

## Chapter Three

## Time and Place

### Human Evolution

This chapter relates the mainstream scientific conventions on the evolution of the human specie.

As more than forty different scientific disciplines interrelate with this subject, it is not surprising that there are disagreements on many matters. Nevertheless, it is still possible to state the generally agreed conclusions - and list some of the exceptions and variations.

The chapter has been structured to relate the conventions on human evolution in the context of several scientific disciplines, notably: Paleoanthropology, Paleoecology, Paleogeology, Palaeontology, Morphology, Orthodontology and Molecular Biology.

Paleoecology and Paleogeology are relatively new scientific disciplines, which have made an important contribution to the increase in factual evidence - relating the prehistoric, biospheric conditions to the prehistoric, floral/faunal interrelationships.

In particular, they have noted the variations in prehistoric, biospheric temperature and humidity. In this context, a decrease in temperature is very often accompanied by a similar decrease in humidity - as water accumulates in the polar regions, in the form of ice.

The temperature variations affect the biosphere both latitudinally and longitudinally, but in different ways. The main geographic changes are latitudinal. When the temperature rises, the size of the tropical and temperate regions increase. When the temperature falls, the subtropical and polar regions increase.

By contrast, the longitudinal variations tend to be localised, and are primarily due to the results of continental drift. This causes the formation of mountain ranges, which interfere with the movement of moisture-laden air. In addition, when continental drift creates oceanic trenches, the resultant cold currents change atmospheric circulation patterns.

This background information, on the formative influences upon the prehistoric biosphere, provides an excellent structure upon which to base this account of the mainstream conventions on human evolution.

### Classification

In the Linnaean classification system, the human specie belongs to the class of Mammals; the order of Primates; the super-family of Hominoidea; and the family of Hominidae.

New World monkeys are classified as Platyrrhini, while Old World monkeys and apes (including humans) are classified as Catarrhini. The latter are further sub-classified, with the Old World monkeys called Cercopithecoids, while apes and humans are called Hominoids.

The similar sounding term: Hominids, applies only to humans and their prehistoric, non-ape ancestors.

## **Helpless as a Baby**

## **Time and Place**

The mainstream scientific conventions on hominoidal evolution, suggest that the ancestors of the hominoids diverged from the ancestors of the Cercopithecoid monkeys, about 32 million years ago.

According to Paleogeological data, this date coincides with an increase in the prehistoric biosphere's temperature and humidity.

At present there is no data concerning the divergence of the ancestors of the small hominoids, (i.e., the ancestors of the Gibbon). However, there is abundant fossil evidence concerning the divergence of the ancestors of the larger hominoids, which indicates that this radiation took place about 17 million years ago.

The Paleogeological records suggest that once again this date coincided with another temperature variation. This time, the climate was becoming colder and drier.

### **Africa and Asia**

It appears that continental drift may have been partly responsible for the division of the tropical habitats of the hominoid ancestors of the Orang-utan and the African apes. About 10 million years ago, continental drift linked Africa and Arabia with Eurasia, thereby allowing the migration of African hominoids and many other mammals, into Europe and Asia.

At this time, the Alps rose in Europe; the Taurus mountains in Turkey; and the Zagros mountains in Iran. By contrast the Tethys Sea, which used to link the Mediterranean with the Red Sea disappeared -- causing large changes in atmospheric and oceanic circulation patterns.

Two of the better known fossils from this period, are classified as Proconsul and Ramapithecus. The present conventions hold that the former became extinct about 18 million years ago, and was an ancestor of all the hominoids, except the Gibbon. Ramapithecus became extinct about 10 million years ago, and was a variant specie of the direct ancestor of the Orang-utan.

The next major species divergence took place about 7.5 million years ago, when the ancestors of the African apes diverged from the Hominids.

There is some disagreement, between the Palaeontologists and the Molecular Biologists concerning the divergence point of the Gorilla. The former estimate a divergence date of about 7.5 million years, while the latter (using data on the RNA content of mitochondria) consider the Gorilla diverged from the Chimpanzee line about 2 million years ago.

The divergence between the Hominids and the African apes coincided with another temperature variation. This time the biospheric climate was entering another warm phase.

