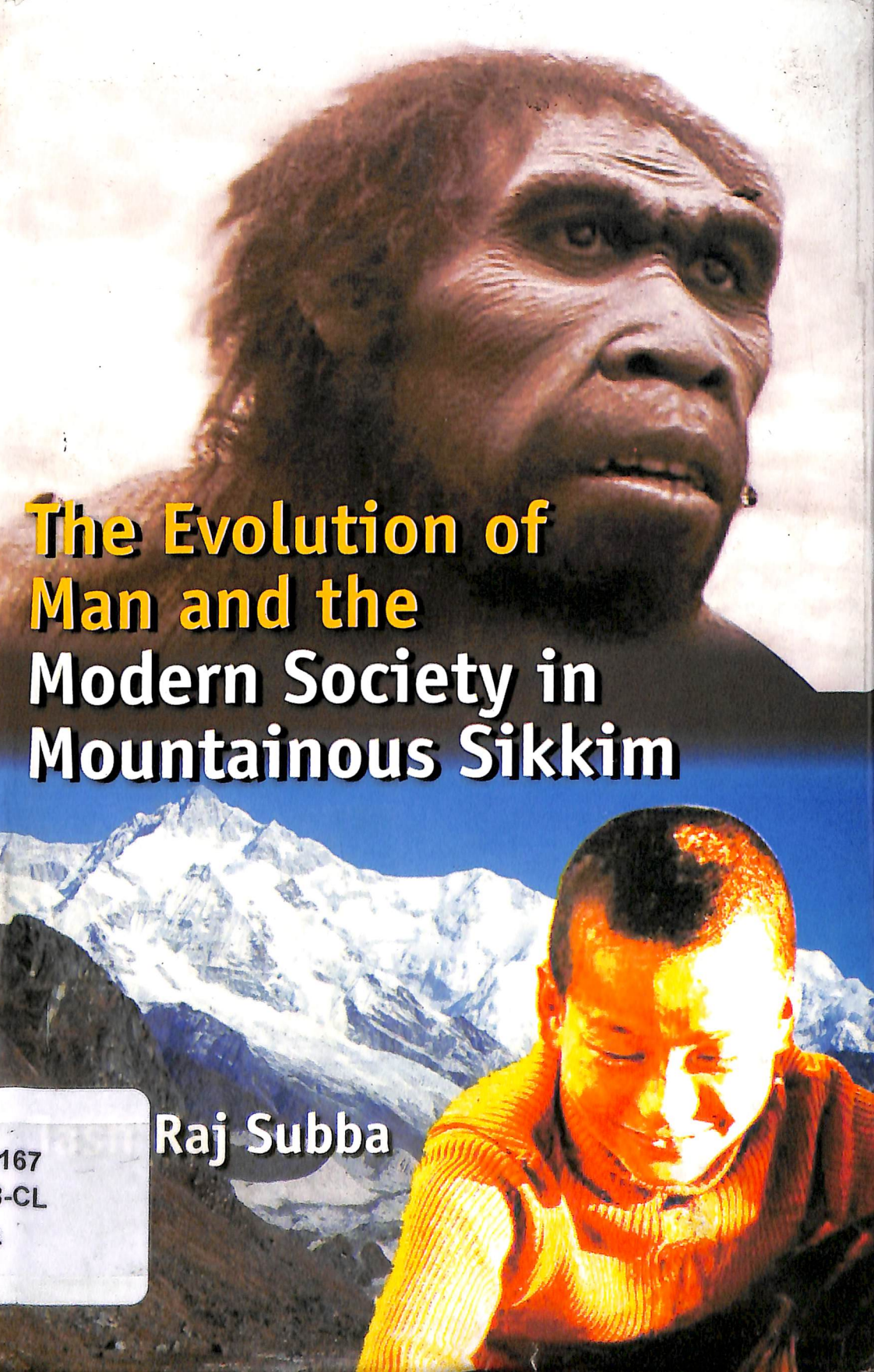

The Evolution of Man and the Modern Society in Mountainous Sikkim

Raj Subba

THE EVOLUTION OF MAN AND THE MODERN SOCIETY IN MOUNTAINOUS SIKKIM

J.R. Subba

GYAN PUBLISHING HOUSE
NEW DELHI-110002

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Foreword

This book, titled "The Evolution of Man and the Modern Society in Mountainous Sikkim" written by J.R. Subba, is an interesting reading. It is evident from the writing of Mr. Subba that he is interested in human bio-cultural history in an evolutionary perspective. He has written many books on Sikkim, but this one has been done on a different idea, altogether. This book considers human phenomenon on a global scale, but considers local scenario, as a part of the whole.

He has chosen five chapters in this book with topics ranging from mega evolutionary history of man, along with three other important human cultural attributes viz. food production, writing system and developmental stages of human society, and finally sustainability issues of Sikkimese population. Although he made an attempt to portray global scenario pertaining to the chosen topics in first four chapters, his focus was retained on the Sikkim Himalayan specifics. The last chapter, however, was purportedly designed for the Sikkim Himalaya, as a representative locale of the Hindu-Kush Himalaya in terms of a sustainable developmental model. Overall, placing Sikkimese population and its society in the realm of evolutionary paradigm has been the goal of this book.

Human evolution, both at macro- and micro-level, has been an important topic of study for long. Over the last 100 years, several developments, both theoretical and methodological, added new dimensions in the study of human evolutionary history. Furthermore, the study of human biological diversity has been enormously challenging

and historically been controversial. In this book, Mr. Subba tried to enrich the readers on important points of human evolution.

Food production, including maintenance of livestock is one of the essential features of bio-cultural survival for majority of global human populations. Understanding the evolutionary aspects of food production and livestock rearing takes us back to the era of domestication of wild plants and animals. The fascinating saga pertaining to evolution from hunter-gatherers to food producers tells us about the techno-ecological adaptations of humans in an evolutionary sense. Mr. Subba made an attempt to place before the readers a profile of evolutionary history of food production, considering both global and local levels.

It is true to note that the history of progression of human beings from hunter-gathering (savagery) to civilization include the development of agriculture, metallurgy, complex technology and writing system. The evolutionary aspects of the writing systems and its variations, the world over has been dealt with by Mr. Subba in this book Particular detailed discussion on the writing systems of various populations of Sikkim is thoroughly informative.

The evolutionary aspects of human society are an exceptionally interesting topic in the domain of social sciences. It depicts the human-environment interactions in time and space. It also clearly portrays the adaptive significance of these interactions. This book puts emphasis to the history of development of human society in an evolutionary framework. It is done for Indian society in general, and Sikkimese society in particular. The task to describe and analyze social development is a challenging one and Mr. Subba has done a praiseworthy job.

The final chapter deals with a discussion on a project findings and recommendations concerning sustainable livelihood issues of the population of Sikkim. The discussion has found a place in this book, to my understanding, owing to the importance of the issue in the present day modern Sikkim. A fragile mountainous environment demands very cautious steps in the matters of economic choices of people. Sustainable livelihood options, therefore, becomes a genuine necessity. The thorough analysis and interpretations of the available data on agri-horticultural practices of the state, and viability and sustainability aspects of such practices deserves appreciation.

This book, I believe, will be liked by those who want to know on human phenomenon in general, and development of human societies in Sikkim, in particular.

Barun Mukhopadhyay, Ph.D.
Professor-in-Charge
Biological Sciences Division
Indian Statistical Institute
Kolkata

Preface

Charles Darwin was the first man to suggest and prove through evidence collected from fossils that all species had evolved. Next, it was T. H. Huxley who publicly associated humans with apes. Human fossils worked a special magic in the history of scientific evolution study of mankind.

The first chapter examines the fossil evidences of human evolution and their spread around the world. The modern thinking man evolved 50,000 years ago, but his ancestors (*Austrolopithecus afarensis*) started walking upright between 3 and 4 million years ago in the forest; started using stone tools about 2.5 million years ago (*Homo habilis*). However, not much of the evolutionary history of modern man between 50,000 to 11,000 years ago is known so far.

The second chapter provides insight into the evolutionary history of food production by the modern thinking man. The end of the Pleistocene Era and last Ice Age correspond approximately to 11,000 B.C. which marks the beginning of village life in a few parts of the world. The modern man learnt food production by domestication of wild plants 11,000 years ago, first in the Fertile Crescent in Southwest Asia (8,000 B.C.), then in China (7,500 B.C.), in Sahel (5,000 B.C.) and in Mesoamerica (3,000 B.C.). Thereafter, agriculture spread around the world. Similarly, domestication of wild animals also started in the Fertile Crescent; sheep and goat (8,000 B.C.), cow (6,000 B.C.), pig (8,000 B.C.) in China, Horse (4,000 B.C.), and so on. Slowly, the modern man started depending on agriculture for food, and gave up hunting and gathering life style in most parts of the world.

The third chapter illustrates in brief, the evolutionary history of writing systems. The Sumerians of Mesopotamia (before 3,000 B.C.), China (2,800 B.C.), and Mexican Indians (600 B.C.), were the undisputed centres of independent inventions of writing systems. The Alphabet was devised in Egypt around 2,000 B.C. but the Semites were the actual inventors of alphabets about 1700 B.C. The alphabetic writing systems then spread around the world through blueprint copying and idea diffusion thereafter.

In India, picto-phonographic script was developed during Indus Valley Civilization (2,600 - 1,700 B.C.) that lasted for about 1,900 years in the civilization of Dravidians. Historians believe that from this, the Proto-Brahmi script was developed by 1,000 B.C. Based on this Proto-Brahmi script, the Dravidians of South Indian developed the South Indian Brahmi by 800 B.C. Similarly, after the Aryans came to India, they also developed North India Brahmi from the same Proto-Brahmi script probably around the same period. By the time of Emperor Aṣhoka (272-232 B.C.), Brahmi script was well developed in India. Later, a number of regional scripts were developed for the regional languages of India and abroad from the Brahmi script of Ashoka and Gupta's period.

The fourth chapter delves into the evolution history of modern society. Probably, all humans lived in bands untill atleast 40,000 years ago, and most still did till as recently as 11,000 years ago. Tribal organizations began to emerge about 13,000 years ago for the first time in the Fertile Crescent. Later, tribal organization spread in other areas of the world, and in mountainous Sikkim only by 7th century A.D. Chiefdoms arose by 5,500 B.C. in the Fertile Crescent, in Mesoamerica by 1,000 B.C., and in Sikkim by 1642 A. D. States arose around 3,700 B.C. in Mesopotamia, around 300 B.C. in Mesoamerica, over 2,000 years ago in the Andes,

China and Southeast Asia including India, and in Sikkim by 1975 A.D.

