

THE STORY OF CREATION

Chapter-24 PRIMATE TO HOMO SAPIENS

How, in such an alien and inhuman world, can so powerless a creature as Man preserve his aspirations untarnished?

(Russell in 'A Free Man's Worship')

24.01. INTRODUCTION

The Great Nature has produced in Human form, the highest complexity and organisation of matter. We are the best Creation of all created, beautiful in form, wonderful in quality, intelligent in activity, sensuous and lively in interactions.

Still we belong to the animal kingdom as *Homo sapiens sapiens*, even if we dislike the idea. We think that we have achieved something more than animals by our culture and civilisation.

How we came out this animal world to become a separate species of humankind? What's the story of our Creation?

Barely a century ago, people strongly believed that we are the creation of God. Even now, those with rigid traditional faith, think in the same old way.

When the 'theory of human evolution from primates' came up, most of us could not accept it. However scientific facts gradually established – we are not created by an Omnipotent Power. We are the evolutionary product of this vast Nature itself.

When Darwin proposed the theory of evolution under the title, *The 'Origin of Species'*, he showed us the essential pathway of evolution in order to understand how species originated. In 1871, he wrote 'The Descent of Man' with the basic idea that human descended from a kind of ape-man that was intermediate between our present-day apes and human being. Then there was no evidence or proof to support the theory. The only chance to prove it, was to get some fossil of an ape-man.

The German zoologist, **Ernst Haeckel** (1834-1919) wrote '*Generelle Morphologie*' (1865) and '*The History of Creation*' (1868). During months in womb, human embryo recaps its entire evolutionary history – simple organs to gill-arches of fish, to backbone of vertebrates to mammalian structure.

He proposed in the biogenic law – 'ontogeny recapitulates phylogeny'. He depicted a '**Chain of the Animal Ancestors of Man**'.

The chain began with protoplasm and continued to sack-worms in 8th stage of development, mud fish (12th stage), amphibians (14th stage), apes (19th stage), man-like apes orang-utan, gibbon, chimpanzee and gorilla (20th stage), unknown extinct ape-like Man, Pithecanthropi (21st stage), to human being at the last stage.

Haeckel thus inspired the discovery of one ape-like Man that possibly lived upon this planet. A vehement search for the missing link continued from then on.

In our days, we have lots of information about our origin. Geological evidence in this regard are of two kinds – fossil and their artefacts – utilities.

For dating, we employ several methods – stratigraphical, climatic, comparative analysis of flora and fauna. We also use new techniques, like, carbon-14 dating, potassium-argon (K-Ar) dating, ESR dating, amino acid acemisation dating, uranium series dating, and dating by palaeomagnetism.

24.02. HUMAN EVOLUTION

We, the humans, are broadly known by,

Kingdom	– Animal,
Subkingdom	– Metazoa,
Phylum	– Chordata,
subphylum	– Vertebrata,
Class	– Mammali,
Subclass	– Eutheria,
Order	– Primate,
Family	– Hominidae,
Genera	– Homo,
Species	– sapiens.

For quite sometime, human species were found closer to apes and monkeys than to any other animals. Both apes and monkeys have better manipulative skill. Like the development of better and stereoscopic vision, growth of manipulative power seems to imply growth of brain. The brains of ape-man had been much more complex and bigger in size. At some time, their brain became complex enough to cross the line where the world as a mass of undifferentiated sensations became, at least in part, a world of objects. Once that transformation came up, it became the decisive

jump towards mastering the world instead of reacting automatically. We turned into *Homo sapiens sapiens*.

What features we envisage exclusively human, compared to ape or ape-man?

(1) Human must have higher cranial capacity with round shaped head. They have the largest brain size with average cranial capacity of 1600 cc while that of anthropoid ape 500 cc only. Due to this, humans are capable of highly complex and mostly learned behaviour based on numerous symbols and developed speech and language with special tongue and associated areas for superior communication and culture.

(2) Foramen Magnum's location in the human skull lies in the lower part but that in case of ape, the skull is located in a way that its head is bent forward. This connection is not like man.

(3) Human face lies in the lower part of the cranium with eye-hole associated with bone circle and bone-wall and frontal location of eye with stereoscopic vision.

(4) It has short zygomatic arch with less complexity in nasal bone setting and low nasal area.

(5) Human dentition with 4 incisors, 2 canine, 4 pre-molar and 6 molar tooth, totalling 32 teeth on each jaw with 5 cusps in molar teeth. Mammals have 6 incisors, 2 canines, 8 pre-molar and 6 molar teeth in each jaw. Ape-man or apes have 4 cusps.

Dental setting for human species is V-shaped with rounded tips and that of apes U-shaped.

Human has small canine teeth with no space or gap between canine and molar teeth while apes have big canine teeth overlapping and gapping spaces between canine and molar teeth.

(6) Humans are bipedal, capable of walking upright with free hands. Apes can stand and walk only in forward-bent posture; ape-man perhaps walked clumsily.

(7) Humans have acquired tool-making skill with ever-increasing technological fineness.

(8) In human females ovulation is concealed with no obvious oestrous.

(9) Humans have developed marriage and kinship among them in their social behaviour and have a pattern of child-rearing with long infant-care and slow maturation. They usually had non-forested habitat and use home base for many activities.

Human lives longest in life. Their gestation period, childhood or maturity, come late. They also need longest time to get prepared for adulthood.

Comparative analysis shows that cranial capacity increased from gibbon to chimpanzee-orang-gorilla line. Compared to body weight, chimpanzee is next to human, followed by orang and gorilla. Though females are lighter than male and have less cranial capacity but compared to their body weight, they are not inferior.

From body size, we can estimate expected brain size of animals (E_E) by **Jerison's empirical formula** (1973),

$$E_E = 0.12W^{0.67}$$

The ratio of actual brain size to estimated brain size, (E_A / E_E), is called the **encephalisation quotient** (EQ) where E_A = the actual brain size and E_E = estimated brain size.

The EQ appears a better factor for comparing animals as functions of brain. Its size increased from chimp to human being, but EQ of gorilla and orang are little compared to their body. Chimps have higher EQ as 3 while human EQ has been 8.

Table:24.01. Brain size in cc, body size in kg, EQ & %EQ in modern hominids (data from Aeillo and Dean, 1990; EQ & %EQ as per Jerison. source: 'Human Evolution' by Alan Bilsborough, p/39)

	brain	body	EQ	%EQ
Homo sapiens	1250	44	8.07	100
Pan troglodytes (chimpanzee)	410	36.4	3.01	37
Pongo pygmaeus (orang)	413	53	2.36	29
Gorilla gorilla (gorilla)	506	126.5	1.61	20

24.03. EVOLUTION FROM PRIMATE

Linnaeus noted earlier that primates have 4 incisor teeth, 2 collarbones, 2 mammary glands and at least 2 hands with opposable first digit.

The English biologist, **St. George Jackson Mivart** (1827-1900), pointed out in 1873 that primates are placental mammals, having nails or claws (unguiculate) and clavicate features (having clavicles i.e. collar-bone), eye sockets encircled by bones, three kinds of teeth (incisor, canine and molar), brain with posterior lobe and a calcarine fissure, one pair of opposable digit in limbs, big toe (with flat nail or

none), well-developed caecum, pendulous penis, scrotal testes and two mammae. (source: Primate Evolution - Glenn C. Conroy, p/5)

During the Palaeocene epoch (66.4-57.8 myr ago), some kind of **archaic primate** or primate-like mammal (Plesiadapiformes or Plasiadapis), evolved from insectivores. Their fossil remains had been found from North America but were also widespread in Africa, Asia and Europe during tropical conditions of Palaeocene-Eocene. They are called primates because of their dental feature. Antarctic ice formed first in early Oligocene around 30 myr ago. One Primate of this time was known as *Notharctus*.

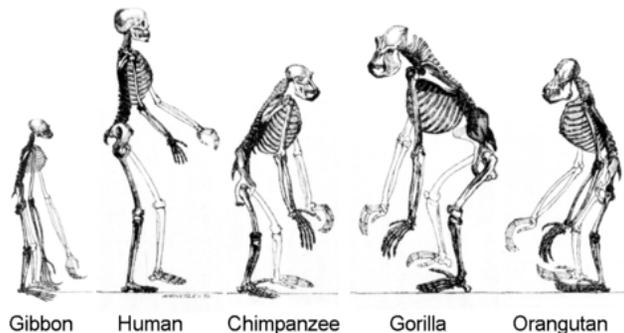


Fig:24.01. The hominoids - descendants of common ancestor.

True primates, called **euprimates**, evolved in Eocene epoch (57.8-36.6 myr ago), when archaic primates became extinct. They were common in Europe, Asia & North America. The earliest remains (*Pondaungia*, *Amphipithecus*) had been found from Burma. The Oligocene epoch (36.6-23.7 myrbp) was most important for their evolution.

In the early Miocene (23.7-5.3 mybp), we find appearance of old world apes and monkeys in East Africa.

Primate fossil evidence found in Germany in 1908s was 16.5 myr old while that from East Africa 15 myr old. These apes were diverse in forms and numerous but gradually diminished from middle Miocene. By the end of Miocene, a different ape-like creature appeared in the scene. They were called hominids.

[Excluding archaic primates, true primates were classified earlier in two sub-orders – prosimii (nearly monkeys) and anthropoidea.

Under prosimii suborder, two families Tarsiidae (tersier) and Lorsiidae (lemur) were included. Anthropoidea sub-order were then divided into three

infra-order – parapithecoidea (extinct), catarrhini, and platyrrhini. Monkeys belong to two later infra-orders.

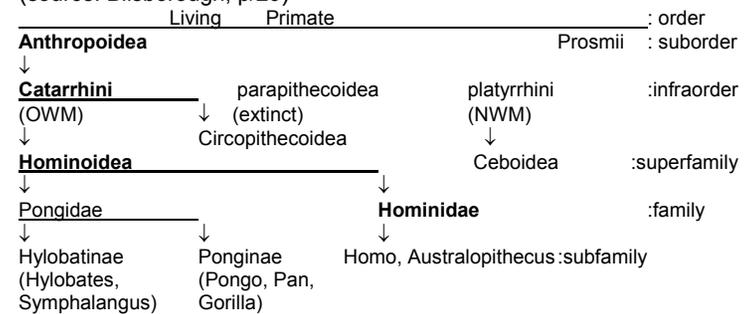
Platyrrhine monkeys, better known as 'New World Monkeys' (NWM of super-family ceboidea) flourished in America. Catarrhine monkeys comprised of Hominoidea and Cercopithecoidea (Old World Monkeys, OWM) super-family.

George Gaylord Simpson (1902-1984) in 1945, classified Hominoidea into two families – Pongidae & Hominidae. Pongidae are further classified into two sub-families – Hylobatidae & Ponginae (Pongo, Pan, Gorilla). Hominoidae include two sub-families of Homo & Australopithecus.

Some extinct Hominoids / pongids were dryopithecus, gigantopithecus, shivapithecus etc.

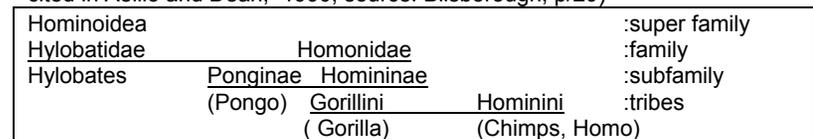
Humans belong to *Hominidae* family that included two genus - Homo and Australopithecus.

Table:24.02. Simpson's Old classification scheme of primates (1945) (source: Bilsborough, p/20)



Glenn C Conroy in 1990 classified Hominoidea super-family into 3 families – (1) Hominid (in Latin *Hominidae*), (2) *Pongidae* (orang-utan, gorilla and chimpanzee) and (3) *Hylobatidae* family (Gibbons).]

Table:24.03. Clade based Hominid classification scheme (by Andrews, cited in Aeillo and Dean, 1990; source: Bilsborough, p/20)



Until about 1960, the hominoids were usually divided into two families – humans and their extinct relatives in **Hominidae**, and other apes in **Pongidae**.

In recent times, Phylogenetic classification of primates based on DNA evidences & fossil present a different picture. The Order Primate is now classified into two suborders – *Strepsirhini* (wet-nosed primates) & *Haplorhini* (dry nosed primates).

Strepsirhini contains most of the prosimians and is divided into (1) Lemuriformes (lemur) & (2) Loriformes (loris).

The *Haplorhini* includes the three living group: (1) prosimian tarsiers, (2) simian monkeys and (3) apes. The *Haplorhini* metabolism lost the ability to make its own Vitamin C.

Haplorhini split into two infra-orders -- *Platyrrhini* and *Catarrhini*.

Platyrrhines (New World monkeys) have prehensile tails and males are colour blind. They may have migrated to South America on a raft of vegetation across the Atlantic ocean (about 4,500 km wide).

Catarrhines mostly stayed in Africa as the two continents (America & Africa) drifted apart. One ancestor of catarrhines might be *Aegyptopithecus*. *Catarrhini* splits into 2 super-families – Old World monkeys (Cercopithecoidea) and apes (Hominoidea).

Table:24.04. Two Infra-order (under Order Primate)

<i>Strepsirhini</i>	Lemuriformes (lemur)		
	Loriformes (loris)		
<i>Haplorhini</i>	<i>Platyrrhini</i>	<i>NWM</i>	
	<i>Catarrhini</i>	<i>OWM, Hominoidea</i>	

Then came the application of techniques from molecular biology to primate taxonomy. **Morris Goodman** (1925-2010), the American scientist, used his 1964 immunological study of serum proteins to propose a division of the hominoids into three families – (1) human-great apes in Hominidae, (2) non-human great apes in Pongidae and (3) lesser apes (gibbons) in Hylobatidae.

The trichotomy (three way division) of hominoid super-family prompted scientists to ask which family speciated first from the common hominoid ancestor.

Within the super-family Hominoidea, gibbons (Hylobatidae) are the out-group. This means that the rest of the hominoids are more closely related to each other and grouped into Hominidae family. The Hominidae family now contained subfamilies **Homininae** and **Ponginae**.

Investigation showed orang-utans (pongos) to be the out-group. This led to the placing of the chimps & Gorilla in the subfamily Homininae..

To try to resolve the hominine trichotomy, some authors proposed the division of the subfamily Homininae into the tribes - Gorillini (African apes) and Hominini (humans) tribes.

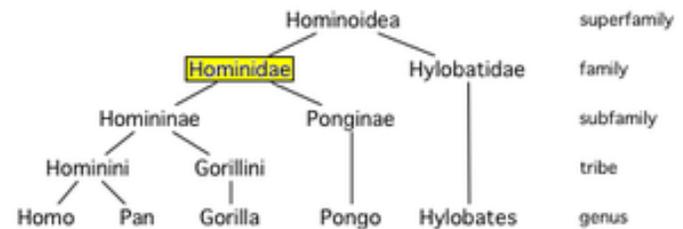


Fig:24.02. Family tree showing the extant hominoids: humans (genus *Homo*), chimpanzees and bonobos (genus *Pan*), gorillas (genus *Gorilla*), orangutans (genus *Pongo*), and gibbons (four genera of the family Hylobatidae: *Hylobates*, *Hoolock*, *Nomascus*, and *Symphalangus*). All except gibbons are hominids.

However, DNA comparisons provide strong evidence that within the subfamily Homininae, gorillas are the out-group. This suggests that chimpanzees should be in Hominini group along with humans. Thus Homonini produced Pan (chimps) and Homo genus. The classification was proposed by Morris Goodman et al. in 1990 (refer to Fig.24.02).

The a very general timeline for Human evolutionary genetics are often shown, as follows in Table:24.03.

Table:24.05. Timeline for Human evolution

order	:	primates	(75,000,000	years	ago)
suborder:		haplorrhini	(40,000,000	years	ago)
infraorder:		simiiformes			
parvorder:		catarrhini	(30,000,000	years	ago)
superfamily:		hominoidea (apes)	(25,000,000	years	ago)
family	:	hominidae (great apes)	(15,000,000	years	ago)
subfamily:		homininae	(8,000,000	years	ago)
tribe	:	hominini	(5,800,000	years	ago)
subtribe	:	hominina	(3,000,000	years	ago)
genus	:	homo	(2,500,000	years	ago)
species	:	homo sapiens	(500,000	years	ago)
sub-species:		homo sapiens sapiens	(200,000	years	ago)

24.04. OLIGOCENE PRIMATES

Let us begin the story with primate evolution during Oligocene period (33.9-23.3 myr) when diverse forms of primates appeared upon our planet. Their fossils were found in America.

Fayum Depression, 240 km south-west of Cairo in Egypt, now an arid basin, was covered with thick tropical forest at that time. The site yielded fossil tarsier (*Afrotarsius*), *Oligopithecus* and primates that occur in two groups -- Parapithecidae and Propliopithecidae.

Under parapithecoidea infra-order, we have species like *Parapithecus frassi*, *P. grangeri*, *Apidium mustafai*, *A. phiomense*, *Qatrania wingi*.

The earliest catarrhine, *Kamoyapithecus*, was found from upper Oligocene at Eragaleit of northern Kenyan Rift Valley. The specimen is 24 myr old. Its ancestry might be related to *Aegyptopithecus*, *Propliopithecus* and *Paranthropus*.

In 2010, the specie, *Saadanius*, was considered closely related to crown catarrhines, dated 29-28 myr ago.

Numerous *Parapithecus* occurring 35-40 myr ago, is known to be the earliest primates. They were merely 30 cm in height. Some remains of lower jaw and teeth had been found from the deposit. It showed 2 incisors, 1 canine, 2 pre-molar (?) and 3 molar tooth with jaw like *Tarsius*. Perhaps it evolved from *Tarsius* in the last Eocene period.

Propliopithecus are larger but less numerous. They also had 2.1.2.3 dental structure.

