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Pre-Flood Giantism: A Key to the Interpretation of Fossil Hominids and Hominoids

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ABSTRACT

Most palaeontologists and palaeoanthropologists, who subscribe to the evolutionary theory of origins, believe that man shared a common ancestor with the pongids at some time in the remote past. Whilst a plethora of hominid and hominoid phylogenies have been devised by evolutionists during the latter half of the current century, the origins of the living anthropoid apes remain largely a mystery.

The acknowledged absence of so-called 'missing links' between the presumed-to-exist common ancestor(s) of both fossil apes and living pongids comes as no surprise to the creationist. He contends that they never existed. Chimpanzees were always chimpanzees, and gorillas were always gorillas, in accordance with genus fixity and predefined limits of variation at the species and sub-species level. The evolutionist, on the other hand, cannot but be perplexed by the conspicuous absence of these vital 'missing links'. However, a dilemma confronting **both** the creationist and evolutionist alike is **the almost total absence of recognizable representatives of the living anthropoid apes in the recent fossil record.**

Palaeoanthropologists have posited a number of possible 'missing links' between a hypothetical common ancestor with the living anthropoid apes and modern man *(Homo sapiens sapiens)*. They include the Afar/Laetoli and gracile australopithecines *(A. afarensis* and *A. africanus*, respectively), the habilines *(A.* and/or *H. habilis)*, and the pithecanthropines (or *H. erectus)*.

Recently, however, suggestions have been made that some, if not all, of these purported **hominids** may be more closely related to the pongids than to man; that is to say, they may be better described as **hominoids**. It is the present writer's opinion that many of the so-called hominids and hominoids are **merely giant forms of pre- and immediate post-Flood pongids**, and that some may be represented amongst extant genera and species of anthropoid ape.

There is a generally accepted principle inherent in evolutionary thinking that 'small gives way to large with the passage of time', for example, the purported horse series. The biblical view of earth history, on the other hand, may well infer that the converse is true; that is to say, that morphological shrinkage (or **diminution**) has taken place in the recent past. In reference to the period immediately preceding the Biblical Flood, the writer of the book of Genesis describes the existence of '*. . . giants* (Hebrew "nephilim") *on the earth in those days, **and also afterward***' (Genesis 6:4). The Russian geologist I. A. Rezanov, in his book **Catastrophes in the Earth's History**, relates a Mexican legend in which reference is made to the destruction (by God) of **a race of giant men, who existed before the Flood**.

The fossilised remains of both flora and fauna are, as a rule, significantly larger in the past than in their extant counterparts. One possible explanation for this 'shrinkage' over time is that the growth potential of living organisms has been impeded through earlier maturation and declining longevity; a consequence of changes in the prevailing biospheric conditions during the earth's recent past. It is proposed that these changes were brought about by, and as a consequence of, geophysical, atmospheric and biological changes, initiated during the Flood. The writer proposes that morphological shrinkage is **primarily a phenomenon of the post-Flood period, as was declining longevity and earlier skeletal maturation.**

The following paper examines the phenomenon of **pre-Flood giantism and post-Flood diminution**, and their implications for the interpretation of purported fossil hominoids and hominids. An attempt is made to establish a time-frame during which these creatures lived (and died). The morphological characteristics of living anthropoid apes and modern man are then compared and contrasted, including reference to comparative and relative brain size. All too often, popular journals and books describing fossil hominids and hominoids concentrate on a single, or few, man-like features, ignoring a great many other characteristics which are unquestionably pongidal.

A model, based on a biblical framework of earth and human history, is devised for the interpretation of fossil

hominoids and hominids. The model embraces **simultaneous migration and morphological shrinkage** of post-Flood populations of anthropoid apes and men, together with a rapid radiation of various life-forms (including the great apes) from the immediate vicinity of Mt Ararat (in Eastern Turkey).

An attempt is made to deduce the likely extent of post-Flood diminution. Comparisons are drawn between several living primates, including the gelada baboon *(Theropithecus gelada)* and the orang-utan *(Pongo pygmaeus)*, and their possible immediate post-Flood ancestors, *Simopithecus* and *Sivapithecus meteai/indicus*. It is deduced that diminution, of the order of 33 percent in body height or length, may not be unrealistic.

The writer then suggests that *Sivapithecus meteai* and *indicus* (from Turkey and Pakistan, respectively) represent migrating populations of post-Flood orang-utan; the former, described in evolutionary terms as representing the **derived condition**, being closer in morphology and body size to the giant, pre-Flood form, whilst the latter represents the assumed-to-be more-primitive (ape-like) form of the genus.

Evidence of diminution in the human species is evinced through comparisons of the cranial capacities of recognizable fossil men (e.g. the Neanderthal and Cro-Magnon races) and those of modern man; the late Pleistocene humans possessing cranial capacities 20 percent greater than the modern-day average.

The perceived decreases in cranio-facial, dentitional and/or post-cranial remains of *Sivapithecus, Simopithecus (Theropithecus)* and late Pleistocene man, to those of their extant descendants, are relevant to the interpretation of fossil hominoids and hominids. If the cranial capacities or skeletal dimensions of the fossil ancestors of orang-utans, geladas and man were substantially greater in the past, then the same might also hold true of other primates.

Notional mean values and ranges in cranial capacity for pre-Flood chimpanzees and gorillas are predicted prior to an analysis of the cranio-facial remains of a number of fossil hominoids and hominids (including the *Homo* habilines, gracile and robust australopithecines, and the Hadar/Laetoli fossils).

It is suggested that these fossils may be broken down into two groupings: the first characterised by dolichocephalic (oval) braincases and generally representative of the gracile australopithecines and *Homo* habilines (post-Flood diminution accounting for the significant differences in cranial capacity), and the second group by spherical braincases and massive musculature anchorage structures — the robust australopithecines. The former group shares strong affinities with the living pygmy chimpanzee, *Pan paniscus,* whilst the robust line may represent an extinct form of pygmy gorilla.

'MISSING LINKS' OR PRE-FLOOD PONGIDS

Some time ago the author purchased a copy of Dr Donald C. Johanson and Maitland A. Edey's book, **LUCY: The Beginnings of Humankind**.[1] Johanson had acquired considerable media exposure following the discovery of 'Lucy' (AL 288–1) and the *afarensis* species of Australopithecines. Reports of the discovery of the so-called 'first human family' were splashed across the pages of most of the world's major tabloids. The December, 1976 edition of **National Geographic** carried the story of the discovery of the Hadar hominids under the heading, 'Ethiopia Yields First "Family" of Man'.[2]

Johanson and Edey's book purported to give account of subsequent expeditions and investigative work following the initial discoveries and newspaper hype. The authors recounted many of the difficulties they had encountered in interpreting the fossilised remains of the *afarensis* hominids. Palaeontology and palaeoanthropology have never been sciences in the strict sense of the word. They have been fraught with misinterpretations, false leads and claims, frauds and personality clashes.

Prior to making the discoveries at Hadar (Ethiopia), Johanson had been undertaking doctoral research on chimpanzee dentition. On page 127 of **LUCY: The Beginnings of Humankind** the authors recounted how Johanson had acquired access to a vast number of chimpanzee skulls from within the United States. However, he still felt the need for a larger sample group in order to complete his dissertation.

> *'. . . I also needed more chimpanzee skulls to complete my dissertation. There were two collections in Europe that, added to those in the United States, made a total of 826 specimens, a large enough sample to be statistically valid. (These, incidentally, were all of modern chimpanzees.* ***No fossil chimpanzee skull has ever been found.)'***[3]

Some 56 years earlier, a lecturer at the University of Witwatersrand, Johannesburg — Raymond Dart — announced to a disbelieving world the discovery of a 'missing link' older than the near-men of Western Europe (i.e. the Cro-Magnon and Neanderthal races). Dart's claims of a hominid status for the fossil (which subsequently became known as the Taung child) were treated with varying degrees of skepticism by the experts of the day. The skull bore a striking resemblance to juvenile chimpanzees, possessing a rounded cranial vault, prognathous (protruding) jaws and simian-like chin. However, its dentition was discernibly different to that found in living species of chimpanzee. Its cheek teeth were large in comparison to its front teeth.[4] It lacked pointed (or conical) canines; they were neither large nor projecting, as is the case in extant juvenile and adult chimpanzees. Furthermore, because of the reduced size of the canines, there were no associated diastemata ('gaps' between the canines and adjacent teeth; second incisor in the upper jaw, and first premolar in the lower jaw) present in either the mandible (lower jaw) and upper jaw (maxillary/palate).

The skull was certainly larger than that belonging to a baboon of similar age (estimated to be approximately six years old). Sir Arthur Keith, the famous British anthropologist and anatomist, concluded that the skull belonged to a juvenile chimpanzee or gorilla. Despite the skepticism expressed concerning the purported hominid status of the Taung child, Dart went ahead and gave it a new and separate taxonomic description — *Australopithecus africanus* (or 'southern ape of Africa').

Comparative lateral views of the Taung child and a juvenile chimpanzee are shown in Figure 1. The morphological similarities are self-evident. An early estimate of the Taung child's cranial capacity (525cc) was later reduced to 407cc.[5] An estimate of the anticipated adult cranial capacity (440cc) has been documented by R. L. Holloway.[6] This value is well within the range of modern chimpanzees, although some 16 percent above the mean value.

In his book, **The Natural History of Man**, Professor J. S. Weiner stated that:

> *'The ape-like profile of* Australopithecus *is so pronounced that it* ***can be superimposed on that of a female chimpanzee with a remarkable closeness of fit****, and in this respect and others it stands in contrast to modern man.'*[7]

Richard Leakey, a long-time advocate of polyphyletic approaches to hominid origins, has consistently asserted that the gracile australopithecines *(A. africanus)* have no place in the evolutionary origins of man. His often controversial views have recently led him into conflict with Donald Johanson and Timothy White; so much so, that they have charged that:

> *'Modern chimpanzees, by this definition* (Richard Leakey's) *would be classified as* A. africanus *(gracile australopithecines).'*[8]

Such a charge is not to be taken lightly, since it implies that (at least in Leakey's opinion) *A. africanus* should be dethroned as a hominid.

More recently, Johanson's own *afarensis* finds have come under attack by a number of authorities. Several leading exponents of the transformist view, including Noel T. Boaz[9] and Phillip V. Tobias,[10] have suggested that *A. africanus* and *A. afarensis* are one and the same species; that is to say, they are **conspecific**. Several other authorities, including Adrienne L. Zihlman, J. E. Cronin and Nancy Makepeace Tanner, have drawn remarkable analogies between gracile australopithecines (including some of the Hadar material) and the living pygmy chimpanzee, *Pan paniscus*.[11-13] There appear to be strong morphological affinities between the limb bones of AL 288–1 ('Lucy') and extant pygmy chimpanzees.[14] Furthermore, some of the basal jaws from the Sidi Hakoma Formation at Hadar (e.g. AL 199, 200 and 400) also share morphological affinities with *Pan paniscus*.[15]

More recently again, and following the discovery of a specimen of *Homo habilis* in Tanzania's Olduvai Gorge (OH 62), Johanson and his fellow-workers from the Institute of Human Origins were forced to concede that the post-cranial skeletal remains of the habiline shared many characteristics with his earlier *afarensis* find, 'Lucy' (AL 288-1).[16] This discovery raises serious questions concerning the presumed hominid status accorded the habilines.

It is the opinion of this author that many of the so-

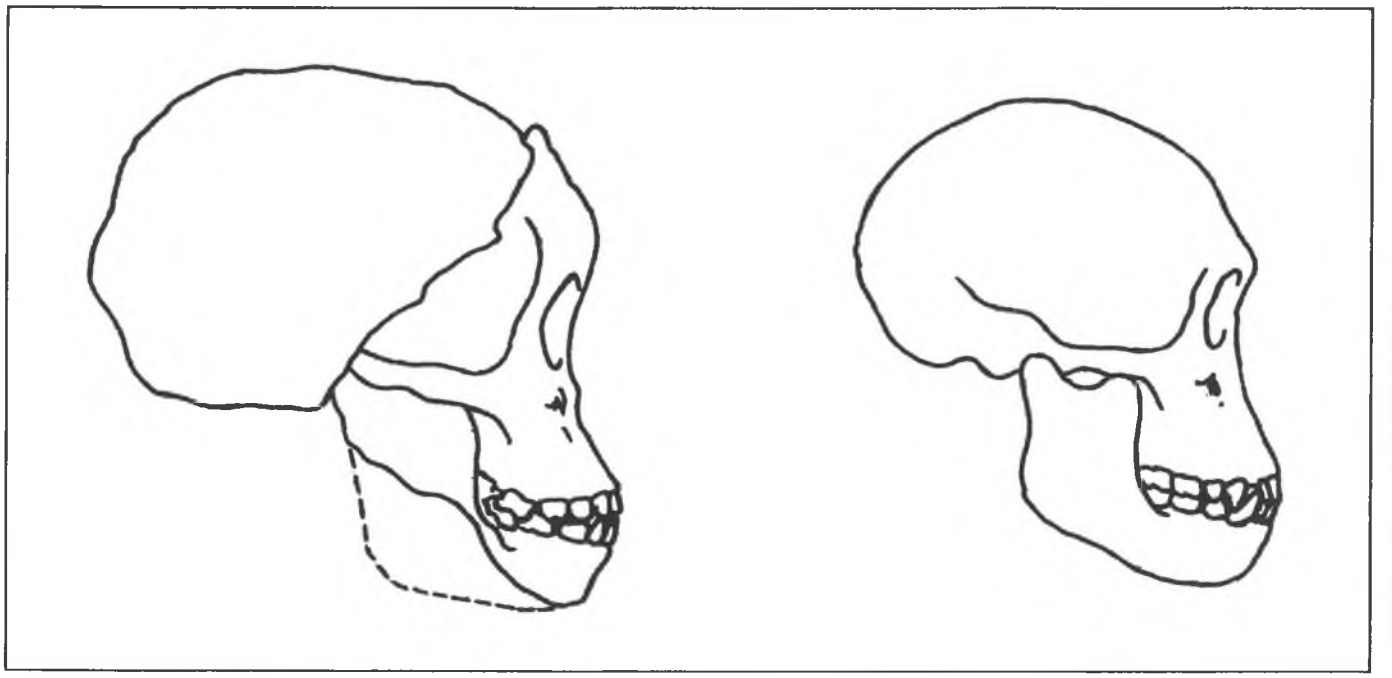


Figure 1. LATERAL VIEWS OF 'TAUNG CHILD' AND JUVENILE CHIMPANZEE

called fossil hominids adorning current anthropological and palaeontological texts are **giant forms of post-Flood anthropoid apes**.

To date, most creationist appraisals of fossil hominids have taken the form of critiques of the evolutionary literature. For some time now, there has been a need to develop a credible creationist model of human and pongid history (and origins). To this end, the present author has adapted Dr John Osgood's **'Pond-Ripple'** model of human history, devised a few short years ago, and applied it to the pre-Flood giantism hypothesis.[17] It is the author's belief that it may be possible to trace the descendants of giant, pre-Flood pongids as they repopulated the earth following the Biblical Flood. Post-Flood migration and simultaneous morphological shrinkage — subjects which will be examined in this paper — provide a basis for testing the validity of the pre-Flood giantism hypothesis, and especially as it pertains to possible identities of purported hominoids and hominids.

The writings of many prominent evolutionists have been cited in the development of this model. There has been an increasing willingness on the part of some evolutionary authors to question established beliefs concerning man's origins. In the past, there has been a tendency to accentuate the man-like characteristics of some purported hominids and, at the same time, play down the obvious ape-like features. In this regard, the recent writings of such authors as Adrienne Zihlman, Nancy Makepeace Tanner, Charles Oxnard, J. T. Stern, R. W. Susman, C. B. Stringer, Noel Boaz, John Gribbin and Jeremy Cherfas are to be commended.

A number of articles by creationists, including Gary E. Parker, Duane T. Gish, Joseph P. Dillow, Erich A. van Fange, Malcolm Bowden, Chris Hummer, Gerald Duffet, Kevin C. McLeod and A. W. Mehlert, have been of assistance in the development of the following model. I am particularly indebted to the late Dr Arthur C. Custance; his thoughtful **Doorway Papers** have provided many valuable insights into dietary induced changes in dentition and skull morphology.

The following paper is by no means exhaustive in its examination of the available data. If anything, it points out how little material of worth has been recovered by the palaeontologist and palaeoanthropologist in the 130 years since the publication of Darwin's **The Origin of the Species**.

It is hoped that the pre-Flood giantism hypothesis will provide sufficient scope for further development and research. The strength of the proposed model lies in its predictive nature, and to this end, it may provide a positive alternative to the current naturalistic (transformist) theory of origins.

THE PHENOMENON OF GIANTISM IN THE FOSSIL RECORD

The fossil record abounds with instances of **giantism,** that is, forms of life which are measurably larger in their ancient, ancestral form (as represented by fossil remains) than their living equivalent. An excellent example of such is elucidated by Richard Leakey in his book, **The Making of Mankind**.[18] Leakey describes the discovery of fossilised remains of giant baboons at Olorgesailie in Kenya. These creatures — giant versions of the living gelada baboon *(Theropithecus gelada)* — were said to be the size of female gorillas.

The Pleistocene of Australia has revealed countless examples of giantism — for example, giant kangaroos *(Palorchestes,* and the short-faced kangaroo, *Procoptodon)*; giant wombats *(Phascolonus)*; giant monitor lizards (which grew to lengths of up to 6 metres); giant echidnas; even a giant cuckoo bird! Birds such as the *Genyornes* and *Mihirungs* grew to enormous proportions; the latter attaining heights of up to three metres (or 10 feet) and weighing approximately 500kg. It is thought that the Mihirung may have co-existed with the early Aboriginal inhabitants of this continent.

Visitors to the small New Zealand town of Matakohe, who take the opportunity to visit the town's Otamatea Kauri Museum, will discover one of the world's most impressive displays of giant 'fossilised' insects. These insects were trapped and preserved in **amber resin**. When compared with extant specimens of the same species, their size is huge.

Elsewhere in the world, there have been discoveries of the fossilised remains of giant Cretaceous crocodiles, which reached lengths of 15 metres (50 feet). The fossilised remains of a boa constrictor, which attained a length of 18 metres (60 feet), have also been found.

Giantism would appear to have been an almost universal phenomenon amongst land-dwelling vertebrates deriving from Flood (Palaeozoic and possibly Mesozoic) and immediate post-Flood (Cainozoic, but excluding Holocene) deposits. In fact, it would appear that the fossilised remains of species, for which there are recognizable living representatives today, are, **as a rule, measurably larger**. This applies equally to both flora and fauna.

The question arises: if the phenomenon of giantism existed in the recent past and for much of geological history, why isn't it still operative in the biological realm? This author suggests that changes have taken place within the earth's biosphere in the recent past — changes which have led to shrinkage of both flora and fauna to present-day sizes and proportions.

Atmospheric and climatological factors play an important role in determining the 'character' of living creatures and organisms. It is possible that the biospheric conditions, in which the now-fossilised life-forms lived, were to some degree different to those we experience today; **conditions which had been conducive to giantism**.

It is acknowledged by most palaeoanthropologists that the purported radiations of various forms of hominoid

and hominid took place during a period of immense, world-wide climatological change. Such radiations are said to have occurred during the Miocene, Pliocene and Pleistocene periods of earth history; **at a time when the continents were 'drying out'**, and vast tracts of rainforest were being replaced by a succession of woodland and open grassland (savannah) patterns of vegetation.[19,20] The present author believes that these periods corresponded to the immediate post-Flood era, and that the radiations may, of themselves, represent the migratory movements of the descendants of giant, pre-Flood forms of anthropoid ape —some of which are still represented by extant species.

What, then, were the contributing factors leading to the drying-out of the continents and morphological shrinkage of the various forms of life? Before attempting to answer this question, it would serve us well to examine how growth potential is regulated in the present-day world.

Growth Regulation in Today's World

Body growth in apes and humans is regulated mainly from the anterior lobe of the **pituitary gland** — partly directly and partly via other endocrine glands such as the thyroid. This gland is also responsible for the regulation of other endocrine glands, such as the thyroid and thymus. The anterior lobe of the pituitary gland secretes a hormone, known as **growth hormone**, which stimulates and controls the growth of bones, muscles and body organs.

When an oversecretion of the hormone takes place in infants or children prior to the onset of puberty, gigantism may result.[21] If oversecretion takes place in adulthood, **acromegaly** results. Acromegaly is a disease manifested in the thickening and distortion of the body's bones. Insufficiency of the hormone in infancy may lead to **dwarfism**. Secretion of the hormone from the pituitary gland is influenced by:–

(1) The age of the individual,
(2) Exercise, stress, fasting and sleep, and
(3) By the level of other hormones in the body's blood.

Before the growth hormone can exert its effect on bones, muscles and body organs, it must be converted to a substance known as **sulphation factor**.[22] Dwarves lacking the ability to convert growth hormone to sulphation factor, even when in possession of normal or excess levels of the hormone, will not grow to normal size and body proportions.

Growth hormone is transported throughout the body by blood. The hormone is dissolved in the blood plasma, along with other substances, including very small quantities of salts, sugars, proteins and enzymes.

As stated previously, the hormone is responsible for the activation of bone growth. Growth in long bones involves the replacement of cartilage in the **epiphyseal plate** by bone; new cartilage is simultaneously added to the **epiphysis**, and the entire replacement process is called **ossification**. This process continues in mammals until **maturation**. It then ceases, with the fusion of the epiphysis and the **diaphysis**. At this point in time growth ceases. By way of contrast, ossification in reptiles continues throughout the adult life; therefore growth continues into old age.[23] This fact, together with **prolonged longevity** (in the pre-Flood world), may serve to explain why dinosaurs grew to such huge proportions.

If the long bone of a fossil hominid is found with the epiphyseal plate still separate, it may be concluded that the creature was a juvenile; conversely, if the epiphysis is fused to the diaphysis, then it may be concluded that the creature was a mature adult when it died. However, this does not give a direct clue as to the actual age of the creature, since there is no way of being certain of the creature's potential life expectancy. Most palaeontologists and palaeoanthropologists presume that the life expectancy of hominids approximated that of the living anthropoid apes — that is, about 40 years. This may be an erroneous assumption, as we will see shortly.

If the longevity of anthropoid apes and humans were to have been significantly greater in the past, then it is also possible that delayed maturation (skeletal maturity) may have been responsible, in part, for the phenomenon of giantism. What evidence do we have that such was the case in past geological times?

A Biblical Perspective on Longevity and Maturation

The biblical record of early human history teaches that longevity was appreciably greater amongst the antediluvian (pre-Flood) patriarchs than those of the post-Flood era. It may also be construed that maturation was delayed in pre- and immediate post-Flood patriarchs. The ages of the pre-Flood patriarchs at the birth of their respective lineal messianic descendants (not necessarily first-born sons) are **significantly higher** than those of the post-Flood patriarchs. It can be inferred from this that both maturation and sexual maturity occurred later in the antediluvian patriarchs.

Table 1 illustrates the dramatic decline in patriarchal longevity following the Flood. The table encapsulates data compiled from the genealogies of Genesis 5 and 11 according to the Massoretic and Septuagint (LXX) Texts, and sets them within the context of the standard Gregorian calendar. The lifespans of Moses and David have been included (for comparative purposes). Several key events in earth and human history have also been chronicled, including the Creation Week, the Noahic Flood and the possible conclusion of the Ice Age (during Peleg's lifetime).

The average lifespan for the ten pre-Flood patriarchs (Adam through to Noah) exceeded 850 years according to both texts. By way of contrast, the average life expectancy in Western cultures today is only about 70 years, and

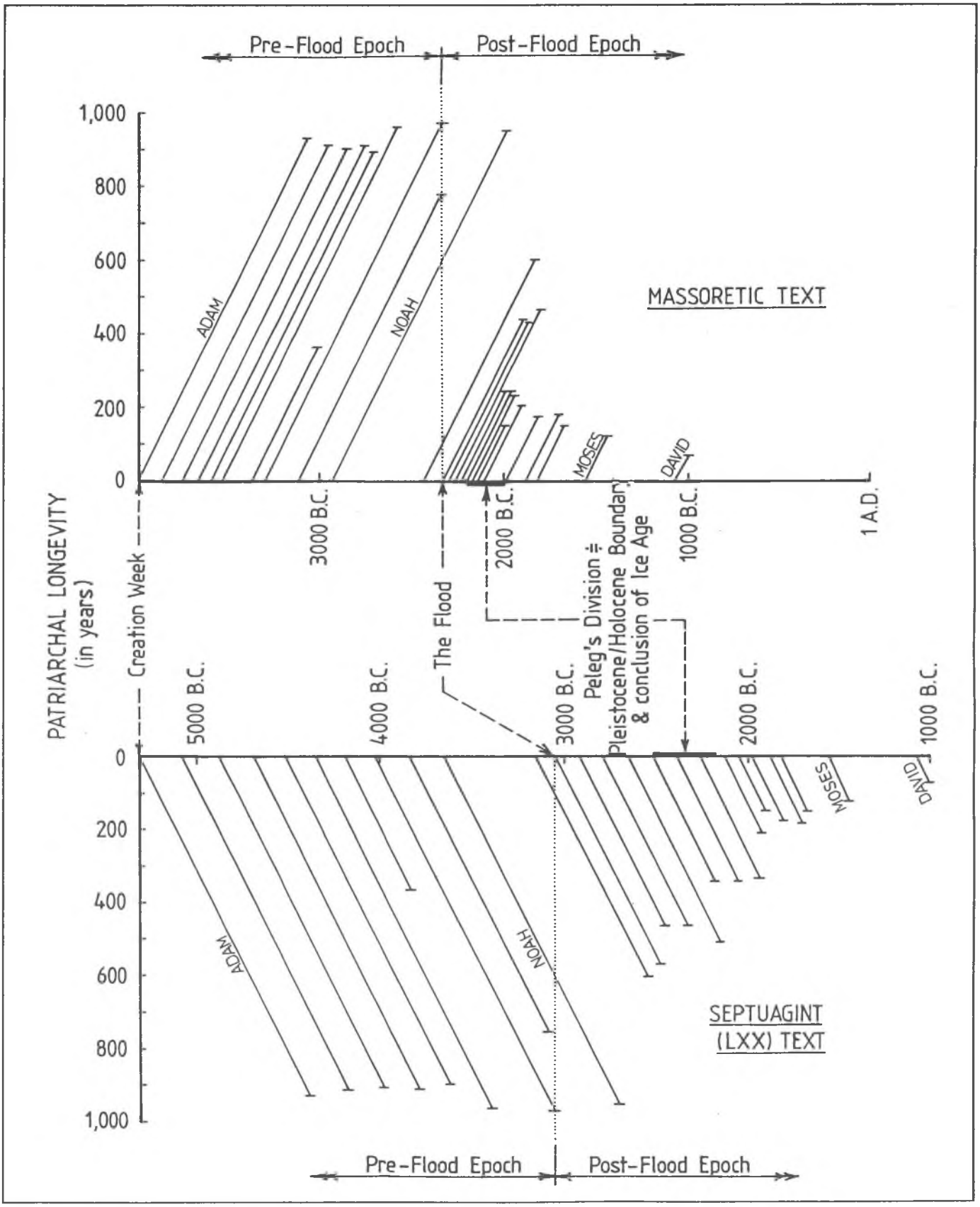


Table 1. PRE- AND POST-FLOOD PATRIARCHAL LONGEVITY AS DEFINED IN THE MASSORETIC AND SEPTUAGINT (LXX) TEXTS OF THE OLD TESTAMENT.

this is with the benefit of modern medical science, treatment of drinking water, sewerage systems and balanced, nutritious diets. The Scriptures indicate that an anticipated life expectancy of 'threescore years and ten' was applicable even during the lifetime of David (Psalm 90:10). Therefore, it would appear that over a period of 1,250 to 2,000 years (the respective intervals between the Flood and David's lifetime according to the aforementioned texts), life expectancy **declined to about eight percent of the pre-Flood average**. Despite having been born some one hundred years before the Flood, Shem (a son of Noah) experienced a significant reduction in longevity.

The significantly higher ages at which messianic descendants (sons, though not necessarily firstborns) were born to the pre-Flood patriarchs suggests that sexual maturity and skeletal maturation occurred somewhat later than is the case today. It also appears possible that the extension of the growth phase (prior to skeletal maturation) contributed significantly to the phenomenon of giantism amongst pre- and immediate post-Flood humans, as appears to have been the case in many other creatures (if not universally amongst all pre-Flood fauna).

Factors Contributing to the Post-Flood Decline in Longevity

The aging process is abetted by a number of factors, including:

(1) The mutability of cells generally, and red blood cells specifically;
(2) The deterioration of the circulatory system;
(3) The presence of heavy oxygen, or **ozone** (0_3), in the earth's lower atmosphere, where it can be inhaled by fauna and humans; and
(4) Dietary considerations.

Concerning the first factor, the ability of red blood cells to transport vital oxygen (and other nutrients, salts and minerals) to body tissue, and to remove carbon dioxide, is severely impeded when they have been damaged. Several geophysical phenomena, including the depletion of the earth's ozone layer (which shields the earth from harmful ultraviolet radiation), the collapse of the earth's postulated pre-Flood vapour canopy, and the diminishing strength of the earth's magnetic dipole (which shields the earth from the solar wind and cosmic radiation), have contributed to the ever-increasing accumulation of potentially lethal mutations (or genetic defects). This accumulation of genetic effects (otherwise known as 'genetic load'), especially during the post-Flood era, is likely to have contributed greatly to the documented decline in longevity (Genesis 5 cf. Genesis 6:3 and Psalm 90:9, 10).

Now the destruction of the ozone layer was probably precipitated, initially, by widespread volcanism during and immediately after the Flood. The presence of ozone in the air we breathe is a major contributing factor to accelerated aging. Ozone inhibits respiration through reducing the lung's diffusing capacity.[24] It is also capable of damaging red blood cells and body tissue, and if concentrations are sufficiently great, can lead to a drastic reduction in life expectancy.

On the basis of a reduction in longevity and duration of the growth phase for living creatures, including man, it is postulated that the post-Flood fossil record might contain the remains of various genera and species of animals **which exhibit decreasing body size during the course of recent geological history.**

The Pre-Flood Biosphere

The biospheric conditions, under which many now-fossilised creatures lived, appear to have been somewhat different to those we experience today.[25, 26] These former conditions would have been conducive to giantism. The phenomenon of giantism was made possible through negligible genetic load, prolonged longevity and delayed skeletal maturation, and was **sustainable only as long as these conditions prevailed**.