The fifth chapter summarizes briefly the SARD-M (Sustainable Agriculture and Rural Development in Mountainous Region) Policy Assessments for mountainous Sikkim. The Policy Assessment study was a part of a three-year Project (2005-07) led by the FAO (Food and Agriculture Organization), Rome, and participated in by ICIMOD (International Centre for Integrated Mountain Development), Kathmandu, Nepal. I was involved for this study project as Consultant in India (Sikkim). The study aims to support the rural livelihoods of mountain peoples by facilitating the design, review, implementation and evolution of relevant policy packages and institutional processes promoting SARD in mountain region. The study examines the strengths and weaknesses of SARD-M policies, provide technological framework or guidelines for appropriate steps of interventions and suggests to overcome weaknesses for sustainable agriculture and rural development in mountainous Sikkim

J.R. Subba

Acknowledgements

I am extremely grateful to those who helped me on various aspects of study while preparing the manuscript for this book, especially, Dr. E. Sharma, Dr. P. Gyamtsho, and Dr. N.S. Jodha of ICIMOD, Kathmandu, Nepal; Dr. Takashi Takahatake, FAO, Rome, and various Sikkim Government Departmental Heads and officials for SARD-M Policy Assessment Study in India (Sikkim).

I am thankful to Shri P. K. Chamling, the Hon'ble Chief Minister of Sikkim and Shri Somnath Poudyal, Hon'ble Minister Agriculture and Horticulture for allowing me to accept the consultancy work for SARD-M in India (Sikkim) during 2005-2007.

I also extend my grateful thanks to all the learned scholars, whose works I have consulted and referred to in this book.

I acknowledge my thanks to Mr. Pema Wanchuk, Editor, Now, News Paper, Gantok, Sikkim for going through the manuscript; and Mr. Dependra Dewan and Mrs. Sheela Thami Dahal, Himadri Printers, NamNang, Gantok for laser type setting.

Lastly, I am also extremely thankful to Dr. Barun Mukhopadhyay, Ph.D. Professor-in-Charge.Biological Sciences Division, Indian Statistical Institute, Kolkata for writing a befitting foreword.

J. R. Subba

1
The Human Evolution

On September 1, 2007, I happened to visit the World Tour Exhibition of Lucy – the Plio-Pleistocene hominid fossil, the ancestor of humankind discovered at Hadar in Ethiopia by Johanson, D. C. and White, T. M. in 1976. The experts at the Natural Science Museum, Houston, USA, where the exhibition was being held told me three things about Lucy:

(i) Lucy is different from all other fossils discovered and named thus far. She is very old, very primitive, a very small hominid, and named *Australopithecus afarensis*.

(ii) It is her completeness [40% of the fossil bones recovered] that makes her unique. Until she was found, there weren't any very old and complete skeletons. The oldest till Lucy was Neanderthal remains, barely 75,000 years old. Neanderthals disappeared with the appearance of the Cro-Magnon "cave man" which arrived 40,000 – 50,000 years back and may have disappeared as recently as 10,000 years ago. The cavemen were men like us. Yes, there are older hominid fossils discovered, but they are all fragments. Everything that has been reconstructed from them has had to be done by matching up those little pieces – a tooth here, a bit of jaw there, may be a complete skull from some where else, plus a leg bone from some other place.

(iii) Lucy is approximately 3.5 million years old. She is the oldest, most complete, best-preserved skeleton of any erect-walking human ancestor that has ever been found.

All human beings are hominids, but not all hominids are human beings. The paleoanthropologists can picture human evolution as starting with a primitive apelike type that gradually, over a long

period of time, became less and less apelike and more manlike. There was no abrupt crossover from ape to human, but probably a rather fuzzy time of in-between types that would be difficult to classify either way. We have no fossils yet that tell us what went on during that in-between time. Therefore, the handiest way of separating the newer types from their ape ancestors is to lump together all those that stood up on their hind legs and became bipedal. That group of men and near-men is called hominid.

The paleoanthropologists have studied the evolution of species. They found that descent, and lines of related species could be traced in fossils. The fossils with which Darwin chose to back up his "The Origin of Species" theory were as uncontroversial as he could make them: obscure marine organisms, small branacles, long-extinct clams, and so on.

Now, based on the evidence of the fossils of species collected from various places around the world, the paleoanthropologists have studied biostratigraphic evidence of living species and divided the Living-World into three broad Eras; Viz:

(a) Paleozoic Era of antiquity to 230 million years before the present,
(b) Mesozoic Era of 230 to 63 million years before the present; and
(c) Cenozoic Era of 63 millions of years before to the present.

Each Era has been further divided into different periods. The sequence of evolution of living species of the world could be summarised as follows:

a) Paleozoic Era (? to 230 million years before the present):

(i) Prior to the Cambrian period (600-500 million years before the present), only single-celled and small multi-celled forms such as bacteria, algae, fungi and small, soft-bodied marine animals were living in this world.
(ii) Trilobites, worms, sponges and early mollusks appeared in the sea during the Cambrian period (600-500 million years).
(iii) Primitive fish, clams, starfish, corals, and seaweeds evolved during Ordovician period (500-425 million years).
(iv) First land plants, scorpions and millipedes appeared on land in the Silurian period (425-405 million years).

(v) First large treelike land plants, many sea vertebrates and first amphibians appeared in the Devonian period (405-345 million years).

(vi) Giant primitive insects on land and first reptiles appeared in the Carboniferous period (345-280 million years). Fish fauna also flourished.

(vii) First modern insects appearance and development of amphibians and reptiles occurred during the Permian period (280-230 million years). Fish fauna proliferated in the sea but trilobites became extinct during this period.

(b) Mesozoic Era (230 to 63 million years before):

(viii) First dinosaurs appear, and the appearance of lobsters and other arthropods in sea marked the Triassic period (230-181 million years).

(ix) The Jurassic period (181 –135 million years) marks the appearance of first true mammals and birds. Dinosaurs were at their peak during this period.

(x) Dinosaurs become extinct in the Cretaceous period (135-63 million years). Great increase in numbers of small mammals; and hard wood forests with large modern trees appeared during this period.

(c) Cenozoic Era (63 to 0 million years before):

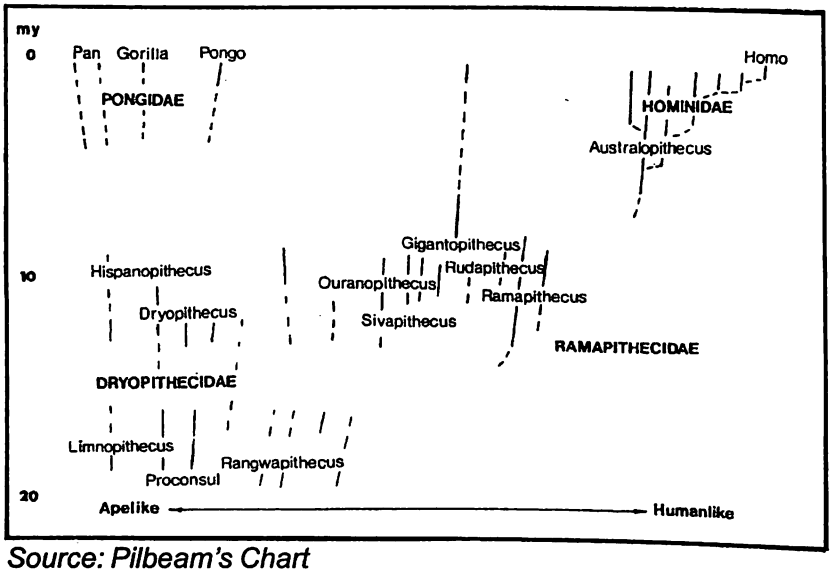
(xi) The Tertiary and Quaternary period (63-0 million years) are marked by the first appearance of prosimians and large mammals which begin to dominate land. Bony fish become abundant in sea; and appearance of sharks.

Further, the paleoanthropologists have divided the last quarter of the Cenozoic Era to the present (25 to 0 million years before) into three categories Viz: (a) Miocene (25 – 5 million years before the present); (b) Pliocene (5 – 2 million years before the present) and, (c) Pleistocene (2 – 1 million years before the present).

(a) Miocene (25 – 5 million years before the present):

Prior to 25 million years, proto-monkeys and proto-apes – the

ancestors of modern apes and monkeys evolved from more primitive prosimian forms. Miocene apes evolved about twenty million years back. One of the earliest forms known is the *Dryopithecus africanus* (also known as *Procosul* after a captive ape that lived in the London Zoo), found by Louis Leakey at Lake Victoria. Other



Source: Pilbeam's Chart

Dryopithecus-like forms turn up in later millennia, sprinkled down through eighteen and seventeen million all the way to about nine million years ago. They existed in several shapes and sizes, and were scattered widely in Africa, in central and southern Europe, and in Asia. Like all apes, they frequented forests, and their distribution follows the range of the great tropical forest belt that girdled the earth at the beginning of the Miocene. The most recent attempt to sort out the confusing Miocene ape tangle was made by David Pilbeam. Pilbeam, a pioneer scientist of Miocene apes, in his twenty years of study lumped the several forms of Miocene apes into a family – the Dryopithecids and Ramapithecids. He placed *Limnopithecus* at the extreme left of his chart in his plain arrangement because it is the most apelike of the Miocene types. *Ramapithecus* was a very small form, no larger than a medium-sized dog, at 30 lbs. or so, collected from India, Pakistan and Europe.

It was not a biped but an agile four-footed animal perhaps equally at home in the trees as on the ground. It probably used tools with no greater proficiency that the chimpanzee does nowadays.

Pilbeam divided these fossils into two major groups: the Dryopithecidae - those that do not have hominid dentition and were presumably ancestral to modern apes, and the Ramapithecidae - those whose dentition have hominid traits. Of the latter, *Ramapithecus* is considered the most humanlike; therefore it is farthest to the right on Pilbeam's chart. The true hominids are placed even farther to the right, and there is a large gap between them and *Ramapithecus*.

Fossils of another giant Miocene ape, the *Gigantopithecus*, were collected from Pakistan and India. These were about nine million years old. The *Gigantopithecus* (not a human ancestor) went extinct as recently as half a million years ago in China. Of the others, *Sivapithecus* medium size ape fossil collected from Pakistan is now the best represented with more than sixty fossil pieces, jaws and teeth recovered to date. It is possibly more terrestrial than a chimp.