Five primate lower jaws from Fayum deposits, were known before 1960. When **Elwyn LaVarne Simons** (b1930) of Yale University organised expeditions in 1961, he recovered several fossils. The skull of specie *Aegyptopithecus zeuxis* recovered by the team, indicated that it weighed only 6 kg with brain size around 30 cc.

The German geologist, **Richard Markgraf** (1869-1916), discovered several species, known as, *P. frassi*, *A. phiomense*, *P. haeckeli* & *P. markgrafi*.

24.05. MIOCENE HOMINOIDS

Miocene Period spans for 23.3-5.2 myr ago from present. In early Miocene period (23.3-16 myr), hominoids first appeared in East Africa and Eurasia. They occurred broadly in two types – **Dryomorphs** & **Ramomorphs**.

In early and middle Miocene, species were mostly **proconsul**, **limnopithecus**, **micropithecus**, **dendropithecus** and **rangwapithecus** and are referred to as **Dryomorphs**. They were found in East Africa and Europe

During the middle Miocene period (16-12 mybp), major fossils are **Ramapithecus**, **Kenyapithecus**, **Gigantopithecus** and **Shivapithecus**. All are referred to as **Ramomorphs**. Miocene **Ramomorphs** were found mainly in Eurasia.

Some regroup Miocene hominoids into four families, such as, (1) **Proconsulidae** (*dendro-pithecus*, *proconsul*, *rangwa-pithecus*, *dionyso-pithecus*, *limno-pithecus*, *micro-pithecus*); (2) **Oreopithecidae** (*Oreo-pithecus*); (3) **Pongidae** (*dryo-pithecus*, *giganto-lufeng-*, *shiva-pithecus*); and (4) **Pliopithecidae** (*lacco-pithecus*, *plio-pithecus*).

Among Miocene hominoids, *Dryopithecus fontani* (20 myrbp) was found in 1856 from St. Gaudens of France by **M. Fontan**. The remain was simply a jaw, described in 1856 by the French palaeontologist **Edouard Lartet** (1801-1871). Charles Darwin knew about this specie before publication of his book, '*The Origin*'. One humerus and two other jaws were recovered from the same site some time later.

In 1926, **H. L. Gordon** found the first hominid fossil from Koru in Kenya. Remains from Songhor and Rusinga Island were discovered by **Louise Leakey** (1903-1972) and **D. G. MacInnes** in 1930-31. The British scientist, **Silverfrid Le Gross Clark** (1895-1971), and Leakey carried out further expeditions in 1947-51. Remains were discovered also from China.

Pliopithecus evolved 20 myr ago and flourished in Europe until 11-12 myr ago. The face appeared flat like ape-man. The molar tooth had 5 cusps. It could possibly move in a semi-erect stance and at the same time freely moved in trees. The specie is commonly accepted as ancestor to modern gibbons.

Proconsul remains were also 20 myr old. We recovered several species of this genus. They were perhaps smallest **Proconsuls** discovered from Rusinga Island, Mfwangano Island, Koru, Songhor and Fort Tirin.

Earliest species lived 20-18 myr ago while youngest from Fort Tirin site 14-12.5 myr ago.

In 1948, the British paleoanthropologist, **Mary Leakey** (1913-1996) found distorted skull fragments of a female *P. africanus* (KNM-

RU7290) from Rusinga Island. The skull measured 167 cc. suggesting a body weight of 10-12 kg. The specie *P. nyanzae* weighed about 40 kg, as estimated from their lower leg and foot-bones. Proconsul foot are like both ape and monkey.

Shiwalik Hills of Himalayas produced many Ramomorphs. First hominoid remains in the Shiwalik area of Pakistan were found by one pilgrim in 1915. It was named *Dryopithecus gigancious* (later called *Gigantopithecus giganteus*). In the same year, an upper and lower jaw from the area were found. The specie was named then *Dryopithecus punjabicus* (later renamed *Ramapithecus punjabicus* and then into *Shivapithecus sivalensis*). In 1968, three pieces of one big jaw with over-sized molar tooth were discovered from Bilaspur area of Himachal Pradesh in India. Broadly, all come under the general name of **Dryopithecus**.

In 1930, **G. E. Lewis** of Yale University found again in the Shiwalik area two pieces of upper and lower jaws, with palate attached in one. Other remains were 2 molar, 2 premolar tooth with a cavity of canine, the root of one incisor and the cavity of another. With these finds, he brought forth **Ramapithecus** and **Brahmapithecus** that lived by the end of Miocene.

From the cavity of the canine teeth, Rampithecus discovered by Lewis, appears to have small teeth; small canine tooth suggests sidewise movement of jaw like man since ape-man with overlapping canine moved jaws in vertical direction. They ate fruits and leaves and also stiff foods. Perhaps they had to go out of jungles into grasslands to get food. In all probability, they ate small animals.

Rampithecus lived widespread in Asia, Africa and Europe. Perhaps they could use tools. On re-examination of jaws in 1961, Elwyn Simons found *D. punjabicus* and Rampithecus belonging to same group. In 1965, Elwyn Simons and **David Pilbeam** (b1940) of Harvard, observed that *D. punjabicus* and Brahmapithecus were also the same specie.

Kenyapithecus-wikeri found by Leakey in 1961 at Fort Tirnin area of Kenya and dated by K-Ar method as 14 myr old, were also found similar to Rampithecus. At Fort Tirnin area, Leaky found leg bones of deer and a pile of stones. He guessed therefrom that the specie ate bone-marrow breaking bones with those stones. It is probable that implements were required for the purpose as they were handicapped with small canine tooth in order to tear anything.

During the Miocene period, Kenyan sites of Fort Tirnin, Maboko Island, Majiwa and Kaloma, yielded many Ramomorphs. Fort Tirnin

specimens were 14-12.5 myr old. Four specimens were described earlier as *Kenyapithecus wickeri*, renamed as *S. africanus*.

In 1960 remains of *Shivapithecus Indicus*, were found in East Africa. David Pilbeam found an almost complete fossil in Pakistan. The specie appeared in Eurasia 15 myr ago and disappeared within 8 myr.

Several teeth had been found from Neudorf an der March of Czechoslovakia, belonging to the specie named *S. darwini*. From 1973, numerous jaws and teeth were recovered from site near Salonika, Greece. These were 10-11 myr old. A lower jaw was recovered from Pyros near Athens. Koenigswald described them as *Greaecopithecus freybergi* in 1972. Later it was called *S. meteai*.

Pasalar of Turkey yielded 100 teeth of at least twenty individuals aged between 16.5-13 myr. From Candir Formation of Ankara, a mandible 12 myr old, was found. It was first described as *S. alpani* (later renamed into *S. sivalensis*).

Mt. Sinap of north-west Ankara produced mandibular fragments and a palate belonging to *S. meteai* (previously called *Ankarapithecus*).

Richard F. Kay and EL Simons, in 1983, reorganised numerous specimens into three groups of Shivapithecus – *S. indicus*, *S. sivalensis* and *S. simonsi*. Three more types are referred – *S. darwini* from Czechoslovakia and Turkey, *S. africanus* from Pasalar of Turkey and *S. meteai* from Turkey. In China,

Ramomorphs were found from **Lufeng** of Yunnan Province, China, under the direction of **Wu Rukang** (Yu-Kang). Five lower teeth were recovered. The species are now assigned to *S. sivalensis* and *S. indicus*. By 1986, numerous fossils of 350 skeletal parts were found from which some scientists formed a new genus *Lufengpithecus*.

The youngest Miocene hominoids was probably *Oreopithecus* 9 myr old, found in Italian coal beds.

Thus we find that Aegyptopithecus were 28 myr old, followed by Dryopithecus and Pliopithecus, both 20 myr old. Rampithecus evolved around 14 myr. There occurred periodic fossil gaps. It is not yet clear how far those gaps are significant.

The quartet – Proconsul, Dryopithecus, Ramapithecus and Shivapithecus, disappeared around 8 myr ago. Then we find a big gap in fossil records over the interim period. In absence sufficient fossil records, we can only guess that genus Australopithecus

evolved from some Miocene ancestors (Dryomorphs) during the Pliocene period.

A likely ancestor of the Australopithecines is the Ardipithecus genus that lived some 4.4 million years ago.

The term '**australopithecine**' refers generally to any species in the related genera *Australopithecus* or *Paranthropus*.

These species occurred in the **Pliocene-Pleistocene** era. Possibly *Australopithecus*, appeared about 4 myr ago while *Paranthropus* about 2.7 myr ago. *Australopithecus* is sometimes referred to as the 'gracile (slender) australopithecines', while *Paranthropus* are called the 'robust australopithecines'.

They were bipedal and dentally similar to humans, but with a brain size not much larger than modern apes. They also lacked encephalization characteristics of the genus *Homo*.

The *Homo* genus appear to be descended from australopithecine ancestors. According to some, *Australopithecus* branched off from *Kenyanthropus platyops* some 3.5 myr ago. Humans appeared about 2.4 myr ago with *Homo habilis*.

An alternative possibility is the derivation of *Homo* directly from *Ardipithecus* with an as-yet-undiscovered link connecting *Ardipithecus* and *Homo habilis* existing in parallel to the Australopithecines in the period 4.0-2.5 myr ago.

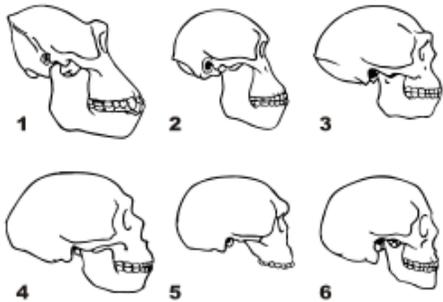


Fig:24.03. Craniums : 1. Gorilla 2. Australopithecus 3. Homo erectus 4. Neanderthal (La Chapelle aux Saints) 5. Steinheim Skull 6. Euhominid

24.06. HOMINID FAMILY

The Hominid family was divided into **Australopithecus** and **Homo** genus.

Among numerous *Australopithecus* fossils with numerous names given by their discoverers, efforts to bring some order was tried several times. Three major genus in *Australopithecus* group have been identified –

A. afarensis,
A. africanus, and
A. boisei.

Homo genus was then regrouped into –

H. habilis,
H. erectus,
H. neanderthal,
Archaic H. sapiens and
H. sapiens.

From *A. afarensis*, the specie *H. habilis* evolved, followed by *H. erectus*, *H. neanderthal*, *Archaic H. sapiens* and *H. sapiens*. This is one of several scheme of human origin.

***A. afarensis* > *H. habilis* > *H. erectus* > *H. Neanderthal* > *Archaic H. sapiens* > *H. sapiens*.**

The first *Homo* fossil we could find, was the skull fragment at **Cannstadt** of Germany around the year 1700. It was scientifically described 135 years later.

In 1822, another fossil was discovered from Paviland cave of Swansea by the English theologian-geologist **William Buckland** (1784-1856). Six years later, some human bones were discovered from Bize Cavern and from the Cavern of Pondres Nimes of France. Unfortunately, all remains were lost.

The story of human origin depends on estimation of age of fossils and its proximity to human features. Lots of differences occur while framing the sequence of pre-humans. With more and more discoveries, the sequence is continuously refined. There may be finer points in filling up details of changes but the basic plan of human evolution from ape-man stock is not lost.

Though Neanderthals were almost in the last stage before emergence of *Homo sapiens*, its specimen was discovered first.

We begin our description of *Australopithecus* preceded by three new finds - *Sahelanthropus Tchadensis*, *Orrorin Tugenensis* & *Ardipithecus*.

24.06.01. SAHELANTHROPUS TCHADENSIS

One new species, *Sahelanthropus tchadensis*, was named in July 2002 from fossils discovered in Djurab desert of Chad in Central Africa by a team led by the French palaeontologist, **Michel Brunet** (b1940), with three Chadian Adoum Mahamat, Djidoumalbaye Ahounta and Gongdine Fanone & one Frenchman Alain Beauvian. It is the oldest known hominid or near-hominid, dated between 6-7 myr old.

This species is known from a nearly complete cranium nicknamed, **Toumai**, and a number of fragmentary lower jaws and teeth. The skull has a very small brain size of approximately 320-380 cc. It is not known whether it was bipedal.

S. tchadensis has many primitive ape-like features, such as, small brain-size, along with some other features (such as the brow ridges and small canine teeth, which are characteristic of later hominids). This mixture, along with the fact that it came from around the time when the hominids were thought to have diverged from chimpanzees (i.e. around 6.3-5.4 myr ago), suggests that it was close to the common ancestor of human and chimpanzee.

24.06.02. ORRORIN TUGENENSIS

Another new species, *Orrorin tugenensis*, was named in July 2001 from fossils discovered in Lukeino Formation in Tugen Hills of western Kenya by **Brigitte Senut** and **Martin Pickford** (b1943) year before.

The fossils found so far from five individuals, include fragmentary arm and thigh bones, lower jaws, and teeth and were discovered in deposits that are about 6 myr old. The limb bones are almost 1.5 times larger than those of Lucy, and suggest that it was about the size of a female chimpanzee.

Its discoverers claimed that genus 'Orrorin' was a human ancestor, adapted to both, bipedality and tree climbing, and that the australopithecines are an extinct offshoot.

Given the fragmentary nature of the remains, other scientists have been sceptical of these claims so far (Aiello and Collard 2001). A later paper (Galik et al. 2004) has found further evidence of bipedality in the fossil femur.

24.06.03. ARDIPITHECUS

The species, *Australopithecus ramidus*, was named in September 1994 (White et al. 1994; Wood 1994) from some

fragmentary fossils dated at 4.4 myr. The fossil was discovered by Tim White in 1992-93 from Afar Depression in Middle Awash river valley of Ethiopia.

A more complete skull and partial skeleton was discovered in late 1994. Based on that fossil, the species was reallocated to the genus 'Ardipithecus' by White and others.

This fossil was extremely fragile. Its excavation, restoration and analysis took long 15 years.

In 1999-2003, a team led by the Ethiopian researcher **Sileshi Semaw** discovered bones and teeth of nine individuals at Afar region. The fossils were dated 4.32-4.51 myr old. In 2009, palaeontologists formally announced the species. It was the nickname '**Ardi**'.

Ardipithecus ramidus was about 120 cm tall and weighed about 50 kg with brain size 300-350 cc. The skull and brain are small, about the size of a chimpanzee. It was bipedal on the ground, though not as well adapted to bipedalism as the australopithecines were, and quadripedal in the trees. It lived in a woodland environment with patches of forest. This further indicated that bipedalism did not originate in a savannah-like environment.

A number of fragmentary fossils (teeth and pieces of skeletal bones) were discovered between 1997 and 2001 from Afar (?) and dated 5.2-5.8 myr old. They were originally assigned to a new subspecies, *Ardipithecus ramidus kadabba*, and later to a new species, *Ardipithecus kadabba* by Yohannes Haile-Selassie, Gen Suwa and Tim White in 2004.

One of these fossils is a toe bone belonging to a bipedal creature, but is a few hundred thousand years younger than the rest. Its identification with *A. kadabba* is not firm.

24.07. AUSTRALOPITHECUS

The long gap in fossil-remains spanning several myr, between hominoid Ramapithecus and hominid Australopithecus was a matter of much concern. The hominid group appeared some 8-3 myr ago in Africa as the primary stock for humans evolution from thereon.

Raymond Dert (1893-1988) was born in Brisbane of Australia but worked in Witwatersrand Medical School of Johannesburg in South Africa as a Professor of Anatomy. In 1924, by sheer chance, he came across with a fossil recovered from a limestone mine at Taung, in Kalahari area of South Africa, 300 km from Johannesburg.

It was a fossil brain-cast, almost a complete skull and face of one 5-6 year old boy. It did not show great eyebrow ridges. The jaw did not jut forward. It had rounded forehead with full set of milk teeth and the first molar teeth tooth just emerging. The fossil was popularly known as the **Taung Child**.

The face resembled human face. Long jaw and big incisor teeth like baboon were missing. Canine and incisor teeth were small. The creature could probably walk upright. Cranial capacity measured nearly 500 cc, slightly higher than ape. The creature possibly weighed between 27-32 kg.

The poor child was named *Australopithecus africanus* of *Homo simiadae* genus. The scientific community was reluctant to accept this discovery as great as the missing link. Dert had to fight alone for long ten years to establish his claim until further excavations proved him right.

The Scottish surgeon, **Robert Broom** (1866-1951) supported Dert as a significant discovery of missing link. Broom was Master of Surgery and a great believer of human evolution. He joined Transval Museum in Pretoria in 1934. Though he agreed with Dert, it became apparent to him that the matter would not be convincing until some adult fossil was found.

Sterkfontein cave was in Krugddorp, Pretoria, 50 km away from Johannesburg. The owner of the cave had put up a strange ads – ‘Come to Sterkfontein and find the Missing link’. The cave was known to have baboon fossils.

In 1936, Broom went to Sterkfontein and discovered within eight days pieces of skull and other fossils. He named it *Australopithecus transvaalensis*, (later changed to *Plesioanthropus transvaalensis*).

The cranial capacity of the skull (SK5) is 480 cc and estimated age 2.5 myr. Many more fossils were found before and after WWII. From four skulls found, average cranial capacity was calculated as 485 cc. The specie is now called *Australopithecus africanus*.

In 1937-38, Broom collected from Barlow, the manager of Sterkfontein mine, a wrist-bone, a facial fragment, part of thighbone, and one upper jaw with four teeth. He got further a palate with one molar tooth. The real discoverer of the fossil was a local boy who got them from a cave deposit at Kromdraai, some 3.0-1.5 km from Sterkfontein. Mr. Barlow, the manager of the lime-quarry, gave it to Broom. Later he managed to collect four teeth that fitted in the palate. Soon he recovered from the site, left side of skull, a palate and a part of right lower jaw.