The biblical account of origins and early earth history provides us with several clues as to the nature and cause of these biospheric changes. It appears that the early earth may have been enveloped by a water vapour canopy — the 'waters above the firmament' of Genesis 1:6, 7. This canopy seems to have remained in place until the commencement of the Biblical Flood; at which time it collapsed (Genesis 7:11).

Three possible consequences arising from the presence of such a canopy above the earth's lower atmosphere would have been:

(1) A significantly **higher atmospheric pressure** at sea level (in his book **The Waters Above**,[27] Dr Joseph Dillow suggests a value twice that of the present-day figure) due to the 'weight' of the water vapour acting down upon the underlying atmosphere under the influence of gravity;
(2) A **'greenhouse effect'**, due to the entrapment of the re-radiated heat by the vapour canopy; and
(3) A **more moderate global climate** (possibly subtropical from pole to pole, or of lesser climatic extremes).

Aside from a significantly higher atmospheric pressure, it is also likely that the mix, or proportion, of constituent atmospheric gases was slightly different in the pre-Flood biosphere. For instance, it is probable that a higher concentration of atmospheric carbon dioxide prevailed in the pre-Flood world, giving rise to slightly higher tropospheric air temperature gradients, higher humidity levels, more luxuriant and prolific plant growth, and the physiological condition known as **hypercapnia**.

Past variations in the composition of the atmosphere (albeit slight variations in the ratios of oxygen, nitrogen, carbon dioxide and other rare gases) and higher atmospheric pressure have long been advocated by creation-

ists.[28] Recently, a number of evolutionists have begun to advocate similar ideas. Studies by Gary Landis and Robert Berner of fossil amber resins have revealed past variations in the concentration of oxygen entrapped within the substance. These studies suggested the existence of **a higher oxygen concentration in the past**. Landis pointed out that

> *'To get higher percentages of oxygen requires an increase in the absolute amount of oxygen — it would not have occurred as a result of less nitrogen, which is a stable gas.'*[29]

Landis concluded that the most logical explanation for the higher oxygen concentration is that **atmospheric pressure was significantly higher in the past**.[30] Landis's studies have included amber resins found in **sediments of purported Miocene, Eocene and Cretaceous age**. Significantly, the writer of the **New Scientist** article, in which Landis and Berner's findings were detailed, quotes Landis as saying that a dense atmosphere could also explain how the ungainly pterosaur, with its stubby body and wing span of up to 11 metres, could have stayed airborne.[31] Just such an explanation has been advocated by creationists for many years.[32]

Food Demands and Giantism

The potential size of a living creature at maturation is limited, in part, by its ability to sustain and promote tissue and cellular regeneration. Giant pre- and immediate post-Flood forms of fauna (including humans) would have had substantially greater food demands than their smaller, extant descendants. These demands would have progressively lessened, in proportion to body size, in successively smaller generations following the Flood.

In a pre-Flood world in which an abundance of giant, tropical and sub-tropical forms of flora propagated, the considerable dietary needs of giant creatures (including dinosaurs) would have been readily satisfied. Such lush growth was sustainable because of the presence of the enveloping water vapour canopy and biospheric greenhouse beneath.

In the pre-Flood giant form, transportation of vital nutrients (including salts, sugars, minerals, proteins etc.) and oxygen, as well as the removal of waste products (following metabolism), would have necessitated **a larger blood supply**; blood plasma for the transportation of digested food (nutrients) and waste products, and red blood cells (or corpuscles) for the distribution of oxygen to different parts of the body. The additional red blood cells, required for the transportation of oxygen to the body's tissues, would have been produced in sufficient quantity **through the expansion of the body's marrow regions (located in enlarged long bones)**.[33]

The Impact of Higher Atmospheric Pressure on Living Creatures

How, then, did living creatures cope with the needs to transport larger quantities of nutrients and oxygen to body tissue in the pre-Flood world?

In the pre-Flood world air would have been 'forced' into the lungs of living creatures in greater concentrations as a consequence of higher atmospheric pressure. In contrasting today's vertebrates with those of the pre-Flood epoch, Dillow noted that

> *'. . . due to the greater oxygen requirements of the large vertebrates, they required more oxygen than the present diffusing force could supply . . . a reduced oxygen tension in the atmosphere due to the condensation of the vapour canopy could have been one change which might have some bearing on why giant animals do not exist today.'*[34]

Changes in the atmospheric pressure affect living creatures in two ways: firstly, the increase in (total) pressure itself requires modifications in the body's structure (or physiology) to cope with the added pressure, and secondly, the partial pressures of the constituent gases of the atmosphere (i.e. oxygen, nitrogen, carbon dioxide etc.) exert **toxic effects** on living creatures.

Terrance L. Smith, in an article entitled 'The Effect of Elevated Atmospheric Pressure on Living Things', examined the interaction of atmospheric pressure (both total and partial) and living organisms and concluded that

> *'. . . less than a doubling of the present atmospheric pressure would be allowed. It would be possible to increase the atmospheric pressure by holding the pO_2 at the maximum allowable and filling out the pressure with nitrogen or some other filler gas';*

the doubling factor corresponding to Dillow's pre-Flood sea level value of 2.18 ATA.[35,36]

Now nitrogen (N_2) is neither used nor produced in the body, and as such, constitutes a filler gas. Whilst the requirements of additional oxygen for giant, pre-Flood forms of life can be adequately explained in terms of an increase in atmospheric pressure and red blood cell count (the amount of haemoglobin in the blood being a direct measure of the blood's oxygen-carrying capacity), there does appear to be a problem arising from the amount of filler gas (nitrogen) being forced into the lungs. Concerning this problem, it is interesting to note that:

> *'Whether an equilibrium is established between gas in the alveolus and the capillary blood depends on the diffusing capacity, but it also depends on the amount of gas which needs to be transferred to reach equilibrium. A gas like N_2,* ***which is less diffusible than O_2****, comes into equilibrium very quickly in a unit of blood entering the capillary because* ***it is so (relatively) insoluble that not much must cross the border to establish the same P_{N_2} on both sides****. On the other hand, since O_2 and CO_2 have great solubilities in blood, many molecules must be transferred to achieve equality of tensions.'*[37]

Enriched Concentrations of Carbon Dioxide in the Pre-Flood World

The phenomenon of giantism may well have been the **biological norm** in the pre-Flood world. Conversely, the comparatively smaller stature and size of extant creatures (including man and the pongids) would be deemed normal for present-day biospheric conditions.

Along with a higher atmospheric pressure, it also appears that the relative abundances of atmospheric gases differed slightly in the past. It has recently been suggested that the atmospheric concentration of CO_2 was greater in past geological ages.[38] An enriched atmospheric concentration of CO_2, aside from being responsible for keeping the pre-Flood earth warmer, might also have led (indirectly) to retardation of the aging process in living creatures. It may also have triggered the release of greater quantities of **growth hormone** (at normal concentrations) from the pituitary gland **over an extended growth period**, thereby inducing giantism.

Enriched atmospheric CO_2 (which may induce the physiological condition known as **hypercapnia**) gives rise to a more acidic blood, which in turn causes the brain's blood vessels to expand (vasodilate). This enables more oxygen to reach the brain's cells. Greater oxygenation of these cells enhances their electrosensitivity, thus improving regulation of the body's neuro-endocrine system.

The **hypothalamus**, a small, part of the mid-brain, is responsible for the regulation of the neuro-endocrine system (including the release of hormones such as growth hormone from the pituitary gland). Low atmospheric levels of CO_2 cause the brain's blood vessels to vasoconstrict, which in turn reduces cerebral blood flow and, consequently, oxygenation and electrosensitivity of the hypothalamic cells.[39] These factors may lead to a breakdown of the hypothalamic suppression system **and accelerated aging**. Donald W. Patten has suggested that the present-day atmosphere, being CO_2 deplete (following the Flood), is abnormal, and has been responsible, in part, for the reduction in longevity of living creatures.[40] Earlier sexual and skeletal maturity, and possibly reduced skeletal size, may have accompanied this post-Flood decline in longevity.

MAN AND THE ANTHROPOID APES

David Lambert recently suggested that:

*'Anatomical comparison suggests strongly that **our bodies are apes' bodies redesigned as bipeds**.'*[41]

Similarities in the skeletal structures of man and the anthropoid apes have long been cited by evolutionists as evidence of a common ancestry in the remote past. Creationists, on the other hand, have argued that **homology** (similarity of form) represents a basic pattern or design which has been adopted (with or without modification) in various genera. The creationist also asserts that the functional nature of these designs demands the existence of a Designer.

When we turn to discussions on hominids, there is an inevitable bias towards the presumed hominine (man-like) characteristics of these creatures. Very often, these characteristics assume an importance far beyond their true value. It is quite common for the many ape-like characteristics of purported hominids to be played-down, or even overlooked, at the expense of a small number of questionable, man-like characteristics.

For instance, when Mary Leakey discovered the fossilised remains of a large, robust australopithecine in the Olduvai Gorge in Tanzania (during 1959), the creature was almost immediately pronounced to be a hominid, and therefore, ancestral to modern man.[42] The remains comprised the rear half of a braincase, the supraorbitals, partial zygomatics, maxilla, and a complete permanent upper dentition and palatal arch. Under somewhat controversial circumstances, the find was assigned a separate taxonomic classification — *'Zinjanthropus boisei'* — and accessioned OH 5 (Olduvai Hominid 5).[43] The caption, 'Nutcracker Man', was soon applied to the creature, whose cheek teeth were enormous.

The discovery of stone tools at the same site where 'Zinj' was found convinced Louis Leakey that this creature was, indeed, hominid.[44] The upper dentition of 'Zinj' conformed to the 2.1.2.3 pattern of anthropoid apes and man. Despite the fact that the dental arcade was decidedly U-shaped (a characteristic of living anthropoid apes), Louis Leakey seized upon the fact that the creature's canines were relatively small and non-protuding as evidence for its hominid status.

Many palaeoanthropologists of the day disputed Louis Leakey's decision to assign *'Zinjanthropus'* to a separate genus especially since the creature shared many affinities with the somewhat smaller robust australopithecines of the South African Transvaal. Indeed, this had been Louis Leakey's first impression also, and had it not been for the associated tool culture, it is doubtful whether *'Zinjanthropus'* would have ever achieved a status above hominoid. He would have remained a sub-species of *Australopithecus robustus*; albeit, a larger version of the same. (The possible significance of the size differential will be seen later).

'Zinjanthropus's' cranial capacity was later (1967) estimated to be approximately 530cc; well within the range of the African great apes, and approximating the average for extant male gorillas. However, the shared affinities with gorillas did not cease with similar cranial capacities. The *Zinjanthropus boisei* skullcap was surmounted by a sagittal crest of moderate size; the facial region was decidedly dish-shaped, with a long a prognathic upper jaw; nuchal cresting was featured toward the rear of the braincase; the nasal aperture was broad (as opposed to piriform), and was not underpinned by an anterior nasal spine; the facial region was domi-

ANTHROPOID APES	MAN *(Homo sapiens)*
* long, flattened calvaria (generally dolichocephalic)	* high, rounded cranial vault (generally mesocephalic)
* relatively small cranial capacity (80 to 750cc)	* relatively large cranial capacity (800 to 2,000cc plus)
* low relative brain size	* high relative brain size
* prognathic jaw region	* comparatively vertical face
* pronounced nuchal cresting	* slight nuchal cresting
* prominent cheek bones (wide zygomatic arches)	* tightly hugging cheekbones (weak zygomatic arches)
* prominent sagittal keeling or cresting	* occasional keeling only
* strong post-orbital constriction	* very slight post-orbital constriction, if any
* non-piriform nasal aperture	* piriform nasal aperture
* anterior nasal spine absent	* anterior nasal spine present
* prominent brow ridging	* slight brow ridging in some races (diet induced)
* comparatively large eye orbits	* moderate sized eye orbits
* absence of a forehead	* steep, prominent forehead
* inconspicuous, or absent mastoid process	* prominent mastoid process
* prominent occipital protruberance	* non-existent or very small bun
* posteriorly located foramen magnum, and rearward facing occipital condyles	* foramen magnum located centrally on the underside of the braincase
* U-shaped dental arcade	* rounded or parabolic dental arcade
* large, conical canines	* small, spatulate canines
* large diastemata present in upper and lower jaws	* diastemata rarely present
* receding lower jaw at symphyses ('simian chin')	* forward protruding or incipient chin
* simian shelf in mandibles	* no simian shelf in mandibles
* relatively flat palate, posteriorly	* relatively high palate, posteriorly
* first lower pre-molar of sectorial form	* first lower pre-molar of bicuspid form

Table 2. COMPARISON OF CRANIO-FACIAL CHARACTERISTICS IN PONGIDS AND MODERN MAN (HOMO SAPIENS)

nated by prominent cheekbones (zygomatics); the eye orbits were relatively large, and well buttressed on the upper margins (supraorbitals); and there was no forehead above the supraorbitals. In these respects, and others, this large, robust australopithecine was similar in cranio-facial morphology to extant gorillas. Yet these characteristics were ignored, or overlooked, in many popular accounts concerning the discovery of this creature.

The hominid status of *Zinjanthropus boisei* was short-lived, however, for less than a year after its discovery *Homo habilis* was unearthed in nearby deposits of comparable geological age.[45] 'Zinj' was unceremoniously dumped from the phylogenetic branch leading to modern man, and shortly afterwards, reclassified as *Australopithecus boisei*.

Homo habilis was decidedly more gracile and chimp-like than *A. robustus* and *boisei*, and in some respects, similar to the smaller gracile australopithecines of South Africa. However, an expanded cranial capacity suggested that this new hominid represented a more advanced form of the smaller Transvaal creatures; intermediate between *A. africanus* and *H. erectus*.[46]

Before examining the characteristics of purported fossil hominoids and hominids, it would serve us well to familiarize ourselves with distinguishing cranio-facial characteristics of man and the pongids (see Table 2).

Documented Ranges in Cranial Capacity for Extant Pongids and Man

The extent of variation in cranial capacity in 'normal' humans is great. Donald Johanson has suggested a range for modern humans of between 1,000 and 1,800cc.[47] His long-time protagonist, Richard Leakey (the co-discoverer of Skull 1470, and Director of the National Museums of Kenya), has suggested a wider range (1,000 and 2,000cc),[48] whilst Lawrence S. Dillon, author of **Evolu-**

tion: Concepts and Consequences, suggests an even wider range again (900 to 2,300cc).[49]

Cranial capacities falling outside Dillon's provisional range have been documented in scientific journals. At the top-end of the range they are extremely rare. To this author's knowledge there have only ever been three recorded determinations exceeding 2,000cc — these being the Russian novelist, Turgenev (2,021cc), a United States Senator and an idiot — the latter two being of equal capacity (2,800cc).[50]

At the low end of Dillon's range there are the Wedda pygmies of Sri Lanka. However, there is a determination for an adult, female Australian aboriginal as low as 830cc.[51] In neither of the aforementioned instances could these people be described in any way as being intellectually incompetent or sub-normal.

The late Dr Arthur C. Custance, a Canadian anthropologist of note, has pointed to the so-called **'cerebral Rubicon'** as being the lower threshold for complete human competency and normality.[52] It was once thought to occur at 900cc. More recently, however, a number of authorities have suggested lower values (Vallois, 800cc; Robinson, 750cc and Weidenreich, 700cc).[53] Below the cerebral Rubicon the individual is described as being **microcephalic** ('small-brained').

Despite the fact that microcephalics may possess cranial capacities within the range of the larger anthropoid apes, they do not exhibit behaviour patterns that can be construed as being typical of pongids. Ralph L. Holloway, perhaps the world's foremost authority on hominid craniometry, put it this way:

> *'(such) examples of microcephaly make salient the fact that something in the way of human specificity exists, **even when the brain is deficient**.'*[54]

Richard Leakey and Roger Lewin put it in slightly different words when they said:

> *'. . . the internal organisation . . . is most important in determining the scale of wit and intellect.'*[55]

In other words, functional design takes precedence over cranial size in determining human IQ.

There would appear to be general agreement concerning the mean cranial capacity for modern man — this being 1,350cc. Richard Leakey has suggested a slightly higher value (1,360cc),[56] which appears to have been derived from an earlier work by Holloway.[57] Adrienne Zihlman has preferred to round this value up to 1,400cc.[58] On the down-side, Kevin C. McLeod suggests a lower value of 1,305cc (with males averaging 1,360cc, and females 1,250cc).[59] Whilst such a variation may appear significant, it may well reflect smaller sample sizes. For the purposes of this paper, Dillon's value (1,350cc) will be adopted.[60]

Table 3 shows in graphical form the respective ranges in cranial capacity for the living anthropoid apes (gibbon, chimpanzee, orang-utan and gorilla) and that for modern man, *Homo sapiens sapiens*. The measured ranges in

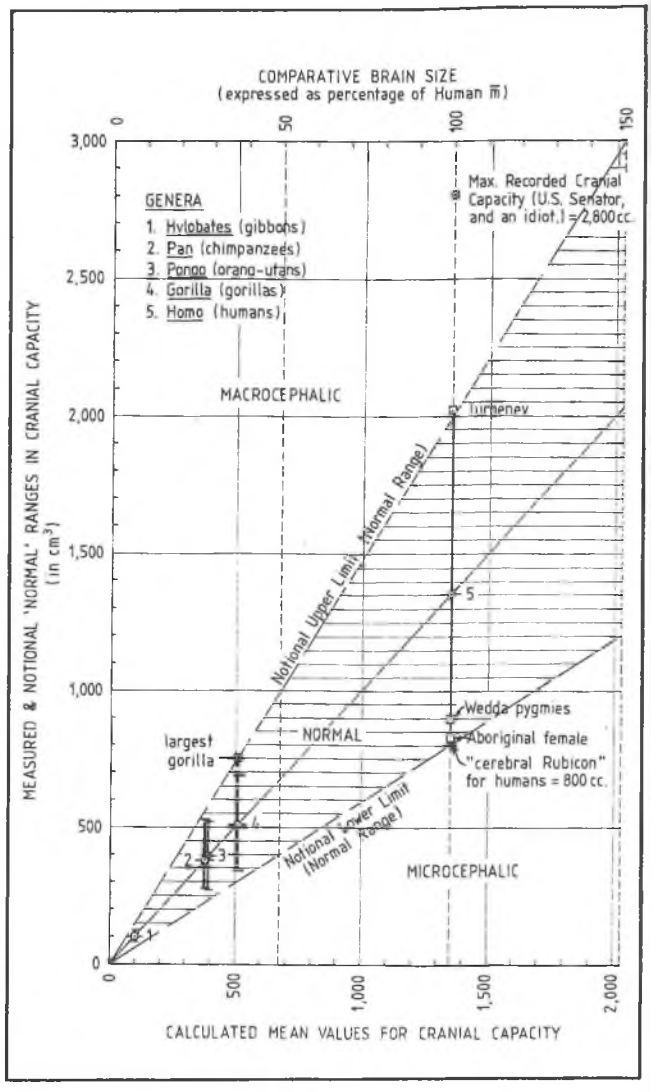


Table 3. MODERN MEASURED AND NOTIONAL 'NORMAL' RANGES IN CRANIAL CAPACITY OF HUMANS AND ANTHROPOID APES.

cranial capacity for the respective genera are denoted by thick, vertical lines, whilst the mean values for the same are denoted by the symbol '-⊙-'. A measure of the **comparative brain size** of the various pongids, in reference to that of modern man, is shown by the horizontal scale at the top of the Table.

The cited ranges in cranial capacity and the respective mean values for the various genera have been taken from literature available to the author at the time of writing. The sample size has a severe effect on the likely range (upper and lower limits) for a particular population group. As a rule, the larger the sample size, the wider the range will be. Suffice to say, that the craniometric data for the various anthropoid apes is usually derived from comparatively small samples. The measured ranges in cranial capacity for the various pongids are likely to be conservative.

The cited ranges in cranial capacity for the anthropoid apes are as follows:-

1. Gibbons (Hylobates) 82 – 125cc (m = 103cc)[61]
2. Chimpanzees (Pan) 280 – 530cc (m = 380cc)[62]
3. Orang-utans (Pongo) 276 – 523cc (m = 392cc)[63]
4. Gorilla (Gorilla) 340 – 752cc (m = 506cc)[64]

Table 3 serves to illustrate how far removed from modern man the pongids are in terms of cranial capacity. The cited upper limit for gorillas — the largest of the living anthropoid apes — is less than the cerebral Rubicon value assigned by Vallois to the human species, whilst the mean cranial capacity for chimpanzees is **less than 30 percent of the human average**.

The figures cited for gibbons are for the sub-species, *Hylobates lar*. Those cited by Nickels, Hunter and Whitten for chimpanzees refer to the combined common and pygmy species. Concerning the genus *Pan*, the common chimpanzee *(P. troglodytes)* exhibits slight sexual dimorphism in respect of cranial capacity.[65] Sexual dimorphism is even more pronounced in orang-utans and gorillas.[66] On the other hand, it is difficult to discern any dimorphism in the mean cranial capacities of pygmy chimpanzees *(P. paniscus)* and gibbons.[67]

It shall be noted that the ranges for the Asiatic apes are distributed fairly equally about their respective means. The African apes, on the other hand, are not; the mean values for both chimpanzees and gorillas being displaced toward the low-end of their respective ranges. This may reflect the presence of single, but exceptional, determinations of cranial capacity for specimens at the high-end of the range. Such is certainly the case with gorillas, where the highest recorded value (752cc) exceeds the second highest determination by some 67cc. If the higher figure is ignored, then the distribution becomes more symmetrical about the mean.

Whilst recognizing that there are recorded instances of human crania exceeding the notional upper limits of normalcy cited by Leakey and Holloway, they are extremely rare. Similarly, the lower limit of normalcy in humans would appear to correspond to Vallois' value for the cerebral Rubicon (800cc). Thus, a **notional 'normal' range** for humans lies between 800 and 2,000cc. The ratio of the upper to lower limit in humans therefore resolves out at 2.5:1. **This ratio is not exceeded by any of the anthropoid apes**. The present ratios for chimpanzees, orang-utans and gorillas cluster around 2:1, with the gorilla yielding the widest ratio (2.2:1).

Crania, which fall outside the notional normal range, are described as **microcephalic**, when less than the notional lower limit for a particular genus, and **macrocephalic**, when greater than the notional upper limit. The largest recorded value for gorillas (752cc) falls just outside the notional upper limit for the genus.

Notional normal ranges in cranial capacity for the living anthropoid apes may be deduced by extending the thick, vertical lines through until they intersect with the radiating lines denoting notional upper and lower limits in 'normal' cranial capacity. The known existing ranges for the various genera of anthropoid ape generally fall within these notional normal ranges. It is to be anticipated that, as the sample size increases for the various pongids, the measured range will continue to approach the notional limits.

There would appear to be an emerging **pattern of limits** implicit in these measured ranges. Such patterns point to a **homologous relationship**, and may be cited by both creationist and evolutionist as corroborative evidence for their respective theories of origins; common, pre-defined limits of variation vs. common ancestry.

The ranges (both measured and notional) in Table 3 are **applicable to present-day biospheric conditions only.**

Now man's origins, according to the transformist view, lie in a yet-to-be identified common ancestor with the pongids. It is generally presumed that man's ape-like ancestors were smaller than he, and that cranial expansion has been a significant factor in determining the success of *Homo sapiens sapiens*. (One possible exception to this belief was Weidenreich's proposal that the extinct primate, *Gigantopithecus*, was ancestral to man.[68])

On a superficial level, the larger cranial capacity of gorillas could be construed to mean that they represent a more 'advanced' form of primate than, say, the chimpanzee. Yet almost without exception, the palaeoanthropologist will suggest that man shares a common ancestor with the chimpanzee in the more-recent past than he does the gorilla.

As shall be seen later in this paper, the purported cranial expansion in hominids (a primary argument in favour of man's evolutionary origins) is contradicted by the evolutionist's own measurements.

Relative Brain Size

The ratio between a creature's brain volume and body weight is termed its **relative brain size**. It is calculated according to the formula:-

$$\text{Relative Brain Size (R.B.S.)} = \frac{\text{Cranial Capacity (in cc.)} \times 100}{\text{Body Weight (in gm.)}}$$

The weight of a human brain is usually expressed in grams, and its capacity in cubic centimetres. Numerically, the two units of measure are virtually equivalent for the same specimen; that is to say, one cubic centimetre of 'grey matter' equals one gram in weight. Therefore, relative brain size is also a measure of the ratio between the weight of the brain and the body.

Most palaeoanthropologists regard man to be more closely related to the African, rather than Asian, anthropoid apes.[69] If relative brain size is an indicator of morphological relatedness, we would expect the R.B.S. values for chimpanzees and gorillas to approximate those for

Genus/Species	Sex	Cranial Capacity (m, in cc.)	Body Weight (m, in kg.)	Relative Brain Size
Gorilla	M	550	175	0.31
	F	440	85	0.52
Orang-Utan	M	433	86	0.50
	F	384	39	0.98
Chimpanzee – common	M	400	49	0.82
	F	385	41	0.94
– pygmy	M	350	45	0.78
	F	350	33	1.06
Gibbon	M	100	6	1.67
	F	100	6	1.67
Man (modern)	M	1,400	63	2.22
	F	1,300	54.5	2.39

Table 4. RELATIVE BRAIN SIZES FOR THE PONGIDS AND MAN.

modern man. If this were not the case, then we could still expect their respective values to be closer to man than those for the gibbon and orang-utan. Such is not the case, as Table 4 demonstrates.

The anthropoid ape, whose relative brain size value most closely approximates those for modern man, is the gibbon, *Hylobates lar*. Gorillas, by virtue of their enormous bulk, are the most remote. Table 4 has been arranged in ascending order of combined male/female values.

With respect to relative brain size, it can be seen that the values for male and female gibbons are identical. When we turn to common chimpanzees and humans, there is a slight degree of variation, whilst in the remaining anthropoid apes the variation is considerable. Such variations reflect degrees of sexual dimorphism and allometry.

Sexual Dimorphism and Allometry

When it is possible to discriminate between males and females on the basis of shared, but dissimilar, morphological features, the creatures are said to be **sexually dimorphic** (with respect to these particular features). Sexual dimorphism is manifested in many different ways in anthropoid apes — for example, differences in body weight and height, cranial capacity, degrees of 'robustness' in bone structure, prognathicity etc. For instance, the males of all three sub-species of gorilla are, as a rule, twice the weight of females, and possess cranial capacities, on average, 25 percent greater than females. There is little dimorphism present in the canines of humans and gibbons. However, in chimpanzees the variation is pronounced. Pygmy chimpanzees *(Pan paniscus)* exhibit little dimorphism in respect to cranial capacity and canine size. Common chimpanzees *(Pan troglodytes)*, on the other hand, exhibit slight dimorphism in cranial capacity and a pronounced degree in canines.[71]

Male anthropoid apes, with the exception of gibbons, are heavier and more robustly-built than their female counterparts. As a rule, they are taller and more likely to develop **sagittal crests** and robust **zygomatic arches** (for the attachment of stronger muscles).

Relative brain size may be used, to some extent, to discriminate between males and females of a known species or genus; the lower R.B.S. values corresponding to the males. The difference in values is more pronounced in gorillas, orang-utans and pygmy chimps. In the remaining genera, the differences are not nearly so pronounced.

When the R.B.S. values for males and females are 'close' we may presume that the sexes share nearly identical cranial capacities and body weights **or** are proportionately similar. On the other hand, when the values differ significantly (such as in gorillas, orang-utans and pygmy chimpanzees) the sexes are said to vary **allometrically**; that is to say, the smaller of the two (the female) is **not simply a scaled-down version of the larger (male) sex**. Thus allometry is reflecting differing body proportions.

With respect to relative brain size in living pongids, sexual dimorphism and allometry are quite variable. Whilst the two species of gibbon — *Hylobates lar* and *Hylobates syndactylus* — exhibit only slight dimorphism

and allometry, the two species of orang-utan and three sub-species of gorilla exhibit greater degrees of both. Varying degrees of dimorphism and allometry are to be found in extant chimpanzees.

Relative brain size may, in certain circumstances, be useful in discriminating between species or sub-species of a particular genus. For instance, the Central African chimpanzee, *Pan troglodytes troglodytes*, with R.B.S. values of 0.67 (males) and 0.80 (females), can be readily distinguished from the East African chimpanzee, *Pan troglodytes schweinfurthii* (0.98 and 1.24 respectively).[72] At the species level, the mean body weights of *Pan paniscus* and *Pan troglodytes schweinfurthii* are approximately the same in males and equal in females; yet their cranial capacities, and therefore R.B.S. values, differ significantly.

However, overlaps do exist at the species and sub-species level. This makes discrimination very difficult in some instances. For example, the two living sub-species of orang-utan — *Pongo pygmaeus pygmaeus* (from Borneo) and *Pongo pygmaeus abelii* (from Sumatra) — are indistinguishable in terms of mean cranial capacity, body weight and therefore relative brain size. As B. Harrisson has stated:

> *'Two subspecies have been described . . . but differences between them are not great enough to make it easy, even for an expert, to identify a captive live orang-utan whose origin is not known, as coming from Sumatra or Borneo.'*[73]

There are overlaps to be found at the genus level. Whilst it is possible to discriminate between gorillas and chimpanzees on the basis of relative brain size, the situation is not nearly so clear-cut for gorillas and orang-utans. Male orang-utans and female gorillas share similar R.B.S. values; the problem being further compounded by the fact that they share similar mean cranial capacities and body weights. In such circumstances discrimination (apart from visual) is possible through a comparative study of the cranial and post-cranial morphology.

In summary, the calculation of relative brain size can be seen as a useful tool in distinguishing man from the living anthropoid apes, of whom he is said (according to current transformist theory) to have shared a common ancestry. It is, however, abundantly clear that there is a **distinct gap** between the values for the larger pongids (gorilla, orang-utan and chimpanzee) and those for modern man, despite their morphological diversity. The living pongids are **small-brained** creatures. Not only do they possess small cranial capacities when compared with man, but their cranial capacity/body weight ratios (relative brain size) are also comparatively small.

Relative brain size may also be useful in determining the true status of hominoids and hominids. To date, however, comparisons with modern man and the living anthropoid apes have been severely impeded by the scarcity and incompleteness of fossilised skeletal remains of hominoids and hominids. Poorly preserved and often distorted cranial material have led to questionable determinations of endocranial volume (ECV) or cranial capacity. Similarly, post-cranial remains, including trunk and limb (long) bones, are also subjected to plastic deformation, fracturing and weathering during the fossilisation process. The resultant poor state of preservation may give rise to false estimates of body weight.

