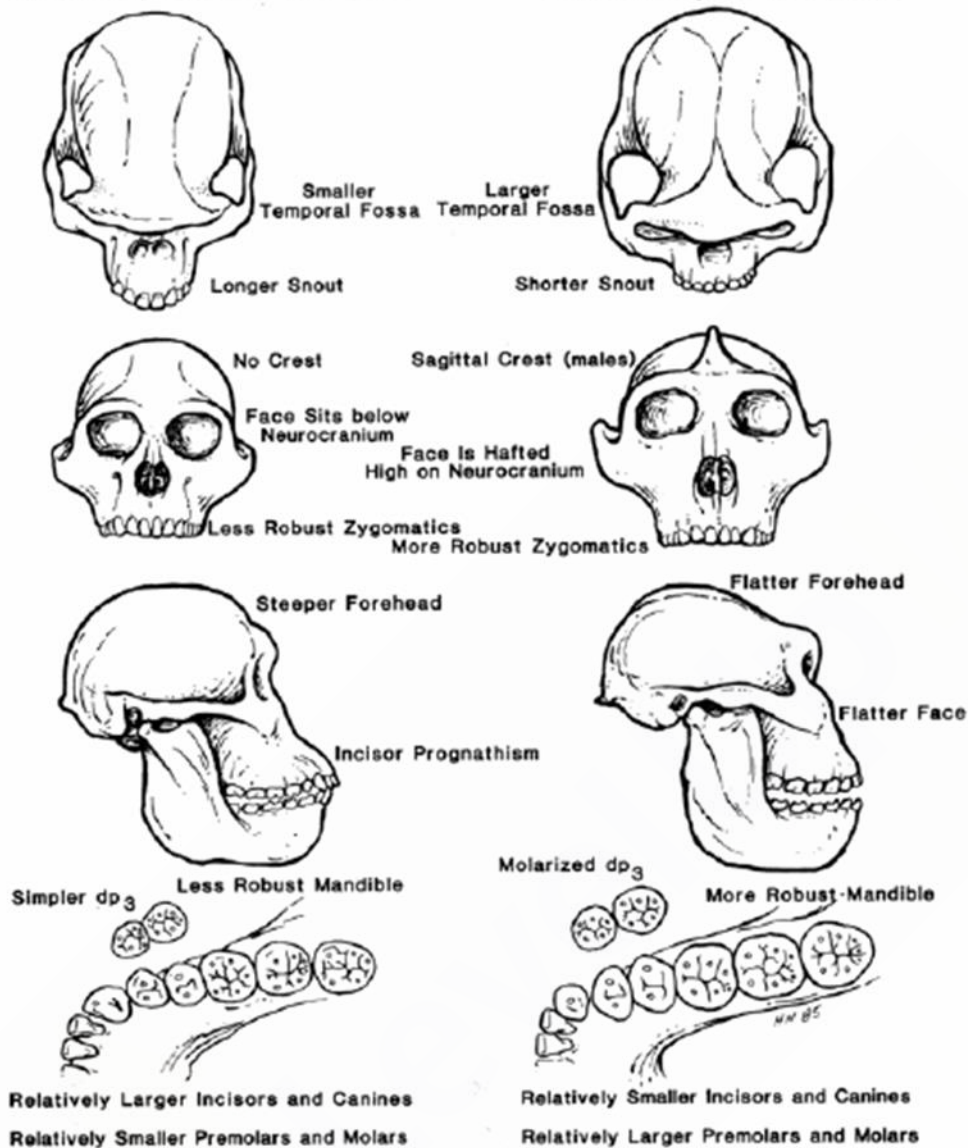
Trait	Gracile	Robustus
Distribution	East Africa	East Africa and South Africa
Time	4.4 – 2 million years	2.3-1.8 million years
Height	3.5-4 ft	3.11-4.4 ft
Cranial capacity	400-600 cc	500-600cc
Supraorbital ridges	Lack of prominent brow ridges	large
Foramen magnum	Quite forwardly placed	Forwardly placed
Temporal Fossa	Small	Large
Snout	Long	Short
Sagittal crest	Absent	Present
Location of face	Below neurocranium	High on neurocranium
Face	Prognathic Incisors	Flat Face
Zygomatic	Not particularly robust	Robust
Forehead	Steep	Flat
Mandible	Not particularly robust	Very robust
Relative size of incisors and canines	Large	Small
Relative size of premolars and molars	Small	Large

## *Australopithecus*

[Fleagle, 1999]