From all these, reconstruction was made and the fossil-specimen came to be known as **Kromdraai Man**. It appeared more robust and larger. Broom called it *Paranthropus robustus*.

Scientists began to accuse Broom that he was creating new genera at very minor differences. Meanwhile Broom recovered an elbow joint, an anklebone, some hand-bones and finger-bones. In 1941, a juvenile mandible was also found. The fauna suggested an age of 2-1 myr.

These discoveries supported Dert's claim that a small-brain, bipedal man-like ape having manipulative skill once lived in South Africa. Later he described the Taung, Sterkfontein and Kromdraai fossils into one sub-family Australopithecine.

Experts describe *P. robustus* now as *Australopithecus robustus*. Its average braincase appeared as 500 cc.

In 1947 Broom discovered a good specimen of Australopithecus skull from Sterkfontein. Later he recovered a fine lower jaw, a pelvis and vertebral column with leg bone fragments, part of shoulder blade and upper arm. These evidences clearly indicated that the creatures had a man-like jaw and ape-like skull. So they are midway between ape and human.

The Scottish Anatomist-Anthropologist, **Arthur Keith** (1866-1955) proposed in his book ‘*A New Theory of Human Evolution*’ (1948) that Australopithecus represented the pre-human stock from which various divisions of mankind evolved in late Pliocene. Erect posture was probably the most ancient quality and large brain development the latest. About 750 cc cranial capacity should be taken as the limit beyond which creatures would be called humankind.

In 1948, at **Swartzcrantz** lime-quarry mines, not very from Sterkfontein, some more fossils (crania, mandibles, post-crania) were found by Broom. They were named *Paranthropus crassidens* dated 1.5-2.0 myr. The mandibles appeared like a robust australopithecine.

Next year a very different hominid was found. It was named initially as *Telanthropus capensis*, later classified as *Homo erectus*. This was the first site to show that australopithecine coexisted with homo genus.

In 1945 at **Makapan cave** of Macapansgat Valley in north Transval, 300 km from Sterkfontein, a team of students from Witwatersrand University led by the South African palaeoanthropologist, **Phillip Vallentine Tobias** (1928-2012) under Raymond Dert, found some fossils with breccias.

Two years later, Dert's researcher **J. W. Kitching** found back portion of one skull. The cave showed many evidences about the lifestyle of the occupants of the cave. They used bones as tools and weapons. They were thought to be violent carnivores who even ate their own people. The idea was contested by some who suggested that they were not hunters, rather hunted.

Dert named those cave dwellers *Australopithecus prometheus*. They were later included into *A. africanus* who lived 2.5-3.0 myr ago. The braincase had a capacity of 400-500 cc, with moderate to large jaws and dentition.

In recent times we have with us some new findings of *Australopithecus*. as new species.

Australopithecus anamensis

The specie, *Australopithecus anamensis*, was named in August 1995 (Leakey et al. 1995). The material consists of 9 fossils, mostly found in 1994, from **Kanapoi** in Kenya, and 12 fossils, mostly teeth, found in 1988, from **Allia Bay** in Kenya (Leakey et al. 1995).

These existed 4.2-3.9 myr ago, and has a mixture of primitive skull, and advanced body. The teeth and jaws are very similar to older fossil apes. A partial tibia (the larger of the two lower leg bones) provides strong evidence of bipedality, and a lower humerus (the upper arm bone) is extremely human-like. Note that although the skull and skeletal bones are thought to be from the same species, the fact is not yet confirmed.



24.04. *Australopithecus afarensis* skull reconstruction, displayed at Museum of Man, San Diego, California. (source: Wikipedia)

Australopithecus afarensis

A. afarensis existed between 3.9-3.0 myr ago. They had an ape-like face with a low forehead, a bony ridge over the eyes, a flat nose, and no chin with protruding jaws and large back teeth.

Cranial capacity varied from about 375-550 cc. The skull is like a chimpanzee but with human-like teeth. The canine teeth are much smaller than those of modern apes, but larger and more pointed than those of humans. The shape of jaw is between the rectangular shape of apes and the parabolic shape of humans. However their pelvis and leg bones far more closely resemble those of modern man. They were bipedal (although adapted to walking rather than running (Leakey 1994).

The bones show strong physique. Females were substantially smaller than males, as per sexual dimorphism. Height varied between about 107 cm and 152 cm. The finger and toe bones are curved and proportionally longer than in humans, but the hands are similar to humans in most other details (Johanson and Edey 1981).



Fig:24.05. A reconstruction of *A. Afarensis*.

Most scientists consider that *A. afarensis* was partially adapted to climbing in trees. Others think it as evolutionary baggage.

This species, *Kenyanthropus platyops*, was named in 2001 from a partial skull found in Kenya with an unusual mixture of features (Leakey et al. 2001). It is about 3.5 myr old. The size of the skull is similar to *A. afarensis* and *A. africanus*, and has a large, flat face and small teeth.

Australopithecus africanus

A. africanus existed between 3-2 myr ago.

It is similar to *A. afarensis*, and was also bipedal, but body size was slightly greater. Brain size may also have been slightly larger, ranging between 420 and 500 cc. This is a little larger than chimp brains (despite a similar body size), but still not advanced in the areas necessary for speech. The back teeth were a little bigger than in *A. afarensis*. Although the teeth and jaws of *A. africanus* are much larger than those of humans, they are far more similar to human teeth than to those of apes (Johanson and Edey 1981). The shape of the jaw is now fully parabolic, like that of humans, and the size of the canine teeth is further reduced compared to *A. afarensis*.

Australopithecus garhi

The species *Australopithecus garhi*, was named in April 1999 (Asfaw et al. 1999). It is known from a partial skull find.

The skull differs from previous australopithecine species in the combination of its features, notably the extremely large size of its teeth, especially the rear ones, and a primitive skull morphology. Some nearby skeletal remains may belong to the same species. They show a human-like ratio of the humerus and femur, but an ape-like ratio of the lower and upper arm. (Groves 1999; Culotta 1999)

Australopithecus aethiopicus

A. aethiopicus existed between 2.6-2.3 myr ago. This species is known from one major specimen, the **Black Skull** discovered by **Alan Walker**, and a few other minor specimens which may belong to the same species. It may be an ancestor of robustus and boisei, but it has a baffling mixture of primitive and advanced traits.

The brain size is very small, at 410 cc, and parts of the skull, particularly the hind portions, are very primitive, most resembling *afarensis*. Other characteristics, like the massiveness of the face, jaws and single tooth found, and the largest sagittal crest in any known hominid, are more reminiscent of *A. boisei* (Leakey and Lewin 1992). A sagittal crest is a bony ridge on top of the skull to which chewing muscles attach.

Australopithecus robustus

A. robustus had a body similar to that of *africanus*, but a larger and more robust skull and teeth. It existed between 2.0-1.5 myr ago.

The massive face is flat or dished, with no forehead and large brow ridges. It has relatively small front teeth, but massive grinding

teeth in a large lower jaw. Most specimens have sagittal crests. Its diet would have been mostly coarse, tough food that needed a lot of chewing. The average brain size is about 530 cc. Bones excavated with robustus skeletons indicate that they may have been used as digging tools.

Australopithecus boisei

A. boisei, earlier called *Zizanthropus boisei*, existed between 2.1-1.1 myr ago. It was similar to robustus, but the face and cheek teeth were even more massive, some molars being up to 2 cm across. The brain size is very similar to robustus, about 530 cc. A few experts consider boisei and robustus to be variants of the same species.

Australopithecus sediba

Two spectacular new hominid fossils found in a cave at **Malapa** in South Africa in 2008 and 2009 have been assigned to a new species, *Australopithecus sediba* ('sediba' means 'wellspring' in the local seSotho language). Discovered by a team led by **Lee Berger** and **Paul Dirks**, it is claimed to be the best candidate yet for an immediate ancestor to the genus *Homo*. The fossils are between **1.78 - 1.95 million years** old, about the same date of the oldest *Homo erectus* fossils.

The first fossil, MH1, found by Lee Berger's son Matthew, is an almost complete skull and partial skeleton of an 11 to 12 year old boy.

The second fossil, MH2, is a partial skeleton of an adult female, including some jaw fragments. The boy's brain has a typical australopithecine size of 420 cc, compared to the smallest *Homo* brain of 510cc. Both skeletons are small, about 130cm (4'3") tall.

A. sediba is most similar to, and quite likely descended from, *A. africanus*. The upper limbs are long suitable for climbing, and similar to other australopithecines. Many features of the hip, knee and ankle bones show it was bipedal but the foot bones are still quite primitive. However Berger et al. list many other features of the skull, teeth, and pelvis in which it resembles early *Homo* fossils.

The discoverers have suggested that *A. sediba* might be ancestral to either *Homo habilis* or *Homo rudolfensis*, or that it might be a closely related sister group to *Homo* - not a direct ancestor, but a close cousin. Anatomically *sediba* would be a plausible *Homo* ancestor, but as the authors admit, these two individuals existed after

the earliest known Homo fossils (at about 2.3 million years), so they can't be human ancestors. However, it's not impossible that the sediba species had already existed for a few hundred thousand years and that early members of it could have been human ancestors.

Interestingly, prominent scientists quoted in the media have split fairly evenly on the question of whether sediba should have been assigned to Homo or Australopithecus. Bill Kimbel, Don Johanson, Susan Anton and Colin Groves went for Homo, while Meave Leakey, Tim White and Ron Clarke didn't. Some scientists have even suggested that it may be a late-surviving variant of *A. africanus*. However, overall body plan was australopithecine, and hence put it in that genus.

Australopithecus afarensis and *africanus*, and the other some species above, are known as **gracile australopithecines**, because their skulls and teeth are not large and strong. Gracile means slender. Despite this, they were still more robust than modern humans.

A. aethiopicus, *A. robustus* and *A. boisei* are known as **robust australopithecines**, because their skulls in particular are more heavily built. They have never been serious candidates for being direct human ancestors. Many authorities now classify them in the genus *Paranthropus*.

24.08. HOMO HABILIS & AFRICA

Four African sites, Olduvai Gorge, Omo valley, Afar desert and East Turkana soon became the cradle of prehuman settlement. Numerous species were recovered from these sites, from *Australopithecus* to *Homo* (*habilis*, *erectus*, *sapiens* etc.).

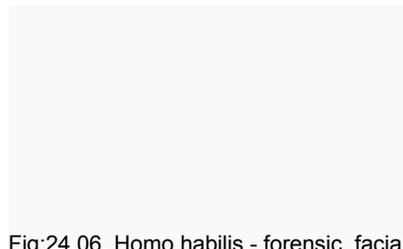
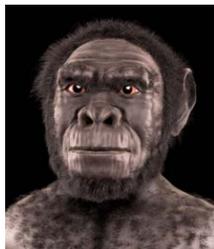


Fig:24.06. Homo habilis - forensic facial reconstruction /approximation.

24.08.01. OLDUVAI GORGE

Olduvai Gorge is now a rough desert land in Serengeti terrain of north Tanzania in East Africa. Some 2 myr ago this place was a fertile land with small lakes and marshy areas at the base of two volcanoes. There were vegetation and many wild animals including early human habitations. Volcanic eruptions preserved rich fossils that are presently exposed to us. The stratum in five units, was dated by radioactive K-Ar method as 1.9 -0.6 myr old.

The German neurologist-paleontologist, **William Kattwinkel** (1866-1935) incidentally discovered the site in 1911. Within two years, an expedition was made in the area under the leadership of the German volcanologist-paleontologist, **Hans Gottfried Reck** (1886-1937) of Berlin University.

An ancient human skull and skeleton (**Olduvai Man**) was discovered which according to Reck was of middle Pleistocene period. Others did not accept it.

Meanwhile, in 1927, the British archaeologist-naturalist, **Louis Seamour Bazett Leakey** (1903-1972) of National Museum of Kenya, discovered some human fossils from a burial site near **Lake Elmenteita** in Kenya. The fossils appeared very much like the Olduvai Man.

In 1928-29, more skulls were discovered that resembled close to Olduvai. The fossils were associated with stone tools that were surprisingly absent in case of Olduvai Man.

In 1931, Leakey and Reck went to Olduvai in search of tools used by early men. Within hours they found what they had expected. The Olduvai Man created a kind of **pebble tool culture** and possessed necessary manufacturing skill. Hence their origin in the Pleistocene period (2-0.01 myr) can be reasonably accepted.

Leakey also explored some old sites near **Kanjera** in Lake Victoria area. There he discovered 2 skull fragments (**Kanjera skull**). He got from another site near Kanam West, some mandible fragments. According to him, the finds represented *Homo sapiens*, that were older than Olduvai Man.

Leakey organised another expedition in Olduvai Gorge and recovered large amount of Stone Age tools. He explored about 300 km length of the fossil-rich Gorge in more than thirty sites.

In 1935, the young archaeologist, **Mary Nicol** (1913-1996), discovered from one such site 2 skull fragments. Mary Nicol became Mary Leakey post-marriage, in the next year.

Olduvai gradually appeared to be the campsite of early men. Lots of human-like bones were preserved there with tools and even remains of their meal. Some evolutionary changes were naturally expected preserved in this region.

In 1951, expeditions were made with the financial assistance from **Charles Boise**. Two sites (Bell's Korongo and Sam Howard's Korongo) provided many stone implements, waste flakes and animal bones. The place appeared like a hunting ground for fossil bones. Four years later, two hominid teeth – a canine and a molar, were found. Then in 1958, another tooth was found at MK-I, a Bed-I site wherefrom Oldowan tools were unearthed earlier in 1931.

In 1959, Mary Leakey succeeded to find one cranium skull of a young man who lived some 1.75 myr ago on the FLK living-floor in Bed-I of Olduvai Gorge. Its cranial capacity amounted to 570 cc. Leakey thought that the specimen was not an australopithecine. They named it *Jinjanthropus boisei*. In the same area, many tool implements were also uncovered.

The above Zinj was to be considered a near-man capable of making tools even though their brain size was small. It proves the theory that '**tools ante-date man**'. The specie was introduced as **Nutcracker Man**, presently described as *Australopithecus boisei*. They display most of the features of *A. robustus* to a greater degree.

In 1960, Louis Leakey recovered from Olduvai, parts of cranium (**OH9**) from upper Bed-II. **Holloway** estimated its cranial capacity as 1067 cc while that of another specimen (**OH12**) found by **Margaret Avery** in upper Bed-IV showed 727 cc only. Both appeared 0.7-1 myr old.

Jonathan Leakey (b1941), the eldest son of Louis and Mary Leakey, was only nineteen years old when he came across a fossil specimen. It was a lower jaw of a cat. Soon the site produced a tooth and a finger bone of hominids.

Further excavation produced a collarbone and fragments of skull (of OH7 with cranial capacity 660 cc). It occurred in the FLKNN site of the lowest strata Bed-I of Olduvai dated 1.75 myr old. The fossil belonged to a boy 11-12 year old. This specimen **OH7** is now taken as the **type specimen of *Homo habilis***.

Gradually huge amount of fossil remains numbering more than 2000, were recovered from this site. Among them many hominid fossils were found scattered over the floor area. The remains included 12 foot bones, 21 hand bones, 1 toe bone, 1 finger bone,

more skull fragments and 1 mandible. There were some 48 artefacts also in the FLKNN living-floor.

In 1963, hominid remains of OH13 (**Cinderella**) were recovered from MNK site from lower Bed-II. Its cranial capacity was measured as 673 cc. The specimen was regarded as female one.

Type specimen OH7 support OH13. Fragments of cranium and dentition (**OH16**) was recovered from FLKII Maiko Gully. It was a male, nicknamed **George**, with cranial capacity of 638 cc.

In all, fossils of at least three members including one young individual were found. The skull measured 680 cc by Phillip Tobias. This is well beyond Australopithecine brain case and more inclined towards Homo.

These specimens were given a name of ***Homo habilis*** meaning 'handy man' that lie between Australopithecus and *Homo erectus*. The name was given by Dert in 1964.

In 1968-69, **Peter Nzube** found complete skull of a *Homo habilis* at site DK in lower Bed-I, named OH24, **Twigg**, with 600 cc capacity. The overlaying tuft dated 1.75 myr. It was the oldest specimen of the Olduvai hominids.

Soon more specimens were discovered - 2 skulls, 1 lower jaw and end joint of a big toe. The remains were found from Bed I to middle of Bed II, thus indicating a range of 750,000 year. In the upper Bed II, remains of *Homo erectus*, 1.2 myr old were found by Louis Leakey in 1970.

In 1971, an ulna (OH36) was found by **Muia Mutala**, the foreman. Pelvis of *H. erectus* was found from WK site associated with abundant Acheulean stone industry. It became soon established that *Homo habilis* were associated with Oldowan culture and *Homo erectus* with Acheulian.

(It is now widely taken that members of *H. habilis* measured 600-684 cc cranial capacity. Incisor of male and female were same. Height varied between 1220-1370 mm and weight between 27-32 kg, male female almost equal. Foot bones proved that the members could stand on foot and walk regularly. Hands resembled a lot like human being. They could make and use tools, found in the strata. Implements include chopper, Acheulian hand-axe, scrapers, rounded stone used as hammer, shovel-type among 18 varieties of early stone age tools. They ate greens, fish, snakes, birds and mammals perhaps and threw the wastes around their homes. *Homo habilis* were considered as human ancestor evolving into *Homo erectus*.)

Scientists disputed over definition of the genus *Homo*. **Earlier it was taken by Arthur Keith that beyond 750 cc average species should be called *Homo*.** Some proposed that relative brain size would be a better criteria for the purpose. The shape of the skull and face, bipedality, dental characteristics and opposable thumb are also important features for the genus. Stone tools associated with fossils should also be considered to confirm their *Homo* status.