(b) Pliocene (5 to 2 million years before the present):

The Hominid fossils of *Australopithecus afarensis* from Hadar, Ethiopia, *Austrelopithecus afarensis* from Laetopli, Nairobi, Hominid fossils of Kanapoi, and *Australopithecus africanus* from South Africa represent the period of Pliocene period (5 to 2 million years).

(c) Pleistocene (2 to 0.01 million years before the present):

The Hominid fossils of *Australopithecus africanus* and *Austrelopithcus robustus* from Omo, Turkana, Olduvai, South Africa, *Homo habilis* from Turkana, Olduvai, *Homo erectus* from Turkana, Olduvai, *Homo erectus* from throughout the world, and *Homo sapiens neanderthalensis* and *Homo sapiens sapiens* from Old and New Worlds represent the period of Pleistocene.

Paleoanthropologists hold that our closest living relatives are the three surviving species of the great ape: the gorilla, the common chimpanzee, and the pigmy chimpanzee (bonobo). Their

confinement to Africa, along with abundant fossil evidence, indicates that the earliest stages of human evolution also played out in Africa. Human history, as something separate from the history of animals, began here about 5 to 9 million years ago, as the discovery of *Ramapithecus, Shivapithecus* etc. types of hominids in Europe, Pakistan and India suggest. Around that time, a population of African apes broke up into several populations, one of which proceeded to evolve into modern gorillas, a second into the two chimps, and the third into humans. The gorilla line apparently split off slightly before the split between the chimp and the human lines. Fossils indicate that the evolutionary line leading to humans achieved a substantially upright posture 4 to 3.5 million years ago, a population now known as *Australopithecus afarensis* (example is Lucy). Then *A. afarensis* population began to increase in body size and in relation to brain-size around 2.7 to 2.2 million years ago. Those proto-humans are generally known as *Australopithecus afarensis, Homo habilis, Homo erectus*. The fossils indicate that *A. afarensis* broke up into several populations of two lines, one leading to "gracile" types hominid *A. africanus* between 2.7 to 2.2 million; and then evolved into a population of "robust" type hominid *A. robustus* with larger mandibles and larger molars between 2.1 to 1 million years ago. These became extinct a million years ago. The line is known as australopithecines and they are not our ancestors.

The other line evolved into several populations of *Homo habilis* with larger front teeth between 2.3 to 1.8 million and evolved into several populations of *Homo erectus* with larger body size, shape and larger brain between 2.0 to 1.5 million years ago. *Homo erectus* evolved into several populations of *Homo sapiens neaderthalensis* between 2.0 to 0.5 million and the modern thinking man *Homo sapiens sapeins* by 50,000-40,000 years ago. They are our ancestors. The paleoanthropologists have described the fossil evidences of human evolution in detail as follows:

1. The Early Fossil Discoveries

Man has always been more interested in his own origins; he traces his family roots and takes pride in their length. He follows

the histories of nations to his own roots. He looks behind recorded history to the beginnings of civilizations, and ultimately to the beginnings of humanity itself. Where he comes from is what interests him most. Human fossils thus work a special magic for him.

Charles Darwin was the first person to indicate and prove through fossil evidence that all species had evolved. He also hinted that evolution had something to do with humans as they are now; "Light will be thrown on the origin of man and his history" (Charles, Darwin, 1964). It was T. H. Huxley who publicly associated humans with apes. He pointed out the great range of similarities between man and what he recognized to be man's closest living relatives, the gorilla and the chimpanzee. From this, he reasoned that the three had a common and not extremely remote ancestor. Since these apes were found only in Africa, Huxley suggested that fossils of the joint ancestor might also be found there. Unfortunately, no known fossil ancestors had been found in Africa till that time.

A great deal of this basic spadework was done in the latter half of the nineteenth century. In 1891, a Dutch scientist, Eugene Dubois found parts of a skull and a leg bone in a Solo riverbank in Java. The great age of his finds, an estimated half-a million-years-old, and its extremely primitive appearance caused it to be viewed with great suspicion. He named his find *Pithecanthus erectus*. Meanwhile, German paleontologists Rudolf Virchow and Sir Arthur Keith's group accumulated new evidence. Heidelberg Man, represented by a heavy apelike jaw containing manlike teeth, was discovered in a commercial sandpit in Germany. The Heidelberg Man was named *Homo heidelbergensis*. This was followed by the Peking Man, the product of a decade of digging in a series of caves in Choukoutien in China by Canadian, Davidson Black in 1927. Here, the sample was much larger, 5 skulls, 15 smaller pieces of the skull or face, 14 lower jaws and 152 teeth. The Peking Man was named *Sinanthropus pekinensis* (China Man from Peking). The caves also contained a great many implements, some made of stone, others of the bones and antlers of animals that the cave dwellers had slaughtered. They had also presumably cooked them, because the cave floors contained layer after layer of charcoal,

indicating the presence of fires that had been kept alight for long periods of time. Clearly, these cave dwellers were humans estimated to be living approximately half a million years before the present. Forty years later, anthropologist G.H.R. von Koenigswald went back to the same river in Java and found more skull pieces which tended to confirm Keith's belief that the Java Man was a man. If that was so, then the name Dubois had given it would have to be changed. Derived from the Greek word *pithecus* (ape) and *anthropus* (man), it all too clearly expressed Dubois' belief that it was indeed an evolutionary halfway step between modern apes and modern man. The implication here was that all the above fossils were manlike but not quite human enough to be called *Homo*. And yet, they certainly were not apes.

The discovery of the Peking Man provided the beginnings of a range of variations, whereas a single find like Heidelberg Man or Dubois's Java ape-man could not. Later discoveries, notably some excellent fossils from East Africa, clarified the picture to a point where all the above-mentioned fossils are now almost universally recognized as being highly variable members of a single wide-ranging species that was directly ancestral to modern man, and all of them have been given the name *Homo erectus* (erect walking man). They were *Homo*, albeit somewhat different from us. Their brains were smaller, their skulls were thicker, their eyebrow ridges more prominent and their jaws heavier. In fact, all their bones were heavier. They were exceptionally powerful, both the men and the women, with muscles to match their thick frames. It was this toughly built, medium-sized, medium-brained direct ancestor whose evolutionary escalation from *erectus* to *sapiens* is now believed to have taken place between four hundred thousand and one hundred thousand years ago (Johanson D. and Edey M., 1981:27-39).

1.1 South Africa: the first Man-apes

Dr. Raymond Dart studied a skull obtained from a young South African woman interested in fossils who had in turn brought it from the Taung lime works in 1924. The skull was of a six-year-old, with a full set of baby teeth and its six-year molars just erupting. It was

definitely not a young baboon. The skull was too high and rounded, and the face was too small; baboons have long snouts and very low crowns to their heads. It appeared more like a young chimpanzee, but was too high-crowned for that. Its teeth could be neither of a chimpanzee nor a baboon. Both have large canines; in the fossil, the canines were scarcely larger than those of a human child. The foramen magnum – the hole, from which the nerves of the spinal column ascend into the brain, was at the bottom of the skull, suggesting that during its short life, this six-year-old had walked upright. In baboons and chimpanzees, the foramen magnum is located towards the back of the skull, reflecting the more nearly quadruped posture of those animals. Dart named this as *Australopithecus africanus*, the southern (*Australo*) ape (*pithecus*) from Africa. But it quickly became known as the Taung Baby, and has been so known ever since. Estimated by its finder to be as much as a million years old, this fossil was so extremely primitive that many scientists were convinced for years that it was an ape. It is, in fact, the first *Australopithecus africanus*, an authentic hominid, many of whose fossils have been found since.

Robert Broom at Strekfontein, Kromdraai in South Africa found a second type of australopithecine fossil in 1936. The fossil was like that of Taung Baby but differed in many respects. In fact, it appeared different enough to justify the creation of a new genus for it. Broom chose the name *Plesianthropus transvaalensis* (near-man from the Transvaal) for this fossil. He also found another type of fossil teeth from a schoolboy at Kromdraai, from a farm near Sterkfontein in 1938. The Kromdraai ape-man seemed more primitive than the others, not so much close as dimly foreshadowing the human condition. He settled on the name *Paranthropus* (towards man) *robustus*. The *robustus* he tagged on to underscore the specimen's larger size and generally more massive bone structure. Like Dart, Broom had no difficulty in recognizing all these South African fossils as erect-walking hominids, although he desperately needed some post-cranial bones to convince others. More fossils were found in subsequent years. The larger, robust primitive *Paranthropus* is found only in the two younger caves. The slender,

more manlike little *Australopithecus/ Plesianthropus* is found only in the three older ones. Recognition of two distinct types of australopithecine in Africa came with the discovery of more fossils. The robust type has a more massive jaw and larger molars than the gracile type. It also has a prominent bony ridge on top of its skull.

Latter, Raymond Dart found another fossil at Makapansgat, north of Johannesburg, South Africa, in 1947 and named it *Australopithecus prometheus.* Broom and Robinson also found numerous fossils in the cave sites of Swarkrans, South Africa and named the species *Paranthropus crassidens.*

However, scientists have now systematized the above names, applying scientific rules for naming them. From the 1950s on, all the South African ape-men have been known as australopithecines. They are divided into two types, a slender "gracile" type and a burlier, more primitive-appearing "robust" type. The former, of which the Taung Baby was the original, the "type specimen", retained its original name of *Australopithecus africanus.* With it went all the fossils from Makapansgat and Sterkfontein; all were "gracile" types.

The big, burly specimens from Kromdraai and Swarkrans, although measurably different from the gracile species, were obviously the same general types of creature. They too were erect-walking ape-men. They were put in the same genus but into a different species. They were named *Australopithecus robustus* (Ibid: 40-70).

1.2 East Africa Man-apes and Potassium-argon Date

Louis Leakey and his wife Mary Leakey went to Olduvai, East Africa in the 1930s in search of stone tools. Olduvai lies under the rain shadow of an enormous extinct volcano, the celebrated Ngorongoro Crater. The couple had been collecting fossils from all over East Africa for years, and had managed to match certain styles in tool making with similar industries in Europe. Those at Olduvai were different. They were so primitive – single cobbles with a flake or two knocked off one end to provide a crude cutting or chopping edge, that to an untrained eye they would not have resembled shaped implements at all. Nevertheless,

he and Mary recognized them for what they were, and gave the industry a name - Oldowan.