Some Paleoecologists, who have been studying a period known as the Terminal Miocene Event, have concluded that between five and six million years ago the climate became much cooler than previously. This period of sharp climatic change has been documented by: analysis of deep-sea cores and terrestrial deposits; by fossil pollen and land snails; and by dramatic changes in mammalian life.

## Helpless as a Baby

## Time and Place

The sharp drop in temperature produced a rapid build-up of ice in Antarctica. The resulting ice sheets took up so much water that sea levels world-wide dropped between 160 to 190 feet. In addition, rainfall in many places was correspondingly affected.

Across many regions of tropical Africa, warm climates became cool; and wet lands became arid. The heavily wooded areas were replaced by grassland and scattered clumps of trees. The normal habitats of the ancestral apes were greatly affected by this change.

Studies of prehistoric fauna, have shown that at this time many species of forest or bush antelopes became extinct, while whole new groups of open-country, grazing antelopes appeared for the first time ever on the fossil record.

## Hominids

The Hominids are divided into two genera, namely: Australopithecus and Homo. The former appear first upon the fossil record about four million years B.P. (before present). The first specie are generally classified as Australopithecus Africanus, (and were previously known as Australopithecus Gracile). The earliest fossils of this specie indicate that it was semi-bipedal.

Modern techniques of measurement and analysis, using X-rays and CAT scans, have shown the femur of these fossils to be similar in structure to that of the human specie. Fortunately, the fossils have been found in an area which was subject to much volcanic activity. This means that the frequent layers of ash produced by the volcanoes can be analysed for dating purposes using the argon 40/argon 39 dating method.

Palaeontologists have discovered footprints in a layer of volcanic ash, which has been dated at 3.75 million years. Photogrammetric techniques have proved that these footprints were made by a semi-bipedal hominid.

About 3.8 million years B.P. the Earth was affected by another temperature variation. This time the climate became cooler and drier.

The most complete fossil skeleton of this period, is that of a female hominid, which is classified as a separate specie, namely: Australopithecus Afarensis. Some Palaeontologists regard this as a variant specie of Australopithecus Africanus. The geographical locations are similar, but there is a large time displacement as the A. Afarensis fossil is dated at 3.5 million years B.P.

Australopithecus Afarensis had large cheek teeth which were capped with thick enamel. This is considered to have been an adaption to chewing large quantities of fruit, seeds, pods, roots and tubers.

The morphology of A. Afarensis shows quite clearly that it was bipedal, but the toe bones and metatarsal are long and curved. Compared with humans, the arms of this hominid were relatively long, while the legs were short.

The A. Afarensis is primitive in most of its features. The adult males were probably between 50 - 100% larger than the females. Individual weight varied from about 25 - 50 kgs. The fossil evidence is very varied, but the brain seems to have been about the same size as that of the African apes. However, it is not clear whether the brain size/body weight was larger or smaller.

## Helpless as a Baby

## Time and Place

In some ways, the face and palate resemble that of the Chimpanzee, but the overall skull shape is more similar to that of a female gorilla. In this context, the *A. Afarensis* has large teeth and is more robustly built than a Chimpanzee. However, the canine teeth of both sexes have a low crown, and have lost their ape like forward projection.

These hominids of East Africa lived in an area consisting primarily of woodland and Savannah, away from the forests. There is no evidence of any tools, but it seems probable that they would have used tools like those of Chimpanzees, namely: stems, leaves, wood and stones.

Between 2.5 million and 2 million years B.P., the African hominids underwent a modest adaptive radiation. In South Africa, fossil evidence indicates the emergence of *Australopithecus Robustus* and *Homo Habilis*. At the same time, in East Africa, *Australopithecus Boisei* appears on the fossil record.

*Australopithecus Boisei* was a very robust specie of hominid, with very large jaws and teeth. However, although it was much larger than *A. Afarensis* and *A. Robustus*, it was smaller brained, and the male was markedly larger than the female. *A. Boisei* may have dug with sticks, and hammered food with stones, but there is no evidence that it used tools intensively.