From 1964, specimens of *Homo habilis* were recovered from Olduvai Gorge, Sterkfontein, Swartzcraantz, Omo and East Turkana.

The next phase of Olduvai expedition was taken over by **Donald Carl Johanson** (b1943) and **Timothy Douglas White** (b1950) in 1984-85.

In 1986, Tim White recovered from Olduvai some hominid remains (OH62) from DDH, close to FLK site. The age appeared to be 1.75-1.5 myr. They found 302 pieces of fossils. There was an adult individual, a female perhaps who died 1.75/1.8 myr ago. The find was a *Homo habilis*, having similarities to *A. afarensis*. She was only 914 mm in height with hands hanging to her knees like apes. It points out that some ape-like characteristics were continued for sometime as the feature of early hominids.

Mary Leakey and her youngest son Philip (b1949) discovered in 1974 hominid fossils at Laetoli, near Olduvai. There were human-like tooth and two fragments of jaw of a youth and an adult. The specimen resembled to Afar finds even though two places are 2000 km apart. Fossils recovered were 3.5 myr old.

Laetoli footprints were discovered later.

Laetoli footprints were very interesting due to unique combination of climatic, volcanic and mineralogical factors. In 1976, Andrew Hill first discovered series of animal tracks. For next two years, seven sites were exposed with footprints in a cement-like volcanic tuff next year. The hominid trail among them was not clear enough. Only two prints were better exposed. Mary Leaky was almost certain about its hominid origin.

Next year she with Philip and Andrew Hill, discovered definite footprints of earliest human ancestors that lived in the area. The print was preserved in a rare accident. Volcanic ash from Sadiman erupted light ash followed by rain showers. The ash fell on fresh foot-marks and hardened like cement in rains very shortly. The ash yielded an age of 3.6-3.75 (3.59-3.77) myr. This left two parallel trails of five

prints, measured 215 x 100 mm and 185 x 88 mm with gap of 472 and 387 mm. The trails are parallel 250 mm apart. Foot-size and stride suggests larger individuals 140 cm tall and the smaller one about 120 cm. There were also tracks of different animals.



Fig:24.07. Replica of Laetoli footprints, exhibit in the [National Museum of Nature and Science, Tokyo, Japan](#). (source: Wikipedia)

The discovery conclusively proved that walking on two legs was as old as 4 myr old. It means **bipedalism evolved earlier than sufficient brain development and tool making.**

In Olduvai, *Homo erectus*-like fossils were also found ageing 1.0-0.5 myr. Average cranial capacity of younger remains was mostly around 630 cc. It resembled more like *Australopithecus* and *Homo habilis* than Peking-Java Man. Most likely, Olduvai was inhabited by some pre-*Homo erectus* with *Jinjanthropus* and *Homo habilis*. Gradually *Homo erectus* evolved there from the old stock.

From the discovery by Richard Leaky from Turkana Lake in Kenya, it is observed that the fossil had about 900 cc cranial capacity which is quite close to Peking man. The species lived there 1.5 myr ago.

It can be taken as granted that the site Olduvai George was occupied by *Homo habilis* approximately 1.9 myr, *Paranthropus boisei* 1.8 myr ago, and *Homo erectus* 1.2 myr ago. *Homo sapiens* occupied the site 17,000 years ago. This place significantly showed increased developmental and social complexities in hominins.

As evidence, we find their production and use of stone tools, indicating their better cognitive capacities. The inhabitants practiced of both scavenging and hunting, highlighted by the evidence of gnaw marks predating cut marks, and comparisons on percentages of meat versus plant in the early hominid diet.

Furthermore, the collection of tools and animal remains in a central area is another evidence of increased social interplay and communal performance. (Wikipedia)

24.08.02. OMO VALLEY

Like Olduvai George, another fossil-rich area is the **Omo valley** of Ethiopia. It is formed by Omo river that drained into Lake Turkana (Lake Rudolf) of north Kenya, at a distance of 300 km from Nairobi.

Now we find it a hot region but it was not so in those days. Then there was a river with green forests and many animals, just an ideal place for human settlement. Volcanic eruptions stratified in about forty stratas of which the lowest one is 4 myr old. The place was discovered during Count Teleki's hunting trip in 1888.

The first fossil from this area was found in 1902. The area became a very important one in 1933 when the French geologist, **Camille Arambourg** (1885-1969) published a survey report of the area indicating it fossil-rich.

Big expeditions require big money. After some stray searches by individuals, International Omo Research Expedition was formed in 1966, headed by **Francis Clark Howell** (1925-2007) of Chicago (later California) University with **Yves Coppens** (b1934) and **Richard Leakey** (b1944). Camille Arambourg was in the French team with Louis Leakey.

In 1967, Leakey team discovered 2 skulls 100,000 year old. Next year, the French and American teams discovered tooth of *Homo habilis*, followed by several stone tools next year.

The American and French team discovered in all about 231 hominid specimen spread over 94 sites. The rich finds consisted of 4 skull fragments, 9 jaws and 208 tooth and some other bones. These represented all four early human specimen - *Homo habilis*, *Homo erectus*, *Australopithecus africanus* and *Australopithecus boisei*, dated around 3 myr.

Omo sequence is divided into six formation. K-Ar dating reveals earliest one as 4-3 myr old while the youngest one as less than 0.2 myr.

24.08.03. AFAR DESERT

The **Hadar** river is in the **Afar desert** in north-east Ethiopia, 240 km north-east of Addis-Ababa and flows down to the main stream Awash. Afar is a fractured depression featured in the Earth's crust. It

links the African Rift Valley to the rift systems of Red Sea and Gulf of Aden.

In 1969, the French geologist, **Maurice Taieb** (b1935) who earlier participated in the Omo expedition, found fossil deposits in this region. Three years later, Taieb and Donald Johanson, visited Hadar region to find it quite promising for fossils.

Next year in 1973, Yves Coppens of Musee De l'Homme in Paris, Donald Johanson, Maurice Taieb and **John Kalb** of Ethiopia, undertook **International Afar Research Expedition**.

In the very first year, Johanson found from a bed, 3 myr old, some human-like leg bones. The fossils clearly confirmed that its owner could walk on two legs. This is perhaps another old evidence of bipedalism.

In 1974, **Alemaeyhu Asfaw** of Geology Department of Ethiopia, found 4 hominid specimens. One was a palate with 16 teeth in place. The specimen showed combination of ape-like as well as man-like features. These hominids could walk upright, ate meat, and used tools, some 3 myr ago. They belonged to Homo genus.

Donald Carl Johanson (b1943) made the most spectacular discovery on 24th December 1974. It was from a sediment bed 100 meter below the surface near the extinct lake. About 40% skeleton was unearthed, consisting of skull fragments, mandible, arms, some vertebrae, ribs, left pelvic bone, left thighbone, and parts of right leg. From the pelvis bone, it was evident that the individual was a female, not taller than 122cm (most likely 107 cm). The skeleton was listed as **A.L.288-A Partial Skeleton**. The world knew her in the name of **LUCY**.

It is presently dated between 2.9 to 3.65 myr. Experts grouped her as *A. africanus* though discoverers named it to be new specie, *A. afarensis*. The type specimen, LH4, was from Laetoli though bulk came from Hadar.

During the period, 1974-1976, the Hadar team of Johanson discovered about 200 fossils of males, females. There were at least 4 children in the group that consisted of 13 individuals in a site designated A.L.333. This number may go up to 30 heads. It was claimed that they represented the Homo group 3 myr old. This one was the first find of a **Family of Human**.

In 1979, Johanson and Timothy White proposed a scheme on human evolution. They placed the specie *A. afarensis* at the bottom of the scale and *Homo sapiens* at the top. *A. afarensis* lived 3.75-3.0 myr ago. From *afarensis* we are to go through *A. africanus*, *A.*

robustus followed by *H. habilis*. The specie *A. africanus* diverged 2.5 myr ago and *H. habilis* 1.9 myr. *Homo erectus* were found to occur in 1.8-0.2 myr ago. Perhaps *H. habilis* evolved from *A. afarensis* in between. Mary Leaky and Richard Leaky, could not agree to this scheme. (Refer to clause 24.13 below)

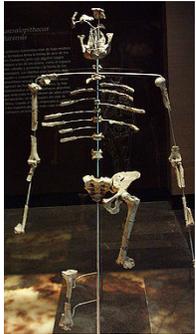


Fig:24.08. A replica of the remains of Lucy, Museo Nacional de Antropología, Mexico City

In 1981, Timothy White and **John Desmond Clark** (1916-2002) discovered more fossils from sites in the Afar desert, only 72 km away from Lucy's. Upper part of the femur bone belonged to 16/17 year old male who must be a two-legged creature. Seven fragments of one or more skull were found just 800 meters away from the site. The team believed that the creature had 400 cc cranial capacity, 124 cm height and walking posture like human being.

In fact the Hadar specimens came from three sites - Sidi Harkoma (SH), Denam Dora (DD), and Kadar Hadar (KH). They were dated around 3.4 myr.

Some other sites were located in Kenya and Morocco. Sites near **Lake Baringo** of Kenya produced fossils and stone artefacts. In 1969, Mary Leakey announced the finding of a complete mandible with some cranial remains. They were associated with Acheulian tools.

The hominid fossil was discovered from a dune of **Kebibat** near Rabat on the Atlantic coast of Morocco. The remains include parts of vault, left maxilla and lower jaw. In 1954, two mandibles were discovered from **Ternifine** of Morocco, followed by some other remains in the next season. Two sites, **Thomas Quarry** and **Sidi**

Abderrahman, yielded more fossils. **Sale** yielded fossils with cranial capacity of 880 cc.

24.08.04. EAST LAKE TURKANA

East Turkana Research Project organised search for hominid fossils in north Kenya. Lake Turkana was called earlier Lake Rudolf. Richard Leakey was the key figure behind the Project. During Omo expedition, Richard Leakey, son of Louise & Mary Leakey, chartered a helicopter and surveyed the north eastern shore area of the Lake. The area appeared highly promising. So he pulled out of Omo-team and led an expedition in East Turkana next year in 1968. Only three eroded jaws were collected in the first attempt.

In 1969, the American geologist, **Anna Kay Behrensmeyer**, found some stone tools. Analysis by potassium-argon dating of KBS tuff of Kobi Fora formation, indicated an age of 2.4 myr ago (revised later to 2.6 mybp \pm 260,000 years). Hence tool making appears to be much older (2.6 mybp) than indicated in Olduvai finds (1.9 mybp). Later the dating had to be revised further to 1.88 \pm 0.02 mybp.

In the same year, Richard found one complete hominid skull of Zinj type or robust australopithecine type. The skull was very similar to *Australopithecus boisei*. His assistant discovered another skull fragments which was neither australopithecine or Homo type.

In 1970, sixteen hominid fossils were found followed by twenty-six more next year. In 1972, **Bernard Ngeneo**, one of the assistants working with Richard Leakey, caught sight of a fossil, identified later as **1470 MAN**.

It appeared to be the oldest Man with the large brain like a Homo. Identification of the skull became a problem as one could not be sure whether it should be called a Homo or Australopithecine. Debate continued as regards its age also, 2.5 myr or 1.8 myr. The skull showed 800 cc cranial capacity. Other evidences indicated two legged locomotion. The inhabitants were tool makers and hunters, capable of making choppers, scrapers and other tools.

Meanwhile a complete cranium from Koobi Fora region, Baringo, Kenya, on east side of the Lake was collected in 1975 Bernard Ngeneo dating 1.78 myr. It was designated as **KNM-ER 3733**, having cranial capacity of 848 cc as estimated by Holloway. The whole skull is similar to some of the Peking Man fossils. Because the facial features are less robust than that of the Turkana Boy, this skull is thought to be female.

The braincase of **KNM-ER3883** with 800 cc brain capacity was dated 1.59 myr. These fossils belonged to early *H. erectus*. In 1980, parts of cranium (of KNM-ER 730) were recovered. It was from the same individual whose mandible was collected ten years ago.

From the Turkana lake area, Kay Behrensmeyer and **Leo Laport** with Meeve Leakey discovered in 1978-79 foot marks of some two legged creatures. The owner was 150 cm tall with 54 kg weight. Foot measured 260 x 100 mm. Prints were dated 1.75 myr ago.

In 1984, **Kamoya Kimeu** from Richard Leakey and Alan Walker team, discovered from Nariokotome on the west shore of Lake Turkana almost one entire skeleton of a 1.6 myr old boy. It appeared from the fossil that the boy was 11 or 12 years old, the only major omissions being the hands and feet. It was with 160 cm height and 55 kg weight. Its cranial capacity was about 880 cc that would have been 910 cc at adulthood. The adult would have reached a height of 185cm.

Except for the skull, the skeleton is very similar to that of modern boys, although there are a number of small differences. The most striking is that the holes in his vertebrae, through which the spinal cord goes, have only about half the cross-sectional area found in modern humans. One suggested explanation for this is that the boy lacked the fine motor control we have in the thorax to control speech, implying that he wasn't nearly as fluent a speaker as modern humans are (Walker and Shipman 1996).

The specimen was called **Turkana Boy** and designated **KNM WLT 15000**.

Next year, another robust australopithecus skull was discovered on the western shore of Lake Turkana. They were 500,000 year older than the earlier one. It was found in a bed of sediment 2.5 myr old. The specimen appears as *A. boisei* (**Black skull**, KNMWT17000 at Lomekwi, west Turkana, 2.5/2.6 myr, 400 cc).

24.08.05. HOMO GEORGICUS

This species was named in 2002 to contain fossils found in Dmanisi, Georgia, which seem intermediate between *H. habilis* and *H. erectus*. The fossils are about 1.8 million years old, consisting of three partial skulls and three lower jaws. The brain sizes of the skulls vary from 600 to 780 cc. The height, as estimated from a foot bone, would have been about 1.5 m (4'11"). A partial skeleton was also discovered in 2001 but no details are available on it yet. (Vekua et al. 2002, Gabunia et al. 2002)

24.09. HOMO ERECTUS

24.09.01. JAVA MAN

The genus *Homo erectus* is one of the proto-humans. The **Pithecanthropus** popularly known as the **Java Man** is now included in this genus. They lived in Pleistocene era some 500,000 year ago. One enterprising Dutch man, **Eugene Dubois** (1858-1940), first found out fossil-remains of Pithecanthropus.



Fig:24.09. A model of *Homo erectus* from Museum of Archaeology, Herne, Germany.

Strongly charged with the idea of early man, Dubois resigned from Amsterdam University and went to East Indies in 1887 with a job in the medical corps of Dutch East Indian Army. He would search for the missing link there, as he strongly believed that the link would be found in the land of orang-utan and gibbon. Three years later he found a primate's chin with right premolar teeth and socket for canine teeth from one **Kendung** deposit at the foot of Mt Lawu. Next year he found some fossil remains, a tooth, a skullcap (Trinil 2), in **Trinil** village on the bank of river Solo in central Java. By 1892, he collected one thighbone (Trinil 3) and another teeth. The individual was named *Anthropopithecus erectus*, changed in 1894 into *Pithecanthropus erectus*.

Dubois believed that he had discovered the missing link and presented papers to the 3rd International Congress of Zoology (1895). The world community showed mixed reactions to his claim. In the 4th Congress (1898), he presented his argument after re-examination. The specie *Pithecanthropus erectus* should be an intermediate form between ape and man. The cranial capacity varied from 775 to 900cc (av. 860 cc). **Holloway** determined endo-cranial capacity of Trinil cranium as 940 cc. Scientific community were still unconvinced. And the enterprising dutchman Dubois could not accept this neglect.

Then in 1929, came the discovery of Peking Man. Soon new fossils were discovered from Java by others. A skull was recovered from **Ngandong** from the banks of Solo, not very far from Trinil. It was found by the German palaeontologist, **Gustav Heinrich Ralph von Koenigswald** (1902-1982). It was known as **Solo Man**. Some 17 cranial, 2 tibiae and numerous other fragments were found within 1931-33. Ngandong 1, 6 and 12 skull had 1172, 1251 and 1090 cc cranial capacity respectively. In 1976, cranial remains of one or two individuals were recovered from the same area.

Around 1937-39, Koenigswald discovered more specimens, 3 skulls from **Sangiran**, some 75 km away from the earlier spot. The famous B-mandible (Sangiran-1b) was found in 1936. The first cranium turned up next year. This Sangiran-2 braincase had 813 cc capacity and Sangiran-4 skull 908 cc. In 1941, a jaw fragment was found.

Further villagers at **Tandjung** discovered the skull designated as Sangiran-10 in 1963. The skull had 855 cc capacity. Two more skulls, Sangiran-12 and Sangiran-17, had 1059 cc and 1004 cc capacity.

In 1936 fossils were found from **Mmodjokerto** of Java (17 cranial parts and 2 tibiae).

In 1973, another site, **Sambungmachan**, produced a braincase, having 1035 cc brain capacity, discovered by Jacob.

In 1939, Koenigswald came to work with Franz Weidenreich at Peking. It gradually appeared that Java Man and Peking Man were actually identical. They compared their fossils with those found earlier by Dubois and became more convinced. Both represented the same early human.

24.09.02. PEKING MAN

Like the Java Man, the **Peking Man** is also included in the *Homo erectus* group. They flourished in Pleistocene era. [Their cranial capacity varied from 850-1300 cc (av. 1075 cc) and height from 150-160 cm. It is said that Peking Man knew to use sticks and stones.]

'Lung Ku' means dragon's bones and 'Lung Ya' dragon's teeth. These were readily available in Chinese drugstores as traditional medicines. In 1899, one German naturalist, **K. A. Haberer**, collected some dragon bones from a shop in Peking and found among them one molar tooth of a primate. It was a small fossil-remain of the Chinese ape-man, called *Sinanthropus*.