Mary found a skull popularly known as "Zinj" (means East Africa in Arabic, christened by her husband) in Olduvai in 1959. It was the first australopithecine discovered outside South Africa, and the first anywhere to be reliably dated through Potassium-argon technique of dating. Its age was 1.8 million years. It is a super-robust type, with the largest molars and jaw of any specimen found so far. No South African australopithecine has ever been found in sure association with any tool. We still don't know whether they used them. Given the lack of evidence, it looks as if they didn't. Louis, finding something special in the teeth of the fossil, named the specimen *Zinjanthropus boisei*. That name did not last long. Others, noting the close resemblance to robust types of South Africa renamed as *Australopithecus boisei*.

By the 1950s, morphological studies of Le Gros Clark had finally recognized the erect, ape-brained australopithecines, as hominids. That meant that they were members of the human family; but whether they were ancestors or cousins was could still not be determined. Most of the experts are however now willing, tentatively, to assign to *A. africanus* the place of an ancestor now, even more than before, on the basis of its presumed age.

Meanwhile, potassium-argon technique was developed by the Italian scientists to estimate the age of lava flows and volcanic ash deposits in the vicinity of Rome. This depends on measuring the amount of decay of a radioactive isotope of the element potassium into another element, argon. The 1.8 million-year date for Zinj was responsible for some astonished second looks at the dates that paleontologists had been taking down alongside their trees of mammalian evolution they have been laboriously constructing (Ibid: 71-135; Aronson, J.L. et al. 1977:323-327).

1.3 The Earliest Man – Homo habilis of East Africa

In 1962, Louis Leaky found another hominid fossil at Olduvai, East Africa. This time the fossil was not an

australopithecine but a true human ancestor. In 1964 a full report was released by a team consisting of John Napier from England, Phillip Tobias (Dart's student of South Africa) and Louis himself. They had recovered some more fossils over the previous two years from this area and made a rigorous examination. These were larger-brained than australopithecine, and they placed them in the genus *Homo*. The age of this new *Homo* was estimated at 1.75 million years old and they named the fossil *Homo habilis* (handy man, a name suggested by Raymond Dart), in honour of its having been the maker of the stone tools.

However, Louis Leakey's *Homo habilis* was subjected to severe criticism for a long time. The principal reason was the scrappy condition of the evidence for the four specimens found were badly preserved. The first find, a mandible with cranial fragments, was named Johnny's Child after its finder, Leakey's son Jonathan. The second one, Cindy, was a lower jaw and teeth, some bits of an upper jaw and a patch of skull. The third, George, had only his teeth and some very small skull fragments. The fourth, Twiggy, was represented by a crushed cranium and seven teeth. Despite the fragmentary condition of these skulls, a preliminary study suggested that they were probably larger than the typical gracile skull from South Africa.

Australopithecines fell into a multimillion-year gap - between true humans and late Miocene apes. And it was Le Gros Clark's review of ape and human teeth that determined that australopithecines were not apes. But they were not humans either. Australopithecine teeth, in short, were their very own. So were their brains, which were in the 430-550 cc range, consistently larger than ape brains, notably smaller than *Homo erectus* brains (700-750 cc). That in-between condition, in brain and teeth, was what made it possible to regard australopithecines as transitional on the line of descent from apes to humans, closer to *Homo*, but not yet *Homo*.

Leakey, Napier and Tobias introduced their fossils as human and named *Homo habilis* on the basis of brain size, which was larger than the australopithecine brain. The teeth were different,

more humanlike; the skull was a different shape, again more humanlike. Others criticized the suggestion because Tobias's calculation of the brain size at 642 cc was questionable because of the poor quality of the samples. They also challenged the conclusions about the teeth. They pointed out that not enough was known about the rest of *habilis*' skeleton to warrant any positive ideas about it at all. On the matter of brain size, Ralph Holloway of Columbia University, examined the specimens latter, and came up with substantially the same conclusions as Tobias. The findings of both men were later confirmed by the recovery of a nearly complete skull of a similar type in northern Kenya a few years later. Its brain was larger than any of the three in Olduvai. However, brain size alone is now recognized as a questionable index of species identification because of its variability. Thus, *Homo habilis* fell into that narrow shadow zone between *Australopithecus* and *Homo erectus*, and perhaps there was not enough room there during that time (Johanson D. and Edey M., 1981:97-104).

1.4 Omo and Clark's Biostratigraphy

The tri-national – "Cooperative International Anthropological Expedition" led by Louis Leakey carried out fossil find research at Omo. Initially, the Kenya team was lea by Leakey himself, but was soon entrusted to his son Richard Leakey. The French team was led by Arambourg but he passed away and the team was then led by a young man named Yves Coppens. The American contingent was led by Howell. Each team was set up to act independently of the others in the area specified for them. The research expedition started in 1967 and continued upto 1974.

"Geology of Omo is a marvel. It preserves a continuous record of events that is unique in the study of fossil hominid evolution. Its uniqueness results from a combination of special qualities. First it is fairly big. It is not gorge like Olduvai, but a jumble of eroded outcroppings that cover well over a hundred square miles. Second, it is deep. The deposits are more than three thousand feet thick, which means that the bottom ones is extremely old; you don't get

three thousand feet of material deposited overnight. Third, it is faulted. That means that you don't have to dig down three thousand feet to get to the bottom layer. The earth's crust has tilted or buckled, and the layers are sticking up at an angle, so that even the oldest are exposed here and there on the surface of the ground. In fact, you don't have to dig at all. You just walk along. As you go, each step you take carries you forward or back in time" (Howell, F. C. 1973).

The exposed sequence of strata at Omo constituted an immense geological ruler, with sections of time marked off by about two hundred separate and distinct deposits of mud, clay, sand, gravel, and volcanic ejects. More than a hundred of these layers contained fossils. All together, they spanned about three million years in time, running roughly from four million years ago to one million years ago.

In the eight years (1967-1974) that the Omo expedition operated, it collected close to fifty thousand specimens, representing more than 140 species of mammals. Some of the little ones – rats, mice and shrews – were valuable because such small animals do not move about much and are extremely sensitive to environmental change. Equally important, Howell's practice of carefully mapping every fossil made it possible to follow the evolutionary development of various types through time. Beautiful sequences of antelopes, giraffes and elephants were obtained; new species evolving out of old ones and appearing in younger strata, then dying out as newer ones in still younger strata replaced them. Evolution, in short, was taking place before the eyes of the Omo surveyors, and they could time it! The finest examples of this process were in several lines of pigs which had been extremely common at Omo and had evolved rapidly. Basil Cooke produced family trees for pigs whose various types were so accurately dated that pigs themselves bacame measuring-sticks that could be applied to finds of questionable age in other places that had similar pigs.

This work is called biostratigraphy. What Howell did was produce a whole strip of edge with his Omo dates. The hominid finds there, although their quality was not exceptional, did fit the frame. This type of study enabled Clark Howell to review and find four different kinds. Since he knew how old they were, he could

arrange them on the table, which had not been possible before, even if he could not fit them together. Equally important, some of his finds were Pliocene, more than two million years old. He had broken out of the Pleistocene, reviewed the hominids and accordingly came out as follows:

A small hominid resembling the South Africa gracile australopithecine began to appear at Omo at three million, went on certainly to 2.5 million, and might have persisted till about two million years ago, although the quality of the fossils makes that further persistence debatable.

A robust hominid, more closely resembling the super-robust Zinj than the South African *robustus* appeared at two million and disappeared at one million. Of the four types found at Omo, this one was by far the most abundant.

Traces of *Homo habilis* occurred in a few seemingly manlike teeth and are dated at about 1.85 million.

Finally, *Homo erectus*, first seen at about 1.1 million.

The review gave an idea about possible relationships hominid fossils available so far. With all the gracile types occurring before two million and all the robust ones after two million at Omo as well as in South Africa indicates that the former types might be the ancestors of the latter. Second, with *Homo habilis* occurring at Omo as well as at Olduvai after two million, speculated that it too may have had a gracile ancestor. *Homo erectus*, first seen at about 1.1 million, speculates that it too have had gracile or *habilis* ancestor (Johanson D. and Edey M., 1981:107-135).

1.5 Homo habilis of Koobi Fora

Richard Leakey started a fossil find expedition at Koobi Fora in 1969. The project was supported by the Kenyan Government. The Hominid fossils began to appear almost immediately. The team found hominids in greatest abundance were the robust australopithecines. Also found were some smaller specimens which, to Leakey, seemed to fall comfortably within the range of Cindy, George and Twiggy, those elusive *habilis* specimens from Olduvai. He hoped not only to strengthen his father's claim that *Homo habilis* existed as a valid species, but also to extend the known life

of that species further back in time. The deposits were larger and richer than those at Olduvai, they went deeper into time, and many of the fossils yielded were of better quality.

In 1972, Richard Leakey announced an utterly dazzling find: a superb skull from below the KBS stuff (after the name of woman from Yale University - Kay Behrensmeyer). Inasmuch as the stuff had been dated at 2.6 million years by a pair of English potassium-argon specialists, this meant that the new skull was older than that. The new find was designated KNM-ER 1470 (Kenya National Musium – East Rudolf). The skull 1470 is Richard Leakey's most dramatic find at Koobi Fora, and one of the most important hominid fossils found anywhere. It is definitely *Homo*. The credentials of *Homo habilis* were suddenly and dramatically improved by 1470. It provided more than enough room for a species, and *Homo habilis* thereafter was generally accepted as one. It is in far better condition than any of the *habilis* specimens from Olduvai and has a larger brain. It was first thought to be nearly three million years old (2.9 million years old) – an awkward date indeed, for that made it older than many of its presumed australopithecine ancestors. More recent dating from purer ash samples has convinced most authorities that it is less than two million years old.

In fact, the only older hominids found anywhere were two from northern Kenya – an arm bone from Kanapoi that may be four million years old, and a jaw piece containing one molar from Lothagam that is about five and a half million years old. Both are too badly worn and fragmentary to reveal much about themselves, except that they are probably hominids.

There were dissenters of course. The principal one was C. Loring Brace of the University of Michigan. Brace and his followers lumped 1470 and believed in a simple family tree. It goes: *Australopithecus – Homo erectus – Homo sapiens*.

Among the most significant finds at Koobi Fora is an excellent *Homo erectus* skull. It is dated at 1.5 million years old. It lived alongside robust australopithecines and no anthropologist in the world would argue today that those two are con-specific. One of the marvels of evolution is how so many seemingly similar plants

and animals have managed to find ways of making a living cheek by jowl with each other. This seems to have been the case for early hominids as well. The gracile/ Homo type begins to emerge as a smaller-jawed, smaller-toothed omnivore; the robust type as an increasingly specialized eater of coarse vegetable matter. That divergence in diet alone would be enough to permit the coexistence of two types of erect hominids. Thanks to Richard Leakey, through his findings we know today that two did coexist (Ibid:136-149).