Nevertheless, there have been a number of estimates of body weight and cranial capacity in recent years for specific hominoids and hominids. These estimates provide us with very tentative values of relative brain size, and shall be discussed in a future paper.

SIMULTANEOUS POST-FLOOD MIGRATION/ MORPHOLOGICAL SHRINKAGE MODEL

For some time now, palaeoanthropologists have considered the African continent as a focal point for early hominid origins. Such origins are said to have coincided with periods of major climatic change; changes which were simultaneously affecting all the earth's continental land masses. The African continent, for instance, experienced a transformation of vast tracts of tropical rainforest into open woodlands and savannah grasslands during the Late Miocene. It was during this period of continental 'drying out' that the purported hominoid-hominid (or ape-human) split is thought to have taken place. The divergence of the hominoid ancestors of the living anthropoid apes is thought to have occurred somewhat earlier — the great Asian ape, the Orang-utan, preceding the African apes by between 5 and 8 million years.

In contrast, the biblical record of (earth and) human history chronicles the events associated with a global cataclysm — the Noahic Flood — a cataclysm which substantially reshaped the earth's lithosphere and, at the same time, destroyed all flesh (save that preserved in the ark of Noah). Resettlement of the earth, following this cataclysm, is said to have commenced from the 'mountains of Ararat' in Eastern Turkey. Human resettlement of the earth is likely to have occurred somewhat later than that by wildlife, having been delayed as a consequence of the events of Genesis 11:1–9.

Now, whilst there is broad agreement amongst creationists that most of the earth's sedimentary deposits were laid-down during the biblical Flood, there is a divergence of opinion as to which deposits constitute those of the post-Flood era. The boundary between Flood and post-Flood deposits has been the subject of many creationist papers. Whitcomb and Morris assigned the Miocene and Pliocene deposits of the Late Tertiary period to the concluding period of the Flood year, thereby restricting post-Flood deposits to the Pleistocene and Holocene epochs only.[74] Austin, on the other hand, has favoured the inclusion of both Tertiary and Quaternary deposits,[75] whilst

Northrup,[76] and Setterfield,[77] have suggested that the Mesozoic era may also be post-Flood. Woodmorappe has taken a more conservative stance, preferring

> *'. . . to allow parts of the upper column to be post-Flood in specific regions, but only where* ***absolutely demanded*** *by very strong evidence.'*[78]

The subject matter of the present paper deals primarily with the Pliocene and Pleistocene deposits of East and South Africa. The writer believes these deposits to be post-Flood. For the purposes of the present discussion, the standard geological terms for the various epochs and periods shall be used to distinguish strata within particular localities and/or profiles. However, their application in correlating deposits from more remote regions of the continent is **less certain**. If climatological changes associated with the drying-out of the African continent were to have taken place over a relatively short time-frame, then the **correlation of remote deposits by index fossils may well be illusory** (due to the likely rapidity of floral succession and faunal migration).

Before expounding the simultaneous post-Flood migration and morphological shrinkage model, it would serve us well to establish an approximate time-frame during which these climatological changes took place, and during which time the fossil hominids and hominoids lived and died prior to fossilisation taking place.

Establishing a Biblical Time-Frame for Post-Flood Fossil Pongids

Many fossil hominid and hominoid sites are to be found in, or immediately adjacent to, the **East African Rift Valley**. The Rift Valley is thought to have been formed comparatively recently, geologically speaking, between 15 and 20 million years ago, according to current evolutionary estimates. This corresponds to the Early to Middle Miocene epoch of the Tertiary period.

The term **rift valley**, in this instance, may be a misnomer. Reginald M. Daly has described the East African 'Rift' as

> *'. . . an enormous, dried-up floodriver valley . . .'*;

a kind of giant continental sluiceway.[79] Citing the noted geologist, Arthur Holmes, Daly suggests that there is no corroborative evidence to support the notions that the valley is either a compression-induced sunken **graben** or a tension (or split-apart) rift.

If Daly is correct, then it may be that the East African Rift Valley was formed at the conclusion of the Flood year; at the same time as *'The mountains rose, and the valleys sank down'* (Psalm 104:8) to receive the abating Flood-waters. The sides of the 'Rift' were then eroded and deposited, subsequently, in the former sluiceway. It is these deposits in which the fossilised remains of purported hominids, along with many other faunal genera, are to be found.

There appears to be little, if any, evidence of the fossilised remains of anatomically modern men *(Homo sapiens)* being found in the sedimentary deposits of East Africa prior to the Late Pliocene. A fossilised human skeleton, recovered from upper Bed II deposits in Olduvai Gorge in 1913 by Professor Hans Reck, is, perhaps, the oldest evidence of post-Flood man recovered to date.[80] Reck's skeleton has been assigned to the Early Pleistocene epoch. A rough circle of stones (thought to be the remnants of a wind-break), and a 'lissoir', found in stratigraphically lower deposits in the same Gorge, suggest that humans may have been present in this region **somewhat earlier than the fossil evidence suggests;**[81, 82] the DK I and FLK NN I sites, where these cultural artifacts were found, dating Late Pliocene or Early Pleistocene.[83]

Co-incidentally, the earliest evidences of the presence of humans in East Africa (Oldowan-type stone tools) is to be found in the Late Pliocene deposits of Hadar, Ethiopia. These deposits, which have been dated radiometrically at approximately 2.5 million years, are said to antedate the Olduvai artifacts by some three-quarters of a million years, according to the evolutionary time-scale. Similar stone tools, recovered from the Omo region of southern Ethiopia, are thought to be slightly older than the Olduvai cultural remains, but younger than those found at Hadar. The Hadar tools cannot, however, be associated with the *A. afarensis* hominids, since these cultural artifacts were recovered from stratigraphically higher sediments.[84]

The rather conspicuous absence of fossilised human skeletal remains and cultural artifacts between the Middle Miocene and the Late Pliocene may, of itself, be evidence that post-Flood settlement of the African continent by humans took place **after** habitation by wildlife. Such a scenario accords well with **a deferred, post-Flood dispersion of humankind from Babel** in the land of Shinar (Mesopotamia), as related in the book of Genesis.

Fossil hominids, including *A. afarensis*, *A. africanus*, *A. boisei/robustus*, *A.* or *H. habilis*, and *H. erectus*, are regarded by evolutionists as having belonged to the lineage which ultimately gave rise to modern man. These creatures are said to have spanned the interval between and including, the Middle Pliocene and Middle Pleistocene epochs. If, however, the transformist view of human origins is incorrect, then it increases the probability that many, if not all, of these creatures were merely immediate post-Flood pongids. Where, then, do these creatures fall into the biblical model of earth (and human) history? The present author believes that these creatures lived, and died, in the intervening years between the conclusion of the Flood-year and the termination of the Quaternary phase of the Ice Age.

The most severe phase of the Ice Age is thought to have occurred immediately prior to the Pleistocene/Holocene boundary.[85] The slide into the Ice Age (and colder global temperatures) is thought to have commenced during the Miocene epoch or, perhaps, slightly earlier.[86]

The formation of the vast continental ice sheets would

have paved the way for a rapid resettlement of the post-Flood earth. The locking-away of vast quantities of water (as ice) would have been instrumental in bringing about a number of critical changes to the earth's biosphere, including:

(1) A lowering (world-wide) of sea levels, and a consequent creation of land bridges between the various continents;
(2) A nullification of the humid conditions which would have prevailed, world-wide, during and immediately after the Flood-year;
(3) A dramatic drying-out of the continental landmasses; and
(4) A rapid succession of changing vegetation types in the sub-tropical and temperate regions of the earth.

It is therefore possible to postulate a rapid succession of faunal and floral types in certain regions of the earth during this critical phase of earth and human history. The establishment of land bridges would have aided in the rapid colonisation of the earth by both wildlife and post-Flood humans. Habitation of even the remotest regions of the earth (by wildlife, at least) would have been effected prior to the termination of the so-called Würm glacial when, it has been suggested, sea levels rose by as much as 140 metres (450 feet) in the wake of rising global temperatures.[87]

Now the book of Genesis implies that human migration, away from the Mesopotamian region (and as a consequence of the confusion of tongues, at Babel), occurred during the lifetime of Nimrod — a great grandson of Noah. It is not known how long after the Flood Nimrod lived, since the Hamitic genealogies do not stipulate lifespans or ages at the begetting of lineal descendants. It would, however, appear to be possible to date the termination of the Ice Age, and therefore the Pleistocene/Holocene boundary, via the Messianic genealogy of Genesis 11.

The Division of the Earth in the Days of Peleg

In Genesis 10:25 we read that '. . . two sons were born to Eber (a post-Flood patriach of the Messianic lineage); the name of the one was **Peleg, for in his days the earth was divided.**' A number of creationists have suggested that this verse may allude to the concept of continental drift. One advocate of this position is Bernard E. Northrup. Dr Northrup undertook an extensive examination of the root of the name, Peleg (or P–L–G), and his conclusions were as follows:

> *'Through a broad spectrum consideration of this root in Hebrew, Aramaic, Coptic, Ethiopic, Arabic, Syrian, Sanskrit, and Greek, I have been forced to conclude that this is built upon the pre-Babel phoneme, P–L, which remarkably conveys division in several languages.*
>
> *Furthermore, I conclude that* ***the combination P–L–G suggests division by means of water in many occurrences.*** *Indeed, in classical Greek I have located 18 developments of the same root, ALL of which refer to the sea. It is NOT the root chosen by Moses to describe the division of families and peoples in the two instances in Chapter 10 where he discussed that kind of division (vss. 5, 32).*
>
> *Also,* ***the linguistic and family division can be demonstrated to have taken place approximately three generations before "the earth was utterly divided by water (Lit.) for which Peleg was named.'***[88]

Could this verse (v. 25), therefore, be referring to the melting of the continental ice sheets at the close of the Pleistocene epoch **and the submerging of the previously existing land bridges between the various continental landmasses**? If this be the case, then it may be possible to derive a time-frame from the Genesis genealogies into which the sediments containing purported hominids belong. It might also be inferred that the post-Babel radiations of the human population, including the Neanderthal and Cro-Magnon races, would have taken place toward the end of this same time-frame; these fossil men having been recovered from Late Pleistocene deposits, including those laid-down during the so-called Würm glacial.

Lower and upper limits for the interval between the Flood and Peleg's 'division' can be derived from the genealogies contained in Genesis 11:10–18; see Table 1. They range from 101 to 340 years if the Massoretic text of the Old Testament is followed, and between 531 and 870 years for the Septuagint (LXX). It is beyond the scope of the present paper to assign a preference for either version. Suffice to say that the author believes that **East African deposits, at the very least post-dating the Middle Miocene and pre-dating the Holocene epoch, fall wholly within this time-frame.** It is also believed that it was during this post-Flood period that giant pongids (purported hominoids and hominids) migrated away from the mountains of Ararat, southward, into East (and ultimately, for some, South) Africa. Furthermore, it was during this same period that these creatures experienced morphological shrinkage.

Post-Flood Migration of Anthropoid Apes

The book of Genesis records that post-Flood resettlement of the earth commenced from the region of the mountains of Ararat (Genesis 8:4,19); these mountains being located in Eastern Turkey, near that country's borders with the USSR (specifically Soviet Armenia) and Iran.

The simultaneous post-Flood migration/morphological shrinkage model postulates that it may be possible to trace the migration routes taken by post-Flood genera of anthropoid ape, as they journeyed away from Eastern Turkey. For instance, the post-Flood ancestors of the living orang-utan *(Pongo pygmaeus)* would have migrated away from the immediate vicinity of Ararat, initially in a westerly direction, and arrived in their present-

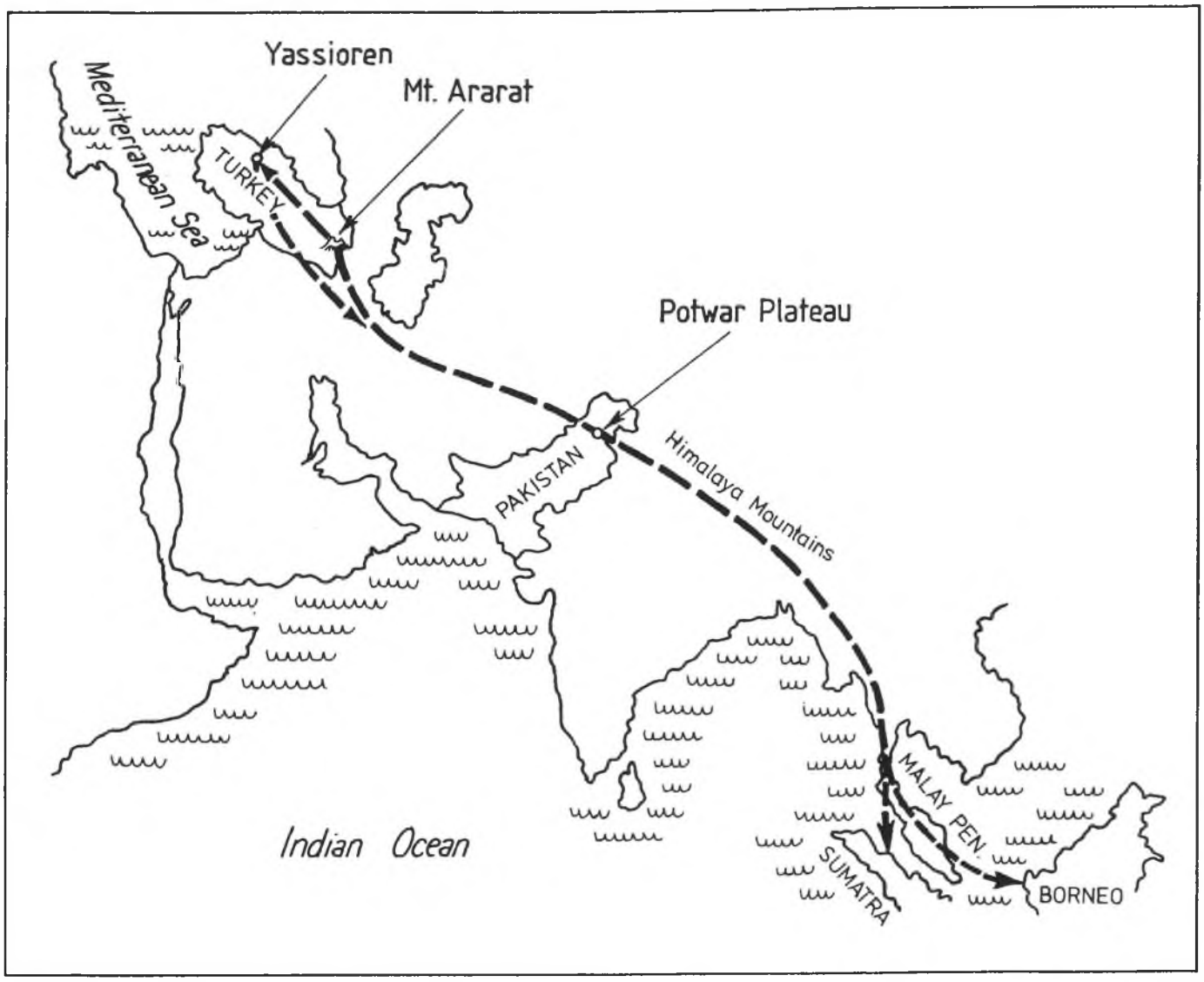


Figure 2. POSSIBLE POST-FLOOD MIGRATION ROUTE OF THE SIVAPITHECINES.

day native habitats (the tropical rain-forests of Borneo and Sumatra) several centuries later.

Whilst en route, some of these creatures may, themselves, have become victims of **secondary catastrophes**, such as flash floods, subsequently becoming fossilised; their remains becoming a record of their migration through, or temporary habitation of, a specific region. Naturally, the same principle would apply to the post-Flood descendants of a great many forms of wildlife in addition to the anthropoid apes.

Having accepted this premise, it is noteworthy that the fossilised remains of large, orang-like creatures have been found in Turkey. These creatures, classified *Sivapithecus meteai*, were recovered from Middle Miocene deposits at Yassiören, some 55 kilometres north-west of Ankara, in Turkey.[89]

Furthermore, the fossilised remains of a second orang-like creature have been recovered from the Potwar Plateau of the Siwalik region of Pakistan; these creatures being ascribed to the taxon, *Sivapithecus indicus*.[90]

If these creatures are one and the same, that is to say, they are **conspecific**, and they are also **congeneric** with the living orang-utan, then their post-Flood migration route may have approximated that shown in Figure 2. The respective ages of these large sivapithecines are consistent with a radiation away from the Ararat region; *S. meteai* (Middle Miocene) being slightly older than *S. indicus* (Late Miocene). It would also appear that the two living sub-species of *Pongo (P. pygmaeus pygmaeus* and *P. pygmaeus abelii)* reached their present-day habitats (Borneo and Sumatra respectively) **prior to the end of the Ice Age**; after which time the Plio-Pleistocene Malay Peninsula land bridges were severed by a rise in sea level. (Of course, such a premise has obvious implications for

research into the fossil ancestors of extant Australian marsupial mammals.) It may also be possible to seek out intermediate ancestors in, say, Plio-Pleistocene deposits between Pakistan and the Malay Peninsula. Likewise, one could also predict finding older intermediate ancestors of *Sivapithecus* in Middle to Late Miocene deposits between Turkey and Pakistan. Therefore, the model is both predictive and to some extent testable.

Now, fossilised remains of *Sivapithecus meteai* have been found in deposits of the middle Sinap Series north of Yassiören. These deposits abound with a variety of fossilised fauna. On the other hand, the deposits below the middle Sinap Series are noted for their paucity of fossil remains.[91] This paucity suggests that the region was inhabited by few creatures when the lower Sinap deposits were being laid down. Perhaps these deposits were laid down during the immediate post-Flood era, when radiatory migration (away from the immediate vicinity of Mt Ararat) was in its earliest phase and population levels were extremely small.

The significance of *Sivapithecus meteai* is twofold: firstly, its affinities with the great Asian ape, the orang-utan, and secondly, its comparative size with respect to *Pongo* and the fossil ape, *S. indicus*.

Peter Andrews and John E. Cronin have noted that the facial characteristics of *Sivapithecus meteai*

> '. . . *bear strong resemblances to that of the orang-utan*' and '. . . *combine to produce a face shape similar to that of the orang-utan and different from comparable-sized gorillas.*'[92]

However, they also suggested that *S. indicus* could **also** be linked to *S. meteai* and the orang-utan (based on comparative studies of GSP 15000 and MTA 2125).[93] In an earlier paper, Andrews and I. Tekkaya had presumed that

> '. . . S. meteai *possessed the derived condition with respect to the primitive hominoid morphotype and* S. indicus *the primitive condition.*'[94]

In an editorial comment on David Pilbeam's **Nature** article, 'New hominoid skull material from the Miocene of Pakistan', Andrews stated that

> '*Pilbeam has been very cautious in his assessment of the similarities his new specimen (i.e. GSP 15000) shows with the orang-utan* . . . (he then lists some of the similarities, adding) . . . *All these characters are present on the* S. indicus *skull,* ***and some at least*** *are known to be present on other species such as* Sivapithecus meteai *and* Sivapithecus punjabicus.'[95]

Now presupposing that *S. meteai*, *S. indicus* and extant orang-utans *(Pongo pygmaeus)* are congeneric, it is reasonable to assume that *S. indicus*, being the more recent of the two fossil apes, will more closely approximate in form the great Asian ape. This appears to be precisely what Andrews and Tekkaya were saying in the aforementioned statements.[96]

However, it also appears that, morphological affinities with the orang-utan aside, *S. meteai* and *S. indicus* can be discriminated on the basis of overall size. The older of the two fossil apes, *S. meteai*, is significantly larger than *S. indicus*, which in turn is larger than most living orang-utans.[97] This observation will be elaborated shortly.

Morphological Shrinkage and Proportional Changes in Body Size

Small changes in body size can have a significant bearing on body weight and capacity — even when proportionality is retained. For instance, in genera where sexual dimorphism is pronounced and allometry minimal, males may possess body weight significantly greater than their female partners, yet exhibit little discernible difference dimensionally. Such is the case in living orang-utans (where the weight in males may be double that of females, yet the height differential may be only of the order of 30 percent). Likewise, a two year-old girl may have reached half her potential adult height, yet possess only one-fifth of her mother's weight.

Similarly, substantial variations in cranial capacity within a specific population do not necessarily imply large-scale differences in craniometric dimensions. Again, it may be difficult to discern any significant difference in size and outward appearance.

Body **weight** and cranial **capacity** (or endocranial **volume**) vary as a **cubic function**, whilst the occlusal surfaces of teeth (i.e. the biting surface **area** of the tooth crown) differs as a **squared function**. The relevance of such observations to the pre-Flood giantism hypothesis may not be readily comprehended. However, the basis of the hypothesis involves a **scalar shrinkage** in body size during recent (post-Flood) earth history.

Donald W. Patten has noted that so-called 'prehistoric' mammals, for whom there are recognizable living descendants, are, **with respect to their height or length**, generally 30 to 40 percent larger than their living counterparts.[98] Assuming that such creatures represented pre- or immediate post-Flood ancestors of extant genera and species, then the impact of such variations on overall body size, weight, cranial capacity and dentitional morphology (including the occlusal areas of post-canine cheek teeth) may be assessed. Figure 3 illustrates, diagrammatically, proportional changes in body size of the magnitude observed by Patten (a 33 percent variation in height is postulated).

The average adult male *Homo sapien* stands about 1.675 metres tall. The mean height for his pre-Flood ancestors would notionally resolve out to 2.2 metres (or H). However, when we turn to notional estimates of, say, occlusal areas of cheek teeth, cranial capacity or endocranial volume, the differences between extant humans and their pre-Flood ancestors were decidedly more pronounced. For instance, the maximum **mesiodistal** (crown length; l) and minimum **buccolingual** (crown breadth; b) dimensions for molars and pre-molars are used to determine the occlusal areas (l x b) of these teeth. Assuming

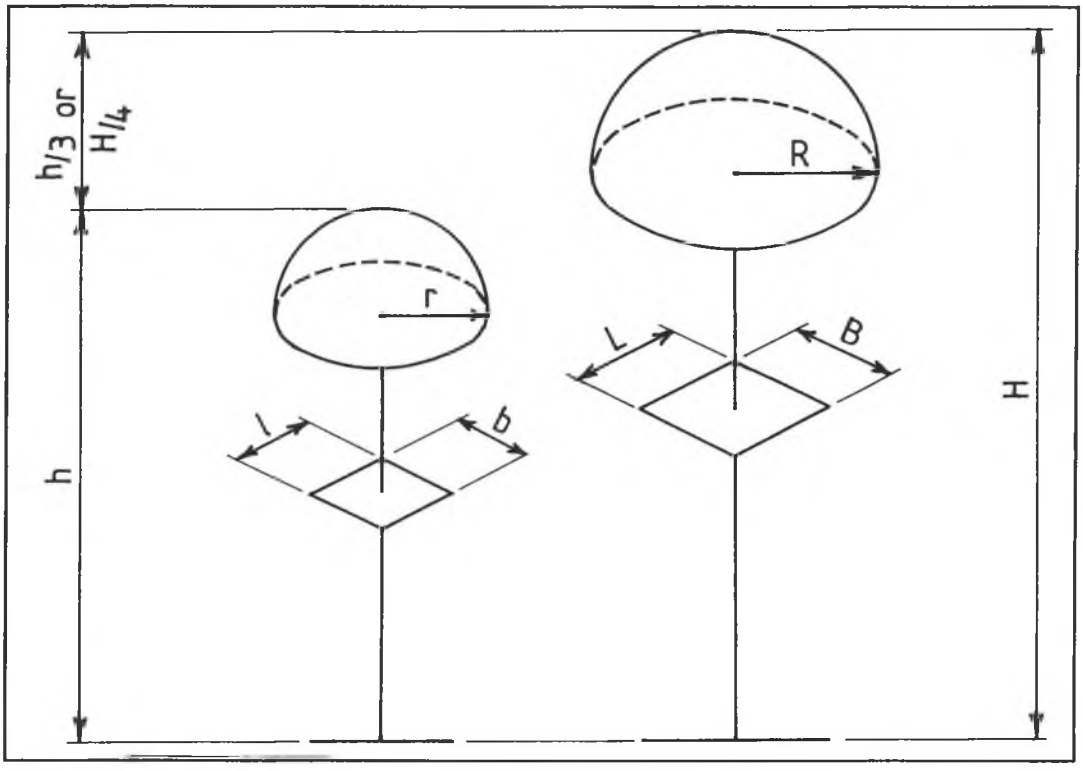


Figure 3. PROPORTIONAL (SCALAR) VARIATIONS IN BODY SIZE

that the crown dimensions of the pre-Flood ancestor were 33 percent greater than those of modern man, the notional occlusal areas for the teeth of pre-Flood man would be calculated according to the formula,

$A = (\frac{4}{3})^2 (l \times b)$;

resulting in a 78 percent greater occlusal area. Thus, if we assign mesiodistal and buccolingual values of 10.7 and 9.8mm respectively for the lower third molar (M_3) of modern man, we would obtain extant and pre-Flood occlusal areas of 105 and 186mm^2 respectively.

Turning briefly to the determination of endocranial volumes, a simple analogy can be drawn by assuming that the human cranium takes the shape of a hemisphere of volume,

$V = \frac{2}{3} \pi r^3$.

The mean endocranial volume for modern males is 1,400 ml. The corresponding radius may be calculated using the formula,

$r = \sqrt[3]{\frac{3V}{2\pi}}$;

yielding a value of 8.74cm for r. A notional pre-Flood value of endocranial volume, based on a proportional increase in radius of 33 percent, will be calculated according to the formula,

$V = \frac{2}{3} \pi(\frac{4}{3} r)^3$

This gives a notional pre-Flood ECV value of approximately 3,200 ml. Calculations of cranial capacity will yield equivalent numerical values; only the units change (ml. being replaced by cc.). Thus, the notional pre-Flood values of cranial capacity and endocranial volume **represent an increase of 137 percent on the modern values**.

Whilst a notional mean pre-Flood height for adult males of 2.2 metres may, at first, seem extreme, it is well to remember that the Scriptures testify to the existence of giant humans **both before** (Genesis 6:4) **and after the Biblical Flood** (Numbers 13:33). The Philistine nation may well have represented the last vestiges of these pre-Flood giants; their champion, Goliath of Gath, is credited with being over 2.8 metres (9 feet) tall (1 Samuel 17:4).

The controversial giant human footprints, found in the limestone bed of the Paluxy River (near Glen Rose, Texas), are therefore to be anticipated according to the pre-Flood giantism hypothesis. These footprints, ranging in length from 23 to 60 centimetres (9 to 24 inches), have been mirrored in various regions throughout the southwest United States, including the Hopi Reservation in Arizona, near Mount Whitney in California, and near White Sands, New Mexico.[99] Most of the Paluxy footprints averaged about 39 centimetres (or 15½ inches), and are significantly larger than those for modern men and women.

Simultaneous Post-Flood Migration and Morphological Shrinkage

In the aftermath of the Flood, the earth's continents would have been gradually repopulated by wildlife — commencing from the region of Ararat, and radiating outwards toward the extremities of the continental landmasses. As post-Flood migration took place, it is likely

that secondary catastrophes would have overcome various extant, or now extinct, forms of wildlife, whilst they were en route to their new habitats. Under such catastrophic circumstances, fossilisation would have been likely. If migration took place over a time-frame of several centuries, or more, and the interval between successive catastrophes had been of sufficient duration, then the fossilised remains of succeeding generations of wildlife (including pongids and man) might evince morphological shrinkage.

Therefore, provided a given species had occupied a particular site or region for a sufficient length of time, then the stratigraphic record of that place might provide evidence of changes (reductions) in body size. Furthermore, morphological shrinkage might also be detected in deposits of increasing remoteness to the original point of disembarkation (Ararat).

NOTIONAL LIMITS TO THE MORPHOLOGY OF PRE–FLOOD PONGIDS AND MAN

How much larger, then, were the pre- and immediate post-Flood ancestors of the living pongids and man? In the preceding section the present writer cited Patten as suggesting a figure of between 30 and 40 percent (in respect to body height or length) was in order. Is such a figure realistic and consistent with the fossil evidence? And if so, is it applicable to pre-Flood anthropoid apes and man?

The basic premise of the pre-Flood giantism hypothesis is that hypercapnia-induced giantism was **'pandemic' to all terrestrial forms of antediluvian life (including both flora and fauna).** It may also be argued that the fossil record, as it pertains to the Miocene and subsequent geological epochs, contains the remains of a graded succession of fossil pongids, which are **decreasing in body size with the passage of time**. The largest representatives of the giant fossil forms of pongid genera are therefore anticipated to be found in Miocene (or even earlier) sediments.

Until comparatively recent times, palaeontologists believed that there were no recognizable ancestors for any of the living anthropoid apes. The following quotations were typical:

> *'. . . the fossil record of pongids (modern apes) is non existent, making a glaring deficiency in the whole story.'*[100]
>
> *'At any rate, modern gorillas, orangs and chimpanzees spring out of nowhere, as it were. They are here today; they have no yesterday, unless one is able to find faint foreshadowings of it in the dryopithecids.'*[101]
>
> *'After the Miocene only monkeys have been found as fossils — apes, in other words, became so rare that they appear not to be present in Pliocene and Pleistocene deposits.'*[102]

Such a view can no longer be endorsed, in view of a number of significant discoveries in recent years. These discoveries will be discussed shortly.

Now, when it comes to phylogenetic histories of the origins of modern apes and man, the evolutionist generally assumes that small fossil apes gave rise to larger fossil hominoids, and from these, still larger ancestors of the living pongids and man emerged. The pre-Flood giantism hypothesis, on the other hand, asserts that genus fixity and post-Flood morphological shrinkage provide a much more rational explanation of the fossil record as it pertains to the ancestors of the living anthropoid apes and modern man. The two mutually exclusive views may be summarised as follows:

Evolutionary (or Transformist) view:	Small fossil apes (hominoids) and and man-apes (hominids)	→	Large extinct or living varieties of pongid and man
Creationist (or Biblical) view:	Giant pre- and immediate post-Flood forms of fossil apes and man	→	Smaller extant or now extinct varieties of pongid and man

When giant forms of extant creatures are found in the fossil record, they are usually assigned a distinctive taxonomic description; a classification which seldom bears any resemblance to the genus or species names of the living variety. For instance, earlier in this paper, mention was made of the discovery of the fossilised remains of

giant baboons at Olorgesailie, in Kenya. These creatures have usually been assigned to the genus, *Simopithecus*, yet they bear strong resemblances to the living gelada baboon, *Theropithecus gelada*. These giant geladas have been found in deposits ranging in age from the Late Pliocene to Late Pleistocene, and in their largest form *(Theropithecus oswaldi mariae*, from Olduvai Gorge) **approximate in body size female gorillas.**[103]

It is generally presumed that these giant geladas became extinct during the Late Pleistocene period. But what if they didn't? Could the living gelada baboon represent the last vestiges of a population of giant, pre-Flood geladas, which underwent morphological shrinkage during the post-Flood era (following changes in biospheric conditions after the Flood)? Could these giant forms of gelada represent intermediate 'links' in this shrinkage process?