Fossil collection was just a hobby of Swedish mining expert **Johan Gunnar Anderson** (1874-1960). He came to work in China as

an advisor to the government. Actually, the Swedish Professor **Carl Wiman** (1867-1944) of Uppsala University made him interested in fossils.

In 1921, a young Austrian palaeontologist **Otto Zdansky** (1894-1988) came to China and joined hands with him to look for more fossils. Zdansky discovered one molar teeth in a lime-quarry near Chou K'ou Tien village, only 80 km from Peking.

Chou K'ou Tien is now called **Zhoukoudien** or Jekodien cave. The tooth was human-like, the first evidence of an early man in China. Later he found another teeth while examining heaps of fossil bones. In 1926, this discovery was announced and the owner of the teeth was called the **Peking Man**.

Davidson Black (1884-1934), the Canadian teacher of anatomy, Peking Union Medical College, became interested in the Chou K'ou Tien teeth. Due to him, another excavation at Chou K'ou Tien was arranged in 1927. There one graduate student of Wiman, **Anders Birger Bohlin** (1898-1990), discovered a tooth in the cave. Black examined the find and compared it with those of Zdansky. Surprisingly the teeth belonged to the same individual. He identified it as a new specie, *Sinanthropus pekinensis*.

Next year Bohlin uncovered fragments of lower jaw with three teeth in place. The jaw appeared ape-like. In 1929, the Chinese scientist **W. C. Pei**, also called Pei Wenzhong, (1904-1982) made the prize discovery of one complete skull. The brain capacity was found 1000 cc, quite close to Java Man.

Chou K'ou Tien yielded more fossils. After Black's death, the French preist-geologist, **Pierre Teilhard de Chardin** (1881-1955) and then the anatomist **Franz Weidenreich** (1873-1948), took charge of the excavation. Before Sino-Japanese war could stop the work in 1937, remains of more than 40 males, females and children, were found including 5 skulls, 9 fragments of skull, 11 mandibles, 147 tooth, 7 thigh bones, 2 upper arm-bones, 1 collarbone and 1 wrist-bone. Some skulls were broken. About 100 thousand stone tools and pieces were collected with artefacts made from animal bones and deer-horns.

Habitation was distributed over ten strata with clear marks of fire and ashes upto seven meter deep ash-bed. The inhabitants possibly knew the use of fire, though recent studies throw doubt. A good collection of quartz and cherts, indicate that the material were brought to the site with a purpose. It means capacity of purposeful behaviour of its owners.

Weidenreich studied the fossils and documented them laboriously. Then came the second world war. Weidenreich went to America with complete set of casts, photographs, drawings and information in 1941. Japan joined the war in the same year. It was decided to send all fossils to America for safe preservation there. The treasure left Peking in the ship, President Harrison. Unfortunately the ship ran aground on its way. Nothing more was heard about the fossils since then. They were all lost, leaving only some documents and casts.

In 1949, further excavation was made in the Chou K'ou Tien cave when five hominid teeth were found. It yielded two limb fragments in 1951, a female mandible in 1958 and two skull fragments in 1966. Surprisingly these skull fragments fitted with some earlier finds of 1934 and thus gave a complete skull. In 1958 at **Maba**, another skull was recovered.

In 1963-64, W. C. Pei and **J. K. Woo** discovered from **Lantian**, south of Jekodien, about 950 km south west of Peking, one skull and one jaw. David Pilbeam estimated them 0.5 to 0.7 myr old.

In 1978, *Homo erectus* skulls were found from **Dali** and two years later from **Hexian**. Dali skull was dated 0.25 myr. The fossil remains found in 1927 were originally dated 0.35 myr. From recent finds in East Africa of almost identical type, we get the revised date of 1.5 myr as more acceptable one.

In 1978, the Chinese Academy of Sciences conducted a detail study of Zhoukoudien cave site. The site recorded development of one community over a pretty long period. Early men used fire 460,000 year ago. They lived there for 230,000 year and exhibited considerable increase of brain size over this period. The community left stone tools that showed their growing skill in tool manufacturing. They were skilled hunters, commonly hunting deer. They lived in groups, shared foods, and divided labours.

However in 1984, **Lewis Binford** and **Nancy Stone** further checked these evidences. In their opinion, Peking men were more likely scavengers than hunters. Further they used fire at some later stage of development. Whatever said about their social grouping, appears inconclusive.

cranial capacity (cc) of	gorilla	- 855
	Australopithecus	- 435-650
	Java Man	- 850
	Peking Man	- 1115-1225

24.09.03 H. ERECTUS FROM OTHER SITES

The species *Homo erectus*, our predecessors, includes Java man and Peking man. Its fossil-remains were found in Olduvai Gorge in Tanganaika. It is estimated that the species existed in East Africa 2 million to 300 thousand year ago. **KNM-ER 1481** was the earliest fossil of *Homo erectus* belonging to an age of 2 myr.

Terrah Amta area of Neis City in Riviera, France, is the site on the bank of Mediterranean Sea. While bulldozing earth in 1966, the geologist, **Auri de Lumle**, observed some unusual stones while he was just watching the works casually. The site was later found to be the ancient site of human habitation. Twenty-one strata yielded remains of 35,000 birds of different species, implements, rudimentary house, and ashes from woods even foot marks. Though no human fossil was found, scientists believed that it was inhabited by *Homo erectus* or likes 1 myr ago. Some suggest that first evidence of home was found in Terra Amta. Lumle discovered about 21 homes. Fire was burnt in a central place of each home site. Stone still with marks of chopping meats was found not far from the fire. Some red ochre found might be used for their decorations of the body.

De Lumle and his wife **Marie Antoanet** discovered from a cave in Riviera many flint implements, weapons made from animal bones and deer-horns, choppers made from pebbles and other things. These were 1 myr old. Implements found in **Straska Scala cave** of Czechoslovakia were dated 0.7 myr.

Taralba and **Ambrona** are two villages on the banks of Ambrona about 160 km north east of Madrid in Spain. Francis **Clark Howell** (1925-2007) of America discovered from these places many stone implements dated more than 300,000 year. Although no fossil was found, occupants were believed to be *Homo erectus*. In Taralba, hunters came at least 10 times within 300 to 400 thousand year ago. May be they are six different groups or the same group of savages reaching the same spot again and again.

Oldest evidence of fire is from **Eskel cave** in south France some 0.75 myr ago. From **Vertshsolosh** of Hungary, **Petrolana** of Greece, many fossils bones were recovered that show distinct resemblance to modern man and *Homo erectus*. The Petrolana specimen was relatively complete and was dated 0.2-0.4 mybp. Its cranial capacity was measured as 1200 cc.

From **Narmada** area of India and **Latamne** of north Syria, stone implements so far discovered, indicate activities of *Homo*

erectus. So far indicated, *Homo erectus* also lived in north and east of South Africa. Thus we may say that this species lived widespread in Africa, Asia and Europe.

In 1950, evidences of *Homo erectus* were found from **Sidi-Abder-Rahman** and **Ternifin** of Algeria of north Africa. **Kamil Aramburg** in 1955 found from a sand-pit in Ternifin hand-axe, fragments of lower jaw and skull. He then called its owner **Atlanthropus** but now the specie was included into *Homo erectus*. The specimen dates 0.6 myr or earlier.

Table:24.06. important Homo erectus (source: Bilsborough, p/148)

site	fossils	dating(myr)
Baringo, Kenya	mandibles	0.3-0.5
Nariokotome, Kenya	skeleton WT15000	1.6
*Koobi Fora, East Turkana, Kenya	crania (3733, 3883), mandibles (820, 992), post cranial, skeleton (1808)	1.6-1.8
Sidi abderrahman, Morocco	mandibles	c0.4
Thomas Quarry, Morocco	mandibles, cranial fragments	c0.4
Trinil, Java	skull cap, femur	0.5-?0.7
Sangiran, Java	many crania, mandible	0.5-0.7
Kabuh	fragments	
Puchangan	few finds	0.7-?1
Modjokerto, (Perning), Java	cranium	0.7-?1
Ngandong, Java	crania, post cranial	?0.1-0.5
Sambungmachan, Java	cranium	?0.1-0.5
Zhoukoudian, China	crania, teeth, post cranial	0.25-0.5
Hexian, China	cranium, mandible	0.25-0.3
Lantian, Gongwanling, China	cranium	c0.7
Olduvai Gorge, Tanzania upper bed II	cranium- OH9	1.2
Olduvai Gorge, Tanzania bed III-IV	cranium OH12, hip bone & femur OH28, mandibles OH 22,23,57	0.7-1
Swarkrans, SA	mandible SK15	1-1.5
Tighenif, Algeria,(Ternifine)	mandibles TI-III	0.6
Narmada, India	cranium	cranium

* = H. ergaster/ H. erectus

Homo ergaster

Some scientists classify some African *erectus* specimens as belonging to a separate species, *Homo ergaster*, which differs from the Asian *H. erectus* fossils in some details of the skull (e.g. the brow ridges differ in shape, and *erectus* would have a larger brain size). Under this scheme, *H. ergaster* would include fossils such as the Turkana boy (KNM-WT15000) and ER 3733. These were described earlier, clause 24.08.04.

Homo antecessor

Homo antecessor was named in 1977 from fossils found at the Spanish cave site of **Atapuerca**, dated to at least 780,000 years ago, making them the oldest confirmed European hominids. The mid-facial area of *antecessor* seems very modern, but other parts of the skull such as the teeth, forehead and brow-ridges are much more primitive. Many scientists are doubtful about the validity of *antecessor*, partly because its definition is based on a juvenile specimen, and feel it may belong to another species. (Bermudez de Castro et al. 1997; Kunzig 1997, Carbonell et al. 1995)

24.10. ARCHAIC MAN

In 1930, in **Swancombe** village of north Kent of Thames river, not far from London, upper portion of the skull (probably of a female) was found by **Marston**. The specimen was known as **Swancombe Man**. Geological age of the strata was estimated to be 250,000 year. Twenty five years later, another fragment of Swancombe skull was recovered.

In 1930, one female skull was found in a valley of granules near **Steinheim** near Stuttgart Germany. The skull from back was rounded like a modern woman but its thick bone and high brow-ridges indicated antiquity. In 1964, the fossil was found of recent origin on computer analysis at Cambridge.

In 1965, in a stone valley of Vertoshsolosh, 700km south-east of Heidelberg and 48 km west of Budapest of Hungary, **Lassilo Vertosh** found one skull and some teeth. The specimen is known as **Vertoshsolosh Man**. The fossil is undoubtedly 500,000 year old. The skull showed big cranial capacity (1400cc). At first glance it was difficult to place the specimen in a group - it could not be older than Swancombe Man but quite modern as regards its cranial capacity. Associated stone implements were crude and early Oldowan type.

There were signs of homes. Burnt marks indicate use of fire. Broken bones of 15 species of animals were found which they probably ate.

In 1971, **Auri de Lumle** and his wife Marie Antoinette discovered one broken skull of a hunter from a cave near Totavel. It was near Pyrennes of France. The fossil, known as **Totavel Man**, is 200,000 year old. Remains were associated with some implements. There were two heavy jaws having one decaying molar teeth. The specimen with slanting foreheads had eye-brow ridge less high compared with Erectus; jaw and teeth were bigger than Neanderthals; cranial capacity was midway between Erectus and Neanderthals. Totavel men highly resembles Swanscombe Man. They were perhaps post-erectus but pre-Neanderthals.

In 1978, **Aries Pullians** found in a cave in a small village of **Petrolana** of north Greece some pieces of upper skull, fragments of spinal chord, stone implements and animal bones. The individual lived 240,000-160,000 year ago. It showed both Erectus and early sapiens features.

All these specimens are grouped by some into *Archaic Homo sapiens*. Archaic forms of Homo sapiens first appear about 500,000 years ago. The term covers a diverse group of skulls which have features of both Homo erectus and modern humans. The brain size is larger than erectus and smaller than most modern humans, averaging about 1200 cc, and the skull is more rounded than in erectus. The skeleton and teeth are usually less robust than erectus, but more robust than modern humans. Many still have large brow ridges and receding foreheads and chins.

There is no clear dividing line between late erectus and archaic sapiens, and many fossils between 500,000 and 200,000 years ago are difficult to classify as one or the other.

H. Heidelbergensis

Early in 20th century, one lower jaw was uncovered from a sandpit in **Mauler** village near Heidelberg, Germany (1907). **Otto Shoetenjack** identified it as a fossil of early human. Interestingly on examination inside jaw where tongue is attached, Shoetenjack was convinced that its owner could utter words. The species was called then *Homo hidelbergensis* (considered as European model of *Homo erectus*).

From the remains of extinct animals found in the same strata, its age was taken as 0.5 myr.

24.11. NEANDERTHALS

Paul Schmerling (1791-1836), the founder of Palaeontology in Belgium, found from **Engis cave** near Liege of Belgium, seven human skulls in 1831. They were buried with rhinos and mammoths of the same age. These came to be known as **Engis skull**. The claim of ancestry for the skull did not get support because people were in no mood to believe the story of human origin from apes in those days, except the English geologist Charles Lyell. Few men cannot change the public opinion of this magnitude so easily.

Neanderthals belonged to Homo group living 100,000-35,000 years ago on this planet. Fossil remains were discovered in Europe, Africa and Asia.

The first such fossil was from Gibraltar. During military construction work, an old skull was found in the **Forbes Quarry**. This was mentioned in a scientific society journal in 1848. Incidentally the fossil evidence came into the notice of an ethnologist, **Hodgkin**, who referred it to **George Busk** (1807-1886) of Royal College of Surgeons. The fossil became known as **Gibraltar skull**. Busk acknowledged its importance. Another fossil was discovered in Germany in the mean time.

While clearing the caves in the mountain pass in the **Neander valley** between Dusseldorf and Elberfeld in Germany, remains of early human were found in a limestone quarry as early as 1856. Possibly it was a full skeleton but dumped by workers unknowingly. Several weeks later, a teacher of Elberfeld, **J. K. Fuhrrott**, noticed it. By that time only the skullcap and some limb bones could be recovered. These remains were shown to **Hermann Schaffhausen** (1816-1893) of Bonn University, who became convinced that these belonged to an ancient human and decided to present them to the scientific world. The fossil had prominent eyebrow ridges characteristic of large apes and presented a savage face. It belonged to a barbarian, he thought

George Busk translated Schaffhausen's paper for publication in English in 1861. Charles Lyell examined the plaster cast. Thomas Huxley studied them. A great controversy raged over the specimen. Is it an early human-like life, linking ape and man, or just a peculiar deformity of one human being?

M. Mayer of Bonn University, dismissed the remains as that of one Cossack soldier of recent time. Huxley pointed out that the cranial capacity of the skull was quite close to human. **William King**

(1809-1886) of Queen's College, Galway, named the specie as *Homo Neanderthalensis*.

The specie later showed heights between 155-160 cm with cranial capacity as big as 1540 cc. It had receding chin, sloping forehead with brain similar in size to modern man. The debate over Neanderthal remains continued, as the fossil-remains were not exhaustive enough to reach any reasonable conclusion. More finds were required to corroborate any hypothesis.

In 1886, some portions of two complete skeletons were found in a limestone cave of **Grot-de-Spy** of Belgium, associated with crude stone tools and bones of extinct animals that lived in the last ice-age. The remains resembled to Neanderthals.

In 1899, hundreds of bones and tooth of at least ten occupants, with thousands of Mousterian implements and animal bones, were discovered from **Krapina rockshelter** of erstwhile Yugoslavia. The artefacts and implements showed Neanderthal connections.

In 1908, skeleton of one old man, dated 40,000 year, was discovered from a cave near La-chapelle-aux-Saints village of France. It was known as **Old Man of Chapelle-aux-Saints**.

Dordogne area of south-west France was rich in fossils. From **Le Mousteria** area of that region, not far from the previous one, skeletons with broken skull of one sixteen year youth were found. The Mousterian art was first discovered in 1860 and its makers were later identified as Neanderthals. In the **La Ferrassie** (1909) and **La Quina** rock-shelter of France (1911), some fossils (skull and skeleton) of male, female and children were found, dated 55,000-33,000 year old.

According to **Marcellin Boule** (1861-1942), the eminent palaeontologist and Director of French National Museum of Natural History, Neanderthal Man was quite different from modern man. When he developed a possible look of the creature, it appeared like an anthropoid ape. The creature had divergent toes like apes and walked like orang-utan. He could not straighten knees and walked upright with forward head. They had jugged jaw with low-grade intelligence and language. But its cranial capacity was very close to human species.

Grafton Elliot Smith (1871-1937) of London University, described Neanderthal Man belonging to separate specie other than *Homo sapiens*.

Some years ago, the French palaeontologist, **Camille Arambourg** (1885-1970) in 1955 and two anatomist, **A. J. E. (William) Cave** of London and **William Strauss** of America, in 1957,

studied the fossil remains and observed that the Old Man of Chapelle-aux-Saints suffered from severe arthritis. According to them, there was no reason to assume that their posture differed significantly from a modern man. They could walk upright, almost like us. Given a bath, a collar and tie, the man would pass unnoticed in a New York subway.

In 1921, the caves of **Broken Hill** in Zambia, southern Africa, produced some fossils similar to Neanderthals with Old Stone Age implements and extinct animal bones.

Four years later, some pieces of skulls were found from the bank of **Galilee Lake** of Israel.

From **Tabun cave** of Mt. Karmel of Israel, one female skeleton was discovered in 1929 by the British-American team led by **Dorothy Garrode**. It was named *Paleoanthropus palestinus* dated 38,000-39,000 year. Then from **Skhul cave** of the same Karmel hill area, ten fossils were found. Some of them resembled to traditional European Neanderthals and some to modern man. One was very close to *Homo Sapiens*.