1.6 The Hadar Hominids

The Hadar, Ethopia expedition camp was established on a low bluff overlooking the Awash River in 1973. The first expedition team led by Johanson concentrated mostly on geology and surveying, and was notably thin on paleontological expertise. Their first hominid find at Hadar was a knee joint, dated as more than three million years old, the oldest such fossil on record. The angle at which the two bones connect is what convinced paleoanthropologists that it was a hominid. In apes. the connection would be straight. The hominid knee joints are oval; those of the ape are round. A manlike knee joint meant manlike walking. This would be the first evidence from anywhere that anything had walked upright three million years ago.

The second expedition was held in 1974. The Johanson and Taib's team this time consisted of Basil Cooke, the pig specialist; Michel Beden, the elephant specialist; Vera Eisenmann, the horse specialist; Germaine Petter, the carnivores specialist; Jean-Jacques Jaeger, the rodent specialist; and Claude Guerin, the rhinoceros specialist. Alemayehu Asfaw, a good fossil finder was in the team and found a hominid jaw, then another upper jaw with every one of its teeth in position. Tigrean, another worker of the team found the third jaw. In australopithecines, the molars are very large and the incisors, the front teeth are very small. In humans the reverse is true. Our molars are small, and our incisors comparatively large. The jaws collected were more human than australopithecine. The canines, on the other hand, seemed neither human nor australopithecine and held a hint of a more apelike condition. Their

peculiar blend of Homo and australopithecine traits, with a whiff of something more primitive, was utterly baffling. Adding to the perplexity was a size problem: although both of Alemayehu's specimens were adults, one was much larger than the other, suggesting the coexistence of two species of hominids at Hadar. Another significant find at Hadar was the *Hipparion* horse's teeth with intact ectostylid that became extinct some time after three million B.C. The true horse *Equus* is a migrant from Asia and appears in East Africa at two million (Ibid:176-177).

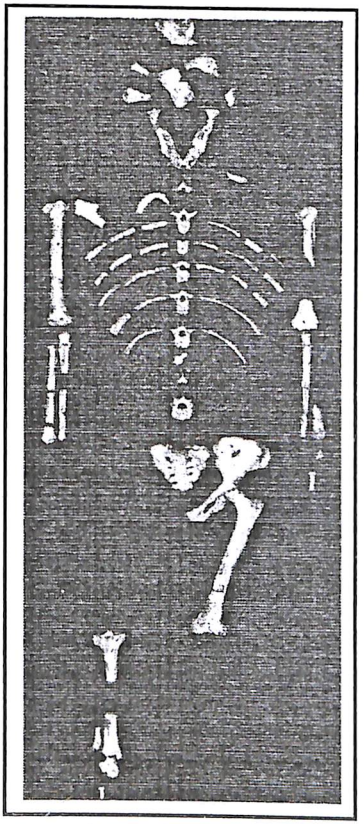
The most significant find of Hadar was of Lucy by Gray and Johanson. Lucy was utterly mind-boggling; there was no other way to describe her. At nearly half of a complete skeleton (40%), Lucy seemed incredible to the scientists even as they saw the evidence accumulating before their eyes. It was not more than three and a half feet tall, had a tiny brain, and yet walked erect. Its jaw was V-shaped, not as rounded in front as some of the other mandibles, and smaller than any of them. Furthermore, its first premolar had only a single cusp. The larger jaws had two-cusped premolars. Since the one cusp condition is the more primitive and the two-cusp condition the more human, experts concluded that Lucy was different from the larger-jawed type. Lucy proved that hominids had walked erect at three million B.C. More surprising yet, they had walked before their brains had begun to enlarge (Ibid:164-185).

During the third Hadar Field Season in 1975, the Johanson's team found the First Family at site 333. The fossils were: one was a hominid heel bone, other was a femur, teeth at the bottom of the slope and two other bones halfway up, two fibulas, two shin bones; indicating the presence of more than one individual (Ibid: 208-219).

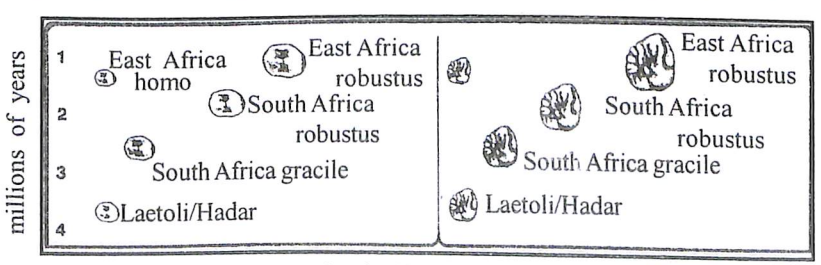
Dating the Hadar fossils took seven years and required the synchronization of five techniques: geology, potassium-argon dating, fission-track dating, paleomagnetism, and biostratigraphy. All were necessary for the gradual development of a detailed and accurate stratigraphic column. Aronson, an expert on potassium-argon dating is now reasonably sure that the basalt is 3.75 million years old. That would make Lucy and the first Family close to 3.5 million years old, the jaws and knee joint close to 4.0 million years old (Ibid:187-207).

1.7 Lucy and Laetoli Hominids

Hominid fossils inclusive of Lucy of Hadar and the hominid fossils and footprints of Laetoli reveal that around three million years ago, erect walking hominid evolution took place in Hadar and Laetoli. *Homo* traits in fossils of that age could be seen in these fossils. The teeth of the fossils had already evolved away from an ape condition and were clearly more human. In the fossils, premolars and molars are smaller and the front teeth larger and these are human traits. But they also had traits that made them different from human teeth. They had very big back teeth, some of them were truly massive, twice the size of a modern human molar. Secondly, the enamel on the back teeth was extremely thick, much thicker than in human teeth. Thirdly, the front teeth were remarkably smaller in comparison with the back teeth. The ones with massive jaws and molars were Australopithecines, while the ones with smaller jaws and molars were *Homo*. Biometric analysis demonstrated that the Hadar and



Lucy (fossil)



Teeth Arrangement: premolar (left) molar (right) of Human Ancestors.

Laetoli hominids were not Homo but some kind of early australopithecine (Ibid: 255-278).

The analysis which positions teeth from left to right in increasing order of size, and from top to bottom according to age, makes clear that "small" was "primitive", and that large molar size never occured in humans, but appeared later among australopithecines, reaching its maximum in the younger robust types. The examples shown in the chart are premolars (left) and molars (right). It was the australopithecine teeth that had changed. They had gone in a direction of their own to satisfy a life-style somewhat different from that being lived by early humans, a life-style that would become increasingly specialized for coarse vegetarian diet and lead to the development of larger and larger teeth (ibid: 255-278).

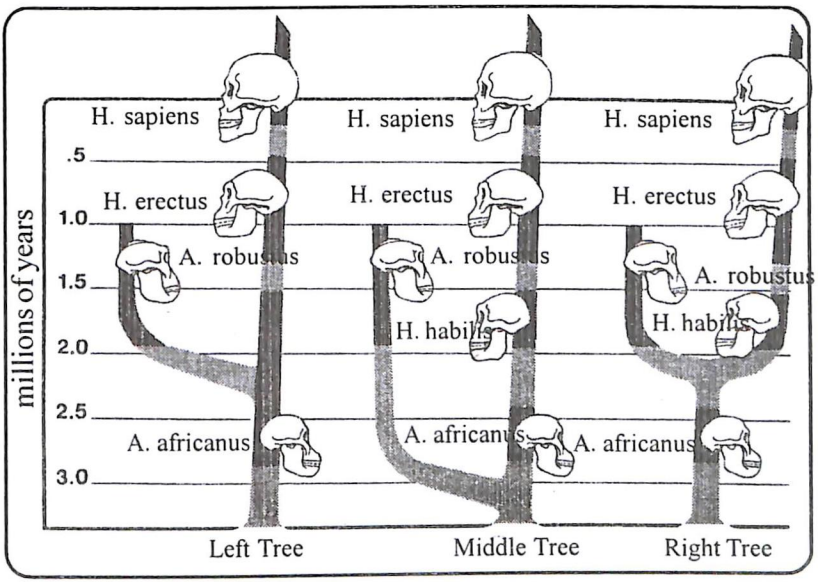
1.8 Laetoli fossils and footprints

Between 1974 and 1977 Mary Leakey and her team found forty-two hominid teeth, some of them, associated with bits of jawbone. One in particular LH-4 (Laetoli Hominid 4), was a fine specimen, a mandible with nine teeth in place. They also found some hominid footprints, one of the most extraordinary cases of preservation and discovery in all of paleoanthropology. The hominid footprints of one adult man and another smaller of a pregnant woman walking together were found just below the present surface of the ground in some shallow layers of ash and were extremely fragile. The hominid fossils and footprints of Laetoli were dated three million years old (ibid: 236-252).

2. Family Tree of Human Ancestors

In paleoanthropology, before the discovery of fossils and Lucy at Hadar and fossils and footprints at Laetoli, there were three well-known Family trees of human ancestors. The First one, espoused by Brace and others, recognizes only one branch of the hominid tree, and the existence of only one kind of hominid at a time. Recently, however, Brace has permitted the branching

off of *Australopithecus robustus*, because it is too unlike the *Homo* types that follow it to fit on the man line. The virtue of this tree is its simplicity. Brace, a "lumper" does not accept *Homo habilis* as a valid species. He lumps it with *Australopithecus africanus* (tree at left).