According to Louis Leakey, the Olorgesailie specimens of *Simopithecus*

> *'. . . must have been* ***about twice as massive as a very large gelada****, the biggest living baboon, judging not only by its jaw but also by its limb bones.'*[104]

Now the remains of *Simopithecus*, in contrast to otherfossil apes and monkeys, are relatively well known and complete. By way of contrast, the scarcity and incompleteness of fossilised remains of hominoids and hominids has rendered any assessment of their relationship to living genera of anthropoid ape or man an extremely tentative and speculative undertaking. Indeed, both hominoid and hominid phylogenies have been repeatedly modified (**often substantially**) following the discovery of more complete remains. However, to say that there are no known fossil ancestors of the living anthropoid apes would appear, in the light of a number of recent discoveries, to have been a little premature.

Consider, for instance, the fossilised remains of the Miocene ape, *Sivapithecus*.

Prior to the late 1960s very little was known about the fossil apes belonging to the genus, *Sivapithecus*. The first fossilised remains of *Sivapithecus indicus* were recovered in the Siwalik Hills of Northern India (now Pakistan) during 1910. The fossils (comprising the fragmented remains of two lower jaws and some isolated teeth) were pronounced by Guy Pilgrim, their discoverer, to belong to possible primitive ancestors of modern man.[105]

At the time of the initial discovery of *Sivapithecus indicus* Pilgrim also found the remains of a smaller ape, which he mistakenly called *Dryopithecus*, and which was later renamed *Ramapithecus punjabicus*. The remains of the latter comprised the right half of an upper jaw and the left half of a lower jaw. The mandibular fragment included the preserved remains of two pre-molars and three molars. Despite the morphological similarities which existed between the respective sets of cheek teeth in *Sivapithecus* and *Ramapithecus*, Pilgrim concluded that separate genera were warranted. The ramapithecine jaws were perceived to be slightly smaller than those belonging to *Sivapithecus*. The possibility of sexual dimorphism was overlooked.

Since 1967, however, several more complete specimens of *Sivapithecus* have been recovered. The first of these, from Yassiören in Turkey, was not analysed closely until late 1976.[106] A detailed study of the remains of the *Sivapithecus meteai* maxillary (accessioned MTA 2125) led Peter Andrews, of the British Museum of Natural History, and I. Tekkaya to the conclusion that:

> *'In the description of the maxilla and dentition . . . the closest comparisons in most cases were with the orang-utan.'*[107]

Then in 1979–80 a further specimen of *Sivapithecus* was recovered from deposits of the Dhok Pathan Formation of the Potwar Plateau in Pakistan.[108] The find was suggested to be of Late Miocene age, according to David Pilbeam. Excellent photographic reproductions of this find, subsequently accessioned GSP 15000, are to be found in two books by Richard Leakey — **The Making of Mankind** (p. 47; Michael Joseph edition, 1981) and **Human Origins** (p. 22; Hamish Hamilton edition, 1982).

In his initial description of GSP 15000 Pilbeam described the cranio-facial remains as follows:

> *'Sufficient frontal bone is preserved and enough known of the position of temporo-mandibular joint and adjacent temporal bone to reconstruct tentatively the anterior half of the brain case.* ***This was hafted high on the face, as in Pongo but unlike Pan****; . . . In this feature, and in facial profile, jaw joint morphology, malar morphology, orbital shape and disposition, and overall palatal shape,* ***the specimen is quite orang-like.****'*[109]

Two years later Pilbeam reiterated these thoughts in **Scientific American**. Concerning the remains of *Sivapithecus*, he conceded that they resembled those of the sole surviving Asian great ape, the orang-utan *(Pongo pygmaeus)*; particularly in the face and palate. Yet despite these morphological affinities, Pilbeam could only bring himself to suggest that *Sivapithecus*

> *'. . .* ***may*** *have been ancestral to the only living large hominoid of Asia, the orangutan.'*[110]

Peter Andrews was not nearly so guarded. In a letter to the British science journal, **Nature**, Andrews stated:

> *'It thus appears that* Sivapithecus *(including* Ramapithecus*) is part of the orang-utan clade . . . In other words* "Ramapithecus" *can no longer be considered as part of the human lineage but as part of the orang-utan lineage.'*[111]

Alan Walker, a colleague of Richard Leakey, has, in the light of the aforementioned evidence, gone so far as to describe orang-utans as **'living fossils'**.[112]

However, the significance of the recent *Sivapithecus* finds does not cease with the affinities they share with extant orang-utans. Returning briefly to Pilbeam's **Nature** article, we read that:

> *'The midfacial length from orbit to nose is greater*

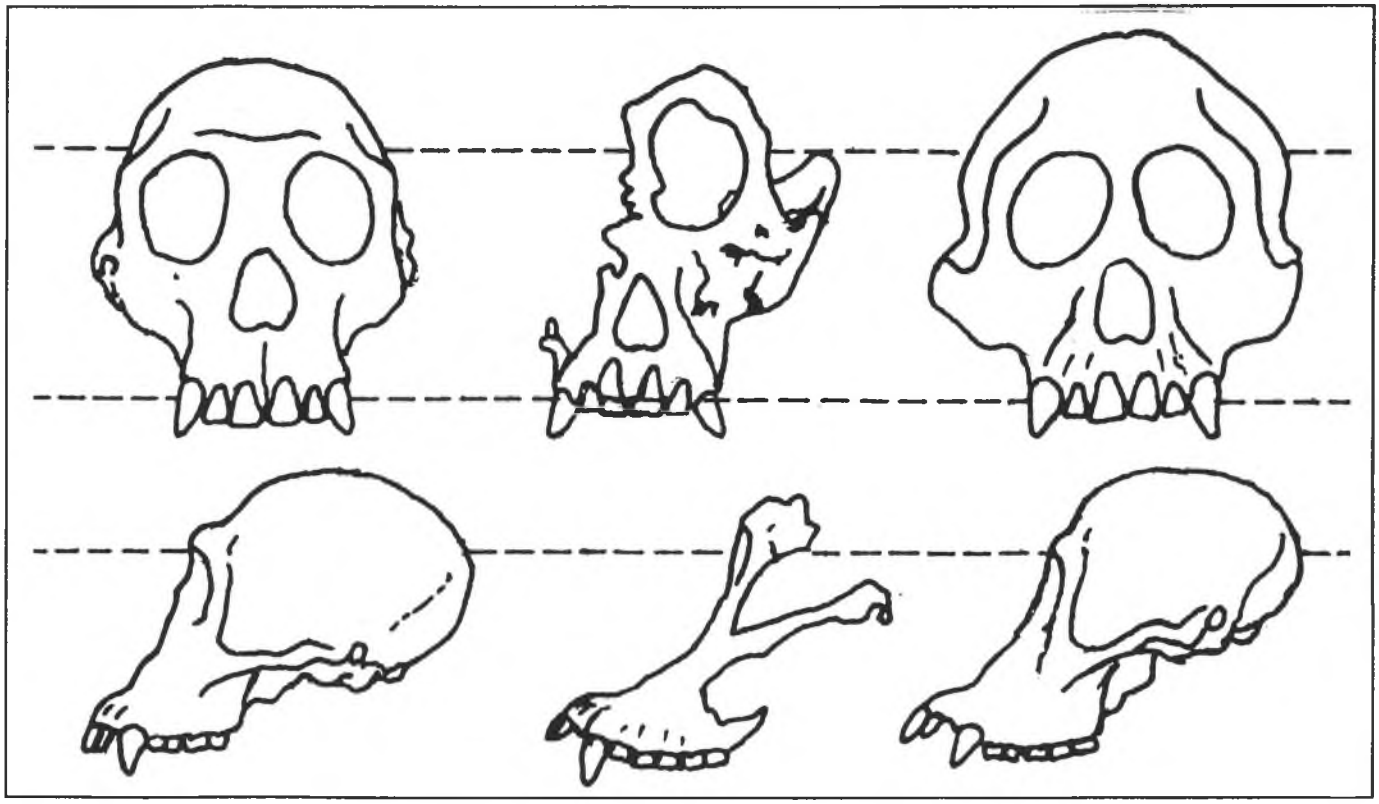


Figure 4. COMPARATIVE ANTERIOR AND LATERAL VIEWS OF CRANIO-FACIAL REMAINS OF CHIMPANZEE (LEFT), GSP 15000, AND ORANG-UTAN. NOTE THE HEIGHT OF THE EYE ORBIT OF S. INDICUS *IN RELATION TO* PAN *AND* PONGO.

than that in Pan *or* Pongo.'[113]

In fact, the impression one obtains from comparative anterior and lateral views of the GSP 15000 reconstruction of *S. indicus* and skulls of *Pan* and *Pongo* is that the Miocene ape was **significantly larger than both extant chimpanzees and orang-utans**. Observe the relative size of the eye orbits and nasal apertures of GSP 15000 and *Pongo* in Figure 4.

When we turn to *Sivapithecus meteai*, the size differential with respect to *Pongo* is **even greater** (see Figure 5). Included in this species are the fossilised remains of several taxons, including *Ouranopithecus macedoniensis* and *Ankarapithecus meteai*, as well as the Sinap lower face and maxillary, MTA 2125. Peter Andrews and I. Tekkaya, in defining the new taxon of *S. meteai*, noted that:

> *'The similarity of the A. meteai mandible to the new Greek specimens led one of us (Andrews 1976) to group them in one species. As* meteai *has priority over* macedoniensis, *and as it was considered that* ***the new species was simply a larger version of*** **S. indicus**, *the resulting name used was* S. meteai.'[114]

Although acknowledging the existence of many shared characteristics in these large Sivapithecines, Andrews and Tekkaya concluded that the three species were congeneric, **but not conspecific**.[115]

However, these incremental variations in size may well evince morphological shrinkage and, perhaps, changes in diet. Nevertheless, the authors concluded that

> *'. . . with the evidence of similarity presented here between* S. meteai *and the orang-utan the likelihood must be increased that they are related.'*[115]

Early Fossilised Human Remains

The evolutionist contends that fossils of recognizably 'modern' man are not to be found in deposits older than late Pleistocene. This is not to say that such fossils have not been found; it merely reflects **a reluctance on the part of evolutionists to accept such fossils at face value.**

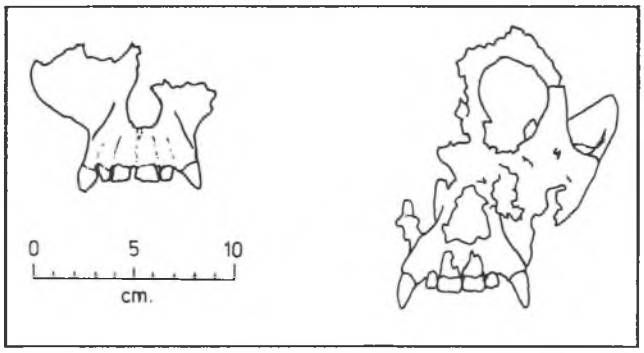


Figure 5. COMPARATIVE ANTERIOR VIEWS OF MTA 2125 (S. METEAI) *AND GSP 15000* (S. INDICUS)

Many examples can be cited: the Freiburg skull (recovered from coal measures of presumed Tertiary age),[117] Hans Reck's relatively complete human skeleton (from upper Bed II deposits in Tanzania's Olduvai Gorge),[118] the Castenodolo cranium from Northern Italy (of Pliocene age)[119] and the Calaveras skull (also of Tertiary age).[120]

Many other specimens have become 'skeletons in the closets' of palaeoanthropologists and museums around the world. Robert Broom and C. W. H. Schepers (both devout evolutionists) conceded that:

> *'When someone produces relics of Homo sapiens in geological deposits more ancient than Mid Pleistocene, we seek all manner of unlikely explanations for such an improbability, even going so far as to discredit usually reliable witnesses. Such finds ultimately become veritable skeletons in the cupboard to anthropologists, who, in the* ***subconscious endeavours to support dogma****, even fail to describe such finds fully enough to allow fools to enter where angels fear to tread.'*[121]

It is anathema to the evolutionist to admit to the possibility of finding a human skull, for instance, in coal measures of Tertiary age.

A century ago, and in reference to the discovery of the Castenedolo skull, the distinguished French anthropologist De Quatrefages wrote:

> *'One could only oppose it* ***on the ground of general doctrine****, with which it appears to be in contradiction'*[122] and *'. . . there exists no serious reason for doubting the discovery, and, if made in a Quaternary deposit, no one would have thought of contesting its accuracy. Nothing can be opposed to it but theoretical* **a priori** *objections similar to those which long repelled the existence of Quaternary man.'*[123]

The aforementioned specimens, together with the large Olmo skull from Northern Italy,[124] are of a **decidedly more modern appearance than Late Pleistocene Neanderthal crania**. Yet there is an outright reluctance on the part of most palaeoanthropologists to even acknowledge their existence, let alone their significance to the current origins debate.

Whilst it would appear that most of these contentious fossils have been discovered in post-Flood deposits, there is a dire need to determine precisely how long after the Flood these individuals lived (are they Tertiary or Quaternary burials?) There is also a need to establish whether there are any reliable evidences (whether fossil or artefactual) of pre-Flood man.

Post-Flood Ancestors of Modern Man

The failure of evolutionary palaeoanthropologists to recognise the existence of such fossils, and more particularly, their geological age, has stifled detailed investigation of these important fossil finds. Nevertheless, in the absence of such vital information, we do have determinations for fossils of **recognizably 'modern' men,** including Ice Age cave dwellers such as the **Neanderthal** and **Cro-Magnon** races. These populations of fossil men probably represented some of the earliest migrations of humans away from the Mesopotamian Valley; post-dating both the Biblical Flood and the confusion of tongues at Babel.

Modern theories of human origins suggest that these people bridged the gap between the *Homo erectus* (or Pithecanthropine) phase of human evolution and the modern-day *Homo sapiens sapiens*. If such theories are to have any credibility, we would anticipate that the mean cranial capacities for these Late Pleistocene populations would be intermediate between the Pithecanthropines (for which mean values ranging from 880 to 1,100cc have been documented by various authorities) and the modern mean value (1,350cc). Such, however, is not the case. The mean value for the Neanderthals has been variously quoted as between 1,450 and 1,500cc (some authorities suggest even higher values), whilst that for the Cro-Magnon race is generally documented at 1,600cc or more. These values suggest that the immediate ancestors of modern man possessed cranial capacities between 7.5 and 18.5 percent greater than the modern-day average.

It is worthwhile noting, however, that the previously cited mean value for Cro-Magnon and Neanderthal man may be too low.

A variety of distinctive population groups, including the Grimaldi, Predmost, Vogelherd and Les Eyzies types, have been encapsulated within the Cro-Magnon race. Alfred S. Romer, the distinguished vertebrate palaeontologist, suggested that males of the Cro-Magnon race possessed mean cranial capacities of between 1,700 and 1,800cc; females, however, were *'. . . smaller-brained.'*[125]

K. C. McLeod has suggested a range of between 1,600 and 1,900cc,[126] whilst the 1967 Edition of the **Encyclopaedia Britannica** cited a range of between 1,550 and 1,760cc (i.e. between 14 and 29 percent greater than the modern average).[127]

Concerning the Neanderthals, the same edition of **Britannica** cited an average cranial capacity of 1,450cc.[128] However, by 1979 Nickels, Hunter and Whitten were suggesting an average of 1,500cc.[129] Dr Thomas McKern, and his wife Sharon, had noted some ten years earlier that the Neanderthals of Western Europe and Iraq (Shanidar) possessed skulls which

> *'. . . although very low and long . . .'* (*'dolichocephalic'* by definition), were *'. . . huge. Cranial capacities climb*(ed) *over 1600cc in numerous specimens, a figure well over the average cranial capacity for modern man.'*[130]

Finally, F. E. Poirier observed that the human brain underwent a reduction in cranial capacity of approximately 300cc between the Neanderthal phase and the modern era,[131] whilst Robert Charroux has suggested an average of 1,600cc for the Neanderthals.[132]

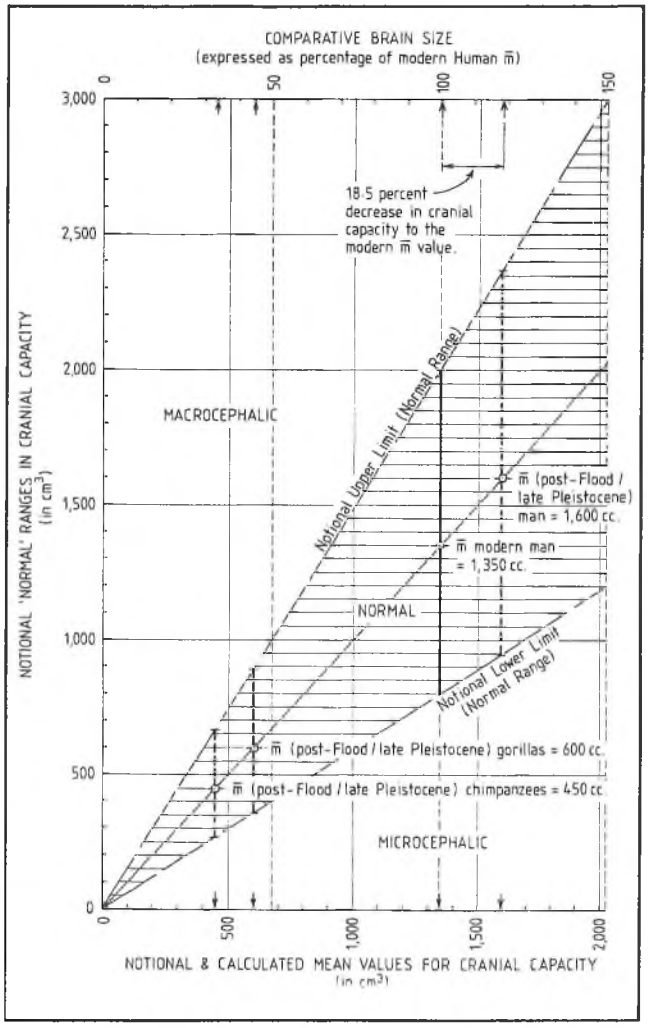


Table 5. NOTIONAL 'NORMAL' RANGES IN CRANIAL CAPACITY FOR POST-FLOOD (LATE PLEISTOCENE) CHIMPANZEES, GORILLAS AND HUMANS.

The Neanderthal and Cro-Magnon races also possessed dentitions which were substantially larger than those of modern man. Concerning the Neanderthals, J. A. J. Gowlett has stated that they

*'. . . were characterized by heavy brow ridges, long low skulls, **and large teeth**, but so were other early men, such as those from Ngaloba and Broken Hill'*,[133]

whilst Henri J. Delporte has noted that

*'. . . the teeth of other fossil humans classed as Cro-Magnon, show that the dentition of Cro-Magnon man was nearly identical to that of modern man. Most of the teeth, however, especially the last molars, are **distinctly larger than those of most modern peoples.**'*[134]

Despite the reduction in tooth size over recent geological history, it would appear that jaw shrinkage has proceeded at a somewhat more rapid pace — the result of which is the common occurrence of **impacted wisdom teeth**. David Lambert has suggested that overcrowding is

*'. . . **a legacy of jaw shrinkage** — a relatively recent product of evolution.'*[135]

It is hard to imagine how such a painful and deleterious condition can be described as a 'product of evolution', however. It certainly doesn't constitute a morphological improvement.

Table 5, shows in graphical form the notional ranges in cranial capacity for post-Flood chimpanzees, gorillas and man. They reflect a uniform decrease in mean cranial capacity of 18.5 percent to today's mean values (ref. Table 3). The notional ranges are shown as broken, vertical lines in each instance, whilst the present-day 'normal' range for modern man is shown as a continuous, vertical line. Post-Flood ranges are constrained within the notional 'normal' upper and lower limits for pongid and human cranial capacity; a region defined by cross-hatching.

According to the evolutionary time-scale, the Neanderthal and Cro-Magnon races lived during the late Pleistocene period; that is, between 120,000 and 10,000 years B.P. In fact, most specimens have post-dated 50,000 years B.P. For the purposes of this paper it is presumed that these people were the earliest post-Flood inhabitants of the European, Asian and African continents. They are also to be regarded as having post-dated the earliest settlement of the Mesopotamian Valley (at Babel).

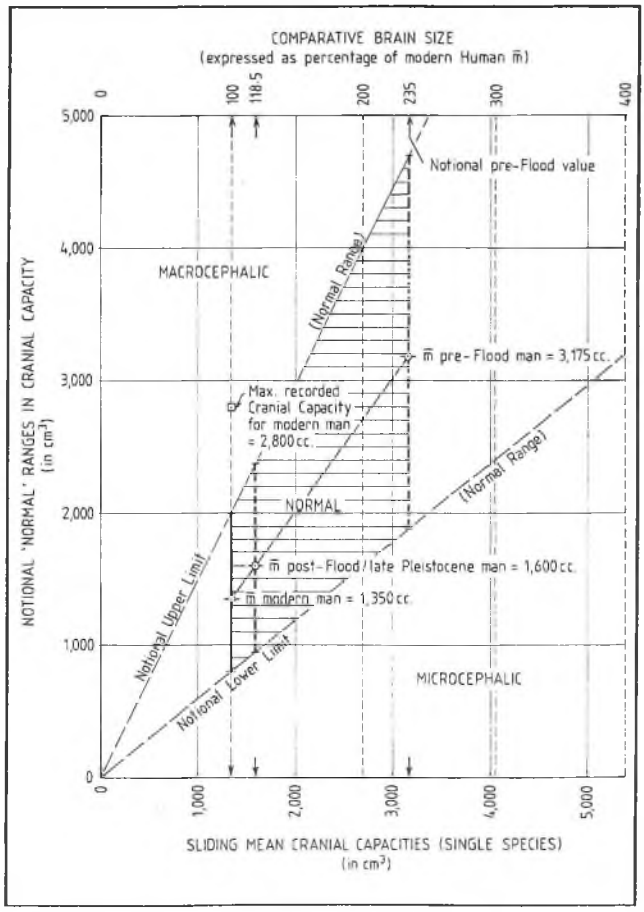


Table 6. NOTIONAL 'NORMAL' RANGES IN CRANIAL CAPACITY OF GIANT PRE- AND IMMEDIATE POST-FLOOD HUMANS.

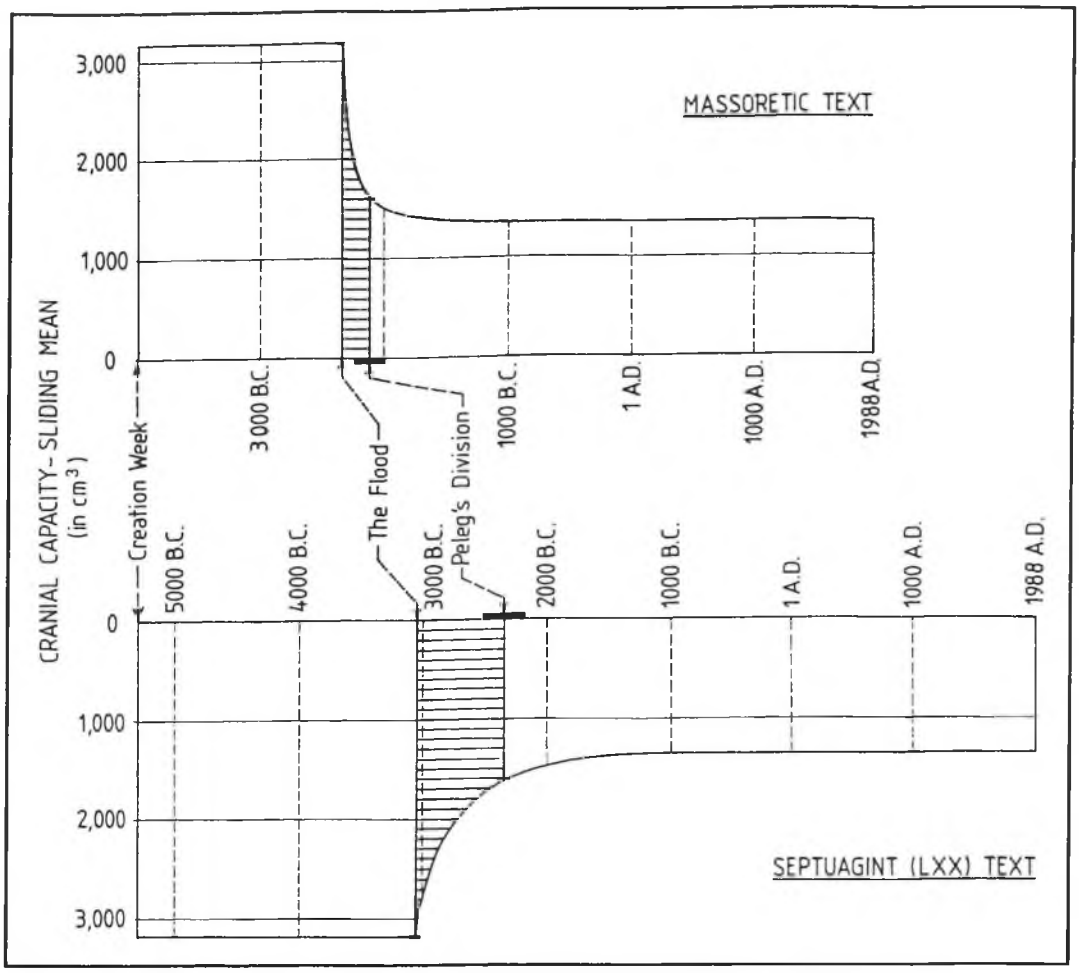


Table 7. HYPOTHETICAL CHANGES IN CRANIAL CAPACITY OF HUMANS THROUGHOUT EARTH HISTORY.

Now these particular races are often associated with Ice Age cave dwellings in Europe, which suggests that these people lived prior to, or during, the melting of the continental ice sheets at the close of the Late Pleistocene epoch. It was suggested earlier that the conclusion of the Würm glacial corresponded with 'Peleg's division.'

We cannot be absolutely certain as to how long after the Flood these populations lived. They certainly post-dated the dispersion from Babel (which is generally regarded as having occurred during the lifetime of Nimrod, the founder of this city-state).

Now Nimrod was the great grandson of Noah, and a member of the second generation of the Hamitic line to be born after the Flood. Peleg, on the other hand, was of the fourth generation of the Messianic line to be born after the Flood. However, because of the dramatic decline in longevity following the Flood, it is conceivable that Nimrod and Peleg were contemporaries of one another for a time (the assumption being made, that the life-spans as indicated for the post-Flood Messianic patriarchs in Table 1 were typical of mankind generally throughout this period of post-Flood history). If this be the case, then it is possible that these cave dwellers lived about the same time as Peleg; either a little before, or during his lifetime.

The Cro-Magnon and Neanderthal races represented the last vestiges of giant human beings (Genesis 6:4). Their cave dwellings were probably make-shift shelters, which had been occupied during the Ice Age by migrating populations following the catastrophic dispersion from Babel.

It may well be that the mean cranial capacity of pre–Flood man was **substantially greater than those of the Cro-Magnon and Neanderthal races**. If these pre-Flood giants were 33 percent taller than modern man, and their bodies proportionately the same, then a notional mean cranial capacity of approximately 3,200cc would be anticipated (see Table 6). The above notional ranges for pre- and immediate post-Flood human crania may then be placed into a historical time-frame based on biblical and secular records (see Table 7).

Relevance to Pre-Flood Pongids

If the extent of post-Flood morphological shrinkage in pongids were comparable with that proposed for

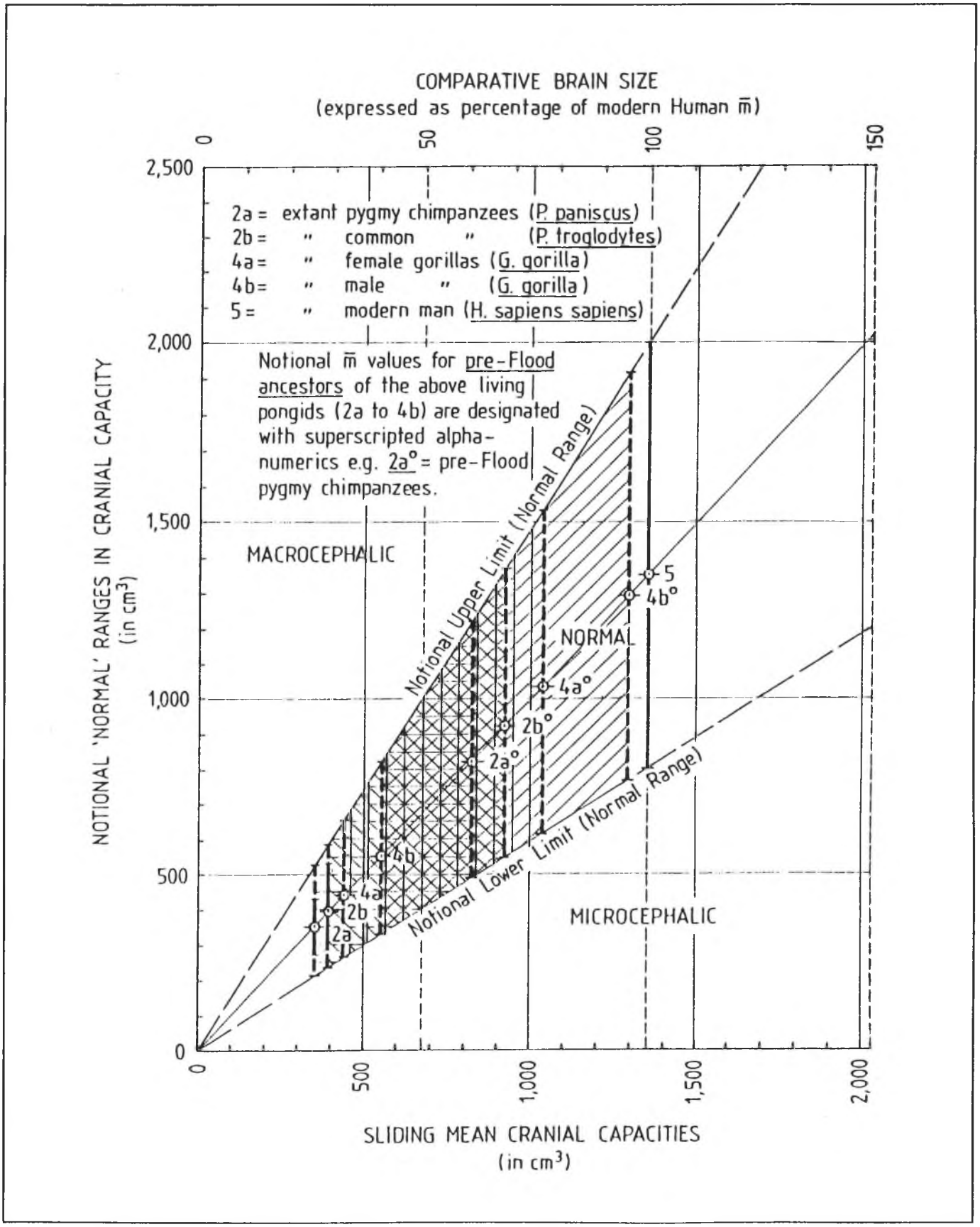


Table 8. NOTIONAL 'NORMAL' RANGES IN CRANIAL CAPACITY FOR LIVING AND PRE-FLOOD AFRICAN ANTHROPOID APES.

humans — that is to say, the extant values are about 75 percent of the pre-Flood body dimensions — then we would anticipate ranges in cranial capacity of the order of those shown in Table 8.