In 1931, about eleven skulls were discovered from the riverbed of **Solo** in Java.

Fig:24.10. Neanderthal child from Teshik Tash. Reconstruction



Fossil-remains of a boy-like Neanderthals, was found in the cave of **Teshik-Tash hill** about 126 km from Samarkand, Uzbekistan. The boy was deliberately buried and surrounded by goat skulls.

In 1951, American Anthropologist **Ralph Solecki** and his team unearthed from a cave near **Shanidar** of north Iraq nine partial skeletons including one forty year old man. The unfortunate man, 44,000 year old and 160 cm tall, died from roof collapse. He had rheumatism, decayed teeth and one crippled arm. Shanidar cave

possibly housed many Neanderthals more than 60,000 year ago. They appear like present-day Kurds taking shelter in caves to avoid severe cold-wind. Four flower burials had been discovered dating more than 40,000 year. It appears that Shanidar evolved to Neolithic culture 10,000 year ago with animal husbandry and agriculture.



Fig:24.11. Reconstruction of a Neanderthal man and woman from the Neanderthal Museum at Mettmann of Germany.

In 1979, Neanderthal remains were found from a rock-shelter at **Saint-Cesaire** in Charente-Maritime region of France. The remains were associated with tools of early Palaeolithic period dated 31,000-34,000 year. The finding suggests that Neanderthals coexisted with modern humans in the same place and the same age. Remains of Neanderthals were also unearthed from Czechoslovakia, Hungary, Italy, Greece and China.

It is now accepted that Neanderthals lived in Europe widely for a period of 100,000 year. Some say they might even emerge 300,000 year ago in Europe. If so, they must have evolved earlier in Africa. They were hunters and gatherers, strong and well built with cranial capacity of 1700 cc. They were adaptive and different from contemporary inhabitants but disappeared surprisingly 35,000 years ago. Based from Neanderthal vocal tracts, some observe that they were not capable of full range of human speech. It is not clear whether Neanderthals evolved into modern human or were replaced by them or lost their identity inter-breeding with the modern species.

General consensus is that human evolved separately from *H. erectus* and Neanderthals were sports of Nature.

***Homo floresiensis*: the Hobbit**

The specie, *Homo floresiensis*, was discovered at the **Liang Bua cave, Flores**, of Indonesia in 2003 (Brown et al. 2004, Morwood et al. 2004, Lahr and Foley 2004). It was only about 1 meter tall and bipedal, with a very small brain size of 417 cc. The skull has human-like teeth with a receding forehead and no chin. The fossils have been discovered from 38,000 to 18,000 years ago, though archaeological evidence suggests it lived at Liang Bua between at least 95,000 and 13,000 years ago. It used stone tools and fire, and hunted pygmy elephants (mostly juvenile ones), Komodo dragons, and the giant rats found on Flores. Its discoverers believe that *floresiensis* is a dwarf form of *Homo erectus*. It is not uncommon for dwarf forms of large mammals to evolve on islands.

The most complete *floresiensis* fossil, LB1, consists of an almost complete skull and a partial skeleton consisting of leg bones, parts of the pelvis, hands and feet, and some other fragments. LB1 was an adult of about 30, probably female judging by the pelvis. Males could have been larger, though the other fossils found so far indicate only individuals about the same size as LB1. Because of the damp condition and young age, the bones of LB1 have not fossilized.

The brain size of the *floresiensis* skull is very small, 380cc only. This is as small as any australopithecine ever discovered. Even chimps, physically bigger than *floresiensis*, range from about 300 to 500 cc. This is smaller than would be expected even for a dwarf form of *Homo erectus*. It suggests some kind of active selection for a small brain size for some reason. Human pygmies, unlike *H. floresiensis*, have their brains as large as those of normal humans.

There has been some speculation that the stone tools found with it were actually made by them or not. Can they do it with such a small brain? The same tools are found through the entire deposit (from 90,000 to 13,000 years ago). Interestingly, they are not like stone tools made by *Homo erectus*.

Can it evolve from *erectus* to *floresiensis* with such reduced body? Some speculate that *floresiensis* might have evolved from something smaller, like the Dmanisi hominids found in Georgia, some of which have brain sizes between 600 and 700 cc, smaller than the 800-900cc typical of early *erectus*.

Flores was also in the news in 1998, when **Mike Morwood** (who is also involved with this new find) announced the discovery of stone tools from another site on Flores dated at 840,000 years. It was assumed at the time that this was evidence of *Homo erectus*, since *erectus* was the only pre-sapiens hominid known to have existed in Indonesia. Because Flores is thought to have always been separated from Java by a deep sea passage, this indicated a hitherto-unsuspected ability of *H. erectus* to cross sea barriers. The possibility now exists that the hominid responsible for this early archaeological evidence might not have been *Homo erectus*, but something else such as a Dmanisi hominid or a partly evolved form of floresiensis.



Fig: 24.12. Skull of LB1 compared with a modern human.

Modern humans arrived on Flores between 55,000 and 35,000 years ago, and presumably interacted with floresiensis, though there is no evidence at Liang Bua. However Indonesian folklore tells of creatures called Ebu Gogo which were small, inarticulate, and walked with an odd gait. This sounds remarkably suggestive of floresiensis, but it could easily be coincidence - if floresiensis had been found in Ireland, we'd possibly be wondering if they were leprechauns.

The discovery of *H. floresiensis* does not change the broad story of human evolution. It was possibly not ancestral to us. But since it is the most extreme example of human adaptation ever found, it suggests that humans are more subject to evolutionary forces than we tend to think.

24.12. HOMO SAPIENS

Specimen fossil of our true ancestors were found in Europe. **Fontchevade Man** was found in a cave near **Fontchevade** city on the Atlantic coast of France. It was estimated to be 110,000 year old. Remains found were parts of frontal skull and brow-ridges. The

species appeared to come up after third Ice-age and showed conspicuous modern features of *Homo sapiens*.

In 1997, Tim White discovered from **Herto village** of Ethiopia (140 km north-east from Addis Ababa) 3 skulls including skull of a minor. The age as per Argon-dating is 160,000 to 154,000 year ago. They were known as ***Homo Sapiens Idultoo***. In Afar language, 'Idultoo' means 'elderly person'.

Table:24.07. major sites of *Homo sapiens* (source: Bilsborough, p/163)

site	fossils	Dating myr)
Kabwe, Zambia	cranium, post-crania	0.1-0.2
Bodo, Ethiopia	crania	0.2-0.4
Eliye Springs, Kenya	cranium	?0.1-0.2
Laetoli, Tanzania, (Ngaloba)	cranium	0.1-0.15
Ndutu, Tanzania	cranium	0.2-0.4
Saldhana, South Africa	cranium	0.2-0.4
Makapansgat, SA, cave of Hearths	mandibles	?0.2-0.4
Florisbad, SA	cranium	?0.1-0.15
Sale, Morocco	cranium	c0.4
Kebibit, Morocco	cranium	0.15-0.2
Jebel Irhoud, Morocco	skull, cranium vault, others	?0.1-0.2
Dali, China	cranium, mandible	0.2-0.25
Maba, China	skull cap	0.1-0.2
Petrolana, Greece	cranium	?0.2-0.4
Swanscombe, UK	cranium	0.2-0.4
Steinheim, Germany	cranium	0.2-0.4
Biache, France	cranium	0.12-0.2
Lazaret, France	teeth, skull fragments	0.12-0.2
Fontchevade, France	skull fragments	0.12-0.2
Montmaurin, France	mandible	0.12-0.2
La Chaise, France	teeth, cranial & post cranial fragments	0.1-0.25
*Mauer, Germany	mandible	0.5
*Vertesszollo, Hungary	occipital	0.2-0.4
*Arago, France	crania, mandible, post-crania	0.2-0.4
*Bilzingslaben, Germany	cranium	0.2-0.3
*Atapuerca, Spain	skull fragments, mandibles, teeth, post cranials	0.2-0.35

* = Homo sapiens-Homo erectus

Cromagnons were prehistoric modern humans (early *Homo sapiens sapiens*) of European Upper Palaeolithic period. They were identified roughly 30,000-35,000 year old. The term "Cro-Magnon" came to be used in a general sense to describe the oldest modern people in Europe. By the 1970s, the term was used for any early modern human the World over, as was the case with the far-flung Jebel Qafzeh remains in Israel and various Paleo-Indians in the Americas.

Recent analyses based on more current data concerning the migrations of early humans have contributed to a refined definition. Current scientific literature prefers the term "**European Early Modern Humans**" (or **EEMH**), instead of "Cro-Magnon". The oldest EEMH specimen with a modern and archaic (possibly Neanderthal) mosaic of traits is the Cro-Magnon Oase 1 fossil dated 34,000–36,000 years before present.

The first fossils were found in **Abri de Crô-Magnon** (French: rock shelter of Crô-Magnon) near the commune of Les Eyzies-de-Tayac-Sireuil (in Vézère valley of Dordogne area) of SW France. In 1868 **Louis Lartet**, son of Edouard Lartet was the discoverer. Four skeletons belonged to one middle-aged male, one/two young male, one young woman and one 2/3 weeks baby. They were found with some tool implements. They possibly lived on this Earth 25,000 year ago. They were 170 cm tall on average.

Remains of the similar fossils were also found in **Grimaldi cave** of south Italy and from Sonslad area of France. The skeleton found from Grimaldi near Menton in 1872, was covered with red ochre and decorated with pierced seashells and teeth of red deer. Skeletons of two children were found from another cave at Grimaldi. They wore belts of perforated seashells.

The human remains of Cromagnon and Grimaldi were from upper Palaeolithic (Aurignacian) stone culture with fine flint and bone tools. They must be efficient toolmaker and artist with some kind of awareness of death or possessing faith in afterlife. They were linked to Lascaux cave paintings.

The Aurignacian culture flourished in southern France and Germany. Lartet had identified the tools a few years before he found the first skeletons. The Aurignacian differ from the earlier cultures by their finely worked bone or antler points and flint points made for hafting, the production of Venus figurines and cave painting.

Soon remains were found from other regions. The oldest non-archaic human remains are from **Peștera cu Oase** (the Cave of

Bones) near the Iron Gates in Romania. The site, situated in the Danubian corridor, may have been the Cro-Magnon entry point into Central Europe. The cave itself appears to be a hyena or cave bear den. Human remains may have been prey or carrion. No tools are associated with the finds.

Oase 1 holotype, a robust mandible, discovered on February 16, 2002, combine a variety of archaic, derived early modern, and possibly Neanderthal features. The fossil appears close to European early modern humans among Late Pleistocene samples. The fossil is considered the oldest known early modern human fossil from Europe. Two laboratories independently yielded collagen ¹⁴C age averaging to 34 950, +990, and –890, equivalent to about 45 000 calendar years.

A nearly complete skull of a young male (Oase 2) and fragments of another (Oase 3) were found in 2005, again with mosaic features some of which is paralleled in the Oase 1 mandible.

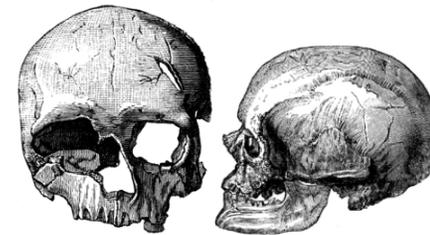


Fig:24.13. Female & Male Cro-Magnon skull

The type specimen from a rock shelter at Les Eyzies, Dordogne, France is marked as **Cro-Magnon-1**, carbon dated to about 28 000 ¹⁴C years old. (27,680 ± 270 BP). Compared to neanderthals, the skeletons showed the same high forehead, upright posture and slender (gracile) skeleton as modern humans.

The remains of Cro-Magnon-1 are found along with pieces of shell and animal tooth in what appear to have been pendants or necklaces. This raises the question of intentional burial. If they buried their dead intentionally, it would suggest they had a knowledge of ritual, by burying their dead with necklaces and tools, or an idea of disease and that the bodies needed to be contained. Analysis shows that the humans of this period led a difficult life. In addition to infection, several individuals found had fused vertebrae in their necks,

indicating traumatic injury. The adult female found at the shelter had survived for some time with a skull fracture.

A fossil site at **Predmostí** is located in the Moravian region of Czech Republic. The site was first discovered in the late 19th century, conducting excavations between 1884 and 1930. The original material was lost during the 2nd World War. In the 1990s new excavations were conducted.

The Predmostí site appear to have been a living area with associated burial ground with some 20 burials, including 15 complete human interments, and portions of five others, representing either disturbed or secondary burials. Canibalism has been suggested, though it is not widely accepted. The non-human fossils are mostly mammoth. Many bones are heavily charred, indicating they were cooked. Other remains include fox, reindeer, ice-age horse, wolf, bear, wolverine, and hare. The Predmostí site is 24,000-27,000 years old. The people were essentially similar to the French Cro-Magnons. Though undoubtedly modern, they had robust features indicative of a big-game hunter lifestyle.

The finds from **Mladeč Caves** in Moravia (Czech Republic) is younger than the Oase skull and mandible. The caves yielded the remains of several individuals. Few artifacts found therein, have been classified as Aurignacian. The finds have been radiocarbon dated to around 31,000 radiocarbon years (possibly somewhat older in calendar years).

Anatomically, modern humans evolved in East Africa some 100 000 to 200 000 years ago. An exodus from Africa over the Arabian Peninsula around 60 000 years ago brought modern humans to Eurasia, with one group rapidly settling coastal areas around the Indian Ocean and one group migrating north to steppes of Central Asia.

Cromagnons appeared well grown, strong and vigorous. Heights ranged from 178-193 cm. Legs were longer than arms with big hands and short fingers. Their cranial capacity was measured at 1590-1750 cc. Their head was dolicocephalic; glabella bow ridge was well marked. Orbits were rectangular and low. Nose was long and narrow. They possessed strong and powerful jaw. Philip Liberman and Edmund S. Crelin examined their throat, nose pharynx and tongue and suggested that they could form words and pronounce it fast.

Cro-Magnons were tan or lighter in skin colour. A small ivory bust of a man found at Dolní Věstonice dated 26 000 years, indicate the

Cro-Magnons had straight hair. Somewhat later Venus of Brassempouy may show curly or braided hair.

Like Neanderthals, the Cro-Magnon were primarily big-game hunters, killing mammoth, cave bears, horses and reindeer. In **Mezhirich** village in Ukraine, several huts built from mammoth bones have been unearthed. Cro-Magnon artifacts suggest that they knew how to make woven clothing. Apart from the mammoth bone huts, they constructed shelter of rocks, clay, branches, and animal hide/fur. These early humans used manganese and iron oxides to paint pictures and may have created the first calendar around 15,000 years ago.

Table:24.08. List of some *Homo sapiens*

species - Homo	lived when (myr ago)	lived where	adult height (m)	adult mass (kg)	cranial capacit y (cc)	fossil record	Discovery
<i>antecessor</i>	1.2-.08	spain	1.75	90	1000	2 sites	1997
<i>cepranensis</i>	0.9-0.8?	Italy			1000	1 skull cap	1994/ 2003
<i>erectus</i>	1.5-0.2	Africa, Java, China, India, Caucasus	1.8	60	850 (early) 1100 (late)	many	1891- 1892
<i>ergaster</i>	1.9 – 1.4	Eastern & Southern Africa	1.9		700– 850	many	1975
<i>floresiensis</i>	0.10? – 0.012	Indonesia	1.0	25	400	7 human	2003/ 2004
<i>gautengensis</i>	>0.2-0.6	South Africa	1.0				2010
<i>georgicus</i>	1.8	Georgia			600	4 human	1999/ 2002
<i>habilis</i>	2.3-1.4	Africa	1.0- 1.5	33-55	510- 660	many	1960/ 1964
<i>hiedelbergensis</i>	0.6-0.35	Europe, Africa, China	1.8	60	1100- 1400	many	1908
<i>neanderthalensis</i>	0.35- 0.03	Europe,we strn Asia	1.6	55-70	1200- 1900	many	(1829)/ 1864
<i>rhodesiensis</i>	0.3-0.12	zambia			1300	Very few	1921
<i>rudolfensis</i>	1.9	kenya				1skull	1972/ 1986
<i>sapiens idultu</i>	0.16- 0.15	Ethiopia			1450	3 craniums	1997/ 2003
sapiens	0.02- present	World-wide	1.4- 1.9	50- 100	1000- 1850	Still living	

The Cro-Magnon shared Europe with Neanderthals for some 10,000 years or more. The nature of their co-existence and the extinction of Neanderthals has been debated. Suggestions include peaceful co-existence, competition, interbreeding, assimilation and genocide. Other modern people, like the Qafzeh humans seem to have co-existed with Neanderthals for up to 60,000 years in the Levant. Earlier studies argue for more than 15,000 years of Neanderthal and modern human co-existence in France.

The Neanderthal Châtelperronian culture appears to have been influenced by the Cro-Magnons, indicating some sort of cultural exchange between them. At the original Châtelperronian site layers of Châtelperronian artifacts alternate with Aurignacian, though this may be a result of interstratified ("chronologically mixed") layers, or disturbances from earlier excavations. The "**Lapedo child**" found at Abrigo do Lagar Velho in Portugal has been quoted as being a possible Neanderthal/Cro-Magnon hybrid, though this interpretation is disputed.

The **Grimaldi Man** may have been a contemporary of modern humans, distinct from the Cro-Magnons. The find is from the **Grotte des Enfants** near Menton on the French Riviera. The two known skeletons are shorter and more gracile than the Cro-Magnon, and the skulls are taller and less robust, with signs of prognathism, all interpreted as African traits.

The interpretation of the Grimaldi finds as belonging to a "negroid" race, is complicated by the two skeletons being that of a woman and an adolescent and some dubious reconstruction. The finds were classified as Cro-Magnon under the wide use of the term. Due to the reconstruction and racist theory forwarded by the early description, the Grimaldi finds have been largely ignored in recent literature.