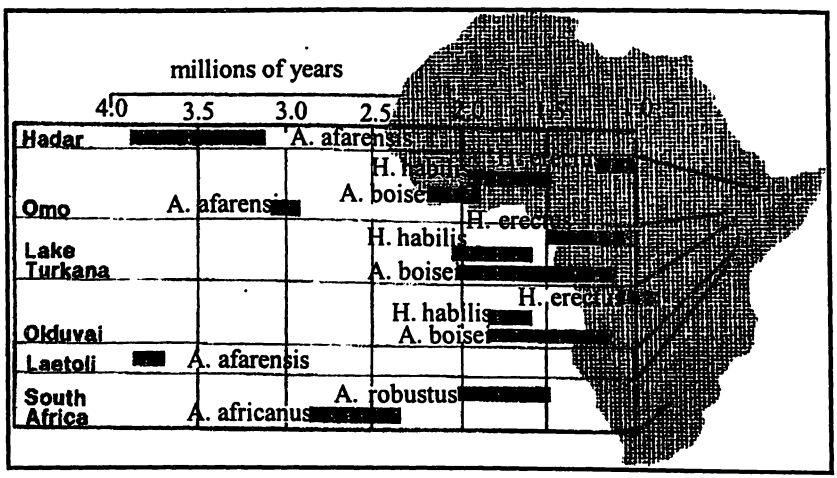
Three Well-known Family Trees of 1960s-70s
Source: Johanson D. and Edey M., 1981:281

The second family tree, reflecting the views of John Robinson, attempts to restore the awkward contradiction, which results from the observation that "robust" types have more "primitive back teeth than gracile" types, although, on the evidence of South African caves, they are younger. Robinson's solution was to place the "robust" types correctly in time (2.0 to 1.0 million years ago) and then assume a common ancestor with the "gracile" *Australopithecus africanus* (centre tree).

The third family tree, the most accepted in the 1960s and 1970s, reflects a growing consensus that *A. africanus* was ancestral to both *A. robustus* and *Homo habilis*. It acknowledges that increased molarization of the teeth through time was an australopithecine trait, not a human one, but assumes that this tendency, already

evident in *A. africanus*, was not evidence enough to dislodge it as a human ancestor (right Family tree).

Realizing that none of these family trees could accommodate the new evidence produced by Johanson and White from their fossil studies at Hadar and Laetoli, they decided to draw a new tree of their own.

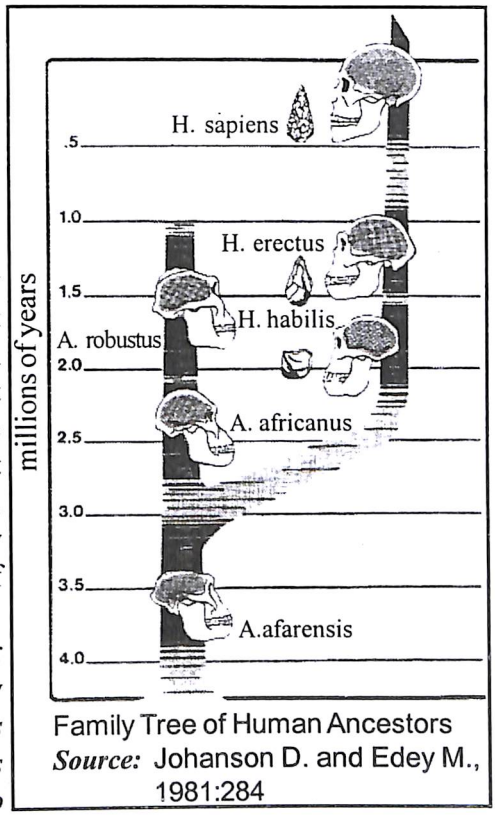


Arrangement of fossils by type and place of find
Source: Johanson D. and Edey M., 1981:283

They placed all the African hominids on a diagram according to their age, type and location. To place the South African fossils, they used the most recent estimates of Elizabeth Vaba, a South African biostratigrapher, for the ages of both the "robust" and the "gracile" types. For Omo, they already had good dates. For Lake Turkana, they took Curtis' potassium-argon dates and the fossil pig evidence and accepted Richard Leakey's identification of the fossils there. For Olduvai, Hadar and Laetoli they took the published potassium-argon dates. The next step was to simplify by ignoring locality and pulling the fossils together by type (ibid: 283).

Consolidating the information in the chart above, the simplest family tree of the human ancestors has been derived. All the *A. afarensis* fossils can be lumped between 4.0 and 3.0 million, all the *A. africanus* ones between 2.7 and 2.2 million, all the *A. robustus* between 2.1 and 1.0, and so on. They are convinced that *A.*

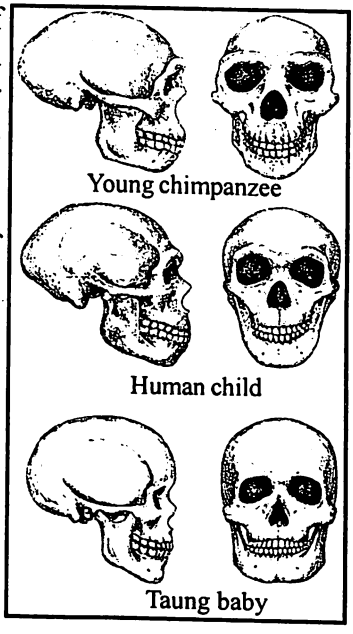
afarensis, the oldest and most primitive hominid known, was ancestral to all others. They reason that increased molarization was a late australopithecine phenomenon and they have located the types that display it accordingly, with *A. robustus*, the most heavily molarized, at the end of that line. That leaves the *Homo* types, with back teeth essentially unchanged from those of their ancestor *A. afarensis*, on a line of their own, with the increasingly advanced *Homo erectus* and *Homo sapiens* evolving out of *Homo habilis*. Tools, as the chart indicates, are a *Homo*, not an australopithecine, invention (Ibid: 284-287).



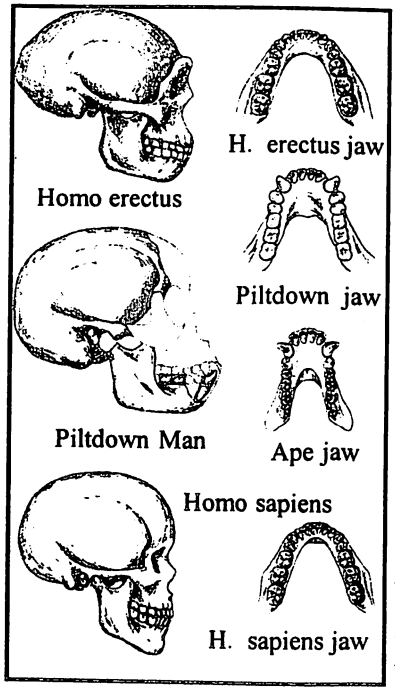
Family Tree of Human Ancestors
Source: Johanson D. and Edey M., 1981:284

In 1856, J.C. Fuhlrott a German science teacher dug out a fossil from a quarry near his home as displayed them as bones of a man, but not those of a modern man. This was the first non-modern human fossil ever found and named the Neanderthal Man evolved from *Homo erectus,* estimated between 200,000 to 75,000 years ago with larger brain and eye ridges. It underwent decades of controversy. Some think it was the same species as us. Others think it was an ancestor. There are a few who consider it a kind of cousin. That matter is unresolved because many of the best Neanderthal fossils were collected in Europe before anybody knew how to excavate sites properly or conduct proper dating. Consequently, we do not have exact age for most of the Neanderthal fossils.

One and a half million years of evolution in humans has produced a higher and rounder skull, a much larger brain, and a distinct chin (which is missing in *Homo erectus*), the modern thinking man *Homo sapiens*. There has been a gradual disappearance of *Homo erectus'* heavy eyebrow ridges (Ibid: 43).



An amateur scientist, Charles Dawson, had collected Piltdown Man skull pieces in 1912 from a gravel pit in England. It was named *Eoanthropus dawsoni*. No date could be ascertained in this case either. It had a very large brain, comparable to that of a modern man. Instead of a human jaw, it had one shaped like that of an ape; in fact, it could have been an ape jaw except that it had manlike molars, flat on their grinding surface (Ibid: 49).



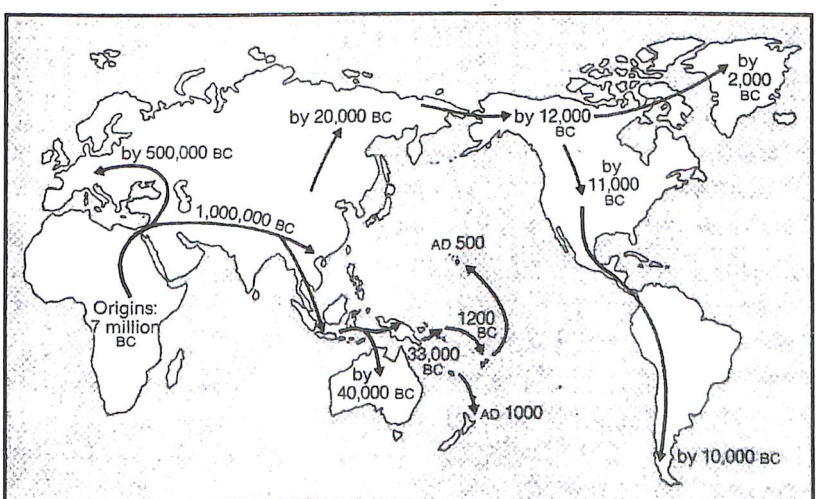
The problem with the Piltdown Man becomes clear when it is compared with *Homo erectus* and modern *Homo sapiens*. The Piltdown cranium is like that of modern man in shape and size and not like *Homo erectus* at all. But its jaw is more primitive than either, having the boxlike configuration and huge pointed canine of large apes. It appears to be made up of a human skull and an ape jaw arbitrarily joined together, which is what it ultimately turned out to be.

Cro-Magnon Man, so named for the locality in Southern France was found where the bones were first unearthed. Many specimens were recovered; among them were complete skeletons so virtually indistinguishable from those of present humans that even the most skeptical had to concede that they were human. Cro-Magnon Man had been living there for forty or fifty thousand years and may have disappeared as recently as ten thousand years ago. They were men like us, men who could paint beautiful pictures and could presumably think complex thoughts, men who routinely made a variety of useful stone tools and clearly had an elaborate culture, in many respects, more sophisticated than some of the so-called "savage" cultures found in isolated parts of the earth to this day.

Homo sapiens sapiens, the modern man, evolved from the older *Homo erectus* fifty thousand years ago (Ibid:281-293).