Now to some, these notional pre-Flood ranges may appear extreme. However, it is well to remember that there is a growing body of evidence confirming the existence of giant fossil apes in the past — for example, *Gigantopithecus blacki* and *bilaspurensis*, *Dryopithecus* (Proconsul) *major*, *Ouranopithecus macedoniensis*, *Sivapithecus meteai* and, to a lesser extent, *Sivapithecus indicus*. If the cranio-facial, palatal and mandibular remains of these creatures are indicative of overall body size, then cranial capacities substantially greater than those recorded for the living African and Asian anthropoid apes can be anticipated. To date, preserved calvaria belonging to these fossil apes have eluded palaeontologists.

However, the plausibility of the hypothesis can be seen through a simple extrapolation of the heights of pre-Flood ancestors of the living anthropoid apes. For instance, extant male gorillas stand on average about 1.7 metres high; their female partners slightly shorter. If the pre-Flood ancestors of the gorilla were of the order of 33 percent taller than their extant descendants, they would still be smaller than the extrapolated height for the largest fossil ape — *Gigantopithecus blacki*.[136]

ANALYSIS OF PURPORTED HOMINOIDS AND HOMINIDS

Palaeoanthropologists recognise as many as five distinct species of Australopithecine. They are *Australopithecus afarensis*, *Australopithecus africanus*, *Australopithecus robustus*, *Australopithecus boisei*, and *Australopithecus habilis*. There is, however, no universal agreement as to the validity of these five taxons. For instance, concerning the taxon, *Australopithecus afarensis*, Donald Johanson and Timothy White regard it as sufficient to cover a diverse, sexually dimorphic population of hominids.[137] Richard Leakey[138] and Yves Coppens,[139] on the other hand, suggest that there may be more than one species (or even genera) present in the Hadar population, whilst Mary Leakey does not recognise the taxon at all.[140]

In recent years a number of authorities, including Noel Boaz,[141] and Phillip Tobias,[142] have suggested that *A. afarensis* and *A. africanus* may be conspecific. Similar sentiments have been expressed concerning the robust and boisei-type Australopithecines.[143] Furthermore, there has been much discussion and debate concerning the nature of the taxon, *Homo habilis*. Some authorities have suggested that the habilines were merely large-brained gracile Australopithecines. For instance, in 1975 Milford Wolpoff and C. Loring Brace suggested that

> '. . . *perhaps ER 1470 and 1590* (were) *simply large australopithecine specimens.*'[144]

Two years later, Brace and his co-author, Ashley Montagu, were even more emphatic, describing the 1470 skull as being

> '. . . *indistinguishable from a large brained Australopithecine.*'[145]

G. Clark concluded that

> '. . . *from a palaeontological point of view, there would be no problem in downgrading* habilis *to an Australopithecine.*'[146]

Other authorities, including David Pilbeam, have preferred to divide the habilines into two genera; the smaller and more primitive form being designated *A. habilis*,[147] and a larger, more advanced form (which includes Skulls 1470 and 1590) being called *Homo habilis*.[148] Still others have suggested that some of the smaller habilines might be better ascribed to the species *A. africanus*. Richard Leakey is amongst this number.[149, 150]

The confusion surrounding the aforementioned taxons has led to a plethora of hominid phylogenies; these phylogenies reflecting diverse views as to the nature of human evolution (branched vs. polyphylogenic; splitting vs. lumping etc.). Any assessment of purported hominids is, therefore, fraught with difficulties arising as a consequence of this diversity of opinion.

In the preceding section, we established notional ranges in cranial capacity (and by implication, endocranial volume, or ECV) for pre-Flood common and pygmy chimpanzees and male and female gorillas. The notional ranges took into consideration that, with respect to endocranial volume or cranial capacity, there is only a slight degree of sexual dimorphism present in common chimpanzees *(Pan troglodytes)* and virtually none in pygmy chimpanzees *(Pan paniscus)*. In all three sub-species of gorilla sexual dimorphism is pronounced; males, as a rule, possessing a cranial capacity approximately 20 percent greater than females. The notional 'normal' ranges for anthropoid apes and man were assumed to be the same; with upper and lower limits corresponding to a top-to-bottom ratio of 2.5:1. The notional mean for each pre-Flood genus or species was based on a uniform increase of 2.35 times the corresponding extant value.

Having said this, we may now proceed to an analysis of the gracile and robust Australopithecines (including the larger habilines).

Table 9 records actual and estimated determinations of cranial capacity for the various species of *Australopithecus* and *A./H. habilis*. Accession numbers are used to identify each fossil hominid for which there are documented measurements of cranial capacity. The accession numbers may also be used to identify the geographic sites from which their remains were recovered.

The hominids have been categorized into four distinct groups. They are: *Australopithecus afarensis*, *Australopithecus africanus*, *Australopithecus robustus/boisei*, and *Australopithecus* and *Homo habilis*. There may be other specimens for which there are recorded de-

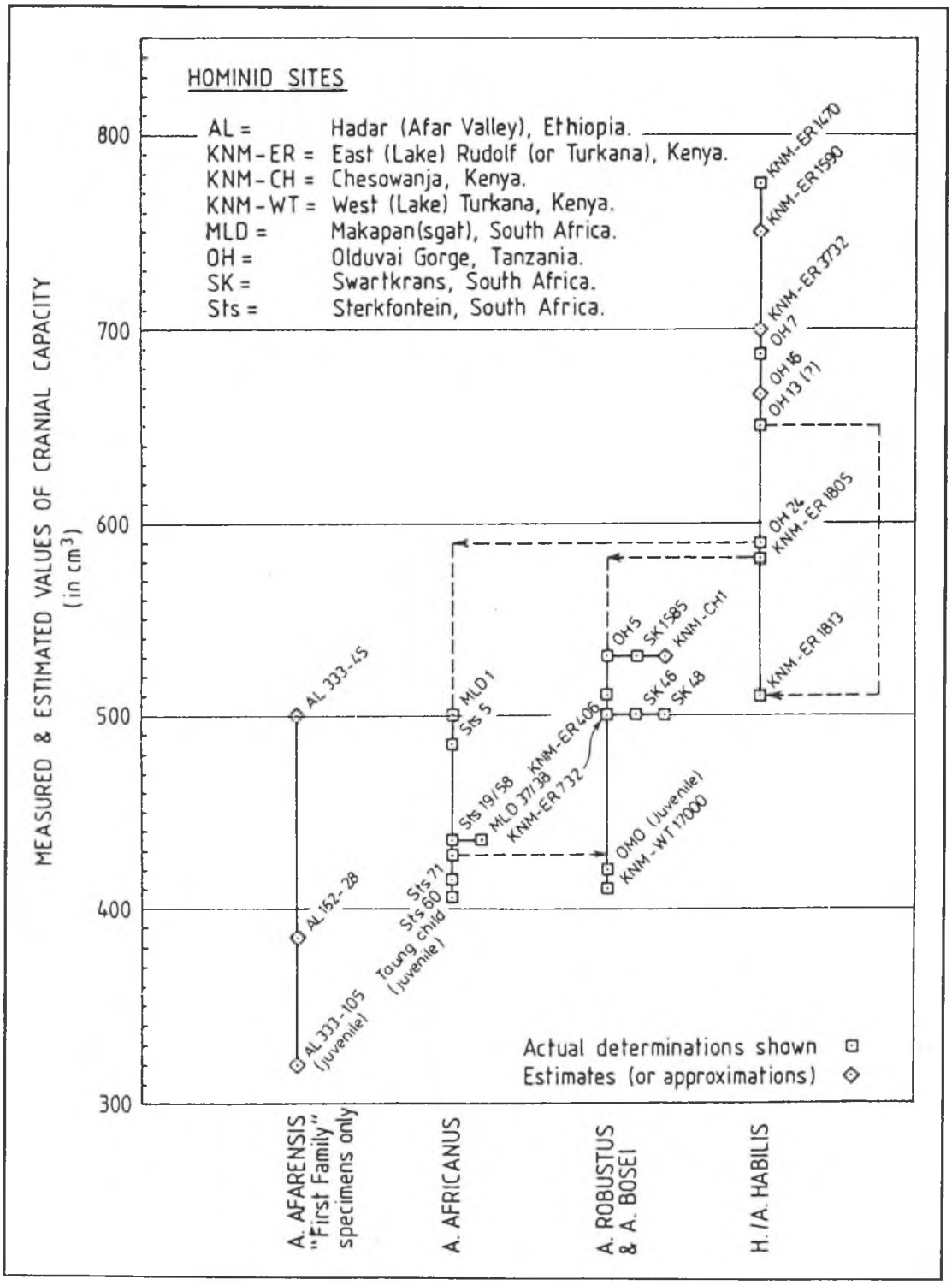


Table 9. GENERALLY ACCEPTED MEASUREMENTS AND ESTIMATES OF CRANIAL CAPACITY FOR EAST AND SOUTH AFRICAN HOMINIDS

erminations or estimates of cranial capacity that the resent writer has missed during his investigations. Any uch data can only serve to expand the sample size and herefore the value of the analysis. The sample size is xtremely small, and reflects the poor state of preservaion of hominid remains, generally. The author would be most appreciative of any assistance readers can offer in regards to identifying omitted determinations.

The assignment of KNM–ER 1805 to *A./H. habilis* is preferred by most authorities. However, several authors have suggested that this specimen could be assigned to *A. boisei*, since the cranium features a well-developed sag-

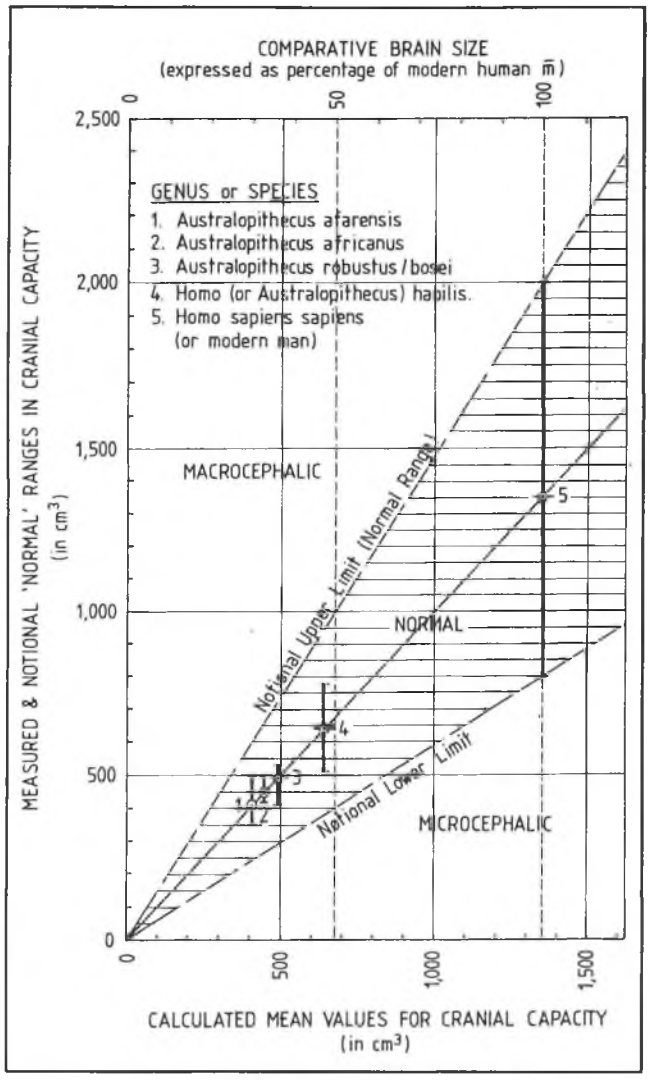


Table 10. RECORDED RANGES IN ADULT CRANIAL CAPACITY AND COMPARATIVE BRAIN SIZE OF FOSSIL HOMINIDS AND MODERN MAN, HOMO SAPIENS.

ittal crest. C. B. Stringer, on the other hand, has even suggested that the specimen could be classified *H. cf. erectus* on chronostratigraphic grounds.[151] Therefore, assignment to *habilis* is provisional (being based on cranio-facial affinities it shares with Skull 1470).

The documented cranial capacity for OH 13 (650cc) has been questioned by a number of authorities in recent years. A lower value, approximating that determined for KNM–ER 1813 (510cc), has been suggested by several writers.[152] Arguments in favour of the lower value will be discussed shortly.

Several of the cranial determinations documented in Table 9 belong to juveniles. The Taung child's adult cranial capacity has been estimated at 440cc, as has the Omo juvenile (uprated from 420cc).[153] These estimates are based on the premise that the eruption of the lower first permanent molar (M_1) into occlusion coincides with the attainment of 95 percent of the adult cranial capacity. This coincidence is common to all living primates.

Substituting the uprated (adult) values for the Omo, Taung and Hadar juvenile crania, we may determine mean adult cranial capacities for each of the four groups. They resolve out as follows: *A. afarensis* (412cc); *A. africanus* (448cc); *A. robustus/boisei* (495cc) and *A./H. habilis* (641cc). The range and mean cranial capacity for each group is shown in Table 10. It shall be noted that the **comparative brain size** for these purported hominids shifts slightly to the right of the mean values for the living great apes (see Table 3 for comparison). This illustrates that hominid crania were, in general, somewhat larger than those of living anthropoid apes from Africa; yet they still remain very much removed from the modern human average (1,350cc).

A useful measure of what constitutes a valid taxon is the calculated **coefficient of variation** (or C.V.) — that is, the standard deviation expressed as a percentage of the mean. In the living great apes and man the coefficient of variation is generally of the order of 10 percent, or slightly less. An exception to this rule is to be found in the species *Gorilla gorilla*, where higher figures (of up to 13 percent) have been reported. This latter figure represents the largest variation in living pongids. It has been suggested by Chris Stringer that a coefficient of 10 percent is to be anticipated in valid hominoid species. This same value could likewise be applicable to hominid species (when ECV determinations are confined to adults).

Turning then to the four groups of fossil hominids, we obtain the following results. The small sample for *A. afarensis* (n=3) yielded a **provisional** coefficient of variation of 18.8 percent! The calculated C.V. values for the larger samples of *A. africanus* (n=7) and *A. robustus/boisei* (n=9) resolved out at 7.0 and 8.5 percent, respectively. When we turn to *A./H. habilis*, however, we are confronted with a significantly larger value of 15.3 percent for nine crania. Superficially, this would suggest that more than one taxon is being sampled for each of the *A. afarensis* and *A./H. habilis* samples. However, the possibility that diminution has taken place during recent (post-Flood) geological history, as we shall see shortly, may negate such a view of at least one species *(A./H. habilis)*.

The respective ranges for *A. africanus*, *A. robustus/boisei* and *A./H. habilis* approach three standard deviations in width; again reflecting the smallness of the respective samples. Distribution about the mean is lopsided in the *A. africanus* and *A. robustus/boisei* samples.

When all 28 determinations and estimates of cranial capacity are 'lumped' together into a hypothetical super-species, the resultant coefficient of variation is a massive 20.8 percent — suggesting that we are dealing with more than one hominid species. If we exclude the morphologically dissimilar robust australopithecines *(A. robustus boisei)* from the sample (n=19), the resultant C.V. for this 'gracile' population of hominids actually increases to

23.9 percent. The proximity of the robust sample to the calculated mean for the larger sample (n=28; m=521.5cc) leads to a slightly higher standard deviation (s=127.7cc as opposed to 108.4cc), and therefore, higher coefficient of variation when the nine robust specimens are removed from the sample. However, if the nine habiline specimens are excluded, and the robust australopithecines reinstated to the lumped sample, then the C.V. drops dramatically to 11.4 percent, giving some measure of support to the single species hypothesis of C. Loring Brace,[154] Stephen Jay Gould and David Pilbeam.[155]

A Possible Instance of Localised Morphological Shrinkage

In 1973 Ralph L. Holloway detailed the results and implications arising from his efforts to determine endocranial volumes of selected East African hominids.[156] Amongst the six cited East African specimens were two skullcaps assigned to the taxon, *Homo erectus*. The larger, **and stratigraphically older**, cranium (OH 9) had been recovered from upper Bed II deposits in the Olduvai Gorge of Tanzania, and yielded an ECV of 1,067cc. The smaller cranium, accessioned OH 12, had been extracted from (stratigraphically higher) Bed IV deposits, and yielded a substantially smaller ECV of 727cc. The variance exhibited in the ECV determinations posed an immediate dilemma to Holloway: were they simply extremes of a range, perhaps reflecting pronounced sexual dimorphism within a single species, or did OH 12 represent a remnant of the earlier taxon, *Homo habilis*? And what if these values did not represent extremes in range? (Such variations seldom occur in small samples of populations.)

Holloway summarised the dilemma as follows:

> *'Even accepting the OH 9 as a large male from the upper end of the range and OH 12 as a small female,* ***there still remains a very considerable difference, and also a large hiatus between the Bed II habilines and OH 9.***'[157]

The skull fragments of OH 12, like the OH 9 cranium, were very robust and unlike those of the Olduvai habilines, posing a further dilemma. Of course, had the craniums been found in the opposite stratigraphic order, then the dilemma would never have existed; the skullcaps would have been said to evince pronounced sexual dimorphism or cranial expansion.

There is, however, a third possible explanation for the degree of variance in these *H. erectus* specimens; an explanation which is overlooked by palaeoanthropologists because of their evolutionary **presupposition of cranial expansion** (and increased body size) for the *Homo* line during Plio/Pleistocene history. If the two specimens are indeed conspecific (i.e. both belonging to the same taxon, *H. erectus)*, then they may well evince morphological shrinkage having taken place within the species between the timing of their respective burials.

Such a proposition is, however, anathema to the evolutionist's belief that small, primitive ape-like creatures gave rise to larger man-apes, and ultimately, *Homo sapiens sapiens*. Yet there are many such instances in the fossil records of Plio/Pleistocene East Africa, as we shall see, presently.

The Habilines from East Africa

The concept of morphological shrinkage was entertained, for a time, by Louis and Mary Leakey. Concerning the cranio-facial remains of the Bed I Olduvai habiline, OH 24, the Leakeys and R. J. Clarke wrote:

> *'Until the discovery of Olduvai H. 24 it was considered that the difference in morphology* ***and in size*** *between the cranial parts and dentition of the type of* Homo habilis *from Bed I and those of the paratype from Bed II (Olduvai H. 13)* ***might have resulted from the elapse of a prolonged time interval.***'[158]

The discovery of OH 24 and the subsequent determination of its endocranial volume (590ml) put paid to the concept of morphological shrinkage, at least until recent times. OH 24 represented a **basal** Bed I hominid, having been found in deposits stratigraphically lower than the larger juvenile habiline, OH 7 (687cc). Yet it also possessed a cranial capacity slightly less than the adult habilines from Bed II (OH 13, with an estimated cranial capacity of 650cc, and OH 16, with estimates ranging from a low of 633cc[159] to a high of 700cc[160]). The four Olduvai habilines collectively yielded a mean cranial capacity of 648.5cc, with a standard deviation (s) of 41.8cc, and a conservative coefficient of variation of 6.5 percent. Thus, after much debate, it was concluded that these creatures belonged to a homogeneous single species, *Homo habilis*. However, all this changed with the discovery in 1972 of

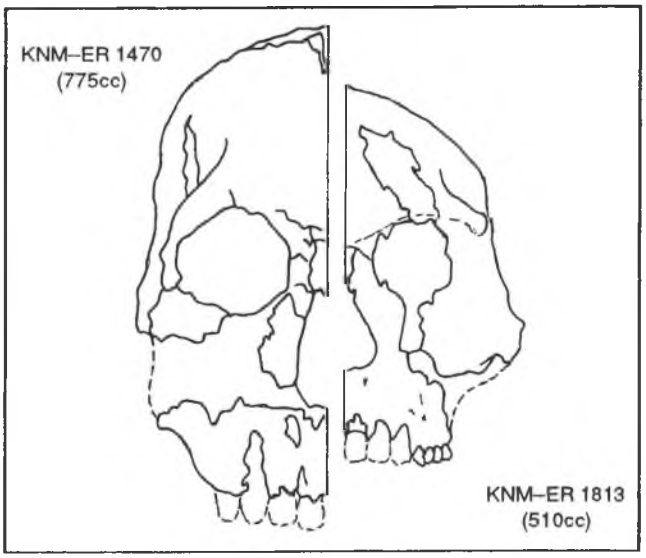


Figure 6. EARLY APPRAISALS OF KNM–ER 1470 AND 1813 SUGGESTED THAT THEY REPRESENTED MALE AND FEMALE OF THE SAME SPECIES.

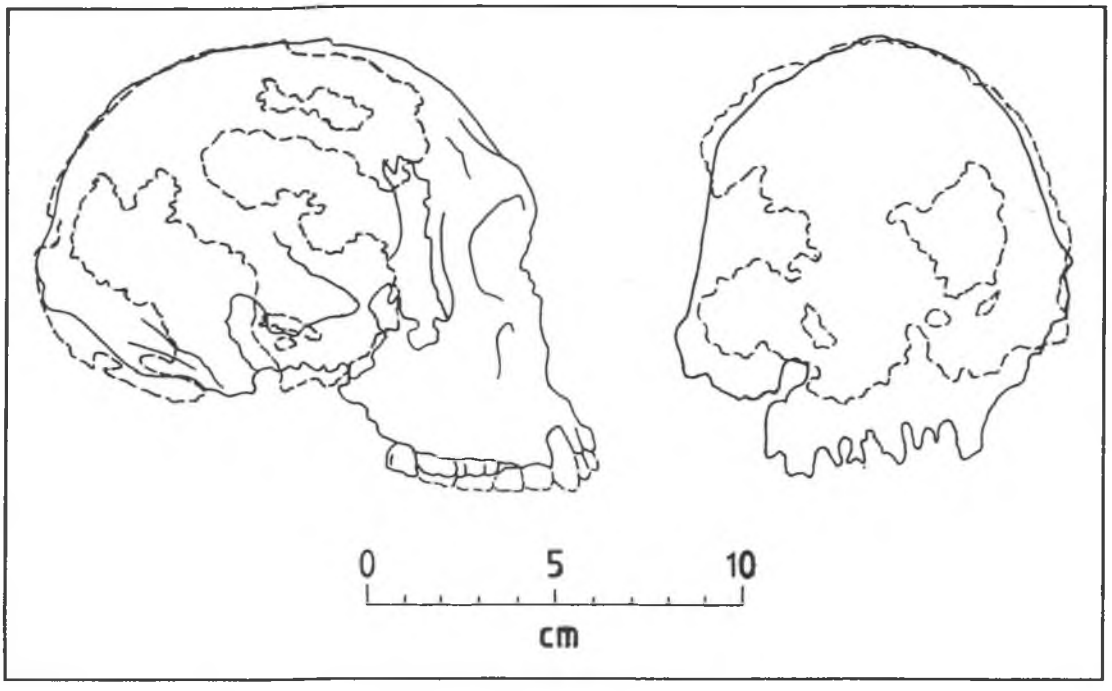


Figure 7. LATERAL AND POSTERIOR VIEWS OF HABILINES KNM ER 1813 (FULL OUTLINE) AND OH 13 (BROKEN OUTLINE) REFLECT A REMARKABLE CLOSENESS OF FIT DESPITE COMPRESSION AND DISTORTION OF THE FORMER.

Skull 1470 (KNM–ER 1470).

A preliminary estimate of cranial capacity for Skull 1470 (810cc) was later refined to 775cc.[161] More recently, this has been further reduced to 752cc.[162] The inclusion of ER 1470 in the taxon, *H. habilis*, saw the coefficient of variation increase to 10 percent, which, considering the small sample size, was likely to be conservative. An uneasiness about the taxon began to develop.

A large juvenile cranium from nearby Ileret (KNM–ER 1590; estimated cranial capacity of 750cc) was also recovered during 1972 and assigned to the taxon.[163] A year later, the fossilised cranium and maxillary of a very small habiline were recovered from post–KBS deposits at Koobi Fora. The skull, accessioned KNM–ER 1813, possessed a cranial capacity of 510cc.[164] The coefficient of variation for the seven habiline specimens (four from Olduvai and three from Lake Turkana) suddenly leapt up to 13.7 percent, and opened up the debate concerning the nature and validity of the taxon.

Initially, Richard Leakey took the position that such a large range (510 to 775cc) in a small sample (n=7) indicated pronounced sexual dimorphism in a single species; indeed, for a time he suggested that KNM–ER 1470 and 1813 were male and female respectively[165] (see Figure 6). However, by 1974 Leakey had changed his mind; suggesting that some of the smaller habilines (including ER 1813 and possibly OH 24) could be justifiably downgraded to gracile Australopithecines *(A. africanus)*.[166]

As previously stated, a question-mark hangs over the endocranial value for OH13. The base and rear of this skull are said to be 'virtually identical' to that of the smaller habiline, KNM–ER 1813.[167] Its estimated cranial capacity (650cc) was regarded by Walker and Leakey as being too-high.[168] An ECV approximating that of KNM–ER 1813 (510ml) might well be more appropriate, in view of Walker and Leakey's belief that

> *'. . . the usual reconstructions of OH–13, which have assumed that the specimen had a large cranial capacity and an* erectus*-like skull,* ***are in error****."*[169]

Such a possibility has been given some measure of support by C. B. Stringer, who has chosen to express OH 13's ECV in terms of a range (510–650ml).[170] Certainly, comparative lateral views of the two skulls reflect a remarkable closeness of fit (see Figure 7).

Support for a lesser ECV is to be found in the fact that the mandible of OH 13 (an adult) is some 20 percent smaller than that of the type of *H. habilis*, OH 7 (which belonged to a juvenile).[171] Furthermore, the paratype mandible was decidedly smaller than the sub-KBS mandible, KNM–ER 1802, from Koobi Fora.[172] According to Walker and Leakey, the mandible of OH13

> *'. . . could just as well have been hinged to a small-brained, thin-vaulted skull like that of KNM–ER 1813.'*[173]

Indeed, these authorities have suggested that there is a *'striking resemblance'* between the teeth of KNM–ER 1813 and OH 13.[174]

Alan Walker has contended for some years that KNM–ER 1813, OH 13 and OH 24 represented late surviving forms of *A. africanus*.[175] Chris Stringer, however,

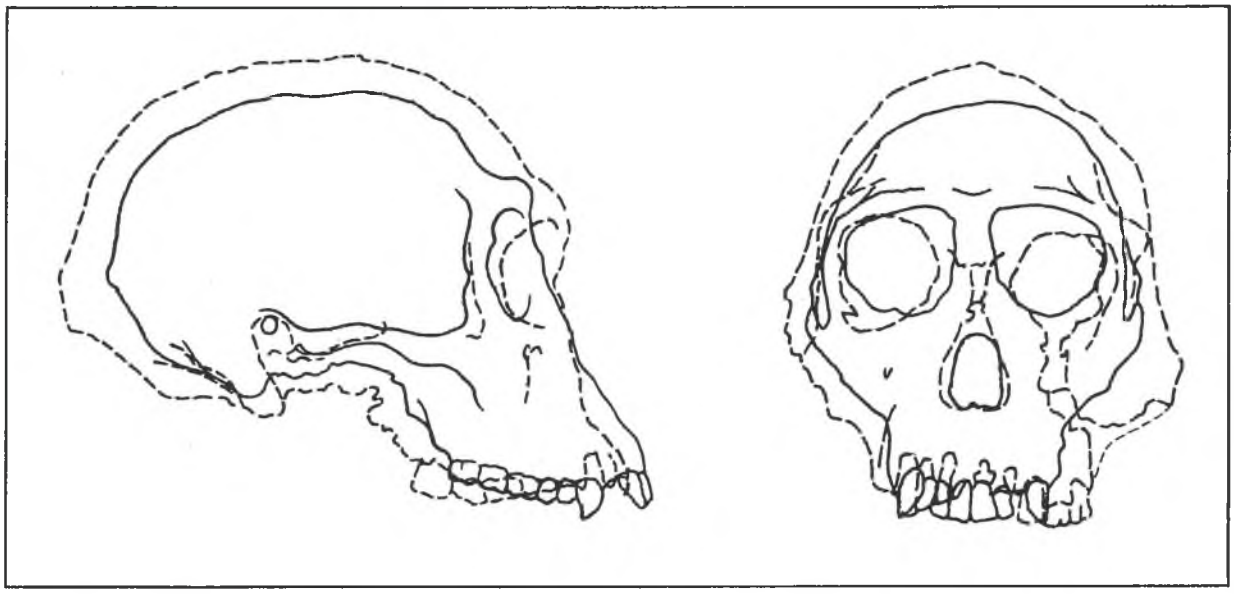


Figure 8. OVERLAPPING LATERAL AND ANTERIOR VIEWS OF AN ADULT FEMALE PYGMY CHIMPANZEE AND KNM–ER 1813. NOTE THE INCIPIENT SUPRAORBITAL TORI (BROW RIDGES) AND PROGNATHIC UPPER JAW IN THE HABILINE SPECIMEN.

whilst conceding that ER 1813 and OH 13 should be placed together in a single species, also asserts that his own investigations

> *'. . . provide little support for classification of KNM–ER 1813 as* A. africanus, ***as long as the small endocranial volume of the specimen is not accorded undue significance.'***[176]

Returning, then, to the excessive coefficient of variation in the habiline taxon, Stringer, has noted that:

> *'While two subsets can easily be created which each have the expected variation of 10% or less, this cannot be achieved while KNM–ER 1470 and 1813 are grouped together . . . on this basis alone it is unlikely that these two fossils are conspecific* ***unless a measure of special pleading is allowed.'***[177]

Having broken the habilines into two groupings (the first group comprising KNM–ER 1470, 1590, 3732, OH 7 and 24, and the second group including KNM–ER 1805, 1813, OH 13 and 16) Stringer concluded that:

> *'A* ***gradualistic*** *evolutionary explanation for the different characteristics shown by specimens such as KNM–ER 1470, OH 24 and KNM–ER 1813 is also possible . . . where the apparently earlier specimens retain more characters from an* A. africanus*-like ancestor, and the supposedly later specimens (such as KNM–ER 1813) show more characteristics of* H. *cf.* erectus, ***but the endocranial volume data contradict such a scheme, since the early segment of the sample has large values,*** *approaching* H. *cf.* erectus, ***while the late segment has small values,*** *more like* A. africanus. *Even the argument that the early segment is dominated by male individuals, and the later segment by females seems insufficient to account for this situation.'*[178]

More recently, and in the aftermath of the discovery of a new habiline in 1986 (accessioned OH 62), Stringer and Bernard Wood have suggested that the taxon comprises two (or possibly three) separate species.[179] However, if Stringer and Wood were to consider the possibility of morphological shrinkage having taken place within the species over the purported Plio/Pleistocene period of deposition, then the taxonomic problems would be automatically resolved. The evidence could then be taken at face value, without requiring the creation of additional species or sub-species.