In the same area, *H. Habilis* appeared about the same time. It had a larger brain than the *Australopithecenes*. There was probably another, small brained and small toothed hominid living in East Africa at this time; but there are insufficient fossils to allow a new classification.

The Paleoecological evidence suggests that there was another variation in the Earth's temperature, starting about 1.9 million years B.P. This time the biosphere began to get warmer.

### **Homo Habilis**

*Homo Habilis* was like the *Australopithecenes* in respect of its teeth and face. However, it had a significantly larger brain, averaging about 700 cubic centimetres. Its limb bones are not like those of the *Australopithecenes*. They are much more similar to later types of the Genus *Homo* (with the exception of modern *H. sapiens Sapiens*).

The implication is that the limb changes resulted in a change of locomotion, with the hominid becoming more bipedal than before. In addition, the changes in the dimensions of the female pelvis suggest an increase in the size of the new born infant.

The first archaeological sites appear at the same time as *A. Boisei* and *H. Habilis*, in East Africa. Concentrations of used and altered stones, often brought from some distance away, have been found together with animal remains. These sites are linked, in Paleontological terms, with the fossils of *H. Habilis*; and suggest a dietary change -- with more animal food.

By 1 million years B.P., all the *Australopithecenes* and *H. Habilis* had become extinct.

The Paleoecological record shows that about one million years B.P. the Earth had another global temperature variation, this time getting colder.

## Helpless as a Baby

## Time and Place

### Homo Erectus

The oldest fossil of Homo Erectus dates from about 1.6 million years B.P., and was found in East Africa. By 1 million years B.P., this specie of hominid had spread to south eastern and eastern Asia, and survived in that area until about 300,000 years B.P.

H. Erectus resembled later specie of Homo (modern H. sapiens Sapiens excepted) , in both body size and robustness. It was larger brained than H. Habilis (more than 800 cubic centimetres), and it had front teeth as big as those of earlier hominids. However, its cheek teeth and face were smaller.

The archaeological record suggests some H. Erectus populations were making larger, symmetrically flaked stone tools known as bifaces, or 'hand axes' . Moreover, there is evidence that some H. Erectus populations may have used fire.

The Paleoecological data shows that the Earth underwent more rapid temperature variations, with warm periods at 750,000; 350,000; and 150,000 years B.P. These alternated with cold periods at 450,000; 230,000; and 70,000 years B.P.

Homo sapiens Archaic appears on the fossil record about 500.000 years B.P. These hominids had the big browed, flat skulled shape of H. Erectus. However, the teeth were a little smaller. By 200,000 years B.P., the fossil evidence suggests that the brain volume had expanded considerably.

At about 125,000 years B.P. Homo sapiens Neanderthal appears on the fossil record. By now the brain, in terms of size and organisation, was similar to that of modern Homo. sapiens Sapiens.

### Homo sapiens Neanderthal

The Paleoanthropological conventions on the H. sapiens Neanderthal, consider they were much more robust than present day humans -- and much stronger.

The Orthodontologists have shown that Neanderthal teeth were larger than those of present day humans, although many of the teeth examined show great signs of wear. By analogy with present day Eskimos, it is thought that this was due to the need to soften animal hides by chewing them.

The Homo sapiens Neanderthal body proportions, with rather short lower limbs, were like those of Eskimos, Lapps and other cold-adapted peoples.

They had notably large heads, and faces which retained the heavy brow ridges that tended to curve over the eye sockets. Receding cheekbones, weak chins, large noses, and protruding jaws were characteristic - particularly so in the case of the H. sapiens Neanderthal of Europe. The average brain was larger than present day humans, and just as well developed. However, the brain weight-to-body size was probably similar.

Their remains are found chiefly in caves and rock shelters, where they took refuge. They produced much better stone tools than their predecessors. These Mousterian tools, as they are known, are finer and much better shaped than those of H. Erectus.

## Helpless as a Baby

## Time and Place

The wear marking on many tools suggest that these were used mainly for cutting and scraping hides. This suggests a change of diet, from gatherer-hunter to hunter-gatherer, living mainly upon meat. These people lived through the ice ages, on the arctic tundra and ice fields.