3. The Spread of humans around the world

The human history of origin remained confined to Africa for about 3.0 to 4.0 million years ago. The first human ancestor to spread beyond Africa was the excellent hunter-gatherer *Homo erectus*, as is attested by fossils discovered on the Southeast Asia



The spread of Humans around the world

Source: Diamong, J. 1997

island of Java and known as the Java Man; and second in Choukoutien, China, known as Peking Man dated to a million years ago. The earliest unquestioned evidence for humans in Europe stems from around half a million years ago from Neanderthals. One would certainly assume that the colonization of Asia also permitted the simultaneous colonization of Europe, since Eurasia is a single landmass not bisected by major barriers. But evidence from half a million years ago suggests that human fossils had diverged from older *Homo erectus* skeletons in their enlarged, rounder, and less angular skulls. African and European skulls of half a million years ago were sufficiently similar to human skulls, so modern that they are classified in our species, *Homo sapiens*, instead of in *Homo erectus*. This distinction is due to evolution from *Homo erectus* to *Homo sapiens*. About half a million years ago, human populations of Africa and western Eurasia started to diverge from each other and from East Asian populations in skeletal details. Many skeletons known as Neanderthals and sometimes classified as a separate species, *Homo neanderthalensis*, represent the population of Europe and Western Asia between 130,000 and 40,000 years ago. Neanderthals were the first humans to leave behind strong evidence of burying their dead and caring for their sick. The evidence for a localized origin of modern humans, followed by their spread and then their replacement of other types of humans elsewhere, seems strongest for Europe. Cro-Magnons came into Europe with their modern skeletons, superior weapons, and other advanced cultural traits, some 40,000 years ago. Within a few thousand years, there were no more Neanderthals left. This, after Neanderthals had been evolving as the sole occupants of Europe for hundreds of thousands of years. That sequence strongly suggests that the modern Cro-Magnons somehow used their superior technology and their language skills or brains, to infect, kill, or displace the Neanderthals, leaving behind little or no evidence of hybridization between Neanderthals and Cro-Magnons.

Human occupation of Australia and New Guinea, joined at that time in a single continent with Eurasia, ranges from between 40,000 to 30,000 years ago. Within a short time of that initial peopling, humans had expanded over the whole continent and adapted to its diverse

habitats - from the tropical rain forests and high mountains of New Guinea to the dry interior and wet southeastern corner of Australia.

During the Ice Ages, so much of the oceans' water was locked up in glaciers that sea levels dropped hundreds of feet below Asia and the Indonesian islands of Sumatra, Borneo, Java, and Bali became dry lands. As did other shallow straits, such as the Bering Strait and the English Channel. Thus, humans occupied these islands about 33,000 years ago, probably by paddling across. Another extension of human range that soon followed was the one into the coldest parts of Eurasia – to Siberia by 20,000 years ago.

It is uncertain when, but it is speculated that the Americas were first colonized around 14,000 years ago. The oldest unquestioned human remains in the Americas are at sites in Alaska dated to around 12,000 B.C., followed by a population of sites in the United States south of the Canadian border and in Mexico in the centuries just before 11,000 B.C. The latter sites are called Clovis sites, named after the type-site near the town of Clovis, New Mexico, where their characteristic large stone spear points were first recognized. Clovis descendants would reach Patagonia, lying 8,000 miles south of the United States, Canada border, in less than a thousand years. The Siberians crossed to Alaska, either by sea across the Bering Strait or on foot at glacial times when the Bering Strait was dry land. The Bering land bridge, during its millennia of intermittent existence, would have been upto a thousand miles wide, covered by open tundra, and easily traversable by people adapted to cold conditions. The bridge was flooded and became a strait again fairly recently when sea level rose around 14,000 B.C.

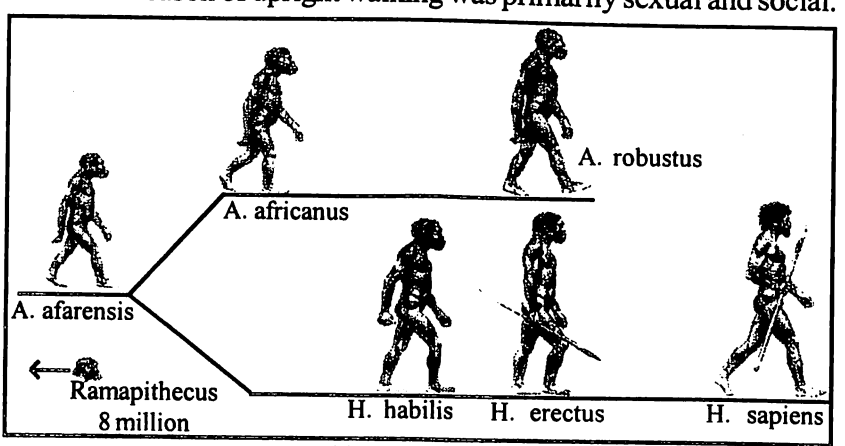
Soon thereafter, a north-south ice-free corridor opened in the Canadian ice sheet, permitting the first Alaskans to pass through and come out in the Great Plains around the site of the modern Canadian city of Edmonton. That removed the last serious barrier between Alaska and Patagonia for modern humans. The Edmonton pioneers would have found the Great Plains tempting, teaming as they were with game and they were the excellent hunter-gatherers. They would have thrived, increased in numbers, and gradually spread south to occupy the whole hemisphere. The Americas could thus have first

been settled around 11,000 B.C., and quickly filled up with people reaching southern end of South America by 10,000 B.C.

The settlement of the world's remaining islands was not completed until modern times. Mediterranean islands such as Crete, Cyprus, Corsica, and Sardinia were inhabited between about 8,500 and 4,000 B.C. Caribbean islands were inhabited around 4,000 B.C. Polynesian and Micronesian islands peopled in between 1,200 B.C. and 1,000 A.D. Madagascar was inhabited by humans sometimes between 300 and 800 A.D. And Iceland was inhabited only in the Ninth century A.D. Native Americans, possibly ancestral to the modern Inuit, spread throughout the High Artic around 2,000 B.C. That left, as the sole uninhabited areas awaiting European explorers over the last 700 years, only the most remote islands of the Atlantic and Indian Oceans such as the Azores and Seychelles, plus Antarctica (Diamond, J.1997 :35-52).

4. When did our Ancestors start walking upright?

Our hominid ancestors learned to walk upright in the forest, not out on the Savanna, even though that's where they were found living later. When they arrived in the Savanna, they were already bipeds. Fossil evidence reveals that they learned to walk upright between 3.0 and 4.0 million years ago. And they did it without the benefit of tools. The reason of upright walking was primarily sexual and social.



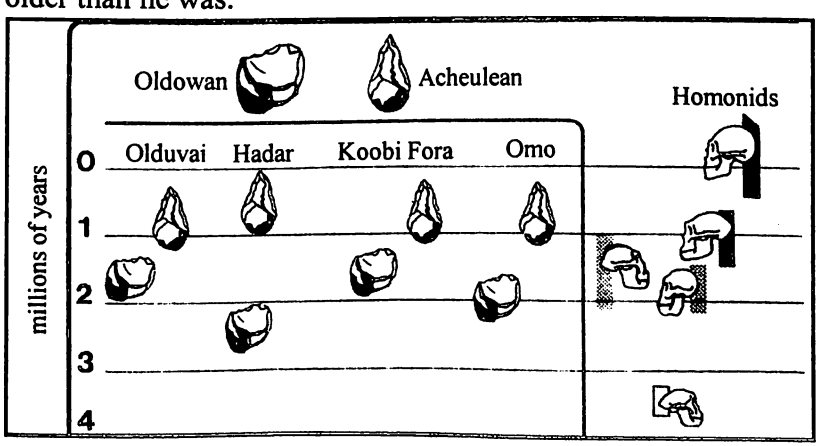
Human Ancestors

Source: Johanson D. and Edey M., 1981:286-87

Once they had perfected upright walking, they were free to walk wherever they chose, because upright walking itself is not inefficient. Upright walkers can walk all day as well as quadrants and it's only when they try to run that the quadrants are faster than bipeds. The fossil finds of Hadar, such as the knee joint, the first family, the jaws, Lucy, and fossils and footprints of Laetoli, lumped and named as *Australopithcus afarensis* are evidences of upright walking dated between 3.0 and 4.0 million years old. Tool using was insignificant around 3.0-4.0 million years ago. *Homo habilis* started using tools only in 2.5 million years ago. Our hominid ancestors were socially and sexually innovative apes who became bipeds and, as a result, managed to propagate human kind better than other apes. It was sheer luck that the human ability to stand up, leaving his hands free that led to a latter development of tools and a culture, and a still larger brain in modern humans (Lovejoy, C.O., 1980:52-250).

5. When did our Ancestors start using tools?

Calculating the age of a stone tools is not easy. Stone does not lend itself to radiometric dating even though it may have been made of volcanic rock. The reason is that the hominid that made it, may have picked up a piece that was fifty or a hundred million years older than he was.



Types of Stone Tools

Source: Johanson D. and Edey, M. 1981: 231

He may even have made the tool in one place and dropped it in another. Thus, stone tools have played a mixed role in the elucidation of early African prehistory.

The Hadar-Laetoli fossil specimens (*Australopithecus afarensis*) represent a common ancestor to the later australopithecines (*Australopithecus africanus* and *Australopithecus robustus*) and to *Homo* (*Homo habilis, Homo erectus,* and *Homo sapiens*). Divergence between the latter two types probably began around three million years ago. One line of evolution leading to australopithecines the *Australopithecus africanus* represents an intermediate stage on the way to *Australopithecus robustus* evolved from the ancestor *Australopithecus afarensis*. Paleoanthropologists however do not believe that this line was ancestral to humans. They believe that the humans evolved from another branch of *Australopithecus afarensis*, a process which began some three million years ago and was accomplished about two million years ago. By then, the human ancestors recognizable as *Homo habilis* walked on earth. So did other cousins, the *Australopithecus africanus* and *Australopithecus robustus*. For about a million years they appear to have lived side by side. A million years back, there were no australopithecines left. They had become extinct. There is no fossil evidence to prove that the australopithecines were using tools (Johanson D. and Edey, M. 1981: 35-52).

Homo habilis were the first human ancestors to devise stone tools and use it for hunting. *Homo erectus* evolved from *Homo habilis* around 1.5 to 1.0 million years ago. They are the human ancestors. *Homo erectus* is ancestral to the modern man *Homo sapiens* evolved around 50,000 years ago. Extremely primitive Oldowan tools of *Homo habilis* were found by Leakey at Olduvai Gorge and are now known to date back at least 1.8 million years, probably even back to two and a half million years, on the evidence of similar artifacts found at Hadar, Omo and Lake Turkana. Acheulean tool types appeared with *Homo erectus* suddenly about 1.5 million years ago and are believed to have evolved little thereafter. Both *Homo erectus* and Acheulean tool types were stubbornly

resistant to change for at least a million years. It would seem that the needs of an Early African hunter-gatherer were adequately served by the Acheulean toolkit and that there was little or no reason to improve it further. An arrangement of Oldown and Acheulean tools according to site and age reveals that the Oldowan are probably the work of *Homo habilis* and that the Acheulean are the work of *Homo erectus*. Oldowan tools at 2.5 million from Hadar suggest that *Homo habilis* may ultimately turn out to be that old also, since there is no good evidence from anywhere to indicate that australopithecines made tools of either type. Apparently stone tools are an invention of *Homo* (Ibid: 278-293).