A Possible Living Habiline?

In recent years a number of leading palaeoanthropologists have begun to recognize the existence of similarities in gracile Australopithecines and the living pygmy chimpanzee, *Pan paniscus* (or bonobo). Nancy Makepeace Tanner has commented:

> *'As long ago suggested by Coolidge (1933), it is quite possible that the pygmy chimpanzee,* Pan paniscus *— when more data are available on behaviour in the wild — might serve as an even more specific model than the common chimpanzee. Pygmy chimpanzee and hominid anatomy are* ***particularly close in some respects.'***[180]

Adrienne L. Zihlman *et al.* have suggested that:

> *'Given these morphological and behavioural data, we maintain that pygmy chimpanzees present a general pattern from which other African hominoids could have developed. This contention is further supported by comparing pygmy chimpanzees with the earliest hominids.'*[181]

Figure 8 shows comparative lateral and anterior views of an adult female bonobo (full outline) and the habiline skull, KNM–ER 1813 (broken outline). In both comparative views, there is a remarkable closeness of fit (even though there is a significant difference in faciocranial size).

The pygmy chimpanzee is confined to the equatorial rainforests of the Congo (Zaire) River Basin, in northwestern Zaire. This basin is located some 1,600 kilometres west of famous East African hominid sites such as the Olduvai Gorge and Laetoli, in Tanzania, and Koobi Fora/Ileret, on the shores of Lake Turkana (in northern Kenya). These sites once abounded in rainforest vegetation. Today, the rainforests have been replaced by a succession of woodland forests and open savannah grasslands. Could it be that following the decimation of these rainforests, the bonobo migrated westward in search of this familiar, but retreating, habitat (which provided his food requirements; predominantly soft fruits and foliage)?

A southward post-Flood migration of pygmy chimpanzees (and other pongids) is postulated in Figure 9. After leaving the vicinity of Mount Ararat (Turkey), these creatures either entered the African continent via the Jordan River Valley and the Sinai Peninsula or via Mesopotamia (modern Iraq) and Saudi Arabia. Their migratory

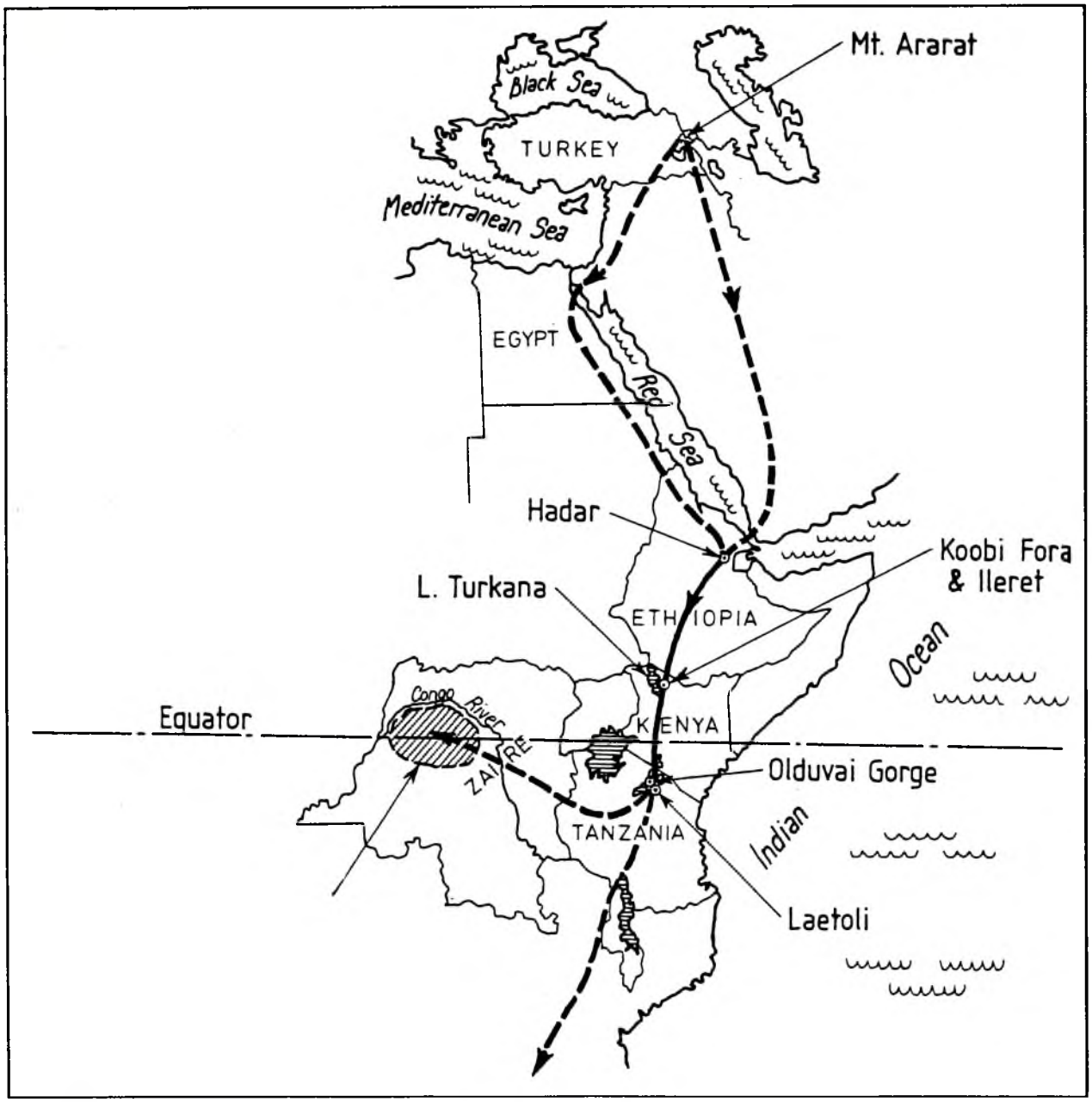


Figure 9. POSTULATED POST-FLOOD MIGRATION ROUTES OF PYGMY CHIMPANZEES AND OTHER EXTANT AND EXTINCT FORMS OF ANTHROPOID APE.

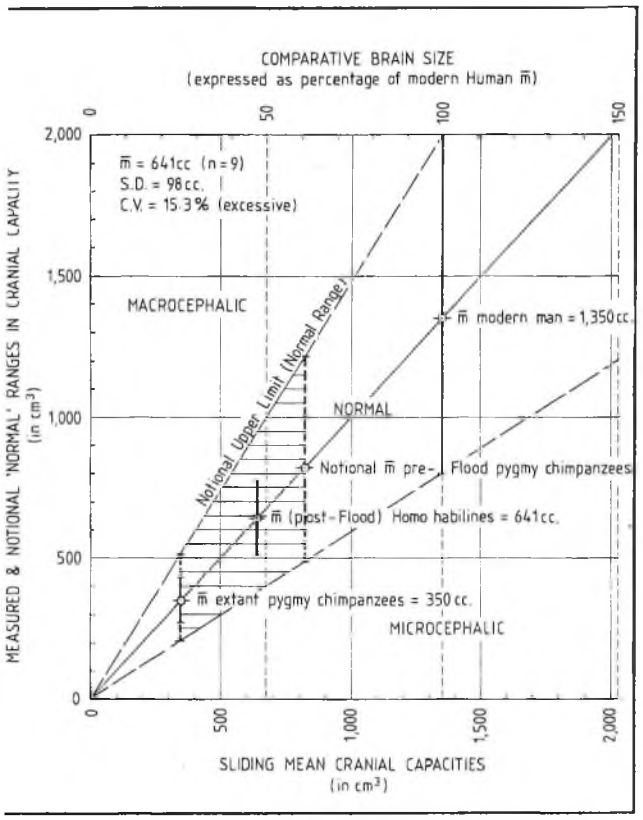


Table 11. COMPARATIVE BRAIN SIZES AND RANGES IN CRANIAL CAPACITY OF PRE-FLOOD AND LIVING PYGMY CHIMPANZEES CONTRASTED WITH THOSE FOR THE HABILINE SAMPLE.

route through East Africa could have been through the Rift Valley from Hadar (in Ethiopia) and on into Kenya, Tanzania and beyond.

Returning to the measured and estimated values for habiline cranial capacity, the nine specimens documented in Table 9 yielded a mean value of 641cc (adopting 775 and 510cc, respectively, for KNM–ER 1470 and OH 13). Now this sets the habiline sample in-between the notional pre-Flood range for pygmy chimpanzees and that for their extant descendants (see Table 11).

A number of interesting observations can be deduced from this small collection of fossilised crania.

Firstly, the Kenyan sample (from Koobi Fora and Ileret), comprising KNM–ER 1470, 1590, 1805, 1813 and 3732, produce a mean value of 663cc, standard deviation (s) of 113cc, and coefficient of variation of 17.1 percent (which, again, is excessive). The sample deriving from Olduvai Gorge (Tanzania), by way of comparison, produced values of m=648.5cc, s=41.8cc and C.V.=6.5%. If, however, the lower estimate for OH 13 is adopted (that is to say, OH 13 = KNM–ER 1813 = 510cc), then the mean for the four Olduvai habilines drops to 613.5cc, whilst the standard deviation and coefficient of variation increase to 80.7cc and 13.2 percent, respectively.[182] This, then, would represent a significant decrease in cranial capacity between the Kenyan and Tanzanian populations (of the order of eight percent). Could this tendency evince support for our hypothesis of simultaneous migration and morphological shrinkage? Remember, the sites from which the Turkana and Olduvai habilines were sampled are separated by nearly 900 kilometres.

Secondly, when we dissect the Koobi Fora/Ileret population, we find the larger habilines (KNM–ER 1470, 1590 and 3732) derive from deposits below the KBS (or Ileret equivalent) marker Tuff. Smaller versions of the same creatures (ER 1813 and possibly 1805) were found in deposits above the KBS Tuff at Koobi Fora; suggesting that the species had undergone morphological shrinkage during the period of deposition (see Figure 10).

Now the perceived reduction in cranial capacity **contradicts the established view of cranial expansion in purported hominids with the passage of time** (see Table 12).

It is worthwhile noting that the juvenile cranium, KNM–ER 1590, featured a sagittal keel,[183] whilst quite prominent sagittal and nuchal cresting characterised the ER 1805 cranium.[184] The presence of these musculature anchorage points suggests that ER 1590 and 1805 were

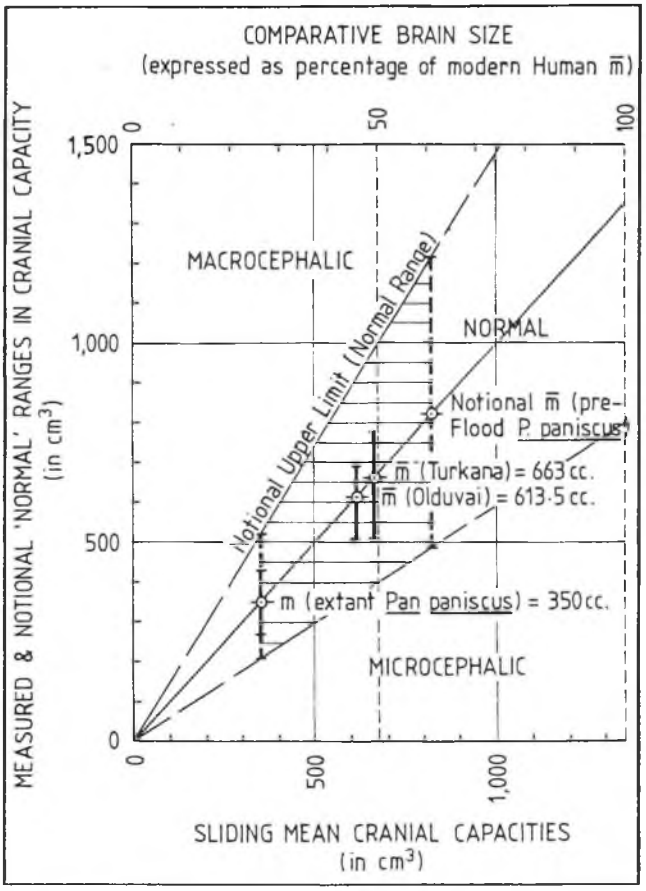


Table 12. PERCEIVED REDUCTION IN CRANIAL CAPACITY OF HABILINES DURING SOUTHWARD MIGRATION.

more robust than the other habilines of the Kenyan sample; perhaps identifying these creatures as males of the species.

Now there also appears to be an increase in simian-like features amongst the smaller, and younger, post–KBS habilines (see Figure 10 again). For instance, in a review article in **Nature**, John E. Cronin *et al.* noted that:

> *'ER 1813 shows **incipient supraorbital tori** depressed in the glabellar region, a post-toral sulcus, a post-toral temporal ridge (similar to OH 9), a slightly more antero-posteriorly **elongated cranium** than specimens such as OH 13, a slight torus and **a mid-facial region slightly more prognathous than ER 1470**.'*[185]

The elongation of the cranium coincides with the reduction in height of the cranial vault and the development of the supraorbital tori and musculature anchorage structures. These changes may be diet related (perhaps reflecting a shift from soft to hardy vegetation or even one including some meat). These possibilities shall be explored in a future paper.

Turning, then, to the Olduvai habilines, the most complete cranial remains are attributed to Olduvai Hominid 24. A detailed description of these remains in **Nature** included a preliminary estimate of cranial capacity (560cc), but was qualified by the following statement:

> *'The crushing of the whole cranium had also been taken into account when considering the cranial capacity, **which must inevitably have been greater than the absolute capacity as measured now.**'*[186]

The cranium, when recovered, was severely distorted. The base of the cranium had been depressed into the brain cavity, and it was conceded that subsequent attempts to correct the distortion

> *'. . . had resulted in the vault of the skull being lower than it was originally, and the backward projection of the occipital is now exaggerated.'*[187]

In 1972, an anonymous writer to **Nature** suggested that it was vital not to underestimate the degree of distortion still present in OH 24, even after reconstruction had been completed.[188] He stated that at least two areas of *'gross distortion'* had resulted in the skull appearing longer than it should, and that correction for this distortion would decrease the cranial capacity as published. In the same issue of **Nature**, Phillip Tobias contended that

> *'. . . a large part of the cranial base (was) stove inwards, particularly the posterior cranial fossa.*

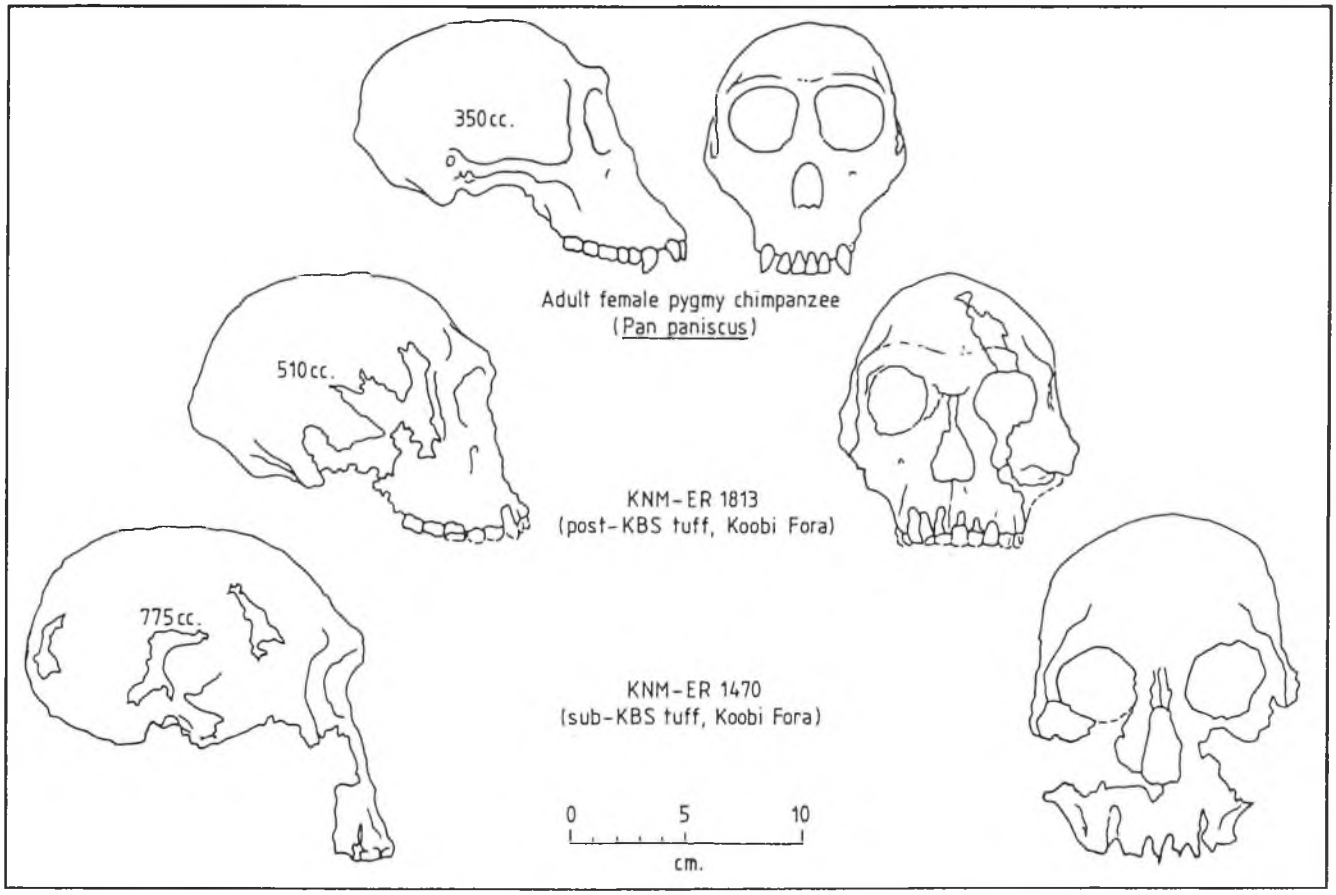
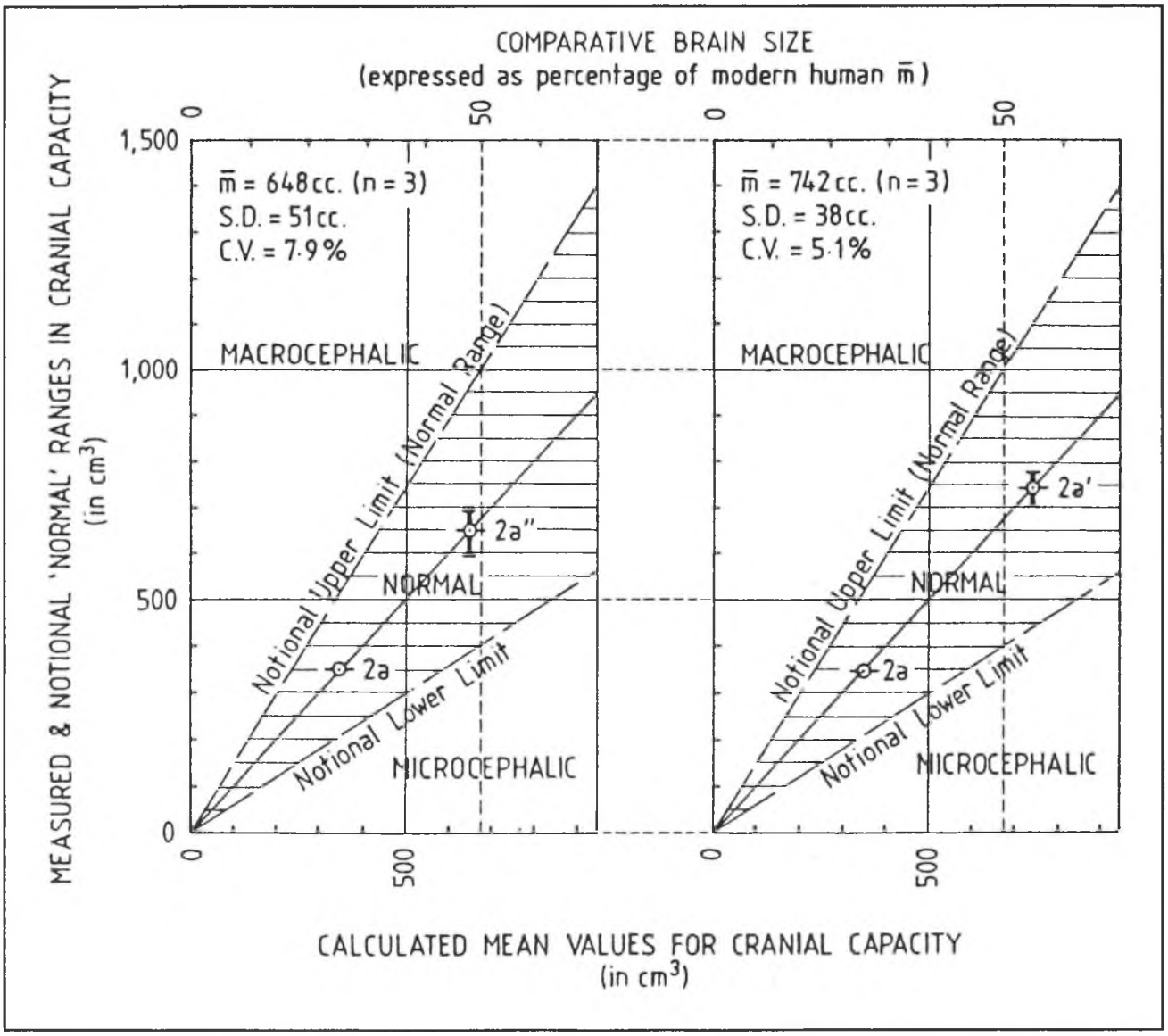


Figure 10. COMPARATIVE LATERAL AND ANTERIOR VIEWS OF EAST TURKANA HABILINES AND PYGMY CHIMPANZEE, PAN PANISCUS, *DEMONSTRATE AN INCREASING SIMIAN APPEARANCE AND MORPHOLOGICAL SHRINKAGE.*



'able 13. PERCEIVED REDUCTION IN CRANIAL CAPACITY BETWEEN THE SUB-KBS HABILINES FROM KOOBI FORA/ILERET (RIGHT) AND 'HOSE FROM OLDUVAI GORGE WHICH WERE FOUND BELOW THE BED II FAUNAL CHANGE.

Some reduction in the measurable cranial capacity must certainly follow.'[189]

Thus, Tobias felt that a value of 600cc or more was justified, and quoted Ralph Holloway as having independently arrived at an endocranial value of 590cc; a figure reiterated by Holloway in 1973.[190] More recently, however, Holloway has conceded that his value of 590cc might have been overestimated.[191]

As stated previously, the habiline status of OH 24 has not been accepted by all authorities. The aforementioned anonymous writer to **Nature** discerned that

'. . . one of the most interesting aspects of the morphology of OH 24 is the ***remarkably close similarity this specimen shows with MLD 6, an australopithecine from Makapansgat, South Africa.*** *Although MLD 6 is a fragmentary specimen, the preserved portion of its central facial area shows a near identity with the comparable portions of OH 24, not only in size and shape but in detailed morphology.'*[192]

If this view is correct, and OH 24 were to be assigned to the taxon *A. africanus*, then there is a substantial reduction in cranial capacity between the Olduvai specimen and those recovered from the South African Transvaal (the South African graciles averaging 440cc). Again, such a trend would be consistent with our hypothesis of simultaneous southward migration and morphological shrinkage.

The value assigned to OH 16 (667cc) is a mean of two separate estimates by Tobias (633cc; 1971) and Holloway (700cc; 1978). An earlier estimate by Holloway

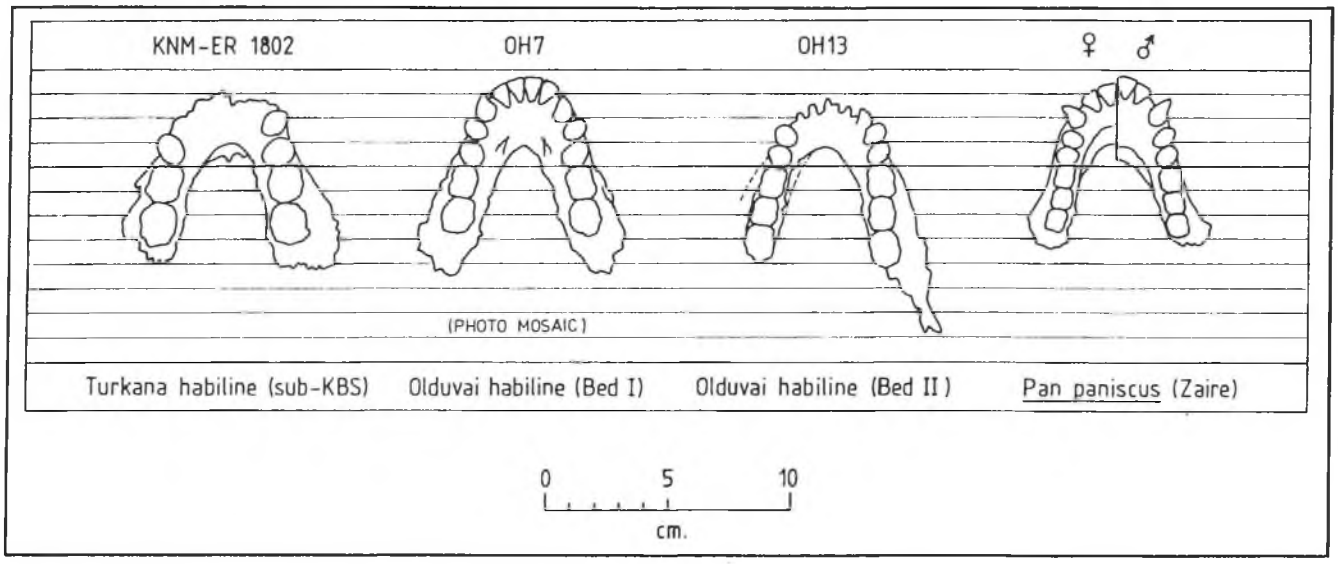


Figure 11. SUPERIOR VIEWS OF HABILINE AND PYGMY CHIMPANZEE MANDIBLES. NOTE THE GENERAL DECREASE IN ROBUSTICITY AND OVERALL SIZE OF THE MANDIBLES AND DENTITION, LEFT TO RIGHT.

(650cc) was qualified with the following statement:

> *'Although the value . . . may be doubtful in view of the fragmentary nature of the skull, it is unlikely that it is grossly inaccurate if the large size of the frontal portions and the associated dentition are considered.'*[193]

(The occlusal areas and length/breadth indices for the cheek teeth of OH 16 and the type specimen, OH 7, are very similar; suggesting that the two habilines were of similar size and morphology).

Concerning the type of *H. habilis* (OH 7), Milford Wolpoff and C. Loring Brace have noted that:

> *'The parietals were found crushed flat, and both the curvature of the bones and their fit on the sagittal suture were reconstructed. The cranial capacity is, and has been anybody's guess, but the close correspondence of the parietal arc dimensions with those of other specimens of known capacity suggest* ***a value significantly in excess of 500cc is unlikely****.'*[194]

Now the aforementioned statement is significant in view of Holloway's statement that

> *'. . . the parietals of OH 7* ***more than cover the completed OH 13 parietal regions*** *on the reconstructed endocast (which gave a value of 650cm³) . . .'*[195]

It follows, that if the determination for OH 7 is overstated, then that for OH 13 will also be too large. Furthermore, if the cranial capacities of the Olduvai habilines are significantly less than the published values, then it serves to accentuate the extent of morphological shrinkage which has taken place between the Kenyan and Tanzanian samples.

The Olduvai habilines may be provisionally divided into two groups: the first group comprising the type of the taxon, OH 7, OH 16 and (possibly) OH 24, whilst the second group comprises the cranio-facial remains of OH 13 together with the mandible of the same creature. These groups have been distinguished on the basis of associated faunal remains. David Pilbeam noted that:

> ***'The lower parts of Bed II are faunally similar to Bed I,*** *although upper Bed I and lower Bed II contain some rather more evolved elements than lower Bed I';*[196]

hence, the inclusion of OH 16 in the first group. OH 13, on the other hand, was recovered from deposits **a little above the faunal change in Bed II.**[197] The inclusion of OH 16 in the first group is the only point of difference with a similar attempted grouping of the East African habilines by Stringer.[198]

Having broken the East Turkana and Olduvai habilines into the aforementioned groupings, several observations can be made:

(1) The sub-KBS habilines (KNM–ER 1470, 1590 and 3732) from Koobi Fora/Ileret are significantly larger than the post-KBS specimens (KNM–ER 1805 and 1813); the reduction in cranial capacity being of the order of 25 percent;
(2) The sub-Bed II faunal-change habilines (OH 7, 16 and possibly 24) may be somewhat larger than later Bed II specimens (as exemplified by OH 13); and
(3) The sub-KBS habilines are significantly larger than the habilines recovered from below the Bed II faunal change at Olduvai (see Table 13).