### *Australopithecus africanus*

### *Paranthropus robustus*

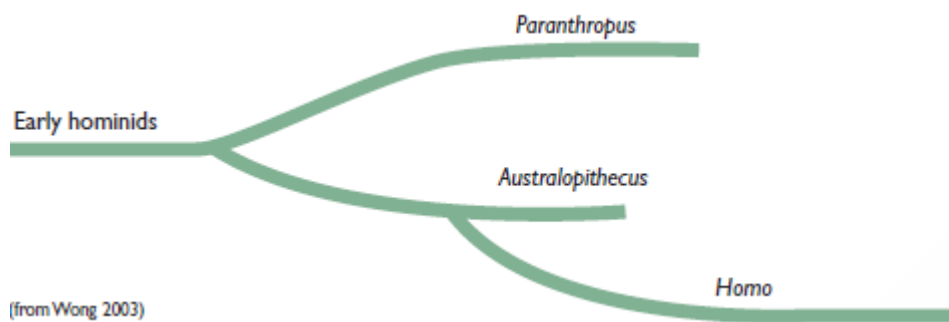


### PHYLOGENIC STATUS:

Not surprisingly, there is much disagreement among paleoanthropologists with respect to reconstructing phylogenetic relationships for the australopithecines. Furthermore, the discovery of new fossil specimens that are unexpected often cause dramatic re-organizations of hominid phylogenies. In addition to this, some new fossils are so out of line with current phylogenies that they cannot be positioned anywhere sensibly on phylogenetic trees and are often left aside with question marks accompanying them.

Most authorities generally agree that the hominids from about 4 mya on can be grouped into two natural categories, *Australopithecus* and *Paranthropus*. There is also general agreement that it was some member of *Australopithecus* that gave rise to *Homo*. A simple tree, then, would look like this





Currently there are three main phylogenetic trees each with its own cadre of proponents. The problem of whether *Australopithecus africanus* represent early grade in homo lineage or a small brain hominid arising as a separate product of *Ramapithecus* radiation is yet to resolve.

This Pliocene and Pleistocene fossils have shown both hominid and ape like features. However the hominid features are overwhelming. The presence of ape like features can be accounted for by way of common inheritance from a hominoid or Pongidae ancestor.

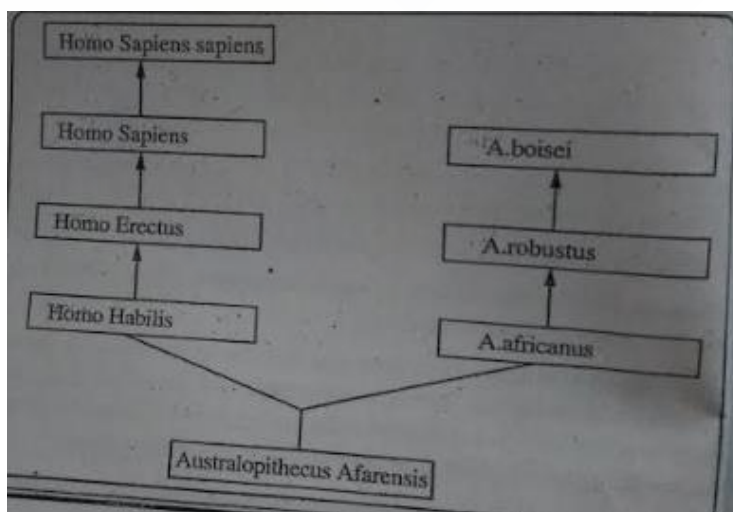
According to **Donald C Johnson and Timothy White** the east African fossils *Australopithecus afarensis* split into two branches and australopithecine line represented by *A. africanus*, *P. robustus*, *P. boisei* and a hominid line represented by *Homo habilis*, *Homo erectus* and *Homo sapiens*.

This split was supposed to have happened 3 million years ago. The australopithecine line progressively became robust. This pattern generally called two branched theory had its variants also. For some it is *A. africanus* which is the common link between the australopithecine line and homoline. For still others these two branch represent parallel evolution.

According to this two branch theory *A. afarensis* gave rise to *A. africanus* 3 million years ago of the same height living up to two million years ago.