6. Food Habits of the Human ancestor and its impact on Larger Animals

The earliest known human ancestors of 8.0 to 10.0 million years ago such as *Ramapithecus, Sivapithecus, Gigantopithecus, Limnopithecus, Hispanopithecus, Ouranopithecus* and *Rudapithecus* lived on essentially vegetarian diet, and perhaps occasionally catching small prey. This condition of vegetarian diet of our ancestors probably remained more or less unchanged upto around 3.0 million years ago (until the disappearance of *Australopithecus afarensis*). With the bifurcation of evolutionary lines into the populations of Australopithecine and *Homo* sometime around three million years ago, divergence in the food habits of our ancestors becomes evident. The australopithecines (*A. africanus* and *A. robustus*) fed on more and more coarse vegetarian diet with the development of larger mandible, larger premolars and molars. On the *Homo* line (human ancestors *Homo habilis, Homo erectus*) the molars remained unchanged. But with their invention of Oldowan stone tools by *Homo habilis* and Acheulean tools by *Homo erectus*, their food habits specialized to an omnivorous diet. They developed better hunting skills with their newly invented stone tools and became excellent hunter-gathers. They could live on any kind of diet depending on availability and this is one of the main reasons of their survival.

Homo erectus evolved into *Homo sapiens* and finally into a very successful hunter-gatherer. Their diet consisted of fruits, vegetables, roots and tubers, tender shoots, scavenging and hunting of both small and large animals (Ibid:278-293).

7. Extermination of large animal species by humans

With the spread of *Homo spp. (H. habilis, H. erectus, H. sapiens),* rapid extermination of large animal species took place. Eurasia, the world's largest continent was the first victim of mass extermination of large animal species by humans. Today, we regard Africa as the continent of big mammals. Africa was the least affected continent in the extermination binge launched by humans. In spite of Africa's long occupation before the colonization of Eurasia a million years ago, the proto-humans were at such a primitive stage then that they posed no serious threat to the larger animals there. Though not in the manifest abundance of Africa's Serengeti Plains, Modern Eurasia also had many species of big mammals such as Asia's rhinos, elephants and tigers, and Europe's moose and bears and until classical times lions. Most big mammals of Africa and Eurasia survived into modern times because they had coevolved with proto-humans for hundreds of thousands or even millions of years. They therefore received ample time to evolve a fear of humans as our ancestors' hunting skills improved. In contrast to Africa and then Eurasia, Australia/ New Guinea today has no equally large mammals, in fact no mammal larger than the 100 lbs. kangaroos. This continent formerly had its own suite of diverse big mammals, including giant kangaroos, rhino-like marsupial leopards. It also had a 400 lbs. ostrich-like flightless bird, impressively big reptiles including a one-tone lizard, a giant python and land-dwelling crocodiles. This mega-fauna of Australia/ New Guinea disappeared with the arrival of humans around 40,000 B.C. These big animals had the misfortune suddenly being confronted, without any evolutionary preparation; by invading modern humans possessing fully developed hunting skills. The

invading humans hunted these big animals indiscriminately for food, pushing them into extinction. Similarly, the dodo of Mauritious, giant lemurs of Madagascar, the big flightless geese of Hawaii etc are examples of extermination by humans. Soon after the arrival of humans in Siberia around 20,000 B.C. Eurasia's wooly mammoth and wooly rhinoceros went extinct.

Like Australia, the Americas had originally been full of big mammals. About 15,000 years ago, the American West looked much as Africa's Serengeti Plains do today, with herds of elephants and horses pursued by lions and cheetahs, and joined by members of such exotic species as camels and giant ground sloth. Just as in Australia/ New Guinea, so in the Americas, most of those large mammals were hunted to extinction. While the extinctions probably took place 30,000 years ago in Australia, they occurred around 12,000 years back in the America. For those extinct American mammals whose bones are available in greatest abundance and have been dated especially accurately, one can pinpoint the extinctions as having occurred around 11,000 B.C. Perhaps the most accurately dated extinctions are those of the Shasta ground sloth and Harrington's mountain goat in the Grand Canyon area; both disappeared within a century or two of 11,000 B.C. The hunters expanding southward through the Americas, encountering big animals that had never seen humans before would have found American animals easy kills and ended up exterminating them.

The spread of human habitation having excellent hunting-gathering skills and omnivorous diets around the world has been mainly responsible for extermination of larger animals from many newly inhabited continents and island of the world. Added to this is the climate change factor often reasoned for extinction of many big animal species. Extensive extermination of big animals by human hunter-gatherers, and excessive extraction of wild food-plants continued upto the end of 12,000 B.C. The age also marks the end of the Pleistocene Era and the last of Ice Age. The end of Pleistocene Era marks the scarcity of food for the hunter-gatherers due to excessive killing

of bigger animals and also excessive harvest of wild food-plants the world over, which compelled the human race to find alternative means of food for survival in some parts of the world. The situation also compelled the human race to think over domestication of plants and animals for food, give up their nomadic lifestyles and start village or settled life with agriculture at least in some parts of the world for survival. However, many isolated countries or places inhabited by primitive tribes continue a hunting-gathering lifestyle even today (Diamond, J. 1997: 157-175).

8. Human habitation in Sikkim

Archeologists organize the chronology of human habitation into several periods.

(i) Archaic Period (c. 38,000 B.C. - 2,500 B.C): migration of human beings which started about 40,000 years ago from Africa.

(ii) Formative or Pre-classic Period (c. 2,500 - 100 B.C.): Village grew in size and population.

(iii) Proto-classic Period (c. 100 B.C. -300 A.D.): Complex Urban cultures began.

(iv) Classic Period (c. A.D.300 - 900): writing reached a high level of complexicity; peak of the classic culture.

(v) Post-classic Period (c. A.D. 900 - 1520): abandonment of classic cultures and beginning of modern cities.

So far as habitation of Sikkim is concerned, the aboriginal Lepcha and Limboo mythology (oral myths) maintains that Greater Sikkim was inhabited by these aboriginal tribes from the Archaic period of human migration (c. 38,000 - 2,500 B.C.). The Limboo Mundhum (oral myth) describes that the Limboo progenitors were created by their creator god *Sigera Yabhundin Mang Porokmi Wambhami Mang* with the blessing of the Almighty Goddess *Tagera Ningwaphuma* at Phoktanglungma-Pembenlungma (Kumbhakarna/ Jannu) mountain through the process of biogenesis. Similarly, the Lepcha tradition narrates that the Lepcha progenitors were created

by their Goddess *Itbu-mo* out of the untroden snow of Kangchenjunga at the mountain itself (Subba, J.R. 1999; 2005; 2008).

Historical evidence of the human habitation in this part of the Himalayan region is available only from the Pre-classic or Formative period (c. 2,500 - 100 B.C.) onwards. Legend has it that there were 29 Rajas/ Kings of the Kirant (Limboo, Khambu, Yakha) Dynasty of Nepal beginning with Yalamber, whose capital in the beginning was at Yalung, on the bank of Yalung River, a tributory of Tamber River in Limbuan - the land of the Limboo tribes, now in Eastern Nepal. Limbuan is the landmass bounded by the Arun River to the West and Mechi River in the East and was a part of Greater Sikkim between 1642 A.D. to 1733 A.D. During the reign of the seventh Kirant King, Jitedasti, Sakya Simha (Buddha) is believed to have come to Nepal. The Kiranti oral history also hands down that Jitedasti assisted the Pandavas in the great war of Mahabharara and was killed in battle which dates back to about 600 B.C. During the reign of Stunko (226 B.C.), the fourteenth king of this dynasty, Ashoka, the king of Pataliputra (Patna), came to Nepal (Vansittart, E. 1896:10-27).

Similarly, the first Lepcha king (Panu), Thekong Adek ruled the present area of Sikkim in the 7th century A.D. (Classic Period). Subsequently, 10 Lepcha Kings/ Panus (the religious and administrative tribal chiefs) ruled this part of Sikkim upto 1642 A.D (Classic and Postclassic period). The last Panu was Thekong Mon Solong who continued his kingship till the establishment or formation of a Chiefdom with Namgyal Dynasty in Greater Sikkim (Halfdan, Siegen 1967; Subba, J.R. 2008:2-3).

Greater Sikkim (inclusive of Limbuwan in present day Nepal, Chumbi valley now in Tibet, and Har Chu and Ammo Chu valleys in present day Bhutan) was inhabited mainly by Lepcha, Limboo and Bhutia tribes, the last arriving after the 13th century A.D. They continued their hunting-gathering lifestyles till the end of eighteenth century (1890 A.D.). They were still primarily hunter-gatherers also practising shifting cultivation (slash and

burn cultivation) on the sloppy mountainous lands.

This is evident from the "Himalayan Journal - Notes of Naturalist" by Hooker J.D Vol. I: pp123-124 who visited Sikkim on November 1949. In his own words:

> ".. rice forming their chief sustenance; ..grown without irrigation, and produced a large, flat, coarse grain which becomes gelatinous, and often pink, when cooked. Pork is a staple dish, and they also eat elephant, and all kinds of animal food. When traveling, they live on whatever they can find, whether animal or vegetable. Fern-tops, roots of Scitaminece, and other flower-buds, various leaves, and fungi are chopped up, fried, and eaten. They drink out of little wooden cups, turned from knots of maple or other wood. ... Their intoxicating drink, which seems more to excite them to debauch the mind, is partially fermented Murwa grain (*Eleusine coracana*) finger millet. Spirits are rather too strong to be relished raw, and when a glass of wine is given to one of the party he sips it, and hands it round to all the rest. ... They never inhabit the same spot for more than three successive years, after which the Rajah demands an increased rent. They therefore, squat in any place, which he can render profitable for that period, and then moves to another. His first operation, after selecting a site is to burn the jungle; then he clears away the trees, and cultivates between the stumps. Some low steep spurs were well cultivated, though the angle of the field was upwards of 25 degree, the crops, chiefly maize. Large fish, chiefly Cyprinoid, were abundant in the beautifully clear water of the rivers."

Only in the last decade of the nineteenth century (1890s A.D.), when the Colonial British Administration started settling Nepalese from Nepal by clearing the forest, did settled agriculture on permanent basis through bench terracing of the lands for cultivation begin in Sikkim.