When the larger habilines from East Turkana and Olduvai (six specimens, including the contentious OH 24) are lumped into a single population, we obtain a coefficient of variation of 9.4 percent. The remaining three specimens (assuming the lesser value for OH 13) yield an uncorrected value of 7.8 percent.

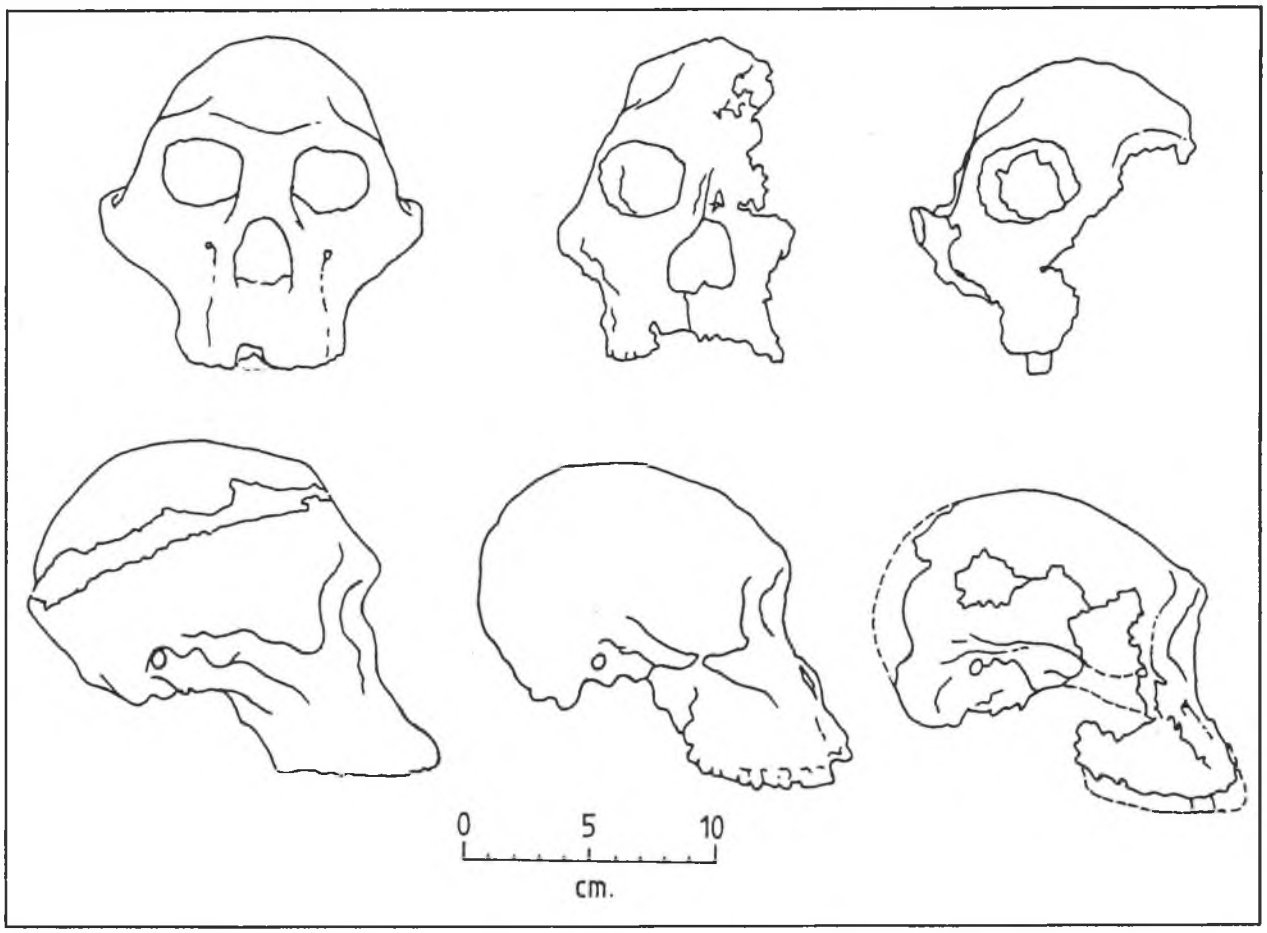


Figure 12. COMPARATIVE ANTERIOR AND LATERAL VIEWS OF STS 5 (LEFT), STS 71 AND KNM–ER 732. NOTE THE SIMILARITIES IN FORM OF THE STS 71 AND ER 732 CALVARIAE.

The reduction in cranial capacity is also accompanied by a reduction in tooth size — especially the cheek teeth. A distinct gradation in the size of molars and pre-molars is evinced in both the East Turkana and Olduvai habiline mandibles and palates.

The habiline mandible, KNM–ER 1802, which was discovered in sub-KBS deposits at Koobi Fora, has been associated with specimens of *H. habilis* such as KNM–ER 1470 and 1590 by a number of authorities.[199] Its preserved cheek teeth (P_3 to M_2) are characteristically larger in both mesiodistal and buccolingual dimension, and therefore occlusal area, than the habilines found below the faunal change in Bed II of the Olduvai Gorge. In fact, the occlusal areas of the cheek teeth of KNM–ER 1802 are between 10 and 26 percent greater than those of OH 7.[200] The cheek teeth of OH 7 and 16 are, in turn, significantly larger than those of OH 13; the occlusal areas of the cheek teeth of OH 7 being 20 to 30 percent greater than the middle Bed II habilines[201] (see Figure 11). Those of OH 16 (lower Bed II) are comparable in size and occlusal area to the corresponding teeth in the type specimen, OH 7; thus lending a further measure of support to the belief that OH 16 should be grouped in the Bed I habilines.[202]

The same trend is to be observed in the upper jaws and dentitions of the habilines, though the preserved remains are somewhat scarcer. These trends (of reduced jaw size and robusticity in the cheek teeth) shall be expounded further in a future article.

The Gracile Australopithecines

The gracile australopithecines from the South African Transvaal were recovered in cave infill deposits at three separate sites — Taungs, Sterkfontein and Makapansgat. It is thought that the remains of robust australopithecines have also been found at Sterkfontein and Makapansgat.[203]

Now these sites are more remote to Mt Ararat than are the hominid sites of East Africa. It is therefore unlikely that the Transvaal cave deposits are earlier than those in which hominid remains have been found in Ethiopia, Kenya and Tanzania.

The mean cranial capacity for the six specimens assigned to the taxon, *A. africanus*, calculates out at 440cc. This is some 12 percent greater than the calculated mean for common chimpanzees and 26 percent greater than

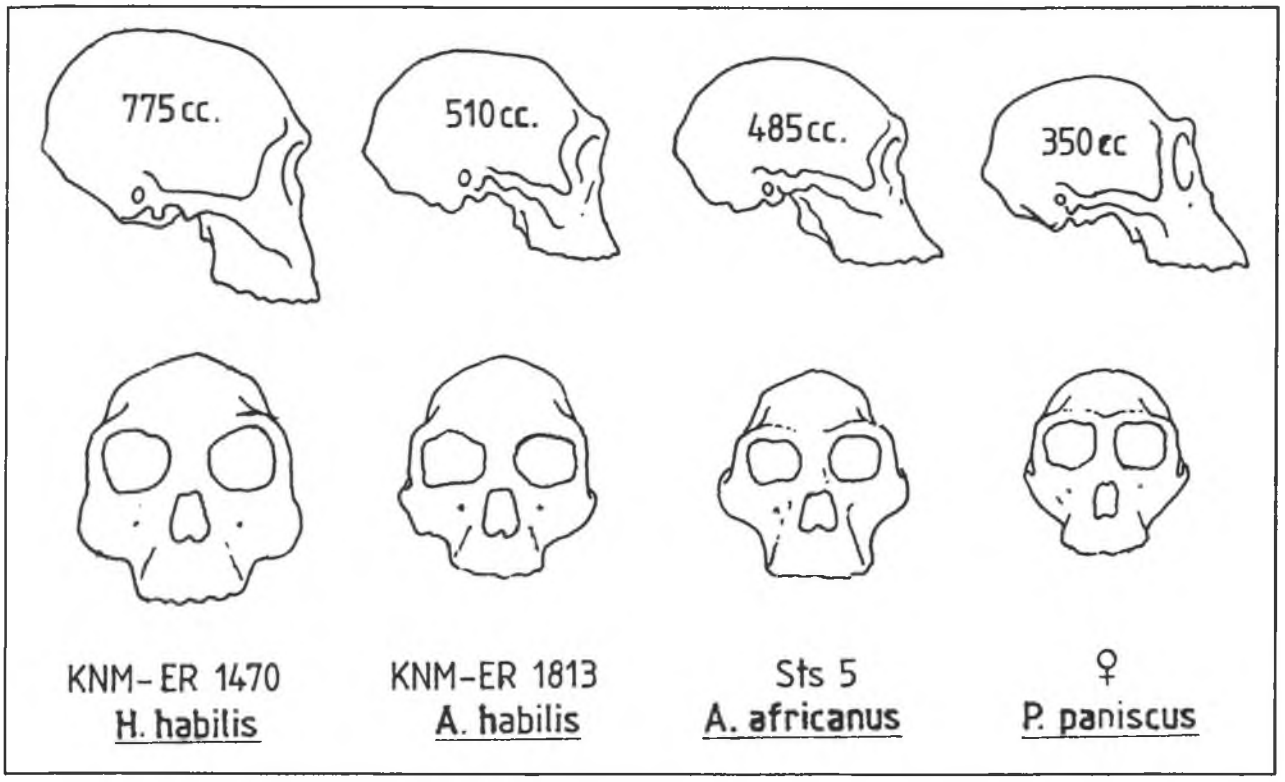


Figure 13. THE POSSIBILITY THAT HOMO HABILIS *AND SOME OF THE GRACILE AUSTRALOPITHECINES* (A. AFRICANUS) *ARE CONSPECIFIC MAY PROVIDE FURTHER EVIDENCE FOR SIMULTANEOUS SOUTHWARD MIGRATION AND MORPHOLOGICAL SHRINKAGE DURING THE POST-FLOOD EPOCH. THE FEMALE PYGMY CHIMPANZEE, PAN PANISCUS, IS INCLUDED IN THE COMPARISON.*

pygmy chimpanzees. It is also some 25 percent less than the value assigned to OH 24 (590cc), which is also regarded as possibly belonging to the taxon. If OH 24 did, indeed, belong to the taxon, then we have yet another instance of simultaneous southward migration and morphological shrinkage; OH 24, in this instance, representing an earlier inhabitant of the African continent than the gracile specimens from South Africa.

Now there is considerable morphological diversity within the gracile australopithecines. For instance, the Sterkfontein specimens, Sts 5 and Sts 71, are **quite dissimilar in cranial morphology**; yet the latter exhibits

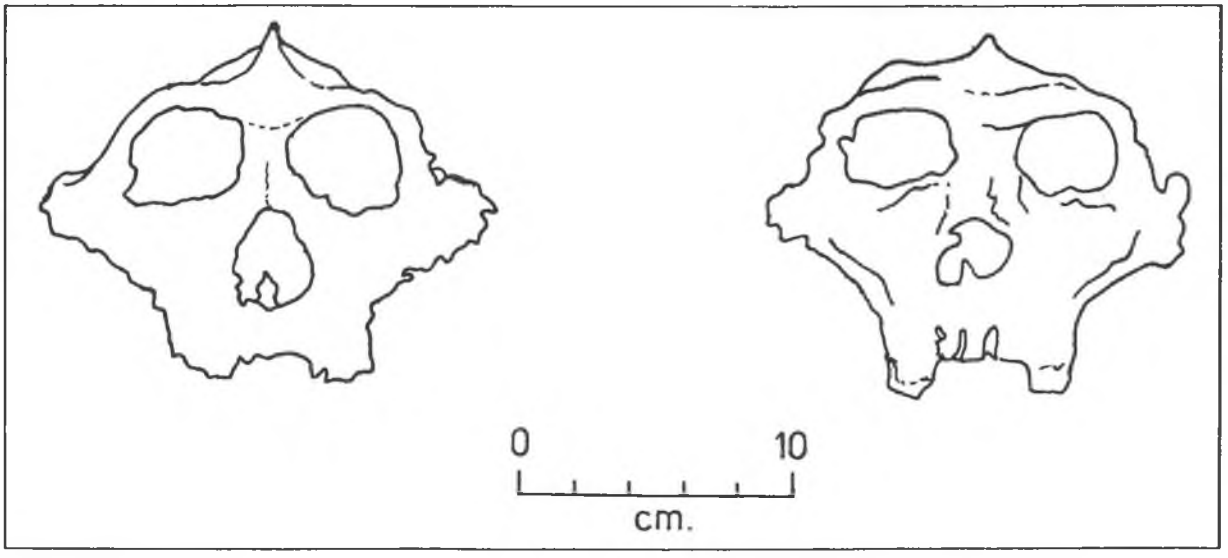


Figure 14. ANTERIOR VIEWS OF KNM–ER 406 (A. BOISEI *FROM ILERET) AND SK 48* (A. ROBUSTUS *FROM SWARTKRANS).*

many features found in the East Turkana specimen, KNM–ER 732.[204] This is particularly evident in anterior and lateral views of the skulls (see Figure 12). Again, however, there is a disparity in cranial capacity; KNM–ER 732 exceeding Sts 71 by about 17 percent (their respective cranial capacities being 506cc and 428cc).[205] This disparity is not as great as that between OH 24 and the mean value for the gracile australopithecines (34 percent), but then again, the deposits in which ER 732 was found (post-KBS deposits at Ileret) are probably not as old as those in which OH 24 was found (lower Bed I at Olduvai Gorge).

As was stated earlier, a number of authorities have, in recent years, argued that the habilines of East Africa are merely large-brained (and dare I say it, giant forms of) gracile australopithecines. Comparative lateral and anterior views of, say KNM–ER 1470 *(H. habilis)* and Sts 5 *(A. africanus)*, suggest that such a view is not beyond the bounds of possibility. Indeed, if we place Sts 5 (with its cranial capacity of 485cc) between KNM–ER 1813 and the female pygmy chimpanzee depicted in Figure 10, the transformation becomes more complete and convincing (see Figure 13).

The above specimens of *H./A. habilis* and *A. africanus* feature dolichocephalic braincases, with relatively high cranial vaults and forehead regions (not unlike those of chimpanzees generally, and the pygmy chimpanzee specifically). Postorbital constriction is moderate, as is the degree of flare in the zygomatic arches. Again, these characteristics are also typical of pygmy chimpanzees; however, they differ markedly from the robust australopithecines in these respects.

Whilst the earliest reconstruction of Skull 1470 featured a near vertical (*Homo*-like) face, later reconstructions have been characterised by an increasingly prognathic and longer upper jaw. The 'skirt-like' profile created by the zygomatic arches (when viewed anteriorly) is uncharacteristic of humans, yet is typical of habilines and gracile australopithecines. Furthermore, the range of face/cranium values for *Australopithecus* (51.0 to 64.5) exceed those for modern man (30.0 to 45.0), and KNM–ER 1470 falls within the range of the former (at 59.0).[206]

It is the writer's belief that the gracile line of *Australopithecus* (including *A.* and *H. habilis*) are essentially chimp-like in facial morphology, and that the living pygmy chimpanzee, *Pan paniscus*, may be a descendant (sub-species) of this line.

The Robust Australopithecines

The nine recorded determinations or estimates of cranial capacity for acknowledged robust australopithecines yielded a mean value of 495cc. They range from the diminutive KNM–WT 17000 (410cc)[207] to the partial cranium from Chesowanja, KNM–CH 1 (≥ 530cc).[208] The estimate for the Chesowanja cranium was based on comparisons with other specimens of *A. robustus/boisei*; specifically SK 1585 and OH 5. The anterior (frontal) region **only** of the CH 1 cranium was preserved.[209]

The robust australopithecines have been arbitrarily divided into two separate species, *A. robustus* and *A.*

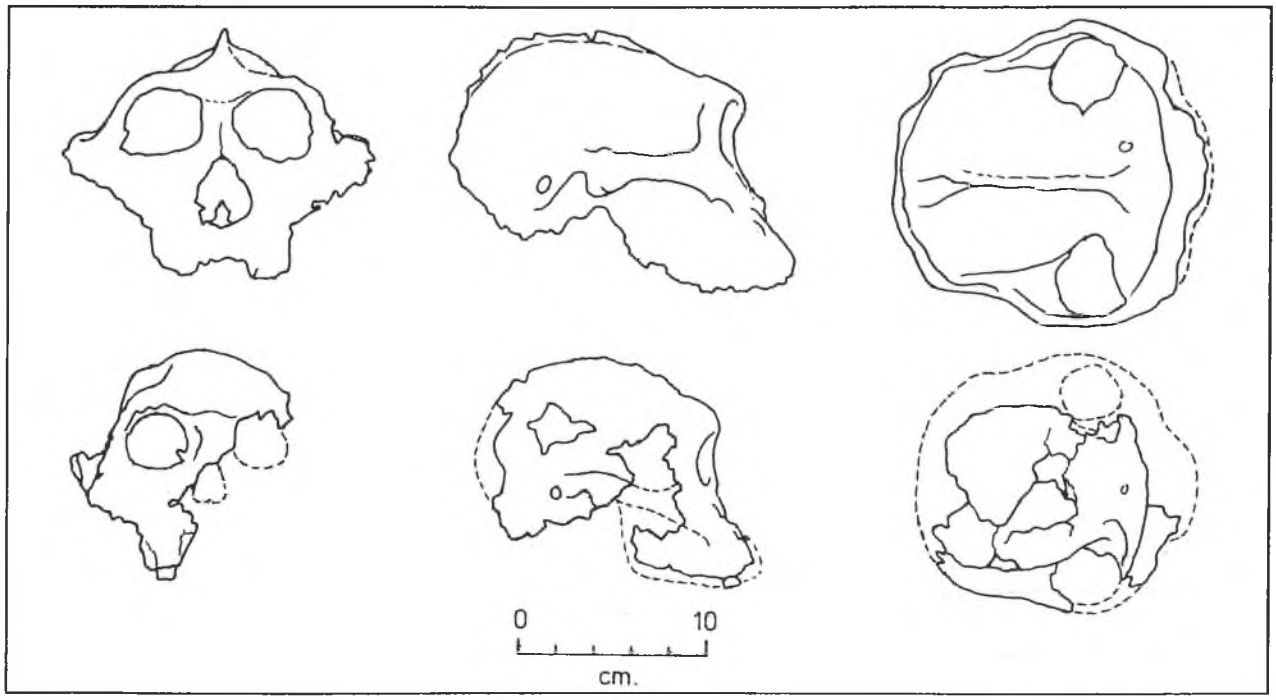


Figure 15. ANTERIOR, LATERAL AND SUPERIOR VIEWS OF KNM–ER 406 (TOP) AND KNM–ER 732 (BOTTOM); POSSIBLE MALE AND FEMALE FORMS OF AUSTRALOPITHECUS (PARANTHROPUS) ROBUSTUS/BOISEI.

boisei. The taxon *A. robustus* describes the smaller of the two species; the species deriving from the South African Transvaal (specifically the cave systems of Swartkrans and Kromdraai). The larger species, *A. boisei*, derives from Plio/Pleistocene deposits of East Africa (at sites such as the Olduvai Gorge and Peninj in Tanzania, Chesowanja and Koobi Fora/Ileret in Kenya, and Omo in southern Ethiopia).

The distinction between the two species, however, is not always obvious. Not all palaeoanthropologists recognize the validity of separate taxons. Indeed, when the type specimen of *A. boisei (Zinjanthropus boisei*, or OH 5) was first discovered by Mary Leakey in 1959, her husband, Louis Leakey, remarked that it was simply another robust australopithecine.[210] Later, when tools were discovered at the same site, Louis chose to ascribe the find to a separate taxon — *Zinjanthropus boisei*.[211] His long-standing colleagues, Phillip Tobias and F. Clark Howell, disagreed with the decision to create a new genus and species for 'Zinjanthropus'; Tobias preferring to place the hominid in the genus, *Australopithecus*, but recognizing it as a separate species, *A. boisei*, and Howell preferring to classify it as a robust australopithecine, albeit a large one.[212]

Richard Leakey and Roger Lewin chose to describe the two populations of robust australopithecine in the following manner:

> *'As it turns out, all the robust australopithecines that lived in East Africa were* ***built on the same pattern as their South African cousins, but they were significantly bigger*** *— they were hyper-robust.'*[213]

Whilst giving endorsement to the concept of separate taxons (species), John E. Cronin *et al.*, have conceded that

> *'. . . some of the* A. boisei *specimens, whether studied through actual measurements or through observations of their topography, are found to fall* ***within the range of the less specialized species,*** **A. robustus**.'[214]

The morphological similarities of two species are borne out particularly well when one compares the East African *A. boisei* specimen, KNM–ER 406, with the robust australopithecine from Swartkrans, SK 48 (see Figure 14).

Before proceeding with an overview of the taxons, mention should be made once again of the partial skull KNM–ER 732 from Ileret. In this particular specimen most of the right side of the face and braincase were preserved. The specimen has been suggested as **a possible female companion to the larger, robust skull KNM–ER 406**.[215] The specimen lacks the sagittal crest of ER 406 and other robust australopithecines; however, in all other respects, the specimen is remarkably similar in morphology to its larger East African contemporary. Its preserved pre-molar and molar teeth have been described as being

> *'. . . only a little less massive than those of the robust one';*

(i.e. ER 406).[216] Leakey and Walker have described ER 732 as being somewhat 'gracile' in appearance and decidedly smaller; yet its cranial capacity has, curiously, been estimated at 506cc by Holloway (just four cubic centimetres less than that of ER 406).[217] They concluded concerning these and similar fossil hominids from East Africa that:

> *'If amongst the species* A. robustus *the morphological differences between males and females were as great as they are among gorillas, then the robust, crested specimens from East Turkana could be males and the more gracile specimens could be females.'*[218]

In reference to the shared affinities between ER 406 and 732, J. T. Robinson stated that

> *'. . . although KNM–ER 732 appears gracile compared to other local robust-type skulls,* ***its morphology is not that of gracile skulls****: instead it has the low frontal region, brow ridge form, dished face, powerful jugal arch, relatively great postorbital constriction, spheroidal braincase, protuberant and pneumatized mastoid region, and glenoid well above the occlusal plane, that characterize the robust hominids.* ***The absence of the sagittal crest usual in the robust form is not a problem; even in the normally large-crested gorilla smaller females have no crest. Leakey is probably right in interpreting this specimen as a female of the robust form; it does not blur the distinction between robust and gracile hominids.'***[219]

Certainly, the skulls appear morphologically and proportionately similar when viewed anteriorly, laterally or superiorly (see Figure 15).

Returning then, briefly, to the Chesowanja cranium; this also may be the female form of the *A. boisei* species. The specimen has been described as a mixture of robust and gracile characteristics.[220] For instance, the postorbital constriction is not nearly as great as that observed in robust australopithecines,[221] but more in keeping with that found in KNM–ER 732. Alan Walker *et al.* have stated that:

> *'Several features of the cranium immediately suggest affinities with* Australopithecus robustus *(Broom, 1938) and* A. boisei *(Leakey, 1959). These are the size and generally massive build of the face, very small canine, massive, buccolingually expanded cheek teeth, the morphology of those teeth, evidence of a prominent glabella and a broad dished face. . . . KNM–CH 1 has clearly much bigger anterior and middle cranial fossae than in Olduvai Hominid 5 or as seen in the SK 1585 natural endocast — the only robust specimens available for comparison — and much bigger than in* A. africanus *specimens.'*[222]

In summarizing the characteristics of KNM–CH 1, the same authors admitted that the specimen represents

> *'. . .* ***a somewhat confusing amalgam of features.*** *Some features resemble those of* A. robustus *and* A. boisei, *some* A. africanus *and some show trends that have been taken before as typical developments*

towards Homo.'[223]

The estimated cranial capacity of KNM–CH 1 (≥ 530cc) is comparable with, or larger than, the values determined for OH 5 and the SK 1585 natural endocast; it is also larger than the determinations for the post-KBS (equivalent) robust specimens from Ileret, KNM–ER 406 and 732.

Now Chesowanja is roughly midway between Olduvai and Koobi Fora/Ileret. In establishing a relative chronology for the fossil hominids at the three locations it is generally acknowledged that the Bed I *A. boisei* specimen from Olduvai (OH 5) **antedates the post-KBS (equivalent) specimens from Ileret**. The Chesowanja deposits, in which the partial cranium CH 1 was found, are said to be faunally similar to those of Olduvai Bed II.[224] However, as Alan Walker *et al.* have noted, the fossilised remains of the proboscidean, *Deinotherium bozasi*, have also been recovered in the same deposits at Chesowanja.[225] This creature is not known to have existed in deposits at Peninj **nor above lower Bed II** deposits at Olduvai Gorge. This suggests the possibility that the Chesowanja deposits are older than what is generally presumed; that they are **at least of comparable age to those lower Bed II deposits at Olduvai**, and possibly even older.

We conclude this discussion on the robust australopithecines with an examination of the recent find from Lomekwi, West Turkana, KNM–WT 17000.[226] This *A. boisei* specimen has, by virtue of its early dating (2.5 million years B.P.), led to calls for drastic revisions of current hominid phylogenies.[227]

The hyper-robust nature of the specimen (which features the largest sagittal crest to be preserved in any robust australopithecine, pronounced postorbital constriction, spherical braincase, prominent brow ridges, a broad nasal aperture, and a dish-shaped and prognathic upper jaw) has resulted in the constriction of the calvaria's development; so much so, that KNM–WT 17000 possesses the smallest cranial capacity for any robust australopithecine (410cc).[228] In overall morphology, WT 17000 resembles a small, male gorilla. Each of the aforementioned craniofacial characteristics is to be found in extant male gorillas. Furthermore, Walker *et al.* have noted that, along with many shared 'primitive' characteristics with *A. afarensis*, KNM–WT 17000 possesses

> '. . . *extremely convex inferolateral margins of the orbits* ***such as found in some gorillas***.'[229]

Despite possessing one of the smallest hominid cranial capacities ever recorded, KNM–WT 17000 featured a very prognathic upper jaw and the remnants of a hyper-robust dentition.[230] Shipman has described the two preserved crowns — one broken, and one complete — as rivalling the largest hominid teeth ever found (comparable in occlusal area with the same teeth in OH 5).[231] One implication arising from this apparent contradiction is that the recovery of hyper-robust mandibles (such as those of KNM–ER 729 and 3230;[232] from the upper member of the Koobi Fora/Ileret Formation) **does not necessarily infer that their owners possessed large cranial vaults.** Quite the converse could be true.

Due to the sporadic distribution of East African robust australopithecine cranial remains (i.e. *A. boisei*), it is unclear, at this point in time, whether diminution was evinced in specific localities. However, as has been noted in the **Nature** article on Skull WT–17000, at least one authority has suggested that

> '. . . *robust australopithecines became smaller in skull and tooth size with time*.'[233]

If, as this writer suspects, the South African species represents a smaller and later population of *A. boisei* (morphological differences being diet-induced), then this would provide further evidence that the robust line became progressively smaller during a post-Flood, southward migration.

The Hadar/Laetoli Hominids

There has been much controversy concerning the validity of the taxon *Australopithecus afarensis*, to which the hominids from Hadar (Ethiopia) and Laetoli (Tanzania) have been assigned by Johanson and White.[234] Mary Leakey believes that her Laetoli hominids — comprising mainly jaws and isolated teeth — are closely aligned to specimens belonging to the genus *Homo*.[235] Included in this number is the LH–4 mandible ('adopted' by Johanson and White as the type-specimen for their newly created taxon). For a time, Johanson himself believed that some of the Hadar material (specifically Alemayehu's jaws, AL 199–1 and AL 200–1 palates, and two mandibles from the same Sidi Hakoma Formation, accessioned AL 266–1 and AL 277–1) exhibited certain affinities with certain East African specimens of *Homo habilis*.[236,7]

As stated previously, a number of authorities, including Boaz and Tobias, have rejected the taxon of *A. afarensis* completely. On a number of occasions, Tobias has suggested that there are strong affinities between the Hadar creatures and gracile australopithecines from Makapansgat.[238] On the other hand, Johanson and White contend that the Hadar hominids represent a single, but sexually dimorphic, species.[239]

Johanson's about-face concerning the nature of the Hadar hominids was dramatic, and no doubt, heavily influenced by the views of Timothy White (a former student of Milford Wolpoff, a long-time advocate of the single-species hypothesis).[240] As Mary Leakey stated:

> '. . . *many people still feel that the Hadar hominids are* ***far too diverse to belong to any single species***, *whatever new or old name it might be given. As I remember that was also Johanson's own belief for the first few years, but Timothy White* ***appears to have converted him to the view that was eventually published***.'[241]

Indeed, in the original **Nature** paper describing the hominids, Johanson and his co-author, Maurice Taieb, summa-

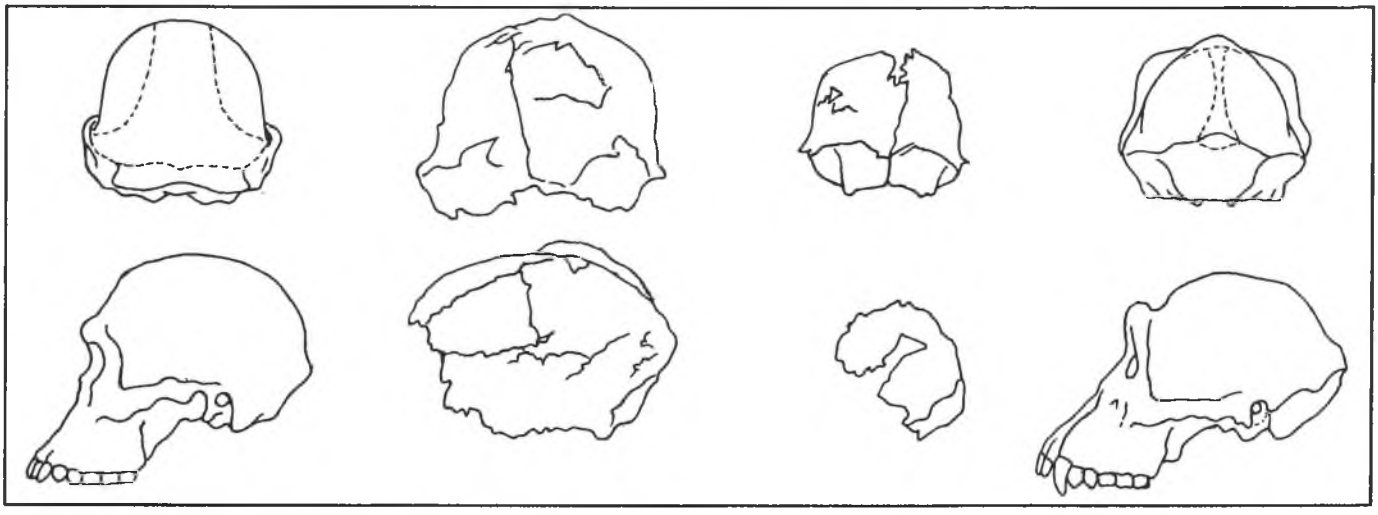


Figure 16. COMPARATIVE POSTERIOR (TOP) AND LATERAL VIEWS OF A. AFRICANUS *(LEFT),* H. HABILIS *(KNM–ER 1805),* A. AFARENSIS *(AL 162–28) AND* PAN *(EXTREME RIGHT).*

rized the fossil collection in the following manner:

> *'On the basis of the present hominid collection from Hadar it is tentatively suggested that some specimens show affinities with* A. robustus, *some with* A. africanus (sensu stricto), *and others with fossils previously referred to* Homo.'[242]

This view was reinforced in the Hadar faunal listing, where three separate species of Hominidae were identified (*A.* aff. *robustus*, *A.* aff. *africanus*, and *Homo* sp.).[243]

Now it is interesting to note that if Johanson's original view were to be shown to be correct, then we would be again confronted with a further instance of **devolution**; the 'derived' condition (as represented by the large, *Homo*-like mandibles and palates from the Sidi Hakoma Formation) preceding the 'primitive' condition (as represented by the mandible of 'Lucy' and the cranio-facial remains of other hominids from the overlying Denen Dora and Kada Hadar Formations). Perhaps this subconsciously influenced White into suggesting a single-species appraisal of the Hadar hominids. Yet such a scenario is consistent with that found at other East African sites, e.g. Koobi Fora/Ileret and Olduvai Gorge (where the 'advanced' large-brained habilines precede the smaller, more ape-like, habilines or gracile australopithecines).