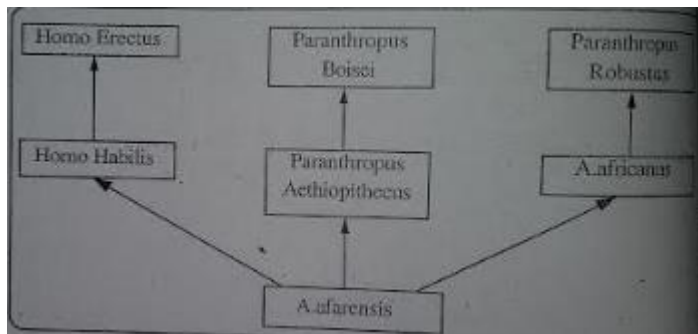
Next arrived *A. robustus* which showed marked increased in the robustness of the body face, jaws and teeth and it had lived up to 2.3 to 1.8 million years ago. Finally the last and the most robust form *A. boisei* lived in east Africa from roughly 1.8 to 1 million years ago.

The second branch of this model the homo line also shows a shortening of the face but there is marked decrease in the size of both cheek teeth and the front teeth. There is a massive increase in the size of brain also.



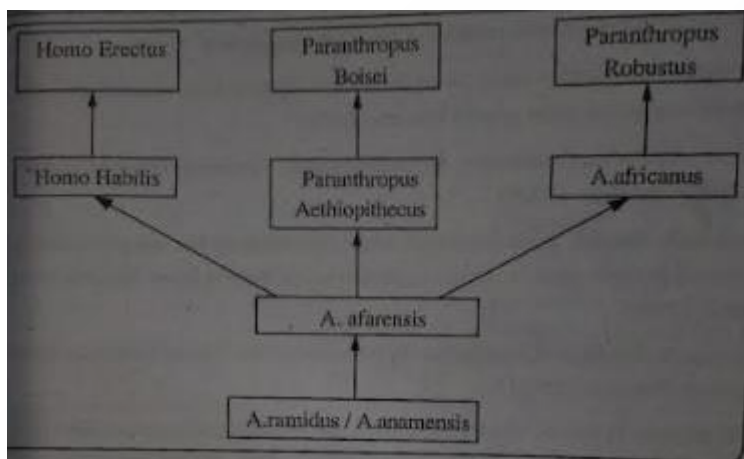
### Three branch theory

The two branch theory of **Johannson and White** was generally accepted until the discovery in Northern Kenya in 1985 by Alan Walker of a complete new type of hominid skull called *A. aethiopicus*. Majority of anthropologist believe that early hominids had three branches instead of two. **One is homo line, second is boisei line, and the third is africanus- robustus line.**



### Prevailing View since 1995-96

The common ancestor for robustus and boisei was finalized with 1986 view i.e. *A. afarensis*. After discovery of *A. ramidus* in Ethiopia in 1994 and *A. anamensis* in Kenya in 1995 it was clear that they roamed in Africa in the same time about 4 million years ago and hence they were contemporaries.



### Extinction:

All paleo anthropologists concluded that the robust australopithecines became extinct because of the following reasons

1. Over specialization of diet
2. fight with technologically advanced *Homo habilis*
3. Predation by *Homo habilis*
4. Non- primate predation.

	<i>A. anamensis</i>	<i>A. afarensis</i>	<i>A. africanus</i>	<i>P. robustus</i>	<i>P. boisei</i>
<b>Dates</b>	4.2–3.8 mya	3.9–3 mya	3.5–2.3 mya	2.2–1.5 mya (?)	2.2–1 mya
<b>Sites</b>	Lake Turkana Middle Awash	Hadar Omo Laetoli Maka Lake Turkana Dikika	Taung Sterkfontein Makapansgat Lake Turkana (?) Omo (?) Malapa (?)	Kromdraai Swartkrans Drimolen	Olduvai Lake Turkana Omo
<b>Cranial capacity (in ml)</b>	(no data)	380–500 mean = 440	370–515 mean = 440	520 (based on one specimen)	500–530 mean = 515
<b>Estimated size (average, in lb)</b>	114	110	100	105	101
<b>Skull</b>	Canines large, but hominid-like canine roots More apelike chin than <i>A. afarensis</i> Tooth rows parallel as in apes	Very prognathous Receding chin Large teeth Pointed canine with gap Shape of tooth row between ape and human Hint of sagittal crest	Less prognathous than <i>A. afarensis</i> Jaw more rounded Large back teeth Canines smaller than <i>P. robustus</i> , larger than <i>A. afarensis</i> No sagittal crest	Heavy jaws Small canines and front teeth Large back teeth Definite sagittal crest	Very large jaws Very large back teeth Large sagittal crest
<b>Postcranial skeleton</b>	Bipedal knee and ankle joints Fibula intermediate between ape and hominid	Long arms Short thumb Curved fingers and toes Bipedal	Similar to <i>A. afarensis</i> but possibly with longer arms and shorter legs	Hands and feet more like modern humans Retention of long arms	Similar to <i>P. robustus</i>