During a relatively short span of 100,000 years, the H. sapiens Neanderthal spread throughout Europe, the Middle East, Western and Central Asia. They were contemporaries of other forms of H. sapiens Archaic found as far away as China and South Africa.

## Homo sapiens Sapiens

The transition from Homo sapiens Neanderthal to modern Homo sapiens Sapiens was marked by a reduction in the robustness of the skeleton, face and teeth. There were also further changes in the morphology of the female pelvis, suggesting that the size of the new born infant was getting larger - despite a general reduction in the size of the skeleton.

Modern H. sapiens Sapiens appears on the fossil record in various parts of the world, notably the Middle East, South Africa and South East Asia. They appear to have evolved from the H. sapiens Archaic, rather than the H. sapiens Neanderthal. The earliest remains are dated between 50,000 and 100,000 years B.P.

By 35,000 years B.P. the H. sapiens Neanderthal seem to have become extinct, and about the same time a robust form of modern H. sapiens Sapiens replaced them nearly everywhere.

This robust form of modern H. sapiens Sapiens is called Cro-Magnon, and the evidence suggests that these people were highly skilled nomadic hunters, who followed reindeer in their seasonal migrations. They had developed the use of spear-throwers, and generally sought shelter in caves and rock shelters -- like the Neanderthals. Their tools were still stone and bone, but much more skilfully worked; and they also decorated caves with artistic representations of their prey.

## Tool Manufacture

Modern H. sapiens Sapiens has changed relatively little, in terms of structure or brain size, but the archaeological record shows a steady rate of improvement in tool manufacture. The conventions suggest that genetic evolution was replaced by cultural evolution. However, the marginal variations in skeletal structure imply a degree of genetic adaption to tools, in respect of changes in the morphology of the hands and the amount of neurophysiological evolution related to hand movements.

The Mousterian tool industry, associated with the Neanderthals, was overlapped by the Levalloisian tool industry. This produced thin, oval shaped knives by working a large tortoise shaped core.

The late Palaeolithic tool making industries are all associated with modern H. sapiens Sapiens. The Aurignacian and Gravettian tool makers made blades and scrapers in long, thin flakes. The Solutreans developed the technique of pressure flaking. This involves the removal of many tiny flakes of stone by pressing the point of a wooden tool against the flint work piece. This culture produced leaf-shaped spear tips up to 18 centimetres long.

## **Helpless as a Baby**

## **Time and Place**

In the late Palaeolithic period, the Magdalenians produced tools for carving and engraving wood, bone, and antlers, for use as implements or weapons.

The Mesolithic cultures refined the tool making techniques, and are particularly noted for the production of microliths. These are tiny flints which were used for arrow heads.

### **Agriculture**

In the Neolithic period, as modern *H. sapiens Sapiens* began to practice nomadic and sedentary agriculture, these cultures developed grinding and polishing techniques for the finishing of stone tools. The earliest archaeological evidence of sedentary agriculture, is about 18,000 years B.P. As with previous cultures, there was a considerable overlap between the development of agriculture, and the gradual switch from hunter-gatherer cultures to those based upon nomadic herding, or arable farming.

The ratio of hunting to gathering of the *H. sapiens Sapiens* tribes varied according the environment. In the arctic regions the cultures were heavily dependent upon meat -- hunting seals, whales, fish, shellfish, reindeer and walrus. In subtropical regions, the diet was mainly fruit, nuts and tubers, but this was varied with opportunist spearing of game.

The stability of these cultures indicates that in all but the very worst seasons the tribes enjoyed a good surplus of food -- and had plenty of leisure time

The mainstream conventions agree that the establishment of sedentary agriculture (where the farmer is not nomadic, but stays in one place), led to a tremendous increase in the rate of cultural evolution. However, there are no agreed conventions on the reasons for this increase in the rate of change.

### **Conclusion**

Chapters One, Two and Three have related a simplified account of the mainstream scientific conventions on universal, ecological, and human evolution.

The next chapters describe the author's propositions on the process of general and human evolution. As such, they attempt to relate a simplified account of the evolution of life -- with specific reference to the evolution of the Human specie.