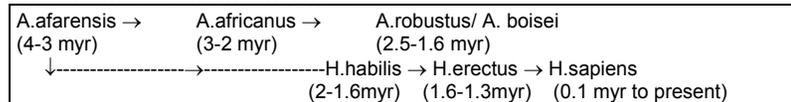
In 2008, archeologists found a small bone fragment from the fifth finger of juvenile hominine at **Denisova Cave**, Altai Mountains, Siberia. Artifacts, a bracelet, had been carbon-dated as 40,000 yr ago. DNA analysis of the fossil revealed that modern humans, Neanderthals and Denisova hominine shared a common ancestor 1 myr ago. All three may have co-existed together. New hominine is thought to be out of an early migration out of Africa.

24.13. GENERAL PICTURE

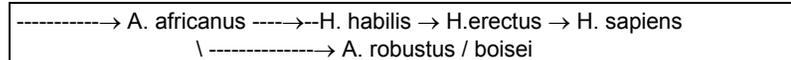
To sum up, we may divide human evolutionary period into three stages (refer to Appendix C, Graham Richard's *Human Evolution* p /326-329) –

- (1) primate to hominid evolution,
- (2) Australopithecus evolution to *Homo habilis* and
- (3) *Homo habilis* to *Homo sapiens*.

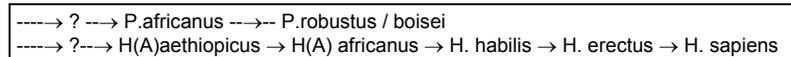
1. Scheme of Johanson-White



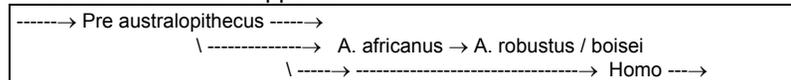
2. Scheme of Tobias



3. Scheme of T.R. Olson



4. Scheme of Yves Coppens



We are more concerned with two later stages of evolution to establish our origin. These can be further re-classified into four or five sub-stages - (1) australopithecus evolution, (2) *Homo habilis* evolution, (3) *Homo erectus* evolution, (4) *Archaic Homo sapiens* and/or *Homo sapiens* evolution.

At present state of discoveries, most-likely evolutionary schemes show four possibilities by Johanson-White, Phillip Vallentine Tobias (1925-2012), T. R. Olson and Yves Coppens (b1934) as shown.

24.14. MOLECULAR STUDY

In recent times, human evolution from primates is investigated under molecular studies. The studies are being made in several lines – immunological (response of immune system to proteins), amino

acid sequence of protein, nucleotide base sequence, DNA hybridization, DNA annealing etc.

In 1962, **Morris Goodman** (1925-2010), Professor of Anatomy at Wayne State University School of Medicine, Detroit, took up immunological technique of **George Nuttall's** precipitin reaction and compared antigens with antiserum to check up affinities of different primates.

Human was found closer to African apes (gorilla and chimpanzee) than to Asian apes (gibbon and orang-utan). This raised question mark for classifying Pongidae and Hominidae in two separate families. It suggested on the contrary that the phyletic line branching Gorilla, Homo and Pan was separated from more ancient lines leading to Hylobates and Pongo.

The biochemist **Allan Charles Wilson** (1934-1991) and his student anthropologist **Vincent Matthew Sarich** (1934-2012) investigated blood protein **albumin** at Berkley. Assuming split between OWMs and hominid-apes at about 30 myr ago, it showed three-way split among Chimpanzee, gorilla and human around 5 myr ago. Asian Orang-utan diverged some 10 myr ago. The dates contrasted with the theory that hominids diverged more than 14 myr ago. This result was published in the journal 'Science' in 1967.

The Austrian-American biochemist **Emile Zuckerkandl** (b1922) and Linus Pauling (1901-1994) investigated around 1960 **amino acid sequence of haemoglobin** of different primates. The blood protein consisting of two protein chains, shows 1% change occurring after 6 myr. The gorilla, chimps and human haemoglobin show almost indistinguishable pattern while they differed slightly from Orang-utan pattern.

Walter M. Fitch (1929-2011) of California University and **Emanuel Margulish** (1920-2008) of Northeastern University near Chicago, analysed amino acid sequence of protein enzyme, 'cytochrome c'. The change was found to occur by 1% in a span of 20 myr.

Recently we have yet another way to compare single-copy DNA of two species. It is called **DNA-DNA hybridisation** according to which single copy DNA evolves at a uniform regular rate. The hypothesis is yet to give a realistic model for evolution of DNA but patterns indirectly hint of evolutionary branching. It shows that 99% DNA-bases are identical in human and chimps.

Raoul E. Benveniste and **George J. Todaro** at the National Institute of Health, Washington, created DNA hybrids of four primates - man, gibbon, baboon and squirrel monkey. They noted down the difference between man-gibbon as 6%, man-baboon 9% and man-squirrel monkey 15%.

Simon Eastaie & his colleagues compared DNA sequences of specific genes from different species – OWMs, NWMs, orang-utans, human, chimps, rats, mice and marsupials.

The molecular-biologist cum ornithologists, **Charles Gold Sibley** (1917-1998) and **John Edward Ahlquist** working at Yale University, also worked on the subject studying bird taxonomy.

From all these studies it appears, according to **Jared Mason Diamond** (b1937) of University of California in 1998, that 98.4% of our DNA base sequence are identical to those of common chimps and pygmy chimps.

Paleontological and molecular evidences are not in agreement on several issues, particularly on splits of human from others. There are gaps in fossil evidences that bring problems to make evolutionary trees. Distribution of fossils – Asian apes, African apes, ape-man man-apes in Asia and Africa are also to be explained.

Molecular studies show that five hominids – gibbon, chimp, orang-utan, gorilla and human, share a common ancestor 12 myr ago. These ancestors were tree-dwellers with brachiating life style. *Rampithecus* might have evolved from them as dead ends. Modern apes are survivors from *Dryopithecus* type evolved from them. Due to climatic changes that reduced forestry, before onset of Ice epoch, some ancestors had to come down from trees and adapt to knuckle-walking. The Asian apes remained where they were born. One line, ancestor of knuckle-walking modern apes, migrated from Asia to Africa. They evolved into chimps, gorillas and other hominids. Palaeontologists however do not accept this view.

Protein analysis helped to establish evolutionary gaps between species. From 1985, changes in **genetic structure of mitochondria** in living cells tried to establish evolutionary distances within species and between populations.

The DNA of mitochondria (mtDNA) is uniquely uniform in Nature. It consists of 37 genes in the same way, specify the same set of molecules, in all metazoan animals. They reproduce by division (i.e. asexually or cloning). Since mitochondria in sperm cells disintegrate at fertilisation, animals inherit mitochondria only from females. Thus mtDNA passed unaffected by recombination from generation to

generation. This fact has been utilised to determine evolutionary distances among populations of close species. It has been noted that **average rate of evolutionary divergence** in human population is about 3% per myr.

Analysis revealed that modern humans existed longest in Africa. Non-African people had come from a small group of people who left Africa quite recently to spread around the world. It appears that modern human originated between 140,000 and 290,000 year ago in Africa. We all carry mtDNA of one African mother who lived 10,000 generations before. So our common mother is an **African Eve**. **Mitochondrial Eve**.

It is stated that Mitochondrial Eve lived approximately 200,000 years ago, most likely in East Africa. *Homo sapiens sapiens* were developing as a distinct population nearly the same time. Mitochondrial Eve lived later than *Homo heidelbergensis* and the emergence of *Homo neanderthalensis*, but earlier than the out of Africa migration.

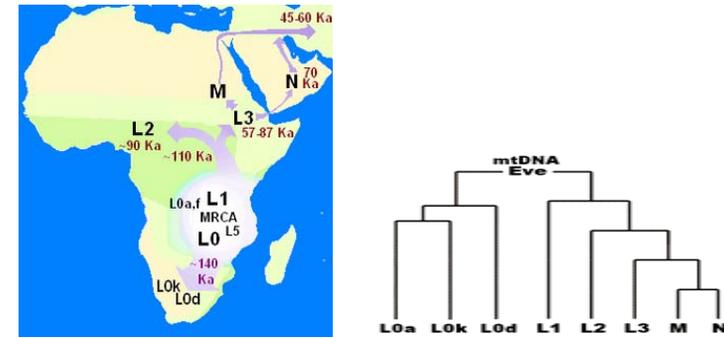
The "Eve" story was against the multiregional hypothesis. It boosted the hypothesis of modern humans originating relatively recently in Africa and spreading from there, replacing more "archaic" human populations such as Neanderthals.

Analogous to Mitochondrial Eve, Y-chromosomal Adam is the man from whom all living humans are descended patri-lineally. The inherited DNA in the male case is his nuclear Y chromosome, rather than the mtDNA. There is no reason why Mitochondrial Eve and Y-chromosomal Adam should necessarily have lived at the same time. Y-chromosomal Adam is estimated to have lived between 237,000 and 581,000 years ago based on a study published in March 2013. (Source: Wikipedia)

Earlier studies have estimated the date for Y-MRCA as between 60,000 and 142,000 years ago.

The British anthropologist, **Christopher Stringer** (b1947)) supported '**Out of Africa origin theory of human**' or **recent single-origin hypothesis**. Ancestors of non-African people left the continent 90,000-180,000 year ago. They reached Europe by between 55,000-28,000, Asia by 53,000 and Australia by 33,000 year ago. Around 1988, it appeared that genetic evidences fit well with the fossil evidences regarding origin of human in Africa and their migration to Europe

Fig:24.14. Haplogroup of Modern Humans & Simplified Human mitochondrial phylogeny



The studies of Neanderthal mtDNA do not show that Neanderthals did not or could not interbreed with modern humans. But lack of diversity in Neanderthal mtDNA sequences, and differences between Neanderthal and modern human mtDNA, strongly suggest that Neanderthals and modern humans developed separately. They did not form part of a single large interbreeding population. The Neanderthal mtDNA studies will strengthen the idea of Neanderthals as a separate species which did not significantly contribute to the modern gene pool.

At a conference at Cold Spring Harbour Laboratory on Long Island in October, 1997, population geneticists reported a new method that would confirm the origin of human species dated by other means. In the past, coding region of DNA that produce proteins were studied. Coding regions will not alter much since mutations will alter protein it specifies with fatal consequence. In non-coding regions, mutations make no difference to individual and hence they yield fair data regarding diversity and age of the population.

Mark Stoneking (b1956) of Pennsylvania State University, estimated that non-Africans split away from Africa some 122,000-152,000 year ago. He analysed genetic elements, called **Alu insertions**, in 34 population around the world. From his study, sub-Saharan African population possessed greater diversity than non-Africans.

Population geneticists analysed **male** or **Y chromosome** as marker like mitochondrial DNA. **Michael F. Hammer** of Arizona University said that present mutations started around 185,000 year ago. The date confirms to that of mitochondrial DNA. Strangely it suggests male migration from Asia back to Africa.

Elizabeth Watson of Massey University in New Zealand said that Turkana people of Kenya showed greatest diversity in mitochondrial DNA. This indicates its place of origin at Kenya. Most believe that there were more than one migration from Africa but perhaps all came from north-east Africa.

Douglas Cecil Wallace (b1946), a pioneer researcher on mitochondrial DNA, suggested that age of African mitochondrial DNA may be set at 130,000-170,000 year ago, that of Asians 50,000-70,000 year and the root of European lineage at 40,000-50,000 year ago.

Studies are being done in many different ways from which a comprehensive evolutionary theory of human being is to be established. Molecular evidences are to be identified with type of early human fossil.

According to the **Out of Africa** model, the first species of Homo genus, *Homo habilis* evolved in East Africa 2 myr ago. Members of this species migrated to different parts of Africa. *Homo erectus* evolved more than 1.8 myr ago. Within 300,000 yr they spread in the Old World. It is yet to be settled whether modern human speciated in East Africa from *Homo erectus* and then migrated out of Africa to replace early humans in Eurasia or not.

The American palaeo-anthropologist, **Milford H. Wolpoff** (b1942) proposed **multi-regional hypothesis** of human origin in 1988. Human evolution began 2.5 myr ago within a single continuous human species. They oppose the Recent African origin citing fossil evidence insufficient.

Studies of haplogroups in Y-chromosomal DNA and mitochondrial DNA broadly support the recent African origin. Evidence from autosomal DNA also lends support.

Mitochondrial DNA analysis place the early European population as sister group to the Asian ("Mongol") groups, dating the divergence to some 50 000 years ago.

A 2003-sequencing mitochondrial DNA on two Cro-Magnons, (23,000 and 24,000 years old Paglicci 52 and Paglicci 12), published by an Italo-

Spanish researchers led by David Caramelli, identified the mtDNA as Haplogroup N.

Haplogroup N is found among modern populations of Europe, the Middle East, North Africa and Central Asia, and represent the northern branch of the out of Africa migration of modern humans.

Its descendant haplogroups are found among modern North African, Eurasian, Polynesian and Native American populations.

The inland group is the founder of North and East Asians (the "Mongol" people), Caucasoids and large sections of the Middle East and North African population.

Migration from the Black Sea area into Europe started some 45 000 years ago, probably along the Danubian corridor. By 20 000 years ago, the whole of Europe was settled.

Recent genetic studies of a wide selection of modern humans indicate some form of hybridization with archaic humans took place after modern humans emerged from Africa. About 1 to 4 percent of the DNA in Europeans and Asians appears to be derived from Neanderthals, though none of it can conclusively be tied to a European event.

24.15. STONE AND ARTEFACTS

Evolution of primates to *Homo sapiens* is studied in archaeology. The study is based upon early stone tools and implement with wastage, caves-shelters-occupation sites with windbreaks, post-holes and hearth-sites, horn-bone-shell-wood artefacts, cave paintings, painted stones, carvings and pottery. Artefacts include all products of tool manufacturing including wastes and tools mean implements or products proper. Towards Upper Palaeolithic artefacts made from bones, shells, horn, wood began to appear. Less than 35,000 years ago, there appeared cave art, painted stones, carvings, followed by wooden objects and pottery in Mesolithic and Neolithic age. Palaeolithic age is most important in order to trace down human evolution from pre-human stage.

Once the Greek poet Hesiod suggested four stages of human history – Age of the Gods (Golden Age), Age of the Demi-Gods (Silver Age), Age of the Hero (Bronze Age), and Age of Man (Iron Age). Then in 18th century, French archaeologist Nicholas Mahudel proposed the categorization of prehistoric times into ages of stone, bronze and iron.

The Danish prehistorian **Christian Jurensen Thomsen** (1788-1865) also proposed in 1836 three stage classification of human culture based upon tools – **Stone Age, Bronze (& Copper) Age**

and **Iron (& Steel) Age**. Jens Jacob Worsaae proposed the same three age system in 1859.

The Stone Age is further divided into **Palaeolithic** or Old Stone Age, and **Neolithic** or New Stone Age. Later **Mesolithic** and Chalcolithic Ages were introduced. John Lubbock () introduced the division in 1865 in his book 'Pre-historic Times'.

The Palaeolithic Stone age is further divided into Lower-Middle-Upper Palaeolithic age. Neolithic are also divided into pre-pottery and Pottery Neolithic, followed by Chalcolithic Age.

Though there occurred 'no clear unilinear succession of stone industries', self-trained American archaeologist, **John Wymer** (1928-2006) observed in 1982, technological progress in four stages - chopper-core industries, hand-axe industries, transitional industries and light stone industries of flakes and blades.

Eolithic age was earlier called as the dawn of the stone age. First eoliths were collected in Kent by one **Benjamin Harrison** (1837-1921) in 1885 and named by J. Allen Browne. In 1910, **James Reid Moir** (1879-1944) collected some eoliths from Red Craig. Later he got more at Foxhall, near Ipswich. The specimens appeared man-made. In Europe, eoliths were found in the crags in East Anglia. In continental Europe specimens were found by A. Rutot and H. Klaatsch. Some claim that crude uni-facial hand-axe pebble tool was used by *Rampithecus* 9-10 myr ago. Recently, eoliths are taken as geofacts only, not as evidence for Pliocene hominids.



Fig:24.15."A sharp rock", an **Oldowan** pebble tool, the most basic of human stone tools.

Paleolithic Stone Age began 2.0-2.6 myr ago with **Oldowan** and **Acheulean** industry. It continued in many places till 57,000 yr. It is now broadly divided further into Lower, Middle and Upper Paleolithic Age.

The Lower Palaeolithic Stone Age (2.6 myr – 100,000 yr) is associated with Cromerian, Chellean (or Abbevillian), Acheulean,

Clactonian, Tayacian, Levalloisian industries. Here we find mainly the development of simple stone tools (e.g. hand axes).

Cromerian industry derived its name from Cromer in Norfolk, consist of large flakes made from a core. Cromer sites appear to be workshops for flake industry.

The earliest tools were crudely chipped with one or two blows, identified as **Oldowan choppers**. They are also classified as core tools. The same technique produced hand-axe industry of Acheulian. The industry was found in Olduvai Gorge of Tanzania presumably produced by Homo habilis and called Oldwan (2.6-1.8 myr). People subsisted then on scavenged meats and wild plants.

Acheulean industries (1.7–0.1 myr) are mostly core-tools of coups-de-poing type. Core tools are made by knocking flakes off from a nodule of flints until desired shape is obtained. The industry was quite wide-spread in Africa, particularly in South Africa, also available in Palestine, Trans-Jordan, south-east India, and west Europe (Spain, central Italy, north-east France, southern Belgium, south-east England etc.). The tradition possibly spread out from Africa around 400,000 ybp. It pushed Oldowan industry to survive on its fringes, in South East Asia and one or two northern sites in Clactonian industry.