There is considerable merit in Johanson's original view, as a cursory examination of the Hadar hominids will show.

Hominids from the uppermost formation (Kada Hadar) are few in number — the most notable being the partial skeleton dubbed 'Lucy' (AL 288–1) and a partial cranium, AL 162–28. 'Lucy' is regarded by most authorities, including Johanson himself,[244] as being very primitive and atypical of the Hadar hominids.[245] Commenting on the remains of AL288-1, Nancy Tanner suggested that

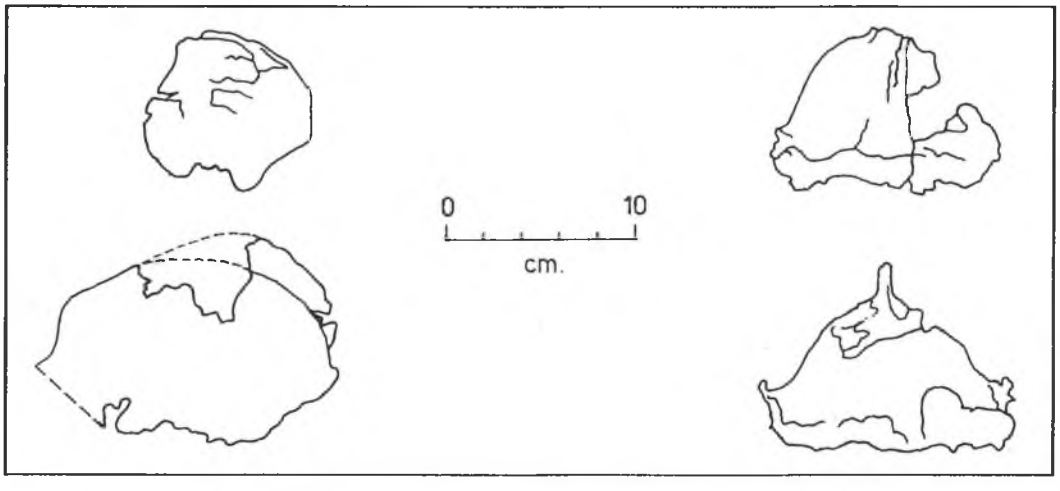


Figure 17. COMPARATIVE LATERAL AND POSTERIOR VIEWS OF AL 333–45 (TOP) AND KNM–WT 17000 (BOTTOM) REVEAL STRIKING SIMILARITIES IN FORM.

they resembled the basal Laetoli hominids and were also like the gracile australopithecines from Sterkfontein — though more primitive (especially in aspects of the mandible and pelvis).[246] The mandible and dentition of AL 288–1 are somewhat smaller than remains from the Sidi Hakoma Formation (e.g. AL 266–1, AL 277–1 and AL 400–1).[247]

The partial cranium, AL 162–28, is very small; in fact, it is thought to be the smallest **adult** calvaria of a hominid recovered to date.[248] Holloway has suggested a likely cranial capacity of between 374 and 400cc.[249] Comparison with the small *A. boisei* cranium, KNM–WT 17000, suggests that a cranial capacity in excess of 400cc is unlikely.[250] The nuchal region shares many affinities with modern chimpanzees, and the temporal/nuchal cresting is quite pronounced (see Figure 16). When viewed either posteriorly or laterally, AL 162–28 shares closer affinities with *Homo* habilines such as KNM–ER 1470 and especially KNM–ER 1805 than it does gracile australopithecines.

However, the shared affinities between the AL 162–28 cranium and modern chimpanzees do not cease with external characteristics of the calvaria. Dean Falk has noted that the endocast of AL 162–28 reveals that the lunate sulcus

> '. . . *merges with the intraparietal sulcus ( ), as does the lunate sulcus in* Pan; *it is rostral to the lambdoid suture, as is the lunate sulcus in* Pan; *and has a sulcus-like texture and shape similar to the lunate sulcus in* Pan.'[251]

Turning then to the remains from the middle formation of the Hadar Series (Denen Dora deposits), it appears that two species — perhaps *A. africanus* and *A. robustus/boisei* — are present. The partial cranium AL 333–45[252] shares strong morphological affinities with KNM–WT 17000 *(A. boisei)*, especially when viewed laterally and posteriorly (Figure 17). According to Johanson and Edey, this First Family cranium was characterised by

> '. . . *a strong apelike arrangement of muscle markings on the back of its skull.*'[253]

Pat Shipman has drawn comparisons between AL 333–45 and WT 17000. She states that the former

> '. . . *is heavily built and crested, and in several ways resembles the new* boisei *skull*';

that is WT 17000.[254] A provisional cranial capacity of 500cc has been assigned by Holloway to the cranium.[255]

Another cranium from the same formation, AL 333–105, included most of the facial region.[256] Although heavily distorted, the juvenile's cranio-facial remains bear a resemblance to the gracile australopithecine, Sts 71, from Sterkfontein (especially the maxilla). The estimated cranial capacity — 320cc[257] — is exceedingly small for any hominid. When adjusted upwards to a **presumed** adult value (352cc),[258] the calvaria approximates the cited mean value for pygmy chimpanzees.

A facial fragment from the same formation (Denen Dora), AL 333–1,[259] comprising the left and right maxillae and partial zygomatic bones, bears a strong resemblance to the *A. africanus* specimen, Sts 5.

Turning then to the Sidi Hakoma Formation, very little cranio-facial material has been preserved. Little can be said about the fragment AL 58–22,[260] so we will concentrate on the left temporal fragment, AL 166–9.[261] Tanner has described this skull-side as a ***'rather large'*** and ***'robust'*** temporal fragment, and has added that the specimen

> '. . . *also bears important resemblances to* ***that part of the skull on chimpanzees.***'[262]

Do the Hadar hominids constitute more than a single, but variable (dimorphic) species? The preliminary coefficient of variation (18.8 percent when the uprated 'adult' value is adopted for AL 333–105)[263] would suggest so, although such a small sample size (n=3) will no doubt distort the true picture. However, it is worthwhile noting that Walker *et al.* have suggested that the *A. boisei* cranium, KNM–WT 17000, shares many primitive features found in *A. afarensis*; features which are not known in *A. robustus/boisei*.[264] On the other hand, Olsen has suggested that *A. afarensis* comprised two species — one of which gave rise directly to *A. boisei*.[265] The observations of Dean Falk are instructive in this regard. She has noted that the transverse sinus cannot be discerned between the occipital and cerebellar lobes of the AL 162–28 endocast yet is present in both the adult AL 333–45 and juvenile AL 333–105 endocasts.[266]

Summarizing then, some of the Hadar hominids (e.g. AL 162–28, AL 166–9, AL 288–1 and the fossil jaws from the Sidi Hakoma Formation) share strong affinities with *Pan* (and particularly pygmy chimpanzees). Others, such as AL 333–45 and AL 333–105 resemble *A. boisei* remains such as KNM–WT 17000 (and are therefore gorilla-like in appearance). The Sidi Hakoma jaws (e.g. AL 199-1, AL 200–1, AL 266–1, AL 277–1 and AL 400–1) are regarded as being conspecific with Mary Leakey's Laetoli material, which she regards as belonging to the genus *Homo*. Unfortunately very little cranio-facial material is known from the Sidi Hakoma Formation. If and when such material is recovered, it may well resemble that of large-brained habilines. If this be the case, then diminution will be once again evinced (the Sidi Hakoma hominids representing a larger version of the stratigraphically younger Kada Hadar creatures). Of course, if such a proposition were to be confirmed, then a major revision of the relative chronologies of the various East African hominid sites would be called for.

CONCLUSIONS

In this paper, an attempt has been made to develop a scientific model which facilitates the interpretation of purported fossil hominoids and hominids within a biblical framework. The model was based on the premise (hy-

pothesis) that giant forms of anthropoid ape existed prior to, and immediately following, the Biblical Flood. These ancestral forms of pongid (some of which have living descendants, and still others which are now extinct) existed by virtue of slightly different biospheric conditions (including higher atmospheric pressure and CO_2 concentrations), negligible genetic load and greater longevity. In the aftermath of the Flood, and following the collapse of a pre-Flood vapour canopy, these ideal biospheric and physiological states were modified — resulting in genetic deterioration, reduced longevity and morphological shrinkage.

According to the model, many of the so-called fossil hominoids and hominids were fossilised during post-Flood periods of intense geological activity. Such activity took place in the centuries immediately following the global Flood (specifically between the close of the Flood-year and the termination of the Ice Age). It is suggested that it was during this same period that the Neanderthal and Cro-Magnon races of man lived (though probably closer to the close of the Ice Age than the fossil hominoids and hominids). The model also suggests that the phenomenon of giantism, evinced to a certain degree in these fossil men, was 'pandemic' to all forms of life, including man *(Homo sapiens)*. It was noted that the cranial capacities of these races were some 20 percent greater than the modern-day average. Pre-Flood values were likely to have been substantially greater.

The same hypothesis suggests that the Late Tertiary (Middle Miocene onwards) and Pleistocene deposits of the Quaternary periods in Africa, Asia Minor and possibly Major contain a graphic account of the post-Flood migrations of various forms of pongid, away from the immediate vicinities of Mount Ararat (in Eastern Turkey). As these creatures migrated into, and repopulated, the post-Flood continental land masses, they left a record of diminishing body size (both at a local and continental level).

The hypothesis has been shown to be supported by a number of separate lines of fossil evidence, including:

(1) The reduction in size of cranio-facial remains of the fossil ape, *Sivapithecus*; the largest forms *(S. meteai)* deriving from Middle Miocene deposits of Turkey and Greece, and a smaller form *(S. indicus)* from Late Miocene deposits in Pakistan. Both fossil forms exhibit strong morphological affinities with extant orang-utans; yet are **significantly larger** than the great Asian ape. *S. meteai* is regarded as representing the 'derived' (less ape-like) condition, and the latter form, *S. indicus*, the 'primitive' (more ape-like) condition.

(2) The reduction in size of the cranio-facial and dentitional remains of the East African sample of habilines (*Homo* and *Australopithecus habilis*). Such a trend is featured at both East Rudolf (Koobi Fora/Ileret) and Olduvai Gorge, where the sub-KBS and sub-Bed II faunal change habilines are decidedly larger than their descendants.

(3) There appears to be evidence that the sub-KBS sample of habilines from Koobi Flora and Ileret are **larger than** the sub-Bed II faunal change sample from Olduvai; perhaps evincing morphological shrinkage during a southward migration.

(4) Again, the older specimens of *habilis* appear to be the 'derived' form, whilst the younger specimens share a great many 'primitive' features found in *A. africanus*.

(5) The growing belief that the Homo habilines are merely large-brained gracile australopithecines *(A. africanus)* lends further support for a reduction in body size during southward migration. Leakey and Walker's contention that some of the smaller habilines would be better ascribed to *A. africanus* serves to strengthen the argument that the habilines and gracile australopithecines are congeneric, and may also be conspecific (if the possibility of morphological shrinkage is taken into consideration).

(6) The robust australopithecines of the South African Transvaal *(A. robustus)* are, as a rule, morphologically smaller than their East African relatives. If the *A. boisei* and *A. robustus* specimens are congeneric and conspecific, then it follows that morphological shrinkage may have accompanied a general southward migration of these creatures.

(7) The recognition by at least one authority that diminution occurs within the robust australopithecine sample over time.

(8) The recognition that the Hadar hominids *(A. afarensis)* may comprise two distinct species, or even genera (perhaps gracile and robust australopithecines). This then opens up the possibility that diminution is evinced in the gracile line; that is to say, the hominids deriving from the Sidi Hakoma Formation being larger than those from the younger Kada Hadar deposits.

(9) Again, the more primitive (ape-like) specimens of *A. afarensis* (e.g. AL 162–28 and the remains of 'Lucy', AL 288–1) derive from the youngest hominid bearing deposits. Conversely, the fossil jaws which have been likened to those of the *Homo* habilines (AL 199–1, AL 200–1, AL 266–1, AL 277–1, and AL 400–1), including the *A. afarensis* type specimen, LH 4 (from Laetoli), were recovered from the older Sidi Hakoma deposits.

Diminution, as it pertains to fossil hominoids and hominids, contradicts the evolutionary premise (presupposition) that modern man arose from smaller, ape-like ancestors. On the other hand, post-Flood diminution would appear to be consistent with the biblical narrative as it pertains to human origins and early earth history.

Whilst recognizing that the number of fossil calvariae, for which there are known determinations of endocranial volume, is appallingly small, there does appear to be a growing body of evidence that diminution in cranial ca-

pacity took place during the so-called Late Tertiary and Quaternary periods; the deposits of these periods having been laid down shortly after the termination of the Flood-year. Furthermore, this phenomenon would appear to be manifested on both a local level (where diminution is evinced in remains from successively younger strata) as well as within and between continents (where post-Flood migration is also perceived, along with morphological shrinkage).

Predictions can be made on the basis of the hypothesis (pre-Flood giantism), and the model (of simultaneous post-Flood migration and morphological shrinkage) is capable of falsification. As such, the hypothesis and model provide a viable alternative to the transformist theory of pongid and human origins. They also carry implications for other forms of wildlife and their origins.

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47. Johanson and Edey, Ref. 1, p. 107.
48. Leakey, Ref. 18, p. 131. Quoting Leakey: '*A word of warning about the implication of brain size in humans: the variation is enormous and is not necessarily related to intelligence. Jonathan Swift, for example, had a brain of around 2,000 cubic centimetres . . . whilst Anatole France managed more than adequately with a mere 1,000 cubic*

centimetres . . . Clearly, there is more to intelligence than the size of the brain, but exactly what it is remains a mystery.'

49. Dillon, L. S., 1978. **Evolution: Concepts and Consequences**, C. V. Mosby Company, 2nd Edition, St Louis, p. 405.
50. Custance, A. C., 1976. **Evolution or Creation?** (Volume IV of the **Doorway Papers**), Zondervan Publishing House, Grand Rapids, Michigan, p. 224.
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51. Broderick, A. H., 1971. **Man and His Ancestors**, Hutchinson and Co., London, p. 84.
52. Custance, A. C., 1970. Fossil man in the light of the record in Genesis. In: **Why Not Creation?** Lammerts, W. E. (ed.), Baker Book House, Grand Rapids, Michigan, p. 196.
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54. Holloway, R. L., 1968. The evolution of the primate brain: some aspects of quantitative relations. **Brain Research, 7**:128.
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58. Zihlman, Ref. 11, Part V, Plate 110.
59. McLeod, K. C., 1983. Studying the human brain. **Creation Research Society Quarterly, 20**(2):78.
    In the same article McLeod cites cranial capacities for three Bantu brothers, whose mean value was 530cc. McLeod noted that each possessed speech capabilities. The cited mean cranial capacity, incidentally, approximated that determined for *Zinjanthropus boisei*, a robust australopithecine of late Pliocene/early Pleistocene age.
60. Dillon, Ref. 49, p. 405.
    See also: Richard Tullar, 1977, **The Human Species**, McGraw-Hill, New York, p. 200.
61. Schultz, A. H., 1973. **Gibbon and Siamang, 2**:1–54.
    The cited range is applicable to the species *Hylobates lar* only. The larger species of Hylobate, the Siamang, or *Hylobates syndactylus*, exhibits very slight sexual dimorphism in respect to cranial capacity. The measured range for both sexes is 106 to 143cc, with a calculated mean of 123cc.
62. Nickels, M. K., Hunter, D. E., and Whitten, P., 1979. **The Study of Physical Anthropology and Archaeology**, Harper and Row, New York, p. 198.
63. Dillon, Ref. 49, p. 406.
    C. P. Groves, in a personal communication to the author, cites a slightly higher value for male orang-utans (545cc) and a marginally higher mean value for both sexes combined (408cc).
64. Dillon, Ref. 49, p. 406.
    Ralph Holloway, in an article entitled 'Cranial capacity of the hominine from Olduvai Bed I' (**Nature**, 1965, **208**:205–206), cites A. H. Schultz as having specified a slightly wider range (320 to 752cc). This represents the widest range for any living genus of anthropoid ape.
65. The mean value for chimpanzees given by Nickels, Hunter and Whitten (Ref. 62, above) equates well with that determined by the eminent British anatomist, Sir Solly Zuckerman, some years earlier. Zuckerman's research also revealed a slight degree of sexual dimorphism in the cranial capacities of male and female chimpanzees (399 $\pm$ 7.0 and 366 $\pm$ 6.5cc, respectively); see 'An ape or the ape', **Journal of the Royal Anthropological Institute**, 1952, **81** (1 & 2), p. 63. C. P. Groves (personal communication to the present author) cites a slightly higher set of values for male and female common chimpanzees *(Pan troglodytes)*; 408 and 387.5cc, respectively.
66. C. P. Groves cites values of 433.2 and 383.7cc for male and female orang-utans (combined values for both sub-species of orang-utan). He also assigns combined mean values of 565.2 and 482.6cc for the three sub-species of gorilla. These values are slightly higher than those posited by Adrienne Zihlman (Ref. 11, Part III, Plate 63); 550 and 440cc, respectively.
67. Zihlman, Ref. 11, Part IV, Plate 89.
    Zihlman's cited values agree with those provided to the author by C. P. Groves (males = 352cc; females = 349cc).
68. Weidenreich, F., 1946. **Apes, Giants and Man**, University of Chicago Press, Chicago. Referred to in: J.B. Birdsell, 1972, **Human Evolution: An Introduction to the New Physical Anthropology**, Rand McNally and Company, Chicago, p. 205.
69. Pilbeam, Ref. 19, pp. 61–62 (a phylogeny for Old and New World apes and monkeys).
    See also: Jerold Lowenstein and Adrienne Zihlman, 1988. The invisible ape. **New Scientist, 1641**:59.
70. The values cited for mean cranial capacity and body weight have been derived from a number of sources, including: A. L. Zihlman (both sets of data for gibbons and gorillas; Ref. 11, Part III, Plate 63: and cranial capacities for common and pygmy chimpanzees; Ref. 11, Part IV, Plate 89); C. P. Groves (those for orang-utans and body weights for pygmy chimpanzees; personal communication); N. M. Tanner (for body weights of common chimpanzees; Ref. 13, p. 61); and Gerald Duffett (for body weights in humans; **Creation Research Society Quarterly**, 1983, **20**(2):99).
    Zihlman has suggested that, in both species of chimpanzee (pygmy and common), female body weight is generally 80 to 85 percent that of the male. We would therefore anticipate body weights for male pygmy chimps of between 35 and 37.5 kg. The figures cited by Groves, however, suggest that the degree of dimorphism (in body weight, at least) is greater in *Pan paniscus* than it is in *Pan troglodytes*. Allometry is also greater in pygmy chimpanzees.
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72. Derived from data for each sub-species supplied by Colin Groves to the author.
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203. Tanner, Ref. 13, pp. 234–235 (Figure 10:3).
204. J. E. Cronin *et al.* (Ref. 9, p. 120) have stated that: *'Some of the specimens which make up the morphological range of species of* Australopithecus, *that is* A. africanus, . . . *resemble* A. robustus *very closely in topographical features of the face. The fairly complete fossil Sts 71 can be considered representative of the robust end of the morphological range, although fragments and isolated teeth of other specimens* ***hint at the possibility that even more robust individuals existed.'***
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210. Lewin, Ref. 43, p. 138.
211. Leakey, Ref. 42.
212. Lewin, Ref. 43, p. 140.
213. Leakey and Lewin, Ref. 55, p. 58.
On the basis of the data available at the time of writing (see Table 9) it would appear, albeit superficially, that the East African robust sample (n=6, m=488cc and C.V.=10.3%) possessed slightly smaller cranial capacities on average than those from South Africa (n=3, m=510cc and C.V.=3.4%). Such a result contradicts virtually every appraisal of the comparative sizes of these forms (*A. boisei* and *A. robustus*) during the past three decades. For instance, Pilbeam and Gould (Ref. 155, p. 894) have noted that: *'The only complete* A. robustus *brain case (from Swartkrans) yields a volume of 530cc. However, crushed and fragmentary crania from Swartkrans are* ***clearly smaller*** *than the larger* A. boisei *crania . . .'* Furthermore, there is a question-mark hanging over the estimated cranial capacity for *Zinjanthropus boisei*. Wolpoff and Brace (Ref. 144, p. 62) have asserted that: *'Only one published australopithecine allows the determination of both the summed posterior area and cranial capacity, and even in this case (OH 5), we have reason to believe that* ***the capacity is too small.'*** The reconstructed cranium of OH 5, when contrasted with those of other rleatively complete specimens of *A. boisei* (e.g., KNM–ER 406 and KNM–WT 17000), differ appreciably in lateral view — suggesting that the reconstruction is grossly in error, and that a substantially greater ECV is in order.
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231. Shipman, Ref. 227, p. 91.
232. It is interesting to note that Walker *et al.* (Ref. 207, p. 520) have concluded that: '***Only** the largest* A. boisei *mandibles found so far (for example, KNM–ER 729 and 3230) would fit this cranium.*' Yet these mandibles occur very late in the fossil record at East Turkana; post-dating specimens such as ER 406 and 732 (Walker and Leakey, Ref. 150, pp. 52–53). For descriptions of these *A. boisei* mandibles the reader is referred to: Leakey, Ref. 215 (pp. 241–242) for KNM–ER 729; and to: Richard Leakey, 1976, New hominid fossils from the Koobi Fora Formation in Northern Kenya, **Nature**, **261**:575–576, for KNM-ER 3230.
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This view has been reinforced to some degree by comparative faunal correlations and a number of downward revisions of the radiometric ages assigned to the three primary fossil hominid bearing formations at Hadar.
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244. Johanson and Edey, Ref. 1, p. 262.
See also: Johanson, Taieb and Coppens, Ref. 237.
245. See: Leakey and Lewin, Ref. 55, pp. 61–62; and Lewin, Ref. 43, pp. 274–275.
246. Tanner, Ref. 13, pp. 182–183 (Fig. 8:8)
247. Concerning 'Lucy's' mandible, Johanson and Edey wrote: '*. . . she has notably small front teeth. That is one reason her jaw has a distinctive V-shape: her four incisors are not big enough to require that the jaw be wide in front. In striking contrast are the jaws and teeth found by Alemayehu: not only are they **absolutely bigger** than Lucy's, but the front teeth are **bigger** yet. . . . He* (that is, Tim White) *had selected them for size — a graduated series of jaws running from the largest to the smallest in the* (Hadar) *collection. When Lucy's jaw was placed at the end of the series, it became plain that she belonged there. There was a compelling shrinkage of features down to her.*' (Ref. 1, pp. 260, 277)
In respect to the narrowness of the anterior region of the jaw, the AL 288–1i mandible is of similar morphology to KNM–ER 1482 (see Tanner, Ref. 13, p. 247 and Leakey, Ref. 163, pp. 172–173), although the former is **appreciably smaller.**
248. Falk, D., 1985. Hadar AL 162–28 endocast as evidence that brain enlargement preceded cortical reorganization in hominid evolution. **Nature**, **313**:45.
249. Holloway, R. L., 1983. Cerebral brain endocast pattern of *Australopithecus afarensis* hominid. **Nature**, **303**:420.
In this article, Holloway describes the AL 162–28 endocast as yielding an estimated volume '*. . . of just less than 400ml, based on comparison with the Taung endocast . . .*' In a more recent article (Endocast morphology of Hadar hominid AL162-28, **Nature**, 1986, **321**:536), Holloway and William Kimbel refine the estimated cranial capacity to between 375 and 400cc; this range corresponding well with the mean for *Pan*, and in particular, common chimpanzees. Dean Falk (Ref. 248, p. 45) prefers a less precise estimate of 350 to 400cc; the lower end of which approximates the mean for extant pygmy chimpanzees. The value cited in this paper for AL162-28 (385cc) derives from Tanner (Ref. 13, p. 185).
250. Walker, Leakey, Harris and Brown, Ref. 207, pp. 519–520.
251. Falk, D., 1986. Falk replies. **Nature**, **321**:537.
252. Kimbel, W. H., Johanson, D. C., and Coppens, Y., 1982. Pliocene hominid cranial remains from the Hadar Formation, Ethiopia. **Am. J. Phys. Anthrop.**, **57**(4):468–473, 492–493.
253. Johanson and Edey, Ref. 1, p. 263.
254. Shipman, Ref. 227, p. 93.
Another fossil cranium, KNM–ER 407, from East Turkana (Ileret), is morphologically similar to KNM–ER 732 (the presumed female form of *A. boisei*) and AL 333–45: especially when viewed laterally and basally. Viewed posteriorly, however, ER 407 and 732 are not as bell-shaped as AL 33–45 and KNM–WT 17000 (primarily because they lack the sagittal keeling/cresting of the latter specimens).
255. Johanson, Taieb and Coppens, Ref. 237, p. 382.
See also: Holloway, Ref. 257.
256. Kimbel, Johanson and Coppens, Ref. 252, pp. 476–483, 49–498.
257. See: Holloway, R. L., 1983. **Hum. Neurobiol.**, **2**: 105–114.
258. Falk, Ref. 248.
It is worthwhile noting that Falk qualifies this estimate of the uprated adult capacity by the following remark: '*(This estimate may actually be too large because it is based on human data — a 5 year old chimpanzee **would already have obtained its adult cranial capacity**.)*'
259. Kimbel, Johanson and Coppens, Ref. 252, pp. 463–467, 490–491, 499.
260. Kimbel, Johanson and Coppens, Ref. 252, pp. 453–456, 486.
261. Johanson, D. C., and Coppens, Y., 1976. A preliminary anatomical diagnosis of the first Plio/Pleistocene hominid discoveries in the Central Afar, Ethiopia. **Am. J. Phys. Anthrop.**, **45**:221–222, 233 (Plate 5).
See also: Johanson and Taieb, Ref. 236, p. 294.
262. Tanner, Ref. 13, pp. 182–183, 185.
263. If the measured value of 320cc is used instead of the projected adult value, the coefficient of variation jumps up to 22.7 percent. See comments in: Falk, Ref. 258, above.
264. Walker, Leakey, Harris and Brown, Ref. 207, p. 522.
265. Walker, Leakey, Harris and Brown, Ref. 207, p. 522.
266. Falk, Ref. 248, p. 46.
This, and other morphological traits, led Falk to conclude that: '*. . . the endocast of AL 162–28 is small, simple **and ape-like**, and the following combination of features reproduced on this endocast is **typical of ape brains, but rarely, if ever, seen in human brains**.*'
267. Lewin, R., 1990. Humans may have come from Greece, not Africa. **New Scientist**, **125** (1701):15.

POSTSCRIPT

In the January 27, 1990 edition of **New Scientist** Roger Lewin recounted the recent discovery of facial remains and an upper jaw belonging to the fossil ape, *Ouranopithecus macedoniensis*. The new discovery (made by Luis de Bonis and George Koufos) is significant for a number of reasons. Prior to this discovery the only remains of *Ouranopithecus* to have been recovered

comprised a few jaws and isolated teeth. These were described by various authorities (including de Bonis and Donald Johanson) as sharing affinities with the australopithecines. In fact, de Bonis had even suggested that *Ouranopithecus* may have been ancestral to Johanson's *Australopithecus afarensis*.

However, David Pilbeam has suggested that *Ouranopithecus* may have been ancestral to the gorilla. Lewin, in describing the newly discovered remains, suggests that the creature's features '*. . . include broadly spaced eyes, prominent ridges over the brows, and certain aspects of the lower face and palate. The fossil certainly has large canine teeth, unlike hominids.*'[267] The fact that the eyes are broadly spaced and the margins are surmounted by prominent brow ridges suggests that *Ouranopithecus* is more likely to belong to the gorilla lineage, rather than the orang-utan line (as was previously advocated by Peter Andrews).

Irrespective of whether further assessment of the remains demonstrate a relationship with gorillas (or perhaps even robust australopithecines), **a migration from south-eastern Europe to Africa is inferred**.