Clactonian industry (0.3-0.2 myr) from Clacton-on-Sea in Essex, are mostly flake-tools. Small chopping tools, rough scrapers and discs are found with worked nodules of flint, etc. **Levalloisian industry** deal with flake industries. Here the core was prepared by trimming so as to enable it to yield flakes. The technique consists of four steps using some hundred blows. They consist of side-scrapers, points and Levallois flakes. The industry is found in British Somaliland, Egypt, Cyrenaica and Tripoli. Pre-Neanderthals worked Acheulian industry. Tools get its shape while worked on it but flake industry required some advance planning. Neanderthals developed from Acheulian and early Levallois industry to Mousterian industry. Tools from Totavel mostly belong to Levallois type.

The **Middle Palaeolithic Age** emerged sometimes between 300,000 -30,000 yr ago with Mousterian industry. It is associated with the culture of Neanderthals through introduction of flint tools. The implements of pure **Mousterian industry** (300,000-30,000 yr) are mostly flake-tools such as side-scrapers, points, Levallois flakes, discs etc. True Mousterian industry occurs rarely in open stations. The makers used to live in rock-shelters. The climate was very cold then. The culture is found in Western Europe, Eastern Europe, Palestine, Siberia and northern China. Essentially it appears to be a

northern culture but spread also into Africa (North Africa, Kenya, Somaliland, South Africa). From a cave near Elbe River, N Germany, human miniatures of Neanderthal group of people were found. **Aterian** sub-age dates around 82,000 yr of this middle Paleolithic.

Late Pleistocene period is associated with Upper Palaeolithic Stone Age (50,000-10,000 yr) of Baradostian (36,000 yr), Chatelperronian (35,000-29,000 yr), Aurignacian (32,000-26,000 yr), Gravettian (28,000-22,000 yr), Solutrean(21,000-17,000 yr), Magdalenian (18,000-10,000 yr), Hamburg (14,000 yr), Ahrensberg (13,000 yr) and Swiderian (10,000 yr) industry.

Microlith industries of this Age emerged around 35,000 yr ago at the earliest. In the Upper period, Homo sapiens emerged with specialised tools (like burins). The age is quite different with tools essentially made from blades, unlike flakes and cores of earlier era. Blades and burins are found in large numbers.

In the Dordogne area of France, new implements were found. A good site was rock-shelter of Audi, near Les Eyzies. With some coups-de-poing, discs, side-scrapers, Mousterian points, we get end-scrapers, graters and knife-blades (Audi knife) there. Human appeared in late Pleistocene period with upper Palaeolithic stone industry.

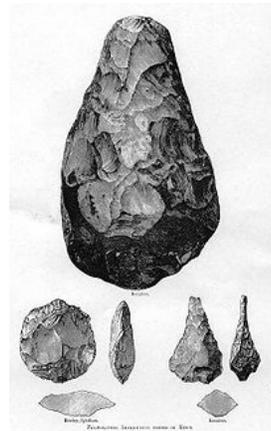


Fig:24.16.Acheulean hand-axes from Kent. *Homo erectus* flint work. The types shown are (clockwise from top) cordate, ficron and ovate.

The French researcher, **Eduard Lartet** (1801-1871) found in 1860 tools of Aurignacian period in a cave near Areina France.

The **Aurignacian culture** is an archaeological culture of the Upper Palaeolithic, located in Europe and southwest Asia. It lasted broadly within the period from ca. 45,000 to 35,000 years ago (between ca. 47,000 and 41,000 years ago as per recent calibration of the radiocarbon timescale). The name originates from the type site of Aurignac in the Haute-Garonne area of France. The oldest known example of figurative art, the Venus of Hohle Fels, comes from this culture. It was discovered in September 2008 in a cave at Schelklingen in Baden-ürttemberg in southern Germany.

Mesolithic (often called epipaleolithic) period is divided into two – Mesolithic-1 (Kebara culture, 20,000-18,000 BC to 12,150 BC) and Mesolithic-2 or the Natufian culture (12,150-9500 BC). Farming appeared in this Age.

Neolithic Age began 10200-8800 BC in the Middle East (Levant, Jericho, West Bank).

Recent findings in Tell Qaramal in Syria may date it around 10,700-9400 BC.

It emerged from Epipaleolithic Natufian culture whose people used wild cereals. The Age is now subdivided into pre-pottery Neolithic-A (PPNA), pre-pottery neolithis-B (PPNB) and Pottery Neolithic(PN).

24.16. CAVE PAINTINGS

Earliest cave paintings are from Upper Palaeolithic age of Europe, mainly confined in France, Spain and Italy. It began around 35,000 year and died down around 10,000 year following the Ice Age.

The cave paintings included imagery and symbols of five types – (1) realistic painting of animals like mammoth, cave bear, horses, cattle and non-mammalian species; (2) 'spahgttti meanders and squigles drawn by fingers over soft clay presenting some animal form; (3) various dots, triangles and squares which may be representations of something; (4) human figure; and (5) hand-prints.

In 1878, the Spanish amateur archaeologist, **Don Marcelino Sanz de Sautola** (1831-1888) discovered **Altamira cave painting** which was first noticed by his 12 year old daughter Maria. Its prehistoric status was initially contested but later accepted as Upper Paleolithic cave paintings featuring drawings and polychrome rock paintings of wild mammals and human hands. Present study suggest its age from 20,000-35,600 years.

The earliest such art in Europe dates back to the Aurignacian period, approximately 40,000 years ago, and is found in the El Castillo cave in Cantabria, Spain. The date coincides with the earliest known evidence for *Homo sapiens* in Europe. Some conjectured that the paintings may have been made by Neanderthals.

The second-oldest known cave art is that of Chauvet Cave in France, the paintings of which date to around 30,000 BCE (Upper Paleolithic) according to radiocarbon dating.

In Australia, cave paintings have been found on the Arnhem Land plateau showing mega-fauna, assumed extinct for over 40,000 years. This made the site a candidate for oldest known painting. Another Australian site, Nawarla Gabarnmang, has charcoal drawings that have been radiocarbon-dated to 28,000 years.

Other examples may date as late as the Early Bronze Age, but the well-known Magdalenian style seen at Lascaux in France (c. 15,000 BCE) and Altamira in Spain died out about 10,000 BCE, coinciding with the advent of the Neolithic period.



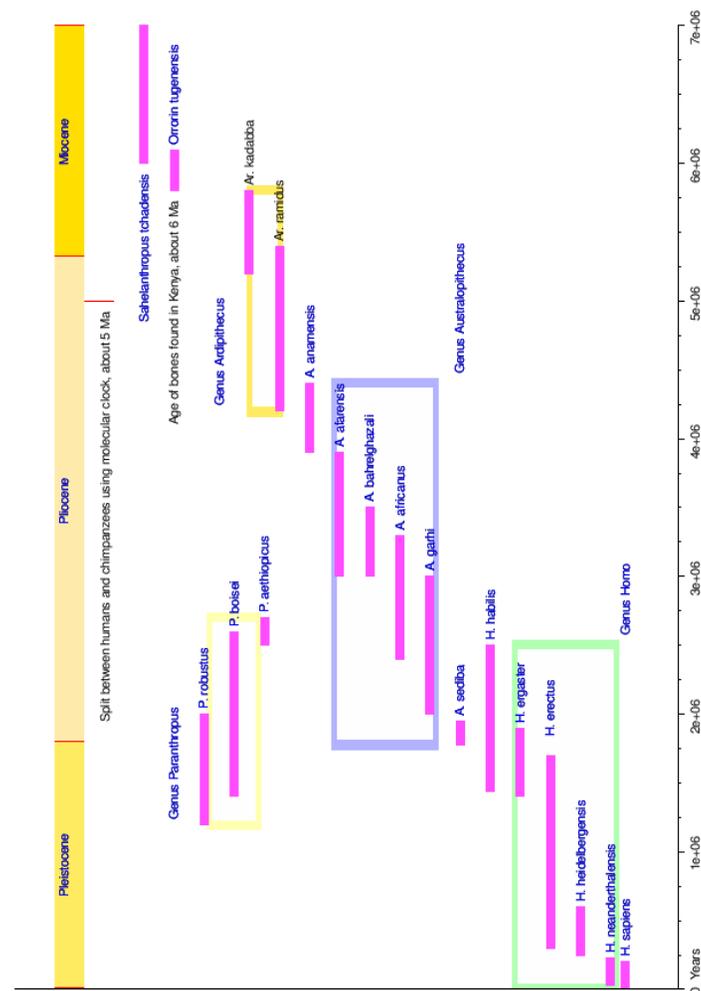
Fig:24.17. Cave of Altamira known as the Sistine Chapel of the cave painting, near Santander, Spain.



Fig:24.18. [Bhimbetka rock shelters](#).

The Bhimbetka rock-shelters of Madhya Pradesh in India exhibit traces of early human settlement. Some analysis suggest that the shelters were inhabited by humans for in excess of 100,000 years. The earliest paintings on the cave walls are believed to be of the Mesolithic period, dating to 12,000 years ago.

Fig:24.19. Hominin species distributed through time. Note: $1e+06$ years = 1×10^6 years = 1 million years ago = 1 Ma. (source: Wikipedia)



24.17. LANGUAGE

The Sumerians of Mesopotamia knew about scripts around some 5000 BC. Script was known from Ugarit of Syria around 3500 BC. Human acquired vocal language much earlier. It was now largely established that humanisation need vocal language for brain development.

Astralopithecus most probably did not know to speak but could make sound and communicated through gesture and vocal sound. Unless 750 cc could be attained, no word could be pronounced. Brain of *Homo Erectus* child could only attain it at about 6 year compared to modern man's in 1 year. Probably, there was some sort of qualitative change that came in 40,000-50,000 year ago. The change may be neuro-biological, permitting development of language. If language was invented earlier, then the change may be due to some population recovery from climatic change. (Source: Knowhow, dt. 24.11.97.)

24.18. MIGRATION IN AUSTRALIA & AMERICA

Early human species spread into Africa, Europe and Asia but they are land-connected for easy migration to different parts of these three continents. But how they reached distant Australia and America? When?

From 1930 onwards, reports began to come in, that tools of early human were found in Australia. In 1967, tools as old as 31,000 yr were reported near Melbourne. In 1968, from the Walls of China Lunette (Dune) near Mungo lake of New South Wales, one female skeleton Mungo-I, dated 24,500- 26,500 yr old and some man-made things were discovered. She was cremated. Another skeleton Mungo-III of a male is dated to be 28,000-32,000 yr. All specimens showed modern human feature.

Some further specimens were recovered from Kow Swamp near Gumbar Creek near Victoria. They are 9,000-13,000 yr old. The area provided many more crania. These are all large and ruggedly built than Mungo-specimens. The features indicate some link with *H. erectus*.

These findings led to the speculation that there might have been two waves of people entering the continent. Alternatively the changes were the result of population movement, hybridisation or selection pressure.

It is not yet clear how they reached Australia, crossing oceans. One possibility is that during the Ice age, sea level went down and

big islands like Java, Borneo, Sumatra became connected with land routes. Australia was still separated from the mainland by 100 km with 8000 meter deep sea. The least gap of Molucca Strait between Sulawesi and Papua New Guinea was estimated as 65 km. They might have crossed water by some crafts.

In 1978 in 4 places near Murchison river on the western side, two Australian scientists discovered 100,000 yr old human tools. The discovery does not fit in the whole story.

Folsom & Clovis culture in America appear 11,000-12,000 yr old. Folsom in New Mexico was discovered in 1926, where extinct bison with a stone arrow-flake had been found. In 1932, at Clovis of same country, researchers discovered remains of extinct animals and stone flakes. In Santa-rosa island of South California, fractured and burnt bones of extinct mammoth were found. Radio-carbon dating of scrapers made from rein-deer, found near Yukon area of Canada, revealed an age of 29,000-27,000 yr. At Los Angeles, the skull discovered in 1936, was measured by carbon dating method aged 23,600 yr. Luis Leaky and his colleagues at foothills of Callico in S California, found things believed to be used by man at 35,000 to 100,000 yr ago. These claims are doubtful to others.

All evidences point out that human entered into the New World during late Pleistocene period. Low sea levels due to glaciation, joined Asia and America through Beringia land bridge exposed between 26,000-11,000 year ago. Mousterian and Upper Palaeolithic hunters that lived in the cold tundra of Siberia, migrated into Alaska. It happened around 20,000 year ago.

Actual human evidence was available from 10,000 year. The people in the new continent moved southward after melting of Wisconsin ice sheets around 12,000 yr ago. The hunting people arrived southernmost edge of South America within 1000 yr.

24.19. ANTHROPOLOGY

Anthropology is also the science of humanity covering archaeological, cultural, linguistic and biological aspects. Permit me to mention just one or two points here.

From anthropological point of view, if we accept that there was one nearly common stock of human origin spread over Africa, Asia and Europe, we find then two broad groups –

- (I) **South-west Group** and
- (II) **North-east Group** or **Mongoloid group**.

The South-west Group is divided into (I.1) **Europoid** spread over South-west Asia, South Europe, North Africa and (I.2) **Negroid** group which is divided into two groups (I.2a) African and (I.2b) Austroloid Negroid.

Mongoloid group can be classified into (II.1) **North Mongoloid**, (II.2) **South Mongoloid** and (II.3) **American Red Indians**.

In historic era, we get several ethnic groups in Africa-Eurasia, such as, **Hamitic** stock evolved in Africa north and north-east of Sahara, **Semites** of Arabian peninsula, **Indo-Europeans** from South Russia that by 4000 BC spread to Europe and Iran, and lastly **Caucassians** of Georgia. There exist numerous other ethnic races in all parts of our planet. How all these groups evolved from the common stock? It's still a long way to understand it.

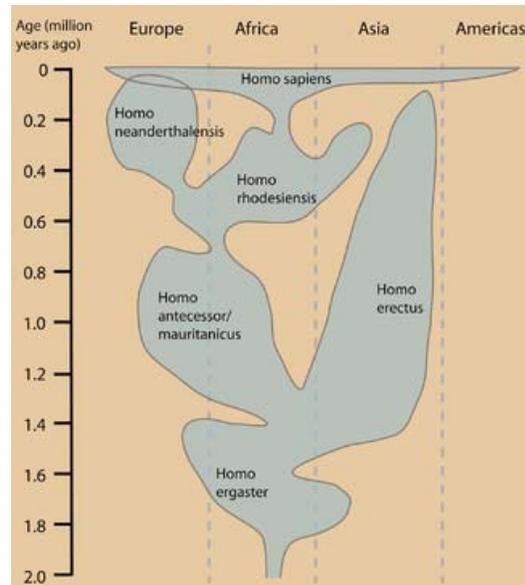


Fig:24.20. One current view of the temporal and geographical distribution of hominid populations. Other interpretations differ mainly in the taxonomy and geographical distribution of hominid species. (source: Wikipedia)

24.20. REMARKS

This is the story how pre-human animals evolved into human species. It's purely an act of Nature. Even though the evolution from primates to hominids is a scientific fact, the fact was fiercely contested by religious authorities and believers of some Omnipotent Power like God. It is also being contested right now.

However the contest is gradually on the downhill side. Like all other scientific facts, it is now broadly accepted by all rational people in view of vast amount of scientific research. Lack of some knowledge in the details of this evolutionary scenario just cannot alter the basic facts of human evolution.

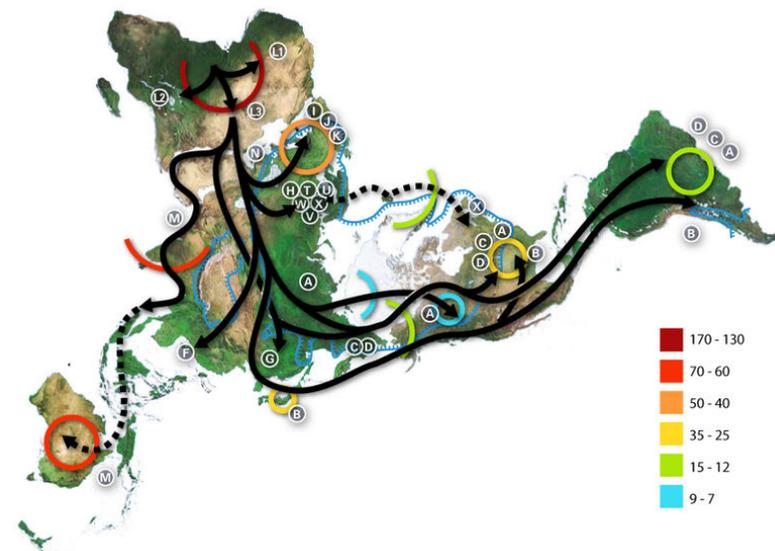


Fig:24.21. Map of human haplotype migration, according to mitochondrial DNA, with Key (coloured) indicating periods in numbered thousands of years before the present. (source: Wikipedia)

We are born in the cradle of Nature from our immediate ancestor hominids. All detail steps of our transformation are not yet finally determined. We are exploring possibilities based on available data.

More discoveries of fossils and other techniques may further realign our pathways to humankind.

We have in all probability come from Africa and dispersed upon the globe. Our brain capacity improved dramatically quite fast, as if, at some point, we crossed the threshold that discouraged earlier cranial development. This threshold may be due to our discovery of language, freedom of hand & working with tools that improved our brain functions immensely.

David Pilbeam wrote in his "Human origins and evolution" -

'Each evolutionary stage was indeed a platform on which the next developed, but each stage existed and must be seen on its terms, not merely as the source of what followed. Australopithecus did not know that *Homo habilis* was the next step, nor did Neanderthals feel us breathing down their necks. There was no single point at which we became human. **Many 'human' qualities seem to have evolved.**'
(highlighted by this author)
